ANATOMY OF FLOWERING PLANTS

TISSUE : Group of cells (common origin & function)

MERISTEMATIC - actively dividing cells

Apical

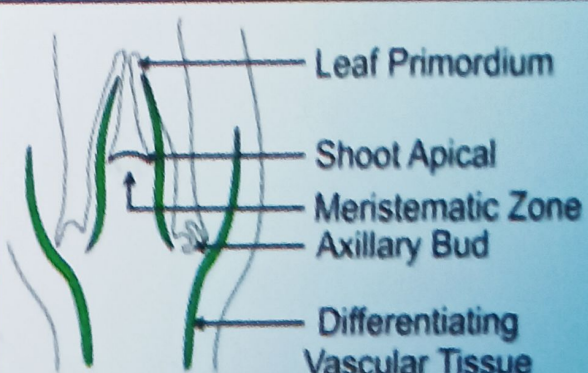
- Tip of root or stem
- Axillary bud- left behind 'stem apical meristems (form branch/ flower)

Intercalary

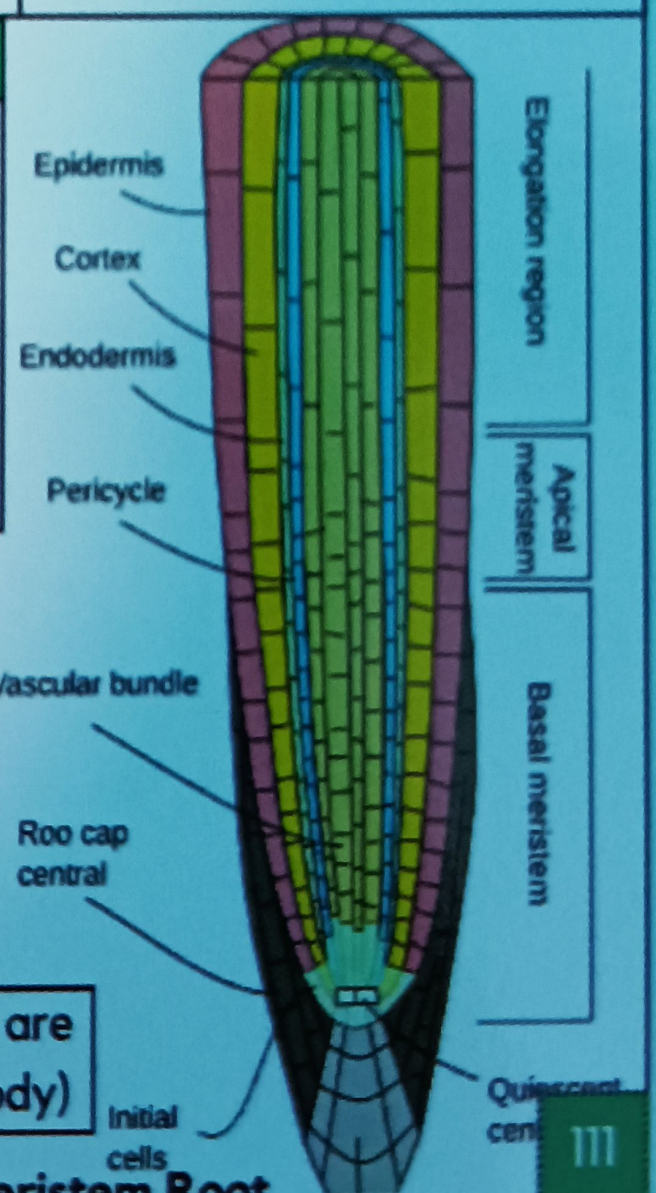
- occur b/w mature tissues
- regenerates parts removed by grazing animals

Lateral

- occur in mature regions
- produce woody axis
- eg- Fascicular vascular cambium, Interfascicular cambium, Cork-cambium
- 2° meristem



Apical Meristem Shoot



Apical Meristem Root

Note- Apical and intercalary are 1° meristem (form 1° plant body)

PERMANENT

When meristematic cells lose the ability to divide, they form permanent or mature cells (form dermal tissue, ground tissue, vascular tissue)

TYPES

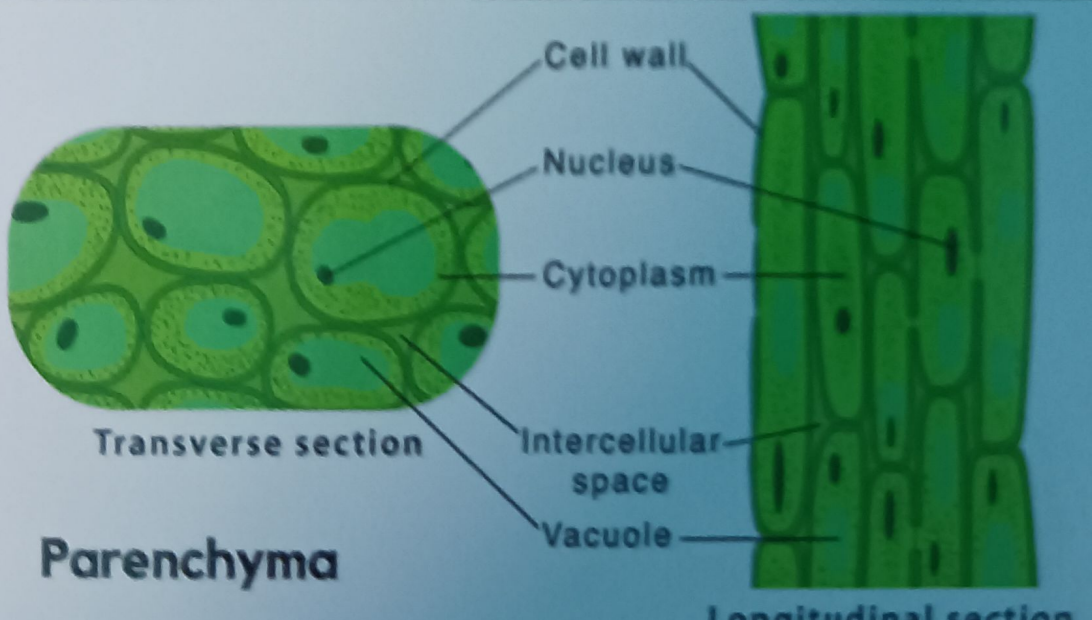
Simple Tissue	Complex Tissue
Only one type of cell	More than one type of cell

Parenchyma

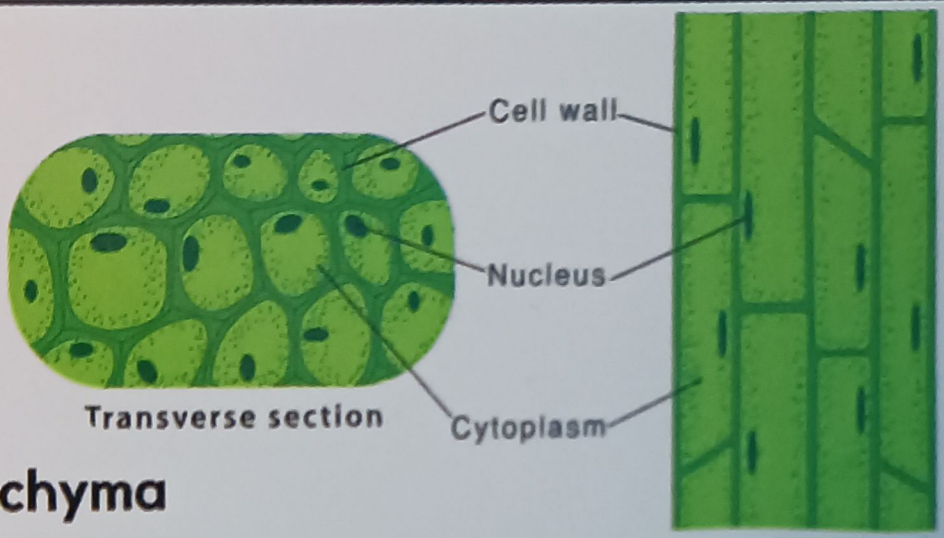
- isodiametric (spherical, oval, round)
- thin walls (cellulose)
- small intercellular spaces
- Function: Photosynthesis, Storage , Secretion.

Collenchyma

- thickened at corners(deposits of cellulose, hemicellulose, pectin)
- oval, spherical, polygonal
- chloroplast (+) (generally) (as assimilate food)
- Intercellular spaces (-)
- found below epidermis in dicots
- Function - support.



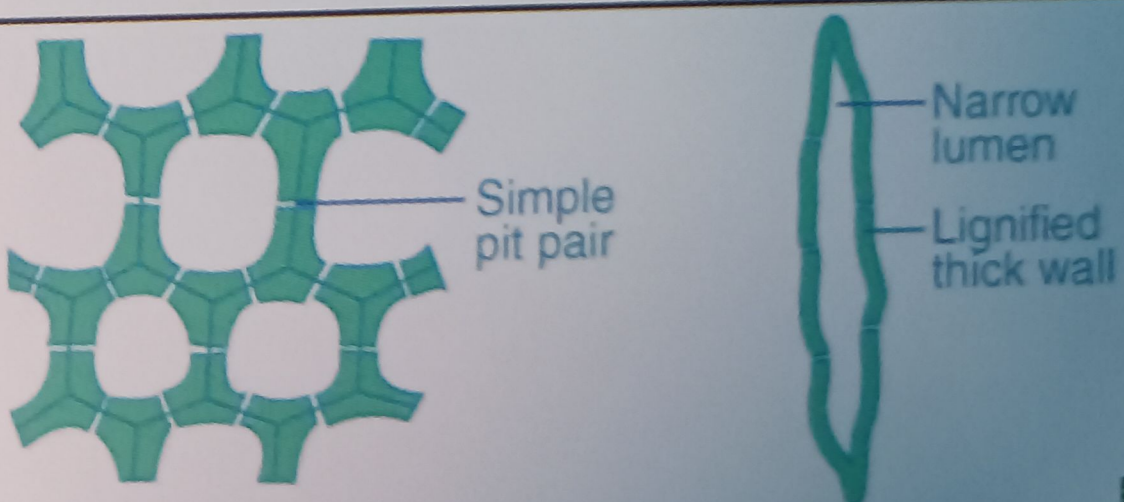
Parenchyma



Collenchyma

Sclerenchyma

- Long, narrow cells ; lignified cell walls ; Pits (+);dead; protoplast(-).
- **Function** - Support
- Types
  - 1. **Fibres** - thick walled ; elongated ;pointed
  - 2. **Sclereids** (dead)
    - spherical, oval; narrow lumen
    - found in fruit walls of nuts
    - pulp of guava, pear, sopata; seed coat (legumes); leaves of tea



XYLEM

Conduction of water and minerals (roots to stem)

Tracheids

- Dead
- Protoplasm(-)
- Elongated (tube like)
- Tapering ends
- Lignified walls

Vessels

- Long-cylindrical (tube like)
- Cells are called vessel members
- Large cavity
- Lignified walls.
- Protoplasm (-);characteristic of angiosperms

Tracheids and Vessels are main for H_2O transportation in flowering plant.

Fibres

- thick walls
- Obliterated central lumen
- septate/aseptate

Parenchyma

- Living
- thin-walls (cellulose)
- store starch & fat
- can also store tannins.

1° Xylem → Protoxylem (1st formed)
1° Xylem → Metaxylem (later formed)

Endarch

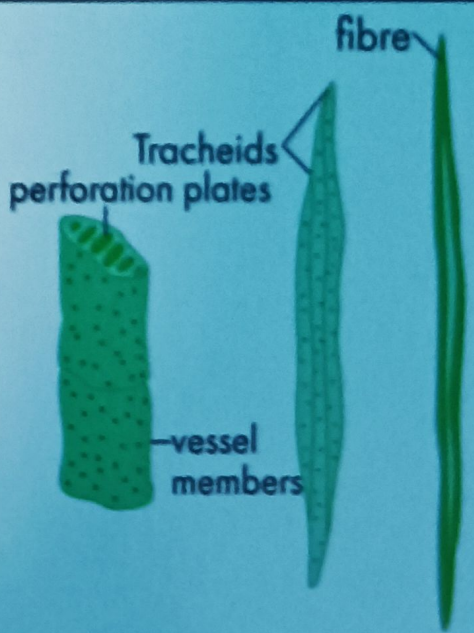
(Inside → out)

- protoxylem (center); metaxylem (periphery)
- In stem

Exarch

(Outside → in)

- Protoxylem (periphery); metaxylem (center)
- In roots



PHLOEM - TRANSPORT OF FOOD

Sieve tubes

- Long, tube-like
- Associated with companion cells
- Perforated end walls
- cytoplasm (+), vacuole(+)
- nucleus (-)
- **Function** is controlled by nucleus of Companion cell.

Phloem parenchyma

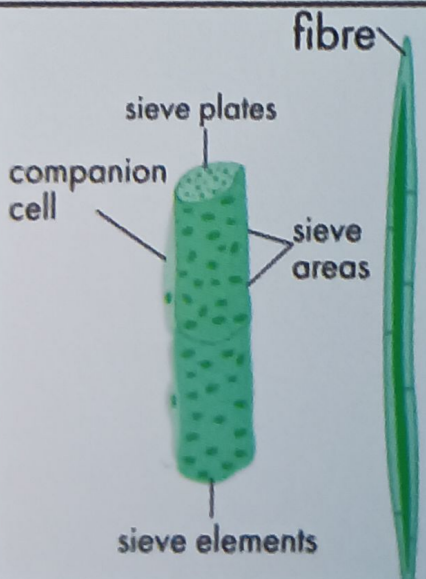
- elongated, tapering cylindrical cells
- cell wall (cellulose)
- pits (+) for plasmodesmata connections.
- store (food, latex, resin, mucilage)
- absent in monocots

Companion cells

- Specialised Parenchymatous Cell.
- Associated with sieve tubes (by pit fields) present between their common longitudinal walls
- Maintain pressure gradient in Sieve Tubes.

Bast fibres

- Sclerenchymatous cells
- Absent in 1° Phloem, Present in 2° Phloem.
- elongated, needle-like apices
- Thick cell wall
- Protoplasm (-); DEAD



Note

- Gymnosperms lack companion cells, sieve tubes
- Protophloem - narrow sieve tubes
- Metaphloem - bigger sieve tubes

TISSUE SYSTEM

EPIDERMAL

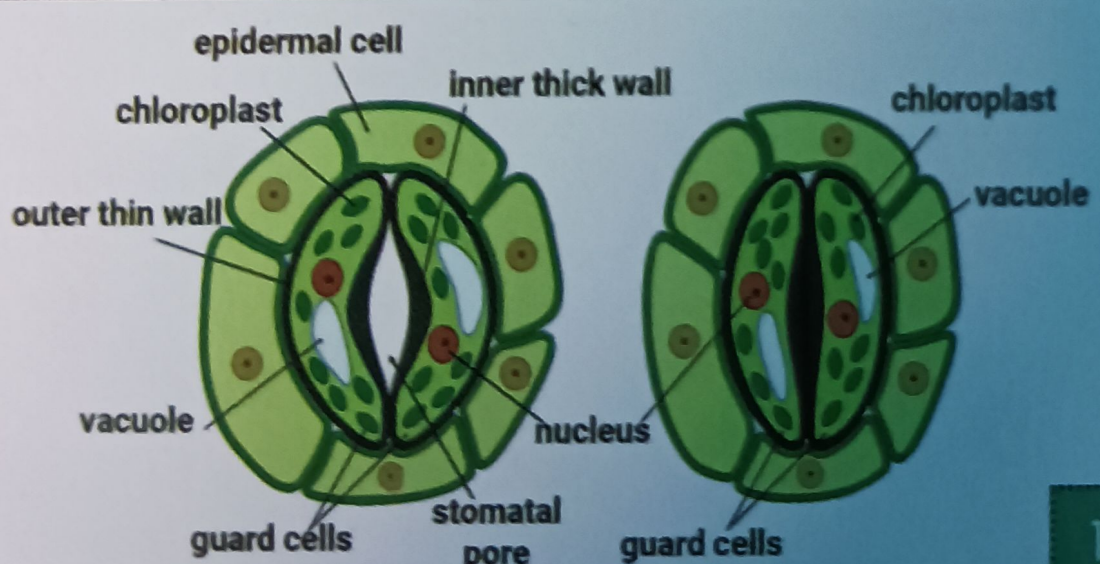
- outer-most covering
- comprises - epidermal cells, stomata, epidermal appendages (trichome, hair)
- **Epidermis** - Single layered ; Elongated, compact ; Parenchymatous cells
- Cuticle (wax) is absent in root → prevents transpiration
- Root hair - unicellular (absorbs H_2O & minerals).
- **Trichomes** - (hair on stem) ;multicellular; secretory (maybe)
  prevent water loss (transpiration)

Stomatal apparatus

stomatal aperture + guard cells + subsidary cells

Guard cell

dumbbell shaped (monocots)	thick-innerwalls; thick-outer walls.
chloroplast (+)	regulate opening of stomata



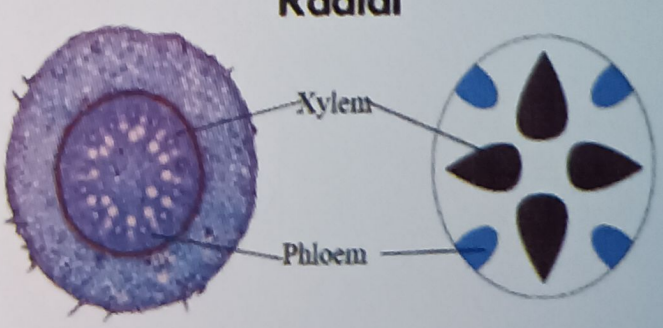
GROUND

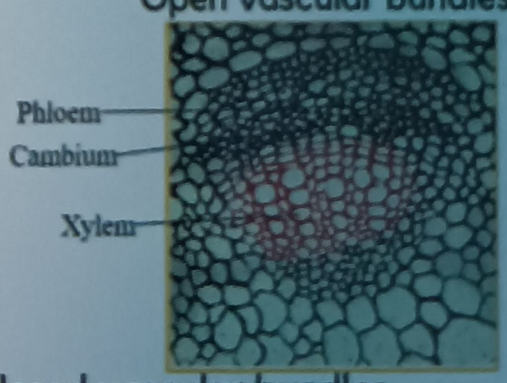
Ground consist of parenchyma, collenchyma, sclerenchyma.

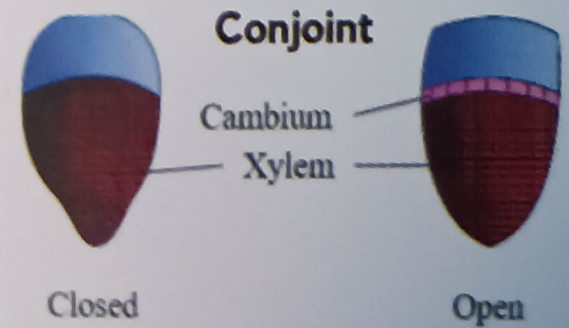
- Parenchymatous cells are present in Cortex, Pericycle, Pith, Medullary rays
- Ground tissue have thin-walled chloroplast cells containing and is called mesophyll.

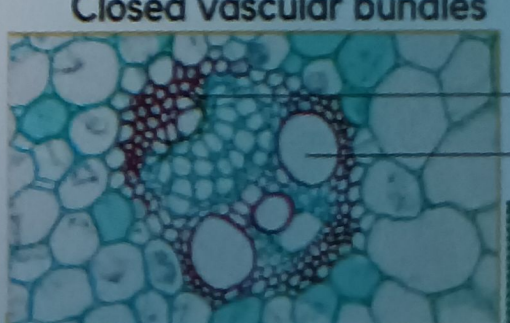
VASCULAR

- Xylem, Phloem
- Dicots→ Cambium (+) → open vascular bundles (form 2° Xylem & Phloem)
- Monocots-Cambium (-) → No 2° tissue (closed vascular bundles)
- If xylem + Phloem are arranged in alternate manner (different radii), it is called radial (in roots).
- Conjoint → along same radii (Stem, Leaves)
- Phloem located outside; periphery to xylem









DICOT ROOT

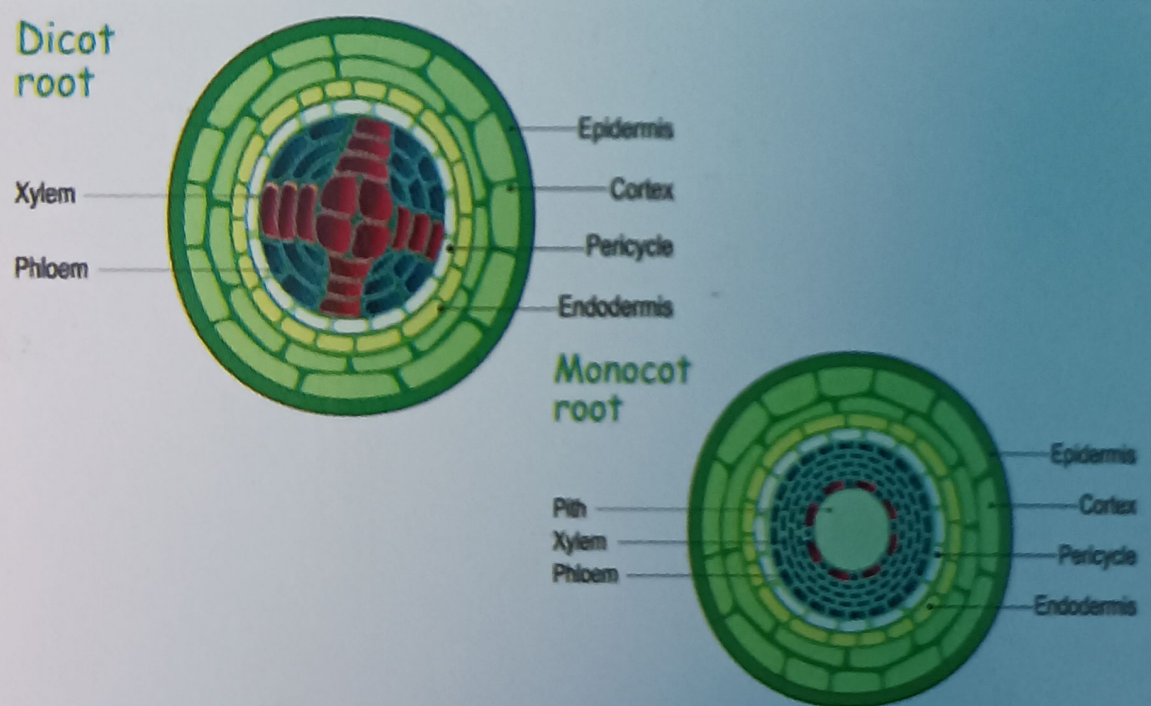
- Epiblema - outermost layer.
- Unicellular root hair
- Cortex- parenchyma.

- endodermis - barrel-shaped cells; intercellular spaces (-) ; deposition of suberin (casparian strips)

- Pericycle- thick walled Parenchyma and it give rise to lateral roots & vascular cambium

- conjuctive tissue-parenchyma b/w xylem & phloem
- cambium ring form b/w xylem & phloem

- Stele-tissues on the inner side of the endodermis such as pericycle, vascular bundles and pith constitute the stele.



MONOCOT ROOT

epidermis, cortex, endodermis, pericycle, vascular bundle, pith

- 6 xylem bundles;larger , developed pith.
- 2° growth(-)

DICOT STEM

- Epidermis - outermost; cuticle(+); trichomes(+); few stomata
- pericycle - semilunar patch (sclerenchyma)
- medullary ray - layers of radially placed parenchyma, b/w vascular bundles
- vascular bundles - rings(*Angiosperms); conjoint; open; endarch
- pith - parenchyma

Cortex

hypodermis

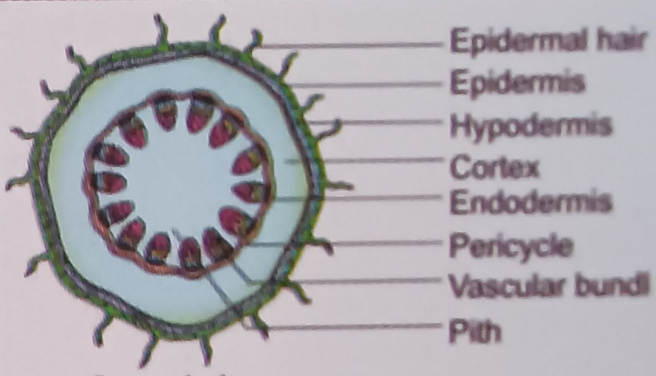
- collenchyma
- provide strength

corticle layer

- parenchyma
- intercellular spaces(+)

Endodermis

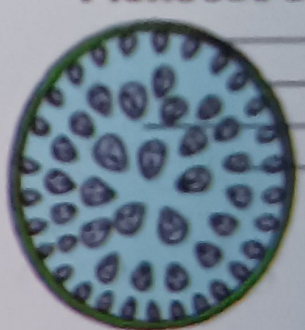
- rich in starch
- layer (starch sheath)



Ground plan

Dicot STEM

Monocot STEM



Ground plan

MONOCOT STEM

- sclerenchymatous hypodermis
- sclerenchymatous bundlesheath
- conjoint, closed, scattered vascular bundles
- phloem parenchyma(-)
- vascular bundles have H_2O containing cavities

DICOT LEAF - 3 parts

1.Epidermis

- covers both adaxial & abaxial part ; cuticle (+)
- abaxial > adaxial (stomata)

2.Vascular system

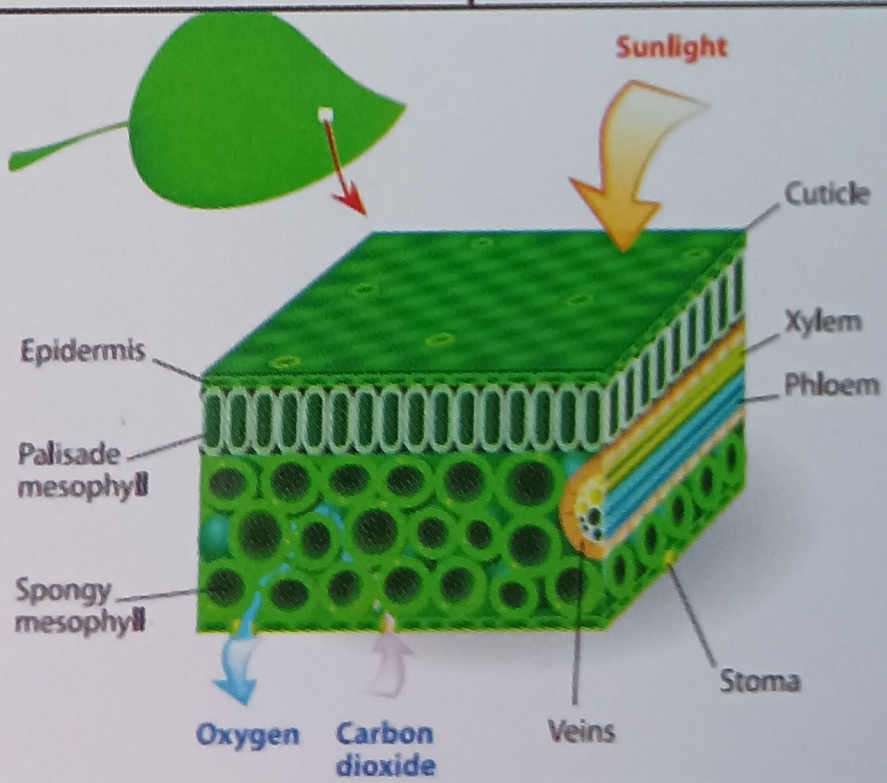
- Vascular bundles (veins and midrib)
- size depends on size of veins
- bundle sheath- surrounds vascular bundles

3.Mesophyll

- tissue b/w upper & lower epidermis
- chloroplast(+)

Mesophyll Types

Palisade parenchyma	Spongy parenchyma
elongated cells	oval, round cells
cells arranged vertically	air cavities(+)
(adaxial part)	(abaxial part)



MONOCOT LEAF

- stomata (+) on both surfaces
- mesophyll not differentiated in palisade & spongy layers

Bulliform cells

- large, colourless cells (modification of adxial epidermal cells) in grass
- Due to water stress Cells become flaccid (leaf curls to avoid H_2O loss)
- Due to absorption of water , Cells become Turgid (Leaf surface exposed)

- Vascular bundles same size (parallel venation)