

# Heterodoxy in Early Modern Science and Religion

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**OXFORD**  
UNIVERSITY PRESS

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# *Introduction*

*Ian Maclean*

The papers united in this collection were originally given in a seminar series held in All Souls College, Oxford on thinkers in the early modern period (roughly 1500 to 1800) whose work touched on both science (understood in a broad sense<sup>1</sup>) and religion, and who in their time were associated with heterodox views in one, or the other, or both, spheres. Contributors to the series were asked to consider the following questions: how was heterodoxy determined in the case of each thinker? What was the effect (if any) of the thinker's heterodox scientific thinking on his religious views? What was the effect of his heterodox theological views (if any) on his science? Is there a homology between his heterodox views in both areas?

These questions presuppose that thinkers in the past were able to measure their deviation from agreed scientific and religious positions; clearly this is much easier at certain times and places, and in respect of certain issues, than others. Most early modern writers who venture into areas in which it is important to determine where they stand on contentious scientific and religious issues set down or imply their own relationship to the orthodoxies of their day; in each case it is important to recognize the particularities of the context in which such determinations are made. In the light of this caveat, contributors chose to discuss thinkers from all over Europe; the topics they discussed concern the soul and the nature of matter (Pomponazzi, Cardano, Lutheran philosophers on the physics of the eucharist, Vanini, Gassendi), cosmology, eschatology, and the question of human destiny (Donne, Galileo, van Lansbergen, Voetius, Fromondus, and Wendelin), and the confrontation of the new philosophies

<sup>1</sup> It is not the intention in this volume to engage in the debate about the use of the terms 'natural philosophy' and 'science'; see below, n. 3.

of the later seventeenth and eighteenth centuries with Christian beliefs and writings (Hobbes, Fatio de Duillier, Newton, Stukeley, Priestley). These issues are related to others which occur in many of the writings discussed, notably the nature of God and his ways of intervening in his creation, and the meaning to be attributed to statements found in Holy Writ about the universe ('mosaic' physics).<sup>2</sup> Not all the figures who are discussed in this volume are well known, but each was chosen to reveal in a symptomatic way issues intimately connected to heterodoxy.

The fact that theology and natural philosophy interacted throughout the early modern period in various institutions and contexts, and that their relative authority was a matter of contention, has of course never been in dispute. An early notorious expression of this contention is to be found in the condemnations at Paris of certain Aristotelian propositions about the world and human nature by Bishop Étienne Tempier in 1270 and 1277; these clearly set theology above natural philosophy, and refute the view that religion and philosophy are distinguished by different orders of truth. The Pomponazzi affair of the early sixteenth century revived this dispute, and is testament to its perennial nature (see below, 12–14). Throughout the period here under discussion, theology never relinquished its claim to determine the boundaries of human enquiry and the conclusions reached by philosophers about nature. By the nineteenth century, however, the struggle between theology and science came to be seen as one between prejudice and rationality; the erosion of the power of religion to constrain scientific enquiry was taken to be proof of the progressive liberation of the human spirit and the 'demagification' of the world. More recently still, this view has been challenged in turn; rather than see the projects of early modern natural philosophers as opposed in some way to theology, the importance of their religious motivation has been stressed, and the ways in which it informed their

<sup>2</sup> Lambert Daneau's *Physice Christiana* (Geneva, 1579), Franciscus Vallesius's *De iis quae scripta sunt physice in sacris literis* (Lyons, 1588), and Robert Fludd's *Philosophia moysaica* (Gouda, 1638) are three of many contemporary sources; see also Ann Blair, 'Mosaic Physics and the Search for a Pious Natural Philosophy in the Late Renaissance', *Isis*, 91 (2000), 32–58.

scientific projects investigated.<sup>3</sup> In an earlier study, John Brooke has analysed in some detail the strategies available to historians in the light of such interpenetration.<sup>4</sup> To offer new interpretations of the book of nature was not necessarily to abandon revealed truths in the form of Holy Writ and the traditions of the Church in favour of observation and experiment. A recurring goal was to adapt the insights of one sphere to the other. Galileo may have claimed that the book of nature was written in the language of mathematics; but in his view this did not entail that theology had suddenly relinquished its role as a privileged mediator of truth through the exegesis of Holy Writ and the determination of the correct interpretation of the traditions of the Church. In his *Letter to the Grand Duchess Christina*, circulated in 1615, Galileo argued that a sound knowledge of nature was one of the best aids to the understanding of Scripture (see below, 128–38).

Nevertheless, it was obvious to any contemporary by the time of the Galileo affair that there were competing orthodoxies in both religion and science, and that the issue of authority had become paramount in both spheres. Once Lutheranism had brought about schism in the Western Church, a series of attempts to define right doctrinal thinking occurred. These theological measures were not paralleled by formal statements of doctrinal differences in natural

<sup>3</sup> A pioneering study of this type is Walter Pagel's 'Religious Motives in the Medical Biology of the XVIIth Century', *Bulletin of the Institute of History of Medicine*, 3 (1935), 265–312; see also Amos Funkenstein, *Theology and the Scientific Imagination from the Middle Ages to the Seventeenth Century* (Princeton: Princeton University Press, 1986); David C. Lindberg and Ronald L. Numbers, *God and Nature: Historical Essays on the Encounter between Christianity and Science* (Berkeley: University of California Press, 1986); R. K. French and Andrew Cunningham, *Before Science: The Invention of the Friars' Natural Philosophy* (Aldershot: Scholar, 1996); David C. Lindberg and Ronald L. Numbers (eds.), *When Science and Christianity Meet* (Chicago: Chicago University Press, 2003). The battle lines of the strongly contested debate about the use of the terms 'natural philosophy' and 'science' in relation to this period, and the possibility of seeing medieval and early modern science as a purely secular undertaking, are clearly set out by Andrew Cunningham and Edward Grant in *Early Science and Medicine*, 5 (2000), 258–300. See also John Hedley Brooke, Margaret J. Osler, and Jitse M. van der Meer, *Science in Theistic Contexts: Cognitive Dimensions, Osiris*, 2.16 (Chicago: Chicago University Press, 2001).

<sup>4</sup> John Hedley Brooke, *Science and Religion: Some Historical Perspectives* (Cambridge: Cambridge University Press, 1991), 16–51.

philosophy, but as Charles Schmitt and others have shown, Aristotelianism also evolved into a multiplicity of doctrines in the course of the sixteenth century, and struggled to relate newly acquired empirical knowledge to the authoritative texts of the philosopher (as well as to serve confessional interests: see below, 89–109). In medicine too, relevant here because of the mind–body problem, there were a number of developments which threatened the unicity of the revived Galenism of the early years of the sixteenth century; these include both Paracelsianism and Hippocratism, as well as the new revisionist positions of figures such as Fracastoro, Fernel, and Argenterio. Orthodoxy expressed itself in different institutional ways: in theology, it was through councils and synods; in natural philosophy, right thinking was defined in this period by individual universities. Such ‘right’ thinking ranges from the doctrine, dangerously akin to the ‘two truths’ heresy, implied by the Albertine tenet ‘de naturalibus naturaliter’, to the theologically driven arts curriculum of Wittenberg designed by Melancthon and the second scholastic developed by Iberian Catholics such as Suárez, Fonseca, and Toletus.<sup>5</sup>

The evolution of scientific enquiry was linked also to the way in which the relationship of the human mind to the world was viewed. Was there a homology between the mind and the (rational) order of nature which predisposed man to the understanding of his environment; an understanding that was in some sense his birthright? This was undoubtedly true for Galileo who saw human reason as a divine gift to be exercised, as for Kepler who saw in geometry a form of access to the divine mind.<sup>6</sup> Alternatively, was human (malign) curiosity more a symptom of the fall from grace?<sup>7</sup> Did the limitations of

<sup>5</sup> Sachiko Kusakawa, *The Transformation of Natural Philosophy: The Case of Philip Melancthon* (Cambridge: Cambridge University Press, 1995); Eckhard Kessler, ‘The Second Scholastic’, in Charles B. Schmitt and Quentin Skinner (eds.), *The Cambridge History of Renaissance Philosophy* (Cambridge: Cambridge University Press, 1988), 507–18; Annabel S. Brett, *Liberty, Right and Nature: Individual Rights in Later Scholastic Thought* (Cambridge: Cambridge University Press, 1997).

<sup>6</sup> See below, 115–44, Rikva Feldhay, *Galileo and the Church: Political Inquisition or Critical Dialogue?* (Cambridge: Cambridge University Press, 1995), and Peter Barker and Bernard R. Goldstein, ‘Theological Foundations of Kepler’s Astronomy’, *Osiris*, 16 (2001), 88–113.

<sup>7</sup> See Peter Harrison, ‘Curiosity, Forbidden Knowledge, and the Reformation of Natural Philosophy in Early Modern England’, *Isis*, 92 (2001), 265–90.

his senses and his reason set limits on his knowledge, such that his mind was the measure of all things, not the things themselves? Could that which was apprised through empirical investigations challenge the rational and metaphysical basis of religiously sanctioned scholastic physics? Could it further challenge the statements about the physical world found in Holy Writ (however these were to be interpreted)? Could there ever be a 'rational religion' (that is a religion wholly consistent with the processes of human enquiry and speculation about nature)? In the course of the seventeenth century, a shift in emphasis occurred from a concern with speculative and truth-centred knowledge informed by the questions set out above to an approach informed by quite different issues: how does nature work, and how can it be put to use? This is sometimes linked to millenarian aspirations to master nature, as in the case of the Hartlib circle. This shift, detectable in the increasing currency of mathematical and experimental approaches to knowledge, is marked also by the vernacularization and vulgarization of scientific enquiry, revealing the public as well as private dimensions of religion and science. The successive changes of religious practice in certain parts of Europe (from Roman Catholic, to Lutheran, to Calvinist) brought about by the change of ruler led eventually not only to the doctrine of 'cuius regio eius religio', but also such views as that of Hobbes, that religion was a form of public conduct regulated by the sovereign (see below, 195–7). In scientific terms, publicity (or privacy) also emerged as an issue, and is reflected both in the decision of audacious thinkers such as Giordano Bruno to expound doctrines previously thought too dangerous to communicate to untrained minds and (conversely) in the secrecy with which they shrouded some of their lines of speculation. Recent scholarship on Newton, for example, has stressed a parallel between the privacy of his conduct of natural philosophy (as he retreated from unpalatable controversy) and the necessary privacy of his heterodox religious life.<sup>8</sup>

It is pertinent here to say a preliminary word about the term 'heterodoxy' and its semantic field; this will not constitute a comprehensive survey of all languages and contexts, but rather an indicative

<sup>8</sup> See below, 223–62, and I. Bernard Cohen and George E. Smith (eds.), *The Cambridge Companion to Newton* (Cambridge: Cambridge University Press, 2002).



sample to highlight one or two features of the term having very strong resonances in the early modern period. The words ‘heterodox’ and ‘heterodoxy’ in Greek, Latin, and various vernaculars, have a long history, and long associations with deviancy, heresy, and error. They belong to a group of words, including ‘paradoxa’, ‘amphidoxa’, ‘cacodoxa’, and ‘pseudodoxa’, having the same Greek stem (‘doxa’): this is usually translated into Latin as ‘opinio’, and often contrasted with the higher form of demonstrative knowledge known as ‘scientia’ (‘epistēmē’). ‘Opinio’ was not viewed negatively by all disciplines in the early modern world: in law, the ‘opinio communis doctorum’ represents the authoritative understanding of the legal texts enshrined in the consensus of the greatest number of jurists or the best experts in a field as to their meaning.<sup>9</sup> ‘Opinio’ belongs to the order of the utilitarian; a given opinion needs only to satisfy the majority of the evidence in favour of a given proposition, whereas a ‘scientific’ proposition must be applicable universally.<sup>10</sup>

Of the group of terms under consideration here, ‘paradox’ was the first to be used in a significant cultural way in the post-medieval period. It was already well known to fifteenth-century humanists from the title of a Ciceronian text which expounds surprising moral propositions held to be true by the Stoics (*Paradoxa*); in the first part of the sixteenth century, it was given new life through its use by Martin Luther and other early religious reformers to describe their radical opposition to Roman Catholic doctrine and practice.<sup>11</sup> At the same time, it was employed in other fields to indicate opinions which

<sup>9</sup> Ian Maclean, *Interpretation and Meaning in the Renaissance: The Case of Law* (Cambridge: Cambridge University Press, 1992), 93–4.

<sup>10</sup> Ian Maclean, *Logic, Signs and Nature in the Renaissance: The Case of Learned Medicine* (Cambridge: Cambridge University Press, 2001), 114–47.

<sup>11</sup> Martin Luther, *Christianissimi Wittenbergensis Gymnasii, multarum Disputationum paradoxa et plane enigmata in Papistica illa mendaciis confusissima Ecclesia* (n.p., 1521); Martin Bucer (1491–1551), *Ein kurtzer warhafftiger bericht von Disputationem . . . so zwischen Cunrat Treger Provincial der Augustiner, und den predigern des Evangelii zu Strassburg sich begeben hat . . . Und hundert Paradoxa oder wunderreden vom gewalt der Schrift, Kirchen und Concilien verteüschet* (Strasbourg, 1524); Sebastian Franck (c.1499–c.1542), *Paradoxa ducenta octoginta* (Ulm, 1534). I owe these references to Agnieszka Steczowicz, whose doctoral dissertation, shortly to appear, will be a major source for the history of Renaissance paradox in all disciplines. See also in general Rosalie Colie, *Paradoxia epidemica* (Princeton: Princeton University Press, 1966).

were either novel in respect of existing doctrine or in contradiction to it. The jurist Andrea Alciato (1492–1550) published a book of legal paradoxes in 1518, which used humanist philological scholarship to refute medieval interpretations of Roman law; following in the footsteps of the humanist doctor Niccolò Leonicensi (1428–1524), who published corrections to the *Natural History* of Pliny in the 1490s, the Tübingen professor Leonard Fuchs (1501–66) wrote a book in 1530 on errors in the writings of more recent physicians which he later termed medical paradoxes.<sup>12</sup>

From the orthodox point of view, Luther's 'paradoxical' views were attacked as heresy, especially after his conscientious stand at the Diet of Worms in 1521;<sup>13</sup> a little later, departure from the orthodoxy of established medical teaching began to be described analogously in the same terms (an understandable analogy for doctors to exploit, as the various ancient schools of medicine were already described as sects<sup>14</sup>). The radical physician and religious thinker Theophrastus Paracelsus (1493?–1541) gloomily records in the *Opus paragranaum* (1529–30) that he was described as the Luther of medicine; soon after, Andreas Thurinus (1473–1543) in Florence, Jeremias Drivere (1504–54) in Louvain, Andrea Camuzio (1510?–78) in Pavia, and Gianfilippo Ingrassia (1510–80) in Naples use the epithets 'Lutheran' or 'heretic' to describe deviant thought in the sphere of medicine.<sup>15</sup> 'Paradox' is also used in the field of natural philosophy to denote departure from generally accepted doctrine; Copernicus's cosmology is described as paradoxical by Joachim Georg Rheticus and Bruno.<sup>16</sup> Through such usage, Galen and Aristotle are transformed into orthodoxies, even quasi-theological orthodoxies (Michel de Montaigne

<sup>12</sup> Alciato, *Paradoxorum ad Pratum libri sex* (Milan, 1518); Leonhart Fuchs, *Errata recentiorum medicorum* (Hagenau, 1530); *Paradoxorum medicinae libri iii* (Basle, 1535); Niccolò Leonicensi, *De Plinii et plurium aliorum in medicina erroribus liber* (Ferrara, 1492); Maclean, *Logic, Signs and Nature*, 20–2.

<sup>13</sup> See Diarmaid MacCulloch, *Reformation: Europe's House Divided, 1490–1700* (London: Allen Lane, 2003), 131 (on the dubious authenticity of 'hier steh ich: ich kann nicht anders, so hilf mir Gott').

<sup>14</sup> Maclean, *Logic, Signs and Nature*, 76–80.

<sup>15</sup> For these references, see below, 26 n.85

<sup>16</sup> Rheticus, *Narratio prima* (Basle, 1541), sig. a2r; Bruno, *La cena de le ceneri*, in *Œuvres complètes*, ed. Giovanni Aquilecchia, trans. Yves Hersant (Paris: Les Belles Lettres, 1994), ii. 37.

refers to Aristotle as the ‘God of natural philosophy’<sup>17</sup>): this was the status they enjoyed in medieval universities, and retained as late as 1657, according to the chymist George Starkey (1627–66), who complains that ‘whosoever should dare to swarve from [Galen and Aristotle] [is] looked upon as Heterodox’.<sup>18</sup>

‘Paradox’ did not only denote departure from established doctrine; it also referred to the new knowledge that was emerging in the course of the sixteenth century in the works of ‘neoterici’ who cited new data, or produced new theory, or did both. In the sphere of medicine, this included both previously unknown botanical and zoological specimens that were brought back by travellers to the New World and elsewhere, and previously unrecorded illnesses, of which the most famous is the Great Pox or French disease.<sup>19</sup> As the Paracelsian doctor Petrus Severinus (1542–1602) says in 1571, ‘paradoxical (i.e. previously unrecorded) diseases called forth paradoxical physicians’.<sup>20</sup> In the sphere of natural philosophy, new knowledge could take various forms: it could be the recovery of ancient doctrines which had been lost, discarded, neglected, or forgotten (such as atomism); it could be the logical extension of the work of the ancients (most clearly seen in the field of mathematics and mechanics); it could be radical revision of Aristotelian physics and cosmology, as in the work of Nicholas Copernicus, Tycho Brahe, and Johannes Kepler.

In natural philosophy and medicine, ‘heterodox’ (and the more rarely used ‘pseudodoxa’ and ‘cacodoxa’) emerged in the following century as a variation on paradox. The Basle physician Felix Platter (1536–1614) seems to have used the two terms in an earlier version of the title of his posthumous book *Quaestiones paradoxae et endoxae* (1625), if we are to believe the title cited by his pupil Johann Heinrich

<sup>17</sup> *Essais*, ed. Pierre Villey (Paris: PUF, 1962), 539 (ii. 12).

<sup>18</sup> George Starkey, *Natures Explication and Helmont’s Vindication* (London, 1657), 18. This reference, and those to the works of Browne, Biggs, and Hales below, are cited in the *Oxford English Dictionary*, s.v. heterodox, heterodoxical.

<sup>19</sup> Jon Arrizabalaga, John Henderson, and R. K. French, *The Great Pox: the French Disease in Renaissance Europe* (New Haven: Yale University Press, 1997).

<sup>20</sup> Petrus Severinus, *Idea medicinae philosophicae, fundamenta continens totius doctrinae Paracelsicae, Hippocraticae et Galenicae* (Basle, 1571), 3: ‘paradoxi morbi paradoxos medicos peperere.’ Cf. Jacopo Zabarella (1533–89), *Opera logica* (n.p. 1586–7), i sig. a3r, who defines ‘paradoxa’ as ‘nova dogmata’.

Frölich in 1612 (*Sēmeiōtice phoibeia, paradoxis et heterodoxis D. Felicis Plateris adornata*); it seems here that ‘heterodox’ designates either an existing alternative version of a doctrine, or a deviant view which is different from, but not radically contrary to, an existing dogma, or an opinion expressed by someone else on a subject on which no doctrine of an authoritative kind is on record. ‘Heterodoxy’ thus appears as a sort of middle or neutral term, which can refer both to revisions of knowledge and to new knowledge; when Sir Thomas Browne refers in his *Pseudodoxia epidemica* of 1646 to a proposition as ‘not only simply heterodoxicall, but a very hard Paradox, it will seeme, and of great absurdity, unto obstinate eares’, and, a few years later, Noah Biggs talks in an equally polemical publication of a ‘not simply heterodoxicall, but a very rough-hewed paradoxicall asseveration’, they seem to be using ‘heterodoxicall’ in this sense.<sup>21</sup>

The domain of theology works in a somewhat different way. There, the more frequently encountered term is heresy (denoting the holding of heterodoxical opinions); it is used in the Acts of the Apostles (translated into Latin as ‘secta’) by Jews to describe early Christian communities, and on more than one occasion in the Pauline epistles to describe splinter groups which threaten Church unity; together with ‘orthodoxy’, it was given a clear institutional sense prior to the Reformation at the Council of Chalcedon in 451. Heresy is not merely the holding of opinions inconsistent with orthodoxy, but presupposes obdurate persistence in such error; it is thus a moral state as well as the holding of false (heterodox) beliefs. This obduracy can manifest itself not only by refusal to abandon false doctrine, but also by the extension and development of orthodox positions beyond the limits sanctioned by the Church.<sup>22</sup>

The Reformation brought with it a conscious rejection of Catholic orthodoxy, and a pressing need for the new Protestant groups to establish their own institutionally approved beliefs in contradistinction to each other and to the Church of Rome. At various councils

<sup>21</sup> Sir Thomas Browne, *Pseudodoxia epidemica* (London, 1646), ii. 3. 66; Noah Biggs, *Mataeotechnia medicinae praxeos* (London, 1651), 214.

<sup>22</sup> Acts 24: 5, 28: 22; Gal. 5: 20; 1 Cor. 11: 19; Titus 3: 10. On heresy see the *New Catholic Encyclopaedia*, s.v; Bruno Neveu, *L’Erreur et son juge: remarques sur les censures doctrinales à l’époque moderne* (Naples: Bibliopolis, 1993). See also below, 87.

and meetings, Christian denominations produced their own versions of orthodoxy: the Roman Catholics at the Council of Trent, between 1545 and 1563; the Lutherans, first in Augsburg in 1530, then again in 1540 (the ‘*confessio variata*’, which set out to accommodate the views of other Protestant groups), and finally in 1577 (the Gnesio-lutheran ‘*Formula of Concord*’); elsewhere in Europe, there were other agreed confessions (the Gallican in 1559, the Belgic in 1561, the Helvetic in 1561–2); the Synod of Dort (1618–19) represents in one sense a culmination of these declarations of doctrine which are for the most part of Calvinist inspiration. The Church of England meanwhile had enacted its thirty-nine articles by 1571.<sup>23</sup> These institutional acts by churches as self-conscious units establishing their own discipline, dogmas, structure, and catechisms occurred during the historical phase often referred to as ‘*confessionalization*’;<sup>24</sup> they were accompanied both by controversial theology, which proliferated from the second half of the sixteenth century onwards, and by the publication of guides to ancient and modern heresies issued by the various denominations.<sup>25</sup>

From the middle years of the sixteenth century, different groups of Protestants use ‘*orthodox*’ to denote consonance with their chosen confessions; the use of ‘*heterodox*’ comes later, and seems at first to refer to emerging or doubtful doctrine as well as error. In his Letter from Dort to Sir Dudley Charlton, Walter Balcanqual describes as ‘*heterodox*’ those articles of faith being drawn up by the Synod about which there was disagreement (or with which he himself

<sup>23</sup> MacCulloch, *Reformation*, 347–99.

<sup>24</sup> See Heinz Schilling, ‘Die “Zweite Reformation” als Kategorie der Geschichtswissenschaft’, in Heinz Schilling (ed.), *Die reformierte Konfessionalisierung in Deutschland: das Problem der “Zweiten Reformation”* (Gütersloh: Mohn, 1986), 387–437; Bodo Nischan, *Lutherans and Calvinists in the Age of Confessionalism* (Aldershot: Ashgate, 1999). I am grateful to Diarmaid MacCulloch for these references.

<sup>25</sup> An extensive bibliography of these works divided by denomination is given in Georgius Draudius, *Bibliotheca classica* (Frankfurt am Main, 1625), 296–301. See also, for a slightly earlier usage of a similar kind, *Tuba Iubilæi Lutherani. Hoc est, Explicatio dicti insignis Habacuc c. 2. 4. Iustus fide sua vivet: in qua nostra de iustificazione hominis coram Deo gratuita thesis orthodoxa confirmatur, antithesis Pontificiorum et heterodoxa in hoc articulo doctrina partim refutatur, partim indicatur, dictumque hoc a pravis Jesuitarum, Bellarmini, Costeri, Riberae expositionibus vindicatur. Quam . . . in illustri Academia Rostochiensi 10. Decembris . . . Publice examinandam proponit Iohannes Tarnovius S.S. Theologiae Professor. Respondente Hermanno Lonero Strandens* (Rostock, 1617).

disagreed).<sup>26</sup> The same usage is found later in the title of Hamon l'Estrange's book of 1641, *God's Sabbath ... briefly vindicated from novell and heterodox assertions*; whereas that of the Dutch theologian Joannes Hoornbeeck (1617–66) in his *De paradoxis et heterodoxis Weigelianis* (1646) seems closer to medical usage in denoting by the term 'heterodox' the less reprehensible departures from orthodoxy in the beliefs of Valentin Weigel's followers. By the middle of the seventeenth century, 'heterodoxy' had strong institutional connotations in various disciplines; it was linked to new or recovered knowledge or doctrine as well as existing opinions, and could designate, as well as views which are less severe challenges to a given orthodoxy than its direct contradiction, a sort of penumbra of emerging opinion not yet fixed in its relation to established doctrine.

The interaction of theology and natural philosophy, of religious belief and theories about the physical world, is complex throughout this period. In any one institutional context, one might (in the most straightforward case) have 'orthodox' religious beliefs which coexist with 'orthodox' scientific ones; one might have 'orthodox' religious beliefs which are coupled with heterodox scientific ones; one might conversely begin from scientific beliefs which lead to religious orthodoxy or heterodoxy; one may also subscribe to a metaphysics or possess a mental predisposition which leads to heterodoxy in both spheres. One's agenda may be driven by religious preoccupations (as it is in the majority of cases), or by scientific ones. These questions can be posed in respect of an evolving range of issues in the early modern period which are discussed in the following chapters: the eternity of matter and the world, the distinction between superlunary and sublunary nature; the (im)materiality and (im)mortality of the soul; 'mosaic' physics; biblical hermeneutics; corpuscularianism and atomism; matter and spontaneous generation; the nature of God (including the 'necessary' limitations placed on his essence such as His incapacity to know singulars or to have complete foreknowledge); the doctrines of occasionalism and voluntarism, with the

<sup>26</sup> John Hales, *Golden Remains* (London, 1688), 524: 'upon Tuesday the canons of the first and second article were approved, except the last of the second article . . . and the second heterodox of the same Article. On Thursday morning it was reasoned whether the last heterodox should be retained.'

related issues of causality, occult properties, and gravity; the question of trinitarianism and unitarianism; *prisca theologia* and the history of religion. The chapters in this volume constitute a set of intriguing case studies which reveal a range of the ways in which these issues interact in the early modern period.

The editors would like to thank the Faculty of Theology, the Faculty of Modern History, and All Souls College, Oxford for their generous financial support of the seminar series on which this collection of papers is based; and Hilary O'Shea and Lucy Qureshi of the Oxford University Press for their unobtrusive efficiency in bringing the book into being.

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## Joining Natural Philosophy to Christianity: The Case of Joseph Priestley

*John Brooke*

In his memoirs Joseph Priestley recalled that, from an early age, he had been ‘much distressed’ that he ‘could not feel a proper repentance for the sin of Adam; taking it for granted that, without *this*, it could not be forgiven me’.<sup>1</sup> His deviation from orthodoxy was to extend in many directions during his life, but he was never to forget his mortification at being denied communion in the congregation he had always attended. The elders of the Independent Chapel at Heckmondwike in the West Riding of Yorkshire ‘refused me, because, when they interrogated me on the subject of the *sin of Adam*, I appeared not to be quite orthodox’.<sup>2</sup> He could not think that the entire human race was liable to the wrath of God and the eternal pains of hell on account of that sin only.

Heterodoxy was a word that Priestley owned. At the Dissenting Academy in Daventry where he studied from 1752 to 1755, the style of theological disputation reflected the educational principles of Isaac Watts and Philip Doddridge. Both sides of a theological argument were represented in debate: Dr Ashworth, Priestley recalled, had taken the orthodox side of every question and Mr Clark, the sub-tutor, ‘that of heresy, though always with the greatest modesty’.<sup>3</sup> Having been exposed to the pride of those who were sure that they, at least, were among the elect, Priestley was to be peculiarly susceptible

<sup>1</sup> Joseph Priestley, *Memoirs of Dr. Joseph Priestley* (London: Allenson, 1904), 7.

<sup>2</sup> *Ibid.* <sup>3</sup> *Ibid.* 11.



to a modest heretic. He tells us that he ‘saw reason to embrace what is generally called the heterodox side of almost every question’.<sup>4</sup>

Priestley will be best known to many as the discoverer of oxygen, even though his view of the gas was very different from that of Lavoisier who gave it its name. Priestley called it ‘dephlogisticated air’ because he believed its ability to support combustion derived from its propensity to absorb the phlogiston emitted from metals when they burned. Lavoisier’s name for the gas reflected his belief that it was an acid producer—an essential component of all acids. Though neither theory survived, Lavoisier’s name of oxygen endured. Not that Priestley himself has been forgotten. In the celebrations of 2004, marking the bicentenary of his death, his commitment to the utility of the sciences could not possibly be overlooked. He makes an irresistible test case for exploring the relations between science and religious heterodoxy. Connections have often been made in the literature, a recent commentator observing that, for Priestley, ‘social progress is in part modelled on scientific progress’ and both scientific knowledge and social improvement flourish best where there is free exchange of ideas.<sup>5</sup> The greatest barrier to social progress was state-imposed uniformity, whether the uniformity was religious, intellectual, or economic.

But there was more to it than that because, in Priestley’s enthusiastic vision, scientific progress was not merely a model but a vehicle for social and religious reform. In a well-known passage he predicted ‘this rapid progress of knowledge . . . will, I doubt not, be the means under God of extirpating all error and prejudice, and of putting an end to all undue and usurped authority in the business of religion as well as of science’.<sup>6</sup> The reformation he sought included the abolition of Test and Corporation Acts under which dissenters were disadvantaged. He himself was never short of grievances: having to pay tithes to a church he had rejected was one. But he never admitted to being a

<sup>4</sup> Cited by Robert E. Schofield, *The Enlightenment of Joseph Priestley: A Study of his Life and Work from 1733 to 1773* (University Park: Pennsylvania State University Press, 1997), 51.

<sup>5</sup> Alan Tapper, ‘Priestley on Politics, Progress and Moral Theology’, in Knud Haakonssen (ed.), *Enlightenment and Religion: Rational Dissent in Eighteenth-Century Britain* (Cambridge: Cambridge University Press, 1996), 272–86, at 275.

<sup>6</sup> Cited by John G. McEvoy and J. E. McGuire, ‘God and Nature: Priestley’s Way of Rational Dissent’, *Historical Studies in the Physical Sciences*, 6 (1975), 325–404, at 380.

political agitator. As he prepared to leave England for America, he was still avowing 'I never preached a political sermon in my life, unless such as, I believe, all Dissenters usually preach on the fifth of November, in favour of civil and religious liberty, may be said to be political.'<sup>7</sup> Priestley's reformation required a reformation of the mind. This could only be achieved through the ministry of the written word. His favourite parable was the parable of the sower, and he probably sowed more words than any other reformer of the eighteenth century. In his word-spinning, reference to the sciences played a strategic role: 'In nature we see no bounds to our inquiries. One discovery always gives hints of many more, and brings us into a wider field of speculation. Now why should this not be, in some measure, the case with respect to knowledge of a moral and religious kind?'<sup>8</sup> Believing that 'learned Unitarians increase, while learned Trinitarians decrease', he saw a direct parallel with the spread of Newton's science towards universal acceptance.<sup>9</sup>

For a historian of chemistry with interests in the relations between 'science' and 'religion' Priestley is alluring. When I first began to study him some twenty years ago he provoked the longest sentence of my writing career. I reproduce it here because it still explains why many find him so fascinating:

What is one to make of a man who proclaimed himself a Christian and denied the divinity of Christ; an apologist who considered this the best of all possible worlds and yet one which could be improved; a theist who denied that God could act directly on the human mind and yet who insisted that his God was more in control of human affairs than the God of religious orthodoxy; a Scriptural exegete who accepted the reality of certain biblical miracles as part of an argument to show that miracles did not occur; a philosophical determinist who believed that a denial of the autonomy of the human will made human beings more, not less, responsible for their actions; an advocate of toleration for Roman Catholics, whilst denouncing Catholic religion as 'properly anti-Christian' and a 'system of abomination little

<sup>7</sup> Joseph Priestley, *The Present State of Europe Compared with Antient Prophecies: A Sermon Preached at the Gravel Pit Meeting in Hackney on 28 February 1894* (London, 1994), Preface, xi.

<sup>8</sup> Joseph Priestley, *The Importance and Extent of Free Inquiry in Matters of Religion* (London: J. Johnson, 1785), 7.

<sup>9</sup> Joseph Priestley, *Reflections on the Present State of Free Inquiry in this Country* (Birmingham: J. Johnson, 1785), 51–9.

better than heathenism'; a materialist who did not believe in matter, certainly not solid matter as usually understood; an empiricist who, having discovered oxygen, not only considered it a compound, but supplied Lavoisier with an important clue for establishing it as an element; and overriding all, a radical in politics and religion, and yet so conservative in his chemical theory that he was left picking nits in the new French system?<sup>10</sup>

A closer look at Priestley's *science* would reveal numerous facets, most reflecting the importance he attached to simple experiments and the scientific instruments that made them possible.<sup>11</sup> We see this in his manipulation and identification of distinct gaseous species; for example his production of oxygen by heating what Lavoisier would call the oxide of mercury. In his defence of phlogiston as a principle of metallicity and combustibility, Priestley appealed to the simple fact that hydrogen (supposedly rich in phlogiston) when passed over red lead gave rise to the metal. He experimented with several gases, including those we call sulphur dioxide, ammonia, nitrous oxide, and nitrogen dioxide. A Leeds brewery was his laboratory for early experiments with 'fixed air', our carbon dioxide.<sup>12</sup> His experiments promised utility with a commercial twist: he had hopes that oxygen might be sold as a fashionable luxury item, that water infused with 'fixed air' might become a saleable cure for scurvy.

A member of the Lunar Society of Birmingham, Priestley saw that chemical analysis could have commercial value. The analysis of clays would provide assistance for Josiah Wedgwood's pottery.<sup>13</sup> A science popularizer as well as practitioner, Priestley enjoyed success with his *History of Electricity* (1767), though rather less with a subsequent history of optics.<sup>14</sup> Priestley's science was communicated as a form of

<sup>10</sup> John H. Brooke, 'A Sower went Forth': Joseph Priestley and the Ministry of Reform', in A. Truman Schwartz and John G. McEvoy (eds.), *Motion Toward Perfection: The Achievement of Joseph Priestley* (Boston: Skinner House, 1990), 21–56, esp. 23–4.

<sup>11</sup> John R. Christie, 'Joseph Priestley: Science, Religion and Politics in the Age of Revolution', in R. Porter (ed.), *Man Masters Nature* (London: BBC, 1987), 88–100, 92.

<sup>12</sup> *Ibid.* 94.

<sup>13</sup> Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760–1820* (Cambridge: Cambridge University Press, 1992), 65–8.

<sup>14</sup> Joseph Priestley, *The History and Present State of Electricity, With Original Experiments* (London: J. Dodsley, 1767); and *The History and Present State of Discoveries Relating to Vision, Light and Colours* (2 vols.; London: J. Johnson, 1772).

science most could perform: no special genius was required.<sup>15</sup> As with his theology, it was egalitarian. He described and prescribed experiments that could be performed at home. Jan Golinski has observed that Priestley's distaste for the chemical system of Lavoisier was associated with an aversion to imperious theorizing and to the expensive apparatus that the Frenchman had at his disposal.<sup>16</sup> Such privilege took science out of the public domain.

To stress Priestley's empiricism is not to say that he had no developed theory of matter. He eventually favoured a model in which the properties of matter all stemmed from the interplay of attractive and repulsive forces. The solidity of an atom could not be a primary quality because there would always be the ulterior question: why did its parts cohere? Priestley's ontology of forces resembled that of the Jesuit natural philosopher Roger Boscovich, who was duly outraged when Priestley used it to eradicate the category of spirit from the world.<sup>17</sup>

A closer look at Priestley's *theology* would reveal that this, not science, was his primary interest, both chronologically and in terms of his identity as a dissenting minister. His private correspondence discloses a higher value placed on the identity and purification of Christianity than on the identity and purification of gases.<sup>18</sup> During his career Priestley was minister to five dissenting congregations, including one of the most opulent in England—Birmingham's 'New Meeting'.<sup>19</sup> What did he preach? Two principles above all. One was the liberty of religious expression, hence his involvement in setting up the first avowedly Unitarian Chapel under the charge of Theophilus Lindsey. The other was a doctrine of the free mercy of God to all who were penitent. Just that. There were no complications stemming from the supposed wrath of God or from a theology of atonement. Priestley happily proclaimed the message that God's intention was that all should be happy.

<sup>15</sup> John G. McEvoy, 'Electricity, Knowledge and the Nature of Progress in Priestley's Thought', *British Journal for the History of Science*, 12 (1979), 1–30.

<sup>16</sup> Golinski, *Science as Public Culture*, 83–7.

<sup>17</sup> A. Truman Schwartz, 'Priestley's Materialism: The Consistent Connection', in Schwartz and McEvoy, *Motion Toward Perfection*, 109–27, 120.

<sup>18</sup> See e.g. his letters to M. Van Marum in Robert E. Schofield, *A Scientific Autobiography of Joseph Priestley (1733–1804); Selected Scientific Correspondence Edited with Commentary* (Cambridge Mass.: MIT, 1966), 246 and 251.

<sup>19</sup> Schofield, *Enlightenment of Joseph Priestley*, 274.

A closer look at the connections *between* his scientific and religious ideas leads us straight into the questions that have provided the rationale for this book. Might heterodoxy in religion predispose one towards an interest in the sciences, perhaps even to heterodoxy as a scientific thinker? Conversely, might a commitment to the sciences lead to, or at least correlate with, heterodoxy in religion?

Rich and illuminating answers have been given in preceding chapters. We should, however, note the difficulty that can arise in deciding whether a piece of scientific work should be described as heterodox. Examples of deviation from established paradigms should not be difficult to chart; but, accepting for the moment Thomas Kuhn's term, there is an immediate problem at times of paradigm change. Interestingly, Priestley was used by Kuhn to support his thesis of incommensurability between competing paradigms and the complementary thesis that observations are theory-laden.<sup>20</sup> Both Priestley and Lavoisier looked at the same gas, but what they saw was different. Where Priestley saw dephlogisticated air, Lavoisier saw oxygen. But what is an 'orthodox' view if one is living through a chemical revolution and contributing to it, as Priestley did? With whom is the comparison to be drawn? To add to the difficulty, Priestley could be conservative, in that he defended phlogiston, and yet be radical in advancing a concept of matter that presaged the dynamical theories of Humphry Davy and Michael Faraday. Is it not then tempting to present Priestley as a spectacular counter-example to a supposed correlation between heterodoxies in science and religion: ultra-radical in religion, ultra-reactionary in chemistry? Tempting but not ultimately persuasive. As John McEvoy has insisted, it is incorrect to see him as a dogmatic champion of phlogiston. During the course of his controversy with Lavoisier, Priestley began to exploit the more subtle position that neither of the competing theories was ultimately demonstrable; both went beyond an empiricist analysis of material substances.<sup>21</sup> Moreover, as Simon Schaffer has indicated, there were

<sup>20</sup> Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962).

<sup>21</sup> John G. McEvoy, 'Causes and Laws, Powers and Principles: The Metaphysical Foundations of Priestley's Concept of Phlogiston', in Robert Anderson and Christopher Lawrence (eds.), *Science, Medicine and Dissent: Joseph Priestley (1733–1804)* (London: Wellcome Trust/Science Museum, 1987), 55–71, 66.

at least two respects in which Priestley *was* radical in his scientific outlook.<sup>22</sup> He deviated from a tradition of popular lecturing in which the powers of nature, such as electricity, were routinely exhibited and manipulated as God's powers, but in displays that seemed to show the transfer of power from God to the experimental philosopher. By contrast, the duty of the lecturer or teacher, according to Priestley, was to display the rationality of God's creation. It was the interconnections and mutual adaptations of the powers of nature, not the powers themselves, which bore witness to the divine plan.

The second element of Priestley's radicalism, according to Schaffer, follows from this. His scientific outlook was one in which the natural world, embracing the human, was understood and celebrated as a *system*. Interpreting nature as an interlocking system conferred significance on scientific facts. As Priestley himself put it when discussing plant respiration, seemingly trivial observations could acquire 'the greatest dignity and importance; serving to explain some of the most striking phenomena in nature, respecting the general plan and constitution of the system, and the relation that one part of it bears to another'.<sup>23</sup> In this respect his theology was not an excrescence, for the system of nature had been devised as a self-replenishing system designed to sustain human life and to promote human happiness.

Although there may be problems in using the term heterodoxy in a scientific context, in Priestley's case they are not so pronounced on the religious front. His systematic rejection of Calvinism structured an emancipation that led to the very apotheosis of heterodoxy. Priestley himself repeatedly constructed an antithesis between what he called the 'orthodox system' and his 'rational system'. When he spoke of a 'dark hole' in the universe he was referring to the Calvinism with which he had grown up and struggled.<sup>24</sup> When he appealed to the 'serious and candid professors of Christianity' he identified five 'orthodox' doctrines that he believed were insupportable. These were that the unregenerate had no power to do God's will; that all humans were born into original sin through the sin of

<sup>22</sup> Simon Schaffer, 'Priestley and the Politics of Spirit', in Anderson and Lawrence, *Science Medicine and Dissent*, 39–53.

<sup>23</sup> F. W. Gibbs, *Joseph Priestley: Adventurer in Science and Champion of Truth* (London: Nelson, 1965), 123–4.

<sup>24</sup> Schofield, *Enlightenment of Joseph Priestley*, 14.

Adam; that only a predetermined elect would enjoy salvation; that Christ was fully divine; and that through his sacrificial death he had made atonement for human depravity.<sup>25</sup>

Priestley's 'rational' system could sound very rational. The forgiveness of a penitent brother, enjoined by Christ, would scarcely deserve the name of forgiveness if one insisted on any atonement. To expect a person to repent of the sin of Adam, or to feel anything like remorse for it, was blatantly unreasonable when, in Priestley's words 'he cannot but know that he never gave his consent to it'. High seriousness and an earnest morality underpinned Priestley's critique. Since the gospel was concerned with the reformation of character there was no room in his rational system for any doctrine that promised sudden acceptance with God. Deathbed conversions were simply not on. 'Some, indeed, are said to have been called at the *eleventh* hour', he noted, 'but none at the *twelfth*.'<sup>26</sup>

It is therefore an easy matter to delineate his heterodoxy with respect to Calvinism because he provided the necessary comparisons himself. And since many dissenters were themselves Calvinists, it was within his own circle that his heterodoxy was most harshly judged. Fiercely dissenting from orthodox dissent he attracted the question 'in the name of common sense, and rational religion what have the orthodox dissenters done to the Rev. Dr. Priestley, that he should set them forth in such a disagreeable point of view?'<sup>27</sup> Another measure of Priestley's heterodoxy was the scope he wished to give to religious toleration. His contention that even Roman Catholics should enjoy toleration worried fellow dissenters who feared that so accommodating a line would provoke reactions that could only jeopardize their own case for relief.<sup>28</sup>

Even when compared with other Unitarians, Priestley stands out as idiosyncratic. In his *Disquisitions Relating to Matter and Spirit* (1777), he rejected all conventional duality between body and soul,

<sup>25</sup> Joseph Priestley, *An Appeal to the Serious and Candid Professors of Christianity* (London: J. Johnson, 1772).

<sup>26</sup> *Ibid.* 5–11 and 18–21.

<sup>27</sup> John Macgowan, *Familiar Epistles to Rev. Dr. Priestley* (London: J. Johnson, 1771), 12.

<sup>28</sup> Martin Fitzpatrick, 'Joseph Priestley and the Cause of Universal Toleration', *The Price-Priestley Newsletter*, 1 (1977).

matter and spirit. He could do so because he invested matter with properties and propensities that had been ascribed to spirit. One consequence was a chemical account of the Resurrection: 'Death, with its concomitant putrefaction and dispersion of parts, is only a *decomposition*; whatever is decomposed, may be *recomposed* by the being who first composed it; and I doubt not but that, in the proper sense of the word, the same body that dies shall rise again.'<sup>29</sup> Such a view of the matter invited a predictable objection. Suppose some poor unfortunate were to drown in the Thames, to be eaten by eels, which in their turn were to grace a table:

Poor Thomas in the Thames was drown'd  
 And though long sought could not be found . . .  
 At the last trumpet's solemn sound,  
 How mangled will poor Tom be found!<sup>30</sup>

Because Priestley's matter, constituted by attractive and repulsive forces, differed from conventional matter or spirit, he considered that it might as well be called spirit as matter. As I have indicated elsewhere, he would have agreed with the remark of a later materialist, John Tyndall, who, after rebuking the philosophers who had made it solid, impenetrable, and inert, complained that matter had been much maligned.<sup>31</sup> Priestley's contemporaries were for the most part mystified. A kindred spirit, Richard Price, repeatedly asked 'What is it that attracts and repels, and that is attracted and repelled?'<sup>32</sup> As for Priestley's account of the Resurrection, Price found it seriously wanting:

<sup>29</sup> Joseph Priestley, *Disquisitions Relating to Matter and Spirit* (London: J. Johnson, 1777); repr. edn. (New York: Amo Press, 1975), 161. The existence of chemical transformations in which substances could be recovered from the products into which they had been transformed had featured in earlier attempts to defend doctrines of resurrection: Fernando Vidal, 'Brains, Bodies, Selves and Science: Anthropologies of Identity and the Resurrection of the Body', *Critical Inquiry*, 28 (2002), 930–74, esp. 948 and 958.

<sup>30</sup> Alexander Bicknell, *The Putrid Soul. A Poetical Epistle to Joseph Priestley on his Disquisitions Relating to Matter and Spirit* (London: T. Bowen, 1780), 17–18.

<sup>31</sup> Brooke, ' "A Sower Went Forth" ', 40.

<sup>32</sup> Joseph Priestley, *A Free Discussion of the Doctrines of Materialism and Philosophical Necessity in a Correspondence between Dr. Price and Dr. Priestley* (London: J. Johnson and T. Cadell, 1778), 19.



It is ... implied, that the men who are to be raised from death, will be the same with the men who have existed in this world, only as a river is called the same, because the water, though different, has followed other water in the same channel ... Did I believe this to be all the identity of man hereafter, I could not consider myself as having any concern in a future state.<sup>33</sup>

Heterodox by the standards of orthodox dissent and even among the Unitarians, Priestley was heterodox again in his attitude towards other religions. If Christianity were to be acceptable to a Muslim or a Jew, it had to be shorn of that which gave offence. Trinitarian doctrines could not pass that test, could not even be made intelligible to the common ploughman. The vision that sustained him was recorded in his *General History of the Christian Church*. Eventually every corruption of Christianity would be removed such that no impediments would remain to which any unbeliever, Jew or Muslim, could reasonably object. Rational Christianity would become the religion of the world. Not surprisingly he was dubbed 'half a Mahometan', though that and other abuse often missed the point. His hope was that, once the Trinitarian obstacle was removed, a rational dialogue between Christianity and Islam would ensue, establishing the one and destroying the other. Such was his confidence in human rationality that he thought less than a century might suffice.<sup>34</sup>

From this preliminary sketch we have caught a glimpse of a heterodox but passionate religious believer, and an experimental philosopher who made an indelible mark in both physical science and metaphysical reconstruction. Can we establish any connections between them? We must certainly be wary of strong claims to the effect that a dissenting education steered him inexorably towards the natural sciences. In his recent biography Robert Schofield observes that Priestley did not do any scientific work for ten years after leaving the Daventry Academy; and did not write as a philosopher of science for more than twenty. Priestley may even give the lie to that weaker correlation between science and religious dissent which suggests that dissenters moved into science by default as other doors were barred. He was, after all, employed at the Warrington Academy to teach

<sup>33</sup> Joseph Priestley, *A Free Discussion of the Doctrines of Materialism and Philosophical Necessity in a Correspondence between Dr. Price and Dr. Priestley* (London: J. Johnson and T. Cadell, 1778), 73.

<sup>34</sup> Priestley, *Reflections on Free Inquiry*, 48–9.

languages. If Priestley's induction into practical chemistry was through the lectures and demonstrations of Matthew Turner, who lectured at Warrington between 1763 and 1765, then there is even a certain irony because Turner was apparently notable as an atheist. As for other origins of Priestley's utilitarian interest in science, it has been suggested that it was through salt that he came to Bacon. While at Nantwich he took an interest in the local manufacture of Cheshire salt and, according to one biographer, probably came across William Brownrigg's *The Art of Making Common Salt* (1748).<sup>35</sup> This was a book with a Baconian preface, extolling a knowledge of the mechanic arts for the relief of man's estate. When Priestley looked forward to a social millennium he suggested it would be brought about by the commercial spirit *aided* by Christianity and true philosophy. But that was rather different from having the scientific or the commercial spirit derive from his religion.<sup>36</sup> This is not to deny that, during his early years at the Warrington Academy, there were opportunities for Priestley to develop his latent interest in the teaching of natural philosophy. Some of his friendships, as with John Seddon, were strengthened by a mutual interest in the sciences. He even gave some twenty lectures on anatomy.<sup>37</sup> But, as Schofield notes, if there was a shift in his interests during the early 1760s, it was more in the direction of history than experimental science.<sup>38</sup> It has even been proposed by Maurice Crosland that Priestley found solace in science as a refuge from religious polemics.<sup>39</sup> This may, however, be a precarious argument, since Priestley appears to have relished every opportunity for theological combat. In the 1780s he wrote that 'on no former occasion have I declined, but on the contrary I have rather courted, and provoked opposition, because I am sensible it is the only method of discovering truth'.<sup>40</sup>

<sup>35</sup> F. W. Gibbs, *Joseph Priestley* (London: Nelson, 1965), 13.

<sup>36</sup> On this and other historiographical complications concerning attempts to correlate scientific activity with religious dissent, see John H. Brooke, 'Joseph Priestley (1733–1804) and William Whewell (1794–1866): Apologists and Historians of Science', in Anderson and Lawrence, *Science, Medicine and Dissent*, 11–27; and 'Science and Dissent: Some Historiographical Issues', in Paul Wood (ed.), *Science and Dissent in England, 1688–1945* (Aldershot: Ashgate, 2004), 19–37.

<sup>37</sup> Schofield, *The Enlightenment of Joseph Priestley*, 137.

<sup>38</sup> *Ibid.* 138.

<sup>39</sup> Maurice Crosland, 'Priestley Memorial Lecture: A Practical Perspective on Joseph Priestley as a Pneumatic Chemist', *British Journal for the History of Science*, 16 (1983), 223–38, esp. 227–30.

<sup>40</sup> Cited by Gibbs, *Joseph Priestley*, 174.

These considerations suggest we have to be cautious about the kinds of claim we might want to make for connections between Priestley's 'science' and 'religion'. These very words might betray anachronism when torn from their contexts. Nevertheless, in the remainder of this chapter I want to suggest that, with due caution, two kinds of interpenetration can be discerned. In the first category are examples where one might plausibly argue that Priestley's religious commitment was relevant to his science or his science relevant to his religion. These are examples where it is possible to say in which direction the arrow of influence might fly. In the second category the connections are mediated by Priestley's philosophy and metaphysics and consequently a more holistic picture is required.

How might Priestley's religious belief be relevant to his science? It is not unduly contentious to observe that religious convictions might predispose a thinker towards one theory or one kind of theory rather than another.<sup>41</sup> This selective role has been common in the history of science and it shows up in Priestley's response to a theory of his contemporary, Erasmus Darwin. Darwin was speculating about spontaneous generation and versifying on the evolutionary transformation of living things. Priestley's theism, for all that it was radical, was not radical enough to accommodate Darwin's hypotheses. For Priestley the gap between organic and organized matter was so great that to postulate a transition was to affirm an effect without a cause. Advocates of spontaneous generation were hell-bent on denying miracles but were in effect proposing one. Priestley accused Darwin of exploiting an exploded doctrine.<sup>42</sup> Behind the accusation, as with his reaction to Hume's scepticism, was Priestley's conviction that all the beautifully adapted animals and plants in the world required an intelligent cause for their explanation.

In Priestley's natural theology we can see other elements that predisposed him towards some forms of scientific argument rather than others. Three examples stand out, though it would surely be possible to find others. A belief in nature as a designed system

<sup>41</sup> For a fuller discussion of salient examples, see John H. Brooke, *Science and Religion: Some Historical Perspectives* (Cambridge: Cambridge University Press, 1991).

<sup>42</sup> Harold J. Abrahams, 'Priestley Answers the Proponents of Abiogenesis', *Ambix*, 12 (1964), 59.

appears to have led him to speculate about mechanisms for restoration, especially, as I noted earlier, for the replenishment of air fouled by breathing. His eventual conclusion was that vegetation was the key. It would be too much to claim that he understood the principles of photosynthesis; but his experimental work was regulated by what he presented as a systematic and sustained enquiry. In August 1771 he announced to Theophilus Lindsey that 'I have discovered what I have long been in quest of, *viz*, that process in nature by which air, rendered noxious by breathing, is restored to its former salubrious condition.'<sup>43</sup> When Sir John Pringle presented him with the Royal Society's Copley medal, he congratulated Priestley for discoveries which showed that 'no vegetable grows in vain'.<sup>44</sup> In the vitiation and restoration of air Priestley himself found a scientific parable of the transformation of evil into good.

A second example of Priestley's natural theology finding expression in his science concerns the economy of nature. If we ask why he found the phlogiston theory attractive it was surely in part because of its economy: the metals had properties in common because they shared the same ingredient, phlogiston. The quest for such unity and economy was to pervade much of nineteenth-century chemistry, with hydrogen a recurring candidate for the ultimate unit of matter.<sup>45</sup> Lavoisier's system may have prevailed over Priestley's but it must not be overlooked that, by making the metals elemental, Lavoisier could not explain why they displayed common properties.

My third example is simply that of a presupposition that came to the surface when Priestley contemplated the properties of his dephlogisticated air, our oxygen. It transpired that a mouse could survive in the new gas more than twice as long as in ordinary air. At first, Priestley found it very difficult to accept that there could be an air that supported respiration and combustion better than ordinary air. The presupposition, common in natural theology, that the natural must be the best, had made it difficult to accept that there might be something better. The shaping of science by religious preconceptions can sometimes be almost too subtle to notice. It can be found again in

<sup>43</sup> Schofield, *A Scientific Autobiography*, 133.

<sup>44</sup> Cited by Gibbs, *Joseph Priestley: Adventurer*, 81.

<sup>45</sup> David Knight, *The Transcendental Part of Chemistry* (Folkestone: Dawson, 1978).

Priestley's tendency to overestimate the restorative effects of shaking noxious airs with water, believing that such experiments mirrored a beneficent natural interaction between the atmosphere and the sea.<sup>46</sup>

What of the effects of science on his religious outlook? At the most obvious level it could help to eliminate superstition. Priestley saw no clash between science and religion when both were properly understood. That has been a common enough apologetic formula, but Priestley wished to say more—that science and religion were fighting on the same side against popular superstition. A telling example would be Priestley's assault on the doctrine that the human mind can be directly influenced by divine initiative.<sup>47</sup> Priestley had no time for this; and his conception of how the mind worked, taken largely from David Hartley, fortified him in that resolve. There were no gaps or spirits through which a spirit being might gain access. The causal nexus of nature, of which humans are part, was inviolable.

Through his science, Priestley could also stock up on metaphors that would enrich his rhetoric. Chemistry in particular provided explosions that erupted in his prose. Thus passive obedience to political authority he dismissed as an 'exploded doctrine'. In his verbal battles with the religious establishment he made good use of gunpowder in predicting the fall of the English hierarchy and the blasting of Anglican privilege.<sup>48</sup>

In these examples we can see a certain directness of relevance in the mutual bearings of Priestley's scientific and religious language. But there is a second category in which the mediation is more pronounced and a holistic analysis becomes the more appropriate. Perhaps it could be expressed like this—that the metaphysics to which Priestley was drawn in his maturity was congenial to both his scientific and religious convictions. Two aspects of his metaphysics are particularly revealing in this respect: his determinism and his monism.

Priestley preferred to speak of the doctrine of philosophical necessity rather than determinism, but its meaning was clear. Effects were

<sup>46</sup> John G. McEvoy, 'Joseph Priestley, "Aerial Philosopher": Metaphysics and Methodology in Priestley's Chemical Thought, 1772–1781', Part 1, *Ambix*, 25 (1978), 1–55; Part 2, *ibid.* 93–111; Part 3, *ibid.* 153–75; Part 4, *ibid.* 26 (1979), 16–38. Part 2, 100–1.

<sup>47</sup> Joseph Priestley, *The Doctrine of Divine Influence on the Human Mind Considered in a Sermon* (Bath: R. Cruttwell, 1779).

<sup>48</sup> Priestley, *Reflections on Free Inquiry*, 40–1. See also Joseph Priestley, *Letters to the Rev. Edward Burn of St. Mary's Chapel, Birmingham* (London: J. Johnson, 1790), p. ix.

physically bound to their causes by the very necessity that David Hume had denied. It was a doctrine consonant with a recurrent motif in Priestley's writing: an aversion to the arbitrary, where by 'arbitrary' he meant flowing from unjustified dictat. When disparaging Calvin's doctrine of predestination he would protest against the 'arbitrary decree'.<sup>49</sup> Following the revolution of 1789 he would refer to the 'late arbitrary government of France'.<sup>50</sup> It is not implausible to suggest that his presuppositions about the natural world were structured by the same deletion of the arbitrary. For if nature could be manipulated by a Sovereign will, what guarantee could there be of its uniformity? Surely the very possibility of a rational science of nature required a non-intervening rather than a manipulative deity? Priestley's conviction that miracles did not belong 'in this age of the world' was certainly of a piece with his scientific determinism.<sup>51</sup> The miracles that had authenticated Christ's ministry had simply rendered more miracles unnecessary. Scientific discoveries helped to disclose the interconnecting threads that were woven into the fabric of nature. There was necessity in the connections. Indeed, the existence of determinate relations between cause and effect was especially congenial for Priestley's account of human discipline and responsibility. In his own words: 'One principal reason why I reject the doctrine of philosophical liberty, is that exactly in the degree in which we suppose the mind not to be determined by motives, in that very degree do rewards and punishments lose their effect, and a man ceases to be a proper subject of moral discipline.'<sup>52</sup>

Priestley elaborated his views in *The Doctrine of Philosophical Necessity*—an appendix to his *Disquisitions on Matter and Spirit* (1777). His conviction was that

motives influence us in some definite and invariable manner: so that every volition or choice, is constantly regulated and determined by what precedes it. And this constant determination of the mind, according to the motives presented to it, is all that I mean by its necessary determination. This being admitted to be the fact, there will be a necessary connexion between all things past, present and to come, in the way of proper cause and effect, as

<sup>49</sup> Priestley, *An Appeal*, 10–11.

<sup>50</sup> Priestley, *Letters to the Rev. Edward Burn*, p. ix.

<sup>51</sup> Priestley, *The Doctrine of Divine Influence*, 9.

<sup>52</sup> Priestley, *A Free Discussion*, p. xxi.

much in the intellectual, as in the natural world; so that . . . according to the established laws of nature, no event could have been otherwise than it has been, is, or is to be, and therefore all things past, present and to come, are precisely what the Author of nature really intended them to be, and has made provision for.<sup>53</sup>

In such passages we see the connections in Priestley's mind between his theology, and his understanding of causality and of the analogy between the workings of nature and those of the human mind. His was a metaphysics that even had pastoral pay-off because 'without this persuasion concerning the uniformity of the laws of nature respecting our minds . . . minister and people will both be subject to great occasional despondency'.<sup>54</sup> We can begin to understand why the parable of the sower meant so much to him. It underlined the point that whether the seed germinated or not depended inexorably on the ground on which it fell. Accordingly, 'all the benefit we are authorised to expect from the gospel arises from the natural effect that the great truths and motives of it are calculated to produce upon the mind'.<sup>55</sup> In the last analysis the doctrine of philosophical necessity eventually bound together Priestley's understanding of nature and history. The whole of nature and the whole of history could be subsumed under divine decree. In this respect Priestley re-established the union of God's purpose in ordaining nature and the regularity of nature itself—a union broken by earlier attempts to separate general and special providence. All was ultimately ascribed to God; general and special providence were integrated without any violation of the natural order. Not surprisingly, Priestley would stress the unity of nature, prophesying that one great comprehensive law might one day be found to govern both the material and intellectual worlds. Even the corruption of Christianity fulfilled a divine purpose in making possible just that repurification to which he himself was so dedicated.<sup>56</sup>

In Priestley's monism there was a second metaphysical position that was congenial to both his scientific and religious commitments. It underpinned his assault on the world of spirits, his vehement defence of the doctrine of resurrection, and his exclusion of

<sup>53</sup> Joseph Priestley, *The Doctrine of Philosophical Necessity Illustrated*. Appendix to *Disquisitions Relating to Matter and Spirit* (London: J. Johnson, 1777), 7–8.

<sup>54</sup> Priestley, *The Doctrine of Divine Influence*, 8.

<sup>55</sup> *Ibid.* 1–2.

<sup>56</sup> Brooke, ' "A Sower Went Forth" ', 37–8.

immediate divine influence on the human mind. For his critique of a mind/matter dualism Priestley was able to adduce philosophical, religious, and scientific arguments. Philosophical in that if matter and spirit were such distinctive things as they were commonly made out to be, it was inconceivable how they could interact at all. Religious, because if the soul were immaterial and the body material, there was the insufferable difficulty whether the two came together at conception, birth, or whenever. And scientific in that chemistry had something to say about spirits. As in Priestley's work on gases, a vocabulary of 'airs' displaced a vocabulary of 'spirits', so the latter could by analogy be expunged from theology.<sup>57</sup>

For Priestley, monism and mortalism went hand in hand, serving to highlight the doctrine of bodily resurrection. At death there was no automatic survival of a separable immortal soul; but, by the grace of God, one had the promise of resurrection in God's own time. Priestley insisted that a unitary view of the human self was the biblical view and it helped him turn the tables on those who accused him of surrendering revelation to reason. Fernando Vidal has shown that during the seventeenth and eighteenth centuries there had been a shift away from the traditional view that the resurrected body had to be constituted by the same material components as its earthly predecessor. Robert Boyle, for example, had argued that since no one particular portion of matter determines personal identity, the sameness of the terrestrial and resurrected individual was not to be judged by material criteria.<sup>58</sup> With his holistic understanding of the human person, Priestley may have felt more constrained to believe that it would be the same body that would eventually be reconstituted after death. Either way, Priestley was adamant that the one essential article of Christianity is the doctrine of resurrection. Without it and without the prospect of rewards and punishment there could be no social control and no ultimate rationale for the reformation of character.<sup>59</sup> Such reformation would pave the way for the final perfecting of humanity in the afterlife, when even the wicked might yet prove capable of improvement.

<sup>57</sup> Ibid. 41.

<sup>58</sup> Vidal, 'Brain, Bodies, Selves, and Science', 955.

<sup>59</sup> Joseph Priestley, *Considerations on Differences of Opinion among Christians* (London: J. Johnson, 1769), 15.



It would be easy to give an account of Priestley in which his secularization of Christianity was a gradual but remorseless stripping away of doctrinal accretion until virtually nothing remained. But what Priestley did believe he believed with fervour and we can certainly misunderstand his heterodoxy if we are tempted to see in it any kind of religious indifference. Christianity had to be purged of its Platonist elements, but the residue could be proclaimed with real conviction, even to the French *philosophes* who Priestley believed had rejected a caricature of the faith and mistakenly thrown away the baby with the bathwater. His encounters with the French provide a concluding, irresistible anecdote: 'When I was dining at ... Turgot's table, M. de Chatellux ... in answer to an inquiry said the two gentlemen opposite me were the Bishop of Aix and the Archbishop of Toulouse, "But", said he, "they are no more believers than you or I". I assured him I was a believer; but he would not believe me.'<sup>60</sup>

Connections between science and secularization are a good deal more slippery than is often supposed. There is a real sense in which Priestley shows them to be so. Certainly in the practical details of a scientific experiment one might have to look very hard to discern any religious investment. Moreover, the separation of science from religious interests and control has been a favourite refrain in literature on secularization. But, as Amos Funkenstein observed, there can be other forms of secularization resulting from the fusion, not the separation, of scientific and religious concerns.<sup>61</sup> In his heterodoxies, Priestley arguably conforms as much to the latter model as the former. Certainly he thought so himself. In a letter from America of 3 April 1800, he declared that one of his primary objects had been to join (natural) philosophy to Christianity, from which it had been 'too much separated'.<sup>62</sup>

<sup>60</sup> Cited by A. D. Orange, 'Oxygen and One God: Joseph Priestley in 1774', *History Today*, 24 (1974), 773.

<sup>61</sup> Amos Funkenstein, *Theology and the Scientific Imagination from the Middle Ages to the Seventeenth Century* (Princeton: Princeton University Press, 1986).

<sup>62</sup> Priestley to B. Lynde Oliver, 3 April 1800, in Schofield, *A Scientific Autobiography*, 302.