

Allen Debus Conference

English alchemy before Newton: an experimental history

Jennifer M. Rampling

Introduction

It seems fitting to discuss the history of English alchemy at an Allen Debus Lecture, since Debus himself contributed a considerable amount to charting the ‘chemical philosophy’ in the British Isles. His special interest was in the advent of chemical medicine, and the ensuing ructions between Paracelsians and the College of Physicians of London.¹ But other aspects of English alchemy have received plenty of attention as well. Charismatic practitioners like John Dee (1527-1609) and Simon Forman (1552-1611) continue to generate scholarly monographs,² while the alchemical activities of the early Royal Society and its celebrated Fellows, Robert Boyle (1627-1691) and Isaac Newton (1643-1727), are now well known thanks to a series of revisionist studies.³ These studies of course favor the seventeenth century and the second half of the sixteenth. However, earlier periods have also had their moments in the sun. In particular, the fifteenth and early sixteenth centuries are illuminated by the distinctive genre of English alchemical poetry, as represented by George Ripley (fl. 1470s), Thomas Norton (d. 1513), and William Blomfield (fl. 1529-1574), among others.⁴

For their enduring fame, these poets owe a certain amount to Elias Ashmole (1617–1692), a founding member of the Royal Society and avid collector of alchemical manuscripts, who published the first collection of English alchemical poetry in 1652. Ashmole hoped that his *Theatrum Chemicum Britannicum* would whet the appetite of English alchemists for their

· Assistant Professor, Program in History of Science, Department of History, Princeton University, United States.
✉ rampling@princeton.edu

¹ Allen G. Debus, *The English Paracelsians* (London: Oldbourne Press, 1965).

² See esp. Nicholas H. Clulee, *John Dee's Natural Philosophy. Between Science and Religion* (London: Routledge, 1988); William Sherman, *John Dee: The Politics of Reading and Writing in the English Renaissance* (Amherst [MA]: University of Massachusetts Press, 1995); Glyn Parry, *The Arch-Conjuror of England: John Dee and Magic at the Courts of Renaissance Europe* (New Haven: Yale University Press, 2012); Lauren Kassell, *Medicine and Magic in Elizabethan London. Simon Forman: Astrologer, Alchemist, and Physician* (Oxford: Clarendon Press, 2005).

³ See, inter alia, Betty Jo Teeter Dobbs, *The Foundations of Newton's Alchemy, or 'The Hunting of the Greene Lyon'* (Cambridge: Cambridge University Press, 1975); Lawrence M. Principe, *The Aspiring Adept: Robert Boyle and his Alchemical Quest* (Princeton [NJ]: Princeton University Press, 1998); William R. Newman, & Lawrence M. Principe, *Alchemy Tried in the Fire: Starkey, Boyle, and the Fate of Helmontian Chymistry* (Chicago: Chicago University Press, 2002); William R. Newman, "Newton's Early Optical Theory and its Debt to Chymistry," in *Lumière et vision dans les sciences et dans les arts*, ed. Danielle Jacquart, & Michel Hochmann (Geneva: Droz, 2010), 283–307; and the recent series of papers by Ana Maria Alfonso-Goldfarb, Márcia H.M. Ferraz, & Piyo M, Rattansi in *Notes and Records of the Royal Society*, that describe several new archival finds.

⁴ On English alchemical poetry, see particularly Robert M. Schuler, ed., *Alchemical Poetry 1575–1700, from Previously Unpublished Manuscripts* (New York: Garland Publishing, 1995); Anke Timmermann, *Verse and Transmutation: A Corpus of Middle English Alchemical Poetry* (Leiden: Brill, 2013).

own national tradition, while also preserving its most cherished fruits. Indeed, he may have succeeded beyond his expectations, since – thanks also to a modern facsimile reprint, and to *Early English Books Online* – his collection is still the major and most readily available source of English alchemical verse.⁵ Scholarship on writers omitted from Ashmole’s pantheon remains relatively sparse, although several recent critical editions suggest that this situation is starting to change.⁶

Rather few alchemical books were printed in England prior to 1600. One result is that the work of many alchemists, named and anonymous – and including the alchemical poets mentioned above – are today known primarily through print editions published a century or two after their deaths, particularly during the great surge in alchemical publishing that started in the 1650s.⁷ Yet, as Ashmole well knew, the preservation of England’s alchemical heritage depended on manuscript survivals. A careful editor, he gathered and collated manuscripts in order to recover what were, in his view, the most authentic versions of original texts. Authenticity was a particular concern in the case of alchemical writing, since even small editorial adjustments could potentially affect the content of a treatise, and hence its reliability as a guide to practice. As Thomas Norton warned in his *Ordinal of Alchemy* (here in Ashmole’s edition):

“And chaunging of some one sillable
May make this Boke unprofitable.”⁸

In practice, copyists often failed to heed Norton’s warning. The very processes by which knowledge was shared were weighted against exact transcription. Translation, versification, annotation, and commentary all transformed texts in fundamental ways, but even the simple process of copying resulted in errors that altered the sense of key phrases or quantities. The intentionally obscure terminology used in alchemical writing cannot have helped. We can all sympathize with the reader who first interpreted the instruction to “Take Adrop, or the Green Lion” as “Take a drop of the Green Lion.”⁹

The consequences of such slips could be particularly significant for a practical science like alchemy, whose practitioners were concerned with reproducing tangible effects. When recipes change, so do the processes – and hence the products – they describe. Over time,

⁵ Elias Ashmole, ed., *Theatrum Chemicum Britannicum* (London, 1652; repr. New York and London: Johnson, 1967), hereafter *TCB*.

⁶ Important exceptions include Charles Webster, “Alchemical and Paracelsian Medicine,” in *Health, Medicine and Mortality in the Sixteenth Century*, ed. Charles Webster (Cambridge: Cambridge University Press, 1979), 301–34; Lauren Kassell, “Reading for the Philosophers’ Stone,” in *Books and the Sciences in History*, ed. Marina Frasca-Spada, & Nick Jardine (Cambridge: Cambridge University Press, 2000): 132–50; George R. Keiser, “Preserving the Heritage: Middle English Verse Treatises in Early Modern Manuscripts,” in *Mystical Metal of Gold: Essays on Alchemy and Renaissance Culture*, ed. Stanton J. Linden (New York: AMS, 2007): 189–214. Recent critical editions and studies include Peter J. Grund, *‘Misticall Wordes and Names Infinite’: An Edition and Study of Humfrey Lock’s Treatise on Alchemy* (Tempe: Arizona Center for Medieval and Renaissance Studies, 2011), and Timmermann, *Verse and Transmutation*.

⁷ Lauren Kassell, “Secrets Revealed: Alchemical Books in Early-Modern England,” *History of Science*, 49 (2011): 61–87.

⁸ Thomas Norton, *Ordinal of Alchemy*, in *TCB*, 11.

⁹ Jennifer M. Rampling, “The Catalogue of the Ripley Corpus: Alchemical Writings Attributed to George Ripley (d. ca. 1490),” *Ambix*, 57 (2010): 125–201 (hereafter *CRC*), on 138–9.

incremental changes may transform a practice entirely. This textual instability affects modern readers as well, but rather than viewing it as a disadvantage, we can make a virtue of necessity, and treat it as an important historical resource. The identification of small changes made by successive readers and copyists may allow us to track chemical processes over surprisingly long periods of time – uncovering, en route, the experimental readings and experimental practices of early English alchemists.

Experimenting with texts

English alchemy, of course, was not always ‘English’. Alchemy arrived in the Latin West in the form of translations from Arabic exemplars in the twelfth century, and the *topoi* and *dicta* of these early works continued to shape the contours of alchemical writing well into the early modern period. The idea of the ‘animal, mineral, and vegetable stone’, for instance – a lemma borrowed from the pseudo-Aristotelian *Secretum secretorum* – was gradually adapted as a convenient shorthand for a variety of alchemical products with different applications.¹⁰ No vernacular language or geographical region had a monopoly on this usage. In the English context, however, this ‘three stones’ model has received attention in part because it recurs in several of the poems included in Ashmole’s *Theatrum*, and also because of Ashmole’s own idiosyncratic discussion in the Prolegomena to his collection.¹¹

In practical terms, the mineral stone was associated with gold-making, its name taken from its main ingredient – a corrosive liquid, or ‘water’, of mineral origin. This corrosive was considered to be highly toxic and therefore unsafe for human medicine, although perfectly acceptable for transmuting base metals into gold and silver. The vegetable stone, however, derived from a ‘vegetable’ solvent – variously interpreted as spirit of wine, distilled vinegar, or tartar, among other things – in which metals could be dissolved. The vegetable component made it safe for human consumption and hence for therapeutic use.

How to make these mysterious liquids, or ‘stones’? One late fourteenth-century treatise pseudonymously attributed to Raymond Lull (c. 1232-1316), the *Epistola accurtationis* gives advice on making animal, vegetable, and mineral elixirs.¹² Here, pseudo-Lull describes the manufacture of the mineral stone using a powerful and toxic corrosive:

¹⁰ I discuss this ‘three stone’ model in my forthcoming book, *The Making of English Alchemy* (forthcoming, University of Chicago Press), esp. chaps. 1–2.

¹¹ Perhaps the best known usage is that of John Gower in the *Confessio amantis*: Ashmole, *TCB*, 368–73, on 370–1. Ashmole added several other kinds of stone to the usual trinity, including an “Angelical Stone” that is too subtle to be detected by any human sense except taste: *ibid.*, sigs. A4v–Bv; see also Kassell, “Reading for the Philosophers’ Stone.”

¹² On the influential tradition of pseudo-Lullian alchemy, see Michela Pereira, *The Alchemical Corpus Attributed to Raymond Lull* (London: The Warburg Institute, 1989); Pereira, *L’oro dei filosofi: saggio sulle idee di un alchimista del Trecento* (Spoleto: Centro Italiano di Studi sull’Alto Medioevo, 1992). On the English context of pseudo-Lullian alchemy, see Pereira, “Mater Medicinarum: English Physicians and the Alchemical Elixir in the Fifteenth Century,” in *Medicine from the Black Death to the French Disease*, ed. Roger French, Jon Arrizabalaga, Andrew

“This water is drawn, as you know, from a stinking menstruum compounded of four things, and it is the stronger water of the world and mortal; whose spirit wholly multiplies the tincture of the ferment.”¹³

Although this passage does not translate into a workable recipe, we can unpack its meaning to gain a sense of what the writer had in mind. First, we have to recognize that he is referring to a particular textual tradition. The ‘stinking menstruum’ (*menstruum foetens*) is a solvent described in another pseudo-Lullian work, the *Testamentum*, written earlier in the fourteenth century. By referring to this ingredient, the writer of the *Epistola* therefore demonstrates that he understands the sense of the earlier work – a necessary demonstration if he is to convince readers that he is in fact Raymond, the author of the *Testamentum*. He also tells us what role the ‘menstruum’ is expected to play in the alchemical work. In alchemical gold-making, gold and silver serve as ‘ferments’ to the stone – that is, they contribute their tincture, or essence, to the elixir, so that it can in turn convey their qualities to base metals at the moment of transmutation. Lull’s stinking menstruum has the power to *multiply* the tinctures of gold and silver, making a small amount of precious metal go further in the alchemical work.

The *Epistola* was indeed accepted as a work of Lull, and came to be very widely read, not least in England, where it had already been translated into English before the end of the fifteenth century.¹⁴ Writing in 1476, George Ripley cited it prominently in his own *Medulla alchimiae* (“The Marrow of Alchemy”):

“Because in this first chapter we will treat on the first elixir, let us therefore disclose somewhat more of this fire against nature, which is a mineral water, most strong and mortal, which serves to that elixir. And this water is drawn by elemental fire from a certain stinking menstruum compounded [*immasata*] of four things, as Raymond says in the *Epistola accurtationis*. And it is the strongest water in the world, whose spirit alone augments and multiplies the tincture of the ferment.”¹⁵

Like Raymond, Ripley here describes the composition of the mineral stone, used in transmutation. However, he has introduced a few significant changes to the text. Whereas pseudo-Lull identified the corrosive liquid simply as a water (*aqua*), Ripley describes it as a fire – the ‘fire against nature’ (*ignis contra naturam*). This is actually the term used in the

Cunningham, & Luis Garcia-Ballester (Aldershot: Ashgate, 1998), 26–52; Rampling, *Making of English Alchemy*, chaps. 1–2.

¹³ Jean-Jacques Manget, *Bibliotheca chemica curiosa*, 2 vols. (Geneva: Chouet, G. De Tournes, Cramer, Perachon, Ritter, & S. De Tournes, 1702), I: 863: “[H]aec aqua extrahitur, ut nostri ex quodam menstruali foetenti immassata ex rebus quatuor, & fortior est aqua mundi & mortalis: cujus spiritus totam tincturam fermenti ampliat.”

¹⁴ London, British Library, MS Sloane 1091, fols. 97r–101v.

¹⁵ George Ripley, *Medulla alchimiae*, in Cambridge, Trinity College Library, MS O.8.32, Pt. 1, fol. 3r: “[Q]uia de primo elixire in hoc primo capitulo agemus: ideo de hoc igne contra naturam que est aqua mineralis fortissima et mortalis elixeri deseruiens illi/ aliquid vltorius disseramus. Hec autem aqua extrahitur igne elementalī a quodam menstrualī fetenti immassata ex rebus .4or. vt Raymundus dicit in epistola accurtacionis et est fortior aqua mundi cuius solus spiritus tincturam fermenti ampliat et multiplicat.” (In manuscript, transcriptions, italicized text denotes the expansion of abbreviations). I discuss the context for this passage further in Rampling, *Making of English Alchemy*, chap. 2.

Testamentum to describe the mineral solvent. Although the term does not appear in the *Epistola*, Ripley signals that he has understood the ‘real’ meaning of Lull’s water, and its relationship to the influential *Testamentum*, by importing it to gloss the *Epistola*’s text. He also mentions elemental fire – that is, normal fire – as the means of drawing the mineral stone from the stinking menstruum, through heating. Once again, this passage serves to position a new treatise in the textual tradition of pseudo-Lullian alchemy (although not, in this case, of Lullian authorship).

Both pseudo-Lull and Ripley use cover names to disguise the identity of their water. If we move on another century, however, we find an attempt to explicate this passage, this time written in English, by the alchemist Humfrey Lock (fl. 1560s-1570s). In 1572, Lock incorporated parts of the *Medulla* into his own treatise on alchemy. Coming to the passage on the mineral stone, he subtly adapts Ripley’s text:

“The fier againste nature, which is a water drawn from the minerall vaine by addicion of naturall [vitriol] and nyter, very strong and mortall, drawn with fier elementalle from a stinckinge menstrue made of 4 thinges ... & is the strongest water in the worlde, by whose sprite the tincture of the fermente is encreased.”¹⁶

Lock’s commentary reveals that he has identified the chemical process disguised by the labels of ‘water’ and ‘fire against nature’. As any early modern practitioner would have known, vitriol (corresponding to iron or copper sulphate in modern chemical parlance) and sal niter (saltpeter) were the basic ingredients of *aqua fortis* (‘strong water’; our nitric acid). When sublimed with mercury, however, they produce corrosive sublimate (mercuric chloride): a process that Lock hints at by referring to the extraction of a substance from the “mineral vein” – that is, from the metal in its raw state, which in this case probably denotes mercury.¹⁷

Other clues in both the *Epistola* and the *Medulla* suggest that all these writers treated the sublimation of mercury with vitriol and salt as a basic starting point for making the mineral stone. That certainly seems to have been the process described in the *Testamentum*, as later readers were quick to identify. However, we cannot always be sure that successive writers are interpreting a process in the same way, thanks to the brevity and ambiguity that characterize such descriptions.

At times, we may even suspect that later writers deliberately twisted the sense of their authorities in order to support a different practice entirely. Take, for instance, *Maria dicit* (“Mary Says”). This short text comments on an aphorism attributed to one of the great

¹⁶ Humfrey Lock, *Treatise*, in Grund, *Misticall Wordes and Names Infinite*, 204. The symbol for vitriol appears in the original manuscript.

¹⁷ I discuss the alchemical use of corrosive sublimate in my forthcoming book. See also Robert P. Multhauf, “The Relationship between Technology and Natural Philosophy, ca.1250–1650, as Illustrated by the Technology of the Mineral Acids” (Ph.D. diss., University of California, 1953), 45 and passim; William R. Newman, “Mercury and Sulphur among the High Medieval Alchemists: From Rāzī and Avicenna to Albertus Magnus and Pseudo-Roger Bacon,” *Ambix*, 61 (2014): 327–44.

alchemical authorities, Mary the Jewess (also known as Mary the Prophetess).¹⁸ The commentator – who may have been a student of Ripley, if not Ripley himself – describes his struggles to understand one of Mary’s cover names, the ‘Heart of Saturn’. “I studied for a long time,” he confesses, “before I was able to understand what it was that was called the Heart of Saturn.” First he took it to mean gold. Yet given the high cost of gold, how could he square such advice with the words of another philosopher, Guido de Montanor, who said that “Purses are not to be loosened for great expenses, which our art does not require”?¹⁹ Clearly a less expensive ingredient was intended.

These are the preliminaries to a piece of exegesis in which the writer contrives to reconcile Mary’s authoritative process with his own alchemical practice – a practice based on ‘adrop,’ or lead, from which he draws another substance “which by masters is called sericon.”²⁰ Yet how do we, as modern readers, know whether his solution is the correct one to Mary’s conundrum? The answer, of course, is that we do not. Part of the fascination of alchemical language lies in its multiplicity of meanings. The writer may have deciphered the riddle correctly, but it is even more likely that he substituted his own plausible reading as a means of invoking Mary’s authority and demonstrating his own cleverness.²¹ Such well known and enigmatic instructions provided the familiar scaffolding around which a range of chemical processes might be tested and explored.

Experimenting with practice

Demonstrating skill in interpreting past authorities, while still keeping the core process hidden – a process of simultaneous revelation and concealment – was important when whetting the appetite of patrons and other readers. It is probably not a coincidence that all three of the related examples cited above are addressed to powerful audiences: pseudo-Lull’s treatise is framed as a letter to King Robert of Sicily (although the epistolary format is clearly fictitious); Ripley sought patronage from the Archbishop of York; and Lock hoped to win favor from William Cecil, Lord High Treasurer to Queen Elizabeth I. Under such circumstances, it literally did not pay to share information too freely. Lock himself admitted to using obscure language in the hope that this might prompt Burghley to recall

¹⁸ The treatise, a component of the so-called *Bosome Book* of George Ripley (CRC 3) circulated with the *Book* in both Latin and English translation from the last quarter of the sixteenth century. On the authenticity of the attribution, see CRC, 132–3.

¹⁹ London, British Library, MS Harley 2411, fol. 41r: “Longo tempore studivi, antequam posui intelligere, quid erat quod dicebatur Cor Saturni. Ego enim audivi pro Auro illud accipi; quod non erat verissimile ... dicente etiam Guido Non sunt dissoluenda marsupia propter magnas expensas faciendas, quas ars nostra non requirit.”

²⁰ Harley 2411, fol. 40r: “Corpus est Adrop de quo fit illud quod à magistris vocatur Sericon.” I discuss sericon, and Ripley’s use of it, in Jennifer M. Rampling, “Transmuting Sericon: Alchemy as ‘Practical Exegesis’ in Early Modern England,” *Osiris*, 29 (2014): 19–34.

²¹ Ripley’s writings were in turn reinterpreted by the seventeenth-century alchemist, George Starkey: see William R. Newman, *Gehennical Fire: The Lives of George Starkey, an American Alchemist in the Scientific Revolution* (Cambridge [MA]: Harvard University Press, 1994), chap. 4.

him from an unappealing position in Russia: "I made it the more darke that I might the sonner be sente for home for to doe it myselfe."²²

When alchemists gathered information for their own use, they had less incentive to disguise their meaning. Unsurprisingly, notebooks, recipe collections, and commonplace books, which often compiled information from diverse sources for the primary benefit of the copyist, tend to provide more explicit information than philosophical treatises or patronage suits. While some recipes were distilled from longer treatises (a practice already deplored as crass reductionism by pseudo-Arnald of Villanova in the fourteenth century),²³ others incorporated snippets of craft knowledge, medical lore, or personal observation.²⁴ They recorded a range of practices and metallurgical effects in addition to the "traditional" outcomes of alchemical medicines and transmuting elixirs. The Elizabethan notebooks of Clement Draper, for instance, are packed with recipes that range from simple processes for *aqua fortis* and 'artificial' vitriol crystals to such chemical marvels as a gold-based liquid that will dye human skin red, but whiten black feathers or horse hair.²⁵ Draper conveniently records his sources in many cases: thus, the skin-coloring water is taken from "a Coppie of Mr Thomas Barkers bowke," whereas other recipes are credited to Lull, Ripley, and Paracelsus.

These recipes had exchange value and could be traded with other enthusiasts, travelling within communities and, once recorded in manuscript, across time. This is not to say that they remained static. Compilers frequently annotated and edited recipes in light of their own experimentation, their wider reading, and their encounters with other practitioners. As a result, notes and emendations can tell us a great deal about how they translated written recipes into practical procedures; revealing how even theoretical treatises were interpreted with an eye to practice – and vice versa.

The great natural philosopher and bibliophile John Dee became interested in alchemy while a student at Cambridge, and over the course of his life collected hundreds of printed books and manuscripts on the subject.²⁶ The survival of large numbers of Dee's books, many of which are annotated with references to other texts, allows us to gauge just how carefully he studied this material and read it against other books in his library. His notes also offer practical observations, for Dee was not just an avid reader of alchemy, but an

²² Cited in Grund, *Misticall Wordes and Names Infinite*, 2.

²³ Arnald of Villanova [pseud.], "De secretis naturae," in Antoine Calvet, *Les oeuvres alchimiques attribuées à Arnald de Villeneuve: Grand œuvre, médecine et prophétie au Moyen-Âge* (Paris: S.É.H.A.; Archè, 2011), 512: "Non credas michi, sed credas philosopho cui est credendum et non fabulis sive receptis quia qui fecerunt receptas nichil sciverunt de scientia sed habuerunt aliquos libros philosophorum loquentium parabolice ... et decipiunt totum mundum cum ipsis receptis."

²⁴ On early modern recipes and practices more generally, see Elaine Leong, & Sara Pennell, "Recipe Collections and the Currency of Medical Knowledge in the Early Modern 'Medical Marketplace,'" in *The Medical Marketplace and its Colonies c.1450–c.1850*, ed. Mark S. R. Jenner, & Patrick Wallis (Basingstoke: Palgrave Macmillan, 2007), 133–52; and Pamela H. Smith, Amy R. W. Meyers, & Harold J. Cook, eds., *Ways of Making and Knowing: The Material Culture of Empirical Knowledge* (Ann Arbor [MI]: University of Michigan Press, 2014).

²⁵ MS Sloane 3748, fols. 17r–18r (vitriol and *aqua fortis*), 40v–45v (gold water). On Draper's notebooks, compiled during his time in the King's Bench prison, see Deborah E. Harkness, *The Jewel House: Elizabethan London and the Scientific Revolution* (New Haven: Yale University Press, 2007), chap. 5.

²⁶ See Julian Roberts and Andrew G. Watson, eds., *John Dee's Library Catalogue* (London: Bibliographical Society, 1990). On Dee's annotation practices, see Sherman, *John Dee*.

active practitioner. Take, for instance, a process for ‘water of mercury’ included in one late medieval recipe collection, MS Ashmole 1451. This recipe dispenses with salt and other ingredients associated with the sublimation of mercury, requiring nothing more than mercury alone. Dee’s marginal note suggests that he had trouble in getting the process to work: for although “This Manuduction is good,” making the first powder is “somwhat to[o] hard.”²⁷

On another occasion, Dee described a series of experiments conducted between 22 June and 6 October 1581. These are recorded in an alchemical notebook, MS Rawlinson D.241, written partly in Dee’s own hand and partly by a scribe. Dee records how he extracted ten ounces of “quick mercury” from a mercury sublimate, “by my diligence in pressing the soft stuff betwene my fingers partly: and by washing it in destilled vineger.”²⁸ This produced a fine, slimy substance which Dee put in a chamber pot and covered in vinegar, “to try what wold comme of it.”

Dee’s experience with quick mercury – varying procedures to see what would happen – suggests an experimental approach to practice. Yet at the same time, his responses to practical observations were shaped by his reading of source texts. For instance, George Ripley, one of his favorite authorities, had elsewhere warned his followers to add liquid very sparingly to the stone, so that “you shall not incontinently suffocate it with water.”²⁹ Dee remembered this passage when conducting his own experiment, noting that he only needed an ounce of his quick mercury “to kepe the water in hand and not to overcharge it, as Ripley in philortium warnes of.”³⁰ The margins of alchemical manuscripts are replete with such observations, reminding us that early modern alchemists – even those as bookish as Dee – regarded medieval texts not just as antiquarian curiosities, but as storehouses of practical information and replicable procedures.

In this case, Dee used information from a late medieval source to monitor his own experimental progress, yet practices gleaned from textual authorities might also be amended in light of practical experience. The pseudo-Lullian fire against nature was read not only as a textual riddle, but as a physical substance to be made. In 1563, Richard Walton, a haberdasher living near St Paul’s Cathedral in London, copied out a recipe for the “The perfecte making of the fyre agaynste nature after Raymond.”³¹ This manuscript, now MS Ashmole 1479, contains numerous works attributed to Walton’s preferred authorities, Lull and Ripley. Walton’s concern, however, was to reduce their laconic remarks about the fire against nature into a coherent practice.

²⁷ Oxford, Bodleian Library, Ashmole 1451, Pt. 2, fol. 3r.

²⁸ Oxford, Bodleian Library, MS Rawlinson D.241, fol. 3r–v. I discuss this case in more detail in Jennifer M. Rampling, “John Dee and the Alchemists: Practising and Promoting English Alchemy in the Holy Roman Empire,” *Studies in History and Philosophy of Science*, 43 (2012): 498–508, on 500.

²⁹ George Ripley, *Philorcium Alchymistarum*, in *Opera omnia chemica ...*, ed. Ludwig Combach (Kassel, 1649), 200: “sed solve per modicum & aqua non suffoces incontinenti.” The water described by Ripley is not, of course, normal water, but the ‘water of the stone’.

³⁰ Rawlinson D.241, fol. 3r.

³¹ Ashmole 1479, fol. 52v.

According to Walton's recipe, the corrosive is made by distilling a pound of vitriol, a pound of vermilion, eight ounces of saltpeter, and four ounces of burned salt – presumably the 'four things' alluded to in the *Epistola*, discussed above. It instructs that the first "faynt water" should be distilled off and discarded, leaving a red spirit capable of dissolving all metals except gold. It will also dissolve gold if sal ammoniac is added. In chemical terms, this recipe makes sense: the distillation of vitriol and saltpeter would produce *aqua fortis*, while adding sal ammoniac would yield *aqua regia* ('kingly water'), the solvent of gold. The pseudo-Lullian adaptation also includes vermilion, or cinnabar: a bright red compound of mercury and sulphur, two substances of great practical and philosophical significance in medieval alchemy. Cinnabar would also supply the mercury necessary for corrosive sublimate. However, is corrosive sublimate what Walton intended?

It seems not. Later, Walton returned to the recipe to strike out one of his original ingredients: the burned salt. A note explains the deletion: "leave the sallte for salte wyll hurte *your* work for salt wylbe salt do what *you* cane."³² Had Walton cross-referenced his recipe against a contrary authority? Or had he tried the process himself, and been unsuccessful? What sort of result, then, did he expect when he tried to reproduce the fire against nature himself? Unfortunately Walton is silent on this point. But as his adjustment reminds us, the most authoritative processes could still be amended when they failed to deliver. Alchemy was a serious – and a practical – business.

Staying true to type?

In 1688, the London publisher and bookseller William Cooper (d. 1689) published *A Catalogue of Chymical Books which have been written Originally, or Translated into English*, in which he listed 422 books.³³ These were not all alchemical, but addressed such wide-ranging topics as travel, mining, medicine, and painting, all of which touched on chemistry. However, Cooper's own publishing enterprise was marked by a particular interest in alchemical books, including a variety of influential treatises written in English – most famously, the works of Eirenaeus Philalethes, alias George Starkey, but also works attributed to Ripley and other medieval authorities. Cooper's endeavors were motivated, at least in part, by his interest in preserving important relics of English alchemy; an antiquarian interest that chimes with Ashmole's hopes for the *Theatrum*. But the aim of accurate preservation of early material was not always best served by print publication.

So far, I have tried to infer how alchemists read their sources by tracing how they adapted and annotated textual authorities dealing with practical topics. Sometimes, the adaptation went farther, to the extent that, by the time texts reached Cooper's press, the form of treatises had already changed beyond recognition. For instance, the *Bosome-Book of Sir George Ripley, Canon of Bridlington* (London, 1683) is not a work of Ripley but almost certainly a composite text assembled by one of his later readers. The new text's relationship

³² Ibid.

³³ William Cooper, *A Catalogue of Chymical Books which have been written Originally, or Translated into English* (London, 1688). On Cooper and the *Catalogue*, see Kassell, "Secrets Revealed."

to its probable fifteenth-century exemplar is tenuous at best, and the practical content of the work – which reads “sericon” as antimony rather than the red lead mentioned in recipes of Ripley’s time – more aptly belongs to the Elizabethan age than to the 1470s.³⁴

Another intriguing case is that of Sir Robert Greene of Welby (c. 1467–c. 1540), an alchemist (and later Count Palatine) active in the first third of the sixteenth century. Greene is best known as a keen transcriber of earlier Latin alchemical treatises, some of which now repose in the Bodleian and Cambridge University Libraries.³⁵ In 1538, Greene also composed a treatise of his own, the *Admonition or Work of Sir Robert Greene*.³⁶ In this short work, he reports himself to be seventy-one years of age, claiming to “have laboured the space of 40 yeeres and more in the Theoricke” of alchemy.³⁷ Yet for all his reading of theory, Greene admits that his practice has yielded ambiguous results. He describes, for instance, an accident in which a poor choice of sealant for his flask led to the contents escaping and falling into the fire, where they were contaminated by ash. At the close of the treatise, Greene acknowledges that his practice was unsuccessful, yet points to several promising observations – including the heavenly fragrance of one of his products – that leave him convinced of the truth of alchemy, “without doubt or fable.” The treatise therefore offers an unusually frank account of the variety of practices that might be attempted by a would-be adept, and the difficulties associated with bringing them to fruition.

A century-and-a-half later, in 1683, Cooper published an anonymous, redacted version of Greene’s treatise under the title of *The Practice of Lights*.³⁸ But this is no longer a relation of Greene’s struggle – and ultimate failure – to reconstruct the products described in his reading. In this version, Greene’s discussion of medical alchemy has been omitted in order to focus the text on transmutation; a common trend in printed alchemica of this period. Gone, too, is the ambivalent conclusion. The treatise instead closes with an exhortation to readers not to reveal its contents except to virtuous men who will be “glad to help the Poor and needy People”; a conventional trope that seems particularly disingenuous in the context of an invented ending for a published book.³⁹ Even Greene’s name has disappeared.

³⁴ *The Bosome-Book of Sir George Ripley, Canon of Bridlington ...* (London: for William Cooper, 1683). See CRC, 197; Rampling, “Transmuting Sericon,” 28.

³⁵ On Greene, see Andrew G. Watson, “Robert Green of Welby, Alchemist and Count Palatine, c.1467–c.1540, *Notes and Queries* 32, no. 3 (Sept. 1985), 312–13.

³⁶ The treatise – which was probably written in Latin and translated fairly soon afterwards into English – and Greene’s authorship are discussed in Rampling, *Making of English Alchemy*, chap. 4. Copies of the English translation are found in MSS Ashmole 1415, fols. 85r–96r (seventeenth century, hand of Elias Ashmole); Ashmole 1426 (Pt. 9), fols. 3r–17r (mid-sixteenth century); Ashmole 1442 (Pt. 3) (seventeenth century); Ashmole 1490, fols. 165r–166v (dated 13 August 1592, hand of Simon Forman); and Ashmole 1492 (Pt. 9), 197–205 (dated 23 August 1604, hand of Christopher Tylour). Extracts are found in British Library, MS Sloane 1744, fols. 22v–23v and 58r–v (early seventeenth century, hand of Thomas Robson).

³⁷ Ashmole 1492, Pt. 9, 205.

³⁸ Anon., *The Practice of Lights: or An Excellent and Ancient Treatise of the Philosophers Stone*, in Eirenaeus Philalethes, *The Secret of the Immortal Liquor called Alkahest, or Ignis-Aqua* (London: for William Cooper, 1683); reprinted in *Collectanea Chymica: A Collection of Ten Several Treatises in Chymistry, concerning The Liquor Alkahest, the Mercury of Philosophers, and other Curiosities worthy the Perusal ...* (London: for William Cooper, 1684), 27–44.

³⁹ Anon., *The Practice of Lights*, 44.

The *Practice of Lights* tells us more about the interests and concerns of a later editor than it does about Greene's own practice – and in the polemical and politicized climate of later seventeenth-century English alchemy, it seems that ambiguity did not sell. The redaction of Greene's name may have been deliberate, since by the seventeenth century he had come to be associated with fraudulent practice, thanks to a critical mention in Blomfield's famous poem.⁴⁰ Yet these insights only come to us thanks to the survival of the original treatise. Although manuscript copies of the work continued to circulate well into the seventeenth century, these will of course be missed by readers who concentrate on print. For those interested in the experimental aspects of Greene's practice – or in alchemy as practiced in the first half of the sixteenth century, a rather neglected period in English alchemy – the printed *Practice* will be of no use at all. By smoothing away embarrassing associations and confessions of practical difficulty, the edition overwrites the very evidence we have been looking for – the experimental endeavors of practically-minded alchemists.

These endeavors involved an experimental approach to both matter and reading. To solve exegetical problems, alchemists cross-referenced their reading matter with other books, and also with their own practical experience. Such minute changes are easily passed over when we focus on a single source. By examining the widest range of witnesses possible, in both print and manuscript, we get a clearer sense of how individuals varied in their responses to practical problems and textual puzzles. These instances offer a window – admittedly a small one, and glazed with rather thick, grimy panes – into the experimental practice of English alchemists before the century of Boyle and Newton.

⁴⁰ "Bloomfields Blossoms," *TCB*, 309.