Chapter 2

Setting the Scene: Poison and Potency

> *Desire, hatred, and ignorance, these are the three worldly poisons. The victorious Buddha does not have poisons. The authentic Buddha conquers poisons*[22] *(Tibetan Saying).*
>
> *Mercury has great potential. They call it* pārada *[in Sanskrit].* [...] *a person who has suffering also has the potential to liberate himself from suffering. Mercury has many poisons* [...] *some have to be washed away and some have to be bound, and tamed. Then the potential comes out and then it is "liberated mercury,"* dröl (sgrol) pārada*; we say "mercury, the king of* rasāyana*,"* (dngul chu bcud kyi rgyal po)*. If you have a little bit of* chü [rasāyana] *inside your body, then you do not attract disease* [...]*. Ju Mipam says if you have some* ngülchu *inside your body your elements will be shiny. He refers to the tamed* ngülchu *(Gen Rinpoche Rakdo Lobsang Tenzin [Rakdo Rinpoche], Dean of the Sowa Rigpa Department, CIHTS, Sarnath).*[23]

Taming substances and the origin myth of poisons

Tibetan notions of mercury as both a poison and a potent substance are often anchored in Indic myths about the churning of the milky ocean, the creating of the universe along with good and evil, antidotes and poisons, and the idea that the strongest poison can also become the best elixir. Tibetan medical texts—for example, the seventeenth century *Blue Beryl (Bai ḍūrya sngon po)* commentary by Dési Sangyé Gyatso (1653–1705)—frequently include an origin myth of poison. This myth is also depicted on the related medical scroll painting (Fig. 10), which illustrates the chapters on poisons in the *Four Treatises*, the fundamental Tibetan medical work which was compiled by Yutok Yönten Gönpo (fl. twelfth century) and his students in the twelfth and thirteenth century (McGrath 2017a, 296).[24]

22 Translated from Jampa Trinlé and Tseten Jigme (2006, 778 / 10–11): *'dod chags zhe sdang gti mug gsum/ 'di dag 'jig rten dug gsum ste/ bcom ldan sangs rgyas dug mi mnga'/ sangs rgyas bden pas dug bcom mo/.*

23 Interview, Sarnath, March 16, 2015.

24 For the Tibetan version of the *Four Treatises* see, for example, Yutok Yönten Gönpo (1982). For recent publications on the history, content, and commentaries of the *Four Treatises* see Gyatso (2015), McGrath (2017b), and Yang Ga (2010,

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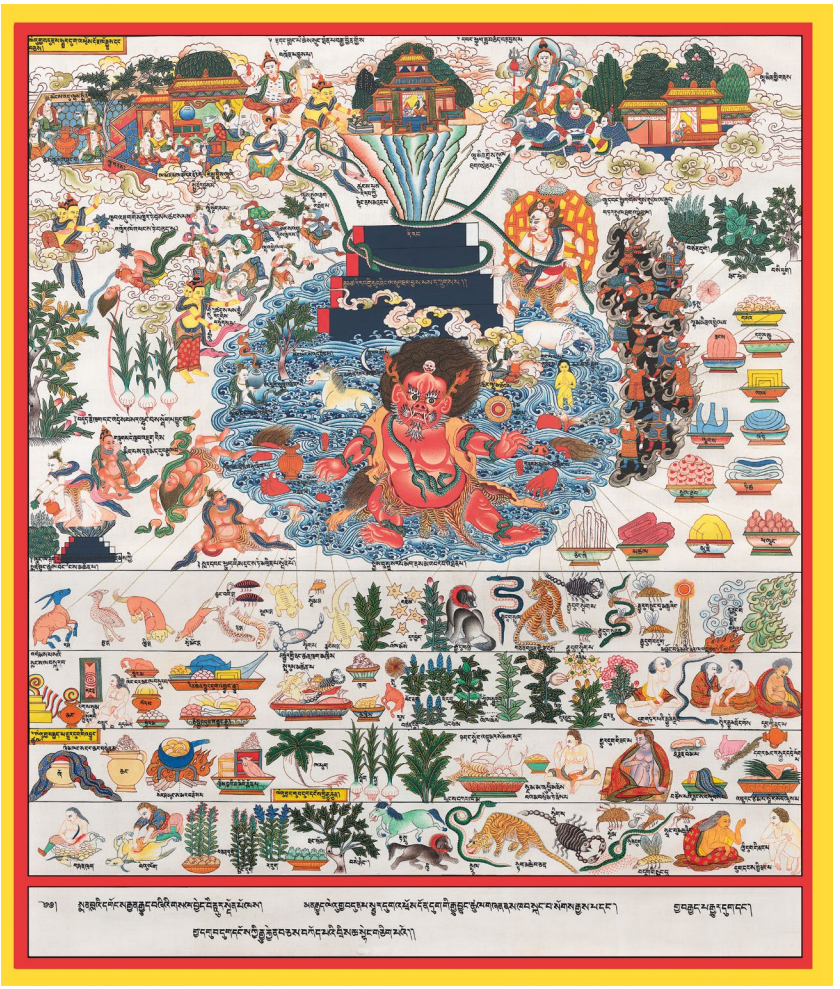

Figure 10: This Tibetan medical thangka illustrates the chapters on poisons from the *Four Treatises* and its *Blue Beryl* commentary. Photo: Scroll paintings created by Dharmapala Thangka Center, School of Thangka Painting, Kathmandu, Nepal, www.thangka.de (Dharmapala Thangka Center 2019 / CC-BY-SA 4.0).

> In their desire for immortality, the gods and demons churned the milky ocean of the universe at the bottom of which lay a vase of immortality. A terrible creature, the manifestation of poison called Halāhala, emerged from the ocean and had to be subdued with the power of mantras. Its body shattered and various types of poison—including mercury—dispersed around the world. The gods and demons fought for the vase of immortality, which also arose from the ocean and contained the elixir. During the fight, the demon Rahu was killed. His blood mixed with some drops of the elixir that also fell to earth, giving rise to potent substances that can be used as antidotes to poisoning, for example, myrobalan and garlic (summarized from Parfionovitch, Dorje, and Meyer 1992, 117).

The basic idea of this myth is that both elixirs and poisons arise from the same source; therefore, medicinal substances that were formed from both good and evil can be used not only to transform poisons into elixirs, but also to make antidotes to treat poisoning. This fundamental premise is essential in understanding the use of poisonous substances—specifically mercury—in Sowa Rigpa medicine compounding or *menjor* practices.

The method of achieving the transformation of mercury is known as "taming" or *dülwa*. The idea of taming demons into protectors of Buddhism is such a pervasive approach to negativities in Tibetan culture that it is not surprising to find parallel notions of taming in Sowa Rigpa, where *dülwa* is the larger umbrella term for all kinds of processing that transform or tame the nature of substances.[25] One of these methods is called *dukdön (dug 'don)*, which translates as taking out the poison or harmful parts and deals with the pre-processing or cleaning of substances having *duk (dug)*.

Notably, the Tibetan term for poison, *duk*, shows parallel linguistic histories in the Sino-Tibetan and Tibeto-Burmese language families. The Old Chinese root of the Modern Chinese *du* 毒 is cognate with the Tibetan *duk*.[26] Paul Unschuld (1975) analyzed the origins of the Chinese pictogram for *du* and how meanings of *du* changed over time. Originally, the pictogram meant "snake in the grass"; in early Chinese literature the term stood for both poison and suffering; and in Buddhism it acquired the figurative meaning of suffering (Unschuld 1975, 182). Ulrike Unschuld (1977) pointed out that the Chinese term *du* not only means poison but also a potent drug. It is linked to ideas of strength and power. In earlier Chinese pharmaceutical literature *du* mainly meant "active curative strength."[27] In modern

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2014). Parts of the *Four Treatises* have been translated into English. See, for example, Clark (1995) and MTK (2011c, 2015, 2017a).

25 Tenzin Thaye, personal communication, McLeod Ganj, October 30, 2012.

26 The Sino-Tibetan Etymological Dictionary and Thesaurus (STEDT 2016) cites Coblin (1986) for the Sino-Tibetan reconstruction and Matisoff (2003) and Chou (1972) for the Tibeto-Burman reconstruction.

27 In many societies the same term is used to denote the strength as well as the poisonousness of a substance. See, for example, Shepard (2004).

Chinese pharmacology, however, *du* apparently only refers to the poisonous character of a substance (Unschuld 1975, 180). In his extensive studies on drugs and poisons in ancient and medieval China, Obringer (1997) elaborates on how Chinese drugs were supposed to have a certain toxicity in order to be considered effective, thus linking ideas of poisons and potency.

While a detailed comparison with Chinese concepts of poisonousness is beyond the scope of this book, I note that Tibetan concepts of *duk* go beyond notions of substances being poisonous. Since in Sowa Rigpa, *duk* is polysemous, careful contextual translations are necessary. In Sowa Rigpa, *duk* is not always equal to poison. *Duk* might refer to harmful parts but also to "rough" and indigestible matter, which would weaken the digestive fire, *médrö (me drod)*, and therefore has to be removed or made "smooth."[28] Substances might have various types of *duk* that can easily be removed through washing, or, for example, by removing the bark of a root, or taking out flower sepals or fruit stones.[29]

Despite the close linguistic link to the Chinese term *du*, the Chinese meaning of *du* as a classification of drugs that are "potent medicines" (Unschuld 1975) is not explicitly found in the Sowa Rigpa contexts presented here, even though Tibetan processing practices are aimed at enhancing the power or *nüpa* of the substance or compound. Substances having *duk* (e.g. aconite, mercury) can be transformed into strong medicines through transforming and taming *duk*.

The notion of taming is fundamentally a Buddhist one with clear tantric parallels. The subjugation idea goes back to the well-known Indian Buddhist myth in which Śiva in the form of the demon Rudra, along with his entire entourage, is subdued by Buddhist deities and transformed into protectors of Buddhism (Mayer 1996, 104–128). This process is twofold and involves killing and reviving the demon (or negativities) into transformed protectors or Bodhisattvas (equaling wisdom; Mayer 1996, 104). This is similar to the above origin myth of poisons, where Rahu is killed but some of his blood is revived and becomes an antidote to poisons, for example, in the form of garlic. Thus, demons becoming protectors parallel poisons becoming potent medicines.

The conversion of Śiva (in the form of Rudra or Maheśvara) into a Bodhisattva is an important topic and narrated with great variations in Vajrayāna literature and other yoga and tantric traditions in Tibet.[30] Such processes of taming are not necessarily described as peaceful affairs, which Dalton (2011) shows for the Mahāyāna culture of Tibet during the post-imperial period.

28 For details on making substances "smooth" in Sowa Rigpa see Blaikie (2014, 267–270), Saxer (2013, 63–75), and van der Valk (2017, 241; 2019).

29 This is described in the twelfth chapter of the Subsequent Tantra of the *Four Treatises* (MTK 2015, 139).

30 Buddhist myths of taming Śiva are manifold. See, for example, Mayer (1996, 1998) on the taming of Śiva in the form of Rudra in Vajrayāna, and Davidson (1991, 1995) on the taming of Śiva in the form of Maheśvara by the Bodhisattva Vajrapāṇi, transforming him into the wrathful deity Heruka. See also Samuel (2008).

While his writings on violent rituals have stirred contentious debate among scholars, his translation and analysis of the founding myth of Buddhist tantrism reveals that the struggle to subdue Śiva, in the form of Rudra, is filled with violent imagery (Dalton 2011, 2–5, 18–43, 159–206).

Also later, during the eleventh century and the introduction of Buddhism from India to Tibet, *dülwa* was a central theme in the context of the "wild" land that had to be tamed, illustrated in the various myths in which the "supine demoness" was geographically pinned down through building Buddhist monasteries at her central vital points (Dalton 2011, 113–125; Gyatso 1987; Miller 1998). In Buddhism, *dülwa* also refers to monastic discipline, a translation of the Sanskrit *vinaya*. The so-called three mental poisons of desire, hatred, and ignorance in Buddhist philosophy equally need to be tamed through Buddhist mind training—employing vocabulary quite similar to the taming of poisons in Sowa Rigpa.

Mercury also appears in metaphors of Buddhist mind training. For example, the Indian master Atisha (fl. eleventh century CE) translated some Indian tantras into Tibetan in which processes of mental purification parallel the alchemy of mercury. As the contemporary Buddhist teacher Geshe Lhundup Sopa explains: "The alchemical catalyst mercury *(rasadhātu)*, absorbs all the karmic and afflictive obscurations and turns them into the roots of virtue and omniscience" (Geshe Lhundup Sopa 2001, 18). Thus, mercury can transform almost everything: "As copper when touched by mercury turns into pure gold, so the afflictions when touched by pure gnosis become true causes of virtue" (2001, 18). While mercury here is mentioned in the context of its alchemical use in the making of gold and not necessarily medicines, the tantric understanding of poisons underlines their potency. In other words, the potency of poisons and negativities lies in their potential to be transformed.

Similarly, the subjugation myths hold a powerful message for Buddhist practitioners: "Maheśvara [Śiva] illustrates for the meditator that defilements, no matter how corrupt, are themselves the stuff of awakening" (Davidson 1995, 545). What these examples across the religious-medical fields show is that something being poisonous may also indicate its inherent strength and transformability into a beneficial substance. In a religious and cultural environment where themes of evil are actively engaged, poisons are more easily considered living agents that have a social life of their own. In some Tibetan areas, this still finds expression in poison fears and local beliefs of a "poison god" (e.g. Da Col 2012).

In this book I suggest that some of the processing techniques of calcining, triturating, and boiling mercury parallel these tantric and mythological taming ideas. Mercury is tamed by confronting it with substances that bind and transform its toxic characteristics and invoke its essence (*bcud du 'gugs pa*; Dawa Ridrak 2003, 420 / 14), which has the quality of an elixir, just as the essence of the mind has the Buddha nature.

These notions of poisons—their links to Buddhist ideas and their potential to transform into something helpful—deeply pervade Tibetan

medical ideas of *duk* as that which is harmful, and *men (sman)* as that which is beneficial. The making of medicine, called *menjor*, employs considerable time and effort to eliminate, clean, and process *duk*, the transformations of which are a time-consuming and important part of *menjor* processing. To understand mercury refinement techniques, we thus need to keep in mind this larger context of Tibetan cultural and religious approaches to taming. In Sowa Rigpa *menjor*, it is thus not primarily the Paracelsian dosage that makes a substance a poison or a remedy (Grell et al. 2018; Hedesan 2018; van der Valk 2019). The way a poison has been tamed, its synergy with other substances, and the ability of a person to digest a poison, also define poisonousness. All of the above deeply influence the cultural construction of toxicity and safety surrounding the use of mercury in Sowa Rigpa practices. This is also illustrated by the ways in which Tibetan physicians protect themselves from poisoning while refining mercury (see Chapter 6). Once the substance is fully tamed, it is considered safe, similar to a subjugated demon who has been tamed to safeguard Buddhism.

Now that we have an insight into how the taming of poisons is understood in the Tibetan world, the following chapters will situate various taming efforts by Sowa Rigpa specialists historically as well as in contemporary practice and analyze how they are debated, negotiated, and achieved or not. These explorations into taming will touch on issues of science, gender, pharmaceutical practices, medical knowledge transmission, and global regulatory efforts to phase-out the use of mercury. To provide the context for these explorations, I will introduce some of the sources of mercury in the mines of Central and South Asia. Then, an ethnographic vignette will take us to an Old Delhi market where mercury is traded—exploring some of the on-the-ground realities and risks of mercury trade in India and Nepal, which are countries without mercury mines. This is followed by an exploration of Tibetan terms for different forms of mercury and related processing procedures, before outlining the larger politics of toxicity affecting Sowa Rigpa mercury practices today.

Sourcing mercury

Chemically speaking, mercury is an element (Hg) that occurs naturally in ores, largely in a form bound by sulfur, as in cinnabar rock (HgS: mercury(II) sulfide, or red mercuric sulfide). Mercury as a heavy metal easily forms amalgams or alloys with other metals. Sourcing it from natural cinnabar ores causes pollution of the environment and occupational hazards for those mining it, because mercury vaporizes significantly when heated. “Raw” or elemental mercury is used in mining gold; once it has bound with the gold, it is again heated and evaporates into the atmosphere as elemental Hg. It is thus recognized not only as a toxic heavy metal but also as a significant environmental pollutant (Kim, Kabir, and Jahan 2016; Zuber and Newman 2012). Mercury has been used in India for centuries, but has to be imported.

A 2005 report by the Delhi-based non-governmental organization Toxics Link, which is devoted to raising awareness of toxic substances and to eradicating mercury from India, says: "Of the stated global demand of mercury of about 3,000 tonnes, India emerges as the single second largest consumer, importing approximately 250–300 tonnes annually" (Toxics Link 2005, 72).

Mercury ore is not naturally occurring in India, except in the Sitpur region of Gujarat (White 2013, 215). The nearest mines are in Dardistān (in northern Pakistan and northern Kashmir) and in Garmsir, Afghanistan (Baldissera 2014, 129, note 18). In Indian alchemy,[31] mercury is also known as *pārada*, referring to the "land of mercury"—the land of the Parthians or Persian Baluchistan (2014, 129)—from where it was sourced. Maxson (2009, 11) reports that today "there is no significant mercury mining in Asia except in mainland China, primarily in the region of Guizhou," which is in southwestern China. Large deposits were also found in its neighboring province Yunnan, and in the past cinnabar was traded from there to Tibet, as well as via maritime routes to south India where it is widely used in Tamil medicine (Fenner 1979, 98). White (1996, 65–66) also mentions that the mercury supply for Tibet came from Yunnan. The demand for mercury has traditionally been high in Tibet and Nepal, not because of mercurial medicines but because of the fire-gilding techniques required for making Buddhist statues (Lo Bue 1981, 33–34). Natural cinnabar rocks can be found and were probably sourced locally from various places in Tibet.[32]

Because of its long history of sourcing and trade, it is not surprising to find Chinese terms for mercury and cinnabar in classical Tibetan medical texts. A prime example is found in the *Four Treatises*. There, in addition to the Tibetan term for liquid metallic mercury, *ngülchu*, and for cinnabar, *tsel (mtshal)*,[33] we also find the Tibetan *chu shak (cu'u gshag)*, a phoneticised version of the Chinese term for cinnabar, *zhūshā* 朱砂, meaning red sand. *Chu shak* is a synonym for vermilion,[34] also known by the Tibetan term *gyatsel (rgya mtshal)*, meaning Chinese or foreign vermilion. Another frequently occurring polysemous Tibetan word for various forms of mercury is *dachu*

31 See Wujastyk (2019) for detailed definitions of alchemy in India. Alchemy is frequently "used as a synonym for *rasaśāstra*, the body of knowledge concerned with the methods for producing and using mercurials and its associated literature" (Wujastyk 2019). Transformation in Indian alchemy refers not only to the substances themselves, but also to the consumers taking them and the practitioners transmuting metals, who might attain well-being, health, and extraordinary powers *(siddhi)* in the process. Indian alchemy as a form of proto-chemistry includes metallurgical technology more broadly without soteriological aims.

32 Cinnabar ore has been reported by various authors to be found in some parts of Kham, e.g. lower Powo in Kongpo in eastern Tibet, near Mount Targo in central Tibet, in southeastern Tibet, and near Mount Kailash in western Tibet (summarized by Lo Bue 1981, 44).

33 The word *tsel* appears already in the Dunhuang manuscripts in descriptions of funeral rites of Tibetan kings, where it is an honorific term for blood, but could also mean cinnabar. Daniel Berounský, personal communication, Prague, November 11, 2016.

34 Jampa Trinlé and BMTK (2006, 202). Vermilion typically refers to the paint pigment or scarlet color of cinnabar, but also to artificial cinnabar.

(da chu), a term Tibetan doctors told me is of Chinese origin.[35] The appearance of such terms in Tibetan medical texts[36] might point to the trade of various types of cinnabar from China that were used in Tibetan medicines.

Another Tibetan term for cinnabar frequently appearing in medical texts and in my interviews with Tibetan physicians is *chokla* or *choklama* (Deumar Tendzin Püntsok 2009, 119/3–11). Some amchi identify *choklama* as the cinnabar rock and use *tsel* for cinnabar powder, but this is not consistent. *Chokla* is used for both natural and artificially made cinnabar rock, although artificial cinnabar is officially called *dachu*.[37] Some amchi use the term *chokla* for cinnabar rock as well as triturated and roasted cinnabar powder (see Chapter 6).

Today, the cinnabar available in Indian markets is largely artificial, produced in factories. The method is simple: in principle, liquid mercury is mixed with sulfur, which turns black, and is then heated in retort, vaporized, and condensed as a mercury sulfide rock, which when powdered is bright red in color. Tibetans process it further for use in their medicines and as a crimson-color coating for some of their pills, which has become controversial because of the high levels of Hg found in pills coated with or containing *chokla* (see Chapter 6).

Tibetan physicians in India today rely on traded mercury—in the form of liquid mercury bought in either metal or plastic containers. They do not distill mercury themselves from cinnabar, although relevant distillation techniques are described in the *Four Treatises*.[38] As mentioned in the Introduction, I observed the distillation of liquid mercury from artificial cinnabar only at the Ayurvedic pharmacy of Balendu Prakash in Dehradun, where distillation was considered one of the processing steps.

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35 *Dachu* is also called *tselkar (mtshal dkar)*, which Deumar Tendzin Püntsok describes as a color made from vermilion *(mtshal)* and white chalk *(dkar = ka rag)* used in *thanka (thang ka)* painting. See Onoda (2011, 184). *Dachu* is also a synonym for *ngülchu* and artificial cinnabar, *choklama*. A contemporary Tibetan medical dictionary describes *dachu* as a type of earth mineral medicine *(sa rdo'i sman)*, having "the shape of *chokla*, but it is more whitish in color than that" (*dbyibs cog la ma 'dra ba la kha dog de las dkar ba*; Jampa Trinlé and BMTK 2006, 347, quoting Deumar Tendzin Püntsok 2009, 119/14–15). Deumar Tendzin Püntsok classifies *dachu* under meltable mineral medicines and writes that it cures broken bones (*da chus rus pa chag pa sbyor bar byed*; 2009, 119/12). In some medical contexts, *dachu* appears to refer to calomel (mercurous chloride, Hg_2Cl_2) or corrosive sublimate (mercuric chloride, $HgCl_2$), see Gerke (2015b, 551). Gawé Dorjé (1995, 58) identifies *dachu* as Hydragyrum Sulphidum. For identifications and references, see also Czaja (2017, 125, note 21).

36 *Dachu* is mentioned in text Eight of the *Eighteen Additional Practices* (*Cha lag bco brgyad*; Yutok Yönten Gönpo 1999, 542/5). Deumar Tendzin Püntsok has a separate entry on *dachu* (2009, 119/12–120/5). Karma Ngélek Tendzin (b. 1700; 1973, 533/3–4) mentions *chu shak* in a formula to treat venereal diseases. See Gerke (2015b, 546).

37 Tsering Norbu, personal communication, Materia Medica Department, Men-Tsee-Khang, Dharamsala, May 14, 2015.

38 One method describes making cinnabar ash or *tsel tel (mtshal thal)*, which involves the extraction of mercury from cinnabar. Here, powdered cinnabar is burned in a sealed clay pot by heating it from below and cooling it from above; the condensed liquid mercury is collected from the top of the pot and the ash at the bottom is used in medicine. See Yutok Yönten Gönpo (1982, 597/5–9); MTK (2015, 114–115).

Following the poison: An ethnography

In 2011, I decided to "follow the poison" on one of its trading trails through the Khari Baoli market in Old Delhi, the largest market for medicinal plants in North India.[39] I had heard about it in Kathmandu a few weeks earlier when I interviewed Amchi Wangchuk Lama, a senior Tibetan physician who had settled in Nepal from Kyirong in southwestern Tibet. He had processed mercury and made *tsotel* and precious pills back in Tibet (see Chapter 4), but since becoming exiled in Nepal he was only able to do simple mercury processing, such as the "cold taming" called *kardül* or *drangdül (grang 'dul)*, and the "hot taming" called *tsadül* (see Chapter 6). He bought *tsotel* ready-made from the Dzongsar Monastery in Degé in eastern Tibet. When I met him in 2011, he said: "Ingredients are getting too expensive. Mercury used to cost 600 Nepali rupees a kilo in Kathmandu; now it costs 15,000 Nepali rupees.[40] It comes from Delhi by bus."

Imagining the transport of liquid mercury from Delhi all the way to Kathmandu by bus, I went to the Khari Baoli market, at Chandni Chowk in Old Delhi, where liquid mercury was sold, apparently in the dried fruit and herb section. Not knowing what to expect, I took a walk through the lanes of little shops, their goods piled high. Indian porters were carrying sacks of merchandise on their backs, mingling with the customers, who bought the products from the open stalls. I arrived at an area lined with shops selling dried fruit and herbs and asked around for mercury. A salesman pointed me to a shop with white-tiled walls, shelves on either side, a small sales counter, and a bench for customers. Signs stating "Fixed price! No bargaining!" gleamed on several walls. Hans Raj & Sons sold mostly dried fruits, and the counter was filled with stainless-steel bowls full of cardamom, raisins, and nutmeg. The shop was tiny, but business was good. I sat down on the tiny wooden bench, and we began talking. I asked for the price of mercury. He started at 7,000 Indian rupees. When I told him I was a researcher and not interested in actually buying it, he said the going sales price was 6,500 rupees per kilogram. I calculated that Amchi Wangchuk had paid around 3,000 rupees extra per kilogram for the transport to Kathmandu.

Hans Raj explained: "We used to sell a lot of mercury, also to Ayurvedic companies, but the price has gone up from 350 rupees per kilogram, twenty-five years ago, to 6,500 rupees now. The price went up drastically three to four years ago, but I don't know the reason. Three years ago [in 2008] it was around 1,600 rupees per kilogram." "Where do you get your mercury from?" I asked. He replied, "We just buy it down the road, at the

39 See Banerjee (1998) on the environment discourse concerning the medicinal plant trade in the Khari Baoli market. A survey of the mercury trade in this market was conducted by Toxics Link in 2005 (no longer online), but see Wankhade (2003, 53–54) on mercury sales in Tilak Bazaar, and Toxics Link's (2019) "Mercury Campaign."

40 In December 2011, 15,000 Nepali rupees were approximately 9,500 Indian rupees or 130 euros.

chemist market in Tilak Bazaar. Here, in Khari Baoli, about eight to ten shops sell mercury." I asked to see the mercury, and he showed me two small plastic bottles with white lids that screwed on, wrapped in a clear plastic bag (see Fig. 11). "We keep around two to four kilograms of mercury in stock," he said, handing me the bottles. I was struck by the weight of the high-density liquid (one kilogram easily fit into one approximately 250 ml bottle).

I continued into the bazaar and inquired in a few other shops that sold mercury. I discovered that herbs and chemicals were sold together; metals were sold in another specialized market. Herb shops also sold borax, potash, copper, and sulfur. I was surprised to see that mercury was sold alongside herbs and not at the metal market. I later learned that Ayurvedic physicians buy their raw materials here and since they often need mercury for their *bhasmas*, they want to buy everything together from one shop. I walked onwards to the Tilak Bazaar, where the shopkeeper had told me I would find the wholesalers for mercury and sulfur.

I entered the Baburam & Sons chemist shop. A sign at the shop entrance read: "Fine heavy industrial chemicals and pharmaceuticals, metals & shampoo." They were busy. The scene reflected the generational change gripping modern India: The father, Baburam, sat at the counter with an old phone and heavy, handwritten account books, while the son sat at the back of the shop with a laptop and mobile phone, typing numbers into an excel sheet. I asked the father, "How much mercury do you sell?" "About thirty to forty kilograms a month," he promptly replied. "We sell it to brokers, who then sell it to companies making light bulbs and thermometers. Only a few Ayurvedic companies come." The son then joined the conversation: "We sell pure mercury, others also sell commercial mercury." I had not heard of this distinction, and realized that there must be a variety of definitions of what is considered "pure," and by whom. "What is the difference?" I asked. He explained: "The pure one has a better shine, but we cannot really tell the difference and have to trust our dealers. That is why everyone here usually deals with the same dealer over many years."

Revisiting this encounter as I write, I see a parallel to what Tibetan physicians have told me. They describe pure mercury as having a better shine after the initial rust, in Tibetan called *ya* (*g.ya*, which refers to impurities, oxidation, dust particles, and the like), is removed during the many stages of processing, and the mercury becomes "similar to a cleaned mirror" (*me long phyis pa ltar*, Dawa Ridrak 2003, 424/11).

Baburam's mercury apparently came from Turkey, which was surprising since most of the mercury mines in Turkey were closed by the 1990s (UNEP 2010, 2). He himself could not tell the difference in quality and trusted his dealer. He showed me the one-kilogram plastic bottles of mercury, which were similar to the ones I saw at the herb market. Around the corner from Baburam's shop, I saw a standard wholesale mercury metal flask containing 34.5 kg (Fig. 12) outside a shop selling spices and wholesale *puja* ritual implements. A half-torn label read "Liquid mercury. Net (34.5 kg)," and on

Figure 11: Two bottles of liquid mercury sold at an herb and spice shop in Old Delhi, 2011. Photo by author (Gerke 2011 / CC-BY-SA 4.0).

Figure 12: Mercury flask (34.5 kg) from the US in front of a wholesale shop at Tilak Bazaar, Old Delhi, December 2011. Photo by author (Gerke 2011 / CC-BY-SA 4.0).

the side of the rusty can I deciphered "USA" on the dirty label. Interested in learning more, I settled down at the shop—Kamal Sales Corporation.

Kamal, a young man, was open for conversation and told me he sold ten to fifteen kilograms of mercury per month. Kamal's broker lived in Dubai and bought the mercury himself from Spain and Turkey, sometimes the USA. "Some brokers come to take the mercury to Ayurvedic companies," he said. "But I don't have direct contact with the doctors." I asked him how he poured the mercury from the large flask into the small plastic bottles and Kamal responded, "I do it myself," pointing to a white ceramic-coated metal bowl sitting on a shelf on top of a colorful carton of ritual camphor incense. What happened next is one of several examples I would encounter during fieldwork; my own perception of toxicity influenced the ethnographic encounter since I was unable to pretend neutrality—the ethnographic myth of objectivity. I was once again reminded that "fieldwork is [...] a personal encounter and ethnography [...] an intersubjective reality" (Hastrup and Elsass 1990, 302).

"Do you cover your mouth and nose when you handle the mercury?" I asked, my concern no doubt evident. "No," Kamal answered. "What do you do if you spill some?" He showed me how he would pick up the mercury globules with two sheets of paper and roll them back into the bowl. He noticed my obvious unease. I was thinking of his regular exposure to the invisible mercury vapor. At least his shop was open to the street. In response to my concern, he asserted, "But I mostly sell the 34.5 kilogram canisters for 2.10 lakhs rupees each [210,000 rupees, around 3,000 euros in 2011]." This was around 6,000 rupees per kilogram. He continued, "I don't fill the one kilogram bottles very often. Mostly companies buy it for making thermometers, light bulbs, [...]." He appeared not to have given much thought to mercury toxicity, occupational risk, and his exposure to a toxin, but was responding to my concerns spontaneously, as evident from his bodily expressions. This "embodied sense of toxicity" as I decided to call these bodily reflexes towards the differently perceived toxicity of mercury came up in several instances during fieldwork. They were among the most challenging moments of my ethnographic encounters with different forms of mercury.

Looking around his shop, I also noticed pieces of a shiny gray metal in a bowl next to various types of spices, mostly pepper and coriander seeds. "This is lead," he explained. "It comes from Morocco. They use it for cosmetics, especially to make *kajal* [eyeliner] for women." He also shared that he does not know his brokers, who were elusive and did not have a fixed location. This conversation revealed to me the difficult, somewhat untraceable path of this heavy metal.[41]

Pondering the perception of risk and toxicity among these wholesalers in Old Delhi, I now had a better idea of where the mercury that Amchi Wangchuk had mentioned had come from. Some other amchi in Nepal told me how they once bought a bottle of mercury in Kathmandu. It was

41 See, for example, Mohta (2010) on *kajal* as a dangerous cosmetic.

considered an expensive ingredient, and they proudly took it on a flight to the high mountains of Dolpo in western Nepal to make medicines there. Unfortunately, it was in a glass bottle and it broke during the flight, the little shiny pellets rolling across the floor of the small aircraft.[42]

After India signed the UNEP treaty to ban mercury in 2014, I visited the same market stalls at Khari Baoli and Tilak Bazaar again in March 2016 (five years after my previous visit), to see whether there were visible changes in the mercury trade. The brothers at Hans Raj & Sons were very welcoming when I reminded them of my previous visit. I asked how the mercury trade was going. One of the brothers said, "Trade is down. The price is down to 2,800 rupees per kilogram, and we sell only two to three bottles, maybe five a month to Ayurvedic doctors who come here to buy medicinal plants." The price they quoted was lower than in the other shops, which charged 4,000 rupees per kilogram. They still had the small plastic bottles readily filled from Tilak Bazaar, which was around the corner. The shopkeeper then said, "Mercury now comes from the African mines, not anymore from Spain." I asked about other forms of mercury; he responded that there used to be a white powder—called *rasakarpūra*—in the market, but that it was very toxic and had been banned. *Rasakarpūra* has been identified as calomel (Hg_2Cl_2, mercurous chloride)[43] and as mercuric chloride ($HgCl_2$, corrosive sublimate).[44] Other shopkeepers I talked to that day confirmed that calomel was very toxic and banned. He then showed me a piece of artificial cinnabar, of which he only knew the Urdu term *shingraf*.[45] It sold for the same price as mercury. Natural cinnabar rock is rare and not available in the markets.

I turned the corner and went to the same shops in Tilak Bazaar that I last visited in 2011. Baburam & Sons were busy with paperwork and not inclined to be interviewed in depth. On my inquiry about their mercury sales, they said, "Prices are down because companies who used mercury for thermometers and light bulbs are phasing out mercury. But you can buy a flask of mercury [34.5 kg] for 3,800 rupees per kilogram." The son explained further: "The current price drop of crude oil makes it cheaper

42 The story was told during the Sowa Rigpa workshop in Kathmandu in December 2011.

43 In tropical India calomel was used—especially after the 1750s—in "high doses to treat many common ailments, including dysentery and fevers," as well as common liver diseases among Europeans in India, and was widely used to treat syphilis (Harrison 2010, 149).

44 *Rasakarpūra* has not always been identified as the same substance. Note, for example, that Dutt identified "*rasakarpūra* as 'per-chloride of mercury' or 'corrosive sublimate', though he noted that the product available at medical markets at the time of his writing (in the 1870s) was not pure perchloride [= dichloride, $HgCl_2$] of mercury, but a mixture of calomel and corrosive sublimate" (Wujastyk 2015c, 1048, note 13, quoting Dutt 1877, 37).

45 It is called *hiṅgūla* in Sanskrit and Hindi. Unani medicine peaked in Delhi during the Mughal period (1526–1858). See Preckel (2015, 906). Many medicinal substances are still traded under their Urdu names. On mercury and cinnabar in Unani medicine, see Preckel (2015).

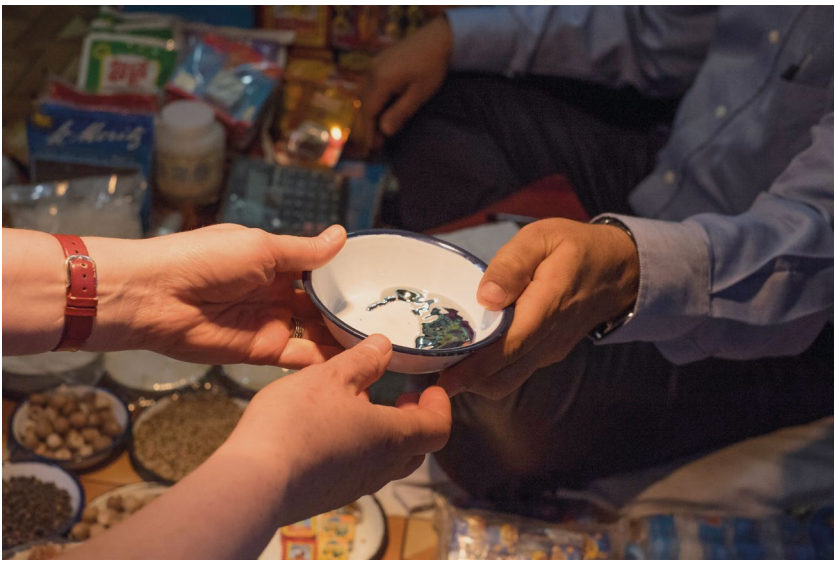

Figure 13: The shopkeeper offering the author a sample of liquid mercury in an enamel bowl to check its shine. Tilak Bazaar, Old Delhi, March 2016. Photo: Thomas K. Shor (Shor 2016 / CC-BY-SA 4.0).

to transport mercury, which is heavy, but still the demand is down in the industry." Their supply is now sourced mainly from China and Africa. I left them to their paperwork and walked across to Kamal's. In 2011, I was unprepared for his perception of safety. This time I consciously tried not to react to how he dealt with mercury exposure. In his shop of ritual supplies, incense, and spices, I again noticed a bowl of lead next to a bowl of cardamom. Asking what it was he answered, "This is lead, used for the *kajal* eye liners for women—only 280 rupees per kilogram." In the midst of his bowls of lead and spices, I noticed a little bottle of mercury and inquired about it. He immediately took the bottle, opened it, and poured some of the liquid mercury into an enamel bowl and handed it to me to check its shine (see Fig. 13).

"Mercury costs only 2,800 rupees per kilo if you buy a container," he said, pointing to a large metal container in the back of his shop. I noticed the Chinese characters (Fig. 14). He poured the mercury back into the bottle, spilling quite a bit. The silvery mercury globules moved quickly between his spice bowls. With his fingers, he playfully made the globules move together into one large drop, the size of a rupee coin, which he then scooped up with a piece of paper and back into the mercury bottle (Fig. 15). A few globules kept rolling around but he appeared to be unconcerned. "No problem," he said, "later." This time I did not react, but my mind went to the Nepali educational film on containing a mercury thermometer spill in a hospital that I had shown during my lectures to Tibetan medical students to initiate discussions on toxicity (see Introduction). The way the nurse in the film cleaned

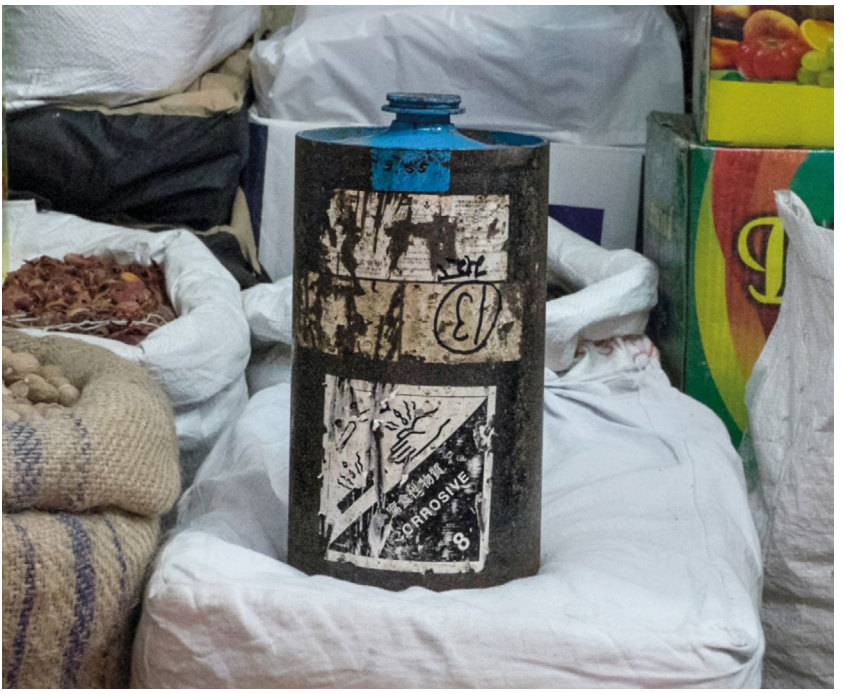

Figure 14: A Chinese flask of elemental mercury (34.5 kg) at the same wholesale shop in March 2016. Photo: Thomas K. Shor (Shor 2016 / CC-BY-SA 4.0).

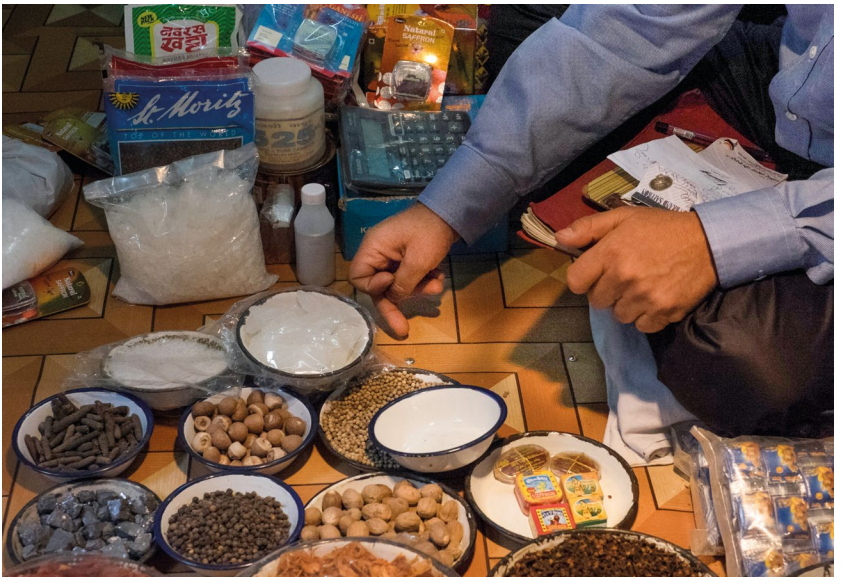

Figure 15: The shopkeeper containing a mercury spill with his fingers and a piece of paper at a wholesale shop at Tilak Bazaar, Old Delhi, March 2016. Photo: Thomas K. Shor (Shor 2016 / CC-BY-SA 4.0).

up the spill (wearing gloves and a mask) and the way in which Kamal did it illustrates strikingly different embodied approaches to mercury's toxicity.

"Sales are down because mercury is now available everywhere," he said. "You can buy it in the bazaars of Hyderabad, Mumbai, and Chennai. Previously, you could only buy it in Delhi; now so many shops have it, even here." I asked him who bought it and he said, "Ayurvedic companies still use it, but *rasakarpoor* [calomel][46] is banned. That is really bad; mercury is okay." He also informed me that he still filled the bottles himself. "No problem," he said, wiping his hands on a piece of cloth.

I learned more about the mercury sales when I dropped into an Ayurvedic herb shop that I had not seen previously. A young Indian man ran the shop, which he had taken over from his father, whose photo hung over the counter. He offered me a seat in the middle of the shop while we spoke. He proudly told me about the size of the Khari Baoli market, and that it was the largest wholesale spice market in Asia, with its 10,000 little shops in tiny lanes, and that huge business was conducted there. He was doing well and had travelled abroad, including a visit to Germany. Sellers kept their supplies in large warehouses outside Delhi and brought their daily orders by truck into the market. The shops only had the space to keep samples. He offered me a chair and placed a bottle of mercury in front of me. As a white woman, I did not remain unnoticed for long, and a crowd of his workers and some men stood around the shop to watch. Some of his workers made a joke about how mercury is like Śiva's semen, with the ability to give one power and make one younger. I added that they also needed sulfur, the blood of Parvatī, to make it work. They laughed and the shopkeeper then showed me samples of yellow sulfur.

I asked whether he sold *hingul* or *chokla* in his shop, using the Hindi and Tibetan names on purpose. To my surprise he said, "*Choklama* is a Tibetan name." He opened his drawer and took out five old typewritten sheets of Tibetan and Hindi *materia medica* names, each sheet individually laminated. They must have survived many years in his shop. "We are the suppliers for the Tibetan medical institute in Dharamsala," he said. "It all began when a Tibetan monk in red robes came to my father's shop one day in the 1970s. Now they come once a year, always look for the best quality, and pay on time." He showed me the Tibetan names for mercury *(ngülchu)* and for cinnabar *(chokla)* on the sheets. "They have a lab, and if samples are bad or if there is any moisture or fungus, they send back the whole lot. They always go for quality; they buy the best Kashmir saffron for 3,000 euros per kilogram." He pulled out his mobile phone and pointed to the name and contact number of the current amchi in charge of purchasing raw materials; they communicated through WhatsApp. I recognized his name, and we found common ground to talk, but he was careful not to divulge any of his business details, which I respected.

46 *Rasakarpoor* is the anglicized form of the Hindi word, which however derives from the Sanskrit *rasakarpūra,* and here refers to calomel.

I happily sat at the center of his shop holding my fieldwork treasures (Fig. 16): a bottle of mercury, some artificial cinnabar, and yellow sulfur (Fig. 17).

"How do you know the mercury you sell is pure?" I asked. "I don't. Now, sometimes they add lead to the mercury," he admitted. "Rumor has it that Chinese mercury is often adulterated. But how much lead can they add? One or two kilos maximum, it hardly matters," he speculated, not considering how lead in mercury might affect medicine making. If contaminated mercury were used to make artificial cinnabar, *chokla* would also have lead. "Ayurvedic companies and physicians come to buy from me," he said. "Mercury prices are down by half, but mercury sales are up." He was the only one of the four sellers I spoke with that day who said the sales were doing well. "Mercury is freely available everywhere; I could get you 500 large iron flasks right now from the surrounding shops if you needed them." Although this statement was probably an exaggeration, the shopkeeper sounded confident. Later in our conversation, he said that he had never heard of the UNEP ban on mercury, which India signed in 2014. Before we parted, he offered me a gift of liquid mercury in a small plastic bag. Considering my flight the next day, I declined, but gladly accepted a piece of *chokla*. "Tibetans process it and mix it with milk to treat broken bones," he explained; he had clearly picked up some traditional knowledge from his Tibetan customers. Afterwards, I stood outside his shop for a few moments, collecting my thoughts and looking around for a water tap to wash my hands, when an Indian man with a cloth bag around his shoulder addressed me in Hindi, asking whether I wanted some mercury. He hinted that he also had the adulterated kind, for cheaper. He must have watched me in the shop. Realizing I was not a buyer, he walked off. I wondered if he was one of the small junk dealers who collect mercury from hospital waste and resell it (Toxics Link 2005, 24–29).

On reflection, although I never did an exhaustive survey at Khari Baoli and only went twice to the same three shops and once to the Men-Tsee-Khang supplier, there were a few noticeable changes between 2011 and 2016: the price of mercury had halved, the demand in the industry seemed somewhat less, and the market was flooded with mercury. The demand for mercury among Ayurvedic companies and practitioners appeared to be ongoing. No more metallic mercury from mines in Europe or the USA were mentioned, but the supply at these shops in 2016 came from China[47] and Africa,[48] and there were some concerns regarding possible contamination of mercury with lead.

The visits to the Khari Baoli market triggered some basic questions: What was "pure" mercury? Who defined the term, and how was it defined?

47 China is already mentioned as a source of mercury in a report on the Delhi mercury trade in 2005 (Toxics Link 2005, 27).

48 Morocco and Algeria are also known exporters of mercury to India (Toxics Link 2005, 64).

Figure 16: Fieldwork treasures: the author holding an artificial cinnabar rock and a bottle of liquid mercury at Khari Baoli market, Old Delhi, March 2016. Photo: Thomas K. Shor (Shor 2016 / CC-BY-SA 4.0).

Figure 17: Artificial cinnabar *(chokla)*, liquid mercury, and yellow sulfur at a shop in Khari Baoli market, Old Delhi, March 2016. Photo: Thomas K. Shor (Shor 2016 / CC-BY-SA 4.0).

Exploring concepts: Pure or processed?

We can assume that there will be a different understanding of a substance such as mercury in societies with different conceptions of purity as it relates to basic components of matter.[49] Tibetan ideas of mercury toxicity cannot be understood merely within anthropological frameworks of representation, symbolism, or belief. What follows is *not* a description of different epistemologies or a binary comparison between the biomedical and Sowa Rigpa views. Rather, in this section I continue to "follow the poison" as I did in the Old Delhi market, but this time through the particular Tibetan terminology associated with mercury and its different interpretations.

What terms do Tibetan medical practitioners use when discussing the processing of mercury? During fieldwork, English-speaking Tibetan physicians in India expressed the necessity to detoxify or purify mercury before it can be used in medicines. They used these English terms freely and interchangeably, often referring to the detoxification of substances as purification, and processed mercury as pure mercury. However, when speaking Tibetan, they used several technical terms, explained in the following paragraphs. Related processing practices will be discussed in Chapter 6; here I unpack and define the technical terms.

The composite Tibetan term *düljong ('dul sbyong)* combines the meaning of taming, or *dülwa,* with purifying, or *jongwa (sbyong ba*, also *dag pa byed pa)*. *Düljong* is a fundamental practice in Sowa Rigpa pharmacology, or *menjor,*[50] in which poisons are tamed and harmful components transformed or eliminated through skillful detoxification practices collectively called "taking out the poison," or *dukdön*, in order to develop the medicinal effect of a compound (see Tidwell and Nettles 2019).

We need to understand that in Sowa Rigpa, purifying refers to the idea of transforming a harmful substance, or *duk*, into something beneficial, or *men*, that has the capacity to be metabolized or properly digested by the body; this digestive process is known as *juwa ('ju ba)*. In the *Four Treatises,* such digestion is defined as the separation of nutritional essences (*dwangs ma*, which then create blood, flesh, and so forth) and waste products (e.g. urine, feces). The intake of too much *duk*, either in the form of

49 Tidwell and Nettles (2019) point out that in Buddhist philosophy and also in Sowa Rigpa the tiniest piece that makes up matter *(rdzas)* is called *dültren (rdul phran)*. They clarify that "the concept of 'purity' in Tibetan *menjor* [medicine compounding] is not linked to a single-type particle and relates closer to activities of the elemental dynamics," by which they mean the complex interrelationships between the five elements (water, fire, earth, wind, and space) and the absence of capacity to do harm. This is an important difference from a Western conception of purity that defines it as a single type of atom or element (see, for example, Schwabl 2013).

50 With the term pharmacology, I refer to *menjor rikpa (sman sbyor rig pa)*, a large field of Sowa Rigpa knowledge comprising the study of *materia medica* (pharmacognosy) as well as the compounding of medicine, or *menjor*, in which *dukdön* and *düljong* are included. In this book, I largely use *menjor* when referring to these complex techniques.

improperly processed substances in medicines or unsuitable foods, is considered harmful to the body, and over time leads to illness. This necessitates the pre-processing of substances and is evident from complex Sowa Rigpa *menjor* techniques that prescribe *dukdön* and *düljong* processing for all kinds of herbal, mineral, metal, and precious substances before compounding them into formulas.

In Tibetan we find the same terms for taming and purifying substances also applied to the mind; for example, taming the mind is known as *sem dülwa (sems 'dul ba)* and mind training is called *lojong (blo sbyong)*. This shared use of verb forms emphasizes correlating ideas in Tibetan mind–body practices (Garrett 2009; Tidwell and Nettles 2019). These mind–body correlates are also evident in how mental states are deeply interlinked with the balance and imbalance of the three physiological principles, called *nyépa (nyes pa)*,[51] which are the defining paradigms determining the causation of illness in Sowa Rigpa. These principles are understood to be affected by untamed negative emotions as much as by different amounts of indigestible *duk* in foods and other substances.

In Sanskrit alchemical literature, the purification of mercury is—often mistakenly—called *śodhana*, a term that is used for the processing steps that aim at ridding mercury of impurities and unwanted characteristics.[52] The overall term for these processing steps in Sanskrit alchemical literature is *saṃskāra* (White 1996, 266–269).[53] The translation of *śodhana* as purifying is problematic; Dagmar Wujastyk (2013) suggests "perfecting" as the more appropriate translation. This translation issue also echoed my discussions with the Ayurvedic physician Balendu Prakash in Dehradun. Prakash argued:

> Actually, mercury is not purified but amalgamated with more and more substances in the process. So it actually becomes more and more impure. *Śodhana* is not about purifying but about processing. These things get lost in translation.[54]

When translated literally, English equivalents of Tibetan medical terms are often incorrect. They frequently derive from colloquial Tibetan and are polysemous. For example, the term *juwa*, which means to digest, can also acquire the more technical meanings of to melt or to dissolve in *menjor*

51 The three *nyépa*—the term has often erroneously been translated as "humor"—are the basic principles of Sowa Rigpa physiology that are imbedded into the larger cosmology of the five elements. The three *nyépa* are *lung* (*rlung,* predominated by the element wind), *tripa* (*mkhris pa,* predominated by the element fire), and *béken* (*bad kan,* predominated by the elements earth and water). For introductory summaries on the *nyépa* see, for example, Lobsang Tsultrim Tsona and Tenzin Dakpa (2001) and Hofer (2014).

52 Dagmar Wujastyk, personal communication, Vienna, June 2019.

53 Note that in Sanskrit medical literature *saṃskāra* has a different meaning and describes the rites of passage for humans, such as birth, marriage, etc. Dagmar Wujastyk, personal communication, Vienna, June 2019.

54 Vaidya Balendu Prakash, personal communication, Dehradun, September 18, 2013.

or alchemy (Fenner 1979, 120). Thus we need to broaden the contexts in which to explore the medical meanings of detoxification, and what is considered toxic or pure, and why. I use the terms processing, detoxifying, or purifying in the ways in which Tibetan medical practitioners used these terms themselves in our conversations. Broadly and chemically speaking, purified or detoxified mercury in most Indian and Tibetan traditions is a more or less stable material, amalgamated with other metals and bound to other minerals or elements—in most cases sulfur. However, within the Tibetan, Indian, and other medical traditions (Unani, Persian, Chinese, etc.), these meanings are more complex.[55]

In these medical systems, mercury processing is described variously as killing, cooking, dyeing, subduing, drying, or resurrecting, to mention a few of the technical terms that appear in two edited journal issues on mercury in traditional medicines.[56] For example, the Tibetan medical practitioner Sonam Dolma (2013, 114–115) chooses the term purifying as her translation of the Tibetan term *dülwa*, which she defines as "to overpower, or to eliminate the harmful effects of a substance, thereby subduing the negativity of the substance and generating and reinforcing its positive side." The term purification can easily be misunderstood here. A reader with a science background and no prior knowledge of Asian medicine might think that purified mercury as spoken of here means 100% pure mercury—a pure metal free of alloys or adulterants. That is not the case. The concept of pure mercury from a chemical perspective is based on the assessment of a single type of atom (see Schwabl 2013), which was developed as a model in the early nineteenth century (Rosenfeld 1971). As discussed further below, this definition is currently the sole basis for toxicity laws surrounding mercury. For now, let us remember that the atomic model of Hg has little to do with the Indian and Tibetan ideas of processed or tamed mercury, which is also considered pure by its English-speaking practitioners.

When Tibetan physicians talk about pure mercury, they are referring to a stable mercury compound formed with pre-processed sulfur—which in the case of *tsotel* is a complex organometallic mercury sulfide compound with eight metals, eight minerals, and many other ingredients used during processing or mixed into it (see Chapter 6). Considering the atomic model, processed mercury is probably a better and less misleading term in English than pure mercury. Refined mercury (in German: *veredelt*) is also an apt term since it denotes an increase in value and preciousness through processing. The young generation of Tibetan physicians I met in

55 See, for example, White (1996, 269–273) for a discussion of purification in Siddha alchemy.

56 These journal issues are proceedings of two academic events on mercury. In Berlin, I organized the symposium titled "Mercury – Elixir of Life or Poison?" in 2012, with a focus on mercury in Ayurveda and Sowa Rigpa (see the special issue edited by Gerke 2013a). Dagmar Wujastyk organized the workshop in Zurich in 2013, which focused on "Mercury in Medicine: Fluid Economies of Knowledge and Trade" and included historical perspectives from China, Burma, and Graeco-Arabic or Islamic medical traditions (see the special issue edited by Wujastyk 2015a).

India are not oblivious of chemistry and typically think about mercury in terms of an element before they enter their Sowa Rigpa studies. They are mostly not familiar with the complex Buddhist teachings on small particles and matter, which might serve as a useful parallel to understand atoms and elements (Tidwell and Nettles 2019). Quite unlike their senior teachers (some of whom do not speak English), they received a basic science training, are familiar with chemistry, and understand idioms such as the "half-life of mercury." As my examples in Chapter 7 will show, this often leads to culturally-specific forms of translations of toxicity and concepts of safety where science is employed in multiple directions—a process that has already been observed in several Tibetan medical contexts (Adams, Schrempf, and Craig 2011a; Kloos 2011, 2015).

To avoid any major misunderstandings or assumptions when discussing mercury processing from Sowa Rigpa perspectives, I will explain some of the key Tibetan terms in more detail in the following section. Acknowledging that these might not be terms correlating to relevant terminology from chemistry, I will use the term processing or refining to refer to various complex acts of mercury transformation, be they pharmacological, (al)chemical, ritual, or mechanical in nature. These are activities and techniques—such as mixing, triturating, washing, or cooking mercury with various substances—that Tibetan physicians engage in when actively processing it. It is beyond the scope and objective of this book to analyze what happens chemically when Tibetan physicians make *tsotel*, although I will later refer to some of the few existing scientific studies of *tsotel* and precious pills and document what Tibetans physicians think about scientific approaches of chemically analyzing *tsotel.*

"WELL-ACCOMPLISHED" MERCURY

What Tibetan physicians call pure, processed, refined, or detoxified mercury, in the Tibetan language is called well-accomplished or perfected mercury, or *ngülchu drup (dngul chu grub)*.[57] This so-called accomplishment is achieved through certain procedures often dubbed alchemical in English. In Tibetan, the technical term for making *tsotel* is *ngülchu tsodru chenmo*, which is usually translated as "Great Mercury Processing" or "Great Mercury Refinement." The term contains the Tibetan words *tso (btso)*, which means to cook, refine, or distill, and *tru (bkru)*, which means to wash. These refer to procedures of washing liquid mercury with reactive substances or water and boiling it with various additives inside a caldron. The practice is also called *ngülchu drupa (dngul chu grub pa)*, which translates to accomplishing or perfecting mercury.[58] This *menjor* accomplishment is complex. Not

57 We find this term, for example, in the title of the early Tibetan canonical work *Treatise on Perfecting Mercury (Dngul chu grub pa'i bstan bcos)*, in Sanskrit *Rasasiddhiśāstra*. See Bhalipa et al. (1994–2008a); see also Chapter 3.

58 *Drup* can mean refining a substance through processing, but in a Buddhist context it also refers to ritual accomplishment, as in *druptap (sgrub thabs*, Sanskrit:

only do the poisons of mercury have to be transformed in order for the refined compound *tsotel* to be safe for use in other medicines, the ritual procedures that are part of *tsodru chenmo* also have to be carried out successfully.

In Tibetan, the term for ritual is *choga (cho ga)*, which also means method, knowledge, procedure, or technique; briefly, it refers to something that needs to be done to accomplish something. A *menjor* procedure is often simply called *choga*, even without any Buddhist rituals attached to it. However, the practice of triturating substances while reciting mantras, for example, is also part and parcel of *choga*, and it is difficult and—to my mind—unnecessary to distinguish clearly between ritual and medical procedure in a *menjor* setting (Gerke 2016a).

The processing of mercury involves both *drup* and *choga*—accomplishment and procedure, respectively. While making *tsotel*, mercury undergoes the longest and most complicated procedure in Tibetan *menjor* practice, which can take several months. As we will come to understand from the Tibetan physicians I interviewed, the longer the procedure (involving many steps of processing), the safer the final result. In Tibetan medicine, *choga* is human effort and skill put into the transformation of substances in time and space. The approach is similar to the understanding of accomplishments in Buddhist mind practices, which require a certain amount of effort by the practitioner to engage in regular and often time-consuming repetitive daily practices over many years to achieve forms of *drup*. Taming the mind and mental negativities, like taming a wild horse, takes time, effort, and skill. Likewise, taming a poison takes a lot of effort and skill, as expressed by Tenzin Thaye in the opening quote to the introduction. Even though there are short versions of *choga* for mercury, such as cold taming known as *kardül* or *drangdül* and hot taming or *tsadül*, the best *choga*, i.e. making *tsotel*, has the most complex and longest duration, involving many steps of processing. Based on this (and other aspects that will be explained later), Tibetan physicians trust its potency and safety.

MERCURY, THE ELEMENT—*NGÜLCHU* THE AGENT

To understand the Tibetan terminology used in the processing of mercury, we need to temporarily bracket out our chemically determined perception of mercury as an element (Hg), and instead look at mercury as a living substance. Because it is volatile and moves quickly, mercury has a versatile character: it changes form, devours other substances, and penetrates everything it encounters. It appears to be "alive," an attribute given to metals in Indian alchemy. Mercury is considered an active agent. From Tibetan and Indian alchemical perspectives, mercury is alive and thus *does* things,

sādhana). See Garrett (2009, 209) for these close relationships between medicine and ritual in the context of "accomplished medicines," known as *mendrup (sman sgrub)*.

often expressed in active language (see below). Thus, the role of the practitioner is to tame its aliveness into a stable, i.e. immobile, compound.

David Gordon White in *The Alchemical Body* tells the story of how the medieval alchemists of India held a worldview in which sexual fluids were seen as homologous to metals (White 1996, 5). It is easy to comprehend how liquid shiny silvery mercury was seen as homologous to the god Śiva's semen. According to White, "the sexual essence of the Absolute" is present in the mineral world. Mercury is all-absorbing (it can "eat" other metals) "as Śiva, who at the end of cyclic time, implodes the entire universe into his yogic body, thereby transforming existence into essence" (1996, 6). Thus, processing mercury is all about controlling the volatile activity of the metal. Mercury has to be transformed and made less mobile and more stable so it cannot evaporate when heated. When it is "fixed," it can be manipulated and eventually controlled and tamed, in other words the poison has become an elixir.[59] This, in brief, is the main tantric objective of taming mercury into a potent medicine.

Various Tibetan textual sources use specific vocabulary to describe the behavior of mercury. To understand its liveliness, let us look at its behavior described in the Indic alchemical and tantric texts that made it into the Tibetan Buddhist canon. On its way to accomplishment or perfection mercury eats *(za ba)* and pierces or penetrates *('bugs byed* or *'bigs par byed)*[60] other metals and substances (Simioli 2013, 50, 53). Note that mercury here is treated as the agent that can act upon other substances, the objects.

In the following quote from the *Kālacakratantra*, an important Indian Buddhist tantric text from the eleventh century, mercury is described as having the ability to penetrate metal and eat what pierces the body, i.e. destroy disease. Additional substances must be boiled with mercury in order to take care of those parts that could not be pierced by mercury. Such substances take an active role in the "accomplishment" of mercury:

> Mercury is of two types: that which accomplishes and that which does not accomplish; that which pierces and that which does not pierce. It accomplishes when it pierces metal, moreover, eating that [which] pierces the body also. What mercury does not pierce will be transformed by that which is boiled with that mercury. The process of piercing metal and its complete piercing, having expelled the defects of the metal, destroys all disease (*Kālacakratantra*, Chapter 5, verse 204, translation by Fenner 1979, 155).[61]

59 See White (1996, 266–269) for a detailed description of mercury processing through eighteen techniques called *saṃskāras*. Accordingly, the first set of eight detoxify mercury enough to be used internally as medicine. The second set of eight further prepare mercury to transform the alchemist's own body into "alchemical gold."

60 In a fifteenth-century Tibetan medical text, "Piercing-One" is an epithet for mercury (Gyatso 1991, 40).

61 The original quote reads (Fenner 1979, 218/5–13): *ro ni grub dang grub pa ma yin rnam pa gnyis su 'dir 'gyur 'bugs byed dang 'bugs byed min/ grub pa lcags ni 'bugs par byed te slar yang de ni zos pas lus kyang 'bugs par byed pa'o/ gang zhig 'bugs byed min*

Other terms we come across in early descriptions of mercury processing techniques are the words killing *(bsad pa)* and devouring, or *zajé (za byed)*. In the early canonical Tibetan medical texts that were translated from the Sanskrit, the process of calcining metals into a fine ash or oxide is referred to as killing (Simioli 2013, 53; in Sanskrit *māraṇa*, see White 1996, 267).[62] These texts list varying numbers of metals and minerals. Specifically, while perfecting mercury, "eight devouring minerals," called *zajé kham gyé (za byed khams brgyad)* or briefly *kham gyé*, devour the poisons of mercury, and the "eight binding metals," known as *ching jé chak gyé ('ching byed lcags brgyad)* or briefly *chak gyé*,[63] bind them. Strictly speaking, not all of the *kham gyé* are minerals, but most Tibetan physicians call them minerals when they speak English, and I will refer to them as such (see Chapter 6 for their varying identifications).

These examples demonstrate the nature of the specific terminology used in Tibetan texts to describe the processing of mercury. It is important to be sensitive to the fact that English renderings of processing and detoxification should be understood in this book as broad English labels used to refer to very specific procedures that aim at manipulating the *qualities* of substances, not necessarily the substance itself. As Fenner explained: "To the alchemist, the process was seen as a matter of manipulating qualities. The differences between gold and other metals were not seen in terms of substance so much as color, malleability, and so on" (Fenner 1979, 67). This focus on the characteristics and properties of substances that are transformed during processing rather than on the substance itself is a critical point, which is also highlighted in recent studies on *tsotel* (see Tidwell and Nettles 2019).

Similarly, when it comes to the understanding of *nüpa* in Tibetan medical contexts, the term does not necessarily refer to the substance as such, but more often to its qualities (Ploberger 2015). In the Tibetan language, complex notions of potency are articulated under the umbrella term *nüpa*, which is frequently translated into English as potency, referring to a substance's capacity to have an effect. *Nüpa* appears as a central and unifying concept of potency, around which other terms and classifications are established. It can appear as a clearly defined technical term with precise characteristics but might carry multivalent meanings in other contexts.

Sowa Rigpa practitioners frequently talk about the potency of substances *(rdzas kyi nus pa)* as one of the three key pillars of *menjor*, along with the potency of mantras *(sngags kyi nus pa)*, referring to consecration,

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pa'i dngul chu ro de bskol ba dang ni bsgyur ba gyur pa dag gis kyang / lcags ni 'bugs shing rjes su 'bugs te mtha' dag nad 'phrog rul pa'i lcags ni rnam par spangs nas so//.

62 The "killing" or calcination of metals, turning them into ash, is first found in one Sanskrit medical text of the ninth century, and also in early alchemical texts from about the tenth century onwards, but dating these early texts is problematic and it is debated whether this terminology of mercury first appears in medical or alchemical texts (Dagmar Wujastyk, personal communication, Vienna 2016). See also Dagmar Wujastyk (2013, 18) and Dominik Wujastyk (1984).

63 These are copper *(zangs)*, gold *(gser)*, silver *(dngul)*, iron *(lcags)*, bronze *('khar ba)*, brass *(ra gan)*, tin *(gsha' dkar)*, and lead *(zha nye)*.

and the potency of dependent arising *(rten 'brel gyi nus pa)*, referring to the enhancement of *nüpa* through processing substances at auspicious times (Gerke 2019b; for the basic activities of these different modalities in Sowa Rigpa *menjor*, see Tidwell and Nettles 2019).

A relevant example from the *tsodru chenmo* practice is that the most sacred and auspicious day of manufacture is the day when the most significant changes in color and texture occur while triturating pre-processed mercury with pre-processed sulfur. Recitation of mantras and performing of rituals accompany this process (Chapter 6). The visible transformation of the whitish substance that turns into a blackish powder is so impressive that it is called confrontation or "meeting the enemy," in Tibetan *dratré (dgra sprad)*, alluding to a powerful, transformative encounter (Dawa Ridrak 2003, 424/28). The phrase "meeting the enemy" is impressive also because of its visible proof of the successful taming of mercury and the accomplishment of its potency.

The above examples should serve to clarify my approach. While not questioning the potential danger of poisonous substances in medicines, if we want to go beyond a chemical gaze we need to analyze the terms Tibetan physicians themselves use and study the medical sensibilities and specific enskilment that inform their practices and perceptions of potency.

IN THE WORLD OF ESSENCES AND ELIXIRS: *RASĀYANA* AND *CHÜLEN*

Tibetans recognized early on that mercury is a poison. Therefore, the arising question is why mercury was used in medicines at all.[64] To understand this in the Tibetan context, we need to further explore a few key technical terms and themes surrounding this notion of a poison becoming an elixir, which is encapsulated in the taming narrative and origin myth of poisons, explored at the beginning of this chapter. Here, I will briefly discuss the body of knowledge surrounding essences and elixirs and how they are embedded in the wider corpus of longevity, alchemy, and rejuvenation practices in Sanskrit and Tibetan medical texts.[65] Contemporary Tibetan physicians' interpretations of terms often differ significantly from what is in their texts. Walter (1980, 10–11) reminds us that to call a drug an elixir might just mean that it is a potent drug and not that it is alchemical in nature. All the technical terms surrounding the alchemy-elixir-rejuvenation complex require context-specific definitions for us to make sense of their very wide applications. How can we understand the position of mercury in this multifaceted field?

64 Medical historian Andrew Cunningham explores the same question about using mercury as medicine in Europe (2018b).

65 Since the mercury practices I studied for this project are largely of Indic origins, I do not consider Chinese mercury practices in this book. It is also beyond the scope of this work to develop comparative approaches with the history of Chinese mercury practices. See Needham, Ping-Yu, and Gwei-Djen (1976) on the use of cinnabar in medicine in China.

The Sanskrit term *rasāyana* is often translated as rejuvenation or alchemy; however, some scholars think that the meaning of alchemy as a discipline attributed to the term *rasāyana* (which refers more to a set of practices) is a much later development.[66] *Rasāyana* is, however, by and large considered the principal Sanskrit term referring to the material aspects of alchemical processes (Samuel 2010), and also refers to rejuvenating drugs or tonics (Wujastyk 2015d), as well as the final stages in alchemical operations in which the elixir is imbibed by the practitioner.[67] *Rasāyana* is also one of the famous eight branches (Tib. *yan lag brgyad*, Skt. *aṣṭāṅga*) of the fundamental framework of medical classification in both Indian and Tibetan traditions. Two of these eight branches deal with important aspects of vitality—the branch of healing the aged focuses on rejuvenation while the branch of restoring virility targets fertility (see Gerke 2012 [2013], 332–333).

Besides describing the composition of elixirs and tonics, *rasāyana* in most Indian alchemical traditions also refers to the transmutation of metals into gold (Walter 1979, 319); and while *rasa* is one of the synonyms of mercury, it can mean many other things as well, such as the sap or juice of plants. Already in early Sanskrit medical texts, the divergences of approaches, ingredients, and *rasāyana* practices "are so great that any single definition of *rasāyana* is put into question" (Wujastyk 2014, 170).[68] Early Indian Ayurvedic compendia of the first to third century CE allude to a substance called *rasa* that could have been mercury (Wujastyk 2013, 17). We can be more certain that the first formula used for ingesting mercury is found in the Ayurvedic compendium of the seventh century CE, the *Aṣṭāṅgahṛdayasaṃhitā* (see Chapter 4), which prescribes mercury (here called *pārada*) "as an ingredient of a 'rejuvenating tonic' *(rasāyana)*" (Wujastyk 2013, 18).

The Tibetan translation of *rasāyana* as "the coming forth by itself *[āyana]* of the fluid essence *[rasa]*" (compare with White 1996, 73) is *chülen (bcud len)*, which means imbibing the essence or *chü (bcud)*. *Chülen* is also translated as essence extraction, referring to its manufacturing. Walter (1980, 66, note 4) emphasizes that in Tibetan the term *chülen* is consistently used "when referring to metallic, non-metallic, and yogic alchemy, as well as in its Ayurvedic sense of 'tonic.'" The body of Tibetan *chülen* practices is enormous and also heterogeneous. Many Tibetan Buddhist masters wrote *chülen* recipes for a variety of therapeutic effects, ranging from dietary techniques to survive in harsh retreat environments on little food to meditative rejuvenating agents and medicines. There are hundreds of *chülen* recipes without demarcated classifications. Of the seventy-three *chülen* texts which were recently analyzed by Oliphant (2016), only four list mercury as an ingredient for longevity-enhancing *chülen*.

66 Dagmar Wujastyk, personal communication, Vienna, March 2016.
67 Dagmar Wujastyk, personal communication, Vienna, June 2019.
68 See Wujastyk, Newcombe, and Barois (2019) for a comprehensive introduction on the various definitions of *rasāyana* and its link to longevity practices in Sanskrit medical and alchemical works.

The term *chülen* has frequently been translated as elixir (Emmerick 1990, 89), the elixir of rejuvenation (Parfionovitch, Dorje, and Meyer 1992, 119), and as alchemy (Lai 2013, 229). The labels rejuvenation and alchemy have a rather esoteric connotation, and rejuvenation is a popular term in contemporary product descriptions of Tibetan *chülen* that are marketed as supplements.[69] Some *chülen* are indeed elixirs and are mentioned in the *Four Treatises* in the form of pills, liquids, decoctions, extracts, or liquors, but not all of the manufacturing techniques could be called alchemical in the sense of substances undergoing a transformation, or involving base metals. A *chülen* can also be an essence extracted from outer elements and Buddha fields by means of visualization (Gerke 2012 [2013], 350–353). *Chülen* practices are divided into inner and outer practices (Samuel 2010; Lai 2013). In the *Kālacakratantra*, they are presented as internal *chülen (nang gi bcud len)*, which involves tantric practices aimed at longevity and enlightenment within a complex cosmology, and external *chülen (phyi'i bcud len)*, dealing with the preparation of elixirs and gold making *(gser gyur)* (Lai 2013, 230).

Thus the *Kālacakratantra* points to two important relationships Tibetan physicians typically associate with mercury: first, the fundamental interrelationship of mercury with Indian Buddhism and second, with the complex themes of longevity and immortality. Overall, the *Kālacakratantra* favors internal meditative alchemical practices and considers external substance-dependent practices that rely on actual materials as mundane (White 1996, 71; Fenner 1979, 80, 183–184; see also Samuel 2010). The *tsodru chenmo* technique discussed in this book—although showing some parallels to the mercury-related verses of Chapter 5 of the *Kālacakratantra*—has not been introduced to me as originating from it. Contemporary Tibetan physicians told me that the complex *tsotel* practice goes back to the enigmatic figure of Orgyenpa, who, although trained in the *Kālacakratantra,* introduced more complex mercury processing techniques to Tibet from his journey to the Swat Valley (see Chapter 4).

The terms for alchemist in classical Tibetan do not contain the word *chülen* but speak of a wide variety of activities an alchemist would be involved in, such as processing mercury, creating wealth, transforming gold, and enhancing immortality.[70] As far as I know, none of the terms for alchemist are used today for Tibetan physicians producing medicines containing mercury, and none of the Sowa Rigpa experts making *tsotel* would call himself an alchemist. A Sowa Rigpa medical practitioner who is specialized in making medicines is called a medicine compounder or

69 See, for example, a supplement developed by the Men-Tsee-Khang in Dharamsala, called Elixir of Rejuvenation *(rgas pa gso ba bcud len chen mo)*, which translates as "the great essence extraction healing the aged" (Gerke 2012b, 212–214).

70 Tibetan dictionary terms for alchemist are, for example: "the mercury person" *(dngul chu pa)*, "one able to create wealth" *(nor bsgyur mkhan)*, which is the Tibetan translation of the Sanskrit *dhātuvāda* in the *Mahāvutpatti* (quoted from Walter 1980, 66); "a practitioner of the art of transforming materials into gold" *(gser 'gyur gyi rtsi sgrub mkhan)*; and "someone who attained the nectar of immortality" *('chi med kyi bdud rtsi bsgrub mkhan)* (Kazi Dawasamdup 1919, 31).

menjorpa (sman sbyor pa) and the pharmacy is called house of medicine compounding or *menjorkhang (sman sbyor khang)*. However, the English term alchemist is frequently used by scholars when referring to Tibetan practices involving the transformation of metals, which is perhaps due to the historical roots of the term alchemy (e.g. the Greek *khēmia* or *khēmeia*, referring to the art of transmuting metals) and related meanings in the European languages. I prefer to avoid the overloaded term alchemy, especially in discussions of Tibetan mercury practices; however, I use alchemy in the Indian context, referring to works of early iatrochemistry, and alchemist when referring to its practitioners. Note that a trained Sowa Rigpa physician typically compounds *and* prescribes medicines; in India, there is no specialized degree in Sowa Rigpa *menjor*. Only recent institutionalization has led to a separation of medicine making and clinical practice (Pordié and Blaikie 2014), but this separation has not yet translated into separate institutionalized degree courses on making medicines.

This chapter began with the origin myth of taming poisons into elixirs and outlined Tibetan indigenous understandings of what that means in relation to mercury processing in Sowa Rigpa. There is no doubt that mercury has been considered highly toxic (and potent) across Asia. However, the toxicity of mercury also has global and political sides to it, which have influenced ideas of its risks and dangers and how it should be controlled, phased out, and regulated.

Today, modern science significantly shapes our understanding of toxicity and safety. Current approaches to toxicity in Asian medicines too easily preclude indigenous perceptions of poisons, universalizing Western understandings of toxicity. Government policies are based on mercury's elemental structure, often without distinguishing between its chemical bonds and their varying toxicity. The issues that are at stake in the discussion of mercury in Asian medicines often center on the politics of mercury toxicity. On what basis is mercury measured, defined as toxic, and legally negotiated? Who decides what is toxic? Below, I give some examples of how mercury's chemical toxicity—in itself a cultural story—informs the UNEP ban and pharmaceutical regulations in the European Union. How does it impact studies of toxicity in Asian medicines, and what does this tell us about the politics of toxicity? The following sections provide important background information for my broader socio-historical analysis of themes of taming, which I introduce in Chapter 3 through the anthropological lens of the pharmaceutical nexus.

The politics of mercury toxicity

This book follows the story of mercury—a highly toxic metal (in most of its forms)—not just in the world of Tibetan medicine but in relation to the politics of toxicity, global regulations, and the larger issues of safety that are considered global public health concerns today. The recent, legally

binding, global UNEP ban on mercury—which aims to shut down mercury mines and reduce the use of elemental mercury (Hg) as a global pollutant—has raised new questions regarding the safety of the therapeutic use of processed mercury (largely as forms of mercury sulfide) in Asian medicines.[71] It also raises questions on the ways in which such legislation is introduced to Asia, often ignoring the medical epistemologies of Asian medical traditions, several of which are actively practiced in India and are officially recognized under the Ministry of AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha, Sowa Rigpa, and Homeopathy). The UNEP mercury ban is in itself a testimony to the cultural story of a specific depiction of mercury's chemistry receiving a global hegemonic status. Before outlining the parameters of the UNEP mercury ban, I shall first briefly summarize how the chemical forms of mercury have influenced debates on mercury's safety in Asian medicines. The metrics followed in these studies are discussed in the last section of this chapter.

THE CHEMICAL GAZE: MERCURY AS AN ELEMENT

The natural science of chemistry considers mercury as an element with high density (13.534 grams per cubic centimeter). Mercury is liquid at room temperature and highly toxic for most organisms due to its considerable vapor pressure. Its toxicity varies greatly, depending on its organic (i.e. linked to carbon atoms, e.g. methylmercury in fish, ethylmercury in preservatives) and inorganic forms (i.e. without carbon atoms, e.g. mercury vapor, mercurous chloride (calomel), dental amalgam, cinnabar), summarized in Appendix A. Because of its high toxicity in most of its forms, serious attempts have been made during the last decades to stop mercury emission, particularly from various industries (e.g. cement, coal).

Mercury has a fascinating history revealing a rich tapestry of varying therapeutic applications and changing perceptions of safety (Cunningham 2018a; Goldwater 1972). Despite its health risks being at least partially known since ancient times, the applications of mercury (compounds) are surprisingly numerous. Its use has ranged from the extraction of gold, the felting of hats ("mad hatter"), the making of thermometers, electric light bulbs, and switches, to the treatment of syphilis. The medical use of mercury was widespread in European medicine for almost 500 years—from the late 1490s until the late 1950s (Cunningham 2018b, 173).

Anyone reading on mercury toxicity might be surprised by its complexity.[72] Not only does the heavy metal have different half-lives in various human tissues—varying from three days to decades (Kim, Kabir, and Jahan 2016, 382)—the body's absorption of mercury is also highly variable

71 For related publications and reports see UNEP (2019).

72 Different forms of mercury and their toxicity have been documented in numerous studies. See Bernhoft (2012) for a recent summary of mercury's forms of toxicity and treatment.

and depends on its different chemical forms, each of which causes a different public health concern (Clarkson and Magos 2006; see Appendix A for a summary). Mercury poisoning can also be hidden; high levels of mercury in the blood and/or urine do not necessarily give a clear indication of the distribution of mercury in the body. For example, someone can have severe mercury toxicity with low levels of Hg in blood and urine (Kim, Kabir, and Jahan 2016). Symptoms of mercury poisoning can be manifold, and because they can affect all parts of the body, they are difficult to diagnose (e.g. through neuro-cognitive tests, Hg levels in urine, blood, and hair) and are generally treated with chelating agents (Bernhoft 2012). Even though mercury toxicity is well studied, the debates concerning the toxicity of mercury amalgam used for teeth fillings demonstrate how scientists themselves have held contradicting views on mercury safety for decades and how economics and the power of health insurance companies—who for the most part only pay for the less expensive mercury fillings—plays a role in the politics of toxicity.[73]

To follow the debates concerning mercury toxicity in Asian medicines, it is important to understand that different mercury compounds with varying solubility and stability/reactivity have vastly different absorption levels in the body, varying from less than 0.01 to 95% (Clarkson and Magos 2006, 613; Liu et al. 2008, 813). The organic dimethylmercury, first synthesized in the mid-1850s, is absorbed up to 80% when breathed, and when ingested is intestinally absorbed at around 95%, of which around 90% is excreted through feces and less than 10% through urine (Ye et al. 2016). When crossing the blood–brain barrier it can cause significant symptoms of acute toxicity, such as dyspnea, nausea, and vomiting, while long-term exposure can lead to tremors, psychological disturbances, salivation, fatigue, and insomnia (Clarkson and Magos 2006, 613, 619), as well as diarrhea, blurred vision, tremors, paralysis, and memory loss (Kim, Kabir, and Jahan 2016). Forms of inorganic mercury do not cross the blood-brain barrier but can accumulate in the kidneys (Ye et al. 2016). Long-term effects of low but chronic Hg exposure might contribute to common diseases that are not easily associated with mercury, such as sleeping disorders, hearing loss, mood problems, or high blood pressure (Kim, Kabir, and Jahan 2016, 381–382). Eating contaminated fish can cause methylmercury toxicity—known since the 1950s because of Minamata disease[74] (Clarkson and Magos 2006, 625–628, 631). Drinking liquid mercury as a laxative—an eighteenth-century European therapy for constipation—is relatively harmless, while eating one gram of mercuric chloride (known as corrosive sublimate) can be fatal (Clarkson and Magos 2006, 612, 616).

73 For a summary of the amalgam debates see, for example, Bates (2006).

74 Minamata is the name of a city and bay in Japan that was heavily poisoned with methylmercury from industrial waste in 1956, leading to almost 2,000 deaths from Minamata disease, caused by consuming contaminated fish.

It is worth noting that the chemical form of mercury that is least absorbed by the body—mercury sulfide (cinnabar)—is the one used in most Asian mercury-containing medicines.[75] Due to its very low solubility, less than 0.2% of mercury sulfide is absorbed through the intestinal tract into the body, and thus large amounts would have to be ingested to cause toxicity symptoms, mainly in the kidneys (Liu et al. 2008). Cinnabar is typically not converted into the more toxic methylmercury by human gut bacteria (Zhou et al. 2011). It is important to note that Sowa Rigpa experts do not use cinnabar in unprocessed conditions (see Tidwell and Nettles 2019; Yeshi et al. 2018).

In Asia, physicians and pharmacy staff involved in mercury processing, when transforming liquid metallic mercury into the less toxic mercury sulfide, are often exposed to toxic mercury fumes, and sometimes experience symptoms when precautions are not taken. Temporary blurred vision is a common side effect of occupational mercury exposure (Cavalleri and Gobba 1998), which several Tibetan physicians I interviewed who had processed mercury experienced (Chapter 6).[76]

THE GLOBAL MERCURY BAN

The UNEP mercury ban is the world's first globalized effort to phase out mercury from industry. Here I introduce the ban, its main objectives, and how it might affect Asian medical traditions, even though traditional medicine is not mentioned anywhere in the treaty. I also document some of the reactions to the ban among Ayurvedic and Tibetan practitioners in India.

The ban was initiated by Switzerland and Norway and was adopted by the Governing Council of the United Nations Environment Programme in 2009. On January 19, 2013, UNEP passed the text of the legally binding treaty called the Minamata Convention on Mercury, aimed at preventing emissions of the neurotoxic heavy metal worldwide.[77] The European Union and ninety-one countries signed the document in October 2013 in Japan.[78] India signed the treaty in October 2014 and has until 2020 to implement it. The research conducted for this project thus largely fell into the period leading up to and during India's signing of the treaty.

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75 For example, the two forms of mercury sulfide compounds mentioned in Indian *rasāyana* texts are *kajjalī,* which is black in color and metacinnabar (β-HgS), and *rasasindūra*, which is red cinnabar (α-HgS) (Bhatt 2013). See Tidwell and Nettles (2019) for further explanations on the types of cinnabar in *tsotel* and how *tsotel* samples could be analyzed without chemically degrading the substance in the process.

76 Constricted visual fields and loss of vision have been reported after exposure to (di)methylmercury (Clarkson and Magos 2006, 630, 632) and temporary loss of color vision after exposure to mercury fumes (Cavalleri and Gobba 1998).

77 See Hortoneda (2013) on "Minamata Convention Agreed by Nations."

78 For a full coverage of this conference, see IISD (2013).

Looking through the long reports from the four years of negotiations (2009–2013), the use of mercury in traditional medicines rarely features. A request to exempt "traditional religious use" was made by one delegation during the second meeting in Japan (UNEP 2011a, 39). In the third report, only one country "expressed concern for the listing of traditional medicines" (UNEP 2011b, 30). The fourth report stated that "two representatives highlighted the need for exemptions for mercury-containing products, such as cinnabar, for use in traditional medicines" (UNEP 2012, 10–11). Unfortunately, the report does not mention which countries these representatives came from. In the fifth and final session in 2013, it was eventually decided to exclude from the treaty "products used in traditional or religious practices" along with "vaccines containing thiomersal as preservatives" (UNEP 2013, 61). One should note that the term "traditional or religious practices" does not explicitly include medicine, though traditional could be interpreted as including traditional medical practice.[79]

According to these UNEP session reports, the use of mercury in traditional practices is a minor issue when it comes to the overall concern about mercury as a heavy-metal pollutant through mining, coal combustion, cement production, industrial waste, and mercury-containing products such as light bulbs, thermometers, blood pressure devices, skin-lightening soaps and creams, and dental amalgam fillings. Nevertheless, Ayurvedic practitioners in India have realized that the UNEP mercury ban could affect their metal ash *(bhasma)* practices[80] if mercury mines were shuttered and trade curtailed. The point was raised in the Indian media by Dr. Anand Chaudhary, head of the Department of Ayurvedic Pharmaceutics (Rasa Shastra & Bhaishajya Kalpana) at Banaras Hindu University (BHU), which specializes in mercury and other Ayurvedic metallic preparations. Dr. Chaudhary (and others, e.g. Baghel 2013) argued for an exemption explicitly for the use of mercury in Ayurveda, and not just as part of the loosely defined "traditional or religious practices."[81] He wrote to the Indian prime minister requesting specific exemptions for the use of mercury in Ayurveda.[82] To date, a response is still awaited. Tibetan practitioners in India have not lobbied for an exclusion so far. When talking about this with Tibetan physicians in Dharamsala, I noticed a sense of powerlessness because of their feelings of political marginalization as refugees and considering the much larger size of the Ayurvedic pharmaceutical industry.

79 See UNEP (2008) on "Cultural Uses of Mercury." For the full text of the Minamata Convention, see UNEP (2017).

80 These metal ashes are made from mercury, lead, and other metals (Chaudhary 2011; Galib et al. 2011). On recent debates on *bhasma* toxicity see Banerjee (2013) and Nagarajan et al. (2014).

81 See Chandra (2013), TNN (2014a), and Dagmar Wujastyk (2015b, 820).

82 Dr. Anand Chaudhary, personal communication, BHU, Varanasi, March 14, 2015. See also TNN (2014b).

THE ATOMIC MODEL

The European Union—like most countries—bases the analysis of metal contaminants in traditional medicines, drugs, or food on the atomic model (Schwabl 2013). This is founded on a certain interpretation of risk from contaminants and the ability to measure them with literally 99.9999% accuracy, which is then considered the hegemonic status quo in a given legal and regulatory context. The interpretation of risk follows the risk-benefit model that regulates the safety of medicines internationally. Only if the benefit outweighs the risk can a drug be allowed to enter the market (Wiesner 2014). EU regulations rely on pragmatic forms of implementation and a simplified science: is Hg present or not? (Schwabl 2013). Legally it does not matter which chemical bond Hg appears in and whether it is more or less toxic. Any form of Hg in a traditional drug from Asia entering the EU is not tolerated by EU laws. This is a good example of one of the pitfalls of using quantitative measurable data or metrics to measure and evaluate global health problems (Adams 2016). Adams points out that "metrics enable certain kinds of medical practices while impeding others. They generate forms of knowledge and certainty about some things even while effacing others" (Adams 2016, 225). While it is definitely useful to have a global measure to account quantitatively for mercury toxicity, the pragmatic focus on measuring Hg effaces opportunities for a more detailed assessment of the different mercury compounds (e.g. mercury sulfide) that have hugely varying levels of toxicity. This would be roughly analogous to only testing for and banning another highly dangerous element in its chemically pure form: sodium. Sodium is highly reactive, readily catches fire, and can explode on contact with atmospheric moisture, yet when combined with chlorine—another dangerous element in itself—the resulting sodium chloride is found in every kitchen as common table salt.

This limiting focus on Hg and the lack of attention to the various chemical compounds of mercury is a crucial point when assessing the toxicity of Asian medicines containing processed cinnabar. Below I will introduce a few studies to point out the pitfalls of this limitation and discuss what is at stake for Asian medicines when the methodologies used to measure Hg toxicity do not take into account the bioavailability of the different chemical forms of mercury. I will also introduce a few studies that have taken a different approach.

One case is the widely-cited—and critiqued (e.g. Banerjee 2013; Gerke 2015c; Sébastia 2015)—study on mercury in Ayurvedic formulas sold online in the US (Saper et al. 2004, 2008). Contemporary Ayurvedic *rasaśāstra* or rejuvenating supplements frequently contain higher levels of heavy metals than other supplements. The Saper study found they contained the largest amount of metals among the surveyed supplements with 40%, while 20.7% of the samples were found to have potentially toxic levels of lead, arsenic, or mercury (2008, 918). However, one major shortcoming of Saper's

study is that the investigators did not differentiate between the types and chemical species of heavy metals used. In the case of mercury and arsenic, not taking into account their vastly different levels of absorption leads to questionable results and biased conclusions. What is often overlooked in such studies is that the amount of mercury detected in the products is not equal to the amount of mercury absorbed and eventually accumulated by the body. Depending on the nature of mercury compounds, they will differ in solubility and reactivity, and will consequently have varying levels of toxicity.

The focus of most studies on mercury in Asian medicines to date (with a few exceptions noted below) has been on the element Hg, irrespective of its bioavailability. Here lies the crux of the dilemma for its use in Asian medicines. The authors of the Saper study themselves acknowledge that the "specific physical form or chemical species of the metals" used in *rasaśāstra* were not taken into account (Saper et al. 2008, 922), a significant methodological lapse when it comes to mercury and the vastly different levels of toxicity of its chemical compounds. They reason that "the physicochemical form of metals in rasa shastra medicines and their bioavailability have not been fully characterized or reported" (2008, 922). Studies on the toxicity of *tsotel* reveal similar shortcomings (Sallon et al. 2006, 2017). Obviously, economic factors contribute to such lapses—it is considerably more expensive to test the various chemical compounds of mercury in substances and human tissues than to simply check for Hg. Simplified and pragmatic approaches to defining and detecting mercury toxicity by merely measuring the concentration of Hg, while more economic and practical, are also an expression of the metrics and politics of mercury toxicity that has begun affecting medical systems in South Asia. Sébastia (2015) discusses this politics of toxicity and how the study by Saper et al. (2004) and others impacted the reinforcement of Good Manufacturing Practices (GMP) by AYUSH in 2005. The consequence has been a reduced production of mercury-containing medicines in small-scale Siddha medicine manufacturing units in South India (Sébastia 2015, 937–938). It remains to be seen how the implementation of the UNEP mercury ban and any possible negotiations for exemptions for AYUSH medical systems will further affect these and other Asian medical practices.

More nuanced studies addressing the chemical state of elements have been conducted, largely on Traditional Chinese Medicine (TCM) in the PRC. Wu et al. (2011, 839), for example, showed that "different chemical forms of arsenic and mercury have different toxic potentials" and that "both cinnabar and realgar [arsenic sulfide] are much less toxic than well-known mercurial[s] and arsenicals." The PRC is also leading in the chemical analysis of *tsotel*, having a vested interest in the pharmaceutical business of precious pills (Saxer 2013).

In 2007, the micro-structure and chemical composition of a *tsotel* sample from Qinghai Province, PRC, was analyzed for its elements as well as chemical composition, which showed mercury as mercury sulfide crystals

that are insoluble in water, and in the form of solid micro-particles (Yan, Ma, and Zhu 2007). According to this study, a sample of *tsotel* from Qinghai was mainly composed of Hg, C, S, and O, as well as trace amounts of Si, Mg, Fe, Al, Ca, Se, K, Cu and Ni, in addition to other elements.

A detailed study analyzed four samples of *tsotel* from Tibet, Qinghai, Gansu, and Sichuan and found *tsotel* to be "mainly an inorganic mixture of HgS [mercury sulfide], sulfur, and graphite, forming nanoparticles" with trace amounts of "other elements, including Mg, Al, Si, K, Ca, Fe, Cu, Zn, Rb, Sn, and Pb" (Zhao et al. 2013, 2–3).[83] This study also found organic substances from the plant and animal materials added during the processing, and concluded that "the system was too complicated to analyze the organic substances in detail" (2013, 3). This is understandable considering that quite a number of plants, minerals, and animal substances are used during processing. They do not count as the ingredients of *tsotel* but are used to boil and triturate mercury, pre-process the eight metals and minerals, and to some extent, they would end up in the final compound.

The first toxicity study that was carried out at the Men-Tsee-Khang in Dharamsala was incomplete but revealed that their sample of *tsotel* "demonstrated the presence of mercury 44.7%, calcium 1%, sulfur 42.5%, silver 0.4%, iron 1.5% and copper 0.5% [= 90,6%]. Most mercury was in the form of mercuric sulfide (HgS) with smaller amounts as mercuric sulfite ($HgSO_3$) and mercuric sulfate ($HgSO_4$)" (Sallon et al. 2006, 409). While these two studies paid more attention to the identification of different Hg compounds, they still lack accuracy because of the complexity of the multi-component substances used in making *tsotel* and the lack of scientific methods to determine exact compound compositions such as the form and phase of HgS molecules. Tidwell and Nettles (2019, 140) mention several recent studies on *tsotel* that used "additional techniques, including 2-D powder X-ray diffraction and others that do not chemically degrade the substance." These studies found that "*tsotel* is primarily mercuric sulfide (HgS) nanocrystals, with excess sulfur and small amounts of carbon and other elements. No signal for single element mercury was found by the non-destructive analysis (Zhao et al. 2013; Yan 2007; Li et al. 2016)."

Each study used different analytical techniques and *tsotel* samples, and thus results differ. They are also difficult to compare because of the lack of standardized manufacturing methods across Tibetan pharmacies. The composition of *tsotel* varies considerably between different pharmacies (Zhao et al. 2013). With the lack of standardized production, each batch of *tsotel* in each pharmacy would have to be checked individually. Moreover, the amount of Hg varies within individual precious pills (Aschoff and Tashigang 1997, 133–135; Sallon et al. 2017), and the composition of raw materials used in precious pills sold under the same name by different factories differ significantly and are not standardized (Schwabl A. 2001).

83 Energy dispersive x-ray analysis (EDX) of nine *tsotel* samples showed that they contain "Hg, S, O, Fe, Al, Cu, and other elements" (Li et al. 2016, 1).

The studies introduced above show that the issues at stake in mercury toxicity studies of Asian medicines largely center around developing fine-tuned methodologies to measure mercury's bioavailability[84] versus only the elemental Hg content of a compound to clearly judge the levels of its toxicity. Studies on the nanoparticles size of *tsotel* (e.g. Li et al. 2016; Zhao et al. 2013) might help to better understand its pathways in the body and its potential efficacy. However, the lack of standardization across pharmacies and countries that produce *tsotel* as well as the use of multiple substances during processing will make it very difficult to scientifically evaluate all of its ingredients. Except Tidwell and Nettles (2019),[85] current studies do not address Sowa Rigpa parameters used in the processing of poisonous substances or raise questions of how making a "rough" substance "smooth" could translate into a chemical process and an appropriate scientific research methodology. Such cross-cultural translations of research methodologies are challenging and would require researchers on both sides to receive special training. I will give some examples of such transcultural processes between Western and Tibetan researchers based on ethnographic observations during the second *tsotel* study in Dharamsala in Chapter 7, where I look at how Sowa Rigpa ideas of taming translate into Tibetan approaches to science.

None of the existing scientific studies on *tsotel* mentioned above has analyzed its complex processing technique, *tsodru chenmo*, step-by-step. It would require a team of scientists, significant finances, and extensive cooperation with Tibetan *menjor* specialists. Views regarding scientific approaches towards studying *tsotel* greatly varied among my interlocutors in India. The current Men-Tsee-Khang director, Tashi Tsering Phuri, told me in 2012 that he would welcome an analysis of the final product *tsotel*, but not a step-by-step analysis of the process.[86] Some Tibetan physicians, including the previous Men-Tsee-Khang director, Dr. Tsewang Tamdin, would welcome a chemical analysis after each step of the processing (MTK 2011a, 6); others I spoke with support an analysis of the final product for scientists "to verify that we know how to purify mercury," leaving it up to science to prove them right. These opinions reflect very different views on what science can and should accomplish for Tibetan medicine (Adams, Schrempf, and Craig 2011a; see Chapter 7). Moreover, issues of secret knowledge transmission and safeguarding intellectual property rights (Pordié 2008; Pordié and Gaudillière 2014) need to be respected here.

84 See more recent studies by Bolan et al. (2017) and Jayawardene et al. (2010) on bioavailability of heavy metals in traditional medicines. Such studies provide a more specific risk-assessment of medicines that contain mercury and other heavy metals in their varied chemical forms, whether designed on purpose or through environmental contamination.

85 These authors address some of the challenges involved in developing a pharmaceutical research approach based on Sowa Rigpa medical theory, defining some of the key terminology of related pharmacology and *menjor* concepts.

86 Tashi Tsering Phuri, personal communication, Dharamsala, September 29, 2012.

Considered together, it does not increase the likelihood of detailed *tsotel* studies being conducted any time soon.

In summary, mercury toxicity studies—Hg nuanced or not—all relate to measurements of concentration based on the concept that matter consists of discrete entities, atoms, or molecules, as generally accepted in biomedical science. Most of these studies are additionally impacted by issues surrounding production, standardization, contamination, occupational safety, and ownership of knowledge. We still lack concepts (and funds) to scientifically investigate and characterize complex pharmacological techniques such as *tsodru chenmo*, which ideally would include Tibetan epistemologies of taming poisonous substances and methods that do not chemically degrade *tsotel* before analyzing it (see Tidwell and Nettles 2019, for suggestions). One of this book's major objectives is, for the first time, to explore the various epistemologies that inform and underlie Tibetan mercury processing techniques, create a better socio-historical understanding of these practices, and highlight what is at stake in their survival.

The following chapters concentrate on the theme of taming and how this plays out in the social dynamics of those processing mercury into *tsotel.* I explore the historical and contemporary knowledge transmission of this practice, its encounter with global safety and toxicity debates, and what this tells us about the cultural translation of toxicity.