Lecture Outline:

Gaining perspective: The historic timescale of life on Earth
Hierarchical organization of multicellular organisms (cells → whole organism)

**Tissues** are groups of cells that perform a common function

Flowering plants are made up of three basic *tissue types*: dermal, ground, and vascular tissues

The organization and anatomy of major *plant organs*: stems, leaves, and roots

Flowering plants are categorized as *monocots* or *eudicots* based on morphology

Anatomical differences in the stems, leaves, and roots of monocots and eudicots
The history of life on Earth

Key events in life’s history include:

1. the origins of single- and multi-celled organisms
2. the colonization of land by plants and other organisms
Origin of solar system and Earth

Prokaryotes

Atmospheric oxygen

Archaean

Proterozoic

Paleozoic

Mesozoic

Cenozoic

Humans

Plants colonize land

Animals

Multicellular eukaryotes

Single-celled eukaryotes

Humans

Prokaryotes

Atmospheric oxygen

Origin of solar system and Earth

Billions of years ago

Proterozoic

Archaean

1

2

3

4

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If the earth’s life was a 24 hour clock, humans have been here on earth for ~5 seconds!
The plant body is organized into a **root** and **shoot system** (stems and leaves), connected by **vascular tissue**

3 basic **plant organs:**
1. roots
2. stems
3. leaves
Meristems are regions of active cell division

- **meristems** = plant tissues that are actively dividing and remain embryonic as long as the plant lives
  - Because of meristems, plants have **indeterminate growth**

Eastern white pine
*Pinus strobus*

Laura Hill
*Homo sapiens*
Growth in plants: **Apical** and **lateral** meristems

**Apical meristems** are responsible for *primary growth* = growth in **length** – located at the tips of roots and shoots of all plants

**Lateral meristems** are responsible for *secondary growth* = growth in **thickness** (woody plants)

– 2 types of lateral meristems:

1. **vascular cambium**
2. **cork cambium**
Woody plants have *both* apical and lateral meristems

Herbaceous plants have *only* apical meristems
Apical meristems

Lateral meristems
Structure and function are correlated at all levels (cells to whole organism)
Hierarchical organization of *multicellular* organisms (e.g., plants, animals)

- cells → tissues → tissue systems → organs → whole organism

  - e.g., tracheids
    - e.g., xylem
  - e.g., vascular
    - e.g., stem
  - e.g., angiosperm (flowering plant)
Apical meristems give rise to 3 plant tissue systems:

1. **dermal tissue**
   (outer covering)

2. **vascular tissue**
   (transport)

3. **ground tissue**
   (storage, photosynthesis, support, etc.)
Types of dermal tissue

stomata (leaf pores) allow for gas exchange (CO₂ in and O₂ out)
Types of dermal tissue

Stomata (leaf pores) allow for gas exchange (CO₂ in and O₂ out).

Trichomes

Stinging nettle (*Urtica dioica*)
Types of dermal tissue

**stomata** (leaf pores) allow for gas exchange \( \text{CO}_2 \text{ in and O}_2 \text{ out} \)

**periderm** replaces the epidermis in woody plants
Types of ground tissues

Parenchyma

Collenchyma

Sclerenchyma

Figure 3.4  Ground tissues. (a) Parenchyma cells are the most abundant plant tissue type and have characteristically thin cell walls. (b) Collenchyma cells have primary cell walls that are thickest at the corners. (c) Sclerenchyma cells have very thick secondary cell walls and are nonliving.
Types of vascular tissue – xylem and phloem

Water-conducting cells of the *xylem tissue*
- *tracheid cells*
- *vessel elements (cells)*

Sugar-conducting cells of the *phloem tissue*
- *sieve tube members (cells)*
- *companion cells*

*Figure 3.5* (a) Xylem. The conducting cells of xylem are tracheids and vessel elements. (b) Phloem. Sugars are loaded by companion tube members for transport.
Tissue structure is correlated to its function

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<th>Tissue Type</th>
<th>Cell Types</th>
<th>Function</th>
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<td>Epidermis</td>
<td>Epidermal cells</td>
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<td>Periderm</td>
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<td>Protection</td>
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<td>Ground</td>
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<tr>
<td>Parenchyma</td>
<td>Parenchyma cells</td>
<td>Storage, photosynthesis</td>
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<tr>
<td>Vascular</td>
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<td>Xylem</td>
<td>Tracheids, vessel elements, fibers, parenchyma</td>
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<td>Sieve tube members, companion cells, fibers, parenchyma</td>
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