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## ***Healing with Mercury: The Uses of Mercury in Arabic Medical Literature***

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**Abstract:** Three textual traditions can be discerned in Arabic medical literature: the early translations from Greek, Syriac and Indian sources; the autochthonous tradition, which reached its height between the tenth and thirteenth centuries; and the translations from Latin sources, beginning in the seventeenth century. This study traces the medical use of mercury and its derivatives within these traditions. The Greek works translated into Arabic like those of Galen or Paul of Aegina did not prescribe mercury as a remedy for human beings because of its toxicity. However, many scholars of the second period, including Rhazes (d. 925), Ibn al-Jazzār (d. 979), Avicenna (d. 1037), Abū l-‘Alā’ Zuhri (d. 1131) and Muḥammad al-Idrīsī (d. 1166), described the external application of mercury. Many terms were used to describe these varieties of mercury – the living (*zi’baq ḥayy*), the dead (*zi’baq mayyit*), the murdered (*zi’baq maqtūl*), the sublimated (*zi’baq muṣa‘‘ad*) and the dust of mercury (*turāb al-zi’baq*). To reconstruct the meaning of these terms, I examine various recipes for mercurial preparation given in these works. The internal use of mercury is documented in the sixteenth century in a work by Dawūd al-Anṭākī (d. 1599), who used the term *sulaymānī* to refer to a sublimated derivative of mercury. I attempt to reconstruct the modalities of knowledge transmission from the Indian and Persian East into Arabic medicine, and from the Arabic world into the Latin West. I also address the impact of translations into Arabic of Latin works in the seventeenth century, such as the *Practicae medicinae* and *Institutionum medicinae* by Daniel Sennert (d. 1637), the *Antidotarium generale et speciale* by Johann Jacob Wecker (d. 1586) and the *Basilica Chymica* by the Paracelsian Oswaldus Crollius (d. 1608).

**Keywords:** mercury, Arabic medicine, iatrochemistry, medical chemistry

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# 1 Introduction<sup>1</sup>

In the seventh and eighth century, mercury was already well known in the Islamic world. Its physical properties – its fluidity, its property of amalgamation and its reflection of light – inspired many metaphors in poetry.<sup>2</sup> Fascination with the precious metal inspired legends such as the story of the mercury fountain in the palace garden of Khumārawayh (r. 884–896), the second Ṭūlūnid ruler of Egypt.<sup>3</sup> The Egyptian chronicler Ibn Taghrībirdī (1410–1470) writes:

[Khumārawayh] had a basin erected in that palace and filled it with mercury. The reason for that was that he complained to his physician of insomnia. The doctor recommended a massage but [Khumārawayh] disdained it and said: ‘I cannot bear it if someone puts his hand on me.’ The doctor said to him: ‘[Then] order the erection of a mercury basin.’ So [Khumārawayh] ordered a basin to be built, 50 cubits long and 50 cubits wide, and had it filled with mercury, for which he spent huge amounts of money, and put silver rails with silver rings into the corners of the fountain [to fix] well-manufactured ropes of silk. He ordered that a leather mattress be made which could be filled with air and then bound tightly. It was put onto that basin, fixed with the silk ropes to the silver rings and [Khumārawayh] laid on that mattress which trembled and swung permanently owing to the movements of the mercury as long as he stayed on it.<sup>4</sup>

This anecdote illustrates the rumours of lavish extravagance, frivolity and generosity which surrounded Khumārawayh. Nevertheless, it could hardly describe a real incident because of the low vapour pressure and the toxic effects of mercury. A similar story is narrated by al-Bīrūnī (d. 1048) in the introduction of his book on mineralogy, *Kitāb al-jamāhir fī maʿrifat al-jawāhir*.<sup>5</sup> Al-Bīrūnī warns against excessive sexual intercourse and recounts the anecdote of al-Mutawakkil (r. 847–861), the tenth Abbasid caliph, whose organs became very weak and disabled him from motion in sexual intercourse. A basin filled with mercury was prepared for him and a leather rug was put on it so that al-Mutawakkil would be moved by the mercury’s movement.

These two anecdotes attest to the use of mercury in a therapeutic context. But were mercury and its derivatives also part of other cures in Arabic medicine? This issue has been addressed at the margins in editions of medical compendia or pharmacopoeias that contain entries on mercury as a simple or as a toxin.

<sup>1</sup> All dates are given according to the Gregorian calendar.

<sup>2</sup> See Ullmann 2004: 113–129.

<sup>3</sup> See Haarmann 2012: “Ḳhumārawayh” in EI 2. ed.

<sup>4</sup> Ibn Taghrībirdī 1992: III, 67–68. Own translation. All following translations are by the author unless stated otherwise.

<sup>5</sup> Bīrūnī [1936]: 15.

These usually mention an external application against scabies and lice.<sup>6</sup> Käs has explained the nomenclature of mercury and its transmission in numerous Arabic works of pharmacognosy, but excluded its medical indications.<sup>7</sup> Some light was shed on a few indications of mercury derivatives in the seventeenth century in a study of my own on the transfer of medical knowledge from Europe to the Ottoman empire.<sup>8</sup> It would thus be of interest to learn how mercury and its derivatives were used as remedies in Arabic literature in the various historical periods, as well as how contact with other medical cultures influenced its usage. This study therefore addresses particularly the medical indications of mercury and its derivatives in influential Arabic compendia from the eighth to the eighteenth century. It attempts to identify the first time the application of mercury is mentioned, to follow the developments of its application, and to trace its transmission through the various cultures with which Arabic medicine came in contact.

By Arabic medicine, I mean not only the body of medicine developed during the Islamic “Golden Age” (c. tenth to twelfth century CE) – which has also been called Islamic medicine, Graeco-Arabic medicine and Graeco-Islamic medicine – but every medical compilation written in Arabic, the lingua franca of Islamicate civilisation. In the history of Arabic medicine, I differentiate between three traditions, according to the interactions with medical traditions written in other languages and developed in other cultures:<sup>9</sup>

1. The first phase of translations from Greek, Syriac, or Indian texts into Arabic, beginning in the second half of the eighth century under the Abbasid Caliphate in Baghdad and continuing until the tenth century
2. The second phase of compilation of autochthonous works, beginning parallel to the translation movement and reaching its climax between the tenth and thirteenth centuries (with many of the compilations undergoing translation into Latin in the eleventh and twelfth centuries)
3. The third phase of translation from Latin, beginning in the seventeenth century<sup>10</sup>

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**6** For example, see Adams 1844–47: III 385, II 238–239; Ibn al-Bayṭār 1874: II, 177–178; Ibn Sinā 1987: 493–494; Schmucker 1969: 224; al-Ṭabarī 1928: 324, 408.

**7** See Käs 2010: II, 692–697.

**8** See Bachour 2012: 193–194.

**9** On the transfer of knowledge between Arabic and other cultures, see Pormann/Savage-Smith 2007: ch. 1 and ch. 6.

**10** The developments in Arabic Medicine during the fourteenth and sixteenth century are so far largely unexplored.

The present study demonstrates that many developments took place during all three of these phases. These include new mercury derivatives, new forms of application, and new indications of a wide range of maladies.

## 2 Nomenclature

Many names and pseudonyms for mercury are known in Arabic literature. However, it was mainly referred to as *zi'baq* or *zībaq*, a term derived from the Middle Persian word *živak* or *zībag*, which is derived from the Indo-Germanic root for “life” (Sanskrit *ḡīv*).<sup>11</sup> Further variations were *zāwūq* and *zuwaq*.<sup>12</sup> In addition, many transcriptions of the Greek name hydrargyrum are documented as *ūdrarjūrīs*,<sup>13</sup> but they were not widespread. In the alchemical literature, many pseudonyms for mercury were in use. Siggel lists 120 versions in his book on pseudonyms in Arabic alchemical literature, *Decknamen*.<sup>14</sup> Some of them refer to certain physical characteristics of the mineral such as “the volatile” (*farrār* and *fārr*), “the volatile slave” (*‘abd ābiq*), “the heavy” (*thaqīl*) or “the speedy” (*sarī‘ al-ḥaraka*). Others relate to the sulphur–mercury theory, such as “the father of the minerals” (*abū l-ma‘ādin*), “the female” (*unthā*) or “the white bride” (*‘arūs bayḍā’*), or to mystical alchemical concepts such as “the divine water” (*mā’ ilāhī*), “the phoenix” (*‘anqā’*) or “the spirit of matter” (*rūḥ al-ajsād*).

## 3 Mercury in translations from Greek sources

In the second half of the eighth century, the Abbasid caliphs and their ministers initiated the translation of Greek medical works into Arabic on a large scale.<sup>15</sup> The books were translated either directly from Greek or intermediately via Syriac.<sup>16</sup> Among the most important of the translated works was the *Materia medica* of Pedanius Dioscorides (c. 40–90). This was translated by Iṣṭifān b. Bāsīl (fl. mid-ninth century) and Ḥunayn b. Ishāq (d. 873 or 877) under the title

<sup>11</sup> Ullmann 2004: 113; Käs 2010: II, 694; Kahl 2012: EI, 2. Ed.

<sup>12</sup> Ullmann 2004: 113, 116.

<sup>13</sup> Dubler/Terés 1952: 417.

<sup>14</sup> Siggel 1951b: 33–54.

<sup>15</sup> See Ullmann 1970: 25–100.

<sup>16</sup> See Ullmann 1970: 100–103.

*al-Maqālāt al-sab‘ min kitāb Diyāsqūrīdūs wa-huwa hayūlā l-ṭibb fī l-ḥashā’ish wa-l-sumūm*.<sup>17</sup> It contains an entry for hydrargyrum, which is defined as *zi’baq* (*ūdrarjūrīs wa-huwa al-zi’baq*).<sup>18</sup> Dioscorides describes a sublimation method for extracting mercury from cinnabar (*minūn* or *qanābārī*) and indicates that the metal can also be found in mines (*ma’ādin*). Interestingly, no derivatives of mercury are mentioned. Dioscorides describes mercury as lethal if drunk due to its heaviness (*thiqal*), which makes it corrode (*akala*) the internal organs (*a’ḍā’ bāṭina*).<sup>19</sup> As an antidote he recommends drinking milk (*laban*) abundantly, or wine (*khamr*) with squaw mint (*fūtanj jabalī*) or hissop (*zūfā*).

The other Greek authority in Arabic medicine who mentioned mercury was Galen (d. 216). The Arabic Corpus Galenianum comprises several books on pharmacognosy, including *De simplicium medicamentorum facultatibus* or *Kitāb al-adwiya al-mufrada*, translated into Arabic by al-Biṭriq and later by Ḥunain b. Iṣḥāq (d. 873).<sup>20</sup> Parts of this book were included virtually completely by Ibn al-Bayṭār (d. 1248) in his pharmaceutical encyclopaedia *Kitāb al-jāmi‘ fī mufradāt al-adwiya wa-l-aghdhīya* (Compendium of simple drugs and foods).<sup>21</sup> On the topic of mercury, the following statement is attributed to Galen: “I have not experimented with it to assess whether it kills if drunk, or what it causes if applied externally.”<sup>22</sup> Al-Rāzī also quotes Galen in his *al-Ḥāwī*, mentioning mercury among other drugs which are harmful for human beings even if taken in the smallest amounts.<sup>23</sup>

Ibn al-Bayṭār also quotes Paul of Aegina (c. 625–c. 690), a Byzantine physician best known for his seven-volume medical encyclopaedia.<sup>24</sup> This work was translated into Arabic in the ninth century under the title *Kunnāsh al-thurayyā* (Compendium of the Pleiades, a reference to its seven treatises). Unfortunately, the *Kunnāsh al-thurayyā* is only preserved fragmentarily in citations by several Arabic authors.<sup>25</sup> On mercury, Paul says that “it is rarely used for medical purposes because of its lethal effect (*qattāl*). Some people burn it (*ḥaraqa*) until it becomes like ash (*ramād*), mix it with other substances and give

<sup>17</sup> Käs 2010: I, 9–11. Further translations of the *Materia medica* are described by Käs (see Käs, 2010: I, 9–15).

<sup>18</sup> Dubler/Terés 1952: 417.

<sup>19</sup> Dubler/Terés 1952: 417.

<sup>20</sup> Käs 2010: 16.

<sup>21</sup> Ullmann 1970: 48, 281–283.

<sup>22</sup> Ibn al-Bayṭār 1874: II, 178, L. 8–9.

<sup>23</sup> Rāzī 1955–1970: XX, 598–599.

<sup>24</sup> Ullmann 1970: 86–87; Ibn al-Bayṭār 1874: I, 178, L. 17–18.

<sup>25</sup> Ullmann 1970: 86–87.

it as beverage (*saqā*) to the sufferers from colic (*qawlanj*) and the so-called ileus (*ilāwus*).<sup>26</sup> This citation is the first mention of internal application of mercury in the Arabic medical literature: the physician refers to it, but does not recommend it.

Ibn al-Bayṭār, (allegedly) quoting Aristotle, gives additional detail about the toxicity and use of mercury. The quotation is in fact taken from Pseudo-Aristotle's *Kitāb al-aḥjār* (Book of the stones), which was attributed to an anonymous Arabic author and circulated in several textual versions:<sup>27</sup>

The vapour (*duḥān*) of mercury causes hemiplegia (*fālij*), convulsions (*ra'dat al-a'dā'*), loss of hearing (*dhahāb al-sama'*), madness (*dhahāb al-'aql*), syncope (*ghashāwa*), yellow tint (*ṣufrat al-lawn*), tremor (*ra'sha*), (*tashabbuk al-a'dā'*), bad smell of the mouth (*tabakhhur al-fam*) and dryness of the brain (*tayabbus al-dimāgh*). Snakes (*ḥayyāt*) and scorpions (*'aqārib*) flee from the vapour of mercury otherwise they vanish by it. Mercury dust (*turāb*) could be used as a toxin against mice if mixed into their food. Mercury can kill lice (*qaml*) and ticks (*qirdān*) that affect animals because of its virtues (*khuṣūsiyya*).<sup>28</sup>

To summarize: The Greek authors Dioscorides, Galen and Paul of Aegina did not use mercury as a remedy for humans because of its toxicity. However, we learn from Paul of Aegina, who lived considerably later, that a derivate of mercury was used internally against colic and ileus in his times. This seventh-century physician documents an important modification in the use of mercury, namely as a cure for human beings. This might be due to contact with Indian physicians or medical works, since mercury was already being used as a cure in ayurvedic medicine as early as the seventh century.<sup>29</sup>

<sup>26</sup> This citation is in the Greek text of Paul Aeginta under ὑδράργυρος: “Hydrargyrum, mercury, is scarcely used for medical purposes, being deleterious. But some having burnt it, so as to reduce it to ashes, and mixed it with other articles, have given it to drink in cases of colic and ileus.” (Adams 1844–47: III 385).

<sup>27</sup> See Ullmann 1972: 105; Käs 2010: I 5–7. *Kitāb al-aḥjār* has several versions. In the edition of Ruska, the symptoms of toxicity are not mentioned: “[Mercury] kills lice (*qaml*) and ticks (*qirdān*). Its dust (*turāb*) kills mice if mixed into their food. If Mercury was heated by fire, it evaporates and causes hemiplegia (*aflajahū*) and other illnesses (*asqām*) to everyone who is near of it.” (Ruska, 1912: 123). However, the symptoms of toxicity are mentioned in al-Qazwīnī's cosmography *'Ajā'ib al-maḥlūqāt* (Wüstenfeld 1848–49: I 243).

<sup>28</sup> Ibn al-Bayṭār 1874: I, 178, L. 17–18.

<sup>29</sup> For example, the Indian physician Burzōē who lived at the time of Khosrau I (r. 531–579) transferred medical knowledge to the Middle East (see Ullmann 1970: 104). For the use of mercury as medicine in ayurvedic medicine see Dagmar Wujastyk 2013.

## 4 Mercury in translations from Indian works

Our knowledge of the translations of Indian medical works and their impact on Arabic medicine is marginal. Ullmann suggests that the influence of these works was limited to the adoption of particular therapies or remedies, but that the system of Arabic medicine as a whole remained Greek.<sup>30</sup> Nevertheless, several Indian medical compendia were translated into Arabic. The most important of these are the two oldest classical ayurvedic Sanskrit texts known to us, the *Carakasamhitā* and the *Suśrutasamhitā*.<sup>31</sup> The *Carakasamhitā* was translated by ‘Abdallāh b. ‘Alī from Persian into Arabic after its translation from “Indian” (*hindī*) into Persian. The *Suśrutasamhitā* was translated by the Indian physician Mankah, who lived at the court of Hārūn al-Rashīd (r. 786–809), on behalf of Yaḥyā b. Khālid.<sup>32</sup> The *Aṣṭāṅgahṛdayasamhitā* of Vāgbhata, written in the seventh century, was also translated by Ibn Dahn under the title *Astānkar al-jāmi’*.<sup>33</sup> The *Aṣṭāṅgahṛdayasamhitā* is especially important, because it mentions the external as well as the internal use of mercury as a medicine. It contains a recipe for a topical cream against freckles and another for the internal use of mercury as a rejuvenatory.<sup>34</sup> Unfortunately, these translations are preserved only in fragmentary citations in al-Rāzī’s *al-Ḥāwī*, in al-Birūnī’s *al-Jamāhir fī ma’rifat al-jawāhir* and in ‘Alī b. Abī Saḥls Rabbān al-Ṭabarī’s (d. c. 870) *Firdaws al-ḥikma fī l-ṭibb*.<sup>35</sup>

*Firdaws al-ḥikma fī l-ṭibb* (The paradise of wisdom in medicine) is a medical encyclopaedia which also contains an important introduction to Indian medicine. In 36 chapters, al-Ṭabarī describes the general principles of medicine and dietetics and certain diseases and disorders, as well as some composed remedies.<sup>36</sup>

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<sup>30</sup> Ullmann 1970: 103–104.

<sup>31</sup> Ullmann 1970: 104–105; Ibn Abī Uṣaybi’a 1998: 435.

<sup>32</sup> Ullmann 1970: 104–105; Ibn Abī Uṣaybi’a 1998: 435.

<sup>33</sup> Ullmann 1970: 104–105; Ibn Abī Uṣaybi’a 1998: 435. Ibn Abī Uṣaybi’a lists yet other medical books which were translated into Arabic (See Ibn Abī Uṣaybi’a 1998: 435–439).

<sup>34</sup> For further translations from Indian into Arabic see Ibn Abī Uṣaybi’a 1998: 435–39 and Ullmann 1970: 103–107. For the usage of mercury in Sanskrit medical texts see Dagmar Wujastyk 2013.

<sup>35</sup> Ullmann 1970: 104–105.

<sup>36</sup> Ṭabarī 1928: 557–620. The first 34 chapters were translated into German by Alfred Siggel, see Siggel 1951a. The last two chapters, amounting to about the half of the treatise, deal with remedies used for cosmetic purposes and against uterus disturbances (chapter 35), as well as special recipes from ayurvedic medicine (chapter 36).

He quotes the *Carakasamhitā* (*kitāb Jarak*),<sup>37</sup> the *Suśrutasamhitā* (*kitāb Susurd*),<sup>38</sup> the *Aṣṭāṅgahṛdayasamhitā* (*kitāb Ashtāṅqahardī*)<sup>39</sup> and a work on pathology called *Nīdāna* by the physician Mādhavakara (*kitāb nadān*).<sup>40</sup> I have not found any reference to mercury or any of its derivatives in this treatise. However, al-Ṭabarī mentions mercury twice in other parts of his encyclopaedia.

In the chapter on mineral simples, al-Ṭabarī devotes an entry to mercury (*zi'baq*).<sup>41</sup> He claims that the dust of mercury (*turāb al-zi'baq*) kills mice and is useful against scabies (*jarab*) and pruritus (*ḥakka*) if mixed with vinegar (*khall*). Mercury is dry (*yābis*) and astringent (*qābiḍ*), and kills lice (*qaml*) when smeared on the head.<sup>42</sup> In a chapter on skin diseases, al-Ṭabarī describes a remedy against scabies that also contains the dust of mercury:<sup>43</sup>

[Take] equal parts of yellow sulphur (*kibrīt aṣfar*), dust of mercury (*turāb al-zi'baq*), red arsenic (*zirnīkh aḥmar*) and chebulic myrobalan (*halīlaj*) as well as five Spanish flies (*dharārīḥ*). Grind the drugs and douse the Spanish flies with oil (*zayt*). Adjoin [the ingredients], smear the body with it and sit under the sun.

These are the first known descriptions of mercury as a medicine for humans in an Arabic compendium. It is notable that the recipes contain the so-called dust of mercury (*turāb al-zi'baq*), the very term that Paul of Aegina used to refer to a burnt ash of mercury. This derivative is mixed with vinegar or oil in combination with other ingredients. As the Greek texts do not indicate mercury as a cure, the origin of these remedies must lie elsewhere. Since the first Arabic medical text mentioning mercury was written by a physician who was well acquainted with Indian medical works, it seems likely that he was inspired by Indian medicine. However, it should be noted that the translated ayurvedic works that are at present known to us do not contain corresponding recipes. Some earlier physicians had mentioned the external medical application of dust of mercury, but their writings are preserved only in fragments such as that of Māsarjawaih, a Jewish Persian who lived in Baṣra in the seventh or eighth century,<sup>44</sup> who according to Ibn al-Bayṭār recommended

<sup>37</sup> Ṭabarī 1928: 578.

<sup>38</sup> Ṭabarī 1928: 562.

<sup>39</sup> Ṭabarī 1928: 565.

<sup>40</sup> Ṭabarī 1928: 578; Ullmann 1970: 105. This book was translated into Arabic on behalf of Hārūn al-Rashīd (see Ullmann 1970: 105).

<sup>41</sup> Ṭabarī 1928: 408.

<sup>42</sup> Ṭabarī 1928: 408.

<sup>43</sup> Ṭabarī 1928: 324.

<sup>44</sup> Ibn al-Bayṭār 1874: I, 178; Ullmann 1970: 23.

using the dust of mercury (*turāb al-zi'baq*) with vinegar (*khall*) against scabies and pruritus.<sup>45</sup>

## 5 Mercury in translations from Syriac

In the eighth and ninth century, several medical books were compiled in Syriac which were preserved in fragments as citations in posterior compendia. Some Syriac authors mentioned the external application of mercury. Al-Rāzī quotes a medical compendium entitled *Kunnāsh al-khūz*, written in Syriac by physicians in Godēshāpūr in the Persian province of Khuzestan and later translated into Arabic.<sup>46</sup> According to this book, mercury is beneficial against scabies and ulcerous wounds (*qurūḥ radī'a*) and its dust kills mice.<sup>47</sup>

Yuḥannā b. Sarābiyūn (Serapion) wrote a medical compendium in Syriac in 873 which was translated into Arabic by Mūsā b. Ibrāhīm al-Ḥadīthī and Ibn Bahlūl.<sup>48</sup> The Arabic version was translated into Latin by Gerhard of Cremona (1114–1187) under the title *Practica aliter breviarium nuncupata*, and it was later printed several times.<sup>49</sup> Serapion was quoted by Rhazes in *al-Ḥāwī* in the chapter on lice and nits (*fī l-qaml wa l-ṣu'āb*) as recommending the use of “killed mercury” (*zi'baq maqtūl*) mixed with vinegar (*khall al-khamr*) and rose oil (*duhn al-ward*).<sup>50</sup> Serapion also recommends another mixture of mercury (*zi'baq*) with arsenic (*zirnīkh*) and mustard (*khardal*) which is then mixed with vinegar and rose oil.<sup>51</sup> This recipe is the first to contain liquid mercury, rather than a derivative of it, in an ointment.

## 6 Mercury in the medical and alchemical compilations of Rhazes

Abū Bakr Muḥammad b. Zakarīyā' al-Rāzī (b. 865), the Persian physician and alchemist, compiled several medical compendia.<sup>52</sup> In *al-Ḥāwī* he devotes an

<sup>45</sup> Ibn al-Bayṭār 1874: I, 178.

<sup>46</sup> Ullmann 1970: 101.

<sup>47</sup> Rāzī 1955–1970: XX, 598.

<sup>48</sup> Ullmann 1970: 102–103.

<sup>49</sup> Keil 2002: VII, 1775.

<sup>50</sup> Rāzī 1955–1970: XXIII, 2. part, 123.

<sup>51</sup> Rāzī 1955–1970: XXIII, 2. part, 123.

<sup>52</sup> See Ullmann 1970: 128–137.

entry to mercury as a simple, but lists only the opinions of previous authors we already know: Dioscorides, Galen, Paul of Aegina and the authors of *Kunnāsh al-khūz*.<sup>53</sup> In his *Kitāb al-manṣūrī fī l-ṭibb* he describes the liquid metal (*zi'baq 'abīṭ*), the sublimated (*muṣa'ad*) and the killed mercury (*maqtūl*) in the toxicology section.<sup>54</sup> These three kinds of mercury are also mentioned in a citation of al-Rāzī by Ibn al-Bayṭār, reporting that the metal is cold but becomes warm, pungent (*ḥirrif*) and solvent (*muḥallil*) if it is sublimated (*ṣu'ida*), which accounts for its use against scabies and pruritus. If it is “killed” (*qutila*), it becomes burning (*muḥriq*) and useful against scabies and lice.<sup>55</sup> Accordingly, we would expect to find uses for the sublimated as well as for the killed mercury in *Kitāb al-manṣūrī*. However, al-Rāzī mentions only the dust of mercury (*turāb al-zi'baq*) and killed mercury (*zi'baq maqtūl*) in the therapeutic sections of his compendium. “Dust” here is probably used as a synonym for sublimated mercury. Against ringworm (*su'fa*), Al-Rāzī prescribes an inunction or ointment that contains the dust of mercury, burnt salt and vitriol (*milḥ wa-zāj muḥarraḡayn*), sulphur (*kibrīt*), gallnut (*'afaṣ*), chelidonium majus (*'urūq ṣufr*), litharge (*mardāsanj*) and aristolochia (*zarāwand*), triturated in wine vinegar (*khall khamr*) and rose oil (*duhn al-ward*).<sup>56</sup> Against melasma (*kalaf*), he prescribes the dust with mahaleb cherry (*ḥabb al-maḥlab*), peeled seeds of melon (*biṭṭikh*) and radish (*fijl*).<sup>57</sup> Against lice on the edge of the eyelids (*qaml kā'in fī l-ashfār*), he uses the dust with alum (*shabb*), red arsenic (*zirnīkh aḥmar*), Lice-Bane (*maywīzaj*) and gum (*ṣamgh*) as a collyrium or eye salve, but he cautions that it should be applied very carefully, with the eyelid held for the span of one hour, in order to prevent contact with the eye.<sup>58</sup> Against scabies (*jarab*), he uses killed mercury with litharge of silver (*qilīmiyā al-fiḍḍa*), oleander leaves (*waraq al-diflā*), soaproot (*kundus*), alkali (*qalī*) and litharge (*mardāsanj*). The ingredients are triturated with wine vinegar and rose oil. The patient applies the ointment and sleeps overnight. The next day, he should wash his body first with vinegar and green moss (*ashnān akḥḍar*), then with hot water and finally with cold water in a bath (*ḥammām*). Finally, he should smear his body with an oil (*duhn*).<sup>59</sup>

<sup>53</sup> Rāzī 1955–1970: XX, 597–599.

<sup>54</sup> Rāzī 1987: 368–369.

<sup>55</sup> Ibn al-Bayṭār 1874: II, 178.

<sup>56</sup> Rāzī 1987: 246.

<sup>57</sup> Rāzī 1987: 248.

<sup>58</sup> Rāzī 1987: 259.

<sup>59</sup> Rāzī 1987: 252.

Is the so-called dust of mercury identical to sublimated mercury? What is the sublimation method used to prepare it, and what was the preparation method for killed mercury? Al-Rāzī wrote several books on alchemy; I therefore consulted the most comprehensive of them, namely *Kitāb sirr al-asrār*, to establish the nomenclature of the mercury derivatives and to answer the questions about the preparation methods for the killed and sublimated mercury.<sup>60</sup> In this work, al-Rāzī describes many methods for the solidification (*‘aqd*) of mercury. Mercury is triturated with mustard (*khardall*) and cooked with vinegar (*taṭbukhuhū bi-l -khal*) and salt (*milḥ*). After that it is sprinkled with oil (*zayt*), strewed with ashes (*ramād*), poured with lead (*usrub*) or tin (*qal’ī*), and melted several times until it becomes solid.<sup>61</sup> This solidified mercury (*zi’baq ma’qūd*) is used to synthesise further mercury derivatives and no medical uses are mentioned for it. It is difficult to predict the chemical composition of the product. It must be a mixture containing several salts of mercury, such as mercury oxide and mercury acetate, probably mixed with other salts of tin and lead.

The chapter on the sublimation (*taṣ’īd*) of mercury has two sections, the first describing the sublimation for whitening (*taṣ’īd al-zi’baq li-l -bayāḍ*), and the second the sublimation for reddening (*li-l -ḥumra*). Each section describes several procedures.<sup>62</sup> The first group of procedures leads to a white derivative, which is probably mercury (I) chloride. By way of an example, I will describe the first procedure. The solidified mercury is triturated with salmiac (*nushādar*), with salt (*milḥ*) or with ash (*ramād*). It is sprinkled with vinegar (*khal*) on a plate and thoroughly triturated in the morning, noon and evening. After that, it is sublimated in a glued laminated bottle (*qārūra muṭayyana*) in an oven on a bed of hot ashes for one night. The next day it is taken out, triturated, mixed with salt, put in the sublimation device called Aludel (*uthāl*), covered with alembic (*anbiq*), and distilled until all the fluids are evaporated. After that the alembic is substituted by a cap (*mikabba*) and the sublimation is conducted over a gentle flame for twelve hours. The sublimate is mixed with the non-sublimated residues, and the sublimation procedure is repeated three times. Next, the sublimate is triturated with burnt bones (*‘izām muḥraqa*) for one hour, then sublimated three times after adding new bones to the mixture. It becomes white and dead (*innahū yabyaḍḍu mayyitan*). This complicated procedure would probably produce mercury-II-chloride (HgCl<sub>2</sub>). The procedure continues, and the white sublimate is mixed with castor oil (*duhn al-kharwa’*) and put in a glued laminated bottle and then placed in a mixture of ash and coal powder (*diqāq al-faḥm*).

<sup>60</sup> See Jawad 1994: 65–205; Ruska 1937: 100–110.

<sup>61</sup> Jawad 1994: 78.

<sup>62</sup> Jawad 1994: 79–86.

The coal is set alight and the sublimate solidifies in the bottle “like a chinese mirror” (*mithl al-mir’āt al-ṣīniyya*).<sup>63</sup> The products of this chemical reaction could be mercury oleate decomposing in the high heat and producing an oxide which, in turn, produces the sublimated mercury-II-chloride in colourless, bright crystals.<sup>64</sup>

The second group of procedures yields a red derivative, which must be *mercurius praecipitatus ruber*, or mercury (II) oxide (HgO). I will describe the third procedure as an example.<sup>65</sup> One rotle<sup>66</sup> of mercury which has been solidified with gold marcasite (*marqashīthā dhahabiyya*), one rotle of vitriol (*zāj*) and a half rotle each of yellow sulphur (*kibrīt aṣfar*) and saltpetre (*milḥ andirānī*) are triturated and mixed with the water of oak ash (*ramād al-ballūt*) for four hours, until no traces of mercury remain. After roasting (*tashwī*), the mixture is sublimated in the sublimation device called Aludel (*uthāl*) seven times. Mercury sublimates as a red substance. Subsequently the sublimate is poured with salmiac water (*mā’ nushādir*). Vitriol and copperas (*qalqant*) are added to the solution. Finally the mixture is roasted until it becomes red, like the liver.<sup>67</sup>

In *Kitāb sirr al-asrār*, there is no mention of any medical uses of the prepared alchemical mercury derivatives. Further, the nomenclature of the alchemical treatise differs completely from that used in the medical compendia *al-Ḥāwī* and *al-Manṣūrī*. In *Sirr al-asrār*, “*maqtūl*” does not indicate a specific product. On the other hand, “*mayyit*” refers to the sublimated mercury. This term might be considered as synonymous with *maqtūl*, although it describes the status of being dead (*mayyit*) rather than referring to the state of having been killed (*maqtūl*). The term “sublimated” is used, but al-Rāzī always differentiates between the red and the white sublimate, whereas in the medical texts no specific kind of sublimate is mentioned. The term “dust of mercury” is not mentioned at all in the sections on mercury preparations, while the term “solidified” (*ma’qūd*) does not occur in the medical texts. The differences in nomenclature and the absence of any cross-references between the alchemical and medical texts written by the same author confirm Ullmann’s assertion that these two sciences remained separate disciplines and that no alchemical procedures were used to prepare medical compounds.<sup>68</sup>

<sup>63</sup> Jawad 1994: 80–81.

<sup>64</sup> Mercury (II) chloride may take the form of a white powder or transparent crystals (see Hunnius, 1998: 1155).

<sup>65</sup> See Jawad 1994: 83–86.

<sup>66</sup> One rotle (*raṭl*) is 12 ounces (*ūqiyya*) (Hinz, 1955: 28).

<sup>67</sup> Jawad 1994: 84.

<sup>68</sup> Ullmann 1970: 129.

## 7 Mercury in the *Canon of medicine* of Avicenna

The Persian polymath Abū ‘Alī al-Ḥusayn b. ‘Abd Allāh Ibn Sīnā (980–1037) can be considered the most famous scholar of the second phase of the compilation of autochthonous medical texts.<sup>69</sup> His *al-Qānūn fī-l-ṭibb* (*Canon of Medicine*) consists of five volumes. The first concerns the general rules of medicine, the second is a pharmacopoeia of simple drugs, the third and fourth volumes deal with pathology, and the fifth volume is an *Aqrābādihīn*, or a pharmacopoeia of composite drugs. The second book of the *Canon* contains an entry on mercury (*zi’baq*).<sup>70</sup> Interestingly, Ibn Sīnā classifies mercury according to the system of qualities and degrees, describing it as cold and humid in the second degree (*bārid raṭīb fī l-thāniya*).<sup>71</sup> To understand the system of degrees, I consulted *Kitāb al-mā’*, the first medical dictionary in Arabic, written in the eleventh century by a student of Ibn Sīnā, Abū Muḥammad al-Azdī al-Ṣuḥārī (d. 1073).<sup>72</sup> Al-Azdī explains in the entry “*daraja*” (degree):

If a drug is temperate (*mu’tadil*), it will not change the temper of the body (*kayfiyyat al-badan*) if applied internally; a drug in the first degree (*daraja ūlā*) will slightly change the temper of the body, a drug in the second degree (*daraja thāniya*) will cause obvious, but not toxic effects; a drug in the third degree (*daraja thālitha*) will cause toxic effects (*ḍarr*), and in the fourth degree (*daraja rābi’a*) it will be lethal (*qatal*).<sup>73</sup>

Defining mercury as humid in the second degree therefore means that if applied internally, it would cause obvious but not toxic effects. This interpretation concurs with the results of an experiment conducted by al-Rāzī on a monkey. He allowed the monkey to drink metal mercury (*zi’baq ‘abiṭ*) and observed him wriggling and clutching his belly with his hands. He deduced that the metal did not cause much harm if applied internally, despite causing severe pain in the abdomen and intestine; that the metal is excreted from the body without alteration, and that movement accelerates its elimination.<sup>74</sup>

In the chapter on simples, Ibn Sīnā describes three other forms of mercury: vapour of mercury, sublimated and killed mercury.<sup>75</sup> Vapour of mercury (*dukhān al-zi’baq* or *bukhār al-zi’baq*) causes toxic effects such as hemiplegia (*fālij*),

<sup>69</sup> See Ullmann 1970: 152–156.

<sup>70</sup> Ibn Sīnā 1987: I, 493–494.

<sup>71</sup> Ibn Sīnā 1987: I, 493.

<sup>72</sup> Ṣuḥārī 1996: I, 10–14.

<sup>73</sup> Ṣaḥārī 1996: II, 72–73.

<sup>74</sup> Ibn al-Bayṭār 1874: II, 178.

<sup>75</sup> Ibn Sīnā 1987: I, 493–494.

tremors (*ra'sha*), loss of hearing (*yudhhibu l-sama'*) and sight (*yudhhibu l-başar*) and foul breath (*bakhr al-fam*). Reptiles (*hawāmm*) and snakes (*ḥayyāt*) flee from it. Sublimated mercury (*muṣa'ad al-zi'baq*) is astringent (*qābiḍ*) and lethal (*qattāl*). As an antidote, Ibn Sīnā recommends milk (*laban*) and emesis (*qay'*). Interestingly, Ibn Sīnā mentions the term “*muṣa'ad*,” quoting Galen, who claimed that he had not experimented with it. The third derivative is the so-called killed mercury (*zi'baq maqtūl*), the only derivative for which Ibn Sīnā describes medical indications, namely against lice (*qaml*), nits (*ṣībān*), and scabies (*jarab*). It could also be combined with remedies against scabies and ulcerous wounds (*qurūḥ radī'a*). Ibn Sīnā also refutes the opinion that the “killed mercury” is lethal. He uses the term “*maqtūl*” in reference to Paul of Aegina, who mentioned that some apply it internally against ileus. However, Ibn Sīnā does not mention this use in his chapter on ileus in the third volume of the *Canon*.<sup>76</sup>

In the chapter on mercury poisoning, Ibn Sīnā differentiates three kinds of mercury: living, killed and sublimated.<sup>77</sup> The living mercury (*zi'baq ḥayy*) causes no harm to most people if taken internally (*akthar man yashrabuhū lā yataḍarrar bihī*) and is excreted unaltered from the human body. But if it is dropped into the ear, it causes grave symptoms of severe pain (*alam shadīd*), amentia (*ikhtilāṭ 'aql*), spasm (*tashannuj*), and even epilepsy (*ṣar'*) and stroke (*sakta*). In this case, Ibn Sīnā recommends hopping on one foot (*ḥajal 'alā fard rijl*) while leaning the

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<sup>76</sup> Ibn Sīnā 1987: II, 1495–1497. In the edition of al-Qashsh (1987), who used the printed version of Būlāq, many recipes contain a mixture of mercury with herbal oils or resins. Against apoplexy (*sakta*), the oiling of the spine with a mixture of mercury and styrax is recommended. Against a cold temperament of the stomach, we find a recipe for oiling the abdominal region with olibanum, costus oil and mercury. Another substance called mercury oil is injected into the urethra (*iḥlīl*) against the wind of the bladder (*rīḥ fī l-mathāna*), the atony of the bladder (*istirkhā' al-mathāna*) and hypertrophy of the testicles (*'iẓam al-khiṣyatayn*). But all these applications do not fit into the concept of humoral pathology of *contraria contrariis*, since all these diseases are considered to be cold, just as mercury is defined as cold and humid in the second degree. There is also some doubt as to what is meant by the oil of mercury (see Ibn Sīnā 1987: II, 920, 1255, 1566, 1565, 1619.). The problem was caused by the very similar graphic appearance of the words *zi'baq* and *zanbaq*, the latter referring to jasmine oil. This oil was indeed applied for the listed indications, for example against urinal incontinence (*taqṭīr al-bawl*), cold colic (*qūlanj bārid*), against testicle cold tumours (*waram bārid fī l-khiṣya*), penis fissures (*shiqāq*), menstruation disorders (*iḥtibās al-ṭamth*), hernia (*fatq*) and as an aphrodisiac (*muqawī li-l-bāh*) (see Ibn Sīnā 1987: II, 1480, 1578, 1598, 1600, 1601, 1616, 1617, 1622, 1623). Several application forms were used, such as clysters (*yuḥqan fī l-iḥlīl*), vaginal suppositories (*ṣūfa maghmūsa fī l-zinbaq wa yuḥtamal dākhil al-raḥm*), inunctions (*ṭilā'an*), bandages (*ḍimād*) or compresses (*kammāda*) (see Ibn Sīnā 1987: II, 1480, 1578, 1598, 1600, 1601, 1616, 1617, 1622, 1623). A comparison with the edition of *Kitāb al-Qānūn fī l-ṭibb* published in Rome in 1593 reveals the misprints (See Ibn Sīnā (1593): III, 323, 431, 543, 565).

<sup>77</sup> Ibn Sīnā 1987: III, 2086–2087.

head to the side of the corrupted ear so that the fluid metal can flow out through the auditory canal. He does not approve of the method using lead eyeliner (*mīl min al-raṣāṣ*) to bind mercury to it. On the other hand, both sublimated and dead mercury (*zi'baq mayyit*) – the latter probably synonymous with killed mercury (*zi'baq maqtūl*) – have destructive effects, with severe symptoms such as colic (*maghṣ*), volvulus (*iltiwā' am'ā'*), haemorrhage (*mashy al-dam*), stomachache (*thiql al-ma'ida*), swelling of the body (*yarim jismuhū*) and urinary retention (*yaḥtabis bawluhū*). The therapy for poisoning with dead or sublimated mercury is vomiting (*taqyi'a*), drinking myrrh (*murr*) in wine (*sharāb*) or honey water (*mā' al-'asal*), and applying an enema with borax (*yuḥqanu bihī bi-bawraq*). In addition, the abrasion of the intestine (*saḥj al-am'ā'*) requires treatment, and the heart should also be strengthened with the proper remedies.

Like al-Rāzī, Ibn Sīnā also mentions the “dust of mercury” (*turāb al-zi'baq*), which is probably identical with sublimated mercury. It is used as a simple drug against wet dermatophytosis (*su'fa raṭība*),<sup>78</sup> and also as a compound drug against melasma (*kalaf*) in combination with honeydew melon pits (*bizr al-biṭṭikh*), sour cherry (*maḥlab*) and bitter almonds (*lawz murr*).<sup>79</sup>

Killed mercury (*zi'baq maqtūl*) is also indicated for external application against a variety of maladies in the volumes on pathology. Primarily, Ibn Sīnā prescribes it against scabies and pruritus as both a simple and a compound drug, but he advises the application of these remedies far from the region of the stomach and noble organs (e.g. heart, liver and brain).<sup>80</sup> He praises the recipe described by al-Rāzī, but lists fewer ingredients, namely only oleander leaves, litharge and litharge of silver triturated with vinegar and rose oil. The application modality is the same as al-Rāzī's.<sup>81</sup> Two further recipes are described: the first is a mixture of killed mercury with fluid styrax (*may'a sā'ila*) and rose oil (*duhn al-ward*); the second is a mixture with fluid styrax (*may'a sā'ila*), seeds of viola (*bizr al-banafsa*), costus (*qusṭ*), soaproot (*kundus*) and animal glue (*gharā*) mixed with vinegar (*khall*).

In addition to these well-known indications, Ibn Sīnā recommends using killed mercury against hematoma (*dam mayyit*), macula (*bursh*), freckles (*namash*) and melasma (*kalaf*). He extols an “incomparable recipe” (*dawā' jayyid lā yūjad lahū naẓīr*): two drams of killed mercury and three of flour (*ṭaḥīn*) are to be triturated with syrup of bitter almond (*lawz murr murabbā*) until no traces of mercury remain visible and the flour turns black. Finally, the

<sup>78</sup> Ibn Sīnā 1987: III, 2225.

<sup>79</sup> Ibn Sīnā 1987: III, 2211.

<sup>80</sup> Ibn Sīnā 1987: III, 2232; I, 37–39.

<sup>81</sup> Ibn Sīnā 1987: III, 2232.

same amount of triturated melon seeds (*bizr al-biṭṭikh*) is added. For one week, the patient should apply the ointment at night and wash it off the next day.<sup>82</sup> Finally, Ibn Sīnā prescribes killed mercury as a corrosive against fistulas (*nawāsīr*) and warts (*tha'ālīl*).<sup>83</sup> The formula against warts contains killed mercury, lime mortar (*nūra*), arsenic (*zirnīkh*), alkali (*qalī*), ash of oak (*ramād al-ballūṭ*), oil (*zayt*), salt (*milḥ*), onion juice (*mā' al-baṣal*), tassel hyacinth (*bulbūs*) and goat droppings (*ba'r al-mā'iz*).<sup>84</sup>

But what is killed mercury? Fortunately, Ibn Sīnā describes a preparation method for it in the chapter on the therapy of fistulas (*fī 'ilāj al-nawāsīr*).<sup>85</sup> Mercury is killed (*yuqtal*) by mixing it with ammoniac (*nushādar*), arsenic (*zirnīkh*), sulphur (*kibrīt*) and copper rust (*zinjār*). One part of the prepared mercury is mixed with the same amount of iron shavings (*burādat al-ḥadīd*), a half part of lime mortar (*nūra*) and a half of alkali (*qily*). The mixture is then sublimated in Aludel (*uthāl*) or put in a bottle to be dried, as the alchemists do it (*ahl al-ishtighāl bi-hādhā l-bāb*). It sublimates into a salt (*yaṣ'ad ka-l-milḥ*). A fistula (*nāṣūr*) can be corroded with it, but the site must be treated with grease (*samn*) and also with cures against sores (*qurūḥ*). Thus the killed mercury (*zi'baq maqtūl*) is a white corrosive sublimate that must have contained mainly mercuric chloride (HgCl<sub>2</sub>). This result leads to a further unclarity. Since Avicenna mentions sublimated mercury (*zi'baq muṣa'ad*) alongside killed mercury in the very same chapter – i.e. in the chapter on mercury as well as in the chapter on its toxicity – we would expect the two terms to indicate two different derivatives. Since the *Canon* contains no further preparation methods for mercury derivatives, this ambiguity cannot be solved.

All recipes for killed mercury prior to this mention included the term *maqtūl* (the past participle of the verb *qatala*, kill). Hence, all of them must have contained a chemical derivative. On the other hand, Avicenna used the verb *qatala* in combination with vinegar in a recipe against lice and nits: “Take pulverised mustard (*khardal*) und soaproot (*kundus*), douse them with a small amount of vinegar and kill the mercury by trituration (*taqtīlu al-zi'baq saḥqan*).”<sup>86</sup> The verb *qatala* here clearly refers to a physical procedure in which the fluid metal is triturated with the other ingredients. Although a chemical reaction would be possible, resulting in mercury acetate, the mixture would mainly contain the dispersed metal.

<sup>82</sup> Ibn Sīnā 1987: III, 2212.

<sup>83</sup> Ibn Sīnā 1987: III, 2236–2237, 2011.

<sup>84</sup> Ibn Sīnā 1987: III, 2236–2237.

<sup>85</sup> Ibn Sīnā 1987: III, 2011.

<sup>86</sup> Ibn Sīnā 1987: III, 2243.

Examination of the terminology used in the *Canon* indicates that the ambivalence of the expression *zi'baq maqtūl* must be addressed. A sentence like *al-zi'baq al-maqtūl fī may'a sālila* could be correctly understood as “the killed mercury is mixed with styrax.” In this case, the prepared recipe contains a chemical derivative. If the sentence was understood as “the mercury is killed [by mixing it] with fluid styrax” – which is syntactically correct – a remedy would be prepared which contained the dispersed liquid mercury. This ambiguity might have led to a modification in the composition of ointments containing mercury in later medical compendia as discussed below.

Avicenna describes two further recipes containing the liquid metal in addition to that mentioned above against lice and nits. The first is a collyrium or eye salve against leucoma (*bayāḍ*), and the second is an ointment (*marham*) against the Persian fire (*nār fārisī*). Since the first preparation includes heating a mixture of black lead and mercury in wine, mercury acetate must result as a product of the chemical reaction:

Take two drams of black lead (*burādat al-abār*) and one dram of mercury (*zi'baq*), triturate them together, put them in a cane tube (*unbūb qaṣab*) and seal the opening of the tube with dough (*'ajīn*), envelop the whole tube with dough and then with a mixture of mud (*ḥīn*) and hair (*shār*), encase it in sainfoin (*sulūk*), wrap it again with mud and cook it with wine (*khamr*) until it petrifies (*taḥajjar*) and becomes like ceramic (*khazaf*). You take it out of the tube. It becomes like an eyeliner (*ka-l-shiyāf*). Or you take three drams of triturated white litharge (*iqḷimiyā abyāḍ*) and you mix it with the drug and fill it into a new tube and proceed as before. If it petrifies, dry it with papers of flax (*awrāq kattān*) and take one dram of it and half a dram of unperforated pearls (*lu'lu' ghayr mathqūb*) and triturate it thoroughly until it becomes very fine like dust (*ghubār*). You should apply the juice of iris root (*'uṣārat aṣl al-sawsan*) on the eyelid (*ukḥul*) for three days, and after that, apply it alternately with the essence of iris root (*yawman min hādhā al-dawā' wa-yawman min 'uṣārat al-sawsan*).<sup>87</sup>

The second recipe is for a cochineal ointment (*marham marqūn al-qirmiz*), which was applied against Persian fire (*nār fārisī*) and pain of the buttocks (*waja' al-maq'ada*).<sup>88</sup> It contains three drams each of colocynth (*shaḥm al-ḥanzal*), soap-root (*kundus*), moss (*ashnān*) and sulphur (*kibrīt*), six drams each of litharge (*martak*) and collyrium of yellow hornpoppy (*shiyāf māmithā*), twelve drams each of Peganum harmala (*ḥarmal*) and cochineal (*marqūn al-qirmiz* or *dūd al-qirmiz*), ten drams of asphalt (*zift*) and two drams of mercury (*zi'baq*). The cochineal is mixed with oil and applied.<sup>89</sup> The concentration of mercury

<sup>87</sup> Ibn Sīnā 1987: III, 2454.

<sup>88</sup> Ibn Sīnā 1987: III, 2421.

<sup>89</sup> Ibn Sīnā 1987: III, 2421.

amounts to only 3.3 per cent (2 drams in 60). This is a very low concentration compared with the concentration of mercury in the grey salve used against syphilis, which amounts to 30 per cent.<sup>90</sup>

All the above-discussed remedies demonstrate that the applications of mercury were considerably more extensive in the *Canon* of Ibn Sīnā than in the texts translated from Greek, Syriac or Indian sources. Mercury was used against lice, nits, scabies, pruritus, hematoma, macula, freckles, melasma, fistula, pain of the buttocks, and against leucoma and Persian fire. Nevertheless, mercury and its derivatives were applied only externally in the form of ointment, powder, or collyrium. Ibn Sīnā prescribes mainly killed mercury (*zi'baq maqtūl*): six recipes for compound drugs contain it, and it is recommended twice as a simple against scabies and as a corrosive against fistulas. The dust of mercury is also indicated as a simple, and additionally as an ingredient in one recipe against melasma and wet dermatophytosis. On the other hand, Ibn Sīnā, rather exceptionally, describes liquid mercury: in one recipe against lice and nits, and in the cochineal ointment (among numerous ingredients) against Persian fire.<sup>91</sup>

## 8 Transmission of mercury preparations to the western Arabic world and Latin Europe

If we survey the medical compendia discussed above, we can identify two aspects in common: they originated in the east of the Islamic world, and they primarily recommend a chemical derivative of mercury in topical remedies. However, if we turn to the Arabic medical and pharmaceutical texts written in Andalusia, Sicily and the Maghreb, we will notice a shift in the composition of mercury recipes: they contained liquid mercury.

Ibn al-Jazzār (d. 979), who lived in Kairouan, describes a recipe with mercury, burnt lead (*murdāsanj*), vinegar and oil against lice, scabies and pruritus in his pharmacognosy *Kitāb al-I'timād fī l-adwiya al-mufrada*.<sup>92</sup> In his medical book, *Zād al-musāfir wa qūt al-ḥāḍir*, he describes an inunction against scabies, pruritus and ulcers that he praises as a miracle (*innahū 'ajīb*).<sup>93</sup> It contains ten drams of litharge of gold (*martak dhahabī*), three drams each of

<sup>90</sup> See Hunnius 1998: 1423; Eulenburg (1885–1890): XVI, 328.

<sup>91</sup> In his *al-Qānūn fī l-ṭibb*, Ibn Sīnā describes a preparation that contains mercury against Persian fire (see the preparation of cochineal ointment (*marham marqūn al-qirmiz*)).

<sup>92</sup> Ibn al-Jazzār 1985: 176.

<sup>93</sup> Ibn al-Jazzār 1996: 585, 338.

ceruse (*isfidāj al-raṣāṣ*) and white litharge (*iqḷīmiyā al-fiḍḍa*), and two drams each of turmeric (*kurkum*), fluid styrax (*may'a sā'ila*) and mercury. The drugs are triturated, and the mercury is killed (*yumāt*) by mixing (*khalāṭa*) it with styrax and the other ingredients in a mortar.<sup>94</sup> The mixture is beaten with one ounce of rose oil and soured vinegar, and beaten until it foams and becomes a fine ointment. It is applied in the bath (*ḥammām*) and before sleeping.

The physician Abū l-'Alā' Zuhr (d. 1131) of Cordoba describes three recipes for compound drugs with mercury against vitiligo (*bahaq*) in his *Kitāb al-mujarrabāt*.<sup>95</sup> The first contains four drams of mercury, two of soap (*ṣābūn*), three of sour vinegar (*khall ḥādhiq*) and one ounce of rose oil (*duhn al-ward*).<sup>96</sup> The ingredients are finely triturated with mercury in a mortar until finely mixed with mercury (*yud'aku l-jamī' fi l-mihrās na'aman ḥattā yakḥṭaliṭa ma' al-zi'baq na'aman*). The sieved ash of French tamarisk (*ramād al-ṭarfā'*) is added, and everything is well triturated to produce an ointment. The second ointment contains one dram each of yellow sulphur (*kibrīt aṣfar*), shells (*ṣadaḡ*) and indigo (*nīl*), three drams of mercury and as much as is needed of sea squill oxymel (*sharāb sakanjabīn 'unṣulī*).<sup>97</sup> Once the ointment is prepared, it can be stored until needed. Then a piece of it is kneaded with the bile of a goat (*marār al-mā'iz*) and applied to the depigmentations.

The third remedy is prepared in a procedure involving several steps, but Zuhr claims that it cures depigmentations like a miracle (*taf'alu fi'lan 'ajīban*). Three drams each of caber roots (*aṣl al-kabar*), pellitory of Spain (*'āqir qarḥā*), raisin (*zabīb*), soaproot (*kundus*), broadleaved pepperweed (*shīṭaraj*), black hellebore (*kharbaq aswad*) and madder (*fuwwa*) are triturated and soaked in sour vinegar for a day and a night. The mixture is then gently cooked, rubbed and sieved. In the meantime, three drams of yellow sulphur, one and a half drams of verdigris (*zinjār*), two of sea foam (*zabad al-baḥr*) and one and a quarter each of alum (*shabb*) and borax (*bawraq*) are mixed, and ten drams of mercury added to the mixture. Once the drugs have been triturated thoroughly in a mortar, the mixture is transferred to a red copper pot (*āniyat nuḥās aḥmar*) and stirred over a low flame until it burns. It is taken from the fire, doused with the vinegar extract of the herbs, and left overnight. The next day, it is kneaded with henna (*ḥinnā'*). The ointment should be applied, left for one night, and wiped away on the next day.<sup>98</sup>

<sup>94</sup> The term „*qatala*“ (murder) is not used here. See below for a discussion of the terms.

<sup>95</sup> See Ullmann 1970: 162; Zuhr 1994: 109–113.

<sup>96</sup> Zuhr 1994: 113.

<sup>97</sup> Zuhr 1994: 110. Oxymel or *sakanjabīn* is a kind of syrup which contains vinegar and honey (see Ṣaḥārī 1996: II, 280).

<sup>98</sup> Zuhr 1994: 109.

Another scholar from Cordoba, Muḥammad al-Idrīsī (d. 1166), who lived in Sicily at the court of King Roger II, describes a remedy for a compound drug against leprosy (*baraṣ*) in his compendium on simples, *Kitāb al-jāmi‘ li-ṣifāt ashtāt al-nabāt wa-ḍurūb anwā‘ al-mufradāt*.<sup>99</sup> It contains two drams of mercury and three drams each of bitter almond (*lawz murr*) and melon seeds (*bizr baṭṭikh*). These are mixed (*khuliṭa*) and triturated (*saḥaqa*) in a mortar (*hāwin*) until the mixture turns black (*ḥattā yaswadda*).<sup>100</sup>

Among all these remedies written by scholars of the western Arabic world, two aspects emerge distinctly. On the one hand, they contain liquid mercury, mixed with herbal ingredients as a vehicle. Ibn al-Jazzār uses rose oil, vinegar and fluid styrax; Abū l-‘Alā’ Zuhr applies rose oil, vinegar and oxymel (a mixture of honey and vinegar<sup>101</sup>); al-Idrīsī uses oil of bitter almond and melon seeds. Thus, all the recipes contain either vinegar or bitter almond, which contains 30–50 per cent organic oils.<sup>102</sup> It is likely that mercury (II) acetate  $(\text{CH}_3\text{COO})_2\text{Hg}$  is produced in most of these remedies, a substance which is reported to be efficacious against freckles.<sup>103</sup> On the other hand, not one of the authors uses the verb “*qatala*” (to kill) to describe the process of dispersing the mercury. Zuhr employs the verbs *da‘aka* and *ikhṭalaṭa*, meaning “to triturate” and “to mix” respectively; Al-Idrīsī uses the verbs *khalata* and *saḥaqa*, meaning “to mix” and “to triturate”; and Ibn al-Jazzār uses *khalata*, “to mix”, and the verb *amāta*, which means “to murder.” Interestingly, preparations with killed or sublimated mercury are not mentioned in the texts of these authors. It is difficult to identify the reasons for this change. The ambiguity of the term *maqtūl* might have played a role. Another possible reason is the geographical proximity of the mercury mines in the vicinity of Cordoba, Almadén, so that liquid mercury was easily available. For instance, al-Idrīsī claims that metallic mercury only exists in Andalusia.<sup>104</sup>

Further developments in the composition of mercury inunctions occurred in Latin Europe. As Lesky indicates, Matthaeus Secundus Platerius (fl. twelfth century) describes the mortification, i.e. dispersing, of mercury with ash and saliva or with hair and saliva in his *Circa instans*.<sup>105</sup> Later on, mercury was mainly killed with lard, old oil or with vinegar and mustard.<sup>106</sup> The range of

<sup>99</sup> See Ullmann 1970: 277–278; Idrīsī 1995: I, 148–149; II, 206–207.

<sup>100</sup> Idrīsī 1995: I, 149; II, 206.

<sup>101</sup> See Hunnius 1998: 1017.

<sup>102</sup> See Hunnius 1998: 1136.

<sup>103</sup> See Hunnius 1998: 1155.

<sup>104</sup> Idrīsī 1995: I, 149; II, 206.

<sup>105</sup> Lesky 1959: 3176.

<sup>106</sup> Lesky 1959: 3176.

vehicles used to disperse the liquid metal was greatly extended, comprising animal components such as lard and saliva. A further development is related to the application of mercury to a therapeutic schedule, first documented by Teodorico Borgognoni (1205–1298). He used a mercury inunction against leprosy, scabies and gout according to a schedule that comprised three steps: a purgation cure, a mercury inunction on the extremities in warm, temperate rooms, and a sweating cure.<sup>107</sup> The application of the highly concentrated salve in a warm atmosphere must have led the mercury to volatilise due to its low vapour pressure, leading to its absorption by inhalation. With the emergence of syphilis, *unguentum hydrargyri cinereum* or the grey salve was used more frequently following the same regimen. It mainly contained the liquid mercury dispersed in animal grease or vaseline.<sup>108</sup>

For several centuries, the efficacy of the grey salve was subject to intense discussion. The results of some empirical studies were summarised in the entry on mercury in *Real-Encyclopädie der gesammten Heilkunde*.<sup>109</sup> Mercury as a liquid metal cannot cross the intact skin barrier unless it undergoes an oxidation reaction. In ionised form, however, it can cross the membrane cells and react with proteins, leading to symptoms of intoxication. Since mercury has a low vapour pressure, it volatilises easily and can be absorbed by the mucous membranes of the lungs, which possess the ability to convert the metal into oxydyle. Only if the metal is topically applied with a greasy vehicle can it infiltrate the sebaceous glands, hair follicles and openings of the perspiratory glands, where it undergoes an oxidation reaction and can subsequently be absorbed by intact skin. Consequently, mixing the liquid metal with greasy lard or vaseline elevates the absorption of mercury and leads to a more effective, or toxic, formula.

## 9 Mercury as an antisyphilitic

The beginnings of syphilis in Egypt are documented by the historian Ibn Iyās (d. 1524) in his chronicle *Badā'i' al-zuhūr fī waqā'i' al-duhūr*.<sup>110</sup> In his first entry dated July 1498, he mentions a new lethal disease under the name “pustule of the Franks” (*ḥabb ifranjī*) and says that it began to spread at the beginning of the

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107 Lesky 1959: 3177.

108 Eulenburg (1885–1890): XVI, 328.

109 Eulenburg (1885–1890): XVI, 314–315.

110 Spies 1968: 382–384.

ninth century after the Hijra (i.e. from 1495), thus in parallel to its increased transmission in France. Ibn Iyās also describes the severity of the disease, and the helplessness of physicians, in two further entries from the years 1500 and 1515. However, the first mention of this disease in a medical compilation written in Arabic does not appear until about one hundred years later, in a compendium by Dāwūd al-Anṭākī (d. 1599). This might be due to our currently limited knowledge of medical works written in Arabic in the modern age. On the other hand, several medical works written in Persian mention syphilis, and describe remedies containing mercury or its derivatives.<sup>111</sup> Since physicians in the Ottoman empire were part of an elite of educated scholars proficient in the three languages of Arabic, Persian and Turkish, medical books written in Persian were probably accessible to physicians practising in many parts of the Ottoman empire.<sup>112</sup>

The therapies prescribed by Dāwūd al-Anṭākī reflect knowledge of both European and Eastern approaches to syphilis treatment. As syphilis became widespread, three forms of treatment with mercury emerged: topical treatment, fumigation and internal use. The topical treatment was developed in Europe and included the application of *unguentum cinereum* in a warm closed atmosphere after purgation.<sup>113</sup> Fumigation therapies with cinnabar were also used in Europe in the sixteenth century:<sup>114</sup> The naked patient was enclosed in a barrel-like appliance and the vapours of mercury ascended from a pan with glowing coal and cinnabar. This method, which was only applied in cases of inveterate syphilis, was prescribed by several physicians such as Giovanni da Vigo (1466–1520), the personal physician of pope Julius II, the Venetian Niccolo Massa (d. 1569), Gabriele Falloppio (1523–1562) and by Andrea Mattioli (1500–1577). Conspicuously, all these physicians are Italian. On the other hand, fumigation therapy was described as early as 1511 by the Persian physician Mujīb Yūsufi b. Muḥammad b. Yūsuf in his medical compendium *Tibb-i Yūsufi*.<sup>115</sup> Thus, fumigation therapy might have been introduced into the Ottoman empire from Persia and after that, as a consequence of flourishing relations with Italy, into Europe, where it was further refined using a barrel-like appliance.

<sup>111</sup> For a detailed recipe, see the contribution of Johannes Thomann in this volume.

<sup>112</sup> See Shefer-Mossensohn 2009: 185–187.

<sup>113</sup> A variety of recipes which were collected by Dr Hartmann Schedel were edited by Sudhoff (Sudhoff, 1912: 61–79). They reflect the practices applied to treat syphilis at the turn of the fifteenth to the sixteenth century, not only in Germany but also in Europe, since he collected recipes that originated in France and Italy.

<sup>114</sup> Lesky 1959: 3179.

<sup>115</sup> Yūsufi 2010: 78; The detailed recipe is given in the contribution of Johannes Thomann in this volume.

The internal application of mercury was prescribed both in ayurvedic and in Persian medicine in the sixteenth century. Several Persian physicians prescribed mercury as pills or an electuary.<sup>116</sup> Bahā' al-Dawla describes an electuarium of mercury (*ma'jūn-i sīmāb*) containing the liquid metal in his medical compendium *Khulāṣat al-tajārib*, written in 1501.<sup>117</sup> In 1511, al-Yūsufi describes a recipe for a mercury pill (*habb-i sīmāb*) which contains liquid mercury in his *Ṭibb-terpi Yūsufi*.<sup>118</sup> In 1569, 'Imād al-Dīn Maḥmūd b. Mas'ūd b. Maḥmūd al-Ṭabīb compiled a treatise on syphilis, the *Risālat-i ātishāk*, which was translated into Arabic.<sup>119</sup> He mentions several recipes for pills with mercury, or with mercury combined with the sublimated derivative *sulaymānī*, or with mercury combined with killed mercury.<sup>120</sup>

The recipes for the mercury pills are likely to have been adopted from Indian sources, as mercury was used internally in ayurvedic medicine. Extensive contact between Persia and India must have promoted the transfer of medical knowledge from India to Persia and from there to the rest of the Islamic world. 'Imād al-Dīn, for example, travelled to Khorasan, Baghdad, Constantinople and Egypt in pursuit of knowledge, a journey that lasted ten years from 1546 to 1556.<sup>121</sup> He indicates that the pill prescribed by Bahā' al-Dawla was used in Constantinople, in Europe, in India and in other places, thus giving an impression of the international spread of recipes against syphilis.<sup>122</sup> 'Imād al-Dīn occasionally indicates the inventor of the recipes. He describes a paste that is a European prescription (*az ḥukamā-yi firang manqūl-ast*)<sup>123</sup> and a pill taken against syphilis that was used by Europeans (*habb-i zībaq ki firang isti'māl kunand*).<sup>124</sup> Thus, the internal use of mercury as pills did not originate in Europe, or 'Imād al-Dīn would have used the attribute "European" to describe the pills as he does in the case of the paste. In addition, 'Imād al-Dīn comments in his treatise on syphilis that Bahā' al-Dawla "has composed a work and

**116** See the contribution of Dagmar Wujastyk and Johannes Thomann in this volume.

**117** Bahā' al-Dawla 2008: 300; Elgood 1931: 484; see the contribution of Johannes Thomann in this volume.

**118** Yūsufi 2010: 77; see the contribution of Johannes Thomann in this volume.

**119** Elgood 1931: 476–478; Serjeant 1965: 247–248.

**120** Elgood 1931: 476–478; 'Imād al-Dīn 1569: 26–28.

**121** Elgood 1931: 466.

**122** Elgood 1931: 484. The pages 43 and 44 are missed in Majlis 6307.

**123** Elgood 1931: 477; 'Imād al-Dīn 1569: 26.

**124** 'Imād al-Dīn 1569: 28; Elgood 1931: 478 whereas Elgood translates this sentence with "An European Prescription for Atishak" which is obviously wrong. I would like to thank Dr Hamid Hosrawi for his help with the Persian.

collected therein the sayings of some of the Greek and experienced Indian physicians.”<sup>125</sup> Since, unlike the Indian physicians, the Greek authors did not use mercury as a medicine, Bahā’ al-Dawla may have adopted his recipes involving the internal application of mercury from ayurvedic medicine.<sup>126</sup>

On the other hand, the first mercury pills in use in Europe were the so-called *pillulae Barbarossae*.<sup>127</sup> Barbarossa (1466–1546) or Khayr al-Dīn Pāshā, the famous Turkish corsair and grand admiral of the Ottoman fleet who assumed the role of intermediary between Francis I and Süleymān, gave the recipe to the King of France, who was himself syphilitic.<sup>128</sup> Lesky suggests that the pills were composed of raw mercury, flour and laxatives.<sup>129</sup> In another version, they were composed of mercury, flour and turpentine.<sup>130</sup> These were occasionally used until the nineteenth century, as reported by Kraus, a physician and specialist in venereal diseases. He indicates that the pills were composed of mercury, rose conserve and the juice of liquorice (with six grains containing one grain of mercury).<sup>131</sup> Wherever the corsair obtained the recipe, it originated from the East, or the physician at the court of Francis I would have been familiar with it.

## 10 Mercury in *al-Tadhkira* of Dāwūd al-Anṭākī

Before we turn to the third phase in the translation and reception of medical knowledge from Latin into Arabic, we shall return to the works of Dāwūd al-Anṭākī. The work of this author has not yet been the subject of much research, and it is still unknown to what extent he was acquainted with Western medical concepts.<sup>132</sup> Al-Anṭākī originated from Antioch and undertook educational journeys to Mecca, Damascus and Egypt, where he worked at the hospital Bīmāristān Qalāwūn in Cairo. He authored an influential medical compendium,

**125** Elgood 1931: 466.

**126** A further piece of evidence for the increased contact between India and Persia is a translated medical compendium of the sixteenth century. Bhūwah b. Khawāṣṣ Khān compiled an extensive medical compendium in Persian called Ma’dīn al-shifā-i Sikandarshāhī. This work was based on Sanskrit medical works such as Carakasamhitā, Suśrutasamhitā and Jātūkarna (Ullmann 1970: 106).

**127** Lesky 1959: 3183; Voigtels 1817: IV, 277.

**128** See Lesky 1959: 3183; Galotta 2012: EI, 2. Ed.

**129** Lesky 1959: 3183.

**130** Voigtels 1817: IV, 277.

**131** Kraus 1872: 38.

**132** İhsanoğlu 2008: I, 197; Ullmann 1970: 181–182.

*Tadhkirat ūlī l-albāb wa-l-jāmi‘ li-l-‘ajab al-‘ujāb* (Memorandum book for those who have understanding and collection of wondrous marvels).<sup>133</sup>

The *Memorandum* contains an entry on mercury (*zi’baq*) in the section on simples, and this is mentioned also in the chapters on syphilis and on pills.<sup>134</sup> Mercury is classified as cold in the second degree and humid in the third degree. Two kinds of mercury are differentiated: the oriental sublimate (*al-sharqī minhu al-muṣa‘‘ad*) and the occidental ore (*gharbī khām*). Among the indications are ulcers (*qurūḥ*), scabies (*jarab*), pruritus (*ḥakka*), syphilis (*ḥabb ifranjī*) and Persian fire (*nār fārisī*). It is applied externally as an ointment and through fumigation, and internally in the form of pills.

Externally, al-Anṭākī recommends a recipe against syphilis and Persian fire as used in the hospital (*bīmāristān*) in Cairo that contains the liquid metal and uses the same regimen described above by European physicians. After the patient’s body is purged, the patient is oiled with a mixture of mercury, olibanum (*kandar*), resina laricis (*rātīnaj*), beeswax (*sham‘*) and oil (*zayt*), then kept covered for a full week, during which time he may not eat salty or otherwise intemperate food. The oiling must be repeated three times a week. Alternatively, it might be sufficient to oil only the neck and the extremities. The patient will be cured after showing symptoms such as joint pain (*waja‘ mafāṣil*), swelling of the pharynx (*waram fī l-ḥalq*), loss of teeth (*fasād al-famm*) and drooling (*riq yajrī*).<sup>135</sup>

Al-Anṭākī describes further recipes for external application against scabies, pruritus and lice. He describes a mixture of mercury, henna (*ḥinnā‘*) and oil, which was to be applied in the warmth of the bath (*ḥammām*).<sup>136</sup> He also indicates that the amalgam of mercury and silver can be applied externally against ulcers (*awrām*) and against haemorrhoid inflammation (*bawāsīr*).<sup>137</sup>

Fumigation is also described by al-Anṭākī. The recipe contains mercury with serpent skin (*salkh al-ḥayya*) and cones of the Mediterranean cypress (*jawz al-sarw*). He indicates that teeth, ears and eyes should be protected during fumigation so that they will not be damaged.<sup>138</sup> In addition, al-Anṭākī recommends patients to wear a wool thread soaked in mercury around the throat. This, if we dismiss the magic concepts that might be involved, is probably a simple form of fumigation therapy.<sup>139</sup>

<sup>133</sup> Ullmann 1970: 181–182.

<sup>134</sup> Anṭākī (s. a.) : I, 117, 184; II., 81; III, 48–49.

<sup>135</sup> Anṭākī (s. a.): I, 184; III, 48–49.

<sup>136</sup> Anṭākī (s. a.): I, 184.

<sup>137</sup> Anṭākī (s. a.): I, 250.

<sup>138</sup> Anṭākī (s. a.): I, 184.

<sup>139</sup> Anṭākī (s. a.): I, 184.

Internally, al-Anṭākī describes three recipes for pills. He explains that mercury only has a lethal effect when applied internally if it is fixed, for example by sublimation. Hence, for internal application he recommends that pills should be made with the liquid metal as follows:

Take a fourth part of musk (*misk*) and amber (*'anbar*), a half part of mercury, a full part of opium (*afyūn*) and one and a half parts of scammony (*saqamūniyā*). Euphorbia (*farbiyūn*) may be added. Then you add rose oil and wheat flour (*daqīq al-ḥiṅṭa*) and knead everything to produce pills.<sup>140</sup>

In the chapter on pills, he describes another kind of pill which was also in use in the hospital in Cairo against Persian fire, syphilis, chancroid (*ākīla*) and other persistent types of ulcers (*qurūḥ*). It was composed of mercury, sulphur with sublimated mercury (*sulaymānī*), turpeth (*tarbadh*), senna (*sanā*), black mustard (*khardall aswad*), olibanum (*kandar*), tragacanth (*kuthayrā*) and greater celandine (*'urūq ṣufr*).<sup>141</sup>

The third pill contains only sublimated mercury or the so-called *sulaymānī*. However, al-Anṭākī warns against the internal application of mercury in the form of chickpea-like pills taken against Persian fire and syphilis. These were composed of wheat flour, turmeric (*kurkum*), sulphur, olibanum (*lubān*) and sublimated mercury (*sulaymānī*). Smearing the extremities with such a mixture would be dangerous as well. Nevertheless, those of very strong constitution could benefit from this drug.<sup>142</sup>

Al-Anṭākī prescribes the composition and preparation of the mercury derivative called *sulaymānī* in an entry devoted to this subject in the sections on simples in the *Memorandum*.<sup>143</sup> This drug, which is also known as *salmānī* or as *dawā' al-sha'ath* (drug against skin patches) because it removes melasma (*āthār*), was imported from Venice (*yujlab min a'māl al-Bunduqiyya*). Nevertheless, al-Anṭākī explains its preparation method: one rotle of good mercury and one ounce of white arsenic (*rahj* or *samm al-fa'r*)<sup>144</sup> are well triturated, mixed and sublimated. It seems that there were many sorts of *sulaymānī*, as al-Anṭākī indicates that the best sort is the stable fresh white one (*razīn ḥadīth abyad*). Furthermore, he mentions two classifications for *sulaymānī* according to the degree system: it is hot in the second degree and dry in the third degree, or it is hot and dry in the fourth degree. Al-Anṭākī lists several therapeutic

140 Anṭākī (s. a.): I, 184.

141 Anṭākī (s. a.): I, 117.

142 Anṭākī (s. a.): II, 48–49.

143 Anṭākī (s. a.): I, 198.

144 This method was mentioned by B. R. Sanguinetti, who explains that *samm al-fa'r* (the poison of mice) is white arsenic oxide (see Sanguinetti, 1866: 110).

indications: it heals wounds on the same day and corrodes warts, haemorrhoids and all sorts of melasmas if applied externally, causing, however, insufferable pain. It can be applied internally to dry ulcers (*qurūḥ*), phlegmatic knots (*uqad balghamiyya*) and bleeding abscesses (*khurrāj nāzif*), but such an application is very dangerous. Concerning the toxicity of *sulaymānī*, al-Anṭākī indicates that it is a lethal poison, causing hoarseness (*buhūḥa*), obstruction of the oesophagus (*inṭibāq al-marī*) and anorexia (*suqūṭ al-shahwā*).

Al-Anṭākī does not, however, explain the origin of the term *sulaymānī*. The term *sukkar sulaymānī* was used by many pharmacologists to indicate a special sort of sugar.<sup>145</sup> As al-Anṭākī describes it, it is a kind of highly refined cane sugar. The canes are pared, cut and pressed, the juice is cooked until it becomes viscous and put in a huge jar for sedimentation for one week, then the jar is broken and the contents cooked again and poured through many filters. This refined product is called *sulaymānī*.<sup>146</sup> “Sulaymānī” is the arabised version of the name Solomon with the nisba suffix, hence the adjective means “the sugar of Solomon,” but the origin and cause of this relation are unclear. The other problem consists in the use of the term *sulaymānī* for sublimated mercury. It is possible that the two substances showed similarities in physical appearance. Dozy proposes another possibility, explaining *sulaymānī* as a deformation of the word “sublimatum.”<sup>147</sup>

## 11 Mercury in translations from Latin in the seventeenth century

In the sixteenth century, new and revolutionary medical concepts emerged in Europe. The new doctrine, or *nova medicina*, was attributed to the Swiss-German physician Theophrastus Philippus Aureolus Bombastus von Hohenheim (c. 1493–1542), better known as Paracelsus. Paracelsus used alchemical remedies in his therapy that included mercury and antimony derivatives, and applied them internally. At the turn of the sixteenth to the seventeenth century, iatrochemical remedies were further developed by his followers, such as Oswaldus Crollius (c. 1560–1608), and they were proved efficacious in healing some diseases. The alchemical remedies became an integral part of the remedy repertoire used by Paracelsists and by Galenists as well. The age of iatrochemistry in Europe had begun.<sup>148</sup>

<sup>145</sup> See for example Ibn Sīnā (1987): 1225, 1646, 2249.

<sup>146</sup> Anṭākī (s. a.): I, 194.

<sup>147</sup> Dozy (1929): s. v. *sulaymānī*.

<sup>148</sup> Friedrich/Müller-Jahncke 2005: 285–325.

In the second half of the seventeenth century the court physician Ibn Sallūm al-Ḥalabī (d. 1669) encouraged the adoption of Western medical knowledge from Latin compendia. Ibn Sallūm was born in Aleppo, where he studied the sciences (*‘ulūm*), especially medicine, and worked as a physician at the hospital (*dār al-shifā’*) of Aleppo. In 1654, he came to Istanbul in the retinue of the governor of Aleppo, İbşir Mustafa Paşa, staying for the remainder of his life. After serving as a senior physician at the hospital of Sultan Mehmed II, he entered the ranks of the royal court physician and in 1656 was appointed imperial chief physician (*ḥekimbaşı*). He died in 1669 in Yenişehir, Thessaly.<sup>149</sup>

Several works are attributed to Ibn Sallūm, but the only book whose author is demonstrably the chief physician himself is *Ghāyat al-bayān fī tadbīr badan al-insān* (The clearest explication of treatment of the human body), written in Ottoman Turkish. Ibn Sallūm compiled this work during his tenure as *ḥekimbaşı* in 1664 on orders from Sultan Mehmed IV (r. 1648–1687).<sup>150</sup> In the chapter on syphilis, Ibn Sallūm refers to treatments involving mercury in the form of pills, an inunction or ointment, or an inhalation. However, he warns of its risks, indicating that these treatments should only be applied under a physician’s supervision; he intentionally keeps quiet about matters of detail (*terk eyleyüb yazmadıq*) and does not prescribe any recipes containing mercury.<sup>151</sup> *Ghāyat al-bayān* was translated twice into Arabic, by Muḥammad al-Rayyis al-Ghazzī (d. 1718) and by Muḥammad b. Sharīf al-Ḥalabī in 1843.<sup>152</sup> However, a comparison of the chapter on syphilis in the Arabic edition with the Ottoman original, MS Köprülü 1/975, reveals that Ibn Sallūm’s caution was omitted and that some recipes containing mercury in the form of pillulae, fumigations and inunctions were added.<sup>153</sup> All of them were taken from *Ghāyat al-itqān fī tadbīr badan al-insān*, a medical encyclopaedia in Arabic which was attributed to Ibn Sallūm.<sup>154</sup>

Many medical works adopted from Latin were attributed to Ibn Sallūm.<sup>155</sup> In fact, he merely initiated and promoted these translations in his capacity as chief physician.<sup>156</sup> Among these books are Daniel Sennert’s (1572–1637) *Practicae medicinae, Institutionum medicinae, De febribus, De arthritide and De scorbuto*,

**149** Bachour 2012: 36–43.

**150** Bachour 2012: 66–71.

**151** See Ibn Sallūm 1664: fol. 283v, 11.

**152** Ibn Sallūm 2013: 16.

**153** Compare the Ottoman version of *Ghāyat al-bayān fī tadbīr badan al-insān* in Ibn Sallūm 1664: fol. 281v, 13–283v, 11 with the edited Arabic translation in Ibn Sallūm 2013: 868–875.

**154** Compare the edited Arabic translation with the chapter on syphilis in *Ghāyat al-Itqān fī tadbīr badan al-insān* fol. 281v, 18–284v, 16.

**155** Bachour 2012: graphik 3, 5.

**156** Bachour 2012: 49–50.

Johann Jacob Wecker's (1528–1586) *Antidotarium generale et speciale* and Oswaldus Crollius's (1560–1608) *Basilica Chymica*. The Arabic compendia were cut-and-paste products which included sections from several Latin works combined into complementary works. All of them included recipes including mercury or its derivatives. *Al-ṭibb al-kīmiyā'ī al-jadīd* (The New Medical Chemistry) in particular must have played a very important role by introducing iatrochemistry into the Ottoman empire, because it describes chemical preparation methods for mercury derivatives. I will now summarise the mercury dosage forms and recipes which were introduced to the Arabic reader through these adaptations:

- Recipes for grey salve (*marham*): In *Ghāyat al-itqān* we find a recipe for mercury which is “killed” with vinegar of sea squill (*khall al-‘unṣul*) and mixed with olibanum (*kandar*), ceruse (*isfīdā*) and lard (*shaḥm al-khinzīr*).<sup>157</sup> In another recipe, mercury is mixed with turpentine (*ṣamgh al-buṭm*), ceruse, mastic and lard.<sup>158</sup> Since lard is a product of pigs, it is doubtful whether this vehicle was acceptable to Muslim physicians or patients.
- Recipes for pills (*ḥabb*) including mercury or killed mercury: The chapter on syphilis in *Ghāyat al-itqān* contains two recipes with liquid mercury (*zi'baq*) and one with killed mercury (*zi'baq maqtūl*).<sup>159</sup> In *Tarjamat al-aqrābādhīn al-jadīd* we find another recipe with the metal as an ingredient: 10 drams of rhubarb (*rāwand*), three drams of scammony (*saqamūniyā*), six drams of mercury washed with citrus juice (*mā' al-laymūn*), two drams of wheat flour (*daqīq ḥinṭa*) and one dram of musk (*misk*). The mixture is formed into pills the size of chickpeas so that five of them weigh one dram. They are coated with gold leaves (*yudhahhab bi-waraq al-dhahab*) and one pill every day for 30 days is applied until salivation occurs. Then the patient should drink the water of fennel (*mā' rāziyan*) and wash his mouth.<sup>160</sup>
- A recipe for a mercury dressing (*ḍimād*): It is described in *Tarjamat al-aqrābādhīn al-jadīd* and contains asafoetida (*ushaq*), sweet myrrh (*jāwashīr*), rose [oil] (*ward*), gum Arabic (*ṣamgh ‘arabī*), field bindweed (*liblāb*), one and a half ounces each of chicken fat (*shaḥm dajāja*) and goose fat (*shaḥm iwazz*), one ounce of marrow of a cow shank (*mukhkh sāq al-baqar*), two drams each of labdanum (*lādan*) and styrax (*iṣṭirāk*), three drams each of colchicum (*sawranjān*), iris (*irsā*), one dram of cinnabar (*zunjufur*), six drams of mercury (*zībaq*) and iris oil (*duhn al-sawsan*),

<sup>157</sup> Ibn Sallūm 1722: fol. 59r, 10–14.

<sup>158</sup> Ibn Sallūm 1722: fol. 283v, 1–2.

<sup>159</sup> See Ibn Sallūm 1722: fol. 284r, 6, 16; fol. 284v, 2.

<sup>160</sup> Ibn Sallūm 1681: fol. 26v, 1–7.

turpentine (*tarmantīn*), gum of terebinth (*'ilk al-buṭm*), and wax (*sham'*) as necessary.<sup>161</sup>

- Recipes for fumigations (*bukhūr*): In *Ghāyat al-itqān*, cinnabar was used in fumigation with other incense, sometimes also with *sulaymānī* (*mercurius praecipitatus albus*).<sup>162</sup>
- Recipes for aqueous solutions (*mā'*) or decoctions (*maṭbūkh*): The chapter on syphilis in *Ghāyat al-itqān* contains two recipes for a mixture of *sulaymānī* and alum (*shabb*) dissolved in aqua of plantain (*mā' lisān al-ḥamal*), of roses (*mā' al-ward*) and of lemon (*mā' al-laymūn*).<sup>163</sup> *Sulaymānī* is also prescribed against fistulas (*nawāsīr*) in a decoction with aqua of plantain and roses.<sup>164</sup>

The preparation of several mercury derivatives is described in the translated compilations as well. These are:

- *Mercurius sublimatus rubeus non-corrosivus* or the so-called *arcanum corallinum Paracelsi*: This is translated as *zi'baq marjānī ḥulw* (sweet coralline mercury) in *al-Ṭibb al-kīmiyā'ī al-jadīd*,<sup>165</sup> chemically known as mercury (II) oxide (HgO). Heating purified mercury with saltpetre (KNO<sub>3</sub>), vitriol (X<sub>2</sub>SO<sub>4</sub>) and distilled vinegar (CH<sub>3</sub>COOH) results in a red and yellow sublimate. This is heated again with saltpetre (KNO<sub>3</sub>) and alum (Al<sub>2</sub>O<sub>3</sub>). The red and yellow sublimate is collected, and the yellow sublimate is transformed into red mercury (II) oxide by heating.<sup>166</sup> This was used internally against dropsy (*istisqā'*) and syphilis (*ḥabb ifranjī*).<sup>167</sup>
- *Mercurius sublimatus*: This was translated as *zi'baq muṣa'ad* in *al-Ṭibb al-kīmiyā'ī al-jadīd*. It is prepared by heating the raw sublimated mercury with equal amounts of spirit of vitriol (H<sub>2</sub>SO<sub>4</sub>) and spirit of saltpetre (HNO<sub>3</sub>), distilling the spirits from it and sublimating the residue by heating.<sup>168</sup> The raw sublimate was prepared, as far the general sublimation method indicates, by mixing it with salt (*milḥ*) and sand (*raml*).<sup>169</sup> The method seems to be a purification of the sublimated mercury, which is in its pure form a white crystalline powder and must be mainly composed of mercuric

161 Ibn Sallūm 1681: fol. 36r, 18-f01.36v. 2.

162 Ibn Sallūm 1722: fol. 283v, 12–18.

163 Ibn Sallūm 1722: fol. 283v, 24-fol. 284 r, 1–3.

164 Ibn Sallūm 1722: fol. 290v, 9–11.

165 Bachour 2012: 193.

166 Bachour 2012: 193; Ibn Sallūm (1676b): fol. 34v, 19-fol. 35r, 8.

167 Ibn Sallūm 1676b: fol. 35r, 8.

168 Bachour 2012: 193; Ibn Sallūm (1676b): fol. 35r, 8–10.

169 Ibn Sallūm (1676a): fol. 23r, 8.

chloride ( $\text{HgCl}_2$ ).<sup>170</sup> This was recommended as a purgative and, like the previous derivative *zi'baq marjānī ḥulw*, was also used internally against dropsy and syphilis.<sup>171</sup>

- *Turpetum minerale*: *al-Ṭibb al-kīmiyā'ī al-jadīd* describes the preparation of *tarbadh ma'danī*. Alkaline mercury (II) sulphate ( $\text{HgSO}_4 \cdot 2\text{HgO}$ ) is prepared by heating mercury with sulphuric acid until fumes are emitted. Subsequently, it must be washed with hot water. The resulting *turpetum minerale* can be used internally to treat dropsy, syphilis, gout, pneumonia, scabies and mange, fever and as an antidote.<sup>172</sup> A similar recipe is also described in *Tarjamat al-aqrābādhīn al-jadīd* under the heading “calcination of mercury” (*taklīs al-zi'baq*).<sup>173</sup>
- *Terra foliata mercurialis*: A preparation method for this derivative is described in *al-Kīmiyā' al-malakiyya*. Purified mercury is mixed with sublimated mercury ( $\text{HgCl}_2$ ), doused with distilled vinegar ( $\text{CH}_3\text{COOH}$ ), and left for maceration. Ultimately, a white powder precipitates consisting mainly of mercury (II) acetate ( $\text{Hg}(\text{CH}_3\text{COO})_2$ ), which was used for external application to remove melasma and mange.<sup>174</sup>
- Another preparation of mercury is described in *Ghāyat al-itqān* that is synthesised by distillation of tartaric oil (*duhn ṭarṭīr*) with mercury. It was used externally against impetigo (*qūbā'*).<sup>175</sup>
- Another mercury derivative which is called the oil of mercury (*duhn al-zi'baq*) is described in *al-Ṭibb al-kīmiyā'ī al-jadīd*.<sup>176</sup> It is prepared by mixing pure mercury with vitriol (*zāj*), saltpetre (*bārūd*) and alum (*shabb*) and finally distilling the mixture. The distillate is washed with spirits (*'araq*) and distilled again. A milky liquid, the oil of mercury, is obtained which is used internally to cure chancre of kidneys and bladder.

But did Ottoman physicians apply these mercury recipes in the treatment of their patients? Did they synthesise the mercury derivatives whose preparation methods had become accessible in Arabic and were described in very clear language? These questions represent an interesting line of further research that could be addressed if purchase lists or notebooks of pharmacists or physicians are found and evaluated.

**170** See Bachour 2012: 178–179.

**171** Ibn Sallūm (1676b): fol. 35r, 11–12.

**172** Bachour 2012: 193–194; see Ibn Sallūm (1676b): fol. 34r, 2-fol. 34v, 18.

**173** Ibn Sallūm 1681: fol. 54r, 21–fol. 54v, 5.

**174** Bachour (2012): 194; Ibn Sallūm (1676b): fol. 52r, 12–18.

**175** Ibn Sallūm (1676b): fol. 278v, 7–9.

**176** Ibn Sallūm (1676a): fol. 31r, 15–20.

## 12 Conclusion

This study has examined the medical indications of mercury and its derivatives in influential Arabic compendia from the eighth to the eighteenth century, and has traced its transmission through the various cultures with which Arabic medicine came into contact.

The Arabic translations of Galen and Dioscorides do not describe any medical uses of mercury or its derivatives for humans. However, Paul of Aegina mentions that some of his contemporaries used a burnt modification of mercury. In the eighth century, the external use of so-called killed mercury and dust of mercury is documented. This development may be due to contact with Indian medicine. Avicenna and Rhazes extended the indications for externally used remedies containing killed mercury or the dust of mercury. The composition of mercury ointments, however, underwent a change in the writings of authors in the western parts of the Muslim world during the eleventh and twelfth century. Their formulas contain liquid mercury, triturated with a herbal greasy vehicle containing mainly vinegar and rose oil. With the spread of syphilis in the late fifteenth century, new recipes with mercury were introduced into Arabic medicine. These are documented by Dāwūd al-Anṭākī, a scholar of the second half of sixteenth century. He describes new kinds of applications: ointments, fumigations or pills, including mercury as well as sublimated mercury (*sulaymānī*) or an amalgam with silver. These remedies were probably adopted from Persia and India as well as from Europe. In the seventeenth century, the translations of Latin works commissioned by Ibn Sallūm al-Ḥalabī introduced many iatrochemical recipes into Arabic and Ottoman medicine that could have had a huge impact on medical practice in the Ottoman empire. Its actual repercussions on medical practice, however, can only be appreciated on the basis of pertinent source material.

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