GOD AND NATURE

Historical Essays on the Encounter between Christianity and Science

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UNIVERSITY OF CALIFORNIA PRESS
Berkeley • Los Angeles • London

University of California Press
Berkeley and Los Angeles, California

University of California Press, Ltd.
London, England

Library of Congress Cataloging in Publication Data

Main entry under title:
God and nature.

Rev. papers from an international conference held at the University of Wisconsin—Madison, Apr. 23–25, 1981.

Bibliography: p.
Includes index.
1. Religion and science—History of controversy—Congresses. I. Lindberg, David C. II. Numbers, Ronald L.
BL245.G63 1986 261.5'5 85-7548
ISBN 0-520-05538-1 (alk. paper)
ISBN 0-520-05692-2 (paper)

Printed in the United States of America

4 5 6 7 8 9

To
Vern and Barbara Carner,
whose generous support
made this volume possible

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Acknowledgments

This book is the outgrowth of the editors' shared conviction that the interaction of science and Christianity has been of profound importance in the shaping of Western civilization—a conviction nurtured by our respective historical apprenticeships with Edward Grant and Richard S. Westfall (Lindberg) and A. Hunter Dupree and Roger Hahn (Numbers). It is also a reflection of our belief that historians have an obligation to share the fruits of their labors with the reading public. In recent years historians of science and religion have substantially revised many of their opinions but have generally addressed themselves only to fellow professionals. It seemed time to correct this situation. As a first step in that direction we organized an international conference on the historical relations of Christianity and science, held at the University of Wisconsin—Madison on 23–25 April 1981, to which we invited several dozen church historians and historians of science. This book has grown out of that conference.

In organizing the conference and editing this book we have accumulated many debts, which we gratefully acknowledge. The entire project owes its existence to the generosity of the Carner Foundation of Dallas, Texas, and the support provided by the Anonymous Fund, the Humanistic Foundation, and the Knapp Bequest of the University of Wisconsin—Madison. Vern and Barbara Carner adopted our project in its infancy, offering financial and moral sustenance—to say nothing of the coveted "Christianity and Science" coffee mugs given to each conference participant! The Carners are in many respects the true parents of this project.

Early in our efforts we formed an advisory committee to assist us in organizing the conference. For their dedication and wisdom we express gratitude to William Coleman, Edward E. Daub, and Robert M. Kingdon of the University of Wisconsin; John Dillenberger of Hartford Seminary Foundation; Martin E. Marty of the University of Chicago; and Richard S. Westfall of Indiana University.

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Christianity and the Newtonian Worldview

Margaret C. Jacob

All his [Christ's] laws are in themselves, abstracted from any consideration of recompense, conducing to the temporal interest of them that observe them.

—Richard Bentley, 1692

Thus the wise Governour of the World, hath taken Care for the Dispatch of Business. But then as too long Engagement about worldly Matters would take off Mens Minds from God and Divine Matters, so by this Reservation of every Seventh Day, that great Inconvenience is prevented also.

—William Derham, 1714

The interplay between science and religion in seventeenth-century England served to transform both. Far from being in conflict, as historians used to suppose, science and religion (as systems of ideas) modified each other in the course of the century. Mainstream English Protestants gradually embraced a version of the new science that supported traditional Christian metaphysics, while scientists responded to the necessity of protecting an established church and religiosity by significantly modifying the mechanical philosophy of nature and purging it of its materialistic tendencies. But this process, this transformation of ideas, did not occur in minds divorced from everyday reality. Intellectual change does not generally occur in that way. Scientists and churchmen alike were coming to terms with economic and political forces that were new and profoundly unsettling. Today we use words like *capitalism* and *revolution* to describe these forces; in the seventeenth century men (and some women) spoke of nature and God, of laws spiritual and natural, of self-interest or greed, of business, and of the necessity for order and harmony. Both science and religion were seen as being capable of imposing that order, but

agreement among the educated as to which version of either would best serve was difficult, if not impossible, to achieve. This failure to agree convinced some thinkers that science and nature, properly understood, were sufficient principles by which human beings might order reality. The resulting "deism," or even "atheism," became a vital part of an intellectual transformation found throughout western Europe in the eighteenth century, commonly described by historians as the "Enlightenment." Almost unwittingly, in the early decades of the eighteenth century, science helped to foster the first generation of intellectuals among whom could be found a significant number of quite articulate opponents of all forms of traditional Christianity.

THE SEVENTEENTH-CENTURY BACKGROUND

The Protestant Christianity embraced by Isaac Newton (1642–1727) and his Newtonian followers had been molded by a new social and economic order that emerged in seventeenth-century England. A powerful market society operating according to the necessities of supply and demand existed in seventeenth-century London and the southern market towns, and any clergyman worthy of a pulpit there had to address that fundamental social and moral reality. Of course, this commercial society, which grew increasingly more conspicuous by the late seventeenth century, had emerged within the context of political revolution. The English Revolution, understood as a matrix of social and political upheaval that began in the 1640s and that culminated in the Revolution of 1688–89, gave increased political power to the landed and commercial classes. By the late 1690s the great London financiers had their Bank, while the landed gentry, with their side interests in commerce and trade, ruled over their parliamentary seats with little interference from the crown.[1] In London and the market towns men of "business and dispatch," as one clergyman in the 1660s described them, represented a new class and a new political force for whom both learning and divinity had to be practical and applicable if they were to be meaningful.

The Christianity that spoke most directly to this postrevolutionary elite was not the rigorous Calvinism of the 1630s and 1640s, which had inspired a generation of revolutionary saints. Rather it was a liberal (at the time one said "latitudinarian") Anglicanism that repudiated predestination, yet continued to define religion as an individual matter wherein the conscience of the laity must be respected, and that firmly subordinated church to state, insisting that bishops serve, not manipulate, the political system. If that liberal Christianity

had a birthplace and theological center, it was Cambridge. There as early as the 1650s the Cambridge Platonists, Henry More (1614–1687) and Ralph Cudworth (1617–1688), repudiated the doctrine of predestination, while the young mathematician and clergyman Isaac Barrow (1630–1677), an associate of Newton, recorded privately his belief that religion must address itself not to "cloisters (whence much of it came)" but to "congregations of tradesmen and merchants."[2] In the select circle of liberal Anglicans that Newton frequented, Cambridge was intellectually alive and not the arid wasteland chronicled by commentators[3] who want to downplay the stimulation provided Newton by More and Cudworth or the importance of Isaac Barrow and the Cambridge divines in shaping the irenical, anti-Calvinist, millenarian, and violently antimaterialistic Christianity that became central to Newton's own religiosity.

Not only was this liberal Anglicanism basic to Newton; it was also embraced by a new generation of Cambridge-trained clergymen who used both pulpit and press to articulate for the educated elite what was nothing less than a new version of the Christian message. They addressed themselves to the competitive and self-interested world of the market and found its ethics, when restrained by Christian virtue, compatible with salvation. And for our purposes even more important, they used the new science of the seventeenth century as a foundation upon which this liberal Christianity might rest its case for God's benevolent overseeing of society and commerce. Chance and disorder are only apparent, not real, they argued, and God instills order in a world made complex by competition, market fluctuations, and (not least) political upheaval. Science, liberal Anglicans argued, proves the reality of that inherent, providentially directed, natural harmony. By the late seventeenth century the new science and the new Anglicanism reinforced one another. We should hardly be surprised to find the young Isaac Newton incorporating into his natural philosophy, and hence into his science, definitions of matter, space, and time that were deeply indebted to the liberal Anglicanism of Restoration Cambridge. The Newtonian synthesis entered the eighteenth century as an intellectual construction born in response to the English Revolution. More than any other philosophy of the early modern period, Newtonianism in turn shaped the beliefs and intellectual aspirations of an age we have come to describe as enlightened.

But if liberal Anglicanism was sympathetic to men of business, to the necessities and ethics of the marketplace, to what most people today would call material interests, how could it also have been so violently opposed to materialism in philosophy? In seventeenth-century England philosophical materialism, although derived from a

variety of sources and found among very disparate social groups, was uniformly condemned by Christian apologists as "atheism" and as disruptive of the very fabric of social obligation. They condemned it for endorsing the worst aspects of market competition and worldly self-interest, or they associated it with the religious heresies promulgated by lower-class social reformers intent upon undermining the church's privileges, who were oftentimes drawn from the ranks of the people victimized by the new wage market.

Because there were so many varieties of materialism in mid-seventeenth-century England, no one definition identifies all its proponents and their various social beliefs and interests. All did, however, share one common philosophical assumption: while traditional Christian metaphysics argued for a separate spiritual realm, distinct from matter and body—in effect the world of God, angels, and souls—materialists obliterated that distinction. They might argue that souls are in bodies in such a way as to be indistinguishable one from the other, or they might simply assert that there is only matter in the universe. The sources of seventeenth-century materialism were numerous: ancient philosophers like Aristotle or Epicurus, new scientists like Hobbes, or popular heresies and beliefs that saw nature as alive and fertile without the need of divine intervention. Such philosophical heresies were particularly rife during the English Revolution. In the reaction that followed that Revolution, symbolized by the Restoration of Charles II in 1660, progressive churchmen sought to advance the cause of science under royal patronage and still to purge it of any materialistic tendencies. At stake in their enterprise, as they perceived it, was not simply the reconciliation of science and religion. Heresies that eliminated the spiritual realm, and hence its priestly overseers, threatened the very order of society—church, aristocracy, property, and privilege.

In the 1640s and 1650s Levellers, Quakers, Diggers, and Muggletonians—to name the better known sectaries of the period—argued that if God dwelt in Nature (some went so far as to say that God is Nature), then all human beings partake of the divine in this world as well as in the next. And from that metaphysic the radicals drew certain social conclusions. Should not all people share in the riches of the earth? If God dwells in us all, what need have we of clergymen and churches, and are there such things as sin and hell?[4] That sort of pantheistic materialism could justify social leveling, and the Cambridge Platonists waged a violent campaign in pulpit and press against that heretical and dangerous response to social and economic inequality. In the 1660s Newton wrote a manuscript treatise wherein he too condemned the materialism of the "atheists," "the vulgar,"

who on this occasion were probably followers of a very paganized version of Aristotle's philosophy of nature.[5] Whatever its source, materialism represented the gravest intellectual heresy confronted by the English church.

The philosophical heresies associated with lower-class radicalism had their analogue in another species of materialism believed to be prevalent among the educated classes themselves. The major political philosopher of the English Revolution, Thomas Hobbes (1588–1679), had used the new science and mechanical philosophy to argue that only matter and motion govern the operations of nature, and in that formulation churchmen saw a profound threat to social harmony as well as to Christianity itself. According to Hobbes, desire and passion rule in the heart—we are nothing but matter impelled by force—and as a result, churchmen argued, Hobbes's materialism, which saw the actions of matter as governed only by laws inherent to it, sanctioned the unrestrained use of passion in pursuit of self-interest—to paraphrase Hobbes, the marketplace of the all against the all.[6]

While churchmen read Hobbes as a blatant materialist and atheist, they were also suspicious for different reasons of his French contemporary, René Descartes (1596–1650). Although Descartes was a committed theist, his natural philosophy rested on a radical separation of matter and spirit. This was a separation so radical that the Cambridge Platonists, among others, came to fear that Descartes had freed matter to operate on its own, without the assistance of spiritual agencies. In effect, Descartes defined matter in such a way that it could be seen as part of Hobbes's self-contained material order. Newton himself called Descartes a materialist and argued that his science would undermine all religious belief. At almost precisely the same time the vice-chancellor of Cambridge University, Edmund Boldero of Jesus College, ordered that Descartes's work not be read.[7] Both Hobbes and Descartes addressed the highly educated, and what later seventeenth-century Anglican Christians, including Newton, wanted was an equally sophisticated natural and religious philosophy that would effectively counter materialism of whatever origin while maintaing a liberal stance in matters of doctrine. Churchmen wanted social harmony without the threat of social disorder coming from below, but also without the rapacious self-interest (which ultimately fed the flames of lower-class radicalism) so characteristic of the "crafty ill-principled men," as John Evelyn, one of the founders of the Royal Society, called the ungodly and prosperous.

Under the linkage forged by the Cambridge Platonists, Barrow, Newton, and the Newtonians during the late seventeenth and early eighteenth centuries, Christianity and science entered into an alliance

addressed to the moral reality of a market society, the first of its kind (outside of the Netherlands) to exist in one of the highly centralized nation-states of the early modern period. Science and natural philosophy, as interpreted by Newton and his followers, offered a model of the stable, ordered, providentially guided universe within which could occur that competition so basic to the operations of the restrained, yet relatively free, market society.

THE BOYLE LECTURES

Through the efforts of the first generation of Newtonians—Richard Bentley, Samuel Clarke, William Derham, and William Whiston—Newton's natural philosophy was preached from the 1690s onward at the podium provided by a prestigious London lectureship. It was presented as the cornerstone of a liberal, tolerant, and highly philosophical version of Christianity, a natural religion based upon reason and science that came dangerously close to deism but that managed, in Newton's own lifetime, never to slip over that particular ledge. Perhaps the major reason why the early Newtonians remained aggressively Christian, or more precisely Anglican, derived from the active role that Newton took in the promulgation of his natural philosophy. When the great natural philosopher and supporter of the church, Robert Boyle, was in his last illness and the terms of his will establishing what became his famous lectureship became known to his intimates, a close friend of Newton, the Scottish mathematician David Gregory, recorded in a memorandum dated 28 December 1691 a revealing glimpse of Newton's sense of what his philosophy might achieve. From the date and contents of Gregory's memorandum it appears likely that Newton was referring to the projected Boyle lectures. His description of the "public speech" and the contents of "ane Act," that is, a college speech, thesis, or disputation, closely resembles the contents of lectures first given in 1692 by Bentley. Newton, in effect, suggested that his discoveries in celestial physics would show the cosmic qualities in the laws of nature and hence would serve the argument from providential design better than the reliance on the "general contrivance" in animals and plants used by John Ray in his *The Wisdom of God Manifested in the Works of the Creation* (1691). Gregory's memorandum reads:

> In Mr Newton's opinion a good design of a publick speech (and which may serve well as ane Act) may be to shew that the most simple laws of nature are observed in the structure of a great part of the Universe, that

the philosophy ought ther to begin; and that Cosmical Qualities are as much easier as they are more Universall than particular ones, and the general contrivance simpler than that of Animals Plants etc."

In January 1692 Newton may also have suggested Richard Bentley as the first Boyle lecturer, and earlier, in July 1691, Bentley had already received instructions through another liberal churchman, William Wotton, on how to understand the *Principia*. Wotton took a keen interest in the Boyle lectures, as did his patron and leader of the church party, Heneage Finch. In the autumn of 1692 Bentley developed his version of Newton's philosophy and used it as the underpinning for his social vision. Before publishing those sermons Bentley consulted with Newton, and the first of Newton's four replies began with the now famous words: "When I wrote my treatise upon our Systeme I had an eye upon such Principles as might work with considering men for the beliefe of a Deity and nothing can rejoyce me more than to find it usefull for that purpose."[9] By way of assistance to Bentley, Newton may have written an account of his system of the world; a manuscript version of that draft survives among Newton's unpublished papers.[10]

In the early eighteenth century the numerous editions and translations of the Boyle lectures became the major vehicle for disseminating Newtonian natural philosophy to the educated laity both in England and on the Continent. On the basis of Newton's behind-the-scenes interest in those lectures, his consistent antimaterialism, and his devout, but highly liberal and irenical, Christianity, this foremost English scientist should also be described as a Newtonian in the social and ideological sense. He condoned the Boyle lectures that articulated the social vision of Bentley, Clarke, Derham, and the other liberal divines; and he lent the prestige of his achievement to what became in their hands an enlightened philosophy that supported the pursuit of sober self-interest, that endorsed human domination over nature, and that encouraged the application of scientific learning to the problems posed by navigation, agriculture, and industry. In short, Newtonianism became an ideology that justified commercial capitalism, empire, scientific progress, and a new religiosity geared more to the vicissitudes of this world than the rewards of the next. This is not to say that social factors and political interest can account for Newton's scientific achievements, his mathematical genius, or his philosophical insights into the structure of physical reality. But it is to say that, with his consent, his science served a precise ideological function in the early decades of the eighteenth century. After 1688–1689 it was used to shore up the newly reconstituted monarchy and established church as the bulwarks of order, stability, and prosperity; only strong government, centralized and coordinated by court, placemen, and bishops, would make the pursuit of economic interests possible. The cosmic order and design explicated in the *Principia* became, in the hands of Newton's early followers, a natural model for a Christian society, providentially sanctioned and reasonably tolerant of diverse religious beliefs, provided they did not threaten the stability of the polity (hence the exclusion of Catholics and anti-Trinitarian heretics with their propensity, or so it was imagined, for purely rationalist explanations of supernatural phenomena). Yet the Newtonians argued, against the demands made by contemporary reformers, that no further political reform was necessary beyond that embodied in the so-called Revolution settlement of 1689.

In polemical response to the materialism of Hobbes and the pantheism of the political radicals, Newton's closest friends, Bentley, Clarke, and Whiston, took to their pulpits and in their lectures and writings preached primarily to a London-based and prosperous—often mercantile—audience. They extolled the virtues of **self-restraint** and public-mindedness, while at the same time assuring their congregations that prosperity came to the virtuous and that divine providence permitted, even fostered, material rewards. The same providence that generates the mechanical laws at work in the universe oversees the workings of society and government, and men must see to it that their political and economic actions conform to the stability and harmony decreed by supernatural authority. While tolerating doctrinal differences among Christians themselves, reasonable people must acknowledge a vast cosmic order, imposed by God, and attempt to imitate it in society and government. In Boyle lectures that were read and admired by eighteenth-century thinkers as diverse as Samuel Johnson and Jean-Jacques Rosseau, Samuel Clarke argued that religion reinforced by science should play a vital role in state policy.[11] Liberal Anglicanism preaches social order and political stability—in other words, that men should not be "extremely and unreasonably solicitous" to change their stations in life and that they should not become, in the words of Bentley, "men of ambitious and turbulent spirits, that [are] dissatisfied . . . with privacy and retirement."[12] The natural rulers should be allowed their positions and stations; they, of course, must practice a moral virtue that is conducive to harmony because God's providence sees to it that it is. There can be no doubting the absolute necessity for social stability and no doubting that the moral laws ordained by God for its attainment are universal and guaranteed to work. The physical order explicated by Newton proclaims order and stability, but this order comes not from matter or nature but directly from God, whose will operates in the universe either directly or through active principles. The "world natural"

stands as a model for the "world politick," and Newton's explanation of the first provides a foundation upon which the government of the second should rest. Without that model, what refutation could work against the radicals or the Hobbists, whose prescriptions rested upon observed behavior and upon the experience of political revolution?

In the most influential and consistently republished lectures ever delivered during the eighteenth century, the Newtonians soothed and assured their congregations, but they also simultaneously exhorted them. Wealth, leisure, and power in the hands of the natural rulers of society fulfilled the providential design, yet all had to be used with moderation and in the service of a liberal and tolerant Christianity. Social harmony and political stability complement an ordered universe explicated by Newton, where matter is dead or lifeless, its motion controlled by the will of God; in short, as Clarke explained, "there is no such thing as what men commonly call the course of nature, or the power of nature. [It] is nothing else but the will of God producing certain effects in a continued, regular, constant, and uniform manner."[13] The Newtonians succeeded, as had the Cambridge Platonists before them, in proclaiming the providential and interventionist God who allowed the ordered universe to operate according to discernible laws of nature.

NEWTONIANISM AND DEISM

The charge most commonly leveled against this Newtonian Christianity of the eighteenth century was, and is, that it quickly degenerated into deism. Yet all the evidence we possess about Newton's own religiosity confirms his theistic and providential understanding of God and his biblical sense of history. In his millennial paradise, "the new Jerusalem that [mystical] spiritual building in Sion where of the Chief corner stone is [Christ]," the returned Savior will "rule with a rod of iron."[14] Indeed, Newton discussed events in his own time—for example, the war against France during the reign of Anne—as possible signs leading to the institution of that expected godly paradise.[15] There was nothing remote about Newton's God, and surely if the term *deism* had any meaning in the eighteenth century, it lay in a definition of God that allowed Him to exist but not to participate, and that relegated Christianity to a series of ethical maxims taken less, rather than more, seriously.

Yet after we have pointed to Newton's intensely Christian temper or to the vagaries in defining deism during the eighteenth century, the charge that something less than Christian emerged in church-sponsored, science-based English Protestantism still will not

go away. The charge bears relevance not to the religiosity of the first generation of Newtonians—not even to Samuel Clarke, whose anti-Trinitarianism was drawn from his reading of Newton's science[16] but did not, in my reading of his writings, lessen his commitment to a liberal Christianity as he understood it—but rather to the second generation of Newtonians. These were scientists and ideologues who came into their own in the 1720s, in that complacent world of Whig oligarchs that so impressed foreign visitors like Voltaire. In their hands Newtonian science fostered a variety of cultural institutions and philosophical systems that seem to bear little resemblance to the Christianity in which Newton, or Whiston and Clarke for that matter, personally believed.

Not least of these new institutions was Freemasonry, that secret male fraternity officially established in 1717 in London. It grew out of the old artisan guilds but became, under the leadership of Whigs and Newtonians, a totally "speculative" (to use the Masonic term) brotherhood of bourgeois gentlemen and aristocrats dedicated, as their official *Constitutions* proclaim, to religious toleration, Baconian experimentalism, and court-centered government. The leading spirit in British Freemasonry was the Anglican clergyman Jean Theophile Desaguliers (1683–1744), the official experimenter of the Royal Society, who had known Newton well; indeed, Newton stood as a godparent to one of Desaguliers's children.[17] Desaguliers combined a clerical career, which he rather neglected, with an avid dedication to Newtonian science and Freemasonry. He lectured widely in England and the Netherlands on the practical application of Newtonian mechanics to industry and agriculture. He also encouraged the formation of Masonic lodges in the provinces and abroad, while his own London lodge at the Horn Tavern was among the most prestigious in the country and the one to which the French philosopher, Charles Louis de Secondat Montesquieu, proudly belonged.

In the hands of Desaguliers and his Newtonian associates in the new fraternity, in particular Brook Taylor (1685–1731) and Martin Folkes (1690–1754), the London Masonic lodges became places where literate and cosmopolitan men could seek a grounding in the new science and mathematics made simple and participate vicariously in the "Royal Art" of architecture, with its supposedly ancient wisdom still intact, while worshiping the new science-inspired God, the "Grand Architect," as he was called. The official Masonic *Constitutions* of 1723 prescribed that "in ancient Times Masons were charg'd in every Country to be of the Religion of that Country or Nation, whatever it was, yet 'tis now thought more expedient only to oblige them to that Religion in which all men agree, leaving their particular opinions to themselves."[18] Into that fraternal and secretive religiosity a

variety of creeds could comfortably fit; indeed, eighteenth-century Freemasonry, in both England and the Continent, housed Newtonians, pantheists, materialists, and deists, with the specific identity of the object of worship revered at lodge meetings under the name of "Grand Architect" known only to the individual worshiper. In effect, the eighteenth-century Freemason could worship Newton's God or Nature, and the difference depended not upon communal experience, which consisted largely of banquets and processions, nor upon rituals and ceremonies, which were largely secular in origin, nor upon doctrine, but solely upon the private meaning attached to language.

As a cultural institution Freemasonry betrays the linkage between Newtonianism, when embraced by the educated laity, and deism. But there were also purely intellectual constructions of Newton's system made by that second generation of Newtonian scientists which further suggest that connection. In particular, the writings of Henry Pemberton (1694–1771) are representative of this "de-Christianized" Newtonianism. Pemberton was educated in Leiden under the great physician and chemist Herman Boerhaave, from whom he probably learned his Newtonianism. Pemberton's willingness to defend that system against the Continental followers of Leibniz brought him to Newton's attention, and by 1725 he was supervising the production of the third edition of the *Principia* (1726). Although various London Freemasons who were publishers and printers were involved in its actual production, and indeed in the general dissemination of Newtonian science, Pemberton, unlike Desaguliers, Folkes, and Taylor, does not appear to have been a Mason.[19]

The writings of Pemberton and his Newtonian colleagues repeated themes made famous by the great Boyle lecturers. Yet this next generation of Newtonians toned down the polemics aimed at freethinkers and materialists, which had been so characteristic of the earlier period. The accomplishment of the Hanoverian Succession in 1714 had engendered a modicum of political complacency. Dedicating his exposition of Newton's philosophy to Robert Walpole, the first prime minister, whose government embodied reason as it did his "masculine perspicuity and strength of argument," Pemberton claimed that Newton had read and approved the greater part of this treatise.[20]

Pemberton's *A View of Sir Isaac Newton's Philosophy* (1728) is a much more straightforward and succinct account of Newton's philosophy of nature, his definitions of matter, space, time, the vacuum, and the law of universal gravitation, than that found in the Boyle lectures. Christian apologetics has been deemphasized in favor of a general, but constant, emphasis on the power of the deity, on a straightforward explanation of Newtonian physics. Whenever Pemberton enters into

polemics, it is against the materialists: those who assert that gravity is essential to matter; those who would assert the eternity of the world; those who deny the supremacy of God in every aspect of creation.[21]

In the second quarter of the eighteenth century, during Walpole's era, a fashionable Newtonian and providentialist "deism" can be found among the educated elite, who grew less interested in the doctrinal rigidity of the early Newtonians. Their natural religion was transformed into an ethical system (seldom dwelt upon at any length) buttressed by Newtonian explanations of the universe. And most important, there is no evidence to indicate that Bentley, Clarke, or in the 1720s Newton himself disapproved of this fashionable extrapolation. Nor should they have. This natural religion, so broad as to accommodate Protestants and even "deists" of whatever doctrinal persuasion, at every turn asserted God's benevolent, if somewhat impersonal, relationship to his creation. It was a tested bulwark against materialism in philosophy as well as against the political radicalism associated with the English Revolution. By 1730 most observers declared that church and monarchy rested more securely than they had in previous decades and that the seeds of destruction lay in internal corruption rather than in the schemes of the radicals.

Given the increasingly obvious deemphasizing of religious doctrines in favor of a science-based natural religion championed by the Newtonians, it is understandable that European intellectuals hostile to organized religion, particularly as found in Catholic countries, rushed to embrace the Newtonian synthesis. That was precisely the response of the young Voltaire, who after arriving in England in 1726 became an ardent Newtonian. Indeed, he knew Clarke's Boyle lectures intimately, and with his Newtonian faith in place Voltaire launched violent polemics against clerics, religious persecution, and most forms of organized worship. His contemporary and the leading Dutch Newtonian of the eighteenth century, Willem Jacob s'Gravesande, taught Newtonian physics at Leiden for decades, believed deeply in divine providence, and seems to have had no scruples about associating with pantheists, materialists, and Freemasons—perhaps even joining the last-named organization. The assimilation of Newtonian science into Western thought produced the first generation of European thinkers for whom faith in the order of the universe proved more satisfying than faith in doctrines, creeds, and clerical authority.

CHRISTIAN OPPOSITION TO NEWTONIANISM IN ENGLAND

By the middle of the eighteenth century many English Protestants had become convinced that the growth of deism and materialism, the

degeneration of public and private morality, and political corruption should be laid at the door of liberal Anglicanism and its science-supported natural theology. In this age of Whig ascendancy the opponents of Newtonian Christianity predictably came from the political opposition, the Tory or "country" wing of the Anglican church. By the 1740s this Tory disaffection led to the questioning of the most basic tenets of liberal Anglicanism. Tory thinkers became increasingly convinced that the Newtonians, possibly even Newton himself—although few, if any, of his contemporaries outside his circle knew what we now know about his ideological involvements and his religious beliefs—had, by their avowal of the new mechanical philosophy as the foundation of natural religion, effectively undermined all religion. Ironically, in the light of what we know about the ideological uses of seventeenth-century science, they believed that the Newtonians had opened the door to the radicals, to the atheists, deists, and Spinozists. This anti-Newtonian thrust within Tory Anglican thought received its most elaborate explication in the voluminous writings of John Hutchinson (1674–1737) and his many followers.[22] Although primarily given to natural-philosophical explanations of the universe, this anti-Newtonian movement also displayed strongly mystical and spiritualizing tendencies. It sought to keep aspects of Newtonian science, while finding in nature proof for doctrines as diverse as the Fall of Man and the Trinity.

Throughout the eighteenth century the anti-Newtonianism of the devout may have been much more widespread than has as yet been imagined. Methodist preachers could be found who "bitterly inveighed against Newton as an ignorant pretender who had presumed to set up his own ridiculous chimeras in opposition to the sacred philosophy of the Pentateuch."[23] If any thread united such disparate religious positions as those of the Hutchinsonians and the "enthusiastic" Methodists, it was in fact their opposition to establishment culture and its liberal and Newtonian spokesmen. Tory or "country" opposition, in particular its Christian and God-fearing element of whatever sectarian persuasion, saw the materialists as the quintessential symbol of a corrupt age and as the wayward, but inevitable, offspring of their science-deceived elders. Even within Cambridge itself a reaction set in against the alliance of science and religion, and throughout the eighteenth century the college common rooms and lecture halls witnessed isolated attacks on a form of religion now totally dependent upon principles of attraction and inertia and definitions of matter and motion.

A few examples should suffice to illustrate the religious sensibilities of these anti-Newtonian critics and the depth of their dissatisfaction.

George Cheyne (1671–1743), one such critic and one of the finest doctors of his age, became an early convert to the Newtonian natural philosophy and wrote a long treatise (*The Philosophical Principles of Religion*, 1705, 1715) in support of natural religion based upon Newtonian principles. Indeed, Cheyne was so convinced of the argument from design that he believed divine providence to have designed the waters at Bath as the means by which the English might cope with their weather and diet.[24] Apparently Cheyne knew whereof he spoke; he had been a "Free-liver" and suffered from extreme obesity for many years. He then became a pioneer for clean living and careful diet and an expert on gout.

By the 1730s Cheyne had become convinced that the body politic was severely ailing, and he traced its disease to "spurious Freethinkers, active Latitudinarians, and Apostolic Infidels."[25] As Cheyne grew increasingly disaffected from the ruling Whig oligarchy, he spoke more and more bitterly about liberal divines and freethinkers and turned toward Methodism.[26] At precisely the period of his political disaffection Cheyne also grew skeptical of the new science with its emphasis upon induction and calculation. In his search for physical well-being in man and government, Cheyne abandoned the Newtonian synthesis and opted for an increasingly spiritualized understanding of nature and for a contemplative, almost mystical and millenarian, version of Christianity.[27] In the face of the corruption he universally perceived, Cheyne, the young Newtonian, became the disaffected and antiestablishment Methodist. For the first time in Protestant Europe the eighteenth century witnessed a widespread disaffection from the new science, characterized by a growing sense that science had betrayed the very religious sensibility that had done so much during the previous century to foster it.

The rule of the liberal divines in the government of the church further inflamed the clerical (as well as lay) opposition to Whig hegemony in church and state and low-church Anglicanism. Given the power of the latitudinarians, few if any of the opposition clergy ever emerged out of the political and ecclesiastical wilderness to become effective spokesmen against the prevailing order. By the 1720s and 1730s Walpole was said to have found his pope in the Whiggish Edmund Gibson, bishop of London, while the liberal Newtonian Benjamin Hoadly, who had learned his science from Samuel Clarke, incited the Tory opposition by arguing for the subordination of church to state. Hoadly was rewarded with a bishopric for his efforts in support of the Whig interpretation of ecclesiastical government. In contrast, alienated Tory and anti-Newtonian churchmen, such as the Hutchinsonian George Horne (1730–1792), generally kept their opin-

ions to themselves. Only in 1790 did Horne finally obtain high ecclesiastical office as bishop of Norwich; in the interim he confined his opinions on current events and the state of the church to his private diary.

Horne's diary is therefore a valuable guide to the Tory and anti-Newtonian conscience, and it reveals that he believed that "Arianism and Deism . . . have darkened the sun." In a moment of self-pity he bitterly recorded: "These [are] poor gentlemen the Hutchinsonians because they'll never get any preferment. The bishops . . . all entered into a league never to promote them . . . [yet] we are not of the numbers of them who preach Christianity for gain or take orders because we are likely to get more by that than by anything else."[28] Horne was convinced that the Whigs and liberal churchmen had invented pernicious political and religious principles—"religion of nature [is] a chimera"—while Whig principles almost invariably lead to republicanism.[29] Horne was convinced that mathematics could never provide ultimate certainty about the nature of reality—"nothing but revelation can ever set us right, or give us certainty." And to make the danger to religion even more extreme, Horne believed that the radicals were everywhere; he observed "a presbyterian who said that man was not born for serving kings—so chopping his neck with his hands."[30] Horne knew "ranters" in his own time (a radical sect of the 1650s) who, true to their naturalistic doctrines, make everything god, which "is the dregs of the old corrupt heathen philosophy."[31] If Horne's observations were true to a larger reality, perhaps we can better understand why the guardians of the Whig constitution enforced some of the most repressive legislation against disruptive elements ever to be devised in the history of English criminal law.

Despite this catalogue of woes induced by the specter of popular radicalism and irreligion, Horne reserved enough animosity to list tersely the many failings of John Tillotson, archbishop of Canterbury (1691–1695) after the Revolution, who more than any other archbishop in his century had shifted the church's thinking toward religious toleration, constitutional monarchy, and the new science. Well after 1750 Horne condemns Tillotson as if he were alive and well and charges that he "denies the divinity of Christ . . . denies the eternity of hell torments . . . speaks of the Old Testament as not good nor relating to Christ . . . makes Christianity good for nothing but to keep societies in order the better that there should be no Christ than that it should disturb societies."[32] Horne had discerned, as had many of his alienated lay and clerical contemporaries, the social (but not necessarily the spiritual) message that lay at the heart of Newtonian natural religion. That its spokesmen were perceived as putting their blessings on a

corrupt and godless society merely confirmed opposition attempts to find alternative forms of science and Christian worship.

Generally these attempts to find an alternative to Newtonian science and natural religion led to the exercises in baroque metaphysics that we associate with Hutchinson and his writings on science and the Trinity, or to the philosophical idealism of Bishop Berkeley, which was to play an important role in the German Enlightenment. These critics never succeeded, however, in breaking the linkage between Newtonian science and the liberal Christianity of the church's leadership. As a result, late in the eighteenth century William Blake, who was sensitive to that linkage, came to see Newton as a symbol of oppression, as a party to commercial and industrial society and to the endorsement of economic exploitation inherent in the social ideology of liberal Anglicanism.[33]

Only in the nineteenth century did Darwinianism deliver a severe blow, not to Christianity as such, but to science-supported and liberal Anglicanism. Not only did Darwin expose the scientific failings in the argument from design; some of his important followers also called in question that model of social order and benign harmony, born in reaction to revolution, which had for so long denied the realities of commercial society. Yet for nearly a century, beginning in the 1690s, Newton's science had provided the intellectual foundation for a unique version of European Protestantism, one particularly suited to the maintenance of political stability and an unprecedented degree of religious toleration, all within the context of a rapidly expanding commercial society.

NOTES

1. For a discussion of this political process see J. H. Plumb, *The Origins of Political Stability, England, 1675–1725* (Boston: Houghton Mifflin, 1967), pp. 159–189.

2. Margaret C. Jacob, *The Newtonians and the English Revolution 1689–1720* (Ithaca, N.Y.: Cornell Univ. Press, 1976), p. 45. For preachings against predestination in Cambridge during the 1650s see Trinity College, Cambridge, MS R.10.29, notes made by Isaac Barrow on sermons by Benjamin Whichcote, Ralph Cudworth, John Arrowsmith, and others.

3. Richard S. Westfall, "Isaac Newton in Cambridge: The Restoration University and Scientific Creativity," in *Culture and Politics: From Puritanism to the Enlightenment*, ed. Perez Zagorin (Berkeley, Los Angeles, London: Univ. of California Press, 1980), pp. 135–164. For a different perspective see James Jacob and Margaret Jacob, "The Anglican Origins of Modern Science: The Metaphysical Foundations of the Whig Constitution," *Isis* 71 (1980): 251–267.

4. Christopher Hill, *The World Turned Upside Down* (New York: Viking Press, 1972), pp. 112, 114, 176, 318–319.

5. *Unpublished Scientific Papers of Isaac Newton*, ed. A. Rupert Hall and Marie Boas Hall (Cambridge: Cambridge Univ. Press, 1962), pp. 141–142.

6. Jacob, *Newtonians*, pp. 169–171.

7. John Craig to John Conduitt, 7 Apr. 1727, Cambridge University Library, MS Add. 4007, fol. 686. Cf. John Gascoigne, "'The Holy Alliance': The Rise and Diffusion of Newtonian Natural Philosophy and Latitudinarian Theology within Cambridge from the Restoration to the Accession of George II" (D. Phil. diss., University of Cambridge, 1981), p. 115 (citing Bodleian Library, MS Rawlinson C.146, fol. 37). This is a very useful thesis, which documents Newton's relations with other fellows in his university and modifies the account found in Richard S. Westfall, *Never at Rest: A Biography of Isaac Newton* (Cambridge: Cambridge Univ. Press, 1980), chap. 3.

8. *The Correspondence of Sir Isaac Newton*, ed. H. W. Turnbull, 7 vols. (Cambridge: Cambridge Univ. Press, 1959–1977), 3:191. Cf. James E. Force, *William Whiston: Honest Newtonian* (Cambridge: Cambridge Univ. Press, 1985).

9. Jacob, *Newtonians*, p. 156.

10. I. B. Cohen, "Isaac Newton's *Principia*, the Scriptures and Divine Providence," in *Philosophy, Science and Method: Essays in Honor of Ernest Nagel*, ed. S. Morgenbesser, P. Suppes, and M. White (New York: St. Martin's Press, 1969), pp. 523–548.

11. *A Discourse Concerning the Unchangeable Obligations of Natural Religions and the Truth and Certainty of the Christian Religion* (London, 1706), pp. 152–153.

12. *The Works of Richard Bentley*, ed. A. Dyce, 3 vols. (London, 1838), 3:24. For Whiston see Force, *William Whiston*.

13. *A Discourse . . .*, in *A Collection of Theological Tracts*, ed. Richard Watson, 4 vols. (London, 1785), 4:246; a more accessible edition.

14. Frank E. Manuel, *The Religion of Isaac Newton: The Fremantle Lectures, 1973* (Oxford: Clarendon Press, 1974), pp. 132–133. Appendix taken from Newton's manuscripts.

15. Margaret Jacob, "Newton and the French Prophets: New Evidence," *History of Science* 16 (1978): 134–142.

16. Larry Stewart, "Samuel Clarke, Newtonianism, and the Factions of Post-Revolutionary England," *Journal of the History of Ideas* 42 (1980): 53–72.

17. For Desaguliers and Freemasonry in general see Margaret Jacob, *The Radical Enlightenment: Pantheists, Freemasons, and Republicans* (London and Boston: George Allen & Unwin, 1981), pp. 122–126.

18. Ibid., p. 280, in appendix; a reprinting of a portion of the 1723 edition of James Anderson, *The Constitutions of the Freemasons* (London).

19. J. R. Clarke, "The Royal Society and Early Grand Lodge Freemasonry," *Ars Quatuor Coronatorum* 80 (1967): 110–119. Of the two hundred known Masons based in London in the 1720s, one out of four was a Fellow of the Royal Society.

20. Henry Pemberton, *A View of Sir Isaac Newton's Philosophy* (London, 1728), dedication. The subscription list is heavily Whiggish.

21. Ibid., pp. 22, 180–181, 406–407.

22. A. J. Kuhn, "Hutchinson vs. Newton," *Journal of the History of Ideas* 22 (1961): 303–322.

23. Barnard Semmel, *The Methodist Revolution* (New York: Basic Books, 1973), p. 20.

24. See George Cheyne, *An Essay on the Gout, with an Account of the Nature and Qualities of the Bath Waters* (London, 1720).

25. George Cheyne, *Dr. Cheyne's Account of Himself and His Writings: Faithfully Extracted from His Various Works* (London, 1743), p. 21.

26. *An Essay on Regimen . . . Serving to Illustrate the Principles and Theory of Philosophical Medicin, and Point Out Some of Its Moral Consequences* (London, 1740), pp. xiv–xv; *The Letters of Dr. George Cheyne to the Countess of Huntingdon*, ed. Charles F. Mullett (San Marino, Calif.: Huntington Library, 1940), passim.

27. *Essay on Regimen*, pp. viii, 206–208, 227–236.

28. "Commonplace Book I of George Horne, Bishop of Norwich." Owned by Sir Robert Arundel, but now in the possession of the University Library, Cambridge, MS Add. 8134/B/1, fol. 2 (made available by the kindness of Christopher Wilde). Probably written in the 1760s. For further evidence of tension between Hutchinsonians and Newtonians see Walter Wilson, *History and Antiquities of Dissenting Churches and Meeting Houses in London . . .*, 2 vols. (London, 1808), 2:90. Cf. C. Wilde, "Hutchinsonianism, Natural Philosophy and Religious Controversy in Eighteenth Century Britain," *History of Science* 18 (1980): 1–24.

29. "Commonplace Book," fols. 29, 42–43.

30. Ibid., fol. 70.

31. Ibid., fol. 100.

32. Ibid., fol. 111.

33. David V. Erdman, *Blake: Prophet against Empire* (New York: Doubleday, 1969), pp. 224, 367, 484.