

**Physiological Dynamics in Animals & Plants – Lecture 3 –
Plant Form and Function – Morphology and Growth**

- I. As in animals, form follows function in plants.
- II. Roots and shoots are adaptations to living on land.
 - A. Roots and shoots are interdependent “systems”.
 - B. Roots are heterotrophic; shoots are autotrophic.
 - C. Shoots depend on roots for water and minerals; roots depend on shoots for food.
 - D. Water and minerals are carried between roots and shoots through xylem; sugars are carried between shoots and roots through phloem.
- III. The root and shoot systems of monocots and dicots differ somewhat and may be modified to carry out additional functions.
 - A. Angiosperms (ca. 275,000 species) can be divided into two groups – monocots and dicots based on a number of distinguishable morphological characteristics.
 - B. Dicots have one large taproot with smaller lateral roots that branch from the taproot; monocots have fibrous roots.
 - C. Both types of roots may have root hairs.
 - D. Some plants have aboveground adventitious roots.
 - E. The shoot system typically includes stems, leaves, buds, flowers, and fruits.
 - F. Stems are an alternating system of nodes and internodes; leaves are attached to stems at nodes.

- G. Buds may be axillary or terminal; terminal buds inhibit development of axillary buds into leaves = apical dominance.
 - H. Leaves consist of a blade and a petiole that attaches the blade to the stem – leaf morphology is different in monocots and dicots. Leaf morphology can be highly variable from species to species.
- IV. Five major cell types make up plant tissues.
- A. Parenchyma cells
 - B. Collenchyma cells
 - C. Sclerenchyma cells
 - D. Water-conducting cells (of xylem): tracheids and vessel elements
 - E. Food-conducting cells (of phloem): sieve-tube members
- V. The five cells types comprise three major tissue systems in the organs of the plant: dermal, vascular, and ground tissue systems
- A. The dermal system = epidermis
 - 1. Root hairs, trichomes, cuticle
 - B. Vascular system = xylem & phloem
 - C. Ground tissue system = space between vascular and dermal tissues = the bulk of a young plant
 - 1. Composed of parenchyma, collenchyma, and sclerenchyma cells
- VI. Plants grow from meristems, internal embryonic tissues, throughout their lifetimes.

- A. Most plants grow as long as they live = indeterminate growth.
- B. Annual plants complete their life cycle in \leq one year; biennial plants take two years; plants that take longer are perennials.
- C. Cells of the meristem from which new cells are made are called initials; those that are formed from initials are called derivatives.
- D. Plants grow in length (elongate) and in girth.
- E. Elongation = primary growth is from apical meristems at the tips of roots and stems = root apical meristems and shoot apical meristems, respectively.
- F. Secondary growth (increase in girth) is found only in woody plants and is from lateral meristems.

VII. Primary growth of roots

- A. Roots can be divided into three zones – the zone of cell division, the zone of elongation, and the zone of maturation.
- B. The protoderm, the procambium, and the ground meristem are three meristems that give rise to dermal, vascular, and ground tissues, respectively.

VIII. Primary growth of shoots

- A. Shoot apical meristems include protoderm, procambium, and ground meristems.
- B. Shoot growth is “modular”.
- C. Leaves arise from “primordia” on the flanks of the shoot apical meristem.

- IX. Secondary growth of woody plants occurs from lateral meristems – the vascular cambium and the cork cambium.
- A. Vascular cambium produces secondary xylem and phloem.
 - B. The cork cambium produces cork.
 - C. Cork cambium + cork = periderm
 - D. Secondary phloem + periderm = bark
 - E. Primary and secondary growth occur simultaneously but in different parts of the plant.