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The History of Science and Theology

Peter Harrison

This entry offers a history of the different ways in which the formal study of the natural world has been related to theological considerations in the Western Christian tradition. Because what counts as science and what counts as theology has changed over time, it begins with a history of the concepts ‘theology’ and ‘science’ and the bearing of these conceptual shifts on their relationship. This is followed by a general account of the kinds of relations obtained between science and theology in different periods from antiquity to the present. A final section deals with three recurring issues that also exemplify some general principles.

Keywords: Natural philosophy, Scientific revolution, Darwinism, Laws of nature, Conflict thesis, Theology and science

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1 History of the concepts

The term ‘theology’ (*theologia*) can be traced to the ancient Greeks and was probably coined by Plato (*Republic* 379a.; Plato 1997: 1017; see Jaeger 1948: 4). As a description of the systematic and rational explication of doctrines, it was not widely adopted by Christian thinkers until the thirteenth century. The English expression ‘science’ has a similarly long pedigree, going back to the ancient Greek *episteme* which was subsequently rendered into Latin as *scientia*. However, from classical antiquity to late modernity it was the expression ‘natural philosophy’, and not ‘science’, that was used to describe that aspect of philosophy concerned with investigation of the natural world. Only in the nineteenth century did ‘science’ take on its present meaning, referring to various disciplines concerned with the formal study of nature, characterised by a particular method and conducted by specialists.

1.1 The origins of ‘theology’

From the patristic period to the high Middle Ages, reflection on the truths of the Christian faith was not understood as ‘theology’ but rather focused on the reading of scripture (*lectio divina*) and the practicalities of teaching (*doctrina*). *Lectio divina* involved processes of reading, prayer, and contemplation. This was less a matter of rational explication of Christian doctrines than a process of spiritual formation. It was characteristic of the approaches of Origen (c.184–c.253) and subsequently Ambrose of Milan (c.340–397) and Augustine of Hippo (354–430), becoming a well-established monastic practice from the sixth century. What may appear to be doctrinally focused discussions during this period typically concerned practical pedagogy, although formal credal statements were important for maintaining church unity and establishing the bounds of orthodoxy. For these reasons, the primary site of interaction between natural philosophy and Christianity during this period was biblical exegesis rather than systematic theology.

A key step towards a more formal ‘theology’ was taken in the twelfth century by Peter Abelard (1079–1142), who introduced dialectical reasoning into the reflections on Christian doctrine. Abelard effectively moved Christian theology beyond the interpretation and harmonization of biblical and patristic teachings to something more like a rational reflection on the nature of God, albeit one that continued to be informed by traditional authorities (Turner 1997). A number of Abelard’s works have *theologia* in the title, introducing this term, in something like its modern sense, into Western Christendom. Peter Lombard’s (1095–1160) highly influential *Sentences* also represents an important stage in the development of a more systematic, dialectical theology. It was compiled from sayings of the Church Fathers, but organized around specific theological topics such as the Trinity, creation, the incarnation, and the sacraments.

These new theological approaches were practised in a new institutional context, as the locus for theological reflection moved from monasteries to cathedral schools and the first universities. This was accompanied by a shift of emphasis away from contemplative practice to rational disputation. Crucially, the university curriculum was increasingly influenced by the newly translated corpus of Aristotelian writings. These changes were not universally welcomed and the term ‘theology’, along with the dialectical approach that it signalled, was met with resistance (Evans 1980; Brown 1990: 82–97). This was not altogether surprising, since ‘theology’ was a pagan expression not found in the New Testament and rarely encountered in patristic writings. Augustine had equated ‘theology’ with pagan thinking about the gods (*City of God* VI.5; NPNF1 2: 113-114) and in the thirteenth century Thomas Aquinas still preferred to use the expression *sacra divina* (holy teaching) in some contexts. These reservations notwithstanding, both ‘theology’ and the systematic approach associated with it became central to Christian intellectual activity from this period onwards.

1.2 Theology as a science?

The question of the scientific status of the new practices of theology became a concern in the thirteenth century as scholastic thinkers sought to calibrate the status of Christian teaching against Aristotle’s taxonomy of different forms of knowledge. Aristotle had observed a basic distinction between theoretical sciences, concerned with knowledge, and practical sciences, concerned with action. A third set of disciplines concerned *productive* activities. There were three theoretical sciences: natural philosophy (or physics), mathematics, and theology (or metaphysics). These were distinguished by their subject matter. Natural philosophy dealt with material, immutable things, mathematics with immutable things associated with matter, and theology with the most abstract things of all, which were immaterial and immutable (*Metaphysics* [*Met.*] 1025b19–1026a33; Aristotle 1984: 1619–1620 [vol. 2]). Aristotle had also set out criteria for what counted as genuine *scientia* or science. This involved certain or demonstrable knowledge deduced from self-evident first principles or axioms (*Posterior Analytics* [*An. Post.*] 74b5–12; Aristotle 1984: 120 [vol. 1]; and *Physics* [*Phys.*] 93a1–25; Aristotle 1984: 153 [vol. 2]). Aristotle’s treatment of the virtues was an additional consideration, for *scientia* was not simply a form of knowledge, but was one of the intellectual virtues (*Nicomachean Ethics* [*EN*] 1139b14368; Aristotle 1984: 1799 [vol. 2]). Scientific knowledge, in Aristotle’s sense, was thus inseparable from particular habits of mind that enabled that knowledge.

Thirteenth-century thinkers who engaged with the Aristotelian corpus were confronted with a number of questions that relate to our topic: How was Aristotle’s ‘theology’ related to Christian teaching or *sacra doctrina*? Was Christian theology a science in the Aristotelian sense? If so, was it a practical or theoretical science? How did the intellectual virtues, requisite for wisdom and scientific knowledge, relate to the Christian virtues? At a more

substantive level, given that natural philosophy was concerned with knowledge of the natural world, how was the conduct and content of natural philosophy to be related to Christian teaching and practice?

On the question of how Christian theology fitted into the Aristotelian mould, Franciscan thinkers tended to hold that theology was a form of wisdom and, if anything, a practical rather than a theoretical science. Franciscan theologian Bonaventure (1221–1274) contended that theological science was a habit that had as its chief end 'that we become good' (*Commentary on the Sentences* 1.13; Bonaventure 1882). On the other side, Aquinas famously contended that *sacra doctrina* was a theoretical science (Davies 1990). It was by no means obvious, however, that theology fitted the Aristotelian model of a deductive science based on self-evident first principles since the first truths of Christianity are not self-evident but revealed. Aquinas ingeniously drew upon the Aristotelian idea of a *subordinate science* – a science that relies upon another to provide its axiomatic premises – to argue for the scientific status of theology. He suggested that while the first principles of theology – in essence the articles of the Christian faith – might not be self-evident to us, they are to God himself. We can come to know these first principles by means of revelation and hence have access to God's self-knowledge. Strictly speaking, theology is a genuine science for God but a subordinate science for us (*Summa Theologiae* 1a. 1, 2; EDP 1: 5).

The emergence of the idea of theology and its identification as theoretical science offered one answer to the question of the relation between science and theology in the Middle Ages: theology was a species of the genus science. Because theology was now constructed as a systematic, dialectical enterprise, as opposed to the more formative and scripturally focused *lectio divina*, it was also possible to inquire into the relationship between its propositional content and the propositional content of natural philosophy.

1.3 From natural philosophy to science

From the period of classical antiquity to late modernity, natural philosophy (or 'physics') was the closest equivalent to modern science. But there were also the related disciplines of mathematics, mixed mathematical sciences, and natural history (Harrison, Numbers and Shank 2011). Natural philosophy concerned the causes of natural events and, as we have seen, was one of Aristotle's theoretical sciences along with mathematics and theology. Mixed mathematics, a subordinate science, involved mathematics applied to more practical matters as for example in music or astronomy. Natural history offered descriptive accounts of natural things and lacked the causal explanations that characterised natural philosophy.

While natural philosophy was the activity closest to our modern science, it differed from it in important ways. For a start, it typically covered such topics as God, the angels, and the soul. Unlike modern physics, natural philosophy also excluded mathematical treatments.

This was on account of Aristotle's insistence that the methods of one science not be applied in another (*An. Post.* 75a38–39; Aristotle 1984: 122 [vol. 1]; and *On the Heavens* [*De Cael.*] 299a2–20; Aristotle 1984: 490 [vol. 1]). Natural philosophy sought to offer a causal account of the motions of the heavenly bodies. Mathematical astronomy – a mixed or subordinate science – was instrumentalist activity that provided calculations that would enable prediction of their observed positions. It 'saved the appearances' rather than offering genuine causal explanations.

The theoretical sciences also represent different stages of intellectual formation. Implicit in the three-fold division of the theoretical sciences was a process in which the philosopher might begin with the tangible objects of the senses (natural philosophy) and proceed by way of the less visible and tangible (mathematics) to the highest and most abstract subject of all (theology) (Daniélou 1953: 17–26; Blowers 2008; Bragues 2009: 73–90). On this understanding, the relationship between Christianity and the Aristotelian sciences would as much be about competing forms of spiritual practice as potentially conflicting doctrines about the world.

The most significant challenges to the Aristotelian understanding of *scientia* took place during what is commonly known as 'the scientific revolution' – roughly the period between the publication of Copernicus' *On the Revolution of the Heavenly Spheres* (1543) and Isaac Newton's *Principia Mathematica* (*Mathematical Principles of Natural Philosophy*; Newton 1999). Practitioners of the new sciences were happy to ignore Aristotle's prohibition on mixing the methods of the theoretical sciences (natural philosophy, mathematics, and theology). This made possible a genuinely mathematical natural philosophy (that is, a mixing of mathematics and natural philosophy), reflected in the new label 'physico-mathematics' and in the very title of Newton's magnum opus (Cunningham 1991).

Less well appreciated is the fact that the relaxation of this Aristotelian requirement also enabled a new combination of theology and natural philosophy which came to be designated 'physico-theology' (Blair and Greyerz 2020; Harrison 2005). Natural philosophers gave themselves the licence to draw upon theology and make theological speculations, effectively becoming 'secular theologians' (Funkenstein 1986: 4–10). It is often claimed that modern science was made possible through a liberation of the study of nature from the dominance of theology. However, in many respects the scientific revolution sees a more intimate connection between natural philosophy and theology than the preceding Middle Ages, when both Aristotelian strictures against mixing the methods of the theoretical sciences and also the institutional separation of the faculties of arts and theology tended to keep them well apart. Between the seventeenth and nineteenth centuries much of the critical reflection on the relation between natural philosophy and theology was carried out by natural philosophers.

The introduction of experimental and inductive methods also meant that the new sciences did not fit the long-standing deductive model set out in Aristotle's logical writings. Philosopher John Locke thus pointed out that a natural philosophy based on experiment could not be a true 'science' in the traditional sense, since it did not carry the demonstrative certainty that Aristotle had demanded (Locke 1975: 645, first published 1700). But natural philosophers happily conceded this, contending that Aristotle had set the standard unrealistically high. This meant that the new science was still not called 'science', and the traditional labels 'natural philosophy' and 'natural history' continued to be in use until the nineteenth century. Both enterprises were strongly informed by natural theology.

Finally, during the nineteenth century, the English word 'science' fully took on its modern meaning, referring to what we now know as the natural sciences and explicitly excluding moral, philosophical, and theological considerations. At the same time, 'biology' came to be preferred to 'natural history' and was numbered among the sciences, too. The notion of a scientific method, exclusive to the sciences, also appeared at this time along with a new label for its practitioners – 'scientist' (Ross 1962; Thurs 2011). These developments enabled, for the first time, talk of the relations between theology and science in our modern sense.

2 Shifting historical relations

The history of the relevant concepts clarifies what can be said, from a historical perspective, about the relations between 'science' and 'theology'. While strictly speaking that relation came into existence only during the nineteenth century, it is profitable to consider what might in some sense be the equivalent relationship in preceding periods. For early Christianity and much of the patristic period, the comparable concern is the relationship between aspects of pagan philosophy and biblical interpretation; for the Middle Ages, between Aristotelian natural philosophy and theology or *sacra doctrina*; for the early modern period, between experimental natural philosophy and natural history on the one hand and theology on the other; for the modern period, between science and theology as presently understood.

2.1 Early Christianity and the patristic period

Not surprisingly, given the analysis above, we do not encounter in early Christian writings explicit discussions of the relations between science and theology. The closest we get lies in more general references to the relationship of the Christian gospel to philosophical traditions, pagan religions, and Jewish beliefs and practices. These tend to be understood, initially at least, not in terms of potentially conflicting doctrines, but rather competing forms of life. We encounter New Testament references to tensions between the gospel

and ‘the wisdom of this world’ (1 Cor 3:19; cf. 1 Cor 1:12; Jas 3:15) along with the need for followers of Christ to avoid ‘profane *and* vain babblings, and oppositions of science [*gnōseōs*] falsely so called’ (Tim 6:20 KJV). These are suggestive of a conflict between Christian teachings and the dominant thought forms of the prevailing culture. Yet, at the same time, the Christian gospel was understood to be the fulfilment of both Jewish and pagan expectations. These dual aspects are evident in St Paul’s reception in Athens. On the one hand, Epicurean and Stoic philosophers are depicted as sceptical of his message. On the other, Paul quotes a Stoic poet and suggests that the inchoate theology and worship of the Greeks was an imperfect and partial version of what was now fully manifested in the Christian gospel (Acts 17:18-33; cf. Rom 1:20). This ambivalence towards worldly learning carries over into the attitudes of the Church Fathers.

The North African Church Father Tertullian (c.160–c.225) famously asked what Athens had to do with Jerusalem, seemingly suggesting an opposition between Christianity and pagan wisdom (*The Prescription Against Heretics* 7; ANF 3: 246). Yet several Church Fathers, especially those writing in Greek, took a more conciliatory approach, proposing that philosophy, like the Old Testament, was a preparation for the Christian gospel. Eusebius of Caesarea (c.260–c.341), regarded Christianity as a new kind of philosophy (*Preparation for the Gospel* 1.3; Eusebius of Caesarea 1903: 19). Others also stressed the common formative aspects of pagan philosophy and Christianity, with Clement of Alexandria (c.150–c.220) suggesting that philosophy, and especially the speculative sciences, prepare the soul to receive the truth (*Stromata* 1.1, 1.5; ANF 2: 303, 305). Clement and Origen (185-253) also drew upon the idea of the speculative sciences as stages through which the soul progresses. This is reflected in the Aristotelian order which began with the tangible things of natural philosophy before moving on to the more elevated truths of theology (*Stromata* 1.28; ANF 2: 340; *In Cantica Canticorum*: Prologus 3; ACW 26: 39–42).

Subsequently, Augustine would propose that the quest for the blessed life (*beata vita*) was something shared by both pagans and Christians, but that only in Christianity could that quest be fulfilled (*Sermons* 150; Augustine of Hippo 2007: 31). Augustine also argued that philosophers had taught things that were in accord with the Christian faith, and that the liberal arts contained truths fit for use. Christians should adapt these for the preaching of the gospel and the reading of scripture (*On Christian Doctrine* 2.40.60; NPNF1 2: 554-556). In a famous passage from *On the Literal Meaning of Genesis* he cautions against the rejection of well-established facts of natural philosophy and natural history which may seem to conflict with the literal sense of scripture.

> Now, it is a disgraceful and dangerous thing for an infidel to hear a Christian, presumably giving the meaning of Holy Scripture, talking nonsense on these topics; and we should take all means to prevent such an embarrassing situation, in which people show up vast

> ignorance in a Christian and laugh it to scorn. (*The Literal Meaning of Genesis* 1.19.39; ACW 41: 42–43)

In same work, Augustine also responded to 'scientific' objections to the narratives of creation raised by the Manichaeans, setting out the principle that if the literal words of scripture conflict with a demonstrated truth of natural philosophy, then the relevant biblical passage must be interpreted in some non-literal way (*The Literal Meaning of Genesis* 2.9.21; ACW 41: 59). This principle was later invoked by Galileo in his discussions with the Holy Office (McMullin 1998). As we have seen, the standard for what counted as a demonstrated truth, on Aristotle's model at least, was quite high. But the general principle was clear. Well-established scientific claims should not be lightly rejected and, where possible, apparent conflicts with scripture should be resolved by resorting to non-literal readings.

2.2 The Middle Ages

The recovery of the full corpus of Aristotelian writings in the twelfth and thirteenth centuries led to new ways of thinking about the relations between Christian teachings and Greek philosophy. Because philosophy was no longer a living tradition, the mode of relation tended to shift away from a comparison of different forms of life to one that focused on contrasting methods, approaches, and doctrinal content. As noted above, the methods of Aristotelian logic were deployed in the construction of a more systematic 'theology' which, in turn, was accommodated in various ways to Aristotle's understanding of the speculative sciences. This led to unease in certain quarters, with some arguing that the substance of Christianity was more to do with spiritual formation rather than dialectical disputation. (The latter remains very much the focus in the Eastern Orthodox tradition, which is critical of the dialectical turn taken by the West.) This tension was also related to differences over which philosophical approach was more consonant with Christianity: Neoplatonism or Aristotelianism. By the close of the thirteenth century the broad consensus was with those who had come to terms with Aristotelianism, with Aquinas' 'synthesis', embodied in the monumental *Summa Theologiae*, being the most conspicuous representation of this development.

The formal censure of certain Aristotelian doctrines during the thirteenth century offers a useful insight into some of the key issues. In 1277 Stephen Tempier, the Bishop of Paris, issued a Condemnation of 219 theological and philosophical propositions, many of which were topics of disputation within the Faculty of Arts at the University of Paris. The heterogeneous list condemned theses relating to the relations between theology and philosophy, the nature and knowledge of God, and a range of natural philosophical topics concerning angels, the eternity of the world, the soul, and human freedom (Piché 1999). This event has sometimes been read as an instance of historical conflict between science

and religion or, more plausibly, reason and faith. But there was much more to it than that. It is true that the 1277 Condemnation probably reflects tensions between the Faculty of Arts and the higher Faculty of Theology, and the sentiment that arts scholars were improperly straying into theological territory. It was also a reaction against the introduction of 'pagan' thought – Aristotle and his Arabic commentators – into the university curriculum. However, the science versus religion interpretation requires that Aristotelian methods and doctrines be problematically equated with 'science', whereas in fact liberation from adherence to Aristotelian doctrines later became a hallmark of scientific progressivism. Accordingly, some have argued that the 1277 Condemnation, irrespective of Tempier's intentions, contributed in positive ways to the emergence of modern science (Duhem 1954; Grant 1979). However interpreted, the episode illustrates the importance of not uncritically equating modern science with Greek natural philosophy.

A relevant aspect of post-1277 debates concerns the way in which divine omnipotence was deployed to reject specific Aristotelian teachings and spur counterfactual thinking. One of the condemnations, for example, prohibited denial of the existence of a vacuum (the vacuum, according to Aristotle, was an impossibility). It was argued, against Aristotle, that a vacuum was something that God could bring about if he so wished. Scientifically significant discussions about the nature of space were similarly prompted by theological reflection on divine omnipotence, divine omnipresence, and the spatial location of angels (Thijssen 2018; Bakker, Delphine and Palmerino 2018). Theological considerations thus stimulated new and critical thinking about long-standing scientific orthodoxies.

In the fourteenth century, a growing theological emphasis on the primacy of God's will, characteristic of Franciscan thinkers, implied a different kind of relation between Creator and creation. Nature had previously been understood as an expression of God's being. For thinkers such as Duns Scotus (c.1265–1308) and William of Ockham (c.1287–1347), creation instead became a contingent expression of the divine will. This theological 'voluntarism' would have a major impact on the emergence of modern science and, arguably, on the development of Western modernity itself (Foster 1934; Oakley 1961, 2019; Blumenberg 1985).

2.3 The early modern period

Many of the key elements of modern science were established during the period between the sixteenth and eighteenth centuries. These included the mathematization of natural philosophy, a new experimental and inductive approach to knowledge, the growth of explanations couched in terms of laws of nature, new institutional and communal settings for the practice of natural philosophy, and the beginning of a long process that would propel the natural sciences to a position of unparalleled epistemic authority. Theological considerations played an important role in these developments. The theme of reform was

common to both the Protestant Reformation and Scientific Revolution; the concept of laws of nature, along with new investigative practices, was indebted to theological voluntarism (a late medieval development); new ideas of vocation gave rise to religious motivations to study nature; the biblical narrative of the fall both informed experimental methods and gave legitimacy to fledgling new sciences; a powerful alliance between natural philosophy and natural theology consolidated the social status of the new scientific approaches.

It must be said that just as the Protestant Reformation had its roots in late medieval Catholicism, the early modern sciences were not totally divorced from what had come before. Accordingly, the familiar historiographical category 'the Scientific Revolution' needs to be deployed with some caution (Shapin 2018; Park and Daston 2006). That said, it is significant that historical actors drew connections between these two epochal events – with Francis Bacon (1561–1626), for example, suggesting that the dual reformations of religion and the sciences were providentially ordained (1974: 42, first published 1605). Certainly, the Protestant Reformation had facilitated a questioning of traditional authorities, with scholastic Aristotelianism singled out for particular censure by Martin Luther. Early modern natural philosophers thus again confronted the question faced by their predecessors: which philosophical tradition best serves Christianity and the study of nature? While their patristic and medieval forebears had opted, respectively, for Neoplatonism and Aristotelianism, from the seventeenth century onwards a Christianized Epicureanism gradually came to displace a range of competing philosophical approaches.

The success of Epicureanism may seem puzzling given its long association with atheism. But a singular advantage of Epicureanism was that it seemed to offer greater scope for direct divine action than the Christian-Aristotelian synthesis. If Aristotle had posited a world in which the inherent qualities of objects determined their behaviours, the austere atomism of modern Epicureans postulated only inert, invisible particles in motion. In the Christianized version of Epicureanism, God was needed to put matter into motion, and he did so according to laws that he directly willed. French philosopher René Descartes (1596–1650) expressed it this way: 'God imparted various motions to the parts of matter when he first created them, and he now preserves all this matter in the same way, and by the same process by which he originally created it' (Descartes 1985: 24 [vol. 1]). Motion, on this understanding, was not intrinsic to matter but depended on directly God's acting regularly in accordance with his immutable will.

Descartes' novel conception of divinely instituted laws of nature found wide acceptance with other early modern natural philosophers. The preface to the second edition of Isaac Newton's masterwork, the *Principia*, explains that while Aristotelians had sought to understand nature by seeking the '*inherent forms and qualities*' of things, modern philosophers instead 'have undertaken to reduce the phenomena of nature to

mathematical laws' (Newton 1999: 381, first published 1687; emphasis added). These laws are not intrinsic to nature, but are directly impressed upon it by God:

> [T]his World—so beautifully diversified in all its forms and motions—could not have arisen except from the perfectly free will of God, who provides and governs all things. From this source, then, have all the laws that are called laws of nature come, in which many traces of the highest wisdom and counsel certainly appear, but no traces of necessity. (Newton 1999: 397)

Once again, the doctrine of creation, along with ideas of divine freedom and omnipotence that were the product of the late Middle Ages, had a direct bearing on the investigation of nature.

The mathematical character of the laws of nature, which represents a break from Aristotle's prohibition on mixing mathematics and natural philosophy, was similarly justified by theological considerations. In his treatment of physics, William of Ockham had already proposed that mathematics might be applied to substance or qualities as discussed within natural philosophy (Goddu 1984). Now Johannes Kepler (1571–1630) insisted that God, if he wished, could have chosen to use mathematics in his arrangement of the cosmos, whatever Aristotle and his followers might say (Kepler 1999: 123, first published 1621). Galileo likewise proposed that the book of nature had been written by God in mathematical language (Kepler 1999: 237–238, first published 1623).

The new admixture of natural philosophy and theology also had implications for the status of scientific practitioners who could now understand themselves as being engaged in an intrinsically theological activity. Kepler, who made the crucial discovery of the mathematics of elliptical planetary orbits, related how he had once aspired to be a theologian but came to understand that God was no less praised through his work in astronomy (Kepler 1945: 40 [vol. 13]). Robert Boyle similarly contended that natural philosophers were, in effect, 'priests of nature' (Boyle 2016b: 238 [vol. 3], first published 1663; Fisch 1953). This hybrid theological/scientific identity had been partly premised upon new Protestant conceptions of vocation, which challenged the traditional hierarchy of medieval estates. The priesthood, according to this understanding, represented only a difference of office and not higher religious status.

The new methods deployed in the study of nature were also related to theological considerations. The fact that the laws of nature were determined by free divine choice with 'no traces of necessity', as Newton put it, meant that the order of nature could not be rationally intuited, but would need to be established by empirical investigation. Descartes explained that: 'Since there are countless different configurations which God might have instituted here, experience alone must teach us which configurations he actually selected in preference to the rest' (Descartes 1985: 256 [vol. 1]). The revival

of Augustinian understandings of original sin and its effects also contributed to the new experimental approach. Here the argument was that fallen human minds could not aspire to a demonstrative knowledge of nature's operations. Aristotle had been able to entertain his ambitious vision only because he was unacquainted with the idea of original sin. In reality, in a fallen world, knowledge would have to be painstakingly pieced together from numerous observations, conducted by countless individuals, and accumulated over the generations. Because nature had also fallen it was no longer transparent to human minds and needed to be investigated by rigorous and sometimes invasive experiments. Experimental science could thus be understood as a palliative for original sin (Harrison 2007).

In addition to influencing the experimental methods of natural philosophy, the biblical narrative of the fall also helped establish the social legitimacy of natural philosophy. We now tend to think that the value of the natural sciences is more or less self-evident. The material and technological benefits that they bestow seem to provide an obvious reason to value them. However, during the period when the modern experimental sciences were first being established significant questions were asked about their legitimacy. They were especially vulnerable on account of their alliance with a religiously suspect Epicureanism. Another weakness was that the practical and applied knowledge at which the sciences aimed was deemed to be unworthy of genuine seekers after knowledge. Supporters of more traditional approaches stressed the importance of moral formation over the quest for material comforts. Finally, it was not clear at this historical juncture whether experimental natural philosophy could even make good on its promise of providing practical amenities (Harrison 2021).

One way to think about the legitimacy question is to compare the trajectory of modern Western scientific culture with the fate of the 'sciences' in other cultures: ancient Greece, China, medieval Islam. What we tend to see in these comparative cases is a 'boom-bust' pattern in which science enjoys periods of efflorescence but as interests shift to other concerns never becomes a central and enduring feature of the culture (Ben-David 1971; Cohen 2010). Science, in short, fails to consolidate. While material factors certainly play a role in explanations of the varying fortunes of the sciences in these contexts, it is equally true that consolidation requires a strong source of ideological legitimacy. A key part of the story of science's success in the West relates to the fact that it was able to harness the legitimising power of Christian theology (Gaukroger 2006).

The biblical narrative of the fall played a crucial role in this process of legitimation. At the time, it was commonly held that Adam in his state of innocence had possessed a perfect knowledge of nature's operations but that this had been lost following the fall. The natural sciences were presented as ways of partially restoring the knowledge that the human race had surrendered on account of original sin. Francis Bacon declared in an influential

manifesto for the new science: ‘For man by the fall fell at the same time from this state of innocency and from his dominion over creation. Both of these losses however can even in this life be in some part repaired; the former by religion and faith, the latter by arts and sciences’ (Bacon 1857: 247-248 [vol. 4]). According to this view, the sciences were redemptive practices, working hand in hand with religion to help restore to the human race some of its prelapsarian perfections.

The charge that experimental natural philosophy failed to address the traditional moral goals of learning was also countered on theological grounds. Bacon contended that natural philosophy was concerned with ‘the glory of the creator and the relief of man’s estate’ (Bacon 1857: 295 [vol. 3]). This latter goal was explicitly identified with the Christian virtue of charity. Robert Boyle proposed similar religious justifications for the pursuit of experimental natural philosophy. By studying nature we learn of both God’s wisdom and power and of our religious and moral duties to our neighbours (Boyle 2016b: 292 [vol. 3], first published 1663).

A powerful alliance between natural theology and the formal study of nature was characteristic of the relations between theology and science from the seventeenth century through much of the nineteenth century. Natural philosophy and natural history provided premises for the arguments that sought to establish the existence, power, and wisdom of God. These often focused on the contrivances (design) of living things, but inferences were also drawn from the harmony of the laws that governed the natural world. Moreover, while there was a tendency to regard the natural sciences as a source for rational arguments in support of Christianity, many writers appealed to religious affections and, as Boyle expressed it, sought to advance ‘sentiments of devotion’ (Boyle 2016a: 114 [vol. 11], first published 1688). In one of the classic works of natural theology from the period, *The Wisdom of God manifested in the Works of Creation* (1691), pioneering botanist John Ray announced that his aim was ‘to Stir up and Increase in us the Affections and habits of Admiration, Humility, and Gratitude’ (Ray 1691: preface).

Some early physico-theological works sought to harmonize the new physics and cosmology with biblical narratives and prophecies (Blair 2000; Vidal 2003). Cambridge Platonist Henry More (1614-1687) reconciled the creation accounts of Genesis and biblical prophecies of the destruction of the world by fire with Descartes’s cosmology (1653: 135, 150,161f.; 1660: 240). Thomas Burnet provided detailed descriptions of the physical mechanisms of the biblical flood and final conflagration in his *Sacred Theory of the Earth* (1681; 1689). William Whiston did something similar but with a revised Newtonian cosmology, proposing that the biblical flood had been occasioned by a passing comet (Whiston 1696). Comparable works were produced in Europe (Zuber 2015; Jorink 2020). For the most part, however, physico-theological works of the eighteenth century avoided reference to special revelation, restricting themselves to what could be known of God from

the natural world alone. These scientifically informed works of natural theology, written in the vernacular, became an important medium through which the discoveries of naturalists were communicated to a wider public. Ray's *Wisdom of God* was published in six English editions, followed by translations in German, French, and Dutch. Works by William Derham (1657–1835), William Paley (1743–1805), Benjamin Nieuwentijt (1654–1718), and Noël-Antoine Pluche (1688–1761) also circulated widely and in numerous translations (Blair 2016; Bruker 2020; Blair and Greyerz 2020).

Physico-theology remained a popular genre, especially in England, until well into the nineteenth century. David Hume's (1711–1776) philosophical objections to the argument from design, set out in the posthumously published *Dialogues concerning Natural Religion* (1779), seemed to have had little impact, possibly because the work of Ray, Derham, and Paley had a broader agenda than just mounting a philosophical argument. There was less consensus in France and Germany, perhaps on account of a persistent Enlightenment anticlericalism in the former and Immanuel Kant's (1724–1804) searching criticisms of natural theology in the latter. Enlightenment *philosophes* in eighteenth-century France, in particular, were dismissive of the physico-theological amalgam. Voltaire (1694–1778) thus passed unflattering judgements on the pious endeavours of Abbé Pluche who, it has been plausibly argued, was the model for Pangloss in his satirical *Candide*. In progressivist Enlightenment versions of history priests, theologians, and ecclesiastical institutions were cast as the historical enemies of reason and inhibitors of what was imagined to be the natural growth of the sciences. In the *Encyclopédie*, Jean d'Alembert (1717–1783) seized upon Galileo's collision with the Holy Office to leap to the general conclusion that ignorant theologians had habitually waged war against natural philosophy (1995: 74, first published 1751). Ironically, this had originally been an argument deployed by Protestants against 'papism'. This putatively negative relation between benighted theologians and rational practitioners of science came to be written into influential Enlightenment versions of history. Nicolas de Condorcet (1743–1794) could thus declare in his *Sketch for a Historical Picture of the Progress of the Human Spirit* that 'the triumph of Christianity was the signal for the complete decadence of philosophy and the sciences' (2012: 51, first published 1795). This narrative of conflict would subsequently be deployed more broadly in the nineteenth century as a strategy for driving a wedge between theology and the natural sciences, and breaking up a long-standing, if not always amiable, partnership.

2.4 The nineteenth century and beyond

The natural sciences and natural theology remained closely connected for much of the nineteenth century. The 1830s saw the publication in England of the Bridgewater Treatises, eight impressive volumes dedicated to illustrating 'the Power, Wisdom, and Goodness of God, as manifested in the Creation' (Topham 1998). These works, written by some of the leading scientific figures of the age, were not simply variations on Paley's

classic work, however, and did not uniformly focus on organismic design. They tended to converge upon the idea of a law-governed, yet dynamic, natural world that differed from Paley's comparatively static view of a single miraculous creation (Topham 2022). Polymath William Whewell (1794–1866), author of the third volume on astronomy and physics, reiterated the seventeenth-century view that the uniformity of nature, expressed in terms of immutable laws, was grounded in the constant and ubiquitous exercise of the omnipotent powers of God. This was the characteristic position of the leading 'men of science', most of whom held fairly conventional theological views (Stanley 2014). We find a similar commitment in theological writings, with John Henry Newman (1801–1890), in spite of his reservations about the apologetic uses of 'evidences', pointing out that 'Science and Revelation agree in supposing that nature is governed by uniform and settled laws' (Newman 1843: 5–6, 197–198). For Newman, purposeful divine interventions could be understood only against the background of the constant operation of laws of nature.

Specific developments in physics were also linked to theological considerations, as in the case of gravity in the seventeenth century. Physicists such as Michael Faraday (1791–1867) and James Joule (1818–1889) maintained that while energy could be manipulated by human beings, it could be created or destroyed only by God. For them the law of conservation of energy was grounded in theological considerations. The second law of thermodynamics, which predicts the heat death of the universe, was similarly understood in terms of Christian eschatology by prominent physicist, Lord Kelvin (1824–1907) and others. James Clerk Maxwell (1831–1879), whose remarkable scientific attainments include the successful theoretical unification of the principles governing light, magnetism, and electricity, related his accomplishments to the fact that the operations of nature were the creation of a single divine mind (Stanley 2020).

Some of this renewed emphasis on the divine origin of laws of nature was in response to an opposed view, characteristic of a number of French thinkers, that laws of nature *precluded* divine activity. Certainly, the amicable relationship with natural theology characteristic of British science was less in evidence across the channel. Naturalist George Louis Leclerc, Comte de Buffon (1707–1788) distanced himself from 'the dark clouds of physical theology', setting out a history of the earth that differed from a literalist biblical chronology (1749: 202) and drawing censure from the Faculty of Theology at the Sorbonne as a consequence. Pierre Simon Laplace is also well known for having rejected Newton's reliance upon divine intervention to secure the stability of the solar system (Hahn 2005: 51–56, 172). In the sphere of biology – a term newly coined in the nineteenth century – Jean-Baptiste Lamarck's (1744–1829) theory of the transmutation of species was suggestive of a natural origin for all forms of life. Like Buffon and Laplace, Lamarck was a deist, but his project was incipiently naturalistic and materialistic (Brooke 1991:

307–373). Much of the perceived religious danger of these came from the philosophical or political positions that they could been seen as licensing.

Already France had witnessed a form of extreme mechanistic materialism in the radical proposal of Julien de La Mettrie (1709–1751) that the soul was material and human beings mere machines (1745; 1748). Dutchman Jacob Moleschott (1822–1893) along with German philosophers Carl Vogt (1817–1895) and Ludwig Büchner (1824–1899) subsequently built upon mechanical and reductionist biology to elevate materialism to the status of an all-encompassing metaphysics. This amounted to a denial of an immaterial soul and non-material beings. These materialist writers also sought to challenge religious authority and replace it with scientific authority (Wolfe 2014; Gregory 1977). They were distinctive in claiming that their atheism was not an implication of their philosophical commitments, but of the natural sciences. Unhelpfully for its protagonists, materialism was associated with political radicalism and was widely regarded as a threat to social stability. This limited its appeal. Thus, while there was a significant current of anti-Catholicism and anti-clericalism in these materialist writings, this did not lead to a widespread conflict between theology and the scientific establishment (Dittrich 2014).

A more subtle competition took place at the level of the respective claims of natural sciences and humanistic disciplines in fostering moral and spiritual development. One of the strongest justifications for including the natural sciences in the university curriculum was their purported role in building character or *Bildung* (Van Bommel 2015). A key question was thus which of the disciplines, ranging from theology and the classics to physics and mathematics, best contributed to the right kind of intellectual and moral formation (Fairholme 1883: 28; Henslow 1851; Layton 1973). Arguments for the inclusion of the sciences as central components of education led to a questioning of the institutional authority of university theologians and philosophers. It was in a somewhat defensive mode that John Henry Newman argued for the importance of theology in the university curriculum, pointing out that scientific education was ‘but an imperfect training of the intellect’ (Newman 1908: 266, first published 1865). Here again are echoes of the older mode of relation which consisted in competing spiritual visions.

None of this is to say that specific scientific doctrines were completely irrelevant to the relations between science and theology, as the inception of Charles Darwin’s theory of evolution by natural selection illustrates. The 1859 publication of *The Origin of Species* is typically regarded as a watershed in the relations between theology and the natural sciences, marking a decisive end to a physico-theological tradition centred on divine design. The issues of evolution and theology warrant a separate treatment beyond the few brief remarks offered here and in section 3, below. However, it is worth observing that the negative impact of Darwin’s theory on theology can be overstated (Lightman 2009). There were pre-Darwinian theories of evolution and, as already noted, forms of natural

theology and versions of the design argument that were largely untouched by the inception of evolutionary theory (Swinburne 1979: 133–135; Roberts 2010). Assumed connections between evolutionary thinking and political radicalism and materialistic atheism were important factors in the negative reception of Darwinism. Moreover, for many of Darwin's contemporaries, the growth of biblical criticism presented a more significant challenge to traditional Christian belief than doctrines of the natural sciences (Altholz 1994).

Substantive questions aside, the advent of evolutionary theory provided an occasion to promote the social legitimacy of the sciences. This was no longer to be accomplished by strengthening connections with theology, but rather by aligning science with reason and human progress, and crediting theology with an inhibitory role. This stance had been characteristic of some strands of Enlightenment thought but suffered from the disadvantage of being inconsistent with conspicuously positive relations between natural philosophy and theology, both past and present. Now, contemporary tensions relating to evolutionary theory could be exaggerated, generalized, and read back into history. Part of the strategy of advocates of conflict involved the construction of an anachronistic history, going back to the ancient Greeks and pitting an immobile theology and dogmatic theologians against a rational and progressive science. Biologist Thomas Henry Huxley (1825–1895) and physicist John Tyndall (1820–1893) adopted this approach (Tyndall 1875; Huxley 1893, first published 1887 [cf. Renan 1883]; Haeckel 1929, first published 1899). In his review of Darwin's *Origin*, Huxley memorably wrote that '[e]xtinguished theologians 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' (Huxley 1870: 278). Two works by American authors were also enormously influential in disseminating this narrative: John William Draper's *History of the Conflict between Religion and Science* (1874) and Andrew Dickson White's *History of the Warfare of Science with Theology in Christendom* (1896; see also Ungureanu 2019). For these writers the course of history was to be understood in terms of a 'conflict of two contending powers, the expansive force of the human intellect on one side, and the compression arising from traditionary faith and human interests on the other' (Draper 1874: vi).

These influential advocates of conflict would often distinguish theology and theologians, both typically regarded with hostility, from 'religion' which, understood in their rather diffuse sense, was thought capable of peaceful co-existence with science (Lightman 1987: 116–145; Ungureanu 2019). This is suggestive of a competition for epistemic and social authority between 'scientists' – a term newly coined in the nineteenth century – and theologians (Ross 1962; Turner 1978; Barton 2018). Scientific naturalists called for practical measures in the reform of scientific and educational institutions, and reshaped the persona of 'the scientist', a vocation now understood as exemplifying a set of rationally grounded epistemic virtues that contrasted with the groundless 'faith' of the clerical

class (Galton 1874; Youmans 1897; Heyck 1982; Barton 2018: 292–361). Their project met with considerable success, and the accompanying narrative of a historical conflict between theology and science, in spite of its historical limitations, became a key part of the self-understanding of the modern West. In the twentieth century the emergence of religiously motivated anti-evolutionary movements, initially in North America but now a global phenomenon, lent credence to this narrative (Numbers 2006).

3 Three substantive issues

Historical relations between science and theology should not be understood primarily in terms of a history of competing or complementary doctrines. Nevertheless, substantive issues have played an important role in their relations – although these often turn out to be more about deep-seated philosophical or metaphysical concerns than straightforward empirical matters. This section gives brief consideration, from a field of possible topics, to three recurring issues that exemplify some general principles about the historical relations between science and theology.

3.1 The eternity of the world

Aristotle had taught that the world was eternal, in contrast to Jewish and Christian views that the world had been created in time (or 'with' time). This was not a straightforward conflict between Christianity and philosophy since ancient philosophers themselves had been divided on this question (Sedley 2007). That said, the prestige of Aristotle meant that his views about the matter demanded a response. In the sixth century, the Christian philosopher John Philoponus (490–570) wrote against the eternity of the world on several occasions, arguing for the inconsistency of Aristotle's position while at the same time outlining a unified dynamics that was to prove influential in the period of the scientific revolution (Sorabji 1987; Grant 2007: 58-60, 194–195). A number of medieval works also addressed this question (Dales 1989). In *De aeternitate mundi*, Aquinas cautiously suggested it was theoretically possible for a world to be both created and eternal, since 'creation' refers to a relation of dependence and not a temporal beginning. He concluded that reason alone cannot determine the question: it is by faith that we know that the world is not eternal (Wippel 1981).

The issue was still live in the early modern period, with radical works such as *Theophrastus redivivus* (1659) rehearsing a cluster of related materialist tropes: the world is not created but eternal, God does not exist, the soul is mortal, religion is a fraud. Again, this was not straightforwardly a science versus theology matter since scientific orthodoxy consistently favoured the temporality of the earth, if not the universe. But, for some, the pernicious idea of the eternity of the world was of greater concern than the newly emerging ideas of biological transmutation, which at least implied some temporal starting point. In the nineteenth century, the arrow of time implied by developments in thermodynamics

was widely held to have shattered the idea of the world's infinite duration. Rudolf Clausius (1822–1888) and Lord Kelvin, both pioneers in the field, proposed that the second law of thermodynamics disproved the materialist conception of an eternally recurring, cyclical world (Kragh 2008). For their part, atheistic materialists were not enamoured of the idea of the heat death of the universe which was an implication of the new cosmological models.

In the twentieth century the issue emerged once again in the context of cosmological speculations and competition between steady-state and big bang theories. In the 1930s, Nobel Laureate Robert Millikan (1868–1953) supported the idea of an eternally recurrent universe. Far from seeing this as an alternative to creation, he proposed that this theory actually supported the idea of God's ongoing creative activity. More generally he argued that modern science supported the teachings of Christianity (Halvorson and Kragh 2019). By the 1950s, however, the steady-state view had become a weapon in the arsenal of naturalists who claimed that it counted decisively against the idea of creation. Astronomer Fred Hoyle (1915–2001) thus pitted it against the new 'big bang' theory (his own derisory designation), which he regarded as tantamount to religious fundamentalism. In the end, the big bang theory won out over the steady-state hypothesis. Because it suggests a beginning of the universe, the big bang theory has been regarded by some as supportive of the idea of creation, to a degree justifying Hoyle's concerns. Accordingly, and in conjunction with appeals to anthropic fine-tuning, big bang cosmology has been supposed to support a new version of the argument from design (Swinburne 1996). Twentieth-century cosmological theories, in the form of 'physical eschatology', have also been related to Christian teaching about the end times and, controversially, even immortality (Tipler 1994; 2007). However, new quantum and string cosmologies challenge both the idea of the big bang as some kind of absolute beginning and some of the premises of anthropic fine-tuning arguments.

From this compressed history, three observations follow. First, some treatments of this topic conflate scientific conceptions of the temporal beginning of the world with theological concepts of creation. Second, the same scientific doctrines have often been invoked in support of both theism and atheism, and sometimes at virtually the same historical moment. Third, particularly over the past 100 years, the relevant science has shifted significantly. All of this suggests that there are risks in yoking theology too closely to what, from a longer historical perspective, turn out to be ephemeral scientific hypotheses. Theologians have typically been more sensitive to such risks than their scientific counterparts.

3.2 Chance or design?

Among the ancient philosophical schools only Epicureanism attributed a significant role to chance in the operations of nature. The general consensus in western antiquity was

that there was too much order in the natural world for chance to make sense as a general account of things. The natural order was typically understood as either a product of intelligent design (Plato) or as resulting from an inherent teleological order (Aristotle). Aristotle admitted that there were rare chance events, but insisted that they could not be accommodated within genuine scientific explanations (*Met.* 1026a34-1026b4; Aristotle 1984: 1620–1621 [vol. 2]). Not unexpectedly, the Church Fathers were united in their opposition to Epicurean doctrines of chance. These were dismissed as impious and foolish, and opposed to Christian understandings of creation and providence. Dionysius of Alexandria (200–265) devoted a complete work to the refutation of Epicureanism. One of his more intriguing arguments was that if our minds were just fortuitous arrangements of atoms we would have no reason to be confident in the reliability of their operations, rendering the arts and sciences completely useless (*From the Books on Nature* 1-4; ANF 6: 85-89).

If order were obvious in nature, it was less so in history. Augustine maintained that the rise and fall of kingdoms is under the control of providence and that what was often referred to as ‘fate’ was just a way of speaking of ‘the will or power of God’ (*City of God* 5.1; NPNF 1: 84). Aquinas revisited this issue in the thirteenth century, observing that while most philosophers had acknowledged that there was a conspicuous order manifested in nature, there were understandable doubts about human history ‘because there is no sure order apparent in human events’ (*Expositio super Iob ad litteram*, prooemium; Aquinas 2016: 1). Christian philosophers, he proposed, were assured of God’s providential control, not by disinterested observations of history but by the lessons of scripture. Aquinas followed Aristotle in allowing that there were rare, but genuine, accidents in history.

John Calvin (1509–1564) combined aspects of the positions of Augustine and Aquinas. God’s providence is not as obvious in history as it is in nature, yet history is no less governed by God: it is just that his purposes may be hidden. What appears to many as ‘fate’ Christians can recognize by faith as the secret plan of God (*Institutes of the Christian Religion* 1.16.8; Calvin 1962: 242-243 [vol. 1]). Calvin also denied the Aristotelian-Thomist position that allowed for chance events. God does not just *permit* certain states of affairs, he insisted, but *rules* every event (*Institutes* 3.23.1; Calvin 1962: 226 [vol. 2]). This position would be reflected in the modern view of nature as governed by invariable laws and the attempt to accommodate all apparently exceptional events within schemes covered by general laws. Ironically, with the nineteenth-century secularization and reification of laws of nature, this was thought to generate difficulties for how God might operate in the natural world. Some of Calvin’s contemporaries had other concerns, with his strong emphasis on the sovereignty and rule of God reviving difficult questions about determinism, divine foreknowledge, predestination, and human freedom.

The legacy of different understandings of the transparency of divine purposes, respectively in nature and history, was acutely felt when in the nineteenth century natural history ceased focusing simply on the atemporal structures of living things and relocated them in a temporal, historical trajectory. The principle of the hiddenness of divine purposes in history should now have been extended to the realm of nature, but the impetus of a long-standing expectation of seeing divine purposes in the natural world meant that there was a lingering expectation that design should still be conspicuous in a newly historicized nature (Harrison 2016). This misplaced expectation fuelled confusion about the theological significance of evolution by natural selection. For some, moreover, the transposition of natural history into the sphere of history proper shifted the balance decisively in favour of the ancient Epicurean hypothesis (see, e.g., Monod 1971).

These brief considerations point to a cluster of recurring theological and philosophical questions that have a scientific dimension. The most general of these questions concern an enduring tension between freedom and determinism, both for nature and human agents. Also noteworthy is the paradox for thoroughgoing naturalists raised by Dionysius of Alexandria, concerning how the chance origins of human cognitive powers might be squared with a reliance on their deliverances. The propensity of naturalistic or evolutionary accounts of mind to be self-defeating has more recently been argued by Alvin Plantinga (Beilby 2002; Plantinga 2011). The question, as old as Aristotle, of the adequacy of scientific explanations that purport to eschew teleology has not gone away either (Kullman 2014; Simpson, Koons and Teh 2018; Feser 2019), and this concern is not restricted to those with theological motivations (Nagel 2012). Finally, the fortunes of the design argument, following the historicization of biology, highlight the importance of distinguishing the historical sciences, such as evolutionary biology and geology, from the physical sciences. The historical features of the former place them in a different relation to theology than the latter, although these differences are disguised by uncritical applications of the broad category ‘science’. In ‘theology and science’ literature, physics will sometimes problematically stand in for the whole of science, especially for those seeking to emphasize affinity. Conversely, for advocates of conflict, it is often evolutionary biology that stands in for science. This points to the importance of properly parsing the modern category ‘science’.

3.3 Human uniqueness

In his *General Introduction to Psychoanalysis* (1917), Sigmund Freud declared that science had dealt three great blows to human pride: first, when Copernicus dethroned earth from the centre of the universe; second, when Darwin showed that humans and animals shared a common descent; and third, when Freud himself revealed that the

human psyche was largely driven by unconscious forces over which it had little control (Freud 1920: 246–247, first published 1917; cf. Du Bois-Reymond 1883).

Freud was essentially correct to propose that challenges to human uniqueness were largely a modern phenomenon, and one in which the sciences had played a key role. However, he was wide of the mark in his assessment of the impact of Copernicanism. Human dignity was not threatened by heliocentricity. In the prevailing Ptolemaic scheme, the centre of the universe was the furthest from the heavens and literally the least elevated place to be. If anything, Copernicanism entailed a promotion of the earth and its inhabitants (Danielson 2010). However, because Galileo's championing of a version of Copernicanism subsequently became emblematic of science-religion conflict, it was often assumed that something of intrinsic theological significance must have been at stake, namely the status of human beings. In fact, the crucial issue in the Galileo affair was the scientific question of whether there was any compelling evidence that the earth was in motion. The scientific consensus at the time was that such evidence was lacking (Graney 2015). Also important was the issue of who had the authority to interpret scripture (not mathematicians such as Galileo was the view of the Holy Office), and whether mathematical astronomy should be understood realistically or instrumentally (Blackwell 1991; McMullin 2005). While the 'Galileo affair' is often presented as emblematic of science-theology conflict, it was certainly not understood in those terms at the time.

The advent of evolution by natural selection was a different case, with some substantive theological issues at stake (McGrath 2020: 43–50; De Cruz and Smedt 2020). Initially, conflict with the literal interpretation of scripture was not the major consideration, although the plotline of sacred history, which involved the triad of creation, fall, and redemption, faced some challenges. The mechanism of natural selection, while by no means scientifically well-established at the time, was a more acute concern. Because it implied an open-endedness to the evolutionary processes it was seen to be inconsistent with a teleology that was linked to God's providential ordering of nature (Hodge 1874; Gould 1989; cf. Conway Morris 2003; Plantinga 2011). Darwin's theory also raised new questions about human uniqueness and the basis of human morality. This meant that his theory had theological critics. By the same token it also had significant theological defenders (Livingstone 1984; Livingstone, Hart and Noll 1999; Moore 1979; Roberts 1988). Responses to Darwin, in short, exhibited the complexity that for most historians characterizes the historical relations between science and religion (Brooke 2007; Livingstone 2014; Lightman 2019).

Regarding Freud's third affront to human dignity, it is certainly true that modern psychology, in some of its forms, has presented challenges to theology. This is partly because the social sciences were explicitly intended by some of their early protagonists to compete directly with theology by offering 'scientific' accounts of the person and

human societies (Milbank 2006; Smith 2014). To the extent that psychology offers reductionistic and deterministic accounts of the human person, moreover, it inevitably runs up against theological anthropologies. Further, the human sciences have sometimes sought to explain, or explain away, religious commitments or behaviours, as for example in 'evolutionary debunking arguments' (Wilkins and Griffiths 2013; cf. Schloss and Murray 2009), despite the propensity of such debunking to be self-defeating (De Cruz et al. 2011). If the shared subject matter of psychology and theology sometimes occasions competition, by the same token it also enables collaboration, especially in the practical sphere of pastoral theology (Watts 2017).

In sum, long-standing assumptions of human uniqueness (which is not the same as anthropocentrism) were called into question before the advent of a non-teleological theory of evolution. More generally, there seems to be more potential for conflict between theology and those sciences that deal with human beings, which is to say evolutionary theory and the social sciences. Often this is less to do with the putative scientific facts than their imagined moral implications (Evans 2018; Aechtner 2020). This suggests that what sometimes presents as the religiously motivated rejection of evolutionary sciences may be better understood as a conflict between competing ethical worldviews. (See also Theology and Evolution.)

4 Conclusion

The history of the relation between theology and the sciences is intimately related to the history of the categories themselves. The manner in which these enterprises emerge in the West as distinct forms of human activity is an important determinant of their subsequent relations, as is their changing social and epistemic status. Historical contingencies shape what, at any particular time, are likely points of conflict or congruence, especially because the content of modern scientific theories has changed significantly over time (Newman 1843: 4, 9–10; Laudan 1981; Wray 2015). The thesis of a perennial conflict between theology and science is not borne out by the historical evidence, not least because there is no single overarching pattern to relations between theology and the sciences. That said, assumptions about the ultimate intelligibility of nature, which are essential to the scientific endeavour, have often been underpinned by theological commitments. There are, moreover, central philosophical questions of the kind briefly considered above – ultimate origins, chance and necessity, human uniqueness – that are now seen as falling under the jurisdiction of both theology and the sciences. To the extent that these are enduring questions, there are some recurring patterns in their treatment, refracted in the histories of theology, philosophy, and, in the modern period, the sciences. Related to this, the modern historical and social sciences have subject matters that most closely overlap with the subject matter of theology. In these sciences lie the greatest prospects for both conflict and complementarity.

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