Unit I

Pharmacognosy (DP-103)

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Syllabus

1. Definition, history and scope of Pharmacogonosy including indigenous system of medicine.
2. Various systems of classification of drugs and natural origin.
3. Adulteration and drug evaluation; significance of pharmacopoeial standards.

Pharmacognosy

Pharmacognosy is a scientific discipline, which is primarily concerned with the study of crude drugs obtained from natural sources, such as plants, animals, and minerals. The term 'Pharmacognosy' was first coined and used by German Scientist **Seydler** in 1815 in a book he wrote on crude drugs, entitled "***Analecta Pharmacognostica***". It was derived from two *Greek* words: *pharmakon*, which means 'a drug', and *gnosis*, which means knowledge of' or *gignosco*, which means 'to acquire knowledge of'. Thus the literal meaning of pharmacognosy is: knowledge of drugs, or to acquire knowledge of drugs. Thus Pharmacognosy may be defined as the objective study of crude drugs and related substances of natural origin (Plants, Animals and minerals) to acquire knowledge about their nature and properties.

It may also be defined as an applied science which is concerned with acquiring knowledge of all aspects of crude drugs and other natural substances of pharmaceutical importance by the application of various scientific disciplines. In other words, it may be said that Pharmacognosy is an important branch of pharmacy, which deals with the scientific study of the structural, physical, chemical, biochemical and sensory characters of crude drugs and related substances of plant, animal and mineral origin. It also includes a study of their history, distribution, cultivation, collection, identification, preparation, evaluation, preservation, use and commerce.

Studies of some spices and condiments are included in the subject matters of Pharmacognosy, as they possess definite medicinal and pharmaceutical properties. Cinnamon bark, Cardamon fruit and various umbelliferous fruits (Fennel, Coriander, Cumin, Anise, etc.), Mustard seed, Clove flower-bud, and Ginger rhizome are some typical examples of such articles. In addition, pharmacognosy includes studies of a variety of commercial and medicinal products such as pesticides, enzymes, vitamins, antibiotics, allergens, and allergenic extracts.

Since Pharmacognosy has developed over the years through the traditional uses of medicinal plants and other natural products as remedies for ailments, the study of medicinal plants and

traditional medicines of the past and present and their practice also fall under the purview of modern pharmacognosy.

History of Pharmacognosy

The history of Pharmacognosy is as old as civilization. Plants were used medicinally in

- China
- India
- Egypt
- Greece before beginning of the Christian era.

Ancient China

Chinese pharmacy, according to legend, stems from Shen Nung (about 2700 B.C.), emperor who sought out and investigated the medicinal value of several hundred herbs. He reputed to have tested many of them on himself, and to have written the first *Pen T-Sao*, or *Native Herbal*, recording 365 drugs. These were subdivided as follows: 120 emperor herbs of high, food grade quality which are non-toxic and can be taken in large quantities to maintain health over a long period of time, 120 minister herbs, some mildly toxic and some not, having stronger therapeutic action to heal diseases and finally 125 servant herbs that having specific action to treat disease and eliminate stagnation. Most of those in the last group, being toxic, are not intended to be used daily over a prolonged period of weeks and months. **Shen Nung** conceivably examined many herbs, barks and roots brought in from the fields, swamps and woods that are still recognized in pharmacy (podophyllum, rhubarb, ginseng, stramonium, cinnamon bark and ephedra).

Ancient Egypt

The most complete medical documents existing are the *Ebers Papyrus* (1550 B.C.), a collection of 800 prescriptions, mentioning 700 drugs and the *Edwin Smith Papyrus* (1600 B.C.), which contains surgical instructions and formulas for cosmetics. The *Kahun Medical Papyrus* is the oldest it comes from 1900 B.C. and deals with the health of women, including birthing instructions.

However, it is believed that the Smith Papyrus was copied by a scribe from an older document that may have dated back as far as 3000 B.C.

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 Ayurvedic writings can be divided in three main ones *(Charaka Samhita, Susruta Samhita, Astanga Hrdayam 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 Hrdayam* 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.

Ancient Greece and Rome

Greek scientists contributed much to the knowledge of natural history. Hippocrates (460–370 B.C.) is referred to as father of medicine and is remembered for his famous oath which is even now administered to doctors. Aristotle (384–322 B.C.), a student of Plato was a philosopher and is known for his writing on animal kingdom which is considered authoritative even in twentieth century. Theophrastus (370–287 B.C.), a student of Aristotle, wrote about plant kingdom.

Dioscorides, a physician who lived in the first century A.D., described medicinal plants, some of which like belladonna, ergot, opium, and colchicum are used even today. Pliny wrote 37 volumes of natural history and Galen (131 – A.D. 200) devised methods of preparations of plant and animal drugs, known as 'galenicals' in his honour.

SCOPE OF PHARMACOGNOSY

Pharmacognosy is critical in development of different disciplines of science.

- The knowledge of **plant taxonomy**, **plant breeding, and plant pathology and plant genetics** is helpful in the development of cultivation technology for medicinal and aromatic plants.
- Plant chemistry **(Phytochemistry)** has undergone significant development in recent years as a distinct discipline. It is concerned with the enormous variety of substances that are synthesized and accumulated by plants and the structural elucidation of these substances. **Extraction, isolation, purification and characterization** of phytochemicals from natural sources are important for advancement of medicine system.
- The knowledge of **chemotaxonomy, biogenetic pathways** for formation of medicinally active primary and secondary metabolites, **plant tissue culture** and other related fields is essential for complete understanding of Pharmacognosy.
- One should have the basic knowledge of biochemistry and chemical engineering is essential for development of collection, processing and storage technology of crude drugs.
- Pharmacognosy is important branch of pharmacy which is playing key role in new drug discovery and development by using natural products. Pharmacognosy has given many leads for new drug discovery and development.
- It is an important link between modern medicine systems (allopathy) and traditional system of medicine. As part of integrative system of medicine, pharmacognosy can help to increase effectiveness of modern medicine system.
- It is acting as **bridge** between pharmacology, medicinal chemistry and pharmacotherapeutics and also pharmaceutics. It also bridges pharmaceutics with other pharmacy subjects.

- More than 60 percent of world population is still using natural product for their primary healthcare needs. Pharmacognosy can provide safe and effective drugs in combination with modern medicine system.
- Pharmacognosy includes knowledge about safe use of herbal drugs including toxicity, side effects, drug interaction thereby increasing effectiveness of modern medicine.
- Pharmacognosy is an important link between pharmacology and medicinal chemistry. As a result of rapid development of phytochemistry and pharmacological testing methods in recent years, new plant drugs are finding their way into medicine as purified phytochemicals, rather than in the form of traditional galenical preparations.
- Pharmacognosy is the base for development of novel medicines. Most of the compounds obtained from natural product serve as prototype or base for development of new drug which are more active and less toxic.
- By means of pharmacognosy, natural products can be dispensed, formulated and manufactured in dosage forms acceptable to modern system of medicine.
- Development of pharmacognosy also leads to development of botany, taxonomy, plant biotechnology, plant genetics, plant pathology, pharmaceutics, pharmacology, phytochemistry and other branches of science.

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. One reason why there has been resurgence in this area is that conservationists especially in the United States have argued that by finding new drug leads from the rainforest, the value of the rainforests to society is proven, and that this would prevent these areas being cut down for unsustainable timber use. However, tropical forests have produced only 47 major pharmaceutical drugs of world-wide importance. It is estimated that a lot more, say about 300 potential drugs of

major importance may need to be discovered. These new drugs would be worth $147 billion. It is thought that 125,000 flowering plant species are of pharmacological relevance in the tropical forests. It takes 50,000 to 100,000 screening tests to discover one profitable drug. Even in developed countries there is a huge potential for the development of nutraceuticals and pharmaceuticals from herbal materials. For example the UK herbal materia medica contains around 300 species, whereas the Chinese herbal materia medica contains around 7,000 species. Even up to the beginning of twentieth century, pharmacognosy was more of a descriptive subject akin 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 like

- Strychnine (1817)
- Quinine and caffeine (1820)
- Nicotine (1828)
- Atropine (1833)
- Cocaine (1855)

Their structures were 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 resperpine from rauwolfia roots and con-firming 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 hydro-cortisone 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.

Traditional Indian System of medicine (Indigenous)

Ayurveda System of medicine

The old system of treatment in India. It is 5500 years old. Ayurveda believes there are 3 principles 1) cough. 2) Vat. 3) Pitta. These are responsible to maintain health. If their equilibrium is disturbed persons suffers from diseases.

Ayurveda cures the cause of disease. The principles of positive health and therapeutic measures embedded in this system relate to mental, physical, social and spiritual welfare of human beings. Drugs of Ayurveda are obtained mostly from plants.

Dosage of Ayurveda are 1) Bhasma (oxides of metals) 2) Quath (extracts) 3) Gutika (pills) 4) Lep (ointment) 5) Asava & Arishtha (Alcohol containing liquids.) 6) powder. 7) Medicated oils. There are eight branches of Ayurveda.

1. Kayachikitsa (Internal medicine)

2. Kumarbhritya (Pediatrics)

3. Trachchikitsa (Psychological medicine)

4. Shalakya Tantra [(ENT) Ears, Nose & throat]

5. Shalya Tantra (Surgery)

6. Agada tantra (Toxicology)

7. Rasayana tantra (Geriatrics- medicines for the old persons)

8. Vajikaran tantra [Aphrodisiacs, drugs which are sexual stimulants.]

Sidha System of Medicine

The "Siddhas" developed the Sidha system of medicine (Spiritual persons). It is old than ' Vedic culture ' it belongs to Dravidian culture. Like Ayurveda the medicines are prepared from plants. The literature of this system is given in Tamil Language. Like Ayurveda it believes that all objects in universe are made from five elements. 1) Earth. 2) Water. 3) Sky. 4) Air. & 5) Fire.

Diseases are identified by examination of pulse, voice, colour, of urine, tongue, and shadow. Etc. The books are written in Tamil.

Naturopathy and Yoga

Naturopathy is not only a system of treatment but it also teaches the way of living. In naturopathy use of soil and water is important in treatment of diseases mudpacks and steam baths are used. Fasting is also used to treat diseases.

Yoga consists of two parts: -

1. Exercises (physical postures): Improves blood circulation in the body.
2. Meditation: consists of
    1) Breathing exercise
    2) Observance of austerity
    3) Physical postures
    4) Restraining of sense organ
    5) Contemplation

6) Meditation
7) Samadhi

This system helps us to improve physical, mental and social health. It improves personal behavior of the person.

CLASSIFICATION OF CRUDE DRUGS

The most important natural sources of drugs are higher plant, microbes and animals and marine organisms. Some useful products are obtained from minerals that are both organic and inorganic in nature. In order to pursue (or to follow) the study of the individual drugs, one must adopt some particular sequence of arrangement, and this is referred to a system of classification of drugs. A method of classification should be:

a) Simple,
b) Easy to use, and
c) Free from confusion and ambiguities.

Because of their wide distribution, each arrangement of classification has its own merits and demerits, but for the purpose of study the drugs are classified in the following different ways:

1. Alphabetical classification
2. Taxonomical classification
3. Morphological classification
4. Pharmacological classification
5. Chemical classification
6. Chemotaxonomical classification
7. Serotaxonomical classification

ALPHABETICAL CLASSIFICATION

Alphabetical classification is the simplest way of classification of any disconnected items. ***Crude drugs are arranged in alphabetical order of their Latin and English names (common names) or sometimes local language names (vernacular names).*** Some of the pharmacopoeias, dictionaries and reference books which classify crude drugs according to this system are as follows:

1. Indian Pharmacopoeia
2. British Pharmacopoeia
3. British Herbal Pharmacopoeia
4. United States Pharmacopoeia and National Formulary
5. British Pharmaceutical Codex
6. European Pharmacopoeia

In European Pharmacopoeia these are arranged according to their names in Latin where in United States Pharmaco-poeia (U.S.P.) and British Pharmaceutical Codex (B.P.C.), these are arranged in English.

Merits

- It is easy and quick to use.
- There is no repetition of entries and is devoid of con-fusion.
- In this system location, tracing and addition of drug entries is easy.

Demerits

There is no relationship between previous and successive drug entries.

Examples: *Acacia, Benzoin, Cinchona, Dill, Ergot, Fennel, Gentian, Hyoscyamus, Ipecacuanha, Jalap, Kurchi, Liquorice, Mints, Nux vomica, Opium, Podophyllum, Quassia, Rauwolfia, Senna, Vasaka, Wool fat, Yellow bees wax, Zeodary.*

TAXONOMICAL CLASSIFICATION

All the plants possess different characters of morphologi-cal, microscopical, chemical, embryological, serological and genetics. In this classification the crude drugs are classified according to kingdom, subkingdom, division, class, order, family, genus and species as follows.

Class: Angiospermae (Angiosperms) are plants that produce flowers and Gymnospermae (Gymnosperms) which don't produce flowers.

Subclass: Dicotyledonae (Dicotyledons, Dicots) are plants with two seed leaves; Monocotyledonae (Monocotyledons, Monocots) with one seed leaf.

Superorder: A group of related plant families, classified in the order in which they are thought to have developed their dif-ferences from a common ancestor. There are six superorders in the Dicotyledonae (*Magnoliidae, Hamamelidae, Caryophyl-lidae, Dilleniidae, Rosidae, Asteridae*), and four superorders in the Monocotyledonae (*Alismatidae, Commelinidae, Arecidae,* and *Liliidae*). The names of the superorders end in *–idae.*

Order: Each superorder is further divided into several orders.

The names of the orders end in *–ales.*

Family: Each order is divided into families. These are plants with many botanical features in common, and are the highest classification normally used. At this level, the similarity between plants is often easily recognizable by the layman. Modern botanical classification assigns a type plant to each family, which has the particular characteristics that separate this group of plants from others, and names the family after this plant.

The number of plant families varies according to the botanist whose classification you follow. Some botanists recognize only 150 or so families, preferring to classify other similar plants as subfamilies, while others recognize nearly 500 plant families. A widely accepted system is that

devised by Cronquist in 1968, which is only slightly revised today. The names of the families end in *–aceae.*

Subfamily: The family may be further divided into a number of subfamilies, which group together plants within the family that have some significant botanical differences. The names of the subfamilies end in *–oideae.*

Tribe: A further division of plants within a family, based on smaller botanical differences, bin still usually comprising many different plants. The names of the tribes end in *–eae.*

Subtribe: A further division based on even smaller botanical differences, often only recognizable to botanists. The names of the subtribes end in *–inae.*

Genus: This is the part of the plant name that is most famil-iar; the normal name that you give a plant—Papaver (Poppy), Aquilegia (Columbine), and so on. The plants in a genus are often easily recognizable as belonging to the same group.

Species: This is the level that defines an individual plant. Often, the name will describe some aspect of the plant— the colour of the flowers, size or shape of the leaves, or it may be named after the place where it was found. Together, the genus and species name refer to only one plant, and they are used to identify that particular plant. Sometimes, the species is further divided into subspecies that contain plants not quite so distinct that they are classified as variet-ies. The name, of the species should be written after the genus name, in small letters, with no capital letter.

Variety: A variety is a plant that is only slightly different from the species plant, but the differences are not so insig-nificant as the differences in a form. The Latin is *varietas*, which is usually abbreviated to var. The name follows the genus and species name, with var. before the individual variety name.

Form: A form is a plant within a species that has minor botanical differences, such as the colour of flower or shape of the leaves. The name follows the genus and species name, with form (or f.) before the individual variety name.

Cultivar: A cultivar is a cultivated variety—a particular plant that has arisen either naturally or through deliberate hybridization, and can be reproduced (vegetatively or by seed) to produce more of the same plant.

The name follows the genus and species name. It is written in the language of the person who described it, and should not be translated. It is either written in single quotation marks or has cv. written in front of the name.

Kingdom	Plants
Subkingdom	Tracheobionta—Vascular plants
Superdivision	Spermatophyta—Seed plants
Division	Magnoliophyta—Flowering plants
Class	Magnoliopsida—Dicotyledons
Subclass	Asteridae
Order	Asterales
Family	Asteraceae—Aster family
Genus	*Tridax* L.—tridax

Merits

Taxonomical classification is helpful for studying evolution-ary developments.

Demerits

This system also does not correlate in between the chemical constituents and biological activity of the drugs.

MORPHOLOGICAL CLASSIFICATION

In this system, the drugs are arranged according to the morphological or external characters of the plant parts or animal parts, *i.e.* which part of the plant is used as a drug, e.g. leaves, roots, stem, etc. The drugs obtained from the direct parts of the plants and containing cellular tissues are called as *organized* drugs, e.g. rhizomes, barks, leaves, fruits, entire plants, hairs and fibres. The drugs which are pre-pared from plants by some intermediate physical processes such as incision, drying or extraction with a solvent and not containing any cellular plant tissues are called *unorga-nized* drugs. Aloe juice, opium latex, agar, gambir, gelatin, tragacanth, benzoin, honey, beeswax, lemon grass oil, etc., are examples of unorganized drugs.

Organized drugs

Woods: Quassia, Sandalwood and Red Sandalwood.

Leaves: Digitalis, Eucalyptus, Gymnema, Mint, Senna, Spearmint, Squill, Tulsi, Vasaka, Coca, Buchu, Hamamelis, Hyoscyamus, Belladonna, Tea.

Barks: Arjuna, Ashoka, Cascara, Cassia, Cinchona, Cinnamon, Kurchi, Quillia, Wild cherry.

Flowering parts: Clove, Pyrethrum, Saffron, Santonica, Chamomile.

Fruits: Amla, Anise, Bael, Bahera, Bitter Orange peel, Capsicum, Caraway, Cardamom, Colocynth, Coriander, Cumin, Dill, Fennel, Gokhru, Hirda, Lemon peel, Senna pod, Star anise, Tamarind, Vidang.

Seeds: Bitter almond, Black Mustard, Cardamom, Colchi-cum, Ispaghula, Kaladana, Linseed, Nutmeg, Nux vomica,

Physostigma, Psyllium, Strophanthus, White mustard. **Roots and Rhizomes:** Aconite, Ashwagandha, Calamus, Calumba, Colchicum corm, Dioscorea, Galanga, Garlic, Gention,

Ginger, Ginseng, Glycyrrhiza, Podophyllum, Ipecac, Ipomoea, Jalap, Jatamansi, Rauwolfia, Rhubarb, Sassurea, Senega, Shatavari, Turmeric, Valerian, Squill.

Plants and Herbs: Ergot, Ephedra, Bacopa, Andrographis,

Kalmegh, Yeast, Vinca, Datura, Centella.

Hair and Fibres: Cotton, Hemp, Jute, Silk, Flax.

Unorganized drugs

Dried latex: Opium, Papain

Dried Juice: Aloe, Kino

Dried extracts: Agar, Alginate, Black catechu, Pale catechu, Pectin

Waxes: Beeswax, Spermaceti, Carnauba wax

Gums: Acacia, Guar Gum, Indian Gum, Sterculia, Tra-gacenth

Resins: Asafoetida, Benzoin, Colophony, copaiba Gua-iacum, Guggul, Mastic, Coal tar, Tar, Tolu balsam, Storax, Sandarac.

Volatile oil: Turpentine, Anise, Coriander, Peppermint, Rosemary, Sandalwood, Cinnamon, Lemon, Caraway, Dill, Clove, Eucalyptus, Nutmeg, Camphor.

Fixed oils and Fats: Arachis, Castor, Chalmoogra, Coconut, Cotton seed, Linseed, Olive, Sesame, Almond, Theobroma, Cod-liver, Halibut liver, Kokum butter.

Animal Products: Bees wax, Cantharides, Cod-liver oil, Gelatin, Halibut liver oil, Honey, Shark liver oil, shellac, Spermaceti wax, wool fat, musk, Lactose.

Fossil organism and Minerals: Bentonite, Kaolin, Kiess-lguhr, Talc.

Merits

- Morphological classification is more helpful to identify and detect adulteration. This system of classification is more convenient for practical study especially when the chemical nature of the drug is not clearly understood.

Demerits

- The main drawback of morphological classification is that there is no corelation of chemical constituents with the therapeutic actions.
- Repetition of drugs or plants occurs.

PHARMACOLOGICAL CLASSIFICATION

Grouping of drug according to their pharmacological action or of most important constituent or their therapeutic use is termed as pharmacological or therapeutic classification of drug. This classification is more relevant and is mostly a followed method. Drugs like digitalis, squill and strophan-thus having cardiotonic action are grouped irrespective of their parts used or phylogenetic relationship or the nature of phytoconstituents they contain

Sl. No.	Pharmacological category	Example
1.	Drug acting on G.I.T.	
	Bitter	Cinchona, Quassia, Gentian
	Carminative	Fennel, Cardamom, Mentha
	Emetic	Ipecac
	Antiamoebic	Kurchi, Ipecac
	Laxative	Agar, Isabgol, Banana
	Purgative	Senna, Castor oil
	Cathartic	Senna
2.	Drug acting on Respiratory system	
	Expectorant	Vasaka, Liquorice, Ipecac
	Antitussive	Opium (codeine)
	Bronchodilators	Ephedra, Tea
3.	Drug acting on Cardiovascular system	
	Cardio tonic	Digitalis, Strophanthus, Squill
	Cardiac depressant	Cinchona, Veratrum
	Vasoconstrictor	Ergot
	Antihypertensive	Rauwolfia
4.	Drug acting on Autonomic nervous system	
	Adrenergic	Ephedra

	Cholinergic Anticholinergic	Physostigma, Pilocarpus Datura, Belladonna
5.	Drug acting on Central nervous system Central analgesic CNS depressant CNS stimulant Analeptic	 Opium (morphine) Belladonna, Opium, Hyoscyamus Tea, Coffee Nuxvomica, Camphor, Lobelia
6.	Antispasmodic	Datura, Hyoscyamus, Opium, Curare
7.	Anticancer	Vinca, Podophyllum, Taxus
8.	Antirheumatic	Aconite, Colchicum, Guggal
9.	Anthalmintic	Quassia, Vidang
10.	Astringent	Catechu, Myrobalans
11.	Antimalarial	Cinchona, Artemisia
12.	Immunomodulatory	Ginseng, Ashwagandha, Tulsi
13.	Immunizing agent	Vaccines, Sera, Anti toxin
14.	Drug acting on skin membrane	Beeswax, Wool fat, Balsam of Tolu, Balsam of Peru
15.	Chemotherapeutic	Antibiotics
16.	Local Anesthetic	Coca

Merits

This system of classification can be used for suggesting substitutes of drugs, if they are not available at a particular place or point of time.

Demerits

Drugs having different action on the body get classified separately in more than one group that causes ambiguity and confusion. Cinchona is antimalarial drug because of presence of quinine but can be put under the group of drug affecting heart because of antiarrhythmic action of quinidine.

CHEMICAL CLASSIFICATION

Depending upon the active constituents, the crude drugs are classified. The plants contain various constituents in them like alkaloids, glycosides, tannins, carbohydrates, saponins, etc. Irrespective of the morphological or taxonomical char-acters, the drugs with similar chemical constituents are grouped into the same group. The examples are shown in this table.

Sl. No.	Chemical constituent group	Examples
1.	Alkaloids	Cinchona, Datura, Vinca, Ipecac Nux vomica
2.	Glycosides	Senna, Aloe, Ginseng, Glycyrrhiza, Digitalis
3.	Carbohydrates and its derived products	Acacia, Tragacanth, Starch, Isabgol
4.	Volatile oil	Clove, Coriander, Fennel, Cinnamon, Cumin
5.	Resin and Resin combination	Benzoin, Tolu Balsam, Balsam of peru
6.	Tannins	Catechu, Tea
7.	Enzymes	Papain, Caesin, Trypsin
8.	Lipids	Beeswax, Kokum butter, Lanolin

Merits

It is a popular approach for phytochemical studies.

Demerits

Ambiguities arise when particular drugs possess a number of compounds belonging to different groups of compounds.

CHEMOTAXONOMICAL CLASSIFICATION

This system of classification relies on the chemical similarity of a taxon, i.e. it is based on the existence of relationship between constituents in various plants. There are certain types of chemical constituents that characterize certain classes of plants. This gives birth to entirely a new concept of chemotaxonomy that utilizes chemical facts/characters for understanding the taxonomical status, relationships and the evolution of the plants.

For example, tropane alkaloids generally occur among the members of Solanaceae, thereby, serving as a chemot-axonomic marker. Similarly, other secondary plant metabo-lites can serve as the basis of classification of crude drugs. The berberine alkaloid in Berberis and Argemone, Rutin in Rutaceae members, Ranunculaceae alkaloids among its members, etc., are other examples.

It is the latest system of classification that gives more scope for understanding the relationship between chemical constituents, their biosynthesis and their possible action.

SEROTAXONOMICAL CLASSIFICATION

The serotaxonomy can be explained as the study about the application or the utility of serology in solving the taxo nomical problems. Serology can be defined as the study of the antigen–antibody reaction. Antigens are those sub-stances which can stimulate the formation of the antibody. Antibodies are highly specific protein molecule produced by plasma cells in the immune system. Protein are carri-ers of the taxonomical information and commonly used as antigen in serotaxonomy.

It expresses the similarities and the dissimilarities among different taxa, and these data are helpful in taxonomy. It deter-mines the degree of similarity between species, genera, family, etc., by comparing the reaction with antigens from various plant taxa with antibodies present against a given taxon.

Serology helps in comparing nonmorphological charac-teristics, which helps in the taxonomical data. This tech-nique also helps in the comparison of single proteins from different plant taxa.

Adulteration

- Adulteration is a practice of **substituting original crude drugs** partially or fully with other similar looking substances but the later is either free from or inferior in chemical and therapeutic properties.
- A adulteration may also be defined as **mixing or substituting the original drug material** with other **spurious, inferior, defective, spoiled,** useless other parts of same or different plant or harmful substances or drug which do not confirm with the official standards.
- **Types of Adulteration:**

  Adulteration can be broadly classified into two types

  Intentional adulteration:

  Intentional adulteration is mainly encouraged by traders because these original crude drugs are highly costly. So hence they use cheaper variety to reduce the cost burdane and to gain profit.

- **Accidental adulteration:**

  Accidental adulteration occurs without bad intention of the manufacturers or suppliers mainly it occurs during collection of drugs because of same morphological features between two plants.

  Methods of Adulteration

  There are seven types of adulteration methods. They are:

  Substitution with the sub-standard commercial verities

  Substitution with artificially manufactured drug

  Substitution by exhausted drugs

  Substitution by superficially similar but cheaper natural substances

  Substitution by the addition of worthless materials

  Substitution by the addition of synthetic substance

  Substitution of the different part of the plants

- **EVALUATION OF CRUDE DRUGS:**

  Definition of evaluation

  Evaluation of crude drug means determination of identity, purity and quality of a drug. Evaluation of crude is most important to know whether the drugs are adulterated with other substance or not. Before using any crude drug it must be checked for its quality and purity.

- **Methods of evaluation**

  There are five methods for evaluating crude drug for its quality and purity by considering morphological, physical and chemical characteristics.

- Organoleptic evaluation

  Anatomical evaluation

  Physical evaluation

  Chemical evaluation

  Biological evaluation

  Organoleptic evaluation:

  It includes the study of morphology and sensory characters. Two types are present

  Sensory characters

  Gross features

  Sensory characters:

  Size and Shape, Colour, Texture, Odour and Taste are useful in the evaluation of drugs.

- Size and shape:

  Each and every plant has its own shape for its fruits, leaves. And even a particular size is present.

- Example is:

  Size: capsicum

  Leaves

  Shape: Tragacanth- ribbon shaped,

  Acacia- ovoid tear shaped.

- Colour:

  Each and every crude drug or plant has its own color for its flowers, fruits and seeds.

- Example is:

  Cardamom- green colour fruit

  Cinnamon- brown color bark

  Turmeric-yellow colour powder

  Texture:

  Each and every plant has its own texture for better identification.