

Traditional and Modern Pharmacognosy: Perspectives from Chinese and Western Herbal Medicine

By Eric Brand

The timeless human quest to discover natural products that can alleviate disease and suffering has caused pharmacognosy to be described as the “oldest modern science.”(1) The use of plant, animal, and mineral products in the treatment of disease has been documented worldwide for thousands of years, and trade in medicinal products between cultures dates back to ancient times. Over the course of history, pharmacognosy has evolved considerably following advances in disciplines such as taxonomy, agronomy, and chemistry, and tremendous diversity can be seen in the pre-modern approaches used by different cultures to evaluate and apply natural medicines.

The word pharmacognosy, which is derived from the Greek words “pharmakon” (drug) and “gnosis” (knowledge), was first coined in 1811 by an Austrian physician named Johann Adam Schmidt.(2) Traditionally, pharmacognosy focused on the study of crude drugs of natural origin, encompassing aspects such as authentication and quality control. In the modern era, pharmacognosy has expanded beyond traditional techniques such as macroscopic identification and microscopy, and advances in molecular biology and screening methods to identify chemical constituents and therapeutic targets have transformed the field.(3) In recent years, new methods of drug discovery utilizing computer simulation models have been developed to complement the traditional process of investigating potential new drugs based on ethnopharmacological observations.

The concept of a “drug” has evolved over the course of human history, and the discipline of pharmacognosy has evolved along with it. The English word “drug” is derived from the word “dry,” reflecting the fact that drugs originally referred to dried medicinal plants. In addition to plant-based drugs, mineral and animal products have been used as drugs by many different cultures, and a number of mineral and animal drugs were included in classical herbal texts such as Dioscorides’ *De Materia Medica* and the *Divine Farmer’s Classic of Materia Medica (Shen Nong Ben Cao Jing)* from China. Although some additional biological materials such as marine organisms and large fungi have traditionally been used as medicines for centuries, modern pharmacognosy has expanded to investigate new drugs derived from microorganisms such as bacteria and fungi that were inaccessible to research before the modern era.



A Multidisciplinary Science

Pharmacognosy has been a multidisciplinary science throughout history. The importance of plant-based medicines has long caused pharmacognosy to be intricately connected to botany. The close relationship of these two disciplines was emphasized in the 1917 text *Handbook of Pharmacognosy* with the statement: “Vegetable drugs are of vastly greater importance and therefore a knowledge of botany is necessary to an understanding of pharmacognosy.”(4) Indeed, prior to the development of Linnaean taxonomy and plant

classification texts known as “floras,” most texts dedicated to plant identification were “herbals” that also contained details on the therapeutic activities of plants. (5) Today, taxonomic identification of medicinal plants is considered to be a fundamental step in the authentication of medicinal materials. (6)

In addition to botany, the field of chemistry has had a major impact on traditional pharmacognosy. Following the successful isolation of morphine and other pure compounds at the beginning of the 19th century, the notion of active constituents that could replicate the effects of crude drugs attracted tremendous attention. While most official drugs listed in pharmacopoeias around the world primarily consisted of plant-based crude drugs until the early 20th century, the modern concept of “drugs” in popular Western culture gradually began to focus on natural or synthetic active chemical constituents rather than crude natural products.

Today, chemistry remains indispensable in pharmacognosy and is essential for quality control and new drug discovery. In recent years, the multidisciplinary nature of modern pharmacognosy has continued to expand with the arrival of new techniques, such as the use of DNA bar-coding for authentication or the use of metabolomics for assessing pharmacologic effects.

Traditional and modern pharmacognosy both emphasize the authentication of medicinal materials and the discovery of new drugs through research into crude drugs. However, as the techniques to identify crude drugs and to discover new drugs have become more sophisticated, pharmacognosy has evolved to incorporate a range of disciplines and tools that did not exist during the formative era of traditional pharmacognosy. Due to the vast number of natural substances that must be prioritized for investigation, traditional pharmacognosy is often informed by ethnopharmacology, the traditional use of medicinal substances in indigenous cultures. By contrast, in modern pharmacology, the use of high throughput screening techniques allows for the rapid screening of thousands of substances in a short period of time, which expands the number of plants that can be rapidly assessed. Aided by computer simulations and methods of matching libraries of chemical structures to biochemical targets, modern pharmacognosy has expanded the possibilities for drug discovery, making pharmacognosy less dependent on researching substances with a cultural history of medicinal use.

Traditional Pharmacognosy in China

In China, the discipline of traditional pharmacognosy was influenced by exchange with Japan, where a number of new texts devoted to pharmacognosy emerged in the late 19th century. In 1905, the Chinese scholar Zhao Yuhuang studied in Japan and returned to emphasize pharmacognosy as a professor in Beijing; his Qizhou Medicinal Journal became the first Chinese resource that organized materia medica knowledge based on Latin taxonomy.(7)

While this era represents a milestone for the arrival of traditional pharmacognosy as a modern science in China, many aspects relevant to traditional pharmacognosy had been previously explored in Chinese *bencao* literature. For example, the Ming Dynasty illustrated text *Origins of the Materia Medica (Ben Cao Yuan Shi)* was dedicated to the morphological identification of medicinal materials, and previous works such as the *Extension of the*

Materia Medica (Ben Cao Yan Yi) focused on the differentiation of genuine vs. inauthentic medicinals. (7)

In 1593 AD during the Ming Dynasty, the *Compendium of Materia Medica (Ben Cao Gang Mu)* by Li Shizhen was published; featuring 1,892 medicinal substances, this monumental text utilized a novel, two-tiered classification system for organizing natural substances, and remains a rich resource with great relevance for traditional pharmacognosy. Additional *bencao* texts focused on recording medicinal substances from specific geographic regions, such as the *Materia Medica of Steep Mountainsides (Lu Chan Yan Ben Cao)*, which catalogued local medicines from the region around modern-day Hangzhou.(7) *Bencao* literature also includes texts dedicated to medicinal processing, a practice that significantly impacts the chemistry and therapeutic nature of medicinal substances. However, although *bencao* literature remains a rich resource for traditional pharmacognosy, its global impact has long been limited by a language barrier because few ancient *bencao* texts have been translated into Western languages.

As can be seen from these examples, traditional *bencao* literature contains valuable information on the authentication of medicinal materials, classification of natural substances, and acquisition of new drug sources from the exploration of locally used plants by indigenous groups. While these developments arose historically prior to the arrival of the modern science of pharmacognosy, these features nonetheless illustrate a sophisticated level of knowledge regarding the study of crude drugs. By applying techniques such as chemical analysis, laser micro-dissection, genetic testing and taxonomy, modern pharmacognosy is allowing traditional Chinese medical knowledge to be systematically assessed using the scientific method. Chemical analysis allows the effects of traditional processing methods on the chemistry of crude drugs to be studied, and the integration of *bencao* study and modern taxonomy has led to clarification regarding the used plant species for many medicinal materials described in ancient texts. While traditional pharmacognosy techniques such as microscopy have long been essential for determining the authenticity of crude drugs, modern techniques such as combining laser micro-dissection with LC-MS have advanced the discipline of microscopy by determining where active constituents are concentrated within the anatomical structures of botanical materials. This research has significant implications for the quality assessment and production of medicinal materials, and can also help to resolve cases where the traditional literature contains conflicting statements with regard to medicinal quality.(8)

Traditional Pharmacognosy in the West

As in China, the study of crude drugs in the West preceded the formal development of pharmacognosy as a named scientific discipline. Texts dedicated to medicinal materials were first established in Europe in Greek and Roman times, and many local and foreign medicinals were described in ancient Western texts. In the Renaissance period, the arrival of printing technology heralded a dramatic increase in the number of herbal texts that were published, and the literature began to diversify beyond the original foundations laid by Dioscorides. Texts in European languages other than Latin began to proliferate, and with the age of exploration and colonization of new territories, new herbal medicines were introduced to Europe.

Since the time of Theophrastus (a student of Aristotle), there has been a close relationship between the fields of botany and Western herbal medicine. This relationship developed

dramatically after printed texts called “herbals” emerged in the late 15th century, and the relationship between early botanical and medicinal literature is described in detail in key historical works such as *Herbals, Their Origin and Evolution: A Chapter in the History of Botany 1470-1670*, written by Agnes Arber in 1912.⁽⁵⁾ Detailed botanical descriptions were first found in herbals, which focused on plants that were used medicinally; as the discipline of taxonomy developed, botanical descriptions of plants moved beyond herbal medicines to focus on the classification of all plants using the systematic approach that defines modern taxonomy. In a situation that parallels the current state of pharmacognosy, taxonomy itself is divided into traditional and modern approaches; traditional taxonomy favors morphological identification while modern taxonomy is also influenced by newer analytical methods such as genetic testing and chemotaxonomy.

Beyond botanical descriptions of the source plants, traditional knowledge about crude drugs in ancient Western herbal texts often featured discussions of growing regions, harvest times, flavors and properties, as well as characteristics of different preparations, such as tinctures, powders, syrups, etc. Following the invention of the microscope, microscopy was applied extensively in herbal authentication, and numerous discussions related to avoiding adulterants are found in the Western herbal literature. In the 19th century, the discipline of medicinal chemistry advanced considerably, and pure compounds began to become incorporated into Western pharmacopoeia texts (which had previously only contained references to crude drugs and extracts).

Following the successful isolation of pure compounds with medicinal efficacy, the discipline of pharmacognosy in the West gradually began to shift its focus from evaluating the quality of crude drugs based on organoleptic properties to identifying the active components within crude drugs through chemical analysis. Just as the discipline of botany initially began with a focus on plants with medicinal use in traditional culture and then expanded to focus on the classification of all plants, the field of pharmacognosy has expanded beyond its original focus on ethnopharmacology, incorporating new approaches such as high throughput screening to search for novel and undiscovered active ingredients in a progressively wider range of plants. Nonetheless, it is estimated that only about 6% of higher plants have been screened for biologic activity, and only about 15% have been evaluated phytochemically.⁽⁹⁾

The process of discovering new medicines and improving the quality control of existing crude drugs is a monumental task that has occupied humanity since the dawn of written history. In the modern era, enhanced methods of screening and testing have greatly speeded the acquisition of new knowledge, but many known crude drugs remain poorly understood and many potential new drugs are yet to be discovered. Likewise, a tremendous amount of traditional cultural knowledge relevant to the field of pharmacognosy has been recorded around the world, but only a tiny fraction of this knowledge has been disseminated worldwide in multiple languages. Consequently, there is a vast amount of knowledge that remains to be discovered through the application of both traditional and modern pharmacognosy, and both aspects of the field have a bright future and limitless horizons.

References

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