Chapters 3, 5 & 6
Plant structure –
cell, tissues,
organs, systems

Topics

• Plant cell, tissues, organs, systems and body
• Meristematic and permanent tissue types
• Typical leaf structure
• Monocot and Eudicot stems
• Monocot and Eudicot roots

Plant cell
• Large vacuole in mature cells contained by tonoplast – functions: turgor, storage, digestion
• Cell wall – cellulose, hemicellulose, pectin are polysaccharides - later in growth Lignin, at times suberin – strength, transport
• Plasmodesmata – pores on plasmalemma, cell membranes and ER are continues between cells – symplastic transport
• Plastids – chloroplasts, amyloplasts, elaioplasts, chromoplasts – know the functions
• Phragmoplast (scafolding) and cell plate during cytokinesis
• Nonflagellated sperms in many gymnosperms (except Cycads and Ginkgo) and all angiosperms
**Associations of Cells**

- Plasmodesmata connect protoplasts to create the symplast — transport water, nutrients and synthesized materials.

- Many plant cells do not abut each other tightly, so there is intercellular space between.
  - All intercellular space and cell walls together is apoplast — transport mainly water and mineral nutrients.

- Symplast and apoplast together make up the plant.

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**Plant Body**

- Two types of plant bodies:
  - Primary plant body is herbaceous.
  - Secondary plant body is woody.

- Herb - a plant that never becomes woody and covered with bark.
  - It is often an annual.
  - Can be monocot or eudicots.
Challenges of terrestrial sessile life lead to evolution of distinct, specialized tissues and organs

- Competition for sunlight
- Need for transport - water and dissolved minerals and food
- Need for support
- Need for protection

### Tissues

**Meristematic**
- Cells continue to divide
  - Apical meristem: Plant tip, branch tip, root tip - make primary tissues/body
  - Lateral meristem: Vascular cambium, cork cambium (phellogen) - make secondary tissues/body
  - Intercalary meristem: Nodal growth in monocots and horsetail

**Permanent**
- Cells have largely stopped dividing
  - Simple: largely one cell type
    - Dermal tissue
      - Epidermis
      - Periderm
        - Phellem (cork), phellogen (cork cambium), phelloderm
    - Ground tissue
      - Parenchyma - thin primary walls - capable of division - structurally close
        - Photosynthesis, storage - very common in complex tissues
      - Collenchyma - primary wall has thickenings in some areas - strength, flexibility
      - Sclerenchyma - thick secondary walls on primary wall - fibers and sclereids - found in complex tissues also - dead at maturity

**Complex**
- More than one cell type
  - Xylem - tracheids and vessels - parenchyma and fibers too
  - Phloem - sieve tubes and companion cells - parenchyma and fibers too

### Ground - Parenchyma

- Parenchyma cells - only thin primary walls
- Most young mass - most of our food
  - Most metabolically active
  - Most - alive at maturity
- Special parenchyma
  - Chlorenchyma
  - Glandular cells
  - Transfer cells
  - Phloem
Ground - Collenchyma

- Collenchyma cells - primary wall thick in some areas - chloroplasts present sometimes
- Plastic support – living cells
- Collenchyma tends to exist:
  - Beneath the epidermis
  - Supporting vascular bundles

Celery – C, collenchyma
P, parenchyma

Ground - Sclerenchyma

- Sclerenchyma cells - primary wall and a thick secondary wall that is usually lignified
- These walls are elastic
- Sclerenchyma provides strength to plant/tree
- Usually dead at maturity
- Two types:
  - Conductive – vessels, trachieds
  - Mechanical – fiber, sclereids

Complex tissues

Xylem fibers
Xylem parenchyma
Trachieds
Pit membranes
Parenchyma cell
End wall
Secondary wall
Typical Eudicot leaf structure

Discuss functions of each tissue
Draw guard cells to show chloroplasts and uneven thickening
Secondary growth in Eudicot stem (root also)

Mature Eudicot stem

Cross section thru mature eudicot stem showing vascular and phellem tissues and a lenticle (on right)
Root — Young Eudicot and Monocot, and Eudicot secondary growth