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Alchemical Laboratories: Texts, Practices, Material Relics

An Introduction

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Abstract

The alchemical laboratory is one of the most important birthplaces of modern science. Yet it remains a relatively understudied topic. This is due to the scarce historical record of these places which – before laboratories became institutionalized – tended to be make-shift and multi-purpose spaces. Thus an interdisciplinary approach is needed to approach this topic central to the history of experimental knowledge production. This article serves as an introduction to the proceedings of the international symposium 'Alchemical Laboratories. Texts, practices, material relics' held in February 2020 in Vienna and Oberstockstall. It gives an overview of not only the articles contained in this volume but also contextualizes them in current research discourses relevant to alchemical and chymical laboratories, mainly the experimental history of science and the archaeology of alchemy but not reduced to them.

Keywords: Alchemical Laboratories, history of alchemy, history of laboratories, experimental history of science, archaeology of alchemy

Zusammenfassung

Das alchemische Labor ist eine der wichtigsten Geburtsstätten der modernen Naturwissenschaft. Dennoch bleibt es ein noch unzureichend erforschtes Thema. Dies liegt an der Zerstreuung und schweren Zugänglichkeit historischer Spuren dieser Orte, die vor der Institutionalisierung von Laboren zumeist behelfsmäßige, multifunktionale Räumlichkeiten waren. Aufgrund der schwierigen Quellenlage ist es nötig, sich dem Phänomen aus interdisziplinärer Perspektive anzunähern. Dieser Beitrag dient als Einleitung für den Sammelband zum internationalen Symposium 'Alchemische Labore. Texte, Praktiken, materielle Hinterlassenschaften', das im Februar 2020 in Wien und Oberstockstall stattgefunden hat. Er gibt nicht nur einen Überblick über die Inhalte der in diesem Band enthaltenen Artikel, sondern kontextualisiert sie auch in aktuellen Forschungsdiskursen um alchemische und chymische Laboratorien – unter anderem die experimentelle Wissenschaftsgeschichte und die Archäologie der Alchemie.

Schlagwörter: Alchemische Labore, Alchemiegeschichte, Geschichte des Labors, experimentelle Wissenschaftsgeschichte, Archäologie der Alchemie

Introduction

The alchemical laboratory is the birthplace of laboratories all around the world and, maybe even more importantly, a universal metaphor for experimental knowledge production. Yet given its unique relevance to the beginnings of science as we now define it, the alchemical laboratory is still an understudied topic in the historiography of alchemy and the history of science more broadly. This, however, is not due to a failure of the field but rather due to the difficulty of grasping the historical phenomenon of the laboratory. Not only are material relics of alchemical laboratories relatively scarce, both with regard to the buildings in which they were located and the equipment used in practical experimentation, but due to the fact that the types of activities performed there involved tacit artisanal knowledge which is hard to retrace in retrospect and notoriously difficult to encode and transmit textually. Still, textual transmission makes up the largest pool of extant historical sources informing our understanding of the alchemical laboratory. Yet scraps of information can be extracted from a plethora of other types of sources, such as art, objects resulting from chymical experiments, and correspondence. Accordingly, the topic can be understood much more richly from an inter- and multidisciplinary perspective, as this book attempts to do.

In 1986, Owen Hannaway stated in his essay *Laboratory Design and the Aim of Science: Andreas Libavius versus Tycho Brahe* that "the history of the laboratory is an important but neglected aspect of early modern science. [...] Indications are that the laboratory was at first linked exclusively with alchemy and chemistry; only gradually, it seems, was the term extended to describe all those distinctive places where the manipulative investigation of natural phenomena was carried out."[1] But despite this deep interconnectedness between alchemical practice and the development of the concept of the laboratory, there had not been extensive research on the topic when first plans for the international symposium 'Alchemical Laboratories. Texts, practices, material relics' were made in 2018. A number of volumes had appeared on related subjects, such as those on the reflections of laboratories in art[2] or on the archaeological interpretation of laboratory finds such as Oberstockstall or Wittenberg.[3]

1. Hannaway 1986, 585. Hannaway started the discussion on the alchemical laboratory, followed by a rebuttal by Shackelford shortly thereafter, cf. Shackelford 1993; Principe 1998; Newman 1999. I would like to thank the 2020-21 Fellows' Work-In-Progress group from Science History Institute, especially Megan Piorko; the colleagues from the Innsbruck NOSCEMUS project, especially Martin Korenjak and Dominik Berrens; as well as Rafał Prinke for their invaluable feedback and suggestions in the draft stages of this paper.

2. Such as for example Principe 2014b

3. On Oberstockstall: Soukup and Mayer 1997; Osten 1998; on Wittenberg: Meller, Reichenberger, and Wunderlich 2016. On Duke Friedrich's I laboratory in Stuttgart: Nummedal 2007, chapter 5 'Laboratories, Space, and Secrecy.'

Despite the growing popularity of the experiment as a research subject, the very space where scientific experimentation was carried out had been addressed considerably less in the context of alchemy and chymistry. Even the etymology of the term 'laboratory' remains somewhat obscure. The term first started appearing as we presently understand it in the 16th century, coinciding with the moment when the alchemical workplace transitioned from make-shift multi-purpose workspaces to something more institutionalized.[4] However, the term is already in use much earlier and the *-orium* ending of *laboratorium* is reminiscent of room names in monastic contexts.[5] Initially deriving from *laborare* and used broadly to signify a place of work as early as the 12th century, *laboratorium* gradually became associated with pharmaceutical laboratories during the first half of the 16th century, eventually supplanting the earlier term 'pharmacy kitchen.'[6] Accordingly, *laboratorium* evolved from a general term

4. Morris 2015, 19–20

5. Especially footnote 1 in Hannaway 1986, 585. Morris writes that "[b]efore the late sixteenth century, there were no laboratories. To be precise, there was no such word as 'laboratory' until that period. The word first appeared in Latin for the workplace of an alchemist in the 1580s and in English for the same purpose in 1592. Essentially the Latin word *laboratorium* means a workshop, and before there were any laboratories, alchemists in common with other craft workers had workshops" (Morris 2021, 2). This is not entirely correct as the term *laboratorium* does appear well before 1580, yet a detailed etymological study of its early uses is still found wanting. Given Morris' focus on the *chemical* instead of the *alchemical* laboratory, it is understandable that his accounts of the latter omit this sort of nuance. Morris further argues that one cannot speak of a chemical laboratory in the modern sense in the case of multi-purpose or make-shift spaces that were not specifically designed for carrying out chemical operations. He further claims that the rise of chemical laboratories in the modern sense coincides with metallurgical technical treatises such as Agricola's *De re metallica* (1556) or Lazarus Ercker's *Beschreibung allerfürnemisten mineralischen Ertzt und Berckwercksarten* (1574) in the context of the German mining industry as well as the rise of chymistry exemplified in publications such as Libavius' *Alchymia* (1597). One might object, however, that the existence of elaborate publications detailing the technical state of the art suggests that laboratories made up in a more structured manner must have existed before the end of the sixteenth century, serving as inspiration for authors such as Agricola or Ercker. Both describe the tried and tested status quo, not innovations.

6. Instances of the term *laboratorium* in primary sources date primarily to the 17th century. The term does not seem to be used in classic medieval alchemical texts such as Ps.-Geber, Ps.-Lull or Ripley, nor in Paracelsian texts and is not included in Ruland's *Lexicon Alchemiae* (1612). It seems to have gained prominence when it was famously used by Andreas Libavius in 1597 and Tycho Brahe in 1596 for the (al-)chymical laboratory (Hannaway 1986). By the end of the 16th century, the term seems to have been commonly used in pharmaceutical contexts, denoting the pharmaceutical laboratory. In *Apotheken*, such spaces were alternatively termed 'kitchen' in the vernacular. For example, the sentence "Dessgleichen dann der Apothecker *laboratoria*, oder Apothecken Küchen / sollen von Haußküchen abgesondert und beschlossen seyn" in *Friedrich IV., Churfürstlicher Pfaltz Fürstenthumbs in Obern Bayern Landsordnung* (Amberg: Forster 1599), 291, uses the terms synonymously. Gdańsk/Danzig author Johannes Placotomus (Bredtschneider, ~1514–1577) writes in *Pharmacopoea in compendium redacta* (Antwerpen 1560), section 'De laboratorio': "Oportet enim Pharmacopoeum valde occultum eſſe, […] proxima est culina. Vulgo laboratorium dictum, in qua coquatur, conficiatur, & aqua deſtillentur […]," defining the apothecary's workplace as "culina, vulgo laboratorium dictum." Thus, Hannaway's proposal that the term came into use only at the end of the 16th century and was initially associated mainly with alchemical experiments has to be called into question: *laboratorium* was used for the pharmacy laboratory by at least the mid-16th century, as suggested by the formulation *vulgo dictum* in Placotomus. In medieval texts, the laboratory

for a workplace to a specific reference to spaces dedicated to pharmaceutical and alchemical work.[7] Information on what alchemical laboratories would have looked like in the Middle Ages is scarce and we risk inferring anachronistic elements of later laboratories.[8] The early modern term *laboratorium* "referred almost exclusively to a room or house where chemical operations such as distillation, combustion, and dissolution were performed."[9] Towards the end of the seventeenth century, laboratories became "the hallmarks of the new science – the site where theories and hypotheses were purportedly tested by experiment."[10] In the eighteenth century, the professionalization of laboratory work led to an "increasing accuracy of analytical methods and apparatus."[11] The extension of the term to sites of knowledge-making beyond chemistry only happened during industrialization. Frank James encapsulates our modern understanding of the laboratory as "very much a product of, and a symbol of, modern industrial society."[12] While this is true today, the first institutionalized chymical laboratories looked much different. They "resembled the workshops of apothecaries, metalworkers, and pigment makers [...] and shared many [...] components with the workplaces of metal smelters, glassmakers, and potters."[13]

was often called *officina*, but a formal distinction between *officina* and *laboratorium* emerged in 19th century Germany, categorizing distinct areas of a pharmacy, with the third being *Magazin* (Döbereine 1848, 'Einrichtung der Apotheken. §. 37': "Das Laboratorium ist derjenige Ort, in welchem die rohen und noch nicht zubereiteten Arzneimittel verarbeitet werden und kann passend aus drei Abtheilungen bestehen, nämlich aus dem eigentlichen Laboratorium, welches feuerfest sein muß, die nöthigen feſten und tragbaren Oefen, Deſtillirblasen und überhaupt diejenigen Geräthschaften enthält, die bei der Zubereitung der Arzneimittel in Anwendung kommen; ferner die Stoßkammer [...]; endlich die Trockenkammer und das Digestorium [...]."). An occurrence of the term dating back to 1451, cited by DuCange, suggests a broader meaning akin to 'workplace,' though its use appears to have been infrequent. See *Laboratorium* in: Du Cange et al., *Glossarium mediæ et infimæ latinitatis*. Niort: L. Favre, 1883–1887. http://ducange.enc.sorbonne.fr/LABORATORIUM. Its usage can be traced back to Osbern of Gloucester (fl. 1150–75) in *Liber Derivationum* (https://logeion.uchicago.edu/laboratorium), possibly the earliest recorded appearance of the term, and later by Uguccione da Pisa (1140?–1210) in his *Magnae Derivationes* (https://dama.dantenetwork.it/index.php?id=20&L=0&workSign=Uguccione_Derivationes&pb=1579), suggesting its early use in the broad sense of a work area (*locus laborantium*): "Labor, ris, vel labos; inde laboriosus, a, um; unde laboriose adv. et haec laboriositas, tis, et hic labyrinthus; ti, domus Daedali, et dicitur labyrinthus quasi laborem habens intus; et inde labyrinthicus, a, um. Et laboro, as; unde verbalia. Et hoc laboramen, nis, et hoc laboratorium, rii *i* locus laborantium. Et componitur elaboro, as, et collaboro, as, et ab istis verbalia." Hugutio of Pisa. *Liber derivationum* (UBG Ms 0427). Graz: Universitätsbibliothek Graz; Stift Seckau. https://unipub.uni-graz.at/obvugrscript/content/pageview/5851118, 71v. I am grateful to Rafał Prinke for his help with this etymological investigation.

7. Etymologically, one could say that *labor* actually means 'workshop', see Kluge 2012: "Entlehnt aus ml. *laboratorium*, zu l. *labor (-ōris)* m. 'Anstrengung, Mühe, Arbeit', also eigentlich 'Werkraum'."
8. Thomas and Moureau 2022
9. Klein 2008, 769
10. Smith 2006, 292
11. Beretta 2022, 71
12. James 1989, 1, 2
13. Smith 2006, 292

In the 1980s, the field of laboratory studies emerged.[14] Subsequently, the study of the laboratory became popularized and took a decidedly sociological turn, inspired by studies in the tradition of Latour and Knorr-Cetina, conceptualizing the laboratory as "a gateway for understanding how scientific knowledge is produced."[15] The Digital and Computational Humanities have adopted the metaphors of laboratory and experiment to denote the innovative combination of theory and practice in young areas of study.[16] Today, the laboratory has become synonymous with science. So much so that we take its historical and etymological origins for granted. Discussions of laboratories are manifold, yet they all have to acknowledge the history of alchemy as its birthplace. In the historiography of alchemy, its discussion has only taken off since the 'practical turn' related to the experimental history of science[17] and the aforementioned archaeological finds of alchemical laboratories. The laboratory is a place for the "manipulative investigation of natural phenomena"[18] integral to the alchemical and chymical mode of inquiry which Jennifer Rampling has termed 'practical exegesis'.[19]

Research trends around chymical laboratories

Following the spectacular archaeological finds of Oberstockstall, Wittenberg, and others, a whole archaeology of alchemy subfield has emerged alongside those most famous archaeological endeavours into the history of alchemy.[20] In addition to providing us with unique insights into the materiality of alchemical pursuits more generally, the archaeology of alchemy and chymistry has profoundly enriched our knowledge about alchemical laboratories.[21] Beyond experimental archaeology and archaeometry, recent scholarship also has included reconstructing recipes from historical texts and re-enactment. Not only has the alchemical laboratory become a place of special interest for the history of science, alchemical processes also made their way into modern laboratories where they are replicated for research purposes. Within the

14. For example: Cetina 1995; on laboratories in the alchemical context: Hannaway 1986; Crosland 2005; Hartung 2006; Smith 2006; Martelli 2011.
15. Pawlicka-Deger 2020, 2. On Laboratory Studies: Lynch 1985; Cetina 1981, 1992, 1995, 1999, 2001; Vinck 2007; Doing 2008.
16. Lang 2021b
17. Rheinberger 2001, 51
18. Hannaway 1986, 585
19. Rampling 2014; Rampling 2020, 63–64, 97–99, 354
20. Examples for contributions on the archaeology of alchemy are: Soukup and Mayer 1997; Anderson 2000; Principe 2000; Meller, Reichenberger, and Wunderlich 2016; Wunderlich and Werthmann 2016; Veronesi and Martinón-Torres 2018.
21. On the subject of alchemy and laboratory, seen on text from, for example, laboratory notebooks, or the material evidence of archaeological finds: Soukup and Mayer 1997; Anderson 2000; Principe 2000; Newman and Principe 2003; Principe 2014a; Meller, Reichenberger, and Wunderlich 2016; Veronesi and Martinón-Torres 2018.

historiography of alchemy, the use of experimental methods, pioneered especially by Lawrence Principe and William Newman, has resulted in tremendous revisions of the current state of the art in the field. So much so that the journal *Science* spoke of an 'Alchemical Revolution.'[22] A whole range of experimental methods has become established in the experimental history of science under the label of 'RRR methods' (reconstruction, replication, re-enactment).[23] The discussion of the hermeneutics of those experimental methods has characterized them as providers of sensory data that can be used to fill in the documentary gaps in historical sources.[24] An example of this can be seen in the section 'Reconstructing Laboratory Work from Textual Evidence' of this book. Laboratory and experiment have become popular topics, both in the historiography of alchemy and chymistry[25] and the history of science as a whole.[26]

There have been collected volumes on *Instruments and Experimentation in the History of Chemistry*[27], on the methods of the experimental history of science more generally[28] as well as on the alchemical laboratory and its connection to art.[29] But the laboratory is much more than that. It also stands as a well-worn metaphor for places of knowledge production involving practical or experimental aspects. In alchemical and chymical contexts specifically, it is linked to the secrecy surrounding the craft.[30] But it is also a place in close connection with the library, the world of textual knowledge, and the question of books in the laboratory has been brought up many times.[31]

22. cf. Reardon 2011; regarding the "New Historiography of Alchemy", see: Newman and Principe 1998; Principe and Newman 2001.
23. Hendriksen provides a definition: "Performative methods include, but are not limited to, reconstruction, replication, and re-enactment (RRR) of historical experiments, apparatus, processes, and techniques." In: Hendriksen 2020, 314.
24. Fors, Principe, and Sibum 2016, 91
25. On "experimental history of science", especially with regards to the historiography of alchemy and chymistry see: Principe 1987, 2000; Gelius 1997; Newman and Principe 2003; Reardon 2011; Fors, Principe, and Sibum 2016; Neven 2016; Moureau and Thomas 2016; Wunderlich and Werthmann 2016; Martelli 2017; Hagendijk 2018; Hendriksen 2020; Hendriksen and Verwaal 2020; Taape, Smith, and Uchacz 2020.
26. On the laboratory and experiment in the history of science, especially the experimental history of science, for example: Hannaway 1986; Cetina 1995; Dupré et al. 2020a, 2020b; Hagendijk et al. 2020; Sibum 2020.
27. On *Instruments and Experimentation in the History of Chemistry* with regards to the history of alchemy see: Principe 2000; Anderson 2000; Newman 2000.
28. For example Dupré et al. 2020a, 2020b; Hagendijk 2020; Sibum 2020
29. For example in the book *Laboratories of Art*: Neven 2014; Principe 2014a
30. For example Eamon 1994; Long 2001. This even includes spiritual dimensions as discussed by more speculative authors such as Khunrath, see Forshaw 2020 and the contribution by Berit Wagner in this volume.
31. cf. Nummedal 2011, 331–33. On depictions of books in laboratories, see the contribution by Ivo Purš in this volume.

Summary of the proceedings

The conference 'Alchemische Labore. Praktiken, Texte und materielle Hinterlassenschaften / Alchemical Laboratories. Practices, texts, material relics' invited international scholars from a multitude of disciplines to Vienna to investigate the topic of the alchemical and chymical laboratory through an interdisciplinary lens.

(Alchemical) Experiment as Courtly Spectacle

Alchemy was usually practiced hidden away in laboratories but alchemy also had a long tradition of being practiced at court. The first section of this book, '(Alchemical) Experiment as Courtly Spectacle', focuses on how alchemy was practiced at the Habsburg court. Rudolf Werner Soukup's talk was called 'Alchymistische Kunststücke am kaiserlichen Hof. Alchemie unter den Habsburgerkaisern Rudolf II., Ferdinand III. und Leopold I.' (*Alchymical Performances at the Emperor's Court. Alchemy in the Time of the Habsburg Emperors Rudolf II, Ferdinand III and Leopold I*). His keynote sheds light on the alchemical pursuits surrounding the Habsburg emperors of the 16th and 17th centuries, beginning with Rudolf II (1552–1612) in Prague and continuing to Ferdinand III (1608–1657) and his son Leopold I (1640–1705) in Vienna. Birte Camen has recently shown in her diploma thesis that the author of the 1596 manuscript „Alchymische Kunst-Stücke in gutter Ordnungk", an important source for the courtly alchemy at the time of Rudolph II, was the Breslau (Wrocław) physician Dr. Johann Hennemann (1555–1614).[32] We can gather information on the alchemy practiced by emperor Ferdinand III and his brother archduke Leopold Wilhelm from their lively correspondence.[33] Soukup sheds light on the two Leipzig doctors who worked for the latter, Dr. Johann Agricola (1590–1668) and Dr. Johann Michael (Johannes Michaelis, 1606–1667), performing all sorts of (al)chymical processes with a focus on transmutation but also including quite original processes like the „Reibwerk". Their courtly alchemy is documented by material relics such as the coin memorizing the transmutation witnessed by Ferdinand III in 1648. Soukup also shows convincing evidence indicating that Conrad III von Ruessenstein (1604–1668) performed laboratory work for Emperor Ferdinand.[34] Another recent diploma thesis by Elisabeth Tauschitz discusses the mythoalchemical works of Johann Friedrich von Rain und Radelsegg in which he framed the act of denying the possibility of alchemical transmutation as a *crimen laesae maiestatis* (high treason against a sovereign), thus deeply linking

32. Camen 2018
33. cf. Schreiber 2004
34. On alchemical coins see the contribution by Patrick Fiska in this volume.

alchemical laboratory work to the sphere of the Emperor's worldly power at court.[35] Lastly, the Augustinian friar Wenzel Seiler from Brünn (1648–1681) had the honour of becoming Reichsfreiherr after having served as Hofchymicus to Emperor Leopold I. Soukup thus argues that the role of alchemical practice at court fitted perfectly into the self-fashioning and *dissimulatio* customary at court in Leopold's time, helping substantialize *pietas austriaca* and serving as a means of testifying to the power of the emperor.

In her article '*Aurea progenies plumbo prognata parente*. Literarische und politische Dimensionen einer Transmutationsmedaille' (*Literary and Political Dimensions of a Transmutation Medal*), Elisabeth Klecker discusses transmutation medals as a subgenre of "Gedächtnismünzen". Such memorial coins functioned as media of baroque courtly self-fashioning and propaganda. In the example discussed, the medal commemorates a successful alchemical performance in Innsbruck on December 31st 1716 where it can be understood as an allusion to the prophecy of the Golden Age in Virgil's fourth Eclogue, which was a trope of panegyrics. Klecker argues that Karl III Philipp von Pfalz-Neuburg wanted the transmutation symbolized by the coin to be seen as a prosperous omen for his reign. In his article 'Alchemistische Transmutationsmedaillen. Bemerkungen zu den im Rahmen des Kongresses gezeigten Stücken aus dem Münzkabinett des Kunsthistorischen Museums' (*Alchemical Transmutation Medals. Remarks on the Münzkabinett Pieces Shown During the Conference*), Patrick Fiska provides a literature review on alchemical medals and coins, systematizing them in terms of recurring types. In her short article 'Die Rezeption des spätantiken Alchemisten Stephanos von Alexandria am kaiserlichen Hof' (*Stephanos of Alexandria's Reception at the Austrian Court*), Alexandra Koschiček-Krombholz presents a Latin translation of the lectures given by Stephanos of Alexandria, commissioned around the year 1640 by Emperor Ferdinand III, today's Codex Vindobonensis 11453 of Österreichische Nationalbibliothek.

Materiality in the Context of Courtly Chymical Practice

This section contains articles highlighting two different approaches to materiality in the context of courtly chymical practice: an in-depth study of objects made from the seven-fold alloy called *Electrum* and a book history approach to the materiality of texts conveying information about alchemical practices.[36] In her article 'Elec-

35. Tauschitz 2019. The exact birth and death dates of Johann Friedrich von Rain und Radelsegg are not known. His publication is dated around 1680.

36. For a recent discussion of the cipher in Emperor Rudolf II's 'Alchemical Hand Bell' see Bean, Gannon and Lang 2023. For more material culture research regarding the history of alchemy see for example: Smith 2006, 2017, 2020; Nummedal 2011; Neven 2014, 2016; Principe 2014a; Dupré 2017; Valleriani 2017; Hagendijk 2018; Hendriksen and Verwaal 2020, Smith et al. 2020.

trum in the Kunstkammer of Rudolf II. Objects made from Seven Metals', Corinna Gannon discusses three groups of objects used at the court of Rudolf II and in his Kunstkammer which are said to have been made from *Electrum*. Divinatory mirrors, spirit-summoning bells and talismanic medals were supposedly made from this material which originated in late 16th century (Pseudo-)Paracelsian literature. One of those objects is the so-called "Alchemical Hand Bell of Rudolf II." by the Prague artist Hans de Bull,[37] In 'Material Evidence in Alchemical Texts and Arthur Dee's Career as Royal Physician', Megan Piorko discusses the life of Arthur Dee (1579–1651) as Physician at the court of Tsar Mikhail I (1596–1645). She does so by using a bibliographical approach to alchemical knowledge production and book use, investigating how texts were used through alterations and interventions to their physical vessels.

The Material Evidence of Laboratories

The section 'The Material Evidence of Laboratories' brings together archaeology and historical building research to shed light on the Oberstockstall alchemical laboratory and the surrounding area. In 'Glass and alchemy in Oberstockstall: a material culture approach', Umberto Veronesi summarizes the results of the chemical analysis of glass fragments from the Oberstockstall laboratory.[38] Thanks to those analyses it has been possible to determine that high technical quality glass was used exclusively for distillation vessels, whereas the cheaper non-specialized glassware was sourced locally. Such results underline the great potential of archaeology and material culture as a historical source for history of science research.

Walpurga Oppeker asks whether there could have been an alchemist's laboratory in the former Dominican monastery Münzbach (Upper Austria, district Perg) in a room referred to as 'Hostienküche'. She discusses the location in the context of other similar finds such as the famous Oberstockstall laboratory in Kirchberg am Wagram (Lower Austria) or the Franciscan monastery in Wittenberg (Germany), as well as its historical context as property of the Graf of Windhag, Joachim Enzmilner (1600–1678). Oliver Fries contributes a building history approach to the so-called Oberstockstall "Kasten", the part of the building in which the leftovers of the alchemical laboratory were found. He further traces the development of the construction during the period relevant to the laboratory activity.

37. De Bull was active around the year 1600 in Prague. The exact birth and death dates are unknown.
38. Osten 1998

(Everyday) Life in the Laboratory

The section '(Everyday) Life in the Laboratory' contains contributions shedding light on the everyday laboratory practice of individuals like the Hungarian nobleman Boldizsár Batthyány and the Polish master alchemist Michael Sendivogius. In 'The Alchemy of Everyday Life: The Curious Case of Boldizsár Batthyány (1542–1590)', Dóra Bobory discusses contexts that made alchemy relevant to Batthyány's everyday life, such as mining or medicine. She gives insight into the practical reception of alchemical theory outside of scholarly literature, which can be gleaned from Batthyány's correspondence. We encounter names familiar to the Styrian publishing place of this volume, such as Felician von Herberstein or the master of the Graz mint, Hans Lasanz. Rafał T. Prinke and Kamila Follprecht also offer us a glance into the practicalities of historical laboratory work and the everyday lives of alchemical and chymical practitioners by retracing possible locations of the laboratories of Michael Sendivogius (1566–1636). These are the laboratories of his patrons in Cracow, Prague or Stuttgart, those of his rich supporters in Prague or Krzepice or of alchemical friends in Leipzig and Jílové/Eulau. Lastly, it discusses the laboratories Sendivogius is thought to have rented or owned himself in Cracow, Kravaře and Olomouc/Olmütz.

Metaphorical Laboratories and Alchemical Iconography

Moving forward from alchemical practice to visual and metaphorical representations of alchemy and their meanings, scholars have not only looked at 'everyday' and entrepreneurial aspects of alchemy, they have also looked towards alchemy and art.[39] More than just a physical space, the alchemical laboratory was also an imagined space, trenched in an aura of mystique.

In his article 'The Alchemical Laboratory in the Mirror of 16th and 17th Century Fine Art', Ivo Purš explores both the artistic and practical motivations for depicting the alchemical laboratory and its contents in fine art. The moralistic renderings of alchemical laboratories and practitioners in 17th century Flemish and Dutch genre painting ranged from satirical to melancholic portrayals but drew on earlier depictions in more technical treatises which served an entirely different purpose and stemmed from their own production context. Starting with the early 15th-century fresco from Palazzo della Ragione and illustrations from the *Aurora Consurgens* manuscript of the same period, Purš discusses the genre paintings by Jan Steen (c. 1626–1679), Adriaen Van Ostade (1610–1685), David Teniers the Younger (1610–1690) and Thomas Wijck (c. 1616–1677), comparing them to Heinrich Khunrath's (1560–1605) *Oratory and Laboratory* engraving from the *Amphitheatrum sapientiae aeternae* (1595). Additionally,

39. On alchemy and art, see for example: Principe & DeWitt 2002, Principe 2014b, Drago 2019

he compares Cornelis Bega's (1631/32–1664) 'Alchemist' to an anonymous drawing of an alchemist in a late 16th-century manuscript.

In his article 'Allegorical Iconography of Alchemical Furnaces in Sixteenth and Seventeenth Century Manuscripts', Sergei Zotov also concludes that manuals may likely have influenced allegorical depictions in art. However, he notes that furnaces were depicted much less frequently than, for example vials, indicating they might have been perceived as less central aspects which, thus, were less frequently allegorized. He discusses multiple iconographical forms, such as the oven allegorized as fiery beings such as hell mouths, demons or dragons, or as trees and buildings. He argues this imagery might be derived from manuals of military technology such as *Bellifortis* (1402/5) or *De re militari* (5h century AD).

Berit Wagner shows in her article 'ECCE! SIEHE! Heinrich Khunraths gläsernes Artificium und Matthäus Merians hermetischer Philosoph in der Kunstkammer' (*Heinrich Khunrath's Glass Articifium and Matthäus Merian's Hermetic Philosopher in the Kunstkammer*) how illustrations of alchemical apparatus draw on theatrical and performative conventions of contemporary Kunstkammern. It is yet another contribution illustrating very clearly the deep interconnectedness of the laboratory with the Kunstkammer. Wagner draws on Matthäus Merian the Elder's (1593–1650) interpretation of both Andreas Libavius' (1560–1616) *Alchymia* (1606) and Heinrich Khunrath's (1560–1605) *Philosophical Athanor* (1599/1603) in the title page he created for Daniel Sennert's (1572–1637) *Institutionum medicinæ Libri V* (*1611*) to visualize the latter's iatrochemical approach.

Reconstructing Laboratory Work from Textual Evidence

Alchemy was a tradition often described as being caught between 'words and works:' This means it had a rich textual tradition, but the practitioners who conducted experiments sometimes found themselves challenging these established texts with new discoveries made in the laboratory while compiling and commenting on alchemical writings.[40] The contributions in this section 'Reconstructing Laboratory Work from Textual Evidence' engage in such practical exegesis under the banner of the Experimental History of Science to approach the *Processus Universalis* recipe group, attempting to reconstruct laboratory work from textual evidence.[41] In the process of recreating and testing processes described in alchemical texts, experimentation becomes "a new kind of philological tool, in the form of his own experimental practice."[42]

40. cf. Nummedal 2011
41. On the *Processus Universalis* see for example: Gelius 1996; Priesner 2019.
42. Rampling 2020, 98

In this section, there are two contributions on the *Processus Universalis* discussion which was ignited by the writings of Michael Sendivogius (1566–1636) in his *Lumen Chymicum Novum* (1604). Because the original text fragment was quite vague, it became the subject of a plethora of experimental efforts between 1600–1750. The contribution 'Andreas Orthelius und der *Processus Universalis*' (*Andreas Orthelius and the Processus Universalis*) by Thomas Moenius, Alexander Kraft and Gerhard Görmar deals with the commentary on the *Processus Universalis* by Andres Örtel, known in the latinized from as Andreas Orthelius (1583–?), who substantially developed the process instructions. Rainer Werthmann and Christian-Heinrich Wunderlich's contribution 'Eine Rekonstruktion alchemischer Laborprozesse am Beispiel der *Processus Universalis* Rezeptgruppe' (*A Historical Experiment Recreating Alchemical Processes of the* Processus Universalis *Recipe Group*) summarizes first results of experiments done with the aim of testing in how far the *Processus Universalis* process instructions can be translated into modern chemical experiment. In doing so, it highlights the differences in conceptual thinking integral to chymical laboratory work versus that of modern chemists today, such as the focus on the genesis of materials rather than their elemental composition which would have been impossible for early modern chymists to verify in detail.

Finally, the contribution by Michael Fröstl, Stefan Zathammer and Sarah Lang 'Zur Transkription von *Alchemica* mithilfe der Transkribus-Software. Zu Handschriften, Drucken und dem Noscemus GM 6 Modell' (*Transcribing Alchemical Texts Using the Transkribus Software. On Manuscripts, Printed Works and the Noscemus GM 6 Transcription Model*) presents the Transkribus software as a useful tool for the further textual investigation of alchemical literature. It allows users to generate automated transcriptions from digital facsimiles. The Innsbruck NOSCEMUS project has provided a model which can be re-used for this purpose, as well as machine-transcribed 82 texts relating to alchemy and chymistry.

Conclusion

This edited collection, which delves into the multifaceted world of alchemical laboratories, texts, practices, and material relics, explores both well-trodden and less-researched domains relating to alchemical laboratories. Unsurprisingly, emphasis is placed on alchemy in Austria. However, less obvious is the fact that this volume probably contains the most substantial exploration of numismatics in the context of the alchemical tradition to this day – beyond the explicit focus on numismatics in the contributions by Klecker and Fiska, the articles by Soukup and Gannon also discuss alchemical coins and transmutation medals. The history of alchemy seen from a perspective of numismatics had only received little attention so far. However,

in this same section, another topic is prevalent: alchemical patronage and show experiments. Later sections reflect the recent focus on the archaeology of alchemy[43], which has been thoroughly established and is part of the experimental history of science that has become one of the standard approaches to the historiography of alchemy nowadays. When our conference was first devised, many of these topics had been treated only in side notes. Today, this book is part of a vibrant tradition with many exciting publications having appeared recently or about to be published in the near future.[44]

'Alchemical Laboratories. Practices, texts, material relics' integrates material culture with textual artifacts, and it even hints at the possibility of digital documentation, a field likely to grow in the future. *The Chymistry of Isaac Newton*[45] and the *Making and Knowing*[46] projects, pioneers in shaping the historiographical trend of using 'making' as a research tool for analyzing historical recipes and alchemical texts, have used digital scholarly editing to publish their results, and thus, significantly contributed to popularizing experimental methods in recipe research. While initial digital edition projects exist – such as the aforementioned *Chymistry of Isaac Newton*, the *Making and Knowing* project and, more recently, an alchemy web portal by Herzog August Bibliothek Wolfenbüttel[47] as well as *Furnace and Fugue*[48], these are still not a standard practice in alchemy research.[49] Digital methods in the Experimental History of Science have confronted issues such as creating 3D models of historical laboratory equipment[50] and videographic or photographic documentation of experimental reconstructions.[51] First instances of applying even Computational Humanities methods include a Distant Reading approach to Ms. Fr. 640, the book at the base of *Making and Knowing*[52], assessing authorship through stylometry[53], and using computer vision for detecting chymical apparatus.[54]

This book presents significant new contributions on alchemical laboratories, that is, the buildings, the places, but also the individuals working in them and the everyday

43. Soukup, von Osten and Mayer 1993; Martinón-Torres, Rehren and von Osten 2003; Martinón-Torres 2012; Veronesi and Martinón-Torres 2022
44. For example Purš and Karpenko 2023. The recent handbook *A Cultural History of Chemistry* (4 vols.) contains articles on "Laboratories and Technology" for each of the respective periods covered: Aufrère et al. 2022; Beretta 2022; Bilak 2022; Thomas and Moureau 2022.
45. Newman 2009
46. Smith et al. 2020
47. Feuerstein-Herz and Frietsch 2017; see also Hegel and Krewet 2022; Moran 2022
48. Nummedal and Bilak 2020; Lang 2023
49. Martinón-Torres 2011, 233; Lang 2021a
50. Hendriksen/Verwaal 2020
51. *Making and Knowing* project, Smith et al. 2020
52. Godbarge 2020
53. Lang 2021b
54. Lang, Liebl and Burghardt 2023

practices that shaped these spaces. Thereby, it is also part of the trend that focuses on everyday knowledge-making and experimental knowledge production outside of academia.[55] In the case of chymical knowledge-making, the marketplace of entrepreneurial alchemy has much left for us to learn.[56] Recipe research has foregrounded the practical knowledge of artisans and craftspeople.[57] The turn to experimental approaches has reframed the study of historical crafts practices from being a marginal or even esoteric area of history to a focal point for understanding the roots of modern science and the intricate relationships between written texts and embodied practice. 'Books of secrets' represent a genre relevant to early modern laboratory work that remains to be studied in more detail, as they contain simple household recipes alongside chymical experiments and process instructions.[58] Another future direction may lie in investigating technical treatises or the recipes from 'books of secrets' that, thus far, both remain understudied treasure troves for the history of technology, shedding light on the apparatus of alchemical laboratories and the ingredients needed for chymical processes. Chemical replication, as it has been exemplified in the contribution by Werthmann and Wunderlich in this book, will continue to inform us about the knowledge-making of early modern practitioners, integrating material culture with textual artifacts, as seen in the articles by Piorko and Gannon. The recent surge in interest in early modern mining will surely contribute yet again to turning our focus towards alchemical laboratories, instruments and ingredients, highlighting the contributions of everyday knowledge-making in domestic and entrepreneurial contexts.[59]

55. Leong 2018; Werrett 2019
56. Nummedal 2007
57. Nummedal 2011; Neven 2014, 2016; Dupré 2017; Valleriani 2017; Hagendijk 2018; Smith et al. 2020
58. Eamon 1994; Smith 2016; Zweifel 2021
59. Dym 2008; Asmussen and Long 2019; Bilak 2023

Sarah Lang studied Classics and History in Graz and Montpellier. She has been a Digital Humanities researcher at Centre for Information Modelling (ZIM) Graz since 2016 where she works as a PostDoc since fall 2021. In her 2021 PhD thesis in Digital Humanities she has developed a machine reasoning algorithm and semantic web-based analysis tool for alchemical *Decknamen* using the Neo-Latin corpus of early modern chymist Michael Maier (1568–1622). She has held fellowships at German Historical Institute Paris, Herzog August Bibliothek Wolfenbüttel, Leibniz Institut für europäische Geschichte Mainz, Ludwig Boltzmann Institut für Neulatein Innsbruck and the Science History Institute in Philadelphia. She was awarded the Bader Prize for the History of Science by the Austrian Academy of Sciences for her work on computational methods for the history of alchemy in 2021. Since 2023, she is a member of the board of directors of the German Digital Humanities association, *Digital Humanities im deutschsprachigen Raum* (DHd).

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