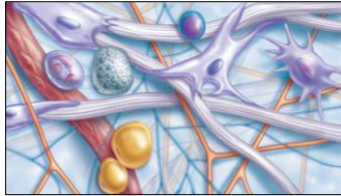


Chapter 4
Tissues: The Living Fabric



Chapter 4: Tissues

Tissue: A group of cells similar in structure; designed to perform a specialized function



Primary Tissue Types:

Tissue:	Cells:	Extracellular Matrix:	Function:
Epithelial	Aggregated polyhedral cells	Miniscule	Line surface / body cavities; Glandular secretions
Connective	Variable fixed / wandering cells	Abundant	Support and protection
Muscle	Elongated contractile cells	Moderate	Movement
Nervous	Intertwining elongated processes	None	Transmission of electrical impulses

Chapter 4: Tissues

Epithelial Tissue:

1) **Epithelia:**

- Cell layers covering internal / external surfaces
- Functions:
 - Provide physical protection (e.g., skin)
 - Control permeability (e.g., blood vessels)
 - Provide sensation (e.g., eye – neuroepithelium)



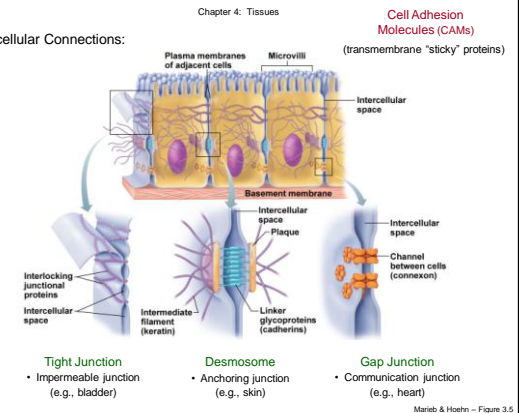
Characteristics:

- High degree of cellularity



Chapter 4: Tissues

Intracellular Connections:



Chapter 4: Tissues

Epithelial Tissue:

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- Cell layers covering internal / external surfaces
- Functions:
 - Provide physical protection (e.g., skin)
 - Control permeability (e.g., blood vessels)
 - Provide sensation (e.g., eye – neuroepithelium)



Characteristics:

- High degree of cellularity
- Polarity (apical vs. basal surfaces)
 - Ciliated epithelium (e.g., trachea)
- Attachment (basement membrane)
 - Epithelia → connective tissue
- Avascularity (no blood vessels)
- Regenerative
 - Germinative cells (stem cells)



Chapter 4: Tissues

Epithelial Tissue:

1) **Epithelia:**

- Cell layers covering internal / external surfaces
- Classification:

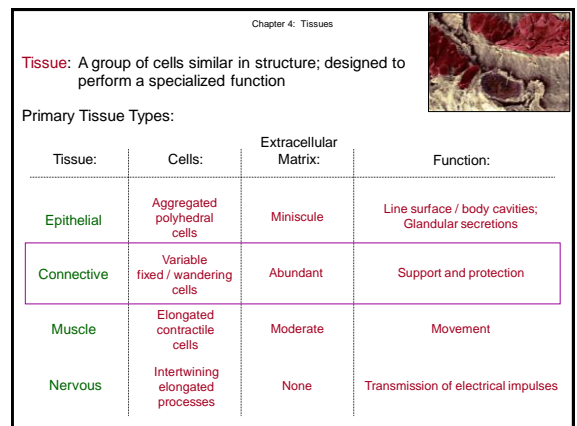
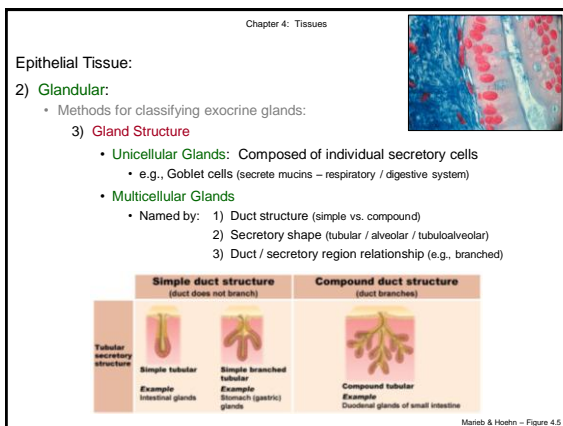
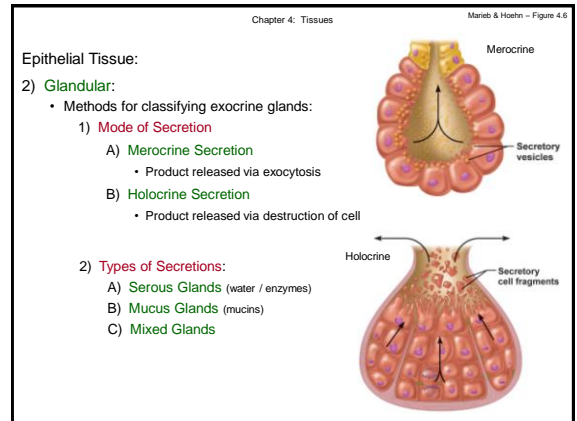
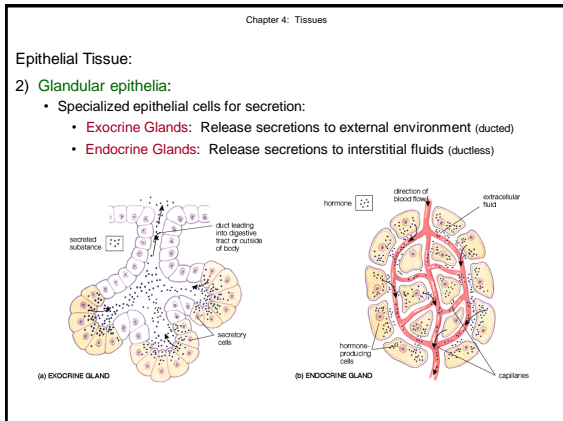
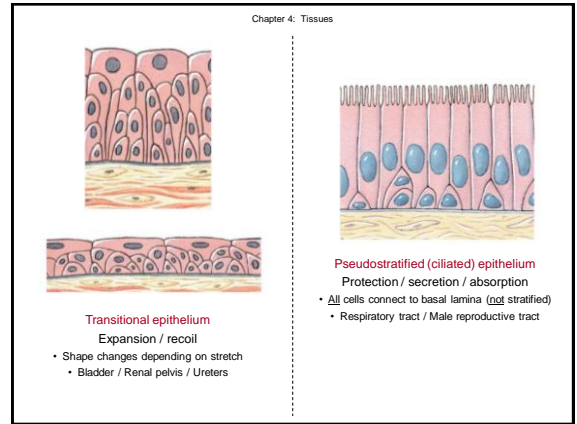
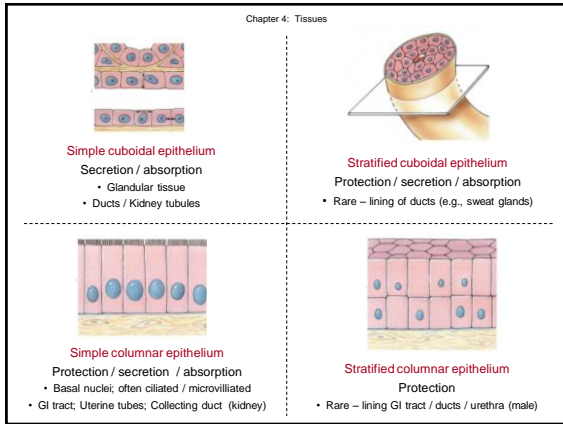
# of cell layers	+	cell shape	=	epithelia type
Simple	→	Squamous	=	Simple squamous epithelium
Stratified	→	Cuboidal	=	
		Columnar	=	

Simple squamous epithelium
Absorption / secretion

- Lining body cavities (mesothelium)
- Lining blood vessels (endothelium)

Stratified squamous epithelium
Physical protection

- Surface of skin
- Lines external openings



Connective Tissue:

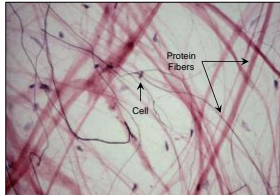
- Located throughout body (never exposed to outside environment)
- Primary functions:
 - 1) Structural framework for body
 - 2) Transport fluids / dissolved materials
 - 3) Protect delicate organs
 - 4) Insulate body

Connective tissues are classified according to the fluidity of the ground substance

• All contain:

- 1) Specialized cells
- 2) Protein fibers (extracellular)
- 3) Ground substance (fluid)

→ **Matrix** (most of volume)



Types of Connective Tissue:

1) **Connective Tissue Proper:** (Syrupy matrix)

A) Cell types:

Fibroblasts / Fibrocytes:

Produce / maintain fibers & ground substance

Adipocytes:

Store lipid droplets (fat cells)

Mast cells:

Stimulate inflammation response (fat cells)

Macrophages / Microphages:

Defense cells; engulf foreign molecules

B) Fiber types:

Collagen:

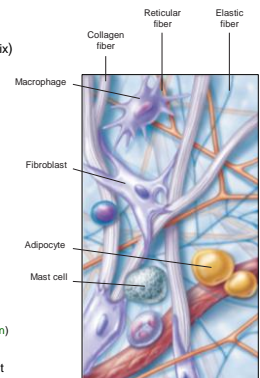
Thick bundles; provide high tensile strength

Elastic:

Branched / wavy; allow for stretch (contain elastin)

Reticular:

Form fine framework; allow for cell attachment



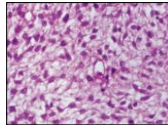
Types of Connective Tissue:

1) **Connective Tissue Proper:** (Syrupy matrix)A) **Mesenchyme:**

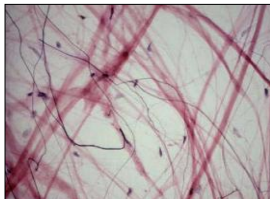
- Embryonic connective tissue
- Star-shaped stem cells; fine fibers

B) **Loose Connective Tissue:**

- "Packing material" of body (fill space / cushion / stabilize / support)



Gives rise to all other connective tissues

**Areolar Tissue**

- Least specialized CT in adults
- Open framework; ↓ fiber #
 - Absorbs shock
 - Distort w/o damage; resilient
 - Fluid reservoir
- Highly vascularized

Attaches epithelia (e.g., skin) to deeper structures

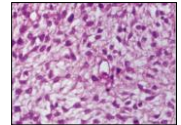
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Gives rise to all other connective tissues

**Adipose Tissue**

- Composed primarily of adipocytes
- Provides padding, absorbs shock, insulates, "filler" around structures
- Metabolically active; incapable of dividing (but mesenchyme cells...)
- White fat (majority)
- Brown fat (↑ blood supply / mitochondria)
 - Thermogenesis (infants)

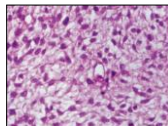
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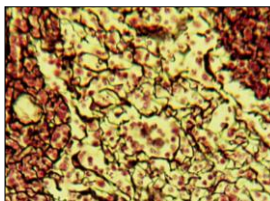
- Embryonic connective tissue
- Star-shaped stem cells; fine fibers

B) **Loose Connective Tissue:**

- "Packing material" of body (fill space / cushion / stabilize / support)



Gives rise to all other connective tissues

**Reticular Tissue**

- Reticular fibers form complex 3-D structure (stroma)
 - Supports functional cells (parenchyma) of the organ

Located in liver / spleen / lymph nodes / bone marrow

Types of Connective Tissue:

1) **Connective Tissue Proper:** (Syrupy matrix)A) **Mesenchyme:**

- Embryonic connective tissue
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B) **Loose Connective Tissue:**

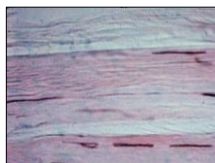
- "Packing material" of body (fill space / cushion / stabilize / support)

C) **Dense Connective Tissue:**

- Offer strength & support; occupied primarily by collagen fibers

Dense Regular Connective Tissue

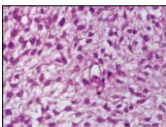
- Collagen fibers run parallel to each other
 - Packed tightly; align with forces applied
- **Tendons** – Attach muscle to bone (transfer pull)
- **Ligaments** – Attach bone to bone; stabilize position of internal organs
- **Aponeuroses** – Tendon sheet; attaches muscle to bone



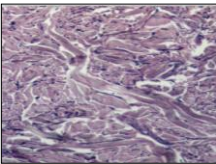
Chapter 4: Tissues

Types of Connective Tissue:

- 1) **Connective Tissue Proper:** (Syrupy matrix)
 - A) **Mesenchyme:**
 - Embryonic connective tissue
 - Star-shaped stem cells; fine fibers
 - B) **Loose Connective Tissue:**
 - "Packing material" of body (fill space / cushion / stabilize / support)
 - C) **Dense Connective Tissue:**
 - Offer strength & support; occupied primarily by collagen fibers



Gives rise to all other connective tissues



Dense Irregular Connective Tissue

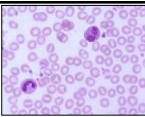
- Collagen fibers run random to each other
- Support stress from many directions
- Contains variable amounts of elastic fibers

Located underlying skin / around bones (periosteum) / around organs (capsules)

Chapter 4: Tissues

Types of Connective Tissue:

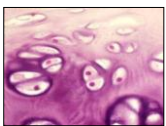
- 2) **Blood:** (Watery matrix)
 - Transports materials through body
- 3) **Cartilage:** (Gel-like matrix)
 - Provides strong framework for supporting body
 - Composition:
 - Matrix = firm gel; contain [1] **chondroitin sulfates** (polysaccharide derivative)
 - Complex with **proteoglycans** in ground substance
 - Protein cores with glycosaminoglycans attached (carbohydrate chains)
 - Form hydrated gel; resist compression
 - Chondrocytes:** Only cell in mature cartilage; sit in lacunae
 - Avascular** (release antiangiogenesis factor)
 - Surrounded by fibrous **perichondrium** (dense irregular connective tissue)



Chapter 4: Tissues

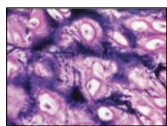
Types of Connective Tissue:

- 2) **Blood:** (Watery matrix)
 - Transports materials through body
- 3) **Cartilage:** (Gel-like matrix)
 - Provides strong framework for supporting body
 - Types of cartilage:



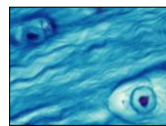
Hyaline Cartilage
(most common)

 - Stiff / flexible support
 - Costals / trachea
 - Reduce friction (joints)



Elastic Cartilage
(elastic fibers)

 - Resilient / flexible support
 - Pinna of ear / epiglottis



Fibrocartilage
(↑ collagen fiber content)

 - Durable / tough
 - Resist compression / absorb shock

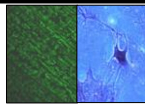
Intervertebral Disks
Meniscus (knee joint)
↑

Chapter 4: Tissues

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Muscle Chapter 9	Elongated contractile cells	Moderate	Movement
Nervous Chapter 11	Intertwining elongated processes	None	Transmission of electrical impulses




Chapter 4: Tissues

Tissue Repair:


The severity of the injury often dictates whether scarring will occur

- Mechanisms of Repair:
 - 1) **Regeneration:** Replacement of destroyed tissue with same tissue type
 - 2) **Fibrosis:** Replacement of tissue with fibrous connective tissue (i.e., scar)




Step 1:
Inflammation

- Injury triggers chemical release
- Cells / fluids invade region
- Clot forms (clotting proteins)
- Scab** = dried outer surface



Step 2:
Organization

- Blood clot → granulation tissue
- Fragile capillary beds
- Fibroblasts (collagen fibers)
- Macrophages "eat" cell debris



Step 3:
Permanent Repair

- Granulation tissue matures
- Contraction occurs
- Remains as fibrosed area
- Epithelium regenerates / thickens

Maniab & Hoehn - Figure 4.12