

## PHARMACOGNOSY - I

1. Definition, history, scope and development of Pharmacognosy.

2. Sources of drugs:

Biological, marine, mineral and plant tissue cultures as sources of drugs.

3. Classification of drugs:

Alphabetical, morphological, taxonomical, chemical and pharmacological classification of drugs.

4. Plant taxonomy:

Study of the following families with special reference to medicinally important plants - Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, Leguminosae, Rubiaceae, Liliaceae, Gramineae, Labiateae, Cruciferae, Papaveraceae.

5. Cultivation, Collection, Processing and storage of crude drugs:

Factors influencing cultivation of medicinal plants.

Types of soils and fertilizers of common use.

Pest management and natural pest control agents.

Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants.

## 6. Quality control of crude drugs :

Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods and properties.

## 7. An introduction to active constituents of drugs :

Their isolation, classification and properties.

## 8. Systematic pharmacognostic study of following :

### a) Carbohydrates and derived products :

agar, guar gum, acacia, Honey, Isabgol, pectin, starch, sterculia and Tragacanth.

### b) Lipids :

Bee's wax, castor oil, cocoa butter, Cod-liver oil, Hydnocarpus oil, Kokum butter, Lard, Linseed oil, Rice, Baan oil, Shaak liver oil and Wool fat.

## Introduction of Pharmacognosy.

In simple words pharmacognosy is the study of plants or other natural sources as possible source of drug.

The term pharmacognosy comes from two greek words pharmakon and gnosis.

Pharmakon → Drug / medicine  
Gnosis → Knowledge

Pharmacognosy is the study of physical, chemical, biochemical and biological properties of drugs.

Pharmacognosy is the study of medicinal usage of various naturally occurring drugs and its history, source, distribution, methods of cultivation, extraction of chemical constituents, medicinal usage, identification, taste, preservation methods, substituents and adulterants.

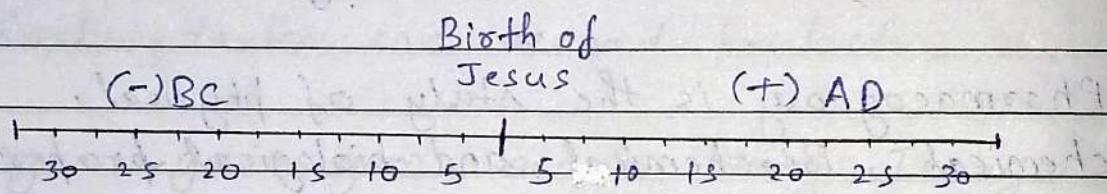
### Crude drugs

Crude drugs are the drugs which are obtained from natural sources like plant, animal, minerals, marine, microorganism and they are used as they occur in nature without any processing except drying and size reduction.

## History of pharmacognosy:

The term pharmacognosy was used for first time by an Austrian physician J.A. Schmidt in 1811, and in 1815 by C.A. Seydel (medical student) in his work titled "Analectica Pharmacognostica".

### AC and BC



### AD

① AD = after birth of Jesus      ① BC = Before birth of Jesus.

② AD = Anno Domini

② BC = Before Christ

③ AD is also known as  
CE (common Era)

③ BC is also known as  
BCF (Before common Era)

④ AD is written as AD 2006.      ④ BC is written as 1000 BC.

⑤ In CE or AD the year  
is written as chronological  
order.

e.g. 1, 2, 3, 4, 5, 6, 7, 8..

⑤ BC or BCF is written as  
substitution order.

e.g. 390, 389, 388, 387,

## Dioscorides (77 AD)

In about 77 AD Dioscorides a greek doctor kept a record of about 600 kinds of crude drugs in his compiled book ("De Materia Medica"), a book that has played an important role in pathology and botany.

## Work of Galen (131-200)

Galen was greek pharmacist, he work on extraction of chemical constituents from the plants. He developed various methods of extraction, therefore the branch of pharmacy which deals with extraction of chemical constituents from plants and animal is called **Galenical pharmacy**.

## Hippocrates (460 - 360)

Before the birth of jesus, hippocrates was a greek scientist, he worked on human anatomy and physiology particularly on circulatory system and nervous system.

He prepared famous oath for physician which was still taken by physician.

He is known as father of medicine.

## Indian History of Pharmacognosy.

It is about 5500 years old Sukta's. The Sukta's of Rig Veda and Atharva Veda. Medicinal properties of plants is given. There are several medicinal plant which are given with their usage. The old Ayurveda book Charaka Samhita and Sushruta Samhita described many medicinal plants. History of pharmacognosy is as old as mankind.

Human beings came to know medicines from nature itself. There is a table explaining various historical development which together contributed to the progress of pharmacognosy. Various traditional system of medicine from different corners of world also played a vital role in the development of pharmacognosy.

S.No.	Name	Profession	Work	Period.
1.	Hippocrates (Father of medicine)	Greek Scientist	Work/study on H.A.P.	460 - 360 BC
2.	Aristotle (Father of Biology)	Greek Philosopher	Animal Kingdom	384 - 322 BC
3.	Theophrastus (Father of Botany)	Greek Philosopher	Plant Kingdom	370 - 287 BC
4.	Dioscorides	Greek Physician	"De Materia Medica" (contain >600 medicinal plant with their usage)	77 AD
5.	Galen	Greek Pharmacist	Medical Pharmacy	131 - 200 AD
6.	Carl Linnaeus (Taxonomy)	Swedish Botanist	Binomial Classification	1753 AD
7.	C.A. Seydler	German Scientist	Coined Work "Pharmacy"	1815 AD

S.No.	Name	Profession	Work	Period
8.	Charles Darwin	English Neutralist	Evolution theory	1809-1883
9.	Sir Joseph D. Hooker	British Botanist	Plant Nomenclature	1817-1911

### Scope and Role of Pharmacognosy.

- Pharmacognosy is an important branch of pharmacy which is playing key role in new drug discovery and development by using natural products.
- It is an important link between modern medicine system (allopathy) and traditional system of medicine. It is a part of medicinal system which is affordable as well as accessible to common man.
- Pharmacognosy can help to increase effectiveness of modern medicinal/medicine system.
- It is acting as a bridge between Pharmacology, Medicinal chemistry, Pharmacotherapeutics, and also pharmaceutics.
- More than 60% of world population is still using natural products of their primary healthcare need. Pharmacognosy can provide safe and effective drug in combination with modern medicinal system.

## Role of Pharmacognosy.

Pharmacognosy includes knowledge about safe use of herbal drugs including toxicity, side-effect, drug-interaction thereby increasing effectiveness of modern medicine.

Pharmacognosy is the base for development of novel medicines. Most of the compounds obtained from natural products 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.

There are vast number of plants and animals species which are not studied systematically.

Development of pharmacognosy also leads to development of botany, taxonomy, plant biotechnology, plant genetics, plant pathology, pharmaceutics, pharmacology, phytochemistry, and other branches of science.

## Alternative Systems of Medicine.

### Ayurveda System.

It is about 5000-year-old system of medicine native to India. It is holistic system of medicine which considers whole body while treating disease and not just a diseased part of body. Ayurveda has thousands years evidence-based history, so it can be just complete system rather alternative system or complimentary system. Ayurveda is a sanskrit word which means (Ayur-life and veda - to gain knowledge or science) science of life. Ayurveda deals with different types of plants, minerals and animal products. Charak samhita by charak includes the principle components or theory of Ayurveda. Sushrut samhita edited by sushrut is about the surgical treatments in Ayurveda.

#### Theory and Principles:

Ayurveda involves following fundamental principles :

→ Triguna : Sta Satva (good), Raja (aggressive), Toma (dullness).

- Tridosha : (Kapha - lubrication, Vata respiration and Pitta - metabolism),
- Panchashil :- (Rasa : Therapeutically active substances,  
Guna : Quality,  
Viaya : Active principle and potency,  
Vipaka : The end product of digestion,  
Prabhava : Actual effect of drug on body),
- Panch Mahabhuta : (Earth, Water, Sky, Fire and Air)
- Saptadhatu : Rasa (Plasma),  
Raktam (Blood),  
Mamsa (Muscles),  
Meda (Fat),  
Asthi (Bone),  
Majja (Bone Marrow and nerves)  
Shukra (Reproductive fluid or semen).

#### • Diagnosis.

When non-equilibrium between any of above principles causes to person suffer from diseases. Ayurveda cures the cause of diseases by considering to mental, physical, social and spiritual welfare of human beings. Observation of body colour, tongue, nail, eyes, extramarks

pulse and investigation of blood, urine and fecal matter is criteria of diagnosing actual cause of disease.

### Treatment:-

Panchakarma is an important treatment in Ayurveda which includes snehan (massage), swedan (steam), vaman (vomit), virechana (expulsion) and basti (medicated enemas). The medicines are given in the form of powder (churna, bhasma), liquid (asava, arishta and taila), semisolid (leha or paka) and tablets (gutika, vati). Treatment of ayurveda involves use of drugs obtained from plant, animal and minerals sources.

Dosage forms of ayurveda are powders (churna), bas bhasma (oxides of metals), quath (extracts), gutika (bills), lep (ointment), asava and arishta (alcohol containing liquids) or taila (medicated oils).

There are eight branches of Ayurveda:

1. Kayachikitsa (internal medicine)
2. Kumarbhritya (pediatrics)
3. Trachchikitsa (psychology medicine)
4. Shalakya Tantra (ear, nose and throat)
5. Shalya Tantra (Surgery)
6. Agada Tantra (toxicology)

7. Rasayana Tantra (geriatrics)
8. Vajikaran Tantra (gynecology).

## Siddha System

Siddha system of medicine is one of the oldest medical systems known to mankind even before ayurvedic system which was flourished in vedic culture, Dravidian culture and Indus valley civilization.

This system of medicine originated from Tamil traditional medicine. The most of literature of this system is given in Tamil language. 18 "Siddhas" (spiritual persons) developed this system so it is called as Siddha. Sage Agasthiyar is considered the guru of all siddhas.

According to Palm leaf manuscript, it is believed that it was first described by Lord Shiva to his wife Parvathy and then to their son Lord Muruga. Then he taught all their knowledge to human beings. Siddhars have to get Siddhi means attainment of supernatural powers.

## Theory and Principles:

Generally, the basic principles of the Siddha medicine are almost similar to ayurveda. The only difference appears is that the siddha system explains in extramarks

detail about various basic treatments of diseases while Ayurveda where surgeries like modern treatments are practiced and written in detail. Siddha system is based on 96 principles and out of these Triguna theory, i.e. vata, pitta and kapha is more prominent. Under normal conditions, the ratio between vatta, Pitta and Kapha is 4:2:1, respectively. Siddha deals with thousands of herbs, animal, mineral and metals. Like in Ayurveda, in Siddha medicine also, the physiological components of the human beings are classified as vata (air), pitta (fire) and kapha (earth and water). Siddha system believes that health is perfect state of physical, mental, social, moral and spiritual component. It is based on Andapinda Thathuram means relationship between universe and human body. Siddhas are called as Vaithiyars.

### Diagnosis:-

A Siddha physician studies eight important things of body i.e. nadi (pulse), kan (eyes), swara (voice), sparism, varna (colour), na (tongue), mala (faeces) and neer (urine).

Guna	Personalities	Complications
Vata	Stout, black, cold and inactive healthy	Increased Vata shows arrogant behaviour paralysis, heart attack.
Pitta	Lean, whitish complexion and perfectionist	Increased Pitta shows graying of hair, anemia and instability.
Kapha	Well built, good complexion and well behaved	Graying of hair, causes jaundice, heart attack.

### Treatment:

Internal as well as external medicines are divided into 32 categories each separately. Pressure or massage techniques are also part of treatment and called as Thokkanam. There are 108 varma points for pressure techniques. Treatment is classified into three categories :

devamaruthuvum (Divine method); manuda maruthuvum (rational method); and asura maruthuvum (surgical method).

In Divine method medicines like parbam, chendooram, guru, kuli-gai made of mercury, sulphur and bhasanams are used. In the rational method, medicines made of herbs like churanam, kudineer, vadagam are used. In surgical method, incision, excisions, use of heat or leech are used.

Treatment in this system emphasizes preparation of fresh medicine. It is then prepared and administered with some Pathya (some restriction).

E.g. Day time sleeping is not allowed or some food material is restricted like chicken, mango, coconut, mustard, groundnut, almond, tobacco etc.

Medicine can be kashayam (extract), churanam (powder), tailams (medicated oil), gulligai (pills), chenduram (metal), bhasmam (calcination product) and or ghritam (medicated ghee).

## Unani System

This system is also called as unani-tibb or yunani medicine which was developed by arab and persian physicians such as Rhazes (al-Razi), Avicenna (ibn sena), Al-zahrawi, and Ibn nafis.

### Book:

Ibn Sina's The Canon of Medicine.

### Theory and principles:

Unani medicine involves concept of the four humours (akhlat) i.e. Phlegm (Balgham), Blood (Dam), Yellow bile (bafrâ') and Black bile (saudâ'). These "humours" are believed to have its roots in the appearance of a blood sedimentation test made in open air, which exhibits a dark clot at the bottom (black bile), a layer of unclotted erythrocytes (blood), a layer of white blood cells (phel/phlegm) and a layer of clear yellow serum (yellow bile). Abnormality in humor leads to disease condition in body.

## Diagnosis :

The human body is considered to be made up of seven components, which have direct bearing on the health status of a person. They are:

1. Elements (Aṣṭaṇa)
2. Temperament (Mījaz)
3. Humors (Akhlāt)
4. Organs (Aaza)
5. Faculties (Qūwa)
6. Spirits (Aṣwah)
7. Functions (Afā'il)

These components are taken into consideration by the physician for diagnosis and also for deciding the line of treatment. In diagnosis Unani Physician (Hakim) ask a patient a lot of questions to know History and decides treatment.

## Treatment :

After diagnosing the disease, treatment involves either to eliminate cause (Izalat sabab), normalize humors (tadeele akhlāt) or to normalise tissues or organs (tadeele aza). Method of treatment involves modification of essential pre-requisites of health (Ilaj - bil - tadbeer) or panchkarma

like in Ayurveda (Ilaj-bil-tadbeer) or pharmacotherapy (Ilaj-bil-advia) or surgery (Ilaj-bil-yad). As far as possible unani medicine therapy attempts to use simple physical means to cure a disease. Some of the techniques used in Ilaj-bil-tadbeer (segmental therapy) include hijamah (cupping), fasd (venesection), taseeq (sweating), idraar-e-baul (diuresis), hamam (turkish bath), dalak (massage), kai (cauterization), ishal (purgation), qai (vomiting), ziyazat (exercise) and taleeq (leeching).

The bases are generally purified by adding aab leemun (lemon juice), sat leemun (lemon extract) or shibb-e-yamani (alum) etc., before making the qiwam. Afterwards, the ingredient drugs are mixed in qiwam to prepare majun, itqifal, laboob, tisyaqat or mufarreh. For making majun or any of its preparation, the consistency of qiwam for majun is three Tars. The consistency of qiwam for laoog is two tars.

Word Majun is derived from Ajn, which means to mix. In this preparation powder of drugs is mixed well in qiwam (basic solution of particular consistency) of sugar or asl (honey). Their names

are given on the name of inventor, chief ingredients or action. Like majun sheikhurrais is named on inventor. majun mullein is named due to its laxative action. Majun azaragi is chief ingredient. So itsifal (triphal), jawazish (digestive tonic), yagooti (ruby containing). berashasha are all majun but according to composition, use, ingredient, preparation method, and other properties, their names are different.

### Homeopathy System:

Homeo means 'similar' and Pathos means 'suffering' so homeopathy is the "system" of similar suffering". German physician Samuel Hahnemann first stated the basic principle of homeopathy in 1796, known as the "law of similars" (let ~~the~~ like be cured by like").

### Theory and principle:

Homeopathy emphasis the root cause of the disease and the nature's law of its cure that is 'like cures like'. Thus, homeopathy deals with the following seven principles which are outlined below:

→ Individualization :

No two individuals in the world are alike, i.e., the disease affecting two individuals cannot be similar though they may share common symptoms.

Therefore, the medicines used to cure the same diseases in different individuals are different.

→ Principle of similars :

Use of the medicine will produce similar symptoms of disease in a healthy individual. For example, an onion is a substance, which makes your eyes water and your nose burn.

If you are having an attack of hay fever with watering eyes and a burning nose, a homeopathic remedy made from onion can relieve it.

→ Principle of simplex :

Only one single simple medicine at one time and no combination is allowed.

→ Minimum dose :

Minimum medicine at a time.

→ Law of proving :

Medicine should have the capacity to produce disease state in a healthy individual.

→ Law of dynamisation :

Medicine should preserve the normal state of healthy body.

→ Vital force :

Medicine should have the capacity to arouse sufficient energy to maintain a healthy body.

Diagnosis :

It involves knowing of complete hereditary history as well as observation of moods, habits, skin, eyes, tongue, blood, urine etc. of patients.

Treatment :

When the symptoms picture matches with the drug picture, the physician always attempts to identify a single medicine. In producing remedies for diseases, homopaths use a process extramarks

called "dynamisation" or "potentiation", whereby a substance is diluted with alcohol or distilled water and then vigorously shaken in a process called "succussion". Three logarithmic potency scales are in regular use in homeopathy for dilution. Hahnemann created the "centesimal" or "C scale", diluting a substance by a factor of 100 at each stage. Homeopathic pills are made from an inert substance (often sugars, typically lactose), upon which a drop of liquid homeopathic preparation is placed. Hahnemann began to test what effects substances produced in humans, a procedure that would later become known as "homeopathic proving".

### The Scope of Pharmacognosy :

- Pharmacognosy gives a sound knowledge of the vegetable drugs under botany and animal drugs under zoology.
- It also includes plant taxonomy, plant breeding, plant pathology, plant genetics and by this knowledge one can improve the cultivation methods for both medicinal and aromatic plants.

- Now a days phytochemistry (plant chemistry) has undergone the significant improvement.
- This includes a variety of substances that accumulated by plants and synthesized by plants.

A vital link between pharmacology and medicinal chemistry:

- Newly detected plant drugs are converting into medicine as purified phytochemicals.
- Pharmacognosy is essential for the evolution of new medicines because crude drugs are used for the preparation of galenical or as a source of therapeutically active metabolites.
- In short Pharmacognosy is an important link between pharmaceuticals and basic science as well as ayurvedic and allopathic system of medicines.
- Pharmacognosy is a science of active principles of crude drugs and which can be help in dispensing, formulating, and manufacturing of dosage forms.

- In other ways the complete knowledge of pharmacognosy will help in recent trend that is in industries.
- As a research tools and in drug delivery systems, and all the departments of pharmaceuticals and one can improve the health care facilities across the world.

### Role of Pharmacognosy :

- 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. It is a part of medicinal system which is affordable as well as accessible to common man. As part of integrative system of medicine, pharmacognosy can help to increase effectiveness of modern medicine system.

- It is acting as a bridge between pharmacology, medicinal chemistry and pharmacotheapeutics and also pharmaceuticals. It also bridges pharmaceuticals with other pharmacy subjects.
- More than 60 percent of world population is still using natural products 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 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 medicines 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.
- There are vast number of plant and animal species which are not studied systematically.
- Development of pharmacognosy also leads to development of botany, taxonomy, plant biotechnology, plant genetics, plant pathology, pharmaceutics, pharmacology, phytochemistry and other branches of science.

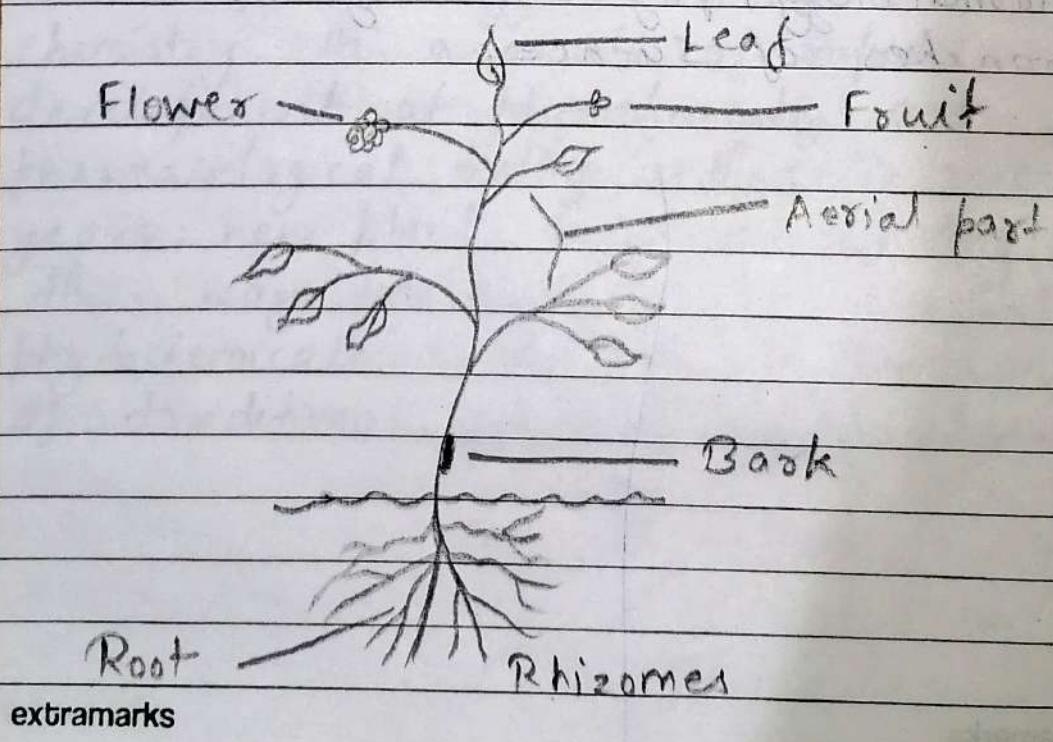
## Sources of Drugs.

Drugs are obtained from six major sources:

1. Plant sources
2. Animal sources
3. Mineral / Earth sources
4. Microbiological sources
5. Marine Sources
6. Tissue Plant Tissue culture.

### 1. Plant Sources:-

Plant source is the oldest source of drugs. Most of the drugs in ancient times were derived from plants. Almost all part of the plants are used i.e. leaves, stem, bark, fruits and roots.



① Leaves:

1. The leaves of *Digitalis Purpurea* are the source of Digitoxin and Digoxin, which are cardiac glycosides.
2. Leaves of *Eucalyptus* give oil of Eucalyptus, which is important component of cough syrup.
3. Tobacco leaves give nicotine.
4. *Atropa belladonna* gives atropine.

② Flowers:

1. Poppy (*Papaver somniferum*) gives morphine (opioid)
2. *Vincetoxicum* gives vincristine and vinblastine.
3. Rose gives rose water used as tonic.

③ Fruits:

1. Senna pod gives anthracene, which is a purgative (used in constipation)
2. Calabar beans give physostigmine, which is cholinomimetic agent.

3. Amla gives vit - c used as antioxidant

(d) Seeds:

1. Seeds of Nux Vomica givestrychnine, which is a CNS stimulant.
2. Castor oil seeds give castor oil.
3. Calabar beans give Physostigmine, which is a cholinomimetic drug.

(e) Roots:

1. Ipecacuanha root gives Emetine, used to induce vomiting as in accidental poisoning. It also has amoebicidal properties.
2. Rauwolfia serpentina gives reserpine, a hypotensive agent.

Reserpine was used for hypertension treatment.

(f) Barks:

1. Cinchona bark gives quinine and quinidine, which are antimalarial drugs. Quinidine also has antiarrhythmic properties.

2. *Aaturopa belladonna* gives atropine, which is anticholinergic.

3. *Hyoscyamus Niger* gives Hyoscine, which is also anti cholinergic.

Part Used	Name of Medicinal Plant	Active chemical constituents	Uses
1. Leaves	Digitalis	Digitoxin	Cardiotonic
	Senna	Sennosides	Laxative
2. Flowers	Clove	Eugenol	Dental Analgesic.
3. Fruits	Opium	Morphine	Potent Analgesic
	Amla	Vitamin C	Antioxidant
	Bael	Marmesin, Aegelin	Antidiarrhoeal, Hepatoprotective Properties
4. Seeds	Castor oil	Ricinoleic Acid	Laxative
	Mustard oil	Oleic Acid	Antarthritic
5. Roots	Rauwolfia	Reserpine	Antihypertensive
	Ipecac	Emetine	Emetics
	Ashvgandha	Withenolides	Anti stress Property.

## 2. Animal Sources:

1. Pancreas is a source of Insulin, used in treatment of Diabetes.
2. Urine of pregnant woman gives human chorionic gonadotropin (HCG) used for the treatment of infertility.
3. Sheep thyroid is a source of thyroxin, used in thyroid deficiency eg. Goiter, Hypo and Hyper thyroidism.
4. Cod liver is used as a source of vitamin A and D.
5. Anterior pituitary is a source of pituitary gonadotropins, used in treatment of infertility.
6. Blood of animals is used in preparation of vaccines.
7. Stomach tissue contains pepsin and trypsin, which are digestive juices used in treatment of peptic diseases in the past. Nowadays better drugs have replaced them.

Animal Part / Product uses as drug	Hormones/ chemicals	Uses
1. Pancreas	Insulin	Diabetes
2. Blood	Vaccines	Several type of Disease treatments
3. Sheep Thyroid	Thyroxine	Thyroid Insufficiency
4. Cod liver oil	Vitamin A & D	Vit. A is useful for vision and vit. D is for Immune system
5. Stomach tissue	Pepsin and Trypsin	Used in Peptic Disease
6. Posterior Pituitary gland (source: Adrenal gland)	Oxytocin	Labor pain and Lactation.
7. Epinephrine / Adrenaline	Adrenaline	Acute Asthma Treatment
8. Urine of Pregnant women and Horse Serum	Human chorionic Gonadotropin (HCG)	Treatment of Infertility.

9. Pancreas of Pig      Pancreatin      Pancreatitis is Treatment

10. Human plasma      Fibrinolysin      Thrombosis Treatment

### 3. Mineral Sources:

#### 1. Metallic and Nonmetallic Sources:

- ① Iron is used in treatment of iron deficiency anemia.
- ② Mercurial salts are used in Syphilis.
- ③ Zinc is used as zinc supplement. Zinc oxide paste is used in wounds and in eczema.
- ④ Iodine is antiseptic. Iodine supplements are also used.
- ⑤ Gold salts are used in the treatment of rheumatoid arthritis.

#### 2 Synthetic Sources:

When the nucleus of the drug natural source as well as its chemical structure is altered, we call it synthetic.

Examples include Emetine Bismuth Iodide.

### 3. Semi synthetic Source:

When the nucleus of drug obtained from natural source is retained but the chemical structure is altered, we call it semi-synthetic.

Examples include Apomorphine, Diacetyl morphine, Ethinyl Estradiol, Homatropine, Ampicillin and Methyl testosterone.

Most of the drugs used nowadays (such as antianxiety drugs, anti-convulsant) are synthetic form.

### 4. Miscellaneous Sources:

1. Fluorine has antiseptic properties.
2. Borax has antiseptic properties as well.
3. Selenium as selenium sulphide is used in anti-dandruff shampoos.
4. Petroleum is used in preparation of liquid paraffin.

## 5. Clay Minerals :

1. Calamine : } Both are used in preparation  
                   of Talcum Powder, cream,  
 2. Bentonite : } Beauty Products Cosmetic  
                   Preparations.

## 4. Microbiological Sources :

- Several types of bacteria play an important role in the production of several types of life saving drugs.
- These are obtained from microorganisms and they used to kill the microbes and to stop the growth of microbes.

1. Penicillium notatum is a fungus which gives penicillin.
2. Actinobacteria give streptomycin.
3. Aminoglycosides such as gentamicin and tobramycin are obtained from streptomycetes and micromonosporas.

S. No.	Drugs	Obtained from Microorganisms
1.	Penicillin	Penicillium Notatum
2.	Chloramphenicol	Streptomyces venezuelance
3.	Grisofulvin	Penicillium Griseofulvum
4.	Streptomycin	Streptomyces griseus
5.	Neomycin	Streptomyces Fradiae

### S. Marine Sources:

Drugs Obtained from Marine (Sea/Ocean)

Examples:- Seaweed, soft coral, Sponges, Fish, Microorganisms.

#### 1) Anti-microbial agents:

[Cholera (Haiza), Tuberculosis (TB), Pneumonia]

- Cephalosporin :- Obtained from Marine Fungus [Cephalosporium Acetonicum]
- Istamycin A and B :- Marine Streptomyces.

## 2) Anti-viral agents:

[Hepatitis, Rabies, small pox, Chicken pox, Flu, HIV, Ebola]

→ Ara A (Vidarabine) : Caribbean Sponge [Tethya Crypta]

→ Avastin and Aravone :-

Sponge (Disidea avasta) used in AIDS treatment.

→ Fucoidan :- Brown Algae [Fucus Vesiculosus]

## 3.) Anti-Parasitic Agents:

[Malaria, Diarrhea, Hookworm]

→ Domoic Acid :- Red Algae [Chondria Asmata] used in the treatment of anthelmintic.

→  $\alpha$ -kainic Acid :- Red Algae [Chondria Asmata]

## 4.) Cardio Vascular Agents :-

• Laminie :- Specific type of red algae [hypotensive effect]

- Octopamine :- Octopus [Octopus Vulgaris]
- Spongiosine :- Caribbean Sponge  
[Cryptotethya crypta]

### 5). Anti-Cancer Agents:-

- Ara C (Cytarabine) :- Caribbean Sponge (Tethya crypta) used in treatment of leukemia
- Crassin Acetate :- Caribbean Gorgonian. [Pseudo-Plexaura Porosa]

### 6. Plant tissue culture:

In vitro cultivation of plant cell/tissue/organ in nutrient media/growth media (solid/Liquid/Semi solid) under aseptic conditions and controlled environment (light, pH, temperature). This type of work/culture is called plant tissue culture.

- Sterile/Aseptic :- free from Microorganism
- In vitro cultivation :- plant tissue culture

Plant tissue culture is based on  
Totipotency (Cell Potency)

Totipotency: Ability or power of a single plant cell to develop in entire plant.

Advantages :

1. Huge amounts of drug can be produced.
2. Drug can be obtained in pure form.
3. It is less antigenic.

Disadvantages:

1. Well-equipped lab is required.
2. Highly trained staff is required.
3. It is a complex and complicated technique.

Application of Plant Tissue Culture :-

1. Production / Regeneration
2. Endangered plant species conservation

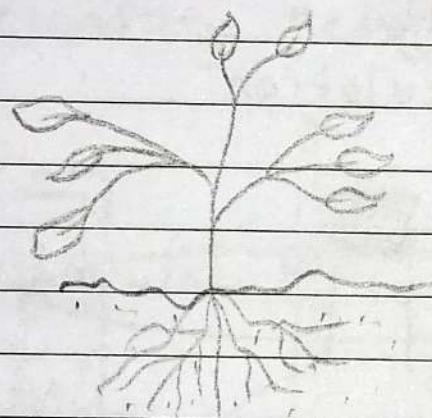
### 3. Large Scale Production of Bio-active Compounds.

Examples :

- Digitalis (leaf) → Digoxin
- Rauwolfia (root) → Reserpine
- Atropa Belladonna (leaf) → Atropine
- Papaya (Fruits) → Papain.

### 4. Herbicide resistance / Disease resistance plant.

### 5. Hybrid Plant / Regeneration of Transgenic plant.



Leaf

[ Explant Material ]



## Surface sterilization

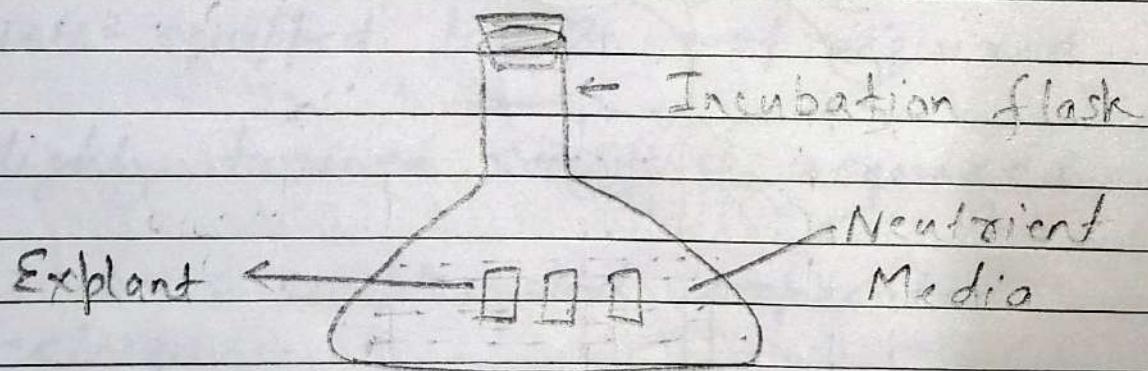
Eg. Mercuric chloride

Sodium Hypo chloride

Cut into small pieces by  
sterile knife

□ □ □ → [Explant]

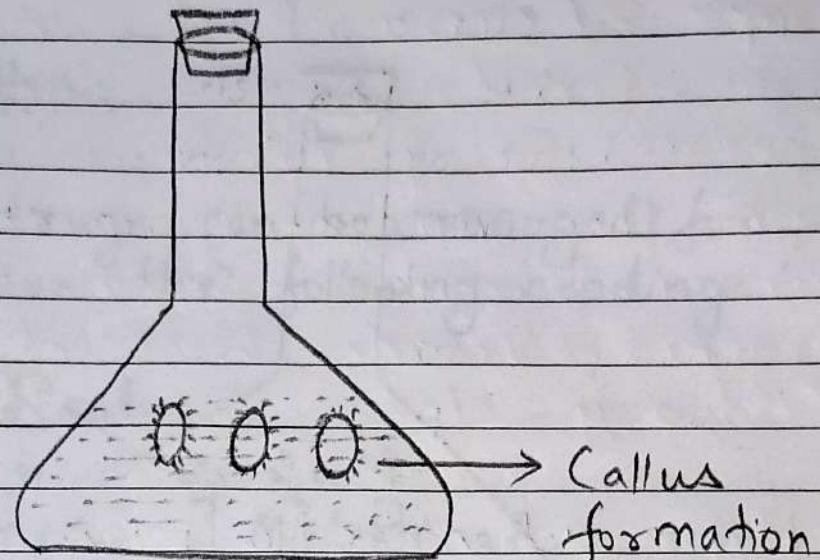
Inoculation



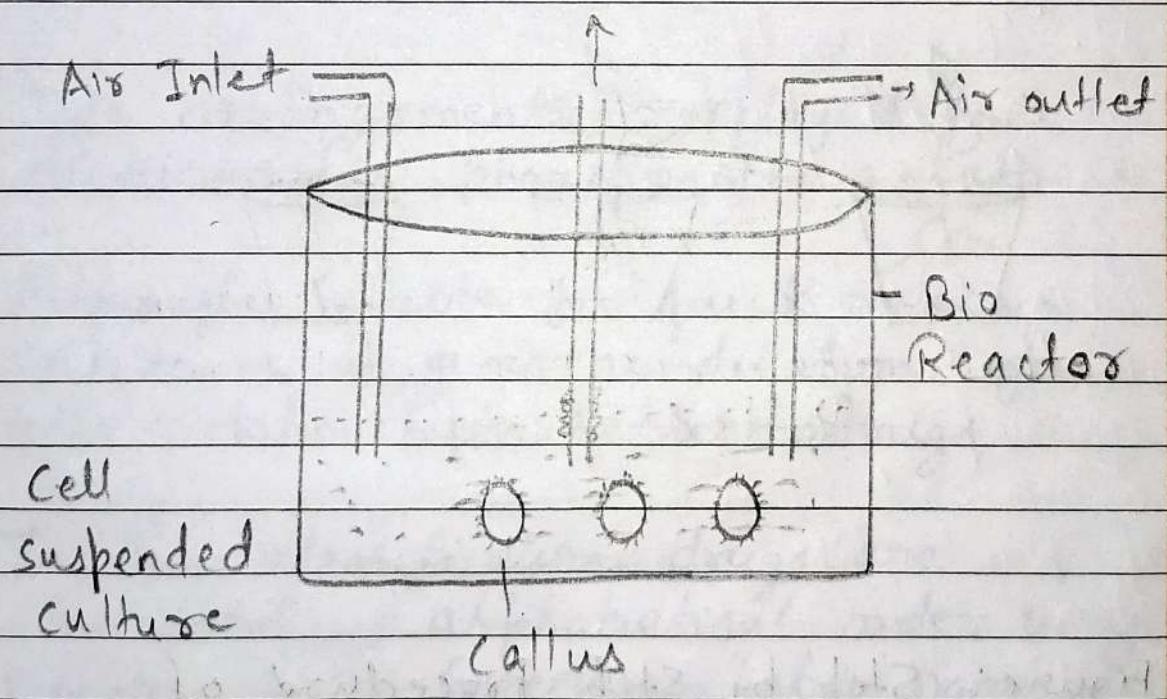
After 1-2 weeks

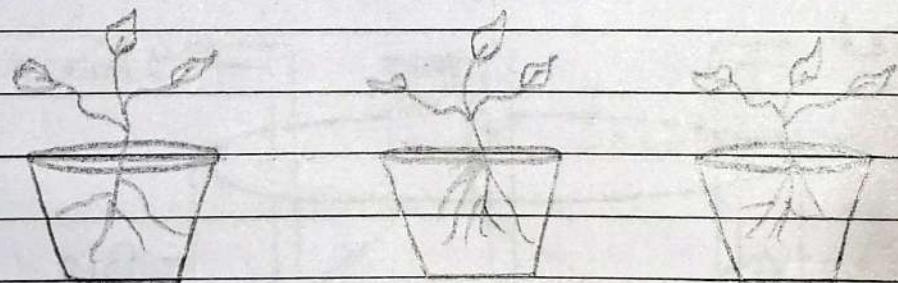
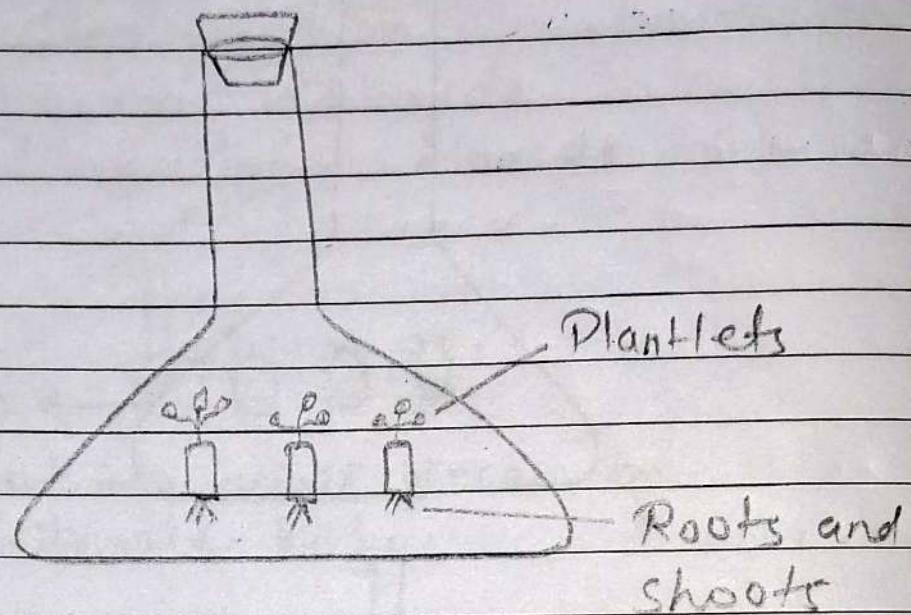
Plant cell

Multiplication  
Start



Production of Bioactive  
(Secondary Metabolite)





Potted plants

Figure:- Step by step Procedure of Plant Tissue culture.

## Classification.

Vegetable drugs can be arranged for study under the following headings :

- Alphabetical
- Morphological
- Taxonomical / Biological
- Pharmacological / Therapeutic
- Chemical.

### 1. Alphabetical.

- Either Latin or vernacular names may be used.
- This arrangement is employed for dictionaries, pharmacopoeias etc.
- Although suitable for quick revision reference it gives no indication of inter-relationships between drugs.

In this classification drugs are classified in alphabetical order using either their Greek or Latin name.

Though pharmacopoeias, formulary, encyclopedias of various countries follow this classification, but due to lack of scientific value now-a-days this classification is not preferred.

Example : Acacia, Bael, Cinchona, Dill, Ergot, Fennel, Ginger, Henbane, Ipecac, Jalap, Kurchi, Licorice, Myrrh, Nux-vomica, Opium, Podophyllum, Quassia, Rauwolfia, Senna, Tea, Urgenia, Vasaka, Wool fat, Yam, Zedoary etc.

\* Major advantage of this method is that it provides quick reference.

## 2. Morphological

Drugs are arranged according to their morphological or external characters of the plant parts or animal parts, i.e. which part of the plant is used as drug.

This is most simple classification method where crude drugs are grouped into two major classes : organized (having such specific parts of plant like root, rhizome, flower, leaf, fruit, bark, seed, wood etc.) and unorganized drugs (dried latex, juice, gum, wax, oil etc.). But many crude drugs are very similar morphologically and hence difficult to distinguish. Many times, crude drug available in powder form that

time morphological classification is not so suitable is not so suitable and acceptable.

### \* Organized drugs:

obtained from the direct parts of the plants and containing cellular tissues.

eg. leaves (digitalis, Senna, belladonna),  
 flowers (clove, saffron),  
 fruits (amla, cardamom, cumin),  
 Seeds (amla, cardamom, cumin),  
 Seeds (ispaghula, linseed, Phyto stigma),  
 herbs (ergot, vinca),  
 barks (cinchona),  
 rhizomes and roots (aconite, ginseng,  
 iperac, rauwolfia),  
 hair and fibers (flax).

### \* Unorganized drugs:

prepared from plants by some intermediate physical process such as incision, drying or extraction with a solvent and not containing any cellular plant tissues.

eg. latex (opium),  
 dried juice (aloe),  
 extracts (agar, catechu, hectarin),

waxes (beeswax),  
 gums (acacia, guar gum),  
 resins (benzoin, colophony, tolu balsam),  
 volatile oil (turpentine, ~~cinnamon~~, cinnamon,  
 peppermint, clove),  
 fixed oils and fats (arachis, castor,  
 olive, cod liver),

### Advantage :-

More convenient for practical study  
 especially when the chemical nature  
 of the drug is not clearly understood.

### Disadvantage:

there is no correlation of chemical  
 constituents with the therapeutic actions.

#### Organised crude drugs

- Obtained from parts of plants
- Well defined structure
- Solid in nature
- Microscopic studies are useful in quality control.

#### Un-organized crude drugs

- Obtained from parts of plants and Animal.
- Not well-defined structures.
- Semisolid, solid, liquid in nature.
- Chemical tests are more useful in quality control.

Examples: Organized drugs.

<u>Parts.</u>	<u>Examples.</u>
→ Leaves	Senna, digitalis, vasaka, eucalyptus.
→ Barks	Cinchona, kuschi, cinnamon, quaiilla.
→ Woods	Quassia, sandalwood.
→ Rhizomes	Turmeric, ginger, valerian, podophyllum.
→ Seeds	Nux-vomica, stoaphanthus.
→ Fruits	Coriander, colocynth fennel, bael.
→ Entire plant	Vinca, belladonna

Examples: Unorganized drugs.

<u>Class</u>	<u>Example</u>
→ Resins	Balsam of tolu, myrrh, ase foetida, benzoin.
→ Gums and mucilages	Acacia, tragacanth, guar gum.

Dried latices

Opium

Dried juices.

Aloes, kino

Volatile oils

Cinnamon oil.

Fixed oils

Cinnamon oil, castor  
oil and Card

Extracts

Catechu

Saccharine substances

Honey.

### 3. Taxonomic / Biological.

Drugs are arranged to the plants from which they are obtained, in kingdom, subkingdom, division, class, order, family, genus and species.

In this classification crude drugs are arranged according to taxonomic order i.e. phylum, division, class, sub-class, orders, families, genus and species. Precise and orderly arrangement of drugs has no ambiguity in this classification. But again, this type of classification lacks scientific value and unorganized crude drugs are difficult to classify.

### Advantage :

It allows for a precise and ordered arrangement and accommodates any drug without ambiguity; helpful for studying evolutionary developments.

### Disadvantage :

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

### Example :

- Phylum - Spermatophyta
- Division - Angiospermae
- Class - Dicotyledons
- Sub-class - Sympetalae.
- Order - Tubiflorae.
- Family - Solanaceae.
- Genus - Atropa
- Species - belladonna.

## \* Class :

- **Angiospermae (Angiosperms):** plants that produce flowers.

Examples :- Rose, Sunflower, Mustard oil etc.

- **Gymnospermae (Gymnosperms):** Plants which do not produce flowers.

Examples: Pinus, Gnetum, Cycads etc.

## \* Subclass :

- **Dicotyledonae (Dicotyledons, Dicots):** plants with two seed leaves.

Examples :- Peanut, Marigold, Sunflower etc.

- **Monotyledonae (Monotyledons, Monocots):** plants with one seed leaf.

Examples :- Palm tree, Grasses, Bananas, Orchids etc.

## \* Suborder :-

A group of related plant families, classified in the order in which they are thought to have developed their differentiation differences from a common ancestor.

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.
- The names of the families end in -aceae.

Examples:- Abocynaceae.

Lamiaceae

Liliaceae

Solanaceae

Papaveraceae

Roseaceae

### \* 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.

Subfamilies end in -oidea.

## \* Genus:

Part of the plant name that is most familiar; the normal name that you give a plant.

- Papaver (Poppy)
- Arachis (Peanut)

## \* Species:

- Level that defines an individual's plant.
- The name describes some aspects of the plant.
- The colour of the flowers; size and shape of the leaves, and it may be named after the place where it was found.
- Should be written after genus name, in small ~~letter~~ letter.

## 4. Pharmacological / Therapeutic

### \* Drugs acting on G.I.T.

- Carminative - Fennel, Cardamom, Mentha
- Emetic - Ipecac

- Antiamoebic - kurchi, Ipecac.
- Laxative → agar, Isabgol, Banana.
- Purgative - senna, Castor oil.
- Cathartic - senna.

★ Drugs acting on Respiratory system:

- Antitussive - Opium (codeine)
- Bronchodilators - Ephedra, Tea
- Expectorant - Vasaka, Liquorice, Ipecac.

★ Drugs acting on Autonomic Nervous System:

- Adrenergic - Ephedra.
- Cholinergic - Physostigma, Pilocarpus
- Anticholinergic - Datura, Belladonna.

★ Drugs acting on Cardiovascular system:

- Cardiotonic - Digitalis, Strophantidius  
Strophanthus, Squill.

- Cardiac depressant: - Cinchona, Veratrum
- Vasoconstrictor - Ergot
- Antihypertensive - Rauwolfia.

### \* Drugs acting on Central Nervous System:

- Central analgesic - Opium (morphine)
- CNS depressant - Belladonna, Opium, Hyoscyamus.
- CNS stimulant - Tea, Coffee
- Analeptic - Nux vomica, Camphor, Lobelia

### Miscellaneous

- Antispasmodic - Datura, Hyoscyamus, Opium, Curare.
- Anticancer - Vinca, Podophyllum, Taxus
- Antirheumatic - Aconite, Colchicum, Griggal
- Anthelmintic - Catechu, Quassia, Vidang.
- Astringent - Catechu, Myrobalans

- Antimalarial - Cinchona, Artemesia
- Immunomodulatory - Ginseng, Ashwagandha, Tulsi
- Immunizing agent - Vaccines, Sera, Antitoxin
- Drugs acting Skin Membrane - Beeswax, Wool fat, Balsam of Tolu, Balsam of Peru
- Local anesthetic - Coca

### 5. Chemical

- Crude drugs are classified depending upon the active constituents.
- Irrespective of the morphological or taxonomical characters, the drugs with similar chemical constituents are grouped together.

This classification is purely based on chemistry of constituents. Different crude drugs are classified according to the presence of major active constituents. This is most preferred method of classification.

## \* Advantage

It is a popular approach for phytochemical studies

## \* Disadvantage

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

## Chemical Constituent Group:

- Alkaloids :- Cinchona, Datura, Vinca, Ipecac, Nux vomica
- Glycosides:- Senna, Aloe, ginseng, Digitalis
- Carbohydrates and its derivates :- Acacia, starch, Isabgol.
- Volatile oil - Clove, Coriander, Fennel, Cinnamon, Cumin
- Resin and Resin Combination - Benzoin, Tolu Balsam, Balsam of Peru.
- Tannins - Catechu, Tea.

- Enzymes - Papain, Casein, Trypsin
- Lipids - Beeswax, Kokum butter, Lanolin.

Parameters involved in pharmacognostic study of crude drug.

Parameters	Description
→ Chemical constituents	major and minor chemical constituents present
→ Chemical tests	To identify crude drug and its chemistry
→ Uses and pharmacological actions	various therapeutic applications
→ Adulterants and Commercial varieties	Useful for quality control.
→ Formulations available in Market.	To understand market potential.
→ Quality control and standardization.	To establish qualitative and quantitative standards with the help of sophisticated instruments.
→ Common names	Names in various languages.

→ Biological source	Genus, species and family.
→ Geographical source	Location
→ History	Discovery of crude drug
→ Cultivation, collection and preparation for market	Time and method of cultivation, irrigation, climate, fertilizers, collection time, processing etc.
→ Morphological description	color, odor, taste, size, shape, extra features.
→ Microscopical description	Cell, tissue type and arrangement, cellular inclusions, special characters etc.