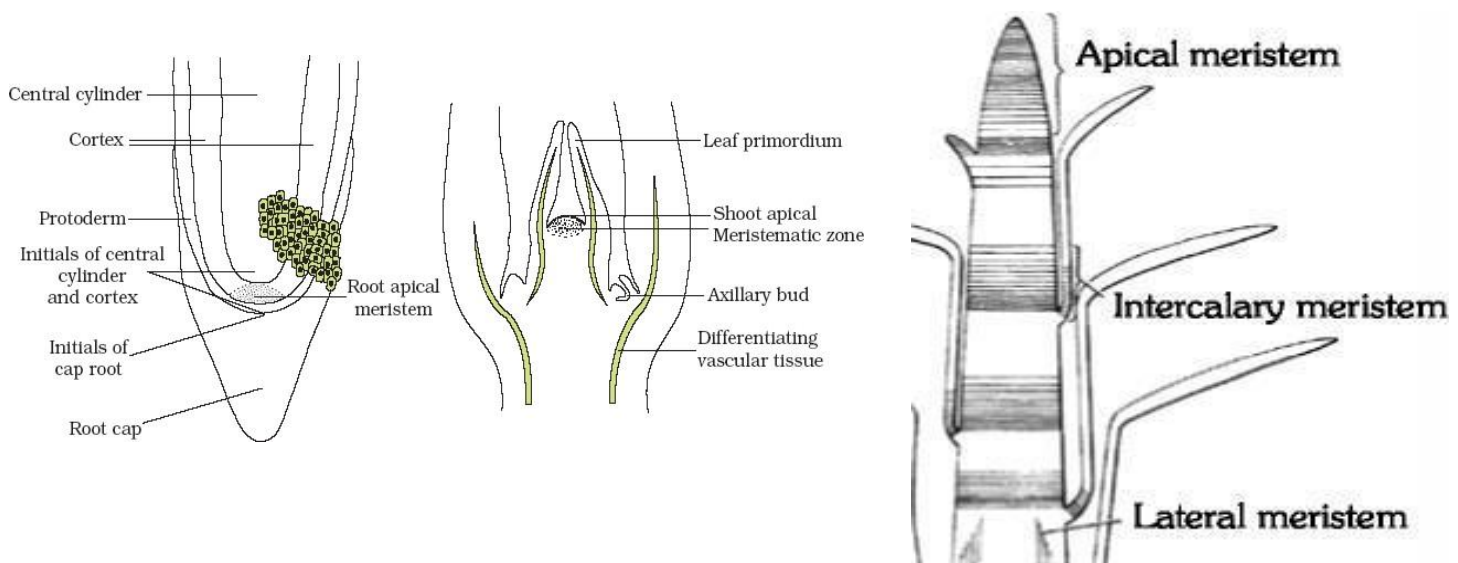


Anatomy of Flowering Plants (TISSUE)



Anatomy of flowering plants

- Anatomically, a plant is made of different kinds of tissues.
- The plant tissues are broadly classified into meristematic (apical, lateral and intercalary) and permanent (simple and complex).
- **Meristematic tissue:** cells divide actively
- **Apical meristem**– occurs at the tip and produces primary tissues, e.g. dermal, vascular and ground tissues
- **Intercalary meristem**– occurs in grasses between matured tissues
- **Lateral meristem**– produces secondary tissues, e.g. cambium

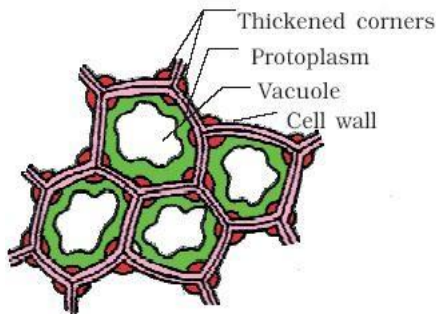


Apical Meristem: Root, Shoot

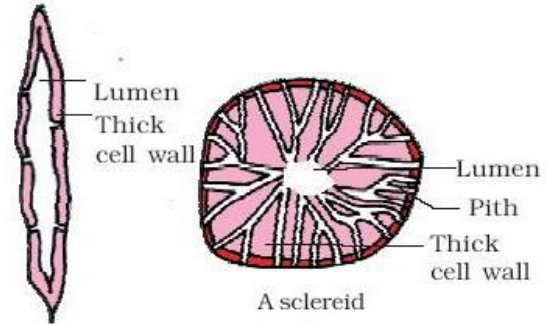
➤ **Permanent tissue:** cells, which don't divide further after attaining their specialized structure and function. Assimilation of food and its storage, transportation of water, minerals, and photosynthates, and mechanical support are the main functions of permanent tissues.

- **Simple tissue:** only one type of cells having the same structure and function

Collenchyma



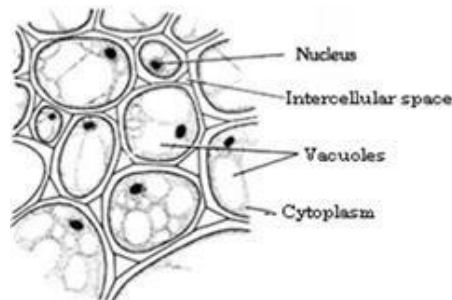
Collenchyma



A fibre

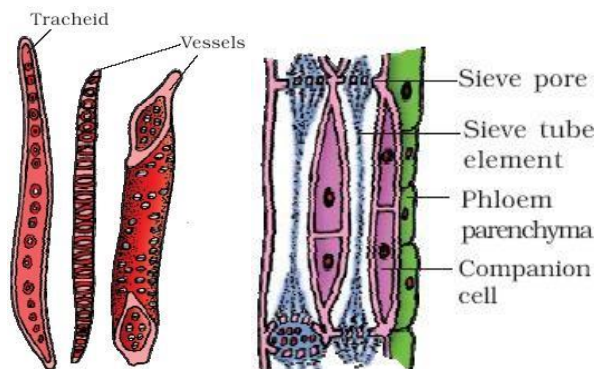
A sclereid

Sclerenchyma



Parenchyma

- **Complex tissue:** more than one type of cells that work in coordination



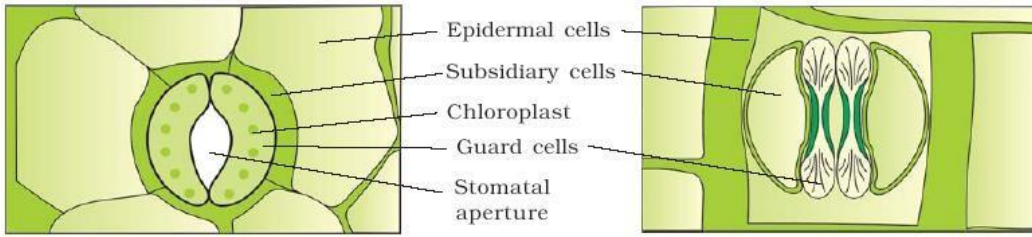
Xylem

Phloem

Permanent Tissue	Name	Structure	Function
Simple Tissue	Parenchyma	-cells are mostly isodiametric -thin cell wall made up of cellulose	-photosynthesis, secretion, storage
	Collenchyma	-closely packed cells with no intercellular spaces -deposition of cellulose, hemicellulose and pectin in the cell wall	-mechanical support -chloroplast containing cells assimilate food
	Sclerenchyma	-elongated cells with thick lignified cell wall -dead cells with no protoplasm -present as fibres or sclereids	-provide mechanical support -present in the seed coat, pulp and walls of fruits
Complex tissue	Xylem	-made up of tracheids, vessels, xylem fibres and xylem parenchyma -vessels and tracheids are the main transporting material -two types of primary xylem, protoxylem and metaxylem -in stem endarch organisation with protoxylem at the centre -in roots exarch organisation	-conducts water from roots to stem and leaves
	Phloem	-in angiosperms, phloem is made up of companion cells, sieve-tube elements, phloem parenchyma and phloem fibres -in gymnosperm instead of sieve tube and companion cells, albuminous and sieve cells are present -phloem parenchyma is absent in monocotyledons	-transport

- There are three types of tissue systems – epidermal, ground, and vascular.
- The epidermal tissue systems are made of epidermal cells, stomata and epidermal appendages.
- The ground tissue system forms the main bulk of the plant. It is divided into three zones – cortex, pericycle and pith.
- The vascular tissue system is formed by the xylem and phloem. On the basis of presence of cambium, location of xylem and phloem, the vascular bundles are of different types. The vascular bundles form the conducting tissue and translocate water, minerals and food material.

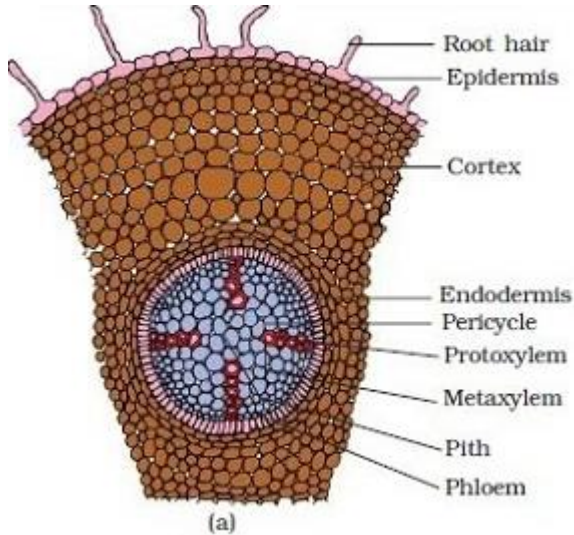
**Diagrammatic representation: (a) stomata with bean-shaped guard cells
(b) stomata with dumb-bell shaped guard cell**



➤ Monocotyledonous and dicotyledonous plants show marked variation in their internal structures. They differ in type, number and location of vascular bundles.

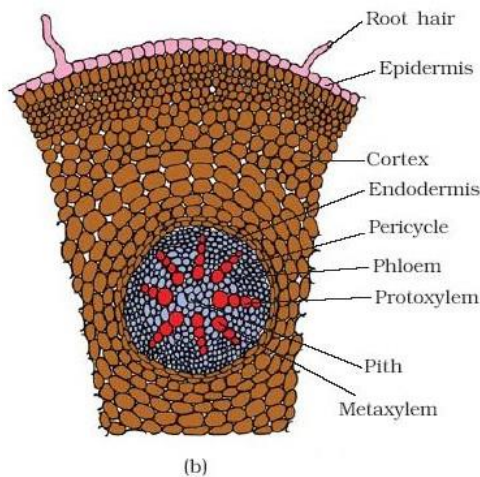
Dicotyledonous Root

- Epiblema is the outermost layer, which contains root hair
- Several layers of cortex present, that ends with innermost layer endodermis, which contains waxy material called suberin forming Casparian strips
- Next is pericycle, which gives rise to lateral roots and vascular cambium
- Two to six vascular bundles are present
- Radial and exarch vascular bundles.



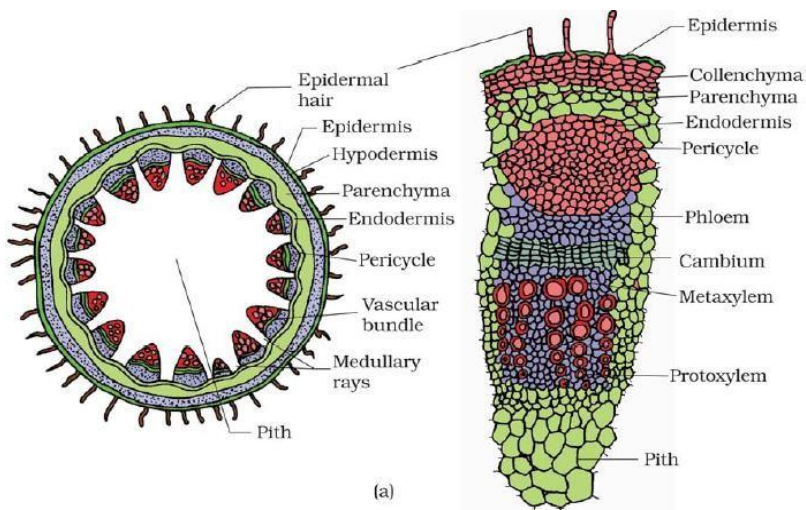
Monocotyledonous Root

- The structure is similar to dicot root but polyarch xylem bundles are present
- Pith is large and no secondary growth
-



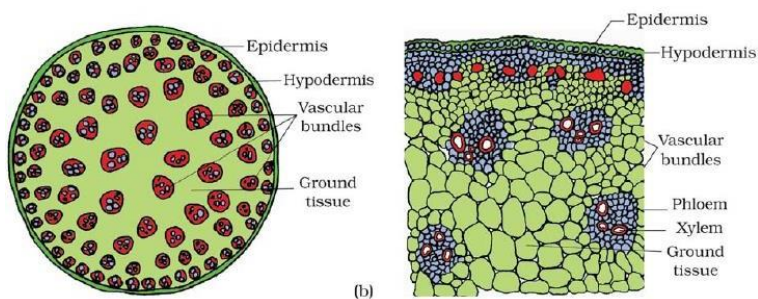
Dicotyledonous Stem

- The outermost layer is the epidermis with cuticle
- Trichomes and stomata may be present on the epidermis
- The cortex consists of three layers; outermost hypodermis (collenchymatous), middle parenchymatous cortical layer and the endodermis containing starch grains
- Below endodermis, pericycle and radially located medullary rays are present
- Vascular bundles are arranged as a ring
- Vascular bundles conjoint, open and with endarch protoxylem



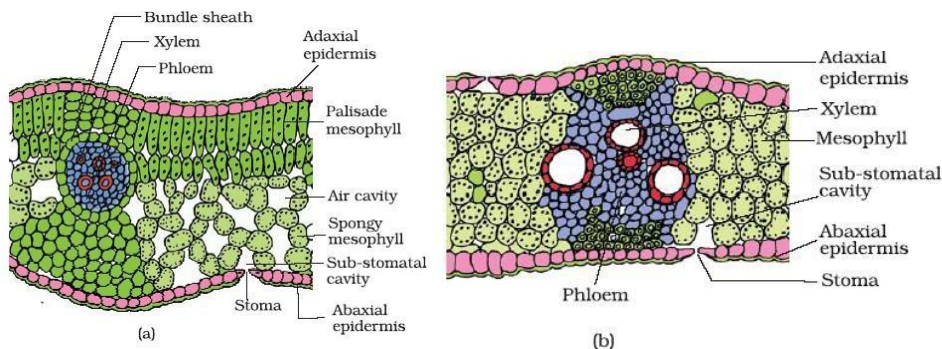
Monocotyledonous Stem

- Hypodermis is sclerenchymatous
- Vascular bundles are scattered, conjoint and closed



Dicotyledonous Leaf

- Also known as dorsiventral leaf due to distinct dorsal and ventral side
- Reticulate venation
- The epidermis covers both the upper and lower surface
- There are more stomata present on the abaxial epidermis
- Mesophyll cells are parenchymatous and perform photosynthesis
- The mesophyll is made up of elongated palisade and oval or round spongy parenchyma cells
- Vascular bundles are surrounded by bundle sheath cells and present on veins and mid-rib



Monocotyledonous Leaf

- Also known as isobilateral as both sides are similar

- Parallel venation
- Stomata are equally distributed on both sides
- The mesophyll is not differentiated between palisade and spongy parenchyma cells
- Some cells of the epidermis are modified to large cells called bulliform cells in grasses, they help in minimising water loss
- Vascular bundles are of the same size



