

PLANT ANATOMY Lecture 18 - Root Meristem Root Cap, & Root Development

- I. Root tip and subapical meristems
 - A. Area of division - a bit back from the root tip because there is division in front of and in the back of the zone of division
 - B. Stuff at or near the area of division (zones)
 - 1. Central cylinder meristem zone
 - 2. Cortical initials zone
 - 3. Central cells zone
 - 4. Columella mother cells zone
 - C. Histogen theory - plant tissue derived from one massive meristem divided into precursors - meristem sometimes referred to as SUBAPICAL MERISTEM
 - 1. Dermatogen ==> protoderm ==> epidermis
 - 2. Plerome (central cylinder zone) ==> procambium ==> vascular tissue
 - 3. Periblem (cortical initials) ==> ground meristem ==> ground tissue
 - 4. Calyptragen (columella) ==> root cap
 - D. Types of subapical meristems
 - 1. Closed (2-4 zones: plerome, periblem, calyptragen) - grasses & many dicots
 - 2. Open (subapical meristem can be hard to distinguish) - LVP
 - a) Sometimes the subapical meristem can be limited to one cell
 - b) LVPs - often limited to one "Mother Cell"
 - 3. With quiescent center (area of no division)
 - a) Proximal meristem located around quiescent center
- II. Root cap
 - A. Protects apical meristem and assists root in penetrating the soil
 - B. Derived from the calyptragen
 - C. Coated with mucilage - polysaccharide + pectin (from dictyosomes)
 - 1. Mucilage is a lubricant to help roots penetrate the soil
 - D. Root cap cells only last for 2-3 weeks
 - 1. Middle lamella weakens as the cells become secretory
 - 2. Cells separate and are sloughed off into the soil
 - E. Responsible for root orientation (georeaction)
 - 1. controlled by starch-containing amyloplasts called statoliths
- III. Root development
 - A. Procambium - divides to produce primary phloem & xylem (continuous and acropetal - toward the tip)
NOTE: opposite is basipetal (toward the base)
 - B. Metaxylem cells enlarge but do not yet deposit secondary wall
 - C. Phloem is found continuous and acropetal
 - D. Xylem is found continuous and acropetal
 - E. Metaxylem deposits secondary wall and dies
- IV. Lateral roots come from divisions within the pericycle
 - A. Pericycle is found opposite to protoxylem ridge
 - B. Small group of cells form in the pericycle
 - C. Group of cells organizes a subapical meristem and a root cap
 - D. Endodermis stretches and ruptures
 - E. Cortex and epidermis are destroyed
 - F. Lateral root reaches environment prepared with root cap, etc.
- V. Secondary vascular tissue
 - A. Vascular cambium is necessary for secondary growth
 - B. Cambial layer is lateral
 - C. Process of secondary growth
 - 1. Vascular parenchyma become meristematic
 - 2. Pericycle outside protoxylem becomes meristematic
 - 3. Resulting vascular cambium produces secondary xylem and phloem
 - a) Produced in what are called SINUSES (area between protoxylem ridges)
 - 4. Secondary phloem is barely visible
 - D. Cork cambium can also function to make protective tissue