Unit I

Pharmacognosy & Phytochemistry (BP-405)

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Classification of drugs:
Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs

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.