Introduction

In a classic discussion of the origins of modern science, the historian Herbert Butterfield drew a much-quoted parallel. Such was the impact of the seventeenth-century Scientific Revolution that the only landmark with which it could be compared was the rise of Christianity. In shaping the values of Western societies, science and the Christian religion had each played a preeminent part and made a lasting impression. Exaggerated or not, such comparisons raise an obvious question. What was the relationship between these powerful cultural forces? Were they complementary in their effects, or were they antagonistic? Did religious movements assist the emergence of the scientific movement, or was there a power struggle from the start? Were scientific and religious beliefs constantly at variance, or were they perhaps more commonly integrated, both by clergy and by practicing men of science? How has the relationship changed over time?

Such questions are easier to formulate than to answer. Since the seventeenth century every generation has taken a view on their importance without, however, reaching any consensus as to how they should be answered. Writing some sixty years ago, the philosopher A. N. Whitehead considered that the future course of history would depend on the decision of his generation as to the proper relations between science and religion – so powerful were the religious symbols through which men and women

conferred meaning on their lives, and so powerful the scientific models through which they could manipulate their environment. Because every generation has reappraised the issues, if not always with the same sense of urgency, there has been no shortage of opinion as to what that proper relationship should be.

In popular literature three positions are commonly found, which, though not equally unsatisfactory, turn out to be problematic. One often encounters the view that there is an underlying conflict between scientific and religious mentalities, the one dealing in testable facts, the other deserting reason for faith; the one relishing change as scientific understanding advances, the other finding solace in eternal verities. Where such a view holds sway, it is assumed that historical analysis provides supporting evidence – of territorial squabbles in which cosmologies constructed in the name of religion have been forced into retreat by more sophisticated theories coming from science. The nineteenth-century scholars J. W. Draper and A. D. White constructed catalogs of this kind, in which scientific explanations repeatedly challenged religious sensibilities, in which ecclesiastics invariably protested at the presumption, and in which the scientists would have the last laugh.

Typical was White's account of the reluctance of the clergy to fix lightning rods to their churches. In 1745 the bell tower of St. Mark's in Venice had once again been shattered in a storm. Within ten years, Benjamin Franklin had mastered the electrical nature of lightning. His conducting rod could have saved many a church from that divine voice of rebuke, which thunder had often been supposed to be. But White reported that such meddling

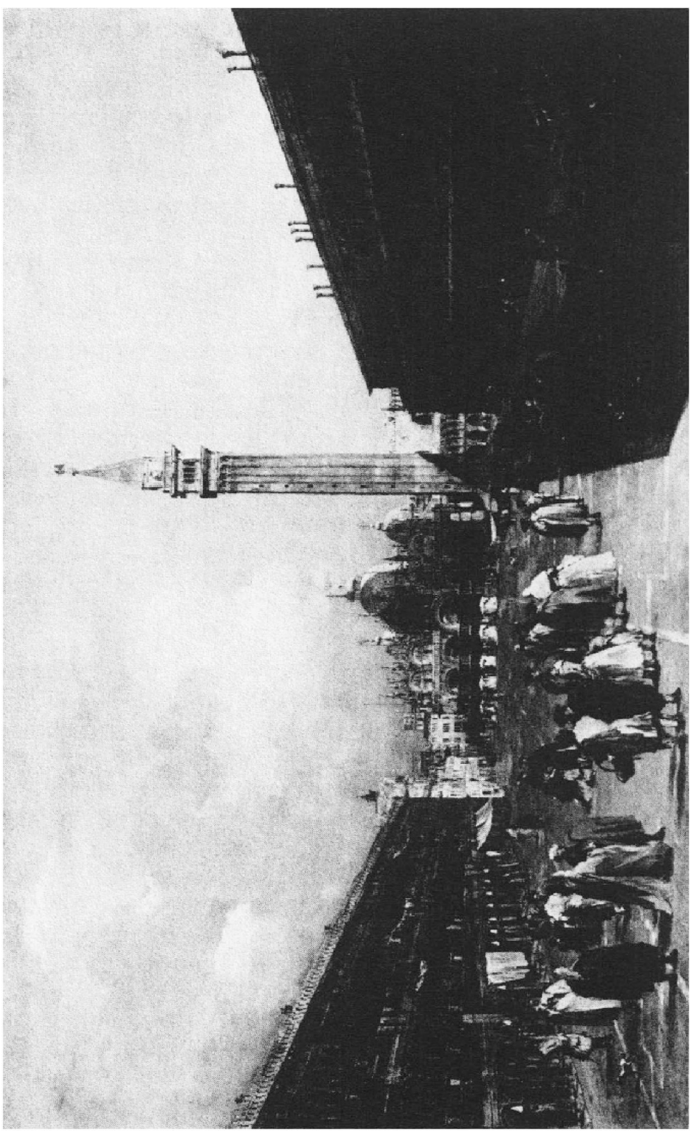

FIGURE INT.1. Francesco Guardi (1712–93), *Venice Piazza San Marco*. Dating from c. 1760, this painting shows St. Mark's Cathedral and its bell tower. Reproduced by courtesy of the Trustees, The National Gallery, London.

with providence, such presumption in controlling the artillery of heaven, was opposed so long by clerical authorities that the tower of St. Mark's was smitten again in 1761 and 1762. Not until 1766 was the conductor fixed – after which the monument was spared. White's picture of religious scruples and shattered towers symbolizes the popular notion of an intrinsic and perennial conflict. An ounce of scientific knowledge could be more effective in controlling the forces of nature than any amount of supplication.

A second, quite different view also appeals to history for its vindication. Science and religion are sometimes presented not as contending forces but as essentially complementary – each answering a different set of human needs. On this view, scientific and theological language have to be related to different spheres of practice. Discourse about God, which is inappropriate in the context of laboratory practice, may be appropriate in the context of worship, or of self-examination. Historical analysis is often invoked to support this case for separation because it can always be argued that the conflicts of the past were the result of misunderstanding. If only the clergy had not pontificated about the workings of nature, and if only the scientists had not been so arrogant as to imagine that scientific information could meet the deepest human needs, all would have been sweetness and light.

It has been argued, for example, that much of the heat could have been taken out of the Darwinian debates if only the Christian doctrine of creation had been properly formulated. That doctrine, it is said, refers to the ultimate dependence of everything that exists on a Creator. It need not entail the separate creation of every species.

Some twentieth-century theologians, notably Rudolph Bultmann, have gone so far as to say that the doctrine of creation has nothing to do with the physical world. Its correct application is to the creation within men and women of an authentic stance toward their earthly predicament. By such means the spheres of science and religion are insulated one from the other.

A third view, which can also be overstated, expresses a more intimate relationship between scientific and religious concerns. Contrary to the first – the conflict model – it is asserted that certain religious beliefs may be conducive to scientific activity. And contrary to the second – the separationist position – it is argued that interaction between religion and science, far from being detrimental, can work to the advantage of both. This more open position clearly appealed to Whitehead, for he raised the question whether the assumption of seventeenth-century natural philosophers, that there was an order imposed on nature, might not have been an unconscious derivative of medieval theology. And he also argued that interaction between religion and science could purge the former of superfluous and obsolete imagery. Once again, the appeal to history is essential to the enterprise. The thesis of the American sociologist, R. K. Merton, that puritan values assisted the expansion of science in seventeenth-century England, would be a good example of historical scholarship in which the mutual relevance of science and religion is affirmed, rather than constant conflict or complete separation.

There are, of course, many variants of these positions. But in their presentation it is almost always assumed that there are lessons to be learned from history. The object of

this book is not to deny that assumption but to show that the lessons are far from simple. The chapters that follow do not pretend to tell a complete or definitive story. They should be read as a historically based commentary rather than as a conventional historical narrative. The principal aim is to assist in the creation of critical perspectives, not to describe a continuous series of seemingly decisive transformations.

Serious scholarship in the history of science 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. Members of the Christian churches have not all been obscurantists; many scientists of stature have professed a religious faith, even if their theology was sometimes suspect. Conflicts allegedly between science and religion may turn out to be between rival scientific interests, or conversely between rival theological factions. Issues of political power, social prestige, and intellectual authority have repeatedly been at stake. And the histories written by protagonists have reflected their own preoccupations. In his efforts to boost the profile of a rapidly professionalizing scientific community, at the expense of the cultural and educational leadership of the clergy, Darwin's champion, T. H. Huxley, found a conflict model congenial. Extinguished theologians, he declared, lie about the cradle of every science as the strangled snakes beside that of Hercules.

The purpose of this book is not to recover the corpses. It is to display the diversity, the subtlety, and ingenuity of the methods employed, both by apologists for science and for religion, as they have wrestled with fundamental

questions concerning their relationship with nature and with God. Such is the richness of the subject that it is well to set aside one's preconceptions. There are surprises in store. The same Franklin who devised the lightning conductor was not ashamed to say that, as for the nature of electricity, he was still in the dark. He *was* ashamed about the confidence with which he had earlier thought the subject mastered. As he reflected on the succession of his theories, he observed that one use of electricity had been to make a vain man humble. Franklin had recognized, as Francis Bacon had before him, a congruence between the virtue of humility and the demands of an experimental method. He had recognized that the majestic towers of scientific theory could crumble as spectacularly as the towers of great cathedrals.

It is just such a succession of incompletely successful theories that the history of science reveals, the survivors having some advantage over their predecessors, but rarely in a manner that made evaluation at their inception a straightforward matter. The popular antithesis between science, conceived as a body of unassailable facts, and religion, conceived as a set of unverifiable beliefs, is assuredly simplistic. Theoretical innovations have usually been controversial, often divisive, within scientific communities. Consequently, when they have impinged on the sacred, there has usually been considerable room for debate. To portray the relations between science and religion as a continuous retreat of theological dogma before a cumulative and infallible science is to overlook the fine structure of scientific controversy, in which religious interests certainly intruded, but often in subtle rather than overtly obstructive ways.

An obvious difficulty arises at this stage. How can one speak about the relationship between science and religion, either as practices or as systems of belief, without first defining terms? It is possible to go only so far in meeting this objection. *Religion* has been defined in terms of belief in supernatural beings or in terms of a commitment to some transcendent "other," which serves to integrate one's life. It may refer to organized institutions that, through creed and ritual, claim to give coherent answers to questions of human destiny. Or it may simply refer to any deeply held convictions that find expression in moral imperatives. Although there is often overlap between such definitions, there need not be. In some of the world's religions, Buddhism for example, belief in a transcendent Creator is not affirmed. Because this book is concerned with the relationship between science and religion in the West, most of the contexts in which the word religion is used will be those in which some variant or some critique of the Christian faith was at stake. Too restrictive a definition can, however, be counterproductive because it may exclude too many questions before they have been asked. If the study of history is to be instructive, it is important not to establish foregone conclusions through the rigidity of definitions.

The same difficulty arises with the word *science*. There have been so many definitions offered by philosophers, and by scientists themselves, that it would require another book to consider them. Many refer to some unique "scientific method" to which exemplary science is supposed to conform. But, as the Cambridge philosopher William Whewell observed, almost a hundred fifty years ago, the *history* of science already showed that each new

branch of scientific inquiry had required its own distinctive methodology. And that very process of increasing differentiation reflected a more fundamental change in the meaning of science – from when it had referred to all knowledge and when theology was "queen of the sciences," to its more modern connotations of empirical investigation and high specialization.

There are at least three reasons why the historian might recoil from the demand that "science" and "religion" be rigorously defined before the exercise may begin. The first can be illustrated by a celebrated remark of Isaac Newton. His most famous book, in which planetary orbits were explained by his gravitational theory, was entitled *Mathematical principles of natural philosophy* (1687). It was not entitled *Mathematical principles of natural science*. When seventeenth-century students of nature called themselves natural philosophers, they were identifying themselves with intellectual traditions in which broader issues than immediate scientific technicalities were discussed. Newton himself remarked that it was part of the business of natural philosophy to discuss such questions as the attributes of God and His relationship to the physical world. Very few physicists today would conceive their role in such terms. The point is that if we prejudge what we mean by science and religion, we might be in no position to appreciate the distinctiveness of Newton's vision. There would be a degree of artificiality in asking how Newton reconciled his "science" and his "religion," if he saw himself pursuing a form of "natural philosophy," in which the two interests were integrated.

The second reason for resisting definitions that might prove too constrictive can also be illustrated from the

late seventeenth century when Thomas Burnet wrote his *Sacred theory of the earth* (1684). In it he assumed the role of a Christian apologist, using a knowledge of history to identify certain mistakes that should not be made when theologizing about nature. Thus he applauded St. Augustine for his warning that science and religion should not be too tightly interlocked, that it was dangerous to invoke the authority of Scripture in disputes about the natural world. The danger as Burnet saw it was this: As scientific understanding advanced, propositions that Scripture had been made to affirm would be proved false. Its authority would then be jeopardized on far more important matters. But, says Burnet with evident condescension, Augustine had fallen into the very trap he had identified. He had used the Bible in his dismissal of inhabitants at the Antipodes. Burnet, so much wiser in the late seventeenth century, is even more aware of the danger and knows how to avoid it.

And yet, anyone reading Burnet's *Sacred theory* today would be struck by the fact that he falls headlong into the selfsame trap. Instead of keeping the spheres of science and the Bible apart, he brings them together. He offers a mechanistic account of how the Genesis flood had come about, and he defines the main epochs of earth history with reference to information gleaned from his Bible. His picture of a submerged earth, in which Noah's ark is conspicuous, shows how the flood was made constitutive of the earth's physical history. The point of the example is not to score points against Burnet but to raise the more sympathetic question: How was it possible for Augustine to behave in a manner that, to a later generation, looked inconsistent? And similarly for Burnet. Part of the answer