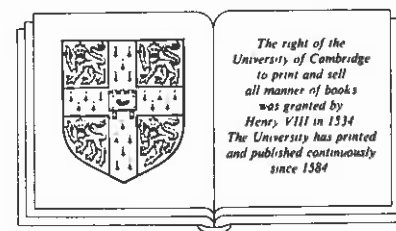


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Reappraisals of the Scientific Revolution

Edited by
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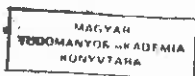
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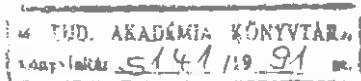
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To A. Rupert Hall and Marie Boas Hall

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Natural magic, hermetism, and occultism in early modern science

BRIAN P. COPENHAVER

Hermes Trismegistus and early modern science: The "Yates thesis"

A quarter of a century ago, in 1964, Dame Frances Yates published *Giordano Bruno and the Hermetic Tradition*. In the first half of this book, Yates described the ancient sources of her hermetic tradition and their rediscovery and interpretation by such eminent Renaissance thinkers as Marsilio Ficino and Pico della Mirandola. In the second half of her extraordinarily influential work, she depicted the controversial Bruno not as a martyr for the progress of science but as a magus, whose program of religious and cultural reform, rooted in hermetic texts mistakenly dated to remotest Egyptian antiquity, was retrograde rather than progressive. Yates sharply opposed Bruno's Copernicanism, which she associated with animism, magic, and an essentially pictorial world view, to the heliocentrism of such persons as Kepler and Galileo, whom she connected with "genuine science" and the study of nature through quantitative analysis. Yates had strong views on the seventeenth century as a watershed between a murky magical past and a future clarified by the advance of science: "No one will deny that the seventeenth century represents that momentous hour in the history of man in which his feet first began to tread securely in the paths which have since led him unerringly onwards to that mastery over nature in modern science which has been the astonishing achievement of modern European man." "With the history of genuine science," she added, "this book has nothing whatever to do," but in the history of science she detected a failure, "a gap." "The history of science can explain and follow the various stages leading to the emergence of modern science in the seventeenth century," she contended, "but it does not explain *why* this happened at this time."¹

Yates then proposed that, since "an intellectual movement" orig-

inates in "a movement of will," one source of the movement called the Scientific Revolution might be that new attitude toward the relation between will and the world that she detected in Renaissance reactions to the *Hermetica*. "Whence and how had this new direction [in science] arisen?" she asked. "One answer . . . is 'Hermes Trismegistus.'" She explained that the name Hermes Trismegistus meant a great many things to her: magic; esoteric numerology; ontological and methodological monism; Ficino's Neoplatonism and Pico's Cabala; Bruno's emblematic heliocentrism; but above all the chronological errors that legitimized the *Hermetica* for Renaissance Christians. She maintained that the same Christian scholars who read in the *Hermetica* a directive to "operate" magically on the world also extended that mandate toward scientific analysis and its technological operations. In John Dee, "a genuine mathematician," she found her best exemplar of the magus whose will reached not only beyond the world but also toward it, and in Isaac Newton she saw a beneficiary of Bruno's hermetic heliocentrism. "Drained of its animism," she claimed, ". . . Bruno's universe would turn into something like the universe of Isaac Newton."²

All this Dame Frances wrote in the last chapter of *Giordano Bruno*, which contains the germ of what later became known as the "Yates thesis" on the relation between "hermeticism" and the rise of modern science.³ In this essay I shall explore some problems with this thesis, whose author always understood it, I believe, more as a stimulus for the research of other historians than as her own definitive response to central historical questions. My own inquiries, in large measure inspired by Dame Frances's example, have convinced me that she was right to see magic, astrology, Cabala, and related belief systems as proper objects of study for the history of science but that her conclusions and speculations on these topics, especially in light of their very great influence, deserve the debate they have provoked and still require correction. Before proposing a few corrections in an essay whose scope cannot match the broader implications, both substantive and methodological, of her work, let me review what Yates and others wrote about Hermes and science after the publication of *Giordano Bruno*.

In 1966, J. E. McGuire and P. M. Rattansi published their widely read article "Newton and the 'Pipes of Pan.'"⁴ McGuire and Rattansi analyzed draft revisions of the *Principia* in which Newton claimed that Thales, Pythagoras, Democritus, and other ancient sages had anticipated him in professing a theory of universal gravitation, as well as other ideas central to his world system. Newton constructed an elaborate "ancient theology" (*prisca sapientia*) as the historiographic foun-

dation of his new science. He saw himself as restorer of an ancient wisdom known to deepest antiquity but lost in later ages of decadence. Among the wise men who once understood the true nature of the world, Newton mentioned Mercurius and Orpheus, favorites of the Renaissance hermetists, but it was a nonhermetic strain of ancient wisdom that most attracted him – a genealogy for Greek atomism that traced this notoriously materialist philosophy back to Moses and the sacred tale of Genesis. The role of this Mosaic atomism in Newton's reasoning, it should be noted, was genealogical or doxographic, not material; fathering atomism on the author of the Pentateuch sanctified a reputedly impious theory of matter for a readership that still venerated biblical antiquity, but the legitimizing association was no source of new scientific insight.

Yates cited McGuire and Rattansi in 1968 in "The Hermetic Tradition in Renaissance Science," where she proposed the emergence of a "Rosicrucian" phase in the hermetic tradition.⁵ She described Rosicrucianism as a Paracelsian current in hermetism that was more given to scientific curiosity than the older, aesthetic hermetism that she ascribed to Ficino and his imitators. She also remarked that the word "Rosicrucian" resembled the word "baroque" in referring vaguely to a broad style or sensibility rather than precisely naming a discrete social or cultural phenomenon. Through Rosicrucianism, the hermetic tradition became an antecedent of modern science; in fact, seventeenth-century science could be seen as a mathematical and mechanical manifestation of the same impulses expressed in magical and animist philosophies of nature in the preceding century. Common to both was a "new turning toward the world and operating on the world . . . , the Hermetic attitude." The Newton who heard the pipes of Pan, she hypothesized, may also have listened to the voice of Hermes.

Yates made her last important statement on the hermetic tradition and the new science in *The Rosicrucian Enlightenment* of 1972. She noted how Elias Ashmole, charter member of the Royal Society, had written of the hermetic John Dee and the Rosicrucian Michael Maier in his *Theatrum chemicum* and how Newton, a later member of the Royal Society, owned and read not only Ashmole's alchemical collection but also the same Rosicrucian material to which Ashmole had referred. Despite her earlier disclaimers of any concrete social realization of the Rosicrucian sensibility, on the basis of such bibliographic and organizational commonalities she speculated "that behind the great exoteric movement typified by Newton's achievements in . . . mathematics and physics, there was also an esoteric movement, connected with the exoteric movement through . . . the importance . . . it attached

to number, but developing this through another approach to nature . . . through alchemy. . . . The two approaches could have met through Rosicrucian alchemy. . . . Traces of the Rosicrucian outlook could be detected," she concluded, ". . . even in Isaac Newton."⁶

Historians have discussed Yates's views widely. Learned journals have filled with rebuttals of her ideas and with refutations of those rebuttals.⁷ Whatever the final consensus on the Yates thesis, there can be no doubt that the learned and imaginative woman who created it led the world of learning in giving the subject of postmedieval occultism a new legitimacy and a new celebrity as a topic of historical discourse. Even though Yates did not make scientific ideas her leading concern, her views became controversial among historians of science. Her notoriety was overdetermined. Because those of her works that are immediately relevant to the history of science were mostly published between 1964 and 1972, in a period full of experiments with irrationalism in politics and culture, she unwittingly contributed to broader historiographic and philosophical debates on "internal" and "external," "rational" and "irrational" schemes of causation and change in the history of science. The polemics that she sparked fueled interest in the writings of other scholars who worked on topics that, like hers, had previously seemed marginal, insignificant – not the "done" thing. It is hard to imagine – before Yates – the History of Science Society awarding its most prestigious prize to a book on the period of the Scientific Revolution largely concerned with alchemy. Without the enormous impact of her work, it is hard to account for the publication, by a great university press, of a survey as much unlike Marie Boas's *Scientific Renaissance, 1450–1630* (1962) as Allen Debus's *Man and Nature in the Renaissance* (1978), which treats essentially the same period. "Hermeticism," which rates fourteen entries in Debus's index, is not to be found in Boas's.⁸

Not all historians of the Scientific Revolution have been convinced of either the truth or the significance of the Yates thesis. One evidence of the uneven reception of her views is the absence, in recent Newtonian scholarship, of a positive, or even a very strong, reaction to Yates's speculations on Newton as heir of Hermes. Among synthetic works of the last few years, I. B. Cohen's *Newtonian Revolution* alludes only briefly to Newton's belief that the Pythagoreans knew the inverse-square law. In *Never at Rest*, R. S. Westfall, who has written elsewhere on the importance of hermetism, finds no hermetic (in Yates's sense) or Rosicrucian motivations in Newton's science. By Westfall's account, the "Hermes" and "hermetic writers" whom Newton knew were alchemical authorities. Westfall's argument that Newton's alchemical studies contributed significantly to his matter-theory

and physics is an important confirmation of the relevance, for the history of science, of an *occultist* tradition of alchemical, astrological, and magical beliefs but scarcely of Yates's conception of a *hermetic* tradition as wellspring of modern science. Westfall also reports that a corrupted "gentile theology" professing an atomist physics was a regular historiographic point of reference for Newton, but he records no role for Hermes Trismegistus in this ancient theology. Gale Christianson's recent study of Newton also treats Yates's Hermes as, at best, an incidental contributor to Newton's intellectual biography: Newton's interest in the *prisca sapientia* reflected "his preoccupation with the great alchemical masters from Hermes Trismegistus to Michael Maier," but Newton also learned from the Cambridge Platonists about a Mosaic, nonhermetic succession of natural-philosophical ideas that lent support to his world system. In these most current versions of Newton's story, so crucial to the Scientific Revolution and so regularly mentioned by Yates, Hermes is not a principal player.⁹

Historical understanding of hermetic influence in early modern science is problematic in many respects, not all of them arising directly from Yates's own writing. In what follows, I shall deal briefly with only a few such problems. I shall attempt, first, to distinguish a stronger *doxographic* role for ancient theologians such as Hermes in validating claims about the natural world from their weaker *theoretical* role in supplying new and convincing explanations of natural phenomena; second, to show how early modern readers found a credible *theory* of natural magic in authoritative and nonhermetic sources from antiquity and the Middle Ages; third, to describe a tradition of *empirical* belief about natural objects whose magical effects were thought to confirm magical theory; and, finally, to argue for a more precise use, in the history of science, of "magic," "hermetic," "occultist," and related terms.

I shall not try to cover all the bases marked out by those who have debated the Yates thesis, much less to answer or even ask all the more important questions about magic and occultism that ought to interest students of early modern science. Despite their reputations for gullibility and mysticism, how did the Italian "philosophers of nature" – Girolamo Cardano, Bernardino Telesio, Francesco Patrizi, Giambattista Della Porta, Giordano Bruno, Tommaso Campanella – weaken the metaphysical foundations of magical belief? How much common ground was shared by two traditions that seemed especially hostile to many of the heroes of the Scientific Revolution: that is, the occultist tradition, from Marsilio Ficino through Tommaso Campanella; and the Peripatetic tradition, from Pietro Pomponazzi through Cesare Cremonini? Did Francis Bacon's polemic against traditional

natural philosophy do more to strengthen, or to weaken, occultism? Did Galileo's laconic abandonment of the Aristotelian doctrine of qualities encourage such later thinkers as Robert Boyle and John Locke to construct a systematic critique of occult qualities? Why did Marin Mersenne, René Descartes, and Pierre Gassendi take up different positions against the bases of magical belief in school philosophy? When Leibniz criticized Newton's idea of force as an occult quality, what did this criticism imply to contemporaries? Did occultist teachings on *spiritus (pneuma)* help breed the aethers, effluvia, fluids, and spirits that thrived even among corpuscular and mechanical philosophers? Can one distinguish alchemy from chemistry in the seventeenth century? What did alchemy contribute to early modern theories of matter? By what date had astrology become incredible to European intellectuals? Did the acceptance of the Copernican world view diminish the reputation of astrology? When did physicians cease to regard astrology, demonology, and witchcraft as medical issues? What did the adjectives "natural," "supernatural," and "miraculous" mean to natural philosophers of Newton's day? Did the organization and institutionalization of early modern science, from the Accademia del cimento to the Royal Society, encourage or discourage belief in magic? These are only a few of the larger questions that suggest how relevant occultism is to the history of early modern science. By taking up different, but related, lines of inquiry, I hope to contribute something to a clarification of terms and purposes that may stimulate others to search out fuller answers.

Discovery and doxography

In 1499 Polydore Vergil, an Italian scholar who spent most of his life in England, published his *De inventoribus rerum*. This history, the first comprehensive account of discoveries written since classical times, has been called a precursor of later histories of technology and science. The reader who notes that the organization of the first book of Polydore's history roughly reflects the curricula of medieval schools and universities may be struck by the last three of its twenty-four chapters, those on magic and divination; they occupy more than one-tenth of the space in Book 1, whose earlier chapters discuss discoveries in various areas of theology, religion, philosophy, language, literature, medicine, mathematics, and natural philosophy.¹⁰ What of Polydore's three chapters on magic and divination? Do they, like his writings on geometry, astronomy, and medicine, also qualify him as an ancestor of Pierre Duhem and George Sarton?¹¹

Polydore, who agreed with Pliny the Elder that magic emerged

from a mixture of medicine, religion, and astrology, would have considered himself a historian of science, if by "science" we mean a systematic effort to explain the world of nature in natural terms. But he was no magus, and no admirer of magic. He repeated Pliny's claim that magic was "the falsest of arts," and in all three of his chapters on magical arts he condemns their practitioners as frauds.¹² Of the inventors of magic he spoke with less conviction. He knew that Pliny had traced its origins to ancient Persia, but neither he nor Pliny had any clear idea of the identity or chronology of the first magicians whom Pliny names. The most familiar was Zoroaster, who probably lived between 1400 and 1000 B.C. By placing Zoroaster five or six millennia before the Trojan War, however, Pliny magnified the antiquity of the magic he despised.¹³ He also fortified its authority by linking it with the philosopher Democritus of Abdera. According to one tradition known to Pliny, a Persian magus accompanied Xerxes on his Greek expedition, and another story told that Democritus's teachers were magi left to his father in gratitude by Xerxes. This is probably the origin of the strange tale, reported by Pliny and repeated by Polydore, that the materialist and unmystical Abderite shared with the shadowy Persians primary responsibility for introducing magic to Greece. Democritus, Pythagoras, Empedocles, and Plato all – as Pliny and Polydore tell it – went to the barbarian East for a magical *prisca sapientia* that began with Zoroaster.¹⁴ It is as remarkable that Hermes Trismegistus is not named by Polydore and his ancient sources when they recite the pedigree of magical wisdom as that these same texts give so prominent a place to Democritus the atomist.

The main inspirations of Polydore's *De inventoribus* were ancient literary and historical sources. He rarely cited a philosophical text, depending instead on the *Lives and Opinions of Eminent Philosophers* by Diogenes Laertius (third century A.D.), and he seems not to have been influenced by the great Platonic philosopher of the fifteenth century, Marsilio Ficino, who published his Latin translation of the first fourteen treatises of the Hermetic corpus in 1471. Ficino also wrote the most influential work on magic of the early modern period, *De vita coelitus comparanda*, the third book of his *De vita libri tres*, published in 1489 and republished in more than thirty editions by the middle of the seventeenth century.¹⁵ In the epistolary preface to *De vita*, Ficino cites Pythagoras, Democritus, Plotinus, and Apollonius of Tyana as "ancient philosophers" whose teachings were important for understanding his magic. More than half a dozen times in the text of this work he also mentions Zoroaster, the magi who followed him, and the *Chaldaean Oracles* attributed to him. Gemistus Pletho, a Byzantine contemporary of Ficino's who popularized the notion that Zo-

roaster had written the *Oracula*, was emphatic in regarding the Persian sage as the fountainhead of ancient wisdom. But Ficino, motivated by his own dramatic "discovery" of the *Hermetica* in 1462, sometimes began his genealogy of *prisca sapientia* with Hermes.¹⁶ Yet in the *De vita*, his longest and most important analysis of magic, Ficino mentions his *Hermetica* only in two chapters out of twenty-six, neither of them particularly kind to the thrice-great Hermes.¹⁷

For the origins of ancient magic the best evidence was the material from Pliny and Diogenes Laertius that pointed to Zoroaster as source and to Democritus as propagator. The celebrity of these texts would have made it difficult for Ficino to substitute Hermes for Zoroaster as inventor of magic; moreover, it was not in his interest to do so. Ficino's original claim that the ancient wisdom came from Hermes appeared in his translation of the *Hermetica*, where he called Hermes "the first author of theology." And in later writings, even when he puts Zoroaster in first position, Ficino remains interested primarily in an ancient gentile theology, not in an ancient magic.¹⁸ This is not to say that he had no concern for the magical content of the *Hermetica* or for the antiquity of magic. His syncretic convictions about the unity of wisdom are another facet of his belief in its antiquity. All the streams of true knowledge, including magical knowledge, converge as they approach their beginning. But the *Hermetica*, the charter documents of ancient wisdom that he had resurrected, are essentially expressions of piety and theology. They have relatively little to say about magic. This is clear whether one reads the texts themselves or the commentaries (*argumenta*) by Ficino and Lefèvre d'Étaples that accompany them in Ficino's translation.¹⁹

The physical and cosmological material in the hermetic treatises that Ficino translated is slighter even than their philosophical content, which is derivative, eclectic, and loose in its organization. But the *Hermetica* were of great moment to a man of Ficino's eirenic disposition because they supported such central Christian doctrines as the divine creation of man, the immortality of his soul, his fall through sin, and his eventual salvation.²⁰ The pagan wisdom that Ficino admired in these texts was sanctified by its similarity to divine revelation, and the Christian dogma that guided his life could be ennobled by association with learned and literate antiquity. For the author of a *Platonic Theology*, so much the better if the teachings of Hermes helped him trace the path between the author of Genesis and the author of the *Timaeus*.

Hellenistic Jews and Christians had also recognized the necessity of associating themselves with the Greco-Roman culture that surrounded them. To this end, Jewish and Christian apologists and his-

torians had adapted an important strategy of Greek historiography to their own needs. Greek "heurematographers" ("discovery writers," from *heurema*, "discovery"), authors of a genre of which no complete text survives, had encountered the problem of contradictory claims for priority of discovery among gods and heroes of localities separated by accidents of geography and dialect. They were also aware that the civilizations of Egypt and Mesopotamia were older than their own, and so they sometimes settled their arguments by ascribing discoveries to the East. Two characteristics of inventors named in this lost body of ancient historical writing became crucial to its Christian users: that they were very old; and that they were not Greek. This apologetic ethnography and chronology allowed the church fathers to ascribe many discoveries to heroes of the Old Testament, especially Moses, and hence to bracket whatever seemed valuable in the classical tradition – Plato's philosophy, for example – between the new covenant and the old. Likewise, because of their ages and nationalities, non-Greek sages like the Persian Zoroaster and the Egyptian Hermes proved almost as important for church fathers as biblical figures.²¹ Because the fathers found heurematography useful in their polemics, its influence survived the Middle Ages until it could be more fully exploited by Polydore Vergil, who, like his Christian predecessors, tried to find a Jewish or oriental inventor for almost everything, including magic.

Doxography, the record of the succession of opinions in Greek philosophy, was another variety of ancient historiography that proved helpful to the fathers in their effort to legitimize Christian thought by linking it to a tradition holier and more venerable than the Greek. This was especially true of doxographical works "on the successions (*peri diadochon*) of philosophers" that originated around 200 B.C. and eventually influenced the *Lives* of Diogenes Laertius. The method of the doxographers, which sets philosophical opinions not only in their biographical contexts but also in the larger framework of world history, appealed to the humanist taste for history, in particular to their impulse to equate value with antiquity.²² In order to understand any human activity, humanists were inclined to seek its genesis, and because they admired the ancients so intensely and imitated them so zealously, they were also inclined to identify the older with the better. These humanist dispositions help explain the popularity of Polydore's *De inventoribus*, which saw thirty Latin editions in his lifetime and more than one hundred editions, in eight languages, by the early eighteenth century. They also help account for the power of the idea of a *prisca sapientia* in early modern thinking about the past.²³ It is in the context of this search for genetic explanations and intellectual

genealogies that the belief in a tradition of ancient pagan learning had its greatest influence. Likewise, the mythical Hermes Trismegistus was most important not so much for the content of what he taught as for the age and provenance of the alien wisdom that he represented. The material in the hermetic treatises became credible and legitimate not because they solved new problems or offered striking explanations but because they referred otherwise commonplace ideas to a sanctifying past. Thus, Ficino's *Hermetica* could be a source of doxographic authority even for magic and natural philosophy, fields to which their material contributions were slight. As Martin Nillson said of the influence of Zoroaster and Hermes in antiquity, "These names were letters of recommendation for the works that bore them." The hermetic signature gave prestige to the few and ordinary magical ideas contained in the writings ascribed to Hermes.²⁴

Magical theory

To appreciate the conceptual insignificance of the texts attached to these names for natural magic and natural philosophy, it is important to understand how certain other texts did in fact provide a different and indispensable kind of intellectual support for the renaissance of ancient magic in the early modern period. What was so compelling about this nondoxographic evidence? Why did Ficino, a premier intellectual figure of his age, believe so strongly in the reality and value of magic that he risked publishing his defense of it just at the moment when his contemporary, Pico della Mirandola, had fallen into disgrace with the church for professing similar doctrines?²⁵ Three categories of ideas bolstered Ficino's convictions.

First, there is the *doxographic* or *genealogical* material described in the preceding section of this chapter. Though Ficino's treatment of magic in *De vita* does not depend heavily on hermetic authority, of which he was so acutely aware, it is full of references to mythical and historical figures, who are usually ancient, often exotic, and sometimes related to one another in intellectual succession, as in the following discussion of astronomical images:

Trismegistus says that the Egyptians used to make [moving images] from particular materials of the world and insert the souls of demons into them. . . . The magi, followers of Zoroaster, used a sort of golden globe marked with characters of the heavenly bodies to evoke a spirit from Hecate. . . . I omit their chants. . . . [which] Psellus the Platonist disapproves and derides. Their astrologers think that the Hebrews reared in Egypt learned to make a golden calf to catch the favor of Ve-

nus and the Moon. . . . Porphyry . . . testifies that images are efficacious. . . . [and] Iamblichus affirms that not only celestial but also demonic and divine powers and effects can be received in materials naturally conforming to superior entities. . . . Proclus and Synesius say exactly the same.²⁶

This passage confirms belief in astrological images not just by piling authority on authority but also by setting the succession of Platonists among the chosen people and gentile sages who preceded them. Without understanding the attitudes to the genealogy of authority discussed earlier, a modern reader will not feel the effect of Ficino's reasoning about the lineage of his ideas.

Ficino used *theoretical* as well as doxographic arguments in *De vita*, though he did not find his theory of magic in the *Hermetica*. Since *De vita* is an excursus from his long commentary on Plotinus, it comes as no surprise that Ficino took much of the philosophic support for his analysis of magic from the Neoplatonists – Plotinus, Porphyry, Iamblichus, Synesius, and Proclus. One of the last philosophers of the ancient world, Proclus wrote one of the few surviving texts that provides substantial theoretical understanding of the magic of late antiquity. Ficino translated it under the title *De sacrificio* (On Sacrifice) and used it to support one of the key arguments in *De vita*, that a natural magic is possible because natural connections among terrestrial, celestial, and higher entities can be awakened by the magus who understands how to manipulate them. This claim was useful to any Christian magus who wished to avoid the charge of using magic for commerce with demons.²⁷ It is also of interest to the historian of science, for it shows how the magic of Proclus and Ficino depended on or, better, was identical with, certain notions about the structure of the natural world. In *De sacrificio* Proclus describes a hierarchical taxonomy of entities that make up the universe and a set of rules governing relations of cause and effect among them. The lion, the cock, and the sun, for example, all belong to one category. The sun is obviously higher than the two earthly animals, but the magus also knows that the cock is higher than the lion, because birds are creatures of the air. He knows, moreover, that both are solar animals: The cock crows at sunrise; the constellation Leo is a solar sign. Hence, the solar powers of the cock can be used magically to counteract the lower, but cognate, powers of the lion.²⁸ These ideas may seem idiosyncratic and baseless, but they were neither. The cock's power over the lion was attested in a literary tradition already ancient in Proclus's time and fated to endure for centuries after. The physical and metaphysical theories explaining the relation between these magical objects and others are apparent in other works of Proclus, especially the *Elements*

of *Theology*. Proclus, whose contributions to philosophy, mathematics, and science are well known, was no fatuous theosophist. His theory of magic was a serious philosophical undertaking.²⁹

So was the *De vita* of Ficino, who consulted a wide range of philosophical, medical, and scientific authorities in order to construct his theory of magic. Since *De vita libri tres* was a medical treatise (its first two books were on health and longevity, the third on astrological medicine), its author knew the works of Galen, who was primarily responsible for the lasting effect of the idea of occult qualities in medicine and philosophy. When Galen had to explain the action of a food or a drug on the body, he preferred explanations based on the perceptible or manifest properties (hot, cold, dry, wet) of the four elements (fire, earth, air, water), but some substances ingested by the body (certain foods, drugs, and poisons) or applied to it (certain amulets) would not yield to such explanations. In these difficult cases, Galen resorted to explanations based on *idiotetes arretoi*, or "indescribable properties," which later came to be called *proprietates occultae*, or "hidden properties," in Latin. Galen taught that "manifest properties," those evident to the senses, could be understood rationally because they fit into the prevailing post-Aristotelian theory of matter, but he regarded experience of occult properties as merely empirical and irrational because it fell outside the system. The purgative action of rhubarb or the antiepileptic properties of a peony amulet were undeniable facts of the physician's experience, but they did not fit the categories available in Galen's matter-theory. If he could not match rhubarb's powers with its manifest properties, an alternative was to attach them to the plant as a whole; thus, Galen spoke of such powers as coming from the "whole substance" of an object.³⁰

Avicenna, Albertus Magnus, Thomas Aquinas, and other thinkers well known to Ficino elaborated this relation between the ideas of occult quality and whole substance into an important feature of medieval and early modern medicine and natural philosophy. The key to these later developments was the Peripatetic concept of *substantial form*. The term does not occur in Aristotle, who nonetheless prepared the way for its emergence in late antiquity and its fuller development in the Middle Ages. Two fundamental dichotomies in Peripatetic metaphysics are *substance/accident* and *form/matter*. The *matter* of a particular object makes it an individual: this emerald rather than that one; its *form* makes it an object of a given kind: an emerald rather than a ruby. The hylemorphic union of matter (*hule*) and form (*morphe*) constitutes an entity whose being is independent, a *substance*, this particular emerald, but the gem's special shade of green has no existence apart from the emerald; it is an *accident*. The *substantial form*

of the emerald gives the stone its existence as such, making it a member of the *species* of emeralds. This is why substantial form and *specific form* are sometimes synonymous. But *accidental form* – the shape of the gem, its weight, its color, the smoothness of its surface – can change while its substantial or specific being remains unaffected. Accidental forms are perceptible; they can be analyzed in terms of the manifest properties associated with the elements. Substantial form in itself, as opposed to its effects, remains hidden from the senses. Thus, just as Galen had called the action of the whole substance "indescribable," medieval authorities who traced this action to the powers of specific or substantial form called it *occultus*, or "hidden."³¹

Medieval thinkers believed that physical change could transform one substance into another. What happened to the substantial form of the old substance? Where did the substantial form of the new substance come from? The theory of elements and qualities complicated these questions, because an element like water was also considered a substance endowed with substantial form. If the elements and qualities of an old substance altered to engender a new one, it would be necessary to account not only for the substantial form of the substance compounded of the elements but also for the substantial forms of the elements themselves. One result of the complex debate on these questions was that some medieval thinkers traced the origin of new substantial forms to the heavenly bodies. If it was difficult to find terrestrial solutions for all the problems of Peripatetic matter-theory and metaphysics, then a celestial remedy was always at hand, especially for Christian thinkers accustomed to looking heavenward for answers to their questions.³²

Ficino's *De vita* was a treatise in iatromathematics or astrological medicine. As a physician, he wanted to take therapeutic advantage of natural powers hidden in the stars and planets, but as a Christian and a priest he worried about the orthodoxy of his position. Was the medical astrology that he wished to practice physically efficacious? Was it also legitimately Christian? The two questions were inseparable for Ficino, and they were most worrisome in the case of amulets and talismans, for the wearing of decorated or undecorated objects for curative purposes raised the specters of idolatry and superstition. In fact, it was Ficino's wish not to cross the fine line between a conceivably legitimate natural magic and a clearly sinful demonic magic that caused him to write ambiguously of the hermetic *Asclepius* in the longest passage of *De vita* devoted to the *Hermetica*. The "god-making" texts of the *Asclepius* described the invocation of spirits in order to animate magical statues, which resemble talismans in all respects but size.³³ Aquinas had followed Augustine in condemning the demonic

statues of Hermes, but he did not agree with him that all such objects – talismans and amulets, for example – were absolutely prohibited. The more flexible attitude of Aquinas was crucial for Ficino, and it depended on the ideas of substantial form and occult quality.³⁴

Aquinas and Ficino, much like Galen, could agree that the curative power of an undecorated amulet is *both* occult *and* nondemonic or natural because it comes from an imperceptible substantial form – not from manifest qualities of the natural object nor from the personal agency of a spiritual being. Moreover, since Aquinas had admitted that their substantial forms arose in the heavens, Ficino also had good precedent for treating such objects as sources of astrological power.³⁵ But suppose the magus wished to decorate an object with astrological signs in order to enhance its kinship to the heavens. Aquinas ruled that if such talismanic signs could be regarded only as a message, then, because messages must be sent and received by intelligent agents, it must be that such signs are directed to nonterrestrial persons; thus they become dangerous occasions of sin against religion. Some talismanic signs, however, might not be messages. If a magus carves a likeness of the constellation Leo on a ruby, the gem becomes a member of the same species of objects that includes the constellation and the animal lion. The carving does not change the substantial form of the stone, which remains a ruby, but it does make the stone a member of a new species; so Thomas said that such carvings or figures were “like specific forms.” Unlike words or letters, which could be construed only as messages, these figures could operate in the absence of any exchange of information between minds; hence, they acted naturally, in the same sense that the whole substance or substantial form of any material object was a natural feature of its being. The activity of all these entities was occult because it arose from imperceptible sources, but it was also natural activity, if by “natural” we mean “nondemonic.”³⁶

The physical and metaphysical theory of substantial forms and occult qualities allowed Ficino to explain the efficacy of his iatromathematics by referring to familiar and well-respected doctrines of medieval philosophy and science whose influence continued well into the early modern period; Robert Boyle and John Locke, for example, found these teachings worthy of extensive rebuttal. The hierarchical cosmologies of the Neoplatonists served Ficino in the same way and would also be remembered after him, especially by the Cambridge Platonists of the seventeenth century. The systematic teachings of Plotinus, Proclus, Galen, and Avicenna were of much greater theoretical influence in Ficino’s astral magic than the eclectic *Hermetica*, and the ideas that Ficino found in Aquinas were even more significant,

not only because they were clearer and fuller than earlier philosophical material (e.g., Proclus) that was often fragmentary and opaque, but also because they were authoritatively Christian ideas. In Ficino’s humanist philosophy, the force of personal authority and the force of philosophical theory became indistinguishable, just as the power of literary tradition and the power of empirical evidence worked synergistically in the same current of argument.

Empirical magic

In much the same sense that we might cite empirical data of X-ray crystallography to substantiate theory in molecular biology, Ficino had *empirical* as well as doxographic and theoretical reasons for his belief in magic. Ficino made claims that can be called empirical about animals, plants, and minerals not because he derived them from his own sense experience nor because he checked them against his own observations; usually he did neither. Such claims qualify as empirical only insofar as they referred to a class of physical objects thought to exist in the world and to have characteristics taken to validate or instantiate various theoretical propositions. Ficino’s source for these claims was almost always an indirect, literary report of an (allegedly) direct observation. The point is that his theoretical convictions about magic were not merely theoretical or wholly a priori; they were also the products of induction – attached, at some distance, to someone’s experience of the world, however attenuated or distorted. For example, in explaining his theory about the relation between occult qualities and celestial forces, Ficino asks the reader of *De vita*,

Who does not know that the occult virtues of things, which are called “specific” by physicians, come not from an elementary nature but from a celestial one? Therefore, . . . rays [from the heavens] can impress on images wondrous and occult powers . . . [which] arise much more quickly than in various mixtures of elements and elementary qualities. . . . Is it not said that certain families among the Illyrians and the Triballi kill people by looking at them, when they are angry, and that certain women in Scythia do the same? And catoblepas and regulus snakes destroy people by shooting rays from their eyes. The marine torpedo also suddenly benumbs the hand that touches it, even at a distance through a rod, and by contact alone the little echinus fish is said to retard a great ship. The phalangia in Apulia transform and quickly benumb the spirits and the mind with a secret (*occultus*) bite of some sort. How does a rabid dog have its effect, even if no bite appears?

... Will you then deny that celestial bodies can perform wonders with the rays of their eyes that gaze on us?³⁷

Ficino wishes to attribute extraordinary, occult powers to the rays (*radii*) of stars and planets. He begins by alluding to an element of the larger theoretical framework of his natural magic: that all occult powers come from the heavens and are thus stronger than the manifest qualities of earthly elements. Next he provides a list of toxic terrestrial phenomena that are all mysterious because their mechanisms are unknown and their effects are rapid. If earthbound objects act so quickly and so marvelously, he concludes, no one can doubt that heavenly bodies work even greater wonders. The theoretical proposition is that occult, celestial forces are very powerful causes of terrestrial effects; the evidence is a set of empirical claims about natural, earthly objects.

An odd list of natural objects. Illyrians, Scythians, Triballi, and other peoples of southeastern Europe had a reputation for the evil eye among the Romans, who liked to locate their witches in faraway places, but to Ficino these can have been no more than names.³⁸ The "catoblepas," or "downlooker," a beast that took its name from a head supposedly too heavy to hold up, may be a confused memory of the African gnu. The "regulus," or "basilisk," may be a distant and fabulous cousin of the spitting cobra (*Hemachatus hemachatus*), which aims its venom at its victim's eyes.³⁹ The notorious "phalangium" may belong to the genus of spiders called *Lathrodectus*, and the "torpedo" is certainly the electric ray of the Mediterranean, *Torpedo narce*. The Latin word *echinus* refers to a hedgehog or a sea urchin or a plant, but when Ficino speaks of it he really has in mind the Greek *echeneis*, or "ship-holder," an imaginative amalgam of several marine species.⁴⁰ What did Ficino know about these strange people and exotic animals? What (beyond their allegedly magical properties) do they have in common?

Direct experience of spider bites and rabid dogs were certainly within Ficino's means. Anyone who traveled to the Italian seacoast or shopped at a fish market might have seen an electric ray.⁴¹ But many of these magical objects, which are the evidence for Ficino's theory of magic, were beyond the range of his observation, either because they did not exist or because they lived only in remote places. As textual rather than natural objects, however, most of them could be found in the *Natural History* of Pliny the Elder, who in turn depended chiefly on an older genre of writings about "natural and mystical powers" inaugurated by Bolos Democritus of Mendes.⁴² Pliny, who wrote his great encyclopedia in the first century A.D., confused this Egyptian of the third century B.C. with the atomist

philosopher of the fifth century B.C. Despite the stories connecting the Greek Democritus with the Persian magi, he seems to have been far removed from the mentality that produced the fragments of crude folk magic attributed to Bolos Democritus. The latter's surviving recipes, most of them preserved by Pliny, are the remains of catalogs of cures based on sympathies, antipathies, and other magical powers of natural objects. Of the considerable literature on magic and alchemy inspired by Bolos Democritus, one of the few survivors is the *Kyranides*, a compendium of magical medicine whose earliest elements can be traced to the third century A.D. and that advertised itself as a divine gift from Hermes Trismegistus.⁴³ When the names Hermes and Thoth appear in medieval works on magic, some of them known to Ficino, they most frequently allude either to the *Kyranides* and similar works or to other hermetic texts on astrology or alchemy that survived into the Middle Ages. Thus, when Ficino listed magical objects from Pliny's collection, he was unwittingly and indirectly referring to an obscurer hermetic textual tradition, which, unlike the "philosophical" *Hermetica* that he had translated, contributed materially to his own defense of natural magic.⁴⁴

It is important to recognize that this "popular" hermetism, despite its present fragmentary condition, aided the transmission of a coherent tradition of medical and natural-historical information about magical objects from antiquity through the Middle Ages and into the early modern period.⁴⁵ Thus, Ficino's choice of evidence to support his theory of magic was not autonomous or whimsical; it was constrained by a tradition. The same magical objects – the cock and the lion, the torpedo and the echeneis, the basilisk, the magnet, the heliotrope, and many more – come up again and again in Western magical literature through the eighteenth century, just as in modern biology textbooks the same examples appear over and over. The medium for both of these traditions is literary, but in the older tradition there was for a long time no systematic requirement that what was claimed in a text should correspond to what could be perceived in the world. Without any regular empirical check on the tradition of magical objects, its literary manifestation came not merely to represent the evidence but actually to constitute the evidence.

Studies of the cock in ancient literature, for example, have shown that its magical dominance over the lion was already canonical by the time Proclus referred to it in *De sacrificio*.⁴⁶ As far as I know, no one has attempted to examine the *fortuna* of these or any other magical objects from their emergence in antiquity to their decline in the early modern period. In order to illustrate the role of this tradition in early modern thinking about natural magic, I shall attempt a brief sketch

of the long history of Ficino's two magical fish, the torpedo and the echeneis.⁴⁷

The torpedo is a real, identifiable species whose stunning effects were correctly observed in antiquity, yet, in the absence of any notion of electricity, the ray's powers resisted explanation. One behavior reported for the echeneis, that it stuck to ships, applies to the modern remora, the marine lamprey, and to other varieties, and it is easy to imagine how such reports might have become associated with otherwise unexplained cases of stalled ships. But the crucial fact was textual: In the beginning of Book 32 of his *Natural History*, which deals with the medical and magical properties of marine life, Pliny described the electric ray and the ship-holder as the two outstanding examples of natural objects possessing occult powers. Many other ancient authorities before and after Pliny – especially Aristotle, Plutarch, Athenaeus, Aelian, and Oppian – debated, amplified, and confirmed the magical reputation of the two fish. Even literary writers uninterested in natural philosophy used them as stock examples of magical objects. Later generations found it especially memorable that Galen recognized the “unnameable properties” of the torpedo, whose medical significance had already surpassed that of the echeneis in late antiquity.⁴⁸ Medieval authors accepted both fish as instances of occult power and also saw them as proofs that miracles had been wrought by a mighty and providential God. Meanwhile, any attachment between the fabled ship-stopper and an actual, identifiable fish completely eroded in the Middle Ages. Even the lexical identity of Pliny's echeneis disappeared in the confusion of texts that failed to distinguish it from his *echinus*, or sea urchin.⁴⁹

Ficino's contemporary, Ermolao Barbaro, solved this textual problem in his critical and editorial work on Pliny, but his philological achievement did nothing to dissolve the bond that kept the echeneis twinned to the torpedo; through much of the seventeenth century they remained an exemplary pair of magical objects. Natural historians from Pierre Belon and Guillaume Rondelet through Ulisse Aldrovandi and Jan Jonston knew what the torpedo was but not how it numbed its prey. By repeatedly confirming the fact of its effect, they also confirmed the time-honored resort to occult qualities as explanation of the effect. And since their humanist natural history was so loaded with philological baggage, these reformers of biology also recertified the intellectual value of the Greco-Roman sources that nourished belief in magic. Because the reformers depended so much on ancient books, and so little on contemporary experience, the best they could do with the echeneis was to reveal the bewilderment of the classical authors. Their most striking use of personal experience was

actually to reinforce older tales of ship stopping with current examples.⁵⁰ Physicians, theologians, philosophers, and many other writers joined the natural historians in commenting on the two fish, almost always as a pair. Those who did not use occult qualities to explain their effects proposed explanations that were sometimes ingenious but never convincing enough to displace occult qualities. This was true through the middle of the seventeenth century, when alternative explanations were often cast in terms of the fashionable corpuscular and mechanical paradigms.⁵¹

The echeneis lost its magic when it gained a biological identity – primarily because of maritime voyages of discovery, exploration, and trade that allowed regular observation of the remora, a fish that stuck to ships but obviously did not stop them. By the early eighteenth century, the remora's arresting but unmagical behavior was so well known, and it was so regularly identified as the echeneis of antiquity, that the fish lost its status as a magical object and its link to the torpedo.⁵² The same improvements in habits of observation that disconfirmed ship stopping reconfirmed the still mysterious powers of the torpedo. Because the prevailing corpuscular and mechanical modes of explanation failed to disenchant the torpedo, the notion of “torporific virtue” remained an idea worth belittling, as late as 1765, in the *Encyclopédie*, nearly a century after Lorenzo Redi and Stefano Lorenzini had moved understanding of the ray's gross anatomy very nearly to modern standards and nearly a century after Molière had made a joke of “dormitive virtue.” Taxonomy and anatomy were to prevail in the Linnaean natural history of the eighteenth century, and the great ichthyologist of the period, Peter Artedi, wished to banish *proprietaes*, occult or other, from natural history; yet the ray's effect remained a puzzle and a focus of attention and, potentially, a buttress to the decaying edifice of magical belief.⁵³ In the 1760s, Edward Bancroft and others, having concluded that the effect of the famous South American eel was in fact electrical, guessed that the same might be true of the torpedo. In a series of simple experiments, John Walsh confirmed Bancroft's conjecture and ended the ray's career as a magical object in 1773 – except insofar as eighteenth-century conceptions of “electrical fluid” resembled the *spiritus* and *pneumata* long counted among the arcana of the magus.⁵⁴

This brief tale of two fishes raises questions about the stories of other magical objects. How many of them remained, like the torpedo and the echeneis, credible instances of magical power through much of what we call the Scientific Revolution? The fate of these two magical objects, in any event, shows that lists of such phenomena in early modern texts should not be assumed to be idiosyncratic or capricious;

that, on the contrary, such objects are often cited as instances of magical power on the basis of an authoritative tradition whose elements played a role like that of empirical data in the confirmation of modern scientific theories; that the longevity of this tradition was great, and that its end was complex, in that not all its elements lost their credibility at the same time or for the same reasons; that the intensifying and refining of scientific observation in the early modern period could reinforce, as well as diminish, the reputation of magical objects; and, finally, that there was no single feature of the Scientific Revolution (much less the mechanical and corpuscular episodes of that revolution) that convinced educated Europeans to end their fascination with magical objects.

The terminology of natural magic, occultism, and hermetism

Thus, during the centuries of the Scientific Revolution, an *empirical* occultism emerged from an ancient literary tradition, enjoyed an expansion of its textual content and an enlargement of its reputation until the early seventeenth century, and remained an important source of natural-historical information through the middle of that century. Proponents of natural magic believed that this *empirical* occultism confirmed a *theoretical* occultism rooted in authoritative concepts of speculative and natural philosophy drawn from works of leading intellectual figures, Christian writers included. A third source of confirmation for belief in natural magic, the magic most of interest to the history of science, was *doxographic*, and it represented not so much a succession of ideas as a succession of names, attached, often vaguely, to ideas. The vagueness of this doxography is a special problem for the history of natural magic in the Scientific Revolution.

Some distinctions of terminology may be helpful. In ordinary modern English, "magic" is a vague term. Like "occultism," it can refer to a set of beliefs and practices historically and materially distinguishable from one another but customarily treated as a group, because from the point of view of orthodox religion or philosophy or, more recently, science, they have seemed illegitimate, erroneous, somehow marginal. The set includes astrology, demonology, divination, witchcraft, Cabala, alchemy, and others, all of which are of historical interest, but not all alike for the history of science. For early modern science, in particular, the most important kind of occultism was what Ficino and his contemporaries called "natural magic." This is how Ficino described it:

Using natural objects, natural magic captures the beneficial powers of the heavenly bodies to bring good health. This

means of action must surely be conceded to those who use their talents lawfully, just as it is in medicine and farming. . . . One practices agriculture, another mundiculture. . . . Just as the farmer tempers his field to the weather to give sustenance to man, so this wise man, this priest, for the sake of man's safety tempers the lower objects of the cosmos [*mundus*] to the higher. . . . [Natural magic] puts natural materials in a correct relationship with natural causes.⁵⁵

Writing in a medical context, Ficino focused on medical magic, but his definition applies broadly. Just as the farmer and the physician use their expert knowledge to manipulate natural objects for desired physical effects, so the magus uses arcane knowledge of the contents of microcosm and macrocosm to achieve wondrous, but natural, results. Part of the special knowledge required for natural magic may be expressed as a set of theoretical principles, of which these are especially important:

1. Occult – as opposed to manifest – powers and forces can and must be used to explain certain natural phenomena.
2. On a cosmic scale, causality is a vector, moving from above to below, from without to within, and thus lending credence to astrology.
3. Fine material substances or gross spiritual substances – *spiritus* or *pneumata* – can and must be used to explain coherence and continuity of action among natural phenomena.
4. The prevailing explanatory context for natural phenomena is organic rather than mechanical.

These principles, which were seriously debated through the middle of the seventeenth century and beyond, had been developed by thinkers of the stature of Plato, Aristotle, Galen, Ptolemy, Plotinus, Avicenna, and Aquinas.⁵⁶ There is no doubt that they are generally compatible with the *Hermetica* translated by Ficino. Moreover, a few passages of the philosophical *Hermetica* explicitly support various points of occultist theory, particularly the notion of astrological causality.⁵⁷ But principles of natural magic were low on the hermetic agenda, and, more important, no idea of natural magic susceptible to rigorous and detailed historical analysis can be said to be "hermetic," as opposed to "Peripatetic" or "Stoic" or "Galenic" or "Neoplatonic." This is not because there are no such ideas (see the sketch of the history of occult qualities above) but because there is no coherent and distinctly hermetic theory of natural magic.

The adjective "hermetic" is an old one. Iamblichus used it in discussing the dubious ancestry of works that circulated under the name of Hermes in his day. Much later, in his debate with Robert Fludd,

Johann Kepler used the expression "Hermetic manner" (*mos Hermeticus*) to characterize what he objected to in Fludd's way of thinking. Seventeenth-century writers frequently used "hermetic" to mean "alchemical" and thus, by extension, to refer to the occultist beliefs and practices with which alchemy was associated. By the middle of the next century, Jakob Brucker, the great historian of philosophy, connected Hermes, Orpheus, and Zoroaster with what he called "the Pythagorean-Platonic-Cabbalist philosophy" of supposititious syncretism, showing that the associations of "hermetic" had drifted far from the texts that Ficino had made famous.⁵⁸ Frances Yates, who made "hermetic" and its cognates important and controversial for modern historians of science, sometimes used this term as if it meant the same thing as "magical" or "occultist" broadly understood. Other historians have done the same, but the history of natural magic in its relation to science would be well served by greater terminological precision and a shift of emphasis.⁵⁹

Kepler can guide us here. In the "Appendix" to the fifth book of his *Harmonices mundi*, published in 1619, he took issue with notions of cosmic harmony professed by Fludd in the first sections of his enormous *Utriusque cosmi historia*, which had appeared in 1617 and 1618. Kepler's remarks were only the first round in a long series of polemics that ultimately matched Fludd against Mersenne, Gassendi, and lesser prophets of the new science, but they give insight into a new and pejorative meaning that the term "hermetic" had acquired by Kepler's time. Fludd, who cites the philosophical *Hermetica* at every turn, had spoken on the subject of cosmic music just at the moment when Kepler was about to make his own declaration in *Harmonies of the Cosmos*, so Kepler wished ardently to distinguish his views from Fludd's:

In [Fludd's] work there are many pictures; in mine, mathematical diagrams keyed with letters. You may also note that he takes great delight in the shadowy mysteries of things, while I strive to bring these same things, wrapped in obscurity, into the light of understanding. The one habit belongs to Chemists, Hermetists, Paracelsians; the other is the specialty of Mathematicians. . . . What he adopts from the ancients, I draw out from nature and build it up from its very elements; he makes confused and incorrect use of what he takes, because of variations of opinion in the traditions, but I proceed in natural order so that everything is corrected according to the laws of nature, and this avoids confusion. In fact, I never attend to opinions established by the ancients except where no confusion follows: Thus, where I expressly refute the an-

cientis . . . , he unwaveringly follows them. . . . When he introduces music into the cosmos, there is this very great difference between us: first, the harmonies he aims to teach are mere symbols . . . , poetic or rhetorical rather than philosophical or mathematical. This is the spirit of his whole book, as the title, *Macrocosm and Microcosm*, makes clear. . . . Following the celebrated axiom of Hermes, he makes *things above similar* or analogous to *things below*. But in order for this analogy to apply everywhere he must often drag things in by the hair so that they will apply on both sides. My view on analogies . . . is clear; they are apt to run on into infinity.

In effect, Kepler has provided a table of opposites that establishes a pejorative sense for "hermetic" as opposed to "philosophical" or "mathematical," the terms Kepler chose to describe the character of the new science he helped found. He contrasted Fludd's pictures to his diagrams; Fludd's poetic symbols to his mathematical notation; Fludd's mysteries to his clarity; Fludd's arguments based on authority and entangled in tradition to his explanations drawn from nature and ordered by nature's laws; Fludd's profligate application of analogy to his much stricter view of the uses of analogy in mathematics.⁶⁰ These were the features of what Kepler called Fludd's "Hermetic manner" or "Hermetic philosophy" in Kepler's *Apologia* of 1622, the work in which he answered Fludd's 1621 rejoinder to his original comments on *Utriusque cosmi historia*. The *Apology* told Fludd that Kepler held "in contempt whatever mathematics you do in a Hermetic manner, not out of hatred for Hermetic matters themselves, . . . but because I have never learned to grasp mathematics except by mathematical demonstrations nor to see into the inner sanctum of your Hermes, which is always completely dark to mathematical eyes."⁶¹ Kepler found Fludd's methods alien and utterly useless to his own inquiries into nature.

Robert Westman has argued persuasively that the antipathy between the hermetic-poetical Fludd and the mathematical-philosophical Kepler was largely a disagreement over the status of pictorial signs and written signs in their relations with things. Everyone remembers Kepler's famous picture of planetary polyhedra, but this geometrical image was for Kepler only a symbol of real, immaterial, invisible relations among the planets. Where Kepler used pictures as adjuncts to arguments expressed in words and numbers, as tokens convenient to the human sensory apparatus and symbolic of intelligible realities, Fludd made pictures essential in his books, not ancillary, and hoped to explain the cosmos through pictures by recreating it poetically. Kepler explained and theorized through linguistic anal-

ysis, Fludd through pictorial mimesis. Fludd's wish to mimic the Creator by making his own book of the world elevated his pictures beyond mere *representation* or description.⁶² Like some of the magical textual objects of empirical occultism, Fludd's pictures *presented* a reality that was autonomous, in that it was independent of reference to any other physical object.

Fludd's theologically audacious project of explaining by the direct, creative act of picturing, rather than by an indirect act of analysis, recalls the mystical tradition in Christianity, which favored an immediate, intuitive relation with God over scholastic ratiocination or sacerdotal ceremony. Fludd unquestionably belonged to a hermetic tradition, however one wishes to define it, but his poetic-intuitive epistemology and psychology also place him in the line of Jacob Boehme, Oswald Croll, Valentin Weigel, Paracelsus, and, ultimately, Johann Tauler, Meister Eckhardt, and the *Theologia Germanica*. Weigel's thought illuminates the kinship between Fludd's hermetism and this German spiritualism. Like Paracelsus, who taught that man gained true knowledge of nature only when human *experientia* became the *scientia* innate in natural objects, Weigel claimed that to know an object was to become that object. Thus possessed of an epistemology that resembled Paracelsian teaching in its religious motivations as much as in its conclusions, Weigel went on to borrow other ideas from Paracelsus: not only the microcosm-macrocosm theory that set the cosmological stage for his epistemology, but also the alchemical and astrological terminology in which he and Boehme cast the drama of human spiritual development. By the middle of the seventeenth century, Weigel, Croll, and Boehme were much in vogue in English translation; their original works had begun to appear in the first decades of the century, when Fludd and Kepler began their polemics. Henry More and other English critics used the word "theosophy" to refer specifically to Boehme's ideas (his collected works of 1730 were titled *Theosophia revelata*) but also more broadly to those of Fludd, Paracelsus, and Agrippa.⁶³ This German spiritualism, or theosophy, fortified by Paracelsian notions of alchemy, cosmology, and matter-theory and amplified by Fludd's special commitments to pictorialism and hermetism, is likely what Kepler had in mind when he condemned Fludd in the following terms: "You say that *certain understanding of the world is given not to worldly but to theosophical wisdom. A theosophist you certainly are; others are cosmosophists. You are wise in invisible quantities, uncountable numbers, a spiritual Sun, self-straying planets discernible only to the mind.*" This reading of Kepler's pejorative use of the term "theosophy" may also prove helpful to modern scholars in distinguishing the theosophical hermetism of

Robert Fludd from the natural magic of Marsilio Ficino, which was not strongly hermetic. Ficino, whose philosophical, literary, and medical skills earned the respect of peers in all fields, developed a natural magic that looked back to the normative natural philosophies of antiquity and the Middle Ages. By contrast, given the filiation of the Weigels and "Behmenists" of the early modern period with the adherents of the Theosophical Society or the followers of a Madame Blavatsky of more recent times, one may say, without taint of Whiggery, that Fludd's theosophical hermetism, which was at odds with prominent natural philosophies of his own day, looked forward to occultist movements culturally more marginal than anything Ficino proposed. By the eighteenth century, the rationalist *Encyclopédie* classified as "theosophists" not only Paracelsus, Weigel, and Fludd but also Croll, Heinrich Khunrath, and Joan Baptista Van Helmont, concluding that they were "men of ardent imagination who corrupted theology, obscured philosophy and abused their chemical knowledge."⁶⁴

If Kepler's description of Fludd's thinking as both "theosophical" and "hermetic" helped establish a pejorative use of those terms in natural philosophy, the status of "hermetic" as a synonym for "alchemical" is less clear. The name Hermes had long been associated with alchemical texts like the *Emerald Tablet*. Some of these alchemical *Hermetica* were read by seventeenth-century "chemical philosophers," who made good use of the legitimacy given the alchemical Hermes by association with Ficino's philosophical *Hermetica* – although not everyone conceded the relationship. As early as 1533, Symphorien Champier, a physician and a follower of Ficino, had argued that the alchemical Hermes was not Ficino's philosophical author but a fabrication of the Moslems and "a stranger to true philosophy." In the next century, although Croll and other Paracelsians still spoke admiringly of "that holy man Hermes," Croll's enemy Andreas Libavius scorned the hermetic tradition as a fount of obscurantism, enthusiasm, and charlatany. Libavius also saw it as a threat to the humanist Aristotelian philosophy and pedagogy upon which he had based his efforts to construct an autonomous disciplinary and didactic base for chemistry. Although Libavius saw hermetic Egypt as the homeland of an "*impostoria chymia*," (fake chemistry), Michael Maier – who shared a publisher and an illustrator with Fludd – used his own books of emblems to make early modern alchemy a distinctly hermetic art by interpreting the whole Renaissance misunderstanding of Egypt, its gods, and its hieroglyphics as an allegory on the alchemical work.⁶⁵

In this context, it is important to recall the relation between Westman's account of Fludd's pictorialism and C. G. Jung's views on the

purpose of the alchemical work. According to Jung, alchemy was more therapy than technology. In order to manipulate them symbolically, the alchemist projected the contents of the unconscious – Jung’s archetypes – onto matter, whose transformations could be treated physically and described verbally as surrogates of less accessible processes in the psyche. The special therapeutic motivation of alchemy demanded just such an efflorescence of the pictorial imagination as appeared in Maier’s emblems; the alchemist’s therapeutic aims and their consequences were as unlike Kepler’s analytic ambitions and achievements as anything in Fludd.⁶⁶ Contemplating Maier’s alchemy or Fludd’s theosophy, one can only suggest that modern scholars deal cautiously with such subtle and refractory materials, especially in deciding what it means to apply the same label, “hermetic,” to these authors and to Ficino.

Allen Debus, in a section of the first chapter of his *Chemical Philosophy* entitled “The Hermetic Revival and the Study of Nature,” finds a bond between François Rabelais and the Paracelsian Peter Severinus in their common urge “to discard their books and seek the truth of nature directly through observation. . . . The ultimate source for both authors,” he maintains, “is the Hermetic . . . *Asclepius*.”⁶⁷ The text that Debus cites from Rabelais’s *Pantagruel* is part of Gargantua’s famous letter to his son. Although it is full of praises for books, printing, libraries, erudition, classical studies – in short, the whole humanist program – Debus reads it as an expression of anti-livresque empiricism on the part of Rabelais. Passing over the view of some critics that the letter is a parody – not a representation of Rabelais’s attitude – we may ask how Rabelais’s commonplace recitation qualifies as hermetic. Gargantua advised his son

that there is no sea, river or spring whose fish you shouldn’t know; all the birds of the air, all the trees, bushes and shrubs of the forest; all the plants of the earth; all the metals hidden in the belly of the abyss; the stones of all the Orient and the South – let none of this be unknown to you. Then carefully reread the books of the Greek, Arab and Roman physicians, without slighting the Talmudists and Cabalists, and by frequent anatomies gain complete familiarity with the other world that is man. And several hours each day begin reading Holy Scripture, first of all the New Testament and the Epistles of the apostles in Greek, and then in Hebrew the Old Testament.⁶⁸

The text of the *Asclepius*, alleged to be “the ultimate source” of these thoughts, is as follows:

As a prophet, I will tell you that after us there will remain

none of that simple regard for philosophy found only in the continuing reflection and holy reverence by which one must recognize divinity. Many make philosophy obscure in the multiplicity of their reasoning by combining it through ingenious argument with various branches of study that are not comprehensible – arithmetic, music, and geometry. Pure philosophy that depends only on reverence for god should attend to these other [teachings] only to wonder at the recurrence of the stars, how their measure stays constant in prescribed stations and in the orbit of their turning; it should learn the dimensions, qualities, and quantities of the land, the depths of the sea, the power of fire, and the nature and effects of all such things, in order to commend, worship, and wonder at the skill and mind of god. . . . The men who will come after us, deceived by the ingenuity of sophists, will be estranged from the true, pure, and holy philosophy. To adore the divinity with simple mind and soul, to honor his works and also to give thanks to the will of god . . . , this is a philosophy unprofaned by relentlessly curious thinking. And this is the treatment of these things.⁶⁹

Wonder, piety, simplicity, contemplation, the danger of curiosity, the incomprehensibility of mathematics – these are surely not the ingredients of a hermetic manifesto for the progress of science. In characterizing the “hostility to the sciences” that he finds in this passage of the *Asclepius*, A. J. Festugière cites the famous words of Tertullian on the remoteness of learned Athens from pious Jerusalem: “After Jesus Christ, all curiosity ceases, all inquiry after the Gospel. Believe, and want nothing more.” According to Debus, the *Asclepius* advocates a “Christianized search for God’s truth in nature that was to appeal to Renaissance philosophers,” but if this text resembles anything Christian, it is the Christianity of patristic writers like Tertullian and Augustine, who feared the world of nature, along with the flesh and the devil, and grudgingly permitted study of nature only as a propaedeutic to piety. It was not the Christianity of John Ray, who saw God’s wisdom manifest in his works and believed that the deepest study of nature was a holy calling.⁷⁰ Nor, obviously, was it the Christianity of the world-affirming Rabelais, whose Gargantua moved easily from the book of nature to the books of Scripture and whose mind was as far from this ascetic text as his language. This passage of the *Asclepius* cannot even be called uniquely or distinctively “hermetic,” except in the textual – and trivial – sense, for both the world-affirming and the world-denying messages broadcast in the various Platonizing religions and pious philosophies of late antiquity were heard by the

authors of the hermetic corpus, who produced a medley of discordant views on the moral qualities of nature. For example, the tenth treatise tells us that the cosmos is not good because it is made of matter; the ninth maintains that to speak of an evil cosmos is blasphemous – despite the fact that the earth is evil. However, even the cosmic piety of the ninth tract leads not to a scientific cosmology but, at best, to an accommodation of cosmology with theology, at the expense of the former as an independent intellectual enterprise. The status of the study of material objects was low even for the “optimist” tracts, because of the pervasive influence in them of the contempt for matter that was widespread in Middle Platonism.⁷¹ Even the ninth treatise is a far cry from the “hermetic theme” that Debus sees in Peter Severinus. After the customary Paracelsian (but un-Rabelaisian) exhortation to book burning, Severinus advises his readers to build their knowledge entirely upon immediate sense experience of human, natural, and artificial objects. If this emphasis on sense experience is truly and distinctively a hermetic theme in Severinus, how does it accord with the hermeticism of the ninth *logos*, which justifies sensation only by making it a kind of intellection and calls the earth “the native land of evil”?⁷²

In an essay on Isaac Newton, Richard Westfall has suggested that hermeticism was important to seventeenth-century science as a position opposed to the mechanical paradigm. While there is no doubt that Hermes remained an authoritative figure for many who contributed to the debates of the Scientific Revolution, it is less certain that our modern conceptions of hermeticism have yet become clear and stable enough to guide us reliably through the thickets of seventeenth-century controversy. Westfall’s hermetist, for example, saw nature as active, organic, and psychic (or ensouled); he asserts that this vitalist and animist conception of nature also encouraged belief in sympathies and spirits. Eugenio Garin has criticized Westfall’s effort to find such “a general meaning” for hermeticism, because it fails to appreciate the special historical circumstances of hermeticism in Newton’s time, as compared to Ficino’s or Thomas Bradwardine’s, and because it gives no distinctive meaning to the word.⁷³ By Westfall’s account, for example, Henry More would qualify as a hermetist. Yet Isaac Casaubon’s redating of the *Hermetica* had convinced More that the Egyptian Hermes was a fraud, and More’s doxography of natural philosophy in the *Conjectura cabbalistica* paid Hermes no honor.⁷⁴ That Newton’s biographer has concerned himself with intellectual-historical realities previously ignored or scorned by historians shows how much the history of science has matured, but this “general” understanding of hermeticism can lead only to more confusion.

In my view, the term “hermetic” should be used primarily to name a set of texts: either the philosophical *Hermetica* published by Ficino and Lodovico Lazarelli – which, we should note, have little to say about magic or science – or popular *Hermetica*, such as the *Kyranides*, which were sources of empirical occultism. How else might “hermetic” be used? We might use it to refer to the ideas expressed in the texts just mentioned: As we have noted, however, these ideas are not only generally incoherent but, as far as the philosophical texts are concerned, especially uninteresting for natural philosophy. Again, the word might be used to describe a body of ideas – or the people who held them – without precise reference to either set of texts. Kepler’s *mos Hermeticus* is evidence of such a usage, which seems to have developed further between his time and Brucker’s; but historians should understand how diffuse the adjective becomes in these contexts. Perhaps by bearing in mind the theosophical and alchemical applications that I have described, scholars can prevent this slippery word from evading our comprehension entirely. The assumption that “hermetic” implies “magical” and the reverse is especially to be avoided. During the Scientific Revolution much debate about magic made no reference to the *Hermetica*; by the same token, for a Fludd or a Francesco Giorgi the theological appeal of the hermetic writings could operate quite independently of any interest in magic. As a substitute for “hermetic,” I suggest that the term “occultist” will serve to refer generally to magic, astrology, demonology, and divination. The term “occultism” and its cognates admittedly are problematic, in the same way that the term “humanism” is problematic. “Occultism” is a nineteenth-century invention, obscured by the special attitudes of that period and by subsequent semantic overlay; hence, it is colored both by nineteenth-century positivism and by twentieth-century occultist fads. But there is precedent for this broad use of “occultist,” and unlike “hermetic,” which should be freed for more exact employment, it implies no particular textual or doxographic content.⁷⁵

Future debate on hermeticism in the history of science should focus on four problems: first, on discovering precisely how natural philosophers and others used the word “hermetic” in the early modern period; second, on deepening our understanding of the meaning of the word in alchemy and the new theosophy; third, on evaluating the significance of the hermetic doxographic tradition as compared to other doxographies bearing on science, especially the tradition that legitimized atomism by associating it with Moses, Pythagoras, and Democritus;⁷⁶ and fourth, on determining the contribution of the popular *Hermetica* to the development of a body of empirical evidence for occultism. Except as they may be interested in topics such as these,

scholars who wish to explore the relation between occultism and early modern science can turn their attention from the "Yates thesis," if they understand this thesis to claim that a distinctly hermetic tradition based on the philosophical *Hermetica* was of central importance in the history of early modern science.⁷⁷ Even as a doxography, and especially after Casaubon's redating of the philosophical *Hermetica* to late antiquity, hermetism was probably less important than Mosaic atomism. In my opinion, however, historians of science ought to pursue the broader implications of the work of Frances Yates, especially her catholic and imaginative desire to explore areas of thought and culture hitherto considered insignificant or inappropriate to serious historical discourse. The decline of natural magic as a normal and legitimate concern of Western natural philosophy, for example, was one of the most important features of the Scientific Revolution. The complexity of that revolution will be better appreciated when research is based on more precise use of terms such as "natural magic" and "hermetism."

Notes

- 1 Francis A. Yates, *Giordano Bruno and the Hermetic Tradition* (London, 1964), pp. 432–47.
- 2 *Ibid.*, pp. 448–51.
- 3 As far as I know, the claim that Yates advanced a "thesis" about the history of science was not her own but that of her critics, as in Robert S. Westman, "Magical Reform and Astronomical Reform: The Yates Thesis Reconsidered," in R. S. Westman and J. E. McGuire, *Hermeticism and the Scientific Revolution*, Papers read at Clark Library Seminar, March 9, 1971 (Los Angeles, 1977). For other criticisms of Yates's views, see this chapter, Notes 20, 30, 45, 58–9, and 74. The *Oxford English Dictionary* (hereafter *OED*) has no entry for "Hermetism," the form that Yates used, or for "Hermeticism." I prefer the former, as a simpler derivative from "Hermetic" (*OED*, s.v.), which appeared in the early seventeenth century in England. These terms are lower-cased in this chapter, in accordance with the practice in this volume as a whole.
- 4 J. E. McGuire and P. M. Rattansi, "Newton and the 'Pipes of Pan,'" *Notes and Records of the Royal Society*, 21 (1966):109–15, 123–7, 130.
- 5 Frances A. Yates, "The Hermetic Tradition in Renaissance Science," in *Art, Science and History in the Renaissance*, ed. Charles S. Singleton (Baltimore, 1968), pp. 263–4, 270–2.
- 6 Frances A. Yates, *The Rosicrucian Enlightenment* (London, 1972), pp. 235, 238, 240–7, 264; a later work, *The Occult Philosophy in the Elizabethan Age* (London, 1979), has little to say about science.
- 7 See Notes 20, 30, 45, 58, 59, 64, 73, 74, 77, this chapter.
- 8 Allen G. Debus, *The Chemical Philosophy: Paracelsian Science and Medicine in the Sixteenth and Seventeenth Centuries* (New York, 1977), was awarded the

- Pfizer Prize in 1978; for lists of Pfizer Prize winners, see *Isis*, 66 (1975):476–7; 75 (1984):359–60; Allen G. Debus, *Man and Nature in the Renaissance* (Cambridge, 1978), p. 157; Marie Boas, *The Scientific Renaissance* (London, 1970), p. 346.
- 9 I. Bernard Cohen, *The Newtonian Revolution: With Illustrations of the Transformation of Scientific Ideas* (Cambridge, 1980), pp. 130, 319; Richard S. Westfall, *Never at Rest: A Biography of Isaac Newton* (Cambridge, 1980), pp. 292, 304–10, 353, 358, 389–90, 434, 509–11, 524–31; Gale E. Christianson, *In the Presence of the Creator: Isaac Newton and His Times* (New York, 1984), pp. 221–3, 256; see also this chapter, Note 72, and for some answers to the questions raised in the last paragraph of this section, see my forthcoming chapter in the *Cambridge History of Seventeenth Century Philosophy*, entitled "The Occultist Tradition in Seventeenth Century Philosophy."
 - 10 The last edition published in Polydore's lifetime was *Polydori Vergilii Urbinatis de rerum inventoribus libri octo, eiusdem in dominicam precem commentariolum* (Basel, 1544); Book 1 occupies pp. 1–88, the chapters on magic pp. 76–88; B. P. Copenhaver, "The Historiography of Discovery in the Renaissance: The Sources and Composition of Polydore Vergil's *De inventoribus rerum*, I–III," *Journal of the Warburg and Courtauld Institutes*, 41 (1978):192–214.
 - 11 P. Vergil, *De inventoribus*, pp. 7–9, 65–7; Copenhaver, "Discovery," pp. 211–14.
 - 12 Pliny, *Natural History*, XXX.1–2; P. Vergil, *De inventoribus*, pp. 77, 80–2, 86.
 - 13 Pliny, *Natural History*, XXX.3–4, 8–9; P. Vergil, *De inventoribus*, pp. 76–8, 80; Joseph Bidez and Franz Cumont, *Les mages hellénisés: Zoroastre, Ostanes et Hystaspe d'après la tradition grecque* (Paris, 1938), 2 vols., 1:5–55, 84–8, 93–4, 115, 144–5; Mary Boyce, *A History of Zoroastrianism: Vol. 1, The Early Period* (Leiden, 1975), pp. 3, 10–11, 20, 189–91, 250–1; Gerhard Delling, "γῶης" and "μάγος," in Gerhard Kittel, ed., *Theological Dictionary of the New Testament*, ed. and trans. G. W. Bromiley (Grand Rapids, Mich., 1967), 1:737–8; 4:356–9; Walter Burkert, "Γῶης zum griechischen 'Schamanismus,'" *Rheinisches Museum für Philologie*, n.s., 105 (1962):38–9, 43–4, 50, 52–5.
 - 14 Pliny, *Natural History*, XXX.8–10; P. Vergil, *De inventoribus*, p. 78; Bidez and Cumont, *Mages*, pp. 85–8, 93–4, 112, 167–73, 190, 196–9; Max Wellmann, "Die Φύσικα des Bolos Demokritos und der Magier Anaxilaos aus Larissa," *Abhandlungen der preussischen Akademie der Wissenschaften, philologisch-historische Klasse*, 7 (1928):14–16, 51.
 - 15 The hermetic work known as the *Asclepius* survives only in a Latin translation, previously attributed to Apuleius, which was known to Saint Augustine; it was first printed in 1469, two years before Ficino published his Latin translation of the first fourteen Greek tractates of the *Hermetica*, to which he gave the collective title *Pimander*, though Πουμάνδης is the title only of the first tractate. The last three Greek *logoi* were translated by Lodovico Lazzarelli and first published by Symphorien Champier in 1507. Fragmentary *Hermetica* related to these writings were collected from Stobaeus, Lactantius, Cyril, and other ancient writers in later editions, of

- which only that of A. D. Nock and A. J. Festugière, *Corpus Hermeticum*, 4 vols. (Paris, 1946–1954) is reliable; references to the *Corpus Hermeticum* are abbreviated as CH. Other important early editions of these “philosophical” *Hermetica* (see this chapter, Note 45) were the work of Jacques Lefèvre d’Etaples, who published Ficino’s *Pimander* in 1494, along with his own brief commentaries. In 1505, Lefèvre brought out a new edition that also included the *Asclepius*; he added commentaries (*argumenta*) for this new text and brought his old commentaries on the *Pimander* up to date. After 1516, Lefèvre’s material was absorbed into later editions of the *Hermetica* identified with Ficino, as in the widely read version printed in the Basel (1576) edition of Ficino’s works: *Marsilii Ficini florentini . . . opera et quae hactenus extiterunt* (1576; reprint edition, Torino, 1959), pp. 1836–71. Yates, *Bruno*, p. 40, n. 1, used this text and cited the work (*Supplementum Ficinianum: Marsilii Ficini . . . opuscula inedita et dispersa . . .* [Florence, 1937], pp. cxxix–cxxx) in which Paul Oskar Kristeller first distinguished Lefèvre’s commentaries from Ficino’s, and yet much of the material that Yates studied in “Ficino’s *Pimander* and *Asclepius*” (*Bruno*, pp. 28–35) is really Lefèvre’s. For *De vita coelitus comparanda* (henceforth called *De vita*), see *Ficini opera*, pp. 519–72. See also Kristeller, “Marsilio Ficino e Lodovico Lazzarelli: Contributo alla diffusione delle idee Ermetiche nel rinascimento,” in *Studies in Renaissance Thought and Letters* (Rome, 1956), pp. 223–4, 233; “Lodovico Lazzarelli e Giovanni da Correggio, due Ermetici del Quattrocento, e il manoscritto II.D.I.4 della Biblioteca comunale degli Ardentini di Viterbo,” in *Biblioteca degli Ardentini della città di Viterbo: Studi e ricerche nel 150 della fondazione* (Viterbo, 1960), pp. 3–10; Raymond Marcel, *Marsile Ficini* (1433–1499) (Paris, 1958), pp. 255–8, 487–96, 747–9; Karl H. Dannenfeldt, “Hermetica philosophica,” in *Catalogus translationum et commentariorum*: vol. 1, ed. Kristeller (Washington, D.C., 1960), pp. 137–56; Eugene R. Rice, Jr., ed., *The Prefatory Epistles of Jacques Lefèvre d’Etaples and Related Texts* (New York, 1972), pp. 134–7; D. P. Walker, *The Ancient Theology: Studies in Christian Platonism from the Fifteenth to the Eighteenth Century* (London, 1972), pp. 66–8; Copenhaver, “Discovery,” pp. 204–8.
- 16 *Ficini opera*, pp. 25, 156, 268, 386, 529, 531, 534, 548, 556, 561, 565, 567, 673, 854, 871–2, 1537, 1836; Yates, *Bruno*, pp. 14–18; Walker, *Ancient Theology*, pp. 13–21; Dannenfeldt, “The Pseudo-Zoroastrian Oracles in the Renaissance,” *Studies in the Renaissance*, 4 (1957):9–13; Michael J. B. Allen, “Marsile Ficini, Hermès et le *Corpus Hermeticum*,” in *Présence d’Hermès Trismégiste*, ed. Antoine Faivre (Paris, 1988), pp. 110–19.
- 17 *Ficini opera*, pp. 548, 571–2; cf. *Asclepius*, 23–4, 37–8; for two other passages (pp. 540–1, 546) in which Ficino mentions a “Mercurius” as author of material not found in the philosophical *Hermetica*, cf. A. J. Festugière, *La Révélation d’Hermès Trismégiste* (Paris, 1950–1954), 4 vols., 1:146–60, 169. Strictly speaking, of course, the *Asclepius* was not one of Ficino’s *Hermetica*, since it did not appear with the Greek *logoi* until Lefèvre’s 1505 edition, but Ficino was familiar with it even before he knew the Greek treatises: Allen, “Marsile Ficini,” p. 110.
- 18 *Ficini opera*, pp. 25, 156, 268, 386, 673, 854, 871–2, 1537, 1836.
- 19 *Ibid.*, pp. 1836–71; see also Note 6, this chapter. For a different point of

- view, see Eugenio Garin, *Astrology in the Renaissance: The Zodiac of Life*, trans. Carolyn Jackson et al. (London, 1983), pp. 40, 47, 65–6, 72.
- 20 Summary outlines of each of the treatises precede them in the edition of Nock and Festugière. See also Festugière, *Révélation*, 2:1–27; *Hermetisme et mystique païenne* (Paris, 1967), pp. 32–69; this material is treated in detail in my “Hermes Trismegistus, Proclus and the Question of a Theory of Magic in the Renaissance,” in Ingrid Merkel and Allen G. Debus, eds., *Hermeticism and the Renaissance: Intellectual History and the Occult in Early Modern Europe*, “Folger Institute Symposia” (Washington, D.C., 1988), pp. 79–110.
- 21 Klaus Thraede, “Erfinder II,” *Reallexikon für Antike und Christentum*, vol. 5 (Stuttgart, 1962), cols. 1194–1202, 1232, 1241–8, 1262–8; Jean Daniélou, *Gospel Message and Hellenistic Culture*, ed. and trans. John A. Baker (London, 1973), pp. 39–73; Copenhaver, “Discovery,” pp. 193–9.
- 22 Hermann Diels, *Doxographi graeci*, rev. ed. (Berlin, 1929), pp. 102–69; B. Wyss, “Doxographie,” *Reallexikon*, 4 (1959), cols. 197–210.
- 23 Walker, *Ancient Theology*, pp. 1–21; Charles B. Schmitt, “Perennial Philosophy from Agostino Steuco to Leibniz,” *Journal of the History of Ideas*, 27 (1966):505–32; “Prisca theologia e philosophia perennis: Due temi del Rinascimento italiano e la loro fortuna,” in *Il pensiero italiano del Rinascimento e il tempo nostro* (Florence, 1970), pp. 212–36.
- 24 Martin Nillson, *Greek Piety*, trans. H. J. Rose (New York, 1969), p. 141; see also Note 45, this chapter.
- 25 Marcel, *Ficini opera*, pp. 495–503.
- 26 *Ficini opera*, pp. 548–9.
- 27 The title of Proclus’s work in the edition of Joseph Bidez, is Περὶ τῆς καθ’ Ἑλλήνας ἱερατικῆς τέχνης (On the priestly art according to the Greeks); see Bidez, *Catalogue des manuscrits alchimiques grecs*, Vol. 6, *Michael Psellus, Epître sur la chrysope; Opuscules et extraits sur l’alchimie, la météorologie et la démonologie* (Brussels, 1928), pp. 139–51. Ficino made a copy of the Greek text around 1461 and completed his Latin translation, entitled *De sacrificio*, by 1489, but the translation was not published until 1497. Ficino’s Latin is edited, and Bidez’s Greek text reproduced, in my article cited in this chapter, Note 20. See also *Ficini opera*, pp. 1928–9; Theodor Höpfer, “Μαγεία” in Pauly-Wissowa, *Realencyclopädie*, vol. 14, pt. 1, cols. 310–11; D. P. Walker, *Spiritual and Demonic Magic from Ficino to Campanella*, *Studies of the Warburg Institute*, no. 22 (London, 1958), pp. 36–53, 75–84.
- 28 Proclus, *De sacrificio*, 149.25–150.20 (Bidez); *Ficini opera*, pp. 549–52, 570; for details, see my “Hermes Trismegistus,” cited in this chapter, Note 20.
- 29 A. Orth, “Huhn,” in *Realencyclopädie*, vol. 8, cols. 2538–9; Wellmann, “Bolos Demokritos,” pp. 20–1; Proclus, *Elements*, 5, 28, 29, 32, 39, 71–2, 79, 103, 140–5; Proclus, *The Elements of Theology: A Revised Text with Translation, Introduction and Commentary*, ed. and trans. E. R. Dodds (Oxford, 1963), pp. ix, xi, xx, xxii, 216, 219, 222–3, 254, 344–5; Lawrence J. Rosán, *The Philosophy of Proclus: The Final Phase of Ancient Thought* (New York, 1949), pp. 245–54; for the contributions of Plotinus to Ficino’s theory of magic, see Copenhaver, “Renaissance Magic and Neoplatonic Philosophy: *Ennead*, 4.3–5 in Ficino’s *De vita coelitus comparanda*,” in *Marsilio Ficino e il*

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- 30 Ficini opera, pp. 543, 560–1; [Galen], *De affectuum renibus insidentium dig-natione et curatione* (Kühn, 19:677–8); Julius Röhr, *Der okkulte Kraftbegriff im Altertum*, Philologus, Supplementband 17.1 (Leipzig, 1923), 1:97–133. For more detail on the ancient, medieval, and early modern theories of occult qualities and substantial forms discussed in the following pages, see my “Scholastic Philosophy and Renaissance Magic in the *De vita* of Marsilio Ficino,” *Renaissance Quarterly*, 37 (1984):523–54; “Astrology and Magic,” in *The Cambridge History of Renaissance Philosophy*, ed. Charles B. Schmitt et al. (Cambridge, 1988), pp. 264–300; see also Massimo Bianchi, “Occulto e manifesto nella medicina del Rinascimento: Jean Fernel e Pietro Severino,” in *Atti e memorie dell’Accademia toscana de scienze e lettere, la Colombaria*, 47, n.s. 33 (Florence, 1982):185–248; Keith Hutchison, “What Happened to Occult Qualities in the Scientific Revolution?,” *Isis*, 73 (1982):233–53; G. MacDonald Ross, “Occultism and Philosophy in the Seventeenth Century,” in A. J. Holland, ed., *Philosophy, Its History and Historiography* (Dordrecht, 1985), pp. 95–115; Simon Schaffer, “Occultism and Reason,” in *ibid.*, pp. 117–43; John Henry, “Occult Qualities and the Experimental Philosophy: Active Principles in pre-Newtonian Matter Theory,” *History of Science*, 24 (1986):335–81; Ron Millen, “The Manifestation of Occult Qualities in the Scientific Revolution,” in M. J. Osler and P. L. Farber, eds., *Religion, Science and Worldview: Essays in Honor of Richard S. Westfall* (Cambridge, 1985), pp. 185–216; L. D. Richardson, “The Generation of Disease: Occult Causes and Diseases of the Total Substance,” in A. Wear et al., eds., *The Medical Renaissance of the Sixteenth Century* (Cambridge, 1985), pp. 175–94.
- 31 G. E. R. Lloyd, *Aristotle: The Growth and Structure of His Thought* (Cambridge, 1968), pp. 51–3, 127–32; Frederick Copleston, *A History of Philosophy*, 8 vols.: Vol. 2, *Medieval Philosophy* (New York, 1962), 2:44–8; *Liber canonis Avicennae* . . . (1507; reprint edition, Hildesheim, 1964), fol. 33; Aquinas, *Summa contra gentiles* (hereafter SCG), II, 58, 92; *Summa theologiae* (hereafter ST), I, 50.2, ad 1–2; 118.2, ad 2; *De occultis operibus naturae*, 3, 6, 14; *De ente*, 14, 22, 46; *Comm. de generatione*, Book 1, lecture 8; *Comm. de anima*, Book 2, lecture 2; *Arnaldi de Villanova opera de medica omnia*, ed. Michael R. McVaugh: vol. 2, *Aphorismi de gradibus* (Granada, 1975), pp. 8, 17–19; see also Joseph B. McAllister, “The Letter of Saint Thomas Aquinas ‘De occultis operibus naturae ad quemdam militem ultramontanum,’” Ph.D. diss., Catholic University, Washington, D.C., 1939, whose paragraph divisions I have used in citing this genuine, important, but little-read work.
- 32 Anneliese Maier, *An der Grenze von Scholastik und Naturwissenschaft: Die Struktur der materiellen Substanz, Das Problem der Gravitation, Die Mathematik der Formlatitudinen*, 2nd ed. (Rome, 1952), pp. 7–14; Robert Lenoble, *Esquisse d’une histoire de l’idée de nature* (Paris, 1969), pp. 71–83.

- 33 Ficini opera, pp. 571–2; *Asclepius*, 23–4, 37–8.
- 34 Augustine, *City of God*, 8.23; 10.9–12, 16; 21.6; *De doctrina christiana*, 2.23.36, 29.45; Aquinas, SCG, 3.99, 104–5; ST, II–II, 96, 2, resp., ad 1–2; *De occultis operibus naturae*, 14, 17–20.
- 35 Aquinas, SCG, III, 92, 104; *De occultis operibus naturae*, 9–11; ST, I, 110, 1, ad 2; 115, 3, ad 2; Thomas Litt, *Les corps célestes dans l’univers de Saint Thomas Aquin*, Philosophes médiévaux, no. 7 (Louvain, 1963), pp. 113–27.
- 36 Aquinas, SCG, III, 104–5; ST, II–II, 96, 2, resp., ad 1–2; *De occultis operibus naturae*, 14, 17–20; *Comm. de generatione*, Book 1, lecture 8; *Comm. de anima*, Book 2, lecture 14; Ficini opera, pp. 552, 554–5, 558–9; Walker, *Spiritual and Demonic Magic*, pp. 42–4.
- 37 Ficini opera, pp. 553–4.
- 38 Apuleius, *Metamorphosis*, 2.1; Lucan, 6.430–506; Pliny, *Natural History*, 7.16–18.
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- 40 Pliny, *Natural History*, 8.97; 9.79–80, 100; 11.79; 32.1–7; Galen, *De locis affectis*, 6.5 (Kuhn, 8:421); Lewis and Short, *Latin Dictionary*, s.v. “1. echinus.”
- 41 *Guilielmi Rondeletii . . . libri de piscibus marinis, in quibus verae piscium effigies expressae sunt* (Lyon, 1554), pp. 360–1.
- 42 Wellmann, “Bolos Demokritos,” pp. 18, 20–3, 34, 37, 40–6.
- 43 *Ibid.*, pp. 3–4, 9–11, 28, 43, 48–53; Wellmann, *Marcellus von Side als Arzt und die Koiraniden des Hermes Trismegistus*, Philologus Supplementband 27.1 (Leipzig, 1934), pp. 1–4, 10–19, 25–6; D. Kaimakis, ed., *Die Kyranden*, Beiträge zur klassischen Philologie, no. 76 (Meisenheim am Glan, 1976), p. 14; Louis Delatte, ed., *Textes latins et vieux français relatifs aux Cyranides . . .*, Bibliothèque de la faculté de philosophie et lettres de l’université de Liège, no. 93 (Paris, 1942); Robert P. Multhauf, *The Origins of Chemistry* (London, 1966), pp. 82–116.
- 44 Festugière, *Révélation*, 1:106–23, 137–87, 201–17, 225–96; *Hermétisme*, pp. 30–2; Multhauf, *Chemistry*, pp. 84, 112–13, 115, 161–7, 184, 198–9; Lynn Thorndike, *A History of Magic and Experimental Science*, 8 vols., (New York, 1923–1958), 2:214–35; the first printing of the *Kyranden* was *Moderante auxilio redemptoris supremi Kirani Kiranides et ad eas Rhyakini Koronides* (Leipzig, 1638); an English translation came half a century later, *The Magick of Kirani King of Persia, containing the magical and medicinal vertues of stones, herbs, fishes, beasts and birds . . .* (London, 1685).
- 45 For the distinction between “popular” and “philosophical” *Hermetica*, see Festugière, *Révélation*, 2:1; *Hermétisme*, p. 30; *Hermetica: The Ancient Greek and Latin Writings Which Contain Religious or Philosophic Teachings Ascribed to Hermes Trismegistus*, ed. and trans. Walter Scott, 4 vols., (Oxford, 1924), 1:1–2; Yates (*Bruno*, p. 44, n. 2) was aware of this distinction, though she ascribed it only to Scott, and she says (p. 47) that “the philosophical *Hermetica* belong in the same framework of thought as the practical *Her-*

metica," citing the astrological content of the *Asclepius* (in my view meager and incidental) and of certain Stobaeon fragments (first introduced into editions of the *Hermetica* by Foix de Candale in 1574). Thus, she forgets Festugière's strong views (*Hermétisme*, pp. 30–2, reprinting an article published in 1948) on the differences between the two bodies of literature, whose most important link was eponymous, not material: "These two series are not unrelated. There are traces of astrology in several of the treatises of learned hermetism, traces of alchemy in the learned treatise entitled *Kore Kosmou* [Stobaeon fragment XXIII, first published by Francesco Patrizi in 1591]. . . . Nonetheless . . . the distinction . . . remains clear enough. The only point in common . . . was that they all present themselves as works revealed . . . by Hermes Trismegistus."

Yates's view of the *Hermetica* as distinctly magical texts is *not* confirmed by the recent research synthesized by Garth Fowden in *The Egyptian Hermes: A Historical Approach to the Late Pagan Mind* (Cambridge, 1986). Fowden's successful critique of the usual distinction between "learned" and "popular" *Hermetica* and his demonstration of common magical interests between the two are convincing for the original context of the *Hermetica* in late antiquity but not for the influence in the early modern period of the treatises known to Ficino and his contemporaries. In her chapter on "Hermes Trismegistus and Magic" (*Bruno*, pp. 44–61), the text to which Yates gives most attention is the *Picatrix*, which, as she recognizes, can be called "hermetic" only because it cites the authority of Trismegistus, not because it claims his authorship. Her conjecture (*ibid.*, pp. 49, 56–7), on the basis of a suggestion made by Walker (*Spiritual and Demonic Magic*, p. 36), that the *Picatrix* was an important source for Ficino's *De vita* is doubtless correct, but its full demonstration awaits the appearance of the second volume of David Pingree's edition of the Latin text; meanwhile see Pingree, "Some of the Sources of the Ghayat al-Hakim," *Journal of the Warburg and Courtauld Institutes*, 43 (1980):1–15.

46 See the references cited in Note 29, this chapter.

47 E. W. Gudger's unreliable but useful article, "The Myth of the Ship-holder: Studies in Echineis or Remora," *Annals and Magazine of Natural History*, 9th ser., 2 (1918):271–305, tells the story of the echeneis as a problem in the history of ichthyology. Chau H. Wu, "Electric Fish and the Discovery of Animal Electricity," *American Scientist*, 72 (1984):598–607, is useful for eighteenth- and nineteenth-century developments in electrophysiology but has nothing to say of the torpedo's role as evidence for the occultist tradition. The indexes in Thorndike's *History of Magic* are invaluable guides to the medieval and early modern literature on magical objects. See also Breiner, "Cockatrice," pp. 30–47. The following sketch of the careers of the torpedo and the echeneis is based on my forthcoming study "Magical Objects and the Transformation of Natural History: A Tale of Two Fishes."

48 Pliny, *Natural History*, XXXII.1–7; Aristotle, *History of Animals*, 505b19–24, 620b19–24; Plutarch, *Table Talk*, 641B–E; *Cleverness of Animals*, 978B–D; Aelian, *Nature of Animals*, 1.36; 2.17; 9.7, 14; Oppian, *Halieutica*, 1.212–43; 2.56–85; Athenaeus, *Deipnosophistae*, 7.314a–e; Galen, *De locis affectis*, 2.2, 6.5; *De simplicium medicamentorum temperamentis et facultatibus*, 11.48; *De*

usu respirationis, 3–4; *De symptomatum causis*, 1.5; (Kühn, 4:497–8; 7:108–9; 8:70–3, 421–2; 12:365); [Alexander of Aphrodisias], *Problems*, Preface; Seneca, *Medea*, 346–63; Ovid, *Halieuticon*, 94–100; Lucan, 6.66–87; Claudian, *Carmina minora*, 49.5, 22.

49 Basil, *Homilies on the Hexameron*, 67E–69A; Eustathius, *Commentary on Basil's Hexameron*, 7.5.3–9, 6.8; Ambrose, *Hexameron*, 5.9.24, 10.30–1; Jacques de Vitry, *Die exempla aus den sermones feriales et communes*, ed. J. Greven (Heidelberg, 1914), pp. 22–3; Thomas of Cantimpré, *De natura rerum libri IV–XII* (Granada, 1974), pp. 134, 139 (7.31, 82); Albertus Magnus, *De animalibus libri XXVI nach der Cölnher Urschrift*, ed. H. Stadler, *Beiträge zur Geschichte der Philosophie des Mittelalters*, nos. 15–16 (Münster, 1916–1920), 15:259, 468, 506, 619–20; 16:1517–18, 1532–33, 1548 (2.1.8.83; 6.2.1.65; 7.1.3.24; 8.3.114; 24.1.6, 48, 127); Vincent of Beauvais, *Speculum naturale* (Strasbourg, 1481), 18.49–50, 75; Bartholemew of England, *De proprietatibus rerum*, trans. John of Trevisa (Westminster, 1495), pp. 460–1; *Tractatus de venenis a magistro Petro de Abano editus* (Mantua, 1473), fols. 3v–4.

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- 62 Robert G. Westman, “Nature, Art and Psyche: Jung, Pauli and the Kepler–Fludd Polemic,” in Brian Vickers, ed., *Occult and Scientific Mentalities in the Renaissance* (Cambridge, 1984), pp. 179–86, 201–7.
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