

**CHAPTER
1****Introduction to
Pharmacognosy****1.1. PHARMACOGNOSY****1.1.1. Definition**

Pharmacognosy is a branch of bioscience dealing with medicinal and related products of crude or primary type and obtained from plants, animals, and mineral origin. It can also be defined as the study of drugs obtained from natural origin.

Pharmacognosy includes a broad spectrum of biological and socio-economic subjects such as botany, ethnobotany, medical anthropology, marine biology, microbiology, herbal medicine, chemistry, biotechnology, phytochemistry, pharmacology, clinical pharmacy, pharmaceuticals, and pharmacy practice.

The **modern pharmacognosy** study is divided into the following **eight fields**:

- 1) **Medical Ethnobotany**: This branch studies the traditional use of plants for medicinal use.
- 2) **Ethnopharmacology**: This branch studies the pharmacological properties of traditional medicinal substances.
- 3) **Phytotherapy**: This branch studies the medicinal use of plant extracts.
- 4) **Phytochemistry**: This branch studies the chemicals obtained from plants. The branch also includes identification of new drugs of plant origin.
- 5) **Zoopharmacognosy**: This branch studies the process by which animals self-medicate, i.e., they treat and prevent diseases by using plants, soils, and insects.
- 6) **Pharmacognosy-Biotechnology**: This branch studies the synthesis of natural bioactive molecules using biotechnology.
- 7) **Herbal Interactions**: This branch studies the interactions between herbs and other drugs and body.
- 8) **Marine Pharmacognosy**: This branch studies the chemicals obtained from marine organisms.

1.1.2. History

The history of herbal medicines continues since human civilisation. Some documents of ancient times showed that in China, India, Egypt, and Greece, plants were used for medicinal purposes a long time before the Christian era began.

Papyrus Ebers (a very famous scroll which is about 60 feet long and one foot wide) is still available and dates back to the 16th century B.C. It contains more than 800 formulae and 700 different drugs. Many medicinally active substances were identified in the 19th and 20th centuries which were used as crude extract. Many medicinal plants were in use since 5000 B.C. in China.

After **Hippocrates** (460-360 B.C.), **Aristotle** (384-322 B.C.), **Dioscorides** (40-80 A.D.), **Galen** (131-200 A.D.), and other early Arabian physicians made important contributions

towards medicine. A period of around 1000 years prevailed during which little advancements were made in the medical sciences. **Galen** (the first pharmacist) had used many materials (including opium) for relieving pain. In the next few 100 years, very minute changes were made in the formulations of the medicaments being used. **Paracelsus**, however, made some major attempts like developing mineral salts having the potential of being universal curative agents. During this era, use of herbal extracts for medicinal purposes never lost its place.

Medicinal plants in **China** had been used since 5000 B.C. **Shennong** wrote the oldest herbal document, **Pentaso** in 3000 B.C. In India also during this period, efforts were made for examination and classification of herbs. **Charaka** divided medicinal plants into 50 groups 10 herbs in each, for a particular illness. **Sushruta** divided 760 herbs in 7 groups based on their common properties. Thus, Ayurveda came up with the well-known treatises, **Charaka Samhita** and **Sushruta Samhita**. The earliest medicinal plant originated in India and used in Ayurveda was described in 1200 B.C. along with other 127 plants.

In the 19th century, **Materia Medica** term was used for the subject now known as Pharmacognosy. While studying Sarsaparilla, **Seydler** (a German scientist) in 1815 coined the term **pharmacognosy** in the title of his work **Analecta Pharmacognostica**.

Swede Linnaeus (the great systematist) classified plants by introducing the system of naming them; this system is known as the **binomial system** which is still in practice. At the end of the 18th century, crude drugs were still used in the form of powders, simple extracts, or tinctures.

During the 19th century, the progress achieved in botanical studies directly influenced pharmacognosy and established the chemical structures of many isolated compounds. **Bentham** and **Hooker**, **A.W. Eichler**, **Engler** and **Prandtl** further classified plants.

G. Mendel made some important observations on plant hybrids, which were published in 1865. Introduction of microscope as an important analytical tool was an innovative advancement in botanical research, especially due to the development of clearing, mounting, and staining techniques of the preparations. In 1865, **Berg** published the anatomical atlas of crude drugs.

Voehl, **Tschirch**, and others in the late 19th century, described significant anatomical properties of some powdered drugs, which proved out to be useful at a period when drug and food adulteration was common. **Greenish** and **Collin** compiled their work, **An Anatomical Atlas of Powdered Vegetable Drugs** in 1904.

In the 20th century, some important drugs (especially hormones and vitamins) were discovered from the animal kingdom. During this century, microorganisms have become an essential source of drugs.

In the 21st century, chemistry and genetics were applied in plants to produce various new plant and herb varieties. Chromatography and many other extraction and isolation techniques were developed in this era for recognition of new medicinally useful chemical compounds (like citric acid).

Scope of pharmacognosy for isolation, extraction, and development of new chemical constituents from medicinal plants was increased by the introduction of new branches of pharmacognosy. These branches include **medical ethnobotany**, **ethnopharmacology**, **phytochemistry**, **zoopharmacognosy**, **pharmacognosy-biotechnology**, and **marine pharmacognosy**. Thus, pharmacognosy made its progression steadily and formed the base and beginning of pharmacy and medicine. Pharmacognosy as an applied science has played an important role in developing different disciplines of science.

1.1.3. Scope

Scope of pharmacognosy is discussed below:

- 1) **Synthetic Drugs and Antibiotics:** The demand of pharmaceutical products of plant origin has increased due to the worldwide use of synthetic drugs and antibiotics.
- 2) **Indigenous System of Medicines:** Plants synthesise biologically active secondary metabolites due to which they are called a **chemical laboratory**. Based on the availability of medicinal plants as raw material, the WHO has emphasised the utilisation of indigenous system of medicines.
- 3) **Herbal Medicines:** Since herbal medicines do not have any toxic or side effect (unlike the modern medicines), they have gained popularity in the recent years.
- 4) **Medicinal Plants:** Medicinal plants are found distributed in almost all parts of India, thus it is the richest source of medicinal plants. Ayurvedic and Unani medicines are manufactured from the drugs supplied by the herb collectors and small traders.
- 5) **Novel Medicines:** The evolution of novel medicines depends on pharmacognosy.
- 6) **Crude Drugs:** Galenicals and therapeutically active substances are prepared using crude drugs, as they cannot be synthesised economically. Crude drugs obtained from medicinal plants also provide intermediates required for synthesising active compounds. Pharmacognosy provided a system in which the active principles of crude drugs can be dispensed, formulated, and manufactured in dosage forms accepted by the Allopathic medicine system.
- 7) **Plant Drugs and Remedies:** Complex diseases like cancer and AIDS are treated by plant drugs and remedies, which are safer than the synthetic medicines.
- 8) **Alkaloids, Glycosides, and Antibiotics:** A large number of these substances have been isolated, identified, and used as a curative agent.
- 9) **Phytomedicines:** The following natural plants are used as phytomedicines:
 - i) **Artemisinin** (antimalarial agent),
 - ii) **Taxol** (anticancer agent),
 - iii) **Forskolin** (an antihypertensive),
 - iv) **Rutin** (used as vitamin P and a capillary permeability factor), and
 - v) **Piperine** (enhances bioavailability).
- 10) **Natural Products:** These have been used as drug substitute for semi-synthesis of many potent drugs.
- 11) **Plant-Based Remedies:** The interest in plant based remedies with a basic approach towards the nature increased in western world, when the people started becoming aware of the potency and side effects of synthetic drugs. Many drugs, e.g., balsam of Tolu, balsam of Peru, benzoin, etc. are imported to India. If these drugs are cultivated in India, foreign exchange can be significantly saved.

1.1.4. Indigenous System of Medicine

Pharmacognosy is a part of applied science developed for studying naturally originating drugs of all types. However, pharmacognosy as a subject aims to study modern allopathic medicine. Many civilisations in different parts of the world were developed and they perished; however the medicine systems developed by them became popular as **alternative systems of medicine** and are still in practice. The modern allopathic system has been considered worldwide the principal system of medicine; thus all the other medicine systems existing in different parts of the world are its alternatives. The

philosophy and basic principles of these alternative medicine systems are different from each other; they have served the humankind by treatment and management of diseases and by maintaining good health.

These alternative systems of medicines are referred to as **traditional systems of medicines**, which are still in use by about 80% of the world population. The traditional Chinese medicine system, Unani system, Ayurvedic system, Amachi, and Homoeopathy are the traditional systems of medicine which in ancient times were practiced only in China, Greece, India, Tibet, and Germany, respectively; but at the present time worldwide population rely on them.

The major systems of medicines that are used alternatively are as follows:

- 1) Ayurvedic system,
- 2) Unani system,
- 3) Siddha system, and
- 4) Homeopathic system.

1.1.4.1. Ayurvedic System of Medicine

Ayurvedic medicine system was established by the Hindus in India several thousand years ago. The Vedic period started with the Aryans. The four holy books (written in Sanskrit) invented with divine inspiration were included in the Vedas, which means **wisdom**. These Vedas were initially conveyed to the students by their teachers in a verbal manner. But during the period of 2500-1500 BC, the Vedas were available in written forms on birch bark. Later, they were even available written on papers.

Rig Veda (the oldest Veda) has drugs and diseases mentioned in it. **Atharva Veda** (the fourth Veda) has ideologies for maintaining health and the medicinal effects of health mentioned in it.

History

Indian medicine is one of the oldest organised medicine systems, thus has a long history. Given below are some historical views about Ayurveda medicine system:

- 1) Its most primitive concepts are available as sacred writings in the **Vedas**, especially in the metrical passages of the Atharvaveda, which dates back to 2nd millennium B.C.
- 2) **Dhanvantari** was idolised as the **God of Medicine** as he received the medicine system from **Brahma**. Later his status started to decline, until when he was credited with having been an earthly king.
- 3) Knowledge in ancient times was transmitted verbally in **Sanskrit language**. It is the Vedic language of 2000-500 B.C. A dissertation named *Sushruta Samhita* carries the most authentic collection of teachings and work of **Dhanvantari**. This treatise has 184 chapters and 1,120 illnesses, 700 medicinal plants, 64 preparations from mineral sources, and 57 preparations from animal sources described in it.
- 4) **Sushruta** (the physician) was the first one to perform **cataract surgery** in the 1st millennium B.C. using **jabamukhi salaka** (a curved needle used for loosening the lens and pushing the cataract out of the vision field). After surgery he used to soak the eye with warm butter and then bandage it.
- 5) *Charaka Samhita*, attributed to Charaka is another work of Ayurveda of ancient time.
- 6) **Bower Manuscript** is the most basic persisting written material which dates back to the 4th century A.D. This book contains the works of Sushruta, description of Indian medicine and its concepts in Central Asia; thus is of special interest to the historians.
- 7) **Vagbhata** (son of a senior doctor, **Simhagupta**) also compiled his works on traditional medicine.

- 8) Early Ayurveda had separate schools for physicians and surgeons. **Agnivesh** (a student of the sage, **Bharadwaja**) wrote the text *Agnivesh tantra* which influenced the writings of Ayurveda.
- 9) **Fa Hsien** (the Chinese traveller) wrote about the health care system of Gupta Empire (320-550). He also gave a description on the institutional approach of Indian medicine. This is still available in the works of **Charaka**, who mentioned a clinic and its equipment.
- 10) **Madhava, Sarngadhara, and Bhavamisra** also compiled their works on Indian medicine.
- 11) During the **Abbasid Caliphate**, the medical works of **Sushruta** and **Charaka** were translated in Arabic language. These Arabic works were transferred to Europe through intermediaries.
- 12) The **Branca** family of **Sicily** and **Gaspere Tagliacozzi** (Bologna) in Italy got acquainted with the techniques of **Sushruta**.
- 13) British physicians moved to India to see how rhinoplasty was performed by native methods, and the reports on Indian rhinoplasty were published in **1794** in the **Gentleman's Magazine**.
- 14) **Joseph Constantine Carpue** lived in India for 20 years and studied local plastic surgery methods; and finally performed the first major surgery in **1815** in the western world.

Principles of Ayurvedic System of Medicine

The development of Ayurvedic medicine system is based on the following 5 pharmacological principles of drug, i.e., **Panchsheel**:

- 1) **Rasa**: It denotes the drug's taste (i.e., **Dravya**), action, and properties. In the table below, **6 types of rasa** are enlisted:

Sweet	Solid + Liquid	Pitta ↑ Kapha ↓
Sour	Solid + Energy	Pitta ↑
Saline	Liquid + Energy	Kapha and Pitta ↑
Pungent	Air + Energy	Vata ↑
Bitter	Air + Space	Vata Pitta ↑
Astringent	Air + Solid	Vata ↑

- 2) **Guna**: It denotes the drug's physical properties. In total **2 pairs of guna** are available, and each pair has opposite activity. In the table below, **10 types of guna** are enlisted:

Guru (Heavy)	Laghu (Light)
Sukshma (Subtle)	Sthula (Gross)
Sthira (Stable)	Sara (Unstable)
Snigdha (Unctuous)	Rooksha (Ununctuous)
Sandra (Dense)	Drava (Liquid)
Sheetal (Cold)	Ushna (Hot)
Manda (Dull)	Tikshna (Sharp)
Mridu (Soft)	Kathina (Hard)
Visuda (Non-slime)	Picula (Slime)
Slakshan (Smooth)	Khara (Rough)

- 3) **Virya**: It denotes the drug's potency and shows two intrinsic properties, **Sheeta Virya** (kapha group) and **Ushna Virya** (pitta group).
- 4) **Vipaka**: It is also known as **nishthapak**, it denotes the end product of digestion. It is different from the **awasthapak prapk** (the stage of initial transformation in

digestion). The 3 types of vipaka which influence kapha, pitta, and vata are madhur, amla, and katu, respectively.

- 5) **Prabhava:** It denotes the drug's power. A drug's rasa, guna, virya, and vipaka may be the same, but its prabhava is always different because of its specificity in chemical composition and site of action.

Five Elements

The **Sankhya theory** of cosmology (an ancient theory on which Ayurveda is based) stated that the world is made up of a combination of different proportions of the following 5 elements, i.e., the **Panchamahabhuta:**

- 1) Akasha (space),
- 2) Vayu (air),
- 3) Tejas or agni (fire),
- 4) Apa or jala (water), and
- 5) Prithvi (earth).

Some authorities believed that the early concept of the 5 elements which the Europeans gave, originated from the Ayurvedic medicine system.

When a human body (a complex and a multicellular organism) is taken as an **example**, the 5 elements signify the following:

- 1) **Akasha:** It denotes the spaces within the body, i.e., mouth, nostrils, abdomen, etc.
- 2) **Vayu:** It denotes the muscular movement.
- 3) **Tejas or Agni:** It denotes the functions of enzymes, i.e., intelligence, digestion, and metabolism.
- 4) **Apa or Jala:** It denotes the body fluids, i.e., plasma, saliva, and digestive juices.
- 5) **Prithvi:** It denotes the body structure, i.e., bones, teeth, flesh, and hair.