

Al-Mustaqbal University

College of Science

General biology-Botany

Professions Theoretical Lecture 5

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**Plant Tissue: Leaf**

The **leaf** is a specialized plant organ optimized for **photosynthesis**, **gas exchange**, and **water regulation**. It is made up of various tissues, each playing a unique role. Below is a detailed breakdown:

**Tissues in a Leaf**

1. **Epidermal Tissue**
   1. **Upper Epidermis**:
      * A single protective layer of cells located on the top surface.
      * Covered by a waxy **cuticle** to prevent water loss.
      * Transparent to allow light to pass to the underlying mesophyll.
   2. **Lower Epidermis**:
      * Contains **stomata**, which are small openings for gas exchange.
      * Stomata are surrounded by **guard cells**, which control their opening and closing.
      * Also has a thin cuticle but less prominent than the upper epidermis.
2. **Mesophyll Tissue**
   1. **Palisade Mesophyll**:
      * Found beneath the upper epidermis.
      * Contains tightly packed cells with numerous chloroplasts, making it the main site of **photosynthesis**.
   2. **Spongy Mesophyll**:
      * Located beneath the palisade mesophyll.
      * Consists of loosely arranged cells with large air spaces to facilitate **gas exchange** (oxygen, carbon dioxide) and some photosynthesis.
3. **Vascular Tissue**
   1. Forms the **veins** of the leaf, crucial for transport:
      * **Xylem**: Transports water and dissolved minerals from the roots to the leaves.
      * **Phloem**: Transports sugars (products of photosynthesis) to other parts of the plant.
4. **Specialized Features**
   1. **Stomata**:
      * Located primarily on the lower epidermis.
      * Allow for gas exchange (intake of CO₂, release of O₂) and regulate water loss through **transpiration**.
   2. **Cuticle**:
      * A waterproof layer that protects against dehydration and pathogens.

**Functions of Leaf Tissues**

1. **Photosynthesis**:
   * Chloroplasts in the mesophyll capture light energy to convert CO₂ and water into glucose and oxygen.
2. **Gas Exchange**:
   * Stomata enable CO₂ to enter and O₂ to exit, crucial for photosynthesis and respiration.
3. **Water Transport and Regulation**:
   * Xylem delivers water for photosynthesis, and transpiration regulates leaf temperature.
4. **Sugar Transport**:
   * Phloem distributes the glucose produced in the leaf to other parts of the plant.

**Plant tissue : Stem**

The **stem** is a vital part of a plant, acting as a central structure that connects the roots to the leaves and other parts. It plays multiple roles in growth, transport, and reproduction. Here's a more detailed breakdown of the stem as a **plant tissue**:

**Functions of the Stem:**

1. **Support**:
   * The stem supports the plant's leaves, flowers, and fruits, enabling them to be positioned for maximum light exposure, crucial for photosynthesis.
2. **Transport**:
   * The stem functions as the pathway for transporting water, minerals, and nutrients.
     + **Xylem**: Moves water and dissolved minerals from the roots to the rest of the plant.
     + **Phloem**: Carries the products of photosynthesis (mainly sugars) from the leaves to other plant parts.
3. **Storage**:
   * Some stems, such as those of tubers (potatoes), store water and nutrients for the plant to use when necessary.
4. **Growth**:
   * The stem contains **meristematic tissues** that allow it to grow in length (via the apical meristem) and in width (via lateral meristems like the vascular cambium).
5. **Reproduction**:
   * Some plants can reproduce vegetatively through stem modifications like **runners** (e.g., strawberry), **rhizomes** (e.g., ginger), or **bulbs** (e.g., onion).

**Structure of the Stem:**

The stem is composed of several tissue types organized into distinct regions:

1. **Dermal Tissue**:
   1. The **epidermis** serves as the outer protective layer. It may have a **cuticle** to reduce water loss.
   2. **Stomata** and **trichomes** (hair-like structures) are also found in the epidermis, aiding in gas exchange and protecting against herbivores.
2. **Ground Tissue**:
   1. **Cortex**: This is the region just inside the epidermis, containing mostly parenchyma cells for storage.
   2. **Pith**: The central region of the stem, also made up of parenchyma cells, mainly for storage.
   3. **Collenchyma**: Found beneath the epidermis, providing flexible support.
   4. **Sclerenchyma**: Provides rigid support and is present in mature parts of the stem.
3. **Vascular Tissue**:
   1. **Xylem**: Transports water and dissolved minerals from the roots to the leaves and other parts.
   2. **Phloem**: Transports the food produced in leaves to the rest of the plant.
   3. The vascular tissue is arranged in **vascular bundles**. In **dicots**, these bundles form a ring, while in **monocots**, they are scattered throughout the stem.
4. **Meristematic Tissue**:
   1. **Apical Meristem**: Located at the tips of the stem and roots, it allows the stem to grow in length (primary growth).
   2. **Lateral Meristem**: Found in plants that undergo secondary growth (increase in girth), such as the **vascular cambium** and **cork cambium**.

**Stem Modifications:**

Stems can modify to serve various purposes:

1. **Storage**:
   * **Tubers** (e.g., potato) store starch and other nutrients.
   * **Corms** (e.g., gladiolus) store water and food.
2. **Support**:
   * **Tendrils** (e.g., pea plants, cucumbers) help the plant climb and stay upright.
3. **Protection**:
   * **Thorns** (e.g., rose plants) deter herbivores.
4. **Photosynthesis**:
   * In some plants like cacti, the stem itself becomes flattened and photosynthetic when leaves are modified or absent.
5. **Vegetative Reproduction**:
   * **Runners** (e.g., strawberry) and **rhizomes** (e.g., ginger) can give rise to new plants.