Unit - IV

Pharmacognosy in various system of medicine

Role of pharmacognosy in allopathy :

→ **Allopathy**

"Allos" (means opposite) + "Pathos" (means suffering).

→ Allopathy is a system of medicine, that combats disease by using remedies that are different from the effects produced by disease to be treated.

eg. Anti-bacterials, anti-virals, for acidity (antacids are used).

→ It is also called as "western medicine" or "modern medicine".

→ The term "allopathy" was coined in 1810 by Samuel Hahnemann.

→ Pharmacognosy ~~it very~~ plays an important role in the treatment of many diseases in allopathy.

→ It places a crucial role in the discovery, characterization, production of drugs.

→ In this system, the drugs / medicines (tablets, capsules, injections, tonics, etc.) are manufactured using synthetic chemicals or chemicals derived from natural products like plants, animals, minerals, etc.

→ This system also uses modern equipment for diagnosis, analysis, surgery, etc.

- **Advantages of allopathy:**

→ Immediate response.
→ Various kinds of dosage forms are available.
→ Modern technology.
→ Efficient management in emergency conditions.

- **Disadvantages of allopathy:**

→ Long term medication causes severe side effects.
→ Drug - drug interaction.
→ Suppress immunity.
→ High cost.

Traditional system of medicine :

▶ The traditional system of medicine is also known as indigenous medicine / folk medicine / alternative medicine, comprises of medical aspects of knowledge, skills & practices based on different cultures & are used to treat diseases.

▶ Types :

The types of traditional system of medicine are as follows :-

AYUSH
- Ayurveda
- Yoga (Naturopathy) → [Drugless therapy]
- Unani
- Siddha
- Homeopathy

(I) Ayurveda :

→ It is an Indian system of medicine.

→ Ayurveda is the combination of two Sanskrit words :

'Ayu' – life

'Veda' – knowledge or science of life.

Thus, Ayurveda means science of life.

→ It is an oldest medical system, that came into existence in about 900 B.C.

→ The 4 "vedas" written by Aryans, they are –

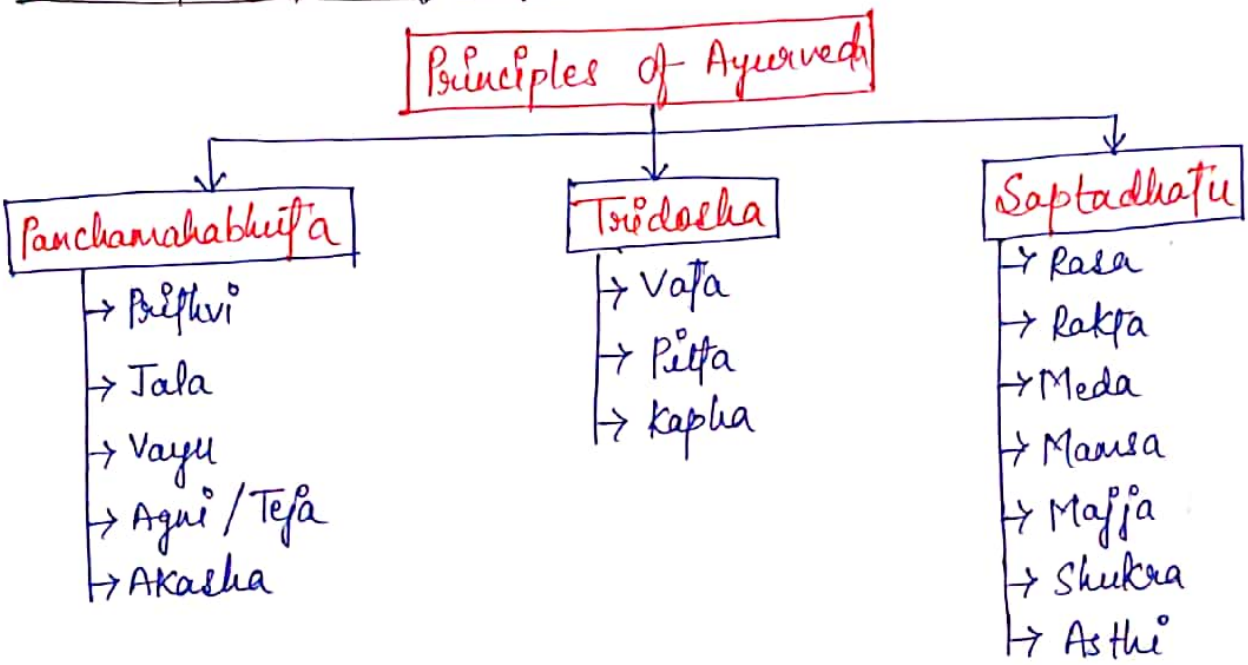
Rig veda, Sham Veda, Yajur veda & Atharva veda.

into that, Upaveda (part) of Atharvaveda.

Ayurveda is the

- Charaka & Sushruta made significant contributions to Ayurveda.
- The book "charak samhita" was written by charaka & he was known as the "father of Ayurveda".

- Basic principles of Ayurveda :



① Panchamahabhuta Siddhanta :

– According to ancient Indian philosophy, the universe is composed of 5 basic elements, i.e. –

- Prithvi (earth)
- Jal (water)
- Teja (fire)
- Vayu (air)
- Akash (space)

– Everything in the universe, including food & the bodies were derived from these bhutas.

(2) Tridosha theory :

→ There are 3 doshas in the body. They are :-

- Vata (Space + air)
- Pitta (fire + liquid)
- Kapha. (liquid + solid)

→ Acc. to this theory, the 5 basic elements (Panchamahabhutas) exist in human body in 3 different forms. Together known as "Tridosha".

→ when these Tridosha present in balanced form in the body is considered as healthy condition. & any imbalance in Tridosha is considered as diseased condition.

→ Ayurveda tries to maintain the ~~balance~~ balance in these elements.

→ Vata – It regulates the nervous system.
– Responsible for the movement & sensation of cell / whole body.

→ Pitta – It regulates energy production, digestion, metabolism, tissue building in the body.

→ Kapha – It regulates heat, ~~mucous~~, formation of fluids, mucous, strengthening of stomach & joints.

③ Saptadhatu theory :

→ The combination of "Panchbhutas" forms 7 basic tissues of the body referred as "Sapta dhatu".

→ The dhatus are the body constituents & forms basic structure of body. They are as follows :-

(a) Rasa – Lymph / Plasma.
(b) Rakta – Blood
(c) Meda – fat tissue
(d) Mansa – muscle tissue
(e) Majja – Bone marrow
(f) Shukra – Semen / Reproductive tissue.
(g) Asthi – Bones

→ Mala – They are the byproducts of the dhatus.
– Partly used by the body & other than that excreted as waste matter after digestion.
– They are as follows :-

(a) Prasad – useful elements absorbed by body.
– Useful matter.

(b) Mutra – Urine
(c) Shakrit – faeces / stool

- **Diagnosis :**

→ The diseases are diagnosed by observation of doshas (vata, pitta & kapha).

→ Under this, skin, eyes, nails & tongue is observed.

→ Recording the pulse.

→ Investigation of mala (urine, stools & sweat).

Unani system of medicine :

→ This system of medicine is originated in Greece by Greek philosopher "Hippocrates" (460-377 BC)

→ Unani system was later developed by Arabs & became popular as Arab system of medicine.

→ Unani medicine got its importance in Egypt, Syria, Iraq, Persia, India, China & other countries.

→ In India, Arabs ~~and~~ introduced Unani system ~~when~~ by Mughals.

→ Unani considers the human body to be made up of 7 components. They are -

Arkan - elements
Mizaj - temperaments
Akhlath - humours
Anza - organs
Arawh - spirits
Quo - faculties
Afal - functions

} A physicians takes into account all these factors ~~before~~ during diagnosis & prescribes medicine.

→ Unani medicine is based in 4 basic elements i.e. - Earth, Air, water & fire which have different temperaments i.e., cold, hot, wet & dry.

→ The body has simple & compound organs which got nourishment through 4 Humours i.e., Blood, Phlegm, Yellow bile, Black bile.

Blood - hot & wet
Phlegm - cold & hot
Yellow bile - hot & dry
black bile - cold & dry.

→ Acc. to this system, health is a state of body in which there is equilibrium in humours & temperaments.

→ When the equilibrium of the humours is disturbed, disease produces.

• Diagnosis :

→ The diseases are mainly diagnosed with the help of Pulse (Nabz), physical examination of Urine & Stool.

• Treatment :

① Regimental therapy - Some drugless regimens are advised for treatment of diseases -
e.g. Exercise, Massage, Hamam (Turkish Bath).

② Dietotherapy - Different diets are recommended for the patients of different diseases.

③ Herbs & drugs are used.
plants, animals

Siddha System of medicine :

→ It is an ancient medicinal system, started before 2000 BC. South Indian

→ It is exclusively linked with Tamil culture & civilization.

→ It is prevalent in the southern states of India, Sri Lanka, Malaysia & Singapore.

→ "Agastya" was believed to be the father of Siddha medicine & he wrote a book known as "Agastiya charkku".

- Basic principles :

→ The 5 principles of Panchamahabhuta theory are -

- Prithvi - earth (gives fine shape to body including bones, tissues, etc)
- Appu - water (representing blood, secretion of glands, etc.)
- Theyu - fire (gives emotion, helps in digestion, etc.)
- Vayu - air (helps in respiration)
- Akasha - Space / Sky

→ Triguna : Vata, pitta & kapha.
— imbalance in the equilibrium of vata, pitta & kapha (Triguna) cause disease.

- **Diagnosis :**

+ The diagnosis of diseases involve identifying its causes.
+ The physician generally involve checking of - Nadi (pulse), Mozhi (voice/speech), Twaka (skin along with tongue), Deiham (body), Malam (feces/stool), Mutram (urine), Vizhi (eye colour).

- **Treatment :**

+ Treatment is based on all diagnostic character of patient.
+ Siddha system extensively use of drugs of vegetable source as well as mineral origin. Use of metals like gold, silver, sulphur, zinc, copper, mica, etc are only seen in Siddha system of medicine.

Homeopathy System of medicine :

Homeopathy

"Homois" + "Pathos"
means like (similar) means treatment.

→ It means the substances capable of causing disorder in healthy subjects are used as medicines to treat similar pattern of disorder. in diluted form

→ This system of medicine was introduced by a ~~German~~ Dr. Samuel Hahnemann in (1755–1843). He was a German physician, chemist & a pharmacist, based on the natural law of healing, i.e.
"Similia Similibus Curentur" which means
"Likes are cured by likes"

• **Fundamental Principles of Homeopathy :**
The basic fundamental principles were discussed by Hahnemann in different sections :–

① Law of similia → Homeopathy is based on the law - "Similia Similibus Curentur" which means "likes are cured by likes.
– In a simple way we can say that, ~~in~~ the medicine administered to a diseased individual is such that if given to a healthy person it produces same disease.

② Law of Simplex : Simple & single drugs should be prescribed at a time.

③ Law of minim : Drugs are administered in minimum quantity to prevent unwanted sideeffects.

④ Drug proving : To apply drugs for therapeutic purpose their curative power should be known.

⑤ Individualization : Medicines can never be prescribed on the basis of name of disease without individualizing each case of disease.

- Treatment :

→ Patients will be asked about their medical history, diet, lifestyle, physical & emotional state.

→ Suitable remedy will be prescribed on the basis of patient's individual symptoms.

CHINESE SYSTEM OF MEDICINE

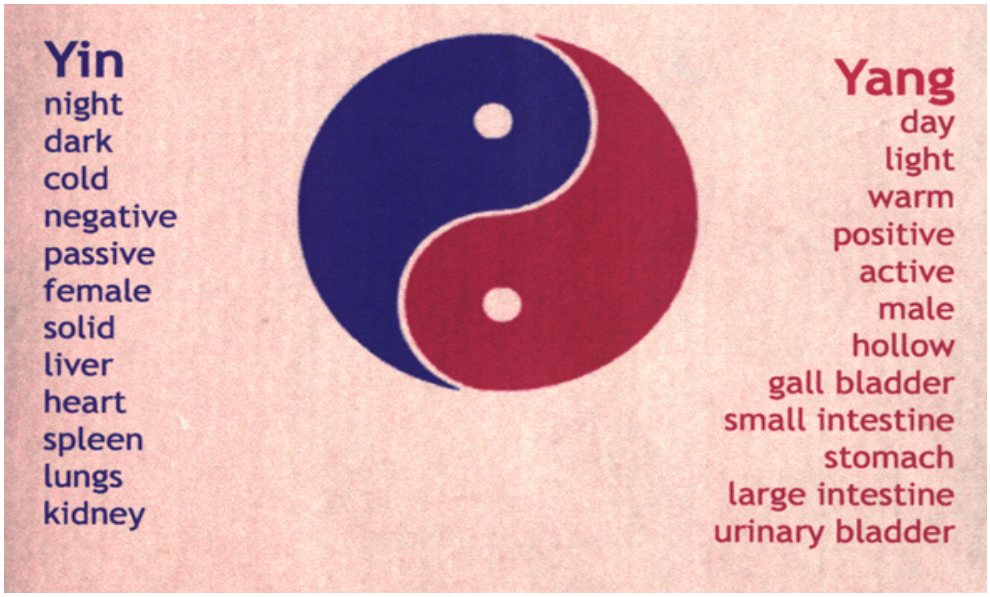
- Traditional forms of medicine have been used in China since the 3rd Century.
- The 1st herbal classic written in China was published in Qin Dynasty (221-206 A.D.) called the Agriculture Emperors Materia Medica.
- Traditional Chinese Medicine is a holistic medicine that considers the "whole" person - body, mind, diet, environment, emotions, lifestyle, and exercise.
- Traditional Chinese medicine system consists of 3 parts. They are:

I. Theory	II. Treatment	III. Prevention
a) Yin & Yang Theory	a) Herbalism	a) Qi gong
b) Five elements Theory	b) Acupuncture	b) Tai-ji
	c) Moxibustion	c) Meditation
	d) Cupping	
	e) Massage therapy	

I. Theory

a) Yin & Yang theory:

- It is a concept of dualism. Yang predominates during the day and turns into yin after dark.
- In human body when the Yin and Yang elements are well balanced, the person is in good health. A person falls sick when the balance is disturbed.

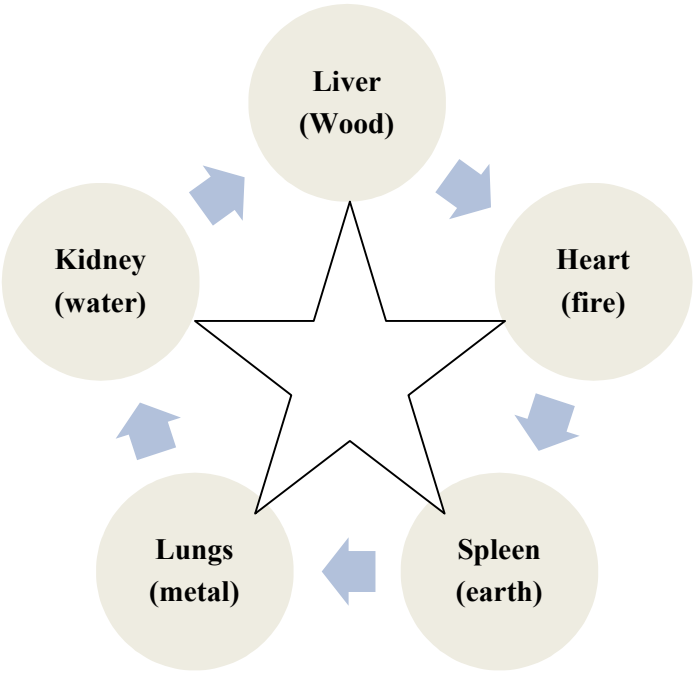


- **Yin and Yang in body:**

Yin	Yang
Lower body	Upper body
Chest and abdomen	Shoulders and back
Interior	Exterior
Internal organs	Bowels
Fluid	Gas
Nourish	Cleanse

b) <u>5 elements theory:</u>

- The 5 vital organs (Heart, Liver, Kidney, Spleen, and Lung) are corresponding to one of the 5 elements of Universe i.e., (Earth, Wood, Metal, Fire, and Water).
- The 5 organs function in an interlocked and interconnected relationship.



- In the human body, if any change occurs in vital organ will affect the other organ and cause disease.

II. <u>TREATMENT</u>

a) <u>Herbalism</u>

- Herbs consists mainly of natural medicinal materials such as plants, animal parts, and minerals of medicinal value.
- Different parts of plants, such as the leaves, roots, stems, flowers, and seeds, are used.

- Each ingredient has unique characteristics and are used to treat diseases.

b) <u>Acupuncture</u>

- Acupuncture involves the stimulation of anatomical points on the body with thin needles. Acupuncture patients usually feel little to no pain because the needles are hair.

Fig: Acupuncture

c) <u>Moxibustion</u>

- Moxibustion is a traditional Chinese medicine technique that involves the burning of spongy herb to facilitate healing.

Fig: Moxibustion

d) <u>Cupping</u>

- In this therapy, cups are placed on the skin to create suction. The suction of the cups mobilizes blood flow to promote the healing of disease.
- The cups can be made of variety of materials including: Glass, Bamboo, Earthenware.

e) Massage therapy

- Also known as Chinese massage (Tui Na).
- Uses wave like motions to loosen joints and nourish muscles.
- Stimulates the flow of Qi (means energy), blood and body fluids.
- Can be used to treat pain, stress or digestion problems.

Fig: Massage

III. Prevention:

a) Qi gong

- Qigong is a Chinese form of exercise.
- It regulates the mind and breathing to promote the flow of energy.

Fig: Qi gong

b) <u>Tai chi</u>

- It involves gentle, dance- like body movements with mental focus, breathing, and relaxation.

Fig: Tai chi

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Introduction to Secondary metabolites

▶ Secondary metabolites :

→ The metabolites which are biosynthesized from primary metabolites are called as secondary metabolites.

→ They are not present in all plants but are present in specific part of plant & family.

→ Examples :- Volatile oils – Resins
– Alkaloids – Tannins
– Glycosides – flavonoids.

Alkaloids :

▶ **Definition** - The alkaloids are the secondary metabolites, which are organic compounds, basic in nature, contains one or more N-atom in a heterocyclic ring system & gives specific physiological activity to human body.

▶ **Properties** -

- They are insoluble in water.
- Soluble in alcohol & in organic solvents.
- Some alkaloidal bases are soluble in water e.g. Caffeine, Ephedrine, Codeine, etc.
- Basic in nature.
- Generally they are crystalline solids.

- Mostly are colourless & few are having colour.
  eg. Colchicine, Berberine, etc.
- Alkaloids containing oxygen are solid in nature.
  eg. Atropine.
- Alkaloids which are free from oxygen are liquid in nature.
  e.g. Nicotine
- They contain N-atom in its structure.

▶ **Identification test :**

The identification test is performed by using various reagents like -

(1) **Mayer's reagent** - It is a potassium mercuric iodide solution.
- It gives cream coloured precipitate.

(2) **Dragendorff's reagent** - It is a potassium bismuth iodide solution.
- It gives reddish brown precipitate.

(3) **Wagner's reagent** - It is a potassium iodide solution.
- It gives red colour precipitate.

(4) **Hager's reagent** - It is a solution of picric acid.
- It gives yellow coloured precipitate.

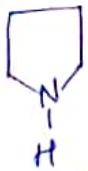
▶ Classification of alkaloids :

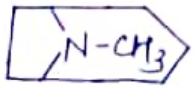
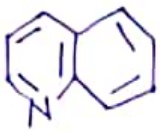
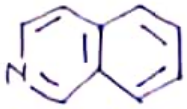
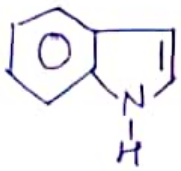
They are classified into 3 main classes :-

(I) True alkaloids
(II) Proto alkaloids
(III) Pseudo alkaloids

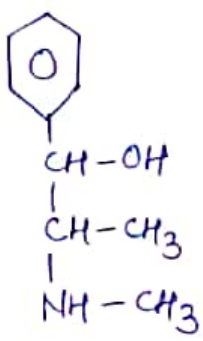
True alkaloids	Proto alkaloids	Pseudo alkaloids
→ They are derived from amino acids.	→ They are also derived from amino acids	→ They are not derived from amino acids.
→ They are having heterocyclic ring with N-atom.	→ They are not having heterocyclic ring with N-atom	→ They are having heterocyclic ring with N-atom.

(I) True alkaloids : further classified into following classes -

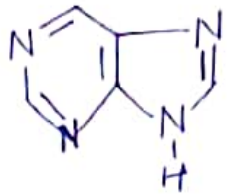
Type	Basic ring	Examples
(1) Pyrrole & Pyrrolidine alkaloids	 Pyrrole  Pyrolidine	- Nicotine - Coca - Hygrine
(2) Pyridine & piperidine alkaloids	 Pyridine  Piperidine	- Arecoline - Anabasine - lobeline.

Type	Basic ring	Example
(3) Tropane alkaloids		– Atropine – Hyoscine – Cocaine – Hyoscyamine
(4) Quinoline alkaloids		– Quinine – Quinidine – Cinchonine – Cinchonidine.
(5) Isoquinoline alkaloids		– Morphine – Codeine – Papaverine
(6) Indole alkaloids		– Ergometrine – Reserpine – Vincristine – Vinblastine
(7) Imidazole alkaloids		– Pilocarpine – Isopilocarpine

(II) Proto alkaloids :

Amino alkaloids		– Ephedrine – Colchicine – Mescaline.

(III) Pseudo alkaloids :

Type	Basic ring	Examples
Purine alkaloids		- Caffeine - Theobromine - Theophylline

Glycosides :

▶ **Definition** - The glycosides are the secondary metabolites which are obtained from plants & which on enzymatic or acid hydrolysis gives sugar & non-sugar moiety.

Glycosides $\xrightarrow{\text{Acid/Enzymatic hydrolysis}}$ Sugar (Glycone moiety) + Non-sugar (Aglycone moiety)

↓

* Gives therapeutic activity.

- Glycone moiety is the sugar part.
- Aglycone moiety is non-sugar part.

▶ **Properties** -

- They are crystalline or amorphous substances.
- They are non-volatile in nature.
- Soluble in water & also in dil. alcohol.
- Insoluble in organic solvents (like chloroform, benzene, ether, etc.)

- They are optically active & devorotatory in nature.
- They are bitter in taste.
- They are colourless compounds.

▶ Classification of glycosides :

(I) On the basis of aglycone moiety.
(II) On the basis of glycosidal linkage.

(I) On the basis of aglycone moiety :

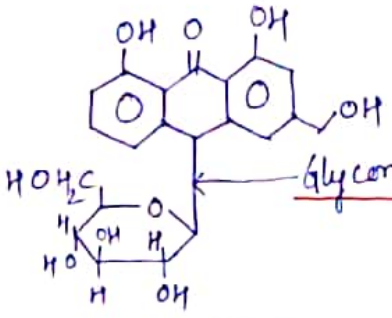
Classes	Examples
(1) Anthraquinone glycosides	Senna, Aloe, Rhubarb.
(2) Cardiac or steroidal glycosides	Digitalis, Thevetia, Squill, etc.
(3) Saponin glycosides	Liquorice, Ginseng, etc.
(4) Cyanogenetic glycosides	Bitter almond, wild cherry bark, etc.
(5) Isothiocyanate glycosides	Black mustard.
(6) Flavonoid glycoside	Ginkgo.
(7) Aldehyde glycoside	Vanilla.
(8) Phenol glycoside	Bearberry
(9) Bitter glycoside	Gentian, Picrorhiza, chiratta, etc.

(II) On the basis of glycosidal linkages :→ [Linkage between glycone & aglycone part]

The glycosides are grouped into the CH, OH, SH & NH linkages present on the aglycone moiety.

(1) C-glycosides :

- In this, sugar molecule is directly attached to C-atom of aglycone.
- Glycone + [OH + H] C – aglycone → glycone – C – aglycone
- e.g. Aloe (Aloin), Cascarosides.



Aglycone part (non-sugar part)

Glycone – C – aglycone linkage

Glycone part (Sugar part)

(Aloin)

(2) S-glycosides :

- Glycone + [OH + H] S – aglycone → glycone – S – aglycone
- e.g. Sinigrin

glycone-s-aglycone linkage

Aglycone part $[CH_2=CH-CH_2-\underset{\underset{N-OSO_3K}{\|}}{C}-S-C_6H_{11}O_5]$ Glycone part

(3). O- Glycoside - Sugar part linked to alcoholic or phenolic group of aglycone part.

- e.g. Sennoside, Glycyrrhizine, Digitoxin.
- Glycone [OH + H] O - Aglycone → Glycone - O - Aglycone

(4) N- Glycoside -

- Glycone [OH + H] N - Aglycone → Glycone - N - Aglycone
- e.g. Nucleosides (Adenine, Guanine, Uracil)

Identification test for glycosides :

(1) Test for anthraquinone glycosides -

- Borntrager test
- Modified borntrager test.

(2) Test for saponin glycosides -

- Haemolysis test
- foam test

(3) Test for steroid glycosides -

- Liebermann - Burchard test
- Salkowski test.

(4) Test for cardiac glycosides -

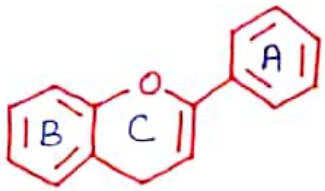
- Keller - Killiani test
- Legal test
- Baljet test

(5) Test for cyanogenetic glycoside –
- Sodium picrate test.

(6) Test for flavone glycosides –
- Ammonia test
- Shinoda test.

Flavonoids :

▶ Definition - The flavonoids are a class of secondary metabolites, which are mostly obtained from fruits & vegetables, & contains 15-C skeleton, 2 benzene rings (A & B) & a heterocyclic ring (C).



(General structure of flavonoid)

▶ Properties -
- Crystalline solid with sharp melting point.
- Soluble in water & alcohol.
- Insoluble in organic solvents.
- They are optically active.
- Consists of 15-C skeleton with 2 benzene rings linked by heterocyclic ring.

- They lowers the cholesterol level.
- They are having anti-oxidant property.

Identification test for flavonoids :

(1) Ammonia test :

Alcoholic sol^{n} of drug
↓
filter paper dipped in it
↓
now exposed to ammonia vapours.
↓
Yellow spot appears
that confirms the presence of flavonoid.

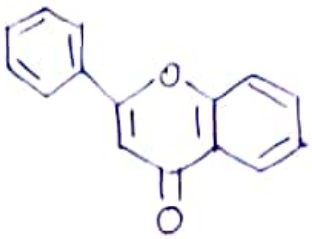
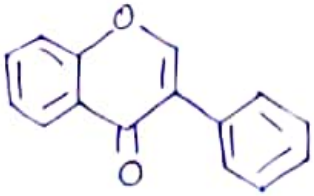
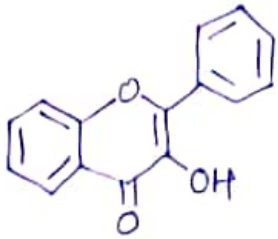
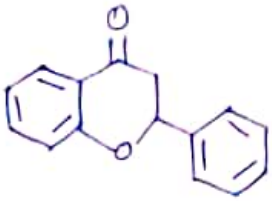
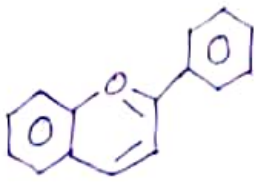
(2) Shinoda test :

Alcoholic extract of drug + Magnesium turnings
↓ mix
dil. HCl added
↓
Red colour produced.

(3) Vanillin HCl test :

Alcoholic sol^{n} of drug + vanillin HCl
↓
Pink colour produced.

Classification of flavonoids :

Class	Structure	Examples
(1) flavone		- Luteolin - Apigenin
(2) Isoflavones		- Daidzein - Genistein
(3) Flavonol		- Catechin
(4) Flavanones		- Naringenin - Hesperitin
(5) Anthocyanidins		- Cyanidin - Malvidin

Tannins :

▶ **Definition** - Tannins are the phenolic compounds, which are having astringent property. that precipitates protein.

→ They occur in both gymnosperms & angiosperms.

→ These secondary metabolites are present in solution form in the cell sap & also in vacuoles.

▶ **Properties of tannins :-**

→ forms colloidal solution with water.

→ They are non-crystalline substance.

→ Soluble in water, alcohol & in glycerine.

→ Sparingly soluble in ethyl acetate.

→ Insoluble in organic solvents

→ Molecular weight ranges from 500 to > 20000.

▶ **Biosynthesis of tannins :**

- Through Shikimic acid pathway.

▶ **Classification of tannins :**

(1) Hydrolyzable tannins.

(2) Proanthocyanidins / condensed tannins.

(1) Hydrolyzable tannins :

→ As the name indicates, these tannins are hydrolyzed by acids / enzymes.

→ The product of hydrolysis are –

- Gallic acid
- Ellagic acid

→ Examples –
- Clove
- Myrobalan
- Chestnut
- Rhubarb

(2) Condensed tannins :

→ Also known as non-hydrolyzable tannins / Proanthocyanidins.

→ They are more widely distributed than hydrolyzable tannins.

→ They are the polymers formed by the condensation of flavans.

→ examples –
- Chlorogenic acid
- Catechin

Identification test :

- Goldbeater skin test
- Phenazone test
- Catechin test
- Chlorogenic acid test
- Gelatin test
- Vanillin hydrochloric acid test

Volatile oil :

▶ **Definition :** The volatile oil is a concentrated hydrophobic liquid which are volatile in nature.

*[volatile - easily evaporated at room temperature]

→ They are also known as essential oil & ethereal oils.

→ They are generally extracted by distillation process by using steam.

→ They are used in perfumes, cosmetics, soaps & for flavouring purpose.

→ They are derived from terpenes & made up of isoprene units (C_5H_8).

▶ **Properties of volatile oils :**

→ Its density is lighter than water.

→ Having characteristic odour.

→ Having high refractive index.

→ Most of them are optically active.

→ Soluble in organic solvents.

→ Insoluble in water.

→ Volatile in nature.

Classification of volatile oils :

Type	Examples
① Alcohol volatile oils	Peppermint oil, Cardamom, Coriander, Rose oil, Sandalwood.
② Aldehyde volatile oils	Cinnamon, Lemon peel, orange peel, Citronella oil, Lemongrass, bitter almond.
③ Esfer volatile oils	Gaultheria, Lavender, mustard.
④ Hydrocarbon volatile oils.	Turpentine oil, black pepper.
⑤ Ketone volatile oils	Caraway, Spearmint, camphor, musk, civet oil.
⑥ Oxide volatile oils.	Chenopodium, Eucalyptus
⑦ Phenolic ether volatile oils	Anise, fennel, Nutmeg
⑧ Phenol volatile oil	clove, Thyme.

Identification tests for volatile oils :

① Thin section of drug + alcoholic solution of Sudan III
↓
Red colour produced (indicates presence of volatile oils)

② Thin section of drug + Tincture of alkane
↓
Red colour indicates presence of volatile oil.

Resins :

▶ Definition - Resins are the class of secondary metabolites which are sticky, flammable, organic compounds, insoluble in water & are exuded by some plants & trees.

→ Plants secrete resins for their protective benefits in response to injury.

→ It protects the plants from insects & pathogens.

▶ Properties -

- They are heavier than water.
- They are hard, transparent or translucent brittle substances.
- Soluble in organic solvents.
- Insoluble in polar solvents.
- Hydrophobic in nature.
- They are obtained by oxidation of terpenes.

▶ Classification of resins :

(1) Oleo resins - It is a combination of volatile oil & resin.
- eg. Turpentine, capsicum, Ginger, etc.

(2) Gum-resins - It is a combination of gums & resins.
- eg. Asafoetida, Myrrh

(3) Oleo-gum-resin : It is a combination of volatile oil, gum & resin.

- eg. Myrrh.

(4) Glyco-resins : These are the combined mixture of resin & glycosides.

- eg. Ipomoea, Jalap, podophyllum.

(5) Balsam : It is a resinous substance which contains cinnamic acid & benzoic acid or their esters.

- eg. Tolu balsam, Peru balsam.

▶ Identification test of resins :-

(1) Alcoholic solution of resin + few drops of $FeCl_3$ solution

↓

produces green colour.

(2) Resin powder + 10ml acetic anhydride

↓

add few drops of H_2SO_4.

↓

purple-violet colour produced.

▶ Uses :

→ They are used as adhesives.

→ In the preparation of cosmetics.

→ Having purgative, laxative & sedative properties.