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Unit IV

Traditional System of Medicines and Plant Secondary metabolites :

- Role of Pharmacognosy in Allopathy and other traditional Systems like
- Ayurveda,
- Siddha,
- Unani,
- Homeopathy &
- Chinese System of Medicine
- Alkaloids
- Glycosides
- Flavonoids
- Tannins
- Volatile Oils
- Resins

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Pharmacognosy in various system of medicine

- Role of pharmacognosy in Allopathy?

Allopathy

"Allos" + "Pathos"
(other or different) (disease or 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.

e.g. Anti-bacterials, Anti-virals, Antacids (used for acidity)

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

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

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

→ It plays a crucial role in the discovery, characterization and the production of Drug.

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→ 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

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• 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 and practices based on different cultures & are used to treat disease.

Types :

The types of ~~medicinal~~ traditional system of medicine are as follows :

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

I Ayurveda : Dhanvantari

→ It is an Indian system of medicine.

→ Ayurveda is a 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 come into existence in about 900 B.C.

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→ the 4 "vedas" written by Aryan's they are-
1 Rig veda, ऋग्वेद
2 Shan Saam veda सामवेद
3 Yajur veda & यजुर्वेद
4 Atharvveda अथर्ववेद
into that — Ayurveda is the upaveda उपवेद
part of Atharv veda.

→ Charak and Sushrut made significant contributions to Ayurveda.

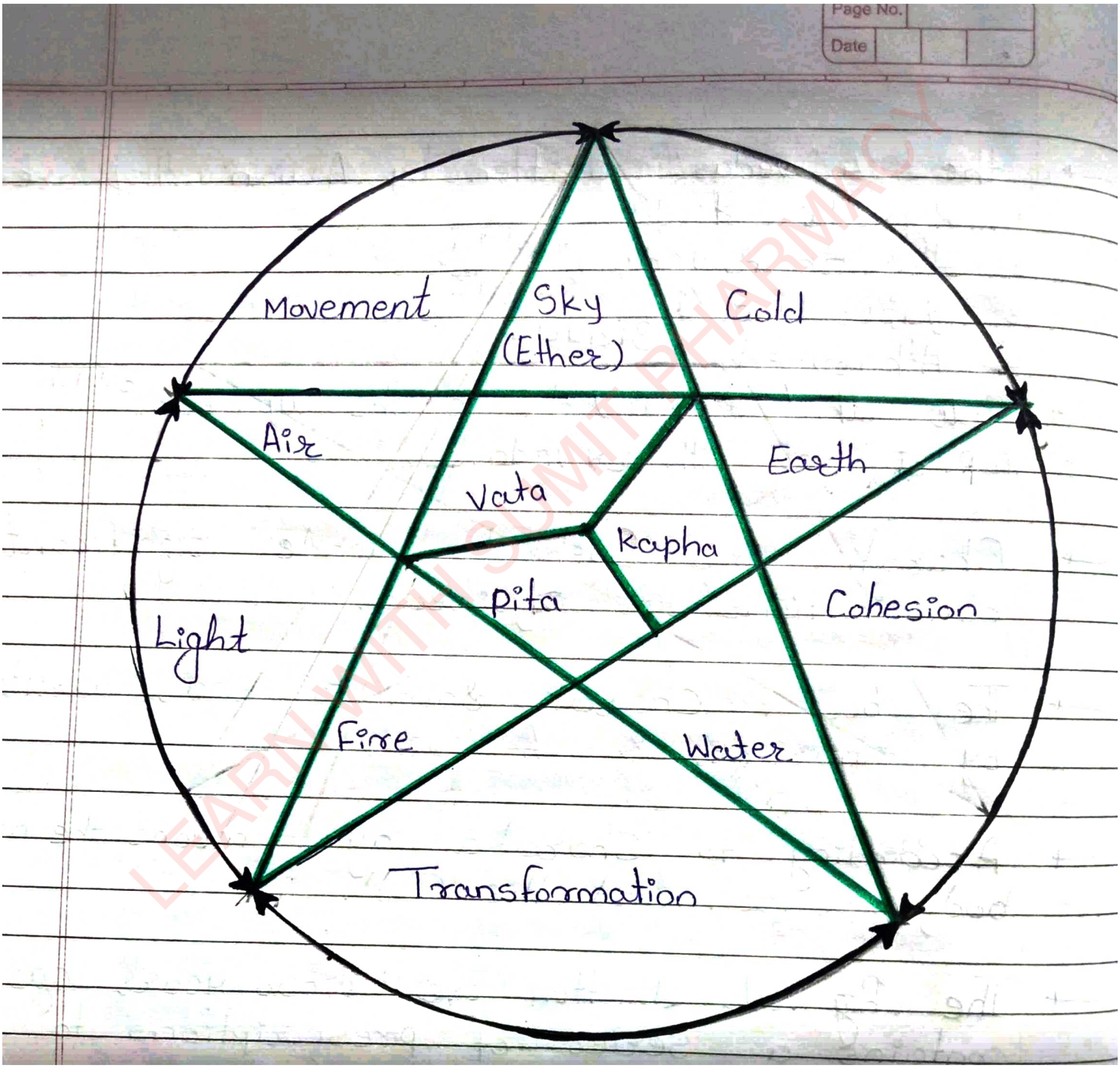
→ The book Charak Samhita was written by charaka. & he was

→ According to Charaka ayu = means the mind, body, senses and the Soul.

→ The Rig Veda (written over 6,000 years ago), contains a series of prescriptions to overcome various ailments of human.

• Basic Principles of Ayurveda: & Siddha Principles of Ayurveda

Phanchabhuta	Tridosha	Saptadhatu
Prithvi	Vata	ras
Jal	pita	rakt
Vayu	Kapha	meda
Agni	3 Killers	majja
Akash	of the life	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Movement
Sky
(Ether)
Cold
Air
Earth
Vata
Kapha
pita
Cohesion
Light
Fire
Water
Transformation
LEARN WITH SUMIT PHARMACY

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1) Panchamahabhuta Siddhanta :

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

Prithvi [Earth]
Jal [Water]
Agni [fire]
Vayu [Air]
Akash [space]

- All these together known as "Panchabhuta."
- These elements are interconnected with the human body by three "doshas".
- Everything in the universe, including food and ~~their~~ bodies were derived from these ~~bhutas~~. phanchabhutas.

2 Tridosha theory :

- There are 3 dosha in the body viz.
  - Vata (space + air)
  - pitta (fire + liquid)
  - kapha (liquid + Solid)

- According to the theory, the 5 basic elements (phanchamabhutas) exist in human body in 3 diff^ forms. together known as "Tridosha".

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- 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 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, formation of fluids, mucous, strengthening of stomach & Joints.

3 Saptadhatu theory -

The combination of "panchabhutas" 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:
1) Rasa = lymph / plasma
2) Rakta = Blood
3) meda = fat tissue
adipose

4) Massa = muscle tissue
5) Majja = Bone marrow Nervine system
6) Shukra = Semen / Reproductive tissue
7) Asthi = Bone

Panchakarma or the Therapy of Purification:

Panchakarma is recommended to purge these unwanted toxins if any present inside the body.

It is also known as cleansing process which is much more pure.

These specialized procedures consist of the following.

- Vaman: It indicates therapeutic vomiting or emesis.
- ~~Vich~~ Virechan: It indicates Purgation
- Basti: It indicates Enema
- Nasya: It indicates elimination of toxins through the nose.
- Rakta moksha: It indicates blood letting or detoxification of the blood.

Documented system Traditional system most ⇒ mp system Health care

- **Treatment in Ayurveda :**

Ayurveda has eight different techniques to diagnose illness, namely Nadi (pulse), Mootra (urine), Mala (stool), Jihva (tongue), Shabda (speech), Sparsha (touch), Druk (vision), and Akruti (appearance).

The treatments are carried out using plant based products procured from roots, leaves, fruits, bark or seeds.

- **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, stool & sweat)

- **Ayurvedic Dosage Forms and their Evaluation Methods :**

Ayurvedic dosage forms can be grouped into four types depending on their physical nature.

A) Solid dosage forms like Vatika Gutika

B) Semisolid dosage forms like Kalka, Aveleha.

C) Liquid dosage forms like Arista, Asava, Taila.

D) Powder dosage forms like Churna.

All the Ayurvedic prepⁿ consists of two words.
The first word may indicate either the disease for which the prepⁿ is used like (Jwarantaka Vati) or the property of the prepⁿ like (kaameshwara - Modaka) or the drug contain (Arjuna Aristha) or the name of some God or Saint (Narayana Taila). and the second word always indicates the type of preparations (Aristha, Vati, Taila etc.).

- **Standardization of Ayurvedic Preparations:**
  Ayurvedic medicines are manufactured under different pharmaceutical process to result in various dosage forms such as extracts, tinctures, decoctions, pills, powders, tablets, capsules, semisolid pastes, jellies, syrups etc.
  The general standardization protocols to determine the percentage of active medicaments could not be followed by Ayurvedic Herbal prepⁿ.]

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Greek.
Parcian system

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 & become popular as Arab system of medicine.

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

- In India Arabs introduced Unani system by Mughals.

- Unani considered the human body made up of 7 components.
  They are -

Arkan = Elements
Mizaj = Temperament
~~Aktath~~ Akhlat = Humours
Aaza = Organs
Arwah = Spirits
Quwa = Faculties
Afaal = Functions

A physician takes into account all these factors during diagnosis & prescribes medicine

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→ Unani medicine is based in 4 basic elements i.e. -
Earth, Air, Water & Fire
which have different temperature i.e.-
State Cold, Hot, wet & Dry

→ The body has simple & compand organs which get nourishment through 4 Humours i.e. Blood, Phlegm, yellow bile, Black bile.

Humores
Blood = Hot & wet
~~Phyleg~~
Sputum Phlegm = Cold & Hot
Sp Yellow bile = Hot & Dry
Black bile = Cold & Dry

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

→ When the equilibrium of the Humours is disturbed disease produces.

Diagnosis:
Imp The disease are mainly diagnosed with the help of pulse (Nabz), physical examination of Urine & Stool.

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Hakim = वैद्य डॉक्टर
वैद्य = medicine

Treatment :

There are six external or physical factors in Unani medicine known as asbab-e sittah-Zarooriah.

All this factors are essential in establishing a synchronized biological rhythm and thus living a balanced existence.

The six asbab-e-sittah-Zarooriah are:

- **Hawa:** It indicates air, in which the quality of the air a person breathe is is thought to have a direct effect on human temperament that gives impact on health.

- **Makool-wo-mashrooob:** It indicates food & drink, in which the nutritional value and the quality and quantity of one's food and drink are believed to ensure physical fitness by strengthening tabiyat

- **Harkat-wo-Sakoon-e-Jismiah:** It indicates exercise and response.

- **Harkat-o-sakoon nafsaniah:** The mental work and the rest.

- **Naum-o-yaqzah:** It is sleep and wakefulness in which an individual's health and alertness are understood.

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- Intebas and Istisraqh = It indicates retention and excretion which considers the metabolism of food and liquid as both affecting and being regulated by tabiyat.]

Or

- Treatment

1. Regimental therapy - Some drugless regimens are adviced for treatment of disease- 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

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Siddha System of medicine:

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

→ It is exclusively linked with Tamil culture & civilization.

→ It is prevalent in the Southern states of India, Srilanka Malaysia & Singapore.

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

- **Basic Principles:**
  the five principles of panchmabhabhuta theory are -
- Prithvi - earth (gives give shape to body including bones, tissue, etc)
- Appu - water (representing blood, secretion of glands, etc.)
- Theyu - fire (gives emotion, helps in digestion, etc)
- Vayu - air (helps in respiration)
- Akash - Space / Sky

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- Triguna: Vata, Pitta & Kapha
  - imbalance in the equilibrium of vata, Pitta & Kapha (triguna cause disease.

- Diagnosis:
  → The diagnosis of disease involve identifying its causes.

→ The physician generally involve checking of - Nadi (pulse), Dhwani (speech/voice), Twacha (skin along with tongue), Deiham (body), malam (feces/stool), mutrcan (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.

[Like cure like]

Small dose

Homeopathy system of medcine:

Homeopathy

"Homois" + "Pathos"

means like (similar) Same means ~~treatment~~ disease

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

→ This system of medicine was introduced by Dr. Samuel Hahnemann in (1755 - 1843) He was a German physician, chemist & a pharmacist based on the natural law of healing, i.e.
"Simila Similibus curenture" 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 simila → Homeopathy is based on the law "Simila Similibus curenture" which means "likes are cured by likes."

- In a simple way we can say that,

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Causing agent asel toch curing agent asel.

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 Drugs 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 cause 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.

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Chinese System of Medicine

- Chinese Medicine (CM) is a broad range of medicine practices which developed in China.

- It include various forms of i) Herbal medicine ii) Acupuncture, iii) Massage iv) Exercise v) dietary therapy.

- The medicine Practitioners used Herbal medicines and various mind and Body practices, such as acupuncture and taichi to treat or prevent health Problems.

- The tradional Chinese medicine is based on 5,000 years of practice and Experie-nces.

- This medicine system provides a complete assessment based on a unique cultural diagnostic and therapeutic approach.

- Chinese medicine System consist of three parts namely theory, treatment & Prevention.

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I. Theory	II Treatment	III Prevention
a. Yin & Yang Theory	a. Herbalism b. Acupuncture c. Moxibustion	a) Qi gong b) Tai - Ji
b. Five Elements Theory	d. Cupping e. Massage therap -y	c) Meditation

- The 1st herbal classic written in China was published in Qin Dynasty (221 - 206 A.D.) called the Agriculture Emperors Materia Medica.

- Tradional Chinese Medicine is a holistic medicine that considers the "whole" person - body, mind, diet, environment, emotions, lifestyle, and exercise.

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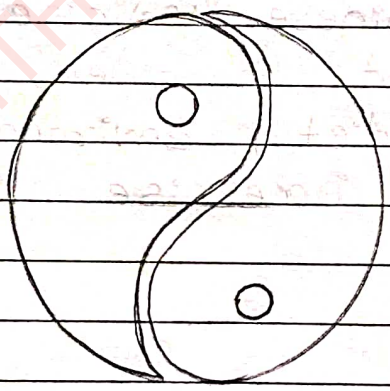
a Yin & Yang theory

- It is the 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	Yang
night	day
dark	light
Cold	Warm
negative	positive
passive	active
female	male
Solid	hollow
liver	gall bladder
Heart	Small intestine
Spleen	Stomach
lungs	large intestine
Kidney	Urinary bladder



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Yin and Yang in body

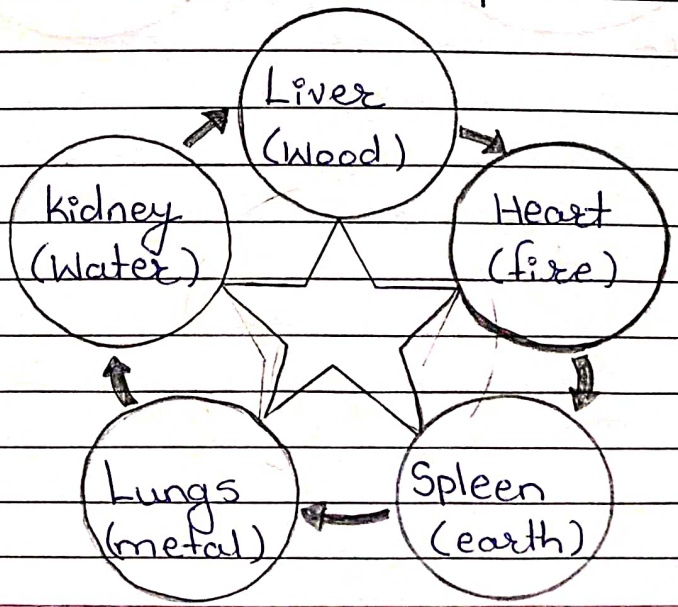
Yin	Yang
Lower body	Upper body
Chest and abdomen	Shoulders and back
Interior	Exterior
Internal organs	Bowels
fluid	Gas
Nourish	Cleanse

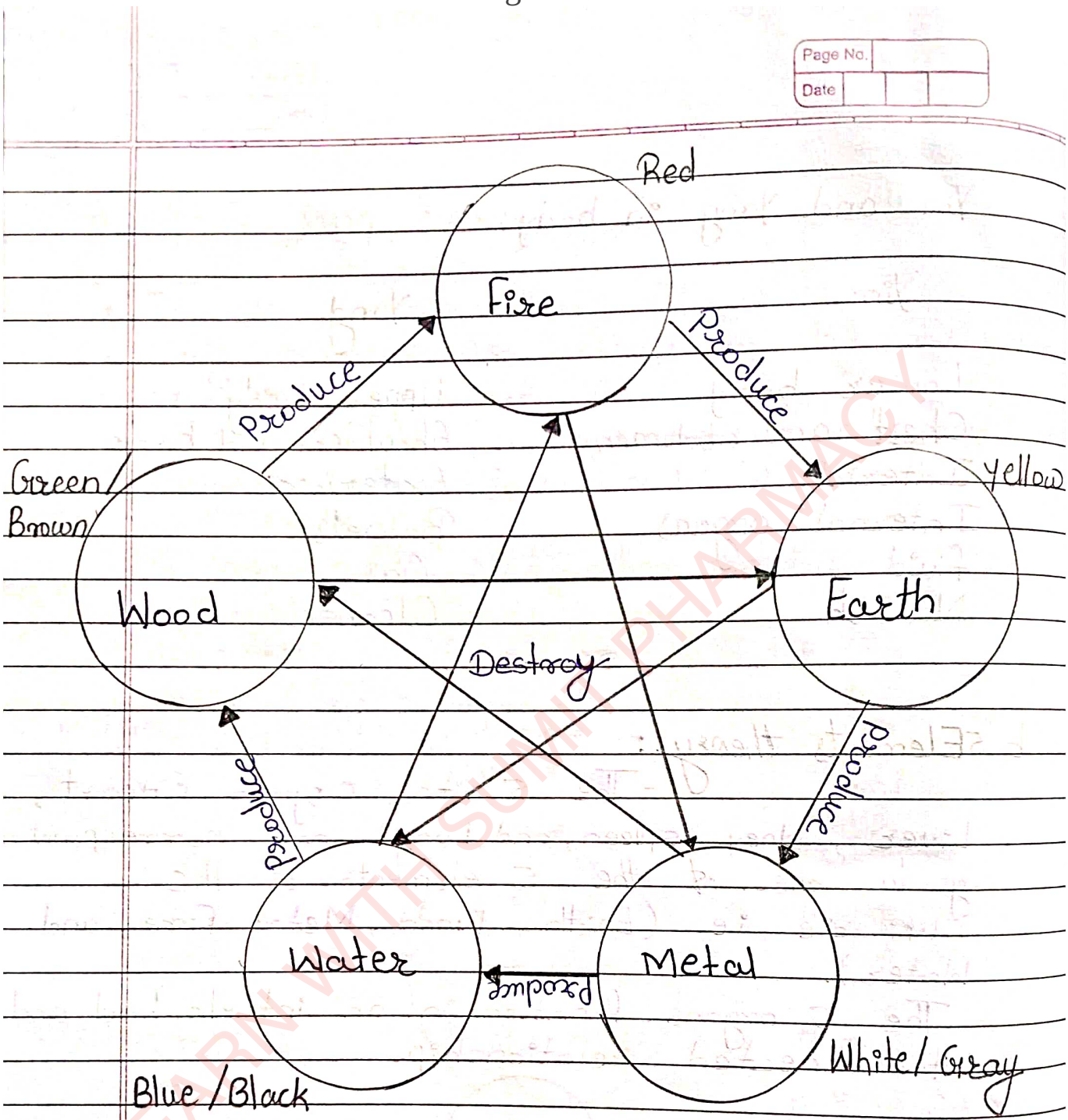
b 5Elements theory :

(An organ of the body which performs a sufficiently important function that damage to the organ can cause death.)

- The 5 vital organs (Heart, Liver, kidney, spleen, and Lung) are correspondin-g to one of the 5 elements of the universe i.e. (Earth, Wood, Metal Fire, and Water).

The 5 organs function in an interlocked and interconnected relationship.





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Principle :

The 8 principles are in this System as follows:

1 **Yin:** Yin is Cold. Yin with yang is indicates for pattern diagnosis and describes the relationship betⁿ other three pairs of principles

2 **Yang:** Yang with yin describes relationship betⁿ the other three pairs of the Principles Like heat is yang.

3 **Interior:** Interior describes diseases at manifest themselves in deep inside the body such as qi, blood, and bone marrow.

4 **Exterior:** Exterior describes diseases that manifest themselves on surface of the body ~~on~~ namely hair, skin, nails and meridians.

5 **Heat:** Heat describes the absence of cold. Its Symptoms are rapid pulse, fever, body chills, dehydration, and a sore throat when it combines with exterior pattern.

6 **Cold:** Cold describes the absence of heat.

7 **Deficiency:** It is used to describe a vacuity in qi, blood or body fluids but it depend on the relation to Interior/Exterior & Cold / Heat.

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8 Excess: Excess is classified as any disease that cannot be identified as a Deficiency pattern.

- Treatment: It aims to restore harmony betⁿ yin and yang with the patients as well as betⁿ patients to the World.
  Treatments are carried out with the help of Herbalism, Acupuncture, moxibustion, cupping and massage therapy.

- Prevention

a) Qi gong:
- Qi gong is a Chinese form of exercise.
- It regulates the mind and breathing to promote the flow of energy.

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

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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.

Example :- Volatile oils - Resins
- Alkaloids - Tannins
- Glycosides - Flavonoids.

1 Alkaloids :

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

- Alkaloids are a large and complex group of highly diverse natural products.

- The name "alkaloids" derived from Alkali was introduced in 1819 by the German Chemist Carl Friedrich Meissner.

- They have low molecular weight

- ~~About 25% alkal higher plants produce alkaloids pro from~~
~~It is highly poisonous but in small quantity~~ it shows therapeutic activity.

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- alkaloids are produce from various parts of plants such as all parts Dhatura, Bark of Cinchona, Seed Nux vomica, Roots Aconite, Leaves Tobacco, Fruits Black pepper, Latex Opium etc.

- As per Ladenburg in 1880, Alkaloid is defined as: Plant derived compounds having a nitrogen based heterocyclic ring within their molecules with basic nature

- They are highly poisonous but in low dose give therapeutic activities.

- Physical Properties:

1. Alkaloids are crystalline in nature, but few are amorphous solid e.g. Emetine
2. Alkaloids are insoluble in water but soluble in most of the organic solvent.
3. Caffeine, cocaine, codeine, nicotine are slightly soluble in water
4. Alkaloids are optically active. Most of Alkaloids are laevo-rotatory but few are dextro-rotatory e.g. Coniine and few are even optically inactive, viz papaverine
5. They have molecular weight in bet° 100-900.

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6 Alkaloids are ~~optically~~ bitter in taste.

7 They are Sometime non-volatile liquids (Ex: Hyoscine, pilocarpine), Sometime Volatile liquids (Ex: Nicotine, Coniine).

8 They are generally colourless.

- Chemical Properties:

1 Alkaloids are naturally occuring organic compound.

2 They mostly contain basic lone pair electron on nitrogen. Hence they are basic in nature

3 Alkaloids react with acids to form salts. this salts are freely soluble in water.

4 They form precipitate with heavy metal iodides.

5 They contain one or more nitrogen in their structure and forms primary, secondary, Tertiary and quaternary ~~amin~~ ammonium salt.

6 They decomposed by heat but some are undergoes for sublimation (e.g. Caffeine, Strychnine).

7 They decomposed at temperature above 70°C for long time.

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Classification:

Alkaloids

- Based on Chemical nature and Structure
- Based on Pharmacological action
- Based on Biosynthesis Pathway
- Based on Taxonomical origin

Based on Chemical Nature & Structure

Based on ring Structure

- Monocyclic (contain single unfused ring.) e.g. Nicotine
- Bicyclic (1,4 N bridge cycloheptane) Atropine, Cocaine
- Polycyclic (having 2 or more than 2 rings.) Strychnine, Morphine, Codeine
- Heterocyclic Pyridine, Quinoline, Indol
- Non-Heterocyclic Steroidal, Tropolone

(O, N, S are the Hetero Atom)

Based on natur/ basicity

- Primary amine 1N [$R\text{-}NH_2$ eg. Norephedrine]
- Secondary amine N_2 [$R_2\text{-}NH$ e.g. Ephedrine]
- Tertiary amine [$R_3\text{-}N$ e.g. Atropine]
- Quaternary ammonium salt [$R_4\text{-}N$ d-Tubocurarine]

Based on Hegnauer's Classification

- True alkaloids derived from directly amino acid. contain
- Proto alkaloids Do not have N in hetro-cyclic ring. eg Ephedrine
- Pseudo alkaloids They do not derived from amino acid contain Nitrogen in hetrocyclic ring e.g. caffeine, Coniine Capsaicin

True alkaloids no contain Nitrogen in Heterocyclic ring e.g. Quinine, morphine,

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Activity	Plant Name	Family	Constituents
Narcotic analgesic	Opium (Papaver Somniferum)	Papaveraceae	Morphine, Codeine.
CNS stimulant	Tea (Thea Sinensis)	Theaceae	Caffeine
	Nux Vomica (Strychnos nuxvomica)	Loganaceae	Strychnine
Anticancer	Taxol (Taxus brevifolia)	Taxaceae	Paclitaxel
	Vinca (catharanthus roseus)	Apocynaceae	Vincrystine, Vinblastine
Antihypertensive	Rauwolfia (Rauwolfia Serpentina)	Apocynaceae	Reserpine
Bronchodilator	Ephedra (Epehedra gerardiana)	Ephedraceae	Ephedrine
	Vasaka (Adhatoda Vasica)	Acanthaceae	Vasicinone
Smooth muscle relaxant	Belladona (Atropa belladona)	Solanaceae	Atropine
	Opium (papaver Somnife-rum)	Papaveraceae	Papaverine
Antitussive	Opium (papaver Somnife-rum)	Papaveraceae	Codeine
Mydriatics	Belladona (Atropa belladona)	Solanaceae	Atropine

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Myotics	Pilocarpus (Pilocarpus Jaborandi)	Rutaceae	Pilocarpine
Antiparasitics	Cinchona	Rubiaceae	Quinine
	Ipecac	Rubiaceae	Emetine
Local anaesthetic	Coca (Erythroxylum Coca)	Erythroxylaceae	Cocaine
~~Anti~~ Antiarrythmic	Cinchona (Cinchona calaisaya)	Rubiaceae	Quinidine

- Classification on the basis on Biosynthesis Pathway:

Pathway	Groups of Alkaloid	Examples
Ornithine derived	Pyrrolidine	Nicotine
	Tropane	Atropine, Cocaine
Lysine derived	Piperidine and Pyridine	Coniine, Lobaline
	Quinazolidine	Lupinine
Tyrosine derived	Isoquinoline	Morphine, codeine, Berbe
	Amino	Colchicine
Tryptophan derived	Indole	Ergot, Vincristine (strychine), Reserpine
	Quinoline	Cinchona, Quinine, Quinidine
Histidine derived	Imidazole	Pilocarpine
Phenylalanine derived	Amino Alkaloid	Ephedrine

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- **Based on Taxonomical Origin:**

Alkaloids are classified on the basis of the biological source. Ex. Quinine from bark of Cinchona calisaya, Rauwolfia from roots of Rauwolfia serpentina, Morphine from dried latex of papaver somniferum etc.

Functions =

- They are as end products of the metabolism or waste product.

- They are storage reservoir of nitrogen for protein synthesis

- They act as protective agent for the plants against attack by predators.

- They act as plants stimulants and regulators in activities such as growth, metabolism and reproduction.

- They act as a detoxification agent, which renders harmless certain substances, accumulation of which might cause damage to the plant.

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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 potassium iodide solution
   - It gives red colour precipitate.

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

Stas Otto method is used for extract the Alkaloids into aqueous and organic.

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Section B = a

a ------- ?

Glycosides:

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

It is the compound C, H, O in their structure which contain complex organic

Glycosides —Acid/enzymatic hydrolysis→ Sugar + Non Sugar (Helpful)

Sugar (Glycone moiety) → Does not show Therapeutics activity.

Non Sugar (Aglycone moiety) → Shows / Gives therapeutic activity

- Glycoside is an organic compound contains C, H and O in their structure.
- They are natural carbohydrate substance.
- They also known as internal acetate
- Sugar and non-sugar parts are linked with glycosidic bridge, known as glycosidic linkage
- This linkage is breaks by acid or enzyme hydrolysis and both glycone and genin parts are separated.

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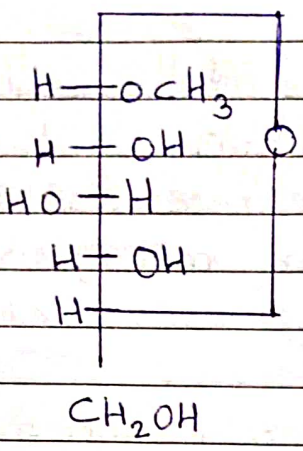
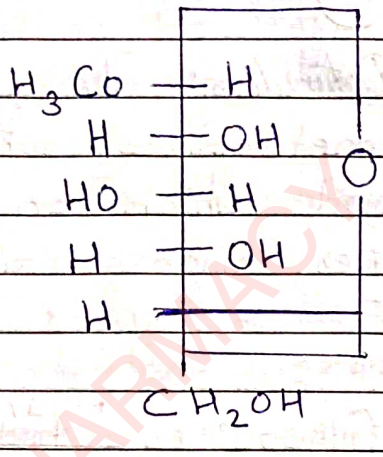


CH_2OH

Methyl-Alpha-D Glucoside



CH_2OH

Methyl-Beta-D-Glucoside

- Separation technique of Glycoside

Glycoside $\xrightarrow[+\text{ Dil. HCL}]{\text{Hydrolysis}}$ Glycone + Aglycone + HCl

Neutrilization by using alkali

(water + Glycone) + Aglyco-ne $\xleftarrow{\text{Filtration}}$ Glycone + Aglycone + Salt + H_2O

chloroform

(Water + Glycone) + (chloroform + Aglycone)

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Properties -

- They are crystalline or amorphous substances.
- They are non-volatile in nature.
- Soluble in water (glycon) & also in dil. alcohol. (aglycon)
- Insoluble in organic solvents (like chloroform, benzene, ether, etc.
- They are optically active & levorotatory in nature.
- They are bitter in taste.
- They are colourless compounds. but some are coloured.
- They are odourless.
- After hydrolysis
- **Classification:**

Glycosides are the larger group of natural secondary metabolites obtained from many higher plants. They are broadly classified into several groups.

They are as follows

Glycosides.

Based on Linkage	Based on nature of glycone	Based on nature of aglycone	Based on therapeutic activity.

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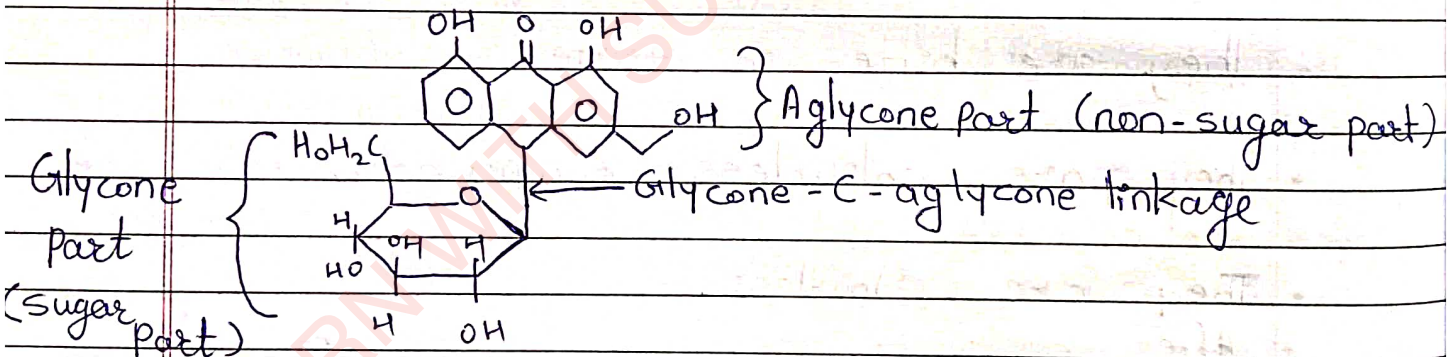
I On the basis of glycosidal linkage : [linkage bet^n glycone & aglycone part]

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.



(Aloin)

2. S-glycoside

Glycone - [OH + H]S - aglycone → glycone - S - aglycone.

e.g. Sinigrin

glycone - S - aglycone linkage.

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

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

- e.g. Sennoside, Glycyrrhizine, Digitoxin.
- Glycone - OH + HO - Aglycone ⟶ Glycone-O-Aglycone

4 N-Glycoside -

- Glycone - OH + HN - Aglycone ⟶ Glycone-N-Aglycone

e.g. Nucleosides (Adenine, Guanine, Cytosine).

5 C & O Glycoside -

II On the basis of aglycone moiety:

	Classes	Examples
1	Anthraquinone glycosides	Senna, Aloe, Rhubarb.
2	Cardiac or steroidal glycosides	Digitalis, Thevetia, Squill, etc
	Digitoxigenin	
3	Saponin glycosides	Liquorice, Ginseng, etc.
4	Cyanogenetic glycosides	Bitter almond, wild cherry bark etc.
5	Isothiocynate glycoside -S	Black musterd.

6	flavonoid glycoside	Ginkgo
7	Aldehyde glycoside	Vanilla
8	Phenol glycoside	Bery berry
9	Bitter glycoside	Gentian, Picrrohiza, Chirata, etc

III On the basis of Sugar moiety:

a Glucoside : Sugar portion is glucose.

b Rhamnoside : Sugar portion is rhamnose.

c Pentoside : sugar portion is pentose.

d Fructoside sugar portion is fructose

e Arabinoside sugar portion is arabinose

IV Based on Therapeutic Nature Glycoside:

1 Cardiac glycoside : Ex. Digitalis, Squill.

2 Laxative glycoside : Ex. Senna, Aloe

3 Anti-ulcer glycoside : Ex Liquorice

4 Bitter glycoside : Ex Chirata, Quassia wood.

5 Local irritant : Ex Black and white mustard.

General chemical test
Test A = Fehling soln produce Red colour
Test B = reagent used.

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6 Analgesic and Antipyretic : ex Salix bark

▶ Identification test for Glycosides :

1 Test for anthraquinone glycosides -
- Borntrager test
- Modified borntrager test

2 Test for saponine glycosides -
- Haemolysis test
- foam test / froth

3 Test for steroid glycosides -
- ~~Libermann~~ Libermann - Burchard test
- Salkowski test

4 Test for cardiac Glycosides -
- Keller - killiani test
- Keddle's test
- Legal test
- Baljet test

5 Test for cyanogenetic glycoside -
- Sodium picrate test.
- mercuric Acetate test

6 Test for flavour glycosides -
- Ammonium test
- Shinoda test

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- functions of Glycoside

In plants:

- They Convert toxic materials into non-toxic form.
- They are source of energy by storage of sugar.
- They regulate the growth.
- They store harmful plant products such as phenol.
- They ~~sto.~~ transfer water insoluble substances by using monosaccharide.

In Animals:

- Glycoside have many group of chemical nature due to that they are used as many therapeutic activities.
- Phenolic glycosides are used as urinary antiseptic effects.
- Alcohol glycosides are used as analgesic, antipyretic, anti-inflammatory action
- Cardiac glycosides are used for heart disease.
- Thiol glycosides are used as pain killer
- Anthraquinone glycosides are used as laxative action.

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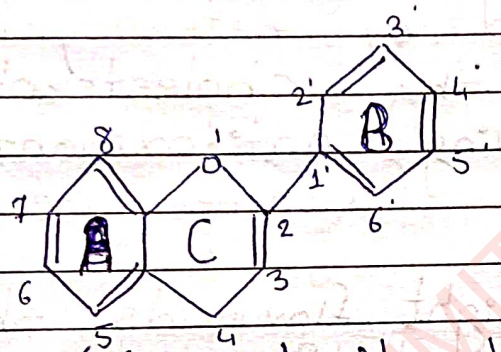
Flavonoids :

- Defination: 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~~ :

- Flavonoids are polyphenolic compound and vastly available in maximum plant species.
- They are generally yellow coloured pigments.
- They are larger group of glycoside.
- They may be described as a series of $C_6-C_3-C_6$ compounds.
- They are largely found in Polygonaceae, Rutaceae, fabaceae and Rosaceae families.

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▶ 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.
- Flavanones and flavonones are unstable compounds.
- Under the UV light flavonoids shows fluorescence of diff^ colours (yellow, orange, brown, red).

• Classification

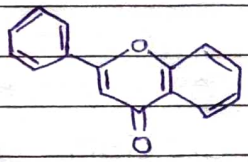
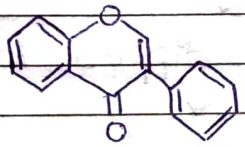
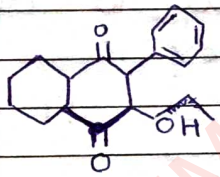
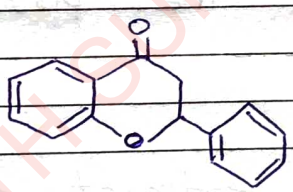
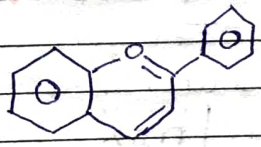
Flavonoids

Based on Groups

- Flavone
- Flavonol
- Flavanol
- Flavanone

Based on place of B-ring location

- True flavonoid
- Iso flavonoid
- Neo flavonoid

	Class	Structure	Examples
1	Flavone		- Luteolin - Aplgenin
2	Isoflavones		- Diadzein - Genistein
3	Flavonol		- Catechin
4	Flavanones		- Naringenin - Hesperitin
5	Anthocyanidin-s		- Cyanadin - Malvidin

➤ Function

- They act as powerful antioxidant like quercetin, xanthohumol, Iso xanthohumol, etc.
- They control the plant growth.
- They inhibit and activate plant enzyme
- They having a role in the biochemistry of Reproduction.
- They have fungicidal properties
- They protect the plant from parasites attack.

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▶ Identification test for flavonoids :

1 Ammonia test :

Alcoholic solution of drug
↓
filter paper dipped in it.
↓
Now exposed to ammonia vapours
↓
Yellow spot appears

That conforms 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

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Tannins:

▸ Definition - Tannins are the phenolic compound -s, which are having astringent property, that precipitates Protein.

- They occur in both gymnosperm & angiosperm.
- These secondary metabolites are present in solution form in the cell sap & also in vacuoles.
- First time the term tannin is coined by Seguin in 1796.

▸ Properties:

- Tannins are dark brown or reddish brown.
- They are amorphous, non-crystalline in nature.
- They are available in the form of powder, flakes or spongy mass.
- They form colloidal sol^n with water.
- They form protective coating in place of wound injury.
- They have astringent in taste.
- Sparingly soluble in ethyl acetate
- Insoluble in Organic Solvent.
- molecular weight ranges from 500 to >2000

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- Classification

Tannins

True Tannins
High molecular weight compound

Pseudo Tannins
Low molecular weight compound.

Hydrolysable Tannins (pyrogallol)

Condensed Tannins (Catechol)

Complex 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 tannines / proanthocyanidins.

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- They are more widely distributed than hydrolyzable tannins.

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

- examples- Chlorogenic acid
  Catechin

3 Complex tannins:

They are group of tannins that biosynthesized from Both Hydrolysable tannins and condensed tannins.

Ex. Acutissimin.

- It is prepared by reacting a substance called Vescalagin, extracted from Oak wood, with a flavanoid from grapes called catechin

Examples =
- Tea Sinensis (Tea)
- Quercus infectoria (Oak)
- Hamamelis Virginiana
- Chestnuts.

II Pseudo Tannins:

They are the sub-groups of tannins b'coz they do not response Gold beater's skin test.

- They are simple phenolic compounds.
- mainly found in dead tissues and dying cells of plant.

Ex. • Coffee, • Nux Vomica, Catechi-ns, Ipecacuanhic acid in Ipecac, etc

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Identification test :

- Gold beater Skin test
- Phenazone test
- Catechin test
- Chlorogenic acid test
- Gelatin test
- Vanillin hydrochloric acid test.

Functions :

- medicinally they are used as antidotes, antiseptics, astringent properties.
- They used in ink manufacturing Industries.
- They used as Preservatives.
- They used for vegetable tanning.
- They used to inhibit lipid peroxidation and plasmin.
- They used for lipolysis in fat cells.

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Volatile oil :

Defination : The volatile oil is a concent-rated hydrophobic liquid which are volatile in nature.

* [Volatile = Easily evaporated at room temp.]

→ 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 oil :

1) It's density is lighter than water.
2) Having characteristic odour.
3) Having high refractive Index.
4) Most of them are optically active.
5) Soluble in organic solvents.
6) Insoluble in water
7) Volatile in nature.

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▸ Classification of Volatile Oils :

Type	Examples
1) Alcohol volatile oils	peppermint oil, Cardamam, Coriander, Rose oil, Sandalwood.
2) Aldehyde Volatile oils	Cinnamon, Lemon peel, orange peel, Citronella oil, Lemon grass, bitter almond.
3 Ester Volatile oils	Gaultheria, Lavender, mustard.
4 Hydrocarbon Volatile oils.	Turpentine oil, black pepp-er.
5 Ketone Volatile oils	Caraway, spermint, campho-r, musk, civet oil
6 Oxide Volatile oils	~~Cluno~~ Chenopodium, Eucalyptus
7 Phenolic ether Volatile oils.	Anise, fennel, Nutmeg
8 Phenol Volatile oil	Clove, Thyme

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Identification tests for Volatile oils:

i Thin section of drug + Alcoholic sol^{n} of Sudan III
↓
Red Colour produced (indicates presence of Volatile oils)

ii Thin section of drug + Tincture of alkane
↓
Red colour indicates the presence of Volatile oil.

Essential oil:

Plants that contains aromatic liquids (derived from shrubs, flowers, trees, roots, bushes, herbs, and seeds) are known as essential oils.

Applications of Essential oils

1) Cosmetics and Toiletries
- (perfumes, spray, soap, detergent, creams, shaving preparations, powders, etc.)

2) Dental Preparation
- (Toothpaste, powder, Mouthwash, antiseptic

3) Medical
- (pharmaceutical prep^{ns})

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4 food Beverages
- (Liquor flavouring agents)

5 Tobacco Industry
- (chewing tobacco, Cigarates)

6 Adhesives
- (paste, glu, cements)

7 Paper and Printing Industry
- (carbon paper, ribbon ink, Wrappers, Writing papers)

8 Textile Industry
- (finishing deodorant)

9 Petroleum Industry
- (Oil, wax, lubricant)

10 Paint Industry
— (paint, varnish, diluents)

11 Motor Industry
(Polish, Plastic goods)

12 Insecticide Industry
(Spray, repellants)

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Resins :

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

→ Plant Secrete resins for their protective benefits in response to injury.

→ It protects the plants from insects & pathogens.

→ Resins are the amorphous products of complex chemical nature.

→ They are simply extractions of plant material, are taken either from the whole plants or from specific parts of the plant. eg. (Bark of trees, flowers of herbs, and buds of shrubs) etc.

→ Commercial resins are collected from fossil material.

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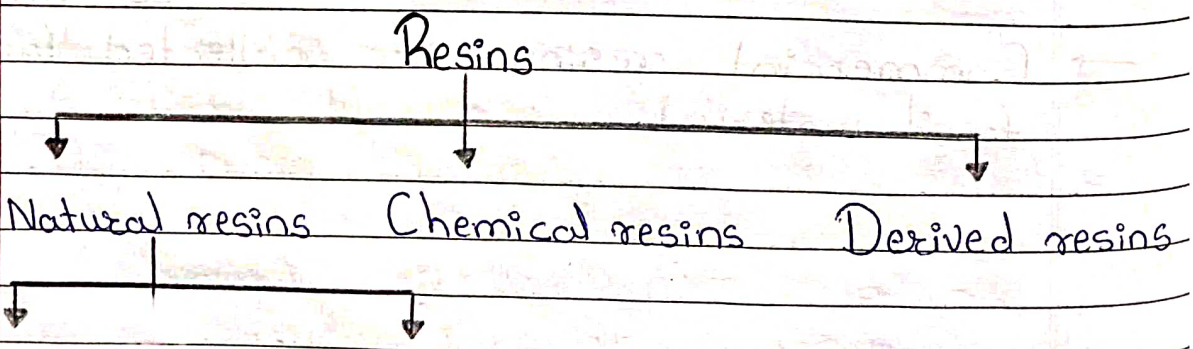
▶ Properties :

1) Resins are heavier than water.
2) They are hard, transparent or translucent brittle substances.
3) Soluble in organic solvents.
4) Insoluble in polar solvents and water.
5) Hydrophobic in nature.
6) They are obtained by oxidation of terpens.
7) They are generally produced by woody plants.
8) When heated, they form smoky flame.
9) Resins are mixture of essential oils.
10) They are oxygenated products of terpene and carboxylic acid.
11) Chemically they contain esters, acids and alcohols.
12) Some resins are chemically inert, known as resenes.
13) Resins generally form soap when boiled with ~~water~~ alkali.
14) Sp. gravity is 0.90 - 1.25.

▶ Source of Resins :



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Classification of Resins.

Resins

Taxonomical (As per botanical origin)	Predominating chemical Constituents	Portion of the main Constituents.
Ex: Berberidaceae resins,	Acid resins	Resins
	Ester resins	Oleoresins
	Alcohol resins	Oleo gum resins
	Glycoside resins	Balsams
	Resenes resins	

1. Oleo resins = It is a combination of volatile oil & resin.
   - e.g. Turpentine, Capsicum, Ginger, etc.
2. Gum resins = It is combination of gums & resins.
   e.g. Asafoetida, Myrrh
3. Oleo-gum-resin = It is a combination of volatile oil, gum & resin.
   e.g. Myrrh.

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4 Glyco-resins: These are the combined mixture of resin & glycosides.
e.g. Ipomoea, Jalap, Podophyclum.

5 Balsam: It is a resinous substances which contains cinnamic acid & benzoic acid or ~~there~~ their esters.
e.g. Tolu balsam, peru balsam.

➤ Identification test of resins:-

1) Alcoholic solution of resin + few drops of $FeCl_3$ sol^n.
↓
Produce Green colour

2) Resin Powder + 10 ml acetic anhydride
↓
add few drops of H_2SO_4
↓
Purple-Violet colour produced

➤ Uses:

→ They are used as adhesives.
→ In the prep^n of Cosmetics
→ Having purgative, laxative & sedative properties.
→ Broadly resins are used as paint, varnishes, perfumery preparations and various pharmaceutical aids.