

## Pharmacognosy: Turning Medicinal Plants into Drugs

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### Introduction

Pharmacognosy, which originates from the Greek words "pharmakon" (drug) and "gnosis" (knowledge), can be regarded as one of the earliest branches of modern science. It primarily focuses on the study of raw drugs derived from plants and animals, including tinctures, teas, poultices, powders, and various herbal preparations. Pharmacognosy encompasses the processes of authentication and quality control for these drugs, utilizing both macroscopic and microscopic examinations of the raw materials. The term "Pharmacognosy" was initially coined by the Austrian physician Schmidt in 1811 and later used by Seydler in 1815 in their work titled *Analecta Pharmacognostica* (Sarkar, 2012).

In the field of pharmacognosy, researchers focus on studying the secondary metabolites present in various natural sources such as plants, animals, and microbes. These sources include plant parts like leaves, seeds, fruits, stems, roots, rhizosphere, herbs, spices, as well as organisms like fungi, algae, corals, starfish, jellyfish, sponges, sea cucumbers, sea urchins, sea weeds, snakes' venom, frogs' skin, cockroaches, and many others (Ahmad *et al.*, 2006; Parveen and El-Taveen, 2019).

According to the World Health Organization (WHO), herbal medicines encompass herbs, herbal materials, herbal preparations, and finished herbal products that contain active ingredients derived from plant parts or other plant materials, either individually or in combination. Herbal medicine is an alternative treatment approach that utilizes different plants and plant extracts. These medicines interact with the human body's immune system to facilitate a detoxification process. Herbal medicines are derived from relatively benign plant matter that the body can easily metabolize (Maqbool *et al.*, 2019).

Plants have long been used as medicinal remedies to treat various diseases, and they continue to be a popular source for discovering new drug candidates. The use of botanical



natural health products is increasing worldwide. It is estimated that approximately 80% of the population in developing countries relies on traditional medicine, often based on herbal prescriptions. Plants are abundant sources of bioactive chemicals, including compounds like atropine, ephedrine, morphine, caffeine, salicylic acid, digoxin, taxol, galantamine, vincristine, colchicine, and many more (Parveen and El-Taveen, 2019).

Therefore, natural products play a vital role on Earth, enabling the existence of human life. The remarkable diversity of nature serves as a valuable resource for herbal drug discovery. Natural products and traditional medicines hold great importance in the field. For many years, natural products and their derivatives have been recognized as sources of therapeutic agents and structural diversity. They exhibit a wide range of multidimensional chemical structures, and their potential as modifiers of biological functions has garnered significant attention (Koparde et al., 2019).

Ayurvedic medicines primarily utilize plant-based raw materials in the form of crude drugs, such as dried herbal powders, extracts, or mixtures of products. Additionally, various tribal communities in the country have a rich heritage of ethnobotanical usage of herbs. Many drugs available in the market today have been discovered from natural sources. For instance, aspirin, known worldwide as the most widely used medicinal agent with analgesic activity, originated from the plant genera *Salix* spp. and *Populus* spp. and is related to *salicin*. Another example is the accidental discovery of the antibiotic penicillin from the fungus *Penicillium notatum* in the laboratory.

*Hypericum perforatum* (Guttiferae) is a plant that yields two compounds, *hypericin* and *pseudohypericin*, which have shown activity against various retroviruses, including HIV. These compounds inhibit the release of reverse transcriptase by stabilizing the structure of the HIV capsid, thus preventing the uncoating process.

Throughout history, natural products derived from medicinal plants have played a significant role in the discovery of clinically useful medicines. Despite the challenges faced in drug discovery from medicinal plants, natural products will continue to be a crucial component in the search for new drug candidates. Current research in this field involves a comprehensive approach that combines botanical, computational, phytochemical, biological, and molecular techniques. Medicinal plants still offer promising leads against various pharmacological targets, including cancer, HIV/AIDS, Alzheimer's disease, malaria, and pain. Several plant-



derived natural product drugs have either been recently introduced or are currently undergoing late-phase clinical trials.

### **Historical development in India (Shi *et al.*, 2020)**

The history of herbal medication dates back to the beginning of human civilization. Herbal medicines have been employed in medical practices since ancient times and are integral to traditional Indian medicine, which encompasses Ayurveda, Yoga, Unani, Siddha, Homeopathy, and other disciplines collectively known as AYUSH. Ayurveda, Unani, and Siddha medicine are representative of the drug application in the AYUSH system. AYUSH emphasizes a holistic approach to healthcare, considering the body, mind, and spirit as interconnected. It promotes physical, mental, and emotional health through harmonious coexistence with nature. Ayurveda, with its roots dating back to 5000 B.C., is a significant component of the AYUSH system (Shi *et al.*, 2020).

Ayurveda is recognized as the world's oldest documented comprehensive medical system. It encompasses eight specialties, including internal medicine (Kayachikitsa), surgery (Salya Tantra), otolaryngology (Salakya), gynecology and pediatrics (Kaumarabhrtya), psychiatry (Bhutavidya), toxicology (Agada Tantra), gerontology (Rasayana Tantra), eugenics and expediting (Vajikarana). Treatment methods in Ayurveda consist of Shamana (palliative therapy), Shodhana (purification therapy), surgical therapy, and diet therapy. One of the key aspects of Ayurveda is its holistic approach, focusing on the close connection between the body and mind. It emphasizes the importance of maintaining balance in all parts of the body rather than simply eliminating external pathogens. Ayurvedic treatments rely on processed natural drugs rather than extracted substances or synthetic chemicals, and they highlight the role of diet in preventing and treating diseases. Ayurveda promotes the belief that "the habits of medicine and food may differ, but the principles remain the same" and places emphasis on consuming healthy food.

India has a long-standing reputation for practicing classical medicinal systems such as Siddha, Buddha, Ayurveda, and Unani. These systems can be traced back to ancient Vedas and other ancient literature and scriptures. The concept of Ayurveda emerged and developed in India between 500 and 2500 BC. The term Ayurveda translates to "science of life," reflecting the ancient Indian system's focus on understanding human beings and their ailments. Positive health, according to Ayurveda, entails achieving metabolic balance within the human body.

The use of plant-derived drugs in modern medicine originated from the utilization of various plant materials such as leaves, roots, stems, flowers, stigmas, bulbs, and rhizospheres in folk and traditional medicinal systems. Over a hundred plants have been identified for their notable antibacterial activities, while many plants have demonstrated strong antidiabetic properties. Compounds like etoposide and teniposide, isolated from a *Podophyllum* species, have been used in the treatment of testicular and lung cancer. Taxol, a well-known secondary metabolite found in *Taxus brevifolia* (Taxaceae), is employed in the treatment of lung and ovarian cancer.

### **Natural drugs available in market: anti-inflammatory**

#### **Himalaya *Boswellia***

Himalaya herbals are herbal products derived from *Boswellia*, a pure herb extract. Boswellic acid is the bioactive molecule found in the gum resin of Shallaki or *Boswellia serrata*. This acid, containing pyrazoline as a lead molecule, supports the body's natural immune response, prevents inflammation, and promotes healthy joints and muscles. *Boswellia* is a natural and safe herb known for its beneficial effects on joint health. It is gentle in its care for joints and has been extensively used in Ayurveda for arthritis and overall well-being. Furthermore, *Boswellia* is known to promote healthy cholesterol and triglyceride levels and provides broad health and immune-modulating benefits.

#### **Ginger**

Ginger has long been recognized in herbal medicine for its immune-boosting properties. It is believed to have a warming effect on the body and aids in the breakdown of accumulated toxins. Ginger is known to cleanse the lymphatic system, acting as the body's sewage system. By preventing the accumulation of toxins, it helps safeguard the body against viral, fungal, and bacterial infections. Additionally, ginger has many health benefits, including its use as a natural remedy for nausea, pain alleviation, anti-inflammatory properties, and potential for diabetes inhibition.

#### **Licorice root**

Licorice root is gaining attention in various research for its potential in treating and preventing diseases such as hepatitis C, HIV, and influenza.

#### **Olive leaf**

Olive leaf possesses antiviral properties, making it effective in treating common colds and combating dangerous viruses.

### Oregano

Oregano oil is showing promise as a superior alternative to certain antibiotics, without harmful side effects. The bioactive molecules carvacrol and thymol, found in oregano oil, exhibit potent properties and can act against viral infections, allergies, tumors, parasites, and disease-causing inflammation.

### Conclusion

With an increasing focus on herbal drug development that minimizes side effects, there are now better opportunities to explore the medicinal and biological properties of previously untapped natural products. It is crucial to identify and visualize unused herbal plants worldwide in order to establish their usefulness. The extraction, isolation, and characterization of phytochemicals from these plants, which are nature's gift, should be approached in a rational and scientific manner. The success of natural products in drug discovery is closely tied to their ability to benefit the general population, providing socio-economic advantages and promoting overall well-being. The health of the common person should be a top priority for the world, as evidenced by the historical reliance on natural herbs for sustaining and extending life. In the twenty-first century, herbal drugs or products derived from natural herbal drug discovery have become indispensable for life on Earth. The drugs from systems like Ayurveda, Unani, and Siddha require scientific investigation and validation of each traditional medicine. Many government and private entities, such as CSIR in New Delhi, are actively involved in this field and have already validated numerous formulations for various therapeutic activities.

**Table 1: Plant-derived anticancer drugs have received FDA approval for commercial production. (Inoue *et al.*, 2019)**

Drug name	Plant resource	Feature
Taxol/paclitaxel	Pacific yew tree	Now the first drug of choice in several tumorous cancers including breast cancer
Vinblastine	Madagascar periwinkle	The first drug of choice in many forms of leukemia, and since the 1950s. it has

		increased the survival rate of childhood leukemias by 80%
Vincristine	Madagascar periwinkle	Another antileukemic drug
Topotecan	<i>Camptotheca acuminata</i>	Has been approved by the FDA for the treatment of ovarian and small cell lung cancer
Irinotecan	Camptotheca acuminata	Has been approved by the FDA for the treatment of metastatic colorectal cancer
Etoposide	<i>Podophyllum peltatum</i>	A semisynthetic derivative of a plant chemical epipodophyllotoxin
Teniposide	Podophyllum peltatum	Another semisynthetic derivative of a plant chemical

**Table 2: Some Drugs from Himalayan Medicinal Plants (Rao, 2019)**

Species	Product	Manufacturer
<i>Saussurea costus</i>	Koflet (Syrup)	Himalayan Drug Co.
<i>Abies webbiana, Ephedra</i>	Kuftone (Cap.)	Dharmani Drug Res. & Inula racemosa Trg. Instt.
<i>Podophyllum hexandrum</i>	Liv.-10 (Syrup) Livosin (Syrup)	Allens Labs (Pvt.) Ltd. (Syrup) Allins India Marketing (P) Ltd.
<i>Nardostachys jatamansi,</i>	Mentat (Syrup)	Himalayam Drug Co.
<i>Abies spectabilis</i>	Octin Expectorant (Syrup)	Myncil Pharmaceuticals
<i>Berberis aristata</i>	Orthoherb (Cap.) Pilex (Tab.)	Walter Bushoell Ltd. Himalayan Drug Co

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