

MEANING OF PHARMACOGNOSY

Pharmacognosy, known initially as *materia medica*, may be defined as the study of crude drugs obtained from plants, animals and mineral kingdom and their constituents. There is a historical misinformation about who created the term *pharmacognosy*. The word *pharmacognosy* is derived from two Latin words *pharmakon*, ‘a drug,’ and *gignoso*, ‘to acquire knowledge of’. It means ‘knowledge or science of drugs’.

Crude drugs are plants or animals, or their parts which after collection are subjected only to drying or making them into transverse or longitudinal slices or peeling them in some cases. Most of the crude drugs used in medicine are obtained from plants, and only a small number comes from animal and mineral kingdoms.

- Drugs obtained from plants consist of entire plants, whereas senna leaves and pods, nuxvomica seeds, ginger rhizome and cinchona bark are parts of plants.
- Though in a few cases, as in lemon and orange peels and in colchicum corm, drugs are used in fresh condition, and most of the drugs are dried after collections.
- Crude drugs may also be obtained by simple physical processes like drying or extraction with water. Therefore, aloe is the dried juice of leaves of *Aloe* species, opium is the dried latex from poppy capsules and black catechu is the dried aqueous extract from the wood of *Acacia catechu*.
- Plant exudates such as gums, resins and balsams, volatile oils and fixed oils are also considered as crude drugs.
- Drugs obtained from animals are entire animals, as cantharides; glandular products, like thyroid organ or extracts like liver extracts. Similarly, fish liver oils, musk, bees wax, certain hormones, enzymes and antitoxins are products obtained from animal sources.

Drugs are organized or unorganized. **Organized drugs** are direct parts of plants and consist of cellular tissues. **Unorganized drugs**, even though prepared from plants are not the direct parts of plants and are prepared by some intermediary physical processes, such as incision, drying or extraction with water and do not contain cellular tissue. Thus aloe, opium, catechu, gums, resins

and other plant exudates are unorganized drugs. Drugs from mineral sources are kaolin, chalk, diatomite and other bhasmas of Ayurveda.

ORIGIN OF PHARMACOGNOSY

Ancient China

Ancient Egypt

Ancient India

Ancient Greece and Rome

Ancient India: In India knowledge of medicinal plants is very old, and medicinal properties of plants are described in *Rigveda* and in *Atharvaveda* (3500–1500 B.C.) from which *Ayurveda* has developed. The basic medicinal texts in this world region-The Ayurvedic writings-can be divided in three main ones (*Charaka Samhita*, *Susruta Samhita*, *Astanga Hridayam Samhita*) and three minor ones (*Sarngadhara Samhita*, *Bhava Prakasa Samhita*, *Madhava Nidanam Samhita*).

Ayurveda is the term for the traditional medicine of ancient India. **Ayur** means life and **veda** means the study of which is the origin of the term. The oldest writing-*Charaka Samhita*-is believed to date back six to seven centuries before Christ. It is assumed to be the most important ancient authoritative writing on Ayurveda. The *Susruta Samhita* is thought to have arisen about the same time period as the *Charaka Samhita*, but slightly after it *Astanga Hridayam* and the *Astanga Sangraha* have been dated about the same time and are thought to date after the *Charaka* and *Susruta Samhitas*. Most of mentioned medicines origin from plants and animals, e.g. ricinus, pepper, lilly, valerian, etc.

Pharmacy separated from medicine and materia medica. It is the science of material medicines, describing collection, preparation and compounding, emerged. Even upto the beginning of twentieth century, pharmacognosy was more of a descriptive subject mainly to botanical science, and it consisted of identification of drugs both in entire and powdered conditions and concerned with their history, commerce, collection, preparation and storage.

The development of **modern pharmacognosy** took place later during the period **1934–1960** by simultaneous application of disciplines like organic chemistry, biochemistry, biosynthesis, pharmacology and modern methods and techniques of analytic chemistry, including paper, thin layer, and gas chromatography and spectrophotometry.

The substances from the plants were isolated, their structures elucidated and pharmacological active constituents studied. The development was mainly due to the following four events:

1. Isolation of penicillin in 1928 by William Fleming and large-scale production in 1941 by Florey and Chain.
2. Isolation of reserpine from rauwolfia roots and confirming its hypotensive and tranquilizing properties.
3. Isolation of vinca alkaloids, especially vincristine and vinblastine. Vincristine was found useful in the treatment of leukaemia. These alkaloids also have anticancer properties.
4. Steroid hormones like progesterone were isolated by partial synthesis from diosgenin and other steroid saponins by Marker's method. Cortisone and hydrocortisone are obtained from progesterone by chemical and microbial reaction.

This period can also be termed antibiotic age, as besides penicillin, active antibiotics like streptomycin, chloramphenicol, tetracycline and several hundred antibiotics have been isolated and studied extensively.

Some of the important aspects of the natural products that led to the modern development of drugs and pharmaceuticals are as follows:

Isolation of phytochemicals

Strong acting substances such as glycosides of digitalis and scilla, alkaloids of hyoscyamus and belladonna, ergot, rauwolfia, morphine and other alkaloids of opium were isolated and their clinical uses studied.

Structure activity relationship

Tubocurarine and toxiferine from curare have muscle relaxant properties because of quaternary ammonium groups. The hypotensive and tranquillizing actions of reserpine are attributed to the trimethoxy benzoic acid moiety which is considered essential. Mescaline and psilocybine have psychoactive properties. Presence of a lactone ring is essential for the action of cardiac glycosides. Likewise anthraquinone glycosides cannot have their action without satisfying the positions at C3, C1, C8, C9 and C10.

Drugs obtained by partial synthesis of natural products

Oxytocic activity of methyl ergometrine is more than that of ergometrine. In ergotamine, by 9:10 hydrogenation, oxytocic activity is suppressed and spasmolytic activity increases. We have already referred to the preparation of steroid hormones from diosgenin by acetolysis and oxidation and further preparation of cortisone by microbial reactions. Steroid hormones and their semisynthetic analogues represent a multimillion dollar industry in the United States.

Natural products as models for synthesis of new drugs

Morphine is the model of a large group of potent analgesics, cocaine for local anaesthetics, atropine for certain spasmolytics, dicoumarol for anticoagulants and salicin for salicylic acid derivatives. Without model substances from plants a large number of synthetics would have been missed.

Drugs of direct therapeutic uses

Among the natural constituents, which even now cannot be replaced, are important groups of antibiotics, steroids, ergot alkaloids and certain antitumour substances. Further, drugs as digitoxin, strophanthus glycosides, morphine, atropine and several others are known since long and have survived their later day synthetic analogues.

Biosynthetic pathways

Biosynthetic pathways are of primary and secondary metabolites. Some of the important pathways are Calvin's cycle of photosynthesis, shikimic acid pathway of aromatic compounds, acetate hypothesis for anthracene glycosides and isoprenoid hypothesis for terpenes and steroids via acetate-mevalonic acid-isopentyl pyrophosphate and squalene.

Progress from 1960 onwards

During this period only a few active constituents mainly antibiotics, hormones and antitumour drugs were isolated or new possibilities for their production were found. From 6-amino penicillanic acid, which has very little antibiotic action of its own, important broad-spectrum semisynthetic penicillins like ampicillin and amoxicillin were developed. From ergocryptine, an alkaloid of ergot, bromocryptine has been synthesized. Bromocryptine is a prolactin inhibitor and also has activity in Parkinson's disease and in cancer. By applications of several disciplines, pharmacognosy from a descriptive subject has again developed into an integral and important disciplines of pharmaceutical sciences.

Technical products

Natural products, besides being used as drugs and therapeutic aids, are used in a number of other industries as beverages, condiments, spices, in confectioneries and as technical products. The coffee beans and tea leaves besides being the source of caffeine are used as popular beverages. Ginger and wintergreen oil are used less pharmaceutically but are more used in preparation of soft drinks. Mustard seed and clove are used in spice and in condiment industry. Cinnamon oil and peppermint oil besides being used as carminatives are used as flavouring agents in candies and chewing gum. Colophony resin, turpentine oil, linseed oil, acacia, pectin, and numerous other natural products are used widely in other industries and are called technical products.

Pharmaceuticals aids

Some of the natural products obtained from plants and animals are used as pharmaceutical aids.

- Thus gums like acacia and tragacanth are used as binding, suspending and emulsifying agents.
- Guar gum is used as a thickening agent and as a binder and a disintegrating agent in the manufacturing of tablets. Sterculia and tragacanth because of their swelling property are used as bulk laxative drugs.
- Mucilage-containing drugs like ishabgul and linseed are used as demulcents or as soothing agents and as bulk laxatives.

- Starch is used as a disintegrating agent in the manufacture of tablets and because of its demulcent and absorbent properties it's used in dusting powders.
- Sodium alginate is used as an establishing, thickening, emulsifying deflocculating, gelling and filming agent.
- Carbohydrate containing drugs like glucose, sucrose and honey are used as sweetening agents and as laxative by osmosis.
- Agar, in addition to being used as a laxative by osmosis, is also used as an emulsifying agent and in culture media in microbiology.
- Saponins and sponin-containing drugs are used as detergents, emulsifying and frothing agents and as fire extinguishers. Tincture quillaia is used in preparation of coal tar emulsions. Saponins are toxic and their internal use requires great care, and in some countries their internal use as frothing agents is restricted.
- Glycyrrhiza is used as sweetening agent for masking the taste of bitter and salty preparations.
- Fixed oils and fats are used as emollients and as ointment bases and vehicles for other drugs.
- Volatile oils are used as flavouring agents.
- Gelatin is used in coating of pills and tablets and in preparation of suppositories, as culture media in microbiology and in preparation of artificial blood plasma.
- Animal fats like lard and suet are used as ointment bases.
- Beeswax is used as ointment base and thickening agent in ointments.
- Wool fat and wool alcohols are used as absorbable ointment bases.

Thus, from the above description it can be seen that many of the natural products have applications as pharmaceutical aids.

Discovery of new medicines from plants-nutraceutical use versus drug development

Little work was carried out by the pharmaceutical industry during 1950–1980s; however, during the 1980–1990s, massive growth has occurred. This has resulted in new developments in the area of combinatorial chemistry, new advances in the analysis and assaying of plant materials and a heightened awareness of the potential plant materials as drug leads by conservationists. New

plant drug development programmes are traditionally undertaken by either random screening or an ethnobotanical approach, a method based on the historical medicinal/food use of the plant.