

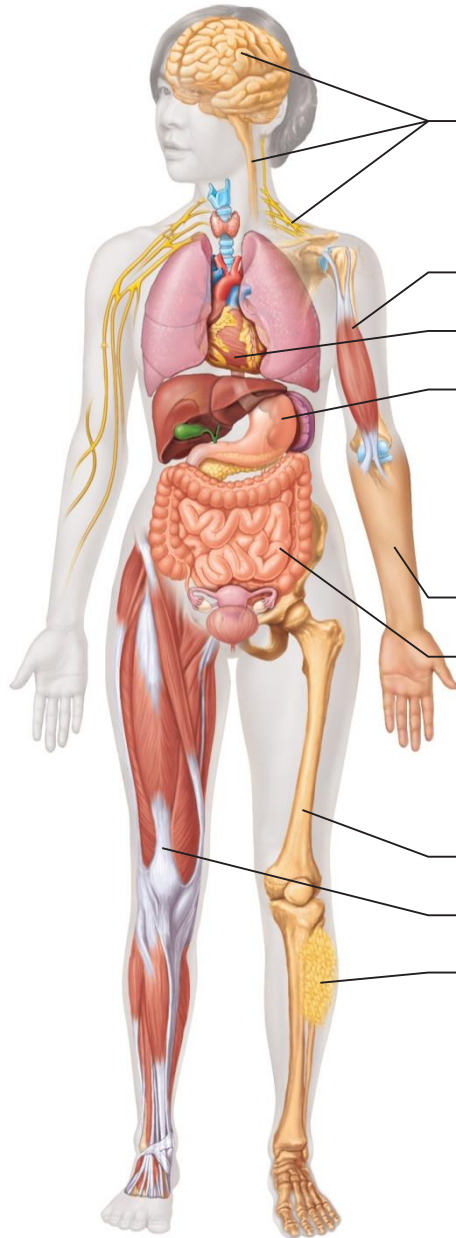
Tissues (Histology)



Tissues

- Groups of cells with a common function
- Four primary tissues
 - Epithelia
 - Connective tissues
 - Muscle
 - Nervous

Various Tissue Locations - Informational



Nervous tissue: Internal communication

- Brain, spinal cord, and nerves

Muscle tissue: Contracts to cause movement

- Muscles attached to bones (skeletal)
- Muscles of heart (cardiac)
- Muscles of walls of hollow organs (smooth)

Epithelial tissue: Forms boundaries between different environments, protects, secretes, absorbs, filters

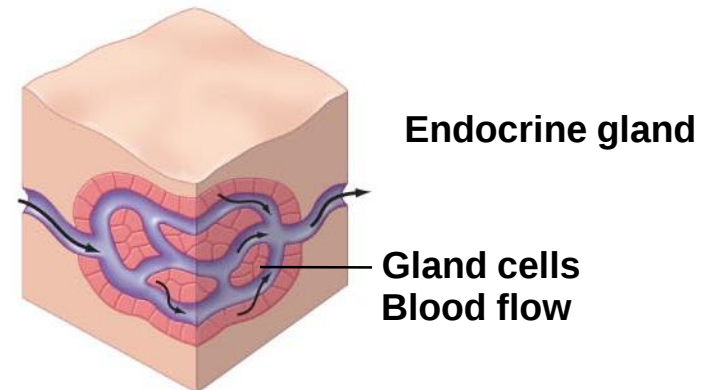
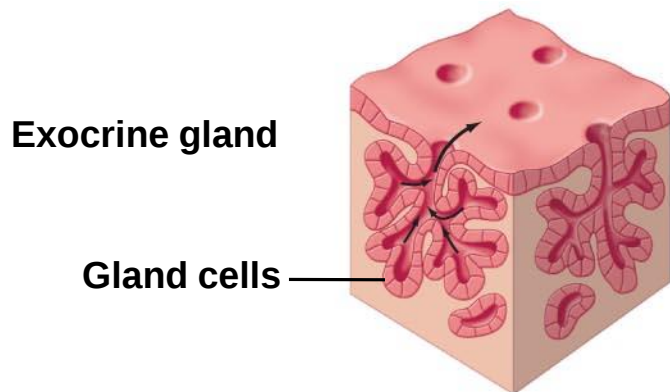
- Skin surface (epidermis)
- Lining of GI tract organs and other hollow organs

Connective tissue: Supports, protects, binds other tissues together

- Bones
- Tendons
- Fat and other soft padding tissue

Epithelial Tissues

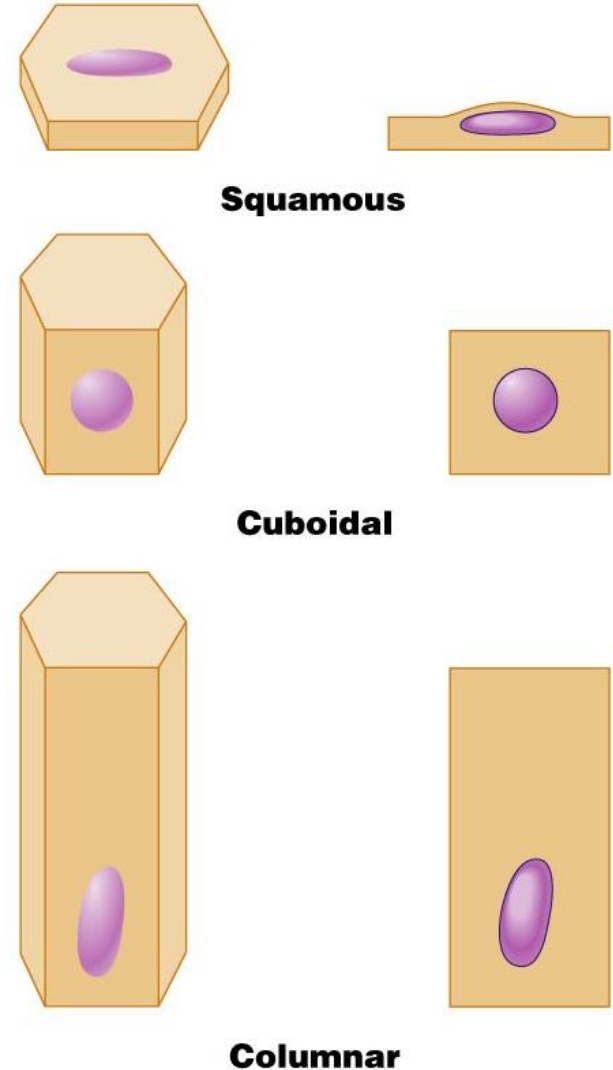
- Line body cavities and cover surfaces
- Glandular epithelia
 - Epithelial cells adapted to make up glands
 - Exocrine glands
 - Secrete into ducts to exterior of body
 - Endocrine glands
 - Secrete into the blood



b) Glandular epithelia secrete a product.

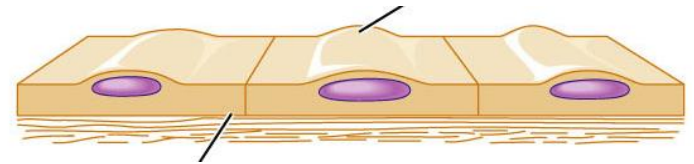
Epithelial Tissues: Classification

- Shape
 - **Squamous**
 - Flattened cells (scale like)
 - **Cuboidal**
 - Cube shaped (box-like)
 - **Columnar**
 - Column shaped

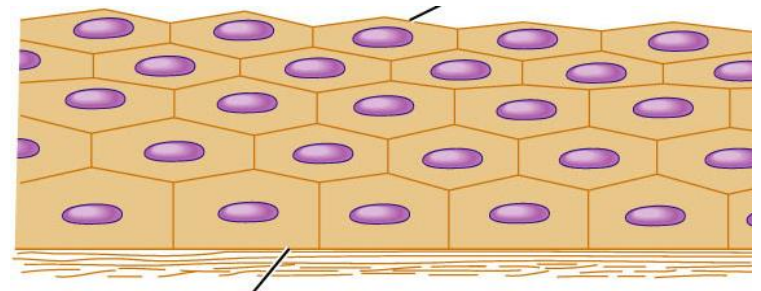


Epithelial Tissues: Classification

- Number of layers
 - **Simple/single-layered**
 - Adapted for diffusion across cell barriers

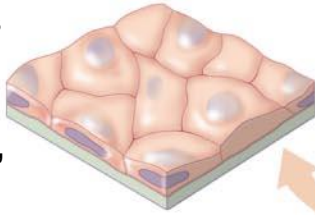


- **Stratified/multiple-layered**
 - Provide protection, as in the skin surface



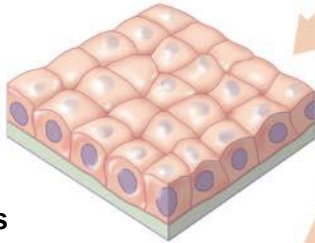
Simple squamous

- Lines blood vessels and air sacs of lungs
- Permits exchange of nutrients, wastes, and gases



Simple cuboidal

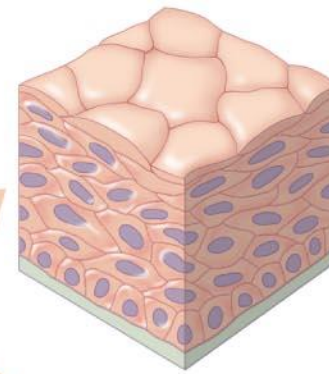
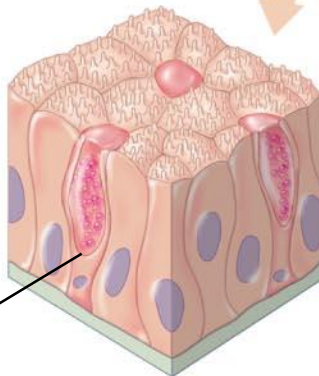
- Lines kidney tubules and glands
- Secretes and reabsorbs water and small molecules



Simple columnar

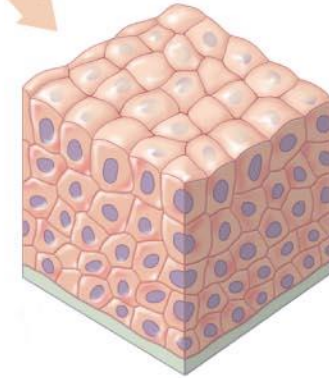
- Lines most digestive organs
- Absorbs nutrients, produces mucus

Goblet cell



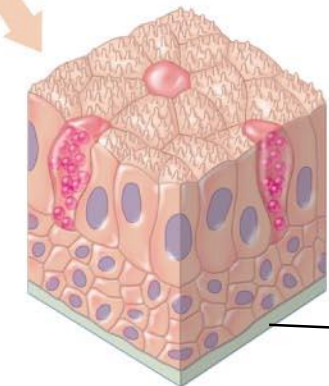
Stratified squamous

- Outer layer of skin, mouth, vagina
- Protects against abrasion, drying out, infection



Stratified cuboidal

- Lines ducts of sweat glands
- Secretes water and ions



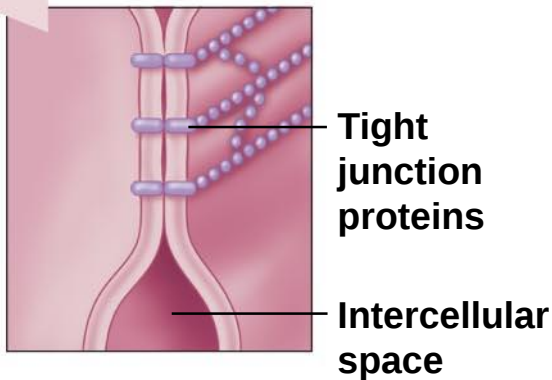
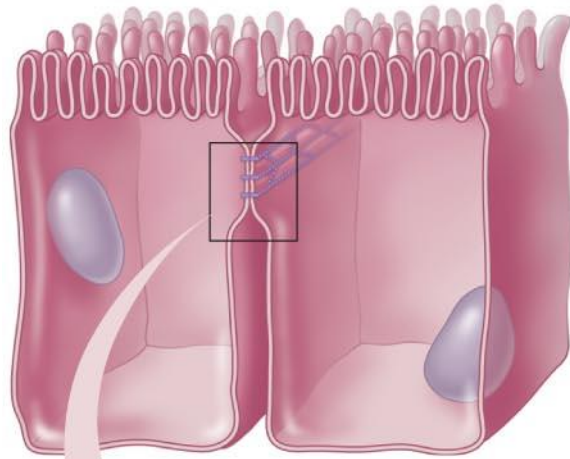
Stratified columnar

- Lines epididymus, mammary glands, larynx
- Secretes mucus

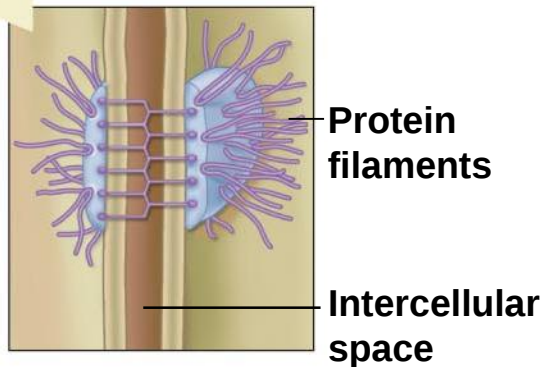
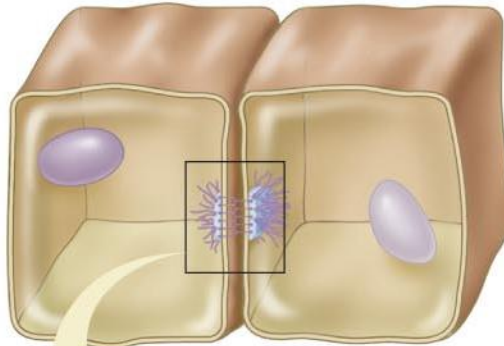
Basement membrane

a) Most epithelial tissues line or cover surfaces or body cavities.

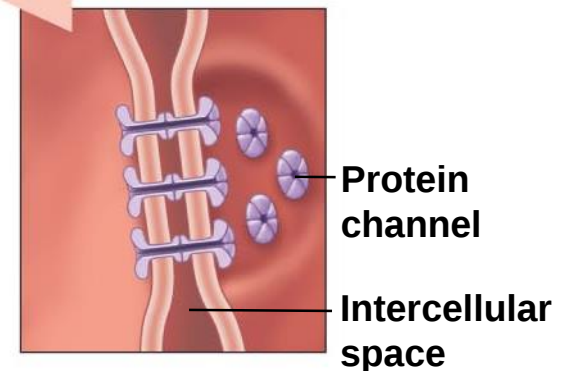
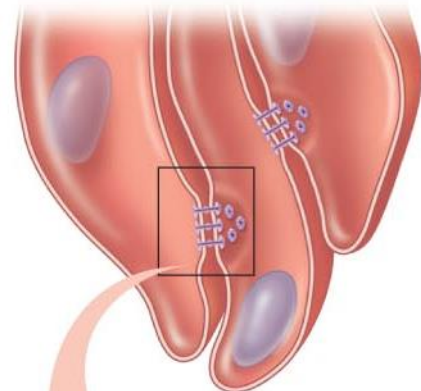
The Basement Membrane Provides Structural Support and Junctions



a) Tight junctions form leak-proof seals between cells.



b) Adhesion junctions anchor two cells together, yet allow flexibility of movement.



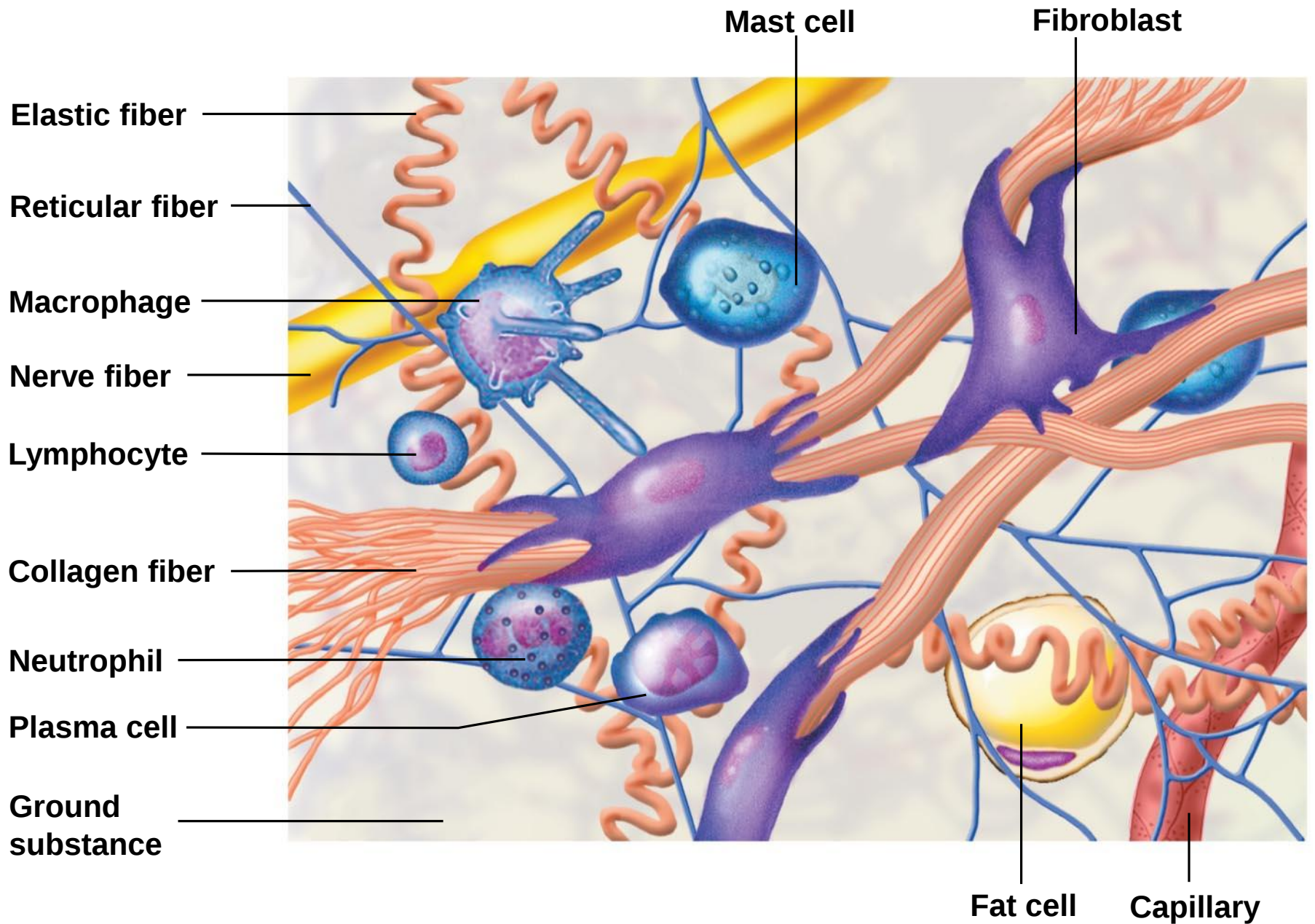
c) Gap junctions provide for the direct transfer of water and ions between adjacent cells.

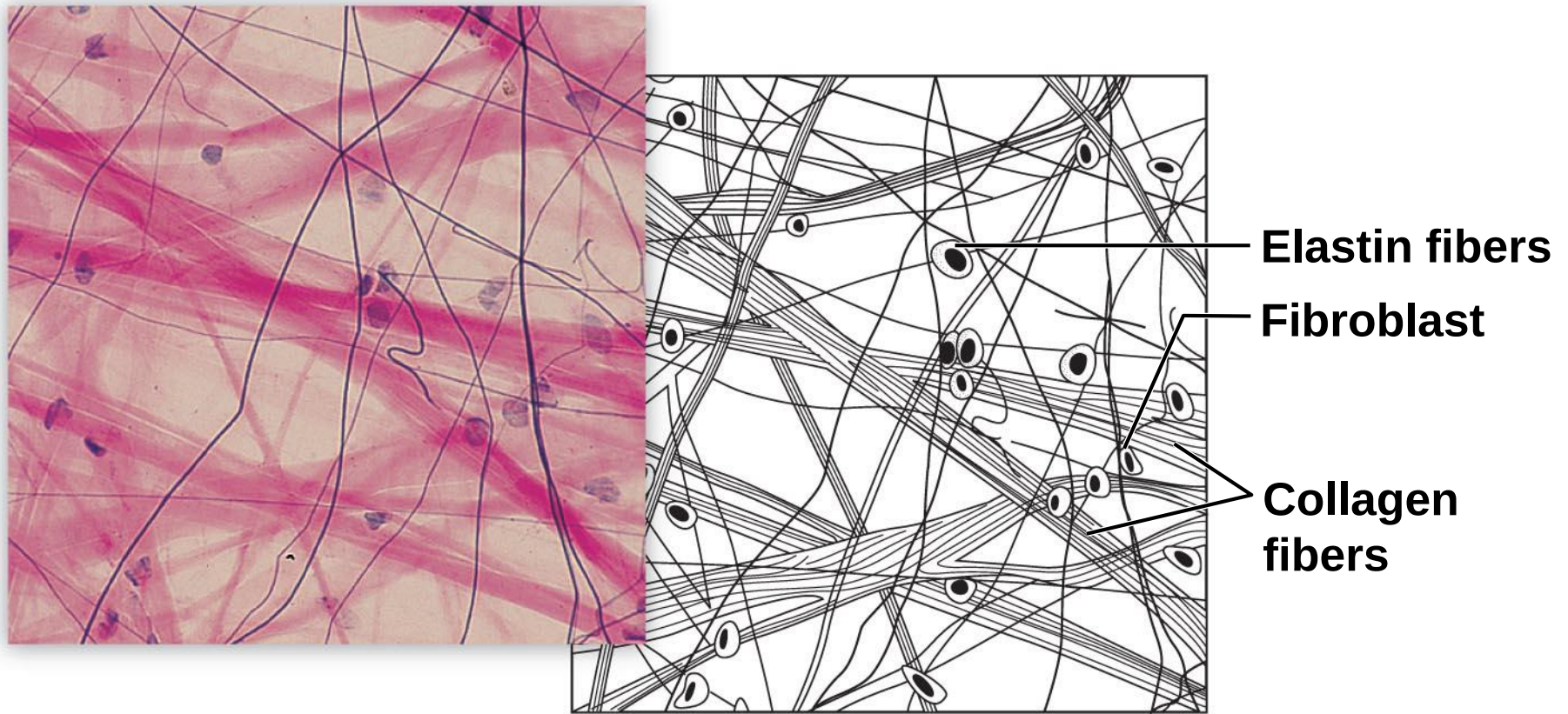
Connective Tissue

- General functions
 - Supports softer organs of body
 - Connects parts of body
 - Stores fat
 - Produces blood cells
- Contains fibers and cells embedded in nonliving extracellular matrix
- Matrix provides the strength
- Two general types
 - Fibrous and special

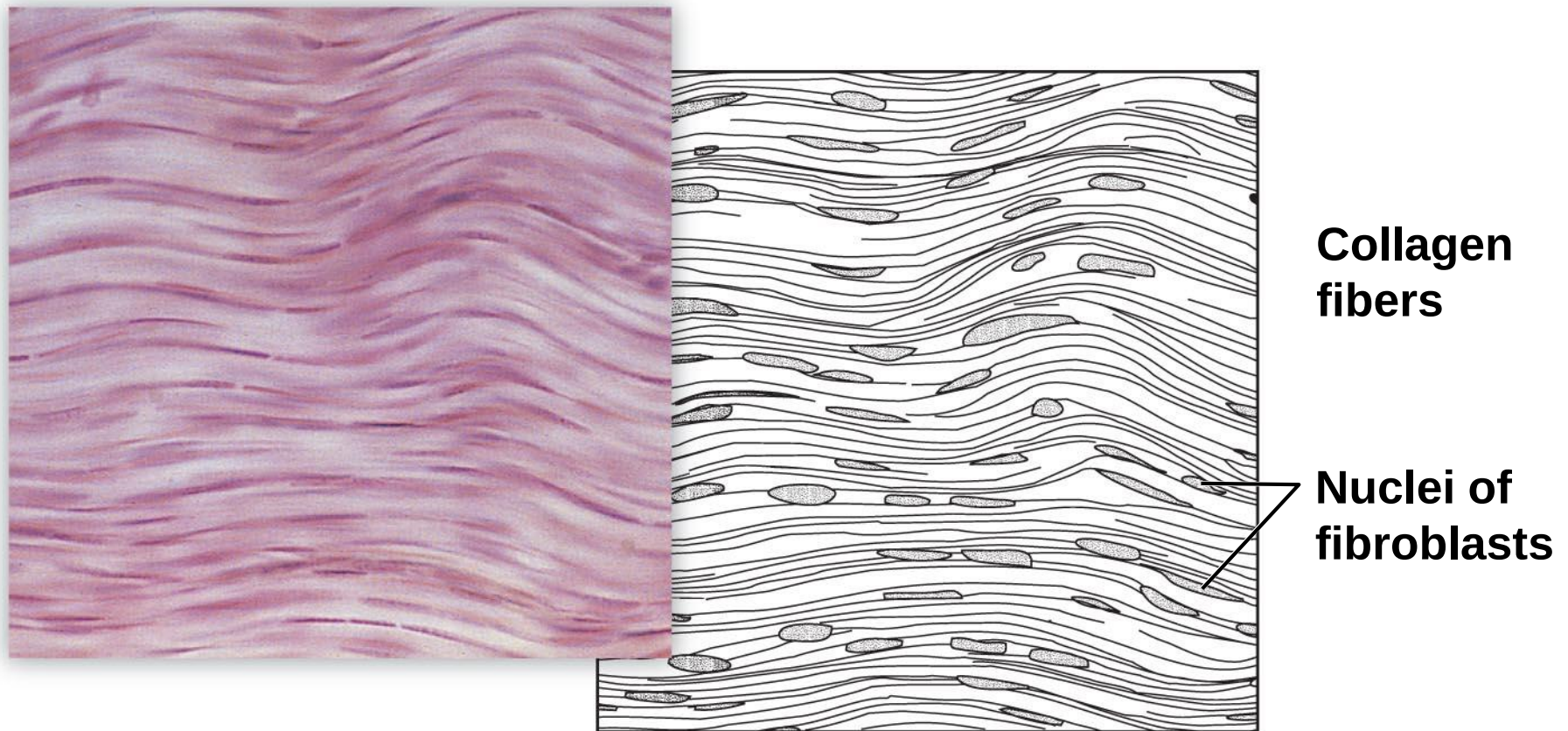
Fibrous Connective Tissue

- Function
 - provides strength and elasticity
- Cells
 - Fibroblasts
 - Macrophages
 - Lymphocytes
 - Neutrophils
- Fibers
 - Collagen
 - Elastic
 - Reticular





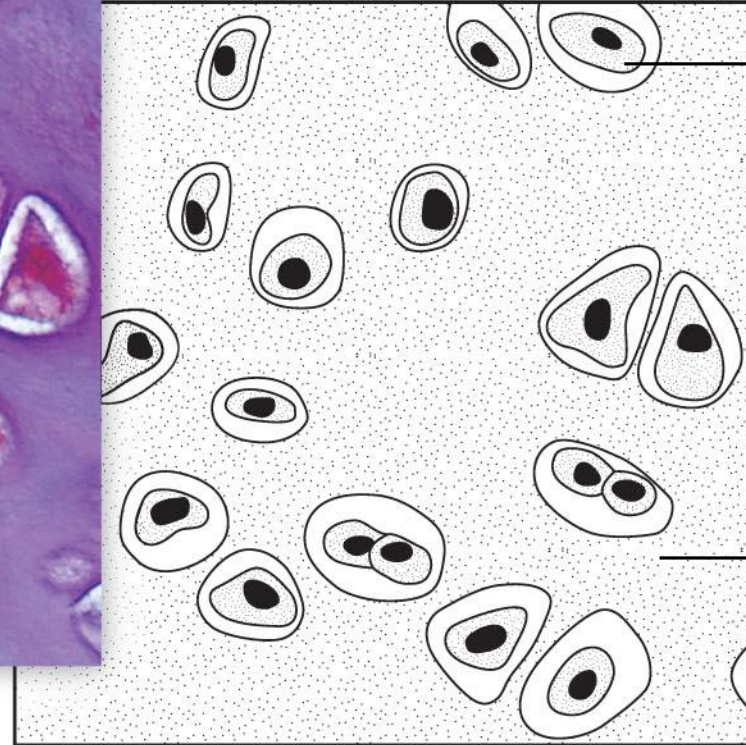
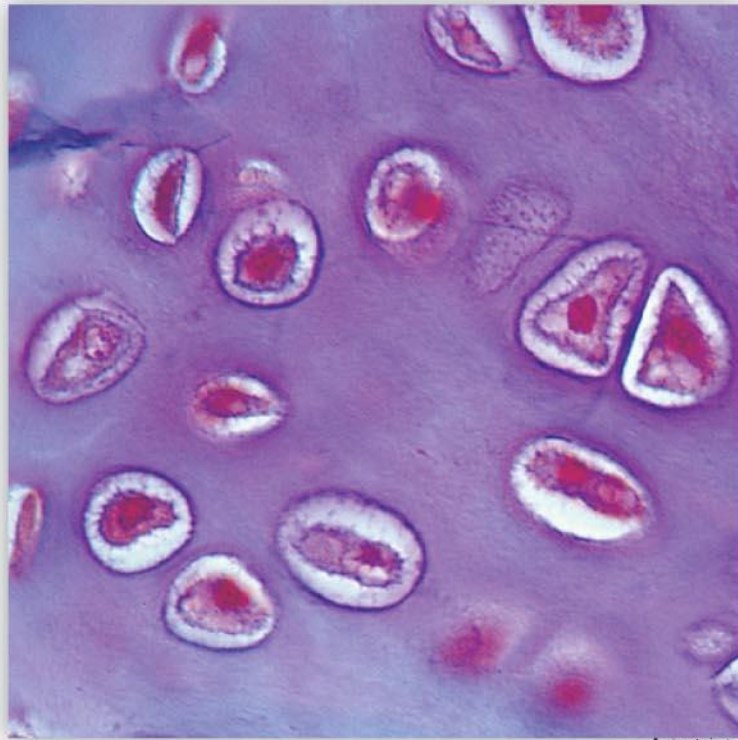
a) Loose areolar connective tissue (X 160). In loose connective tissue the collagen and elastin fibers are arrayed in a random pattern.



- b) Dense connective tissue (X 160). In dense connective tissue the fibers are primarily collagen fibers. In tendons and ligaments the fibers are oriented all in the same direction, with fibroblasts occupying narrow spaces between adjacent fibers.**

Specialized Connective Tissues

- **Cartilage**
 - produced by chondroblasts found in lacunae
 - no blood vessels
 - high collagen content



**Chondrocyte
in lacuna**

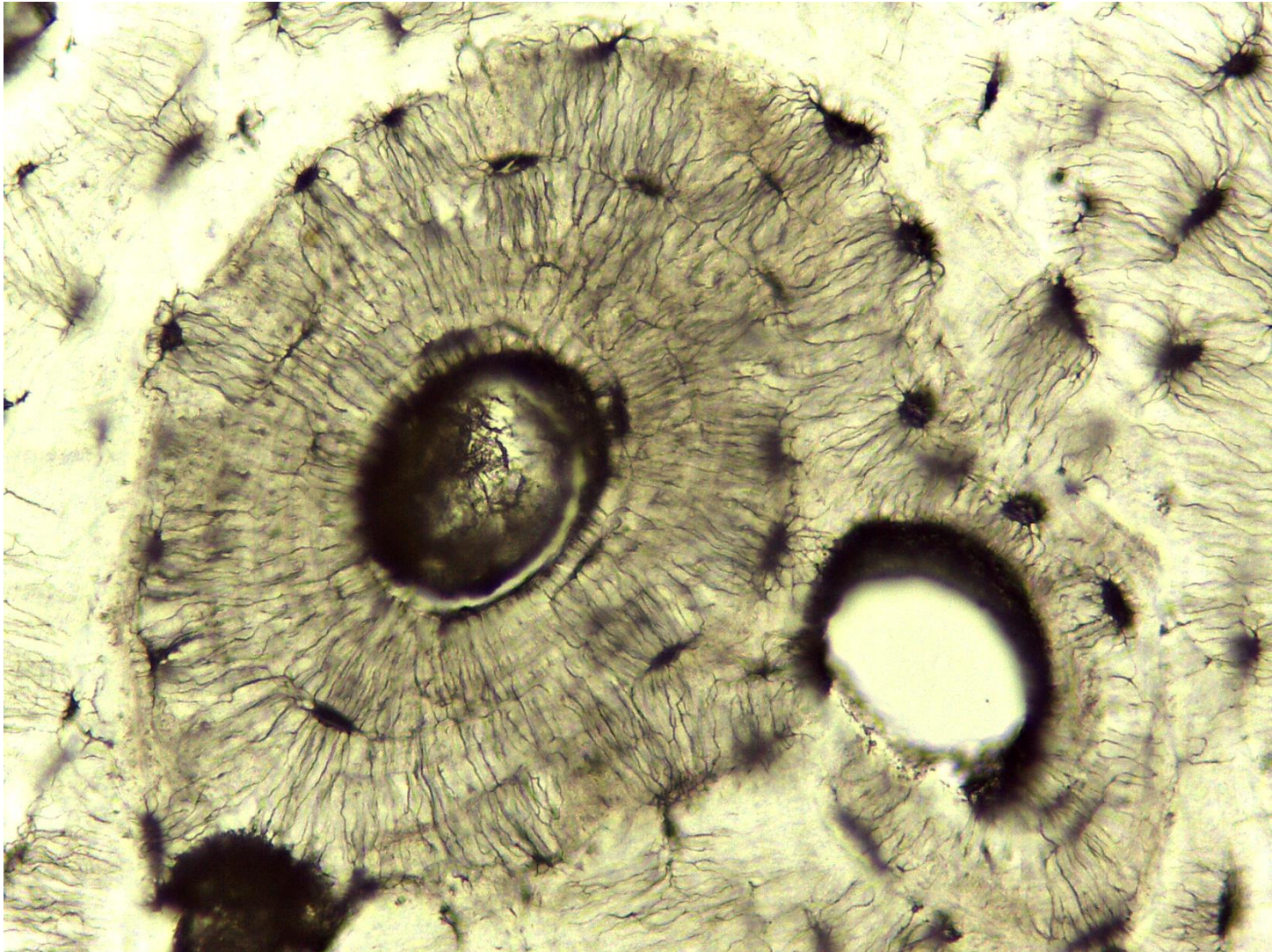
**Ground
substance**

- a) Cartilage from the trachea (X 300). Mature cartilage cells, called chondrocytes, become trapped in chambers called lacunae within the hard, rubbery ground substance. Ground substance is composed of collagen fibers, polysaccharides, proteins, and water.**

Specialized Connective Tissues

- **Bone**
 - inorganic matrix with calcium salts for hardness

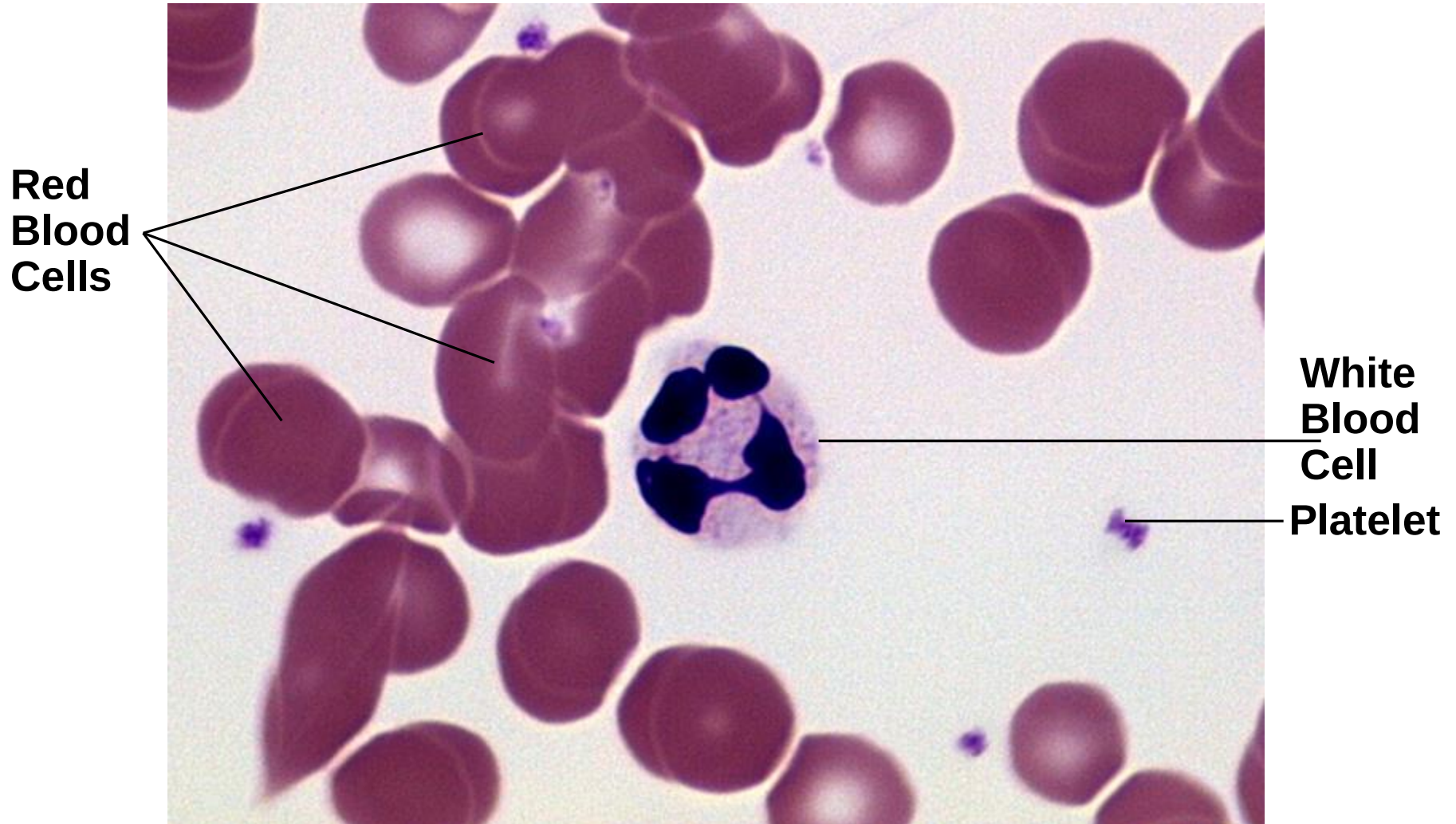
Bone Connective Tissue



Specialized Connective Tissues

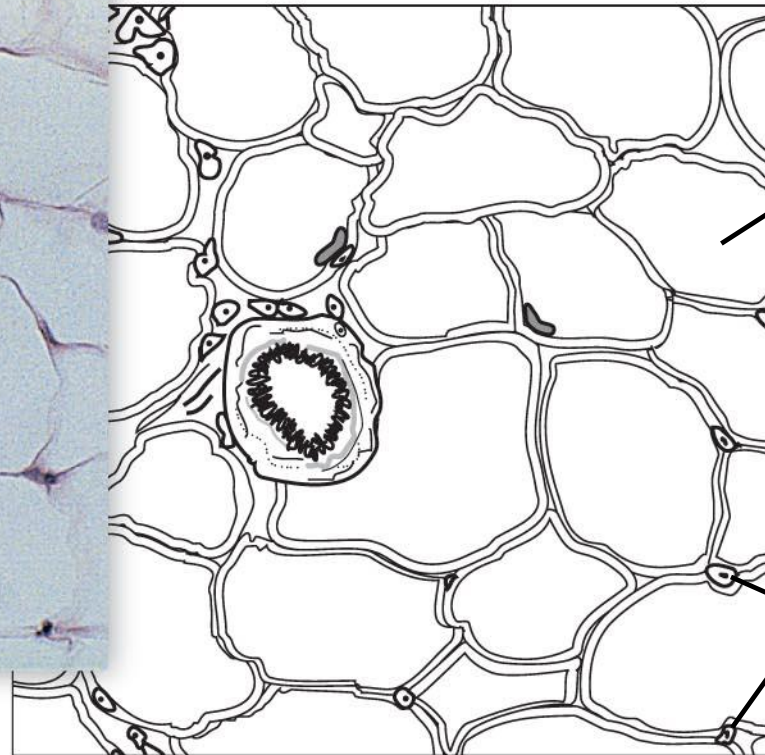
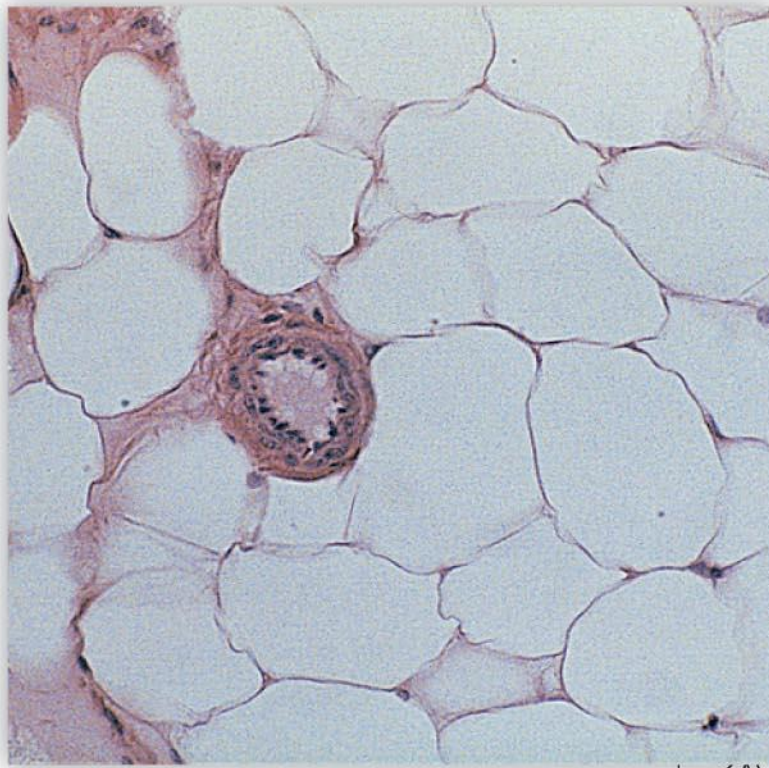
- **Blood**
 - fluid matrix of plasma
 - red blood cells
 - white blood cells
 - platelets

Blood Connective Tissue



Specialized Connective Tissues

- **Adipose tissue**
 - fat cells
 - function in insulation, protection, and energy storage



Vacuole
containing
stored fat

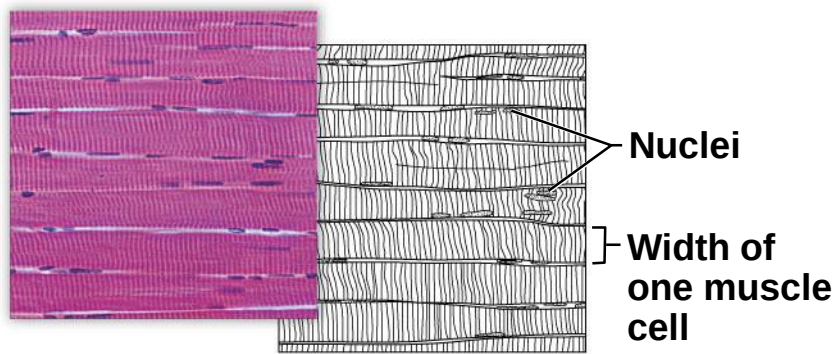
Blood
vessel

Nuclei of
fat cells

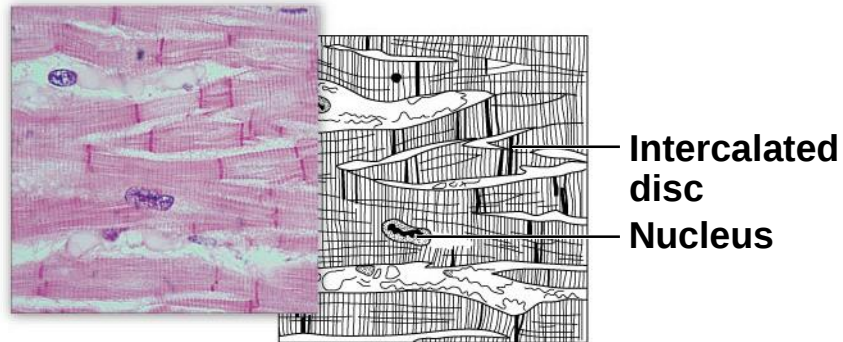
- b) Adipose tissue from the subcutaneous layer under the skin (X 140). Adipose tissue consists almost entirely of fat cells. The fat deposit within a fat cell can become so large that the nucleus is pushed to the side.**

Muscle Tissue Contracts to Produce Movement

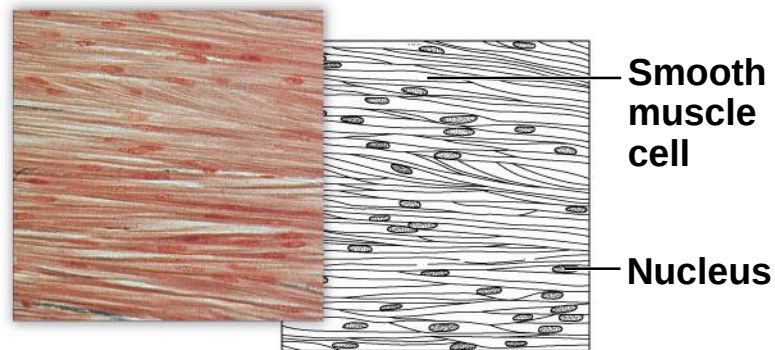
- **Skeletal** muscle
 - Moves body parts
 - Voluntary, multinucleated
- **Cardiac** muscle
 - Functions in the heart
 - Involuntary, single nucleus
- **Smooth** muscle
 - Surrounds hollow structures
 - Involuntary, single nucleus



a) Skeletal muscle (x 100). Skeletal muscle cells are very long and have many nuclei.



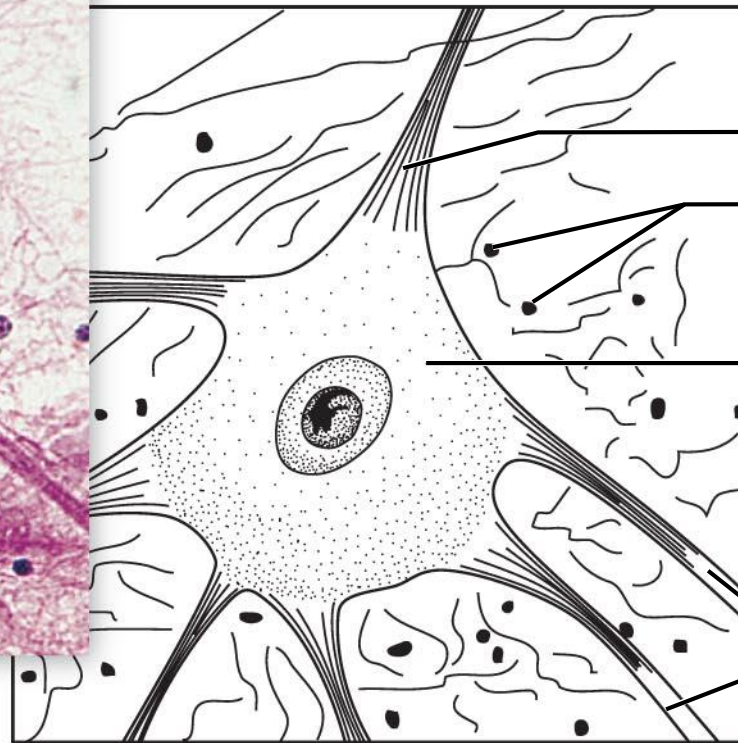
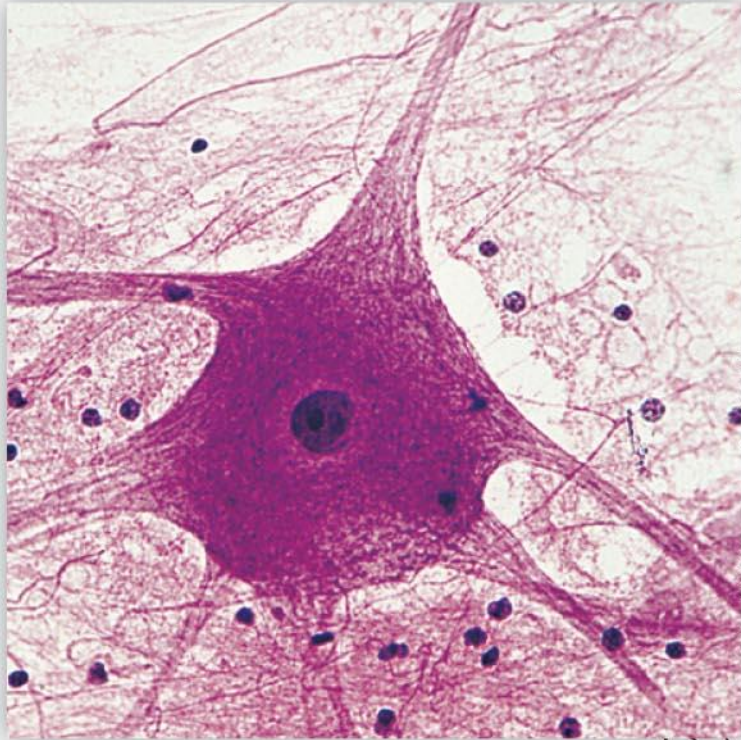
b) Cardiac muscle (x 225). Cardiac muscle cells interconnect with each other.



c) Sheet of smooth muscle (x 250). Smooth muscle cells are thin and tapered.

Nervous Tissues Transmit Impulses

- **Neuron**
 - specialized nervous system cell
 - Function: generate and transmit electrical impulses
 - Structural components: cell body, dendrites, axon
- **Glial cells** support neurons



Axon

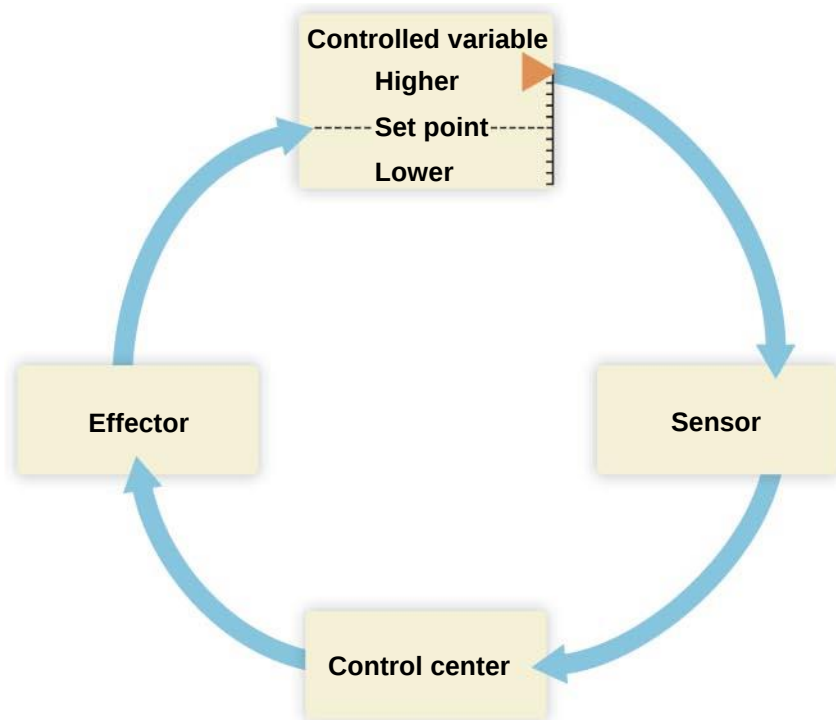
**Nuclei of
glial cells**

Cell body

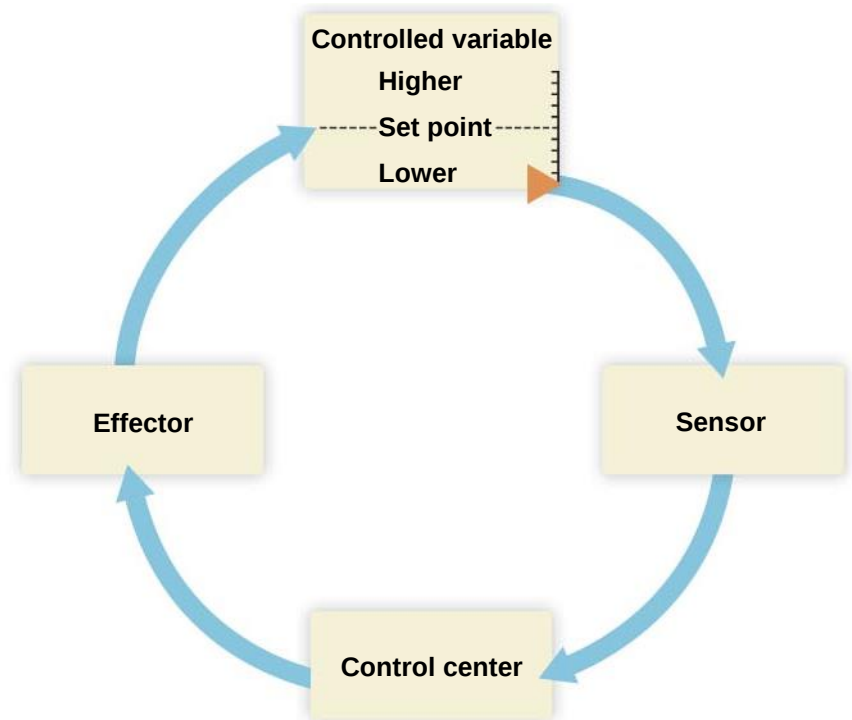
Dendrites

Multicellular Organisms Must Maintain Homeostasis

- Maintenance of relative constancy of the conditions of the internal environment
- **Negative feedback control system**
 - deviations from normal are detected and counteracted
- Components of a negative feedback control system
 - Controlled variable
 - Sensor
 - Control center
 - Effector



a) An *increase* in the controlled variable causes events that *lower* the controlled variable toward its set point again.



b) A *decrease* in the controlled variable causes events that *raise* the controlled variable toward its set point again.

Negative Feedback Helps Maintain Core Body Temperature

- **Controlled variable:** body temperature
- **Sensors:** temperature sensors in skin and internal organs
- **Control center:** hypothalamus
- **Effectors**
 - Blood vessels
 - Sweat glands
 - Skeletal muscles

