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ILLINOIS WESLEYAN UNIVERSITY

**MAGIC, MYSTICISM, AND MODERN MEDICINE:
THE INFLUENCE OF ALCHEMY ON SEVENTEENTH-CENTURY ENGLAND**

**A THESIS PAPER SUBMITTED TO THE FACULTY IN CANDIDACY FOR AN
HONORS BACHELORS OF ARTS DEGREE**

DEPARTMENT OF HISTORY

**BY
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[T]he historian of science can not devote much attention to the study of superstition and magic, that is, of unreason, because this does not help him very much to understand human progress. Magic is essentially unprogressive and conservative; science is essentially progressive; the former goes backward; the latter, forward.... There can not be much incentive to encompass that which is indefinite and to investigate the history of something which did not develop.¹

George Sarton
Introduction to the History of Science

In 1947, historian George Sarton questioned the place of alchemy in the history of science. He was not unlike many historians, who even attacked scholars of the subject, characterizing them as “fabulous creatures” who “seem to be under the wrath of God themselves” and who “become tintured with the kind of lunacy they set out to describe.”² For decades, critics fought hard to keep alchemy out of the history of science. Instead, the emphasis of the Scientific Revolution centered on the mathematical sciences, focusing mainly on the intellectual development from Copernicus to Newton and highlighting astronomy and the studies of motion at the expense of the biological and chemical sciences. It was not until 1945 that the positivism of the history of science was finally challenged by the German historian of medicine, Walter Pagel. In a short 4-page essay entitled, “The Vindication of Rubbish,” Pagel cautioned historians that interpretations “based on the selection of material from the modern point of view, may endanger the presentation of historical truth.”³ Instead of “selecting data that ‘make sense’ to the acolyte of modern science,” Pagel chose to focus on three

¹ George Sarton, *Introduction to the History of Science* (Baltimore: Williams & Wilkins, 1927-47), 1:19.

² Herbert Butterfield, *The Origins of Modern Science, 1300-1800* (New York: Macmillan, 1952), 98.

³ Walter Pagel, “The Vindication of Rubbish,” *Middlesex Hospital Journal*, (Autumn 1945), 2.

very different historical figures of the Scientific Revolution; Paracelsus, van Helmont, and Harvey.⁴ Paracelsus (1493-1541), who is often recognized as the father of Renaissance alchemy and naturalism, became the focus of Pagel's work. Through his research, Pagel was able to show that both the scientific and the "non-scientific" emerged "not as simply juxtaposed or as having been conceived in spite of each other" but as "an organic whole in which they support and confirm each other."⁵ By the 1950s, Pagel laid the foundation for important future studies to be made in the history of alchemy and magic.

Traditionally, historians of science have characterized alchemy as "pseudo-science." Scholars, such as Allen G. Debus, a historian at the University of Chicago, point out that the "works of Paracelsus and his followers are riddled with a mysticism and hermeticism that smacks more of the occult than of what we [historians] would call science."⁶ Not until the 1970s did historians of science begin to accept alchemy as a valid contributor to seventeenth-century medicine. Frances Yates was the first historian to explore the medical world of the alchemist in her book, *The Rosicrucian Enlightenment* (1979). In it, she refuted the idea that alchemy was wholly mystical, showing instead that during the sixteenth and seventeenth centuries numerous alchemists developed highly advanced scientific theories, many of which greatly affected the European medical community. At one point in her book, Yates even comes close "to

⁴ Walter Pagel, *William Harvey's Biological Ideas: Selected Aspects and Historical Background* (New York: Karger, 1967), 82.

⁵ Ibid.

⁶ Allen G. Debus, *Chemistry, Alchemy, and the New Philosophy: 1550-1700* (London: Variorum Reprints, 1987), 18.

insisting that the entire Scientific Revolution developed from Renaissance mysticism and magic.”⁷ Although aspects of her research were clearly exaggerated, her book was effective in heightening the importance of alchemy in the history of science. From her work, a new image of alchemy was born, one which was both modern and provocative. From the 1970s onwards, the importance of sixteenth-and seventeenth-century alchemy quickly became a highly controversial topic among historians of science. At last, alchemy was getting the attention it deserved.

Typically, it has been customary to define the Scientific Revolution in terms of a debate between the “ancients” and the “moderns.” In the medical community, the ancients were represented by the Galenists, who based their philosophy on the teachings of Galen, a Greek physician from the second century A.D. His medical philosophy taught that sickness was caused by an imbalance in a patient’s four humors; phlegm, choler, yellow bile and black bile. This then was often remedied by bleeding a patient, which was believed to restore harmony and balance back to a state of health. On the other hand, the moderns were represented by any emerging philosophy which came into direct conflict with ancient Galenic authority. In this sense, Descartes’s mechanical philosophy, Bacon’s experimental philosophy, and the new corpuscular philosophy of the seventeenth century were all challenges to the long-standing scholasticism of the Middle Ages and thus can be categorized as “modern.” In this sense, alchemy also can be categorized as part of the ongoing “modern”

⁷ Allen G. Debus, “Chemists, Physicians, and Changing Perspectives on the Scientific Revolution,” *Isis* 89 (1998), 66.

debate; it developed out of discontent with Galenic medicine in the sixteenth and seventeenth centuries and sought to replace many of its outdated practices with its own. Furthermore, alchemy was modern in the sense that it developed highly sophisticated medical theories which anticipated those in use today.

Recently, efforts by historians of science have focused more on continental alchemy and not enough on English alchemy. Allen Debus is one of few historians to examine Paracelsian medicine in seventeenth-century England. Yet even he fails to discuss some of the most startling advancements made by English alchemists during this era. Specifically, Debus does not discuss alchemical treatments of the plague and venereal diseases in the seventeenth century. This paper, by contrast, will concentrate on those treatments and show how alchemy was, despite its traditional characterization, quite modern in its medical philosophy and techniques.

The Eclipse of Alchemy in History

Many factors have led historians of science to underestimate the importance of alchemical and chemical philosophy in sixteenth- and seventeenth-century Europe. Recent evidence, however, shows that alchemy was just as vital to the development of modern medical practices as was Galenic medicine. In England, the demand for innovative medical cures during plague outbreaks in the 1650s heightened the importance of alchemy, thus elevating the role of the alchemist to a position of new respect in the English medical community. Initially,

the chemical therapy of the alchemists won acceptance in England by allying itself with Galenic medicine, not by overturning the ancient system as many alchemists attempted to do in other European countries.⁸ Nevertheless, by the end of the seventeenth century, many English physicians and surgeons had adopted the chemical remedies of the alchemists and discarded the more archaic humeral cures of the Galenists. Many historians of science, such as Frances Yates, however, rarely focus on alchemy's influence in England. Even fewer credit alchemy for many of the startling advances made in medicine during this period. Instead, the assimilation of these two systems has gone unnoticed due to the strange subtlety of this medical transformation. Furthermore, the positivist views of historians of science have led many to dismiss alchemy as unimportant because ultimately Galenic medicine and Cartesian mechanicalism triumphed. Nevertheless, in order to understand the complexity of developing medicine at this time, historians of science should not focus exclusively on the eventual success of the mechanical philosophy, but rather on the dialogue between the chemical and mechanical philosophies. This intellectual exchange fashioned the emergence of modern medical practices in the seventeenth century by forcing each philosophy to reevaluate its own system continuously. This ongoing debate between the two chief medical systems has now led Allen Debus to assert that the "resultant controversy between the Chemical and Mechanical philosophers was instrumental in defining the role of method, experiment, mathematics, and

⁸ Alchemical medicine developed quite differently on the Continent, where European alchemists sought to obliterate Galenic practices, which they viewed as Pagan and thus heretical. For more information on European alchemists, see Frances Yates, *The Rosicrucian Enlightenment* (London: Routledge & Kegan Paul, 1972).

even religion in the new science.”⁹ Consequently, only with a thorough examination of alchemical and chemical texts published in seventeenth-century England can the historian of science fully understand the complexity of developing medical practices during this time period.

The establishment of scientific societies throughout Western Europe also obscured the alchemists’ role in the development of seventeenth-century medicine. With the emergence of the *Académie Royale des Sciences* in Paris and the Royal Society in England in the 1660s, natural philosophy was well on its way to becoming a recognizable, modern science by the latter half of the seventeenth century. The Royal Society was particularly successful in organizing and dispersing innovative ideas to the greater part of the European scientific community. Only three years after it received its charter from Charles II in 1662, the Royal Society began publishing England’s first scientific journal, the *Philosophical Transactions*. By 1668, the *Philosophical Transactions* was as much a European journal as it was an English publication; its influence was far-reaching. Under the leadership of Henry Oldenburg, it became customary “for many European scientists as well as the English to report the results of their work to the Royal Society.”¹⁰ Once published, the scientist’s name, as well as his ideas, was quickly disseminated throughout Europe. At this point, historian Allen Debus explains, “modern scientific communication was born.”¹¹ Thus, given the enormous power the Royal Society had on developing science in seventeenth-

⁹ Allen G. Debus, *Chemistry, Alchemy, and the New Philosophy: 1550-1700* (London: Variorum Reprints, 1987), 16.

¹⁰ Rupert A. Hall, *From Galileo to Newton: 1630-1720* (London: Collins, 1963), 145.

¹¹ *Ibid.*, 146.

century England, it is important to understand the reasons why alchemical texts were generally not published in the *Philosophical Transactions*. Alchemists' exclusion from the Royal Society is one of the leading reasons why historians of science have overlooked the influence alchemical and chemical texts had on English medicine.

The establishment of the Royal Society brought with it scientific elitism for the first time in history. This elitism had the power of admitting some intellectuals while excluding others. Undoubtedly, the Royal Society was successful in bringing together many important scientific theories from all over Europe; however, many influential alchemical works were rejected by the Royal Society not because of their questionable validity, but because of the religious and political affiliations of many of the alchemists. With the Restoration of the monarchy in England in 1660, natural philosophy became highly political. Thus, the radical politics of many of the alchemists, who supported the Parliamentary cause during the English Civil War, put them at a disadvantage when trying to publish in a scientific society whose financial and political security depended on the King himself. Similarly, on the continent, the French Paracelsians, who for the most part identified themselves as Huguenots, were discriminated against in the *Académie Royale des Sciences*. Historians of science, however, have largely discussed the developing medical practices of seventeenth-century England in context of the journal literature and books published by Royal Society members. Consequently, historical views about this time period are skewed by the output of the established scientific elite.

Nevertheless, alchemical texts were being printed massively between the years 1550 and 1750. Although these works were not published by the mainstream scientific community, they were nonetheless read by many of the key scientific figures of this time, as evidenced by the voluminous responses written by men such as Mersenne and Francis Bacon against chemical therapy.¹² Even well into the eighteenth century, alchemical texts were being published in numbers that could rival those written by the elites of the scientific world. In John Ferguson's book, *Bibliotheca chemica* (1906), he notes the existence of over 500 alchemical works published in the eighteenth century alone. Additionally, many of these works, considered "pseudo-science" by several historians today, went through numerous editions, showing that these texts were not only read by many interested intellectuals in the seventeenth and eighteenth century, but that they were popular as well. Joseph Chambon's alchemical text, *Principes de physique* (1711), went through at least four editions before it finally went out of print in 1751. Thus, the demand for alchemical books was high in Europe at this time, and by only studying the journal literature of the scientific elite, historians of science have overlooked a very vital aspect of medical history.

Robert Fludd and Alchemical Philosophy

Admittedly, on the surface alchemy and the Paracelsian approach to nature seem anything but conducive to the growth of modern science. Many

¹² Bacon and Mersenne were not the only men to publicly condemn the mysticism of alchemical philosophy; countless other leading figures from this era also expressed similar views. These published critiques of alchemical medicine will be discussed later in this paper.

alchemical works are far too mystical to be categorized as valid scientific works. On the other hand, there are countless other sources which contain medical information in them that can be seen as highly sophisticated when compared to Galenic treatments of this time. In particular, the alchemists took a Neoplatonic view of the universe. Debus notes that this Neoplatonism appealed to an intellectual community which was trying desperately to overturn the scholasticism and Aristotelianism of the Middle Ages. In this sense, alchemy is not unlike Cartesianism or Baconianism, which also offered new approaches to natural philosophy. What distinguished Neoplatonism was its emphasis on mathematics and its mathematical conception of nature. For instance, Copernicus's search for "mathematical simplicity in his reorganization of the heavens," and Kepler's quest for a "new mathematical expression of the motions of the planets" all derive from this emerging Neoplatonic worldview in the sixteenth and seventeenth centuries.¹³

Alchemists, as well, adopted a Neoplatonic view of the universe; this then gave their system the basis it needed to make important medical discoveries in the seventeenth century. Take for example the alchemists' central belief in the macrocosm-microcosm analogy. In his book, *The English Paracelsians*, Debus explains that "macrocosm-microcosm relationship suggests that by the proper study of nature a method of cure for man's bodily ills might be found."¹⁴ In other words, within each man is a smaller universe analogous to the greater universe.

¹³ Allen G. Debus, *The English Paracelsians* (New York: Moffa Press, 1965), 18.

¹⁴ *Ibid.*, 22-23.

Through a critical study of nature, a physician could then apply that knowledge to curing the body.

The macrocosm-microcosm analogy ultimately allowed alchemists to make important discoveries in science by enabling them to apply seemingly non-medical scientific theories to medicine. Thus, those who accepted the macrocosm-microcosm analogy had no doubt that “the knowledge of the macrocosmic phenomena could be properly applied on the microcosmic level.”¹⁵ For example, in the course of his research, Debus details the works and life of English alchemist, Robert Fludd. He shows that when Fludd conducted experiments using a weather-glass (or thermoscope) in the 1630s, he then applied his findings to explaining the mechanics behind the human pulse and the value of urine analysis. Fludd observed that when hot air was blown into the weather-glass, the water in the column became depressed to its lowest degree. He writes, air “approacheth unto the nature of fire; for fire is said to be nothing else, but aire extreamly dilated.”¹⁶ Once the air in the column cooled, it thickened. These observations gave Fludd the means of explaining water levels in summer and winter. Fludd first began by comparing the passages between the northern and southern wells to the column of the weather-glass. He writes, “the fountains of all the world issuing from one sea, do seem to penetrate into the bowels of the

¹⁵ Allen G. Debus, “Paracelsian Medicine: Noah Biggs and the Problem of Medical Reform,” in *Medicine in Seventeenth Century England*, ed. Allen Debus (Berkeley: University of California Press, 1974), 34.

¹⁶ Robert Fludd, *Mosaical Philosophy: Grounded upon the Essential Truth or Eternal Sapience* (London: Humphrey Moseley, 1659; the first Latin edition appeared posthumously in 1638), 70. Please note that all quotes in this paper are copied verbatim from sixteenth- and seventeenth-century texts. Therefore, the spellings are original.

earth, and fill the generall veins thereof.”¹⁷ Therefore, “there is an evident relation between the fountaines of the northern hemisphear, and those of the southern....”¹⁸ From there, Fludd explained that it was logical to expect water levels to drop in the summer because of the “dilation of the air and pressure on the surface.”¹⁹ Conversely, the contraction of air in the cold of winter allowed the water levels to rise, just as he had observed in his experiments using the weather-glass.

According to the earlier views of Aristotle, the low water levels of wells and rivers during the hot summer season were caused by evaporation. The sun drew vapors from these water sources into the atmosphere. Nevertheless, Fludd observed that if this theory were to be true, there would also be more clouds in the summertime and consequently more rain. Thus, Fludd applied his knowledge of air depression to refuting the old Aristotelian belief concerning this phenomenon.

If the weather-glass could explain water levels in the macrocosm, Robert Fludd then believed it could explain certain medical phenomena about man, the microcosm. True to form, therefore, Fludd prepared two treatises on diagnostic method in 1631, both of which relied heavily on his work done with the weather-glass. Besides making tremendous use of the macrocosm-microcosm analogy, both treatises also exemplify the breadth and complexity of alchemical beliefs. In them, Fludd combines both Galenic theories and alchemical theories in order to draw conclusions about the mechanics of the human pulse and the value of urine

¹⁷ Ibid., 109-110.

¹⁸ Ibid.

¹⁹ Debus, *The New Philosophy*, 13: 9.

analysis. For example, traditional Galenic medicine relied heavily on the qualities of hot and cold in diagnosing diseases. Fludd also adopted this belief because this is exactly what the weather-glass measured. Furthermore, Fludd rejected the Paracelsian belief that “like cures like.” Although Fludd’s treatises were purely theoretical, he did believe the weather-glass would ultimately aid a physician in diagnosing diseases. Specifically, he hoped “it would provide a numerical guide to disease,” thus enabling the physician to prescribe a corresponding chemical medicine.²⁰

Robert Fludd’s experiments using the weather-glass allowed him ultimately to make complex discoveries about the mechanics of the human pulse. Fludd, who was always skeptical about the Galenic method of using the pulse to determine the presence of a fever, also rejected the ancient view that the pulse worked through the arteries alone. Instead, Fludd insisted that the pulse resulted “from the dilation and contraction of the heart which moves the arteries.”²¹ This idea Fludd related back to the analogy between light and dark, which also were associated with coldness and warmth. By doing so, Fludd was able to use his discoveries about the expansion and dilation of air in the weather-glass in order to draw conclusions about the origins of the human pulse.²² Fludd discovered that when a bladder-like substance was placed at the end of the weather-glass and the other end was tied tightly with rope, the expansion and contraction of the water levels reflected the effect of coldness and warmth in the action of a pulse.

²⁰ Debus, *The New Philosophy*, 13: 130.

²¹ *Ibid.*, 13: 134.

²² How Robert Fludd drew the specific analogy between light/dark and a human pulse is beyond the complexity of this paper. For more information on this subject, see Allen G. Debus, *Chemistry, Alchemy, and the New Philosophy: 1550-1700* (London: Variorum Reprints, 1987) 13: 135-140.

As an alchemist, Fludd took the macrocosm-microcosm analogy a step further. He believed the rate of a pulse could be described in terms of musical notation. Thus, it became possible for Fludd to relate “the weather-glass both to the rate of the pulse through his knowledge of music – and to the expansion and contraction of the arteries through the bladder experiment.”²³ Inevitably, the macrocosm-microcosm analogy led to his highly modern conclusions concerning the mechanics of the human pulse.

Similarly, Fludd was able to apply his knowledge of the weather-glass to methods involving urine analysis. Unlike many Galenists, who dismissed urine as mere bodily excrement, Fludd believed urine could aid a physician in diagnosing illness in patients. According to Fludd, urine formed “from the vital spirit of air through blood” and thus was connected to atmospheric winds.²⁴ In this sense, the alchemist characterized urine as a “microcosmic rain prepared from blood.”²⁵ Fludd associated more pallid urines with coldness and therefore believed they were weightier than highly colored urine samples which reflected “the rarefaction of summer heat.”²⁶ Fludd described the color of urine in corpuscular terms, believing that the intensity of the color was caused by the presence of sulphur in the urine particles. When sulphur is hidden in the center of the particle, urine appears pale and subsequently is less weighty. Conversely, when the particles are exposed to larger amounts of heat, the motion of the internal sulphur “becomes more vigorous,” making the salt redden and causing the sulphur to

²³ Debus, *The New Philosophy*, 13:138.

²⁴ *Ibid.*, 13: 134.

²⁵ *Ibid.*

²⁶ *Ibid.*

extend “beyond the circumference of the particle.”²⁷ This effect, Fludd believed, ultimately produced a high fever, indicated by the intense color of the urine. Upon developing these theories, Fludd accordingly added a scale of the color and consistency of urine to the graduated column of his weather-glass. Although ultimately his theories were proven wrong, it should be noted that alchemists such as Fludd were recognizing the value of urine analysis long before Galenic physicians did. Again, the macrocosm-microcosm analogy allowed Fludd to push beyond the set limits of Galenic medicine and opened the way for him to develop highly sophisticated medical theories.

Alchemical Treatments of the Plague and Venereal Diseases

The concept of active principles and the macrocosm-microcosm analogy in alchemical philosophy undoubtedly influenced alchemists and non-alchemists alike. However, alchemy’s greatest achievements in the seventeenth century were made in medical science. Most historians of science, though, have concentrated on the medical advancements made by alchemists in Continental Europe. Only one historian, Allen Debus, has examined English alchemy comprehensively. Still, while Debus discusses the experiments and works of Robert Fludd and other English alchemists in detail, he fails to discuss some of the most startling advancements made by alchemists in the area of venereal diseases and the plague. I will now proceed to demonstrate that it was these

²⁷ Ibid.

treatments and diagnostic techniques which made alchemists more advanced than Galenists in the history of medicine.

Previously, alchemists were popular in royal courts because of their claims to be able to turn base metals into gold. The search for the Philosopher's Stone, an imaginary substance famed for its ability to make its owner rich, epitomized the mysticism and lore that ultimately gave alchemists their unfair characterizations as simple magicians. In reality, alchemy was far more complex than it appeared, and while many men devoted their efforts to a continuous search for the legendary stone, many more alchemists devoted their time to chemical medicine.

The Paracelsians' development of a chemical philosophy during the Renaissance laid the intellectual framework for alchemical medicine to emerge as a serious contender to Galenism during the seventeenth century. After his death in 1541, Paracelsus's books began to circulate throughout Europe leading to a growing interest in chemistry amongst intellectuals who had previously denounced alchemists. The Paracelsians sought to replace the heretic "logico-mathematical" method of Aristotle with a chemical science based on religion and nature. In particular, Paracelsus questioned the four elements of Aristotelian philosophy: earth, fire, water, and air. In its place, Paracelsus introduced a new elemental system using salt, sulphur, and mercury. This he coined the *tria prima*. As Allen Debus asserts in his book, *Man and Nature in the Renaissance*, "The introduction of a new elemental system thus ran the risk of calling into question

the whole framework of ancient medicine and natural philosophy.”²⁸

Paracelsus’s intentions were clear: only through a chemical interpretation of medicine could a physician hope to cure a patient. Although Paracelsus did not intend for his new elemental system to replace the old Aristotelian one completely, it nevertheless did cause a stir in the medical community by illuminating the problems that the old Aristotelian elemental system entailed. Furthermore, the Paracelsians’ development of chemistry during the sixteenth century helped them emerge as a serious challenger to the old Aristotelian school of thought in the subsequent century—once again spurring an intellectual environment that allowed for debate and discussion leading into the Scientific Revolution.

Lester King, historian of science at Oxford University, claims that by the end of the seventeenth century “British medicine differed markedly from what it had been at the beginning of that century.”²⁹ Galenism, which was dominant in 1600, had seemingly disappeared by 1700. In his essay, “The Transformation of Galenism,” King examines the reasons why Galenic medicine was vanquished by the eighteenth century, attributing its virtual disappearance mainly to the emergence of Cartesianism and Baconian empiricism. It is my contention, however, that a more important reason for the decline of Galenism in seventeenth-century England was caused by the rise of alchemical medicine. By 1650, England was in crisis—the bubonic plague had killed off a large portion of

²⁸ Allen G. Debus, *Man and Nature in the Renaissance* (Cambridge: Cambridge University Press, 1978), 23.

²⁹ Lester S. King, “The Transformation of Galenism,” in *Medicine in Seventeenth Century England*. Ed. Allen G. Debus (Berkeley: University of California Press, 1974), 7.

its population and showed no signs of stopping. As the epidemic reached its peak in 1651, there was a public outcry for new, innovative treatments. Galenic medicine was simply not producing effective treatments for the plague. Furthermore, the sixteenth and seventeenth centuries brought with them new and violent diseases, such as syphilis and gonorrhea. While Galenists continued to place great emphasis on “curing” fevers (which they believed were diseases themselves and not merely symptoms of a greater underlying problem), alchemists turned their efforts towards finding cures for the diseases themselves. Their successes in producing treatments for these venereal diseases were rooted in their philosophy, which was drastically different from Galenic medical theory.

One of the most startling differences between Galenic physicians and alchemical physicians in seventeenth-century England was their differing concepts of disease. Galenists traditionally believed that illness was caused by an imbalance in a patient’s four humors (phlegm, choler, yellow bile, and black bile). Consequently, one popular, but extremely ineffective method of “curing” a patient was through blood-letting. Most Galenists believed that by bleeding a patient, the body’s humeral balance would be restored and the patient’s health would return. Galenic philosophy taught that the excess of blood or corrupt humors would cause blockages in smaller blood vessels, thus restricting the circulation of blood throughout the rest of the body. Thomas Willis, an English Galenic physician in the mid-seventeenth century, supported blood-letting and

deemed it a “celebrated remedy.”³⁰ Uncharacteristically, however, he, unlike many Galenists, did recognize some of the dangers in this treatment, cautioning that blood-letting “most often fails... because reason holds not at all, one which the Ancients depended, that the Arterious Blood was different from the Venous, or that in the Veins, and was in greater fault and more rageing, and therefore to be let forth.”³¹ Nevertheless, most Galenists upheld the practice of blood-letting and believed it the best way of curing a patient.

Alchemists, on the other hand, were extremely critical of this technique. Because they believed that “diseases were often due to external causes” and were “localized in particular organs,” blood-letting held no place in their medical philosophy.³² Instead, most alchemists sought to cure patients through the administration of a chemically prepared medicine. Girolamo Fracastoro,³³ a non-traditionalist Italian physician who embraced many alchemical ideals, formulated a germ theory in the sixteenth century which preceded Pasteur’s by three hundred years. In 1546, Fracastoro set forth a theory that diseases were caused by the transference of *seminaria*, or seeds, in his treatise *De Contagione*. He also reiterated his beliefs that diseases could be transmitted by direct contact, by clothing and sharing utensils, and by contagion at a distance with diseases such

³⁰ Thomas Willis, *Dr. Willis’s Practice of Physick. Being the Whole Works of that Renowned and Famous Physician: Containing these Several Treatises, viz. II. Of fevers*. (London, 1684) Translated from the Latin edition of Dr. Greenhill (London, 1848, 1850). (Eighteenth Century Medicine), 78.

³¹ Willis, *Dr. Willis’s Practice of Physick*, 120.

³² Debus, *English Paracelsians*, 18.

³³ Girolamo Fracastoro (1483-1553) was born in Verona, Italy. He is also famous for introducing the name syphilis and describing that particular disease. Syphilis first appeared en masse in 1495 in Naples. Fracastoro attributed the spread of syphilis to *seminaria*.

as smallpox and the plague.³⁴ He also maintained that *seminaria* could spread through exhalation. Once inside the body, the seeds multiplied and took over. Fracastoro's germ theory was shared by many alchemists, who sought to prepare medicinal concoctions to cure these diseases.

Admittedly, many alchemists disagreed on several key medical issues. Nevertheless, almost all alchemists recognized the need to introduce experimentation and chemical remedies to the older medical practices of Western Europe. The appearance of syphilis in 1495, which was then named and described by the same Italian Fracastoro in 1509, and the resurgence of the bubonic plague in the mid-seventeenth century, heightened the need for new cures during this era. Most alchemists attacked Galenists for applying ancient methods to diseases that only just came into existence. While Galen himself was a great experimenter—always adding to the vast knowledge he had already divulged to the rest of the world—his followers were not. Instead, they read his texts like scripture; they rarely questioned his assertions and seldom performed new experiments which would enable them to add to his medical volumes. Essentially, Galenic medicine stopped being progressive after Galen's death.

An English Paracelsian, John Hester, criticized the backwardness of the Galenists in his 1590 translation of the Dutch alchemist, Phillip Hermann's work, a *Treatise teaching howe to cure the French-Pokes*. In it, Hester argued:

Now that the diseases of the French Pocks was neyther knowne to them, nor to theyr successors for many yeeres... is a matter so far out of question, that it refuseth all shew of disputation, and

³⁴ Alistar Crombie, *Medieval and Early Modern Science* (Cambridge: Harvard University Press, 1952), 2:284.

therefore as this latter age of ours sustaineth the scourge thereof, a iust whyp of our lycentiousness, so let it (if ther be any to be had) carry the credite of the cure, as some rewarde to some mens industries.³⁵

This attitude reflected a newfound confidence emerging already in the Renaissance. Challenging authority was in vogue. While philosophers were questioning the authority of Aristotle, and political theorists were questioning the authority of the monarch, alchemists were questioning the authority of Galen in an era that had to deal with new, deadly diseases such as syphilis and the plague.

Nevertheless, as Allen Debus points out, as long as disease was attributed to an imbalance of a patient's four humors, "effective medical diagnosis hardly existed."³⁶ To take just one example, Galenists generally did not examine their patients, believing that an examination for the most part was unnecessary. Instead, diagnosis was most commonly based on "water-casting"—a study which involved a patient's urine and was then brought to a specialist in the "art" for further analysis. Unlike Paracelsus and Robert Fludd, however, who suggested that only through a chemical examination could valuable information be obtained from urine specimens, Galenists believed urine was filtered overflow of blood and thus judged a patient's health according to the quantity, not the quality, of the sample. Because "water-casting" was the primary method of diagnosis used by Galenists in the seventeenth century, they were generally ineffective at pinpointing and treating specific diseases.

³⁵ Phillippus Hermanus, *An excellent Treatise*, trans. John Hester (London: 1605; reprint, Oxford: Blackwell's Publisher, 1975), preface.

³⁶ Debus, *The English Paracelsians*, 31.

Alchemists, on the other hand, were far more effective in diagnosing disease. As mentioned earlier with the case of Robert Fludd, urine analysis was a technique practiced by many skilled Paracelsians in England and proved invaluable in aiding a physician in his examination. A “chemical dissection” of urine was made possible through distillation. The fractions obtained from this procedure (as well as the residue) “was to reveal the type of disease as well as its location in the body.”³⁷ Even more startlingly, however, was alchemists’ use of weight in urine analysis. According to Paracelsus, the lowest weighted specimens contained the greatest amount of salt, while the highest weighted samples contained very little salt and had lower mercurial levels. The technique of “weighing” urine, first conceptualized and popularized by alchemists, is still used in the medical profession today. Again, alchemists proved modern in their diagnostic techniques when compared to Galenists, who did not even routinely examine patients.

Alchemists also distinguished themselves from Galenists by differentiating between symptoms and diseases. The ability to distinguish between the two allowed alchemists to focus more on treating particular diseases and less on alleviating symptoms, which ultimately did not cure a patient of his ailment. As mentioned earlier, while most Galenic physicians believed a fever was a disease itself, most alchemists recognized that a fever usually indicated the presence of a more serious disorder. Friedrich Hoffman, a Galenic physician born in 1660, illustrates the typical Galenic habit of categorizing symptoms as diseases. In his work, *Fundamenta Medicinae*, first published in 1695 and later reprinted in his

³⁷ Ibid., 157.

collected works, *Opera Omnia* (1741-50), Hoffmann draws from Galenic works. More specifically, Hoffmann elaborates on the nature of fevers in chapter 3 of his work, writing that “no disease is so universal” as a fever.³⁸ He goes on to describe “the fever,” sorting it into two categories—benign and malignant. He writes that the “benign fevers are brought about by a violent motion” or “an abnormal and too abundant influx of spirits into the heart,” but nowhere does he write that fevers are the effects of other diseases.³⁹ In fact, whenever he comes close to this idea, he seems to assert that diseases such as smallpox and measles are symptoms of a fever, not the other way around. He writes, a “continued fever occurs either with or without exanthemata [skin eruptions]; the exanthemata are either smallpox, measles, petechiae, or purpura.”⁴⁰

Hoffmann also identifies sleepiness as a disease in his *Fundamenta Medicinae*. In chapter 2 of his discourse, he cautions that “Excessive sleep impairs the spirituous property of the blood and humors and occasions a slow and torpid movement in the blood and spirits.”⁴¹ Again, Hoffmann’s adherence to the Galenic belief that sickness is caused by an imbalance of the humors does not allow him to conceptualize diseases as localized entities residing in specific organs. Therefore, Hoffmann categorizes everything, including symptoms, as diseases. Hoffmann ends his chapter by warning the reader that “Anger is a brief madness,” but can serve as a “remedy for cold states.”⁴² Although admittedly this

³⁸ Friedrich Hoffman, *Fundamenta Medicinae*, trans. Lester S. King (London: Macdonald, 1971), 46.

³⁹ *Ibid.*, 52-53.

⁴⁰ *Ibid.*, 53.

⁴¹ *Ibid.*, 46.

⁴² *Ibid.*, 47.

text is important in understanding Galenic medicine in the seventeenth century, when compared to many alchemical works during this same period, *Fundamenta Medicinae* appears out-dated and archaic.

Thomas Nedham, an English surgeon at St. Thomas's Hospital in London in the 1670s, turned to alchemy later in his medical career in order to discover new methods for treating venereal diseases. In his *Treatise of a Consumption and the Venereal Disease*, he slyly criticizes traditional physicians who have been taught Galenic rhetoric by stating that the "most learned Man bred in the Law, is not always the best Lawyer."⁴³ He further asserts that a physician "bred up in the Study of Physick, without a true Notion of Method in Practice, Medicines, and Diseases joined with Experience is but the greater Instrument of Michief...."⁴⁴ Nedham's constant use of the word "experience" is not an anomaly in his alchemical text; it would be, however, if this were a Galenic treatise. In fact, in the first 10 pages of his discourse, Nedham uses the word "experience" 22 times, referring mostly to the numerous experiments he and other alchemists performed in order to arrive at the conclusions they published. For example, when refuting the Galenic belief that contraries cure, Nedham writes that this is "neither true, nor telling" and moreover it is "not reconcilable to Reason or Experience," meaning his own experiments did not yield such results.⁴⁵ Unlike Hoffmann's *Fundamenta Medicinae*, which is a compilation of descriptions of

⁴³ Thomas Nedham, *A Treatise of a Consumption and the Venereal Disease: the Signs or Symptoms of the Venereal Infection with Various Methods of Cure*. Printed by T. Nedham in 1700. [book on-line] (Early English Books Online, accessed 7 October 2003); available from <http://www.lib.umi.com/eebo>, 10.

⁴⁴ *Ibid.*, 11.

⁴⁵ *Ibid.*

“diseases” and cures, Nedham’s discourse backs his assertions with lengthy discussions about the experiments from which he drew his conclusions. In this sense, Nedham’s alchemical work is a precursor to the modern age of experimentation.

Nedham’s discourse exemplifies the idea that alchemists were not just treating “symptoms” in the seventeenth century, but attempting to cure diseases. In his *Treatise*, he criticizes Galenic treatments of syphilis, noting that these “cures” often produced side-effects much worse than the disease itself. For instance, he wonders how vomiting “comes to be a Remedy by Art” when questioning a Galenic treatment of the French-Pocks which deliberately caused nausea in a patient.⁴⁶ Galenists tended to concoct herbal treatments that often incorporated upwards of 100 different herbs, the idea being that one of those herbs had to have a “curing” effect on the ailment. Not surprisingly, those herbal treatments often produced negative effects, and sometimes even fatal effects, on the patient’s health. Nedham, like most alchemists, treated his patients using a chemically prepared medicine. Unlike Galenic herbal remedies, however, these medicines usually consisted of only four or five ingredients.

In another work written by Charles Peter—a former London surgeon in the 1650s who later adopted alchemical practices—he claims to have concocted an “anti-venereal” pill which when taken could cure the ever-deadly disease, gonorrhea. In his discourse, *Observations on the Venereal Disease with the True Way of Curing the Same* (1652), Peter recognizes that there are various stages of gonorrhea—a concept which eluded his Galenic colleagues. He writes, “men

⁴⁶ Nedham, *A Treatise of a Consumption and the Venereal Disease*, 8.

ought to consider, that there is degrees of Infection, and that the ill habit of the Body, doth very much contribute to the afflicting of the Patient....⁴⁷ He goes on to explain that the dosage of his medication, therefore, varies according to the level of advancement of that particular disease. He writes that at its most advanced stage, “one Box of my Antivenereal Pills” will cure the patient of gonorrhea. However, he also admits that “some [stages] are so inveterate, that they will imploy, both Patient and Undertaker in the Cure.”⁴⁸ Thus, while Peter recognized the limits of his treatments, he continued to teach that venereal diseases develop in stages and that the level of seriousness should then correspond with the volume of medication. This is a very modern medical idea, one which was not shared by seventeenth-century Galenists.

Peter also describes the disease, French pocks, in a very modern manner. He claims that the “breath of a Pockery person is infectious” and that a mother can pass the illness to her baby through breast-feeding. He writes that “Disease is very often got by lactation” and advises “those that put their young Children to Nurse, to be wary in chosing of Nurses.”⁴⁹ Peter also noticed that “bleeding...increased the Fever [of a patient], rather than abated it” and refuted the Galenic belief that only through copulation could the pocks spread, showing instead that it could even “be gotten by kissing, especially if either party have an Ulcer in the Throat.”⁵⁰ Thus, through these writings, Peter asserts that pocks are

⁴⁷ Charles Peter, *Observations on the Venereal Disease, with the True way of Curing the Same*. Printed by D. Millet in 1652. [book on-line] (Early English Books Online, accessed 7 October 2003); available from <http://www.lib.umi.com/eebo>, 58-59.

⁴⁸ Peter, *Observations on the Venereal Disease*, 58.

⁴⁹ *Ibid.*, 7-8.

⁵⁰ *Ibid.*, 5.

most commonly spread through direct contact with the bodily fluids of an infected person. He even cautions that if the disease is not treated properly, the “Distemper becomes more inveterate” and can eventually “seize the Liver.”⁵¹ Because Galenists believed venereal diseases were caused by humeral imbalances, they could not conceive of the localization of bacteria or viruses in particular organs, as Peter does in his discourse. Again, alchemical philosophy proved more advanced in its views of diseases and contagion than did Galenic medicine.

As alchemical ideas made their way into the mainstream medical community during the seventeenth century, an ever-increasing number of pharmacists and surgeons began calling for “new, more potent medicines” with “ingredients and formulas other than those described centuries earlier by Dioscorides and Mesue.”⁵² Joseph Duchesne, a French Paracelsian whose books were very influential in England, advocated the use of chemical medicine over herbal treatments. His experiments showed that most mineral waters contained “niter, alum, vitriol, sulphur, pitch, antimony and lead;” these chemicals, he argued, would in turn prove useful in treating the sick.⁵³ The usage of chemical medicines, therefore, became popular among alchemists and non-alchemists alike; even many Galenists resorted to prescribing alchemical treatments by the end of the seventeenth century, as Allen Debus points out in

⁵¹ Ibid., 10.

⁵² Allen G. Debus, *The Chemical Philosophy: Paracelsian Science and Medicine in the Sixteenth and Seventeenth Centuries* (New York: Science History Publications, 1977), 1:115.

⁵³ Ibid.

volume I of his book, *The Chemical Philosophy*.⁵⁴ Nonetheless, as the English alchemist Bostocke shows in his book, *Auncient Phisicke* (1585), the true Paracelsian could be distinguished by his “careful attention to dosage and his use of the chemical art to extract only the valuable essence of dangerous minerals.”⁵⁵ Thus, alchemists’ emphasis on dosage as well as their advocacy of chemical medicines placed them among the more modern physicians of the seventeenth century since both these ideas prevail today.

By 1700, English medicine had changed markedly from what it had been a century before; new chemically prepared remedies had been introduced to the medical community through the writings of such alchemists as Brunschwig, Villanova, and Gesner, to name a few. As Debus argues, these “authors or compilers had not sensed any conflict with Galenic medicine” at first. Consequently, many physicians “saw no reason why any controversy should develop” if they “utilized these cures as auxiliary to the traditional ones.”⁵⁶ For instance, George Baker, a celebrated London surgeon in the latter half of the seventeenth century, was amongst many important Galenists to convert to the new medical system by the close of the century. He would go on to publish and translate many Paracelsian texts for his English colleagues, thus exemplifying this general attitude among traditional physicians in accepting alchemy as a viable medical science in the 1600s.⁵⁷ Furthermore, the *Treasure of Euonymus*

⁵⁴ Debus demonstrates how Galenism and alchemy merged in England by the close of the seventeenth century. Two books by Debus are useful here: *The English Paracelsians* (1965) and *The Chemical Philosophy: Paracelsian Science and Medicine in the Sixteenth and Seventeenth Centuries* (1977).

⁵⁵ Quoted in Debus, *English Paracelsians*, 81.

⁵⁶ *Ibid.*, 80.

⁵⁷ *Ibid.*, 177.

(1559) by Gesner was the first volume of chemical remedies, both organic and inorganic, to be widely accepted in England as a valid alchemical medical text. Thus, while Continental physicians were often forced to choose between the two rival systems, in England a physician often treated patients utilizing both alchemical and Galenic medicine.

Undoubtedly, each system had its flaws. A general distrust of magic prevailed throughout the seventeenth century; however, many Galenic physicians were compromising their own beliefs by the end of the 1600s and instead adopting alchemical treatments as part of their own system. The resurgence of the plague as well as the appearance of venereal diseases, specifically gonorrhea and syphilis, heightened the importance of alchemists in the seventeenth century since Galenists were not discovering effective cures for these ailments. Admittedly, alchemists never did find a definitive cure for any of these diseases; however, their use of chemical remedies and their advanced diagnostic methods elevated them into a position where they could then discover better approaches to alleviating symptoms of these sicknesses. Similarly, alchemical philosophy was more akin to modern medicine since it advocated the belief that diseases “were often due to external causes” and were “localized in particular organs.”⁵⁸ This belief allowed alchemists to conceptualize disease in terms of something similar to “germs,” as embodied in Girolamo Fracastoro’s 1546 treatise, *De Contagione*. By the close of the seventeenth century, alchemists were practicing more modern diagnostic techniques. This allowed them a better understanding of a patient’s state of health. As a consequence,

⁵⁸ Debus, *The English Paracelsians*, 18.

alchemists' treatment methods were more promising than Galenic methods, which relied primarily on blood-letting as a "cure" during this period. Although alchemists were unable to offer a cure for these diseases (indeed this would have to wait for a more advanced medical era), their efforts did produce valuable medical discoveries which were ultimately adopted by other physicians in England by the close of the seventeenth century.

Alchemy and Major Scientific Figures

What I have demonstrated above with respect to the influence of alchemical medicine squares with what other scholars have shown regarding influence of alchemy on other major figures of the Scientific Revolution. Beginning in the sixteenth century and continuing on into the seventeenth century, alchemical ideas invaded "mainstream" science. Specifically, the alchemical relationship between the universe (the macrocosm) and man (the microcosm) influenced men who have traditionally been characterized by historians of science as products of Cartesian Mechanical philosophy. For example, Italian historian of science, Paolo Rossi, contends that William Harvey was influenced by alchemy; this philosophy in turn shaped his discoveries concerning the circulation of blood around the heart. Evidence for this claim can be found in Harvey's book, *De motu cordis* (1628), in which he draws analogies between the circulation of the blood and the circulation of waters in the formation

of rain.⁵⁹ To characterize Harvey's discovery as Galenic, therefore, is to deny very basic aspects of his work. Rossi continues to argue that although the Aristotelian belief in the divinity of natural circular motion drew Harvey initially to study the circulation of blood in the heart, he also recognized that the motion which (he believed) united the heavenly bodies also could be responsible for preserving harmony inside the body.⁶⁰ The distinction between the macrocosm and the microcosm is evident here; only through a circular regenerative movement of the blood through the heart could the body sustain life, and only through that same motion could the universe remain ordered.⁶¹ He writes in defiance of Galenic beliefs:

At length, by using greater and daily diligence and investigation, making frequent inspection of many and various animals, and collating numerous observations, I thought that I had attained to the truth, that I should extricate myself and escape from this labyrinth, and that I had discovered what I so much desired, both the motion and the use of the heart and arteries. From that time I have not hesitated to expose my views upon these subjects, not only in private to my friends, but also in public, in my anatomical lectures....⁶²

Furthermore, Rossi shows how Harvey insisted that the blood was the vital principle, or *anima*, in the body, again going against Cartesian philosophy which disallowed for active principles in a mechanical universe. Similarly, Rossi argues

⁵⁹ Paolo Rossi, *The Birth of Modern Science* (Oxford: Blackwell Publishers, 2000), 159.

⁶⁰ *Ibid.*

⁶¹ Kepler ultimately rejected the Aristotelian idea that circular motion was divine. His discovery that the planets moved in ellipses gave rise to Kepler's 3 laws of planetary motion between 1609 and 1619. Nevertheless, many natural philosophers in the seventeenth century still upheld the divinity of natural circular motion.

⁶² William Harvey, *Exercitatio anatomica de motu cordis et sanguinis in animalibus: An English Translation with Annotations*, trans. Chauncey D. Leake (London: Charles C. Thomas Pub Ltd, 1978), 14.

that Harvey saw the heart as the “sun of the microcosm.”⁶³ This idea, as well, concurs with arguments made by other historians of science that Harvey himself was greatly affected by seventeenth-century alchemical philosophy

The belief in active principles was also an alchemical notion—one which arose from its Neoplatonic view of the universe. While Harvey was undoubtedly influenced by the macrocosm-microcosm analogy, William Gilbert was attracted to the idea of *anima* in the workings of magnetic forces. Gilbert even pays homage to the magical tradition by devoting the whole first chapter of *De Magnete* (1600) to reviewing important works on natural magic. Historians, such as Rossi and Debus, show how alchemical ideas ultimately led Gilbert to distinguish between electrical and magnetic attraction; this was inarguably his single most important contribution to modern science. Because Gilbert’s experiments were grounded in magic and vitalism (an idea which had no place in the Cartesian mechanical universe), matter was both psychic and alive in Gilbert’s studies.⁶⁴ While electrical attraction occurred through material effluvium, magnetic attraction was a spiritual force which originated from a “unique and peculiar” entity.⁶⁵ Gilbert believed this entity was present on all globes, “the sun, moon, and stars,” and he identified it as “primary energy.”⁶⁶ Debus demonstrates how the notion of *anima*, or active principles, was also evident in *De magnete*; Gilbert wrote that the entire universe was alive; “all globes, stars and even this glorious Earth have always been ruled by their own souls which have also been

⁶³ Rossi, *Modern Science*, 159.

⁶⁴ Debus, *English Paracelsians*, 87.

⁶⁵ William Gilbert, *De Magnete*, edited by P. F. Mottelay (New York: Dover, 1958), 105.

⁶⁶ *Ibid.*, 309.

responsible for their self-preservation.”⁶⁷ Again, this idea of active principles in the universe ultimately allowed Gilbert to discover the difference between electrical and magnetic energy. Furthermore, Gilbert established that the Earth itself was a magnet with magnetic fields at the North and South poles. Previously, the North and South poles were assumed to be geographical points, but through his studies in magnetism, Gilbert showed that they were both physical points as well. As respected historians of science now argue, these discoveries would likely have never materialized if Gilbert had not adopted many alchemical beliefs into his own scientific philosophy.

Still, probably the most startling influence alchemy had on a major figure of the Scientific Revolution was on Sir Isaac Newton. Most historians, however, have characterized Newton as the epitome of all that was scientific in the seventeenth century. He was Reason’s embodiment, a man who was “beyond the baser mundanities of human existence” and who single-handedly brought the old world into the modern scientific era.⁶⁸ These hagiographic accounts of Newton’s life began shortly after his death when friend and biographer, William Stuckeley, set out to write his *Memoirs of Sir Isaac Newton’s Life* in the 1720s. Stuckeley saw Newton as a “demigod, almost immortal and utterly without fault.”⁶⁹ This image prevailed for over three centuries. Only recently have some historians of science presented a more accurate picture of Newton, the scientist *and* alchemist.

⁶⁷ Ibid., 310.

⁶⁸ Michael White, *Isaac Newton: the Last Sorcerer* (London: Harper Collins Publisher, 1997), 1.

⁶⁹ Ibid.

In 1936, distinguished economist and Newton scholar, John Maynard Keynes, purchased a collection of the famed physicist's papers at an auction at Sotheby's. The papers, deemed to be of "no scientific value" by Cambridge University ten years prior, revealed a new side of Newton which had previously been ignored by historians. Keynes presented his findings to the Royal Society in 1942 when he argued that Newton was not the first scientist of the modern era, but the "last wonder-child to whom the Magi could do sincere and appropriate homage."⁷⁰ A historical controversy was born.

Keynes's collection consisted of a vast library of alchemical papers and notebooks, all belonging to the renowned scientist. Also mixed among these texts were papers written by Newton himself on the study of Biblical prophecy and natural magic. All in all, Newton actually composed more pieces on alchemy and hermeticism than he did on physics.⁷¹ The historical inaccuracy regarding Newton's career, therefore, dates back to his very first biographers. One historian, Sir David Brewster, in his *Memoirs on the Life, Writings, and Discoveries of Sir Isaac Newton* (1855) does mention his alchemical interests briefly; however, Brewster ends this discussion by trivializing this work as "the obvious production of a Fool and a Knave."⁷² Thus, the image of Newton the alchemist died shortly after his own death in 1727.

⁷⁰ Maynard Keynes, "Newton the Man," in Royal Society, *Newton Tercentenary Celebrations* (Cambridge: Cambridge University Press, 1947), 27-34.

⁷¹ For more information on Newton's alchemical work, see Chapters 2, 3, 7, and 11 in Michael White's book, *Isaac Newton, the Last Sorcerer* (London: Harper Collins Publisher, 1997).

⁷² David Brewster, *Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton* (Edinburgh, 1855), 2: 372.

After Keynes's address to the Royal Society in 1942, however, historians of science began reevaluating Newton's life. Michael White, a Newton scholar, recently published a book which examines in detail the impact alchemy had on Newton's scientific discoveries. Specifically, White shows how the notion of active principles fashioned Newton's ultimate conception of gravity. In the 1670s, before his publication of the *Principia*, scientists believed that gravitational force was caused by ether, which acted as a corporeal medium that helped maintain planetary motion. Although Newton himself subscribed to this belief, by the time he had published his masterpiece in 1687, Newton had "completely rejected the traditional image of the ether in favour of gravity operating by 'attraction at a distance.'"⁷³ His acceptance of the alchemical notion of active principles led him to a radical reassessment of how gravity operated by the early 1680s. In fact, Richard Westfall, a respected historian of science at Cambridge University, argues that Newton "could not have visualised attraction at a distance had it not been for his alchemical work" done years before.⁷⁴ Although this is a bold claim to make, it is doubtful any serious historian after studying Newton's alchemical work would argue that alchemy had no impact on his conceptualization of gravity.

By tracing the evolution of Newton's thoughts concerning gravity between 1672 and 1687, White concludes that "we can see how he came to perceive gravity as operating by action at a distance, made possible by a form of *active*

⁷³ White, *Last Sorcerer*, 205.

⁷⁴ Michael White asserts this on page 205 in chapter 9 of his book, *Isaac Newton: the Last Sorcerer*. The actual claim made by the historian can be found in Richard Westfall, "Newton and Alchemy," in Brian Vickers (ed.), *Occult and the Scientific Mentalities in the Renaissance* (Cambridge: Cambridge University Press, 1984), 330.

principles."⁷⁵ This idea was introduced to Newton as far back as 1661, when mentor and alchemist Henry More taught the budding scientist about a "Spirit of Nature." From that point on, Newton began describing his experiments in alchemical terms. White writes of Newton's experiments in the 1670s:

Newton recorded from his own experiments how certain metals or salts are 'drawn' or 'extracted', that substances 'laid hold' of others when they reacted, and that when they failed to sublime or evaporate they were 'held down.'⁷⁶

Words such as "laid hold" and "drawn" suggest that Newton believed that elements had *anima*, or active principles. This type of language would not appear in a work which was written by a scientist subscribing wholly to Cartesian Mechanical philosophy. By the time Newton set down to write his *Queries* on the *Opticks* in 1704, these ideals were part of his own scientific philosophy. In the *Opticks*, Newton admits that the particles of the universe "are moved by certain active Principles," which he identifies "not as occult Qualities," but as "general Laws of Nature...."⁷⁷ Thus, Newton defended alchemical philosophy, arguing that these "ideas" were not mystical, but were in fact natural and real. These writings lend evidence, therefore, to claims made by historians such as Michael White that alchemy was not just a hobby of Newton's, but a real passion that ultimately had a profound influence on his conceptualization of gravity.

Undoubtedly, alchemy influenced figures from all areas of science during the sixteenth and seventeenth centuries. The idea of the macrocosm-microcosm

⁷⁵ White, *Last Sorcerer*, 209.

⁷⁶ Ibid.

⁷⁷ Isaac Newton, *Opticks*, ed. Bernard Cohen (New York: Dover, 1952), 400.

and the notion of active principles influenced Harvey, Gilbert, and Newton alike. Without alchemical philosophy, many of these men would not have been able to step outside the bounds of Aristotelianism and Cartesian mechanicalism. Thus, only through a complete understanding of sixteenth- and seventeenth-century alchemy can historians fully comprehend the advancements made in science by these three icons of the Scientific Revolution.

Conclusion

Ever since George Sarton branded alchemy as the “study of superstition and magic” in 1947, historians of science have been demonstrating otherwise.⁷⁸ While many historians, such as Frances Yates and Paolo Rossi, have examined the influence of alchemy on Continental medicine, only one historian, Allen Debus, has seriously examined Paracelsian medicine in seventeenth-century England. Even Debus, however, fails to discuss some of the most startling advancements made by alchemists in this era. This paper focused primarily on alchemical treatments of the plague and venereal diseases, demonstrating that these techniques were more akin to modern medicine than Galenic treatments, which relied heavily on blood-letting as a “cure.” Specifically, alchemists’ conception of disease as separate entities “localized in particular organs” forced them to look beyond the conventional practice of blood-letting and instead experiment with the use of chemically prepared medicines.⁷⁹ Similarly,

⁷⁸ Sarton, *Introduction to the History of Science*, 1:19.

⁷⁹ Debus, *English Paracelsians*, 18.

alchemists practiced very modern diagnostic techniques, using urine as a source of detecting infection in a patient. Although alchemists could offer no definitive cures for any of these diseases (nor could Galenists), they had a better understanding of a patient's illness than any other medical group in this era. Accordingly, their treatments reflected a higher level of advancement than Galenic treatments.

Alchemists also differentiated themselves from Galenists by distinguishing between symptoms and diseases. For example, while many conservative physicians in England identified a fever as a disease itself, most alchemists recognized that the presence of a fever signaled a more serious ailment in the patient. The ability to separate symptom from disease was very important if a physician were then going to attempt to cure the patient. Only alchemists, however, were making these distinctions successfully in the seventeenth century. Thus, unlike Sarton's characterizations of alchemy being "backwards" and "unprogressive," alchemy was in fact progressive in its views of diseases and their treatments.

Although a fear of magic and mysticism prevailed throughout the century, by the end of the 1600s Galenic physicians were adopting alchemical philosophy despite its previous associations with witchcraft and sorcery. Lester King contends that Galenic medicine was markedly different by the close of the seventeenth century, attributing this transformation to the influences of Cartesianism and Baconianism. Nevertheless, it is my contention that it was alchemy, more than any other new philosophy, which had the greatest impact on

English medicine. By the close of the seventeenth century, many Galenic physicians, particularly in London, were adopting the remedies, philosophy, and texts of the alchemists. Only through a thorough understanding of alchemy, therefore, can the historian of science fully comprehend the development of early modern medicine.

There is still more work to be done in the study of sixteenth- and seventeenth-century alchemy. Although historians of science are now taking into consideration alchemical philosophy when studying medical developments of this period, much more attention could be devoted to understanding particular treatments of various diseases by seventeenth-century alchemists. While this paper discusses some of these techniques, there is still a great deal more to be learned about this field of science. Only through extensive research of this sort will alchemy's modernity be revealed, allowing it to take its rightful place in the history of science.

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