Plant cells and tissues

Figure 6.9 Anatomy of a single plant cell

Note: “protoplast” = everything inside the cell wall.

Figure 6.8 The plasma membrane

The Chloroplast

• Most of the living world depends on chloroplasts for its energy!
• Two membranes on outside
• Complex membrane structure on inside

Central vacuoles

• Are selective in what passes through tonoplast (membrane enclosing the central vacuole)
• May be used as disposal or storage sites
• Can enlarge by gaining water, resulting in cell growth
Figure 6.27 Microfilaments (actin filaments) are important for cytoplasmic streaming—distribution of materials within a cell.

Figure 6.28 Plant cell walls
Protects cell, maintains shape, prevents excess water uptake.
Plasmodesmata: connect adjacent living cells.

**An introduction to plant tissues**

- **Tissue**: an integrated group of cells with a common function, structure, or both

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**Three tissue systems of plants**

- **Dermal tissue** - outer protective covering
  - Epidermis/periderm analogous to skin
  - Cuticle - waxy coating to preserve water
- **Vascular tissue** - transport system
  - Xylem: carries water and nutrients from roots to leaves. Support and food storage too.
  - Phloem: transport organic nutrients (sugar), amino acids, lipids, hormones etc.
- **Ground tissue** - “everything else”.
  - Pith (internal to vascular), Cortex
  - Function in storage, photosynthesis, & support

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**Plant Cell Types**

- **Epidermis**
  - **Guard Cells**
  - Trichomes (appendages). Can be on roots (facilitate absorption), or on ‘hairy’ leaves - reduce solar radiation in xerophytes. Some secrete salts (in halophiles)

- These cells provide mechanical protection
- Many are covered with a cuticle (cutin and wax) to minimize water loss
**Ground Tissues Parrenchyma and Collenchyma**

- **Parenchyma**
  - Parenchyma: photosynthesis and metabolism (storage and secretion).
  - Collenchyma: support (flexible).
  - Sclerenchyma: storage, support (firm), protection.

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**Parenchyma cells**

- Alive at maturity
- No secondary walls
- Site of most plant metabolism
- Play a role in wound healing and regeneration

**Collenchyma cells**

- Living at maturity
- No secondary cell walls or lignin
- Provide flexible support to growing parts of plant
Sclerenchyma cells

- Thick secondary walls, usually with lignin
- Usually dead at maturity
- Usually specialized for support and strengthening of parts that have ceased elongating.
  - Sclereids impart hardness to seed coats, shells of nuts (give pears their grit)
  - Fibers are usually long, slender, tapered (hemp and flax fibers)

Figure 35.8: The three tissue systems of a plant
Xylem cells

- Dead at maturity
- Tracheids found in all vascular plants
  - Long and thin with tapered ends
  - Lignin for structural support
  - Less specialized than vessel elements (‘safer’ though)
- Vessel elements found mainly in angiosperms (flowering plants)
  - Generally wider, shorter, and less tapered than tracheids
  - Has perforations for more efficient water flow - but perforations are open systems and can be less safe.
Phloem

- Primary and secondary phloem. Primary phloem is often destroyed during elongation of the organ.
- Principal conducting cells are the sieve elements (‘with pores’)

Sieve-tube members

- Alive at maturity, but...
- Lack nucleus, ribosomes, organelles (highly specialized like human red blood cells!)
- Served by nucleus etc. of adjacent companion cells
  - Connected via plasmodesmata