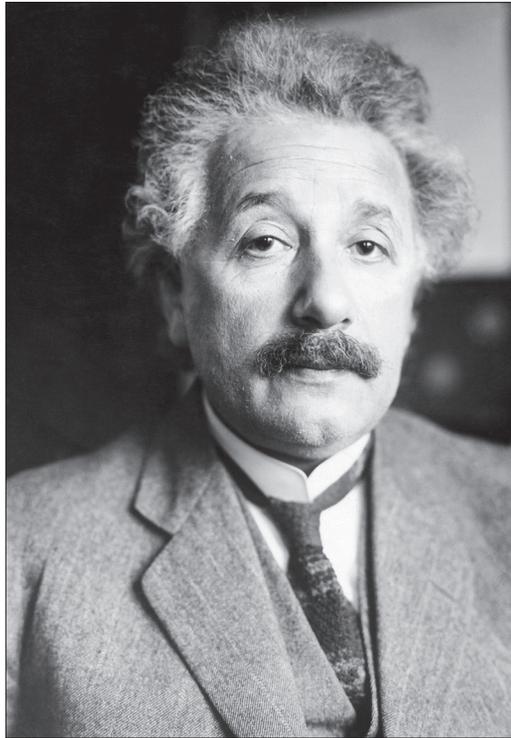


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## Common Ground Between Faith and Science?



(Gamma-Keystone via Getty Images)

Regarded as the most important theoretical physicist of the twentieth century, Albert Einstein held a profound philosophy of religion. He defined cosmic religious feeling as a religious feeling that is beyond dogma and church, experienced as the highest form of spiritual pursuit, and the basis for the noblest scientific research.



# “And Yet, It Moves”: The Conflict Between Faith and Science

By Paul McCaffrey

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The challenge of reconciling faith and science is an age-old human dilemma. Throughout history, scientific inquiry has led to conclusions that run counter to accepted religious beliefs, calling into question the veracity of Scripture, and often generating a backlash from the faithful. These periodic conflicts have led many to conclude that the natural dynamic between science and religion is one of opposition. In the words of Yale psychologist Paul Bloom, “Religion and science will always clash.” One of the most storied of these clashes took place several hundred years ago when scientists discovered evidence that the earth revolved around the sun rather than vice versa. By championing this heliocentric model, the astronomer Galileo Galilei endured a legendary confrontation with the Roman Catholic Church. More than four centuries later, this incident continues to serve as a symbol of the conflict between faith and science.

Galileo was not the first to propose a sun-centered model of the earth’s galaxy. The ancient Greek astronomer Aristarchus of Samos had articulated such a system over 1,500 years before, in the third century BCE. Aristarchus endured accusations of impiety for his efforts, and his scholarship was ignored. In the ancient world, the consensus of both science and religion was that the earth lay at the center of the universe. In the second century AD, the Alexandrian astronomer Claudius Ptolemy developed an earth-centered, or geocentric, model of the cosmos that formed the foundation of astronomy for the next 1,300 years. Heliocentrism was not revived again in earnest until the sixteenth century, when in 1543 the Polish astronomer Nicolaus Copernicus published *De revolutionibus orbium coelestium* (*On the Revolutions of the Heavenly Spheres*) in which he presented mathematical evidence for heliocentrism. Though Copernicus was a cleric, the church did not respond favorably to his work, and the volume was banned. Still, his challenge to the Ptolemaic vision was widely circulated among scientists of the era and the so-called Copernican revolution was set in motion as other researchers began to build on his findings.

Christian religious authorities, whether Roman Catholic or otherwise, dismissed the Copernican theory as antithetical to Scripture. They believed a geocentric system was referenced in the Bible, lending the model divine support. The King James Bible reads, “And the sun stood still, and the moon stayed, until the people had avenged themselves upon their enemies. Is not this written in the book of Jasher? So the sun stood still in the midst of heaven, and hasted not to go down about a whole day” (Joshua 10:13)—in other words, the sun normally moves, but on this

occasion stood still. Isaiah 40:22 declares, “It is he that sitteth upon the circle of the earth, and the inhabitants thereof are as grasshoppers; that stretcheth out the heavens as a curtain, and spreadeth them out as a tent to dwell in.” However, the objections to the Copernican model of the universe went deeper than biblical citations. If scientists proved the earth was not the center of the universe, church leaders feared that its connection to the planet, humanity, and God would be threatened and diminished.

Born in Pisa, Italy, in 1564, Galileo initially made his name as an inventor and physics pioneer, exploring the dynamics of motion. In a famous experiment, he is alleged to have dropped different-sized cannonballs from the Leaning Tower of Pisa, finding that they fell at the same speed. In his early life, astronomy was not his primary area of focus, but based on his own observations of the tides, he accepted the Copernican model while still a young man. In early 1609, he started building his own telescopes and using them to study the skies, making a number of important discoveries, among them the moons of Jupiter. After publishing his findings in the 1610 treatise *Sidereus Nuncius* (*Sidereal Messenger*), Galileo was recognized by his contemporaries as one of the great scientists of the era.

In 1613, in a letter to a former student, mindful of the supposed contradictions between Copernican theory and Holy Scripture, Galileo sought to reconcile the two. He observed, “Holy Scripture can never lie or err, and . . . its declarations are absolutely and inviolably true. I should have added only that, though Scripture cannot err, nevertheless some of its interpreters and expositors can sometimes err in various ways.” Then, taking up the verse from Joshua, he reasoned that rather than contradicting Copernican theory, the text actually supports it. According to the Ptolemaic model, “it is absolutely impossible to stop the sun and lengthen the day,” Galileo wrote.

The letter was copied and circulated, and religious authorities soon took notice. Pope Paul V convened a panel of theologians to investigate Galileo’s teachings and the Copernican model in general. In 1616, the panel concluded that Copernican theory did not align with religious doctrine and instructed Galileo to “not hold, teach or defend it in any way either by speech or writing.”

For a time, Galileo acquiesced to the church’s demands. However, when his friend Cardinal Maffeo Barberini was elevated to become Pope Urban VIII in 1623, he had reason to hope that Copernican theory might receive a better reception at the Vatican. Following audiences with Urban VIII, Galileo came away with the impression that he could resume his explorations, provided he avoid references to religious texts and approach heliocentrism as a mathematical hypothesis.

Emboldened, Galileo penned *Dialogue Concerning the Two Chief World Systems*, in which he laid out his case in support of Copernicus’s model and against Ptolemy’s. Published in 1632, the dialogue featured three characters: Salviati, who argues for the heliocentric system; Simplicio, a proponent of geocentrism—and, as his name implies, somewhat simple-minded; and Sagredo, a thoughtful and initially impartial participant. Galileo’s argument created a stir across Europe. Unfortunately, Urban VIII was not pleased and, in fact, thought Galileo had mocked him, seeing

his own words reproduced in some of Simplicio's comments. The pope banned the book and empanelled a Vatican commission to investigate Galileo for heresy. After uncovering evidence from his earlier brush with religious authorities, including the order that he abandon Copernican theory, the commission referred the matter to the Holy Office—the Inquisition—which soon called a gravely ill Galileo to Rome to defend himself.

In several appearances before the Holy Office in 1633, Galileo repeatedly denied the charges, claiming he did not recall the 1616 order and did not support the Copernican model. Given the evidence, his testimony was problematic. Though he was not interrogated under torture—a common practice at the time—he was threatened with it. The stakes involved were high. Indeed, several decades earlier, in 1600, the astronomer Giordano Bruno had been burned at the stake for suggesting that the earth revolved around the sun, among other supposed heresies. While his reputation and fame as a scholar and a network of influential defenders probably shielded Galileo from such a fate, his life was effectively on the line during the trial. The Holy Office did not believe his denials and found him guilty of heresy. To avoid imprisonment, they ordered him to read a statement confessing to his alleged crimes and renouncing his heliocentric theories. According to legend, after reading his confession, Galileo muttered, "And yet, it moves," supposedly referring to the earth. Thereafter, he was confined to an indefinite house arrest, mostly in his villa outside Florence.

Until his death on January 8, 1642, Galileo spent his last years in studious seclusion and declining health. Avoiding astronomy, he concentrated on his early passion, physics, writing *Discourses and Mathematical Demonstrations Concerning Two New Sciences*, a treatise on geometry and motion published in 1638. It took centuries for the Vatican to clear Galileo's name. In 1822, the church removed *Dialogue* from its list of forbidden books. In 1992, 350 years after his death, the Vatican declared Galileo innocent of the charges. Though persecuted and silenced by the church, Galileo remained a devout Catholic throughout his life. Although his story suggests to some that faith and science must always be in opposition, he never felt such, seeing in both the human mind and the structures governing the universe the work of a divine creator.

The relationship between faith and science has not grown any less complicated since Galileo faced the Inquisition in Rome. Religious institutions no longer wield the sort of blunt temporal authority exercised by the seventeenth-century Vatican, and scientists can carry out their investigations without fear of religious tribunals. Yet faith and science are still not always at ease with one another. In the 1500s and 1600s, the dispute was over the Copernican model. In the modern era, the debate has focused on natural selection and the theory of evolution.

Evolutionary biology and astronomy are vastly different fields of scientific study. The twenty-first-century world is vastly different from the world of the seventeenth century, yet humankind continues to weigh questions regarding science and religion. More than three hundred years ago, the Vatican gave Galileo its answer. In the modern era, many still believe that science should be deferential to the articles of faith. There are also people who feel that religion is a hindrance to human progress,

and use science as a tool to make the case against religious dogma. As Richard Dawkins—a renowned evolutionary biologist, avowed atheist, and author of *The God Delusion* (2006)—argues, “Once you buy into the position of faith, then suddenly you find yourself losing all of your natural skepticism and your scientific—really scientific—credibility.”

Still, these are not the only perspectives. The evolutionary biologist Stephen Jay Gould contended that neither religion nor science has primacy and that in reality there is no clash between them. Rather, as distinct spheres of human study, or “magisteria,” they are wholly separate disciplines that ought to have no bearing on one another. Discussing “the principled resolution of supposed ‘conflict’ or ‘warfare’ between science and religion,” Gould declares, “No such conflict should exist because each subject has a legitimate magisterium, or domain of teaching authority—and these magisteria do not overlap.” According to Gould, science “covers the empirical universe: what is it made of (fact) and why does it work this way (theory).” Religion, on the other hand, “extends over questions of moral meaning and value.” Thus, he recommends leaving science to the scientists and religion to the religious: “We [scientists] get the age of rocks, and religion retains the rock of ages,” he concludes. “We study how the heavens go, and they determine how to go to heaven.”

Galileo’s vision of a symbiotic relationship between science and faith, one discipline informing the other, is an influential one, and many today are uncomfortable keeping the two separated, or declaring one field subservient to the other. German physicist Albert Einstein offered an eloquent summation of this viewpoint, observing, “Science without religion is lame, and religion without science is blind.” The geneticist Francis Collins further articulated the position, stating, “Gould sets up an artificial wall between the two worldviews that doesn’t exist in my life. Because I do believe in God’s creative power in having brought it all into being in the first place, I find that studying the natural world is an opportunity to observe the majesty, the elegance, the intricacy of God’s creation.”

Of course, perceiving the influence of the divine in the natural world is one thing, reconciling the divergence between science and Scripture’s understanding of that natural world is quite another. As the Ptolemaic and Copernican models demonstrate, these differences can be enormous. A literal reading of the Bible suggests that the earth is roughly 6,000 years old; according to scientific estimates, the planet came into being over 4 billion years ago. Such wild discrepancies lead Collins to refer to St. Augustine, who, he says, “wrote that basically it is not possible to understand what was being described in Genesis. It was not intended as a science textbook. It was intended as a description of who God was, who we are and what our relationship is supposed to be with God.” His argument is a slight twist on the one Galileo made in the 1616 letter that first drew the punitive attention of the Vatican. Scripture isn’t wrong, in this view, but it needs to be interpreted correctly. According to Collins, Augustine suggests that some parts of Scripture are beyond interpretation. Collins thus concludes that while faith and science are interconnected and share common ground, Scripture is not meant to serve as an empirical guide to the inner workings of the universe.

# Religion and Science

By Albert Einstein

*The New York Times Magazine*, November 9, 1930

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Everything that the human race has done and thought is concerned with the satisfaction of deeply felt needs and the assuagement of pain. One has to keep this constantly in mind if one wishes to understand spiritual movements and their development. Feeling and longing are the motive force behind all human endeavor and human creation, in however exalted a guise the latter may present themselves to us. Now what are the feelings and needs that have led men to religious thought and belief in the widest sense of the words? A little consideration will suffice to show us that the most varying emotions preside over the birth of religious thought and experience. With primitive man it is above all fear that evokes religious notions—fear of hunger, wild beasts, sickness, death. Since at this stage of existence understanding of causal connections is usually poorly developed, the human mind creates illusory beings more or less analogous to itself on whose wills and actions these fearful happenings depend. Thus one tries to secure the favor of these beings by carrying out actions and offering sacrifices which, according to the tradition handed down from generation to generation, propitiate them or make them well disposed toward a mortal. In this sense I am speaking of a religion of fear. This, though not created, is in an important degree stabilized by the formation of a special priestly caste which sets itself up as a mediator between the people and the beings they fear, and erects a hegemony on this basis. In many cases a leader or ruler or a privileged class whose position rests on other factors combines priestly functions with its secular authority in order to make the latter more secure; or the political rulers and the priestly caste make common cause in their own interests.

The social impulses are another source of the crystallization of religion. Fathers and mothers and the leaders of larger human communities are mortal and fallible. The desire for guidance, love, and support prompts men to form the social or moral conception of God. This is the God of Providence, who protects, disposes, rewards, and punishes; the God who, according to the limits of the believer's outlook, loves and cherishes the life of the tribe or of the human race, or even or life itself; the comforter in sorrow and unsatisfied longing; he who preserves the souls of the dead. This is the social or moral conception of God.

The Jewish scriptures admirably illustrate the development from the religion of fear to moral religion, a development continued in the New Testament. The religions of all civilized peoples, especially the peoples of the Orient, are primarily moral religions. The development from a religion of fear to moral religion is a great step in peoples'

lives. And yet, that primitive religions are based entirely on fear and the religions of civilized peoples purely on morality is a prejudice against which we must be on our guard. The truth is that all religions are a varying blend of both types, with this differentiation: that on the higher levels of social life the religion of morality predominates.

Common to all these types is the anthropomorphic character of their conception of God. In general, only individuals of exceptional endowments, and exceptionally high-minded communities, rise to any considerable extent above this level. But there is a third stage of religious experience which belongs to all of them, even though it is rarely found in a pure form: I shall call it cosmic religious feeling. It is very difficult to elucidate this feeling to anyone who is entirely without it, especially as there is no anthropomorphic conception of God corresponding to it.

The individual feels the futility of human desires and aims and the sublimity and marvelous order which reveal themselves both in nature and in the world of thought. Individual existence impresses him as a sort of prison and he wants to experience the universe as a single significant whole. The beginnings of cosmic religious feeling already appear at an early stage of development, e.g., in many of the Psalms of David and in some of the Prophets. Buddhism, as we have learned especially from the wonderful writings of Schopenhauer, contains a much stronger element of this.

The religious geniuses of all ages have been distinguished by this kind of religious feeling, which knows no dogma and no God conceived in man's image; so that there can be no church whose central teachings are based on it. Hence it is precisely among the heretics of every age that we find men who were filled with this highest kind of religious feeling and were in many cases regarded by their contemporaries as atheists, sometimes also as saints. Looked at in this light, men like Democritus, Francis of Assisi, and Spinoza are closely akin to one another.

How can cosmic religious feeling be communicated from one person to another, if it can give rise to no definite notion of a God and no theology? In my view, it is the most important function of art and science to awaken this feeling and keep it alive in those who are receptive to it.

We thus arrive at a conception of the relation of science to religion very different from the usual one. When one views the matter historically, one is inclined to look upon science and religion as irreconcilable antagonists, and for a very obvious reason. The man who is thoroughly convinced of the universal operation of the law of causation cannot for a moment entertain the idea of a being who interferes in the course of events—provided, of course, that he takes the hypothesis of causality really seriously. He has no use for the religion of fear and equally little for social or moral religion. A God who rewards and punishes is inconceivable to him for the simple reason that a man's actions are determined by necessity, external and internal, so that in God's eyes he cannot be responsible, any more than an inanimate object is responsible for the motions it undergoes. Science has therefore been charged with undermining morality, but the charge is unjust. A man's ethical behavior should be based effectually on sympathy, education, and social ties and needs; no religious basis is necessary. Man would indeed be in a poor way if he had to be restrained by fear of punishment and hopes of reward after death.

It is therefore easy to see why the churches have always fought science and persecuted its devotees. On the other hand, I maintain that the cosmic religious feeling is the strongest and noblest motive for scientific research. Only those who realize the immense efforts and, above all, the devotion without which pioneer

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work in theoretical science cannot be achieved are able to grasp the strength of the emotion out of which alone such work, remote as it is from the immediate realities of life, can issue. What a deep conviction of the rationality of the universe and what a yearning to understand, were it but a feeble reflection of the mind revealed in this world, Kepler and Newton must have had to enable them to spend years of solitary labor in disentangling the principles of cele-

stial mechanics! Those whose acquaintance with scientific research is derived chiefly from its practical results easily develop a completely false notion of the mentality of the men who, surrounded by a skeptical world, have shown the way to kindred spirits scattered wide through the world and through the centuries. Only one who has devoted his life to similar ends can have a vivid realization of what has inspired these men and given them the strength to remain true to their purpose in spite of countless failures. It is cosmic religious feeling that gives a man such strength. A contemporary has said, not unjustly, that in this materialistic age of ours the serious scientific workers are the only profoundly religious people.

# Science at the Crossroads

By Tenzin Gyatso, the Dalai Lama  
DalaiLama.com, November 12, 2005

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*This article is based on a talk given by the Dalai Lama at the annual meeting of the Society for Neuroscience on November 12, 2005, in Washington DC.*

The last few decades have witnessed tremendous advances in the scientific understanding of the human brain and the human body as a whole. Furthermore, with the advent of the new genetics, neuroscience's knowledge of the workings of biological organisms is now brought to the subtlest level of individual genes. This has resulted in unforeseen technological possibilities of even manipulating the very codes of life, thereby giving rise to the likelihood of creating entirely new realities for humanity as a whole. Today the question of science's interface with wider humanity is no longer a matter of academic interest alone; this question must assume a sense of urgency for all those who are concerned about the fate of human existence. I feel, therefore, that a dialogue between neuroscience and society could have profound benefits in that it may help deepen our basic understanding of what it means to be human and our responsibilities for the natural world we share with other sentient beings. I am glad to note that as part of this wider interface, there is a growing interest among some neuroscientists in engaging in deeper conversations with Buddhist contemplative disciplines.

Although my own interest in science began as the curiosity of a restless young boy growing up in Tibet, gradually the colossal importance of science and technology for understanding the modern world dawned on me. Not only have I sought to grasp specific scientific ideas but have also attempted to explore the wider implications of the new advances in human knowledge and technological power brought about through science. The specific areas of science I have explored most over the years are subatomic physics, cosmology, biology and psychology. For my limited understanding of these fields I am deeply indebted to the hours of generous time shared with me by Carl von Weizsacker and the late David Bohm both of whom I consider to be my teachers in quantum mechanics, and in the field of biology, especially neuroscience, by the late Robert Livingstone and Francisco Varela. I am also grateful to the numerous eminent scientists with whom I have had the privilege of engaging in conversations through the auspices of the Mind and Life Institute which initiated the Mind and Life conferences that began in 1987 at my residence in Dharamsala, India. These dialogues have continued over the years and in fact the latest Mind and Life dialogue concluded here in Washington just this week.