CHAPTER 1

GOD, RELIGION, AND SCIENCE

A *Family Circus* cartoon shows a young girl, Dolly, asking her father, "If we send astronauts to Mars, do they hafta drive past Heaven?" While this may strike us as funny, it illustrates the double world in which many of us live. Few educated adults would ask such a seemingly simplistic question. Yet many people live in a bifurcated world in which they have accepted the results of science and presume the reasonable world of scientific endeavor, but, when it comes to thinking about God, their worldview may still be somewhat childish, antiquated, or rudimentary. In the scientific world everything is open to question and results are only as valid as the evidence that supports them. With regard to God, however, both believers and nonbelievers often assume that religious issues can only be settled by reverting to a kind of mythic fideism, belief held in contradiction to reason.

The relationship between science and religion has been long, complex, and at times quite conflictual. While everyone knows about the conflict between the scientist Galileo and the Catholic Church of his day, few know that the Vatican now runs its own observatory and there are priests and ministers with international standing in the scientific community. It remains a commonplace in our media to present science and religion as opposed, a position promoted by those on both sides of the issues. There are scientists who love to portray religion as based on superstition and ignorance; and there are believers who cling to fundamentalist readings of Scripture, particularly of Genesis, and so reject modern scientific theories such as evolution. Then there is the broader public caught in the middle, those who appreciate the technological progress made by scientific advances and may in fact seek to maintain some form of

religious commitment, but are caught in the pull and counterpull of a debate that they struggle to get a proper handle on.

It is to this middle ground that we direct this book. While it will engage with various aspects of the current debate on science and religion, it is unlikely to convert the scientist who insists that science has disposed of God. Nor will it shift a fundamentalist who wants to maintain that the opening chapters of Genesis provide us with an empirical account of what happened in the first six days of creation. Our task is a more constructive one, of providing a genuine alternative to a number of current approaches to questions around God, creation, and evolution. While we will illustrate our approach with examples from contemporary scientific theories, at the heart of this constructive approach is an intellectual tradition that draws on the best of Christian theology and philosophy.

Central to this tradition is an understanding of God as the transcendent cause of the created order. This position, which contemporary theologians increasingly question, nonetheless provides an account of the relationship between God and creation that is best suited to current scientific understandings of the cosmos; at least that is what we shall argue. Before we get there, however, we shall review elements of the history of the relationship between science and religion to highlight the major themes that we shall need to address.

THE EMERGENCE OF MODERN SCIENCE

Human beings have puzzled over the night sky perhaps from the dawn of human history. What are these lights in the sky? Why do they appear to be in such fixed patterns? What are those lights that wander through the otherwise fixed patterns, those "planets" or wanderers of the night sky? What about the sun and the moon? How can we make sense of these phenomena? These were not idle questions for societies that needed to know the timing of the spring and fall equinox and the winter and summer solstices. These events also had a religious significance in many societies. At least here primitive science and religion had a common interest.

The first serious attempt to respond to such questions was the system devised by the Greek thinker Ptolemy (83–161 CE), which placed the earth at the center of the cosmos, with the sun, moon, planets, and stars rotating

around the earth in circular orbits. Of course, it was difficult to fit this model with the actual observations of the planets, in particular, so the model was refined over time to include variations called epicycles to account for the rather odd behavior of the planets. Nonetheless, despite these ad hoc elements, it remained the dominant understanding of the cosmos (in the West) until about the sixteenth century. The first major assault on the Ptolemaic system came from Nicholas Copernicus (1473–1543), who proposed a system whereby the earth and other planets orbited the sun (the heliocentric model).[1] Copernicus maintained the notion of circular orbits around the sun, but to do so required even more epicycles than the Ptolemaic system to match the data. Inspired by new philosophical emphases on empirical observation, the Danish astronomer Tycho Brahe (1546–1601) gathered enormous amounts of precise empirical data on the movements of the planets. Noting the difficulties in fitting this data to the Ptolemaic system, Brahe developed a more complex system in which the sun orbits the earth, while the planets orbit the sun. His assistant, Johannes Kepler (1571–1630), pushed this further to suggest that in fact the sun was central with the earth and planets in orbit around it. Drawing on the empirical data that Brahe produced, Kepler derived a number of laws of planetary motion. Among other things, these specified that the orbits were not perfect circles, as Copernicus had suggested, but ellipses. These were remarkable conclusions to draw from the empirical data and required painstaking calculations. Galileo (1564–1642) added to the picture with empirical observation from more powerful telescopes, providing further evidence of the heliocentric model. In his observations of the planet Jupiter and the discovery of its moons he found a model in miniature of the solar system as a whole.

It was not the intention of these men to provoke a conflict between science and religion. Each grew up in cultures where religious belief was taken for granted. But the religious world of the time was strongly tied to a Ptolemaic cosmology. Indeed, even we moderns need reminding at times that the earth is not the center of the universe. This Ptolemaic model was roughly congruent with biblical cosmology and was entrenched in a certain metaphysical view of the world.[2] Disentangling these religious, scientific, and metaphysical questions was never going to be easy, nor is it necessarily any easier today, as we shall see. The conflict was perhaps as inevitable as it was regrettable, and came to a head most famously in the clash between Galileo and the Catholic Church.

This conflict, however, did little to slow the march of science, with the decisive breakthrough emerging in the work of Isaac Newton (1643–1727). Newton supplied what those prior to him lacked, a new mathematics equal to the task: calculus. With his three laws of motion, including the law of universal gravitation, and his newly invented mathematics, Newton was able to derive the elliptical orbits of the planets and Kepler's other laws.[3] The heliocentric model was now not just a matter of observation; it fit within a mathematical and scientific framework that had explanatory power. This marriage of empirical observation and mathematical formulation was the decisive breakthrough that has become central to our modern conception of science. Newton set the benchmark for all future development in science.

NEWTON AND GOD

Of course, Newton saw no conflict between science and religion. He was a deeply religious person, though of unorthodox persuasion.[4] When he wrote his most famous work, the *Principia mathematica*, he conceived of it as a work that would contribute to natural theology, that is, a philosophical argument for the existence of God: "The most beautiful system of the sun, planets, and comets, could only proceed from the counsel and domination of an intelligent and powerful Being. . . . This divine Being governs all things, not as the soul of the world, but as Lord over all . . . the true God is a living, intelligent and powerful being."[5] The wonders of the cosmos, revealed through scientific discovery, would lead people to acknowledge the existence of God. It is a strategy some would like to promote today. However, Newton had another, more practical reason to evoke God. His account of the solar system had a major difficulty, one that he felt could be solved only by invoking God's action.

When we consider the movement of two objects under Newton's laws of motion, such as the sun and the earth, then an application of the calculus can demonstrate that the orbit will follow an elliptical path, as Kepler had calculated empirically. If you have three or more bodies, however, the problem is more complex. Then each body attracts every other body in some way. Where one body, the sun, is much more massive than the others, certain simplifications can be made, but the problem is still very difficult. Each of the planets perturbs the orbits of the other planets. Why is it that these perturbations

do not cause the whole thing to collapse or send the planets flying off into interstellar space? Mathematically, the problem was too hard for him to solve. Instead, he postulated intermittent divine interventions to ensure the stability of the solar system. For Newton, when a gap in scientific explanation appears, one can appeal legitimately to God's intervention. Thus, with the emergence of modern science, we witness also the emergence of the "God of the gaps" strategy.

It is important to pause here to grasp the larger significance of this move on Newton's part. An earlier Christian tradition spoke in terms of primary and secondary causes. God is the primary cause of everything, but God acts through secondary causes (which we might think of here as "laws of nature"). While the tradition allowed for certain special divine interventions in the form of miracles, these were extraordinary events. By evoking God to resolve the difficulties of the stability of the solar system, Newton was also evoking God as a secondary cause whose regular divine interventions are needed to keep the whole system stable. God was now the explanation, not just of the whole, but of certain parts of the whole. It was a strategy fraught with difficulties.

These difficulties emerged with the work of French mathematician and physicist Pierre-Simon Laplace (1749–1827), sometimes referred to as the French Newton. With more refined mathematical analyses, Laplace made some progress on the issue of the stability of the solar system. His results were published in his *Mécanique Céleste,* a work that took Newton's achievements to a new level. Laplace presented a copy of his work to Napoleon Bonaparte (himself something of an amateur mathematician), who commented that the work contained no mention of God. Laplace responded, "I have no need of that hypothesis."

Of course, the problem of the stability of the solar system is far more difficult than Newton or Laplace could imagine. Another great French mathematician, Jules Henri Poincaré (1854–1912), in fact demonstrated that the general system is mathematically unstable or chaotic. Be that as it may, the positions of Newton and Laplace set a pattern for subsequent debates on the relationship between science and religion. Is God not only a primary cause but also a secondary cause, intervening occasionally to ensure God's order in the universe? Alternately, does the advance of science render God obsolete, an unnecessary hypothesis? We can hear echoes of this in current debates over "intelligent design."[6]

THE "NEWTONIAN" WORLDVIEW AND DEISM

There was a further implication that could be drawn from Newton's success that Laplace was willing to draw. Newton's mathematical laws of motion are "deterministic" in the sense that they provide a model of causation where effect necessarily follows from its cause. There is a direct relationship: if A, then B. For Laplace this meant that if one knew the position and velocity of all the particles of the universe, then using Newton's laws one could know the past and the future with absolute certainty. We would live in a completely determined universe, which was then imagined like a huge machine, or clock, which operated according to fixed laws whose outcomes were absolutely certain. There is some irony in Laplace adopting such determinism because he was also one of the founding figures of mathematical statistics. But for Laplace such statistical methods were needed not because the universe was indeterminate, but because of the limits on our knowledge.

This deterministic "Newtonian" worldview was an interesting mix of science and philosophy with important religious consequences. On the one hand, God was thought of as a supreme watchmaker, who established the universe to operate according to its fixed and immutable laws, to produce a universe with a completely determined future known to God. God knows the future with absolute and mathematical certainty, and so sets the initial conditions of the universe to unfold exactly as the divine will wishes. God can then be viewed as the sovereign Lord of all creation. On the other hand, since the laws of physics determine the unfolding of the universe completely, there is no room left for divine intervention, miracles, or divine revelation in human history. And so we see the birth of Deism, a religious position based on reason rather than revelation, with an all-knowing God who is disallowed by the very establishment of the universe from intervening in it. Given the historical circumstances in Europe at the time, with continual conflicts between differing versions of Christianity, it was an appealing stance for many thinkers.

There is a powerful convergence here between two distinct ideas, one metaphysical, the other scientific. Christians had long held that God was all-powerful and all-knowing. If God is all-powerful, then what God wills to happen necessarily happens. This is a metaphysical position. It is all too easy, however, to marry this metaphysical stance with the determinism or mechanical necessity of the Newtonian worldview. This then becomes the great era of the "argument from design," of which religious apologists at the time were so

fond. They drew a straight line from the evidence of design in nature to the necessity of the laws of nature to the necessity of the divine will and hence the existence of God. It was a powerful mix. At the religious level, however, it was hardly a religion to warm the heart. The God of Deism is remote and uninvolved.[7] Having set the universe in motion, the God of Deism has nothing more to do or say to humanity. And the deterministic conclusions sat at odds with any notion of human free will. In the face of this rationalism, many Christians adopted an intense inner piety, not quite sure what to make of the world at large.

BEYOND THE NEWTONIAN WORLDVIEW: DARWINISM AND QUANTUM MECHANICS

To some extent the Newtonian worldview still dominates our imaginations in relation to the world. We still hanker for a world of "If A, then B." For example, it took decades for the tobacco industry to admit that smoking causes lung cancer. They would repeatedly claim that the relationship was "only" statistical. Many people who smoke do not get lung cancer, so how can it be a cause? Similar arguments arise on the relationship between pornography and sexual violence. Does pornography lead to sexual violence? Many people view pornography and do not commit acts of sexual violence. But that does not mean that there is not a statistical relationship. We have trouble recognizing and accepting this form of statistically causal relationship.

In the scientific world, however, the determinism of the Newtonian worldview suffered a major blow, not initially in the area of mechanics, but in biology. In the nineteenth century scientific interest grew in the question of life and its diversity. How do we account for the rich diversity of life forms that we find on our planet? Was that diversity there from the beginning? Then how do we account for the various similarities we find across all the variety? Different attempts were made to develop a scientific response to these questions, but the one which struck the deepest chord was that proposed by Charles Darwin (1809–1882). Following his voyages on the HMS Beagle, Darwin wrote his famous work *On the Origin of Species*, where he proposed an account of the evolution of species through species variation and natural selection. Though he himself may not have seen it, both these principles are inherently statistical in nature. Species variation will occur with a certain probability, "every

so often." Later developments in biology will refine this by a consideration of random mutations in the genetic code, something of which Darwin was unaware. There is no way of predicting when such mutations will occur or what impact they will have. Natural selection is also statistical in nature. The fittest progeny are more likely to survive and have offspring. But how likely is "more likely"? Again, a statistical analysis is required.

In terms of its impact on biology, Darwin's theory of natural selection has been as significant as Newton's laws of motion for physics. It has added to the empirical data an overarching theoretical perspective that has explanatory force. Without such an overarching perspective the science of biology would simply be data gathering, classifications, and descriptions of living things. With the theory of evolution biological scientists could begin to understand the relationships between living things. Adding modern genetics to the picture creates a powerful construct. This is not to say that it is the final word in biological science. Just as Newton's law of universal gravitation has needed to make way for Einstein's theory of general relativity, which in turn may need to make way for some future quantum theory of gravitation, so Darwin's theory may need to make way for a more refined theory that has greater explanatory force. But despite this, just as Newton's law of gravitation is good enough for most problems in celestial mechanics as a first approximation, so, too, Darwin's theory of evolution will remain a good first approximation to whatever replaces it. It is the best explanatory account we have at present.

Of course, people generally focus on the religious impact of Darwin's theory of evolution in relation to a fundamentalist reading of Genesis. Clearly the two are incompatible, but for many Christians the problem is easily resolved by moving away from a literal reading of Genesis. As far back as St. Augustine (354–430), people had recognized the problem of using the Bible to extract scientific truths and had drawn a distinction between the truths of salvation and those of science. Augustine noted that "whether heaven, like a sphere, surrounds the earth on all sides as a mass balanced in the center of the universe, or whether like a dish it merely covers and overcasts the earth" is not something that the Scriptures determine.[8] In a similar vein the *Catholic Encyclopedia*, published in the first decade of the twentieth century, could find no objection to the theory of evolution on the basis of faith: "It is in perfect agreement with the Christian conception of the universe; for Scripture does not tell us in what form the present species of plants and of animals were originally created by God."[9] What was more difficult for some was the breakdown that Darwinism

had for a Newtonian worldview with its marriage of divine omnipotence and deterministic science. If biological evolution involved chance, then God could not be involved, or at least so some concluded.[10] It is a chorus we still find in contemporary writings, such as those of scientist Richard Dawkins.[11]

Again, we find a heady mix of science, metaphysics, and religious belief. If religious belief in divine creation is equated with a deterministic worldview, then evolution is a deadly blow. If the world is not deterministic and we wish to maintain belief in God, can God still be a provident and omnipotent Creator? Faced with such a dilemma many theologians have adopted a "process" understanding of God, no longer omnipotent or supremely provident, more a benign presence influencing the universe.[12] Like Laplace's conclusion of a philosophical determinism from Newton's laws of mechanics, Darwin's original biological theory has now spilt over into a metaphysical account of the world, a total worldview in which chance rather than mechanistic determinism rules the roost. And just as Laplace's determinism found its home among both atheistic and religious thinkers, so, too, an evolutionary worldview has been embraced by both atheistic and religious thinkers. It will take some effort to untangle the various threads of this debate.

Of course, a determined determinist could still argue that the statistical elements in Darwin's theory are there only because of our incomplete knowledge. Laplace's account could still hold, assuming we could have complete knowledge of all the particles and velocities in the universe. In that case the use of a statistical method would just be a sign of our ignorance. The real challenge to such a position arises in the heart of Newton's own land, in the physics of the very small. While Newton's laws are very good at telling us about planets and cars and planes, it begins to break down when applied to very small things like electrons and protons. At that level, a different type of mechanics is needed, that is, quantum mechanics.

While there are different formulations of quantum mechanics, perhaps the best known is that of Erwin Schrödinger (1887–1961), known as Schrödinger's wave equation. One of its great achievements was its ability to give an account of the various energy levels of the electron in a hydrogen atom. Just as Newton's law provided an explanation of the elliptical orbits of the planet, so Schrödinger's equation provided an explanation of the "orbits" of electrons around the hydrogen nucleus, a problem that had remained unresolved for some time. There is a significant difference between these two achievements, however. Newton's equations allow us to explain precisely the

motion of individual particles. Now, while there are competing interpretations of quantum mechanics, one thing they all agree upon is that the wave equation cannot be used to predict the path of individual particles. What it does is provide information on an ensemble of particles. It is a statistical theory that offers probabilities about the movement and location of subatomic particles, not unlike a weatherman predicting the chances of a thunderstorm. A further consequence is that one cannot precisely measure both the position and velocity of a particle (referred to as Heisenberg's uncertainty principle, from Werner Heisenberg, 1901–1976) so that Laplace's dream of predicting the future cannot get off the ground.

There are heated debates as to whether quantum mechanics is a "complete" account. Perhaps it is possible that a more profound theory could predict the path of individual electrons, through hidden variables that control the destiny of individual particles but which themselves are statistically spread. The great physicist Albert Einstein (1879–1955) rejected the statistical interpretation of quantum mechanics and proposed such a hidden variable account.[13] More recently physicist David Bohm (1917–1992) has developed such a theory, but the debate is far from settled.[14] Certainly there is no simple way forward here, and for the working physicist the statistical account is the best working theory at hand. At present, at least, it would seem that there is an irreducibly statistical component in the way the world operates.

If this statistical component is an intrinsic element in the way the world operates, what are the implications for our understanding of God and God's relationship to the world? Must we banish God altogether or amend our version of God, as the process theologians have done? And does acknowledging such a statistical component abolish the insights of Newton into world process? What would a universe be like that operates with both classical deterministic laws such as those of Newton and statistical laws with random variations such as those of Darwin and Schrödinger?

RANDOMNESS, PURPOSE, AND ETHICS

A further complication that an admission of randomness introduces into the life of believers is the question of purpose. Returning once again to the work of Newton, one of his aims was to banish metaphysical hypotheses of purposefulness, or what an earlier scholasticism called "final causes," from scientific

explanations. Final causes are responses to the type of question that asks, "Why did this come about?" The question "Why do we have eyes?" is likely to be answered, "In order to see." That is their purpose. But this does not provide us with a scientific explanation of the origin of eyes. When the first living organisms developed a responsiveness to light, was this "in order that" we would later develop eyes? Can the final state present us with an explanation of the process of development? For Christian believers the question arises in terms of God's relationship to creation. Is there divine purpose in creation? Does God "plan" for human beings to emerge out of the processes of creation? Can we explain the process by the end point it achieves? The technical term for this issue is *teleology*.

Of course, in a Newtonian deterministic universe, purpose is written into the initial conditions of the universe. If the initial conditions determine it to be so, then life will emerge exactly as the initial conditions determine it to happen. Teleology is strongly present, because the beginning determines the end. Again, as we noted above, this approach strongly advocated arguments "by design" for the existence of God. If evolutionary theory is correct and the evolution of life is a product of random processes, however, can we still maintain that there is purpose in the process? Dawkins and others would answer "no," that evolution eliminates any sense of purpose to creation:

> Natural selection, the blind, unconscious, automatic process which Darwin discovered, and which we know is the explanation for the existence and apparently purposeful form of all life, has no purpose in mind. It has no mind and no mind's eye. It does not plan for the future. It has no vision, no foresight, no sight at all. If it can be said to play the role of a watchmaker in nature, it is the *blind* watchmaker.[15]

And without purpose in creation, why do we need a God to explain what has no explanation? Life has no larger purpose, it fits into no larger plan. Just adjust to the meaninglessness and get on with your life with stoic determination.

Of course, this dichotomy of purpose and randomness needs closer investigation rather than mere assertion. Is randomness opposed to purpose? This appears to be a common assumption of both those who would use evolution to rule out God and those who would question evolution because of the so-called evidence of design.[16] However, can we not use statistical means to attain well-thought-out goals? Indeed, we do so all the time. Consider the

link between smoking and lung cancer. It is well established that smoking causes lung cancer with a certain statistical frequency. We know that if we reduce the rate of smoking in the general public we will reduce the incidence of lung cancer. Suppose we introduce a public-health advertising campaign to reduce the incidence of smoking. Some people will see the ad, others will not. Some people will be moved by the ad to quit smoking, others will not. Some will succeed in quitting, others will not. At each step along the way there will be an instance of statistical causation. In the end, if the campaign is successful we will see a decrease in the number of deaths by lung cancer. We will have achieved our goal using a method full of random processes. And for all our success, we will never be able to point to a single person and say, "Our campaign saved your life," because of the probability-shaped nature of the outcome. Perhaps the dichotomy between randomness and purposefulness is overstated on both sides of the debate.

There is a further implication that arises with regard to the supposed purposelessness of world process. This is the question of morality. If we understand the universe as having purpose written into it by its creator, then morality can be thought of as our conforming to that divine purpose. God had a purpose in creating human beings, "to know, love and honor him in this life and to enjoy his presence in the life to come," as the old catechism would say. Given this approach we understand ourselves as free agents who can conform to that purpose, frustrate it, or reject it altogether. And so we develop a notion of sin. If, however, we reject the notion of purposefulness as something written into the cosmos, what sort of moral code, if any, can claim authority over us? Perhaps our sense of morality is simply the outcome of evolution, itself a random, meaningless process, as suggested by Dawkins.[17] Perhaps we simply need to create our own purpose for life, with moral injunctions such as "Enjoy your own sex lives" or "Don't indoctrinate your children."[18]

The issue of purpose and the possible moral implications adds another thread of complexity to the debate on God and creation. Now we not only have questions of science, metaphysics, and religious belief in the mix but also questions of the source of our moral codes. Do they come from God, from nature, or from reason? Are they objective, written into the very structure of reality in some sense, or purely subjective, a matter of personal choice that in the end is basically arbitrary? This connection between metaphysics and ethics is not new. Charles Taylor has pointed out that, prior to our modern era, the primary sources for people's moral frameworks were metaphysical, particular

assumptions about the metaphysical ordering of the world.[19] One's moral responsibility flowed from his or her place within the larger scheme of things. The Catholic tradition of natural law also makes a strong connection between metaphysics and morality. If one wants both to maintain a role for God as the sovereign Creator of the universe, and to accept that the world unfolds not in a deterministic manner but with a considerable amount of randomness, what are the implications for our understanding of moral action in the world?

AUTHORITY, TRADITION, AND REASON

It is worth noting at this stage something of the cultural impact that the emergence of modern science has had on our world. In fact, this impact is part of the larger picture of the tension that exists between religion and science. In religion there will always be a strong orientation to tradition, which carries with it the authority of a religious founder or text. Christianity in particular understands itself as based on a revelation from God, made manifest in the historical event of the incarnation of Jesus of Nazareth. The person of Jesus, the foundational texts of his early followers, and the institutions which emerged from that initial event have a continued authority within the Christian tradition. Early on, Christian belief found a congenial partner in Greek philosophy. And so a long journey of Christian theologizing was born that sought to bring together faith, which spoke with the authority of religious tradition, and reason, conceived in terms of philosophical reasoning. And even in the arena of philosophical thought there were authoritative figures from the past, such as Plato and Aristotle, whose works were read and commented upon. Indeed, this association of reason with philosophical thought is still evident today in the encyclical of Pope John Paul II, *Fides et ratio*. In that encyclical reason is exclusively discussed in terms of philosophical reason.

Yet, in its earliest forms, what counted as philosophy was a relatively undifferentiated mix of themes, including questions about the nature of existence, of God, of matter, but also concerns about cosmology, physics, and biology. The forms of reasoning were a mixture of logic, of deduction from a priori principles, and of empirical observation. Even at the beginning of the modern era, when Newton wrote his *Principia*, he thought of it as a work in natural philosophy. However, the success of the new empirical methods

in conjunction with mathematical formulations in explaining the world has put the older philosophical arguments into the shadows and challenged those who appealed to religious tradition to settle scientific questions.[20] The dispute between Galileo and the Catholic Church was also a heated debate between Galileo and Aristotelian conceptions of the cosmos and the proper form of science.

The fallout of this conflict was to undermine significantly the authority of arguments based on tradition. An emerging Enlightenment mentality rejected appeals to traditional authority and sought to appeal to "reason" alone as having authority over us. It was not a purely philosophical form of reason, however, as was previously the case, but a scientific form of reasoning that could appeal to the empirical data to settle disputes between competing claims—a marked difference from the interminable disputes between competing philosophical and religious claims. With the success of Newton there emerged a raft of other sciences, not just the physical sciences of physics and chemistry but also sciences of the human condition such as economics, sociology, and psychology. These human sciences were often in direct competition to the claims made by religious traditions, in a far more radical way than concerns over the structure of the solar system or even biological evolution.

At one level there is a tension here between two different knowledge claims, one that takes its stand on tradition, ancient authorities, and texts, the other taking its stand on empirical data. One will seek to settle disputes by appeal to the authority of tradition, the other by appeal to empirical evidence. Both are in some sense an appeal to reason, but reason is conceived very differently in these two approaches. The second approach is more egalitarian or "democratic" because the empirical evidence is there for anyone to verify, while the authority of tradition is held by certain religious "experts": bishops, priests, or theologians. At another level, however, it is a conflict between two competing authority systems. The religious expert has been replaced by the scientific expert as a carrier of socially recognized authority. Few "lay" people (that is, nonscientists) have direct access to the workings of scientific methods or could verify for themselves the claims scientists make. The authority of the scientific expert is reinforced by the enormous success science has had in explaining the world. But for many people it is no more accessible than the output of religious "experts." This clash of authority systems adds another dimension to the science-and-religion debate.

A TALE OF TWO AUTHORS

Perhaps nothing expresses the tensions and divergences in the science-religion debate better than the differing trajectories of two leading authors in the field, Paul Davies[21] and Richard Dawkins.[22] Between them they have authored and co-authored dozens of books on scientific issues that in one way or another address questions of creation, God, and religion. Both are scientists with solid international reputations in their respective fields and both have a gift for clearly communicating the complexities of science in a way that nonscientists can understand. Davies is primarily a physicist and cosmologist, but in his more recent writings he has turned increasingly to the question of the origin of life in the universe. Dawkins is a biologist who has become increasingly strident in his opposition to all religion and religious beliefs. Both have a strong commitment to the importance of reason as a primary source of intellectual authority.

While Dawkins has promoted atheism with an almost evangelical fervor, Davies has shifted more and more from a scientific agnosticism in relation to God to being open to the possibility of God's existence. Dawkins seems to suggest that scientists like Davies, who write favorably about religion, may be being lured by the prospect of receiving money from the Templeton Foundation, which has funded or rewarded many efforts to explore the connections between science and religion.[23] However, one could also note that the path Davies walks has a strong intellectual tradition. In fact, it came as no surprise to those familiar with his work to find him writing in an Australian metropolitan newspaper what came close to a traditional argument for the existence of God.[24] Davies raises the question of the success of science in explaining the world—a point Einstein also made when he noted that "the most incomprehensible thing about the world is that it is comprehensible." Indeed, the very success of modern science in all its forms points to the intelligibility of the universe. Davies goes on:

> Science is founded on the notion of the rationality and logicality of nature. The universe is ordered in a meaningful way, and scientists seek reasons for why things are the way they are. If the universe as a whole is pointless, then it exists reasonlessly. In other words, it is ultimately arbitrary and absurd. We are then invited to contemplate a state of affairs in which all scientific chains of reasoning are grounded

> in absurdity. The order of the world would have no foundation and its breathtaking rationality would have to spring, miraculously, from absurdity. So [Steven] Weinberg's dictum is neatly turned on its head: the more the universe seems pointless, the more it seems incomprehensible.[25]

Of course, Davies is not suggesting that the universe is absurd. He is suggesting that if the universe has no source in intelligence (God), then the success of science is incomprehensible. Davies is implying that this is somehow offensive to reason itself.

The move here is from the field of science to the field of metascience, or what is more commonly called *metaphysics*. The very success of science in explaining the world cannot be explained by science; one cannot use a scientific method to validate scientific method. One must move beyond scientific questions to metaphysical questions about the very nature of reality. The very success of science seems to imply that reality is intrinsically intelligible and reasonable. If this were not the case, science would not get off the ground. It would be building castles on the sand. For Davies the more successful science is, the more it raises the God question with ever-greater force.

Dawkins, too, is clearly captured by the rationality of science and its success in providing rational explanations for natural phenomena. He, too, can be moved to awe at the power of science. But for Dawkins this awe raises no further questions. The move from science to metascience is disallowed and the success of science is simply a brute fact occasioning no further explanation.

Of course, Davies is not trying to prove the existence of God using science. He is using the success of science to raise the metaphysical question about God's existence. He is aware enough to know that science cannot prove the existence of God. Yet, contrary to what Dawkins promotes so fervently, neither can science render the existence of God impossible or unnecessary. What Davies is suggesting is that a strong commitment to the validity of science is highly congruent with belief in the existence of an intelligent and reasonable creator of the universe. And this is what all people call God, as Aquinas would say.

This is not to say that Dawkins's arguments against religion are without foundation. Christians who insist on a fundamentalist reading of the Scriptures in relation to Genesis do a disservice to faith by splitting faith from reason and pitting science against religion. Many people, if forced to choose

between the two, will opt for science because of its more tangible benefits. It is a choice they should never be forced to make. God is the author of all truth, both religious and scientific, so there can be no disjunction between them unless truth is pitted against itself. Nor can attempts to overcome the disjunction by claiming a faith stance as scientific and then forcing the empirical evidence to fit the faith stance, as is done in so-called creation science, be accepted. This is both poor theology and poor science. We can accept the Bible as the word of God without turning it into a scientific textbook. Those who do so provide the enemies of religion with ample ammunition.[26]

This is not the place to address in a systematic fashion all the arguments Dawkins raises in his attack on religion. Others have done so and the reader can profitably turn to these works.[27] The point here is to remind ourselves that a person can be led by science both toward God and away from God. Paul Davies's writings demonstrate an increasing openness to the God question, without abandoning his commitment to science. Indeed, it is his very commitment to science as a rational activity that leads him to raise the question of God. Richard Dawkins, by contrast, has become increasingly vocal in his rejection of religion and God. Much of his argument is that the theory of evolution eliminates any sense of design or purpose in the universe and hence eliminates any argument for the existence of God. He in fact argues that "the Argument from Design, then, has been destroyed as a reason for believing in a God."[28] His commitment to science leads him to conclude that the universe as a whole has no deeper meaning or purpose. There is clearly no necessary leap from science to atheism here.

CONCLUSION

What we have set out in this chapter is the agenda for the rest of the book. The issues of God, science, and creation raise a number of fundamental questions, but these questions need to be carefully unpacked. There are questions that properly belong to the realm of science. There are questions that are properly metascientific or metaphysical. There are basic faith commitments that may relate in some way to these metaphysical problems. And there are also questions about the ethical implications of what emerges in response to these other questions. Getting the questions right and separating out the various concerns is only the start of the process.

Our approach will be largely constructive. That is, the plan is to construct a worldview that is consistent with core Christian beliefs and with the best of modern science.[29] It will draw on the intellectual heritage of Thomas Aquinas (1225–1274) and its modern mediation in the writings of Bernard Lonergan (1904–1984), principally in his book *Insight*.[30] This is admittedly a formidable work and truly ahead of its time. Our own efforts to unpack its implications will only be scratching the surface. But we wager that it will lead us to a better understanding of the issues involved and a clearer resolution than that proposed by others engaging in the present debate.