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Sensing as Knowing: Medicines, the Senses, and Practical Expertise in Late Imperial China

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Abstract

The development of the medicinal trade and markets in late imperial China increased anxiety among scholarly physicians about the authenticity of medicines. Even though the market was typically depicted by scholarly physicians as a place full of tricks and deceptions, it was a repertoire where practical knowledge about authentication was created and circulated. The specialized knowledge was mainly transmitted through oral tradition. But in some instances, it was also written down by scholarly physicians or merchants, allowing us to reconstruct the techniques and their underlying rationales. Authentication of medicines mobilized multiple sensory perceptions of the human body, consisting of observing, tasting, smelling, touching, and performing small tests. All these techniques played different roles in the practice of authentication. Even though these sensory techniques seemed like a collection of trivial and practical records without any coherent rationales, an underlying episteme could be detected through a close investigation. Merchants and practitioners in the market did not understand the nature and materiality of medicines by any established theories. Instead, they actively engaged with the tangible form of medicines through the senses and bodily techniques. This sensory form of knowing indicates a type of practical expertise that is distant from the scholarly tradition of materia medica in late imperial China.

Keywords: Authentication; Market; Medicines; Senses; Practical expertise

> "Those who sell medicines have two eyes, those who prescribe them have only one eye, and those who take them have no eyes at all."
> Chen Jiamo (陳嘉謨), *Ben Cao Meng Quan* (《本草蒙筌》 *Enlightening Primer of Materia Medica*), 1573[1]

1 Introduction

A 16th-century work of *Ben Cao* (本草 materia medica) gave this wise advice in its introduction. For the next three centuries, this proverb had been quoted in multiple compilations and primers of *Ben Cao* in late imperial China. Indeed, most works of the *Ben Cao* published in the Ming and Qing periods were written by and for medical practitioners or elite readers who fell into the categories of "those who prescribe medicines" and "those who take them." In this regard, knowledge about the authenticity of medicines should be as crucial as their therapeutic value. However, the former kind of knowledge did not always stand out as a significant aspect in most printed *Ben Cao*. How could we approach the knowledge of authenticating medicines? Why did it matter? Was it ever recorded in any genre? How was it practiced? These are the first set of questions I intend to explore in this essay. The metaphor of "eye" in this proverb gives another hint. It implies that eyesight is susceptible to deceit, making it an unreliable authentication method. But what about other senses? The medicines and medicinal markets in late imperial China were a world of sensory knowledge that has not yet been fully exposed. This paper also attempts to investigate this realm of senses and its role in knowing medicines.

Senses, or the practice of sensing, are indispensable to both ancient and modern medicine.[2] While most relevant studies in Chinese medicine focuses on the use of sensory techniques in diagnosis,[3] this study turns to materia medica, another prominent aspect in which the senses are widely discussed and mobilized. Not only in China, but also in Europe, India, and the Islamic world, drugs and foods were historically evaluated by either taste or smell, or both.[4] These sensory qualities were thought to be indicators of their therapeutic virtue. *Wei* (味 taste/flavor) occupied a central place in Chinese *Ben Cao*. In the ancient lore of Divine Husbandman (神农), he tasted herbs and encountered 70 poisonous substances.[5] Even though some scholars may use these cases to argue that Chinese medicine was and still is an experience-based science, it is clear the tastes of medicines in *Ben Cao* do not coherently correspond to their actual flavors. It belongs to a unique style of philosophical thinking called "systematic correspondence," in which flavors,

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colors, climates, seasons, viscera, senses, and other natural and bodily things are interconnected within a five-phase system.[6]

The primacy of sight in early modern Europe on one hand downplayed the status of taste and smell, and on the other hand privileged the significance of visual culture in the study of natural history.[7] The lack of true-to-nature illustrations in Chinese *Ben Cao* was thus considered a backward feature of premodern Chinese "science." Nonetheless, recent studies tend to treat Chinese *Ben Cao* on its own terms, discovering its unique mode of knowledge production, categorization, and "innovation."[8] Other than the long genealogy of scholarly *Ben Cao* tradition, the vernacular mode of knowledge production stands out as another important topic in the study of Chinese medicines. These studies have uncovered a previously neglected aspect of Chinese medical knowledge, further articulating a set of latent yet crucial changes that occurred in China's early modern epistemic realm.[9]

This study aims to explore the sensory techniques used in the authentications of medicines during late imperial China, a period spanning from the 16th to 19th centuries. Instead of theoretical concern about the nature of drugs, it emphasizes the tangible and sensory properties of medicines, including shape, surface, color, smell, and taste. It argues that the body and the senses were key epistemic apparatus for practitioners to authenticate and to construct the materiality of medicines in the market. Even though the sensory practice seemed like a collection of trivial and pragmatic records without any coherent rationales, it reflects a practical expertise toward medicinal substances. Practitioners in the market did not understand the nature and materiality of medicines by any established theories but through an intimate connection with the tangible forms of the medicines and their properties.

2 Markets and fake medicines

The need for authenticating medicines rose alongside the development of the market. Since the 16th century, the commerce and market economy in China had developed into an unprecedented state. Vibrant trade facilitated the flow of commodities, including medicines, between different regions of the empire. The expansion of commercial and urban culture expedited an increasing demand for medicines. Not only the commonly used drugs but also new and exotic medicinal substances were brought from the borderland and coastal ports to the economic heartland. The commercialization and monetization of the medicinal trade conjured up a sense of uncertainty and crisis among scholarly physicians who mostly came from the community of learned literati and gained medical knowledge through reading books. They valued the theoretical knowledge from medical classics and also considered themselves bearing a highly moral burden of saving people. From their point of view, wholesale traders, peddlers, vendors, and brokers in the medicinal market were commonly depicted as greedy merchants who solely cared about profits rather than the quality of medicines. The unethical deeds further discredited the market as an unreliable source of knowledge. Scholarly physicians in late imperial China repeatedly emphasized the urgency to reclaim their authority over pharmaceutical knowledge, thus keeping the medical profession from being ruined by untrustworthy merchants.

Many medical writers suggested that one should take special caution when buying medicines. A 16th-century *Ben Cao* primer, *Ben Cao Meng Quan* advised one should "distinguish the fake from the genuine when buying medicine." After quoting the case of fake medicine from the *Ben Cao Jing Ji Zhu* (《本草经集注》 *Collective Commentaries on the Classic of Materia Medica*), the author further enumerated more than a dozen of malpractice he observed in contemporary market. Three categories of tricks employed by merchants can be identified: the manipulation of inferior medicines into a state resembling the superior kinds; the use of cheap substitutes for expensive medicines; adulteration of fake and inferior materials.[10]

This enduring sentiment among scholarly physicians survived the dynastic change in the mid-17th century and continued to prevail during the Qing dynasty. After the fall of Beijing in 1644, the Ming loyalist Li Yangang (李延罡 1628–1721) escaped to Jiaxing, where he practiced medicine for a living. He accidentally acquired a manuscript on the nature of medicines authored by a little-known physician in the late Ming dynasty. Deeply impressed by its innovative interpretation of medicines, Li decided to publish it with a piece of his own introductory essay in 1680. In Li's essay, he wrote a part titled "On Genuine and Fake Medicines."[11] He lamented that physicians in his time solely relied on market for the supply of medicines. Since they no longer prepare medicines themselves, they possessed little knowledge about the authenticity of drugs. Most cases of fake medicine he recorded were directly copied from earlier works, but Li further complicated the meaning of fake medicine. A fake medicine could be a different kind of herb, but in other cases, it also denoted medicinal substances collected from a different (non-authentic) place, taken from the wrong part of plants, or processed by unskillful hands. All these signified inferiorities in their therapeutic value.

A decade later, Wang Ang (汪昂 1615–1694), a scholarly physician from Anhui province, published an enlarged version of his best-seller *Zeng Ding Ben Cao Bei Yao* (《增订本草备要》 *Essentials of Materia Medica, An Enlarged version*) in 1694. He decided to add one paragraph at the end of the general introduction:

> "If one herb does not come from its authentic native place, its value will be reduced; if adulterated in the markets, the property and taste will be completely altered; if not collected in the correct season and time, the quality will be degraded; if the part of the plants is mistaken, the drugs will not be efficacious; if not delicately processed, the therapeutic value will not be fully achieved."[12]

Wang expressed a similar idea to Li's. The decline of the traditional practice of preparing medicines among doctors gave rise to a deep concern among scholarly physicians about the authenticity of medical substances in the market. They considered the malpractice in the market and the ignorance of mediocre physicians as two sides of the same coin, both deteriorating the therapeutic credibility of medical practitioners. For them, the knowledge about the authenticity of medicine was too important to be solely controlled by merchants. They suggested, just as the famous medical writer Xu Dachun (徐大椿 1693–1771) once appealed to the practitioners of his time: "Physicians must prepare medicines themselves!"[13]

All these elite discourses appeared at the turn of the 18th century when a new surge of commercial expansion spread all over the new empire after a temporary interruption during the Ming-Qing transition. This new period witnessed the formation of an integrated market system for medicinal trade in China. Several specialized market towns for medicines rose respectively in the north and south parts of the Qing empire, connecting the main trading routes where medicines from different regions circulated. Commercial pharmacies rapidly spread over most cities and market towns, making all kinds of medicines from remote lands readily available for urban consumers. The rising demand for medicines caused a decrease and even exhaustion of natural resources in many traditionally recognized regions. New sources of medicinal plants were founded, and herbal cultivation also grew in old areas of production. These new and lower priced substitutes appeared in the market, and further complicated the situation for both merchants and physicians.

3 The problem of authenticity

A renowned serial medical publication in the medical community of Suzhou, *Wu Yi Hui Jiang* (《吴医汇讲》 *Collected Notes of Suzhou Physicians*) provided two impressive cases that reflected the difficulty of identifying herbs in the market. The period of its compilation and publication covered nearly a decade, from 1792 to 1801. The whole collection gathered 143 short essays from 40 physicians from Suzhou, covering a wide range of topics from therapeutic discussion to medical ethics.[14] Tang Xueji (唐学吉), a medical superintendent of Wu County, was the only one who devoted several notes to discussing medicines, focusing not only on therapeutic value but also on authentication. He had once traveled to Sichuan in his 20s, where he got a chance to examine several local herbs. These herbs were also sold in the pharmacies of Suzhou. The identity of several kinds, according to him, was mistaken.[15]

The first herb Tang discussed was a purple resin called *Zi Rong* (紫茸). He referenced a pediatric manual from the 13th century, arguing the *Zi Rong* was the seedlings of *Zi Cao* (紫草 Radix Arnebiae). This herb had been applied in formulas for smallpox since the Song dynasty. In the Qing dynasty, the usage of *Zi Rong* increased with the establishment of the *Dou Ju* (痘局 Smallpox Bureau), official institution for promoting variolation in multiple localities. The *Zi Rong* Tang found in the local pharmacy of Suzhou, however, was in fact a purple resin. He thus felt the urgency to clarify the real identity of the herb to avoid incorrect usage of the substance.

The other case was a herbal tuber, *Yu Jin* (郁金 Radix Curcumae). Sichuan province used to provide high-quality wild-grown *Yu Jin*, which had a blackish color. With the exhaustion of natural sources, it had been rarely found during the late 18th century. However, Tang pointed out Suzhou pharmacy ignorantly took another herb, *E Zhu* (莪术 Rhizoma Curcumae), as wild *Yu Jin*, since the two herbs looked similar. Cultivated *Yu Jin*, the dominant type in the market, had white skin and yellow core. People in Suzhou, Tang asserted, mistakenly recognized it as *Jiang Huang* (姜黄 Rhizoma Curcumae Longae).

The two cases epitomized two ways in which marketization imposed thorny questions concerning the identity of medicines. First, as more and more exotic medicines from remote land were brought to the market, physicians encountered contradictions between medical commodities and *Ben Cao* texts. Tang was not the only one who questioned the identity of *Zi Rong*, also referred to as *Zi Cao Rong* (紫草茸) in some cases. It is evident that *Zi Rong* recorded in medical works before the 16th century was stems and roots from a particular herb.[16] However, physicians and medical authors during the 17th and 18th centuries noticed that this name was instead associated with a purple resinous substance in the market. Known as lac or *Zi Jiao Jie* (紫胶蚧 Kerria lacca) at present, it is the resinous secretion produced by an insect native to South and Southeast Asia.[17] It was newly introduced to China from India and Cambodia in the 17th century.

Second, the rise of cultivated species on one hand led to confusion among similar herbs, and on the other hand raised the value of rare wild-grown species. This further stimulated the adulteration of cheap substitutes for high-priced medicines. All the three herbs mentioned in Tang's second case belong to the curcuma genus in modern botanical terms. They were easily misrecognized even by experienced practitioners. Since the 8th century, medical authors had offered ways to differentiate them by observing their distinct colors.[18] Li Shizhen (李时珍) provided an alternative method: *Jiang Huang*

resembled the shape of dried ginger, while *Yu Jin* was analogous to the belly of cicada.[19] This method was frequently cited by medical authors in the Qing dynasty. Given that cultivated *Yu Jin*, which had a similar color to *Jiang Huang*, dominated the market, the new method proposed by Li was more feasible than the traditional color differentiation.

What else can we learn from these cases? Scholarly physicians, who were self-depicted as a prestigious group of medical practitioners, had to take mundane practice in the markets seriously. Even though they tended to despise market practice as full of trickery and deceits, it was also a repertoire they could also acquire new knowledge for "an ever-expanding pharmacy."[20] The need for authenticating medicines emerged with the commercialization of medicinal trade, yet the solution of it was ultimately acquired by consulting the practical knowledge among merchants and dealers in the market. Tang resolved his confusion by examining the substances both in the markets and the producing area. Regardless of all the controversies surrounding the *Zi Rong*, the newly introduced lac soon dominated the market and was then widely used to treat smallpox in Qing China, being the sole medical substance connected with the name *Zi Rong*. The similarity among the three curcuma herbs urged medical practitioners to record multiple methods to differentiate them. Except for Li Shizhen's approach, another author in the late 17th century offered an alternative examination of genuine *Yu Jin*: by simply grinding off a small part of the herb, those that had greenish color inside were authentic.[21]

These practical know-hows increasingly appeared in medical works, including *Ben Cao*, formula books, and medical notes, reflecting a growing concern among physicians on the authenticity of medicines. Such knowledge already appeared sporadically in many *Ben Cao* texts compiled during the medieval period, but they only focused on several precious and exotic items. In the late imperial period, however, the necessity for authentication had expanded to the most commonly used medicines in the market. Some of the knowledge was inherited from earlier texts, and many of them were newly written down by late imperial authors. Before venturing into this newly grown area, I will first introduce the main sources I used to reconstruct the intimate knowledge generated and circulated in the medicinal market.

4 Practical guides

Modern scholars of Chinese medicine tend to separate the knowledge within *Ben Cao* into two distinct types: the natural and the therapeutic. Natural knowledge of medicines includes their morphological description, producing area, harvesting and storage methods, and ways of authenticating and processing. Therapeutic knowledge refers to the healing properties of medicines, like qi, flavor, and main indications. *Ben Cao* texts after the 16th century, as argued by many scholars, was mostly therapeutic-oriented, with special focus on the discussion of therapeutic quality and clinical usage.[22] They were designed either as manuals for new learners or as a synthesis of the author's clinical wisdom. The methods of authentication, along with other kinds of natural knowledge, were largely omitted.

Comprehensive *Ben Cao* works like *Ben Cao Pin Hui Jing Yao* (《本草品汇精要》 *Essentials of Materia Medica Distinctions*), the state-commissioned pharmacopeia of Ming dynasty in 1505, had designed 24 subsections under each item, two of which were named *Yong* (用 parts for medicinal use) and *Zhi* (质 shape and texture). The content under these two subsections documented specific features that were used to identify superior medicines. Moreover, *Ben Cao Gang Mu* (《本草纲目》 *The Grand Compendium of Materia Medica*) had also recorded a considerable amount of authentication knowledge, which supposedly came from Li Shizhen's own experience. However, both compilations were too large to be used as first-hand guides in everyday practice and the former was not accessible for common practitioners in the late imperial period. The texts I'm going to investigate in this section cannot fall into a single category, but they similarly dedicated most or a major part of the content to the knowledge of authentication. Instead of comprehensive compilation, they were accessible and handy manuals that served as practical guides for either scholarly physicians or medicinal merchants.

Many modern traditional Chinese medicine researchers assume that the first published monograph dedicated to the authentication of medicines appeared at the turn of the 20th century. Zheng Xiaoyan (郑肖岩), a physician in Fujian province, was the first to write a book on this topic. In his *Wei Yao Tiao Bian* (《伪药条辨》 *Systematic Differentiation of Fake Medicines*), Zheng accused merchants and apothecaries of using their expertise to manipulate medicines. "Merchants are extremely greedy…They take the fake for the genuine, the cheap for the superior."[23]

Zheng Xiaoyan finished his work in 1901. For its publication, Zheng approached his friend Cao Bingzhang (曹炳章). Cao, a renowned physician in Shaoxing, was delighted to read Zheng's work. He further added his own annotations to each item and published it in a prestigious medical journal, *Shao Xing Yi Yao Xue Bao* (《绍兴医药学报》 *Shaoxing Journal of Medicine*), where he served as the chief editor. In his forward, Cao divided adulterations into two categories. First, in small businesses, merchants always use cheap substitutes with a similar appearance to adulterate the higher-priced medicines. Second, in big pharmacies, apothecaries valued medicines by their appearance rather than therapeutic efficacy.[24]

Even though Zheng and Cao's work remained the first comprehensive work on fake medicine in Chinese history, it does not mean that relevant information only became

popular at the end of the 19th century. Many types of genres, including *Ben Cao*, recipe books, botanical and zoological records, literary sketches, and local gazetteers in the Qing dynasty all consisted of multiple descriptions of medicines and the ways of authentication. An outstanding example was Zhao Xuemin's (赵学敏) *Ben Cao Gang Mu Shi Yi* (《本草纲目拾遗》 *Supplement to The Grand Compendium of Materia Medica*). In preparing the book, Zhao consulted more than 500 books, consisting of both medical and nonmedical titles, and sought information from more than 100 people, mostly local elites, physicians, and even common folks.[25] One of the unique groups of work was the herbal medicine literature. The *Bai Cao Jing* (《百草镜》 *Mirror of the Hundred Herbs*), a work on the local herbs in Zhejiang, was one of the most cited works in *Supplements*.[20] Works like *Cai Yao Lu* (《采药录》 *Records of Medicinal Harvest*) were concerning the knowledge of identifying medicinal plants in the natural environment. Other three titles, the *Yao Bian* (《药辨》 *On Distinguishing Medicines*), *Yao Jian* (《药检》 *On Examining Medicines*), and *Shi Yao Bian Wei* (《识药辨微》 *On the Identification of Medicines and Their Subtleties*), were most likely to be practical guides on the authentication of medicines.[26]

None of these works are extant today, which indicated that these herbal handbooks were probably circulated in manuscripts. Even more practical information on medicines was transmitted through oral account, gathered by Zhao through his real-life encounter with multiple practitioners.[20] Fortunately, there is one such manuscript preserved in the Unschuld Collection in Staatsbibliothek zu Berlin. The handbook, titled *Cai Yao Chu Chan Zhi Nan Quan Juan* (《采药出产指南全卷》 *A Complete Guide on the Producing Area of Medicines*, hereafter *Complete Guide*), was possibly in use during the late Qing and Republican period, owned by a merchant named Zhang Guozhong (张国忠).[27] (Fig. 1) It consists of 262 items, each with a list of producing area(s), the quality of products from different regions, and practical information on authentication. This manuscript is a rare source that was once actually used as a practical guide in the medicinal market. It provides a valuable source to probe into the mercantile knowledge and authentication of medicines.[28] Relevant information can also be found in earlier works. A 1707 recipe collection, *Jing Yan Dan Fang Hui Bian* (《经验丹方汇编》 *A Compilation of Tested Formulas*) authored by Qian Jun (钱峻 ca. early 18th century), attributed adulteration to ignorant buyers who were more interested in low price than in quality. Therefore, the author dedicated the first part of his work to the knowledge of authentication. He claimed that all the methods, 59 items in total, were tested by himself.[29]

A final group of works was manuals and monographs on individual medicines like ginseng and cinnamon. With the rise of ginseng as a high-demand panacea in the Qing dynasty, monographs on ginseng started to appear in the mid-18th century. Some of them showed the literati's interest in collecting historical and literary sources on ginseng, and others presented rich practical knowledge of the ginseng trade. Tang Bingjun's (唐秉钧) *Ren Shen Kao* (《人参考》 *A Treatise on Ginseng*) and Huang Shucan's (黄叔灿) *Shen Pu* (《参谱》 *A Record of Ginseng*) are particularly useful in constructing the empirical knowledge of ginseng trade. Tang made his living by practicing medicine and Huang was a ginseng merchant. They both lived and practiced near Suzhou, a major market for the transaction of ginseng, where they had the chance to observe or even engage in the trade themselves. Huang, as a merchant himself, claimed that his work originated from a conversation with a veteran in the ginseng business, reflecting a great deal of secret knowledge that was previously only possessed by insiders.[30] A similar monograph could be found about cinnamon, an herb cherished in the southern part of China as a panacea. Around 1887, Zhang Guangyu (张光裕), a local scholar from Chenzhou, once lived at the border area between Qing China and Vietnam. During his sojourn, he was able to conduct a broad survey on the cinnamon production. Two years later, he finished a book on the topic and put it into print.[31]

The main difference between these practical guides and mainstream *Ben Cao* was that they were handy rather than comprehensive, practical rather than theoretical, designed for everyday use rather than collecting a plethora of information. All the authors mentioned above proclaimed that their works contained practical expertise gained from experience. Furthermore, Zhang Guozhong and Huang Shucan, as insiders of the medicinal business, unveiled the "secrets" once only circulated among practitioners. Together, all these sources provide a vantage point for modern scholars to explore the rich vernacular realm of knowledge that previously had not been circulated in texts.

5 Sensory techniques in authentication

Before examining the sensory knowledge and techniques for authentication, I need to address a basic but important question: what were medicines in late imperial China? There were two types of common medical substances known in markets and pharmacies. The first was *Sheng Yao* (生药 crude medicines) derived from medicinal plants, minerals, or animal parts. The second was *Shu Yao* (熟药 prepared medicines), which were processed remedies including bolus, powders, plaster, and pellets. The prepared medicines usually underwent a series of complex processing procedures which turned the crude materials into readymade medicines that, in most cases, could be directly taken by patients. Crude medicines, also known as *Yao Cai* (药材 materials for medical use), are the main form of medicines I discuss in this paper. However, the name "crude medicines" did not necessarily mean it was "raw" or "natural." They were not fresh herbs or natural ores, but marketable merchandise that

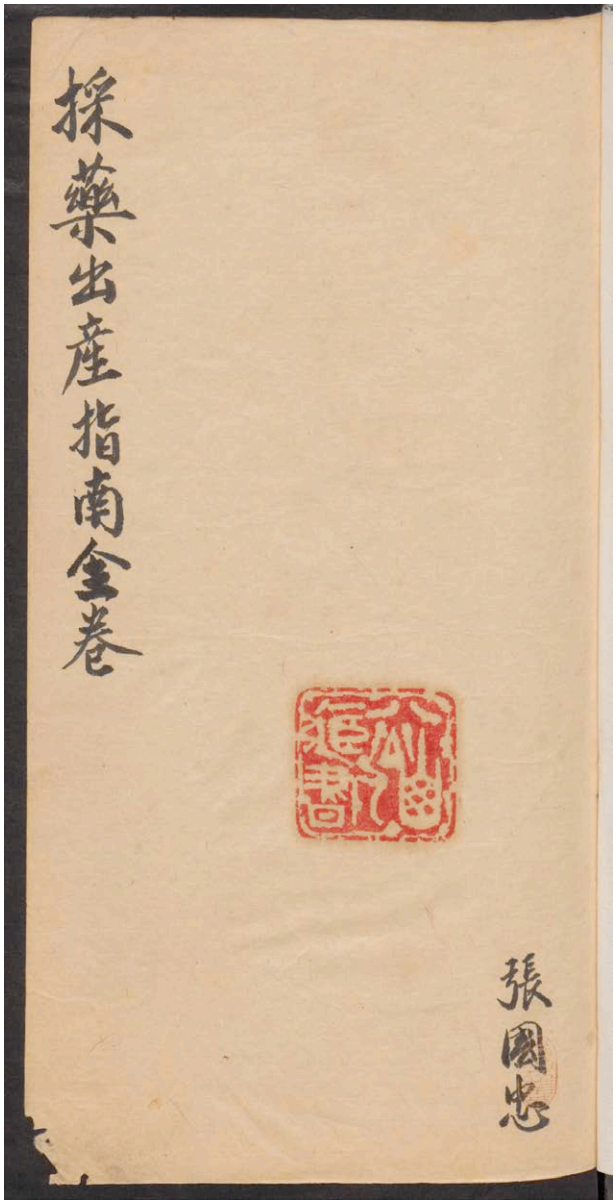

Figure 1. The cover page of *Cai Yao Chu Chan Zhi Nan Quan Juan* (《采药出产指南全卷》 *A Complete Guide on the Producing Area of Medicines*), courtesy of Staatsbibliothek zu Berlin – PK. (source from: https://digital.staatsbibliothek-berlin.de/werkansicht?PPN=PPN3346233030&PHYSID=PHYS_0007).

had gone through a whole set of technical procedures like desiccating, trimming, cutting, slicing, categorizing, and embellishing. In this regard, authentication of medicines in the market had much difference from identifying herbs in the natural environment. They called for distinct expertise and experiences in mercantile goods rather than in pure botanical traits.

5.1 Visual observation

As the epigraph suggested, eyes were not reliable in examining medicines. Since the trickery of merchants were mostly imitating the appearance of genuine medicines, eyesight alone could not determine the authenticity. Nonetheless, visual observation still constituted a considerable part of authentication techniques. One needed to scrutinize the color, shape, and particular characteristics of medicines to estimate their quality. The aim of the observation, in most cases, was not to distinguish the genuine from the fake, but to tell the superior from the inferior. Qian Jun advised that one should examine the entire body before medicines were cut up into pieces.[32] Zheng Xiaoyan agreed on this point since the shape, color, smell, and taste would be altered after cutting or grinding.[33]

In *Complete Guide*, the author listed different kinds of individual medicines, indicating their hierarchical quality by using the terms including *Ding Jia* (顶佳 the best), *Yi Jia* (亦佳 also good), *Ci Zhi* (次之 second grade), *You Ci Zhi* (又次之 third grade), *Ding Ci Zhi* 顶次之" (most inferior), *Bu Kan Yong* (不堪用not usable).[28] Medicines of different qualities came from different places. They were recognized and graded by their color, shape, and sometimes taste (Fig. 2). Qian Jun and Zheng Xiaoyan, however, took a rigid stance toward the quality of medicines. As medical practitioners, they judged the medicines as either genuine or fake. No middle standpoints were tolerated. To achieve the best effect, medical practitioners always prefer medicines of the best quality.

Nonetheless, in the viewpoint of merchants, grading commodities was a very common practice. Cao Bingzhang, as a medical practitioner, made compromises on this point. His annotations to Zheng Xiaoyan's work also embraced medicines of different qualities. It was understandable since medicines of the best quality were not always available or affordable. The record of the *Lu Rong* (鹿茸 Cornu Cervi Pantotrichum) is a good case in point. Qian valued the superior *Lu Rong* with the color of amber and length ranging from 3 to 5 *Cun* (寸, about 10 to 16 cm). Other kinds, according to him, were useless.[34] Zheng only mentioned that the most valuable part came from the blood-stained tip of an antler.[35] Zhang Guozhong, on the other hand, listed 10 kinds of antlers, each from a different original place, with distinct colors, shapes, and hairy surfaces. All were applicable but of varying quality.[36] Cao further graded *Lu Rong* into four categories: wax piece (white and oily), blood piece (yellowish white), wind piece (dark purple), and bone piece (color of bone).[37]

Color and shape were the basic criteria to judge medicines. Huang Shucan listed "ten primary criteria" for estimating ginseng, and nine of them required observation of different features of its outer appearance. He further composed a verse addressing these criteria:

> "Ginseng, king of herbs,
> It is more precious than gold and pearls.
> There are rules in distinguishing its quality,
> The best kind has a smooth surface, straight shape, short body, and texture resembling stick rice.
> The second grade is thick and strong, ripe and twisted,

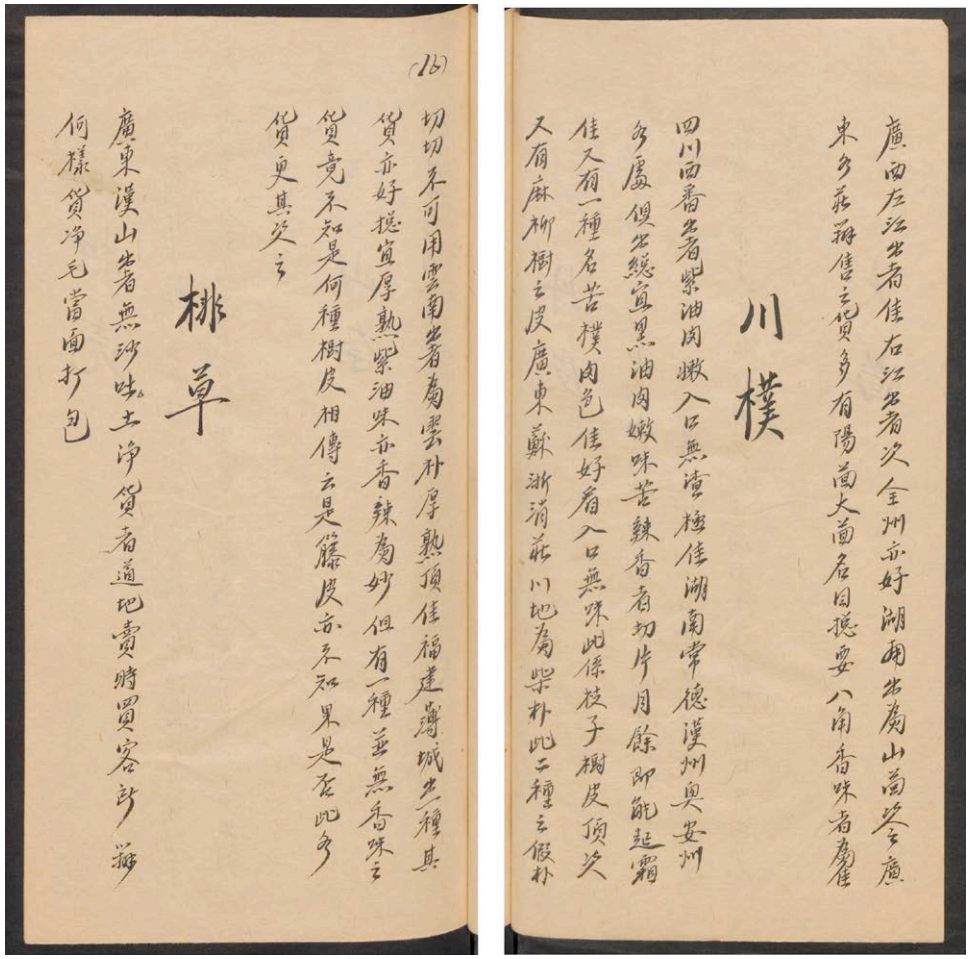

Figure 2 Record of Sichuanese *Hou Po* in *Cai Yao Chu Chan Zhi Nan Quan Juan*, courtesy of Staatsbibliothek zu Berlin – PK. (source from: https://digital.staatsbibliothek-berlin.de/werkansicht?PPN=PPN3346233030&PHYSID=PHYS_0007).

> While the third grade, lean, tiny, hackly on the surface, and loose in texture, cannot have enduring curative effects.
> The most inferior ones were hollow and shrunken,
> It is as worthless as common grass."[38] (Fig. 3)

The colors of medicines were not as apparent as they might seem. For the same herb, the colors of different kinds could be very similar. Yellow and black were easily distinguished. However, differences between yellow, greenish-yellow, reddish yellow, and yellowish white were harder to differentiate. The nuances in the color difference were not possibly transmitted through words, but by multiple comparisons and with years of experience. Sometimes the choice of words also required expertise to understand. In the case of *Dang Shen* (党参 Radix Codonopsis), the inner part of the superior kind was described as white and *Run* (润), while inferior ones had a color of *Dai Bai* (呆白 dull-white).[39] The concept of *Run* was hard to be translated into English. Generally, it was a term frequently used to characterize a particular sensation when one observed and touched a piece of high-quality jade, which was a combination of warm, moist, and smooth. When used in describing other objects, it denoted a jade-like consistency. The opposite feeling, portrayed as *Dai* or dull, expressed the sharp and boring white color that lacked nuance.

Shape and some distinct characteristics were more indicative in telling the quality of medicines. In the case of *Bai Zhu* (白术 Rhizoma Atractylodis Macrocephalae), those that resembled the shape of a gourd, chicken leg, and crane neck were valued as superior. It was a common practice to use analogies of animal or even human body parts to depict the shape of herbs. These pictographic descriptions, though effective among practitioners, were not that easy to be comprehended by non-specialists. It also required experience in comparing all the variations. The best kind of *Bai Zhu* was produced in Yuqian, a town near Hangzhou, and was described as having the shape of a "dragon head and phoenix tail." The dragon head refers to the hairy roots on one end of the stem, and the phoenix tail to the petiole and leaves on the other end. This characteristic was intentionally kept in the trimming of the products. Furthermore, after cutting up into pieces, the authentic Yuqian product would have vermillion dots on the cross sections.[40] Even though several indicative features were emphasized, the authenticity of medicines should be based on the overall examination rather than one single feature. In some

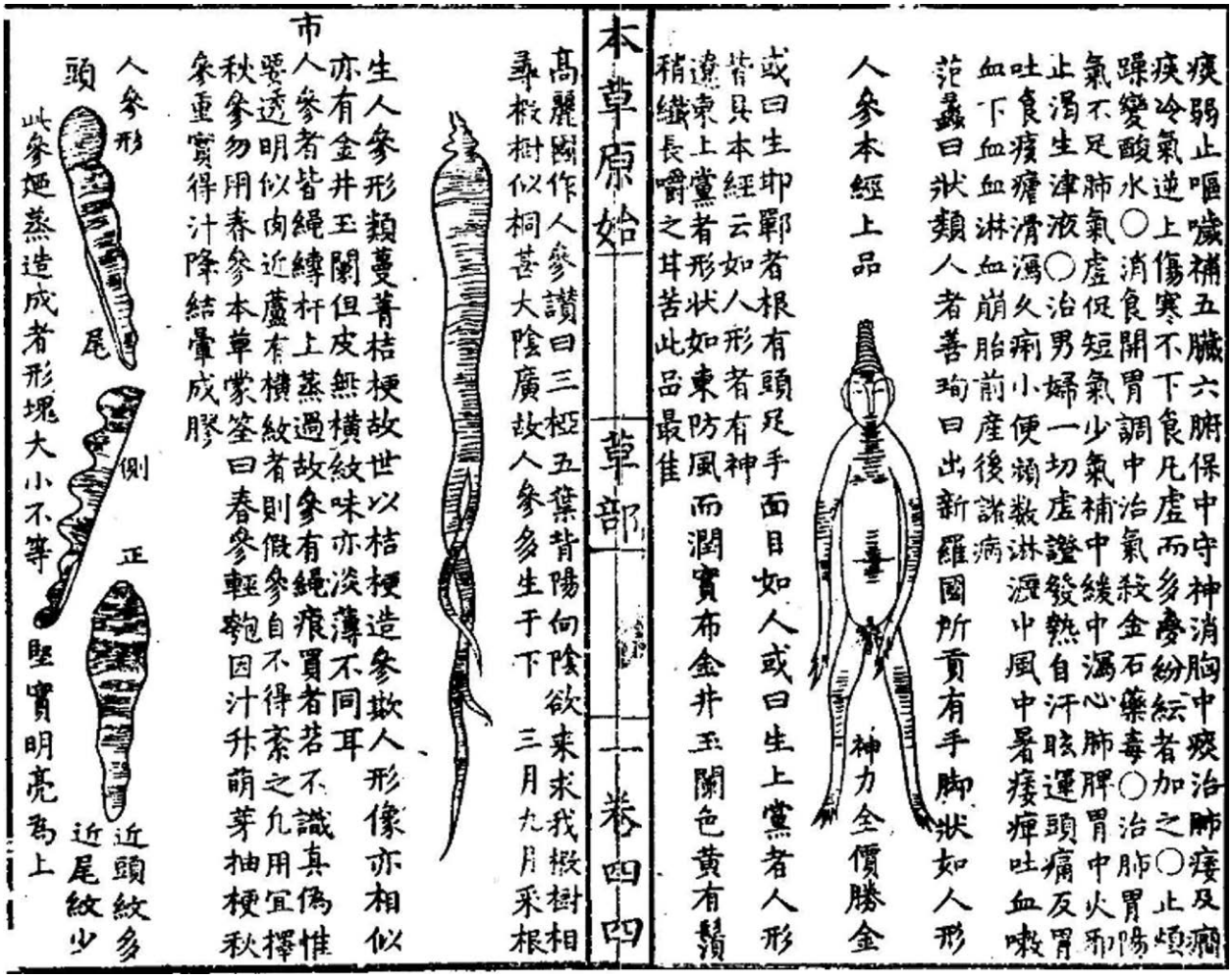

Figure 3 Illustrations of ginseng [source from: Li ZL. *Ben Cao Yuan Shi* (《本草原始》 *Origins of the Materia Medica*). Vol. 1. unknown publisher; 1612. p. 44. Chinese.].

cases, the feature described in textual records could only make sense when comparing materials. The shape of the best wild-grown *Bai Zhu* was described as the crane's neck. This metaphor vividly sketched out its slender and curved body. However, it was not easy for a beginner or an amateur to understand what counted as slender. Only by comparing with the cultivated species, which had a chubby body, could one have a better understanding of the "crane's neck."[41]

5.2 Tasting and smelling

In Chinese medical theory, the four qi and five flavors were the basic properties of medicines. The five flavors consisted of pungent, sweet, sour, bitter, and salty. In some cases, these tastes had an empirical basis. Ginseng tasted sweet, and goldthread had an unpleasant bitter flavor. However, the five flavors had far more connotations and implications than merely the flavors. Each of the flavors indicated a specific effect on the human body. The number "five" also made it possible to pair with the five colors, five viscera, and five phases in metaphysical reasoning. Taste and smell are discussed together since they are closely related both in words and in practice. In Chinese, the qi refers to both the property and the smell of medicines, and *Wei* denoted the taste as well as the smell or *Qi Wei* (气味). The term *Xiang* (香), which mostly refers to the aromatic scent, can also be applied to describing a pleasant flavor.

When used in authentication, practitioners needed to be more sensitive to distinguish the nuances in flavor. Both ginseng and Chinese yam were sweet. However, good ginseng should have a bitter after taste.[42] The Chinese yam produced in Huaiqing, one of the best quality, would give a slightly sour and alkaline flavor.[43] Peppermint and cassia twig tasted pungent. Whereas the best peppermint yielded a cooling effect when tasted, the second-grade product had a slightly bitter flavor.[44] Take a bit of superior cassia twig, its pungent flavor would spread over the whole mouth in a few seconds.[45]

Tian (甜, sweet, note that this is a colloquial word, not the literary term *Gan* [甘] in the five flavors system), *Xiang* (香 a pleasant flavor), *Ku* (苦 bitter), *Xin* (辛 pungent), and *Dan* (淡 insipid), a different

vocabulary of taste from the five-flavor system, were the most frequently used terms in describing the tastes. For those herbs with a sweet flavor, bitter and insipid always indicated an inferior quality. For pungent herbs, insipidity suggested a lower therapeutic effect. Tasting not only aimed to examine the flavor but also to feel the texture. The hardness, tenderness, and stickiness were all important criteria to evaluate the quality. After chewing, superior ginseng and *Hou Po* (厚朴 Cortex Magnoliae Officinalis) would turn into a smooth paste with very little debris left.[46] In the case of *Huang Qi* (黄芪 Radix Astragali), those that gave a sticky and soft sensation in the mouth were the best.[47]

The smell was crucial in examining aromatic medicines. In Chinese medicine, there was also a set of less-known terms, the "five odors," consisting of *Fu* (腐 rotten smell), *Jiao* (焦 burnt smell), *Shan* (羶 smell of mutton), *Xing* (腥 fishy smell), *Xiang* (香 fragrance). Sun Simiao (孙思邈 ca. 541–682) was the first to lay out the content of the five odors. However, unlike the five tastes, the five odors were seldom mentioned in *Ben Cao*. Instead, medical practitioners and medicinal merchants mostly employed the binary category of smell as *Xiang* (香 fragrance, pleasant smell) and *Chou* (臭 fetid, unpleasant smell).

In the *Wei Yao Tiao Bian*, Cao Bingzhang not only added annotations to Zheng's work but also categorized the content into eight sections. One section was dedicated to aromatic herbs. Both authors mentioned that strong or delicate fragrance was a preferable quality for these herbs, while lack of fragrance or any strange odor suggested fake or adulteration.[48] They did not provide further descriptions of smells, perhaps due to the lack of technical terms to describe the fragrance. In *Complete Guide*, only *Xi Jiao* (犀角 Cornu Rhinocerotic) was marked as resembling the smell of sesame.[49] In Chinese medicine, there were also several products, like *A Wei* (阿魏Resina Ferulae) and *Wu Yi* (芜荑 Fructus Ulmi Macrocarpae Praeparata), that emitted a very strong foul odor.[50] The smell was also used in judging the quality of medicines of animal origin. Since the animal parts were always said to have an innate unpleasant foul or fishy smell, the pleasant fragrance always suggested that these animal products were well processed and preserved, and thus considered superior.

A detailed description and categorization of smell were found in the case of cinnamon (*Rou Gui* 肉桂 Cortex Cinnamomi). As the bark of a tropical Asian evergreen tree, it was highly valued as a tonic in medicine and spice in cuisine. Some medical practitioners even compared cinnamon with ginseng, claiming they were the most valuable herbs, respectively, in the south and north borderlands.[51] Zhang Guangyu's work on cinnamon provided a rich knowledge on the examination of its appearance, smell, and taste. He suggested that first, by observing the appearance, one could learn the producing areas of cinnamon; second, by examining the smell, the genuine and the fake were distinguished; and finally, by tasting the flavor, one could tell the superiority among the authentic. The author set six criteria in examining the smell of cinnamon, including *Chun* (醇 pure), *Hou* (厚 thick), *Xin* (馨 pervasive), *Zao* (燥 arid), *La* (辣 pungent), and *Mu Shi Chou* (木虱臭 fetid smell of woodlouse). During the examination, one should rub the inner surface of the bark several times and smell the scent. The fragrance of superior cinnamon would be pure, thick, and pervasive, while the arid, pungent, and foul smell of woodlouse indicated inferiority. Zhang further gave examples of what counted as the smells of arid and pungent. The odor of Sichuanese pepper and clove was arid. *Shan Nai* (山奈 Rhizoma Kaempferiae) and *Zao Jiao* (皂角 Fructus Gleditsiae) smelled pungent. The analogies were effective since these herbs were common items used not only in medicine but also as spices or cleaning agents in everyday life. The fetid smell of woodlouse was a crucial indication of fake cinnamon. Long storage could eliminate the arid and irritant odor. The proper scent of cinnamon could be imitated.[52] Only the fetid smell of woodlouse would remain in the fake or inferior cinnamon.[53]

5.3 Touching

When examining the appearance of cinnamon, the process included more than observation of its color and shape. Local people in the border area between China and Vietnam gave vernacular names for different kinds of cinnamon barks by analogy, like lychee skin, longan skin, tung oil, dragon scales, five colors, iron armor, cinnabar, and crape. These analogies captured not only the color but also the texture of its outer and inner surfaces. According to Zhang Guangyu, the last two kinds were the best. The crape was a delicate silk textile with slight wrinkles. Likewise, superior cinnamon bark should have a textile-like surface with long, straight, and tightly arranged stripes. The lychee skin, longan skin, and dragon scales, those described a coarse surface, were not desirable features of cinnamon.

Zhang further suggested that it was not necessary to be strict regarding the vernacular names and their associate features. Wild-grown tree bark did not always have a predetermined shape that could perfectly fall into those categories. Instead, he proposed three practical criteria for identifying a superior bark, including sturdiness, smoothness, and cleanness. The first two were to be felt by hands. Zhang criticized one popular saying among merchants that superior cinnamon barks should have numerous horizontal stripes on the surface. According to him, the quality of cinnamon was not indicated by one feature, but by the overall examination of its texture and appearance. The best kind should be as sturdy as metal. When felt by hand, its surface was smooth and slippery. The inferior ones had a crumbly texture and

rough surface, which blocked the move of hands when rubbing on the surface.[54]

The case of cinnamon represented the touching examination for many vegetated medicines. Sturdiness, smoothness, and tenderness were the most desirable qualities. Meanwhile, the tongue was another sensitive body part used in examinations involving touch. Unlike tasting which only emphasized flavor, touching by tongue revealed multiple sensations. This examination was mostly used in medicines of mineral, animal, or even human origin. One would feel a sticky sensation when licking a piece of true *Long Gu* (龙骨 Os Draconis). The authentic *Chan Su* (蟾酥 Venenum Bufonis) produced a numb feeling on the tongue. Chewing a piece of *Mu Xiang* (木香 Radix Auckandiae) produced a sticky sensation on the tongue. *Qiu Shi* (秋石 a salty preparation made from children's urine) would immediately melt in the mouth. If not, it must have been adulterated.[55]

5.4 Testing

Even though the sensory techniques are examined separately, the authentication of medicines usually involves multiple senses. Taste and smell were generally regarded as more reliable than visual observation. Touching by hand was a useful supplement to visual observation in examining the appearance and texture, while using the tongue was a more definitive method to test the authenticity of the medicines. Hearing was the only sense not discussed above. As far as I could find, there was only one case that employed the sense of hearing in authentication: the antelope horn. One could hear a slight buzz sound when putting an authentic horn near one's ear. Besides the rich method of sensory examination, there was still another set of techniques applied by practitioners in the market. It employed a small test or experiments to manifest the inner property of medicines.

A newspaper in Tianjin published a set of photographs provided by *Yong Ren Tang* pharmacy in Beijing in 1935, showing a series of top-quality medicines displayed in their store. Among them, there was a piece of cinnamon bark with a label that read "genuine top-quality tributary 'green water and yellow oil' cinnamon bark from the old mountain of *Qing Hua* (真正顶上清花绿水黄油老山贡桂)."[56] (Fig. 4) This label included several jargons that were hard to get by an outsider. Qing Hua (better known as 清化 in Chinese), present-day Tỉnh Thanh Hóa in Vietnam, was known as the producing area for top-quality cinnamon in the Qing period. The phrase "green water and yellow oil" was a typical description of top-quality cinnamon at that time. But what does it mean?

In the *Complete Guide*, the best cinnamon produced in Qinghua was yellow in color and rich in oil. "Green water" was related to the taste examination as described in Zhang Guangyu's work. The examination of cinnamon's taste was not simply putting a small piece

Figure 4 One piece of Cinnamon bark preserved by *Yong Ren Tang* pharmacy, photography taken in 1935 [source from: Unknown author. *Illustrated Commercial Newspaper of Tianjin* (天津商报画刊) 1935; (15): 2.].

in the mouth. Instead, one needed to put a small part of cinnamon in boiled water and taste the decoction after cooling down. The criteria for taste were similar to those for smell, consisting of pure, thick, acrid, and pungent. This examination was not just a double verification of the characteristic already being examined in smell and taste. Zhang suggested one should observe the decoction first before tasting it. The color and consistency of the decoction indicated its quality. First, if the color was white, tea-like, or clear, the taste must be pure. Second, if the decoction was green in color, one needed to further notice its turbidity. Third, if the decoction was red, one had to taste it to determine the quality. In judging the color of cinnamon decoction, Zhang criticized a common idea among merchants. Generally, the merchants valued cinnamon that could yield green decoction. Zhang, however, claimed that some inferior cinnamon and even fake ones could also generate green color in boiled water. In his opinion, the turbidity of the decoction was far more reliable than the color.[57]

The examinations were not limited to tasting or observing. They were small tests or experiments that used other matters and simple processes to test the

authenticity. The tests could be as simple as putting the medicines in water. For example, an authentic *Chen Xiang* (沉香 Lignum Aquilariae Resinatum), literally translated as "aromatic that sinks," would sink and superior *Lu Gan Shi* (炉甘石 Calamina) would float.[58] The rationale of the tests was simple. Generally, a piece of wood would float in water, and stone would sink. However, as a wood of hard and dense texture and a stone of light and loose body, they would act just the opposite of the common expectation. The bear's gall bladder, an extremely rare medicine in the market, could also be examined by a simple process. Squeeze one drop of bile as big as a corn grain and drop it into a bowl of water, if it was genuine, the bile drop went directly to the bottom, forming a straight line in the water.[59] Since water was a common matter in everyday life, these tests were very easy to carry out. Other everyday matters applied include pig's blood, cloth, and lamp wick. A simple examination of *San Qi* (三七 Radix et Rhizoma Notoginseng), known as a powerful agent for hemostasis and detumescence, was to put it into pig's blood.[60] True *San Qi* would turn the blood into water, a clear materialization of its therapeutic effect.

These tests were related either to the texture and property of medicines or to a peculiar phenomenon that might be accidentally discovered in practice. It was not a very common practice to conduct small tests in the authentication. All these cases involved high-valued and rare items in the markets. It is hard to tell whether the authors conducted the tests themselves or they just recorded the information from hearsay. Nevertheless, the records demonstrated that relevant information circulated widely among practitioners. To some extent, these tests had a deeper implication. They manifested, or at least from the point of view of practitioners, the innate nature of medicine in a materialized way.

6 Conclusion

Many methods of authentication are still practiced today in China. Entering a traditional herbal market in China, you can easily find customers standing at a stall, carefully examining medicines by looking, rubbing, smelling, and tasting. Those who fail to do so will be considered novices in the business, prone to the deceptions of fraudulent merchants. To ensure the authenticity of herbal products, state regulations at present require lab test results of a particular marker compound. However, merchants in the herbal market continue to largely rely on their experience of sensory examination as a more reliable way of authenticating medicines. In their opinion, if the therapeutic efficacy of Chinese medicines cannot be fully explained by the existence of any "active components," neither should the authenticity of medicines be determined in a scientific way.

The authentication of medicines has been integrated into the curriculum of modern traditional Chinese medicine education. Many methods in this article are not strange to both traditional Chinese medicine doctors and pharmacists today, as such knowledge has become essential for their training and career. Rather than merely presenting a historical root of authentication knowledge in Chinese medicine, I intend to make a broader and deeper argument about the underlying episteme behind the highly practical expertise. Studies of artisanal practice in early modern Europe discover an "artisanal epistemology." It argues that artisan's practice, though seemingly not theoretical, has its distinct way of knowing nature through the bodily relationship with matter.[61] A similar pattern can be perceived in the case of authentication practice. Merchants and practitioners can also be considered as possessing special expertise, and thus being active knowers of medicines.

The authentication of medicines in the market formed another set of knowledge that diverged from two mainstream scholarly traditions of late imperial China, including both the neo-Confucianist inquiry of drugs' nature and the virtuosic interpretation of drugs' nature in clinical practice.[62] Practitioners in the market were aware of some basic knowledge of *Ben Cao* from popular medical primers,[63] but did not use any established framework in interpreting medicines and their nature. Instead, they actively engaged with the materials through bodily senses. The seemingly trivial and pragmatic expertise reflects an underlying rationale: the innate nature of drugs manifests and materializes through their sensory properties, and thus a deeper understanding of the medicines can be acquired through intimate examinations of their material forms.

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Ethical approval

This study does not contain any studies with human or animal subjects performed by any of the authors.

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