Does Science Exclude God?  
Natural Law, Chance, Miracles, and Scientific Practice

Scripture teaches us some theological truths about sparrows, apples, planets and stars. Jesus taught that a sparrow cannot fall to the ground apart from God's will. God's will also governs apples falling from trees and planets orbiting a star. As the prophet Isaiah wrote, "Lift your eyes and look to the heavens: Who created all these? He who brings out the starry host one by one, and calls them each by name. Because of his great power and mighty strength, not one of them is missing." We also know some scientific truths about sparrows, apples, planets and stars. Sir Isaac Newton discovered something astonishing. The motion of falling apples and the motion of orbiting planets — two very different sorts of objects — can be described by the same set of simple equations. Scientifically, we say that falling apples and orbiting planets are "governed" by and "obey" Newton's Laws of Motion and the Law of Universal Gravitational Attraction. 

Natural Laws do not "govern" the universe
The Bible speaks of God's governance. Modern science speaks about "natural laws." Is there a conflict here? Some people would say "yes." Science is so successful at describing the motion of apples, planets and stars that some people conclude that no further explanation is needed. If science can explain something by natural laws, they believe there is no longer a need for God to do anything. Cosmologist Stephen Hawking accurately reports this common belief when he writes, "These laws may have originally been decreed by God, but it appears that he has since left the universe to evolve according to them and does not now intervene in it." This may be a commonly held picture of how God interacts (or doesn't interact) with the universe, but it is not the biblical picture. The Bible proclaims that God is equally sovereign over all events, ordinary or extraordinary, natural or supernatural. God didn't create the universe like a watch to be wound up, started, and then let go, only intervening occasionally. The Bible proclaims that the universe continues to exist, and behaves in an orderly fashion, only because of God's continual sustaining action. As it says in Psalm 104:

The moon marks off the seasons,  
and the sun knows when to go down.  
You bring darkness, it becomes night,  
and all the beasts of the forest prowl.  
The lions roar for their prey  
and seek their food from God.  
The sun rises, and they steal away;  
they return and lie down in their dens.
Then man goes out to his work,
to his labor until evening.
How many are your works, O Lord!
In wisdom you made them all;
the earth is full of your creatures.\(^4\)

Note the parallel levels of description in that passage. The sun goes down (a natural event), and God brings night (divine action). The lions hunt prey (a natural event), and they seek their food from God (divine providence). The biblical perspective is clear. If something happens "naturally," God is still in charge. This psalm was written more than 2000 years before modern science existed, so the psalmist probably wasn't thinking in terms of "natural laws." However, the psalmist certainly knew the difference between ordinary natural events and extraordinary events. The psalms are filled with praise to God for the times in Israel's history when God did something unusual, something miraculous. So the psalmist undoubtedly understood that there is a difference between a supernatural miracle and an ordinary event like the sun going down or a lion hunting. Yet the psalmist insisted that God was in charge of natural events every bit as much as God was in charge of supernatural events. In fact, God is to be praised and worshipped for those natural events.

With a modern scientific understanding of natural laws, neuroscientist Donald MacKay described the biblical view this way: "...The continuing existence of our world is not something to be taken for granted. Rather it hangs moment by moment on the continuance of the upholding word of power of its creator."\(^5\)

Scientists talk about natural laws "governing" the universe. Christians who are scientists occasionally use that language as well. From a biblical perspective, however, it is incorrect to say that natural laws "govern." God governs. God created natural laws, and God usually governs creation **through** the natural laws he designed and created.\(^6\) God can supersede the ordinary functioning of natural laws any time he chooses, but most of the time God chooses to work in consistent ways through those natural laws. As we study God's creation scientifically, we build mathematical models and descriptions of those natural laws which God created and uses. The rationality and regularity of these laws should be seen as a gift without which we would not be able to understand our world.

All too often we forget these basic biblical truths when we talk about the history of stars or species. Science uses natural laws to describe the history of stars and species. New stars form by the gravitational collapse of interstellar clouds. One species can split into two species through mutation and natural selection. Does a successful scientific description, in terms of natural laws, mean that God was not involved in these processes — at least not in any significant or creative way? Certainly not. God created those natural laws in the first place. God sustains them and is sovereign over them each and every moment. The biblical view is not that God is absent from events which happen by "natural laws;" rather, natural laws describe how God typically governs His creation.

"**Chance** is not an alternative explanation to God
Some people do use the word "chance" as an alternative explanation to God. When they say that something happened by "Chance," they believe that it had no purpose, no significance of any kind, nothing guiding it, no purpose which cares about the final results.

This is not the **scientific** meaning of the word chance, although some scientists do use the word "chance" this way in their popular writings. Noting the role played by random events in evolutionary theory, George G. Simpson has written, "Man is the result of a purposeless and natural process that did not have him in mind."7 Similarly, Douglas Futuyma has written, "Some shrink from the conclusion that the human species was not designed, has no purpose, and is the product of mere mechanical mechanisms — but this seems to be the message of evolution."8 When scientists use the concept of chance in this way, they are adding philosophical overtones which go way beyond the scientific meaning.

When scientists use the concept of chance scientifically, they mean simply this: They could not completely predict the final state of a system based on their knowledge of earlier states. In a scientific theory, the term "chance" is not a statement about causation (or lack of causation); rather, it is a statement about **predictability**.

One of the surprises of 20th century physics was the Heisenberg Uncertainty Principle. In classical physics, it is (in principle) possible to know with absolute precision every physical variable (position, velocity, energy, etc.) of any particle. From quantum mechanics we have learned that, in fact, it is impossible to measure every physical variable of a particle with complete accuracy. Even with complete knowledge of the initial conditions of a system, it is impossible to predict the exact outcome of some measurements. Some scientific measurements have results which — not just in practice, but in principle — are randomly determined. Randomness is built into the very mathematical formalism of the theory.

Scientists often use the term "chance" outside of quantum mechanics, but in a different way. In classical mechanics, if a system is sufficiently complicated (a "chaotic" system) it is impossible to have sufficiently complete knowledge of its initial conditions. The final state of the system depends so sensitively upon the initial conditions that, in practice, it is impossible to predict exactly what will happen. In these systems, based upon experience and certain general considerations, various outcomes can be assigned probabilities of occurring, but the particular outcome cannot be predicted. Some common examples of "chaotic" systems include throwing dice and predicting the weather. Biologists and medical professionals use the word "chance" this way. A doctor might tell you the chance that a disease will recur in a patient. In evolutionary biology, a "chance" event is simply an event which affects an organism's survival (e.g. a natural disaster) or genetic information (e.g. a mutation) but which was not caused by the organism itself and could not have been predicted. "Chance" in evolutionary biology or any other branch of science is a semi-quantitative statement about our inability to precisely predict final outcomes.

The **scientific** use of the term "chance" is entirely compatible with a biblical picture of God's governance. Many Bible passages describe God working through apparently random events. "The lot is cast into the lap, but its every decision is from the Lord."9 Centuries before modern science existed, people understood that some events are unpredictable. Biblical writers proclaimed God as sovereign over random events like casting lots. Biblical writers also
proclaimed God's sovereignty over events which we now describe scientifically using probabilities (e.g. the weather). Scientific randomness poses no fundamental problem to a biblical understanding of God's providence. Just because we cannot scientifically predict the outcome of an event doesn't mean that God cannot be involved in the event, giving it purpose and meaning. Quite the opposite. According to the Bible, chance events are another means by which God can govern.

An analogy or two might be helpful. A scientist has designed a computer simulation of leaves randomly falling off a tree. To anyone observing the simulation, the timing of the falling leaves appears random. However, this scientist can control her computer program to cause any one particular leaf to fall at a particular time and a particular place. The observer would be unable to predict this event or in most cases to observe any difference. In an analogous fashion, God could select the outcome of scientifically unpredictable events in order to achieve particular outcomes. God could do this subtly, interacting with creation in ways which are significant but which we could not detect scientifically. God could also do this dramatically upon occasion, choosing an outcome which is scientifically possible but extremely improbable, something which might even appear miraculous to us.

Another way God might use random processes is to give the created world a bit of freedom. Through the laws of nature, God has given the material creation a range a possibilities to explore, and he gives his creation the freedom to explore that range. For an analogy, consider how some engineers and computer programmers are using "genetic algorithms" in their work. They design a computer program with a goal (e.g. to control a complex manufacturing process). Rather than specify all of the variables in that computer program, the scientists specify for each variable a range of values. The computer randomly selects the variables from the allowed ranges, then measures its own performance on how well it performs its given task. It then randomly alters one or more of the variables, performs the task again, and sees whether it did better or worse. In this way, after enough trials, the computer converges on a set of variables which are ideally suited to performing a particular task. Genetic algorithms in computer programs can also be used for artistic purposes. Some multi-variable mathematical functions, when creatively displayed, make very beautiful pictures. An artist can allow the computer program to randomly change one variable, and then another, and another, allowing the computer to explore a wide range of possibilities, generating a whole series of beautiful and unique pictures.

The Bible teaches that God can precisely select the outcome of events which appear random to us. It is also possible that God gives his creation some freedom, through random processes, to explore the wide range of potentials he has given it. Either way, randomness within natural processes is not the absence of God. Rather, it is another vehicle for God's creativity and governance.

**Science is not intrinsically atheistic**
Not all scientists share a biblical view of nature. Scientists come from a variety of religious traditions. They can hold very different philosophical and religious views of what these things are that we call "natural laws" and "chance". Nevertheless — and here is something which troubles many people, Christians and non-Christians alike — scientists of many different
religious beliefs typically do reach consensus on the same scientific theories and equations. How is it possible that scientists of very different religious worldviews can agree about natural science?

Scholars in the social sciences and humanities know from experience that one's religious beliefs can profoundly affect one's research. Religious beliefs affect how one searches for the truth, what sorts of evidence, and what sorts of answers one is willing to accept. Why is it, then, that in the natural sciences, scholars of many different religious beliefs usually agree about so much? While they might disagree about the philosophical and religious implications of their scientific work, they usually do agree about the scientific results themselves, and they usually agree upon the proper methods for obtaining those results. How is that possible?

One common answer to that question goes roughly as follows: "Science is methodological naturalistic (or methodologically atheistic). Scientific equations and theories don't refer to God or the supernatural. Therefore, scientific equations and theories are methodologically naturalistic. You don't have to be an atheist to do science. You may still believe that God exists; however, you must act 'as if God doesn't exist' whenever you are doing science."

Many atheists and agnostics do claim that science, by definition, is methodologically naturalistic. In fact, a number of Christians also describe science that way. The stress is on the word methodological. Philosophical naturalism is a worldview which claims that supernatural entities do not exist. Methodological naturalism, by contrast, is a tool for conducting limited investigations and for discovering limited truths. Methodological naturalism is an acceptable tool for a Christian to use, the argument goes, so long as she remembers that the discoveries made by using this tool are only partial truths.

There is some merit to this answer. It is important to distinguish philosophical naturalism from methodological naturalism. However, this answer is also misleading in some important respects. In order to see how it is misleading, we should ask ourselves, "What must a scientist believe in order to do science? What are the fundamental philosophical beliefs which support scientific investigations of the natural world?"

Historians and philosophers of science have written entire books in answer to those questions. I will briefly list six points which I believe summarize their answers, acknowledging that this list is, necessarily, a simplification.

**Philosophical beliefs which encourage scientific investigation:**

1) *Events in the natural world typically have (immediate) causes in the natural world.* For example: if a tree falls and a sound is heard, then the falling tree in some way caused the sound. The sound was not caused by some "sound spirit" or other metaphysical entity.

2) *A linear view of time.* The universe is not an endless repeating circle, where every event occurs simply because we happen to be passing that particular point on the circle.

3) *These causes and effects in the natural world have some regularity across space and time.*
4) These causes and effects can be — at least in part — rationally understood by us.
5) We cannot logically deduce, from first principles, nature’s fundamental constituents and behaviors. We must use observations and experiments to augment our logic and intuition.
6) Studying nature in this way is a worthwhile use of time and talent.

Nearly all scientists today hold these beliefs. These beliefs are not scientific. Scientists assume these are true for philosophical and religious reasons. The success of science supports their validity. They are, nevertheless, philosophical statements which lie outside of science.

With the hindsight of science's success, these beliefs may seem obvious to us. Throughout most of human history, however, these beliefs were not widely held. Historically, how did they arise? Many ancient cultures held some of these beliefs, but not others. Most of the brilliant philosophers of ancient Greece, for example, disdained observations and experiments. They held beliefs about the natural world which relied heavily on logical deduction from what they thought where self-evident first principles, but were in fact incorrect.

These particular philosophical beliefs came together at the time of the scientific revolution. Why did the leaders of the scientific revolution hold these beliefs? Several historians of science have argued that they held these beliefs, at least in part, because they held biblical views of the natural world.\(^1\)\(^2\)

Some biblical beliefs about God and nature:
1) **Creation is not animistic.** It is not filled with "gods" or "nature spirits."
2) **Time is linear, not circular.**
3) **God is consistent, not capricious, in His governance of nature.** Therefore, there could be regular patterns that we can discover.
4) **We are made in God's image and we are made suitable for this world.** Therefore, we have hope that we can understand at least some of God's creation through the gifts He has given us.
5) **God was free to create as he wished. We are limited and fallen people.** Therefore, our preconceptions about how the world should work may not be the same as God’s. We must use observations and experiments to learn what God actually did.
6) **Nature is God's creation, so it has value and is worth studying.**

A biblical view of God and the natural world motivates the six philosophical beliefs listed earlier. A biblical view of God and nature offers us reasons to expect the scientific method to be successful. God can still supersede his ordinary governance via natural laws, but this only happens in exceptional circumstances when God has extraordinary reasons for doing something unexpected. Most of the time, God — the God described, praised, and worshipped in the Bible — works in consistent ways.

We should not claim that biblical beliefs about nature caused the scientific revolution. Historians and philosophers of science are still debating which ideological, social, political,
historical, and other factors were most important in bringing about the scientific revolution. Nor should we claim that biblical beliefs compel one to adopt the scientific method. It's not that simple. Scholars are still debating which theological beliefs helped and which hindered the development of modern science. Neither atheists nor Christians should claim to "own" the scientific method.

Clearly, however, the practice of science does not require one to act "as if God does not exist." The claim that science is methodologically naturalistic is misleading. It implies that philosophical naturalism has some sort of ownership of the scientific method, or that the scientific method follows more naturally from philosophical naturalism than from other worldviews. It does not.13

No single philosophical or religious worldview can claim primacy over the scientific method. The philosophical beliefs necessary to do science (such as the six listed above) are fairly limited. They are compatible with many (though not all) religious worldviews. People of different worldviews may disagree about why those philosophical beliefs are true. Atheists and Christians, for example, will give very different answers as to why those philosophical beliefs are true. However, by agreeing that they are, in fact, true, scientists of a wide variety of religious worldviews can work side-by-side and reach consensus on scientific questions..

When a Christian employs the scientific method to investigate nature, a biblical understanding of God and nature motivates her belief that she is using the right method. She is not acting "as if God doesn't exist." She is acting like there is a God—not a capricious God, but the God of the Bible, who made an orderly world and who still governs it in an orderly fashion.

**Overlapping areas of science: theoretical, experimental, observational and historical**

Scientific investigations take many forms. Investigations can be experimental or theoretical, interactive or observational, predictive or retrodictive. It is worth taking a little time to consider how different branches of science, and different styles of scientific investigation, mutually reinforce and correct each other. There are many possible ways to separate science into categories. Since this book is concerned with topics of cosmology, geology and evolutionary biology, I find it helpful to separate scientific activity into these four overlapping areas: theoretical, experimental, observational and historical.

"Experimental science" refers to empirical work, typically done in a laboratory, where an object or a system is studied in relative isolation from its environment. Various tools are used to probe the system, to act upon the system and measure how it reacts. These measurements are (ideally) reproducible. Examples of experimental science would include most modern branches of physics, chemistry and molecular biology, plus some other areas of biology.

"Theoretical science" works with experimental science to build empirical models and to postulate the form of natural laws. These theoretical models and laws are descriptions and generalizations of experimental results. They help scientists make predictions for the results of new experiments and observations.
"Observational science" is done on systems where we can observe behavior, but which cannot be isolated in a laboratory. Few if any tools exist to probe the system and measure how it responds. Experiments are very limited; for the most part we must rely on data which comes to us as the system behaves in ways beyond our control. Examples of observational science include astrophysics, ecology, many areas of geology, and many areas of organismal and developmental biology. Observational science attempts to describe and model the observed behavior of the system using known natural mechanisms and laws. Experimental science provides observational science with improved understanding of natural mechanisms and laws, so that improved models can be constructed. Information also flows the other way. Frequently, observational science makes theoretical contributions which are only later supported by experiments in the lab.

"Historical science" is an extension of observational science. It attempts to reconstruct the physical history of a system by assuming, wherever possible, the regular and continuous operation over time of natural laws. Examples include cosmology, some areas of geology, paleontology and evolutionary biology.

These areas of science overlap. Experimental and observational science blend into each other as the system under study becomes more complex and less controllable. Observational and historical science blend into each other because any study of the present behavior of a system necessarily depends upon inferences about its history, and vice versa. Experimental and historical science are often directly linked. Cosmologists reconstructing the history of stars and galaxies rely on experimental information from particle physics. Geologists perform experiments on rocks to determine their composition. Evolutionary biologists use genetic information gained in the lab. These different styles of scientific investigation reinforce and correct each other. Advances in experimental or observational science allow historical science to make increasingly detailed and predictive models. Historical science often makes theoretical contributions and predictions which are later supported by observation and experiment. By pursuing all of these areas at once, following leads from one branch of science to another, the scientific community makes progress — constructing increasingly accurate scientific explanations of the properties, processes and developmental history of the natural world.

Miracles
The Bible teaches that God is sovereign over natural events, events which we can now describe scientifically. The Bible also talks about miracles. If we remember that God is equally sovereign over natural and supernatural events, we can stop worrying that science threatens the idea of miracles.

The word "miracle" has a number of meanings. It does not automatically imply a violation of natural cause-and-effect. Many miracles in scripture are given cause-and-effect explanations, or such explanations are at least consistent with the written account. However, when the idea of "miracle" is discussed in a science-and-religion context, usually people are thinking of an event which includes a supernatural break in ordinary chains of cause-and-effect.

If natural laws are the way God normally oversees his creation, then God can supersede that ordinary governance in special instances for a good reason. Human beings sometimes behave in
unexpected ways for good reasons. You might know a friend very well, know how he typically behaves, know his habits to the point where you can accurately predict how he will act in most situations. Then one day, he does something totally unexpected. But if you investigate why he did something different that day, you'll find out that there were special circumstances — circumstances which you originally didn't understand. Given those special circumstances, you now understand that he actually had good reasons for doing that surprising thing on that particular day — reasons which are completely consistent with his character. In the Bible, that's often how miracles are depicted. God did something dramatically different, something unexpected based upon how God ordinarily governs creation, but entirely appropriate considering the special circumstances, and accompanied by a verbal explanation of what God was doing and why he was doing it.15

Science is an excellent tool for discovering the ordinary patterns of behavior of nature. Science is a poor tool for understanding the spiritual significance of an unexpected event. When the unexpected happens, or is reported to happen, the most that science can say is that the unexpected event was highly improbable or impossible given our current understanding of natural laws. But natural laws do not constrain God. It is God the Creator who constrains natural laws, not the other way around.16

Science and supernatural explanations
Given that God can supersede the ordinary operation of natural laws, how should we do science? Should we do science expecting to find, everywhere we look, evidence of such breaks in the natural chain of cause-and-effect? Or should we utterly exclude the possibility of such breaks when we study creation, always looking for explanations exclusively in terms of natural laws? A biblically informed view of God should warn us against either extreme. Ordinarily, God governs his creation in consistent ways. God's consistency gives us hope and confidence in our search for universal natural laws and applying those laws to most situations. But God is sovereign over those laws. God can also surprise us with unusual, unexpected events.

Is it possible to scientifically prove that God superseded natural laws in a particular event? Or does science rule out any possibility of such things? A practical understanding of what science can and cannot do should warn us against either extreme. Scientists seek to understand puzzling events and puzzling processes. When faced with a particular puzzling event, science can neither prove nor disprove that natural laws were superseded. What can science do? Science tries to build a quantitative, empirical model of the event using its understanding of natural laws plus information about the physical conditions before, during, and after the event.

Attempts to build empirical models meet with varying degrees of success. As scientists study these puzzling events, they could reach three general types of conclusions:

1) **Explainable event.** Good empirical models predict that known natural laws can explain the event.17,18 (There might still be some puzzling features, but most of the event is well understood.)

2) **Partially explainable event.** Our empirical models are not sufficiently thorough to explain the event entirely. However, based upon what we have done
so far, we believe that known natural mechanisms are sufficient to account for the event. We believe that future improvements in knowledge, more elegant models, and more computing power will eventually allow us to prove that the event is "explainable."

3) Unexplainable event. No known natural laws can explain this event. In fact, there are good, empirical reasons for ruling out any model which relies on known natural laws.\textsuperscript{19}

Scientists don't always agree. For any particular event, there may be some debates in the scientific community as to whether it is explainable, partially explainable, or unexplainable. Yet even when there are debates, the great majority of scientists usually do agree. For example, most scientists would agree that supernovas are "explainable" events. Most would agree that the development of animals from single-celled zygotes into mature adults falls into the category of "partially explainable." A small number scientists argue that the origin of first life on earth is unexplainable in terms of known natural laws; most scientists argue that it should be considered partially explainable. Most agree that the source of the "Big Bang" is unexplainable in terms of known natural laws.\textsuperscript{20}

How do scientists deal with "unexplainable" events? Usually there is no consensus. Individual scientists could reach (at least) five different conclusions about the cause of a scientifically unexplainable event:

A) An as-yet \textbf{unknown natural law} is responsible for the event.
B) A \textbf{supernatural} event occurred. (The event was caused by an intelligent being of an entirely different reality than our universe.)
C) \textbf{Super-human technology} brought about the event. (The event was caused by intelligent beings who are contained in and limited by our universe, but with superior technology.)
D) A very \textbf{improbable} event simply happened.
E) A very improbable event simply happened, but this isn't so surprising because there are \textbf{many universes} and we just happen to live in the one where it happened.

A search through popular books and articles written by scientists will turn up examples of each of these five types of conclusions.

Although these five conclusions are very different from each other philosophically and religiously, they play virtually identical roles in \textbf{scientific} studies. Empirical science cannot distinguish between these five possibilities. Each scientist will reach a conclusion based in part upon philosophical, historical and religious arguments.

Although science cannot decide on the best philosophical/religious conclusion for a scientifically unexplainable event, science does play a vital role in deciding whether an event belongs in the category "partially explainable" or "unexplainable." Philosophical and religious arguments can also properly play some role in these debates. In the boundary areas between "partially explainable" and "unexplainable" events, scientific data, scientific intuition, philosophical and
religious expectations can meet in the same arena. For example, an atheistic scientist might be motivated by her worldview to work hard to push an "unexplainable" event into the "explainable" or "partially explainable" category. This effort might lead her to uncover new natural laws sooner than scientists who don't share her worldview. Alternatively, a scientist might have strong religious reasons for believing that certain events are supernatural, and therefore be motivated to marshal scientific data to show that some events are truly "unexplainable." This effort might lead her to uncover flaws in currently-accepted empirical models sooner than scientists who don't share her religious beliefs.\textsuperscript{21,22}

Scientific conclusions are tentative. Events which today are deemed "explainable" or "unexplainable" could change their status tomorrow with the discovery of new natural laws or better empirical models. Ultimately, the development of new empirical models plays a decisive role in determining whether a "partially explainable" event is "explainable" (if the improved empirical models are successful) or "unexplainable" (if the improved empirical models argue convincingly against scenarios involving known natural laws). While these new empirical models are still being developed, philosophical and religious arguments can sometimes play a legitimate role in persuasion and inspiring testable hypotheses.

In the following chapters of this book, there are many examples of science attempting, over the years, to construct ever-better empirical models of partially explainable events. In many cases (e.g. supernovas), decades of scientific work have resulted in fairly complete and detailed explanations in terms of known natural laws. Occasionally science has come to the opposite conclusion — that although some event definitely happened, no known natural laws can account for it (e.g. the cause of the "Big Bang.") Most of the time, modern science gives us incomplete answers. Most of the time, scientific investigation tells us that some aspects of an event can be understood in terms of known natural laws while other aspects are still puzzling — puzzling, but showing great promise for future discoveries.

**The energy source of the sun — an historical example**

By the late 1800's, most geologists had come to a consensus that the earth appeared to be hundreds of millions or billions of years old. This posed a problem for astrophysicists. Astrophysicists could measure the rate at which the sun was emitting energy. The only natural mechanisms known at the time which could produce the sun's energy was gravitational compression. (As the sun compresses under its own gravitation attraction, it heats up.) Astrophysicists' calculations showed that gravitational compression could not go on for millions of years. Given the rate at which the sun was emitting energy, assuming that the source of energy was gravitational compression, the sun could not be more than a few hundred-thousand years old. What was the solution to this scientific puzzle? How could the earth appear thousands of times older than the sun? Did the astrophysicists get their calculations wrong? Did the geologists get their measurements wrong? Was God miraculously sustaining the sun's energy output? Or was some as-yet unknown natural mechanism providing the sun's energy?

In this case, that last hypothesis was the correct one. Nuclear fusion — a new natural mechanism — was discovered in the early 1900's. It was shown conclusively to be the source of the sun's energy. This new natural mechanism brought astrophysicists' calculations of the sun's
age in line with the geologist's calculations of the earth's age. In addition, the discovery of nuclear processes lead to the discovery of radioactive dating, which independently confirmed and refined the geologist's earlier calculations.

**Newton and Laplace — another historical example**

Isaac Newton's discovery of the Law of Universal Gravitation was one of the greatest scientific achievements in history. By combining his theories with the experimental data gather by other scientists such as Johannes Kepler, Newton showed that the motion of planets going around the sun, moons orbiting around planets, and objects falling near the earth's surface were described by the same simple, universal laws. Newton believed that the Law of Universal Gravitational Attraction was evidence for God's design.

While Newton's equations are simple to write down, their solution is not always simple. It's easy to solve Newton's equations when there are only two objects (e.g. the sun and a single planet) gravitationally attracted to each other. They will orbit each other indefinitely in stable and predictable orbits. But as soon as you have three or more mutually interacting objects, it's almost always impossible to exactly solve Newton's equations. You have to approximate. It becomes difficult to calculate whether or not the planets' orbits will be stable indefinitely. When there are three or more objects, it is possible that their mutual interactions will cause one or more of the orbits to become unstable. Our solar system has one sun, nine planets, plus many moons and smaller objects, all interacting with each other. Are the orbits of all of the planets in our solar system stable over long periods of time, or does their mutual interaction make them unstable?

Newton struggled with this question for some time. He could not come to a definite conclusion, but he eventually came to believe that planetary orbits in our solar system were, in fact, unstable. Each time one planet's orbit brought it close to another planet, they would perturb each others' orbits around the sun. Newton thought that after a few hundred or thousand years of these perturbations, some of the orbits would become unstable.

How did Newton get around this problem? Newton proposed that God occasionally (every few decades or centuries) sent a comet through the solar system — a comet with just the right mass and just the right trajectory so that its gravitational attraction would "correct" the planetary orbits and keep them stable for another several centuries.

A generation after Newton, Pierre de Laplace built on Newton's work. He found better approximate solutions to Newton's equations. Laplace was able to prove that planetary orbits in our solar system really are stable for much, much longer periods of time — stable without the need for God to perform the occasional correction.

When Laplace presented his book on Celestial Mechanics to the Emperor Napoleon, it is said that Napoleon asked, "Monsieur Laplace, why wasn't the Creator mentioned in your book on Celestial Mechanics?" To which Laplace is said to have replied, "Sir, I have no need for that hypothesis."
Laplace's cryptic statement has been interpreted in a variety of ways over the centuries. Perhaps he meant, "I don't need God at all." However, Laplace was a Roman Catholic, so that's probably not what he meant. Or perhaps he meant, "I'm a better scientist than Newton." He may have been pointing out that, whereas Newton needed God to send comets through the solar system to keep things stable, he had done a better scientific job and proved that such comets weren't necessary. Or perhaps he meant something philosophically provocative, such as, "We don't need God governing planetary motion now that we have a scientific explanation (the law of gravity) for it." If that is what Laplace meant, then he would agree with the modern (but unbiblical) notion that God is uninvolved in events which have scientific explanations. Or perhaps Laplace meant something philosophically very tame, such as, "We don't need to refer explicitly to 'acts of God' when calculating planetary motion."

Whatever Laplace meant, this incident raises some interesting questions. Suppose Laplace's results had come out differently. Suppose Newton's hunch had been correct. Suppose God made the solar system in such a way that planetary orbits really are unstable, requiring a careful "correction" every few centuries. Would Christians consider that a good thing, or a bad thing? Suppose you were alive in the time after Newton's work and before Laplace's. Suppose you were aware that the stability of planetary orbits was an unsolved scientific puzzle. Which way would you hope it would turn out? Would you hope that scientific advances would ultimately prove that planetary orbits were stable, or unstable?

The traditional answer of Christian theology is that God could have created the solar system however He wished. We are in no position to tell God which way is better or worse. Yet if we're honest with ourselves, most of us would have to admit to having a personal preference. Planetary orbits which remain stable indefinitely looks like good design. Planetary orbits which become unstable every few centuries seems, to some people, like inferior design. On the other hand, the timely arrival of comets with exactly the right mass and trajectory to correct those orbits would give a powerful argument for God's existence and providential intervention.

The issue of planetary orbits has been settled. Laplace was correct; their orbits are stable over very long periods of time. Many more scientific issues are not yet settled. As we study cosmology, geology and biology today, we are confronted with new scientific puzzles. How did the solar system form? How rare is the planet Earth as a suitable home for life? How did life begin on earth? How did modern life forms come into existence? As we examine the scientific data brought to bear on these questions, and as we ponder the theological implications of their answers, we should be honest with ourselves. We come to these questions with our own biases, with our hopes for how the question will ultimately be answered. We don't even all agree on what those biases should be. Perhaps the best was to minimize the impact our biases is, first of all, to be aware that we have them, and secondly to remember this biblical teaching: God is just as sovereign over natural laws and natural processes as over he is sovereign over miraculous breaks in natural processes.

**Scientific progress**

Scientists make progress by building empirical models, looking for natural laws and natural mechanisms to explain as many aspects as possible of the system they are studying. Scientists
seek to determine precisely which aspects of a system can be explained in terms of known natural mechanisms and which aspects cannot. By this process, new natural mechanisms are sometimes discovered; old models are refined and sometimes discarded as being inconsistent with the data.

In this way, Newton and Laplace advanced our understanding of planetary motion. They successfully built a model, in terms known natural mechanisms, which explained and predicted to high accuracy the behavior of orbiting planets. Their success did not diminish God's governance of creation; rather, their success gave us insight into the intelligibility of God's creation and the wisdom of his governance.

In the centuries since Newton and Laplace, a great deal of scientific progress has been made in this way — progress in measurement science, in observational science, and in historical science — progress in understanding the developmental history and the orderly functioning of creation in terms of the natural laws which God created and sustains. As a scientist and as a Christian, I personally see each new scientific puzzle solved as a cause for renewed amazement and thankfulness to the Creator.

**Scientific puzzles and divine intervention**

A great many scientific puzzles remain. There are many scientific questions (e.g. the development of the first life on earth) where scientists cannot yet build a model, using known natural mechanisms, which plausibly explains the data. It can be tempting for Christians to see these scientific puzzles as potential evidence for God's existence and non-ordinary action in the history of the universe. God is free to supersede his ordinary governance of creation. If God so choose, God could perform events which appear to us as scientifically puzzling or unexplainable events. However, a biblical understanding of God's governance should also warn us from too quickly embracing any particular scientific puzzle as evidence of such.

Consider a hypothetical example in "experimental science." Suppose a scientist claimed that a particular laboratory effect — for example, a five percent alteration in the electrical resistance of a sample — was evidence of God superseding natural laws. I doubt if any Christians would rush to embrace this scientist's claim. No matter how thoroughly and convincingly that scientist accounted for the all the known natural mechanisms affecting the sample, we would still believe that he had made a mistake, or perhaps we would believe that some as-yet-undiscovered natural mechanism was at work causing the resistance change. Why? Theologically, we do not expect that God would perform such "miracles" in the lab. Such behavior seems out of character for the God of the Bible. Experientially we note that, in the past, scientific puzzles such as the one just described often have lead to new understandings of natural mechanisms.

Even if that scientist could demonstrate to us that the five percent alteration in resistance occurred whenever he said a certain prayer, we would still be skeptical that it was evidence of a supernatural break in natural laws. We might believe that an intelligent agent was involved in producing the resistance change, but we would strongly suspect this agent was the scientist herself or else an accomplice. Theologically, we do not expect God to perform miracles on
demand in the laboratory. Experientially, we note that charlatans exist both inside and outside the scientific community.

In "observational science" as well, we do not rush to embrace every scientific puzzle as evidence for God's supernatural activity. There is still a great deal we do not understand about how animals grow from single-celled zygotes into adults, or how whales navigate as they migrate (to name just two puzzles among many). We expect that they will become scientifically more and more explainable as we learn more about these systems. We investigate these systems scientifically with an expectation — not an assurance, but an expectation — that God probably governs growing animals and navigating whales, day by day, through the regular and continuous operation of the natural laws he created and sustains. We have this expectation because of God's biblical revelation of his character, and because of our past experiences of learning how God typically governs his creation.

Our experience as scientists and as Christians, combined with God's revelation, leads us to believe that God usually governs his creation through the regular operation of his natural laws — not only within the past few centuries since Newton, but throughout history; not just locally on earth, but throughout the distant universe. This gives us a good reason for doing "historical science." Using the results of experimental science and observational science, we attempt to reconstruct the history of the universe, the planet earth and life on earth, assuming whenever possible that God used the regular operation of the same natural laws which we see at work in his present-day governance. We do not know for certain how this project will turn out. It might lead us to the discovery that many scientifically "unexplainable" events happened throughout history. Or it might not.

Historical science has greatly advanced since the time of Newton and Laplace. For example, we now have an excellent scientific understanding of how atoms like carbon and iron and uranium have formed and accumulated over billions of years, through nuclear processes in stars and supernovas. When historical science is successful — constructing a model which is internally consistent, theoretically sound, comprehensive in its ability to explain observations, fruitful in guiding research and capable of making detailed predictions — we have a very strong reason for believing that the historical picture given to us by the model is, in fact, an accurate picture of what actually happened. When historical science is successful, we have strong reasons for believing that God chose to govern that part of his creation through the regular operation of natural laws.

Just as with experimental science and observational science, however, many puzzles remain in historical science. God's supernatural activity in the history of a particular system might be detectable, if God so chose. For example, God might have chosen to create the laws of chemistry and biology so that it was impossible for life to arise on earth without God miraculously superseding those laws. If that is what God did, then scientific research into the origins of life should eventually come to the consensus that the formation of first life on earth is scientifically "unexplainable" in terms of natural laws. However, just because scientists today do not have a detailed scientific model for the formation of first life, that does not mean that Christians ought to embrace it as potential evidence for a miracle. Just as in the hypothetical example of the resistance change in the lab, we ought to consider several scientific, theological,
and experiential factors. How much scientific progress has already been made on the question of first life? What are the prospects for future scientific breakthroughs in this area? In this particular instance, do we or do we not have strong theological reasons for expecting that God acted either via natural laws or via superseding them?

**Summary**

A biblical picture of God and nature assures us that God governs creation in consistent and orderly ways. God gives us the gifts we need to study his creation and partially understand it. Scientists of many religious worldviews can work side-by-side and reach consensus about the natural mechanisms at work in the history and the present functioning of the world. The fact that Christians and non-Christians can work side-by-side in science should give Christians, not a sense of fear, but a sense of joy and gratitude. As theologian and reformer John Calvin said, "If the Lord has willed that we be helped in physics, dialectic, mathematics, and other like disciplines, by the work and ministry of the ungodly, let us use this assistance. For if we neglect God's gift freely offered in these arts, we ought to suffer just punishment for our sloth." 23

Scientific progress is made by studying puzzling events and attempting to explain them in terms of known natural laws (or sometimes, in terms of new natural laws which are compatible with older, well-established laws). When science succeeds, its success does not exclude God. Instead, it illuminates God's governance of creation. When science fails to explain an event in terms of known natural laws, it might indicate that God superseded natural laws during that event — but not necessarily. It might also mean that God brought about that event by some unknown natural laws or processes which we might yet discover.

It is tempting to think that we are more faithful to God if we look for evidence of miracles in every scientific puzzle. But hunting for "God's fingerprints" is not necessarily the most faithful approach to study God's creation. Hunting for new scientific explanations, in terms of natural laws which God created and sustains, can be equally God-glorifying — and in many cases may be theologically more defensible. Every time we solve a new scientific puzzle, we are not taking territory away from God's control; rather, we are learning more about how God typically governs his creation. Every time we learn a new scientific truth about God's creation and the gifts which He gave it, it should prompt us all the more to worship the Creator.

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1 Matthew 10:29


4 Psalm 104:19-24, *New International Version*

6 There are at least two different ways for understanding the status of natural laws, both of which are within the tradition of Christian orthodoxy. One view: God proscriptively determines the activity of all material objects from moment to moment. Natural laws are formulas which merely describe the regularity with which God normally acts. Breaks in "natural laws" are instances where God acts, for particular reasons, in ways which are contrary to, or at least extremely improbable from the standpoint of, the regular patterns of God's governance. Breaks in natural laws are not a fundamentally different type of God's activity, but rather instances where God, because of special circumstances, proscribes activity which is (from our perspective). A second view: God has gifted his creation and everything in it with certain creaturely capacities. These capacities are designed to interact with each other in regular fashions which we call natural laws. They do not operate independently of God, but are dependent upon God for their creation, design, and continued existence. God can interact with his creation through these creaturely capacities within the uncertainty and flexibility of the system (*e.g.* flexibility evident in quantum and/or "chaotic" systems). God can also interact with his creation through acts of radical reorganization. Some miracles are breaks in natural laws (or very improbable workings through natural laws) which have special personal and/or spiritual significance. Both of these views have proponents amongst Christian scientists. It is worth being aware of both of these views; however, for the purposes of this chapter and this book, it is not worth debating their differences and relative merits.


10 Some Christian writers, such as Donald MacKay, have proposed that God might select the outcome of *every* apparently random event (*e.g.* every quantum mechanical measurement).

11 The terms "methodological naturalism" and "methodological atheism" do not always mean the same thing. Sometimes the term "naturalism" simply refers to a systematic study of nature. Other times, the term "naturalism" refers to a philosophical belief that supernatural entities do not exist. In debates about biological evolution, the terms "methodological naturalism" and "methodological atheism" are often used interchangeably, both of them referring to the practice of acting as if supernatural entities do not exist (or at least have no influence on material entities).


13 With the success of modern science, it is tempting to think that atheism naturally and necessarily leads to the philosophical beliefs listed above. Not so. Those beliefs follow
naturally from an atheism which it is wedded to a *mechanistic* picture of nature. A mechanistic picture of nature, however, was not a common picture of nature before the rise of modern science. A mechanistic picture of nature is motivated by the success of science. Although some atheists had such a view of nature before the scientific revolution, it is hardly the case that an atheistic worldview, by itself, necessarily leads to such a view.

14 In the Bible, miracles are performed in contexts where the spiritual message should have been clear to the observers. Miracles can be ordinary events with extraordinary timing. (e.g. the famine which began and ended with the prophet Elijah's proclamations) Such miracles are not scientifically impossible or even improbable, but the timing was specially arranged by God and accompanied by a spoken revelation explaining the spiritual significance of the event. Miracles can also be highly improbable events with special timing (e.g. some miraculous cures of illnesses). Such miracles were not scientifically impossible, but they were improbable. Miracles can also be events which simply defy explanation on the basis of natural laws. (e.g. Jesus' resurrection and post-resurrection appearances)

15 This doesn't mean that every event in the Bible described as a miracle was a violation of natural laws; some of them appear to have been scientifically explainable events with extraordinary timing.


17 It is worth mentioning again the biblical view that scientifically explainable events are just as much dependent upon God's governance as unexplainable events. In addition, even when empirical models successfully explain how an event *could* happen, that does not necessarily mean that the model correctly describes how the event *actually* happened.

18 Sometimes, scientifically explainable events occur at special times and places, in ways that have special religious significance to a person or a group of people. The argument can be made that such *coincidental* events must have some unexplainable (supernatural) component. Science cannot answer that question positively or negatively. The most that science can do is attempt to determine the relative probability (infrequency) of the event, possibly taking into account known initial conditions. In determining whether or not a coincidental event had a special supernatural component, one must go beyond science to consider historical, philosophical, and religious questions. (e.g. Was the event's timing and location predicted beforehand? How soundly does the event fit within an established theological framework? Was there a special revelation accompanying the event?)
Some objects or events indicate intelligent crafting. The categories "explainable" and "unexplainable" become problematic in such cases. For example, a paleontologist might determine that the breakage patterns on the edges of some stones are unexplainable (or highly improbable) in terms of ordinary natural laws. However, if hominid bones are found in the same area, the paleontologist might reasonably conclude that the stones were crafted by hominids to be tools. In this model, the intelligent activity of hominids acts as a special kind of natural mechanism. A similar argument is made in the search for extraterrestrial intelligence. If a sufficiently complex repeating radio signal is discovered, the case can be made that no natural mechanism could produce the complex pattern except for the special type of natural mechanism of intelligent activity. In the debate over biological evolution, some people have pointed to the analogous features between biological life and intelligently crafted objects, thereby arguing that biological life was crafted and assembled by an intelligent agent. This argument is not strictly speaking scientific. It is a philosophical argument. Philosophical arguments have a legitimate role, and sometimes a positive role, in science. They can be used to persuade and as a starting point for marshaling scientific arguments and formulating testable hypotheses. The extent to which this philosophical argument is convincing is, obviously, a point of ongoing debate.

There are some speculative theories for "natural" events which could have caused the Big Bang. These theories rely not on known natural laws, but on hypothesized natural laws which have some physical and mathematical analogies with known natural laws.

Both of these biases could be pushed to the extreme, to the detriment of science. One could imagine a scientific community so obsessed with finding naturalistic explanations for unexplainable events that it wastes vast resources on unproductive pursuits which yield no secondary benefits. One could also imagine a scientific community so complacent about supernatural explanations (or, for that matter, super-human or many-universes explanations) that it makes virtually no effort to search for new natural explanations for puzzling events. Fortunately, the present-day scientific community does not seem to fit either extreme. Moreover, it should be noted that scientists from every philosophical and religious persuasion spend most of their time trying to push events from the "partially explainable" category into the "explainable" category.

We should also note that — in addition to disagreeing about whether an event is explainable, partially explainable, or unexplainable — people can also disagree over whether or not a particular event actually happened. For example, if everyone agreed that Jesus' resurrection actually happened, then (almost) everyone would agree that the event was unexplainable by known natural laws. Science cannot determine whether or not the disputed event actually happened; historical and philosophical arguments must be used in that decision. Since the event itself is questioned, the debate must often shift to other events which are generally agreed upon (e.g. the written records and the subsequent behavior of Jesus' followers). Scientific intuition, as well as historical and philosophical arguments, are then brought forward in the debate over whether these agreed-upon secondary events are also truly unexplainable, or merely partially explainable.
