

**Human Anatomy, First Edition**  
McKinley & O'Loughlin

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Chapter 4 Lecture Outline:  
Tissue Level  
of Organization

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**Tissue Level of Organization**

- Tissues are groups of similar cells and extracellular products that carry out a common function.

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**4 Types of Tissues**

- epithelial tissue
- connective tissue
- muscle tissue
- nervous tissue

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## Epithelial Tissue

- Lines every body surface and all body cavities.
- Forms both the external and internal lining of many organs.
- Constitutes the majority of glands.
- Composed of one or more layers of closely packed cells that form a barrier between two compartments having different components.
- Little to no extracellular matrix.
- No blood vessels penetrate an epithelium.

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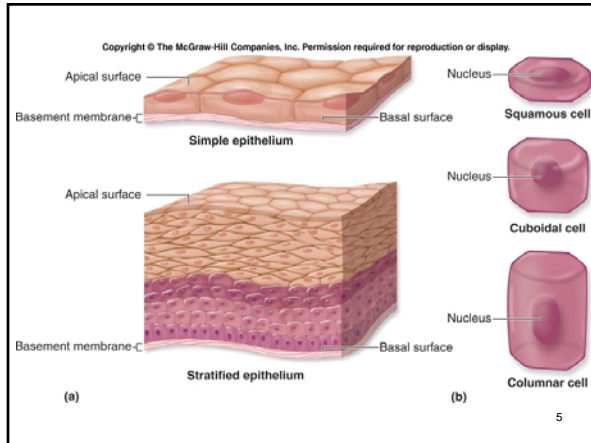
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## Characteristics of Epithelial Tissue: Cellularity

- Composed almost entirely of cells bound closely together by different types of cell junctions.

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## Characteristics of Epithelial Tissue: Polarity

- Apical surface (free, or top, surface)
- Intercellular junctions
- Basal surface (fixed, or bottom, surface)

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## Characteristics of Epithelial Tissue: Attachment

- The basal surface of an epithelium is bound to a thin basement membrane.

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## Characteristics of Epithelial Tissue: Avascularity

- Lack blood vessels.
- Nutrients obtained either directly across the apical surface or by diffusion across the basal surface.

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## Characteristics of Epithelial Tissue: Innervation

- Some epithelia are richly innervated to detect changes in the environment at that body or organ surface.
- Most nervous tissue is in the underlying connective tissue.

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## Characteristics of Epithelial Tissue: Regeneration Capacity

- Frequently **damaged or lost by abrasion** and is **replaced via high regeneration capacity.**
- Continual replacement occurs through the divisions of the deepest epithelial cells (called stem cells) near its base.

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## Functions of Epithelial Tissue

- Protection
- Regulation of materials into and out of the organ or tissue
- Produce secretions
  - Endocrine glands
  - Exocrine glands

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## Functions of Epithelial Tissue

- Nerve endings detect changes in the external environment at their surface.
- Continuously supply information to the nervous system concerning touch, pressure, temperature, and pain.

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## Junctions

- There are four types of cell junctions:
  - tight junctions
  - adhering junctions
  - desmosomes
  - gap junctions

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## Endocrine Glands

- Lack ducts and secrete their products directly into the interstitial fluid and bloodstream.
- **Hormones** act as chemical messengers to influence cell activities elsewhere in the body.

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## Exocrine Glands

- Usually maintain their contact with the epithelial surface by means of a duct.
- Duct secretes materials onto the surface of the skin or onto an epithelial surface lining an internal passageway.

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## Classification of Exocrine Glands

- Form and structure (morphology)
  - simple glands vs. compound glands
- Type of secretion
  - tubular vs. acinar ducts
- Method of secretion
  - tubuloacinar gland

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## Secretion Types

- **Serous glands** produce and secrete a nonviscous, watery fluid, such as sweat, milk, tears, or digestive juices.
- **Mucus glands** secrete mucin, which forms mucus when mixed with water.
- **Mixed glands**, such as the two pairs of salivary glands inferior to the oral cavity, contain both serous and mucus cells, and produce a mixture of the two types of secretions.

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## Merocrine Glands

- Also called **eccrine** glands, package their secretions in structures called **secretory vesicles** which travel to the apical surface of the glandular cell and release their secretion by exocytosis.
- The glandular cells remain intact and are not damaged in any way by producing the secretion.

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## Holocrine Gland

- Secretion is produced through the destruction of the secretory cell.
- Lost cells are replaced by cell division at the base of the gland.

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## Apocrine Gland

- Secretion occurs with the “decapitation” of the apical surface of the cell and the subsequent release of secretory product and some cellular fragments.
- Examples: the mammary glands and some sweat glands in the axillary and pubic regions

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## Connective Tissue

- Most diverse, abundant, widely distributed, and microscopically variable of the tissues.
- Designed to support, protect, and bind organs.
- Binds body structures together.

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## Basic Components of CT

- All CT share three basic components:
  - cells
  - protein fibers
  - ground substance

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## Components of CT: Cells

- connective tissue proper contains fibroblasts,
- fat contains adipocytes,
- cartilage contains chondrocytes, and
- bone contains osteocytes.
  - Many CT's contain white blood cells such as macrophages, which phagocytize foreign materials.

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## Components of CT: Protein Fibers

- Most contains protein fibers throughout the tissue.
- Strengthen and support connective tissue.
- Type and abundance of these fibers varies depending on function.

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## Components of CT: Protein Fibers

- Three basic types of protein fibers:
  - collagen fibers are strong and stretch-resistant
  - elastic fibers are flexible and resilient
  - reticular fibers form an interwoven framework

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## Components of CT: Ground Substance

- Cells and the protein fibers reside within a material called **ground substance**.
- **Nonliving material** produced by the connective tissue cells.
- Primarily consists of molecules composed of protein and carbohydrate and variable amounts of water.
- May be viscous (blood), semisolid (cartilage), or solid (bone).

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## Functions of Connective Tissue

- Physical protection
- Support and structural framework
- Binding of structures
- Storage
- Transport

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## Development of Connective Tissue

- The primary germ layer **mesoderm** forms all connective tissues.
- There are two types of embryonic connective tissue:
  - **mesenchyme**
  - **mucous connective tissue**

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## Classification of Connective Tissue

- The connective tissue types present after birth are classified into three broad categories:
  - connective tissue proper
  - supporting connective tissue
  - fluid connective tissue

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### The Resident Cells of the Connective Tissue Proper

- Fibroblasts
- Adipocytes
- Fixed macrophages
- Mesenchymal cells

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### The Wandering Cells of the Connective Tissue Proper

- Mast cells
- Plasma cells
  - B-lymphocytes
- Macrophages
- Leukocytes

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### 2 Broad Categories of CT

- Loose connective tissue
- Dense connective tissue
  - based on the relative proportions of cells, fibers, and ground substance

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## Supporting Connective Tissue

- Cartilage and bone
- Form a strong, durable framework that protects and supports the soft body tissues.
- Extracellular matrix contains many protein fibers and a ground substance that ranges from semisolid to solid.

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## Fluid Connective Tissue

- Blood is a fluid connective tissue composed of cells called **formed elements**.
  - erythrocytes (red blood cells)
  - leukocytes (white blood cells)
  - platelets
    - erythrocytes transport oxygen and carbon dioxide between the lungs and the body tissues
    - leukocytes mount an immune response
    - platelets are involved with blood clotting

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## Muscle Tissue

- Responds to stimulation from the nervous system causing them to shorten.
- Produce voluntary and involuntary movement.

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## Nervous Tissue

- Sometimes termed neural tissue.
- Consists of neurons, or nerve cells, and glial cells that support, protect, and provide a framework for neurons.

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## Neurons

- Detect stimuli, process information quickly, and rapidly transmit electrical impulses from one region of the body to another.
- Prominent cell body functions in control; information processing, storage, and retrieval; internal communication.

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## Neurons

- Processes extend from the nerve cell body.
  - Dendrite
  - Axon

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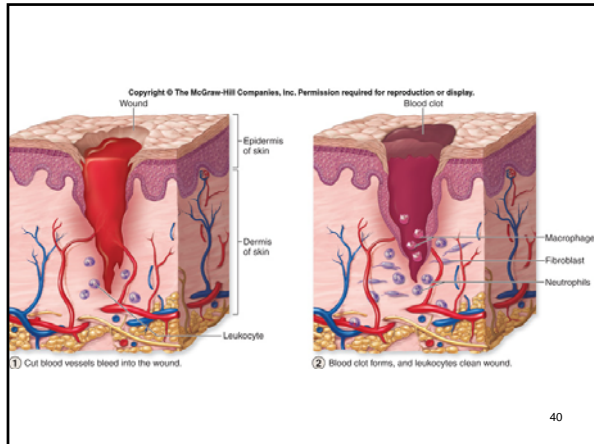
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