

Phytogeography

Fundamental Concept of plant Anatomy:-

The word cell was coined by the English microscopist Robert Hooke.

Further one of the plant anatomist defines cell as a protoplast with or without non living envelop. The cell was consisting of the protoplasmic component and the non-protoplasmic components, the later intimately connected with the initial activity of the protoplast.

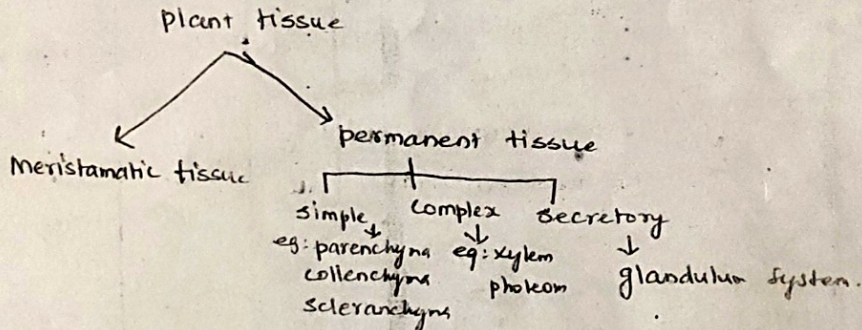
Groups of cell with same form and function is called as tissue. The cell wall, cell membrane, protoplasm as well the middle lamella gives out fine protoplasmic ~~the~~ threads called "PLASMODESMATA". This helps in conduction and communication of food material and stimuli.

Group of tissues showing common feature and some continuity are called as tissue system. Tissue system are classified as follows.

1. Dermal: Outer protective covering system like epidermis, peridermis.
2. Ground (a) Fundamental: Ground tissue made up of collenchyma, parenchyma (storage, support)
3. Vascular: cellular structure like xylem and phloem (Transport)

Tissue and Tissue System:-

Group of cells with the same form and function are called as a tissue.



Difference between meristematic tissue & permanent tissues:

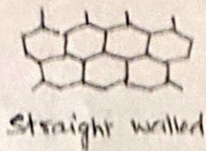
Meristematic Tissue	Permanent tissue
1. Comprises of young cells with having power to divide and multiply.	1. They are living or dead ^{cells} having attained their definite form and size.
2. Cells are present at growing point tips of root, shoot and epidermis.	2. Usually present in ground tissue and make fundamental tissue system.
3. These are closely packed without intercellular spaces.	3. Intercellular spaces are present.

1. DERMAL TISSUE SYSTEM: Eg: Dermis

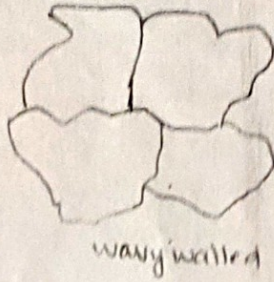
Epidermis is the outermost protective covering. Epidermal cells are often covered on the outside with a thin or thick layer of cuticle which contains a chemical structure called cutin.

- a. Stomata b. Trichomes.

Types of Epidermal cells:

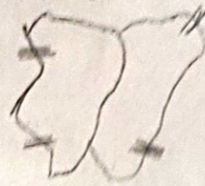


Straight walled



wavy walled

Slightly wavy walled



with cellular striation



Beaded

a. Stomata:

A stomata is made up of a pair of identical cells called "Guard cells" placed parallel to each other and also form a pair in the centre through which gaseous exchange takes place. The epidermal cells surrounding the Stomata are called "Subsidiary cells".

The stomata are classified into ~~four~~ four types.

a. Ranunculaceae (or) Anamocytic (Irregular type)

The cells surrounding the stomatal pores are irregularly arranged and cannot be differentiated from epidermal cells.

b. Cruciferaceae (or) Anisocytic (unequal cells)

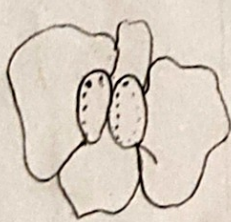
The stomatal pores are surrounded by 3 epidermal cells of which one is smaller than the other two.

c. Rubiaceae (or) paracytic (parallel cells)

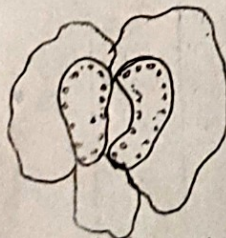
The two subsidiary cells are parallel to that of stomata.

d. Caryophyllaceae (or) Diacytic (Cross celled)

The two subsidiary cells are at right angles to that of stomata.



a. Anamocytic
eg: Digitalis



b. Anisocytic
eg: Datura,
Vinca



c. paracytic
Eg: Senna
coco



d. Diacytic
Vasaka, peppermint.

Handwritten note: "Handwritten figure"

TRICHOMES

These are epidermal appendages. A trichomes can normally differentiated into a base embedded in the epidermal cells and a tube like projecting bodies.

Normally trichomes are two types, (a) covering (b) glandular. Both the trichomes are unicellular (or) multicellular.

covering trichomes have protective function whereas glandular trichomes are secretion of essential oil and alkaloids.

Periderm

The epidermis in matured plants get substituted by periderm which results due to the activity of meristematic tissues called "phellogen" (or) cork cambium. This newly formed 100% 2 layers of phellogen divide and subdivide to form "phellem" (or) cork on the outside and phelloderm on the inner side. In cork the wall being impregnated with substance called Suberin, phellem, phellogen and phelloderm are collectively called periderm. Lenticel are pores identical in function to stomata but occurs in periderm.

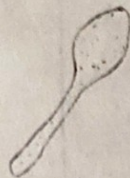
Vascular tissue system:

Phloem is the living tissue conducts food material from leaves to different parts of the plant body, where as Xylem, a dead tissue conduct water from root to leaves.

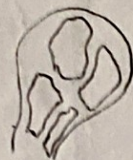
Types of Trichomes



Glandular



Uniseriate glandular



Multiseriate glandular



Unicellular trichome

Phloem:

It consist of phloem parenchyma, sieve tubes and companion cells.

Xylem Usually consist of xylem parenchyma, trachea, tracheids and xylem fibres. Xylem parenchyma helps in storage of wood fibres, mechanical support. Trachea and Tracheids in conduction of water.

Tracheids: They are elongated tubes pointed at both ends and frequently cut across with oblique walls with perforation.

Trachea: They are elongated tubes but without perforated walls.

The earliest form of xylem is called proto xylem and later form called as meta xylem. In case of stem, group of proto xylem point to the centre is called "endarch" where as in a root proto xylem group pointed towards the periphery leading to an "exarch" condition.

In dicot ~~leaves~~ root. The proto xylem bundles are varies from 2-6 where as monocot root the no. of proto xylem group are more than 10 as the result in "poly arch"

Xylem and phloem are associated to form a "Vascular bundle".
The vascular bundles are of following types.

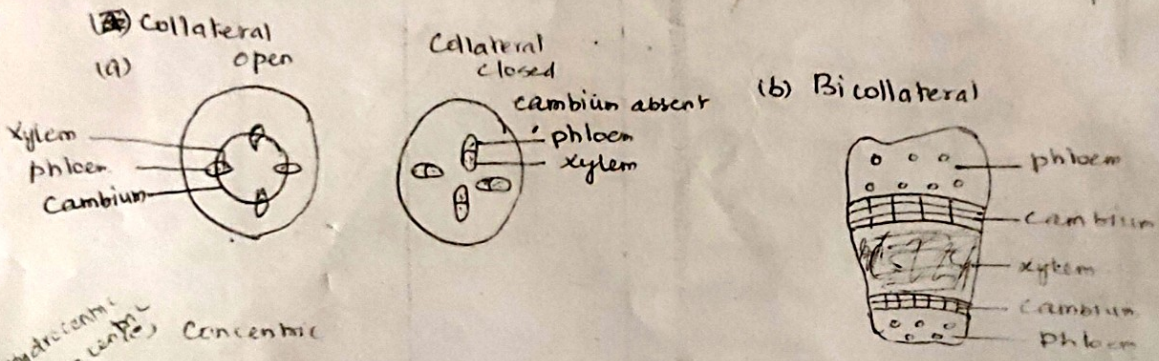
- (a) Collateral (b) Bicollateral (c) Concentric (d) Radial.

(a) Collateral.

This is the most common type of vascular bundle in the stem and leaves. Here xylem and phloem remain side by side arranged on the same radius, phloem on outside. collateral bundle may be opened (or) closed.

(b) Bi collateral.

These are collateral bundles in addition to external phloem, another patch of phloem on the inner side which may be called inner-phloem.



(1) Hydrocentric
(2) Leptocentric
Concentric

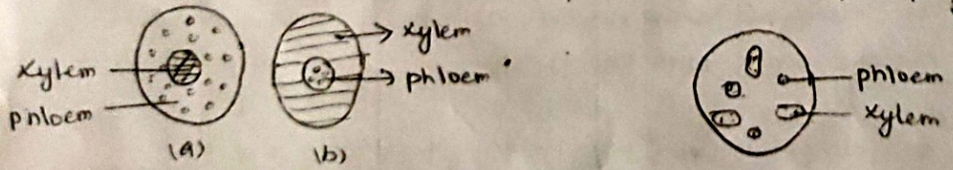
Here one kind of vascular bundle surround the others.

(d) Radial:

Here xylem and phloem occur in separate patches in alternate arrangement. In dicot stem, the vascular bundles are arranged in the form of ring and in monocots the bundles are scattered.

(e) Concentric

(d) Radial eg: podophyllum root.



(a) Hydrocentric (b) Leptocentric

GROUND TISSUES (OR) FUNDAMENTAL TISSUE SYSTEM

1. Parenchyma:

It consist of cells which are living, thin walled with intercellular spaces. These are formed in the cortex of the root, pith of the stem and mesophyll of leaf.

Function: Storage, photosynthesis etc.

2. Collenchyma:

It also contains living cells. These cells are similar to parenchyma. But the cells wall at the corners are thickened with cellulose. This occurs in the cortical region of the stem, petiole, base and midrib.

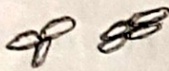
Function: Mechanical strength.

3. Sclerenchyma:

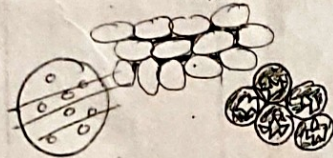
It is a dead tissue. The cell wall are thickened with lignin. They occur in all parts of the plant body where mechanical strength needed. The Sclerenchyma occur in the form of irregular cells called Stone cells (or) Scleroids.

Sclerenchyma fibres are narrow often elongated with pitted ends. These helps in the identification of crude drugs as well as gives mechanical support to plants.

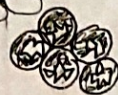
Types of cells:



Parenchyma



collenchyma



Scleroids



Crystal Fibre

Anatomical and Physiological classification of Crude drugs:

According to Haberlandt tissue system can be categorised into 12 classes.

1. Meristematic tissues

Including pinnodial meristem, marginal and apical cells.

2. Dermal System

consist of epidermis including its major wall characters and contents.

3. Mechanical System:

consist of fibres, wood fibres, collenchyma, sclerenchyma cells with scleroids.

4. Absorbing System

Include root hairs, the absorbing tissue, aerial roots, and water absorbing hairs of foliage tissues

5. Photo Synthetic System:

Include chloroplast, chlorophyll containing parenchyma, palisade and spongy cells of leaves.

6. Vascular (or) conducting System:

consist of vascular bundles, tracheids, Sieve element, Xylem parenchyma, phloem parenchyma, laticiferous tissue etc.

7. Storage System: ^{atom} consist of ^{water} water tissue, storage tissue of seeds, ^{lenticels} lenticels and ^{lenticels} lenticels

8. Aerating and Ventilating system:-

It is concerned with intercellular system, stomata, lenticels, and premerophores of breathing roots.

9. Secretory and Excretory system:

Includes digestive glands, oil, resin, mullage, gum, secretory glands.

10. Motor system: consist of the flying hairs and tissues, hygroscopic tissue, vital motor tissues etc.

11. Sensory system:

Includes papillae, hairs and **bristles**, etc...

12. Stimulus Transmitting System:

consist of the protoplasmic connections, **plasmodesmata** etc.

ANATOMICAL FEATURES OF CRUDE DRUGS:

The major anatomical features of the leaf drug can be summarised as the following parts;

(a) Lamina portion (b) midrib portion.

(1) Lamina portion includes upper epidermis, mesophyll, parenchyma cells, spongy parenchyma and lower epidermis

(2) The midrib mainly consist of vascular tissues that is **xylem** and **phloem**

Flower drugs:

The main anatomical features are epidermis, cortex and columnar.

Basic drug:

The main anatomical features are periderm, **cortex**, secondary phloem, and the medullary rays.

Roots and Rhizome drugs:

1. The periderm (~~cuticle~~, cork, phellogen, phelloderm), secondary phloem and medullary rays are the main anatomical feature.

2. In the case of stolons and rhizomes one more feature like pith also present which is absent in the case of roots.

Most of the wood drugs are ~~not~~ constituted by secondary xylem and medullary rays.

Fruit drupe.

pericarp, testa, endosperm are the important anatomical characters.

Seed drupe. Testa, endosperm, and the embryo are the important anatomical features.

MOUNTING AND STAINING OF DRUGS:

Thinnest possible part of a plant is taken on a slide and mounted in a solution of chloralhydrate on slight warming the section gets cleared, cover the section carefully with cover slip. Take care that no air bubbles creep in. Glycerin could also be used as a mounting medium as the section in glycerin remains fresh for a long time.

Staining. In order to differentiate the section are to be stained. This is done by keeping the section for 1-2 minutes with 1% mixture of phloroglucinol and conc. HCl. Lignified cells like Xylem, Sclerenchyma etc. takes up color due to lignification.

Test for starch:

Mount a section on a slide in water. irrigate the section with dilute Iodine. Starch turn blue with Iodine.

Test for fixed oil:

Mount a section containing fixed oil in Sudan III. on warming the fixed oil acquires an orange yellow colour.

Test for mucilage:

The mucilage present in vascular tissue turns pink with ruthenium red solution.

Isolation of ~~the~~ or Diagnostic importance:

Introduction to leaf drugs

Leaves are appendages to the stem which shows a great variety of external forms. This fact make it difficult to formulate a definition which may applicable to leaf.

The best time for the collection of leaves is when the flowers just begin to expand, as the flowering is just arriving at its height. Leaves may be dried carefully so as to retain their fresh green colour and to prevent the decomposition of the active ingredients. The important factor here is to use a temp as low as possible and to carry out the operation as rapidly as possible.

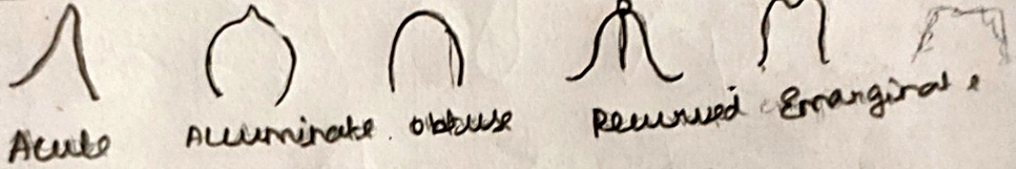
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Histology:

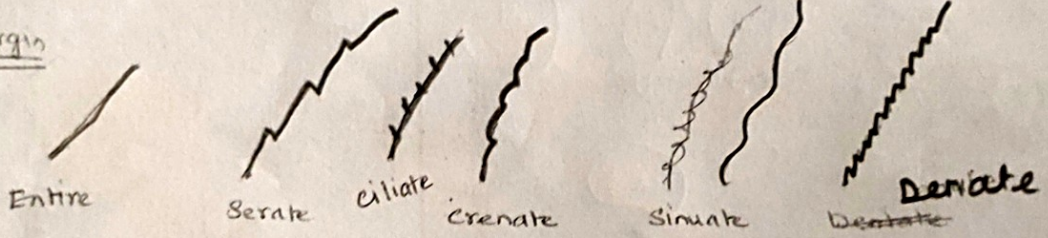
The epidermis is continuous with that of stem. It consists of the single layer of cell but becomes many layered. The outer wall of epidermal cells are called as trichomes. They may be absent in case of glabrous leaves. They are mainly classified into two types (a) covering (b) glandular ^(length/width of trichome or filices) ^{possessing} st

Stomata is another type of epidermal pore. Stomatal index is the average no of stomata present in 1 sq. mm of the leaf surface. The ratio has been showed to have a constant, diagnostic character for a particular species.

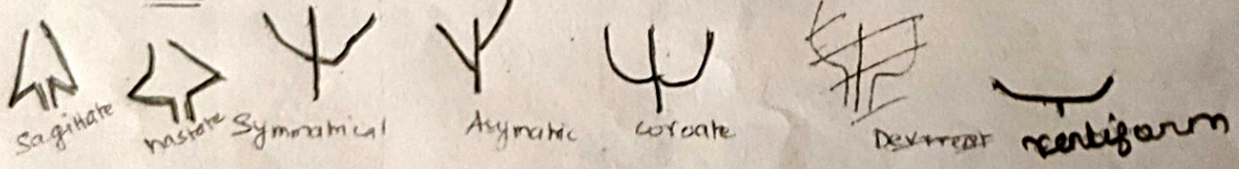
Apex:



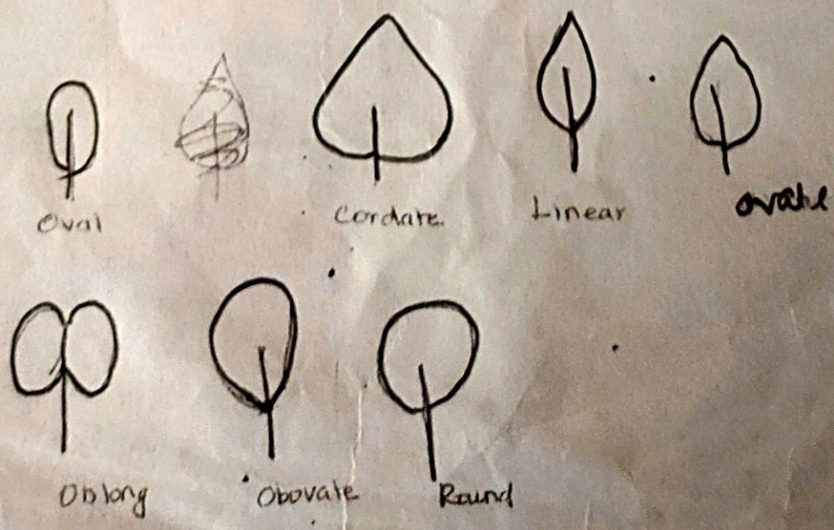
Margin:



Base:



Shape:



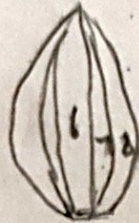
hormonians opp to highest end

Morphology of a leaf is the whole of the parenchymatous ground tissue between the two epidermis palisade cells of mesophyll bear a definite reaction to the epidermal cells

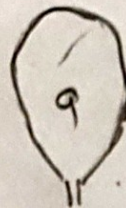
The small areas of the green leaves obtained by the vein ^{and} ^{are} ^{is} ^{ic} ^{le} ^t ^{er} ^m ⁱⁿ ^g ^{er} ^s ^{are} ^{ter} ^m ^{ed} ^a ^s ⁱ ^s ^l ^e ^t ⁿ ^u ^m ^b ^e ^r ^s



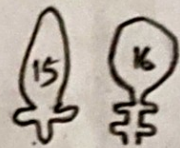
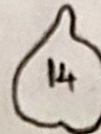
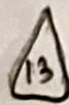
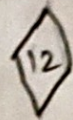
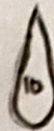
1. acicular
2. elliptical
3. oval
4. oblong
5. round



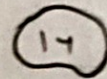
6. linear
7. lanceolate
8. ovate



9. obovate
10. subulate
11. spatulate
12. diamond shaped



13. cuneate
14. cordate
15. acuminate
16. lyrate
17. reniform

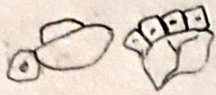


Plant parts and their common anatomical features:

- 1) Root/Rhizome: Epidermis, cortex, endodermis, pericycle, vascular bundle and pith.
- 2) Stem: Epidermis, hypodermis, cortex, endodermis, pericycle, pith.
- 3) Bark: cork (phellem), cork cambium (phellogen), phelloderm, cortex, pericycle, stone cells, phloem, medullary rays, crystals etc.
- 4) wood: Medullary rays, xylem vessels, xylem fibre, Ca oxalate crystals, tracheids.
- 5) Leaf: Upper epidermis, lower epidermis, stomata, trichome, vascular bundle, palisade cells, Spongy parenchyma, starch grain, cut. wax, crystals.
- 6) Seed: Epiderm, endosperm, embryo cell, oil glands, aleurone grains etc.
- 7) Fruit: Pericarp (outermost covering) epiderm (outer layer), mesocarp (middle portion), endocarp (inner portion).
- 8) Flower: Epidermis, parenchyma, anthers, pollen grains, calyx, corolla, androecium, gynoecium.

Cell inclusion

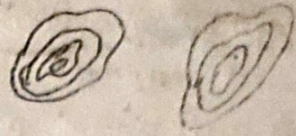
Types of Starch grain



Corn (Zea mays) Gramineae
Round polyhedral



Wheat (Triticum aestivum)
Gramineae
Lenticular (or) oval in shape



Potato
Solanum tuberosum / Ranunculaceae
Irregularly oval and subspherical



Rice (Oryza sativa)
Gramineae
Polyhedral

Calcium Crystals:

— diagnostic value / helps in detection of adulterants
two types: (a) calcium carbonate (b) calcium oxalate

(a) Cal. carbonate: Rare and generally associated with cell wall. They are also called as cytoliths.

(b) cal. Oxalate: Very common, present in almost each part of plant.

- (i) Microcrystals: Amorphous mass in cell, they are minute and present in large no in single cells, is called as idioblast
- (ii) Prism: They are large, single (or) small groups and well developed
- (iii) Cluster: group of numerous prism. The crystals are projecting, pointed, acute angled, and more (or) less spherical
- (iv) Acicular (or) Raphides: They are needle like, slender, long pointed @ the ends. They may be single (or) in bundles.