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The emperor's herbarium: The German physician Leonhard Rauwolf (1535?–96) and his botanical field studies in the Middle East

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Abstract

This paper presents the results of the new interdisciplinary research done on Leonhard Rauwolf's herbarium with plants from the Middle East, which was later owned by Emperor Rudolf II. Using various sources, it examines how the herbarium came into the imperial collections, Early Modern methods of botanical research as described by Rauwolf in his printed travelogue, and how the illustrations for the printed book were produced from the specimens in the herbarium. The appendix (available in the online version) presents the new corrected botanical identification of the c. 200 plants in the fourth volume of Rauwolf's herbarium, and a correct transcription of the Early Modern Latin and vernacular names Rauwolf collected for these plants.

Keywords

History of botany, history of medicine, ethnobotany, field studies, Leonhard Rauwolf

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Introduction

The Habsburg Emperor Rudolf II (1552–1612) was famous for his interest in occult sciences such as alchemy and astrology.[1] In Early Modern times, such "natural secrets" were considered useful for gaining power over nature. For this reason, Rudolf brought scholars to his court who, on his behalf, combined intellectual speculation with empirical experimenting. The emperor, however, also showed an interest in botany, and in 1593 he had the herbarium of the Augsburg physician Leonhard Rauwolf (1535?–96), who had collected rare species in today's Syria, Lebanon, and Iraq, added to his collections.[2]

Just as the sources of occult wisdom lay in the "Orient" in the eyes of Early Modern contemporaries, many also believed at the time that medicine originated from the Egyptians or Chaldeans.[3] Reliance on such speculation was almost self-evident when reflecting on the sources of knowledge available, because Early Modern times knew no specific methods for producing empirical or experimental observations of nature. New and practicable techniques, also used by scientists and physicians, were more likely adapted from craft contexts, in which professional secrecy was of the utmost importance.[4]

The following essay will examine another aspect in the early history of empirical research: the plant world of the Middle East. The Augsburg physician Leonhard Rauwolf has become known in the history of literature because of his detailed report about his journey through Syria, Mesopotamia, Lebanon, and Palestine between 1573 and 1576.[5] His botanical descriptions were based on observations he made there in the markets,

1. See Robert J. W. Evans, *Rudolf II and His World: A Study in Intellectual History, 1576–1612* (Oxford: Oxford University Press, 1973); Peter H. Marshall, *The Mercurial Emperor: The Magic Circle of Rudolf II in Renaissance Prague* (London: Pimlico, 2007); Ivo Purš and Vladimír Karpenko (eds.), *Alchemy and Rudolf II: Exploring the Secrets of Nature in Central Europe in the 16th and 17th centuries* (Prague: Artefactum, 2016).
2. On Rudolf's collection of naturalia, see especially Florike Egmond, *Eye for Detail: Images of Plants and Animals in Art and Science, 1500–1630* (London: Reaktion Books, 2017), pp.22–5 and passim; Eliška Fučíková, "The Collection of Rudolf II at Prague: Cabinet of Curiosities or Scientific Museum?" in Oliver Impey and Arthur MacGregor (eds.), *Origins of Museums: The Cabinet of Curiosities in Sixteenth and Seventeenth Century Europe* (London: British Museum, 2000), pp.47–53.
3. See Johann Lange, *Secunda medicinalium epistolarum miscellanea* (Basel: Johannes Oporinus and Nikolaus Brylinger, 1560), pp.4–24, 187–92, 196–9.
4. Cf. S[tephan] R. Epstein and Maarten Prak (eds.), *Guilds, Innovation, and the European Economy, 1400–1800* (Cambridge: Cambridge University Press, 2008); Pamela O. Long, *Artisan/Practitioners and the Rise of the New Sciences, 1400–1600* (Corvallis: Oregon State University Press, 2011); Lissa Roberts, Simon Schaffer, and Peter Dear (eds.), *The Mindful Hand: Inquiry and Invention from the Late Renaissance to Early Industrialisation* (Amsterdam: Koninklijke Nederlandse Akademie van Wetenschappen, 2007) (History of Science and Scholarship in the Netherlands, vol. 9).
5. On Rauwolf's biography see Karl H. Dannenfeldt, *Leonhard Rauwolf: Sixteenth-Century Physician, Botanist, and Traveller* (Cambridge: Harvard University Press, 1968); Karl H. Dannenfeldt, "Rauwolf, Leonhard," in Charles Coulston Gillispie (ed.), *Dictionary of Scientific Biography*, vol. 11 (New York: Scribner, 1975), pp.311–12; Mark Häberlein,

gardens, and farms, and above all on botanical field studies. It later became part of the story of this doctor, his botanical research, and his herbarium with rare exotic species that the latter was acquired for the collections of Emperor Rudolf in Prague.[6]

The contact between the Augsburg physician and the head of the Holy Roman Empire actually dates back even further. Archive documents show that Rauwolf applied to Emperor Rudolf for a printing privilege as early as 1582 or 1583, since the first edition[7] of his book was published without such a privilege and was soon reprinted in Frankfurt am Main without the author's consent. Rauwolf therefore tried to protect himself from such an abuse. The printing privilege requested from the emperor was granted for the next six years, during which the travel report could no longer be reprinted and sold without Rauwolf's consent. The title page of the second official print, published by Rauwolf himself in 1583, refers to the corresponding imperial privilege.[8] In the present context, however, it is of particular interest that Rauwolf's original petition was noted as an administrative order by chancellor Stieheuser: "All right, but the author shall send a copy of his book to the Chancellery."[9] This note proves that Rauwolf's printed travelogue

"Rauwolff, Leonhard," in: *Neue Deutsche Biographie* vol. 21 (Berlin: Duncker & Humblot, 2003), pp.217–18; Dietmar Henze, "Leonhart Rauwolff," in Leonhart Rauwolff, *Aigentliche Beschreibung der Raiss inn die Morgenländer* (Graz: Akademische Verlagsanstalt, 1971) (Frühe Reisen und Seefahrten in Originalberichten, vol. 9), pp.I–XXIII; Simone Herde and Tilmann Walter, "Neues zur Biographie des Augsburger Arztes und Orientreisenden Leonhard Rauwolf (1535?–1596)," *Sudhoffs Archiv* 94 (2010): 129–56; Fritz Junginger, *Leonhard Rauwolf. Ein schwäbischer Arzt, Botaniker und Entdeckungsreisender des 16. Jahrhunderts* (Schwäbische Lebensläufe) (Heidenheim a.d. Brenz: Heidenheimer Verlagsanstalt, 1969). On his travel report see J. Seide, "Doctors and Naturalists as Pilgrims and Travellers to the Holy Land, *Janus* 48 (1959): 53–61; Vaira Tempel, *Medizin und Pharmazie in Leonhard Rauwolffs "Aigentliche beschreibung der Raiß. . ." Lauingen 1583*, MD thesis Düsseldorf 1966; Romy Günthart, "Ein Botaniker im Heiligen Land: Leonhard Rauwolffs 'Aigentliche beschreibung der Raiß inn die Morgenländer'," *Nova Acta Paracelsica* N.F. 15 (2001): 25–40; Mark Häberlein, "A Sixteenth-Century German Traveller's Perspective on Discrimination and Tolerance in the Ottoman Empire," in: Guðmundur Hálfdanarson (ed.), *Discrimination and Tolerance in Historical Perspective* (Pisa: Edizioni Plus – Pisa University Press, 2008), pp.119–24; Tilmann Walter, "Eine Reise ins (Un-)Bekannte. Grenzräume des Wissens bei Leonhard Rauwolf (1535?–1596)," *N.T.M.* 17 (2009): 359–85.

6. Österreichisches Staatsarchiv, Finanz- und Hofkammerarchiv Wien, Geschäftsbücher, vol. 469, fol. 242r: (*Ausgangsprotokoll der Prager Hofkammer*, August 9, 1593): "Der vizdomb zue Linz solle Doctor Johann [!] Rauchwolffen umb die durch herrn Reichardten Strein umb 310 taller von ime erkauften vier Kreutterbuecher auf jezigem Linzer Bartholomei markt gewißlichen bezallen." See Lydia Gröbl and Herbert Haupt, "Kaiser Rudolf II. Kunst, Kultur und Wissenschaft im Spiegel der Hoffinanz. Teil I: die Jahre 1576 bis 1595," *Jahrbuch des Kunsthistorischen Museums Wien* 8/9 (2008/2009): 205–353, 306–7, No. 1184. We thank Stefan Guzy (Berlin) for pointing us to this evidence.
7. Leonhard Rauwolf, *Aigentliche Beschreibung der Raiss inn die Morgenländer* (Lauingen: Leonhard Reinmichel, 1582).
8. Leonhard Rauwolf, *Aigentliche Beschreibung der Raiss inn die Morgenländer* (Leonhard Reinmichel (printer) / Georg Willers (publisher), 1583).
9. "Fiat, doch gegen Überschickung der exemplarien zur canzley." Österreichisches Staatsarchiv, Haus-, Hof- und Staatsarchiv Wien, RHH, Impressoria, Karton 58, Konv. 1,

caught the interest of the emperor's entourage and was later available at the imperial court. To the second edition of 1583, a fourth part (or chapter) with botanical illustrations was added. Shortly afterwards, in 1584, due to financial difficulties, Rauwolf began looking for a prince or another wealthy buyer for his herbarium. To the botanist Carolus Clusius (1526–1609), from whom he hoped to make such contact, he described the object of purchase as follows: "I carefully glued the plants on paper so that the observer could see them well. In the volume there are also very rare species, which I myself brought from the Orient."[10] Moreover, the herbarium was provided with a solid, primordially red leather cover and an elaborately and colorfully illustrated frontispiece (Figure 1).[11]

Rauwolf's herbarium was only successfully sold when it was purchased by the imperial commissioner Reichardt Strein von Schwarzenau (1538–1600) for the emperor's collections. It can be assumed that the price demanded by Rauwolf was just too high for possible other interested parties, because in August 1593 the imperial servant Hans Popp reported that the formerly agreed 310 Reichstaler for the herbarium still had to be paid to Rauwolf by the imperial chamber.[12] At the emperor's court, as already discussed, the second edition of the travelogue, with the plant pictures printed in the fourth part, was already available. Rauwolf's herbarium was a very valuable acquisition for the imperial collections and would complement his printed work, because Emperor Rudolf was now also in possession of the unique originals collected in the Middle East.

According to Christian Callmer, in 1620 the herbarium was stolen and, in the midst of the turmoil of the Thirty Years' War, brought as spoils of war to the Munich art chamber

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fols. 91–2: Petition of Leonhard Rauwolf to Emperor Rudolf II [1582 or 1583]; German paraphrase: <www.aerztebriefe.de/id/00044633> (accessed January 16, 2020). See Hans-Joachim Koppitz (ed.), *Die kaiserlichen Druckprivilegien im Haus-, Hof- und Staatsarchiv Wien. Verzeichnis der Akten vom Anfang des 16. Jahrhunderts bis zum Ende des Deutschen Reichs (1806)* (Buchwissenschaftliche Beiträge aus dem Deutschen Bucharchiv München, vol. 75) (Wiesbaden: Harrosowitz, 2008), p.434.

10. University Library [afterwards: UL] Leiden, VUL 101 / Rauwolf, L_001: letter from Leonhard Rauwolf to Carolus Clusius, September 7, 1584, edition: Herde and Walter, "Neues zur Biographie des Augsburger Arztes," 150–1 (note 5); German paraphrase: <www.aerztebriefe.de/id/00002742> (accessed January 16, 2020).
11. Cf. Rotraud Bauer and Herbert Haupt (eds.), *Das Kunstkammerinventar Kaiser Rudolfs II., 1607–1611* (Jahrbuch der kunsthistorischen Sammlungen in Wien, vol. 72) (Wien: Schroll, 1976), pp.133–4, No. 2667–9; for more detailed descriptions of the herbarium see Christian Callmer, "Queen Christina's Herbaria," in Folke Sandgren (ed.), *Otium et negotium. Studies in Onomatology and Library Science Presented to Olof von Feilitzen* (Acta Bibliothecae Regiae Stockholmensis, vol. XVI) (Stockholm: Norstedt, 1973), pp.32–7, 33–4; K[urt] Ganzinger, "Rauwolf und Fuchs. Ein Beitrag zur Geschichte der Botanik im 16. Jahrhundert," *Veröffentlichungen der Internationalen Gesellschaft für Geschichte der Pharmazie* N.F. 22 (1963): 23–42, 25–6; Ludovic Legré, *La Botanique en Provence au XVIe siècle: Léonard Rauwolff et Jacques Raynaudet* (Marseille: Aubertin & Rolle, 1900), pp.9–55, 68–97.
12. Österreichisches Staatsarchiv, Finanz- und Hofkammerarchiv Wien, Indizes und Protokollbücher des Bestandes Hoffinanz 1531–1762, vol. 467, fol. 161v (*Einlaufprotokoll der Hofkammer*, August 1593): "Hans Poppen Erinderung Umb Verordnung der bezallung 310. Taller. füer die durch herrn Reichardten Strein erkhauffte Püecher von Doctor Rauwolff füer Ier Mt. ligt da ex."

Figure 1. The richly illustrated frontispiece of Rauwolf's herbarium, on the left and right side depicting a man (probably Rauwolf) collecting and another studying plants. At the top and the bottom of the page there are scenes from the New Testament: Jesus in the Garden of Gethsemane, Jesus approaches Jerusalem riding a donkey.
Photo: Naturalis Biodiversity Center, Leiden.

of Duke Maximilian of Bavaria (1573–1651) – though this remains doubtful.[13] It later fell into the hands of the troops of the Swedish King Gustav Adolf II (1594–1632) and thus came into the possession of his daughter Queen Christina of Sweden (1626–89). Afterwards, it was brought to London by Isaac Vossius (1618–89) and finally transferred to his hometown of Leiden after his death, where it was bought by the Leiden University Library (this time the price was 32,000 guilders). Today it is kept in the botanical collection of the Naturalis Biodiversity Center in Leiden.

In Leiden, the fourth volume of Rauwolf's herbarium was examined by Jan Frederik Gronovius (1686–1762), who published a botanical identification of the included plants in his *Flora Orientalis* of 1755.[14] Recently, however, Ghorbani and others studied the

13. Cf. Callmer, "Queen Christina's Herbaria," p.35 (note 11). Dannenfeldt, *Leonhard Rauwolf*, pp.229–30 (note 5) suggests, according to Hans Ulrich Krafft's travel report, that Rauwolf himself initially sold the herbarium to the Munich art chamber for 200 guilders; however, this is not true.
14. Johannes Fredericus Gronovius, *Flora Orientalis sive Recensio Plantarum, quas Botanicorum Coryphaeus Leonhardus Rauwolffus, Medicus Augustanus, Annis 1573, 1574, & 1575 in Syria, Arabia, Mesopotamia, Babylonia, Assyria, Armenia, & Judaea crescentes observavit, & collegit [. . .]* (Leiden: de Groot, 1755).

volume again, identified all the specimens, and also transcribed and translated the handwritten text describing each specimen in the herbarium.[15]

(Ethno-)Botany in the sixteenth century

Approaches to the botany of the so-called Orient, which was mainly pursued from a pharmacological point of view, already existed in Rauwolf's time, as Garcia d'Orta (c. 1501–68) had published a book about drugs from India.[16] In his travelogue, Rauwolf quoted Carolus Clusius's Latin translation of Garcia d'Orta's work as *Epitome of Indian herbs*.[17] He himself was to add forty previously unknown species to the botanical treasure.

The empirical orientation within sixteenth-century medicine was also strong early on in the realm of botany. The typical *Kräuterbücher*, or herbal books, which were mainly published by doctors in German-speaking countries from the first half of the sixteenth century onwards, in many aspects were based on popular knowledge. Early modern botanists such as the humanist physician Euricius Cordus (1486–1535) reformed the study of plants in a particular way: just as Martin Luther had improved and modernized Christiian theology, experts such as his colleagues Niccolò Leoniceno (1428–1524), Marcello Vergilio (1464–1521), Ermolao Barbaro (1454–93), Wilhelm Kopp (d. 1532), Thomas Linacre (1460–1524), Johann Winter von Andernach (d. 1574), and Leonhard Fuchs (1501–66) struggled to free medicine from its medieval "Spytal of Darkness."[18] Cordus described more thoroughly in his *Botanologicon* of 1534 how contemporary botanists used to do research in the field: during their excursions they carried the editions of the antique texts with them in order to identify as far as possible the species found on site. Then, in order to learn more about the various healing properties of the plants, locals (preferably old women) were interviewed by them.[19]

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15. Abdolbaset Ghorbani et al., "The Typification of Two Linnaean Plant Names Based on Illustrations Published by Leonhard Rauwolf in 1583," *Taxon* 66 (2017): 1204; Abdolbaset Ghorbani et al., "Botanical and Floristic Composition of the Historical Herbarium of Leonhard Rauwolf Collected in the Near East (1573–1575)," *Taxon* 67 (2018): 565–80.
16. Garcia d'Orta, *Coloquios dos simples, e drogas he cousas mediçinais da India* (Goa: Ioannes de endem, 1563).
17. Garcia d'Orta, *Aromatum et simplicium aliquot medicamentorum apud Indos nascentium historia* (Antwerp: Christoph Plantin, 1567); cf. Rauwolf, *Aigentliche Beschreibung*, p.94 (note 8).
18. Euricius Cordus, *Von der vielfaltigen tugent vnnd waren bereitung/ Deß rechten edlen Theriacs [. . .] Ein nutzlich buchlin* (Marburg: Franz Rhode, 1532), fol. Aii r.
19. Cf. Euricius Cordus, *Botanologicon* (Köln: Johannes Gymnicus, 1534); see Alix Cooper, *Inventing the Indigenous: Local Knowledge and Natural History in Early Modern Europe* (Cambridge: Cambridge University Press, 2007); Paula Findlen, *Possessing Nature. Museums, Collecting and Scientific Culture in Early Modern Italy* (Berkeley, Los Angeles, and London: University of California Press, 1994), pp.158–63; Florike Egmond, "Into the Wild: Botanical Fieldwork in the Sixteenth Century," in Arthur MacGregor (ed.), *Naturalists in the Field: Collecting, Recording and Preserving the Natural World from the Fifteenth to the Twenty-First Century* (Leiden; Boston: Brill, 2018), pp.166–211; Brian W. Ogilvie, *The Science of Describing: Natural History in Renaissance Europe* (Chicago; London: University of Chicago Press, 2006), pp.141–5.

The contradictions between the literary knowledge of antiquity and their own empirical observations could no longer be overlooked by the humanist experts. These contradictions could be explained by various factual problems: above all, as Leonhard Rauwolf later explained, the ancient authors had dealt with foreign habitats.[20] Their botanical terminology had also never been standardized, empirical descriptions of plants had never been systematically formulated, and other species were often simply referred to as "known." In addition, illustrations were either completely absent in the texts, unsuitable, or rendered useless by the handwritten tradition over the centuries.

As a result, many of the plants described in ancient texts were no longer identifiable, while others seemed to have a problematic fit with the usual classifications. Even the new editions of the classical texts, refined using humanistic methods, did not bring any decisive progress. Thus, semantic gaps arose that caused scientists and doctors interested in botany to explore nature itself. As far as specialists in Central European flora in and its pharmaceutical effects went, as Cordus noted, there were local healers available.

Accordingly, it was not just a medical outsider like Paracelsus (1493–1541), but also more "serious" experts, who methodically made use of the knowledge of medical laymen:[21] natural secrets (or *arcana* or *mysteria*, as they were also known) at the time could be appropriated and communicated, or more simply: bought and sold.[22] They were also, very successfully, spread by print. For instance, the Italian physician Giovan Battista della Porta (1535–1615), in his *Magia naturalis sive miraculis rerum naturalium* (Naples, 1558), expounded folk recipes for coloring hair, lightening facial skin, preventing dogs from barking, and so on.[23] Until the end of the eighteenth century, such books provided further dissemination of knowledge about such useful secrets of nature.[24]

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20. Cf. Rauwolf, *Aigentliche Beschreibung*, pp.1–2 (note 8); see Karen Meier Reeds, *Botany in Medieval and Renaissance Universities* (New York; London: Garland Publishing, 1991), pp.14–23.
21. Cf. Kurt Goldammer, *Der göttliche Magier und die Magierin Natur. Religion, Naturmagie und die Anfänge der Naturwissenschaft vom Spätmittelalter bis zur Renaissance mit Beiträgen zum Magie-Verständnis des Paracelsus* (Stuttgart: Franz Steiner, 1991); Manuel Kamenzin, "*Denn wer wolt sich wider ein solchen ehrlichen hauffen der Hohen Schulen legen?* Paracelsus und die Universitäten," in Benjamin Müsegades and Ingo Runde (eds.), *Universitäten und ihr Umfeld. Südwesten und Reich in Mittelalter und Früher Neuzeit* (Heidelberger Schriften zur Universitätsgeschichte, vol. 7) (Heidelberg: Winter, 2019), pp.139–61; Charles Webster, *Paracelsus: Medicine, Magic, and Mission at the End of Time* (New Haven; London: Yale University Press, 2008).
22. See Pamela Smith, *The Business of Alchemy: Science and Culture in the Holy Roman Empire* (Princeton: Princeton University Press, 1997); Daniel Jütte, *Das Zeitalter des Geheimnisses. Juden, Christen und die Ökonomie des Geheimen (1400–1800)*, 2nd ed. (Göttingen: Vandenhoeck & Ruprecht, 2012).
23. Giovan Battista della Porta, *Magiae naturalis sive de miraculis rerum naturalium libri IIII* (Antwerp: Christoph Plantin, 1561); Laura Balbiani, *La Magia Naturalis di Giovan Battista Della Porta. Lingua*, cultura *e scienza in Europa all' inizio dell' età moderna* (Bern et al.: Peter Lang, 1999).
24. Cf. William C. Eamon, *Science and the Secrets of Nature: Books of Secrets in the Medieval and Early Modern Culture* (Princeton: Princeton University Press, 1994).

Another aspect was that more and more new medicinal plants came from outside Europe, and some of them, for example Guaiac, China root, Mexican root, and tobacco, were believed to have wonderful effects on their consumers.[25] It also applies, as will be shown in detail later in this article, to the botanical research of Leonhard Rauwolf, who was both curious and accurate in his observations of new botanical objects. Thus, as a protégé and friend of certain Augsburg merchants,[26] he collected all kinds of plant specimens at the bazaars of Tripoli, Aleppo, and Baghdad, and had a keen eye on the market for plants and plant products at the western end of the Silk Road (see Figure 2). At the bazaar in Tripoli, for instance, Rauwolf bought a single leaf of a *Phrynium* species he had never seen before (see online appendix, specimen 68), which was used for wrapping Styrax resin, as he explained in the text next to the specimen.[27] It must have originally been collected in Southeast Asia (probably Indonesia) and was traded via the Eastern Mediterranean to the Levant.

In the field, Rauwolf collected certain plants for the fourth volume of his herbarium, but in his travel report he mentioned many more than the 200 species he brought home with him.[28] (Of the 200 specimens in the herbarium, belonging to 183 species, 150 genera, and 64 families, 191 are still preserved today.) There could be several explanations for this: for example, many plants may have seemed so familiar to him that he did not make an effort to collect them; others he might have collected but did not manage to bring them back to Germany.

In Aleppo, Rauwolf not only saw that white lilies and ornamental plants were available for flower arrangements at the bazaar, but also observed tulips, hyacinths, and daffodils in the gardens of the city.[29] The gardens he visited in Marseille, Crete, Syria, Iraq, and Palestine not only demonstrated to him a variety of flowers, but also the aesthetic and symbolic value that was attributed to plants in different cultures.

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25. Cf. Harold J. Cook, *Matters of Exchange: Commerce, Medicine, and Science in the Dutch Golden Age* (New Haven: Yale University Press, 2007); Marianne Klemun, "Globaler Pflanzentransfer und seine Transferinstanzen als Kultur-, Wissens- und Wissenschaftstransfer der frühen Neuzeit," *Berichte zur Wissenschaftsgeschichte* 29 (2006): 205–23; Annerose Menninger, *Genuss im kulturellen Wandel. Tabak*, *Kaffee, Tee und Schokolade in Europa (16.–19. Jahrhundert)* (Beiträge zur Wirtschafts- und Sozialgeschichte, vol. 102), 2nd ed. (Stuttgart: Franz Steiner, 2008); Staffan Müller-Wille, *Botanik und weltweiter Handel. Zur Begründung eines Natürlichen Systems durch Carl von Linné (1707–78)* (Studien zur Theorie der Biologie, vol. 3) (Berlin: VWB, 1999); Londa Schiebinger, *Plants and Empire: Colonial Biospecting in the Atlantic World* (Cambridge and London: Harvard University Press, 2004); Londa Schiebinger and Claudia Swan (eds.), *Colonial Botany: Science, Commerce, and Politics in the Early Modern World* (Philadelphia: University of Pennsylvania Press, 2007).
26. Cf. Mark Häberlein, "Botanisches Wissen, ökonomischer Nutzen und sozialer Aufstieg im 16. Jahrhundert. Der Augsburger Arzt und Orientreisende Leonhard Rauwolf," in Gernot Michael Müller (ed.), *Humanismus und Renaissance in Augsburg. Kulturgeschichte einer Stadt zwischen Spätmittelalter und Dreißigjährigem Krieg* (Frühe Neuzeit, vol. 144) (Berlin and New York: De Gruyter, 2010), pp.101–16.
27. Ghorbani et al., "Botanical and Floristic Composition," 575 (note 15).
28. Ibid., 565.
29. Cf. Rauwolf, *Aigentliche Beschreibung*, pp.124–5 (note 8).

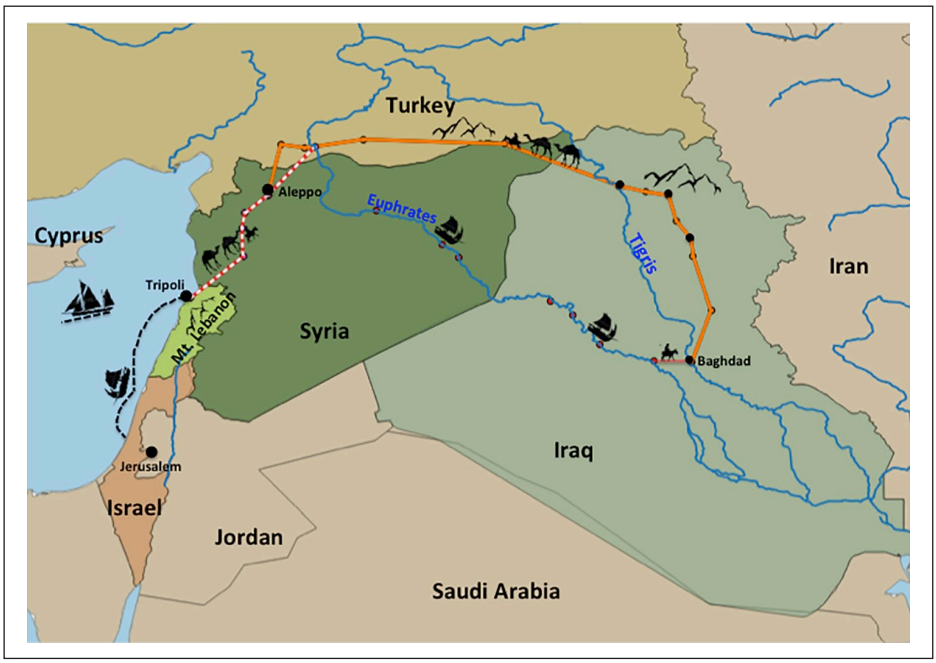

Figure 2. Rauwolf's travel route. The Augsburg physician reached the port of Tripoli on September 30, 1573, and left the city for Aleppo on November 9, 1573. In August 1574, he traveled by ship along the Euphrates to Baghdad, where he arrived at the end of October. In December 1574, he returned to Syria via Kurdistan. In September 1575, he visited Jerusalem as a pilgrim. Returning to Augsburg via the Mediterranean, he arrived there on February 12, 1576. (Modern boundaries are drawn in for easier understanding.)

On many occasions, Rauwolf botanized in the field and sought the advice of regional experts, for, as he once remarked, he would otherwise have overlooked many interesting species.[30] In the following section, various aspects of his botanical research will be examined in more detail, including the practice of botanizing in the field, the economic aspects of doing research on exotic plants, the symbolic dimension of nature and horticulture in Renaissance times, and the plant illustrations in Rauwolf's travelogue.

Searching, collecting, drying, naming

Leonhard Rauwolf followed the classical method of "go[ing] after herbs," as described by Euricius Cordus.[31] Earlier, in 1555, the famous Zurich naturalist Conrad Gessner (1516–65) had also reported in some detail how he, at irregular intervals, made trips to the Swiss Alps in order to refresh his mind and body. Obviously, Gessner's excursions into the Alps were about botanical, medical, and pharmacological issues and their

30. Cf. ibid., p.287.
31. Cf. ibid., pp.62, 268, 287–8.

documentation, since in his company on one occasion were the surgeon Peter Figulus, the pharmacist Petrus Boutinus, and a painter named Johannes Thoma.[32] Together with these "excellent young men," Gessner, under the guidance of a local, Nicolaus von Meggen, climbed the nearby Mont Pilat. It was no coincidence that Gessner took an artist on his excursion: how he systematically sought and managed to expand his stock of realistic nature images has been the subject of recent research.[33]

However, the biggest problem for learned botanists was the identification of rare plants only described within literature, and here only common folk herbalists or *rhizothomi* could help. Even as famous a botanist as Carolus Clusius, Rauwolf's most important literary informant and his correspondent, made, according to his own statement, use of old women (*mulierculae*) and root cutters (*Wurzelschneider* or *Kräutler*) in herbarization.[34] On a first attempt researching without guidance by such a local expert or "erfahrnen der Kreüter," Rauwolf additionally reports that he had to repeat a certain excursion because he had overlooked too many relevant things.[35]

Rauwolf repeatedly emphasized a botanical interest that he had held since youth as the main motive of his journey.[36] However, working as a botanist abroad was not without toil and danger. Once, a mounted and armed Ottoman attacked the researcher in order to get his money, and Rauwolf was, unlike other occasions, unarmed during this episode.[37] An equally big disadvantage was the lack of proper gardening tools: without a suitable instrument (like a spade or a planting trowel), on one occasion Rauwolf had no choice but to tear the plant out, risking damaging it.[38] Rauwolf also mentions a writing board that he took with him to record his many notes and impressions during his journey, which became the basis for his 480-page travelogue.[39] Since four (or more) eyes always see

32. Cf. Conrad Gessner, *De raris et admirandis herbis, quae sive quod noctu luceant, sive alias ob causas, lunariae nominantur, commentariolus: & obiter de aliis etiam rebus quae in tenebris lucent [. . .]* (Zürich: Andreas & Jakob Geßner, 1555), p.44; see Simona Boscani Leoni, "Conrad Gessner and a Newly Discovered Enthusiasm for Mountains in the Renaissance," in Urs B. Leu and Peter Opitz (eds.), *Conrad Gessner (1516–1565). Die Renaissance der Wissenschaften / The Renaissance of Learning* (Berlin and Boston: De Gruyter Oldenbourg, 2019), pp.119–28.
33. Cf. Florike Egmond and Sachiko Kusukawa, "Circulation of Images and Graphic Practices in Renaissance Natural History: The Example of Conrad Gessner," *Gesnerus* 73 (2016): 29–72.
34. Cf. UL Erlangen, Trew, Clusius No. 33: letter to Joachim Camerarius II, August 14, 1576.
35. Rauwolf, *Aigentliche Beschreibung*, p.287 (note 8); on the role of local informants in natural history and the natural sciences, see Findlen, *Possessing Nature*, pp.170–9 (note 19); David M. Gordon and Shepard Krech III (eds.), *Indigenous Knowledge and the Environment in Africa and North America* (Athens; Ohio: Ohio University Press, 2012); Volker Matthies, *Im Schatten der Entdecker. Indigene Begleiter europäischer Forschungsreisender* (Berlin: Ch. Links, 2018).
36. Cf. Rauwolf, *Aigentliche Beschreibung*, pp.1–2, 111 (note 8).
37. Cf. ibid., p.122; see also Häberlein, "Botanisches Wissen," pp.111–15 (note 26).
38. Rauwolf, *Aigentliche Beschreibung*, p.122 (note 8). A spade appears on the frontispiece of the herbarium: see Figure 1.
39. For "Note-taking as Information Management," see chapter 2 in: Ann M. Blair, *Too Much to Know: Managing Scholarly Information before the Modern Age* (New Haven; London: Yale University Press, 2010), pp.62–116.

better than two, Rauwolf was accompanied on his excursions by his best friend Hans Ulrich Krafft (1550–1621) or other travel mates.[40] Accordingly, Krafft often refers in his handwritten travel diary to Rauwolf's printed report to spare himself more detailed information about specific locations or events. Since Rauwolf himself did not speak Arabic, Krafft found a Dutch travel companion for him who had at least some knowledge of the local language.[41]

Much has been published in recent years about early modern herbaria.[42] Unfortunately, in his travelogue Rauwolf does not mention more about the production of his herbarium than the fact that he carried sheets of paper with him to dry the collected plants in, which he later glued onto other paper.[43] Perhaps he assumed that these techniques were already known to botanically interested readers.

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40. Cf. Hans Ulrich Krafft, *Reisen und Gefangenschaft Hans Ulrich Kraffts*. Aus der Originalhandschrift herausgegeben von K[onrad] D[ietrich] Haßler (Bibliothek des litterarischen Vereins in Stuttgart, vol. LXI) (Stuttgart: Litterarischer Verein, 1861), pp.13–14; Rauwolf, *Aigentliche Beschreibung*, pp.111, 121 (note 8).
41. Cf. Krafft, *Reisen und Gefangenschaft*, p.139 (note 40); see also Mark Häberlein, "Situationen des Sprachkontakts in den Berichten deutscher Orient- und Asienreisender des 16. und 17. Jahrhunderts," in Matthias Schulz (ed.), *Sprachliche Aspekte des Reisens in Mittelalter und Früher Neuzeit* (Fremdsprachen in Geschichte und Gegenwart, vol. 13) (Wiesbaden: Harrassowitz, 2014), pp.41–57, 46.
42. See for instance (with numerous older literature) Davina Benkert, "The 'Hortus Siccus' as a Focal Point: Knowledge, Environment, and Image in Felix Platter's and Caspar Bauhin's Herbaria," in Susanna Burghartz, Lucas Burkart, and Christine Götler (eds.), *Histories of Places, Processes, and Objects in Europe and Beyond, 1450–1650* (Leiden and Boston: Brill, 2016), pp.211–39; Maria M. Carrión, "Planted Knowledge: Art, Science, and Preservation in the Sixteenth-Century Herbarium from the Hurtado de Mendoza Collection in El Escorial," *Journal of Early Modern Studies* 6 (2017): 47–67; Alexandra Cook, "The Herbarium as Boundary Object," in *Jean-Jacques Rousseau and Botany: The Salutary Science* (Oxford: Voltaire Foundation, 2012), pp.253–95; Alix Cooper, "Placing Plants on Paper: Lists, Herbaria, and Tables as Experiments with Territorial Inventory at the Mid-Seventeenth-Century Gotha court," *History of Science* 56 (2018): 257–77, 266–9; R[osanna] M[aria] S[tefania] Costa et al., "The Pre-Linnaean Herbarium of Paolo Boccone (1633–1704) Kept in Leiden (the Netherlands) and its Connections with the Imprinted One in Paris," *Plant Biosystems* 152 (2018): 489–500; Lea Dauwalder and Luc Lienhard, *Das Herbarium des Felix Platter. Die älteste wissenschaftliche Pflanzensammlung der Schweiz*, Burgerbibliothek Bern (ed.) (Bern: Haupt, 2016); Findlen, *Possessing Nature*, pp.167–70 (note 19); Alette Fleischer, "Leaves on the Loose: The Changing Nature of Archiving Plants and Botanical Knowledge," *Journal of Early Modern Studies* 6 (2017): 117–35; Ogilvie, *The Science of Describing*, pp.165–74 (note 19); S[anta Gloria] Pulvirenti et al., "Study of a Pre-Linnaean Herbarium Attributed to Francesco Cupani (1657–1710)," *Candollea* 70 (2015): 67–99; A[nastasia] Stefanaki et al., "Breaking the Silence of the 500-Year-Old Smiling Garden of Everlasting Flowers: The En Tibi Book Herbarium," *PloS One* 14 (6): e0217779, <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0217779> (January 16, 2020).
43. Rauwolf, *Aigentliche Beschreibung*, pp.9, 110, 116, 248 (note 8). According to the watermark, all the paper came from a single batch: cf. Ghorbani et al., "Botanical and Floristic Composition," 567 (note 15). About the gluing: alternatively, the samples could only be attached loosely: see Cook, "The Herbarium as Boundary Object," pp.268–70 (note 42).

The geographical conditions one had to deal with in the Middle East, on the other hand, were very unfamiliar to a Western traveler: Rauwolf found some habitats too dry (*dürr*) or barren (*schroff*) for plants by nature, while others seemed to be apparently unsuitable for cultivation (*öd und unerbauet*).[44] In some cases a region appeared uninteresting to a professional because no special plants grew there.[45] Moreover, as every botanist should be aware, the season played a decisive role in the success of an excursion. On some of his excursions, he arrived too early to see blooming flowers and shrubs; elsewhere they were already withered.[46] Even worse, Rauwolf, as a Central European, was surprised when he discovered that the early bloomers in the Middle East were already in full bloom in mid-December.[47]

The main aim of his undertakings was to describe and identify known and formerly unknown plants. If Rauwolf could not identify certain specimens using the literature known to him, he would refer in detail to their similarities to and differences from species in his homeland. For instance, Rauwolf's precise description of a certain useful Arabian plant (*Hibiscus sabdariffa* L., according to Dannenfeldt) reads in English translation as follows:[48]

> Another [useful plant], which can be seen soon after sowing because of its height, looks very similar to sesame, only that the stems are longer and thicker and the leaves are rougher and triple split at the end. (In contrast, the upper leaves of the sesame look more like that of willows in length and color.) The leaves grow separately in their own shoots from the stem. In between there are many beautiful, handsome flowers, which are yellow on the outside with red veins, but purple-brown on the inside. After flowering, the ovary (*bützlein*) forms longer cones, which are as thick and long as a finger. Outside, they are rough and pointed at the end and inside divided into five compartments, in which the seeds can be found properly arranged (very similar to the marsh-mallow or Abutilon). I asked around a lot about this plant, but no other name was given to me than *Lubie Endigi*, meaning "Indian bean." But I know this plant differently, so I think it is rather the *Trionum*, of which above all Theophrastus writes in different places. If you feel like it, take a closer look at it yourself.

However, there were also specimens that he could not identify at all. These were not documented or described by him in any way, but tacitly ignored.[49]

In his herbarium, Rauwolf used the Latin names found in the works of Rhazes, Theophrast, and especially Dioscorides as the relevant authors in pharmacy, or those used by the pharmacists of his own time. The German names (for example *Bärenklau, Mariendistel*, and *Storchschnabel*) are still familiar to garden lovers in Germany today. If the exact species (*geschlecht*) appeared to be "foreign" (*fremd*) or "alien" (*ausländisch*) to him, he added detailed information, preferably about the color of the flowers,

44. Rauwolf, *Aigentliche Beschreibung*, pp.239, 318, 348 (note 8).
45. Ibid., pp.137–8, 152–3.
46. Ibid., pp. 235–6, 258.
47. Ibid., p.213.
48. Ibid., p.193, our translation; for another translation, see Dannenfeldt, *Leonhard Rauwolf*, p.101 (note 5).
49. Rauwolf, *Aigentliche Beschreibung*, p.121 (note 8).

but also about the size and shape of the plant or its habitat. All in all, Rauwolf did all this very precisely, even by modern lexicological standards.

In addition, the Augsburg doctor collected the local plant names and put them together with those known to him from ancient literature. His herbarium therefore also includes detailed information on plant names in various old languages from the Levant.[50] Hans Ulrich Krafft reported how, for this purpose, in 1575 he brought together Rauwolf with a "fine modest Arab man" in Tripoli. This local botanist was surprised that Rauwolf, as a Westener, knew the correct "old" (that is, Graeco-Roman) names of the plants, which obviously were well known to this native expert.[51]

In Rauwolf's first three herbarium volumes, which contain plants collected in France and Italy, the famous Leonhard Fuchs appears as such an unnamed informant. In 1563, Rauwolf must have visited him in Tübingen on his way back from Italy and presented his dried plants to him. But since he did not mention the name of this prominent botanist, this only came to light in 1963, when Ganzinger noticed that some 150 supplementary entries to plant names in Rauwolf's herbarium were from Fuchs' own hand.[52]

Rauwolf's academic training in botany nevertheless must have been thorough and he was familiar with many famous botanists of his time: he himself called Guillaume Rondelet (1507–66) his academic teacher in Montpellier,[53] and visited the University of Tübingen, where he studied under Fuchs, but on the occasion of his *peregrinatio academica* he also visited Padua and Bologna, at the times when Melchior Wieland (1519–89) and Ulisse Aldrovandi (1522–1605) taught there. In Montpellier he studied at the same time as Caspar Ratzenberger (1533–1603), another German doctor who later became famous for his herbarium.[54]

On his way back from Italy, Rauwolf had Johann Bauhin (1541–1613) at his side, who had previously studied in Bologna. The two visited Conrad Gessner in Zurich in May 1563.[55] It is likely that Rauwolf would have presented his dried plants to him too, because Gessner was always very eager for new findings in the field of natural history.

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50. Cf. Ghorbani et al., "Botanical and Floristic Composition" (note 15).
51. Cf. Krafft, *Reisen und Gefangenschaft*, p.162 (note 40).
52. Cf. Ganzinger, "Rauwolf und Fuchs," 29 (note 11); Anastasia Stefanaki et al., "The Early Book Herbaria of Leonhard Rauwolf (S. France and N. Italy, 1560–1563): New Light on a Plant Collection from the 'Golden Age of Botany'," Rendiconti Lincei. Scienze Fisiche e Naturali, Preprint under: https://doi.org/10.21203/rs.3.rs-352450/v1 (accessed May 27, 2021).
53. Rauwolf, *Aigentliche Beschreibung*, p.9 (note 8).
54. Cf. Dannenfeldt, *Leonhard Rauwolf*, p.14 (note 5); Hermann Friedrich Kessler, *Das älteste und erste Herbarium Deutschlands, im Jahr 1592 von Dr. Caspar Ratzenberger angelegt, gegenwärtig noch im Königlichen Museum zu Cassel befindlich* (Kassel: August Freyschmidt, 1870); Dorothee Klein, "Caspar Ratzenbergers Vorrede im Kasseler 'Herbarium Vivum' von 1592. Transkription und ergänzende Betrachtungen," *Philippia* 17 (2018): 197–218; Gustav Zahn, "Das Herbar des Dr. Caspar Ratzenberger (1598) in der Herzoglichen Bibliothek zu Gotha," *Mitteilungen des Thüringischen Botanischen Vereins* N.F. 16 (1902): 50–121.
55. National Library of Medicine, Bethesda, MD, Ms E77, No. 176: entry by Leonhard Rauwolf in Gessner's *liber amicorum*. Underneath, Gessner noted that Rauwolf had visited him, accompanied by [Johann] Bauhin, in May 1563; see Richard J. Durling, "Conrad Gesner's 'Liber amicorum' 1555–1565," *Gesnerus* 22 (1965): 134–59, 136, 144.

In later years Rauwolf corresponded with Carolus Clusius, Johann Aicholz (1520–88), and Joachim Camerarius (1534–98), who had visited him on earlier occasions in Augsburg. Camerarius later called Rauwolf his "very special friend."[56]

The Augsburg doctor also cited a lot of literary sources on botany, many of which are mentioned in the printed travelogue only once, suggesting that he deliberately wanted to quote a broad variety of ancient, medieval, and modern authors like Averrhoes, Avicenna, Dioscorides, Matthias Lobelius, Plinius, Rasis, Guillaume Rondelet, Serapio, and Theophrastus. But there can also be observed a certain preference for current titles, especially Clusius and Rembert Dodoens (d. 1585).[57]

The economic aspect of early modern botany: commerce, products, and markets

As the brother-in-law and acquaintance of some prominent Augsburg merchants, Rauwolf showed a great interest in trading spots such as Lindau, Chur, Marseille, Milan, and Nice, which he visited en route, as well as in the goods handled there. His companion and good friend Hans Ulrich Krafft was a merchant from Ulm. Therefore, Krafft's travel report often deals with luxury goods such as expensive foods, horses, and above all jewels. He describes in detail the conditions under which such gemstones reached Aleppo with the caravans, and how great a profit could be made there.[58] Rauwolf, on the other hand, as a doctor, was particularly interested in plant products for daily consumption and above all in plants with a healing effect, which he observed at the bazaars in Aleppo, Tripoli, and Baghdad.[59]

Rauwolf's travelogue does mention a large number of such goods, some of which were well known, others extremely exotic for a Central European. Included is food, which was consumed on the spot, such as vegetables, salad, endive, kitchen herbs, garlic, eggplant, cucumber, cabbage, pumpkin, Indian melon, leek, rocket, radish, asparagus,

56. See Dannenfeldt, *Leonhard Rauwolf*, pp.30, 221–2 (note 5); Herde and Walter, "Neues zur Biographie des Augsburger Arztes" (with editions of some letters), 142–4, 147, 150–1 (note 5); UL Erlangen, Trew, Clusius No. 116: Letter from Carolus Clusius to Joachim Camerarius, September 4, 1582: Clusius asks for Rauwolf's *hodoeporicum* to be sent to him from Nuremberg; he does not know him personally yet, but his friend Aicholz had visited his garden the year before [1581] when he was traveling to Prague. The receipt of the book was confirmed on October 30, 1582: editions at F. W. T. Hunger, *Charles de l'Ecluse (Carolus Clusius). Nederlandsch kruidkundige, 1526–1609*, vol. II (s'Gravenhage: Nijhoff, 1942), pp.391–2. That Clusius is said to have met Rauwolf personally in Augsburg in 1563 (ibid., vol. I, p.74) is only due to a earlier misunderstanding by Legré. The Camerarius quote is from his *Hortus medicus* (Frankfurt, 1588), p.141.
57. Cf. Rauwolf, *Aigentliche Beschreibung*, pp.8, 60, 114, 117, 173, 281, 284–5, and passim (note 8); Dannenfeldt, *Leonhard Rauwolf*, pp.221, 223 (note 5).
58. Cf. Krafft, *Reisen und Gefangenschaft*, pp.115–25 (note 40).
59. Rauwolf, *Aigentliche Beschreibung*, pp.125 ff., 230 ff (note 8). But even statements on the economic use of plants by Krafft (*Reisen und Gefangenschaft*, pp.91–102 [note 40]) are much more detailed than the corresponding passages about the same plants in Rauwolf, *Aigentliche Beschreibung* (note 8).

root vegetables, and onions;[60] and fresh fruit such as dates, figs, lemons, limes, melons, mulberries, oranges, peach, pomegranates, quinces, and also apples and pears, which were a rare good in the Levant.[61] There were also cut flowers such as white lilies available on the market.[62]

Foods suitable for long-distance trade were: olives, olive oil, or spices such as capers and saffron,[63] and dried fruits such as dates, figs, mulberries, and raisins, which could be offered as a sweet snack mixture together with nuts such as almonds or pistachios.[64] Durable foods, which could be traded over longer distances, were barley, millet, oats, rice, sugar, syrup, and wheat.[65]

Some of these goods flows (for example from Aleppo to Baghdad and further from there to India) were subject to the pursuit of profit, while the supply of Constantinople was rather ensured by compulsory taxes raised by the Ottomans.[66] Rauwolf had a keen eye for the economic and social background of these trading markets: Turks, Moors, and Arabs of rank did not value agriculture highly and preferred to trade for such products (or to appropriate them by taxes or robbery).[67] Even with ordinary grain, good profits could be made through speculation, for example when the grain price was inflated due to the drought in Mesopotamia.[68]

Vegetable products were also used locally, for purposes that Rauwolf (or his readers) were not always able to fully understand: *Chaube* was a hot drink, black as ink, which was enjoyed in company, especially in the morning, and also to treat various complaints, especially of the stomach. Probably coffee was meant.[69] There were also tree branches from which one could produce a "Spießpulver" (*Schießpulver*, that is, gunpowder) on the spot.[70]

Rauwolf's special interest as a physician was the pharmaceutical use of plants. We have no evidence that he ever prescribed his patients the then fashionable *chymical* drugs. Rather, there are various explicit reports by Rauwolf himself that he treated sick people on the way with the help of medicinal plants that he himself had to look for on the spot.[71]

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60. Rauwolf, *Aigentliche Beschreibung*, pp.72–4, 184, 439 (note 8).
61. Ibid., pp.71–2, 113, 192, 261, 316, 360. For tasty exotic fruits as goods see also Krafft, *Reisen und Gefangenschaft*, pp.91–3 (note 40).
62. Rauwolf, *Aigentliche Beschreibung*, p.125 (note 8).
63. Ibid., pp.38, 71, 75, 96, 113, 439, 478.
64. Ibid., pp.71–2, 109, 172–4, 192, 241, 261, 360. In Central Europe raisins sold particularly well during the Christmas holidays, as Krafft (*Reisen und Gefangenschaft*, p.49 [note 40]) exemplified in detail.
65. Rauwolf, *Aigentliche Beschreibung*, pp.71, 105, 108, 198 (note 8).
66. Ibid., pp.137–8, 200, 315.
67. Ibid., p.326.
68. Ibid., p.146.
69. Ibid., pp.102–3; see Dannenfeldt, *Leonhard Rauwolf*, pp.71–2 (note 5); Menninger, *Genuss im kulturellen Wandel*, pp.149–50 (note 25).
70. Rauwolf, *Aigentliche Beschreibung*, p.202 (note 8); see Dannenfeldt, *Leonhard Rauwolf*, p.106 (note 5). For instance, charcoal made from alder buckthorn (*Rhamnus frangula*) was once used to make gunpowder.
71. Rauwolf treated patients in Aleppo and Tripoli and pilgrims on the ship to Crete (Rauwolf, *Aigentliche Beschreibung*, pp.268, 467 [note 8]); see Dannenfeldt, *Leonhard Rauwolf*, pp.141–2 (note 5).

Nevertheless, herbs, roots, and seeds were locally used as medicine, and many drugs stored and sold in pharmacies in Central Europe also came from the East: for example, Rauwolf mentions aloe, mastic, sesame, and opium (whose soothing, pain-relieving effect, but also the danger of addiction, he described in detail).[72] Unknown to the West, *Behen Album* (*Centaurea behen* L.) was used as heat tonic, while *Zarneb Melchi* (*Salix* sp.) was used as a local remedy for back pain.[73]

At that time in medicine, the purification of the body was considered essential for treating diseases, though this did not refer to soap, which was made from olive oil and sold from Aleppo to Baghdad,[74] but to the inside of the body. The use of emetics and laxatives was central to early modern medicine, which is why Rauwolf had a keen eye for laxatives such as Manna Alhagiezi (*Alhagi maurorum* Medik.), terebinths (*Pistacia atlantica* Desf.), and *Nux vomica*.[75] But even though Rauwolf received a salary or travel grant from the Augsburg trading company Manlich, and later declared that he hoped pharmacists would also benefit from reading his book,[76] there is no indication that he exported promising drugs on his journey.

The symbolic dimensions of nature and gardens

On his journey, Rauwolf also visited kitchen gardens to get a quick overview of local species and kitchen herbs. Since the Renaissance, when exotic seeds and bulbs became available through world trade, wealthy garden owners particularly loved to keep exotic plants from distant countries and display them in their gardens.[77] Accordingly, Rauwolf could use the exotic seeds he had brought back from his journey to deepen his contact with the Augsburg elite: he gave his seeds to Hans Heinrich Herwart (1520–83), a rich Augsburger, but mentioned that the warmth-loving plants did not survive the German winter.[78] He also contributed plants to the court garden of Duke Ludwig of Württemberg

72. Rauwolf, *Aigentliche Beschreibung*, pp.113–14, 126, 315, 458 (note 8); see Häberlein, "Botanisches Wissen," p.113 (note 26).
73. Rauwolf, *Aigentliche Beschreibung*, pp.116–7, 126, 146 (note 8); see Dannenfeldt, *Leonhard Rauwolf*, p.84 (note 5).
74. Rauwolf, *Aigentliche Beschreibung*, p.38 (note 8); for the Augsburg soap trade see Häberlein, "Botanisches Wissen," pp.111–12 (note 26).
75. Rauwolf, *Aigentliche Beschreibung*, pp.230, 245, 461 (note 8).
76. Ibid., fols. iii, v.
77. Cf. ibid., pp.9, 16, 117, 184, 327, 454, 457. For early modern gardens see Juliette Ferdinand (ed.), *From Art to Science: Experiencing Nature in the European Garden: 1500–1700* (Treviso: ZeL Edizioni, 2016); Findlen, *Possessing Nature*, pp.256–61 (note 19); *Journal of Early Modern Studies* 6, issue 1 (2017): "Gardens as Laboratories: The History of Botany through the History of Gardens," ed. by Fabrizio Baldassari and Oana Matei; Ogilvie, *The Science of Describing*, pp.151–64 (note 19); Claudia Swan, "Of Gardens and Other Natural Collections in Early Modern Holland: Modes of Display and Patterns of Observation," in Robert Felfe and Kirsten Wagner (eds.), *Museum, Bibliothek, Stadtraum. Räumliche Wissensordnungen 1600–1900* (Kultur. Forschung und Wissenschaft, vol. 12) (Münster: LIT, 2010), pp.173–90.
78. Rauwolf, *Aigentliche Beschreibung*, p.286 (note 8); see Häberlein, "Botanisches Wissen," p.110 (note 26).

(1554–93), from whom he hoped for support in his political problems with the Augsburg authorities. He sent the seeds to the court gardener Sebastian Volmar, because exotic plants were, as Rauwolf remarked to the duke's personal physicians, a special jewel for the pleasure garden of such a high-ranking person and a fitting sign of his prosperity.[79]

On an earlier occasion in 1565, Conrad Gessner had also received rare seeds and plants from him. Rauwolf's empirical knowledge about heat-loving plants was also of interest to other plant-enthusiast friends: Gessner hoped to receive information from him on how best to winter his plants in the garden.[80] Johann Aicholz, professor of medicine in Vienna, reported in 1581 to his Nuremberg colleague Camerarius that he had received instructions from Rauwolf on how to care for his *Opuntia*.[81]

At first glance, Rauwolf's lists of plants seen in various gardens abroad differs little from his observations in the field, but those exotic plants kept in gardens were not only secular symbols of wealth, power, and scientific interest for him. Instead, his descriptions of gardens, as well as those of natural landscapes, were open to a whole range of symbolic and religious meanings attributed to them in Renaissance culture. In fact, Rauwolf's entire travelogue has a transcendent meaning, which is particularly evident in the last part (or chapter) on the Holy Land.[82] In the words of the Bible, the transcendent dimension of the word "garden" is obvious: Rauwolf speaks of the "salvation that we lost in the garden," referring to the Garden of Eden in the biblical account of creation.[83] According to Genesis 3:17–19, gardens stood for peace, fertility, and the divine world order, while natural landscapes symbolized the lost order after the Fall of Man.

Thus, according to Rauwolf's perception, landscapes had a clear and strong symbolic meaning: the desolation of the land around Jerusalem as well as the destruction of the Second Temple resulted from his perception of the guilt of the Jews, who had rejected redemption through Jesus Christ.[84] The political fact that the Ottomans ruled Jerusalem at the time (and, in his opinion, destroyed more there than they rebuilt) was also, according to Rauwolf, a symbol of its spiritual decline, which was further reflected in a population decline and the miserable condition of dwellings and gardens. On the other hand, according to Rauwolf, there were two gardens near Bethlehem, the place where the Christian Messiah was born. As described in the Old Testament, they were founded by King Solomon, and the fertility and order of these two gardens were thus living symbols of salvation.

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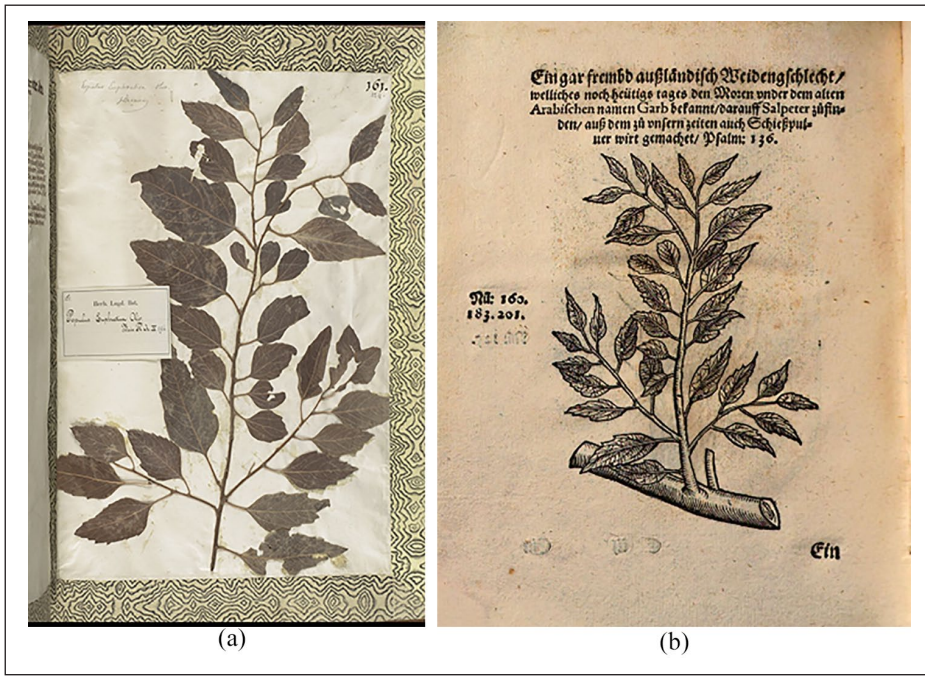
79. Cf. Rauwolf, *Aigentliche Beschreibung*, part four, fols. A iii r–v (note 8): Rauwolf's letter of dedication to Paulus Constantinus Phrygio and Oswald Gabelkover, May 15, 1583.
80. Cf. Conrad Gessner, *Epistolarum medicinalium Conradi Gesneri philosophi et medici Tigurini libri III* (Zürich: Christoph Froschauer, 1577), fol. 60 r: letter to Adolf Occo (1524–1606), January 7, 1565.
81. UL Erlangen, Trew, Aichholtz No. 13: letter to Joachim Camerarius, May 10 [1581].
82. Cf. Tilmann Walter, "Natur, Religion und Politik – Raumerfahrungen bei dem Arzt und Orientreisenden Leonhard Rauwolf (1535?–1596)," in Karin Friedrich (ed.), *Die Erschließung des Raumes: Konstruktion, Imagination und Darstellung von Räumen und Grenzen im Barockzeitalter* (Wolfenbütteler Arbeiten zur Barockforschung, vol. 51) (Wiesbaden: Harrassowitz, 2014), pp.563–75.
83. Rauwolf, *Aigentliche Beschreibung*, p.440 (note 8).
84. Ibid., p.317.



(a) (b)

Figure 3. *Populus euphratica* Oliv. (a) in the herbarium and (b) the same species in print. Even according to the standards of a modern botanist, the pictures are well taken in detail and look very similar to the actual plants.

Photo 3(a): Naturalis Biodiversity Center, Leiden. 3(b): Bayerische Staatsbibliothek München

The illustrations of exotic plants in Rauwolf's travelogue (1583)

The forty-two illustrations contained in the last chapter of Rauwolf's printed travelogue, published in 1583, were woodcuts based on individual plant specimens preserved in his herbarium.[85] Some of the pictures of these models were modified according to the customs of that time. For instance, the branches of trees in the herbarium are represented with the trunk of the tree in the drawing (*Salix* sp. *Populus euphratica, Ficus sycomorus*). Here too Rauwolf occasionally mentioned the local names and uses of the plant in its country of origin in the text next to the illustrations (Figure 3).

In early modern natural history, illustrations normally served as ideal images rather than as portraits of real plant individuals in the narrower sense, since they were primarily intended to illustrate the plant's distinctive features in order to allow an unproblematic identification. "Superfluous" details (associated with damage, individual malformation, or dying) could therefore be omitted by the draftsman in order to focus more on the characteristics than the individuality of a certain plant. Instead, all parts (roots, stems,

85. See Ghorbani et al., "Botanical and Floristic Composition," 568 (note 15). For technical reasons, the plants appear mirror-inverted in print.

branches, leaves, flowers, fruits, and seeds) must be shown and remain recognizable throughout the lifecycle of a plant. Images could even contradict reality and still be didactically meaningful. For example, flowers and fruits were sometimes depicted simultaneously in the illustration, which does not always happen in nature, thus creating images that were "ideal objects, not individuals."[86]

In this sense, illustrations are still of central importance for botanists today. Photography does not fulfill this purpose, and therefore even the printed woodcuts (by Veit Rudolf Speckle, based on drawings and paintings by Heinrich Füllmaurer and Albrecht Meyer) in Leonhard Fuchs' *De historia stirpium commentarii insignes* (Basel 1542) receive high praise to this day. These illustrations are considered unsurpassed in their time, even though the woodcuts by Dürer's pupil Hans Weiditz (d. 1536) for Otto Brunfels' earlier *Herbarum vivae eicones* (3 vols., Strasbourg 1530–6) have a higher artistic value.[87]

It is important to question how realistic an illustration can or must be to make a plant optimally identifiable. Early modern authors, compilers, and editors such as, above all, Fuchs and Conrad Gessner therefore collected as many images as possible to find the best available illustrations for their printed works.[88] This is precisely why Fuchs, in 1563,

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86. Cf. Sachiko Kusukawa, "The Use of Pictures in the Formation of Learned Knowledge: The Cases of Leonhard Fuchs and Andreas Vesalius," in Sachiko Kusukawa and Ian Maclean (eds.), *Transmitting Knowledge: Words, Images, and Instruments in Early Modern Europe* (Oxford: Oxford University Press, 2006), pp.73–96, 81; see also Lorraine Daston, "Epistemic Images," in Alina Alexandra Payne (ed.), *Vision and its Instruments: Art, Science, and Technology in Early Modern Europe* (Pennsylvania: Penn State University Press, 2015), pp.13–34; Lorraine Daston and Peter Galison, *Objectivity*, 2nd ed. (Brooklyn, NY: MIT Press, 2010), pp.55–67; Florike Egmond, "The Garden of Nature: Visualizing Botanical Research in Northern and Southern Europe in the 16th Century," in Juliette Ferdinand (ed.), *From Art to Science: Experiencing Nature in the European Garden. 1500–1700* (Treviso: ZeL Edizioni, 2016), pp.18–33; Egmond, *Eye for Detail*, pp.126–50 (note 2); Pamela H. Smith; "Art, Science and Visual Culture in Early Modern Europe," *Isis* 97 (2006): 83–100.

87. Cf. Brigitte Baumann, Helmut Baumann, and Susanne Baumann-Schleihauf, *Die Kräuterbuchhandschrift des Leonhart Fuchs* (Stuttgart [Hohenheim]: Ulmer, 2001), pp.28–42; Kusukawa, "The Use of Pictures," pp.77–84 (note 86); Claus Nissen, *Die botanische Buchillustration. Ihre Geschichte und Bibliographie*, vol. 1 (Stuttgart: Hiersemann, 1951), pp.40–4; Ogilvie, *The Science of Describing*, pp.192–206 (note 19); Anna Pavord, *The Naming of Names: The Search for Order in the World of Plants* (London: Bloomsbury, 2005), pp.161–204; Walther Rytz, "Das Herbarium Felix Platters. Ein Beitrag zur Geschichte der Botanik des XVI. Jahrhunderts," *Verhandlungen der Naturforschenden Gesellschaft in Basel* 44 (1933): 1–222, 63–112.

88. See Florike Egmond (ed.), *Conrad Gessners "Thierbuch". Die Originalzeichnungen* (Darmstadt: Wissenschaftliche Buchgesellschaft, 2018); Egmond and Kusukawa, "Circulation of Images" (note 33); Daniel Hess, "Wissenschaft und Kunst – Wahrheit oder Verführung? Conrad Gessner und das neue Pflanzenbild im 16. Jahrhundert," in Urs B. Leu and Peter Opitz (eds.), *Conrad Gessner (1516–1565). Die Renaissance der Wissenschaften / The Renaissance of Learning* (Berlin and Boston: De Gruyter Oldenbourg, 2019), pp.161–94 (further evidence can be found in the same new volume on Gessner at pp.67 ff., 83 ff., 195 ff., 368 ff., 581 ff., 607 ff., and passim); Sachiko Kusukawa, *Picturing the Book of Nature:*

had 120 dried plants presented to him by Rauwolf signed off (*reisen*) by the artist Jerg Ziegler.[89] (The planned extended edition of the *Historia stirpium* was not to appear during Fuchs' lifetime, and his heirs also tried unsuccessfully to finance the printing project.)[90]

Perhaps Rauwolf himself was not able to observe this process more closely, but he later in 1582 or 1583 had illustrations made – just like Fuchs and unlike Brunfels' artist Weiditz – of his dried specimens.[91] This was done because the sowing and rearing of the plants he brought with him was not very successful, according to his own statements. He may also have shared the opinion of his correspondent Clusius that dried specimens did not provide a very good basis for illustrations, but there was hardly any other option for exotic plants.[92] Some important reasons for this negative assessment were that in dried plants the exact color of the flowers and leaves was no longer recognizable, and the drying process could also change the original shape of the living plant, but the only other option was to give verbal descriptions with comparison to locally known species.

Rauwolf generally followed the practice recommended by Fuchs when he had the exotic and also, for his taste, exceedingly beautiful *simplicia* with "some expenses"

Image, Text, and Argument in Sixteenth-Century Human Anatomy and Medical Botany (Chicago and London: University of Chicago Press, 2012), pp.107–36, 139–61; Sachiko Kusukawa, "Drawing as an Instrument of Knowledge: The Case of Conrad Gessner," in Alina Alexandra Payne (ed.), *Vision and its Instruments: Art, Science, and Technology in Early Modern Europe* (Pennsylvania: Penn State University Press, 2015), pp.36–48; Nissen, *Die botanische Buchillustration*, pp.55–9 (note 87); Ogilvie, *The Science of Describing*, pp.34–6 (note 19).

89. Österreichische Nationalbibliothek Wien, Cod. 11117-11125; see Baumann, Baumann, and Baumann-Schleihauf, *Die Kräuterbuchhandschrift des Leonhart Fuchs*, pp.98–104 (note 87); Kurt Ganzinger, "Ein Kräuterbuchmanuskript des Leonhart Fuchs in der Wiener Nationalbibliothek," *Sudhoffs Archiv* 43 (1959): 213–24; Siegmund Seybold, "Luca Ghini, Leonhard Rauwolff und Leonhart Fuchs. Über die Herkunft der Aquarelle im Wiener Kräutermanuskriptbuch von Fuchs," *Jahreshefte der Gesellschaft für Naturkunde in Württemberg* 145 (1990): 239–64, 252–4.
90. Cf. Gerhard Fichtner, "Neues zu Leben und Werk von Leonhart Fuchs aus seinen Briefen an Joachim Camerarius I. und II. in der Trew-Sammlung," *Gesnerus* 25 (1968): 65–82, 80; Rytz, "Das Herbarium Felix Platters," 61–2 (note 87); see also University Archive Tübingen, 7/13, No. 7.1: letter from Friedrich Fuchs (1532–1604) to the University of Tübingen, July 16, 1568; German paraphrase: <www.aerztebriefe.de/id/00006403> (accessed January 16, 2020).
91. See Ganzinger, "Rauwolf und Fuchs," 30 (note 11); Rytz, "Das Herbarium Felix Platters," 64, 84 (note 87).
92. UL Erlangen, Trew, Clusius No. 134, edition: Hunger, *Charles de l'Ecluse*, pp.403–4 (note 56): letter from Volcher Coiter to Joachim Camerarius, December 26, 1584; see Ogilvie, *The Science of Describing*, pp.170–1 (note 19). These phenomena are discussed more intensively in F[loriana] Giallombardo and T[inde] van Andel, "Paolo Boccone and the Visual Communication of Pre-Linnean Botany. A Comparison between his Leiden Herbarium, Paris Autoprint and Published Icones (1674)," *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 74 (2019): 15–26.

depicted after his herbarium.[93] The artists themselves, probably from Augsburg, are unfortunately not named, but Rauwolf noted that he was instructed by his good friend Sebastian Volmar from Esslingen.[94] As court gardener of the Duke of Württemberg, Volmar was, like the Augsburg doctor, certainly familiar with Fuchs' statements about botanical illustrations, as Fuchs once taught at the Ducal University of Tübingen.[95]

By depicting only the specimen preserved in his herbarium, albeit with the corrections deemed necessary, each of Rauwolf's illustrations is basically a portrait of a true individual plant. However, one should not forget that it was also customary at that time to make certain flaws disappear when people were portrayed, especially when these were portraits of ruling persons, and this was likely equally true of plant illustrations.

Conclusions

Our new exploration of his herbarium and the evidence from his travelogue have demonstrated the value of Leonhard Rauwolf's scientific work in both botanical and historical respects. He was not an innovator of botanical methods, but a typical practitioner who traveled the Ottoman Empire as a Western pioneer. Or, as the physician and poet Johannes Posthius (1537–97) predicted to the Augsburg physician in a letter poem of July 1582: if he were to comply with the manifold wishes for an illustrated new edition of his travel report based on his unique herbarium, Rauwolf would be praised for centuries for making these exotic plants known to the botanically interested public through suitable illustrations.[96]

But Rauwolf not only observed foreign species, documented them, and brought them to Europe, where his plant specimens even found the interest of emperors, dukes, and kings, he also reported the origins of plants that were available in pharmacies in Europe and some that were still unknown there. He documented the names and uses of plants and their economic importance for the locals, as well as the locals' habit of enjoying coffee. Although Rauwolf never doubted the superiority of the Western religion and aimed to report knowledge that his European readers would find useful, he also contributed to the preservation of the cultural heritage of Syria, Lebanon, and Iraq. For this reason, it is worth emphasizing that Rauwolf's solitary journey to an area under strict Ottoman rule was in fact not an act of colonization, but a genuine ethnographical enterprise.

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93. Rauwolf, *Aigentliche Beschreibung*, part four, fol. A ii v (note 8): Rauwolf's letter of dedication to Paulus Constantinus Phrygio and Oswald Gabelkover, May 15, 1583; this meant that he and not the printer retained control over the woodcuts with plant images: cf. Kusukawa, "The Use of Pictures," p.74 (note 86).
94. Rauwolf, *Aigentliche Beschreibung*, part four, fol. A iii r (note 8).
95. Cf. Leonhard Fuchs, *De historia stirpium commentarii insignes* (Basel: Michael Isengrin, 1542), fol. [α 5] v-β r; see Sachiko Kusukawa, "Leonhart Fuchs on the Importance of Pictures," *Journal of the History of Ideas* 58 (1997): 403–27.
96. Rauwolf, *Aigentliche Beschreibung*, part four, fols. B r–B ii r (note 8): letter poem from Johannes Posthius to Leonhard Rauwolf, July 1582.

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Supplemental Material

Supplemental material for this article is available online.

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