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From Hai Yao, Yang Yao to Xi Yao: Sinification of Material Medical from the West

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Abstract

In ancient China, Daoist philosophers developed the concepts of qi (energy), *Wu Xing* (five elements), and yin (feminine, dark, negative) and yang (masculine, bright, positive) opposite forces between 200 and 600 BCE. Based on these philosophies, *Zhen Jiu* (acupuncture), *Ben Cao* (materia medica), and the practice of *Qi Gong* (energy optimization movements) evolved as the three interrelated therapeutic regimens of Chinese medicine (Note 1). Since the time of Zhang Qian, who discovered China's western regions in the 1st century BCE, *Hai Yao* (the exotic elements of materia medica from the maritime Silk Road countries), had been transmitted from the ancient land and maritime routes of the Silk Road to China in the past two millennia (Note 2). Since the late 17th century, the English East India Company, later called the British East India Company, introduced *Yang Yao* (opium) to the Manchu Qing Empire to balance a growing trade deficit for tea export from China to the British Empire. After the First Opium War ended in 1842, enterprising expatriate chemists and druggists in the treaty ports imported *Xi Yao* (modern medicines from the Western world) for sale to the merchant navy and the local market. From the second half of the 19th century onwards, both *Hai Yao* and *Xi Yao* have become a fully integrated part of modern China's armamentarium for the Chinese medicine and Western hospitals and retail pharmacy sectors. This paper articulates the journey of adoption of exotic elements of materia medica from the ancient land and sea routes of the Silk Road, including the western regions and the rest of the world in the past two millennia. Opium traders, ship surgeons, medical and pharmaceutical missionaries, enterprising traders, and policymakers together transformed *Ben Cao* into *Xi Yao* during the late Manchu Qing dynasty and the early Nationalist Era.

Keywords: Hai Yao, Materia Medica, Opium Cures, Xi Yao, Yang Yao

1 Introduction

Ancient Greeks, Indians, and Chinese shared the same views of life, seeking a balance between the body, mind, and nature. As a result, they have the same three common elements of the origins of life in water, fire, and earth, which, understandably, all living beings, including humans, survive on. Chinese medicine men have adopted novel drugs from neighboring countries and the Western regions. Archaeologists found a silver Persian medicine box, a lacquer box containing incense (olibanum), and minerals materia medica in the burial site of King Zhao Mo (赵昧, 176–125 BCE) in 1983 (Note 3). Arab and Indian traders along the maritime routes of the ancient Silk Road transmitted these

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valuable pharmacy antiques, and *Hai Yao* (海药 the exotic elements of materia medica from the maritime Silk Road countries) from the distant West and South Asia to China (Note 4).¹

The first known official pharmacopoeia, Xin Xiu Ben Cao (《新修本草》 Tang Materia Medica or Newly *Revised Materia Medica*), published in 659 in the early Tang dynasty (618–907), documented 850 drug monographs including 114 new drugs of which several were Hai Yao. The latter's widespread use arose as a direct result of Wang Anshi (王安石, 1021-1086) who initiated the New Policies covering economic and social welfare reforms during his tenure as the grand chancellor (or modern-day prime minister) from 1070 to 1076 in the Song dynasty (960-1279). Seventy Tai Ping Hui Min Ju (太平惠民局 State Municipal Dispensary Stores) were established nationwide to provide out-patient clinical service and dispensing of prepared materia medica including Hai Yao at affordable prices to the public. Volume two of Zhu Fan Zhi (《诸蕃志》 Records of Foreign Countries) documented Hai Yao with medicine monographs by Zhao Rukuo (赵汝适, 1170-1231), the Administrator of Quanzhou Customs in the late Song dynasty, in 1225.

The import of Yang Yao (洋药 opium), the highly addictive narcotic drug, by opium traders from the late 17th to early 20th centuries, speeded up opium addiction until its replacement by "opium cures." The latter were imported initially by Western chemists in the treaty ports

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to substitute opium smoking after the Second Opium War in 1860. The launch of Shen Bao (《申报》) in Shanghai in 1872 and other daily newspapers, as an effective media in the advertising and promotion of imported proprietary medicines including "opium cures" turned a new chapter in the adoption and rise of collectively termed Xi Yao (西药 Western medicine). The highly lucrative "opium cures" market led to the emergence of modern Chinese pharmaceutical industry with Shanghainese entrepreneurs entering the retail and manufacturing sectors. In the late 1910s, a new national identity was taking shape in the young Republic, and some Western-trained academics and politicians called for "total westernization." The "Abolishment of Chinese Medicine" motion, presented at the National Health Conference in 1929 and chaired by the First Minister of Health, Liu Ruiheng (刘瑞恒, J. Heng Liu, 1891–1961), along with the 1930 publication of the Chinese Pharmacopoeia, which contained only 60 or 8.5% of Ben Cao (本草 materia medica) among its 708 drug monographs, marked a watershed moment in the adoption of Xi Yao.

2 Ayurvedic pharmacy

San Le Bao (三勒宝 Triphala) remains a popular health supplement in drug stores today. At the turn of the 6th century, Daoist alchemist cum apothecary Master Tao Hongjing (陶弘景, 456–536) published the Ben Cao Jing Ji Zhu (《本草经集注》 Collected Commentaries on Shen Nong's Classic of the Materia Medica), listing San Le Bao as a Hai Yao. San Le Bao containing black myrobalan, beleric myrobalan, and Indian gooseberry as a kind of wine became a tributary item to treat diarrhea and relief cough of the ruling class in the Chen dynasty (陈朝, 577–589) period.² During the same time, fennel formulations also found their way into the upper echelon of Chinese society.

One and a half-century later, Sun Simiao (孙思邈, 581–682), Master of Medicines, authored a 30-volume medical encyclopedia, Qian Jin Yao Fang (《千金药方》 Important Formulas Worth a Thousand Gold Pieces) in 652. Sun Simiao was a Daoist priest of his time, specializing in minerals as an anti-aging therapeutic. *Qian* Jin Yao Fang included fennel, an aromatic herb relieving flatulence. However, Sun Simiao's most remarkable Ayurvedic formulation was a theriac, the Qi Po Zhi Bing Wan (耆婆治病丸 Jiva Pill) for treating epilepsy, jaundice, cough, deafness, malaria and so on. (Note 5). A few years later, in 657, Tang Emperor Gaozhong (唐高宗, 628-683) authorized and funded a court official, Su Jing (苏敬, 599-674) to correct the inaccuracies reported in the Sheng Nong Ben Cao Jing (《神农本草 经》 Shen Nong's Classic of the Materia Medica) in his second year of reign. Su Jing's supervision of China's first official Pharmacopoeia: Xin Xiu Ben Cao contained 114 new drugs with many kinds of Hai Yao (Note 6). Chen Zangqi (陈藏器, 687–757), another apothecary

court official, recorded opium poppy among others in the Ben Cao Shi Yi (《本草拾遗》 Supplement to 'The Grand Compendium of Materia Medica) released in 739 as a supplement to the Xin Xiu Ben Cao edited by Su Jing (Fig. 1). With vibrant foreign trade, the Maritime Administration built a designated area for commerce and residence for the Arabs, Indians, and Javanese merchants in 741. A maritime trade official was appointed to manage the affairs of the foreign community in Guangzhou. This perhaps was a visionary move by the Tang imperial court as the 8-year An Lushan Rebellion (安禄山之乱, 755–763), and the subsequent dominance of Tibetan and Uigur kingdoms in Central Asia halted the flow of bustling trade in the land route of the Silk Road to the Central Plains (中原) (Note 7).

3 Maritime Silk Road and Hai Yao in Tang and Song dynasties (618–1279 CE)

The first record of *Hai Yao* was the *Hu Ben Cao* (《胡本草》 *Overseas Medicines Record*) compiled by Zheng Qian (郑虔, 691–759) in the mid-eighth century Tang dynasty. Li Xun (李珣, 855–930), a third-generation Persian trader cum apothecary, compiled *Hai Yao Ben Cao* (《海药本草》 *Materia Medica from the Seaboard Area*) during his tour of the Lingnan region the early 10th century (Notes 8 and 9). In the next three centuries after the collapse of the Tang dynasty in 907, the closure of land routes of the Silk Road led to the maritime routes becoming the only viable conduit connecting China and the rest of the world. Before the Song dynasty, *Hai Yao* was imported mainly as tributary presents from



Figure 1 Opium poppy (Papaver somniferum), original colored zincograph. c. 1853 (source from: Burnett MA. Wellcome Foundation; 1851).

faraway kingdoms and states in the Arabian Peninsula, the Indian subcontinent, Southeast Asia and Central and West Asia. With the maturity of paper-making technology, the Song dynasty court took over *Jian Zi Wu* (交 子戶 the paper money printing press), founded by merchants in Chengdu in 1023. With a newly established source of public finance, the Song emperors decided to improve the health of its nationals by initially funding and publishing *Tai Ping Hui Min He Ji Ju Fang* (《太 平惠民和剂局方》 *Beneficial Formulas from the Taiping Imperial Pharmacy*) in 1078.

The publication, comprising 788 formulations for use in general medicine, pediatrics and gynecology developed by the Imperial Pharmacy, was to standardize the formulations for domestically cultivated *Ben Cao* and imported *Hai Yao* for subsidized distribution in state-owned dispensaries. Policy changes in social medicine by appointing physicians to prescribe materia medica containing *Ben Cao* and *Hai Yao* extended to the public was the world's first national health service. It was ahead of its time and benefited more patients than the few royalties and the wealthy class.

The status of Chinese medicine practitioners was elevated as a respectable profession with royal blessing in the 11th century Song dynasty. This change also created an additional venue for those educated for future career development other than sitting the annual *Ke Ju* (科举 state examination) with only a few accepted as court officials. *Ke Ju* was a system of choosing imperial court officials by merit through written examinations rather than by inheritance. It commenced in 605 during the Sui dynasty (581–618) and underwent substantial changes with a formal, three-tier (prefecture, province and national) examination in the Song dynasty (960– 1279) until it was abolished in the final years of the Qing dynasty (1644–1911) in 1905.

Zhao Rukuo became the Maritime Trade Official to inspect import commodities from overseas, including *Hai Yao*, in Quanzhou (泉州 Zayton) in 1224. The following year, Zhao Rukuo complied a two-volume compendium, *Zhu Fan Zhi*. Volume one of *Zhu Fan Zhi* contained monographs describing 158 countries, states, and customs of its peoples, and volume two documented 43 medicine monographs of commonly traded *Hai Yao* (Notes 10 and 11). Many of these herbal remedies, particularly aromatic resins such as frankincense, myrrh and benzoin from Arabia, have been incorporated for routine use in Chinese medicine since the Tang dynasty. *Zhu Fan Zhi* was, however, the first official record of monographs of *Hai Yao* of the time.

4 The Islamic formulary and Zheng He's naval expeditions (1405–1433)

In-land trade within the Mongolian Empire, of which the Yuan dynasty (1271–1368) was a part, was vibrant. Kublai Khan (忽必烈, r. 1264–1293), the first emperor of Mongolian Yuan dynasty, decided to compile a unified

Da Yuan Ben Cao (《大元本草》 Yuan Compendium of Materia Medica) as a first step toward the unified medical system using both Chinese materia medica and Hai Yao.

Kubli Khan appointed Xu Guozhen (许国祯, 1209-1283) as a minister in charge of medical affairs and the compilation of the official Pharmacopoeia, the Da Yuan Ben Cao. A team of 20 medical and pharmacy scholars under the leadership of Minister Xu completed the work in 1288, the 25th year of Kublai Khan's reign. Still, unfortunately, Da Yuan Ben Cao was never released. However, Chinese Muslim medical scholars translated and edited Ibn Sina's (Avicenna, 980-1037) Canon of Medicine of 1025 toward the end of the Mongolian Yuan dynasty in the 1360s. This unofficial publication, Hui Hui Yao Fang (《回回药方》 Medicinal Formulas of the Hui People) contains 650 Hai Yao formulations of popular Arabic and Persian medicines used in the Islamic world (Note 12). The impact of the Hui Hui Yao Fang was short-lived as this was an unofficial publication and carried little if any weight on physicians and pharmacists in the imperial courts of the succeeding Ming and Qing dynasties (1368–1644, 1644–1911). They continued to use Ben Cao as the mainstream materia medica with few Hai Yao from the Hui Hui Yao Fang incorporated for use in Chinese medicine.

The gradual decline of the land and maritime routes of the Silk Road was, to a great extent, due to the isolation policy in place by the Ming emperors. In the fourth year of his reign, Emperor Yongle (永乐帝, r. 1402–1424) issued a decree with Admiral Zheng He (郑和, Muslim name Haji Mahmud, 1371-1433) to lead a fleet of 240 ocean-going ships to conduct seven naval expeditions from 1405 to 1433 (Note 13). Admiral Zheng's navy expeditions brought back the folk medicines of Arabic, Indian, Malay/Indonesian, and Persian origins (Note 14). Nevertheless, the maritime routes were revived temporarily by Admiral Zeng as he died on his way back from the seventh expedition in Calicut, India, in 1433. However, the Ottoman Empire (1299-1922) rulers again blocked land trade to India across the Mediterranean when they seized the City of Constantinople in 1453; for more than a century. Prince Zhu Zi (朱梓, 1370-1425), a renowned apothecary cum botanist and a sibling of Emperor Yongle of the Ming dynasty (1368-1644), complied the Pu Ji Fang (《普济方》 Formulary of General Medicine) in 1406 before Admiral Zheng's return from his first overseas expedition in October 1407. The Formulary listed an exotic element of materia medica, Chaulmoogra oil, from South Asia for treating leprosy.

5 Portuguese traders, Jesuits, Manchu Qing imperial pharmacy and *Yang Yao*

The most important Chinese drug compendium, though not as the official Ming pharmacopoeia, was Li Shizhen's (李时珍) Ben Cao Gang Mu (《本草纲目》 The Great Compendium of Materia Medica). The latter contained 1892 drug monographs and was completed in 1578 and published in 1596 (23rd year of the reign of Emperor Wanli (万历帝, r. 1572–1620). In Li Shizhen's Ben Cao Gang Mu, he often referred to Zheng Qian's Hu Ben Cao of the mid-8th century in the description of Hai Yao.

Portuguese explorer Vasco de Gama, the first European to discover the maritime route to reach India via the Atlantic Ocean, arrived at Calicut on the Malabar Coast in 1499. De Gama's trip to India was continued eastward by his compatriot, Tome Pires (1465–1540), a respectable apothecary cum merchant who led Portugal's first emissary to China in 1517. Forty years later, the Portuguese leased Macau located on the South China coast and 60 km west of Hong Kong, as a trading post from the Ming government in 1557. Twelve years later, Bishop Belchior Carneiro, the Santa Casa da Misericórdia charity institution, set up Asia's first western hospital—St. Raphael Hospital called by the local population called as the *Yi Ren Miao* (医人庙 Temple of Cures) in 1569.

Although the Portuguese traders introduced tobacco smoking to China from South America in the mid-late 16th century, it was reportedly the Dutch traders who introduced opium mixed with tobacco from Java, via Taiwan, to the Chinese mainland a century later. The upper class of the Manchu Qing court found a new way of smoking opium for enjoyment instead of mixing it with tobacco leaves. They picked up the habit of smoking prepared opium, exudates of the opium poppy capsule, in the mid-17th century. Only a small quantity of opium was imported then which had gained the new name of Yang Yao (or overseas medicine) and became a luxury "leisure drug" to the royalties. Toward the end of the 16th century, St. Paul's College (College of Madre de Deus) was established in 1594, with a clinic soon opened. Decades later, Italian Jesuit Matteo Ricci (利玛 窦, 1552-1610) of the Roman Catholic Church led a religious mission and arrived at Beijing in 1601.

The first Roman Catholic Church, Xuan Wu Men Chapel (宣武门教堂 Cathedral of the Immaculate Conception Hsuanwumen), commonly known as the Nan Tang (南堂 South Chapel), was built by Mateo Ricci upon approval by Emperor Wanli (万历帝, r. 1572–1620) in his 33rd year of reign in 1605. Mateo Ricci and his successors followed the Resolutions and Ceremony (礼仪之争 Résolutions and Cérémonial) policy. They gained acceptance by the upper echelon of the imperial court of the late Ming (1601–1644) and later the Manchu Qing dynasty (1644–1911). Pope Alexander VII (r. 1655–1667) issued an edict officially allowing the practice of Confucian rites and Chinese practice in converting non-believers in China on March 23, 1656.

The Governor General of Batavia of the Dutch Indies, appointed by the Dutch East India Company (EIC),

immediately dispatched an emissary on behalf of the Kingdom of Netherlands to the Manchu Qing court in July 1656 (Note 15). Cloves, cinnamon, and sandalwood were presented as tributary gifts to Emperor Shunzhi (顺治帝, 1638–1661), and rose water to the Empress. The regularly stocked items included oils of cardamom, balsam, ambergris, musk, cinnamon, clove, citron, tangerine, and rose in the three locations of the imperial pharmacy stores. Aromatic oils of these herbs and spices have been used as *Hai Yao* to treat minor ailments, holy smoke to dissipate evil spirits, and scent sachets for gentries and nobilities since the Han dynasty.

In July 1685, King Louis XIV of France decided to send a team of six French Jesuits with scientific knowledge a priest, Jean de Fontaney, as the head of the mission, arrived in Beijing in February 1688. Father De Fontaney, a Jesuit cum scholar in mathematics and astronomy, had brought Quinquina (Anglicized term as "Cinchina"), a Peruvian bark named after Countess Cinchona, from the Church's medical stock in Podicherry to cure Emperor Kangxi (康熙帝, r. 1611–1722) intermittent fever in July 1693.³ (Fig. 2) Improving the relationship between the Roman Catholic Church and the Manchu Qing court led Emperor Kangxi to issue an edict allowing Christianity practice in 1692. His Majesty's interest in medicine had motivated foreign missionaries and diplomatic missions to collect and present proven remedies from reliable sources for stock-up by the Manchu Qing imperial pharmacy. The Manchu Qing imperial pharmacy was initially established in 1663, the 10th year of the reign of Emperor Shunzhi (顺治帝, r. 1643-1661), as part of the imperial hospital founded in 1653.

The imperial pharmacy's role was to prepare finished dosage forms of *Ben Cao* in pills, powders, and liquid concentrates for oral use and ointments and pastes for external use in bulk as inventory. In addition, individualized formulations were made by extemporaneous dispensing for the Emperor and the Empress as and when ordered by the imperial physicians (Note 16). The Imperial Pharmacy was closed for 8 years in 1662 and



Figure 2 Cinchona bark, Europe, 1601–1700 (source from: Zell H. Wikipedia).

reopened in 1667 in Emperor Kangxi's 6th year of reign. In 1684, the management of the Imperial Pharmacy was transferred from the Imperial Hospital to the Ministry of Interior. Successors of Emperor Kangxi; Emperors Yongzheng (雍正, r.1722–1735) and Qianlong (乾隆, r. 1735–1796) were also keen to enrich the Imperial Pharmacy with an abundant inventory of *Ben Cao* and *Xi Yao* for routine and military use during their reigns.⁴

Active trade between China's merchants and Britain's East India Company began in Guangzhou in the late 17th century. China exported cinnamon, porcelain, silk, and tea to the U.K.. Americans exported agricultural products and found their native Ginseng, or *American Ginseng* (花旗参 Panax quinquefolius), was the only commodity with health value preferred by the Chinese (Note 17). The first shipment of 30 tons of the *American Ginseng* roots carried on board the *Empress of China* set sail from New York Harbor on February 22, 1784, and sold almost instantly when it reached the port city of Guangzhou (广州 Canton) in the third quarter of 1784.

In 1715, the 61st year of the reign of Kangxi, Wu Ying Dian (武英殿 the Hall of Martial Valour), previously used as a book mending and printing workshop of the Imperial Palace, was converted into a dispensing room of the Imperial Pharmacy. Wu Ying Dian was redesigned for preparing herbal distillates and aromatic oils from Hai Yao presented by overseas delegations or Manchu Qing officials.

Balsamic oil, one of many aromatic oils, was well known for its antiseptic properties for wounds. It was used in military pharmacy in the pacification war against Khoshud's rebellion (1860–1874) in Qinghai, Northwest China, in 1723. An inventory count conducted in *Wu Ying Dian*, the main site of storage of *Xi Yao*, in August 1814 recorded 122 *Ben Cao* were stocked at the Imperial Pharmacy. The other three locations were *Qian Qing Gong* (乾清宮 the Palace of Heavenly Purity), *Yang Xin Dian* (养心殿 the Hall of Mental Cultivation Workshop), and *Yuan Ming Yuan* (圆明园 The Summer Palace) (Note 18). Most of the *Ben Cao* were for oral consumption, and a small number of the *Xi Yao* mostly as aromatic oils or preparations were for external use.

Other satellite pharmacies were located in the premises close to the imperial residences of the Empress, the emperor's mother, and the next-in-line to the imperial throne. Moreover, they reinforced the ruling class's views that aromatic oils such as balsam oil were a unique class of Hai Yao and were held in high regard for hunting and war injuries. Charles-Thomas Maillard de Tournon (铎罗, 1668-1710) the papal legate and cardinal to the East Indies and China, was sent by Pope Clement XI (r. 1700-1721) to meet Emperor Kangxi in 1705. De Tournon informed Emperor Kangxi that Confucian rites and rituals in paying respect to the deceased ancestors were against the Roman Catholic Church's opinions of idol worship. In total dismay, Emperor Kangxi swiftly reversed his 1692 edit. However, his successors continued to forbid the propagation of Catholicism which

lasted 150 years until China signed the Nan Jing Tiao Yue (《南京条约》 Treaty of Nanking) in 1842.

Christianity was viewed with suspicion by the emperors, and missionaries were not allowed to propagate evangelism, Reverend Robert Morrison (马礼 逊, 1782–1834), a British Presbyterian funded by the London Missionary Society (伦敦会 LMS), entered Guangzhou and worked as a translator with the British Factory owned by the EIC in 1809 (Note 19). While there, Robert Morrison used his spare time to propagate evangelism by unofficially translating and distributing the Bible in the Chinese language. Although Morrison was not a qualified physician or surgeon, his knowledge of basic medicine helped him to set up a public dispensary in Macau with the help of a fellow EIC colleague, John Livingstone, who was the assistantship surgeon, of the British Factory in 1820.⁵ Morrison departed China in 1822 with stopovers in Malacca and Singapore and propagated evangelism to the Chinese diaspora before his eventual arrival in the U.K. in 1824. John Livingstone left the British Factory 4 years later in 1826, and his public dispensary work also ceased in Macau.

6 Ship surgeons and free dispensaries

Thomas Colledge (郭雷枢, 1797–1879) succeeded John Livingstone as the resident surgeon of EIC in Macau in 1826 (Note 20). He attended clinics at the British Factory in Canton 6 months a year during the trading season from June to December. Impelled by Christian compassion and paid out of his own expenditure, Thomas Colledge commenced serving poor patients in Macau in the winter of 1827. His friends contributed financially to help Thomas Colledge set up the infirmary specializing in eye diseases, which became Thomas Colledge's Ophthalmic Hospital.⁶ James Ravin, an author cum ophthalmologist, thought the rationale of eye surgery as the primary service in the late 1820s was:

"Western medicine may not have led Chinese in terms of pharmacological agents, but it was far ahead in surgical skill and in understanding of anatomy. Very few procedures were done, the notable exceptions being castration to create eunuchs for the Imperial court, draining pus and closed reduction of fractures. Medical missionaries from aboard found the field wide open for their work and became influential. Cataract surgery was one of the most common surgical procedures by the missionary physicians."⁷

When the British government terminated EIC's trade monopoly with China at the end of 1833, the ship surgeon positions were promptly made redundant. Thomas Colledge then joined as the Senior Surgeon of Medical Service to Lord Napier, the newly appointed Chief Superintendent of British Trade in China in 1834. Thomas Colledge convinced the Protestant Missionaries of the need for a hospital in Guangzhou to serve the local poor. He was instrumental in the setup of the Canton Hospital by convincing his mentee, Peter Parker (1804–1888), to take charge of the project in 1834 (Note 21). Thomas Colledge subsequently became the superintendent of the first Seamen Hospital in Macau in 1837. With seed donations from Wu Bingjian (伍秉 鉴, Howqua II, 1769–1843), owner of E-Wo Hong (怡 和行) and partner of Jardine and Matherson (Fig. 3), financial contributions from other British and U.S. merchant houses, and support from The American Board of Commissioners for Foreign Missions, Parker opened the *Guangdong Hospital* (广东医院 Canton Hospital), in November 1835. The small local expatriate community in Guangzhou supported charity and missionary work.

In October 1836, Thomas Colledge, Peter Parker (派 克, 1804–1888) and Rev. Elijah Coleman Bridgman (裨 治文, 1801–1861), an American Protestant missionary who arrived in Guangzhou in February 1830, suggested the formation of "The Medical Missionary Society in China" (MMS) (Note 22). Frances Mary, Colledge's daughter, recalled in his obituary:

"Not finding his Civil Surgeon's duties sufficient to occupy him, he started, with the help of friends, an Ophthalmic Hospital for the Chinese. When my father left Macau (in 1838). He went down to Edinburgh, took his M.D. at King's College, Aberdeen, 1838, became FRCP Edinburgh, 1840, and was made Fellow of The Royal Society, Edin. 1844."⁸

Robert Morrison, Thomas Colledge, Peter Parker, and other Western surgeons, mostly medical missionaries



Figure 3 Wu Bingjian, the richest man and opium trader in China in the 1830s. Oil painting (source from: George Chinnery [1774–1852], Wikipedia).

and naval or ship surgeons, from the U.K. and the U.S. provided surgical treatment to the much-neglected eye diseases suffered by the poor in the 1830s. Together, they portrayed a positive image in missionary medicine in an otherwise highly controversial opium trading. Moreover, the free clinics' set up by these Western medical pioneers filled the void of Chinese medicine that could not provide ophthalmic surgery. After China lost the First Opium War from 1839 to 1841, the Nan Jing Tiao Yue was signed in 1842, and included the forced cessation of Hong Kong Island and the opening of five treaty ports, namely Fuzhou (福州 Fuchow), Guangzhou (广州 Canton), Ningbo (宁波 Ningpo), Shanghai (上海), and Xiamen (厦门 Amoy) to the U.K. The U.S. and France were also gaining concessions from the Manchu Qing courts in the liberalization of trade with the "most favored nation" status and the practice of religion and medicine. Peter Parker exerted his influence as an official interpreter of the United States delegation in the trade negotiations with the Manchu Qing government in 1844 by including terms favorable to missionaries in propagating evangelism. For example, article 17 of the Wang Xia Tiao Yue (《望 厦条约》Treaty of Wanghia or Treaty of Peace, Amity, and Commerce, between the United States of America and the Chinese Empire) stated:

"Citizens of the United States residing or sojourning at any of the ports open to foreign commerce shall enjoy all proper accommodation in obtaining houses and places of business, or in hiring sites from the inhabitants on which to construct houses and places of business, and also hospitals, churches, and cemeteries."⁹

Besides Robert Morrison, LMS was actively dispatching faithful medical missionaries to China before and after the First Opium War. Some of these pioneers included William Lockhart (洛克), Benjamin Hobson (合 信), John Dungeon (德贞) in Beijing, Thomas Cochrane (科宁), and others. Together, they made a long-lasting impact in transforming Chinese healing art with medical education in anatomy, medical science, and physiology as the basis of biomedicine.

After China lost the Second Opium War from 1856 to 1860, the Tian Jing Tiao Yue (《天津条约》 Treaty of Tiensin) was signed in 1858, unrestricted import of Yang Yao (opium), a habit-forming narcotic drug was allowed, which opened a flood gate to the spread of opium addition. Many new drugs and narcotics, including Aspirin and Heroin, launched in the market at the turn of the 20th century, led the LMS and other North American Christian societies to strengthen the pharmacology knowledge of medical and nursing students. As a result, they dispatched pharmaceutical missionaries in the early 20th century. Bernard Emms Read (伊博恩, 1887–1949) was the first British Christian pharmacist who served as a lecturer at the Union Medical College in Beijing from 1909 to 1932, Alfred John Skinn (斯金 纳) from 1916 to 1917, Arthur John Britland (布里特



Figure 4 MaTavish & Lehmann Chemists, Shanghai, 1908 (source from: Courtesy Shanghai Museum of Medicine).

兰) from 1917 to 1919, John Cameron (康约翰) from 1920 to 1940. One Canadian pharmacist, Edwin N. Meuser (米玉士, 1880-1970), went to Chengdu (成都 Chengtu) from Toronto, Canada, in 1909 and founded the Department of Pharmacy of West China Union University in 1918.

7 Western chemists and druggists and *Xi Yao*

The charity dispensaries in Macau and Canton set up by ship surgeons evolved into commercial marine suppliers in Hong Kong in the 1840s, Shanghai and other treaty ports in the 1850s. Their product range also changed from on-site dispensing to the supply of imported alcoholic drinks and beverages, narcotic drugs, and proprietary medicines in the 1850s to 1860s. The opium substitutes or "opium cures" were initially imported from the U.K. by the British Dispensary (大英药房, operated by McTavish & Lehmann), Laou Teh Kee (老德记 Shanghai Medical Hall), Hong Kong Dispensary (香港 大药房, operated by A S Watson) etc. (Note 23) (Figs. 4 and 5). Initially, "opium cures" of laudanum (10% opium equivalent to 1% morphine) and subsequently potent habit-forming narcotic drugs of cocaine, heroin, and other powders and liquid opium substitutes were marketed through newspaper advertisements.

The same retail and manufacturing chemists in Hong Kong and Shanghai also produced and marketed their brands of proprietary medicines, such as Watson's Antihelmintics from the 1870s. The rapid growth of the Chinese ethical pharmaceutical industry began with the



Figure 5 Lao Teh Kee Dispensary, Shanghai, 1910s (source from: Courtesy Shanghai Museum of Medicine).

use of hypodermic syringes in administering morphine subcutaneously to achieve euphoric effects for chronic opium users in the 1890s. The sterile injectable market grew further with the launch of Salvarsan (an arsenic compound named 606) by Hoechst AG (now Sanofi) in treating syphilis by intravenous injection in the 1910s gave rise to China's first sterile pharmaceutical manufacturers of *Haipu* and *Sine* in Shanghai in the 1920s.

In the 1930s, some of the original players, for example, Koeffer Dispensary and new players such as Xin Yi (信谊药厂 Sine Pharmaceutical) and Xin Ya (新 亚 药 ☐ New Asiatic Chemical Manufacturer), had moved into ethical pharmaceuticals giving rise to the modern pharmaceutical industry. In addition, Chinese chemists and pharmaceutical scientists gained experience and knowledge to extract high-quality Chaulmoogra oil and ephedrine for domestic and export use in treating leprosy and pediatric asthma. Even during the occupation years of Shanghai by the Japanese army from 1942 to 1945, local scientists were able to produce low-potency porcine insulin due to the interruption of insulin from the U.S. By then, Chinese pharmaceutical manufacturers were able to supply most of the generic equivalents of Xi Yao.

8 Conclusion

After Zhang Qian (张骞, 163–113 BCE) opened the land routes of the Silk Road in the 1st century BCE, traffic of Buddhist monks and merchant caravans reached its peak between the 5th and the 8th centuries (Note 24). With

the increasing transmission of Ayurvedic medical concepts and herbal remedies from the Indian subcontinent to China, Hai Yao draws Daoist apothecaries' attention to imported drugs other than Ben Cao and mineral drugs. The adoption of Triphala as a Ben Cao was first reported by Tao Hongjing in his *Ben Cao Jing Ji Zhu* in 499. Other Hai Yao, including fennel and the Jiva Pill, were documented by Sun Ximiao in his Qian Jin Yi Fang in 652. The decree issued by Emperor Xuanzong (唐玄 宗, r. 712–756) to set up the Customs Administration in Guangzhou in 714 was indeed a visionary move. An increase in maritime trade with regular shipments of aromatic oils, frankincense, and other medicinal herbs from Arabia, the Indian Subcontinent, and Southeast Asia to China resulted. It also bypassed the blockage of the land routes of the Silk Road when occupied by Tibetan and Uyghur military forces from the 9th century onward. Evidence of maritime Arab-China trade became vibrant could be shown with the items of a shipwreck on the Belitung Island off the Java Sea in the 9th century (Note 25).

From the 9th to the 13th centuries, records of Hai Yao were first systematically documented in the Hu Ben Cao by Zheng Qian, then in Zhu Fan Zhi by Zhao Rukuo, and finally in the official National Formulary, Tai Ping Hui Ji Fang in 1078. Advances in the printing press, shipbuilding, and the use of the compass in navigation in the Song dynasty further boosted the transmission of religion, science, and medicine between China, India, Southeast Asia, and Arabia through the dissemination, transportation, and distribution of Hai Yao. Quanzhou, located in the southern coastal Fujian province, succeeded Guangzhou as the main port of entry for ships from the 10th to the 14th century. Adventurous traders traveled the alternate maritime routes, bypassing the Tibetan land blockade, bringing their aromatic herbs, spices and rarities of pearls, elephants, rhinos, and tortoiseshells from Arabia, India, Persia, and Southeast Asia to Quanzhou toward the end of the Song dynasty.

The Chinese exchanged such precious imports with silk, tea, and porcelain exports along the maritime route until the Ottoman Empire (1299–1922) hindered trade between West Asia and China by increasing trade tariffs for ships leaving the Gulf of Aden and the Persian Gulf between the mid-14th to 17the century. After Li Shizhen's release of the *Ben Cao Gang Mu* in 1596, Zhao Xueming (赵学敏, 1719–1805) published the *Ben Cao Gang Mu Shi Yi* (《本草纲目拾遗》 *Supplement to the Compendium of Materia Medica*) with an additional 16 *Hai Yao* including cinchona bark, vanilla, Myshore thorn, etc. in 1765.

The first Chinese-owned western chemist and druggist, Taian Dispensary, was founded by six physicians of the Bo Ji Yi Yuan (博济医院, previously called Canton Hospital) with Luo Kaitai (罗开泰), as the manager in 1882. Disciples of John Kerr (嘉约翰, 1824–1901), the hospital director of Bo Ji Yi Yuan, was prescribing morphine injections as "opium cures" for habitual smokers in 1892. A S Watson had the largest portfolio of locally produced "opium cures" registered with trademarks with the British-occupied Hong Kong government. A study of A S Watson's business history revealed that its "golden" opportunity arrived with the sales of morphine injections as "opium cures" in early 1893. A S Watson's association with "opium cures" made it the largest retail chain with over a hundred outlets and the most advanced pharmaceutical and soda water manufacturer in the Chinese mainland by 1910. The acquisition of Shanghai's other leading expatriate chemist brand, the British Dispensary, which had two retail outlets in the Hongkou district and the Bund in 1909, made A S Watson the only retail and wholesale chemist with the most extensive geographical coverage in China.

Alexander Peterson, a ship surgeon of the British East India Company (EIC), began mass vaccination of smallpox in Guangzhou in 1805, leading to other ship surgeons providing free medicine in China in the 19th century. Some ship surgeons such as William Jardine (1784–1843) became the largest opium traders in the 1830s who was the driver behind China's First Opium War between China and Britain from 1839 to 1842. This subsequently led to the conclusion of the *Treaty* of Nanking, with Hong Kong ceded to the U.K. by force. As a result, western chemists and *Xi Yao* began to flourish, with Shanghai increasingly becoming the entrepot among the treaty ports since the 1850s.

Fifty years later, the Union Medical College and Hospital (UMC) became the flagship of modern medicine when Dr Thomas Cochrane received the seeding fund from Empress Cixi (慈禧太后 Empress Dowager) in 1903 to open a new medical facility in 1906. UMC also became the cradle of modern pharmacy when Bernard Read, the first Western pharmaceutical missionary in Beijing, became a member of its faculty of medicine and head of the pharmacy department in 1909. The Xi Yao of significance, such as 606 (Salvarsan or Arsphenamine), was introduced to UMC in Beijing as syphilis was the number one infectious disease in Beijing in the 1910s. UMC was also the first insulin user in China in the summer of 1923, soon after its commercial launch in the U.S. early in the year.¹⁰ Around the same time, the late Manchu Qing court set up two western military medical schools, each with a pharmacy department in 1907 and 1908 in Guangzhou and Tianjin headed by Japanese pharmacy lecturers, respectively. The May 4 movement and the subsequent formation of the Ministry of Health (MOH) under the Republican government in 1928 led to the publication of China's first modern Pharmacopoeia in 1930. The Chinese Pharmacopeia (C.P.) was released in the Republican Era in 1931. Unfortunately, only about 10% of the 700 monographs of the C.P. are composed of Ben Cao, with the remaining entirely focusing on Xi

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Yao. This was a watershed with the majority of drug monographs in *Xi Yao* and a few in *Ben Cao*.

The establishment of state-owned hospitals, and pharmacy schools and the continuing development of the retail and drug manufacturing industries from 1900 to 1949 set the stage for western pharmacy to take root in China. Initially, western chemists entered the proprietary drug business with powdered opium in 1870s and "opium cures" containing 1% morphine as injectables in the early 1890s. Dr. Joseph Needham, a renowned biochemist cum sinologist, articulated the contrast between Chinese medicine and modern Western medicine in his monumental work on the *Science and Technology of Civilization in China* as:

"Modern-Western medicine is generally recognized to be particularly good for acute diseases, as in the case of antibiotics. One regrettable effect of modern-western medicine is that the active principles in certain drugs, as identified by modern pharmacology are administered as simple agents, producing side-effects on the patient. These are sometimes very serious. A feature in which TCM is extremely good is its organic approach to illness. Another excellent feature of TCM is its notion of disease as a process that passes through various stages. This can lead to some very sophisticated cures."¹¹

Prior to the foundation of the People's Republic of China on October 1st, 1949, the academic, hospital, industrial, military, retail, and wholesale pharmacy sectors of Western pharmacy were still at their early developmental stage. There were only 12 pharmacy schools, a few hundred western pharmacies, a cottage industry of 150 generic houses, and 2,000 pharmacists and technicians serving 57 million urban population or 10.6% of the 540 million total population. The journey in the Sinification of Ben Cao from the Ancient Silk Road has come a long way. Today, China has embraced the latest technology in manufacturing and supplying Xi Yao to serve 80% of the world's needs for antibiotics, painkillers and raw vitamin materials. Indeed, 51% of the 10 billion COVID-19 vaccine doses were supplied by China to the Global South, the emerging markets in Africa, Asia and South America in 2021. Over 10% of the Hai Yao listed in Volume 1 (TCM) of the 2020 edition of the Chinese Pharmacopoeia are continued to be imported from countries in the Silk Roads.

Notes

1. The practice of Qi Gong is a healthy energy improvement exercise or movement similar to Yoga in Ayurvedic medicine.

2. The "Western Regions" was a historical term commonly referring to central Asia and the Indian subcontinent west of ancient China. The Western Regions referred to the ancient states in Bactria, Fergana, Sodgiana and Transoxiana in Central Asia, Arsacid and Seleucid in Mesopotamina, and India in South Asia in the "Records of the Great Historian" by Sima Qian in 90 BCE. 3. King Zhao Mo was the second grandson of General Zhao Tuo (*Trieu Da* in Vietnamese), who declared independence of the Nanyue Kingdom (204–111 BCE) at the collapse of the Qin Empire (221–206 BCE) in 204 BCE. Nanyue Kingdom's territories encompassing parts of China today's southern provinces of Guangdong, Guangxi, Jiangxi, Fujian, and Northern Vietnam.

4. Buddhists in China have offered sandalwood oil to their ancestors and gods for over a millennium. For example, a single sandalwood trunk of the 26-m-high Maitreya Buddha statue, engraved on white sandalwood in the Lama Temple (the *Palace of Peace and Harmony*), was brought from Nepal to Beijing three centuries ago.

5. The "Jiva Pill" was reportedly originated from the *Compendium of Charka* (*Charka Samhita*), one of the three ancient Sanskrit foundational texts of Ayurveda. was born in Kashmir around the 1st century C.E.

6. Su Jing was supported by a team of 23 medical and pharmaceutical experts and completed their work within 2 years in 659. Tao Hongjing's *Ben Cao Jing Ji Zhu* double the number of materia medica from 365 recorded in the *Shen Nong Ben Cao Jing* to 730 over a 500-year period with many inappropriately recorded under the influence of the metaphysics school of thought.

7. In the following 35 years of the "An-Shi Rebellion", the Western regions, which were originally ruled under the Tang Empire, were completely blocked by the Tibetan and Uyghur military forces resulting in the rapid decline of the Tang dynasty. The land routes of the Silk Road came to a halt until the Mongolian Empire became the new ruler of Asia in the 13th century. China's connection with the world relied almost entirely on the maritime route of the Silk Road from the 9th to 13th century.

8. The Lingnan region was a geographic area encompassing the lands in the south of the Nanling Mountains which included the modern-day provinces of Guangdong, Guangxi, Hainan, Hong Kong, Macau, and Northern and Central Vietnam.

9. *Hai Yao Ben Cao* contains a total of 128 monographs including 11 minerals, 39 herbs, 49 resins, 15 animals, 10 fruits, and 4 others imported by the maritime Silk Road.

10. Volume 1 of *Zhu Fan Zhi* included faraway lands of Jiao Zhi (交趾), Zhan Cheng (占城) [aka *Chiêm Thành* in Vietnamese or Champa, a kingdom (137–1697 CE) in modern day Central Vietnam], Zhen La (真腊,aka "Siem Reap" in Cambodian or modern day Cambodia), San Fo Qi (三佛齐, aka "Srivijaya", the Samboja Kingdom", 650–1377 CE or modern day Malaya Peninsula and the Indonesian archipelago), Da Qin (大秦, aka "the Roman/ Byzantine Empire", 330–1453 CE), Da Shi (大食, aka "Arabia", 632–1258 CE), *Shijialiya* (aka "Kingdom of Sicily", 1130–1816 CE) etc.

11. Volume 2 included exotic elements such as frankincense, myrrh, styrax, benzoin, agarwood, sandalwood, clove, betel nut, coconut, myrtle, pepper, aloe vera, coral, glass, ivory, ambergris, yellow wax, etc.

12. The Formulary is a complete medical manual based on the Canon of Medicine of 1025, compiled by Persian philosopher cum physician, Ibn Sina (Avicenna, 980–1037).

13. Admiral Zheng was a Persian descendent of Islamic faith who came from a military background in the previous Yuan dynasty, Zheng's religious faith and knowledge of Arabic helped his exploration of 30 odd countries and territories with many Islamic states in the Indian subcontinent, Western Asia, and as far as Zanzibar, an island off the coast of East Africa (now modern-day Tanzania).

14. The exotic elements of materia medica brought back from Zheng He's seven naval expeditions included rhino horn, antelope horn, asafetida, frankincense, clove, cardamom, aloe vera, momordica, styrax oil, amber, hematoxylin, amomum, Malus micro malus, Psoralea corylifolia, benzoin, ambergris, Acronychia pedunculate, Philippine mahogany, rosemary, agarwood, styrax, Pistacia terebinthus, jackfruit, cassia pods, myrobalans etc.

15. The Dutch succeeded the Portuguese and Spanish as the major trader for commodity trading in pottery and silk in the East Asia in the early 17th century. The Dutch EIC was founded in 1602 to conduct trade with India, and Asia on behalf of the Dutch government.

16. A stringent set of dispensing procedures was in place and followed closely by the Imperial Pharmacy staff to ensure utmost quality and safety of such dispensed concoctions. When compounding and dispensing of *Ben Cao* preparations, an apothecary of the Imperial Hospital and a eunuch assistant of the Imperial Pharmacy would monitor the whole process. Each dose was prepared in double portions with one taken by the imperial apothecary or the eunuch assistant before the other portion was presented to the Emperor or the Empress.

17. American Ginseng (Panax quinquefolius), indigenous to North America, is used as a herbal medicine by the indigenous people.

18. Qian Qing Gong (乾清宮 the Palace of Heavenly Purity) was the largest of the three halls of the Inner Court, and served as the Emperor's audience hall, where he held meetings with the Grand Council Yang Xin Dian Gong Chang (养心殿工场 Yangxin Hall Workshop) was a clock repair workshop before part of it was turned into a mini western pharmacy store. The Yuan Min Yuan (圆明园 The Old Summer Palace) was the main imperial residence of Qianlong Emperor and his successors, and where they handled state affairs until it was burn down by the British and French troops in the Second Opium War in 1860. The Zi Jing Cheng (紫禁城 The Forbidden City) was used for formal ceremonies.

19. Robert Morrison was born in Morpeth, North East England, of an Anglo-Scottish religious family. He joined the LMS in 1804 and studied theology, Chinese and attended a course in medicine at the St. Bartholomew's Hospital in London before he was sent to Macau in 1807.

20. Thomas Colledge was born at Kilsby, near Rugby, Northamptonshire in June 1797. He finished his upper school at 15 and served a 5-year medical apprenticeship at the Leicester Infirmary. In 1817, He furthered his studies under Sir Astley Cooper, a renowned surgeon, teaching at the St. Thomas Hospital in London. As a favorite student and a mentee of Sir Astley, he was recommended by the latter to take up a position as an assistant ship surgeon of the EIC in 1819. He eventually took up a residential surgeon position and was based in Macau in 1826.

21. Peter Parker, born in Framingham, Massachusetts to a religious Congregational family, graduated from both the Yale Divinity School with a B.D. and the Yale School of Medicine with an M.D. in 1834. After ordained as a Presbyterian minister at Philadelphia in the same year, Parker set sail for Guangzhou, as a missionary of the American Board of Commissioners for Foreign Missions (ABCFM).

22. In the inaugural meeting of the MMS on February 21, 1838, Thomas Colledge was elected as the President, Parker, Jardine, G.T. Lay, and Bridgman were Vice Presidents and Colledge's assistant, Dr. Alexander Anderson as the Secretary. Soon after the inauguration, Thomas Colledge's senior surgeon position with the Crown was abolished, he returned to the U.K. in April 1838.

23. With China's opium smokers reaching new heights at 30 million in 1880, locally produced "opium cures" containing powdered opium and morphine, which were equally if not more addictive, replaced the higher priced imported preparations.

24. Turkic tribes from the Altai mountains, supported by Sogdian merchants in Central Asia, formed trading stations with caravans traveling from Merv via Bukhara or Samakrand to Kucha, a border town of Sui (581–618 CE) and early Tang (619–689 CE) dynasties.

25. A display of the merchandise in the Asian Civilization Museum in Singapore, showed a typical Arab dhow of 18-m length consisted of 70,000 ceramic pieces, gold and silver loaded in Guangzhou and destined for Baghdad in 826 CE.

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