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The Slow Evolution of a Chimeric Field: Perceptions of *Chymistry* Through Early Learned Journals, 1665-1743

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THE SLOW EVOLUTION OF A CHIMERIC FIELD:
PERCEPTIONS OF *CHYMISTRY* THROUGH EARLY LEARNED JOURNALS,
1665-1743

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
In partial fulfillment of the
Requirements for the degree of
Master of Arts

in

The Department of History

by
Amanda Julia Arceneaux
B.A., Louisiana State University, 2014
May 2017

With much love and gratitude to my mother...
Without you I would not have made it this far, much less have written a thesis.
Thanks for listening, reading, and *caring* about what I study—even if it is *Chymistry*.
...Thank you for everything

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ABSTRACT

Scholars have made the argument that during the eighteenth century “alchemy” came increasingly to be seen as a fraudulent science or a science for charlatans, while chemistry retained its intellectual prestige. Around the same time “alchemy” and “chemistry” began their divergence, the legitimacy of science came increasingly to depend on public demonstrations. The term *chymistry* has become accepted amongst scholars of the field when discussing this etymologically complicated period when the terms alchemy and chemistry were both used by contemporaries to describe the field of knowledge without the distinctions that are placed on the terms today.

This study examines 1,029 articles in thirteen early learned journals published in English, French, Italian, and Latin in Europe from 1665 to 1743. They included articles detailing experiments, observations, and medical practices performed with *chymistry*. As a whole, these sources grant us the ability to trace the evolution of scientific communication and to measure the newly forming social interest in science.

Examining *chymistry* through early learned journals allows us to examine this change through a medium which catered to a community of European readers interested in the topic of *chymistry*. I argue in this thesis that secondary textual analysis of these articles reveals that the journals reflect the slow but steady evolutionary change of the chimeric field of *chymistry*. While alchemical understanding persisted, the journals do demonstrate a gradual shift toward a more modern chemistry had begun by the late seventeenth and early eighteenth centuries. The large body of sources comprised of the early learned journals allows the historian both to review discussions focused on *chymistry* authored at the time of the well-documented divergence of alchemy and chemistry in the late seventeenth century, and to understand better how new forms

of media developed to serve and shape public interest in science. Analyses of these articles reveal not only the books and articles readers expected would best help them to understand *chymistry* but also the language, specific *chymistry* terminology, and experiments done by *chymists* that can help us trace the different fates of “alchemy” and “chemistry” within early modern *chymistry*.

CHAPTER 1
INTRODUCTION:
THE SPECULATIVE PART OF *CHYMISTRY*

LONGVIL: Have you ever tri'd in the Water, Sir?

SIR NICHOLAS: No, Sir; but I swim most exquisitely on Land.

BRUCE: Do you intend to practice in the Water, Sir?

SIR NICHOLAS: Never, Sir; I hate the Water, I never come up the Water, Sir.

LONGVIL: Then there will be no use of Swimming.

SIR NICHOLAS: I content myself with the Speculative part of Swimming [swimming], I care not for the Practick [practical]. I seldom bring anything to use, 'tis not my way. Knowledge is my ultimate end.

---Thomas Shadwell, *The Virtuoso*¹

Thomas Shadwell's comedic satire, *The Virtuoso*, opened in 1676 at Dorset Garden with King Charles II of England in attendance. The play revolves around the titular Virtuoso, Sir Nicholas Gimcrack, and his family. Sir Nicholas stays in his own world creating experiments while two "gentlemen of wit and sense," Bruce and Longvil, go along with his ideas only to aid in wooing Sir Nicholas' two beautiful nieces.² Mishaps occur along the road to eventual courtship for Bruce and Longvil and ruin for Sir Nicholas. Shadwell intended *The Virtuoso* as a satiric commentary on the Royal Society. He saw the Royal Society as proclaiming to leave the domestic and more spectacular aspects of the "old science" behind in their move towards a "new science". Shadwell, however, saw it differently, and used Sir Nicholas as a foil to show how the Royal Society's new science did not reach its lofty goals by remaining spectacular, not fully leaving the private laboratory behind, and remaining a domestic pursuit. Most importantly, Shadwell wanted to show science was theatrical; it seemed Shadwell held little expectation for science developing into anything other than theater. As it turns out, Shadwell was not exactly precognizant.

¹ Thomas Shadwell, *The Virtuoso A Comedy, Acted at the Duke's Theatre. Written by Thomas Shadwell. Licensed May 31. 1676.* Roger L'Estrange., 2003:27.

² Shadwell, *The Virtuoso*, Drammatis Personae.

This developing new science differed from the old in that it began to remove scientific pursuits from private laboratories and transform knowledge that had been secret and privileged into practices that were shared publicly and expected to serve practical purposes. This was an important change because it challenged the power adepts and scholarly scientists had held, opening more opportunities for the public to gain a footing in the newly developing realm of a science that was publicly oriented. John Shanahan argues, “the new science’s legitimacy depended on public trials and witnessed facts, yet images of private space and theatrical imposture haunted the empirical program of the early fellows.”³ In other words, the new science could not help but be spectacular as it required spectators to legitimize its operations. There were many ways for spectators to access this new science: public demonstrations, journals, books, clubs, periodicals, and lectures among them. The new state of affairs reshaped traditional sciences such as math and astronomy as well as the new developing sciences of the seventeenth century, like optics, electricity, and *chymistry*.⁴

William Newman and Lawrence Principe suggested the term *chymistry* in a 1998 article, “Alchemy vs. Chemistry: the Etymological Origins of a Historiographic Mistake.” In this important piece, the two historians of science argued that alchemy and chemistry have been misrepresented by historians. Alchemy can be seen as the transformation of elements in the natural world in physical and metaphysical ways. Contrastingly, chemistry is the same study of elements of the natural world without the emphasis on the philosophical and occult. The main differentiating factor between the two ideas is that alchemists believed supernatural forces played an essential role in their pursuits while chemists dismissed this concept entirely. But, as Newman

³ John Shanahan, “Theatrical Space and Scientific Space in Thomas Shadwell’s *Virtuoso*.” *Studies in English Literature, 1500-1900*, no. 3 (2009): 551.

⁴ The spelling of *chymistry* and later *chymists* and *chymical* is intentional. It is the preferred, inclusive term when discussing the development of the field.

and Principe observe, “the assumption that ‘alchemy’ and ‘chemistry’ refer to separate disciplines prior to the very late seventeenth century is misleading, and attempts to separate them are futile.” To better understand the development of the discipline, the two scholars offer the term *chymistry* as more appropriate for the long period when alchemy and chemistry intermingled together without a clear distinction between the two.⁵ In the past fifteen years, the term *chymistry* has become accepted amongst scholars of the field when discussing this etymologically complicated period since during this time the terms alchemy and chemistry were both used by contemporaries to describe the field of knowledge without the distinctions that are placed on the terms today. With the creation of the term *chymistry*, Newman and Principe have created a way for historians to discuss the *chymical* practices developing during this time without the whiggish misrepresentation of previous decades.

As Newman and Principe argue that, prior to the eighteenth century, practitioners of *chymistry* used the terms “alchemy” and “chemistry” interchangeably. Then, during the eighteenth century, the two terms began to mean different things. Notably, “alchemy” came increasingly to be seen as a fraudulent science or a science for charlatans, while chemistry retained its intellectual prestige. Around the same time “alchemy” and “chemistry” began their divergence, the legitimacy of science came increasingly to depend on public demonstrations. As this thesis will show, this transition was partly achieved through early learned journals that contained articles and book reviews on natural philosophy, including *chymistry*.

This thesis examines 1,029 articles in thirteen early learned journals published in English, French, Italian, and Latin in Europe from 1665 to 1743. Through their reviews of published work and original articles on *chymical* topics, these journals gave an increasingly broad reading public

⁵ William R. Newman and Lawrence M. Principe, “Alchemy vs. Chemistry: The Etymological Origins of a Historiographic Mistake,” *Early Science and Medicine* 3, no. 1 (1998): 64.

access to contemporary scientific debates. They included articles detailing experiments, observations, and medical practices performed with *chymistry*. I have found these articles not only prove the readers of these journals discussed *chymistry* but also reveal how the readers were attempting to understand the burgeoning new philosophy and its challenge to alchemical norms. While historians have studied the best-known journals of this time, namely the *Philosophical Transactions* and the *Journal des Sçavans*, the many other journals published across Europe have not received sustained attention.⁶ As a whole, these sources allow us to trace the evolution of scientific communication and to measure the newly forming social interest in science. Examining *chymistry* through early learned journals allows us to examine this change through a medium which catered to a community of European readers interested in the topic of *chymistry*. I argue in this thesis that secondary textual analysis of these articles reveals that the journals reflect the slow but steady evolutionary change of the chimeric field of *chymistry*. While alchemical understanding persisted, the journals do demonstrate a gradual shift toward a more modern chemistry had begun by the late seventeenth and early eighteenth centuries. The large body of sources comprised of the early learned journals allows the historian both to review discussions focused on *chymistry* authored at the time of the well-documented divergence of alchemy and chemistry in the late seventeenth century, and to understand better how new forms of media developed to serve and shape public interest in science. Analyses of these articles reveal not only the books and articles readers expected would best help them to understand *chymistry* but also the language, specific *chymistry* terminology, and experiments done by *chymists* that can help us trace the different fates of “alchemy” and “chemistry” within early modern *chymistry*.

⁶ Alan G. Gross, Joseph E. Harmon, and Michael Reidy’s *Communicating Science: The Scientific Article from the 17th Century to the Present* is the most recent attempt to examine the scientific journal as a whole across England, France, and Germany. The authors do a remarkable job tracing the similarities and contrasts in the style, presentation, and arguments of journals across these countries from the seventeenth century forward.

The questions treated in this thesis, I argue, are not only linked at a purely historical level relating to the evolution of *chymistry*. They also illustrate the way in which *chymistry* itself serves as a case study in the larger changes occurring in science in the move from private to public that is often associated with the admittedly problematic concept of the “Scientific Revolution.”⁷ In other words, this thesis demonstrates the evolutionary changes developing in *chymistry* concurrently with the larger shift occurring from private to public science. Chapters one and two examine *chymistry*’s role not only in the articles of the early learned journals, but also how the field fits into the larger movement from private towards public forms of knowledge. Chapter three provides a miniature case study examining how the journals discussed traditional alchemical concepts. This case study is intended to provide finer-grained detail about the broader trends in the large body of articles the thesis examines. In all, this thesis illustrates the intermingled nature of *chymistry* alongside its slow evolutionary change, as well as the ongoing shift from private to public conception of science occurring in the seventeenth- to early eighteenth century encapsulated in the periodical form of early learned journals.

Tracing Alchemy’s Fate

Alchemy is best known in the modern world through pop-culture references in literature and movies, often featuring eccentric scientists’ futile attempts to conjure magical transformations. Such references present a caricature of what alchemy was in the medieval and early modern periods. The Oxford English Dictionary defines alchemy as “[t]he branch of study and practical craft [...] concerned with the nature and transformation of physical substances, esp.

⁷ Recent historical scholarship on the “Scientific Revolution” include Steven Shapin, *The Scientific Revolution* (Chicago: University of Chicago Press, 1996); Peter Dear *Revolutionizing the Sciences: European Knowledge and Its Ambitions, 1500-1700* (Princeton, N.J.: Princeton University Press, 2001); Margaret J. Osler, editor *Rethinking the Scientific Revolution* (Cambridge [U.K]: Cambridge University Press, 2000); Margaret C. Jacob *Scientific Culture and the Making of the Industrial West* (Oxford: Oxford University Press, 1997).

the transmutation of baser metals into gold”.⁸ This simplistic definition utterly fails to encapsulate a complicated field. Alchemy, as a subject, is particularly difficult to describe since there is no modern equivalent. Historically, it was a field where both esoteric and exoteric practices were merged together. So while it is difficult to define what alchemy was in the fifteenth and sixteenth centuries, the term can be understood as the study of the transmutation, creation, or combination of elements in the natural world through a philosophical, occult, and practical lens. Alchemists during this time were preoccupied with the idea of theoretical and practical productive goals of creating physical manifestations of their work such as the elusive Philosophers’ Stone, potable gold, better pigments and dyes, and stronger glass. They also sought a metaphysical understanding of the world through these activities. Alchemists were not all the stereotypical “mad-scientists” in the laboratory; they were often artisans, apothecaries, surgeons, scholars, and, yes, some “mad-scientists”.

One of the uniting factors, however, in the wide-ranging field of alchemy was the concept of secrecy. Alchemy was passed down, not in universities, but from master to apprentice. Not only was the knowledge of alchemy only passed on to those chosen by masters of the craft, but the language of alchemy was also shrouded in secrecy. Alchemical texts described many of the laboratory techniques, results, and metaphysical actions involved in alchemical practices using allegory, emblems, and symbols to stand in place of actual material objects. Only those who

⁸ "Alchemy, n. and adj.". OED Online. March 2017. Oxford University Press.
<http://www.oed.com/view/Entry/4691?rskey=nK2Ax&result=1&isAdvanced=false> (accessed March 15, 2017).

were considered special and privileged enough to merit the keys to the craft were granted the ability to access and understand alchemical knowledge.⁹

Over time, historians agree, the norms of alchemical practice evolved. In the context of expanding literacy, publication, and public interest in natural philosophy, reserving alchemical knowledge to a privileged few clearly became impracticable. Yet the precise contours of this change are still poorly understood. In a work that followed their argument for “*chymistry*,” Newman and Principe made the claim that while “the increasing rejection of traditional alchemy during the eighteenth century is generally well known, [...] more detailed studies would be beneficial to define the exact course and means of the repudiation... [as i]ncreasingly from the beginning of the [eighteenth] century there was a tendency to sequester the ‘older’ alchemy from the ‘newer’ science”.¹⁰ Studying the means of that transformation is part of the goal of this thesis. Since the view that the divergence between alchemy and chemistry began in the eighteenth century has been presented and accepted, to further analyze the “exact course and means of the repudiation” it is best to begin slightly before that time period and continue on into the eighteenth century in order to see how the field was represented before, during, and after the divergence. Examining articles that appeared in journals published from 1665 to 1743 allows the historian to review a body of scientific works focused on *chymistry* authored before and during the beginning of the well-documented divergence of the two fields in the early eighteenth

⁹ Examples of references in pop-cultures include J.K. Rowling’s *Harry Potter* Series, the works of Terry Pratchett, the TV series “Full Metal Alchemist” and *World of Warcraft* videogames. Recent historical scholarship on alchemy include William R. Newman, *Promethean Ambitions: Alchemy and the Quest to Perfect Nature* (Chicago: University of Chicago Press, 2004), and *Atoms and Alchemy: Chymistry and the Experimental Origins of the Scientific Revolution* (Chicago: University of Chicago Press, 2006); Lawrence M. Principe, *The Secrets of Alchemy* (Chicago: University of Chicago Press, 2013); Pamela H. Smith, *The Business of Alchemy: Science and Culture in the Holy Roman Empire* (Princeton, N.J.: Princeton University Press, 1994), and *the Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago: University of Chicago Press, 2004); Bruce T. Moran, *Distilling Knowledge: Alchemy, Chemistry, and the Scientific Revolution* (Cambridge, Mass.: Harvard University Press, 2005).

¹⁰ Lawrence M. Principe and William R. Newman, “Some Problems with the Historiography of Alchemy,” in *Secrets of Nature: Astrology and Alchemy in Early Modern Europe*, ed. Anthony Grafton and Lawrence M. Principe (Cambridge, Mass: MIT Press, 2001), 386.

century. It will also help to understand the new emerging public nature of science since the journal was a tool to help spread knowledge through its articles and book reviews.

Finally, it is important to clarify terminology. Most specialists accept that in the late-seventeenth century there was no clear distinction between the terms or practices of alchemy and chemistry as those pursuits are recognized today. However, *some* of the ideas and phrases used in contemporary works were already more associated with what would later be defined as “alchemy” and rejected by chemistry. These ideas constitute the “older” ideas that Principe and Newman suggest were increasingly “sequestered” in the evolution of the discipline. For the remainder of this thesis, I will use the phrase *traditional alchemical thought* to represent the terms and phrases that are more akin to traditional alchemical practices of the fifteenth to early-seventeenth centuries.

The Sources: Early Learned Journals

Early learned journals developed at a time when a staggering increase in the production and publication of books created a need for new forms of communication among the readers. In their article, “Charting the “Rise of the West”: Manuscripts and Printed Books in Europe, a Long-Term Perspective from the Sixth through Eighteenth Centuries,” Eltjo Buringh and Jan Luiten Van Zanden chart out the production of books in Europe from roughly 500 to 1800. Their study observed that the long-term trend in per capita book production demonstrates that Western Europe experienced this change in unison. Most importantly, their work illustrates that the whole of Western Europe underwent a remarkable increase in book production during the early modern era, the pace of which can be seen in Figure 1.¹¹

¹¹ Eltjo Buringh and Jan Luiten Van Zanden, “Charting the “Rise of the West”: Manuscripts and Printed Books in Europe, a Long-Term Perspective from the Sixth through Eighteenth Centuries,” *The Journal of Economic History* 69, no. 2 (Jun. 2009), 425-6.

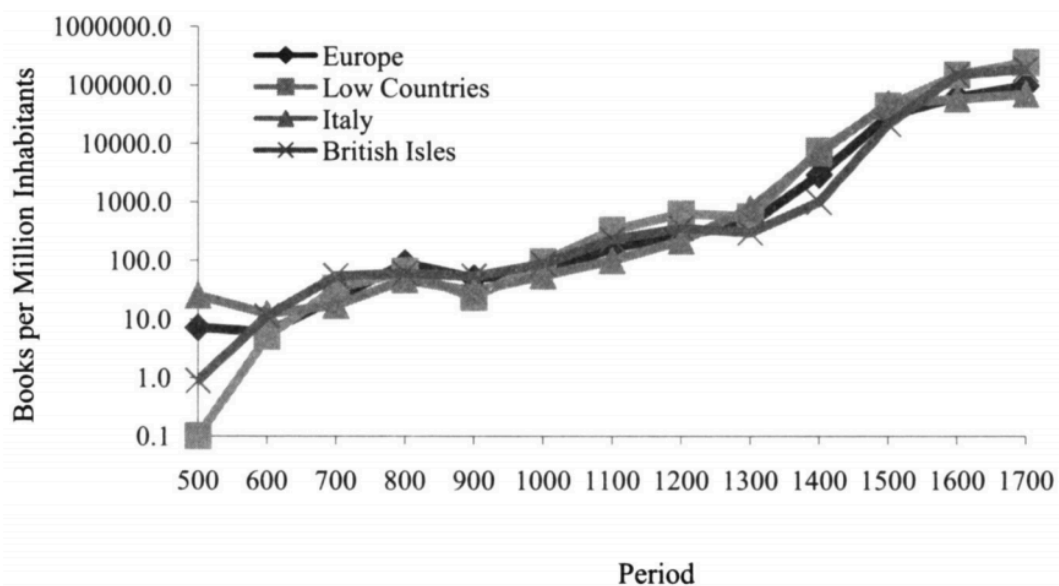


Figure 1: Book production per capita in Western Europe, 501-600 to 1701-1800. NB: This graph is taken from “Charting the “Rise of the West”: Manuscripts and Printed Books in Europe, a Long-Term Perspective from the Sixth through Eighteenth Centuries”.¹²

Information overload became an increasingly serious problem from the sixteenth to the eighteenth century, when scholarly production grew at exponential rates and manifested in increased book production as represented in Figure 1. Faced with proliferating information, readers needed a tool to help them navigate their way to understanding. The existing system of letter exchange among specialists in the Republic of Letters, a network of correspondence that spread across countries linking intellectuals and facilitating the sharing of news and information, had often suffered from lack of privacy, irregularity, and timeliness. As Ann Blair has suggested, review journals were one of a number of genres designed to cope with the new problem of information overload.

The perception of an overabundance of books fueled the production of many more books, often especially large ones, designed to remedy the problem—from new genres like the universal bibliography and the book review to new (or not-so-new) contributions to well-

¹² Buringh and Van Zanden, “Charting the “Rise of the West,” 425.

established genres, including the florilegium, the dictionary and the encyclopedic compilation.¹³

Those trying to keep up with the latest developments, no matter the field, were struggling to do so. This in combination with a rising scientific curiosity developing in the 1600s drove the creation of early learned journals. Most scholars identify the first journal of this type as the French *Journal des Sçavans* first published in January 1665.¹⁴ What followed its publication was a veritable explosion in the journal press.

A learned society or a group of people pushing an agenda, such as a certain religious viewpoint, often published these journals. Learned journals helped readers keep up with new developments, and were able to aid in the transmission of information and circulate knowledge, especially scholarly knowledge, at a more rapid rate. And, the fact that these journals also came from a group and not a single person helped strengthen the idea of a scholarly community. According to Sherman B. Barnes, 330 journals throughout seven European countries were published between the years 1665-1730.¹⁵

With so much competition, it is not surprising that many early learned journals had short runs. Some scholars explain this tendency for journals to die as a result of the market being overwhelmed with similar products, the lack of a consistent editorial board to ensure continuity, or editorial choices to include bad or unappealing content. Despite these issues, early learned journals offered Europeans a rapid, constant source of information ranging from book reviews, articles on the latest scientific, mathematic, and literature works, and news from across national lines. Finally, Adrian Johns offers another reason why these journals became so popular:

¹³ Ann Blair, "Reading Strategies for Coping with Information Overload Ca. 1550-1700," *Journal of the History of Ideas* 64, no. 1 (2003): 12.

¹⁴ Though there is some argument that the English *Philosophical Transactions* appeared first in 1665.

¹⁵ Sherman B. Barnes, "The Scientific Journal. 1665-1730," *Scientific Monthly* 38 no.4 (Mar. 1934): 257.

[b]y issuing small papers, often in the form of letters, writers could make claims to knowledge and originality without the fear of appearing unreasonably ambitious. They could argue that short texts recording observations or artifacts might otherwise have been lost, given their own persisting reluctance to appear in print as authors of large treatises.¹⁶

Johns argues that gentleman and scholars felt uneasy about seeking fame through print. By publishing short letters or articles in the early learned journals they could get around that problem. So early learned journals provided a way for Europeans to gain information more quickly and regularly, and to participate in the world of scholarship in ways that accommodated the behavioral rules for gentlemen.

Out of the 330 journals Barnes identified, this thesis examined thirteen published in English, French, Italian, and Latin in closer detail. (Please refer to Table 1 for a list of these journals). In the following pages, I provide brief descriptions of each of the journals.

Table 1: Early learned journal identification. NB: I have identified only the founder of the journal or major contributing editor due to lack of source information. For the journals that continued to publish past 1743, I only examined the editions published up until 1743.

Language	Journal	Place of Publication	Founder/ Major Editors	Years of Publication
English	<i>Philosophical Transactions</i>	London	Henry Oldenburg	1665-
French	<i>Journal des Sçavans</i>	Paris	Denis de Sallo, Jean Crusson, Jean Gallois,	1665-
	<i>Nouvelles de la République des Lettres</i>	Amsterdam	Pierre Bayle, Daniel de Larroque, Jean Barrin, Jacques Bernard	1684-1718
	<i>Histoire de l'Académie Royale des Sciences, avec les Mémoires de Mathématique et de Physique</i>	Paris	Bernard de Fontenelle, Jean-Jacques Dortous de Mairan, Jean Paul Grandjean de Fouchy	1699-1786

¹⁶ Adrian Johns, "Miscellaneous Methods: Authors, Societies and Journals in Early Modern England," *The British Journal for the History of Science* 33 no.2 (Jun. 2000): 164.

(Table 1 continued)

Language	Journal	Place of Publication	Founder/ Major Editors	Years of Publication
French	<i>Journal de Trévoux</i>	Trévoux	René-Joseph Tournemine, P. de Charlevoix, Peirre Brumoy, François Catrou	1701-1767
	<i>Histoire des Ouvrages des Savans</i>	Rotterdam	Henri Basnage de Beval	1687-1709
	<i>Journal Littéraire</i>	The Hague	Thomas Johnson, Pierre Gosse, Jeane Neaulme	1713-1737
	<i>Bibliothèque Universelle et Historique</i>	Amsterdam	Jean Le Clerc, J.C. de Lacroze, Jacques Bernard	1681-1695
Italian	<i>Giornale de literati d'Italia</i>	Venice	Apostolo Zeno, Pietro Caterino	1710-1710
	<i>La Galleria di Minerva</i>	Venice	Girolamo Albrizzi	1696-1717
Latin	<i>Miscellanea Medico-Physica Curiosa</i>	Leipzig	German Royal Academy of Sciences	1670-1706
	<i>Acta Eruditorum</i>	Leipzig	Otto Mencke, Gottfried Leibniz	1682-1731
	<i>Acta Medica et Philosophica Hafniensia</i>	Copenhagen	Thomas Bartholin, Nicholas Steno	1671-1679

Journals in English

Philosophical Transactions

This is the only journal used in this thesis that originated in England. It was also the only journal to publish in English. It did, however, on occasion publish in Latin and there were plans for official Latin translations that fell through, although, unofficial publications of Latin translations of the journal on the continent eventually appeared.¹⁷ The history of *Philosophical Transactions* is one of the most well-known; it is considered, along with the *Journal des Sçavans*, to be the oldest published scientific journals. Despite common belief due to the close association between the Royal Society of London and the journal, *Philosophical Transactions*

¹⁷ Adrian Johns, *The Nature of the Book: Print Knowledge in the Making* (Chicago: University of Chicago Press, 1998), 515-516.

was not published by the Society until the 47th volume. Instead it was the responsibility, and success, of Henry Oldenburg. Except for a brief period of years in 1676 and 1683, the journal has a continuous history of publication.

Journals in French

Seven French early learned journals were examined for this paper. Some of these journals were published in France and others were published in the Netherlands, generally to evade censorship. All the journals contain content regarding scientific endeavors during the time of their publication and they specifically look at *chymistry*.

Journal des Sçavans

It is considered to be the first scientific journal, published in 1665. The original editor, de Sallo, intended for his journal to “catalogue and describe books published in Europe; to present biographies; to make known experiments in physics and chemistry that might serve to explain natural phenomena; to describe machines and other useful, or curious, inventions.”¹⁸ It was a tall order for the journal and de Sallo also wanted the journal to reach scientific and scholarly communities not just in France but across all of Europe. Due to government pressure, *Journal des Sçavans* had to cease publishing for a short time and then began publishing in infrequent intervals. It reappeared in 1816 under the title of *Journal des Savants* with more literary content.¹⁹

Nouvelles de la République des Lettres

A French journal published in Amsterdam in order to circumvent French censorship from 1684 through 1718, it had several years of suspensions, 1687-1698 and 1711-1715. The first editor of the journal was Pierre Bayle. The *Nouvelles de la République des Lettres* was conceived

¹⁸ A.A. Manten, “The Growth of European Scientific Monograph Publishing before 1850,” in *Development of Science Publishing in Europe*, ed. A.J. Meadows (New York: Elsevier Science Publishers, 1980), 5.

¹⁹ Manten, “The Growth of European Scientific Monograph Publishing before 1850,” 7.

as a hybrid between the type of coverage provided by the *Journal des Sçavans* and the more popular *Mercure Galant*, and often provided book reviews in its editions.²⁰

Histoire de l'Académie Royale des Sciences, avec les Mémoires de Mathématique et de Physique

This journal grew out of the *Histoires et Mémoires* as a way for the *Académie des Sciences* in Paris to publish their regular proceedings. Before this time, work done by the members of the *Académie* was published haphazardly in the *Journal des Sçavans*. Around 1750, the *Académie* decided to publish a journal that would include works not only by the members of their society, but also other like-minded scholars and scientists. It is at this point the “*avec les Mémoires de Mathématique et de Physique*” was added to the original journal’s title.²¹ This thesis examines the first half of the publication in which only members submitted articles, a run from 1699-1743.²²

Journal de Trévoux, Mémoires pour l'Histoire des Sciences & des Beaux-Arts, or Mémoires de Trévoux

A French literary journal published by the Jesuit order comprised of 878 volumes compiled from 1701 to 1761, the *Journal de Trévoux* contained primarily book reviews of scholarly works published not only in France but also throughout Europe. The journal’s contributors wished to be considered as scholars and not solely Jesuits, though many of them were in fact members of the order.²³ The journal was one of the few early learned journals during this time that was edited by a board, a staff of Jesuits, helping to ensure its survival against the resignation of a sole editor.²⁴

²⁰ Sherman B. Barnes, “The Editing of Early Learned Journals,” *Osiris* 1 (Jan. 1936): 155.

²¹ Manten, “The Growth of European Scientific Monograph Publishing before 1850,” 17.

²² Due to reprinting of the editions I looked at, the journals had the titling of *Histoire de l'Académie Royale des Sciences, avec les Mémoires de Mathématique et de Physique*.

²³ “Journal de Trévoux,” Accessed 13 November 2016. <https://artfl-project.uchicago.edu/content/journal-de-tr%C3%A9voux>

²⁴ Sherman B. Barnes, “The Editing of Early Learned Journals,” 157.

Histoire des Ouvrages des Savans

Another French journal published in Amsterdam to escape French censorship. The journal ran from 1687 to 1709 producing 24 volumes. The popularity of this publication is signified by the fact that some volumes have up to four editions.²⁵ Henri Basnage de Beauval was the editor of the journal. *Histoire des Ouvrages des Savans* was modeled after the *Nouvelles de la République des Lettres* in that it mainly published book reviews rather than original articles.²⁶

Journal Littéraire

This was a French publication published in The Hague. Like other similar journals the decision to publish outside France amounted to a choice to avoid censorship. It ran from the years 1713 to 1737, publishing 24 volumes. The journal was written by a literary society that published book reviews and original content.²⁷ It was also one of the few journals that was run by an editorial board and not a single editor. Like many of the other journals of the time, *Journal Littéraire* focused on arts, theology, history, literature, and science. Anne Goldgar remarks that the *Journal Littéraire* was one of the journals most focused on science during its day.²⁸

Bibliothèque Universelle et Historique

Like many of the other French journals, it was published in Amsterdam instead of France. The *Bibliothèque Universelle et Historique* was created by Jean LeClerc as a way to inform French readers about books published in other languages, especially English, during the years following the revocation of the Edict of Nantes and the scattering of French Protestant

²⁵ David A. Kronick, *Scientific and Technical Periodicals of the Seventeenth and Eighteenth Centuries: A Guide* (Metuchen, N.J.: Scarecrow Press, 1991), 103.

²⁶ Gerald Cerny, *Theology, Politics, and Letters at the Crossroads of European Civilization: Jacques Basnage and the Baylean Huguenot Refugees in the Dutch Republic* (Boston: Springer Publishing, 1987), 255-260.

²⁷ Anne Goldgar, *Impolite Learning: Conduct and Community in the Republic of Letters, 1680-1750* (New Haven: Yale University Press, 1985), 2.

²⁸ Goldgar, *Impolite Learning*, 69.

intellectuals across Europe. The *Bibliothèque Universelle et Historique* was the first of a “trilogy” of *Bibliothèques* created by LeClerc. It ran from 1686 to 1693 for 23 volumes. The next two journals after the *Bibliothèque Universelle et Historique* took a more theological and literary bent and did not publish as many reviews about science. This might be attributed to the departure of J.C. de Lacroze who was the main editor of scientific content during the *Bibliothèque Universelle et Historique*’s initial run.

Journals in Italian

Two journals from the Italian provinces were examined during the research process for this paper. While these journals approached their subject matters in different ways, they shared a common approach in *chymistry*. Both examined *chymistry* through a more medical lens than did other European journals examined for this thesis. That is not say they only discussed the medical aspects of *chymistry*, as they also examined other aspects such as corpuscular theory and laboratory set up.

Giornale de literati d’Italia

An Italian literary journal founded in 1710 by Apostolo Zeno, Scipione Maffei, and Antoni Vallisneri, this publication ran until 1740 producing original articles and book reviews for scholars. It often reviewed books published in other languages such as French and Latin. It hoped to copy the *Journal des Sçavans* in form and, one day, in popularity.²⁹ *Giornale de literati d’Italia* was also one of the rare journals that often published the name of article authors, information that was frequently absent in early learned journals.

La Galleria di Minerva

Girolamo Albrizzi published this journal from 1698 to 1717 in Venice. Like many of the other early learned journals of this time, it mimicked the format of the *Journal des Sçavans*. One

²⁹ Mantel, “The Growth of European Scientific Monograph Publishing before 1850,” 17.

of the key reasons *La Galleria di Minerva* had such good content was that Zeno the Apostle and many of his like-minded scientific and scholarly friends published content in the journal. It became apparent during the examination of this journal that around 1710 there was a drop off of *chymistry* related articles in the journals, there appeared no apparent reason for this decline.

Journals in Latin

The journals discussed in this section were often published within the boundaries of the Holy Roman Empire. The unifying factor about these journals is that they were all published in Latin and not in a national vernacular.³⁰

Miscellanea Curiosa, sive Ephemeridum Medico-Physicarum Germanicarum Academiae Naturae Curiosorum

The journal was published in Leipzig during the years of 1677-1715. It was connected to the Royal Academy of Sciences which is credited with its long running stability.³¹ The journal itself published no book reviews. Instead, it published articles and new research by members of the society and scholars from across Europe. The *Miscellanea Curiosa*, as it is often referred to, was published in three decades culminating in 29 volumes. It is considered the first German scientific journal, and it published information mainly in relation to medicine, mineralogy, zoology, and chemistry.³²

Acta Eruditorum

Also published in Leipzig but led by Otto Mencke, scholars often argue that either it or *Miscellanea Curiosa* was the first true scientific journal. However, *Acta Eruditorum* was published from 1682 to 1731, thus commencing several years after the initial publication of *Miscellanea Curiosa*. The content of this journal included short articles, reviews, and letter

³⁰ There are journals published in the vernacular in this geographic area during this time period. I lack, however, the ability to read those vernaculars. In order not to exclude such a wide geographic area, it was decided to examine the journals published in Latin in that region instead.

³¹ Barnes, "The Scientific Journal. 1665-1730," 259.

³² Mantel, "The Growth of European Scientific Monograph Publishing before 1850," 16.

excerpts about scholarly topics, mainly natural philosophy and mathematics. Some scholars suggest that this journal contained fewer scientific articles than the other Latin Leipzig publication.³³

Acta Medica et Philosophica Hafniensia:

This journal was published in Copenhagen instead of Leipzig. Instead of being a purely Latin journal, it occasionally published articles in German and Danish. This journal served a unique purpose: to disseminate the ideas of Thomas Bertholm, a physician who was a professor of anatomy at the University of Copenhagen. It is also unique in that Bertholm can be seen commenting and critiquing the articles in the journals through entries at the end of the articles, something that was not commonly done until the nineteenth century.³⁴ The *Acta Medica et Philosophica Hafniensia* ran from 1671 to 1679 with five volumes.

The Absence of Journals in Spanish

Spain was a major exporter of natural philosophic information about the New World. Recent scholars such as Antonio Barrera-Osorio and Francisco José González have cautioned against the old-fashioned view that religious scruples or specifically Catholic “superstition” made Spain into an scientific backwater, noting that Spanish presses produced numerous books about the New World.³⁵ Spain also produced several newspapers, mainly political in nature, but none of those papers had any significant scientific or natural philosophical content. Indeed, they did not closely resemble any of the other journals discussed above. So, while Spain was a major contributor of published books and newspapers during this time, it is interesting that I could find no record of early learned journals published in Spanish. After secondary research and contacting

³³ Ibid., 16.

³⁴ Ibid., 17.

³⁵ See Antonio Barrera-Osorio’s *Experiencing Nature: The Spanish American Empire and the Early Scientific Revolution* and Francisco José González’s *Astronomia y navegación en España: Siglos XVI-XVIII*.

scholars in this field, I was not able to draw direct conclusions as to why Spain did not produce any early learned journals in the period under consideration, despite Spanish participation in the natural philosophical movement occurring in the Americas and Europe. In later eras, Spain would produce several journals.

Structure of Early Learned Journals

Before discussing how *chymistry* appeared in early learned journals, it is important to understand how the journals were structured. Early learned journals were comprised of two main types of articles: original-content articles and book reviews. Both types of articles had benefits both for the author of the articles and for the reader of the journals. Most of the journals examined in this paper had a combination of book reviews and articles, however some just relied on one form of expression.

Original articles in a journal typically discussed observations, discoveries, and experiments and thereby made knowledge easily accessible to other scholars.³⁶ Publishing in these venues helped authors spread their ideas beyond whatever small university or town they lived and worked in. Furthermore, articles facilitated exchanges between authors and readers, creating for the first time a scientific discourse across Europe available to anyone who paid for the journal, instead of just those who were included in a correspondence chain. There were also disadvantages to publishing original articles in the journals: an author's work could be plagiarized or attacked by strangers, without the author having a chance of rebuttal. Overall, the publications of an article in a learned journal contributed to a trend whereby intellectual life moved further away from geographic and social isolation and came into an audiences' view. Increasingly, it granted an anonymous "public" a say an author's work, even if this public could not claim any expertise in the author's field.

³⁶ Barnes, "The Scientific Journal. 1665-1730," 259.

Reviews of published work were a common feature in early learned journals; indeed some journals were dedicated only to reviewing works. This feature of the early journals functioned in a similar manner to the book review sections of the current academic journals—albeit with a few key differences. Journals and reviewers generally attempted to give an unbiased description of the books selected. Whether or not the journal was successful in achieving that goal is debatable. While the works reviewed might have been targeted to an expert, many of the reviews were written in terms that a non-specialist could understand, which by its nature entailed a form of interpretation. The biggest difference between current book reviews and early modern reviews, however, was the anonymity. Rarely was the reviewer of the book named, so readers, then and now, have little way to know what biases colored a reviewer’s approach to a particular book.

Both original articles and book reviews provide crucial clues that help us understand how *chymistry* was discussed during this pivotal era. They just provide two different ways of analyzing that discussion. It is important to note the differences, and to be aware that the articles often transmit a clearer and more obvious point-of-view than do the book reviews. The articles were trying to start a conversation by relaying newly discovered or relevant information about *chymistry*. Book reviews seem more passive, representing what is available for consumption and what counts as recommended reading, by being selected for review in the journal. Both types of content illuminate how early modern practitioners of *chymistry* discussed and understood the subject.

Parlez-vous Science?

The early learned journals were not published exclusively in Latin, still the scholarly language of the time. One of the most remarkable features about these journals is that they were

often published in the vernacular. This could mean the articles and reviews found in the journals were originally in the vernacular of the journal's country, translated from Latin to the vernacular, or translated from another country's language. The choice of the journal's editors to publish in the vernacular opened up the potential readership of the journal beyond a scholarly audience to include the educated. Yet it is crucial to note that the journals that chose to publish in the vernacular still, oftentimes, included untranslated Latin articles or phrases. Readers without the ability to understand Latin would gain some access to the world of scholarship, but not full access.

Extant sources cast little light on the rationale for these linguistic choices, and it is wrong to see this era as a clear tipping point toward the vernacular.³⁷ Many scholarly books continued to be published in Latin, and many journals during this time also continued to publish in Latin.³⁸ Indeed, when examining the varied journals from across Europe, it proves difficult to make any generalizations about the developing norms of scholarly communication. Some journals, such as the *Bibliothèque Universelle et Historique* and the *Journal des Sçavans* did not differentiate based on the original language of the work, reviewing works originally in English, a language sometimes considered crass and not suitable for scholarly pursuits during this time. For that reason, books in English appear to have been excluded from many other European journals. Other journals, like the *Miscellanea Curiosa Medico-Physica*, solely published articles by the members of their society.

As difficult as it is to ascertain who the target audience of the early learned journals were, it is equally hard to determine who were its actual readers. Who was this public? Who actually

³⁷ These were the journals in the vernacular: *Philosophical Transactions*, *Journal des Sçavans*, *Nouvelles de la République des Lettres*, *Histoire de l'Académie Royale des Sciences, avec les Mémoires de Mathématique et de Physique*, *Mémoires de Trévoux*, *Histoire des Ouvrages des Savans*, *Journal Littéraire*, *Bibliothèque Universelle et Historique*, *Giornale de literati d' Italia*, *La Galleria di Minerva*.

³⁸ For the purpose of this thesis, Latin journals were purposefully sought for the area in the Holy Roman Empire so as to not completely ignore this location due to lack of German on my part.

read these early learned journals? Were the vernacular journals more popular than the Latin ones? Did women read them? Currently only speculative answers to these questions can be formed given the evidence. Looking at the introductions of the journals, however, where many editors leave dedications and acknowledgements, and examining printers' records can provide valuable clues as to where to look to answer those questions since they often dedicate or acknowledge the journals to specific readers. Another way of attempting to find the readers of these journals is looking at catalogues of private libraries. Daniel Mornet completed a study in 1910 that analyzed the ownership of journals in French private libraries from 1750-1780. While his study did not find samples of all the journals examined in this thesis in the private libraries he analyzed, five of them do appear. Mornet's study found that out of the 500 private libraries examined: 101 contained a copy of *Nouvelles de la République des Lettres*, 101 contained a copy of LeClerc's *Bibliothèques*, 83 held a copy of the *Journal des Sçavans*, 50 a copy of the *Journal de Trévoux*, and 30 included a copy of *Giornale de letterati d'Italia*.³⁹ Even Mornet's valuable study leaves many questions unanswered, because he does not specify in which libraries the journals were found. While Mornet's study does not allow us insight into precisely who owned the journals, he does tell us the social position of the owners of libraries he surveyed which included members of high nobility, nobility without a specific title, ecclesiastics, magistrates, lawyers, notaries, doctors and apothecaries, academics, officers, merchants, painters, architects, functionaries (inspectors, secretaries, controllers, registrars, councilors, treasurers, commissaries, clerks, directors, pay-clerks, receivers, etc.), unspecified occupations, and anonymous people.⁴⁰ So it is possible that any of these professions or people were the audience to whom the journal

³⁹ Mornet does not distinguish between LeClerc's three successive journals—*Bibliothèque Universelle et Historique*, *Bibliothèque Choisie* and the *Bibliothèque Ancienne et Moderne*.

⁴⁰ Daniel Mornet, "Les Enseignements Des Bibliothèques Privées (1750-1780)," *Revue d'Histoire Littéraire de La France* 17, no. 3 (1910): 453.

was marketed (if that term is appropriate for the era). At base, Mornet's study demonstrates that early learned journals, including those published outside France, were fairly widely distributed within France.⁴¹

Methodology Part I: Finding *Chymistry*

Initially, the base of data for this research was based on fifteen early learned journals from Europe published approximately from the mid-seventeenth century to the mid-eighteenth century, roughly 1787. They were chosen because they represented a cluster of journals being published before a time of journal specialization, similar but not to the extent of specialization seen today. The date 1787 was selected not at random but because of Antoine Lavoisier's reform of chemical nomenclature. The implementation of a chemical nomenclature marks the moment when many scholars consider chemistry to have become a modern science separate from alchemy or *chymistry*. It also marks a time when specialized chemical journals came to replace the early learned journals examined here as outlets for publication.⁴²

As previously mentioned, these early learned journals were not specialized. They often contained articles on topics including religion, literature, medicine, mathematics, and, sometimes, *chymistry*. The average issue of a journal contained anywhere from 400 to 700 pages.

All but one of the journals examined in this study were available through digital means; the other was available via microfilm. I determined that the fastest and most accurate way to find the articles relating to alchemy, *chymistry*, or chemistry would be by using an Optical Character Recognition (OCR) search on the digitized journals to perform basic-level text mining using a Search and Retrieval technique. OCR is a "technique of translating handwritten, typewritten or

⁴¹ Mornet, "Les Enseignements Des Bibliothèques Privées (1750-1780)," 479.

⁴² It is interesting to note that while the journals themselves were not yet specialized, some journals were beginning to contain "specialized" table of contents, often separating sections into *Chymistry*, Botany, and Mathematics instead of using the common "Natural Philosophy" heading to cover such items.

printed text characters to a machine-encoded text. It is a process of reading handwritten characters and recognizing them.”⁴³ One of the benefits of using OCR on a document is to enable the use of text mining. Text mining is generally “the process of extracting interesting and non-trivial information and knowledge from unstructured text.”⁴⁴ The Search and Retrieval technique used is a way to search internal document collections that have been indexed (i.e. downloaded, digitized OCR journals). The documents are searched via text and if necessary Boolean operators.⁴⁵ The same text terms were used to search each journal to remain consistent. The terms used were variations of “alchemy,” “*chymistry*,” and “chemistry” in the language of the journal as well as in Latin. The Latin form was also searched as many of the journals included the title of an article or book in Latin while the text of a review or content of an article remained in the vernacular. In some cases, however, due to the lettering of the early learned journals, the text terms searched were shortened to their first letters, such as “chym” or “alch”. For the exhaustive list of text terms used to search the journals, please refer to Appendix B.

In the case of the journal on microfilm and two other digital journals that could not be scanned using OCR, the journals’ indices and table of contents were examined for articles that might contain content relevant to the topic of interest; that is, I searched these journals much as a contemporary might have.⁴⁶ While this technique did not produce the same number of articles that the Search and Retrieval technique did, it did allow for these journals to be included in the study. Another drawback of this “old-fashioned” analysis technique is that it did not allow me to find any articles or reviews that may not have been considered *chymistry* by the editors or index-

⁴³ Arindam Chaudhuri et al., *Optical Character Recognition Systems for Different Languages with Soft Computing* (Switzerland: Springer, 2017), 1.

⁴⁴ Vishal Gupta and Gurpreet S. Lehal, “A Survey of Text Mining Techniques and Applications,” *Journal of Emerging Technologies in Web Intelligence* 1 no.1 (Aug. 2009): 60.

⁴⁵ Gupta and Lehal, “A Survey of Text Mining Techniques and Applications,” 74.

⁴⁶ The journals analyzed via the index and table of contents: *Miscellanea Berolinensia ad Incrementum Scientiarum*, *Miscellanea Curiosa Medico-Physica*, and *Nova Literaria Helvetica*.

writers of the journal—a situation that sometimes arose in the twelve other journals. To insure consistency as much as possible, I also searched indices and table of contents for the journals that were examined via text mining.

Methodology Part II: Choosing *Chymistry*

By the end of the Search and Retrieval phase of the text mining of the journals, I found an overwhelming number of hits returned for each journal. This is a problem in the field of text mining, where improvement is ongoing. It takes a very high-powered algorithm and machine to be capable of language comprehension, but “[h]umans have the ability to distinguish and apply linguistic patterns to text and humans can easily overcome obstacles that computers cannot easily handle such as slang, spelling variations and contextual meaning.”⁴⁷ In other words, the computer was able to find, at a speed a human could never match, all terms relevant to alchemy, *chymistry*, and chemistry, but lacked the ability to determine how those words interacted with the larger textual content around them. While it is interesting to know how many “alchemy”s or “chemistry”s were found in the *Philosophical Transactions* in 1688, it is not useful in trying to discover how a contemporary specialist discussed the concept of *chymistry*. To rectify this problem, I examined the placement of each Search and Retrieval term and how it interacted with larger article it appeared in.

After eliminating terms that appeared multiple times in the same article, I began to examine the context of the term in relevance to the article as a whole. It was during this part of the data collection process that the information collected from the journals about *chymistry* became less empirical and more subjective. I had to determine whether or not the article or review was an alchemical, *chymical*, or chemical article. There are no guidelines to follow by contemporary or modern scholars on what makes a *chymistry* article. Without certain guidelines

⁴⁷ Gupta and Lehal, “A Survey of Text Mining Techniques and Applications,” 60.

to follow, I decided that to be considered an article relevant to this study, the article or review had to contain at least one mention of some variation of the following: *chymical* techniques such as dissolution and transmutation, *chymical* properties such as acidity or alkalinity, medicinal procedures referencing *chymistry*, or ideas related to the history of *chymistry*. These categories appear broad, and they are. *Chymistry* as it appeared in the early learned journals was constantly evolving even as it was being published, and it would be erroneous to disregard an idea of *chymistry* for the reason it does not match one's perceived notions of what *chymistry* should be.

As mentioned in the section above and elaborated on in Appendix B, some of the terms used in searching the journals were variations on “*chymistry*” such as “*chymical*” or “*alchemical*”. These terms returned articles that discussed chemicals, acids, and techniques such as dissolution without ever mentioning the full term *chymistry*. This is demonstrated in an article in the 1669 edition of *Philosophical Transactions* that discusses *chymical* properties, such as acid and alkali, salt solutions, and mixing of Sulphur and Mercury, without ever mentioning the word “*chymistry*”.⁴⁸ The topics discussed in this article are by nature part of *chymistry*, and it would be a disservice not to include such an article in the data examined simply because it did not contain the word. I decided to include these types of articles in the data set because a practitioner reading these journals would have gained knowledge of *chymistry* from them.

One of the most common uses of the term “*alchemy*” or “*chemistry*” was to give significance to a person's professional status. For example, an article commenting on the *Tabulae Anatomicae* that appeared in the 1714 edition of the *Giornale de Letterati d'Italia*, mentioned that the contributor of the article has a library of eight thousand volumes which

⁴⁸ “Some Reflexions Made on the Enlarged Account of Dr Witties Answer to Hydrologia Chymica in Numb 51,” *Philosophical Transaction* 4 (1669): 1050-1055. From now on citations of early learned journals will be cited as follows: *Journal Title*, Year of Journal Publication: page number. For example: *Philosophical Transactions*, 1669: 1050-1055.

include *chymistry* texts.⁴⁹ That brief mention of *chymistry* was enough for the Search and Retrieval technique to return the article as relevant, but it was the only mention and the content of the rest of the article had nothing to do with *chymistry*; so, that article was discarded from the data set. Another article that was rejected for similar reasons appeared in the 1687 edition of *Acta Eruditorum*. It briefly mentioned, as an aside, that Robert Boyle wrote a book on experimental *chymistry*; the article then continues on without mentioning anything relevant to *chymistry* again.⁵⁰ Rejecting articles, even though they contained the terms “alchemy,” “*chymistry*,” and “chemistry,” aided in creating a data set that contained a more complete picture of the types of articles and books reviewed that actually discussed *chymistry* in detail.

After analyzing the all of the articles returned from the Search and Retrieval technique, 1,029 articles were left from thirteen journals. Two journals that were initially included in the study, *Nova Literaria Helvetica* and *Miscellanea Berolinensia ad Incrementum Scientiarum* were dropped after the Search and Retrieval technique returned few articles, and I was unable to find copies of the entire run of the journal content. The end set of data is as complete a set of articles and book reviews containing information on how Europeans discussed *chymistry* from 1665 to 1743 as I was able to compile using current technology and available resources. Please refer to Appendix A for a breakdown of the articles per journal.

⁴⁹ *Giornale de Letterati d'Italia*, 1714: 32.

⁵⁰ *Acta Eruditorum*, 1687: 75.

CHAPTER 2

“THE NATURE OF AN ANT,” OR THE NATURE OF *CHYMISTRY* IN EARLY LEARNED JOURNALS

BRUCE: What does it concern a Man to know the nature of an Ant?

LONGVIL: O it concerns a *Virtuoso* mightily: fo it be Knowledge, ‘tis no matter what.

----Thomas Shadwell, *The Virtuoso*⁵¹

In Shadwell’s *The Virtuoso*, the titular character, Sir Nicholas, displays his colony of ants to Bruce and Longvil in hopes of impressing upon them the importance ants can teach humans, especially about governments.⁵² Following Bruce and Longvil’s usual *modus operandi*, they relentlessly mock Sir Nicholas and *Virtuosos* in general. But, as with the entirety of the play, Shadwell allows a glimmer of the truth to emerge in the jest. It seems inconsequential to Bruce and Longvil to study something as trivial as an ant, and for what—mere knowledge! However, to the *Virtuosos* and the scientists, learning the nature, the makeup of a subject helped form a foundation for which they could build greater knowledge, leading to more complex experiments and theories that would not be possible without first studying the “nature of an ant.” This chapter aims to survey the nature of *chymistry* as it appears in the early learned journals and to demonstrate the complexity and variety in the types of *chymistry* that were available for the early learned journal reader to discuss.

In their article “Some Problems with the Historiography of Alchemy,” Lawrence Principe and William Newman proposed a “course of repudiation” to illustrate the divergence of alchemy and chemistry in the late seventeenth and early eighteenth centuries.⁵³ According to these historians of science, alchemy and chemistry remained indistinct throughout the seventeenth century (thus their term “chymistry”). By the early eighteenth century, the term alchemy came

⁵¹ Shadwell, *The Virtuoso*, 42.

⁵² *Ibid.* Apparently colonies of ants mirror a States-General Republic ala the Dutch!

⁵³ Principe and Newman, “Some Problems with the Historiography of Alchemy,” 386.

to refer more narrowly to gold-making, and suggested fraudulent practices. Over the course of the next four decades, alchemy and its traditional notions of transmutation fell into greater disrepute, but, Principe and Newman note, alchemical symbolism survived in a variety of contexts, such as in association with occult religion and freemasonry.

The analysis in this chapter largely confirms Principe and Newman's picture of the increasing divergence of alchemy and chemistry. This chapter argues, on the basis of a study of 1,029 articles discussing *chymistry* that over the course of the period 1665 to 1743 the credibility of and interest in *traditional alchemical thought* waned, while focus on training readers in laboratory techniques—a somewhat recognizable early form of chemistry—grew. At the same time as this development, it is also possible to see the consistent interest in medicinal and artisanal uses of *chymistry* in the early learned journals, useful applications for which the growing distinction between alchemy and chemistry seemed mostly irrelevant. By evaluating the diffusion of differing types of *chymistry* articles and their changing prevalence as time progressed, the overall analysis helps to substantiate the claim that the field of *chymistry* was intermingled between alchemical and chemical ideas but slowly began an evolutionary deviation in the eighteenth century.

Categories of Chymistry

I analyzed articles and book reviews in thirteen early learned journals for their content, the terms chosen to express the ideas of the author, and, in the case of book reviews, how the reviewer evaluated and presented the work being reviewed. For reviews, I examined the content of the books chosen for review in order to find out what the work was about and its contribution to the study of *chymistry*. Second, I evaluated the terms used by the journals authors for practices and ideas to see if the authors expressed their ideas in obscure terms as was common in

traditional alchemical thought, or, conversely, if they used technical terms whose meaning was explained in clear language.⁵⁴ Finally, I examined whether the author of the articles wrote about the topic to make it comprehensible, or adopted terms to obscure their argument to the audience. In the case of book reviews, I looked to see if reviewers sought to make *chymical* works more comprehensible to a non-specialist audience, if they distanced themselves, and if they provided clear opinions on the work they were reviewing. After examining all of the articles in this fashion, I determined that the articles seemed to fall into separate, but not mutually exclusive, groupings: allegorical, methodological, medical, and artisanal. Some combined two of the master categories established for the purpose of evaluation.

The following is a brief sketch of the content of each grouping. These groupings do in no way encompass all types of *chymistry* discussed in the early learned journals. They do, however, demonstrate the breadth of *chymistry* discussed in these journals. This description is intended to give readers a feel for the kinds of *chymical* information available for the early modern practitioner or general reader, the myriad ways that information was delivered, and to demonstrate the evolution from more alchemically based terminology to a style of discussing the field more concerned with training and techniques.

The articles that fit into the allegorical grouping will be discussed first followed by those in the methodological, medical, and then artisanal groupings. Finally, a discussion of the articles that are combination of two groupings will be examined.

⁵⁴ As it has been stated in this paper, in the late-seventeenth century there was no clear distinction between the terms or practices of alchemy and chemistry as recognized today. However, some of the thoughts and phrases used in the works appear to be closer to the fifteenth-seventeenth centuries' concept of alchemy. The use of the phrase *traditional alchemical thought* will represent the terms and phrases that are more akin to traditional alchemical practices of the fifteenth to early-seventeenth centuries.

Allegorical

The allegorical category contains those articles that discussed *chymistry* in terms that were hidden in metaphor or allegorical imagery. Often these articles discussed *chymistry* terms, practices, and theories in indirect ways: they did not always say what they actually meant. Many of the allegories were taken from religious practices and sacred literature. The majority were adopted from Western Christian practice and Biblical imagery, but did not exclude Greek and Arabic imagery. For example, the transformation of metals is often seen as a symbol for the regenerating force of religion in transforming the human soul.⁵⁵ Another common allegorical trope found in the articles is mythology, specifically Greek mythology. These allegories envisioned classical literature as alchemical source material, a means by which ancient knowledge might be recovered. A slightly less mythical allegorical trope is the use of Plato's *Timaeus* and its concepts of microcosms and macrocosms. *Timaeus* discussed the nature of the physical world and human's place in it. The authors of these works made sense of their *chymical* work in conjunction with Plato's concepts. It is noteworthy that many of the works that fall into allegorical category addressed the history of *chymistry*, magic, and the nature of bodies and spirits.

A sampling of how *chymistry* was transmitted in allegorical articles can be found in the 1702 *Histoire de l'Académie Royale des Sciences* article, "Sur des Experiences Faitees Aun Miroir Ardent Convex" in which the author engages in a discussion of the sun, mirrors, antimony, and *chymistry*.⁵⁶ The *miroir ardent* was a bent mirror supposedly able to kindle fire at a distance, attested in the work of Archimedes and long an interest of natural magicians. Antimony is a brittle metallic element frequently used by early modern alchemists, a pre-

⁵⁵ Maurice P. Crosland, *Historical Studies in the Language of Chemistry* (Cambridge, Mass: Harvard University Press, 1962), 10.

⁵⁶ *Histoire de l'Académie Royale des Sciences, avec les Mémoires de Mathématique et de Physique*, 1702: 34-38.

eighteenth century term that dropped out of the lexicon of *chymists* after Lavoisier created a new chemistry rhetoric, although antimony is still used as the name for an element.⁵⁷ Allegorical articles were likely to cite the work of traditional alchemists, biblical and Greek myths, and to discuss the notion of a universal spirit that animates all matter.

In other words, allegorical articles focused more on the language of ancient texts, matters of belief and theory, and often adopted obscure phrases and allegorical imagery to discuss those concepts. At the same time, it is important to acknowledge that the allegorical articles did not relay *traditional alchemical thought* in any simple, unitary way. Offering a unique perspective at the perception of *chymistry* during this time, they composed 26% of all articles, the second highest percentage, of all the *chymistry* material found in early learned journals (see Figure 2).

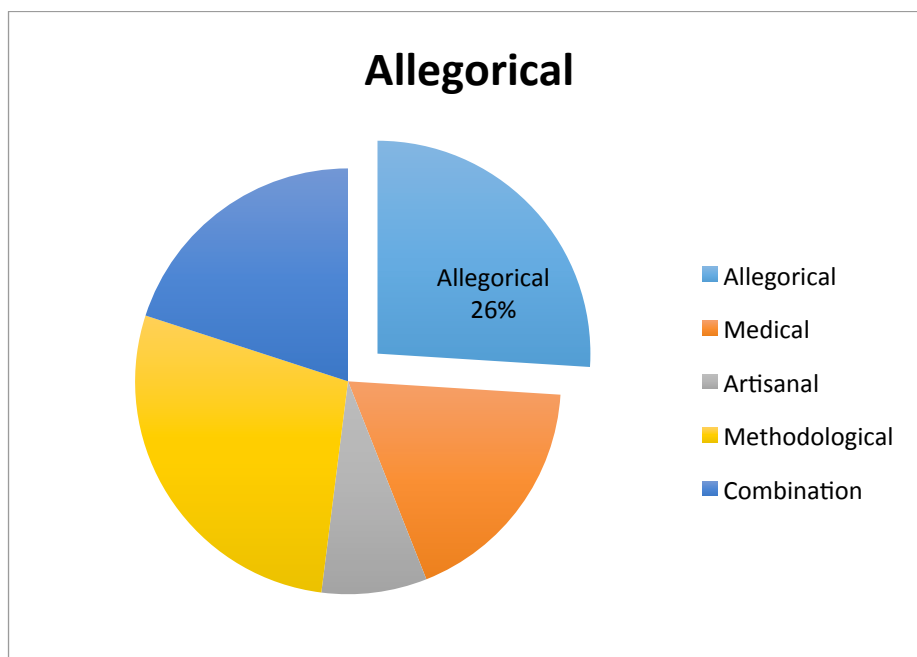


Figure 2: Percentage of allegorical type articles present in early learned journals

⁵⁷ Jon, Eklund. *The Incomplete Chymist: Being an Essay on the Eighteenth-Century Chemist in His Laboratory, with a Dictionary of Obsolete Chemical Terms of the Period*. Smithsonian Studies in History and Technology, No. 33. (Washington, Smithsonian Institution Press, 1975): 22.

Over a quarter of the articles discussing *chymistry* discussed it using allegorical patterns. This shows the persistence of *traditional alchemical thought* in the intermingled period of *chymistry*. Despite the significant percentage of articles, allegorical articles were not a constant throughout the period of 1665-1743. They were the dominate type of articles during the first half of the period studied. But by the early eighteenth century, there was a dramatic decrease in allegorical articles published in early learned journals. Allegorical articles steadily increased in prevalence until the 1700s (expect for a slight dip in the 1690s which all types of articles shared) when a decrease occurred. The argument can be made that as time progressed there was a move away, whether purposeful or not is unclear through this textual analysis, from the publication and proliferation of allegorical articles while there was an increase in methodological articles, which will be discussed in the next section.

Methodological

The methodological category is not a catchall grouping of articles. The articles that fit under its purview use terms that were not obscured in allegorical references, but referred to mundane processes that, in many cases, have survived to become contemporary “scientific” terminology. Some examples of these terms include *la distillation*, *l'exhalation*, *la precipitation*, and *la sublimation*.⁵⁸ These terms can be found defined in *The Incompleat Chemist: Being a Essay on the Eighteenth-Century Chemist in his Laboratory, with a Dictionary of Obsolete Chemical Terms of the Period*.⁵⁹ The fact that the terms could be defined with one unifying definition spoke to their clarity and their acknowledged value in performing experiments and *chymical* operations. Many of these articles define experiments and the process or steps of performing experiments. They also focused less on the mystical aspects such as sprits and

⁵⁸ distillation, exhalation, precipitation, and sublimation.

⁵⁹ Eklund, *The Incompleat Chymist*.

instead focused on descriptions and concrete evidence. Again, it is important to realize that while it seems that the methodological *chymistry* category is similar to the modern understanding of chemistry, it is not.

An article in the 1672 edition of the *Miscellanea Curiosa* provides a good example of a methodological article. Titled, “*Præcellentissimi Viri, Domini et Fautores Honoratissimi*,” the author not only states that his purpose in writing the article is to reveal the secrets surrounding the art of *chymistry* by offering a practical guide on how to set up a laboratory and providing illustrations as well as *chymical* experiments to try.⁶⁰ Later, in the 1688 edition of the same journal, there appears an article, “*Experimenta Chymica*,” that details the main points of twelve different *chymical* experiments and what, if one should choose to replicate them one could expect as results, with elements such as antimony, iron, salt, sulphur, and tartar.⁶¹

The methodological articles focused on *chymistry* processes and directions to perform those *chymical* operations in clear, un-obscure language. The methodological *chymistry* articles were not modern chemistry, and like the allegorical articles, demonstrated distinct leanings toward a particular, practical way of defining the field of *chymical* knowledge. Overall, these types of articles comprised the largest category of articles in early learned journals at 28% (see Figure 3).

⁶⁰ *Miscellanea Curiosa*, 1672: 96-106.

⁶¹ *Miscellanea Curiosa*, 1688: 424-426.

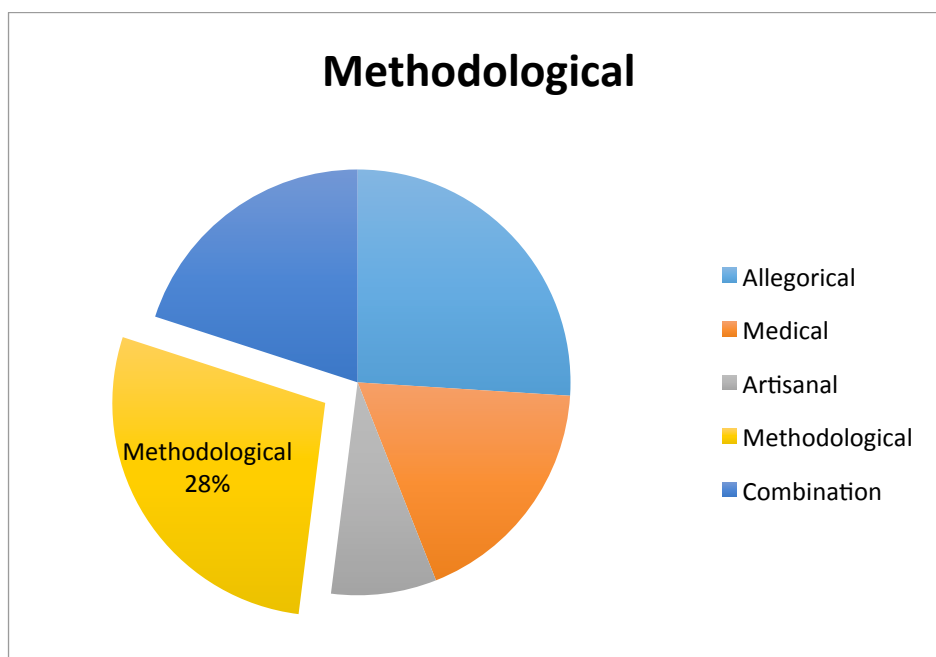


Figure 3: Percentage of methodological type articles present in early learned journals

Similar to the allegorical articles, the frequency of methodological articles increased throughout the first half of the studied period. Unlike the allegorical articles though, they did not have a drastic decrease after the 1700s. In fact methodological articles became the dominant type of article found in early learned journals. The continuation and dominance of methodological articles from the 1700s onwards aids in arguing for the beginning of the diverging ways of thinking developing in the field of *chymistry* during this time.

Medical

Those articles that fall into the medical grouping focus on *chymistry* as a way to create medical remedies. There is little *chymical* theory found in those articles and little explanation of *chymical* practices. Rather, these articles tend to discuss *chymistry* as a means to create a desired outcome: elixirs.

The creation of elixirs was a common goal of *traditional alchemical thought* that was closely related to chemical medicine.⁶² The branch of medical chemistry was first distinguished by the Paracelsians, based on the teachings of Paracelsus, which argued for the application of *chymistry* to cure ailments. The term *iatrochemistry* is often used to describe this form of medical practice, in which Galenic ideas about the humors were abandoned to a *chymically*-based theory about the operation of the body and the means to cure it.⁶³

While these articles in this category tell us little about how alchemy and chemistry eventually diverged, they do show the influence of Enlightenment thought on *chymistry* since they focused on the practical application of *chymical* knowledge to cure illness. If the public sometimes viewed *chymistry* as devoted to pointless experiments, *chymistry*, depicted as a means to serve medicinal purposes, helped the field gain credence and public acknowledgement

The *Galleria di Minerva* in 1700 provides an interesting example of a medical article associating *chymists* and doctors on the basis that they both segregate fluids, specifically bodily fluids in their work.⁶⁴ A review of Christian Lange's book appearing in 1689 edition of the *Bibliothèque Universelle et Historique* places emphasis on Lange's uses of spagyrics (medicines produced from herbs) and explains how they can be created using *chymistry* to get the best result.⁶⁵ And the 1671 *Acta Medica et Philosophica Hafniensia* article, "*Theriaca Danica Minor*" discusses how *chymistry* can be used in surgery as well as how "*chymical fires*" can be used as a mixing agent with silver to create medicines.⁶⁶

The medical articles indicate that *chymistry* and medicine were often seen as naturally complementary subjects and were combined together. *Chymistry* was necessary to create the

⁶² Crosland, *Historical Studies in the Language of Chemistry*, 15.

⁶³ Water Pagel, *Paracelsus: An Introduction to Philosophical Medicine in the Era of the Renaissance*, 2nd Revised Edition (New York: Karger, 1982), 366.

⁶⁴ *Galleria di Minerva*, 1700: 72-76.

⁶⁵ *Bibliothèque Universelle et Historique*, 1689: 92-93.

⁶⁶ *Acta Medica et Philosophica Hafniensia*, 1671: 35-36.

remedies for illnesses. Yet, it appeared that *chymistry* was beginning to play second fiddle to medical theory and practice. The articles often spend the majority of their time describing the symptoms of illnesses and explaining how and why illnesses occur. Very little attention was given to the *chymical* processes involved in making the remedies. It is possible book reviews falling into this category are evaluating works that give more attention to the *chymistry* needed for the remedies. The medical articles represented 18% of the articles examined in the early learned journals (see Figure 4). Throughout the time period examined, medical articles were a consistent presence throughout the journals. While they had their increases and decreases in frequency throughout the near hundred-year period, the data shows that medical discussion of the uses of *chymistry* were prevalent and a common trope in *chymistry*. While these articles contribute little to our understanding of the developing separation of alchemy and chemistry, it is important to not exclude them from an analysis of *chymistry* text reviews as they represented a valuable part of the *chymical* fabric at this time.

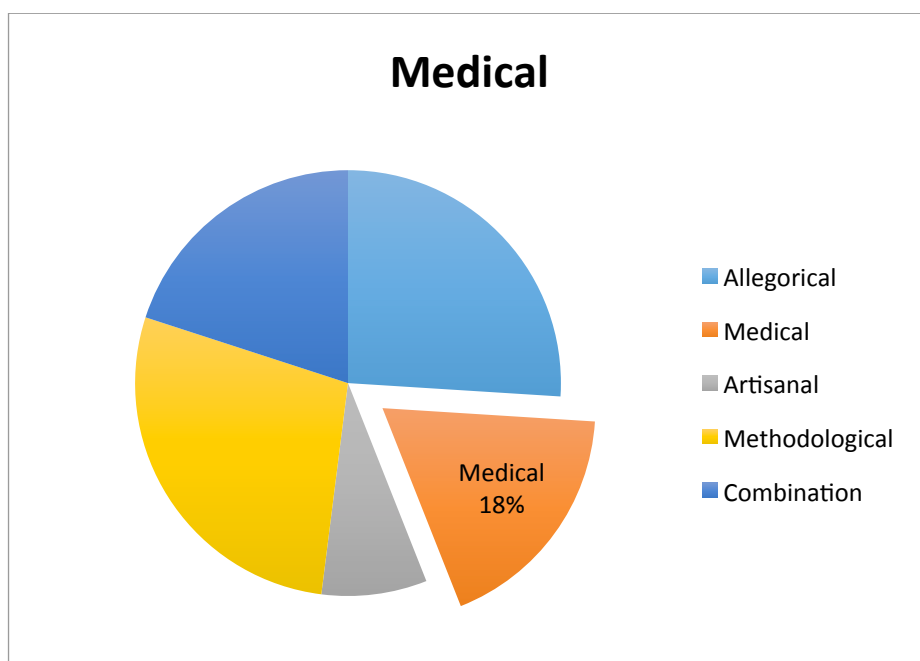


Figure 4: Percentage of medical type articles present in early learned journals.

Artisanal

The articles that fall into the artisanal category are, overall, less common but are no less important than any of the other categories. These articles discussed *chymistry* in ways that were relevant to artisans and practitioners rather than scholars and physicians. The common element uniting these articles is discussion of *chymical* elements to improve glassmaking, metalworking, and various other products.

Scholars such as Pamela Long and Paula Findlen have argued that artisanal problem-solving is relevant to the history of science because “artisanal culture did influence approaches to the investigation into the natural world.”⁶⁷ The articles in the artisanal grouping illustrate this partnership, as they represent the search for different and better artisanal methods driving the use of *chymical* experimentation rather than discoveries in *chymistry* leading to insight into artisanal methods.

As an example of the articles that fall into this category, consider the 1689 article in the *Miscellanea Curiosa*, “*De Vitrificatione Metallorum*” which details how to better glasses and various other metals with the addition of fixed salts.⁶⁸ A year later in the same journal, another article, “*De Vinorum quorumcunq; ac aceti æmulatione, & farina tritecae multiplicanda,*” discusses how *chymical* practices can be used in creating “wines” (more likely, distilled spirits) with different vinegars and wheat flours.⁶⁹ And in the 1710 edition of the *Giornale de literati*

⁶⁷ Pamela O. Long, *Artisan/Practitioners and the Rise of the New Sciences, 1400-1600* (Corvallis: Oregon State University Press, 2011), 28. Recent historical scholarship on artisanal practices in the history of science include Pamela O. Long, *Artisan/Practitioners and the Rise of the New Sciences, 1400-1600* (Corvallis: Oregon State University Press, 2011), and *Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago: University of Chicago Press, 2004); Paula Findlen, *Possessing Nature: Museums, Collecting and Scientific Culture in Early Modern Italy* (Berkeley: University of California Press, 1995).

⁶⁸ *Miscellanea Medico-Physica Curiosa*. 1688. 115-125.

⁶⁹ *Miscellanea Medico-Physica Curiosa*, 1689: 123-30.

d'Italia, contained an article discussing the addition of alkaline and saltpeter to aid in the dissolving and forming of glass.⁷⁰

These articles speak to a reader of the journals that may not be the educated scholar that is commonly associated with the early learned journal. As the issues discussed directly address professions such as glassmaking and winemaking, these articles may suggest a broader readership base.⁷¹ However, since this artisanal grouping represents the smallest category, only making up 8% of the articles, it is difficult to say exactly what audience the authors of the group were trying to reach (see Figure 5).

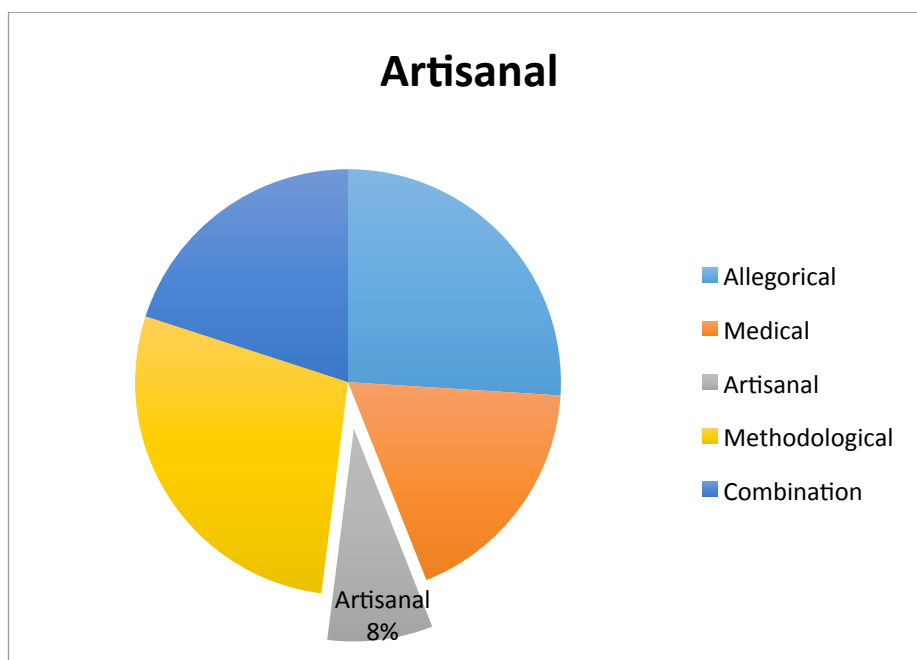


Figure 5: Percentage of artisanal type articles present in early learned journals.

The artisanal category of *chymistry* articles address an important aspect of scientific culture during the early modern period: the practitioner of a craft. Similar to the medical category, artisanal articles remained a constant presence in early learned journals from 1665 to 1743. This evidence points to the argument that artisanal articles were neither allegorically or

⁷⁰ *Giornale de literati d'Italia*, 1710: 57-73.

⁷¹ See the Introduction for a more complete discussion of the readership of early learned journals.

methodologically inclined, but instead incorporated elements that appealed to audience of practitioners that bridged the diverging gap between the two.

Combination

Aside from the four main categories, some articles appear to fit into two, and sometimes even three different categories. These combination articles are mostly medical and methodological *chymistry* articles that contain an allegorical or artisanal reference. While these articles are usually more medical or methodological *chymistry*, they contain enough allegorical references in them to be considered a mixture of categories. All of the medical articles have an aspect of *chymistry* in them, but they do not fall into the methodological section as they do not discuss the *chymical* experiments or processes in great detail. Mostly, the large number of articles that fall into two categories provide evidence of how intertwined alchemy and chemistry remained during the early half of the period under consideration.

An article in the 1704 *Galleria di Minerva* provides a suitable example of the complexity that combination articles bring to the discussion on *chymistry*. In this article, the author employs the terminology of microcosms and macrocosms, an allegorical trope, in conjunction with experimental *chymistry* ideas.⁷² Similarly, in the 1690 edition of the *Bibliothèque Universelle et Historique* a review of Caspar Cramer and Justus Vesti's *Collegium Chymicum* discusses aspects of fermentation, normally a clear, un-obscure term, but adopts allegorical phrases to do so, such as “first light” and “golden calf” which refer to Greek myths that the reader must have prior knowledge of.⁷³

⁷² *Galleria di Minerva*, 1704: 268.

⁷³ *Bibliothèque Universelle et Historique*, 1690: 454-458.

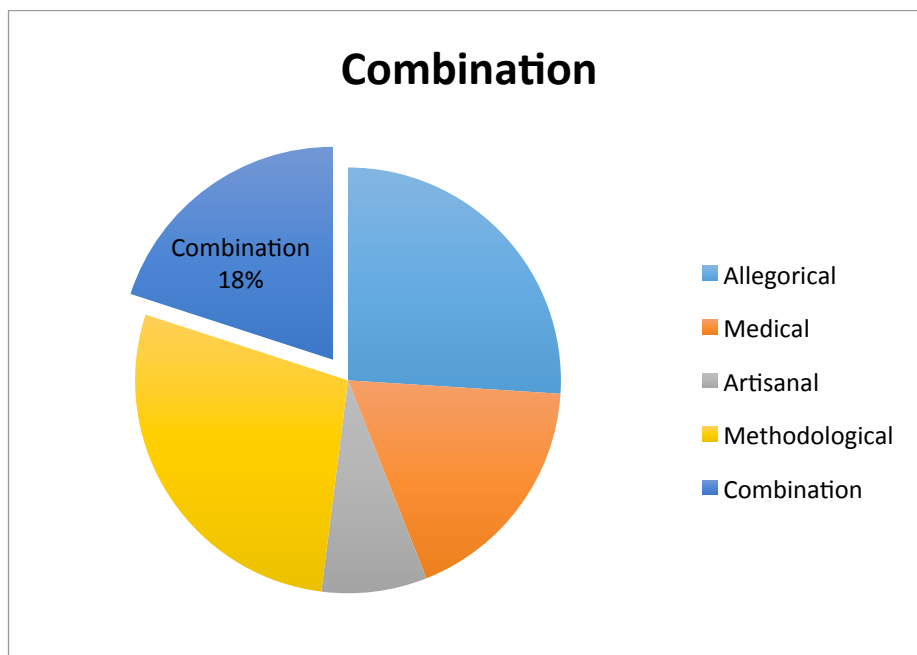


Figure 6: Percentage of combination type articles present in early learned journals

Combination articles comprised 20% of the articles examined (see Figure 6).

They followed a similar trajectory as the allegorical articles in that they had a steady increase of publication until the 1700s and then began a downfall in frequency. Unlike the allegorical categories though, they did not have as dramatic of a decrease in publication after the beginning of the eighteenth century; however, they still decreased at a significant pace. The books that were a combination of two groupings provide the most curious assessment of *chymistry*'s role.

This trend in combination articles makes an argument in support of the premise that *chymistry* entailed a hybrid between alchemy and chemistry in the late seventeenth century. The authors used various degrees of allegorical imagery and artisanal purpose combined with instructions on how to complete *chymical* procedures. These articles and book reviews were not the product of one way of thinking—allegorical or methodological—but a mixed way. The authors spoke of *chymistry* and defined *chymistry* as a mixing of both. One way this could be explained is through the authors' training—they were all products of a university education in the sciences and taught at that level as well. At this time science was a staple at universities but

chymistry was just beginning to become an accepted field of study. When these authors were going through their education they would have been taught scientific procedures. But their *chymistry* education would still have come from those trained through *traditional alchemical thought* first, and scientific method second. The way the books combined these ways of thinking demonstrated the intermingling of these two ways of thought when the field of *chymistry* was on the precipice of change.

Implications

The argument this chapter sets out to illustrate is that through the analysis of 1,029 articles discussing *chymistry* over the period of 1665 through 1743, we can visualize the diverging ways of discussing and thinking about *chymistry*. Examining Figure 7 shows just how varied the discussion of *chymistry* was during this time. It also emphasizes the distribution of categorical tropes most prevalent in each decade examined.

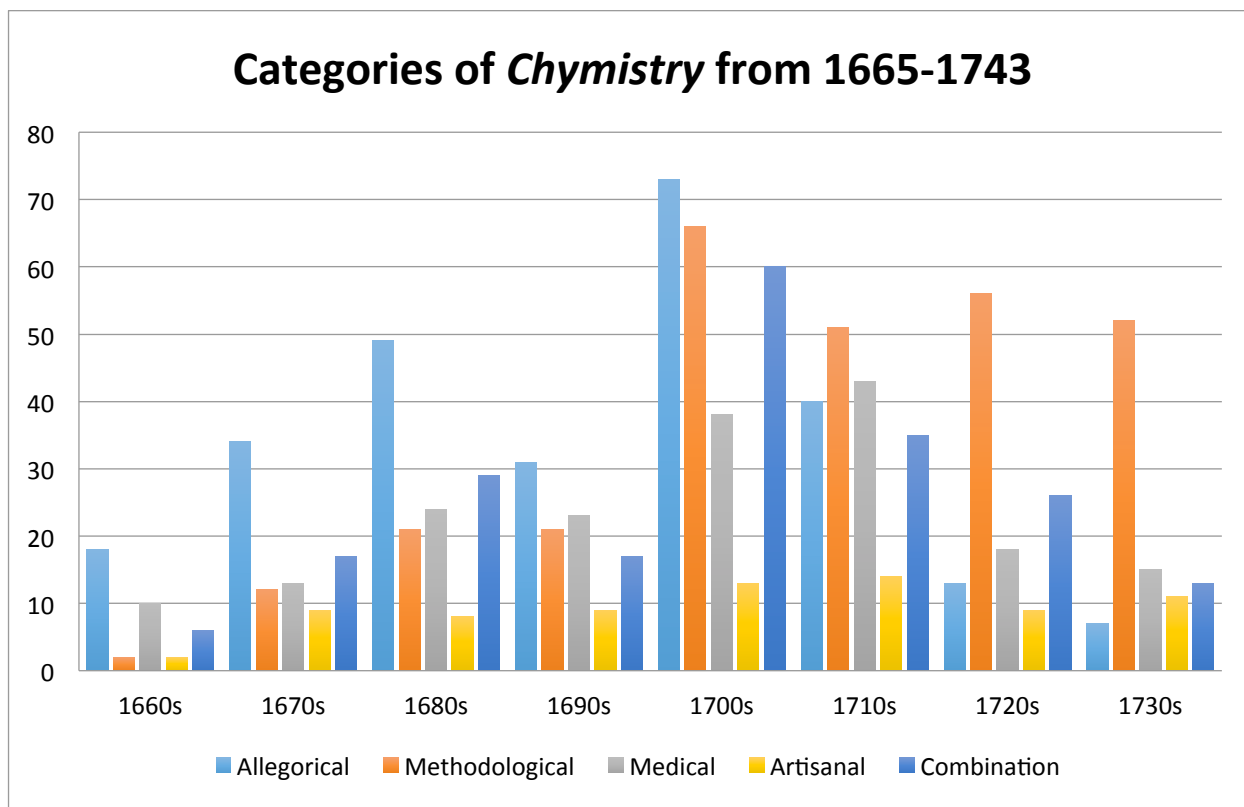


Figure 7: Categories of *Chymistry* from 1665-1743 found in articles in early learned journals

The claim that alchemy and chemistry diverged is most obvious when looking at trends in the publication of allegorical and methodological articles. These articles represent opposing trends of *chymical* thought occurring at this time. Allegorical articles were representative of *traditional alchemical thinking*, while methodological articles show leanings toward more modern chemistry. The fact that both allegorical works with discussions of magic and references to known alchemists existed simultaneously with works that denounced magic and promoted clear instructions of processes speaks to how merged *chymistry* remained in the late seventeenth century.

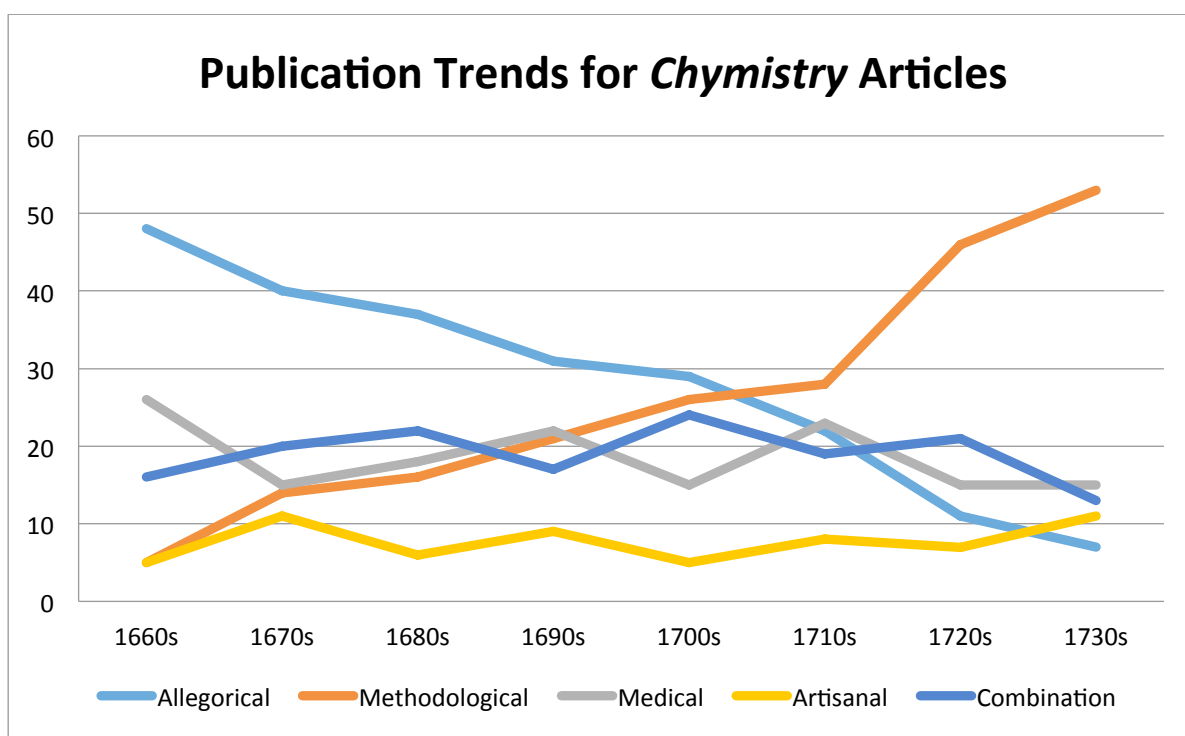


Figure 8: Publication trends for *chymistry* articles found in early learned journals. NB: This chart reflects the changing percentage of articles in this category over time demonstrating the relationships of the various categories within the broad field of articles published.

When transposing the trends of publication for the article categories on top of one another, (see Figure 8) a distinct pattern emerges. As allegorical articles decline in prevalence in the journals, methodological articles rise, a change that occurs around the turn of the eighteenth

century. The articles themselves do not tell why this divergence is occurring, but it is obvious that a divergence in the acceptable ways of discussing *chymistry* is being meted out by the early learned journals. Interestingly enough, when we examine the combination articles, alongside trends in the prevalence of allegorical and methodological trends, we can see that while the combination articles do decline at about the same time as the allegorical articles, they remain more prevalent. This suggests that allegorical remnants of *chymistry* still remained present in *chymical* discussion even as they lost the preeminence as an approach to the topic. This trend lends support to the argument that while there was divergence occurring in the field of *chymistry*, it was a slow divergence in which remnants of *traditional alchemical thought* and modern chemical approaches continued to be intermixed throughout the period.

The medical and artisanal categories present in the data set do little to sway, in one way or another, the idea of an evolutionary change in the field of *chymistry*. They do, however, represent that *chymistry* was consistently being discussed from 1665-1743 and that the discussion of *chymistry* was not restricted to strictly *chymical* aspects, but embraced the practical ways *chymistry* was being used for advance in medicine and artisanal production.

The analysis of *chymistry* articles in early learned journals helps demonstrate the argument that while the field of *chymistry* coalesced between alchemical and chemical ideas, it slowly was beginning to diverge into distinct types of practices.

CHAPTER 3

“WELCOME INTO MY POOR LABORATORY”: PRIVATE AND PUBLIC TENSIONS SEEN THROUGH *CHYMISTRY*

Sir Nicholas: You are right welcome into my poor Laboratory; and if in ought I can serve you in the way of Science my nature is diffusive, and I shall be glad of communicating with such eminent *Virtuoso*'s as I am let to know you are.

---Thomas Shadwell, *The Virtuoso*⁷⁴

Sir Nicholas, Shadwell's titular *Virtuoso*, has no qualms against inviting lesser adepts than himself into his laboratory to share in his learning. He welcomes the chance to present scientific knowledge. He even offers to communicate with other *Virtuosos* to find out more knowledge if Bruce and Longvil desire it. Sir Nicholas is a representative figure of a rising development in the scientific world; the idea that scientific knowledge should be shared with those wishing to know more, or in the case of Bruce and Longvil, even those with no true desire to know. This concept was at odds with the standing convention of only sharing knowledge with other adepts or those already initiated into the sciences. This chapter uses *chymistry* to examine the tensions underlying the shift of knowledge from private to private realms through an analysis of the ways that early learned journals treated secrets.

The analysis of these thirteen journals revealed that the shift from a world in which science was privileged, private knowledge toward the notion that scientific credibility required transparent and public discussion was reflected in the production of books and articles on scientific subjects. Before the last decades of the seventeenth century, *chymical* knowledge had often passed from practitioner to apprentice. By the late seventeenth century, this time-honored tradition seemed to be shifting. And this is the crux of this matter—while there is textual proof of

⁷⁴ Shadwell, *The Virtuoso*, 26.

scientific, or for this thesis *chymical*, “secrets” being published, it is difficult to ascertain how receptive the public was to the divulging of these secrets.

Chymistry was not unique in exposing its secrets via print. William Eamon has noted that this shift from private towards public forms of knowledge was occurring concurrently in the genre of books of secrets, which “revealed recipes, formulas, and ‘experiments’ associated with one of the crafts or with medicine.”⁷⁵ By the late seventeenth century, books of secrets were publishing technological and craft recipes that had once been closely guarded by guilds. Yet, as Eamon points out, “[t]he effectiveness and sophistication of the techniques described in these early manuals varied wildly, and it is difficult to gauge the extent to which they may have actually influenced technical know-how at the popular level.”⁷⁶ Eamon’s work is a reminder that a host of factors influenced how scientific knowledge made the transition from a secret, privileged form of knowledge to knowledge exposed and scrutinized by the public.

In this chapter I argue that it appears many of the writers of the articles and reviews were willing to publish articles that merged private and public aspects of *chymistry* as demonstrated by the authors’ wielding of secrets in their texts, but they often struggled in the execution. In many of the works the reader confronts a need for secret or prior knowledge to understand the texts and articles, as if the writers of both articles and reviews struggled simultaneously to write for the mass public and still treat *chymistry* as a secret art. It was often the audience who did not know how to react to the information exposed. To demonstrate the tensions dividing the private and public pursuit of scientific knowledge, I will discuss articles found in three different journals, the *Acta Medica et Philosophica Hafniensia*, *Bibliothèque Universelle et Historique*, and *Philosophical Transactions*. The examination of how the early learned journal handled “secrets”

⁷⁵ William Eamon, *Science and Secrets of Nature: Books of Secrets in Medieval and Early Modern Culture* (Princeton, N.J.: Princeton University Press, 1994), 4.

⁷⁶ Eamon, *Science and Secrets of Nature*, 133.

reveals how the changing field of *chymistry* was slowly evolving from the secretive tradition of alchemical practices to a more open, technically oriented discipline.

The Rise of Public Science

The late seventeenth century witnessed the acceptance of new forms of scientific expression that fostered the creation of public science. Public science was the mixing of socially formed inquiry of scientific practices that addressed issues such as techniques, methods, and practices. This new concept allowed science to be viewed as a socially acceptable activity rather than a secret pursuit, and critically, it entitled public opinion to play a role in what was accepted or not accepted as fact.

Defining public opinion has proven difficult, in part because the term did not actually develop, etymologically speaking, until 1798. Mona Ozouf discusses how public opinion came to be, first by explaining what *public* and *opinion* meant during the eighteenth century. *Opinion* meant doubtful or probable knowledge specific to an individual, while *public* was defined as many. As a result, it would have been considered illogical to attach *opinion* and *public* together since one denoted an individual's knowledge and the other referred to a group. However, Ozouf argues, the concepts started to be linked as individual *opinion* came to challenge the prestige of ostensibly proven knowledge in the mid-eighteenth century. Around the same time, the idea of *public* ceased to connote a chaotic "many" and came to represent the mass of people as a single entity. These linguistic transformations set the stage for the term "public opinion" to develop and to signify something meaningful.⁷⁷

Yet even if "public opinion" did not enter the (French) lexicon until 1798, a force we would recognize as "public opinion" had already begun to influence scientific ideas and practices. The evidence is visible in the choice of practitioners to hold more public

⁷⁷ Mona Ozouf, "'Public Opinion' at the End of the Old Regime," *The Journal of Modern History* 60 (1988): S1–S3.

demonstrations of experiments and to give lectures to prove and to share what they had learned. Jan Golinski makes the argument that, “making facts through agreement among the witnesses [the public] to an experiment, and then extending them by replicating the experiments in other locations, [... shows] how social relations should be reorganized by science”.⁷⁸ The scientists may have performed their experiments correctly, however the public was able to use their reason to decide if the practitioners were charlatans or if a reproduction of their experiment would be accepted. That is not to say that the public had the final voice in deciding the value of continuing to pursue certain experiments, yet, increasingly, the visibility of a science opened to the judgment of public opinion played a role in defining scientific credibility.⁷⁹

The phenomenon of public science was influenced by new intellectual ideas beginning to circulate throughout Europe. Perhaps the biggest contributor to the notion of public science was the Enlightenment. Enlightenment thought emphasized the power of the reasoning individual to judge for himself or herself, as well as stressing the connections between science and utility. Before this era, scientists like Shadwell’s titular Virtuoso were focused on gathering knowledge to further their understanding of a subject and burnish their reputation. Increasingly by the eighteenth century, public opinion celebrated knowledge for serving useful purposes. Public science, in other words, challenged traditional norms about who had the authority to define what was true and what knowledge was worth pursuing. In his study of public reactions to another traditional practice of adepts—dowsing—from the late seventeenth through the late eighteenth century, Michael Lynn demonstrated how the French public claimed the right to decide on its

⁷⁸ Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820* (Cambridge [England] ; New York: Cambridge University Press 1992), 5.

⁷⁹ Recent historical scholarship on public science include Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820* (Cambridge [England] ; New York: Cambridge University Press, 1992); Michael R. Lynn, *Popular Science and Public Opinion in Eighteenth-Century France* (New York: Palgrave, 2006); Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, N.J.: Princeton University Press, 1985); Steven Shapin, *A Social History of Truth: Civility and Science in Seventeenth-Century England* (Chicago: University of Chicago Press, 1994).

own what represented credible and useful science, despite what the “adepts” or experts thought. Lynn argues that “[t]hroughout the eighteenth century more and more people placed more and more emphasis on reason and utility; but they frequently held a singularly personal version of these ideas, one that could easily ignore the wishes and desires of the intellectual and cultural elite”.⁸⁰ Even as new scientific models of causation made experts dismiss dowsing as superstition, public trials that seemed to show dowsers were able to find sources of water gave the practice some residual public credibility.

The popular medium of journals played a role in these transformations because through them non-expert readers were increasingly able to access the domain of science. These early learned journals provide a lens which to view the shifting boundaries between traditional practices of scientific verification and communication and the emerging public sphere of science. Articles and reviews in the journals made scientific literature available to a wider public in a way traditional scientific practices and publishing had not, especially when journals were written in the national vernacular. Readers did not have to know Latin to be able to follow developments in a variety of scholarly fields. The choice to publish in the vernacular opened the journal up to a wider audience, though we cannot, as we have seen, be certain just how wide that audience actually was. Through the journals, this wider audience was exposed to a science that had once been considered a private pursuit in a laboratory, helping to redefine *chymistry* from a science for adepts to something within reach of any educated person. The rise of public science was marked by the shift from private studying of science to a sharing of results and experimentation with the wider public, redefining *chymistry* from a science for adepts to something within reach of any educated person.

⁸⁰ Michael R. Lynn, “Divining the Enlightenment: Public Opinion and Popular Science in Old Regime France,” *Isis* 92, no. 1 (2001): 36.

The Wielding of Secrets in Early Learned Journals

The following section discusses in detail how the authors, editors, and in some cases, the public handled “secrets” in early learned journals. The analysis of the concept of “secrets” helps to examine the tension between the private and public spheres of science, as articles in early learned journals wrestled with the idea of how to write about a chimeric field that depended upon prior knowledge and information passed through adepts in publications that would reach a mass, and probably, non-adept audience.

Secrets Encoded

At first glance, “*Materia perlatae Larva detecta, & verissima ejusdem material utiliasq; detecta,*” an article which appears in the third volume, with no exact year, of *Acta Medica et Philosophica Hafniensia* seems no different than the numerous other articles discussing *chymistry*. The article, mainly in Latin, discusses an aspect of antimony, a brittle metallic element that had long fascinated *chymists*. In particular, the article discusses in detail a stage in *Materia Perlatae*, a step in creating the diaphoretic antimony, which was often used in medicine. The article never explicitly states what *Materia Perlatae* is; it just discusses the steps necessary to create it and what the practitioner should expect and observe during the various stages of its creation.⁸¹ The author also cites Basil Valentine, a fifteenth-century alchemist who authored many alchemical works, in particular the famous *The Twelve Keys of Basil Valentine* (1599) and *The Triumphant Chariot of Antimony* (1604).⁸²

This article might not attract attention, except that it soon becomes clear that the author of this journal article is not the original author of the text. Rather, the author of the journal article claims to be the first person who has been able to unravel the cipher in which the original text

⁸¹ *Acta Medica et Philosophica Hafniensia*, 1674-1676: 51-53

⁸² Basil Valentine is thought to be a pseudonym from which other German authors published alchemical treatises; however, contemporaries understood his works to be published by one author.

was encoded. As it turns out, the text describing these *chymical* steps was originally recorded in a German manuscript using steganography, the practice of hiding a message within another message. The author of the article was able to discover the cipher, realize it was written in German, and then translate the German into Latin for publication in the journal. The author does not go into detail about how he figured out the steganography except for saying, “[*q*]uib[us] juxta atis *Steganographicae fundamenta diligenter examinatis*,” choosing not to elucidate his purpose or method further.⁸³ The article gives the first paragraph of the steganographic text, the cipher, and the text in German. See Figure 9 for the cipher and Figure 10 for a sample of the steganographic text before decoding.

A.	B.	C.	D.	E.	F.	G.	H.	I.	K.	L.	M.	N.	O.
e.	c.	d.	g.	i.	l.	p.	k.	o.	h.	m.	n.	r.	u.
P.	Q.	R.	S.	T.	U.	V.	W.	X.	Y.	Z.			
t.	x.	f.	f.	w.	a.	a.	z.	q.	8.	b.			

Figure 9: Cipher Key in “*Materia perlatae Larva detecta, & verissima ejusdem material utiliasq; detecta*”⁸⁴

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 foemofwtrugis Zaswbhscinis liom ; zoso eadk or hioris
 hlanmegir pilargir ; Furgier if ofw ior aisan irf siemi , arg
 fukrgis mallw , Zimdkis , fu cemg is gasdk Kaimll gif
 a'amdero aur gin Oatowis fimcfw bas picaksw ledomowo

Figure 10: Sample of the steganographic text before decoding in “*Materia perlatae Larva detecta, & verissima ejusdem material utiliasq; detecta*”⁸⁵

⁸³ “Having carefully examined the art steganographic foundations,” *Acta Medica et Philosophica Hafniensia*, 1674-1676: 48.

⁸⁴ *Acta Medica et Philosophica Hafniensia*, 1674-1676: 48.

⁸⁵ *Acta Medica et Philosophica Hafniensia*, 1674-1676: 48.

It was not uncommon for texts, especially those dealing with alchemical texts, to be shrouded in secrecy. Many texts were written with allegorical phrases as a means of code, while other texts were literally encoded via ciphers and steganography. In his article on the use of ciphers in magical texts, Benedek Láng, argues that ciphers can be used for protection (keeping the uninitiated out), exposure (creating a language that users could manipulate without outside interference), and dissimulation (such as steganography to conceal that messages even exist).⁸⁶ While this schema is helpful to think about the function of ciphers in traditional alchemical texts, it prompts additional questions about this odd article, because, at first glance, no information contained in the article appears suspect, or represents previously unknown knowledge. None of the information published in the revealed text was new to the *chymical* field. The author who translated the article writes only that he discovered the encoded papers, so it is unclear whether or not the original author, who encoded the work, even wanted the text published, especially in its decoded state. But Láng's article provides an interesting hint about how we might understand this article, when he points out that the function of coded texts was not to make the encoded content unavailable, but rather to "invite engagement with the text, which can be described as a special maneuver in the rhetoric of secrecy."⁸⁷ If this is the case, perhaps the original author was not secreting away knowledge about *Materia Perlatæ* but instead wanted the audience to interact with the text, to uncover the cipher, and gain a better understanding of the *chymical* topic it discussed. Alternatively, perhaps the decoding author sought to attract more interest to his material on the basis of the claim it had originally been encoded by its author. Whatever the answer, the *Materia Perlatæ* article demonstrates the early learned journals'

⁸⁶ Benedek Láng, "Ciphers in Magic: Techniques of Revelation and Concealment," *Magic, Ritual, and Witchcraft* 10, no. 2 (Winter 2015): 129-140.

⁸⁷ Láng, "Ciphers in Magic," 125.

willingness to expose and present secrets to the public. The journals seemed, at least in this case, inclined to promote public interest in science through their indifference in keeping secrets secret.

The Promise of Secrets

In 1689, the thirteenth volume of the *Bibliothèque Universelle et Historique*, published a review of Jakob Tollius' *Sapientia Insaniens, Sive Promissa Chemica: Ad Perillustres & Amplissimos Consules Inclytæ Civitatis Amstelaedamensis*, in which the author examined the philosophical theories behind the field of *chymistry*.⁸⁸ In this work, Tollius deploys an allegorical trope—Plato's concept of macrocosms and microcosms explored in *Timæus*—to explain the ways in which different elements unite. Tollius relied on the citation of known alchemists to support his own work. In this book he cited, once again, Basil Valentine, as well as the figure “Geber”, an alchemist who was active during the Middle Ages and wrote many books on alchemy and metallurgy. For example when Tollius discussed *l'illumination* as a *chymical* term and from that proposed *chymistry* as an art, he included quotes from Basil Valentine to support his interpretation.⁸⁹ Geber served as an authority to ground Tollius' discussion of astrological allusions in *chymistry*. Yet, if Tollius cited traditional alchemical authorities, he did little to explain his allusions in ways that would make his book accessible to a broad public. His lack of explanation suggests that only those with previous understanding could hope to further understand the topic which Tollius wrote.

The most interesting aspect, however, of Tollius' work comes when the reviewer mentions as a curious point in the work that Tollius, “*promet de communiquer encore plusieurs autres secrets au Public*”.⁹⁰ Tollius clearly drew heavily on *traditional alchemical thought*, yet was eager and willing to share with the broader public what earlier was a private matter among

⁸⁸ It was published in Latin in 1689.

⁸⁹ *Bibliothèque Universelle et Historique*, 1689: 212.

⁹⁰ “promises to still communicate several other secrets to the Public”. *Bibliothèque Universelle et Historique*, 1689: 214.

chymists. This drew the reviewer's attention. But Tollius' promises were Janus-faced, because several times throughout the review, the reviewer quotes Tollius claiming that one needed to be an adept to have *chymical* processes revealed to them or to understand his references to Geber. So while Tollius firmly believed that he had revealed some secrets of *chymistry* already and appeared to have no qualms against communicating more, he does, perhaps instinctively, rely on an educated readership with some prior knowledge who were, alone, able to comprehend the material he offers up to public view.

In other words, both *Sapientia Insaniens* and the review described here reveal a kind of ambivalence regarding secrets. Throughout the work, Tollius makes reference to the works of Geber and Valentine without explaining them. This requires the public to be "in" on the secret knowledge. As a result, Tollius' book and his reviewer's task of description could not escape from the traditional way alchemists had passed on knowledge, a process reserved to other worthy adepts. But at the same time, the author clearly states, and the reviewer emphasizes, that Tollius wishes to impart secrets to the public. He is willing to share private knowledge, and this seems to be a mark in favor of his work. As a whole, the review exemplifies the difficulties involved in making highly specialized or previously private knowledge available to an uninitiated public. Even if authors agreed that the public had a right to know, they struggled to help them understand.

Secrets Disregarded

In the first volume of *Philosophical Transactions* in 1665/6 there appears a book review for Athanasius Kircher's *Mundus Subterraneus* (Subterranean World). *Mundus Subterraneus* was a two-volume work published in 1664 in Latin. It is considered to be one of Kircher's most scientifically important works in which he describes the structure of the Earth from a physical

and chemical standpoint. The book review takes a fairly standard seventeenth-century approach: it describes what each book contains with little commentary or opinion. The review mentions in Book XI that the author discusses alchemy in some detail. He not only discusses the history of the field, but also what the Philosophers' Stone may be, and transmutation. Kircher then dismisses the topic of alchemy: "Where are delivered the several Processes of the reputed *Adepti*, *Raymund Lulle*, *Azeth*, *Arnold de Villa nova*, *Paracelsus*, *Sendivogius*, &c. but all exploded as false and deceitful."⁹¹ Meaning Kircher had attempted the experiments performed by the "Adepti" without similar (successful) results. The review does not state the full account of the narrative as it occurs in the book, which goes to demonstrate it was not the focus of the review; however, in the work itself, Kircher not only demonstrates the alchemists' claims as fraudulent after he could not produce the same results but also suggests other more *chymical* texts for the reader to try, meaning those with concentrations on methodologies, techniques, and less focus on allegories.

While the review is straightforward—giving a rather unbiased look at Kircher's work—it is *Mundus Subterraneus* itself that causes backlash. Kircher reveals that alchemy, or at least, alchemists' claims are fraudulent. Yet the readers did not accept this. Alchemists such as Salomon de Blawenstein argued against Kircher along with others, attempting to prove alchemy's authenticity. Soon it was not just alchemists creating disbelief. Henry Oldenburg, editor of the *Philosophical Transactions*, initially wrote of *Mundus Subterraneus* saying that Kircher's utilization of techniques from the new science set him apart from other Aristotelian philosophers. After performing an experiment from *Mundus Subterraneus*, Oldenburg altered his judgment explaining that since one of Kircher's experiments failed, the rest would likely as

⁹¹ *Philosophical Transactions*, 1665/6: 112.

well.⁹² Kircher's *Mundus Subterraneus* was the pinnacle of his scientific career; he exposed secrets of alchemy and presented an enlightened way, or so he thought, of studying the world, only to have the public either disregard or refute his claims.

Why then when Kircher revealed his secrets of nature did no one respond? *Mundus Subterraneus* represents the highly conflicted opinions early learned journals held about the exposition and presenting of secrets. It also showcases the public's reaction to those secrets. In this case, Kircher unapologetically exposes secrets; he reveals the private nature of *chymistry* to the public. In her article about different approaches and receptions to science in the seventeenth century comparing Athanasius Kircher and Isaac Newton, Paula Findlen found that at first, the editors and major contributors of the journals supported and even praised Kircher's work. But once some of his own experiments proved faulty, they withdrew their support. Most striking is the backlash of the known practitioners of the craft against Kircher. Once the previously privately held secrets of *chymistry* were revealed to the public, there was an outcry against Kircher's work.⁹³ The practitioners did not want their secrets revealed. *Mundus Subterraneus* was caught in the crosshairs between the tensions of private and public science. Kircher wanted to reveal the secrets, the private knowledge, but once the secrets were revealed, the practitioners were not yet ready to accept the secrets would be publicly available to the non-adepts.

Implications

The three articles discussed demonstrate the tension as science passed from a private to a public form of knowledge. Secrets create an interesting dynamic to analyze the phenomena because secrets are, inherently, meant to be private and closely-guarded, but as these articles demonstrate, by the seventeenth century the reading public gained increasing access to them.

⁹² Paula Findlen, "The Janus Faces of Science in the Seventeenth Century: Athanasius Kircher and Isaac Newton," in *Rethinking the Scientific Revolution*, ed. Margaret J. Osler (Cambridge [U.K.]: Cambridge University Press, 2000), 239.

⁹³ Findlen, "The Janus Faces of Science in the Seventeenth Century," 237-240.

Láng makes the claim that, “[t]he contents of secrets are often not relevant for the study of the dynamics of secrecy; the ability to withhold or share information in itself becomes a power enabling social control, regardless of the object of secrecy.”⁹⁴ The examples studied in this chapter seem to support Láng’s assertion. Although little in the way of stunning “secret” information was exposed in the publications, the very promise of sharing or making public became the focus of dialogue, and sometimes, controversy. It was the choice or power to share the “secreted” information that was important.

This chapter makes the argument that early learned journals often appeared eager and willing to publish *chymical* secrets, but the audience did not always know how to react to information revealed by the journals. The time these journals were publishing, science was shifting from a private to public sphere of knowledge. The articles and reviews contained in the early learned journals are a battleground on which the alteration took place and one of the best places to examine this ongoing change is through the handling of secrets. Secrets are intrinsically private, so the publication, the making public, of secrets represents the shift between private and public. Unsurprisingly, the results were complicated. *Materia Perlatæ* shows the journals’ openness to public science with the decoding and publication of a previous untranslated article. Both *Sapientia Insaniens, Sive Promissa Chemica* and *Mundus Subterraneus* represent the range of conflicting opinion on the private and public spheres of science. *Sapientia Insaniens, Sive Promissa Chemica* has a willingness to share secret knowledge, but one has to have prior private knowledge to understand it. While *Mundus Subterraneus* makes the private public, the practitioners in the journal’s audience recoil against the revelation of the private secrets. For the majority, journals supported the exposition, the publication of secrets, but it was usually with a caveat. Not all the secrets were exposed. Usually prior knowledge was still required to

⁹⁴ Láng, “Ciphers in Magic,” 125.

understand the articles. In some cases the public upon receiving the privately held secrets disparaged at the publication of secrets for the non-adept or were not fully able to grasp the entire argument because of the lack of prior knowledge. It is the choice to either withhold or share the private information that adds to the tension or relieves it, one way or another, because the early learned journals and their audience choose what to do the newly revealed information, the information could not make the choice.

CHAPTER 4 “CHEWING THE CUD” UPON BOOK REVIEWS IN EARLY LEARNED JOURNALS

LONGVIL: *Bruce*, Good Morrow; what great Author art thou chewing the Cud upon? I look'd to have found with your Head-ake, and your Morning-Qualms.

BRUCE: We should not live always hot-headed; we should give our selves leave sometimes to think.

LONGVIL: *Lucretius!* Divine *Lucretius*: But my Noble Epicurean, what an Unfashionable Fellow art thou, that in this age art given to Latine?

BRUCE: 'Tis true, *Longvil*, I am a bold Fellow to pretend to it, when 'tis accounted Pedantry for a Gentleman to spell, and where the race of Gentlemen is more degenerated than that of Horses.

----Thomas Shadwell, *The Virtuoso*⁹⁵

Shadwell's *The Virtuoso* opens with Bruce reading the Latin author *Lucretius* with Longvil mocking him for reading, especially reading in Latin. In keeping with the theme of the play, Shadwell takes one of the common activities for learned gentleman of the time, reading, and satirizes it. The playwright, however, by mocking the reading of an ancient philosophical text, raises the question that if one was not supposed to read “divine” *Lucretius*, what was a gentlemen to read? As the play mirrors the evolution of science from private to public, it also illustrates contemporary condescension for scholasticism, represented by reading of the old science books like *Lucretius' De Rerum Natura* rather than gathering knowledge from observation in the present. In the seventeenth century, a growing mass market of published texts catered to helping readers make educated choices about what and how to read.

As discussed in the previous chapters, book reviews constituted a popular component of early learned journals. Like the book review sections in today's academic journals, reviews in early learned journals allowed the audience to gain an understanding of what was being printed in their field, a useful service as rates of book publications skyrocketed. Also similar to today's journals, multiple journals often reviewed the same book, emphasizing different aspects of the

⁹⁵ Shadwell, *The Virtuoso*, 1.

work. From the standpoint of a modern reader, however, the book reviews in early learned journals were often vague, seem to leave out crucial information, or appear to assume the reader already knew a significant amount about the book under review.

This chapter provides, through a case study of multiples reviews of one book, a glimpse of the style of scholarly communication open to the readers of early learned journals. The case study also traces a stage in the ongoing evolutionary change in the field of *chymistry*. The book under consideration is Jakob Tollius' *Fortuita in quibus, praeter critica nonnulla, tota fabularis historia Graeca, Phoenicia, Aegyptiaca, ad Chymiam pertinere asseritur*, published in Latin in 1687. It is noteworthy that editors published reviews of *Fortuita* in the 1687 edition of their respective journals, remarkably quickly after the book appeared. This chapter examines reviews of *Fortuita* found in the *Bibliothèque Universelle et Historique*, the *Nouvelles de la République des Lettres*, and the *Acta Eruditorum*. In order to understand how the journals' presentation of the book compares with the actual text of the book, I also examined a copy of the 1687 edition of *Fortuita* itself.

The analysis of the differences in the reviews demonstrates the range of ways early learned journals responded to books shaped by *traditional alchemical thought*, such as Tollius' *Fortuita*. As we will see, some of the book reviews attempted to recategorize *Fortuita* as a literary work instead of scientific tome, representative of a larger trend taking place in *chymistry*, whereby alchemical tradition and symbolism was increasingly "segregated" from a scientific discourse carried out in more technical terms. Using Tollius' work as a case study allows us to see a representative example of how this recategorization occurred. By analyzing how three different reviewers responded to Tollius, we gain insight about the very early phases of the divergence of *chymistry* into distinct and unequal forms of knowledge, alchemy, and chemistry.

Jakob Tollius: A Case Study

We have little reliable biographical information about Jakob Tollius, and what little information is available often comes from biographical entries in encyclopedias, which repeat the same information in various editions and provide no citations regarding the source of their facts. While scarcity of information is not uncommon for early modern authors, especially when they appear in journals that seem to have an aversion for bylines, during his lifetime Tollius published several books that received reviews in several different journals. It appears that most of the biographical information about Tollius is pieced together from various correspondences and his own work, *Epistolae Itinerariae, Observationibus et Figuris Adornate*, published posthumously in 1700.

Jakob Tollius was born in Utrecht around 1630.⁹⁶ He had an older brother, Cornelius, a professor that studied philology. It is thought Tollius studied with G. J. Vossius, a famous philologist, historical theologian and suspected Arminian. Tollius worked as a printer in Amsterdam for a time before being offered, and taking, a place as a secretary to D. Heinius in Stockholm, Sweden in 1662. After being dismissed from that position, Tollius returned to Amsterdam and taught at Gouda. While teaching, he began his studies in medicine and eventually received his Doctorate in Physics in 1669. He then left, possibly having been dismissed again, his teaching job. For a period he practiced medicine and taught Greek and Latin lessons. Tollius eventually found an appointment in Leiden but gave it up soon after to become a professor of history and eloquence at the University of Duisburg in 1679. The Elector of Brandenburg heard of Tollius' knowledge in mineralogy and commissioned him to travel through Germany and Italy to study the countries' mines. Tollius may have converted to Catholicism during his stay in Italy; in any event, a rumor suggesting as much circulated in

⁹⁶ There is some argument on whether 1630 or 1640 is the correct decade.

Germany prompting him to return. At his return to Utrecht, he opened a school that was soon closed by the city for various reasons. He died soon after on June 22, 1696.⁹⁷ This short biographical sketch does not explain why Tollius seemed to have such a fascination for *chymistry*, a subject about which he published two books. We are left with a vague outline of a man who had varied scholarly interests, traveled extensively, had suspect religious inclinations, and difficulty keeping a job.

Fortuita in quibus, praeter critica nonnulla, tota fabularis historia Graeca, Phoenicia, Aegyptiaca, ad Chemiam pertinere asseritur

Tollius sets out in *Fortuita in quibus, praeter critica nonnulla, tota fabularis historia Graeca, Phoenicia, Aegyptiaca, ad Chemiam pertinere asseritur* to explain the history of *chymistry*.⁹⁸ What sets *Fortuita* apart is that Tollius grounds the history of *chymistry* entirely in ancient Greek, Phoenician, and Egyptian sources. Complicating the text further, Tollius writes mainly in Latin, but he sporadically incorporates classical Greek and Arabic quotations and passages to prove a point. While it is highly probable Tollius knew classical Greek, it is difficult to ascertain whether he knew Arabic. This means it is possible that the Arabic quotes throughout the text are quotes without any contextualization.

Tollius envisioned ancient texts, especially fables and epics, as sources for recapturing a lost *chymical* knowledge. Ancient mythology, for example, provided explanations of why particular *chymical* actions took place. Fables regarding Juno and the moon, he claimed, could explain Nitrate distillation, while Isis' decapitation referred to the creation of the Philosophers'

⁹⁷ This information is compiled from two different encyclopedic entries on Jakob Tollius: *Biography or Third Division of the The English Encyclopedia*, Vol 6., ed. Charles Knight (London, 1868), s.v. "Jakob Tolius.". And *The Penny Cyclopaedia of the Society for the Diffusion of Useful Knowledge*. Vol. 25 (London, 1843), s.v. "Jakob Tollius."

⁹⁸ This review of *Fortuita* comes from my examination of a 1687 edition of the text. Jakob Tollius, *Fortuita in quibus, praeter critica nonnulla, tota fabularis historia Graeca, Phoenicia, Aegyptiaca, ad Chemiam pertinere asseritur*, (Amstelaedami: Apud Janssonio-Waesbergios, 1687).

Stone.⁹⁹ Most strikingly, Tollius argues consistently through his work that Virgil, Homer, and Plutarch explained nature correctly and sufficiently, so modern practitioners of the *chymical* arts should adopt their style—verse—when presenting *chymical* treatises. *Fortuita* was meant to explain the history of *chymistry* and suggest better ways of writing *chymistry* by attention to classical sources from ancient Greece, Phoenicia, and Egypt.

As unique as *Fortuita* may appear, Tollius was writing in the context of two scholarly trends occurring at this time: the rise of *chymical* interest in Egypt and the Quarrel of the Ancients and Moderns. There was a noticeable rise in publications in both *chymistry* and Egypt beginning in the mid-seventeenth century, a convergence that has led several scholars to explore the possible connections between the two subjects. Sylvain Matton has studied this phenomenon and found that *chymistry* authors ranging from Michael Maier and Tollius to don Pernety and even Athanasius Kircher placed great emphasis on Egyptian mythology as a possible key to *chymical* concepts.¹⁰⁰ Tollius' work, published in 1687, falls squarely in the middle of this revival of interest in Egypt within the field.

The other trend that helps to contextualize Tollius' *Fortuita* is what scholars refer to as the Quarrel of the Ancients and the Moderns. As Anne Blair defines it, the quarrel arose when a group of contemporary classical scholars, known as “the ancients” came to “[resent] the claims of the Moderns that more recent authors and works had surpassed the achievements of antiquity.”¹⁰¹ In relation to science, “modern” scientists argued for new discoveries and observation in the present rather than a science regurgitated from past scholarly work. The “ancients,” on the other hand, called for at least following the examples of the ancient writers, if

⁹⁹ Tollius, *Fortuita*, 75 and 204.

¹⁰⁰ Sylvain Matton, “L'Égypte chez les ‘Philosophes Chimiques’, de Maier a Pernety,” *Les Études Philosophiques*, no.2/3 (1987): 207-224.

¹⁰¹ Anne Blair, *Too Much To Know: Managing Scholarly Information before the Modern Age* (New Haven, Conn.: Yale University Press, 2010), 256.

not using their sources directly and in their entirety. Tollius published *Fortuita* in the very early years of the scholarly controversy that would become known as the quarrel, and falls soundly on the ancients' side. *Fortuita* argues for *chymical* texts to be written in what Tollius believed to be the best way possible, which involved mirroring the ancient authors' style as they had already refined all genres of writing to their most perfect form.¹⁰²

Reviews

The following section analyzes how each of the three journals described Tollius' *Fortuita*. While the reviews show a certain degree of consistency, they also differ in significant ways. Using *Fortuita*, then, is a good case study to see how the average review differed amongst three major early learned journals of the time.

***Bibliothèque Universelle et Historique* Review**

The review for *Fortuita* appeared in the fourth volume of the *Bibliothèque Universelle et Historique* in 1687, composed by an anonymous reviewer soon after the book's publication. The review began with a brief statement about Tollius, offering his employment as Professor of Humanities of Duisburg Academy as a credential for his role as author. The reviewer described *Fortuita* as a work of 31 chapters that argues that the true meaning of ancient fables was related to *chymistry*. He offered brief quotation and summaries from the book to illustrate his description but no long extracts.

Fortuita relied heavily on allegorical imagery drawn from mythological works. Tollius first references the mythological god Juno as "*l'esprit universel qui anime toute la nature*" to discuss a uniting spirit that can be understood through *chymical* processes.¹⁰³ Tollius also alluded to the figure of Cadmus, "*comme lors que les Poetes disent qu'il naquit cinq homes des dents de*

¹⁰² David Lowenthal, *The Past is a Foreign Country—Revisited* (Cambridge [U.K.]: Cambridge University Press, 2015), 166-168.

¹⁰³ "the universal spirit that animates all of nature". *Bibliothèque Universelle et Historique*, 1687: 422.

Dragon semees par Cadmus.”¹⁰⁴ Tollius uses the well-known Greek myth of Cadmus with the rather less well-known, at least for non-adepts, allegorical alchemical imagery of the myth to discuss mercury sublimation through heat: Cadmus, representing usually “the alchemist, serpent, philosophic mercury, the lance, the fire, [or] the oak” which buries, probably in a fire, dragon’s teeth (mercury sublimate).¹⁰⁵ When Tollius was not interpreting myth as an allegory for *chymical* knowledge, he cited the work of well-known alchemists to further his own arguments, including Basil Valentine, the sixteenth-century alchemist Michael Sendivogious, and Joan Baptista Van Helmont. He discusses Basil Valentine’s *Triumph of Antimony* and its treatment of the substance antimony, and employs Van Helmont’s work on gases to symbolize the presence of another spirit, aside from the universal one represented by Juno. In short, the reviewer’s choice of which passages to highlight correctly characterized the main argument and methodology of Tollius’ text, and in doing so revealed its debt to traditional alchemical sources and attitudes.

The reviewer placed strong emphasis on Tollius’ allegorical elements such as mythological stories and phrases to represent not only *chymical* processes but also to narrate his scientific work, highlighting again Tollius’ affinity with the alchemical traditional of writing about *chymistry* in allegories that served to obscure terms and ideas. The reviewer also made sure to highlight Tollius’ discussion of the spirits that animate the entire world, and according to Tollius, can be understood through *chymical* processes. Notably, however, throughout the article the anonymous reviewer was respectful and neutrally descriptive, avoiding any skeptical or mocking tone towards alchemical ideas that were, by this era, beginning to err on the side of controversial and presented a well-rounded review of the book.

¹⁰⁴ “as long as the Poets say Cadmus birthed five men sown from dragon’s teeth”. *Bibliothèque Universelle et Historique*, 1687: 422..

¹⁰⁵ Lyndy Abraham, *A Dictionary of Alchemical Imagery* (Cambridge [U.K.]: Cambridge University Press, 1998), 59-60, 137. This allegorical imagery might be more known than usual among non-adepts as Ben Johnson, in his play *The Alchemist* (1610), also references the same myth and satirizes some of the alchemical allegory.

Nouvelles de la République des Lettres Review

The second volume of Pierre Bayle's *Nouvelles de la République des Lettres*, published in 1687, also published a review of Tollius' *Fortuita*. The *Nouvelles de la République des Lettres* unlike the majority of other early learned journals at this time, named the reviewer, in this case a Monsieur de Veldenrod, and used the decidedly unneutral term "*jugement*" to describe the review it provided. Much like the review in the *Bibliothèque Universelle et Historique*, this review also contained some descriptions of the book, short extracts from the text, and some untranslated Greek phrases. Notably, however, Veldenrod never provides a direct summary of the argument of the book nor even gives a general synopsis, and his review does not elaborate on Tollius background. He does, however, choose certain chapters, chapter 20 and 28 specifically, and goes into a fair amount of detail.

The reviewer, Veldenrod, is forthrightly skeptical about the work, writing near the beginning of his review that, "*M. Tollius pretend renfermer des secrets de la Chymie.*"¹⁰⁶ Tollius' work, he noted, claimed to offer explanations of *chymical* properties through analysis of fables such as those of Hercules and Pyrrha, which seemed an odd way of proceeding.¹⁰⁷ In response to Tollius' discussion of Antimony, the reviewer reacted with bemusement, writing that, "*je n'eusse jamais creû que des paroles de Poete on eut pû extraire une idée de Chymie.*" Then again, the reviewer notes, "*Il y a bien de l'esprit [...] en ce que dit M. Tollius...*" perhaps a pun on the multiple meanings of the word "*esprit*" in the context of alchemy and philosophy.¹⁰⁸

Veldenrod emphasized the eloquence of Tollius' writing and presentation. The review then goes on to provide samples of Tollius' verses, presumably to highlight their poetic qualities,

¹⁰⁶ "M. Tollius claims to hold within the secrets of *Chymistry*". *Nouvelles de la République des Lettres*, 1687: 475.

¹⁰⁷ *Nouvelles de la République des Lettres*, 1687: 475.

¹⁰⁸ "I should never have believed that words of this poet could have extracted an idea from *chymistry*" and "There is much wit, too, in what Mr. Tollius says." *Nouvelles de la République des Lettres*, 1687: 475.

without explaining the larger alchemy-infused narrative context in which they appeared.

Veldenrod judged Tollius' writing style comparable to Virgil and Homer—high praise indeed!

He also mentioned that *Fortuita* contains a discussion of the properties, spiritual and physical, of light. To finish the review, Veldenrod tells the reader that a Mr. du Rondel (presumably Jacques du Rondel, a well-known Huguenot scholar of classical Greek) had heavily criticized several of the ideas put forth in Tollius' work.¹⁰⁹

Veldenrod's review is interesting in that it leaves a reader of this journal uncertain, not just about the quality of Tollius' work, but also about its most basic claims and methodology. If Veldenrod emphasizes any factor at all, it is Tollius' writing style and use of Virgil and Homer. He mentions enough *chymistry* terminology for a reader to realize that *Fortuita* is linked to *traditional alchemical thought*, but does not give enough detail to enable a reader to gain a good grasp of what exactly *Fortuita* argues. Veldenrod's *jugement* indicates that he does not believe that this book holds the secrets to *chymistry*, but at the same time he does not discredit the intelligence of Tollius.

***Acta Eruditorum* Review**

The 1687 edition of the Latin journal *Acta Eruditorum* also published a response to Tollius' *Fortuita*. The reviewer, in this case as with the *Bibliothèque Universelle et Historique*, remained anonymous. The review provides neither long extracts of the text nor quotations. Instead, to describe the book's contents it merely lists an abbreviated title for each chapter; but even then it does not include all 31 chapter headings. The reviewer also gives a very brief, general summation of the work following the chapter listing. The majority of the review,

¹⁰⁹ Mara van der Lugt, *Bayle, Jurieu, & the Dictionnaire et Historique et Critique* (Oxford: Oxford University Press, 2016), 16, 277; Rondel (1630-1715) was a Greek scholar at the Academy of Sedan in France, known for producing reformed pastors, until its suppression in 1681. He then became a professor at Maastricht. He wrote on various ancient authors, but is most well-known for his treatises on Epicurus. Rondel was also a friend and regular correspondent of Pierre Bayle, editor of *Nouvelles de la République des Lettres*.

however, is filled with brief quotes and arguments from the works surrounding the publication of *Fortuita*. The focus of this review, in other words, seems to be to inform readers about the intellectual controversy that surrounded Tollius' work.

The review emphasizes the role assigned to fables in Tollius' book, but provides little elaboration on how the fables are used to elucidate *chymical* arguments. Indeed, the only reference to *chymistry* is in descriptions of the chapter titles, for example Chapter 21, "*ubi de visu ex professo agit: Chymicum denique.*"¹¹⁰ The other chapter titles list various fables following the heading with chapter 23 making reference to, "*in quo Deucalionis & Pyrrhae fabula Chymice enarratur.*"¹¹¹ The reviewer also makes sure to emphasize the poetical nature of the book in the majority of the chapter titles, noting that Tollius discusses Virgil, Homer, and Seneca. The review thus seems to treat Tollius work primarily as a literary work interpreting classical text, rather than as a work of *chymistry*.

Soon the review ceases description of Tollius' work almost entirely, turning instead to discussions of a published response and a work that corresponds to Tollius' authored by Jacques du Rondel and Michael Maier.¹¹² The review employs du Rondel's response, which appeared, in the *Nouvelles de la République des Lettres*, as a critic of Tollius' handling of Latin and Greek texts. He also contextualizes Tollius' work in Egyptian fables with the work done by Michael Maier, an alchemist known for working on the *Atalanta Fugiens*, in the earlier decades of the sixteenth century.¹¹³ The reviewer never mentions Maier's alchemical connections, and instead, focuses on his interpretation of Egyptian fables in comparison to Tollius' own work. Once again,

¹¹⁰ "Finally, where the view avowedly deals with *Chymistry*" *Acta Eruditorum*, 1687: 395.

¹¹¹ "In which the fable of Deucalion and Pyrrha narrate *Chymistry*" *Acta Eruditorum*, 1687: 395.

¹¹² *Acta Eruditorum*, 1687: 395; 393.

¹¹³ Karen Figala and Ulrich Neumann, "'Author Cui Nomen Hermes Malavici' New Light on the Bio-Bibliography of Michael Maier (1569-1622)," in *Alchemy and Chemistry in the 16th and 17th Centuries*, ed. Piyo Rattansi and Antonio Clericuzio (Dordrecht, The Netherlands: Kluwer Academic Publishers, 1994), 121-139; While Maier was considered an alchemist and worked on a highly allegorical, alchemical treatise; the reviewer does *not* mention this.

the *chymical* content, in both Tollius' and Maier's work, is downplayed in favor for more philological considerations regarding Tollius' interpretation of his sources.

The review that appeared in the *Acta Eruditorum* provides a review via proxy of other books written in context and response to Tollius. Rather than providing readers a sense of whether they should buy or read Tollius, it served to alert readers to the debate surrounding Tollius' work. This debate, however, is depicted primarily in philological rather than *chymical* terms.

Implications

Which journal gave the most complete and accurate testimony of Tollius' *Fortuita*? What were the possible reactions the reviews had? This is a difficult assignment to make. On reading all three narratives together, the reader gains a fuller understanding of what Tollius was writing about. Which brings about the question, how many journals did an early modern reader subscribe to, since this case study has shown that no one journal provided a full account? The analysis of these reviews must be implemented on two levels: how the reviewer appraised the work in terms of style and focus and what information was highlighted in the review.

These three reviews of Jacob Tollius' *Fortuita* provide a case study of the various styles of reviews available to readers of early learned journals. Daniel Mornet argued that the journals provided a service to scholars primarily by providing a complete, descriptive picture of the published works they reviewed rather than praising or blaming them.¹¹⁴ In general, the review in the *Bibliothèque Universelle et Historique* corresponded most closely to the pattern Mornet suggested. The anonymous reviewer seemed careful to avoid the expression of judgment on the value of Tollius' work, whereas M. de Veldenrod, the reviewer for the *Nouvelles de la République des Lettres*, both attached his name to his review and provided *jugement*, albeit in a

¹¹⁴ Mornet, "Les Enseignements des bibliothèques privées," 470.

gently critical way. The *Acta Eruditorum*, on the other hand, seemed less interested in providing its readers a neutral description of Tollius' work. By the time its review appeared, there was already a contextualization of Tollius work and the *Acta Eruditorum* chose to offer its readers a sense of that context Tollius' work fell into among scholarly specialists. All of these editorial choices could have provided journal readers with information about Tollius' book, but the nature of the information varied, perhaps an indication of each journal's separate sense of what its readership desired or precisely who that readership was.

The three reviews do suggest, overall, that *traditional alchemical thought* was waning in its intellectual credibility by the late seventeenth century. Only the review in the *Bibliothèque Universelle et Historique* accurately summarizes Tollius' book as a work of *chymistry* and gives sustained attention to this feature of his narrative. The other two reviews, in different ways, downplay the main *chymical* argument of the text and emphasize other qualities, effectively redefining the work as literature or literary history. For Veldenrod, the *chymical* elements of the narrative seem less worthy of discussion than Tollius' treatment of ancient authors and choice to value ancient forms of communication, like verse. This is perhaps a sign that Veldenrod hoped to enlist Tollius in the forming controversies that would come to be known as the Quarrel of the Ancients and Moderns. For the *Acta Eruditorum* reviewer, the task at hand seemed to be to clue readers into the framework Tollius was writing and what was penned by specialists in ancient languages and cultures. In both cases, the way that reviewers evaluated Tollius' work seems to confirm Newman and Principe's claim that alchemical tradition was "segregated" from natural philosophy as mechanism and a commitment to experimental techniques came increasingly to define "proper" *chymistry*. Tollius' work seemed to fit better with intellectual controversies about how to read ancient texts than with attempts to understand *chymical* processes. It is

therefore not clear that the journals facilitated Tollius' communication with the readership he desired.

The analysis here can only provide a glimpse into the ways that this new form of scholarly communication, the early learned journal, reviewed books. Still, it does demonstrate the variety of approaches these journals might adopt and the variety of purposes they could serve for readers. The journals provided a way for members of a growing reading public to access what had heretofore been knowledge reserved to adepts and experts. But in fostering the openness of scholarly communication, the journals also played a role in defining and transforming the disciplines. By highlighting certain *chymical* books over others, they defined which works might be interesting or useful to the public, and sometimes defined what counted as *chymical* knowledge in the first place.

CHAPTER 5
CONCLUSION:
“THE FAULTS AND EXCELLENCES FIND”

SIR NICHOLAS: Am I deserted by all? Well, now ‘tis time to study for use: I will presently find out the Philosophers Stone; I had like to have gotten it last year, but I wanted *May-Dew*, being a dry season.

---Shadwell, *The Virtuoso*

*You can the faults and excellences find;
Pass by the one, and be to th’other kind.
By you he is resolv’d to stand or fall:
What e’r’s his doom he’ll not repine at all.*

---Shadwell, *The Virtuoso*¹¹⁵

Shadwell’s *Virtuoso* ends the play abandoned by his wife, lover, nieces, and uncle. He has even decided to cease seeking knowledge for knowledge’s sake. Like the new science, he has now decided to use his virtuosity for useful matters—finding the Philosophers Stone! How useful or possible this task may be is not discussed. However, it seemed Shadwell held little hope for the new science developing into anything other than “quackery”.¹¹⁶ Shadwell was wrong about the development, though. Examining *chymistry*, as is the focus of this thesis, illustrates this point. The play’s ending lines allude to how the public had the power to decide whether the scientists were true practitioners or charlatans. Whether or not it was a good idea for the larger, non-adept public to decide on the validity of scientific knowledge was debatable. But it was the way things were. It also brings up the issue of whether or not the public had any responsibility for the divergence of alchemy and chemistry in the late seventeenth and early eighteenth century. The analysis of the articles and book reviews found in the thirteen early learned journals in English, French, Italian, and Latin from 1665 to 1743 indicate that the two terms were still indistinguishable from each other in the last decades of the seventeenth century, with no true difference based in language or practice. These articles come from one of the first forays into

¹¹⁵ Shadwell, *The Virtuoso*, 88, 90.

¹¹⁶ *Ibid.*, 30.

providing the interested public access to science through journals and literature. It could be that now that the public had gotten the first taste of the *chymistry* field in these decades, it would be able to form an opinion on it in later years. For now, in these last decades of the seventeenth century, *chymistry* was just beginning to make its mark in the scientific sphere.

The proliferation of early learned journals during this time offers a unique avenue of examining how *chymistry* was discussed by practitioners, scholars, and theorists. It also offers the possibility of looking at a cluster of scientific communication across Europe on a single theme. Many of the journals wrote about the same topics and reviewed the same books. This presents a snapshot of *chymistry* in a hundred year period along with communication through means other than private correspondence, which often took long periods of time, could get lost, and held privacy concerns. The dataset of articles and book reviews on *chymistry* present in early learned journals characterizes a field of study and its communicative network at a point in time when it was undergoing a transmutation between alchemy and chemistry and private and public.

Throughout this thesis, the argument has been made that through the analysis of 1,029 articles in early learned journals in Europe the slow evolution of the chimerical field of *chymistry* can be witnessed. The discussion in the articles demonstrates how alchemy and chemistry were still present through the late seventeenth- to early eighteenth-century; they also show the beginning of its divergence. Newman and Principe call for “more detailed studies [that] would be beneficial to define the exact course and means of the repudiation [of the divergence].”¹¹⁷ This thesis is a step towards answering that call for detailed studies. The information provided in the chapters further endorses, through the exploration of the discussion of *chymistry* occurring in early learned journals, that alchemy and chemistry were interwoven into a conceptual field of *chymistry* during this time; they also show its gradual separation.

¹¹⁷ Principe and Newman, “Some Problems with the Historiography of Alchemy,” 386.

Most interestingly, the 1700s appear to be the time when the fissures in the intermixed fields begin to appear. When examining the data from chapter one, where the discussion of categorization of types of *chymistry* dialogues in early learned journals occurs it is during the turn of the century that a distinct trend emerges. Examining the trend-lines in Figure 11 helps to narrow the time frame of the shift in *chymistry* even further. The trend-lines interest right before the eighteenth century showcasing the change in dominance in allegorical and methodological articles. In the 1700s, articles that discussed *chymistry* in more technical, methodological and less allegorical and *traditional alchemical thought* terms increase in frequency in comparison to the 1600s. They also continue to exert dominance in journals throughout this time. More *traditional alchemical thought* articles are still present, as can be seen in the allegorical article category, but the increase in the methodological article category emphasizes that a new way of discussing of *chymistry* emerged, and it was prevalent not only with the editors of the early learned journals but also with the contributors to the journals. Closer examination of the information relayed in these articles during this more narrowed time period could help further clarify why the divergence of the field became permanent.

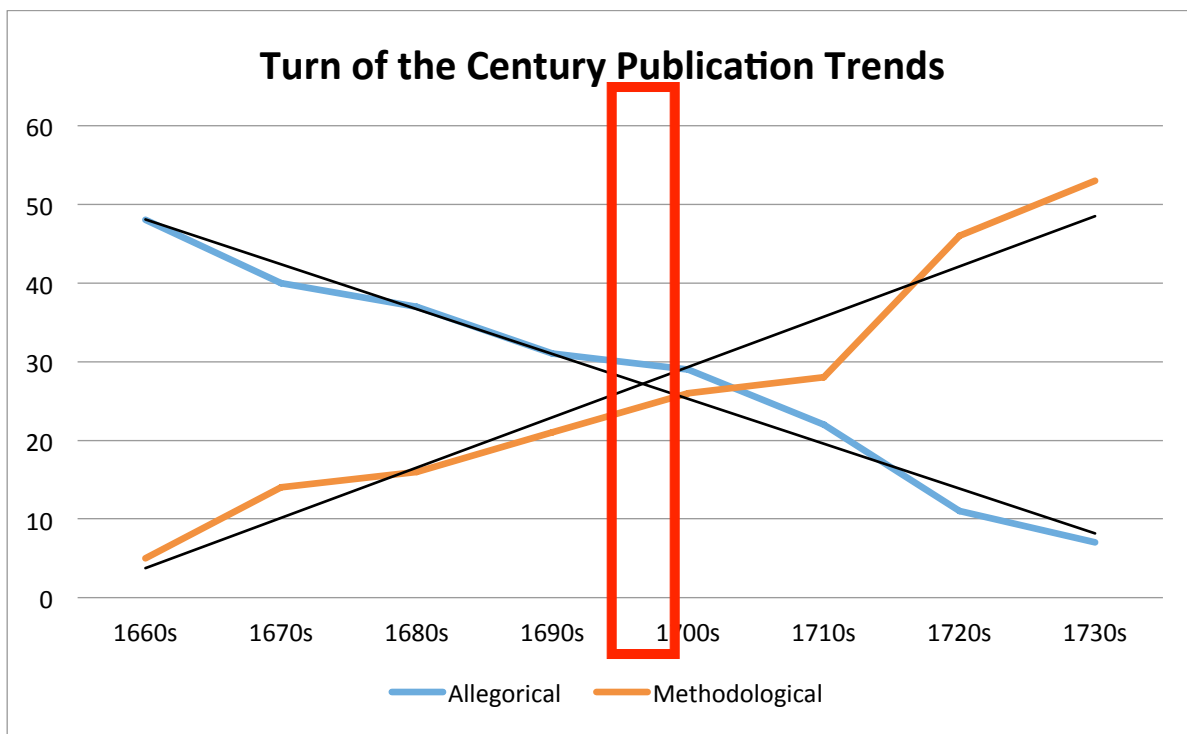


Figure 11: Turn of the century publication trends. NB: The chart reflects the changing percentage of articles in this category over time demonstrating the relationships of the various categories within the broad field of articles published.

Along with *chymistry*'s inner divergence, it was also undergoing a shift that was occurring at the forefront of the scientific sphere in early modern Europe—the shift from private to public science. Chapter two's discussion of the role of secrets and chapter three's use of *Fortuita*'s affected genre recategorization examine how the field of *chymistry* handled such shifting dialogue. The result was often conflicted. The early learned journals seemed willing to help in the transmutation of making what was once considered private knowledge public through the publication of secrets, but the audience of these journals seemed to have mixed reactions on the shift.

Chymistry in the late seventeenth- to early eighteenth- century was a unique field. It was changing from the recognizable practices performed by alchemists to something new and different. But this change did not happen overnight or even over the course of a decade. Instead, it developed over a century or more, allowing the traditional practices to merge with ones newly

forming. The analysis of articles discussing in *chymistry* in early learned journals from 1665 through 1743 captures this period where the field was undergoing its slow evolutionary change and allows for closer examination in order to discover just how alchemy and chemistry diverged and private knowledge shifted to public.

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APPENDIX A: ARTICLES PER JOURNAL

This is following is a breakdown of the number of articles found in each of the thirteen journals examined.

Language	Journal	Years Examined	Number of Articles
English	<i>Philosophical Transactions</i>	1665-1743	176
French	<i>Journal des Sçavans</i>	1665-1743	192
	<i>Nouvelles de la Republique des Lettres</i>	1684-1718	94
	<i>Histoire de l'Académie Royale des Sciences, avec les Mémoires de Mathématique et de Physique</i>	1699-1743	171
	<i>Journal de Trévoux</i>	1701-1743	117
	<i>Histoire des Ouvrages des Savans</i>	1687-1709	13
	<i>Journal Littéraire</i>	1713-1737	23
	<i>Bibliothèque Universelle et Historique</i>	1686-1693	12
Italian	<i>Giornale de literati d' Italia</i>	1710-1740	46
	<i>La Galleria di Minerva</i>	1696-1717	32
Latin	<i>Miscellanea Medico-Physica Curiosa</i>	1670-1706	38
	<i>Acta Eruditorum</i>	1682-1730	106
	<i>Acta Medica et Philosophica Hafniensia</i>	1671-1679	9
Total	-----	-----	1029

APPENDIX B: TERMS USED TO IDENTIFY ARTICLES

The following is a list of the exhaustive terms used in the Search and Retrieval technique to identify the articles with relevant *chymistry* discussions in the early learned journals.

(al)chemia	(al)chymici
(al)chemiam	(al)chymicis
(al)chemica	(al)chymicisq
(al)chemicam	(al)chymico
(al)chemici	(al)chymicorum
(al)chemicorum	(al)chymicus
(al)chemicus	(al)chymie
(al)chimia	(al)chymique
(al)chimiam	(al)chymist
(al)chimica	(al)chymist(e)
(al)chimical	(al)chymist(e)s
(al)chimicam	(al)chymistry
(al)chimiche	“alch”
(al)chimici	“alchy”
(al)chimico	“chem”
(al)chimie	“chim”
(al)chymia	“chym”
(al)chymiam	alchemy
(al)chymica	chemistry
(al)chymical	chimistry
(al)chymicam	

VITA

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