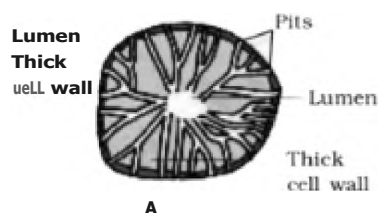


ANATOMY OF FLOWERING PLANTS

The tissue

- A group of cells having a common origin and usually performing common function are called tissues.
- Plant tissues divided as!
- ~~Meristematic~~ Tissue: a). Apical Meristem
b). Internodal Meristem
c). Lateral Meristem
- Permanent Tissue:
 - 1. Simple Permanent Tissue: a). Parenchyma
b). Collenchyma
c). Sclerenchyma
 - Complex Permanent Tissue: a). Xylem
b). Phloem
- Parenchyma is a simple permanent living tissue.
- Collenchyma Consists of cells which are much thickened at corner due to cellulose, hemicelluloses and pectin. They provide mechanical support to the growing parts of the plant like young stem.
- Sclerenchymas are supportive tissue having highly thick walled cells with little or no protoplasm due to deposition of cellulose or lignin. They are of two types fibres and sclereids.



A fibre

Complex Tissues — Xylem and phloem constitute the complex tissues in plants and work together as a unit.

Xylem	Phloem
(a). It conducts water or sap. Xylem is made up of vessels, tracheid, xylem fibre and xylem parenchyma.	(a). Phloem conducts organic food. Phloem is made up of sieve tube elements, companion cells, phloem parenchyma and phloem fibres.

- ◆ Primary xylem is of two types — Protoxylem and metaxylem.
- In gymnosperms, albuminous cells and sieve cells, they lack sieve tube and companion

Epidermal Tissue System

- It forms the outermost covering of whole plant body, which consists of epidermal cells, stomata, epidermal appendages (trichomes and hairs).
- In dicots, stomata are bean-shaped having two guard cells closing the stomatal pore. In monocots, stoma is dumbbell-shaped. Guard cells contain chloroplasts that help in opening and closing of stomata.
- Trichomes are present on stems, which are multicellular branched or unbranched preventing water loss due to transpiration.

The ground Tissue System

- All the tissue between epidermis and vascular bundle forms the ground tissues.
- Leaves the mesophyll, chloroplast containing cell forms the ground tissues.

The Vascular Tissue System

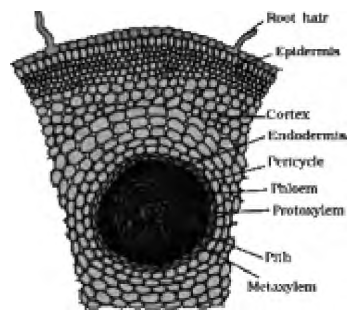
- The vascular system consists of complex tissue, xylem and phloem that together form vascular bundles.
- Open vascular bundle (scattered between xylem and phloem) found in dicot stem.
- Closed vascular bundle (cambium absent between xylem and phloem) found in monocot stem.
- When xylem and phloem within a vascular bundle are arranged in alternate manner on different radii, the arrangement is called radial as in roots.
- * When xylem and phloem are situated at the same radius of vascular bundle. It is called conjoint as in stem and leaves.

Dicotyledonous Root

- The outermost layer of dicot root is epidermis containing unicellular root hairs.
- The innermost layer of cortex is called endodermis having waxy material suberin as Casparian strips.
- Pericycle is present below endodermis.
- Two to four xylem and phloem patches are present.

Monocotyledonous Roots

- Anatomically monocot roots epidermis, cortex, endodermis, pith are similar to dicots except having more than 6 vascular bundles with larger pith.



Dicotyledonous Stem

- **Epidermis** Is the outermost layer of dicot stems having thin layer of cuticle, may contain trichomes and hairs.
- **Cortex** is divided into three sub layers • outer hypodermis (sclerenchymatous), middle cortical layer (parenchymatous) and inner endodermis, which is rich in starch grains so, also known as starch sheath.
- **Vascular bundles** are conjoint, periclinally arranged with protoxylem, Pith is the parenchymatous with intercellular spaces.

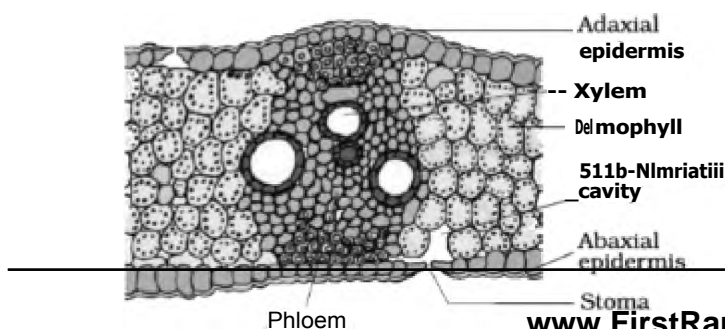
Tricotyledonous Stem

- They have sclerenchymatous hypodermis, large number of scattered vascular bundles surrounded by sclerenchymatous bundle sheath. Vascular bundles discrete and conjoint. Phloem parenchyma is absent.

Dicotyledonous Leaf

- **Epidermis** covers both upper (adaxial) and lower (abaxial) surface. Abaxial surface have more stomata.
- **Mesophyll** bears chlorophyll to carry out photosynthesis, are made up of parenchyma. Spongy parenchyma are spherical and loosely arranged but palisade parenchyma are elongated.
- **Vascular system** includes vascular bundles, which are seen as veins and midribs.

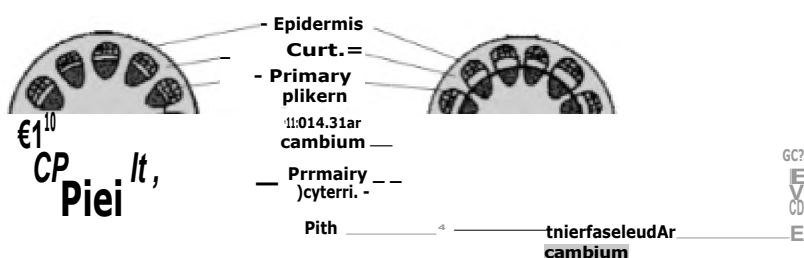
Monocotyledonous leaf (Isobilateral)



- * Stomata are present on both surfaces of epidermis and mesophyll cells are not differentiated as spongy and palisade cells.
- In grasses, some adaxial epidermal cell with veins modify into large, empty, colourless cells called bulliform cells.

Secondary Growth

- It is the growth in girth (thickness) due to the formation of secondary tissues by lateral meristems (vascular cambium and cork cambium).
- In dicots, the vascular cambium is present between xylem and phloem is called intrafascicular cambium. The cells of medullary rays become meristematic to form interfascicular cambium, which together form the complete ring of cambium.



- Cork cambium or phellogen is formed in the outer cortex of stem.
- Cork is impervious to water due to deposition of suberin in cell wall. Phellogen, phellern and phelloderm are collectively called periderm.
- Secondary growth also occurs in stem and root of 'Gymnosperms' but not in monocotyledons.