

THE CAMBRIDGE COMPANION TO  
SCIENCE AND RELIGION

Edited by Peter Harrison



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# Introduction

PETER HARRISON

In 1939 the eminent Cambridge philosopher C. D. Broad observed that discussions of the relations between religion and science among his contemporaries had ‘acquired something of the repulsiveness of half-cold mutton in half-congealed gravy’.<sup>1</sup> Fortunately for readers of this volume much has changed in the years since Broad offered this droll assessment and it is safe to say that the field of science and religion now offers a much more appetizing prospect. There are several reasons for the renewed vigour of discussions about science and religion. Developments in the sciences themselves have played a key role. In cosmology, the rise to prominence of Big Bang theory has led to speculations about how the temporal origins of the universe might be linked with the idea of creation. Related to this, the surprising fact that our universe seems remarkably fine-tuned for the emergence of intelligent life has, for some commentators at least, breathed new life into what had once been regarded as moribund arguments from design. Fine-tuning arguments have also found their way into chemistry and biology, raising intriguing questions about purpose, teleology and their place in the sciences. The profoundly mysterious quantum world continues to challenge commonsense understandings of matter and causation, inspiring religious and philosophical speculations about divine action and free will and, more generally, about the nature of reality itself. In the neurosciences, our increased capacity to study brain structure and function holds out the promise of laying bare some of the physical correlates of religious experience, and thus of shedding some light on the nature of religion itself. Knowledge of the physical basis of heredity with the discovery of the structure of DNA in 1953, followed by the complete mapping of the human genome in 2000, also have implications for religious views of the person, and for what it is to be a human being. Developments such as these point to the possibility of purely materialist explanations of human thoughts, beliefs and desires – explanations often judged to be at odds with religious understandings of personhood.

Leaving aside developments in the sciences themselves, another reason for heightened interest in science and religion has been the persistence, and indeed growth, of influential anti-evolutionary movements. Young-earth creationism, which rejects both macroevolution and geological evidence for the antiquity of the earth, was once associated solely with conservative Christian groups in the United States, but has now begun to enjoy international success in a variety of different religious settings. Also growing in influence is the intelligent design movement which, although it differs from young-earth creationism in important respects, also asserts that biological accounts of the adaptations of living things are incomplete unless they allow room for theistic explanation. These movements enjoy a significant public profile, partly on account of well-publicized court cases relating to their inclusion in the science curriculum of secondary schools. The activities of these anti-evolutionary movements, and the reactions which they have provoked from the scientific community, have led to a perpetuation of the common view that science and religion have been, and will continue to be, locked in perennial conflict. From a philosophical perspective, they also raise some interesting questions about what counts as legitimate science and about where the boundaries between science and religion are to be drawn. Equally significantly, these debates have inspired more general discussions about the roles of science and religion in modern liberal democracies.

Confirming Newton's third law, the rise to prominence of anti-evolutionary groups has been matched by a recent upsurge in an aggressive, scientifically motivated atheism. Many of the basic tenets of the new atheism (represented by such figures as Richard Dawkins, Sam Harris and Daniel Dennett) bear directly on science and religion questions, and it is common to hear its chief advocates claiming that science and religion represent mutually incompatible worldviews, since the former is the embodiment of reason and the latter of a dubious and credulous faith.<sup>2</sup> These views are attended by a historical thesis according to which science and religion have throughout history been at loggerheads. Religion, in this starkly dualistic view of the world, is the primary cause of the ills of modern society. Science, by way of contrast, is depicted as the chief engine of progress and hence as the future hope for the world. To be sure, the arguments generated by this muscular atheism, like those of many of its religious opponents, have not always been of the first rank – indeed much of the rhetoric has been redolent of the old debates that prompted Broad's 'reheated supper' remark – but their emergence has led to the renewal of public discussions of the nature of science, religion and their mutual relations.

Contributing in a less direct way to a renewed interest in science and religion is the fact that dramatic technological achievements in the biomedical sciences now present enormous challenges to traditional moral positions, many of which have been informed by religious perspectives. New reproductive technologies, stem cell research, the prospect of human cloning, along with increased capacity for human enhancement and the prolongation of life, present moral and religious thinkers with unprecedented ethical conundrums. These include not only practical questions to do with specific biomedical procedures, but also more general philosophical questions about how time-honoured religious principles such as the sanctity of human life might be applied in the brave new world generated by these medical technologies. At times, new medical policies and therapeutic techniques have met with resistance from particular religious groups. By the same token, this situation has also prompted new and creative ways of thinking about the meaning of traditional religious values and how they might be applied in these novel and unfamiliar contexts.

As we can see, the questions that cluster around the broad topic of science and religion are varied, and there are a number of different ways of approaching them. Historians are interested in the mutual interactions of science and religion in the past, and the ways in which their past relations inform the present. Philosophers have a concern to see how developments in the sciences might have a bearing on traditional arguments for the existence of God, on accounts of his activity, and on perennial philosophical questions about the nature of the human mind and free will. Also relevant to philosophy are questions about the boundaries of science and religion, and the basis of their knowledge claims. Theologians are concerned to identify features of the sciences that have theological implications, and to determine whether theology can respond to these, or indeed whether theology needs to respond. Sociologists identify patterns of belief about religion and the sciences in society, and analyse the power relations between scientific and religious institutions. Finally, scientists themselves have often engaged in speculation about what implications their scientific endeavours might have for religious belief.

All of these perspectives are represented in this collection. For convenience, however, the contributions have been grouped into three parts. The first will offer a chronological overview of science–religion relations in the West, looking at seminal periods and offering commentary on key episodes. The second will provide an account of prominent contemporary issues in science and religion. The third will explore

some underlying philosophical issues to do with the nature of religion, scientific explanation, divine action, and ways of modelling science and religion relations.

#### THE HISTORICAL DIMENSION

The first five chapters treat historical relations between science and religion. Much recent writing by historians of science has addressed itself, in various ways, to the popular assumption that throughout history science and religion have been engaged in a perennial battle. It is now generally accepted by historians that this erroneous view, known as 'the conflict myth', was largely the invention of two nineteenth-century controversialists, John Draper and Andrew Dickson White.<sup>3</sup> The basic position is clear enough from the titles of their best-known works, respectively, *History of the Conflict between Religion and Science* (1874) and *A History of the Warfare of Science with Theology in Christendom* (1896). Invented or not, the conflict model would not have endured had it not enjoyed at least a superficial plausibility and if it did not play an important role in the self-understandings of those who perpetuate it. In fact, this model draws support from a number of sources: our present experience of religiously motivated anti-evolutionary sentiments and scientifically motivated atheism; well-known historical cases such as the Galileo affair that seem to exemplify conflict; the assumption that science and religion are forms of knowledge based upon mutually exclusive foundations – reason and experience in the case of science, and faith and authority in the case of religion.

When examined closely, however, the historical record simply does not bear out this model of enduring warfare. For a start, study of the historical relations between science and religion does not reveal any simple pattern at all.<sup>4</sup> In so far as there is any general trend, it is that for much of the time religion has facilitated scientific endeavour and has done so in various ways. Thus, religious ideas inform and underpin scientific investigation, those pursuing science were often motivated by religious impulses, religious institutions frequently turn out to have been the chief sources of support for the scientific enterprise and, in its infancy, science established itself by appealing to religious values. This is not to say that there are no instances of conflict, but rather that these instances need to be understood within a broader context. Considered in this light, celebrated cases such as the Galileo affair turn out to be atypical and highly dependent on local rather than global considerations.

Galileo's trial makes for a good story, but it is not emblematic of a larger historical picture.<sup>5</sup>

It is also clear from the historical record that putative instances of science–religion conflict frequently turn out to be conflicts of a rather different kind. It is often forgotten, for example, that new scientific theories almost invariably meet with resistance from the scientific community itself. At times scientific opposition to novel theories has been conflated with religious opposition. In the case of Galileo, the Catholic Church was not opposing science *per se*. On the contrary, it was using its considerable authority to endorse what was then the consensus of the scientific community. This course of action may have been imprudent, and it offends modern sensibilities. But it does not betray any intrinsic antipathy towards science on the part of the Roman Church. Moreover, the boundaries between science and religion were drawn rather differently in the past, and this complicates the way in which we interpret particular historical episodes. Isaac Newton, for example, contended that discussion of the existence of God was a legitimate part of the formal study of nature – a view that few, if any, twenty-first-century scientists would subscribe to.<sup>6</sup> The piety of scientists such as Newton (and indeed of the vast bulk of scientists who, prior to the twentieth century, were committed to theism) also gives the lie to the notion that there is some kind of scientific mindset that is inherently incompatible with religious belief.

Another important consideration in this discussion is the fact that historians have become increasingly sensitive to the dangers of projecting their experience of present events back into the pages of history. Indeed it is clear that the progenitors of the conflict myth, Draper and White, were guilty of precisely this kind of anachronism, reading history through the lens of their present experience of parochial controversies about science and religion. The historical chapters in this volume tell a different kind of story – one that resists the alluring but simplistic narrative of enduring warfare, and seeks to give due consideration to the understandings of the historical actors themselves.

In the first chapter David Lindberg makes direct reference to the conflict myth, and its application to the early interactions between the Christian church and science. It is often assumed that the patristic and medieval periods with which Lindberg deals were the dark ages, in which Christianity exercised its power to smother the science that had been inaugurated by the Greeks and nurtured by the Romans. Lindberg paints a rather different picture, acknowledging episodes of conflict, but pointing out that the more usual pattern was one of peaceful co-existence. In



the patristic period, science was of value to the church at least in part because it could be harnessed to serve religious purposes. In the later medieval period, the church was patron of the universities, and thus indirectly a sponsor of science, which came to be increasingly valued as an independent activity in its own right.

John Henry takes up the story in the next chapter, which deals with the Scientific Revolution – a period which spans the sixteenth and seventeenth centuries. He begins with the Galileo affair, which occupies a special place in understandings of the history of science–religion relations. While not denying that the resources of the Catholic Church were at times mobilized against promoters of particular scientific views, he none the less points out that the circumstances of Galileo’s condemnation were unique, and that it is not helpful to draw general conclusions from this single unfortunate episode. Henry also draws our attention to the fact that, like Galileo himself, virtually all of the major scientific innovators of this period were religious believers, and that many of them were secular theologians who thought carefully about the theological significance of their work. Various theories of the religious origins of modern science are also described and evaluated in this chapter. Rather than thinking about the birth of modern science as arising out of the separation of religious and scientific concerns, Henry suggests that we might regard this period as one that saw Christianity set the agenda for the emergence of modern science.

Natural theology is the topic of the next chapter, in which Jonathan Topham first explores different understandings of natural theology before offering an account of its role in the sciences from the Middle Ages to the end of the nineteenth century. Topham describes the ways in which various natural theologies were mobilized during the seventeenth and eighteenth centuries not only to provide social legitimacy for the new sciences, but to explore their theological implications and, more generally, to foster religious belief in the faithful and sceptic alike. There follows an account of the mixed fortunes of natural theology in the eighteenth century. During this period it was subjected to searching philosophical critiques by Hume and Kant, while influential religious thinkers also expressed reservations about its relevance. Topham’s analysis thus points to the fact that while the advent of Darwinism in the nineteenth century is often identified as the sole cause of the demise of natural theology and especially the argument from design, religious factors themselves played a role.

Darwin and Darwinism figure centrally in chapter 4, in which Jon Roberts describes the variety of religious reactions to the theory of

evolution by means of natural selection. Taking as his focus the period between the publication of the *Origin of Species* in 1859 and the Scopes 'monkey trial' in 1925, and concentrating mostly on England and North America, he offers a detailed account of the variety of religious responses to Darwinism during this period. Darwin's views provoked strongly negative reactions among many of the faithful, and for a variety of reasons: evolution and the mechanism of natural selection appeared to challenge the literal truth of the Bible, the idea of a divine plan for the creation, and the unique status of human beings. Yet, as Roberts clearly shows, the story was not simply one of uniform religious rejection. Darwin also had a number of influential religious supporters and, for that matter, some highly placed scientific critics. Then, as now, religious communities were divided on the question of Darwinism and its theological import.

The fifth chapter, by John Hedley Brooke, explores the connection between science and secularization. Here Brooke challenges the superficially plausible 'science causes secularization' thesis, demonstrating that it is difficult to sustain without significant qualification. Thus, sociologists inform us that reports of the demise of religion are premature. Positing science to account for a historical development that has not actually taken place does not make for a convincing thesis. Brooke also points out that the roots of the idea of a future scientific utopia in which religion has no place is a vestige of the dated and discredited historicism of nineteenth-century positivists. That said, in his conclusion Brooke alerts us to what he calls 'a recurring ironic pattern' in science-religion relations in the West, in which religion provides the initial foundations for a scientific enterprise that will eventually seek to displace it.

#### CONTEMPORARY RELATIONS

An important element of the present interest in science and religion is the controversy about evolution, and in particular the teaching of evolution in secondary schools. As we have noted, potential sources of conflict had already surfaced in the nineteenth-century debates. Evolution by natural selection seemed to call into question the literal truth of the Bible, human distinctiveness, divine providence and the foundation of moral values. But beyond these specific difficulties, which mainstream Christian denominations have largely come to terms with, is the fact that for many of its detractors, evolution is more than a scientific

theory – it is a powerful medium for the propagation of materialism and atheism. In the minds of its religiously conservative critics, moreover, evolution is associated with a variety of social ills: racism, moral relativism, abortion, pornography, and the breakdown of the family unit. While these specific associations may seem far-fetched, the more general perception that acceptance of evolution necessarily entails commitment to materialistic atheism has been rendered more credible by the rise of the new atheism. A number of the new atheists thus enlist evolution as a weapon in their crusade against religion, confirming their opponents' view that evolution is not just science, but an anti-religious ideology. All of this suggests that creation–evolution debates are not instances of a more general conflict between science and religion, but are a symptom of a collision between competing ideologies.

In the first of the chapters dealing with contemporary relations between science and religion, Ronald Numbers takes up a number of these issues, offering a detailed description of the rise of scientific creationism and its recent offshoot, intelligent design. While the former takes as its point of departure the biblical account of creation and is hence committed to a young earth and the centrality of the Genesis flood, the latter seeks to establish the existence of design in nature by identifying instances of irreducible or specified complexity. Common to both groups is the conviction that their work represents legitimate scientific activity, and this explains why they do not consider themselves to be anti-science. Numbers' chapter clearly shows that these movements are not the ineradicable residue of a longstanding Christian commitment to divine creation and biblical literalism, but rather a modern movement whose origins date from the twentieth century. Moreover, while Numbers points to the importance of the US constitutional and educational factors in the growth of scientific creationism and intelligent design, he also provides evidence of the increasingly global profile of anti-evolutionary movements and of their emergence in religious traditions quite remote from the conservative evangelicalism of North America. As a global phenomenon, religiously inspired anti-evolutionism is emblematic of the deeper ideological dimensions of modern discussions of evolutionary theory.

Turning from these more general historical and sociological matters to substantive issues, we can identify as one of the core difficulties generated for religious belief by the theory of natural selection the apparent randomness of natural selection. On the standard evolutionary view, human beings are the happenstance end products of a purposeless process that did not have them in mind. Such a view is at odds both with

traditional religious conceptions of the special status of human beings, and with the idea of God's providential control of nature. In chapter 7, Simon Conway Morris addresses this question, putting forward the suggestion that in spite of the contingencies of natural selection, the evolution of something very much like human beings was, in fact, virtually inevitable. His argument is that natural selection is a search engine that tends to arrive repeatedly at similar solutions. In support of this view he points to the numerous instances of evolutionary convergence. These suggest that while random events clearly have a major role in the evolutionary process, it may still be possible to speak of directionality in this context. Such a perspective (which is not to be confused with intelligent design) considerably reduces the tension between the randomness of evolutionary processes and religious assertions of purpose and directionality.

Questions of cosmic purpose are also addressed in the next chapter, which deals with the larger scale of cosmology. The now dominant Big Bang cosmological theory was first proposed in the 1920s by the Belgian mathematician and Catholic priest Georges Lemaitre, but did not achieve wide acceptance until the discovery of cosmic microwave background radiation in the 1960s. In fact, 'Big Bang' was the derogatory name proposed for the theory by the Cambridge astronomer Fred Hoyle, who at that time supported the alternative Steady-State hypothesis. One reason for initial resistance to the Big Bang theory was that, unlike the rival Steady-State hypothesis, it proposed that the universe has a beginning – a proposition that for some had unwelcome religious implications. Now that the theory is well established, discussions of its religious implications continue and they constitute one of the liveliest areas of contemporary science–religion interchange. An additional dimension has been added to these discussions with the discovery of the remarkable fine-tuning of the fundamental parameters of our universe.

In chapter 8, William Stoeger provides an account of what is at stake in these discussions. He sets out the current view of the history of the universe from the moment of the Big Bang to the present, before proceeding to discuss the possible religious implications of this story. As Stoeger points out, it has been known for some time that our universe is very special and that if any of the four fundamental forces had even slightly different values, our universe would have been simple, sterile and unproductive. On one interpretation, a supernatural intelligence predetermined the basic parameters of the universe so that it would eventually give rise to carbon-based life. On another view, our universe is simply one of a vast ensemble of universes, in which case its

fine-tuned character is less remarkable. Both are legitimate interpretations, Stoeger argues, and while the first lends itself to a form of the design argument for God's existence, both are consistent with a theistic understanding of the universe as created by God. In fact, Stoeger suggests, any cosmological theory will be consistent with a theistic understanding of creation, since the idea of creation refers to the ultimate source of the being and order of the universe while cosmology seeks to provide an account of that order.

In most contemporary interactions between science and religion, including those discussed to this point, religion tends to be the silent partner. It is usually assumed that science is the authoritative voice to which religion must accommodate itself, if it can. In the cases of evolutionary theory and Big Bang cosmology, it might be claimed that religion can add a dimension that is lacking to a purely scientific perspective, but this does not amount to a substantive religious input into the science itself. In chapter 9, Fraser Watts suggests that in the case of psychology and theology a different model is possible. Theology, he contends, can offer special insights into the nature of the human person and can thus both critique and enrich psychology. It does so on the first count by contesting overly reductionistic explanations of human persons, and on the second, by making contributions that arise out of its special familiarity with such features of human experience as guilt and forgiveness. Watts also demonstrates ways in which psychology can make positive contributions to theology. Here the discussion extends to theological anthropology, biblical hermeneutics, religious experience and glossolalia. The general model he offers, then, is one in which theology and psychology can be mutually enriching. This chapter also serves as an important reminder of the difference between religion and theology. The religious life is not simply a matter of making particular propositional claims about the world which are more or less on a par with scientific hypotheses. Religion typically involves practices, behaviours and attitudes which have no direct counterpart in the scientific enterprise. These non-propositional features of religion are often overlooked in science–religion discussions, as a consequence of which religions are often reduced to their propositional contents.

Drawing a distinction between religion and theology reminds us of the fact that there is a moral component to religious belief which is lacking in the sciences. Scientific knowledge is usually considered to be value free. This does not mean that scientists are amoral or that scientific discoveries have no moral implications, but rather that determining what those moral implications might be is not the business of

science itself. A case in point is the discipline of bioethics, which seeks to deal with the plethora of moral questions raised by advances in the biological and medical sciences. In chapter 10, John Evans shows how, in a relatively short time span, advances in the biomedical sciences have indirectly altered in a dramatic way the context in which public discussion of moral issues takes place. These changes have little to do with explicit philosophical or theological positions, but result rather from the necessary application of bureaucratic procedures to medical ethics. As Evans shows, this has meant that there has been an inexorable rise in the preponderance of particular styles of moral reasoning – what he refers to as thin arguments – which embody the principle of commensuration and which are incipiently utilitarian. Thin arguments concern themselves with common standards of measurement and with how to arrive at predetermined outcomes. These arguments are increasingly accepted less on account of their being more morally robust than the alternatives and more because the answers they provide match the institutional contexts in which the questions are framed. For this reason, such approaches have displaced thicker religious approaches, which have traditionally been concerned with less tractable issues of intrinsic value and the desirability of particular outcomes. In a sense, then, while the biomedical sciences represent themselves as value free, on account of the institutional and bureaucratic contexts in which they are embedded they are already bearers of a set of implicit values which forestalls the deployment of thick moral prescriptions. The general lesson of this case study is that in order to understand the relations between science and religious values, we must attend not only to the logic of arguments about moral questions in the realm of the biosciences, but also to the professional, political and bureaucratic contexts in which science and its accompanying technologies are practised and applied.

#### PHILOSOPHICAL PERSPECTIVES

A number of general issues in the field of science and religion fall within the ambit of philosophy. Philosophy of religion deals with the existence of God, exploring such questions as whether the scientific study of nature provides evidence for God's existence and whether scientific investigation relies on implicitly theistic assumptions about the uniformity of nature or the reliability of our cognitions. Also relevant in this context is the issue of how God interacts causally with the world (which takes in ideas about divine action, providence and miracles),

the problem of evil (which for some is exacerbated by the theory of evolution by natural selection), and questions about free will and determinism (for which developments in the neurosciences are sometimes thought to be relevant). A second sub-discipline of philosophy – philosophy of mind – includes within its purview discussions about the nature of consciousness and human freedom, which have a bearing on religious beliefs about the soul and immortality. The third area of philosophy that is of direct relevance to the science and religion field is the philosophy of science. Philosophers of science are concerned with the principles of knowledge used in the sciences, the manner in which knowledge claims are justified and the explanatory scope of the sciences.

One key issue in philosophical discussions of science and religion is the extent to which scientific explanation necessarily excludes reference to the supernatural. A longstanding premise of the rational investigation of nature has been the avoidance of supernatural explanations where possible. This seems to be characteristic of early Greek natural philosophy, and carries over into the Middle Ages. Albert the Great (*fl.* 1250), the teacher of Thomas Aquinas, used the phrase *de naturalibus naturaliter* to convey the idea that it is legitimate to study nature as if God does not intervene. Aquinas and other medieval thinkers adopted a similar stance.<sup>7</sup> In the seventeenth and eighteenth centuries, this principle was not followed to the letter – Isaac Newton famously invoked divine action to stop the solar system grinding to a halt – but the Newtonians sought to avoid explanation by recourse to miracles whenever they could. The commitment to study the world as if God plays no part in the secondary causes of nature is now known as methodological naturalism. This expression became a term of art after its deployment in 1983 by the Christian philosopher Paul de Vries. De Vries sought to distinguish between, on the one hand, a legitimate scientific approach which excluded supernatural explanations but which was still consistent with belief on the part of the investigator and, on the other, what he called metaphysical naturalism which went beyond this to deny the existence of any supernatural entities.<sup>8</sup>

The issue of naturalism, then, is central to questions about the division between religion and legitimate science, and about what counts as a complete explanation. Michael Ruse addresses these issues in his chapter on atheism, naturalism and science. Here he explores the relationship between methodological naturalism and naturalism proper, where the latter is understood as equivalent to atheism. Some of the recent discussions of this question, as Ruse points out, have been prompted by claims of intelligent design theory proponents, who admit to violations

of the principle of methodological naturalism but none the less claim to be engaged in legitimate science. Ruse also discusses the intriguing question, posed by the philosopher Alvin Plantinga, of whether evolutionary naturalism is ultimately self-defeating. If evolutionary naturalism has the capacity to act as a universal acid, the argument goes, then surely it is no less corrosive of evolutionary claims themselves, since these beliefs are ultimately the result of natural processes directed primarily towards our biological survival (rather than towards producing minds capable of grasping metaphysical truths). Darwin himself expressed the problem this way: 'But then with me the horrid doubt always arises whether the convictions of man's mind, which has been developed from the mind of the lower animals, are of any value or at all trustworthy.'<sup>9</sup> Ruse contends that naturalistic explanations of beliefs do not necessarily undermine the veracity of those beliefs, pointing out that this applies equally to religious beliefs themselves which, in the event that some plausible naturalistic explanation could be offered for them, would not thereby be rendered false. Ruse concludes that while methodological naturalism has proved itself a powerful explanatory strategy, there are important questions that lie beyond its scope. These fall into the territories of philosophy or religion.

The nature of scientific explanation is also a central concern of the next chapter by Nancey Murphy. If methodological naturalism has been one key element of modern science, another has been reductionist explanation. Reductionism is the principle according to which the best way to understand a complex phenomenon is to consider the operations of its constituent parts. Related to this general insight are two further ideas – that the scientific principles of higher order sciences such as biology are ultimately reducible to principles of lower order sciences such as chemistry and physics, and that the causes that do the real work in nature are also to be found at these lower levels. While reductionism has given rise to remarkable successes, it generates particular difficulties for our understanding of human consciousness, free will and divine action. Murphy offers a complementary explanatory model, invoking the principles of emergence and top-down causation. These principles make room for non-reductive explanations which are consistent with our intuitions that for most of the time we are in control of our actions. The case of consciousness is a key example. It appears obvious, for example, that atoms and molecules are not conscious. Neither, most of us assume, are individual neurones. But with sufficient numbers, an organization of sufficient complexity and certain external inputs, it seems that systems of neurones do give rise to the property



of consciousness, and this cannot be explained simply in terms of the individual properties of the basic constituents of the system (atoms, molecules and neurones). Properties of this kind, which are not susceptible to reductionist explanations, are referred to as emergent properties, since they arise by emergence out of more basic constituents. As Murphy shows, when we add to this picture the idea of top-down causation, we can also offer an account of how the mind might be able to exercise causal power over a body. But beyond this, she suggests that the model of top-down causation also gives us a helpful way of understanding how divine action in the world might take place in a way that does not do violence to our understandings of natural causation.

In chapter 13 we return to the questions of purpose and meaning, this time considering how evolutionary thinking and the process philosophy of A. N. Whitehead might together make a contribution to new theological understandings. Writing as a Christian theologian, John Haught contends that theology has been slow to adapt itself to a world in which biological and cosmic evolution are inescapable realities. Part of its inability to do this, he suggests, is owing to its commitment to a classical deity, who lies outside of time and who is immutable and hence impassible (incapable of suffering). These commitments, in turn, owe more to the metaphysics of the ancient Greeks than to Christian sources. Haught's suggestion is that the philosophy of Whitehead, which considers the cosmos to be in process and which imagines God himself to be capable of change, is more consistent with both evolutionary theory and key assumptions of the Western religious traditions about the personal and responsive nature of God. These considerations enable Haught to propose an alternative religious metaphysics which is future-oriented, and in which all things evolve towards an ever-increasing beauty in a genuinely open future. More generally, Haught's chapter serves as an example of how different models of God might be regarded as more or less compatible with strands of contemporary science.

The final chapter, by Mikael Stenmark, addresses the important methodological issue of how best to characterize the various ways of relating science and religion. Ian Barbour's four-fold typology – conflict, independence, dialogue, integration – has long been standard in the field. Even in the present collection, this typology has been put to good use by Michael Ruse. Yet while this typology has considerable virtues, not least simplicity, questions can be raised about whether it is sensitive enough to capture the wide range of positions that various individuals and groups adopt. Is it accurate, for example, to classify scientific creationism as an exemplar of the conflict model, when its proponents

explicitly claim to be pro-science? What of advocates of independence for whom peace between science and religion is bought at the cost of translating all propositional claims of religion into moral statements? Is this genuine independence, or a kind of scientistic expansionism? This chapter offers an alternative framework for mapping the relations between science and religion which seeks to be more sensitive to expressed positions of the various players while retaining the virtues of simplicity and versatility. Stenmark is particularly sensitive to the fact that the way in which we conceptualize these two entities – religion and science – makes an important difference to how we map their relations. While it is widely assumed that there is a generic religion, for example, the historical religions do not in fact share a common set of beliefs; neither do all religions stress the priority of belief. When we speak of science and religion, then, it is important to be clear about what religion we are speaking of. Similar considerations apply for the various scientific disciplines, each of which may well have different implications for particular religions.

Stenmark also introduces considerations derived from the philosophy of science, noting that while the substantive claims of the sciences are obviously relevant in science–religion discussions, so too is the stance we take regarding the truth claims of the sciences and the religions. Are scientific theories always provisional? Do they represent increasingly accurate maps of reality or are they better regarded simply as models for making predictions? While many scientists are themselves realists, in the sense that they believe that their theories and models depict reality in increasingly precise ways, there are powerful arguments for instrumentalism, according to which our scientific models are better viewed as fictional devices for making predictions about the behaviours of unseen realities. The relevant criterion for instrumentalists is not truth, but usefulness. There are also varieties of scientific realism, and a range of positions between realism and instrumentalism. Clearly, however, views about the implications for religion of various scientific theories will be different for realists and instrumentalists, and Stenmark seeks to build this into his model.

Any volume such as this suffers from inevitable omissions, and there are many other topics that might have been included. Ideally, a comprehensive treatment of science and religion would give consideration to the social sciences and religion. There is also interesting new work in the cognitive science of religion not treated here. The roles of science and religion in the environmental crisis are also a subject of great importance. Certainly, moreover, most of the topics covered in

this volume could have been treated in more depth. However, the aim of this collection has been to provide some historical perspectives, some general philosophical overviews, and coverage of some of the central topics in contemporary science and religion discourse, with a view to introducing readers to some of the key issues and approaches in the field. Some compensation for its omissions is offered in the Further Reading section, which provides additional resources both for topics covered in this collection and also for the absent topics referred to above.

Readers will also have noticed that while the title proclaims this to be a collection about science and religion, most of the chapters deal almost exclusively with Western monotheistic religions, and primarily Christianity. There are good reasons for this, not least practical considerations of space. It is difficult in a volume of this size to do justice even to the enormous complexity of science–religion relations in the West without adding the further complication of a consideration of non-Western religions. Related to this is the fact that substantive questions to do with relations between the monotheistic Western religions and science cluster around a common set of issues, typically to do with God’s power, his activity or his relation to the world. Non-theistic or polytheistic religious traditions raise a rather different set of questions. Moreover, modern science developed within the matrix of Western Christendom, and accordingly questions relating to the historical relations between science and religion are quite rightly discussed within this matrix. Again, the Further Reading section offers titles for those interested in pursuing the relations between science and the non-Western religious traditions.

Finally, this collection as a whole was not designed to present a single view of science and religion, and individual authors have been given licence to argue for the particular positions that they believe to be warranted. By the same token, as noted above, it does not pretend to represent the full spectrum of views about the relations between science and religion. As is probably already evident, the idea that religion and science have always been, and are of necessity, ranged against each other is not a view that will find much support in this volume. This should be taken as a sign not of bias, but rather of the fact that generally speaking those with more than a passing familiarity with both science and religion have little time for the conflict thesis (in its cruder manifestations, at least). It is probably also worth mentioning that while I have not surveyed contributors on the question of whether or not they have particular religious commitments, it is a matter of public record that our authorship includes atheists and agnostics at one end of the scale and professional theologians at the other.

## Notes

- 1 C. D. Broad, 'The Present Relations of Science and Religion', *Philosophy* 14, no. 53 (1939), 131–54, p. 131.
- 2 On the new atheists, see Tina Beattie, *The New Atheists* (London: Darton, Longman and Todd, 2007).
- 3 Ronald Numbers (ed.), *Galileo Goes to Jail and Other Myths about Science and Religion* (Cambridge, MA: Harvard University Press, 2009), pp. 1–3.
- 4 See especially John Hedley Brooke, *Science and Religion: Some Historical Perspectives* (Cambridge University Press, 1991), pp. 1–15.
- 5 For accounts of the Galileo affair, see Ernan McMullan (ed.), *The Church and Galileo* (Notre Dame University Press, 2005); David C. Lindberg, 'Galileo, the Church and the Cosmos', in Ronald L. Numbers and David C. Lindberg (eds.), *When Science and Christianity Meet* (University of Chicago Press, 2003), pp. 33–60.
- 6 Isaac Newton, *The Mathematical Principles of Natural Philosophy*, tr. Andrew Motte [1792], reprinted with an introduction by I. Bernard Cohen (London: Dawsons, 1968), 2 vols., vol. II, pp. 391–2. Also see Peter Harrison, '"Science" and "Religion": Constructing the Boundaries', *The Journal of Religion* 86 (2006), 81–106.
- 7 See Edward Grant, *God and Reason in the Middle Ages* (Cambridge University Press, 2001), pp. 193–4.
- 8 Ronald L. Numbers, 'Science without God: Natural Laws and Christian Beliefs', in Numbers and Lindberg, *When Science and Christianity Meet*, p. 267. See also Edgar Brightman, 'An Empirical Approach to God', *The Philosophical Review* 46 (1937), 147–69.
- 9 Letter 13230, Darwin to William Graham, 3 July 1881, *Darwin Correspondence Project*, [www.darwinproject.ac.uk/darwinletters/calendar/entry-13230.html](http://www.darwinproject.ac.uk/darwinletters/calendar/entry-13230.html), accessed 24 June 2009.