

PLANT ANATOMY Lecture 17 - Root Structure

- I. Root structure - most information comes from the primary roots of seedlings
 - A. Root cross section (from outside in) FOCUS = DICOT
 1. Epidermis - produces specialized "trichomes" called root hairs
 2. Cortex (exodermis, mid cortex, & endodermis)
 - a) Exodermis - the outer layer of the cortex of some roots (a type of hypodermis that may be suberized or lignified)
 - b) Mid cortex - ground tissue
 - c) Endodermis - just outside the pericycle (has Casparian strip)
 3. Stele (pericycle, vascular parenchyma, phloem, & xylem)
 - a) Pericycle - area of cells just outside the phloem and xylem
 - b) Vascular parenchyma - area between xylem and phloem
 - c) Phloem - protophloem & metaphloem (impossible to distinguish)
 - d) Xylem - protoxylem (outside) & metaxylem (inside)
 - B. MONOCOTS differ in having a pith and a polyarch arrangement of vascular tissue
 1. Very little phloem and a whole of of xylem is a characteristic of roots in monocots
- II. Architecture of primary vascular tissue
 - A. Diarch, triarch, tetrarch, pentarch = dicots, gymnosperms, & most LVPs
 - B. Polyarch = most monocots
- III. Epidermis, exodermis, endodermis, & pericycle
 - A. Epidermis
 1. Velamen - refers to a multiple epidermis (especially in orchids & aerial roots)
 - a) Dead epidermal cells act as a sponge for soaking up water
 - B. Exodermis
 1. Has a delicate Casparian strip
 2. Secondary walls can form over the Casparian strip (thickening to the outside)
 - C. Endodermis - the innermost layer of the cortex
 1. Contains the Casparian strip (band) - looks like a red ribbon
 - a) It forms to prevent passage of materials between cells and forces movement through the symplast (in through living cells)
 - b) The strip is made of a hydrophobic material so that water cannot percolate through the endodermis
 2. The endodermis (with the strip) regulates what goes in and out of the cell
 3. Water loss is also prevented by the endodermis
 4. Secondary walls can form over the Casparian strip (thickening to the inside)
 - D. Pericycle
 1. Can be multiseriate (more than one layer of cells) - especially monocots
 2. In dicots, the pericycle contributes to the meristem for secondary growth
- IV. Vascular tissue (xylem & phloem)
 - A. Xylem in root bundles is exarch (protoxylem exterior & metaxylem interior) NOTE: Xylem in shoot bundles is endarch; Phloem in root and shoot bundles is exarch in roots and shoots
 - B. Xylem development in roots is centripetal (toward center) NOTE: xylem in shoots is centrifugal (toward outside); phloem development is centripetal in roots and shoots
 - C. Xylem secondary tissues are laid down centrifugally in roots and shoots and phloem secondary tissues are laid down centripetally in roots and shoots
- V. Other specializations of the root
 - A. Mycorrhizae ("fungus roots") - normal structure of roots) - 95% of all roots have these
 1. Ectomycorrhizae: envelops root - in root but not in cells - forms a Hartig net of hyphae that goes between cortical cells
 2. Endomycorrhizae: IN cells and dies (Young - fungus benefits Old - plant benefits)
 - B. Nodules
 1. *Rhizobium* - infection thread goes to root through cortex and proliferates vascular tissue - uses root nutrients and, in exchange, provides nitrogen
 - C. Parasites
 1. Hemiparasites - nutrients from the root (variably dependent on plant) - lousewort
 2. Holoparasites - grow on a host (totally dependent on plant) - mistletoe & dodder
 3. Saprophytes - dependent on fungi (variably dependent on fungus) - Indian pipe