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SCIENCE AND RELIGION

A Very Short Introduction

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Chapter 1

What are science-religion debates really about?

In Rome on 22 June 1633 an elderly man was found guilty by the Catholic Inquisition of rendering himself ‘vehemently suspected of heresy, namely, of having held and believed a doctrine which is false and contrary to the divine and Holy Scripture’. The doctrine in question was that ‘the sun is the centre of the world and does not move from east to west, that the earth moves and is not the centre of the world, and that one may hold and defend as probable an opinion after it has been declared and defined as contrary to Holy Scripture’. The guilty man was the 70-year-old Florentine philosopher Galileo Galilei, who was sentenced to imprisonment (a punishment that was later commuted to house arrest) and instructed to recite the seven penitential Psalms once a week for the next three years as a ‘salutary penance’. That included a weekly recitation of the particularly apt line addressed to God in Psalm 102: ‘In the beginning you laid the foundations of the earth, and the heavens are the work of your hands.’ Kneeling before the ‘Reverend Lord Cardinals, Inquisitors-General’, Galileo accepted his sentence, swore complete obedience to the ‘Holy Catholic and Apostolic Church’, and declared that he cursed and detested the ‘errors and heresies’ of which he had been suspected – namely belief in a sun-centred cosmos and in the movement of the earth.

It is hardly surprising that this humiliation of the most celebrated scientific thinker of his day by the Catholic Inquisition on the

grounds of his beliefs about astronomy and their contradiction of the Bible should have been interpreted by some as evidence of an inevitable conflict between science and religion. The modern encounter between evolutionists and creationists has also seemed to reveal an ongoing antagonism, although this time with science, rather than the church, in the ascendancy. The Victorian agnostic Thomas Huxley expressed this idea vividly in his review of Charles Darwin's *On the Origin of Species* (1859). 'Extinguished theologians,' Huxley wrote, 'lie about the cradle of every science as the strangled snakes beside that of Hercules; and history records that whenever science and orthodoxy have been fairly opposed, the latter has been forced to retire from the lists, bleeding and crushed if not annihilated; scotched, if not slain.' The image of conflict has also been attractive to some religious believers, who use it to portray themselves as members of an embattled but righteous minority struggling heroically to protect their faith against the oppressive and intolerant forces of science and materialism.

Although the idea of warfare between science and religion remains widespread and popular, recent academic writing on the subject has been devoted primarily to undermining the notion of an inevitable conflict. As we shall see, there are good historical reasons for rejecting simple conflict stories. From Galileo's trial in 17th-century Rome to modern American struggles over the latest form of anti-evolutionism, known as 'Intelligent Design', there has been more to the relationship between science and religion than meets the eye, and certainly more than just conflict. Pioneers of early modern science such as Isaac Newton and Robert Boyle saw their work as part of a religious enterprise devoted to understanding God's creation. Galileo too thought that science and religion could exist in mutual harmony. The goal of a constructive and collaborative dialogue between science and religion has been endorsed by many Jews, Christians, and Muslims in the modern world. The idea that scientific and religious views are inevitably in tension is also contradicted by

the large numbers of religious scientists who continue to see their research as a complement rather than a challenge to their faith, including the theoretical physicist John Polkinghorne, the former director of the Human Genome Project Francis S. Collins, and the astronomer Owen Gingerich, to name just a few.

Does that mean that conflict needs to be written out of our story altogether? Certainly not. The only thing to avoid is too narrow an idea of the kinds of conflicts one might expect to find between science and religion. The story is not always one of a heroic and open-minded scientist clashing with a reactionary and bigoted church. The bigotry, like the open-mindedness, is shared around on all sides – as are the quest for understanding, the love of truth, the use of rhetoric, and the compromising entanglements with the power of the state. Individuals, ideas, and institutions can and have come into conflict, or been resolved into harmony, in an endless array of different combinations.

The leading historian of science and religion John Hedley Brooke writes that serious historical study has ‘revealed so extraordinarily rich and complex a relationship between science and religion in the past that general theses are difficult to sustain. The real lesson turns out to be the complexity.’ Some of that historical complexity will be explored in subsequent chapters. There has certainly not been a single and unchanging relationship between two entities called ‘science’ and ‘religion’. There are, nonetheless, some central philosophical and political questions that have frequently recurred in this context: What are the most authoritative sources of knowledge? What is the most fundamental reality? What kind of creatures are human beings? What is the proper relationship between church and state? Who should control education? Can either scripture or nature serve as a reliable ethical guide?

Debates about science and religion are, on the face of it, about the intellectual compatibility or incompatibility of some

particular religious belief with some particular aspect of scientific knowledge. Does belief in life after death conflict with the findings of modern brain science? Is belief in the Bible incompatible with believing that humans and chimpanzees evolved from a common ancestor? Does belief in miracles conflict with the strictly law-governed world revealed by the physical sciences? Or can belief in free will and divine action, conversely, be supported and substantiated by the theories of quantum mechanics? One of the answers to the question that is the title of this chapter – What are science–religion debates really about? – is that they are about these issues of intellectual compatibility.

What I especially want to emphasize in this *Very Short Introduction* to the subject, however, is that these contemporary contests of ideas are the visible tips of much larger and deeper-lying structures. My aim throughout this book will be to look historically at how we came to think as we do about science and religion, to explore philosophically what preconceptions about knowledge are involved, and to reflect on the political and ethical questions that often set the unspoken agenda for these intellectual debates. In the rest of this introductory chapter, I indicate the kinds of questions I think we should be asking about science and religion, both as sources of individuals' beliefs and as social and political entities, before also briefly introducing 'science and religion' as an academic field.

Encountering nature

Scientific knowledge is based on observations of the natural world. But observing the natural world is neither as simple nor as solitary an activity as it might sound. Take the moon, for instance. When you look up at the sky on a clear night, what do you see? You see the moon and the stars. But what do you actually observe? There are a lot of small bright lights and then a larger whitish circular object. If you had never learned any science, what would you think

this white object was? Is it a flat disc, like a kind of giant aspirin? Or is it a sphere? If the latter, then why do we always see the same side of it? And why does its shape change from a thin crescent to a full disc and back again? Is it an object like the earth? If so, how big is it? And how close? And do people live there? Or is it a smaller night-time equivalent of the sun? Finally, perhaps it is like one of the little bright lights but larger or closer? In any case, how and why does it move across the sky like that? Is something else pushing it? Is it attached to an invisible mechanism of some kind? Is it a supernatural being?

Now, if you are well informed about modern science, you will know that the moon is a large spherical rocky satellite which orbits the earth completely about once a month and which rotates once on its own axis in the same time (which explains why we always see the same side of it). The changing relative positions of the sun, earth, and moon also explain why the moon displays 'phases' – with either the entirety or only a small crescent of the illuminated half of the moon visible at a particular time. You may also know that all physical bodies are attracted to each other by a gravitational force in proportion to the product of their masses and in inverse proportion to the square of the distance between them, and that this helps to explain the regular motions of the moon around the earth and of the earth around the sun. You will probably also know that the bright little lights in the night sky are stars, similar to our sun; that the ones visible to the naked eye are thousands of light years away and those observable through telescopes are millions or even billions of light years away; so that to look up at the night sky is to look into the distant past of our universe. But however much of all this you know, you did not find it out by observation. You were told it. You possibly learned it from your parents or a science teacher or a television programme or an online encyclopaedia. Even professional astronomers will not generally have checked the truth of any of the statements made in this paragraph by their own empirical



1. The moon as engraved by the artist Claude Mellan from early 17th-century telescopic observations

observations. The reason for this is not that astronomers are lazy or incompetent, but simply that they can rely on the amassed authoritative observations and theoretical reasonings of the scientific community which, over a period of many centuries, have established these facts as fundamental physical truths.

The point is that while it is certainly true that scientific knowledge is based on and tested against observations of the natural world, there is an awful lot more to it than just pointing your sense organs in the right direction. As an individual, even an individual scientist, only the tiniest fraction of what you know is based directly on your own observations. And even then, those observations only make sense within a complex framework of existing facts and theories which have been accumulated and developed through many centuries. You only know what you do about the moon and the stars because of a long and complex cultural history (a small part of which is told in Chapter 2), which mediates between the light from the night sky and your thoughts about astronomy and cosmology. That history includes the successful challenging of the old earth-centred world view by Galileo Galilei, with the help of Copernicus's astronomy and the newly invented telescope in the early 17th century, as well as the establishment of Newton's laws of motion and gravitation later in that century, and more recent developments in physics and cosmology too. It also includes, crucially, the histories of those social and political mechanisms that allow for, and control, the dissemination of scientific knowledge among the people through books and in classrooms.

We should also notice, by the way, that what science often aims to show is that things in themselves are not as they initially seem to us – that appearances can be deceptive. The earth beneath our feet certainly seems to be solid and stable, and the sun and the other stars appear to move around us. But science eventually showed that, despite all the sensory evidence to the contrary, the earth is not only spinning on its own axis but is also hurtling around the sun at great speed. Indeed, one of the characters in Galileo's *Dialogue Concerning the Two Chief World Systems* (1632) expresses his admiration on just these grounds for those who, like Aristarchus and Copernicus, had been able to believe in the sun-centred system before the advent of the telescope: 'I cannot sufficiently admire the intellectual eminence of those

who received it and held it to be true. They have by sheer force of intellect done such violence to their own senses as to prefer what reason told them over that which sense experience plainly showed them to be the case.’ In more recent times, both evolutionary biology and quantum mechanics have similarly required people to believe the most implausible things – that we share an ancestor not only with rabbits but also with carrots, for example, or that the smallest components of matter are simultaneously both waves and particles. People sometimes say that science is just a systematization of empirical observations, or nothing more than the careful application of common sense. However, it also has the ambition and the potential to show that our senses deceive us and that our basic intuitions may lead us astray.

But when you look up at the night sky, you may not be thinking about astronomy and cosmology at all. You may instead be gripped by a sense of the power of nature, the beauty and grandeur of the heavens, the vastness of space and time, and your own smallness and insignificance. This might even be a religious experience for you, reinforcing your feeling of awe at the power of God and the immensity and complexity of his creation, putting you in mind of the words of Psalm 19: ‘The heavens declare the glory of God; the skies proclaim the work of his hands.’

Such an emotional and religious response to the night sky would, of course, be every bit as historically and culturally mediated as the experience of perceiving the moon and the stars in terms of modern cosmology. Without some kind of religious education you certainly would not be able to quote from the Bible, and you would perhaps not even be able to formulate a developed concept of God. Individual religious experiences, like modern scientific observations, are made possible by long processes of human collaboration in a shared quest for understanding. In the religious case, what intervenes between the light hitting your retina and your thoughts about the glory of God is the lengthy history of a particular sacred text, and its reading and interpretation within a

succession of human communities. And, as in the scientific case, one of the lessons learned through that communal endeavour is that things are not as they seem. Religious teachers, as much as scientific ones, try to show their pupils that there is an unseen world behind the observed one – and one which might overturn their most settled intuitions and beliefs.

The political dimension

Among historians of science and religion there have been two interestingly different kinds of attack on the ‘conflict narrative’ favoured by Enlightenment rationalists, Victorian freethinkers, and modern-day scientific atheists. The first strategy is to replace the overarching image of conflict with that of complexity, and to put emphasis on the very different ways that science–religion interactions have developed at different times, in different places, and in different local circumstances. Some scientists have been religious, others atheists. Some religious denominations welcome modern science, others are suspicious of it. Recognizing that neither ‘science’ nor ‘religion’ refers to a simple singular entity is an important part of this approach too, as is acknowledging the existence of considerable national differences. To take just the most obvious example, debates about evolution and religion have, from the beginning of the 20th century and right up to the present day, developed quite differently in the United States than they have in Europe and elsewhere. As I will explain in Chapter 5, the debates about the teaching of evolution in schools that go on in America today emerged through circumstances very specific to that country, most importantly the interpretation of the First Amendment to its Constitution, which prohibits the government from passing any law ‘respecting an establishment of religion’.

If this first approach to the conflict narrative is to change the plot, the second involves recasting the leading characters. This approach says: yes, there have been conflicts that seem to be between science and religion, and they are real conflicts, but they

are not between science and religion. The question then is: who or what are the real antagonists in this story? In a way, we are then just straight back into the messy details of historical complexity. There is certainly not a simple recasting that works for all cases, but the general idea is that the real conflict is a political one about the production and dissemination of knowledge. The opposition of science versus religion is then seen to be standing proxy for some classic modern political conflicts: the individual versus the state, or secular liberalism versus conservative traditionalism. It is interesting to note that in modern America, for example, campaigners both for and against the teaching of evolution in schools have portrayed themselves as representing the rights and freedoms of the people against an intolerant and authoritarian establishment which is controlling the educational agenda. In the 1920s that establishment was portrayed by defenders of evolution as Christian and conservative, but to some religious groups today it seems that a secular liberal elite have taken control of the education system. Debates about science and religion give certain groups an opportunity to argue their case for greater social influence, and greater control over the mechanisms of state education, a case that rests on quite independent political grounds.

These questions about the politics of knowledge will arise repeatedly in subsequent chapters. For the moment, let us consider just one other example – the philosopher and firebrand Thomas Paine. An unsuccessful corset-maker, sacked tax-collector, and occasional political writer, Paine left his native England to start a new life in America in 1774. On his arrival in Philadelphia, he found work as the editor of the *Pennsylvania Magazine*. A couple of years later, his polemical pamphlet *Common Sense* (1776) was a key factor in persuading the American colonists to go to war against the British government, and established Paine as the bestselling author of the age. An associate of Benjamin Rush, Thomas Jefferson, and others of the founding fathers of the United States of America, Paine's

democratic and anti-monarchical political philosophy shaped the Declaration of Independence. After politics, Paine's other great passions were science and engineering. He had attended popular lectures on Newton and astronomy back in England, and he spent many years of his life working on a design for a single-span iron bridge, inspired by the delicacy and strength of one of the great works of nature – the spider's web. His whole philosophy was a scientific one. He saw revolutions in governments paralleling the revolutions of celestial bodies in the heavens. Each was an inevitable, natural, and law-governed process. Later in his life, having had a hand in both the American and French revolutions, he turned his sights from monarchy to Christianity. The institutions of Christianity were as offensive to his enlightened and Newtonian sensibilities as were those of monarchical government. In his *Age of Reason* (1794), Paine complained of 'the continual persecution carried on by the Church, for several hundred years, against the sciences and against the professors of science'.

Paine's version of the conflict narrative makes most sense when seen in its political context. Paine was, indeed, a scientific thinker who was opposed to Christianity. He denounced the Bible, especially the Old Testament, with its stories of 'voluptuous debaucheries' among the Israelites and the 'unrelenting vindictiveness' of their God. To the shock of his friends, Paine wrote of the Bible: 'I sincerely detest it, as I detest everything that is cruel.' Paine also lambasted the 'priestcraft' at work in the 'adulterous' relationship between the Church of England and the British state. What he hoped for, though, was not an end to religion but the replacement of Christian religion by a rational religion based on the study of nature – one which recognized the existence of God, the importance of morality, and the hope for a future life, but did away with scriptures, priests, and the authority of the state. His reasons for this were democratic ones. National churches lorded illegitimate power over the people by claiming special access to divine truths and revelations. But everyone can

read the book of nature and understand the goodness, power, and generosity of its author. In the religion of Deism recommended by Paine, there was no need for the people to be in thrall either to priests or to the state. Science could help to replace Christianity by showing that every individual could find God by looking at the night sky rather than by reading the Bible or going to church. ‘That which is now called natural philosophy’, Paine wrote, ‘embracing the whole circle of science of which astronomy occupies the chief place, is the study of the works of God, and of the power and wisdom of God and his works, and is the true theology.’

Paine’s democratic ideals, including the separation of church and state, are enshrined in the founding documents of the United States. And in modern America too, it is competing political visions that come into conflict in debates about science and religion. American politicians who deny the truth of the theory of evolution and advocate the teaching of a religiously motivated concept of ‘Intelligent Design’ in schools do not do so for scientific reasons. They do so, rather, to send a signal – to indicate their general support for Christianity, their opposition to excessively secularist interpretations of the Constitution, and their hostility to naturalistic and materialistic world views.

A final interesting piece of support for the suggestion that what is really at stake in science–religion encounters is politics, is to be found in two mid-20th-century stage plays. Each dramatizes a famous clash between a heroic scientific individual and a reactionary and authoritarian religious establishment, and does so to make primarily political points. Bertolt Brecht’s *Life of Galileo* was composed during the 1930s and early 1940s. Brecht was a German communist, opposed to fascism, and living in exile in Denmark and subsequently the United States. The play uses the story of Galileo to investigate the dilemmas faced by a dissident intellectual living under a repressive regime, and also to suggest

the importance of pursuing scientific knowledge for moral and social ends rather than purely for its own sake. Brecht saw in the well-known Galileo affair political lessons which could be applied to a world struggling against authoritarian fascism and, in the later version of the play, living in the shadow of the dropping of atomic bombs on Hiroshima and Nagasaki.

Jerome Lawrence and Robert E. Lee's play *Inherit the Wind*, first performed in 1955, and made into a famous film in 1960, was a dramatization of the Scopes 'monkey trial' of 1925. The historical events on which the play was based are discussed in Chapter 5; they centre on the prosecution of a Tennessee school teacher, John Scopes, for teaching evolution in contravention of state law. *Inherit the Wind* used the Scopes case to attack the anti-communist purges of the McCarthy era. Scopes, the heroic evolutionist standing up against a repressive Christian establishment in 1920s Tennessee, stood for the struggle for freedom of opinion, association, and expression by communist sympathizers in the face of a repressive American government machine. Among those sympathizers, incidentally, was Bertolt Brecht, who had been called to testify before the House Committee on Un-American Activities in 1947. In the case both of Brecht's *Galileo* and Lawrence and Lee's *Inherit the Wind*, it was questions of intellectual freedom, political power, and human morality that gave the conflict between science and religion its drama and its interest. The same is true in real life.

'Science and religion' as an academic field

So far we have looked at science and religion in general terms as two cultural enterprises which encounter each other both in the mind of the individual and in the political domain. There is an important further dimension to add to this preliminary picture, which is the recent development of 'science and religion' as an academic field in its own right.

Of course theologians, philosophers, and scientists have been writing treatises about the relationship between natural knowledge and revelation for centuries. Many of these works were very popular, especially in the 18th and 19th centuries. The most famous was *Natural Theology* (1802) by the Anglican clergyman William Paley, which argued from the complex adaptations of plants and animals to the existence of an intelligent designer. However, from the 1960s onwards 'science and religion' took on a more distinct existence as an academic discipline. In 1966 the first specialist journal in the field was founded in Chicago – *Zygon: Journal of Religion and Science*. The same year saw the publication of a very widely used textbook, *Issues in Science and Religion* by the British physicist and theologian Ian Barbour. Since that time, various organizations have been set up to foster this kind of work, including a European Society for the Study of Science and Theology, and an International Society for Science and Religion. There are established academic posts devoted specifically to the study of science and religion at several major institutions, including the universities of Oxford and Cambridge in the UK, and Princeton Theological Seminary in the US.

Academic work by scientists and theologians seeking to develop a harmonious interdisciplinary dialogue has been supported by a range of institutions, including the Roman Catholic Church, through the work of the Vatican Observatory, and also the John Templeton Foundation in America – a philanthropic organization particularly committed to supporting research that harmonizes science with religion. A recent large Templeton-funded project has been devoted to research on altruism and 'unlimited love', for example. One outcome of this has been a book explaining the improved physical health and mental well-being enjoyed by those who live an altruistic and compassionate life.

The John Templeton Foundation spends millions of dollars on research grants each year, including an annual Templeton Prize, currently valued at about \$1.5 million, given to an individual

for ‘Progress Toward Research or Discoveries about Spiritual Realities’. Former winners have included Christian evangelists, leading figures from non-Christian faiths, and also many individuals who have been prominent in the academic dialogue between science and religion, such as Ian Barbour, Arthur Peacocke, John Polkinghorne, Paul Davies, and George Ellis. Like many of those who have contributed to the creation of ‘science and religion’ as an academic subject, all of the figures just named fall into the category of religiously committed professional scientists (and in some cases ordained ministers). There are also many historians, philosophers, and theologians who have contributed significantly to the field. It is a topic that even attracts impassioned contributions from scientific atheists, such as Oxford University’s Professor for the Public Understanding of Science, Richard Dawkins.

I have already mentioned that much academic work in this area has been concerned with the plausibility (or lack of it) of the idea of an inevitable conflict between science and religion. This concern is partly driven by apologetic motives. Many of those involved in the field are religious believers committed to showing that science need not undermine faith. But the denial of conflict (or of any other one-dimensional relationship) is also motivated by more purely academic considerations, several of which will emerge in subsequent chapters.

Whether arguing for conflict or for harmony, it could be objected that any talk about ‘the relationship between science and religion’ obscures the true plurality and complexity of the terms. ‘Science’ and ‘religion’ are both hazy categories with blurry boundaries, and different sciences and different religions have clearly related to each other in different ways. Mathematics and astronomy were both particularly nurtured in Islamic cultures in the Middle Ages, for example, where they were used to calculate the correct times of prayer and the direction of Mecca, as well as for many more secular purposes. Islamic scholars working in academies such as

the House of Wisdom in Baghdad preserved, tested, and improved upon ancient Greek medicine and optics, as well as astronomy and astrology, between the 9th and the 15th centuries. The motto of these scholars was: 'Whoever does not know astronomy and anatomy is deficient in the knowledge of God.' Their works were to be crucial sources for the revival of European learning from the later Middle Ages onwards.

Excluded from more mainstream European academic institutions, Jewish communities formed a particularly strong connection with the science and practice of medicine in early modern Europe. The Roman Catholic Church, despite the high-profile difficulties caused by Galileo's ideas, was one of the most generous sponsors of scientific research during the Renaissance, especially through the investment of the Jesuit order in astronomical observatories and experimental equipment. The relationship between modern scientific knowledge – a characteristically Western system of thought – and the religious traditions of the East, is different again. Here we might think of the interest shown by Buddhists in neuroscientific studies of the state of the brain during meditation, or of Fritjof Capra's 1975 bestseller, *The Tao of Physics: An Exploration of the Parallels between Modern Physics and Eastern Mysticism*. There is, finally, a very particular story to be told about the relationship between evolutionary biology and modern Protestant Christianity – one which we will return to below. The point is that none of these particular relationships can serve as a universal template for understanding engagements between science and religion.

Some think that the extent of oversimplification, generalization, and reification involved in even using the phrase 'science and religion' makes it a non-starter as a sensible topic for academic study. I have some sympathy with this view. It is certainly true that in this book, as in most contributions to the field, the 'religion' under discussion is most often specifically Christianity. However, at least within the Abrahamic, monotheistic traditions of Judaism,

Christianity, and Islam, there is enough common ground, historically, philosophically, and theologically, for a more general discussion to take place. Whether it is possible or desirable to extend that discussion still further to include non-theistic or non-scriptural traditions is another question, and one which I will not explore further here. The monotheistic faiths, however, are all united by the idea that God is the author of two books – the book of nature and the book of scripture – and that the individual believer will find their understanding and their faith strengthened through the careful reading of both books. The intellectual, political, and ethical implications of that shared commitment to reading God's words and his works have developed in comparable, although far from identical, ways in the three major monotheistic traditions.

The fact that the phrase 'science and religion' names an academic field, as well as conjuring up vivid if historically debatable cultural stereotypes, is enough, I think, to justify its continued use as a category of thought (and in the title of this and many other books). Academics and journalists alike continue to write as if there were some ongoing general relationship between science and religion, in terms of which particular contemporary episodes might be understood. Even if that relationship really exists only in our imaginations, it is still important to try to understand how it got there. Since Galileo Galilei and his encounter with the Roman Inquisition takes centre stage in many popular accounts of that relationship, his story is an appropriate place to start our inquiry.