

Anatomy of Flowering Plants

Anatomy of Flowering Plants – Overview

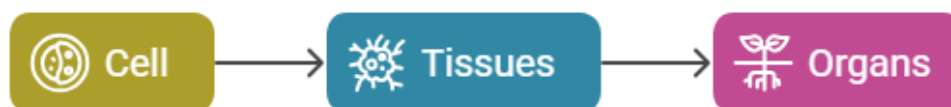
- Structural similarities and variations are observed not only in the **external morphology** but also in the internal structure of plants and animals.
- This chapter focuses on understanding the internal organization and functional structure of higher plants (anatomy).

What is Plant Anatomy?

- **Plant anatomy** is the study of the internal structure of plants.
- It focuses on the organization and arrangement of cells, tissues, and organs within a plant.

Structural Organization in Plants

- The basic unit of structure and function in a plant is the **cell**.
- **Cells** group together to form **tissues**.
- **Tissues** are organized into various **organs** such as the root, stem, and leaf.

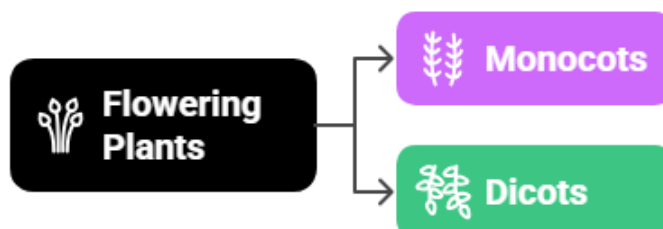


Internal Variations Among Organs

- Different **plant organs** (like roots, stems, and leaves) have distinct internal structures.
- These variations reflect the specific functions carried out by each organ.

Anatomical Differences in Angiosperms

- Flowering plants (angiosperms) are classified into:
 - Monocots
 - Dicots



- These two groups show clear anatomical differences in various organs such as the vascular bundle arrangement, leaf venation, and root structure.

Environmental Adaptations

- The internal structure of plants also shows **adaptations** to different environmental conditions, such as:

- Aquatic habitats
- Arid or desert regions
- Saline soils
- These adaptations help the plant survive and function efficiently in diverse ecosystems.

Tissue System in Plants

- Plant tissues are classified not only based on the **type of cells** they are composed of but also on their location and function in different parts of the plant body.
- According to their structure and position, plant tissues are grouped into three main tissue systems:

1. Epidermal Tissue System

Definition:

- The epidermal tissue system forms the **outermost** covering of the entire plant body and functions as a protective layer.

Components:

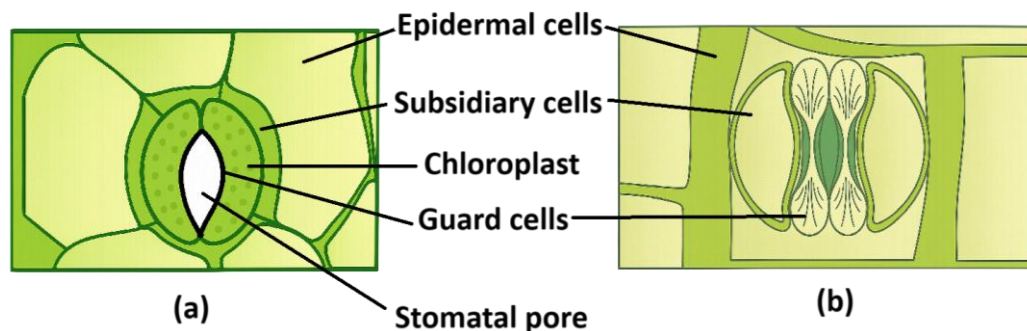
Epidermal Cells:

- Elongated, compactly arranged, parenchymatous cells forming a single continuous layer.
- They contain minimal cytoplasm and a large central vacuole.

Cuticle:

- A waxy layer covering the epidermis (absent in roots) that prevents water loss.

Stomata:



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

- Pores in the epidermis (mainly on leaves) that regulate transpiration and gaseous exchange.
- Each stoma consists of **two guard cells**:
 - Bean-shaped in most plants
 - Dumb-bell shaped in grasses
- Guard cells have thickened inner walls, thin outer walls, and contain **chloroplasts**.
- **Subsidiary Cells:** Specialized epidermal cells around guard cells; together with stomata and guard cells, they form the stomatal apparatus.

Epidermal Appendages:

- **Root Hairs:**
 - Unicellular extensions of epidermal cells; help in water and mineral absorption.
- **Trichomes** (on stems):
 - Usually multicellular, may be branched/unbranched, soft/stiff, or even secretory.
 - Help in reducing water loss by transpiration.

2. Ground (Fundamental) Tissue System

Definition:

- Includes all tissues excluding the epidermal and vascular tissues.

Composition:

- Mainly made up of **simple tissues**:
 - Parenchyma
 - Collenchyma
 - Sclerenchyma

Location & Function:

- Present in cortex, pericycle, pith, and medullary rays of primary stems and roots.
- In leaves, the ground tissue consists mostly of chloroplast-containing parenchyma cells, collectively called **mesophyll**, which is the site of photosynthesis.

3. Vascular (Conducting) Tissue System

Definition:

- Comprises complex tissues responsible for the transport of water, minerals, and food throughout the plant.

Main Components:

- **Xylem:** Conducts water and minerals.
- **Phloem:** Conducts organic nutrients (mainly sucrose).

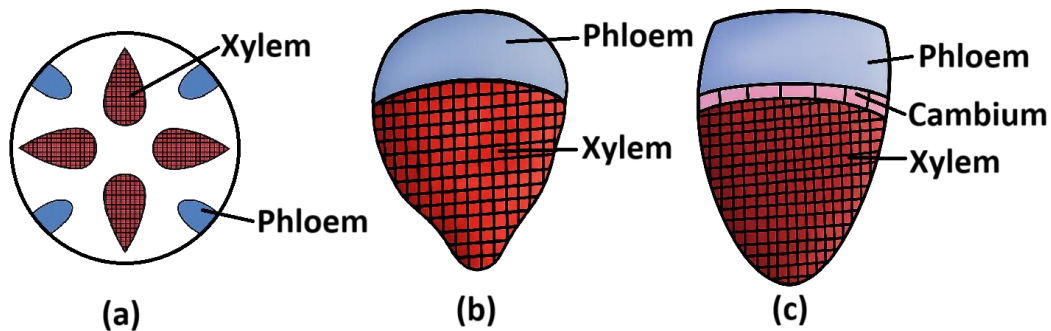
Types of Vascular Bundles:

A. Open Vascular Bundles:

- Found in dicot stems.
- Contain cambium between xylem and phloem.
- Capable of secondary growth (producing secondary xylem and phloem).

B. Closed Vascular Bundles:

- Found in monocot stems.
- No cambium present.
- Do not undergo secondary growth.



Various types of vascular bundles: (a) radial (b) conjoint closed (c) conjoint open

Types of Arrangements:

A. Radial Bundles:

- Xylem and phloem are arranged on alternate radii.
- Common in roots.

B. Conjoint Bundles:

- Xylem and phloem are placed along the same radius.
- Common in stems and leaves.
- Typically, phloem is located on the outer side of the xylem.

Anatomy of Dicotyledonous and Monocotyledonous Plants

- To understand tissue organization in roots, stems, and leaves, the transverse sections of mature zones of these organs are studied.

1. Dicotyledonous Root (Example: Sunflower Root)

A transverse section of a dicot root shows the following internal tissue organization:

A. Epiblema (Piliferous Layer):

- Outermost layer of the root.
- Many cells extend outward as **unicellular root hairs**.

B. Cortex:

- Composed of several layers of thin-walled parenchyma cells with intercellular spaces.

C. Endodermis:

- The innermost layer of the cortex.

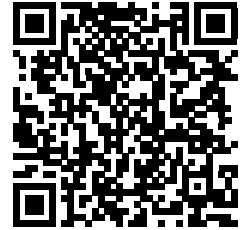


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