Cells and Tissues
Connective Tissue

- Found everywhere in the body
- Includes the most abundant and widely distributed tissues

Functions
- Binds body tissues together
- Supports the body
- Provides protection
Connective Tissue Characteristics

- Variations in blood supply
  - Some tissue types are well vascularized
  - Some have a poor blood supply or are avascular

- Extracellular matrix
  - Non-living material that surrounds living cells
Extracellular Matrix

- Two main elements
  - Ground substance—mostly water along with adhesion proteins and polysaccharide molecules
- Fibers
  - Produced by the cells
  - Three types
    - Collagen (white) fibers
    - Elastic (yellow) fibers
    - Reticular fibers
Connective Tissue Types

- Bone (osseous tissue)
  - Composed of
    - Bone cells in lacunae (cavities)
    - Hard matrix of calcium salts
    - Large numbers of collagen fibers
  - Used to protect and support the body
Connective Tissue Types

(a) Diagram: Bone

Photomicrograph: Cross-sectional view of ground bone (250x).
Connective Tissue Types

- **Hyaline cartilage**
  - Most common type of cartilage
  - Composed of
    - Abundant collagen fibers
    - Rubbery matrix
  - Locations
    - Larynx
    - Entire fetal skeleton prior to birth
Connective Tissue Types

(b) **Diagram:** Hyaline cartilage

**Photomicrograph:** Hyaline cartilage from the trachea (400x).
Connective Tissue Types

- Elastic cartilage
  - Provides elasticity
  - Location
    - Supports the external ear
- Fibrocartilage
  - Highly compressible
  - Location
    - Forms cushion-like discs between vertebrae
Connective Tissue Types

(c) Diagram: Fibrocartilage

Photomicrograph: Fibrocartilage of an intervertebral disc (200x).
Connective Tissue Types

- Dense connective tissue (dense fibrous tissue)
  - Main matrix element is collagen fiber
  - Fibroblasts are cells that make fibers
- Locations
  - Tendons—attach skeletal muscle to bone
  - Ligaments—attach bone to bone at joints
  - Dermis—lower layers of the skin
Connective Tissue Types

(d) Diagram: Dense fibrous

Photomicrograph: Dense fibrous connective tissue from a tendon (500x).

Figure 3.19d
Connective Tissue Types

- Loose connective tissue types
  - Areolar tissue
    - Most widely distributed connective tissue
    - Soft, pliable tissue like “cobwebs”
    - Functions as a packing tissue
    - Contains all fiber types
    - Can soak up excess fluid (causes edema)
Connective Tissue Types

(e) Diagram: Areolar

Photomicrograph: Areolar connective tissue, a soft packaging tissue of the body (330x).
Connective Tissue Types

- Loose connective tissue types
  - Adipose tissue
    - Matrix is an areolar tissue in which fat globules predominate
    - Many cells contain large lipid deposits
  - Functions
    - Insulates the body
    - Protects some organs
    - Serves as a site of fuel storage
**Connective Tissue Types**

**Photomicrograph**: Adipose tissue from the subcutaneous layer beneath the skin (330x).

**Diagram**: Adipose tissue

- **Nuclei of fat cells**
- **Vacuole containing fat droplet**

**Figure 3.19f**
Connective Tissue Types

- Loose connective tissue types
  - Reticular connective tissue
    - Delicate network of interwoven fibers
    - Forms stroma (internal supporting network) of lymphoid organs
      - Lymph nodes
      - Spleen
      - Bone marrow
Connective Tissue Types

Figure 3.19g

(g) Diagram: Reticular

Photomicrograph: Dark-staining network of reticular connective tissue (400x).

Spleen

Reticular cell
Blood cell
Reticular fibers

White blood cell (lymphocyte)
Reticular fibers
Connective Tissue Types

- Blood (vascular tissue)
  - Blood cells surrounded by fluid matrix called blood plasma
  - Fibers are visible during clotting
  - Functions as the transport vehicle for materials
Connective Tissue Types

(h) Diagram: Blood

Photomicrograph: Smear of human blood (1300x)

Blood cells in capillary

White blood cell

Red blood cells

Neutrophil (white blood cell)

Red blood cells

Monocyte (white blood cell)
Muscle Tissue

- Function is to produce movement
- Three types
  - Skeletal muscle
  - Cardiac muscle
  - Smooth muscle
Muscle Tissue Types

- **Skeletal muscle**
  - Under voluntary control
  - Contracts to pull on bones or skin
  - Produces gross body movements or facial expressions

- Characteristics of skeletal muscle cells
  - Striated
  - Multinucleate (more than one nucleus)
  - Long, cylindrical
Muscle Tissue Types

(a) **Diagram:** Skeletal muscle

**Photomicrograph:** Skeletal muscle (approx. 250x).

Figure 3.20a
Muscle Tissue Types

- Cardiac muscle
  - Under involuntary control
  - Found only in the heart
  - Function is to pump blood
  - Characteristics of cardiac muscle cells
    - Cells are attached to other cardiac muscle cells at intercalated disks
    - Striated
    - One nucleus per cell
Muscle Tissue Types

(b) **Diagram:** Cardiac muscle

**Photomicrograph:** Cardiac muscle (800x).

Figure 3.20b
Muscle Tissue Types

- Smooth muscle
  - Under involuntary muscle
  - Found in walls of hollow organs such as stomach, uterus, and blood vessels
- Characteristics of smooth muscle cells
  - No visible striations
  - One nucleus per cell
  - Spindle-shaped cells
Muscle Tissue Types

(c) **Diagram:** Smooth muscle

**Photomicrograph:** Sheet of smooth muscle (approx. 250x).

Figure 3.20c
Nervous Tissue

- Composed of neurons and nerve support cells
- Function is to send impulses to other areas of the body
  - Irritability
  - Conductivity
Nervous Tissue

Diagram: Nervous tissue

Photomicrograph: Neurons (200x)

Figure 3.21
Tissue Repair (Wound Healing)

- **Regeneration**
  - Replacement of destroyed tissue by the same kind of cells

- **Fibrosis**
  - Repair by dense (fibrous) connective tissue (scar tissue)

- **Determination of method**
  - Type of tissue damaged
  - Severity of the injury
Events in Tissue Repair

- Capillaries become very permeable
  - Introduce clotting proteins
  - A clot walls off the injured area
- Formation of granulation tissue
  - Growth of new capillaries
  - Rebuild collagen fibers
- Regeneration of surface epithelium
  - Scab detaches
Regeneration of Tissues

- Tissues that regenerate easily
  - Epithelial tissue (skin and mucous membranes)
  - Fibrous connective tissues and bone

- Tissues that regenerate poorly
  - Skeletal muscle

- Tissues that are replaced largely with scar tissue
  - Cardiac muscle
  - Nervous tissue within the brain and spinal cord
Developmental Aspects of Tissue

- Epithelial tissue arises from all three primary germ layers
- Muscle and connective tissue arise from the mesoderm
- Nervous tissue arises from the ectoderm
- With old age, there is a decrease in mass and viability in most tissues