Shree H.N.Shukla institute of Pharmaceutical Education & Research Rajkot

B.Pharm

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Subject Name: Pharmacognosy and Phytochemistry I
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Chapter 4

Pharmacognosy in various systems of medicine:

Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

Introduction to secondary metabolites:

Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

Introduction

Medicinal plants, since times immemorial, have been used in virtually all cultures as a source of medicine. It is used the world over but in particularly relied on a developing countries. The WHO estimates that about 80% of people living in developing countries rely almost exclusively on traditional medicines for their primary health care. Interest in medicinal plants as a re-emerging health aid has been fuelled by the rising costs of prescription drugs in the maintenance of personal health and well-being, and the bio prospecting of new plant-derived drugs. Medicinal plants are an integral component of ethno veterinary medicine. Farmers and pastoralists in several countries use medicinal plants in the maintenance and conservation of the healthcare of livestock. About 90% of the marketed plant drugs are obtained from wild resources. Today, traditional drugs are used as a starting point for the development of novelties in drugs.

The practice of traditional medicine is widespread in China, India, Japan, Pakistan, Sri Lanka and Thailand. The Indian traditional medicines can be classified into two groups. In the first group are the medicinal preparations belonging to the Ayurvedic, Siddha, & the Unani systems while the folk medicines belong to the second group.

Traditional system in world mainly is

1. **Ayurveda system of medicine**
2. **Siddha system of medicine**
3. **Unani system of medicine**
4. **Chinese medicine**
5. **Greek medicine system**
6. **Homeopathic system of medicine**

Ayurveda

Origin

Ayurveda originated in India and is one of the oldest medical systems in the world. The word Ayurveda means science of life. It is the combination of two words – Ayu (Life) & Veda (Knowledge or wisdom). It is said to have been taught by the creator, Brahma, to Daksha Prajapati, who taught it in turn to the divine twins called the Ashwinikumars. Ashwinikumars were the heavenly healers who taught this science to Indra. When mankind started suffering from various diseases, the wise men like Bharadwaja learnt from Indra the knowledge of medicine. References

of illness, cures and other health-related issues are found in vedas, the oldest recorded compendium of wisdom on the earth (6000 B.C.). Earliest reference to such medicinal plants is to be found in the Rig Veda and Atharva Veda dating back to second millennium B.C. Actually between 30-50% of medicines described in Ayurveda are not known or lost forever. The main source of knowledge of Ayurveda today is two sets of texts each consisting of three books viz.

- **Brihattrayi** i.e., the three major classics
    1. **Caraka Samhita** (1500-1000 B.C.) It is first recorded treatise fully devoted to the concepts and practice of Ayurveda and consists of eight sections divided into 150 chapters and lists 341 plants and plant products for use in medicine. Its hallmark is Kayachikitsa (therapeutic).
    2. **Susruta Samhita** (1500-1000 B.C.) It has special emphasis on surgery and consists of six sections covering 186 chapters and describes 395 medicinal plants, 57 drugs of animal origin and 64 minerals and metals as therapeutic agents.
    3. **Vagbhata** (600 A.D.)
- **Laghuttrayi** i.e., the three minor classics
    1. **Madhava Nidana** (700 A.D.) (It consisting of 1552 verses in 69 chapters)
    2. **Sarangdhara Samhita** (1300 A.D) (It consists of 3 parts, 32 chapters and 2500 verses)
    3. **Bhava Prakasha** (1600 A.D.) (It has 3 sections containing 10,831 verses and nearly 470 medicinal plants are described.)

Basic Principles

Panchamahabhootas

The Universe, according to Ayurveda is composed of five basic elements – **Panchamahabhootas** viz. Earth (*Prithvi),* Water *(Jala)*, Fire *(Agni),* Air *(Vayu),* and Space (*Akash).* As the human body is similarly constituted, there is a fundamental similarity between universe and man. A healthy balance between the microcosm (human being) and the macrocosm (universe) is the basis of health.

Tridosha

Ayurveda is based on the theory of **three humours (*Tridosha)*** i.e. Vata, Pitta and Kapha.

1. **Vatta** is composed of space & air. It is concerned with the physical and mental activities which are activating or dynamic in nature. Vatta represents nervous system or nadichakra as per ayurvedic terminology.
2. **Pitta** is composed of liquid & energy. It indicates biochemical/energy systems. It dominates nutritional & thermogenetic activities & also includes hormonal digestive & metabolic systems.
3. **Kapha** is composed of solid & liquid. It indicates various tissues & organ. It is concerned with integration of structural elements of the body.

Saptadhatu

The **seven body tissues** i.e., fluid components of the body (*Rasa),* Blood *(Rakta),* muscle tissue *(Mamsa)*, adipose tissue(*Medas*), bone tissue(*Asthi),* bone marrow (*Majja*) and reproductive elements (*Sukra)*. The essence of *saptadhatu* called *Ojas* is responsible for immunity and strength.

Trimalas

The **three bio-wastes (*Trimalas)*** i.e. Urine (*Mootra),* Faeces (*Pureesha) and* Sweat *(Sweda)*.

So in ayurveda, its represent **Tridosha – Dhatu – mala siddhanta**. If they are in balance, healthy condition and imbalance called as illness.

Diagnosis

The diagnosis in Ayurveda is based on a two-fold approach to diagnostics viz. (1) Examination of the patient i.e., *Rogi-pareeksha*; and (2) Examination of the disease i.e., *Roga-pareeksha*. The imbalance of Tridosha to cause diseases or disorders is termed samprapti. Ayurveda elaborates a six stage process for diagnosis called Kriya (action) Kal (time).

1. **Accumulation (Sanchaya):** Weak digestive power and excess of dosha is responsible for such a condition. Here toxins (ama) produced by improper digestion collects in the gastrointestinal tract. Toxins resulting from a kapha imbalance accumulate in the stomach, those associated with a pitta imbalance collects in the small intestine and that related to vata malfunction amasses in the colon. Due to the presence of one of these toxins, mild and ill-defined symptoms may show. We should recognize and eliminate the cause instead of ignoring or suppressing it.

2. **Aggravation (Prokapa):** the accumulated, stagnant doshas are now 'excited' by factors as Ahara, Vihara and seasons. The toxins amass in such degree to get provoked in the site of production in the GI tract.

3. **Spread (Prasara):** in this stage, the toxins accumulated in the GI tract start overflowing. Generally, up to this stage the damage is entirely reversible and restoration of Doshic balance can be achieved with proper measures. Or there may be spontaneous Prashama (remission) influenced by seasonal changes. Thus there is sanchaya of pitta in rainy season, prokapa in fall and prasara in early winter.

4. **Augmentation (Sthana Samshraya):** Overflowing toxins migrate, entering and taking refuge in localized, weak or defective Dhatus thereby leading to malfunction and structural damage. It is from here that specific degenerating disease and susceptibilities to serious infections begin.

5. **Symptom Manifestation (Vyakti):** Differentiated symptoms first begin to appear from the location.

6. **Complication/Differentiation (Bheda):** The disease having taken years or even decades to reach this final stage becomes chronic. Offers detailed understanding of the group of

symptoms thereby making clear nature of disease. Might act as predisposing factors for the spread of other diseases.

Panchsheel or Principles of Ayurvedic therapeutics or pharmacological

Ayurvedic therapeutics is based on five pharmacological principles (Panchsheel of the drug). These principles are:

1. **Rasa:** It gives not only taste of drug (Dravya) but may indicate properties and action of drug. Six types of rasa are sweet (pitta increasing, kapha decreasing), sour (pitta increasing), saline (kapha and pitta increasing), pungent (vatta, pitta increasing), bitter (vaata increasing) and astringent (vaata increasing).

2. **Guna:** There are certain physical attributes of drug which supersedes its rasa. There are in total two pairs of guna. Each pair includes activity reciprocal to each other.
    a. Guru and Laghu
    b. Sukshma and Sthula
    c. Sthira and Sara
    d. Snigdha and Rooksha
    e. Sandra and Dense
    f. Sheetal and Ushna
    g. Manda and Tikshna
    h. Mridu and Kathina
    i. Visuda and Picula
    j. Slakshan and Khara
3. **Virya:** It indicates potency of drug. It shows two intrinsic property, sheeta virya (kapha group) and Ushna virya (pitta group)
4. **Vipaka:** The end product of all digestive transformation is vipaka also called nishthapak. Types of vipaka are Madhur, Amla, Katu which effect Kapha, Pitta and Vata respectively. Differs from awasthapal (stage of digestion), prapk (initial transformation) stage of digestion, awasthapal prapk (initial transformation).
5. **Prabhava:** Indicates specific power of drug. Rasa, guna, virya, vipaka of various drugs may be similar but differ in prabhava. This is due to specific chemical composition of drug and site of action of drug.

Branches of Ayurveda

Ayurveda is also known as Ashtanga Veda (science with eight branches) because it is classified into eight different branches. Ayurveda provides comprehensive preventive, promotive and curative aspects of health through eight major clinical specialties.

1. Kayachikitsa (Internal Medicine)
2. Bala chikitsa (Paediatrics)

3. Graha chikitsa - Bhoota Vidya (Psychiatry)
4. Urdhvanga chikitsa (Treatment of eyes, ears, nose, throat and head)
5. Shalya chikitsa (Surgery)
6. Damstra chikitsa - Agada tantra (Toxicology)
7. Jara chikitsa-Rasayana (Gerentorology)
8. Vrishya chikitsa - vajikarana (Aphrodisiacs)

Therapies and Regimen

The rational Ayurveda treatment is carried out in four parts. They are (1) *Dosha* pacifying therapy (*Samsamana*), and (2) Bio-cleansing therapy (*Samsodhana* or Panchakarma) (3) Avoiding causative factors (*Nidana Parivarjana*) and (4) Dietetics (*Pathya Vyavastha*).

Panchkarma

Panchkarma theory means that cleaning or purification of body.

Day	Name	Method
1	Snehan	Oil Bath
2	Swedan	Steam Bath
3	Shirodhara	Mental relaxation
4	Takradhara	With oil using butter milk or used for skin diseases
5	Shirobasti	Tying band around the head and then pouring medication oil into it
6	Netrabasti	For Eye same above procedure
7	Katibasti	Use of waist-lumbar spondylitis

In Panchkarma therapy required cleaning of body which is done by pre-operative cleaning in 7 days. After these 7 days, Panchkarma therapy is applied. The pre-operative cleaning in 7 days are followings.

After this 7 days treatment Panchkarma is done. Panchakarma means the "five therapies"/five therapeutic means of eliminating toxins from the body are *Vaman* (emesis), *Virechan* (purgation), *Nasya* (nasal insufflation), *Basti* (enema) and *Raktamoskshana* (blood-letting by using leech and different instruments).

1. **Vaman:** means that emesis. Treatment of chronic disorders like Asthma, sinusitis, skin disease etc.
2. **Virechan:** means loose motion. It was doing with the help of basti (enema).
3. **Basti:** means enema.
4. **Nasya:** pour oil in nose. E.g. castor oil or ghee (cow) pouring in nose of children in extreme cold. This procedure is for disease of ear, nose and throat.
5. **Raktmoksha:** entire blood which is contaminated is replaced/removed. This is used for skin disease.

This series of five therapies help remove deep-rooted stress and illness causing toxins from the body while balancing the *doshas* (energies that govern all biological functions).

Kshara Sautra

A procedure using medicated thread is a unique minimally invasive para-surgical measure being successfully practiced as a promising therapy for ano-rectal disorders since time immortal by Indian surgeons, widely cited in ancient medical literatures for its safety and efficacy. This technique was practiced by Sushruta (1000-600 B.C.), the famed ancient Indian surgeon. This technique was revived, developed and standardized in the early seventies by eminent scientists.

Rasayana

Literally, *rasayana* means the augmentation of *rasa*, the vital fluid produced by the digestion of food. It is the *rasa* flowing in the body that sustains life. *Rasayana* in ayurveda is the method of treatment through which the *rasa* is maintained in the body. This is a specialized branch of clinical medicine meant for preventing the effect of ageing and to improve memory, intelligence, and complexion, sensory and motor functions. Numerous rasayana medicines are reported to possess diversified actions like immune-enhancement, free radical scavenging, adaptogenic or anti-stress and nutritive effects.

Unani medicine

Unani medicine (Unani-tibb) is one of the oldest medicines in the world. It is still practiced in all parts of the world but mostly it is practiced in India. Unani medicine is an ancient form of medicine first developed by the Greeks in 460 BC. It then spread throughout the Roman Empire by notable scientists such as Galen (201 AD). With the fall of the Roman Empire came the decline in Unani medicine. It re-emerged later in Iran, where Muslim physicians translated the Unani texts into Arabic. While in the Middle East, Muslim physicians begin to refine and further develop Unani medicine. India was then introduced to Unani medicine in the 13th century through the numerous Muslim invasions. Today, Unani medicine is practiced mainly in India by Muslim physicians (called "Hakim").

Principles of Unani system

The Unani medicine is divided into two parts

- Theory
- Practice

Theory is divided into three parts:

- The theory of Naturals
- The theory of Causes
- The theory of Signs

There are seven things which are natural, they are

- Elements (arkan)
- Temperaments (mizaj)
- Humors (akhlat)
- Organs (aza)
- Forces (arwah)

- Actions (afa'al)
- Spirits (quva)

The loss of the any one of these components may lead to diseases or even death of the individual.
There are four basic elements on which unani system of medicine depends:

- Fire (aag)
- Air (hawa)
- Water (pani)
- Earth (mitti)

The force of fire is hot and dry. The force of air is hot and wet. The force of water is cold and wet. The force of earth is cold and dry.

Temperaments

There are nine kinds of temperaments in which eight are non-equable and one is equable. Of the eight non-equable, four are single: hot, cold, wet, and dry; and four are compound: hot and dry, hot and wet, cold and dry, and cold and wet. Unani hakims can classify patients according to their temperament. Hot temperament individuals are physically strong, have good digestion, and a quick temper. Moist temperament individuals are obese and excessively salivate. Cold and dry temperament individuals have a good appetite and prominent blood vessels.

Humoral Theory

There are four kinds of humors:

- Blood (dam)
- Phlegm (balgham)
- Yellow bile (safra)
- Black bile (sauda)

The force of blood is hot and wet. The force of phlegm is cold and wet. The force of yellow bile is hot and dry. The force of black bile is cold and dry.

Organs

There are four kinds of organs: Some are principal organs, comparable to elements and metals; these are four: the brain, the heart, the liver, and the two testicles (in the female, the two ovaries).

Diagnosis

The diagnosis of diseases in Unani system of medicine is through examination of pulse (nabz), urine (baul) and stool (baraz).

Remedies Preparations

Remedies are often provided by the practitioner or are obtained from a specialized herbalist.

Treatments

The Hakims (Unani physicians) believe in four lines of treatment: Regimental therapy (Haj bit tadbeer) - this includes

1. **Exercise**- regular and correct massage, steam baths, fomentation, emesis, purging and enema.
2. **Diet-o-therapy**_(hajbilghiza) - this covers a normal diet, liquid diet for flushing out the system, and a semi-solid diet that will allow the digestive system a rest without resorting to the comparative extreme of a liquid diet.
3. **Pharmacotherapy** (haj bid dawa) - the prescription of medicines derived from animal, mineral or plant sources. Most of the drugs are of herbal origin. These are prepared such that there are no side- effects.
4. **Surgery (**jarahat) - this includes venesection, cupping, leeching and cauterization.

Siddha system

Origin

The origin of Siddha System is attributed to Lord Siva himself. Lord Siva is considered as the first Siddha. He has preached to his consort Parvati and in turn she handed down to Nandi and him to the Siddhas. He taught Sage Agathiya and Agasthya to Pulathiyar, Bogar, Theraiyar and others of Pothigai Hills. In India we had two distinct cultures one is Vedic and the other one is tantric. Those sages were called as Siddhars and the medical system profounder by them is called as Siddha system of medicine. Though the creation of this system is ascribed to Lord Siva, the creator of the universe, the sage Agasthiya is considered as a father figure of this medical system. The Siddha system of medicine is the oldest and was derived from the vegetable kingdom. The word Siddha comes from Siddhi which means an object to be attained or perfection of heavenly bliss. Siddhi generally refers to the Ashtama Siddh, i.e., the eight supernatural powers. Those who attained or achieved these powers are known as the siddhars. The following is the list of eighteen Siddhas according to one recession:

1. Nandi
2. Agasthiyar
3. Thirumular
4. Punnakkeesar
5. Pulasthiyar
6. Poonaikannar
7. Idaikadar
8. Bogar
9. Pulikai Isar
10. Karuvurar
11. Konkanavar
12. Kalangi
13. Sattainathar

14. Azhuganni
15. Agappai
16. Pambatti
17. Theraiyar
18. Kudhambai

There are authors of Siddha treatises like Sattaimuni, Yugimuni, Macha Muni, Kakabusundar etc., whose works are available in parts at the presence day and are being used.

Fundamental Principles

- Five elemental theories
- Three humors
- Seven dhatus
- Fourteen natural urges

Five elemental theories: Siddha Vaidya physicians believed in three major life governing forces or doshas. These doshas—namely vatta, pitta and kapha—stand for some fundamental aspects of life: form, energy and movement. Siddha Vaidya considers that the body is constituted mostly of the earth element and it is located in the space element. The elements of water, fire and air help it to function. These three elements that confer functions to the body are called Tri Dosham or three humors (three functional elements). In general, the health and illness of the body is evaluated as an imbalance of just these three elements of water, fire, and air.

Dosha Corresponding element

- Vatta (Air)
- Pitta (Fire)
- Kapha (Water)

The normal order of vatta, pitta and kappa is the proportion of 4:2:1 respectively. The doshas are further classified into sub - doshas. Vatta is divided into ten, Pitta is divided into five, and Kapha is divided into five sub-doshas. When diseases are classified, the dosha that predominantly is involved may be mentioned. Therefore, a particular disorder can be a Vatta type, a Pitta type, a Kapha type, or a blend of all three. Siddhars described 96 principles as the constituents of human being. They include physical, physiological, mental and intellectual components of a person.

Relative Proportion of the Five Elements

Element Quality / In Nature In the body in plants

1. Earth Form / Solid Limbs Roots
2. Water (Kapha) Motion / Liquid Abdomen Stem
3. Fire (Pitta) Heat / Plasma Chest Leaves
4. Air (Vatta) Breath / Gas Neck Flowers
5. Space Location / Head Seeds Emptiness

Therefore, Siddha Vaidya, based in the natural world, employs corresponding aspects of plants; for example, in human beings who have too much of the fire element, balance can come from eating the leaves of a specific plant.

Sapta Dathu or the Seven Tissue Types

Siddha Vaidya recognizes seven types of essential tissue in the body which support all other tissues in its life and functions. These tissue types are called the seven dathus, which are the following:

1. Rasa (lymph)
2. Kurudhi (blood)
3. Tasai (muscle)
4. Kozhuppu (adipose tissue)
5. Elumbu (bone)
6. Majjai (marrow)
7. Sukkilam and Artavam

Therapies and regimen

The process of the diagnosis of the diseases are based on three diagnostic parameters

1. Poriyalarithal (Inspection through five sensual organs)
2. Pulanalarithal (Inspection through five senses)
3. Vinathal (Interrogation)

There are eight fold methodologies by which the exact diseases are diagnosed and examines the pulse, tongue, complexion, speech, eyes, and palpation in a patient and also examines the urine and stools. This approach is collectively known as eight types of examinations.

1. Naa
2. Niram
3. Mozhi
4. Vizhi
5. Mazham
6. Moothiram
7. Naadi
8. Sparisam

The other factors like the constitution or seasonal factors, co-morbidity also play a vital role in assessing the prognosis and the treatment of the diseases.

Treatment aspects

Optimal results can be obtained if all of following factors are taken in to account in prescribing the treatments.

1. Classification of disease principles (Influencing factors in treatment of individuals)
2. Edaphic factors (Science of soil)

3. Biotic factors (Constitutional)
4. Seasonal factors
5. Diet, Vehicle and adjuvant
6. Surgical methods like incision, excision, heat application, bloodletting and leech application etc.
7. Physiotherapy
8. Using medicines from herbs, minerals

Varmam (Varmas or the Energy Points)

The other basic ingredient of importance in an over view of Siddha philosophy are the Varmas. Varmas are energy points in the body mainly located on the skin and adjacent tissue. Injury to these points is one of the causes of illness in the body according to Siddha sages.

Nadi

The electricity flowing through the individual Nadi is of very low voltage. Given the normal resistance of the skin, it would be impossible for the current to travel very far without the loss of signal strength. Here the Varmas come into play by acting as signal boosting stations! The functions of Varmas go much further than just step up transmitters. Varmas act as routing stations as well. There are ten major energy trunks (Dasa nadi) and 72,000 minor energy channels (Nadi) that link every single one of the body's many trillions of cells. The energy that flows through these channels is focused in certain areas of the body. There are 108 of these Varmas where energy is focused. Disruption of energy flow in these Nadi and Varmas can lead to illness.

Branches of Siddha

1.	Maruthuvam	General medicine
2.	Pillai pini	Pediatrics
3.	Mananalam	Mental diseases
4.	Thalai noi maruthuvam	Ear, Nose, throat and Head diseases
5.	Aruvai maruthuvam	Surgery
6.	Nanju maruthuvam	Toxicology
7.	Kayakalpam	Geriatrics
8.	Sirappu maruthuvam	Special Medicine like Varmam

Homoeopathic system of medicine

In comparison to other traditional systems of medicine, Homeopathy is a newer one and has been developed in the eighteenth century by Samuel Hahnemann- a German physician and chemist. He is proposed that the cause of disease itself can be used for its treatment. Hahnemann put forth the law of similar which says that like cures like. He succeeded in getting relevant results with a large

number of extracts prepared from plants, animals and minerals. He complied all these observations in what is called 'The Organon of Medicine'. The regulation and prevalence of homeopathy is highly variable from country to country. There are no specific legal regulations concerning its use in some countries, while in others licenses or degrees are required. Homeopathic practitioners rely on two types of reference when prescribing remedies: Materia medica and repertories. A homeopathic Materia medica is a collection of "drug pictures", organized alphabetically by remedy that describes the symptom patterns associated with individual remedies. A homeopathic repertory is an index of disease symptoms that lists remedies associated with specific symptoms. Homeopathy uses many plant, animal, mineral and synthetic substance in its remedies.

Basic Principles

Homeopathy is a vitalist philosophy which interprets diseases and sickness as caused by disturbances in a hypothetical vital force or life force. Homeopathy maintains that the vital force has the ability to react and adapt to internal and external causes, which homeopaths refer to as the law of susceptibility. The law of susceptibility implies that a negative state of mind that can attract hypothetical disease entitites called miasms to invade the body and produce symptoms of diseases. Hahnemann conceived of the law of similars, means that "let like be cured by like" as a fundamental healing principle. It is based on that a substance that in large doses will produce symptoms of a specific disease will, in extremely small doses, cure it.

Dilution Theory

During the treatment, the drug extracts and extremely diluted, which is believed to cause potentiation and enhancement of curative effect. The drugs are extracted in the form of mother tincture, which is further diluted in terms of decimal or centesimal potencies. Therefore, Homeopathic remedies are prepared by serial dilution with shaking by forceful striking, which homeopaths term **succession**, after each dilution under the assumption that this increases the effect. Homeopaths call this process **potentization**. In producing remedies for diseases, homeopaths use a process called dynamization or potentization whereby a substance is diluted with alcohol or distilled water and then vigorously shaken by ten hard strikes against an elastic body in a process called **succession**. Hahnemann believed that the process of succession activated the vital energy of the diluted substance. Three logarithmic potency scales are in regular use in homeopathy. Hahnemann created the centesimal or C scale, diluting a substance by a factor of 100 at each stage. The centesimal scale was favored by Hahnemann for most of his life. A 2C dilution requires a substance to be diluted to one part in one hundred, and then some of that diluted solution diluted by a further factor of one hundred. This works out to one part of the original substance in 10,000 parts of the solution. A 6C dilution repeats this process six times, ending up with the original material diluted by a factor 10^{12} (one part in one trillion) (1/1,000,000,000,000). Higher dilutions is described as having a higher potency, and more dilute substances are considered by homeopaths to be stronger and deeper acting remedies. Hahnemann advocated 30C dilutions for most purposes (dilution factor of 10^{60}). In Hahnemann's time it was reasonable to assume that remedies could be diluted indefinitely, as the concept of the atom or molecule as

the smallest possible unit of a chemical substance was just beginning to be recognized. The greatest dilution that is reasonably likely to contain one molecule of the original substance is 12C.

Treatment

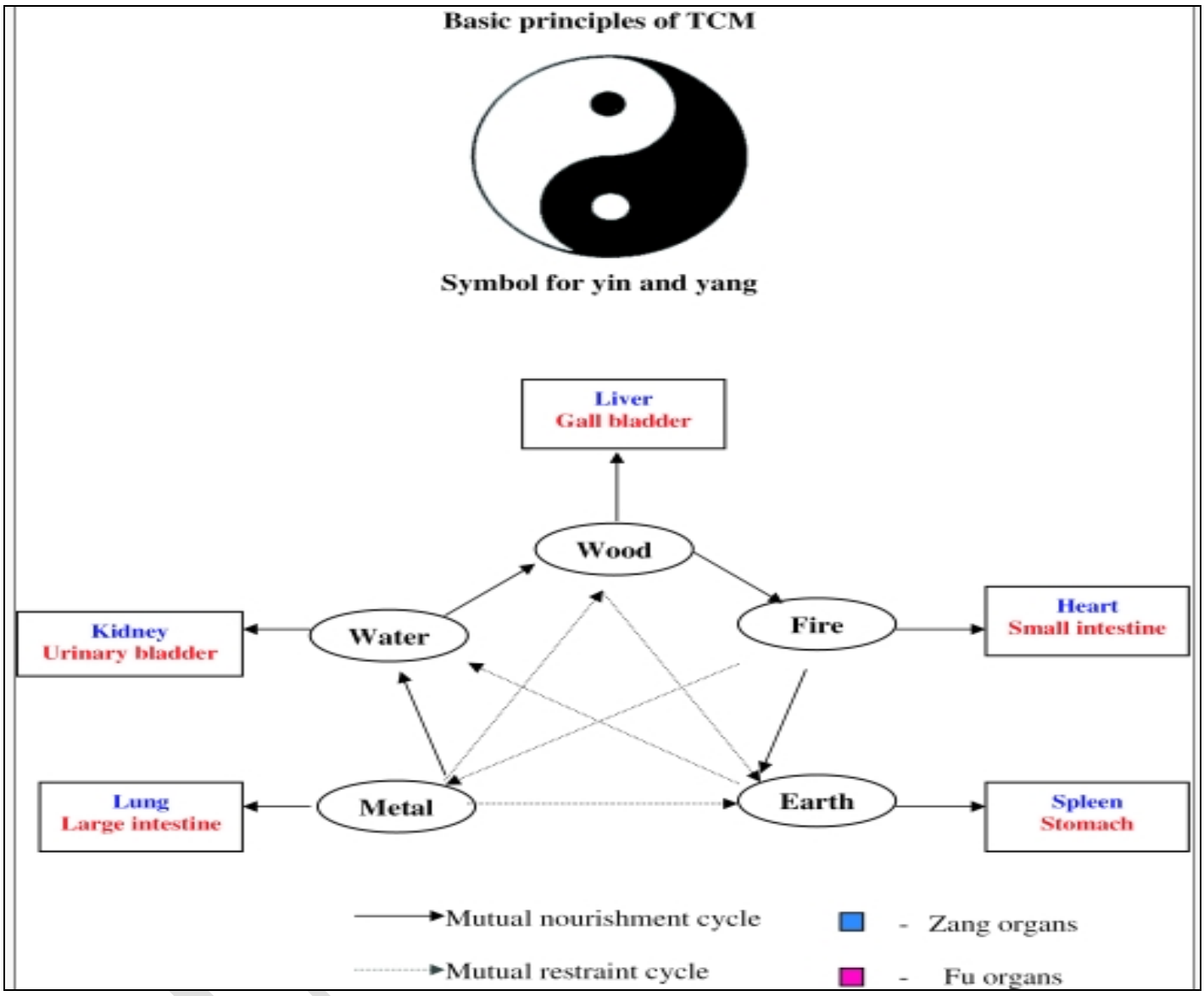
In homoeopathic system, the drug treatment is not specified, but the choice of drug depends on symptoms and the clinical condition of the patient. This is based on the concept of proving and prover. In a healthy person called prover, the symptoms created by different doses of drug extract are noted which is called proving and it specifically considers physical, mental and emotional changes of the prover. Consequently, these symptoms are compared with patient symptoms and accordingly, same type of extract is given for treatment.

Chinese medicine

Basic Concept

Chinese philosophy state that the body is the delicate balance of two polar opposite antagonistic and complementary forces i.e. Yin and Yang. Yin represents 'Earth' is dark and passive while Yang represents 'Heaven' and correspond with sun which is light and active and moon is dark and inactive. One of the major assumptions of the Chinese concept is that diseased condition is due to an internal imbalance of Yin and Yang. Therefore disease can be treated by correcting the imbalance to bring the body back to healthy state. This system believes in five body constituents, five body networks and five body climates. **Five body constituents** involves

1. **Qi (chi) or spirit** –animating force which makes us move, think and work.
2. **Moisture** – protects and lubricates tissue.
3. **Blood** –foundation for bones, nerves, mussels, other organs.
4. **Psyche (shen)-**
5. **Soma or essence (jing**)-reproductive expression of the individuals.



Five body networks are

1. Liver
2. Heart
3. Lungs
4. Kidney
5. Spleen

Five body climates are considered to be

1. **Wind**-cause unsteady movements.
2. **Dampness**-cause oedema.
3. **Dryness**-cause cracking of mucous membrane.
4. **Heat**-may inflame tissue
5. **Cold**-retards circulation.

As the natural forces cause's disturbances in the nature, these five body climates can derange the balance within human body.

Diagnosis

Practitioners of TCM assess a person's overall healthy by checking the pulsation of each wrist and by observing the color of body, face and tongue. The pulse-examination is essentially of diagnostic value. It provide clue as regards the part of body in which the disease has originated and also it is the Yin and Yang that is disturbed.

Treatment

Goal – to adjust and harmonize Yin and Yang. Five ways for treatment

1. Acupuncture
2. Herbal medicine
3. Diet
4. Exercise
5. Massage

Active constituents and secondary metabolites

Active constituents are defined as the constituents or compounds which act on body or a tissue and have pharmacological actions or response on them. Inert constituents are the chemical compounds which do not possess any definite therapeutic value as such but are useful as an adjunct either in the formulation of a drug or in injury. Active constituents are the chemical substances of organic nature which are formed in plants through the activity of their individual cells. The process by which the plants are able to convert the simple chemical substances into complex organic compounds with the help of enzymes is known as biosynthesis. The medicinal value of any plant drug, however, depends on the nature of the chemical constituent present in it and is referred to as active principle. The isolated chemical constituents of plants thus have various applications in medicine.

No.	Primary metabolites	Secondary metabolites
1	They are present in all plants.	They are not present in all plants.
2	They are essential for the life of plants.	They are specific to certain plants or family.
3	They are produced by photosynthesis and biogenesis pathway	They are produced due to metabolism of the primary metabolites.
4	They are considered as the lifesaving useful products	They are considered as the waste product of the metabolism.
5	e.g. carbohydrates, lipids, proteins, fixed oils	e.g. Alkaloids, glycosides, tannins, flavonoids, volatile oils etc.

The main groups of secondary metabolites constituents are:

1. Alkaloids
2. Volatile oils
3. Terpenoids
4. Glycosides
5. Tannins & phenolic compounds
6. Resins & its combinations
7. Derived Carbohydrates
8. Lipids

Alkaloids

Definition:

Alkaloids are basic, nitrogen containing heterocyclic compounds of plant origin having marked physiological actions in humans and animals. Most alkaloids are colourless crystalline solids. They are slightly soluble in water but soluble in organic solvents while alkaloidal salts are soluble in water & insoluble in organic solvents. Most of alkaloids are optically active & very bitter in taste. Alkaloids are the reserve substances with an ability to supply nitrogen and other required elements to plants. Generally, three types of alkaloids.

1. **True alkaloids**: These are alkaloids which contain "N" atom in the heterocyclic ring system and are biosynthesized from amino acids. E.g. trophane, quinolone, imidazole and pyridine
2. **Proto alkaloids:** These are alkaloids which contain "N" atom not in the heterocyclic ring system but present in the side chain and derived from amino acids. E.g. colchicine, ephedrine
3. **Pseudo alkaloids:** They are known as false alkaloids. They have heterocyclic ring with nitrogen but not derived from amino acids. E.g. caffeine, acotinine, solasodine .

Classification

No.	Types of alkaloids	Sources	Constituents
1	Tropane	Datura, Belladonna	Atropine, Cocaine
2	Quinoline	Cinchona bark	Quinine
3	Isoquinoline	Opium	Morphine, codeine
4	Indole	Vinca, Rauwolfia	Vinblastine, Reserpine
5	Imidazole	Pilocarpus	Pilocarpine
6	Purine	Tea, Coffee	Caffeine
7	Pyridine	Tobacco, Lobelia	Nicotine, Arecoline
8	Steroidal	Kurchi	Conessine
9	Amino alkaloids	Ephedra	Ephedrine
10	Pyrrole and pyrrolidine		Hygrine

Properties:-

1. They are generally colorless but Berberine alkaloids are yellow in color.
2. They are solid, crystalline in nature. (e.g. Quinine sulphate) but some of them are liquid in nature. (e.g. Conine, Nicotine)
3. The alkaloidal bases are soluble in nonpolar solvent like benzene, acetone, chloroform but they are insoluble in polar solvent like water whereas alkaloidal salt are soluble in polar solvent and they are insoluble in non polar solvent.
4. Most of the alkaloids are optically active but leavo rotating (l form) of alkaloid is physiologically more active.
5. They are bitter in test.

Chemical test

Extract 0.5g of drug with methanol and perform following tests.

1. Take 0.5ml extract; add 0.1ml **Mayer's** reagent white to buff precipitated is obtained.
2. Take 0.5ml extract; add 0.1ml **Dragendroff's** reagent orange brown precipitated is obtained.
3. Take 0.5ml extract; add 0.1ml **Hager's** reagent yellow precipitated is obtained.
4. Take 0.5ml extract; add 0.1ml **Wagner's** reagent reddish brown precipitated is obtained.

Xanthine alkaloids do not give these precipitates. They are detected by **murexide** test. Take 0.5 ml extract in evaporating dish with very small amount of potassium chlorate and a drop of HCl, evaporating to dryness and exposing the residue to ammonia vapour. A purple colour is produced with Xanthine alkaloid

Glycosides

Definition:

Glycosides are the substances which on hydrolysis yield one or more sugars along with a non-sugar compound. Glycosides are non-reducing, non-nitrogenous organic compound which are found mainly in plant and rarely in animals. These Glycosides undergoes hydrolysis in the presence of acid, enzyme or moisture and produce Glycone moiety (sugar) and Aglycone moieties (non-sugar).

Glycosides $\longrightarrow$ Glycone+ Aglycone

Glycoside is a general term covering a wide range of substances whose common feature is that they are non-reducing, non-nitrogenous organic compounds generally found in plants; rarely in animals and consist of at least one sugar molecule and one non-sugar molecule via glycosidic bond. The sugar component is known as the glycone and the non-sugar component is called the aglycone or genin. The linkage between the sugar and non-sugar compound is known as glycosidic linkage. Glycosides are crystalline, amorphous, or solid compounds. They are optically active and generally leavo-rotatory. They are soluble in water & alcohol while aglycone is soluble in organic solvents and insoluble in water. Glycosides serve as a sugar reserve or storage for the plants. They can be hydrolyzed by moisture, enzymes, acids or alkalis to aglycone and glycone.

Classification of glycoside is carried out by various methods. Here chemical classification is described.

Classification

No.	Types of Volatile oils	Sources	Constituents
1	Anthraquinone	Senna, Aloe	Sennosides, Emodin
2	Cardio active	Digitalis, Thevetia	Digitoxin, Digoxin
3	Saponin	Dioscorea, Liquorice	Diosgenin, Glycyrrhizin
4	Flavonoid	Rutin, Liquorice	Quercetin, Liquiritigenin
5	Coumarin	Psoralea, Ammi	Psoralen, Scopoletin
6	Cyanogenetic	Bitter almond	Amygdalin
7	Isothiocynate	Mustard	Sinigrin
8	Lignin	Podophyllum	Podophyllotoxin
9	Miscellaneous	Saffron, Gentian, Chirata	Gensiobiose

Properties:-

1. Glycosides are crystalline, amorphous or solid compound.
2. They are colorless but some of them are colored.

e.g. - (a) Anthracene Glycosides- red color

(b) Flavonides- yellow

3. They are optically active and generally l form is more active.
4. Glycosides are soluble in water and alcohol whereas aglycone moieties are soluble in organic solvent such as acetone, benzene, chloroform etc.

Chemical Test: Glycosides are generally detected by molisch's test. Glycosides are identified by following test A & B.

Test A: Extract 200mg of drug with 5ml of dilute sulphuric acid by warming on a water bath. Filter it. Then neutralize the acid extract with 5% solution of sodium hydroxide. Add 0.1ml of Fehling A and B until it becomes alkaline and heat on a water bath for 2 minutes. Note the quantity of red precipitate formed.

Test B: extract 200mg of the drug using 5ml of water by warming on a water bath. Filter it. Add 0.1ml of Fehling A and B until it becomes alkaline and heat on a water bath for 2 minutes. Note the quantity of red precipitate formed. Compare the quantity of precipitate formed in Test B with that of formed in Test A. If the precipitate in Test A is greater than in Test B then glycoside may be present because Test A contain sugars plus acid hydrolysis of any glycoside in the crude drug while Test B contain only sugars.

Specific chemical test

Specific glycosides like anthraquinones detected by borntrager's test and modified borntrager's test; cardenolides detected by legat's test, keller killiani test, kedde's test and Raymond's test; cynogenetic detected by sodium picrate test, cuprocynate test; steroidal detected by libermann buchard's test; Saponin detected by foam test and haemolytic test; flavonoids detected by shinoda test

Sr. No.	Glycone/Aglycone	Name of the chemical test	Example of Drugs
1.	Anthraquinone glycosides.	(i) Micro sublimation test (ii) Bornstrager test (iii) Modified Bornstrager test	Senna, Aloe Rhubarb, Cascara
2.	Cardiac glycosides. a) Cardinolide b) Bufadinolide c) Desoxy sugar in cardiac glycosides.	(i) Baljet test (ii) Legal's test Liebermann Buchard Test Kellar Kilani Test	Digitalis, Thevetia , Verium Scilla All
3.	Cynogenetic glycosides.	Sodium picrate test (Grignard's test or reaction)	Bitter almond, Wild cherry bark Linseed
4.	Saponins	(i) Foam production (ii) Haemolytic zone test (iii) Liebermann test	Liquorice, Gokhru Satavari Quallaria bark
5.	Flavonoids	Shinoda's test	Rye
6.	Coumarins	Fluorescence test in alkali media	Psorelea
7.	Reducing Sugar	Fehling's test	Agar, Acacia, Tragacanth, Honey

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Flavonoids

The Flavonoids are a large group of natural products, which are widespread in higher plants but also found in some lower plants, including algae. Most flavonoids are yellow compounds, and contribute to the yellow colour of the flowers and fruits, where they are usually present as glycosides. There are over 2000 glycosides of the flavones and flavonols isolated to date. Both O-

and C-glycosides are common in plant flavonoids; e.g., rutin is an O-glycoside, whereas isovitexin is a C-glycoside.

Most flavonoids are potent antioxidant compounds. Several flavonoids possess anti-inflammatory, antihepatotoxic, antitumour, antimicrobial and antiviral properties. The antioxidant properties of flavonoids present in fresh fruits and vegetables are thought to contribute to their preventative effect against cancer and heart diseases.

Structurally, flavonoids are derivatives of 1, 3-diphenylpropane. Flavonoids can be classified according to their biosynthetic origins.

a. Some flavonoids are both intermediates in biosynthesis and end-products, e.g. Chalcones
b. Other classes are only known as the end-products of biosynthesis. They are divided into further 3 categories
    1. Phenyl side chain at 2 positions e.g. flavonols and flavones
    2. 2- Phenyl side-chain of flavonoid isomerizes to the 3-position and giving rise to isoflavones and related isoflavonoids
    3. Phenyl side chain at 4 position and giving rise to the neoflavonoids
c. Biflavoinds e.g. bhilama

Tannins & Phenolic compounds

Tannin:

True tannins are high molecular weight, complex, organic, non-nitrogenous, polyphenolic substance. They have tanning properties and give Goldbeater's skin test positive. They are widely distributed in plants.

Tanning properties:

Tannins combine with animal protein in hide and prevent their decay and convert them into leather. This property of tannins is known as tanning property.

Examples are:

1) Rhubarb – Gallic acid
2) Catechu – Catechinins Acacia
3) Nuxvomica – Chlorogenic acid
4) Ipecac – Ipecacuanhic acid.

Tannins are complex, high molecular weight, organic, non nitrogenous, polyphenolic compounds occurring in plants. They are characterized by their ability to combine with proteins of animal hides and converting them into leather. This property is called as tanning property and hence the name 'tannins'. Tannins are usually amorphous in nature and form a colloidal solution in water. They produce blue or greenish black colour with ferric salts. When applied to living tissue they combine with proteins and this action is known as astringent action. They are soluble in water,

dilute alkalis, alcohol, glycerol & acetone and sparingly soluble in other organic solvents. Tannins are classified into two groups on the basis of their ability to be hydrolyzed. They form colloidal solution with water having acidic reaction due to polyphenols or carboxyl groups. They are unstable in presence of light and moisture. Tannins produce a deep red colour with potassium ferricyanide and ammonia. Tannins are complex polyphenols which are produced by the polymerization of simple polyphenols.

Classification

Tannins are classified in to 2 groups on basis of goldbeater's skin test

1. **True tannins**
   a. Hydrolysable tannins
   b. Condensed tannins
2. **Pseudo tannins**

No.	Types of tannins	Sources	Constituents
1	Hydrolysable tannins	Rhubarb, Myrobalans	Gallic acid, Ellagic acid
2	Condensed tannins	Cinchona, Catechu	Phlobaphenes, Catechol
3	Pseudo tannins	Coffee	Chlorogenic acid

Properties

They have tanning properties.

1. Tannins are usually amorphous in nature and form a colloidal solution in water.
2. They produce blue or greenish black colour with ferric salts.
3. When applied to living tissue they combine with proteins and this action is known as astringent action.
4. They are soluble in water, dilute alkalis, alcohol, glycerol & acetone and sparingly soluble in other organic solvents.

Chemical test

1. **$FeCl_3$ test:** With ferric chloride solution, they give green, blue, violet or black colour or precipitates.
2. **Gold beater's skin test:** Treat a small piece of gold beater's skin with 2% HCl. Wash distilled water and place in test solution for 5 minute. Wash with distilled water and treat with 1% solution of ferrous sulphate. A brown or black colour is produced on skin if true tannins are present.
3. **Lead acetate solution:** White precipitation
4. **Gelatin test:** 1% tannin solution, add 1% gelatin solution containing 10% sodium chloride, precipitates are produced. If solution containing pseudotannins is sufficiently concentrated, it also gives precipitates.

5. **Phenazone test:** warm aqueous extract of tannins, added 0.5g of sodium acid phosphate. Cool, filter. To the filtrate add 2% solution of phenazone; produced bulky and often coloured precipitates are produced.
6. **Lead acetate solution:** White precipitation

Volatile oils

Volatile oils are evaporate on exposure to air at ordinary room temperature without decomposition & are the odorous constituents found in various parts of the plants. As volatile oils are responsible for the essence or odour of the plant they are also known as essential oils. They are very slightly soluble in water & soluble in organic solvents. Their specific gravity is less than one, except clove oil, which is heavier than water. They have high refractive index & optically active. They occur in plants in glandular hairs, oil glands, oil canals (vittae) etc. volatile oil generally extracted by steam distillation.

Volatile oil:

Definition-Volatile oils are defined as odourous constituent of plant. They are volatile in nature at room temperature without any decomposition. Hence they are also known as Essential oil or ethereal oil.

Classification

No.	Types of Volatile oils	Sources	Constituents
1	Hydrocarbon	Turpentine	Pinene, Camphene
2	Alcohols	Sandal wood, Coriander	Santalols, Linalol
3	Aldehydes	Lemon grass, Cinnamon	Citral, Citronellal
4	Ketones	Caraway, Dill	Carvone
5	Phenols	Clove, Ajowan	Eugenol, Thymol
6	Ethers	Fennel, Nutmeg	Anethol, fenchone
7	Oxides	Chenopodium	Ascaridole

Properties-

5. They evaporate at room temperature and do not leave any permanent spot on paper.
6. Generally they are liquid in nature, except camphor and menthol.
7. They are very slightly soluble in water just to impart odour and taste but they are freely soluble in chloroform, ether and other organic solvent.
8. There specific gravity is always less then one except clove oil due to which it is heavier than water.
9. They have high refractive index.
10. They are optically active

Chemical test

1. They do not fix on paper or cloth, do not stain it, they evaporate from it.
2. They have characteristic odour.
3. They are soluble in absolute alcohol.

NO.	HYDROLYSABLE TANNINS	CONDENSED TANNINS
1.	They are hydrolyzed by acid or enzyme such as tannase.	They are more resistant to hydrolysis
2.	Chemically they're esters of phenolic acid. Such as gallic acid and elagic acid	They're related to catechins and flavonoids pigments, having polymeric formula flavone-3-ol
3.	On treatment with acid/enzyme they produce gallic acid or elagic acid	On treatment with acid/enzyme they are decomposed in insoluble red color compound known as phlobaphenes.
4.	With iron salt or ferric salt they produce blue color.	With iron salt or ferric salt they produce green color.
5.	On treatment with acid/enzyme they produce gallic acid or elagic acid.	On dry distillation they are converted into catechol and hence they are termed as catechol tannins.
6.	e.g. Rhubarb, Clove, Myrobalans, Pomegranate, Eucalyptus.	Cinnamon, Cinchona, Acacia bark, Catechu.

Terpenoids

Terpene represents only the hydrocarbons $(C_5H_8)_n$. Terpenoids represents the hydrocarbons as well as their oxygenated derivatives. Terpenoids are group of natural products whose structure can be divided into a definite number of five carbon containing isoprene unit (C_5H_8). They occur as components of volatile oils. Majority of the Terpenoids occur as complex mixtures of isomeric substances which are difficult to separate. They are also found in resins & latex. The Terpenoids are rationally classified on the basis of the number five-carbon isoprene units present. Most of them are optically active. They are soluble in alcohol, organic solvents and fixed oils.

Classification

No.	Types of terpenoids	Sources	Constituents
1	Monoterpenoids	Lemon, Dill	Limonene, Citral
2	Sesquiterpenoids	Cotton	Gossypol
3	Diterpenoids	Coleus	Forskolin
4	Triterpenoids	Liquorice	Glycyrrhitinic acid
5	Tetraterpenoids	Saffron	Carotenoids

Resins & resin combination

Definition: Resin can be defined as the complex amorphous product of more or less solid or liquid characteristics which on heating first sets softened then melt and clear adhesive fluids. Resins are produced and stored in the schizogenous or schizolysigenous glands or cavities of the plants. Resins are produced in plants normally or abnormally as a result of an injury.

Classification

Resins are classified mostly on the basis of their chemical nature and secondly as per their association with the other group of compounds like essential oils and gums.

1) **Based on Chemical nature is given below:**

1.1. **Resin acids:** Resin acids are the carboxylic acid group containing resinous substances which may or may not have association with phenolic compounds. These compounds are found in Free states or as the esters derivatives. Resins acids can be derivative to their metallic salts known as resonates which finds their use in soap, paints, and varnish industries. **e.g. Abietic acid in Colophony, Commiphoric acid in Myrrh**

1.2. **Resin esters:** Resin esters are the esters of the resin acids or the other aromatic acids like benzoicacid, cinnamic, salicylic acids, etc. They are sometimes converted to their free acids by the treatment with caustic alkali. **e.g. Dragon'sblood, Benzoin**

1.3. **Resin alcohols:** Resin alcohols or resinols are the complex alcoholic compounds of high molecular weight. Like resin acids they are found as free alcohols or as esters of benzoic, salicylic, and cinnamic acid. They are insoluble in aqueous alkali solution but are insoluble in alcohol and ether. **e.g. Benzo resinolin Benzoin, Storesinolin Storax**

1.4. **Resin phenols:** Resin phenols or resin otannols are also high molecular weight compounds which occurs in free states or as esters. **e.g. Peru resin otannolin Balsam of Peru, Tolu resin otannolin Tolu Balsam, Sia resin otannols in Benzoin**

1.5. **Glucoresins:** Resins get combined with sugars by glycosylation and produce glucoresins. Glycoresin can be hydrolyzed by acidic hydrolysis to the aglycone and glycone. **e.g.** Resins of Convolvulaceae like **Jalap resin and Ipomea resins**

1.6. **Resenes:** Chemically inert resin products are generally termed as resenes. They are generally found in Free State and never form esters or other derivatives. Resenes are

soluble in benzene, chloroform and to some extent in petroleum ether. Resenes are insoluble in water. **E.g. Asaresene B in Asafoetida**

Properties:

(1) They are solid, semisolid or liquid in nature.
(2) They are transparent substance.
(3) They are heavier than water.
(4) They burns with smoky flame because of higher number of carbon atom.
(5) On heating they are fused & form soft mass.
(6) Insoluble in water but they are soluble in acetone, chloroform, ether.
(7) On boiling with alkali some resin form soap.
(8) On keeping undergo slow change & due to this darkens in color

Introduction Any of numerous clear or translucent, yellowish or brownish substances that ooze from certain trees and plants. Resin can be defined as the complex amorphous product of more or less solid or liquid characteristics which on heating first sets softened then melt and clear adhesive fluids. Resins are produced and stored in the schizogenous or schizolysigenous glands or cavities of the plants. Resins are produced in plants normally or abnormally as a result of an injury. If the resins are produced as normal products of metabolism without any injury to the plant, the resins are called preformed, normal, or physiological resins. E.g. Copaiba resin. In some plants normally only a few resin ducts are present and the plant produces very small quantity of resin. As a result of wound, injury or abnormal circumstances the plant gets a shock and in the newly developed secondary xylem and bark a large number of resin ducts are formed and resin is produced in large quantity. Resin produced in this way is called abnormal, pathological or traumatic resin.e.g. Benzoin, Tolubalsam, Storax.

Physicochemical Properties

- Resins contain a large number of carbon atoms and when ignited burn with a smoky flame.
- Most of the resins have specific gravity more than one and are therefore heavier than water.
- They are hard, electrically, nonconductive, combustible masses.
- Solubility: Resins are insoluble in most polar and nonpolar solvents like water and petroleum ether, respectively, but dissolve completely in alcohol, solvent ether, benzene, or chloroform.
- Resins are amorphous products of complex chemical nature.
- It can be complex mixtures of acids, alcohols, phenols, esters, glycosides or hydrocarbons.
- They are mixtures of essential oils, oxygenated products of terpene and carboxylic acids found as exudations from the trunk of various trees.