The Janus faces of genius

The role of alchemy in Newton's thought

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Isaac Newton, philosopher by fire

Introduction

Isaac Newton studied alchemy from about 1668 until the second or third decade of the eighteenth century. He combed the literature of alchemy, compiling voluminous notes and even transcribing entire treatises in his own hand. Eventually he drafted treatises of his own, filled with references to the older literature. The manuscript legacy of his scholarly endeavor is very large and represents a huge commitment of his time, but to it one must add the record of experimentation. Each brief and often abruptly cryptic laboratory report hides behind itself untold hours with hand-built furnaces of brick, with crucible, with mortar and pestle, with the apparatus of distillation, and with charcoal fires: experimental sequences sometimes ran for weeks, months, or even years. As the seventeenth-century epithet "philosopher by fire" distinguished the serious, philosophical alchemist from the empiric "puffer" or the devious charlatan or the amateur "chymist," so may one use the term to characterize Isaac Newton. Surely this man earned that title if ever any did.

Since my first monograph on this subject appeared in 1975[1] Newton's alchemy has held a prominent position in historiographic debates of some centrality to the history and philosophy of science. Even though Newton's interest in alchemy had often been noted before and had indeed generated a considerable body of scholarly comment,[2] public recognition of it was forced to a new level after 1975 as the full extent of Newton's commitment to alchemical pursuits was made more and more explicit in reviews,[3]

1. B. J. T. Dobbs, *The Foundations of Newton's Alchemy, or "The Hunting of the Greene Lyon"* (Cambridge University Press, 1975).
2. The historiography of Newton's alchemy prior to 1975 is explored in ibid., pp. 6–20.
3. See especially the following reviews of my book: P. M. Rattansi, "Newton as chymist," *Science* 192 (No. 4240, 14 May 1976), 689–90; idem, "Last of the magicians," *Times Higher Education Supplement*, June 1976; Philip

biographical works,[4] articles,[5] and definitive studies of Newton's library.[6]

Yet even so there has remained the possibility of denying the significance and importance of Newton's alchemy for his great achievements

Morrison, *Scientific American* 235 (August 1976), 113–15; Richard S. Westfall, *Journal of the History of Medicine and Allied Sciences* 31 (1976), 473–4; Kathleen Ahonen, *Annals of Science* 33 (1976), 615–17; Henry Guerlac, *Journal of Modern History* 49 (1977), 130–3; Derek T. Whiteside, "From his claw the Greene Lyon," *Isis* 68 (1977), 116–21; A. Rupert Hall, "Newton as alchemist," *Nature* 266 (28 April 1977), 78; Karin Figala, "Newton as alchemist," *History of Science* 15 (1977), 102–37; P. E. Spargo, *Ambix* 24 (1977), 175–6; Marie Boas Hall, *British Journal for the History of Science* 10 (1977), 262–4; Allen G. Debus, *Centaurus* 21 (1977), 315–16; Margaret C. Jacob, *The Eighteenth Century: A Current Bibliography*, n.s. 1 (1975, published 1978), 345–7.

4. Richard S. Westfall, *Never at Rest. A Biography of Isaac Newton* (Cambridge University Press, 1980); Gale E. Christianson, *In the Presence of the Creator. Isaac Newton and His Times* (New York: The Free Press; London: Collier Macmillan, 1984).
5. Richard S. Westfall, "The role of alchemy in Newton's career," in *Reason, Experiment and Mysticism in the Scientific Revolution*, ed. by M. L. Righini Bonelli and William R. Shea (New York: Science History Publications, 1975), pp. 189–232; idem, "Isaac Newton's *Index Chemicus*," *Ambix* 22 (1975), 174–85; idem, "The changing world of the Newtonian industry," *Journal of the History of Ideas* 37 (1976), 175–84; B. J. T. Dobbs, "Newton's copy of *Secrets Reveal'd* and the regimens of the work," *Ambix* 26 (1979), 145–69; Richard S. Westfall, "The influence of alchemy on Newton," in *Science, Pseudo-Science and Society*, ed. by Marsha P. Hanen, Margaret J. Osler, and Robert G. Weyant (Waterloo, Ontario: Wilfrid Laurier University Press, 1980), pp. 145–69; B. J. T. Dobbs, "Newton's alchemy and his theory of matter," *Isis* 73 (1982), 511–28; idem, "Newton's 'Clavis': new evidence on its dating and significance," *Ambix* 29 (1982), 190–202; idem, "Newton's *Commentary* on *The Emerald Tablet* of Hermes Trismegistus: its scientific and theological significance," in *Hermeticism and the Renaissance. Intellectual History and the Occult in Early Modern Europe*, ed. by Ingrid Merkel and Allen G. Debus (Folger Books; Washington, D.C.: The Folger Shakespeare Library; London: Associated University Presses, 1988), pp. 182–91; idem, "Alchemische Kosmogonie und arianische Theologie bei Isaac Newton," tr. by Christoph Meinel, *Wolfenbütteler Forschungern*, 32 (1986), 137–50; idem, "Newton and Stoicism," *The Southern Journal of Philosophy* 23 *Supplement* (1985), 109–23; idem, "Newton's alchemy and his 'active principle' of gravitation," in *Newton's Scientific and Philosophical Legacy*, ed.

in mathematics, physics, cosmology, and methodology. I argued in 1975 that Newton's alchemy constituted one of the pillars supporting his mature scientific edifice.[7] Nevertheless, since Newton's reputation as one of the founders of modern science rests securely upon achievements in areas of thought still recognized as scientific, and since alchemy has, at least since the eighteenth century, been rejected from the canon of science as hopelessly retrograde, "occult," and false, some scholars have been reluctant to accept the validity of that notion.[8]

Newton's *Philosophiae naturalis principia mathematica*, first published in 1687 and foundational to many later developments in science, has seemed to most readers to be the epitome of austere rationality, and the writer of that remarkable work on "The Mathematical Principles of Natural Philosophy" continues to seem to some of its readers to be a very poor candidate for the epithet "philosopher by fire." Since among Newton scholars I. Bernard Cohen's knowledge of Newton's *Principia* and the manuscript remains associated with it,[9] and since Cohen has been outspoken on that point, one may take his objections as those requiring most serious response. Cohen's detailed examination of the proposition that alchemy made some difference to Newton's science came in a lengthy essay published in 1982.[10] The issue has focused on the origin of Newton's

by P. B. Scheuer and G. Debrock (International Archives of the History of Ideas, 123; Dordrecht: Kluwer Academic Publishers, 1988), pp. 55–80.

6. John Harrison, *The Library of Isaac Newton* (Cambridge University Press, 1978); Richard S. Westfall, "Alchemy in Newton's library," *Ambix 31* (1984), 97–101.
7. Richard S. Westfall, *Force in Newton's Physics. The Science of Dynamics in the Seventeenth Century* (London: Macdonald; New York: American Elsevier, 1971), esp. pp. 323–423; Dobbs, *Foundations* (1, n. 1), pp. 210–13.
8. Whiteside, "From his claw" (1, n. 3); I. Bernard Cohen, *The Newtonian Revolution. With Illustrations of the Transformation of Scientific Ideas* (Cambridge University Press, 1980), p. 10.
9. Isaac Newton, *Isaac Newton's Philosophiae naturalis principia mathematica. The Third Edition (1726) with Variant Readings. Assembled and Edited by Alexandre Koyré and I. Bernard Cohen with the Assistance of Anne Whitman* (2 vols.; Cambridge, MA: Harvard University Press, 1972); I. Bernard Cohen, *Introduction to Newton's "Principia"* (Cambridge, MA: Harvard University Press; Cambridge University Press, 1971); Cohen, *Newtonian Revolution* (1, n. 8).
10. I. Bernard Cohen, "The *Principia*, universal gravitation, and the 'Newtonian style,' in relation to the Newtonian revolution in science: notes on the occasion of the 250th anniversary of Newton's death," in *Contemporary*

ideas on attractive forces, as Cohen pointed out. For although an attractive force of gravity appeared in the *Principia* and was fundamental to later Newtonian dynamics, ideas of attraction (operating either between small particles of matter or between gross bodies) hardly constituted orthodox mechanical philosophy in 1687. Attractive force smacked of the "occult" to the first generation of mechanical philosophers, writing thirty to forty years before Newton, and they had been careful to substitute for attraction the principles of "impact physics" in which *apparent* attractions (magnetic, electrical, gravitational) were explained by the mechanical encounter of very fine and imperceptible particles of a hypothetical aether with the larger particles of matter. Newton's reintroduction of attraction in the *Principia*, and his dismissal there of an aethereal mechanism as an explanation of gravity, had seemed to Westfall and myself a convincing argument for the influence of alchemy on Newton's thought, for much alchemical literature concerns itself with nonmechanical "active principles" that are conceptually similar to Newton's gravity. Cohen disagreed. Arguing that no documents seemed to exist in which Newton took attractive forces under consideration before 1679–80, when Robert Hooke introduced Newton to a dynamical analysis predicated upon inertia and an attractive central force, Cohen concluded that Newton's subsequent departure from orthodox mechanism derived from his own "style" of mathematical abstraction rather than from the conceptual influence of alchemical "active principles" upon him. Cohen in fact insisted that Newton was able to produce his great work of positive science only by putting aside his alchemical and Hermetic interests temporarily and rising above them.

I have challenged Cohen's argument in my review of the book in which it appeared[11] because his position seemed to be based on the a priori assumption that alchemy could never, by its very nature, make a contribution to science. To accept the premise that alchemy could not do so is to prejudge the historical question of whether it did do so in Newton's case, which is after all the point at issue. Furthermore, Newton's alchemical papers, which were not included in Cohen's analysis, document Newton's interest in alchemical "active principles" for an entire decade before his correspondence with Hooke. But while the presence of "active principles" in Newton's alchemical papers, as well as in the literature of alchemy upon which those papers were based, is hardly to be denied at this stage in the debate, it now seems rather less likely to me that Newton

Newtonian Research, ed. by Zev Bechler (Studies in the History of Modern Science, 9; Dordrecht: D. Reidel, 1982), pp. 21–108.

11. Dobbs, *Isis* 74 (1983), 609–10.

transferred the concept of the "active principle" directly from his alchemical studies to his new formulation of gravity, at least not at first, though he may finally have done so. Rather, as will be argued in detail in the following chapters, all issues of passivity and activity, of mechanical and nonmechanical forces, were enmeshed for Newton in a philosophical/religious complex one can only now begin to grasp. Although Newton's first encounter with attractive and "active" principles may well have been in his alchemical study, his application of such ideas to the force of gravity was almost certainly mediated by several other considerations. And because of Newton's important position in the rise of modern science, and because of the importance of the doctrine of gravity as an "active principle" within his own science, one must strive to understand them all.

My studies since 1975 have yielded hints that Newton was concerned from the first in his alchemical work to find evidence for the existence of a vegetative principle operating in the natural world, a principle that he understood to be the secret, universal, animating spirit of which the alchemists spoke. He saw analogies between the vegetable principle and light, and between the alchemical process and the work of the Deity at the time of creation. It was by the use of this active vegetative principle that God constantly molded the universe to His providential design, producing all manner of generations, resurrections, fermentations, and vegetation. In short, it was the action of the secret animating spirit of alchemy that kept the universe from being the sort of closed mechanical system for which Descartes had argued.[12] These themes will be discussed in detail in the chapters to follow as a way of searching out the relationships of alchemical modes of thought to the general concerns of Newton and his contemporaries.

Nevertheless, the primary goal here is the larger one indicated by the subtitle of this book: the role of alchemy in Newton's thought. Newton stood at the beginning of our modern scientific era and put his stamp upon it irrevocably. He may be seen as a gatekeeper, a Janus figure, for one of his faces still gazes in our direction. But only one of them. Like Janus, who symbolized the beginning of the new year but also the end of the old one, Newton looked forward in time but backward as well. It is the vision seen by the eyes of that second face that I pursue by examining the details of his alchemical labors. It is possible to grasp that vision yet not stop there.

I do not assume the irrelevancy of Newton's pursuit of an ancient, occult wisdom to those great syntheses of his that mark the foundation of modern science. The Janus-like faces of Isaac Newton were after all

12. See my articles cited earlier (1, n. 5).

the production of a single mind, and their very bifurcation may be more of a modern optical illusion than an actuality. Newton's mind was equipped with a certain fundamental assumption, common to his age, from which his various lines of investigation flowed naturally: the assumption of the unity of Truth.[13] True knowledge was all in some sense a knowledge of God; Truth was one, its unity guaranteed by the unity of God. Reason and revelation were not in conflict but were supplementary. God's attributes were recorded in the written Word but were also directly reflected in the nature of nature.[14] Natural philosophy thus had immediate theological meaning for Newton and he deemed it capable of revealing to him those aspects of the divine never recorded in the Bible or the record of which had been corrupted by time and human error. By whatever route one approached Truth, the goal was the same. Experimental discovery and revelation; the productions of reason, speculation, or mathematics; the cryptic, coded messages of the ancients in myth, prophecy, or alchemical tract – all, if correctly interpreted, found their reconciliation in the infinite unity and majesty of the Deity. In Newton's conviction of the unity of Truth and its ultimate source in the divine one may find the fountainhead of all his diverse studies.

Newton's methodology

One cannot agree with Cohen's thesis, then, that an essential part of Newton's methodology was deliberately to create mathematical models

13. For a general statement on Renaissance conceptions of this problem, see Paul Oskar Kristeller, *Renaissance Thought and Its Sources*, ed. by Michael Mooney (New York: Columbia University Press, 1979), pp. 196–210; for views contemporary with Newton, see Arthur Quinn, *The Confidence of British Philosophers. An Essay in Historical Narrative* (Studies in the History of Christian Thought, Vol. 17; ed. by Heiko A. Oberman, in cooperation with Henry Chadwick, Edward A. Dowey, Jaroslav Pelikan, Brian Tierney, and E. David Willis; Leiden: E. J. Brill, 1977), esp. pp. 8–20.
14. Here Newton stood within the mainstream of biblical tradition. See especially Psalm 19, which opens with the statement that "The heavens declare the glory of God; and the firmament sheweth his handywork," and Romans 1:20, where Paul declares, "For the invisible things of him [God] from the creation of the world are clearly seen, being understood by the things that are made, *even* his eternal power and Godhead. . . ." I am indebted to Mr. William Elliott for discussion and references on this point: personal communication, 1 April 1987.

as a first step.[15] Mathematics was only one avenue to Truth, and though mathematics was a powerful tool in his hands, Newton's methodology was much broader than that implied by the creation of mathematical models, and Newton's goal was incomparably more vast than the discovery of the "mathematical principles of natural philosophy." Newton wished to penetrate to the divine principles beyond the veil of nature, and beyond the veils of human record and received revelation as well. His goal was the knowledge of God, and for achieving that goal he marshaled the evidence from every source available to him: mathematics, experiment, observation, reason, revelation, historical record, myth, the tattered remnants of ancient wisdom. With the post-Newtonian diminution of interest in divinity and heightened interest in nature for its own sake, scholars have too often read the Newtonian method narrowly, selecting from the breadth of his studies only mathematics, experiment, observation, and reason as the essential components of his scientific method. For a science of nature, a balanced use of those approaches to knowledge suffices, or so it has come to seem since Newton's death, and one result of the restricted interests of modernity has been to look askance at Newton's biblical, chronological, and alchemical studies: to consider his pursuit of the *prisca sapientia* as irrelevant. None of those was irrelevant to Newton, for his goal was considerably more ambitious than a knowledge of nature. His goal was Truth, and for that he utilized every possible resource.

"Modeling" in the modern sense is incompatible with the pursuit of Truth in any case. To create a speculative system or to devise a mathematical scheme that will "save the phenomena" carries relativistic overtones. A modern scientist may readily admit, with a metaphorical shrug, that while we do not know whether the theoretical superstructure of our science is True, that really does not matter because our science is self-consistent and it works, accounting for known phenomena and predicting new ones. If new phenomena appear that require incorporation, or if a theory predicts falsely, our science will be adjusted, but that is a matter of no great moment. After the adjustment we will have a better science, but we will still not have Truth. As Quinn has convincingly argued, that was not Newton's attitude.[16] Newton may profitably be compared to

15. Cohen, *Newtonian Revolution* (1, n. 8), passim.
16. Arthur Quinn, "On reading Newton apocalyptically," in *Millenarianism and Messianism in English Literature and Thought 1650–1800. Clark Library Lectures 1981–82*, ed. by Richard H. Popkin (Publications from the Clark Library Professorship, UCLA, No. 10; Leiden: E. J. Brill, 1988), pp. 176–92; idem, *Confidence of British Philosophers* (1, n. 13).

such twentieth-century thinkers as G. E. Moore and Bertrand Russell, both intent on Truth, neither skeptical of human capacity to obtain it. In fact both expected to save humanity from skepticism and usher in a millennium. So did Newton.

To save humanity from skepticism was the ambition of many a thinker in the seventeenth century. Quinn reports a serious conversation between Descartes and John Dury in which it was agreed that the emergence of skepticism constituted the profound crisis of their period and that a way needed to be found to counter it with epistemological certainty. Descartes chose mathematics, Dury the interpretation of biblical prophecy, as the most promising response to the crisis.[17] The point, of course, is that no one knew then what would ultimately be established as effective. A modern thinker may be inclined to assume that Descartes chose the better part, but in fact the natural philosophy that he claimed to have established with mathematical certainty was soon overthrown by Newton's. Descartes's mathematico–deductive method was not adequately balanced by experiment, observation, and induction; Newton's was.

Perhaps the most important element in Newton's methodological contribution was that of balance, for no *single* approach to knowledge ever proved to be effective in settling the epistemological crisis of the Renaissance and early modern periods. Newton had perhaps been convinced of the necessity of methodological balance by Henry More, who had worked out such a procedure within the context of the interpretation of prophecy.[18] Since every single approach to knowledge was subject to error, a more certain knowledge was to be obtained by utilizing each approach to correct the other: the senses to be rectified by reason, reason to be rectified by revelation, and so forth. The self-correcting character of Newton's procedure is entirely similar to More's and constitutes the superiority of Newton's method over that of earlier natural philosophers, for others had certainly used the separate elements of reason, mathematics, experiment, and observation before him.

But Newton's method was not limited to the balancing of those approaches to knowledge that still constitute the elements of modern scientific methodology, nor has one any reason to assume that he would deliberately have limited himself to those familiar approaches even if he had been prescient enough to realize that those were all the future would

17. Quinn, "On reading Newton" (1, n. 16), p. 179.
18. Richard H. Popkin, "The third force in seventeenth-century philosophy: Scepticism, science, and biblical prophecy," *Nouvelle République des Lettres* 1 (1983), 35–63.

consider important. Because his goal was a Truth that encompassed not only the "mathematical principles of natural philosophy" but divinity as well, Newton's balancing procedure included also the knowledge he had garnered from theology, revelation, alchemy, history, and the wise ancients. It has been difficult to establish this fact because Newton's papers largely reflect a single-minded pursuit of each and every one of his diverse studies, as if in each one of them lay the only road to knowledge. When he wrote alchemy, he wrote as an alchemist, as Sherwood Taylor long ago observed. [19] But when he wrote chemistry, his concepts conformed to those of contemporary chemists.[20] When he wrote mathematics, no one doubted him to be a pure mathematician.[21] When he adopted the mechanical philosophy, he devised hypothetical aethereal mechanisms with the best.[22] When he undertook to interpret prophecy, his attention to the meaning of the minutest symbol implied that nothing else mattered.[23] In only a few of his papers may one observe his attempt to balance one apparently isolated line of investigation with another.

The characteristic single-mindedness reflected by each set of Newton's papers has led to the modern misunderstandings of Newton's methodology, for study of any one set may lead to a limited view of Newton's interests, goals, and methods, and the papers have all too often been divided up into categories that mesh more or less well with twentieth-

19. Frank Sherwood Taylor, "An alchemical work of Sir Isaac Newton," *Ambix* 5 (1956), 59–84.
20. B. J. T. Dobbs, "Conceptual problems in Newton's early chemistry: a preliminary study," in *Religion, Science, and Worldview. Essays in Honor of Richard S. Westfall*, ed. by Margaret J. Osler and Paul Lawrence Farber (Cambridge University Press, 1985), pp. 3–32.
21. Derek T. Whiteside, "Isaac Newton: birth of a mathematician," *Notes and Records of the Royal Society of London* 19 (1964), 53–62.
22. J. E. McGuire and Martin Tamny, *Certain Philosophical Questions: Newton's Trinity Notebook* (Cambridge University Press, 1983), pp. 362–5, 426–31.
23. See, for example, Newton's notes in his copy of Henry More, *A Plain and Continued Exposition Of the several Prophecies or Divine Visions of the Prophet Daniel, Which have or may concern the People of God, whether Jew or Christian; Whereunto is annexed a Threefold Appendage, Touching Three main Points, the First, Relating to Daniel, the other Two to the Apocalypse* (London: printed by M. F. for Walter Kettilby, at the Bishop's-Head in Saint Paul's Church-Yard, 1681); Harrison, *Library* (1, n. 6), item 1115, p. 196; now BS 1556 M 67 P 5 1681 copy 2, Bancroft Library, University of California, Berkeley.

century academic interests. Only Westfall's recent prize-winning biography of Newton has attempted to deal with all of the papers,[24] and even there no radical reevaluation of Newton's methodology was undertaken. To Westfall, the most important part of Newton's work still seemed to be that directed toward topics that continue to be of central importance to modern science: mathematics, mathematical physics, and scientific methodology. Through the lens of the preconceptions of modern scientific culture, one still sees primarily a Newton who founded modern science.

He did do that, of course, but the historian may ask other questions and construct or reconstruct other lenses. When one sees only the Newton who founded modern science, serious historiographic problems arise, and one is left with the difficulty of explaining, or explaining away, the masses of papers Newton left behind that are focused quite otherwise. My own work on Newton began with one very questionable advantage – questionably advantageous in the opinion of most scholars, that is, because the starting point was Newton's alchemy. Newton's alchemy had almost always been considered the most peripheral of his many studies, the one furthest removed from his important work in mathematics, optics, and celestial dynamics. Most students of Newton's work preferred to ignore the alchemy, or, if not to ignore it, then to explain it away as far as possible. But one may, perhaps pardonably, remain unconvinced that a mind of the caliber of Newton's would have lavished so much attention upon any topic without a serious purpose and without a serious expectation of learning something significant from his study of it. Indeed, working one's way through Newton's alchemical papers, one becomes increasingly aware of the meticulous scholarship and the careful quantitative experimentation Newton had devoted to alchemical questions over a period of many years. Clearly, *he* thought his alchemical work was important. So one is forced to question what it meant to him: if Newton thought alchemy was an important part of his life's work, then what was that life's work? Was it possible that Newton had a unity of purpose, an overarching goal, that encompassed *all* of his various fields of study? The lens that I have attempted to reconstruct, then, is the lens through which Newton viewed himself.

In certain ways Newton's intellectual development is best understood as a product of the late Renaissance, a time when the revival of antiquity had conditioned the thinkers of Western Europe to look backward for Truth. Thanks to the revival of ancient thought, to humanism, to the Reformation, and to developments in medicine/science/natural philosophy prior to or contemporary with his period of most intense study

24. Westfall, *Never at Rest* (1, n. 4).

(1660–84), Newton had access to an unusually large number of systems of thought. Each system had its own set of guiding assumptions, so in that particular historical milieu some comparative judgment between and among competing systems was perhaps inevitable. But such judgments were difficult to make without a culturally conditioned consensus on standards of evaluation, which was precisely what was lacking. The formalized skepticism of Pyrrhonism had been revived along with other aspects of antiquity, but in addition one may trace an increase in a less formal but rather generalized skepticism at least from the beginning of the sixteenth century, as competing systems laid claim to Truth and denied the claims of their rivals. As a consequence, Western Europe underwent something of an epistemological crisis in the sixteenth and seventeenth centuries. Among so many competing systems, how was one to achieve certainty? Could the human being attain Truth?[25]

But Newton was not a skeptic, and in fact his assumption of the unity of Truth constituted one answer to the problem of skepticism. Not only did Newton respect the idea that Truth was accessible to the human mind, but also he was very much inclined to accord to several systems of thought the right to claim access to some aspect of the Truth. For Newton, then, the many competing systems he encountered tended to appear complementary rather than competitive. The mechanical philosophy that has so often been seen as the necessary prelude to the Newtonian revolution probably did not hold a more privileged or dominant position in Newton's mind than did any other system. The mechanical philosophy was one system among many that Newton thought to be capable of yielding at least a partial Truth.

Blinded by the brilliance of the laws of motion, the laws of optics, the calculus, the concept of universal gravitation, the rigorous experimentation, the methodological success, we have seldom wondered whether

25. Richard H. Popkin, *The History of Skepticism from Erasmus to Spinoza* (Berkeley: University of California Press, 1979); Charles G. Nauert, Jr., *Agrippa and the Crisis of Renaissance Thought* (Illinois Studies in the Social Sciences, No. 55; Urbana: University of Illinois Press, 1965); Walter Pagel, *Paracelsus: An Introduction to Philosophical Medicine in the Era of the Renaissance* (Basel: Karger, 1958); idem, *Joan Baptista van Helmont. Reformer of Science and Medicine* (Cambridge University Press, 1982); Kristeller, *Renaissance Thought* (1, n. 13); Ernst Cassirer, *The Platonic Renaissance in England*, tr. by James P. Pettegrove (Austin: University of Texas Press, 1953); John Redwood, *Reason, Ridicule and Religion. The Age of Enlightenment in England 1660–1750* (London: Thames and Hudson, 1976). For this last reference, and for discussions on Arianism (to be considered in later chapters), I am indebted to Mary Louise McIntyre.

the discovery of the laws of nature was all Newton had in mind. We have often missed the religious nature of his quest and taken the stunningly successful by-products for his primary goal. But Newton wished to look through nature to see God, and it was not false modesty when in old age he said he had been only like a boy at the seashore picking up now and again a smoother pebble or a prettier shell than usual while the great ocean of Truth lay all undiscovered before him.[26]

Newton's quest was immeasurably large; it generated questions starkly different from those of modern science. For him, the most important questions were never answered, but in reconstructing them lies our best chance of grasping the focused nature of Newton's work within the comprehensive range of his interests. His questions were not ours. They encompassed fields of knowledge that to us seem to have no relevant points of contact.

But that there was a unity and a consistency in Newton's quest will be a central theme of this book. Evidence for the unity emerges when his alchemical papers are considered in conjunction with his other literary remains, not pushed aside with an a priori assumption of irrelevance. The same may be said for the changes in Newton's explanatory "mechanisms" over the long decades of his search. Although those changes have often appeared erratic and inconsistent to later scholars, from the viewpoint of Newton's primary goal the consistency appears. The consistency lies in his overwhelming religious concern to establish the relationship between Creator and creation. The pattern of change results from the slow fusion and selective disentanglement of essentially antithetical systems: Neoplatonism, Cartesian mechanical philosophy, Stoicism; chemistry, alchemy, atomism; biblical, patristic, and pagan religions. I shall argue that it was precisely where his different lines of investigation met, where he tried to synthesize their discrepancies into a more fundamental unity, when he attempted to fit partial Truth to partial Truth, that he achieved his greatest insights.

Not only was Newton's goal a unified system of God and nature, it was also his conviction that God *acted* in the world. Though Newton avoided most hints of pantheism and though his Deity remained wholly "other" and transcendental, Newton had no doubt that the world was created by divine fiat and that the Creator retained a perpetual involvement with and control over His creation. The remote and distant God of the deists, a Deity that never interacted with the world but left it to

26. Cf. David Brewster, *Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton* (2 vols.; Edinburgh: Thomas Constable and Co.; Boston: Little, Brown, and Co., 1855), vol. II, 407–8.

operate without divine guidance, was antithetical to Newton . Newton's God acted in time and with time, and since He was so transcendent, He required for His interaction with the created world at least one intermediary agent to put His will into effect. Just such an agent was the alchemical spirit, charged with animating and shaping the passive matter of the universe.

But was the alchemical spirit God's only agent? Newton's conviction that God acted in creating and maintaining the world never wavered, but his explanations of God's manner of acting underwent drastic and multiple revisions as he examined certain questions. Is the agent of vegetation the same as the agent of cosmogony? Is that agent light, or very similar to light? Is there a different, distinctive spirit for prophetic inspiration? How much activity does God manage by "mechanical principles" and how much requires "active principles"? Is gravity mechanical or active, and will it play a role in the final consummation of all things promised by Scripture? May not one distinguish two sorts of chemistry, the one mechanical and the other vegetative and demonstrative of God's nonmechanical powers? Will the rediscovery of the pure, potent fire that is the ultimate secret of the active alchemical principle lead to the restoration of true religion and the ushering in of the millennium?

Alchemical documentation

That alchemy played a role in Newton's thought is no longer to be denied; one can now trace its contributions with some exactitude. Any hope, however, of reconciling Newton's alchemical work with his recognized achievements in mathematics, optics, and celestial dynamics must first be launched from a firm textual framework of his own alchemical manuscripts, within which framework one may readily see the overriding importance of the alchemical spirit to him.

Newton's alchemical papers have been more widely scattered than any other set of his manuscripts.[27] Major collections of them exist at King's

27. A complete listing of chemical/alchemical papers that were retained by the family until 1936, when they were sold at auction, can be found in *Catalogue of the Newton Papers Sold by Order of the Viscount Lymington to Whom They Have descended from Catherine Conduitt, Viscountess Lymington, Great-niece of Sir Isaac Newton* (London: Sotheby and Co., 1936), pp. 1–19, and in Dobbs, *Foundations* (1, n. 1), pp. 235–48. These papers, as well as others of a chemical/alchemical nature, primarily experimental, are also listed in *A Catalogue of the Portsmouth Collection of Books and Papers*