Introduction to Animal Organization and Physiology

Chapter 36

Organization of the Animal Body (1)

- Cells
  - Are specialized and organized into tissues
  - In multicellular animals, groups of cells have become specialized in a single activity
- Tissue
  - A group of cells with the same structure and function, working as a unit to carry out one or more activities
  - Example: tissue lining the inner surface of the intestine = specialized for absorption of nutrients

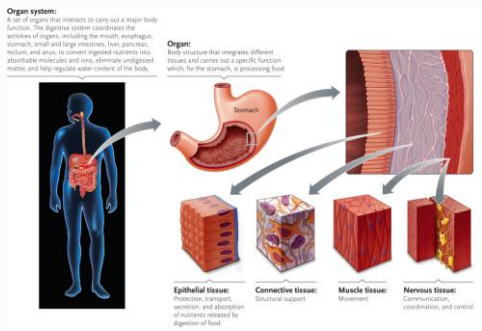
Organization of the Animal Body (2)

- Organ
  - An assembly of tissues integrated into a structure that carries out a specific function
  - Examples: eye, liver, stomach, heart, etc.
- Organ system
  - A group of organs that carry out related steps in a major physiological process
  - Examples: movement, digestion, or reproduction

Animal Tissues

- Classified as:
  - Epithelial
  - Connective
  - Muscle
  - Nervous
- Properties of cells in tissues determine the tissues' structures and functions

Organization of Animal Cells

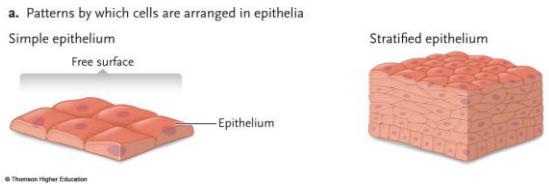


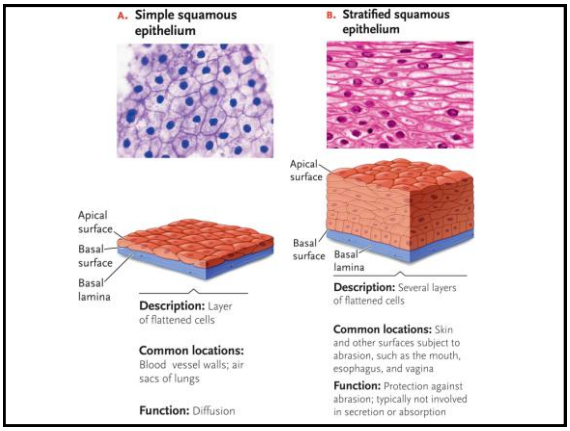
Cell Junctions

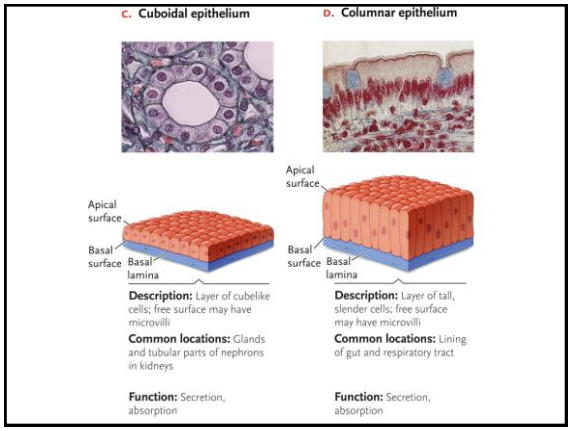
- Junctions link cells in a tissue
  - Anchoring junctions "weld" cells together
  - Tight junctions seal cells into a leak-proof layer
  - Gap junctions form direct avenues (open channels) of communication between the cytoplasm of adjacent cells in the same tissue

Epithelial Tissue

- Consists of sheetlike layers of cells that are usually joined together
- Covers surfaces of body and internal organs
- Lines cavities and ducts within the body
- Protect body surfaces from invasion by bacteria and viruses and also act as filters
- One free surface, often covered with ***cilia*** in internal cavities and ducts
- The *basal lamina* fixes the epithelium to underlying tissues

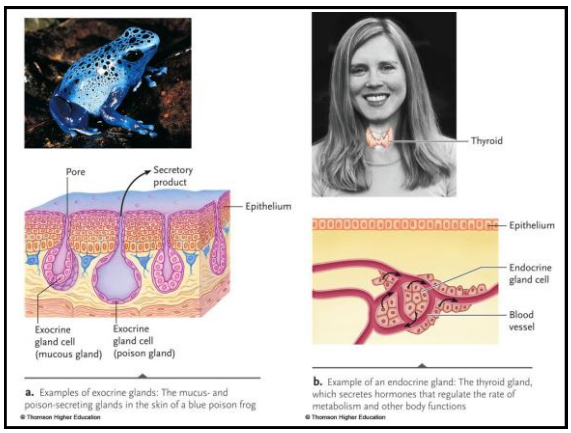






Glands

- Epithelia typically contain or give rise to cells that are specialized for ***secretion***
- Some form structures called **glands**, derived from pockets of epithelium during embryonic development
- Exocrine glands
  - Remain connected to the epithelium by a duct that empties on the epithelial surface
- Endocrine glands
  - Ductless; no direct connection to an epithelium

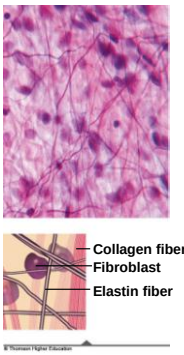


Connective Tissue

- Consist of cells that form networks or layers in and around body structures and that are separated by nonliving material (the ECM - matrix)
- Matrix ranges from fluid (blood), through soft and firm gels (as in tendons), to the hard and crystalline (bone)
  - Supports other body tissues
  - Transmits mechanical and other forces
  - In some cases acts as a filter

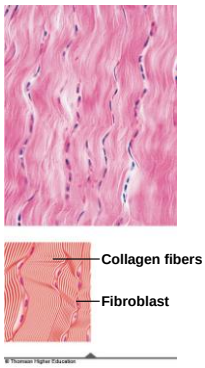
Loose Connective Tissue

- Consists of sparsely distributed cells (fibroblasts) surrounded by an open network of collagen and other glycoprotein fibers
  - Supports epithelia and body organs
  - Covers blood vessels, nerves, and some internal organs
  - Fibroblasts secrete most of the collagen and other proteins



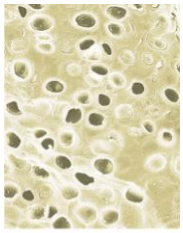
Fibrous Connective Tissue

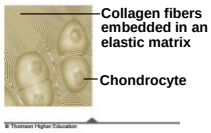
- Contains sparsely distributed fibroblasts in a matrix of densely packed, parallel bundles of collagen and elastin fibers
  - **Tendons** – attach muscles to bone
  - **Ligaments** – connect bones together at joints



Cartilage

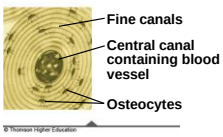
- Consists of sparsely distributed chondrocytes surrounded by a network of collagen fibers embedded in a tough but highly elastic matrix of branched glycoprotein, *chondroitin sulfate*
  - Provides support, flexibility, low-friction surface for joint movement
  - Resists compression and stays resilient





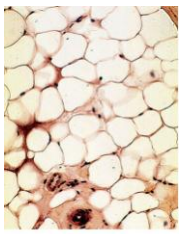
Bone

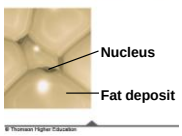
- The densest form of connective tissue that forms the skeleton – supports the body, protects softer body structures, and contributes to body movements
- Osteocytes are embedded in a collagen matrix hardened by mineral deposits (**hydroxyapatite** – calcium-phosphate mineral)



Adipose Tissue

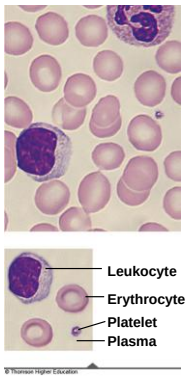
- Consists of large, densely clustered cells, ***adipocytes***, specialized for fat storage
  - Cushions and rounds out the body
  - Provides an insulating layer under the skin





Blood

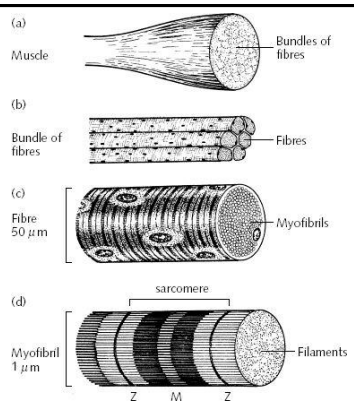
- A type of connective tissue
- Consists of a fluid matrix (plasma) in which erythrocytes and leukocytes are suspended
  - Erythrocytes (RBC's – red blood cells)
  - Leukocytes (WBC's – white blood cells)
  - Platelets

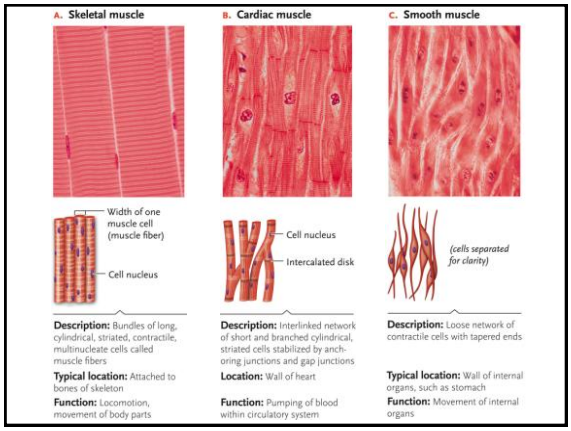


Muscle Tissue

- Muscle tissue consists of cells that have the ability to contract, or shorten – densely packed with little matrix

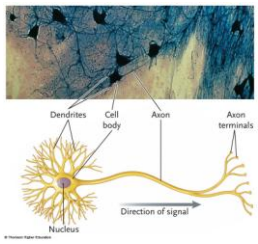
1. Skeletal muscle
   - Moves body parts and maintains posture
   - Responsible for voluntary movements
   - Long contractile cells (muscle fibers)
   - Most are attached by tendons to the skeleton
   - Striated in appearance
2. Cardiac muscle
   - Forms the heart; involuntary muscle
   - Short contractile cells with a branched structure
   - Striated in appearance
3. Smooth muscle
   - Forms layers surrounding body cavities and ducts
   - Involuntary muscle
   - Spindle-shaped contractile cells





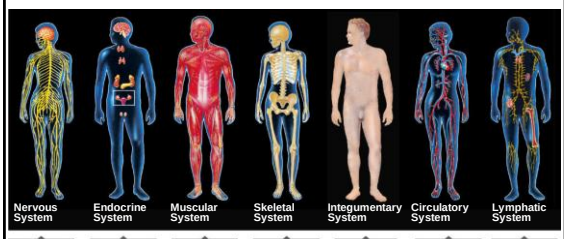
Nervous Tissue

- Neurons communicate information between body parts
  - Consists of: a ***cell body***, which houses the nucleus and organelles, and two processes, ***dendrites*** and ***axons***
- Glial cells support and provide nutrients to neurons or provide electrical insulation between them



Vital Tasks of Organs and Organ Systems

- *Organs and organ systems function together to enable an animal to survive*
  - Maintenance of internal body conditions
  - Nutrient acquisition, processing, distribution
  - Waste disposal
  - Molecular synthesis
  - Environmental sensing and response
  - Protection against injury and disease
  - Reproduction



Main organs: Brain, spinal cord, peripheral nerves, sensory organs

Main organs: Pituitary, thyroid, adrenal, pancreas, and other hormone-secreting glands

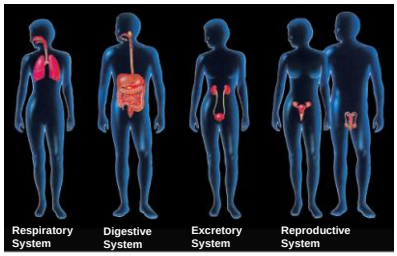
Main organs: Skeletal, cardiac, and smooth muscle

Main organs: Bones, tendons, ligaments, cartilage

Main organs: Skin, sweat glands, hair, nails

Main organs: Heart, blood vessels, blood

Main organs: Lymph nodes, lymph ducts, spleen, thymus



Main organs: Lungs, diaphragm, trachea, and other airways

Main organs: Pharynx, esophagus, stomach, intestines, liver, pancreas, rectum, anus

Main organs: Kidneys, bladder, ureter, urethra

Main organs:
Female **:** ovaries, oviducts, uterus, vagina, mammary glands
Male **:** testes, sperm ducts, accessory glands, penis