

Chapter 4-Tissues, Glands, and Membranes

Histology

- The study of microscopic tissue structure
- **4 Tissue Types- Each with unique functions**
 1. Epithelial Tissue
 2. Connective Tissue
 3. Muscle Tissue
 4. Nervous Tissue

I. Epithelial Tissue

Epithelial Tissue

- Found throughout body
- Covers internal and external surfaces

3 Sides to an Epithelial Cell

1. Apical Surface (free surface)
2. Lateral Surface
3. Basal Surface

I. Epithelial Tissue- Cell Surfaces

1) Apical Surface (free surface)

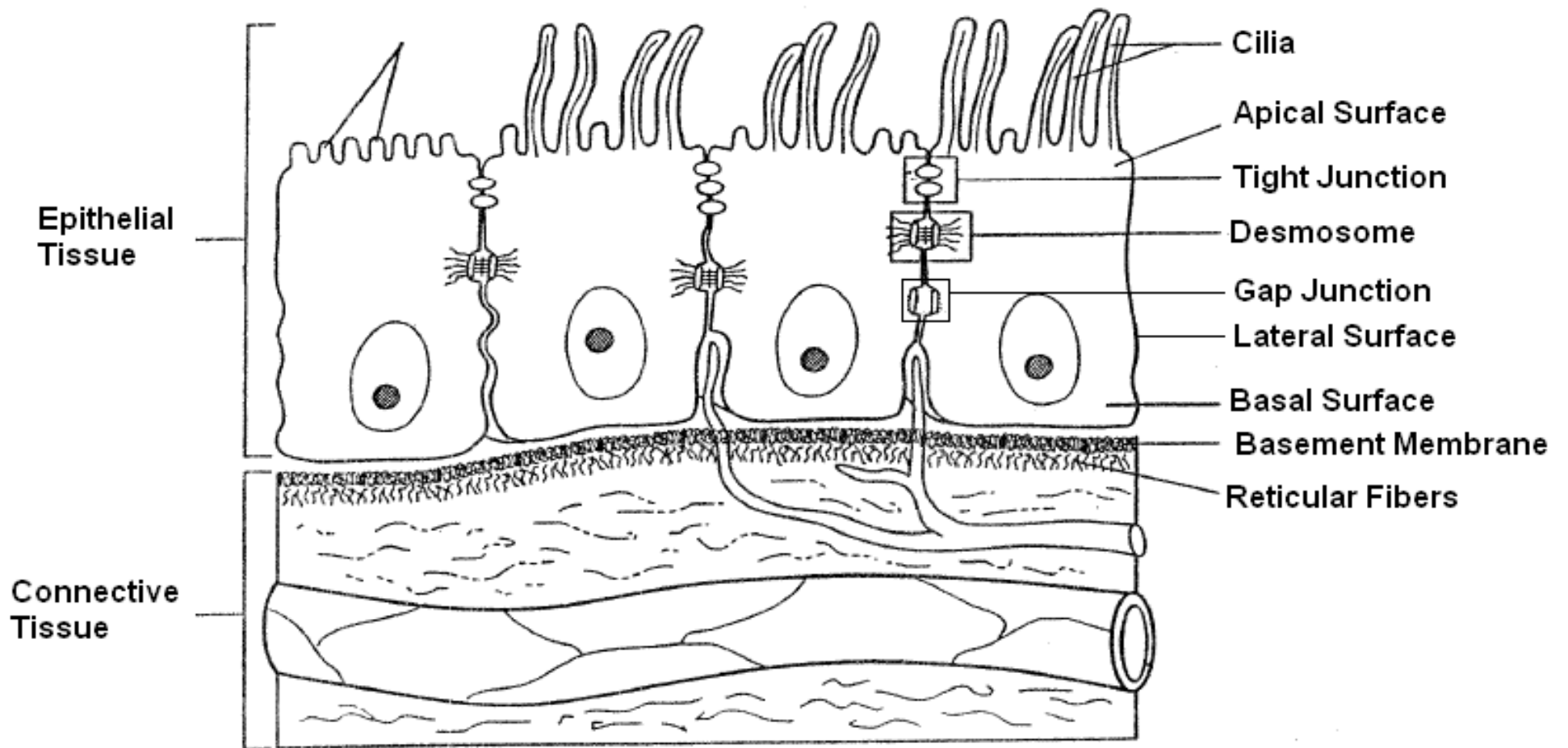
- Surface not in contact with other cells
- Microvilli and cilia

2) Lateral Surface

- Cell Junctions (connections between cells)

3) Basal Surface

- Adjacent to (sits on top of) basement membrane
 - Basement membrane connects epithelial tissue to connective tissue
 - Functions as a filter and as a barrier



I. Epithelial Tissue- Functions

5 Functions

1. Protection
2. Barrier
3. Permits the passage of substances
4. Secretion
5. Absorption

I. Epithelial Tissue- Classification

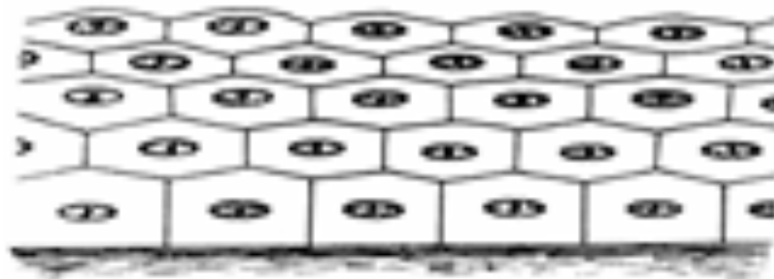
- Classified by **Number of Layers** and by **shape**

Number of Layers

Simple = Single Layer



Stratified = More than 2 or more layers



I. Epithelial Tissue- Classification

Shape

(looking at the nucleus can help determine shape)

Squamous

(flattened)



Cuboidal

(Cube-like)



Columnar

(Taller than is wide)



I. Epithelial Tissue- Simple

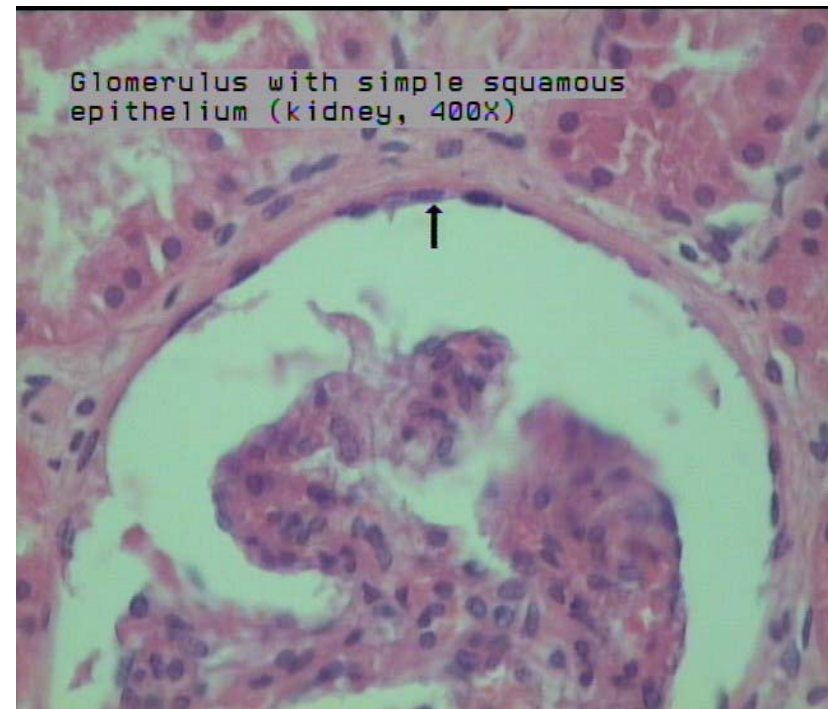
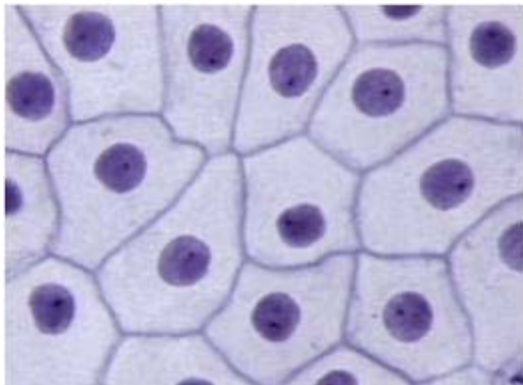
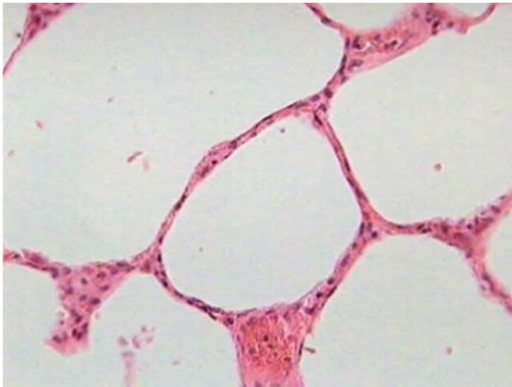
The **function** of epithelial tissue is directly related to the epithelial tissue's **shape** and **number of layers**.

I. Epithelial Tissue- Simple

Simple Squamous ET

-Function: diffusion and filtration

-Located: alveoli (lung), Bowman's capsule (kidney)

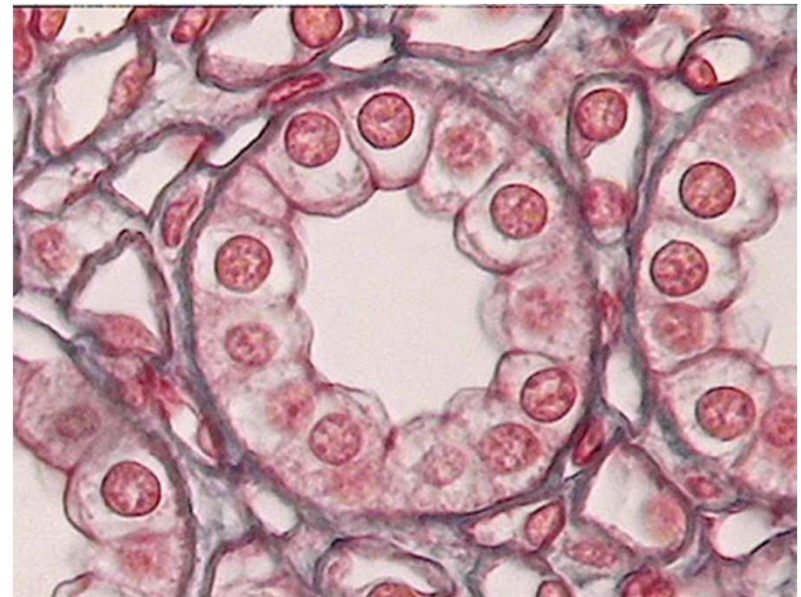
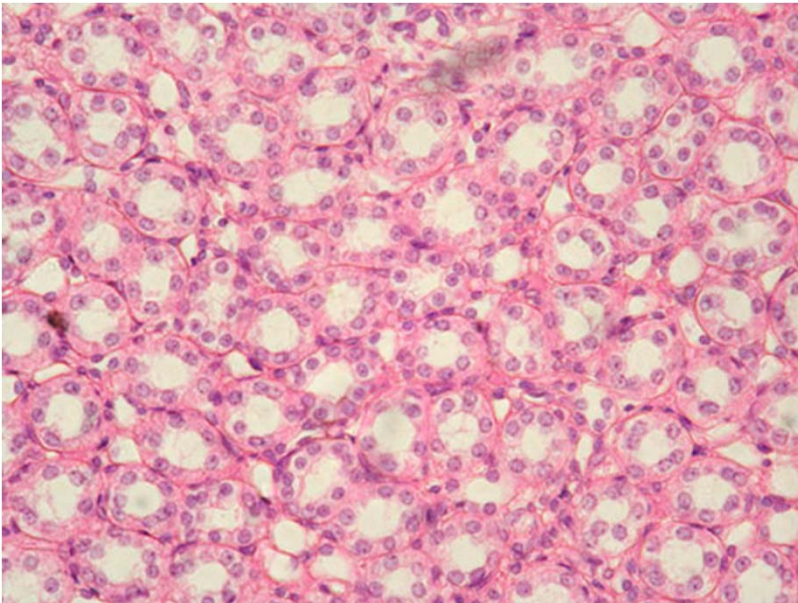
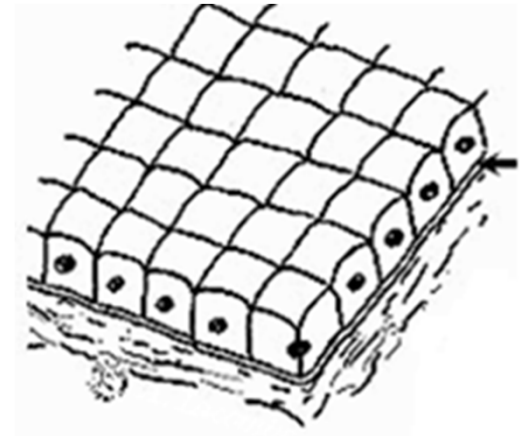


I. Epithelial Tissue- Simple

Simple Cuboidal ET

-Function: Active transport, facilitated diffusion, secretion

-Located: Mitochondria, kidney tubules

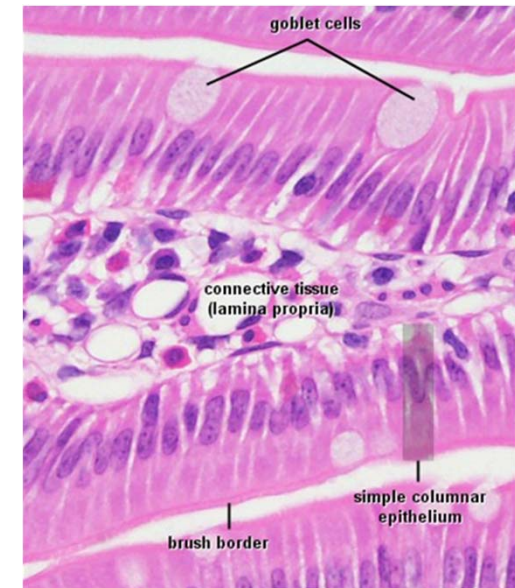
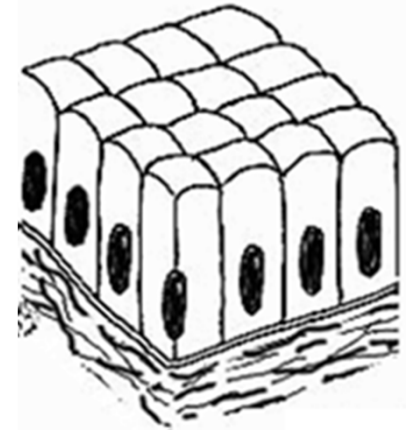


I. Epithelial Tissue- Simple

Simple Columnar

-Function: Secretion, absorption, active transport, facilitated diffusion, or simple diffusion

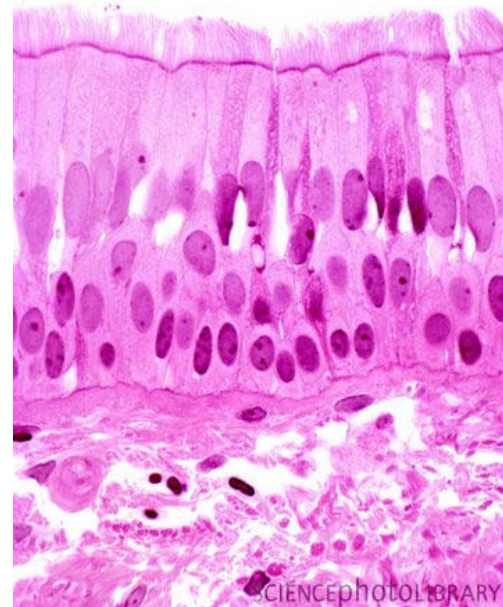
-Located: Small intestines



I. Epithelial Tissue- Simple

Pseudostratified Ciliated Columnar ET

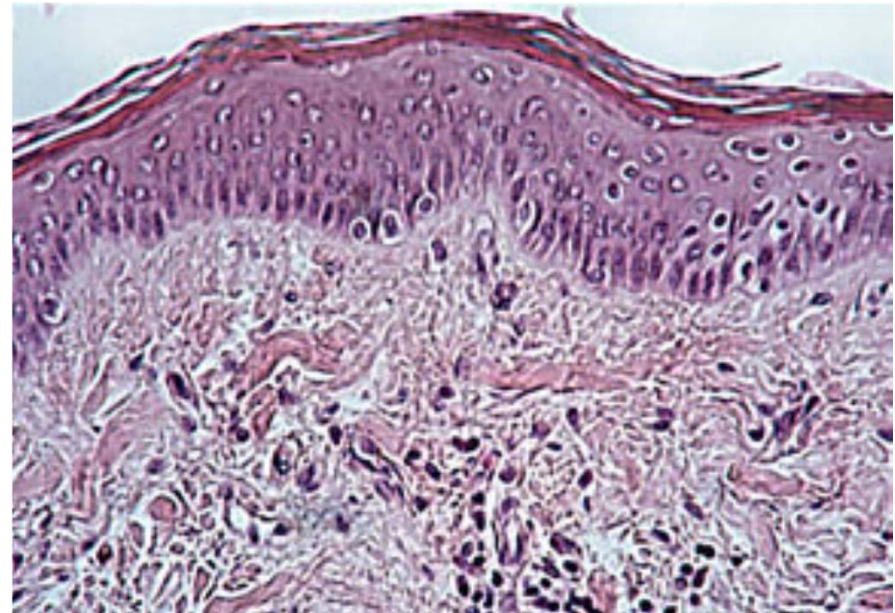
- Function: Secretion
 - Goblet cells
- Cilia on the apical surface
- Located: Respiratory passages, nasal passages



I. Epithelial Tissue- Stratified

Stratified Squamous Keratinized ET

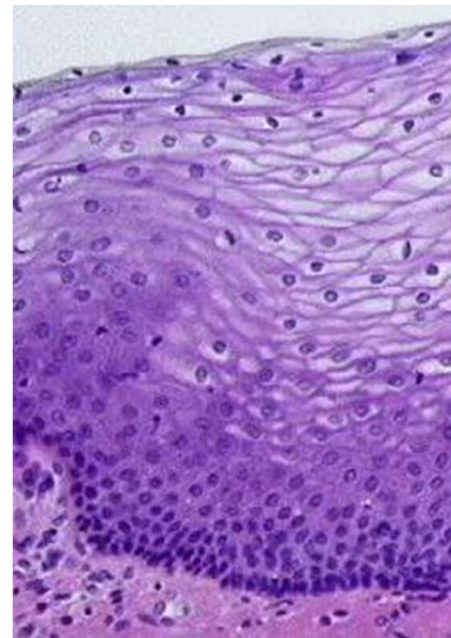
- Function: Protection, barrier, resists loss of water
- Apical surface- squamous
- Basal surface- cuboidal
 - As cuboidal cells undergo mitosis, they are pushed to the surface and flatten and die
 - Cytoplasm is replaced by keratin (tough protein)
- Located: Skin



I. Epithelial Tissue- Stratified

Stratified Squamous Non-Keratinized ET

- Function: resist abrasion
- No Keratin
- Located: Mouth or other external orifices.



I. Epithelial Tissue- Stratified

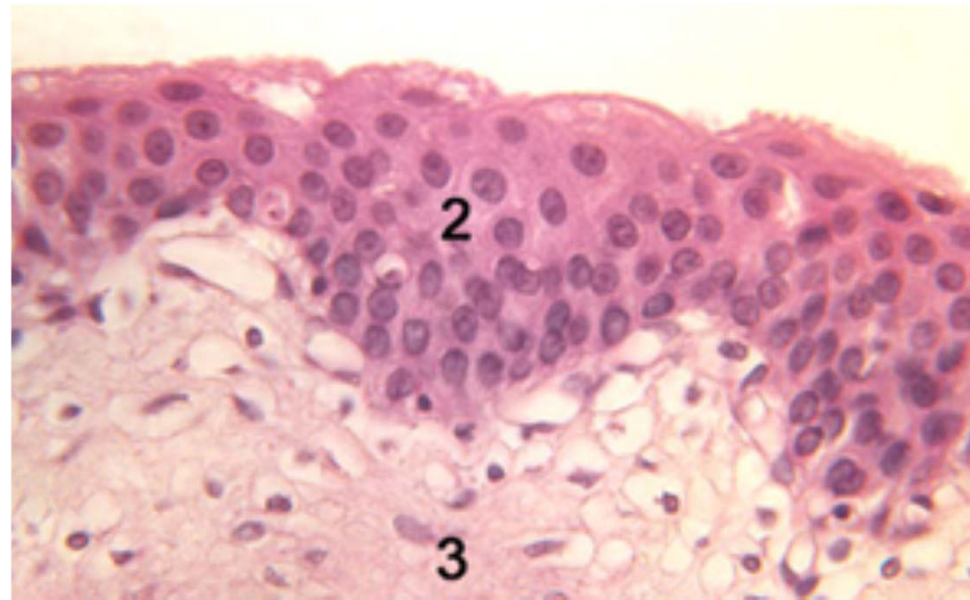
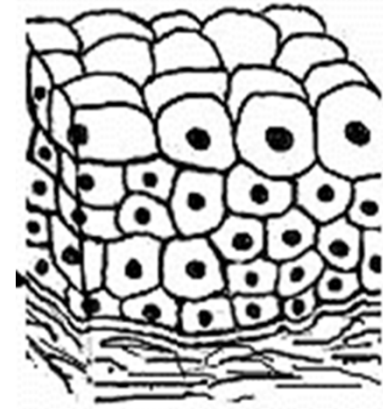
Stratified Cuboidal and Stratified Columnar

- Rare

I. Epithelial Tissue- Stratified

Transitional

- Function: Lines cavities, protection
- Cells “transition” from cuboidal to squamous when stretched
- Location:
Urinary bladder



I. Epithelial Tissue- Structural and Functional Relationships- Free Cell Surfaces

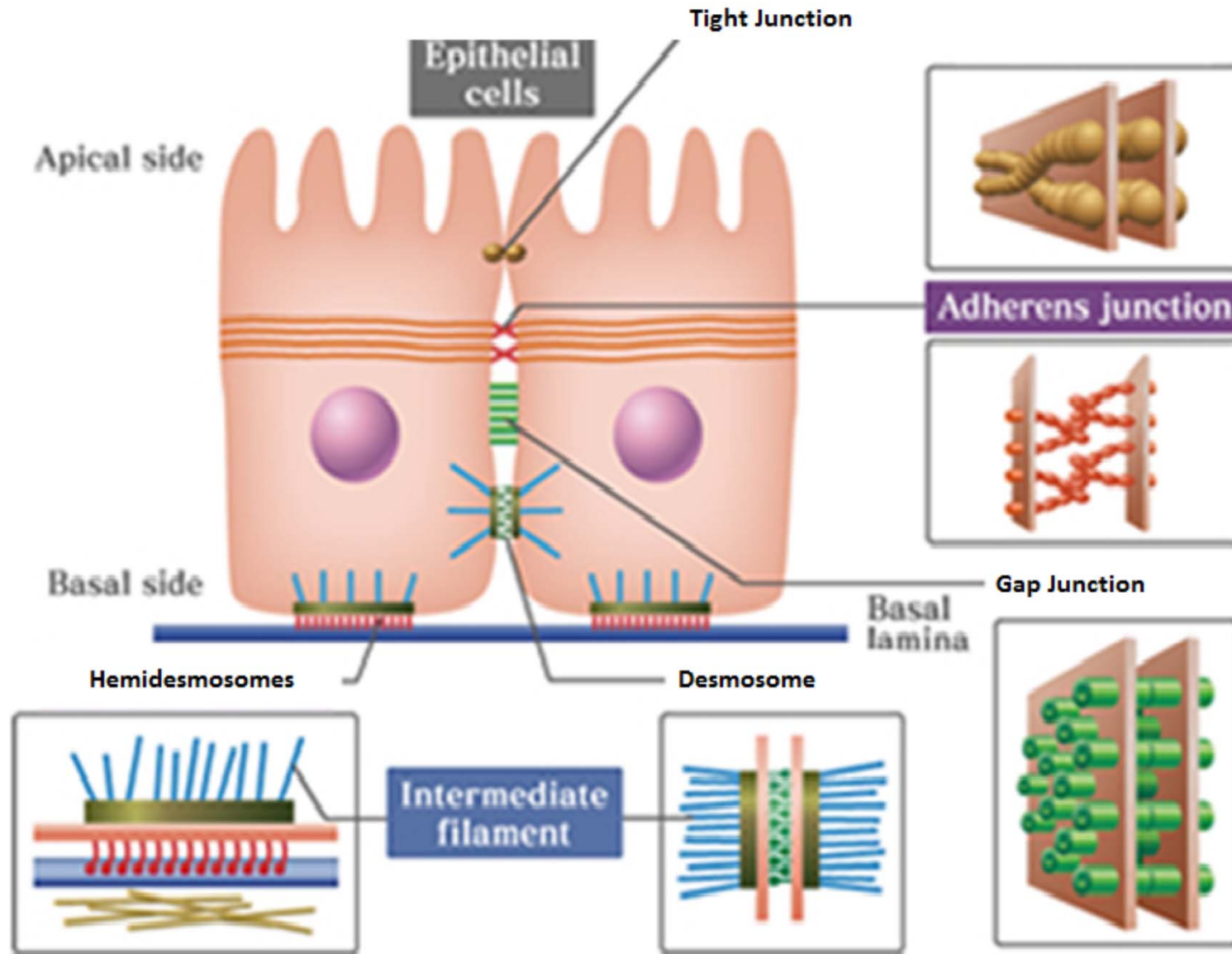
The apical surface is either or has:

1. **Smooth**- reduce friction
2. **Cilia**- finger-like projections that transports substances across the apical surface
3. **Microvilli**- increases surface area of the apical surface for absorption
4. **Goblet cells**- secrete mucus

I. Epithelial Tissue- Structural and Functional Relationships- Cell Connections (Junctions)

- Cell Connections located on **Lateral Surface** of epithelial cell.
- **4 Types**
 1. Tight junction- fuse adjacent membranes
 2. Gap junction- protein tunnel; allows substances to pass between adjacent cells
 3. Desmosomes- connects adjacent cell membranes; allows tissue to stretch
 4. Hemidesmosomes- anchor basal surface to basement membrane

I. Epithelial Tissue- Structural and Functional Relationships- Cell Connections (Junction)



I. Epithelial Tissue- Glands

Glands secrete substances onto a surface, into a cavity or into the blood.

2Types

1. Exocrine
2. Endocrine

I. Epithelial Tissue- Glands

Exocrine Glands

- Has ducts; secretes substances through ducts
- 2 Name System
 - No Branches or Branches = simple or compound
 - End of duct- tubular, acinus, or alveolar



(b) Simple straight tubular
(glands in stomach
and colon)



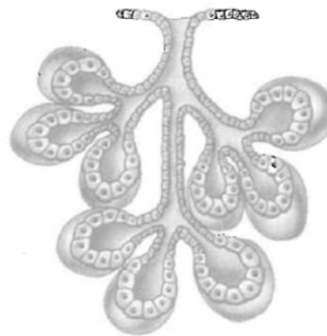
(c) Simple coiled tubular
(lower portion of stomach
and small intestine)



(d) Simple acinar or alveolar
(sebaceous glands
of skin)



(e) Compound tubular
(mucous glands of duodenum)



(f) Compound acinar or alveolar
(mammary glands)

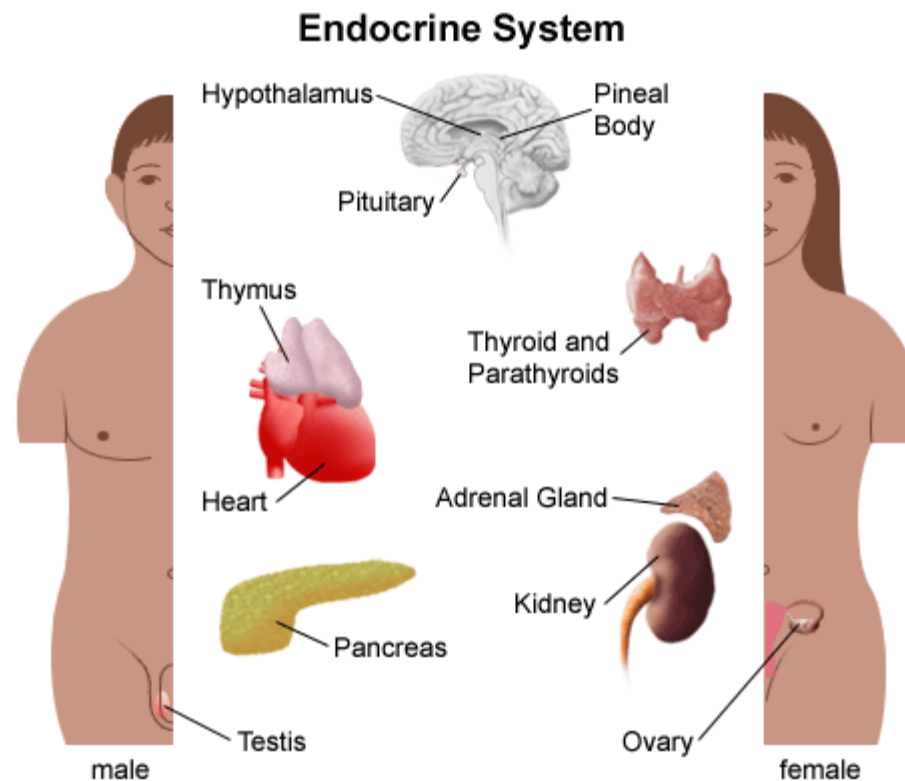


(g) Compound tubuloacinar or
tubuloalveolar (pancreas)

I. Epithelial Tissue- Glands

Endocrine Glands

- Ductless
- Secrete hormones into the blood



II. Connective Tissue

- Characterized by composition of **extracellular matrix**
- **Most Diverse Tissue**- solid, semisolid, liquid

Extracellular Matrix

3 components

1. protein fibers
2. organic ground substance
3. fluid

II. Connective Tissue- Extracellular Matrix

3 Types of Fibers

1. Collagen- white fibers in bundles; resists tensile forces
2. Elastic- yellow fibers; stretch and recoil
3. Reticular- anchors

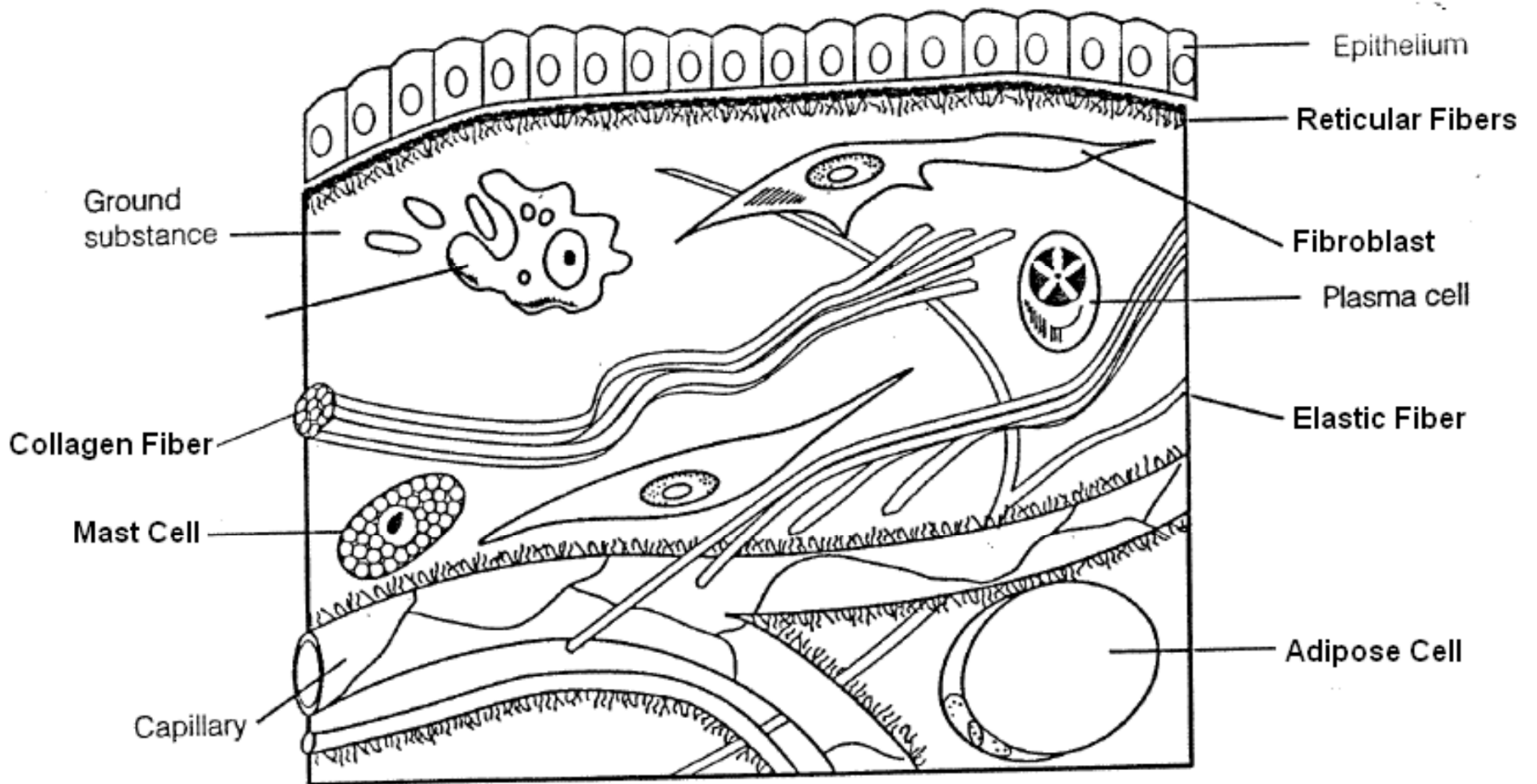
Organic Ground Substance

“stuff” between cells and fibers

II. Connective Tissue- Types of Cells

Connective tissue cells named according to their **function**.

- | | |
|---------------|-------------------|
| -blast | - produce matrix |
| -cyte | - maintain matrix |
| -clast | - destroy matrix |



II. Connective Tissue- Functions

7 Functions

1. Encloses and Separates
2. Connects tissues
3. Support and Movement
4. Storage
5. Cushion and Insulation
6. Transport
7. Protect

II. Connective Tissue- Loose (Areolar) CT

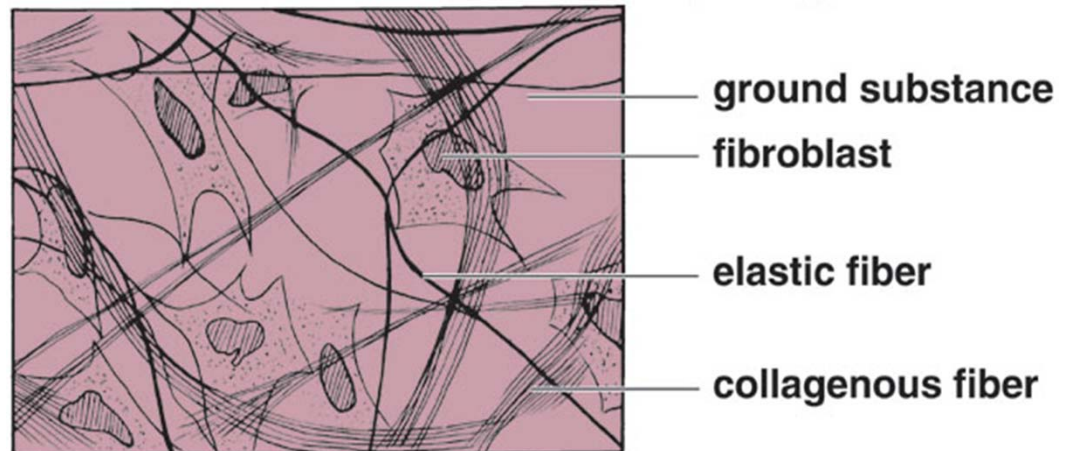
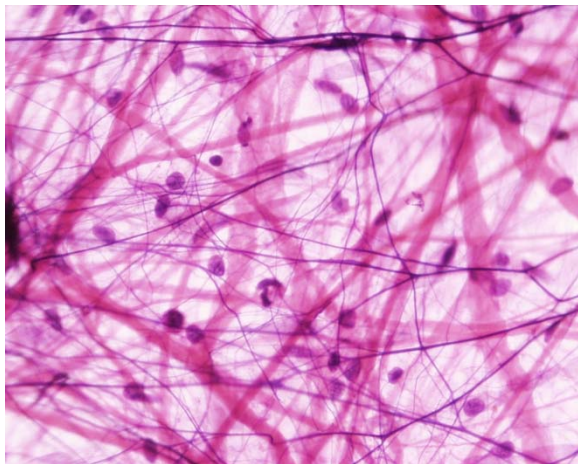
Loose (Areolar) Connective Tissue

Composed of: mostly collagen, few elastic

Cells: fibroblasts

Located: between glands, muscles, nerves, skin

Function: loose packing, support, nourishes



II. Connective Tissue- Adipose

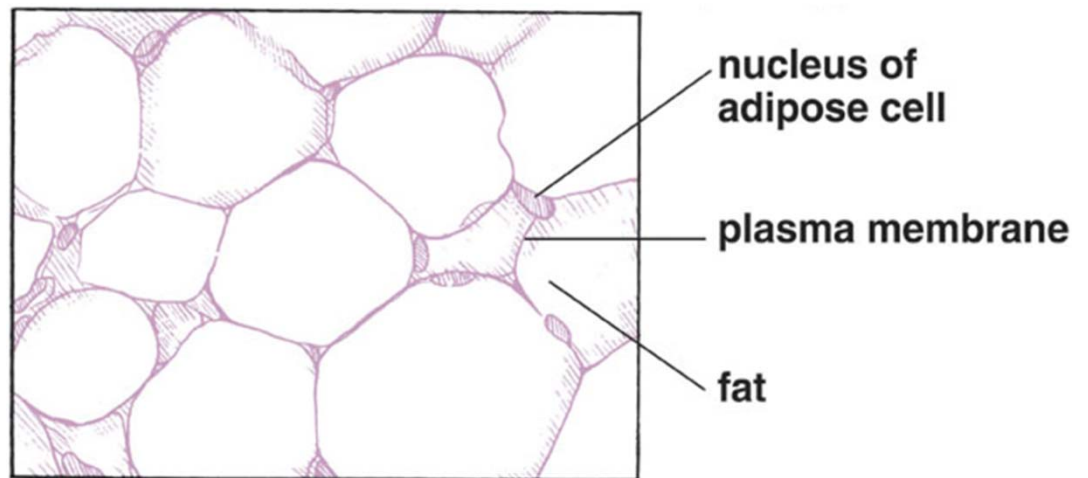
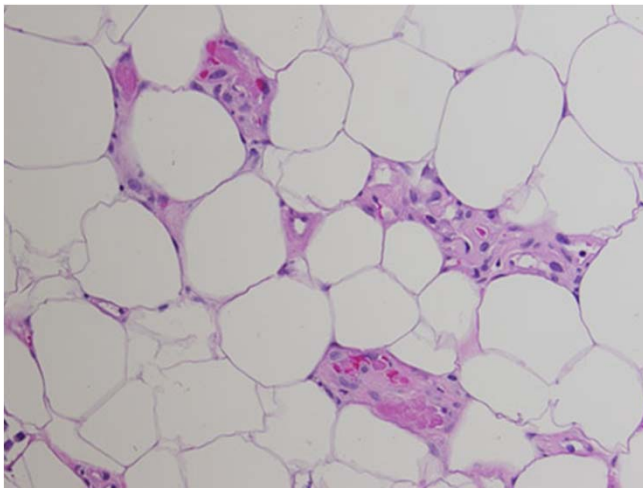
Adipose Tissue

Special loose connective tissue

Composed of: Cells filled with lipids

Location: below skin, around kidneys, mammary glands

Function: cushion, insulation, packing material, energy storage



II. Connective Tissue- Dense Fibrous CT

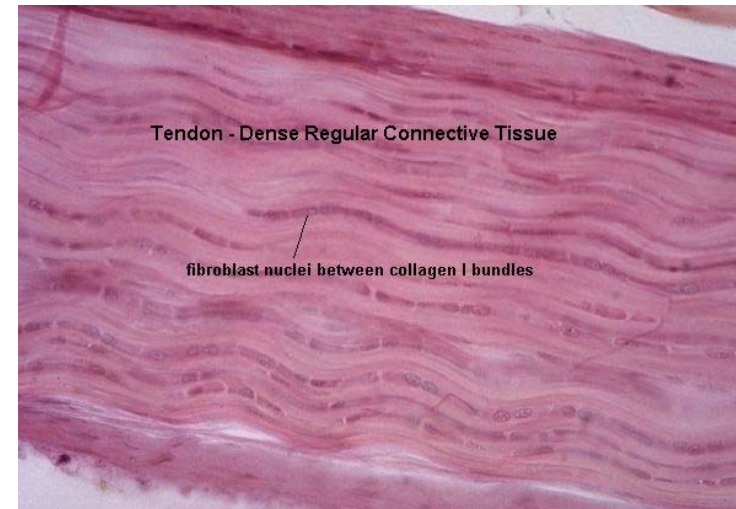
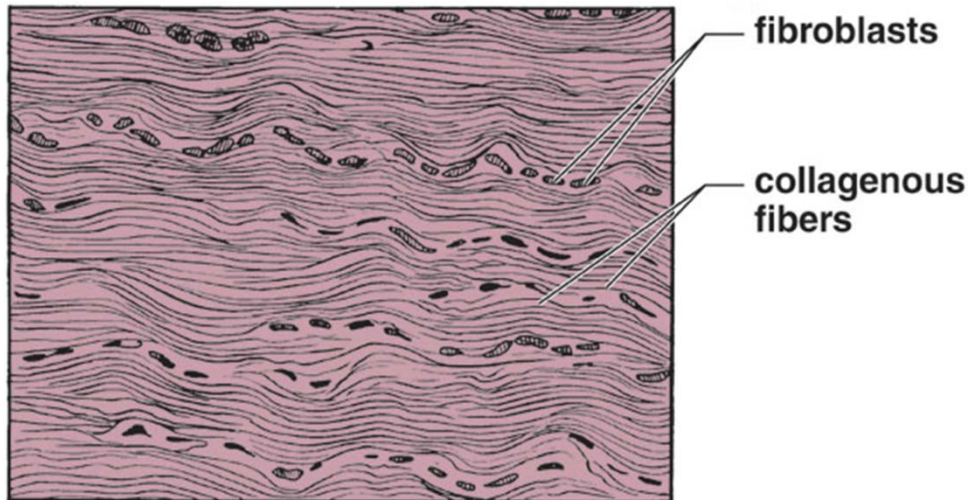
Dense Collagenous CT

Composed of: mostly collagen

Cells: fibroblasts

Located: Ligaments, tendons, skin

Function: withstand pulling forces, resist stretching, great tensile strength



II. Connective Tissue- Dense Fibrous CT

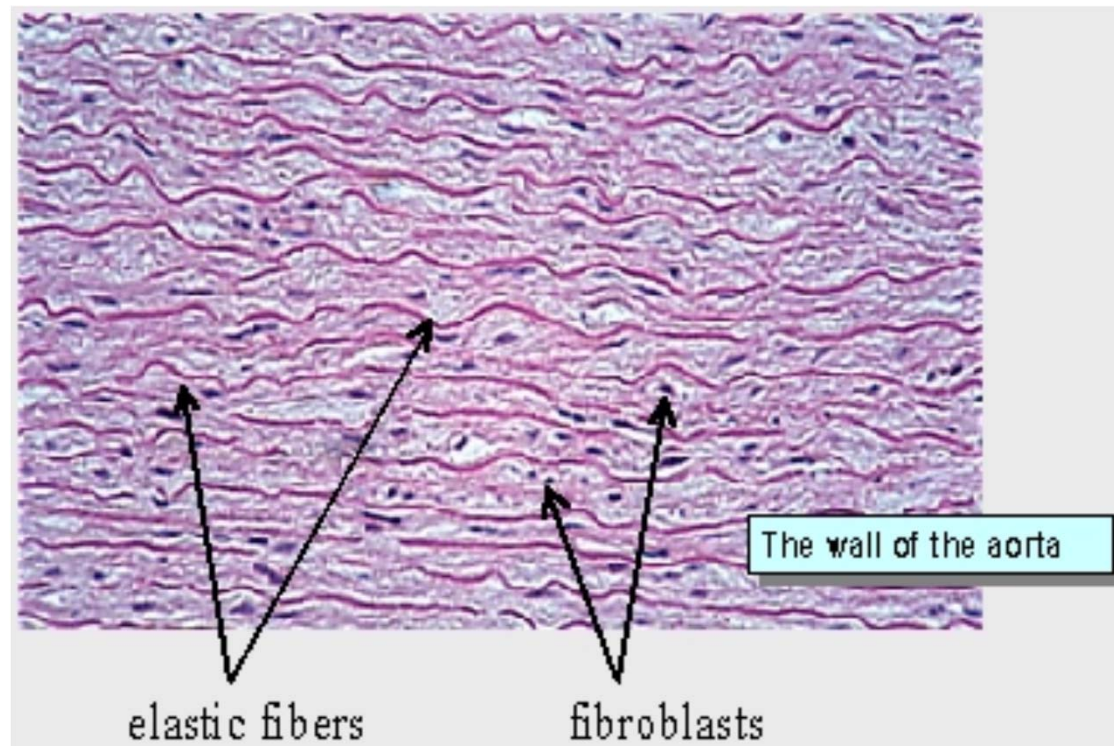
Dense Elastic CT

Composed of: mostly elastic fibers

Cells: fibroblasts

Located: vocal cords, walls of blood vessels

Function: stretch and recoil



II. Connective Tissue- Cartilage

- Chondrocytes- cartilage cells
- 3 Types
 1. Hyaline
 2. Fibrocartilage
 3. Elastic

II. Connective Tissue- Cartilage- Hyaline

Hyaline Cartilage

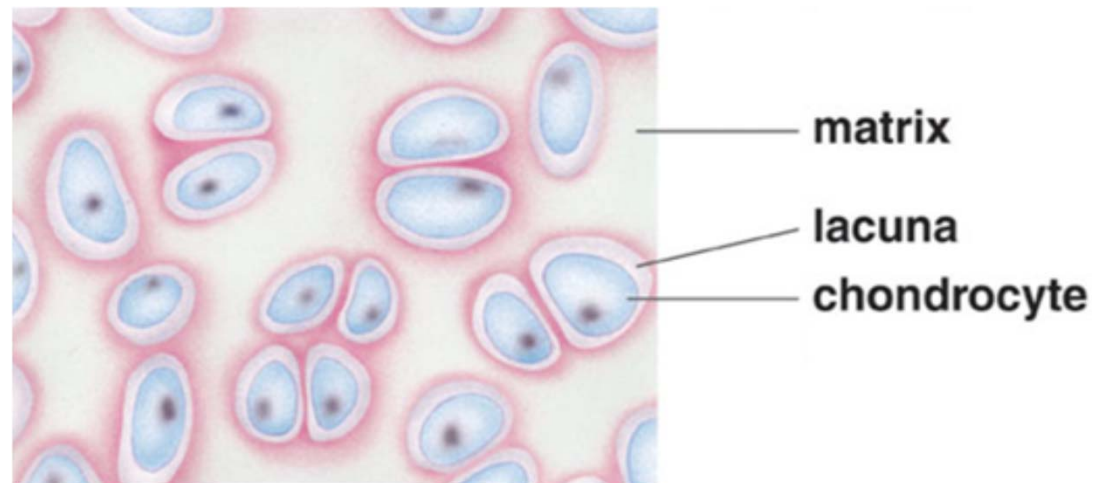
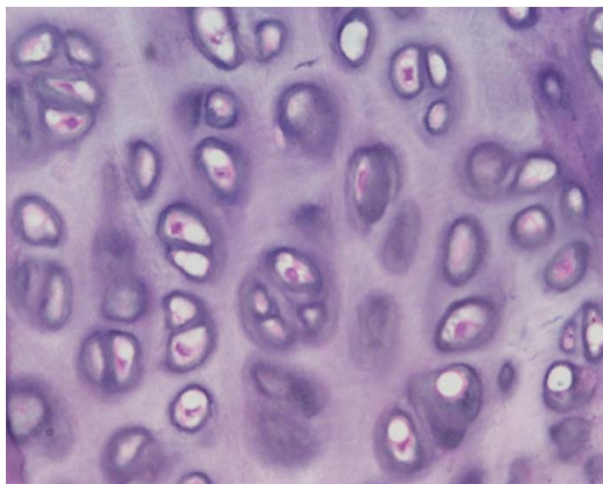
- Most abundant

Characteristics: White, glossy, shiny, smooth, avascular

Cells: chondrocytes

Located: ends of bones, rib cartilage, nose, trachea

Function: Withstand compression, growth of long bones,
rigidity, flexibility,



II. Connective Tissue- Cartilage- Fibrocartilage

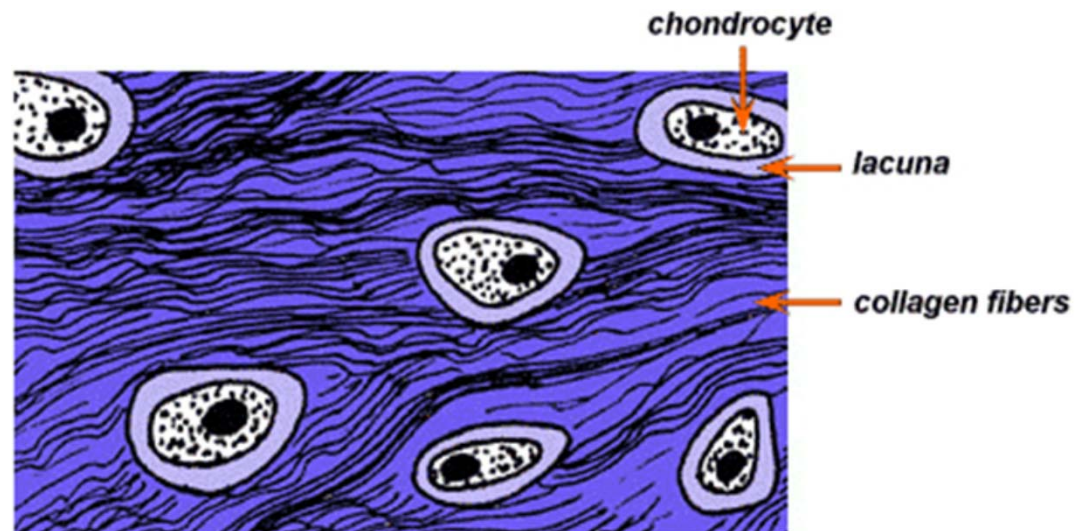
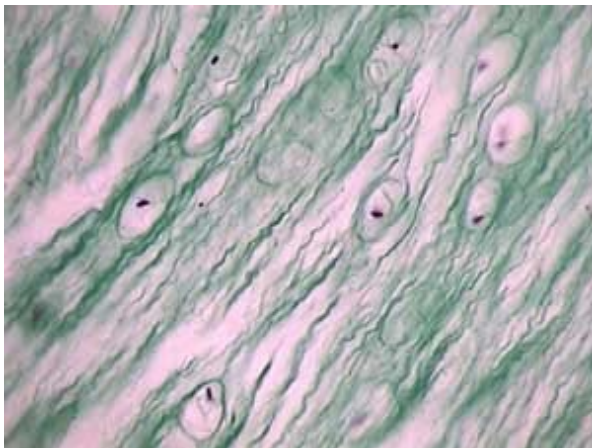
Fibrocartilage

- More collagen than hyaline

Cells: Chondrocytes

Located: vertebral disks, pubic symphysis

Function: Withstand compression and resists pulling and tearing



II. Connective Tissue- Cartilage- Elastic

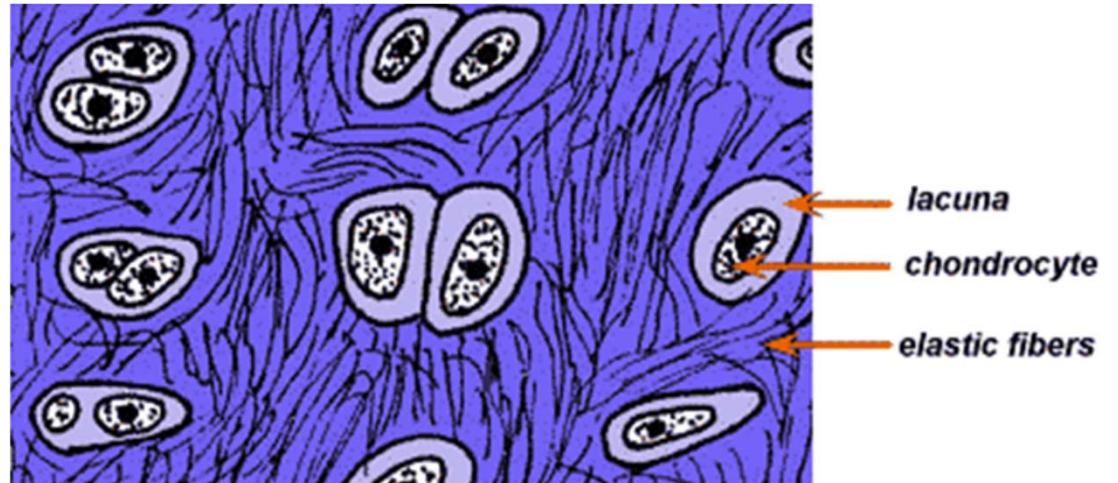
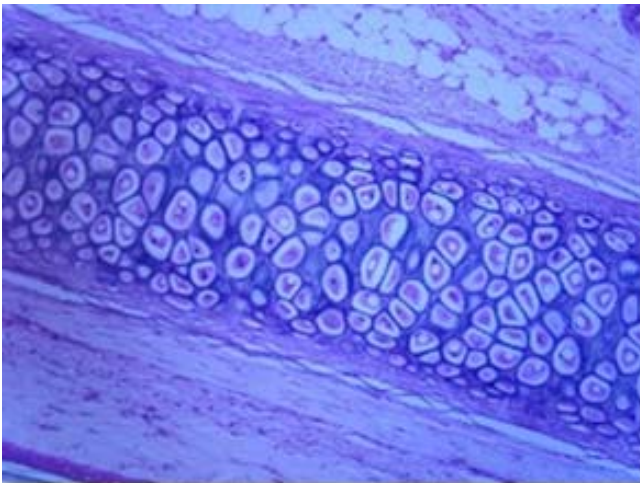
Elastic Cartilage

- Mostly elastic fibers, few collagen

Cells: Chondrocytes

Located: external ear, epiglottis, auditory tubes

Function: Can be stretched and recoil, rigidity, flexibility



II. Connective Tissue- Bone

Bone

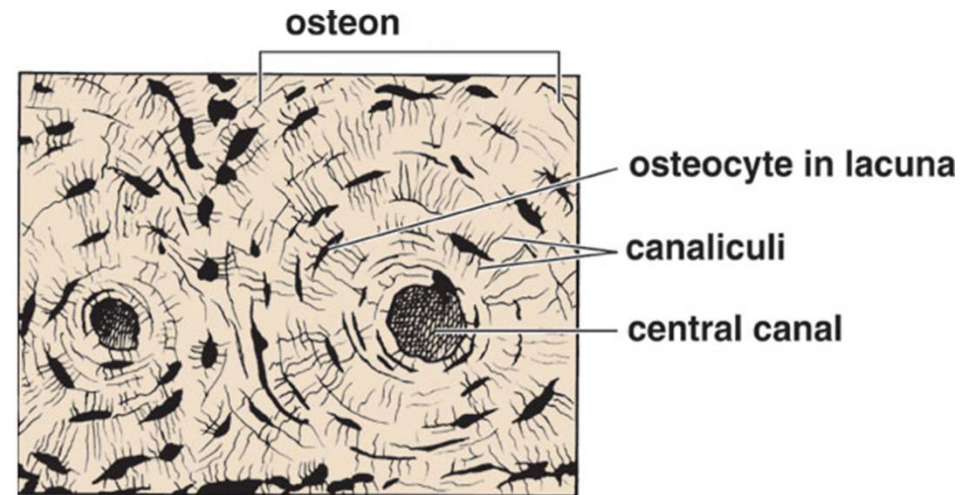
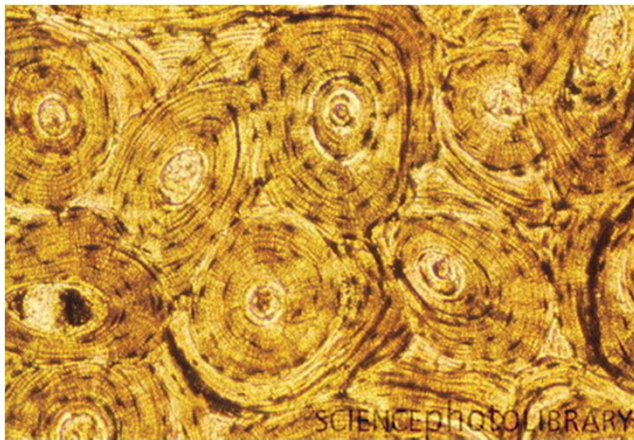
2 Types: Compact bone and spongy bone

Cell: Osteocyte- mature bone cell, osteoblast- bone-making cell

Composed of: Mineralized matrix, calcium and phosphate

Location: Skeletal System

Function: support and protect



II. Connective Tissue- Blood

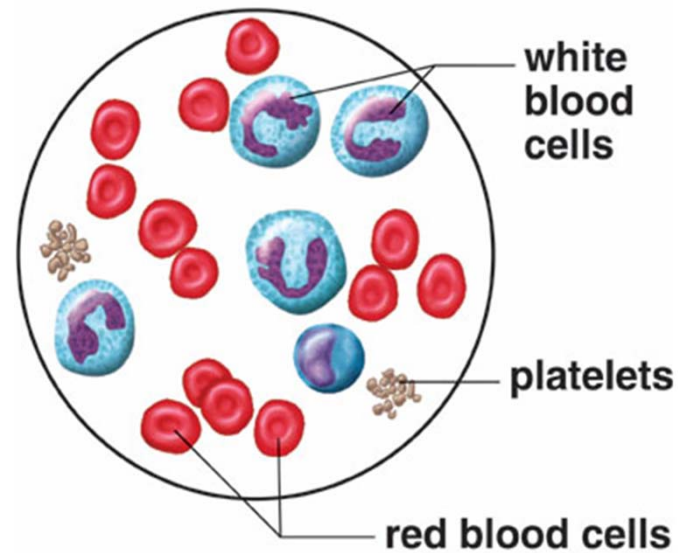
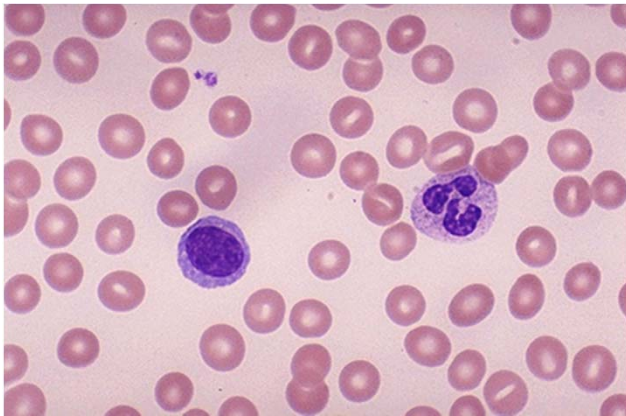
Blood

Composed of: Cells are suspended in a matrix made of fluid; Liquid matrix called plasma

Cells: Red blood cells, white blood cells, platelets

Location: Cardiovascular System

Function: Transport gases and nutrients, regulate body temperature



III. Muscle Tissue

- Muscle tissue has the ability to **contract** (shorten in length) when stimulated.
- Muscles cells are called **muscle fibers**
- **3 Types of Muscles**
 1. Skeletal Muscle
 2. Cardiac Muscle
 3. Smooth Muscle

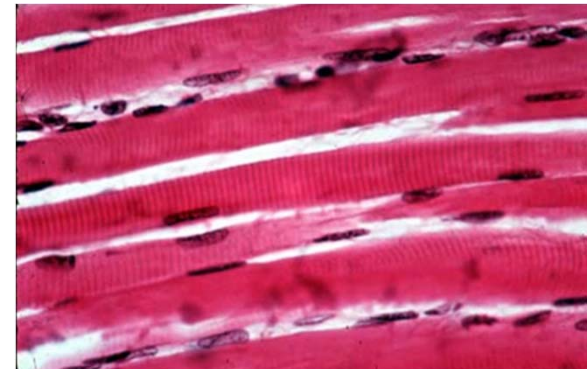
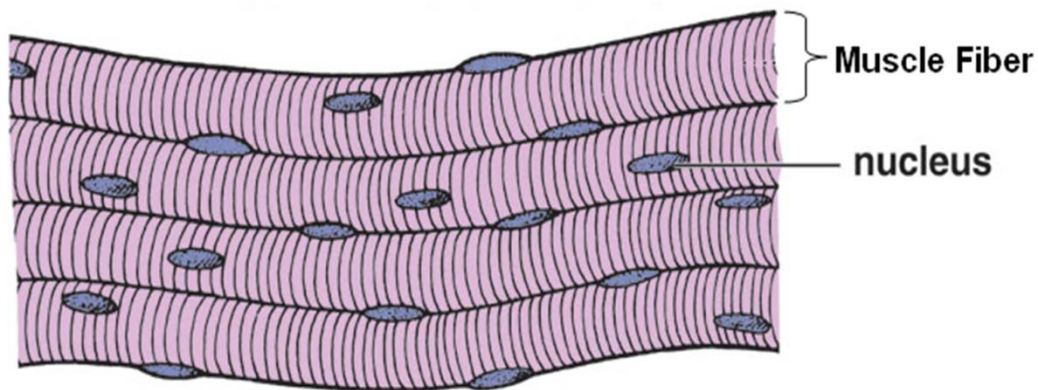
III. Muscle Tissue- Skeletal

Skeletal Muscle

Location: Attaches to the skeletal

Function: Enables movement; voluntary control (conscious control)

Structure: Long, cylindrical, multinucleated per fiber, striated (alternating light and dark bands)



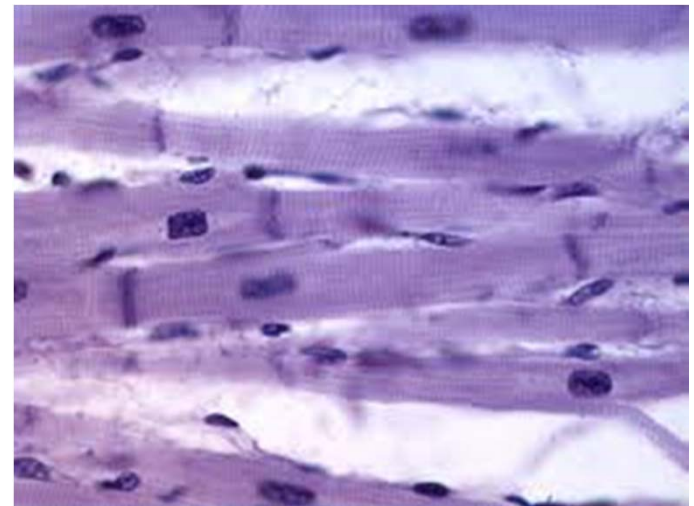
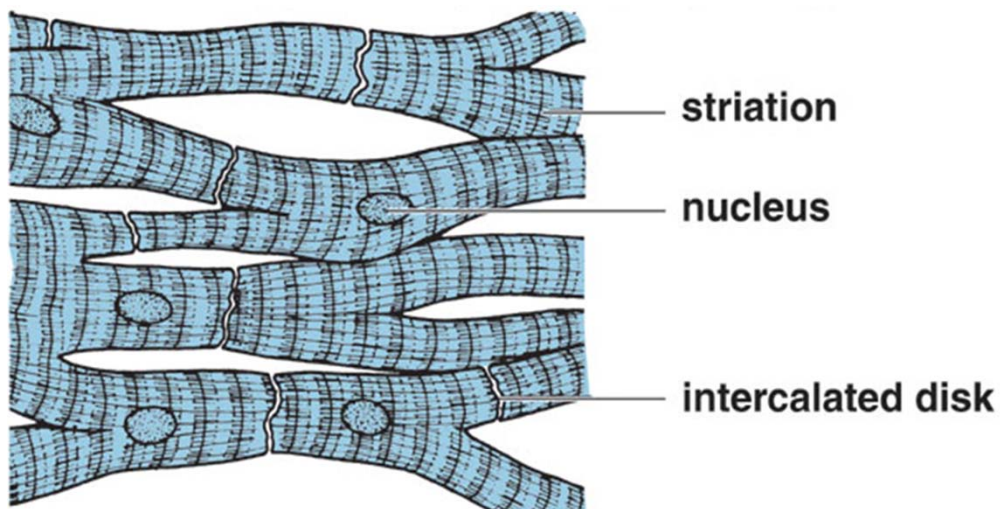
III. Muscle Tissue- Cardiac Muscle

Cardiac Muscle

Location: the heart

Function: Pumps blood; involuntary control (not under conscious control)

Structure: Short, cylindrical, branched, cells connected by intercalated disks, 1 nuclei per cell, striated



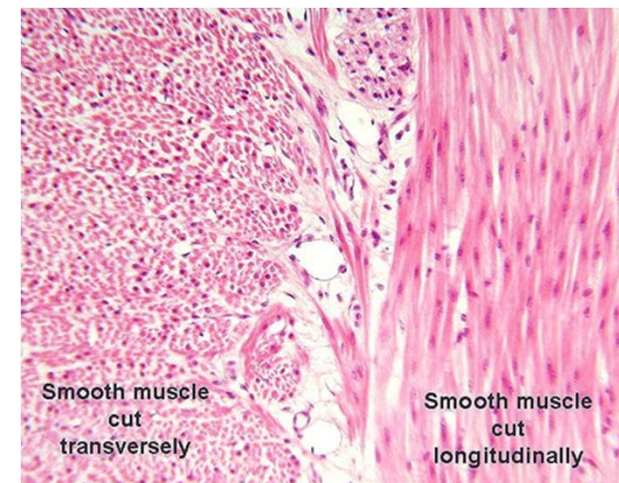
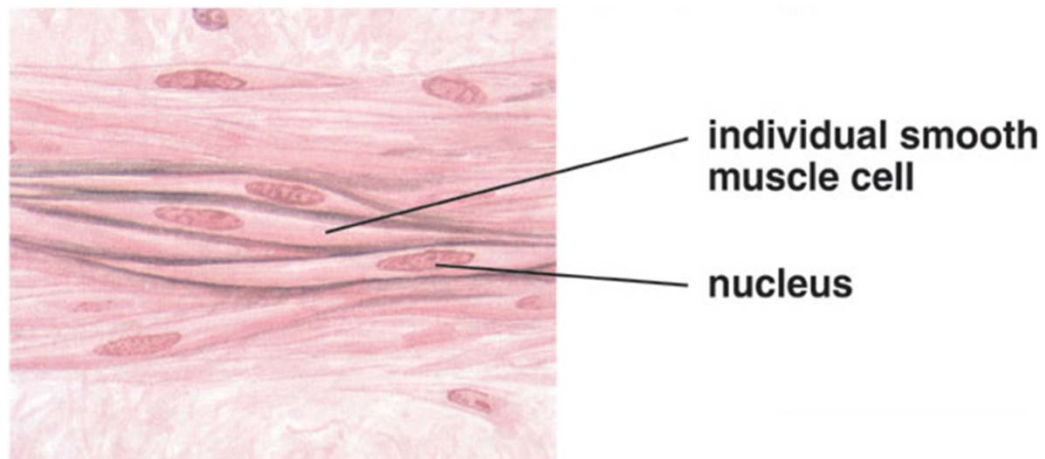
III. Muscle Tissue- Smooth Muscle

Smooth Muscle

Location: the walls of hollow organs and vessels, skin, eyes

Function: Movement of food, digestive system valves;
Constriction/Dilation; Involuntary control

Structure: Cell ends tapered (spindle shaped), 1 nuclei per cell,
non-striated



IV. Nervous Tissue

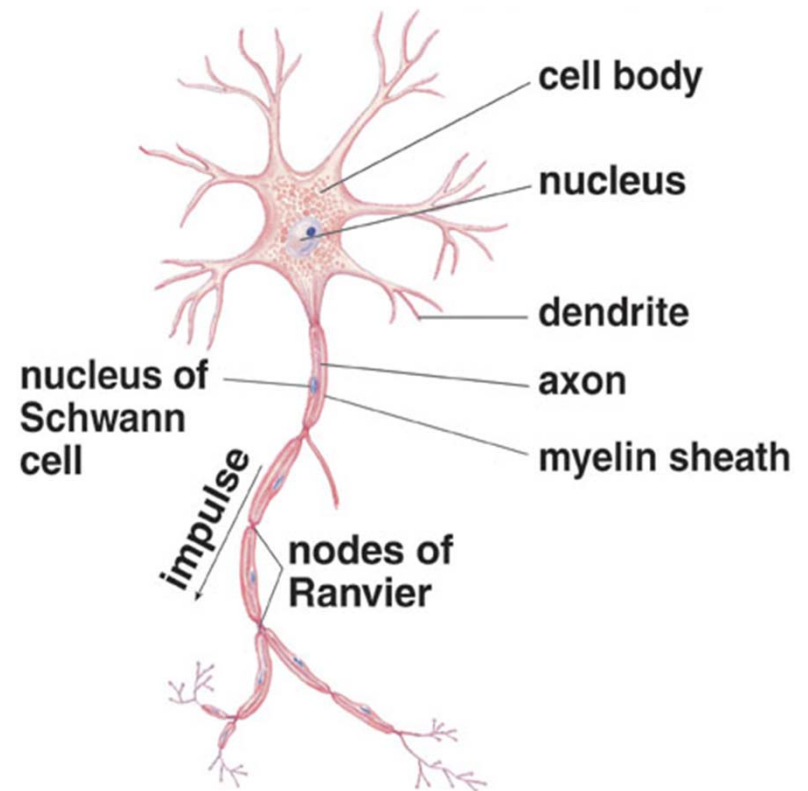
- Nervous tissue has the ability to produce an action potential to communicate
- Nervous tissue has the ability to create, receive, and conduct electrical impulses.
- Coordinates and controls body activities
- **2 Types of Nervous Tissue Cells**
 1. Neurons
 2. Neuroglial Cells

IV. Nervous Tissue- Neuron

Neuron- nerve cell; receives, creates and conducts action potentials (nerve impulses)

3 Main Parts

1. Dendrite- receives electrical signals
2. Cell body (soma)- contains organelles
3. Axon- transmits electrical signals



IV. Nervous Tissue- Neuroglial Cells

- “Nerve glue”
- Supports, nourishes and maintains the health of the neuron

4 Types of Neuroglia

- Microglia
 - Macrophage- engulfs foreign substances
- Astrocytes
 - Provide nutrients
- Oligodendrocytes
 - Form myelin sheaths in CNS
- Schwann cells
 - Form myelin sheaths in PNS

V. Membranes

- Covers structures or lines cavities
- Consists of ET and CT
- **2 Major Categories**
 1. Mucous Membranes
 2. Serous Membranes

V. Membranes

Types of Membranes

1. **Mucous**- lining of dig., resp., urin. Systems, secrete mucus
2. **Serous**- lines cavities, covers organs, 3 parts-parietal, visceral, and cavity, Examples- pleura, pericardium, peritoneum
3. **Synovial**- lines joints, secretes synovial fluid
4. **Meninges**- protective covering of brain and spinal cord
5. **Cutaneous**- skin

VI. Inflammation

Inflammatory Response

- Non-specific defense mechanism
- Mobilizes body's defenses
- **5 Major Symptoms**
 1. Redness
 2. Heat
 3. Swelling
 4. Pain
 5. Disturbance of function

VI. Inflammation- How it Works

1. Break in the barrier
2. Mediators of Inflammation cause symptoms
 - Dilation of blood vessels
 - Increase permeability of blood vessels (Edema)
 - White blood cells, red blood cells, and other cells enter damaged area to begin repair
3. Pain due to exposed nerve endings
4. Tissue repair can begin

http://faculty.riohondo.edu/rbethel/videos/micro_inflammation.swf

VII. Tissue Repair

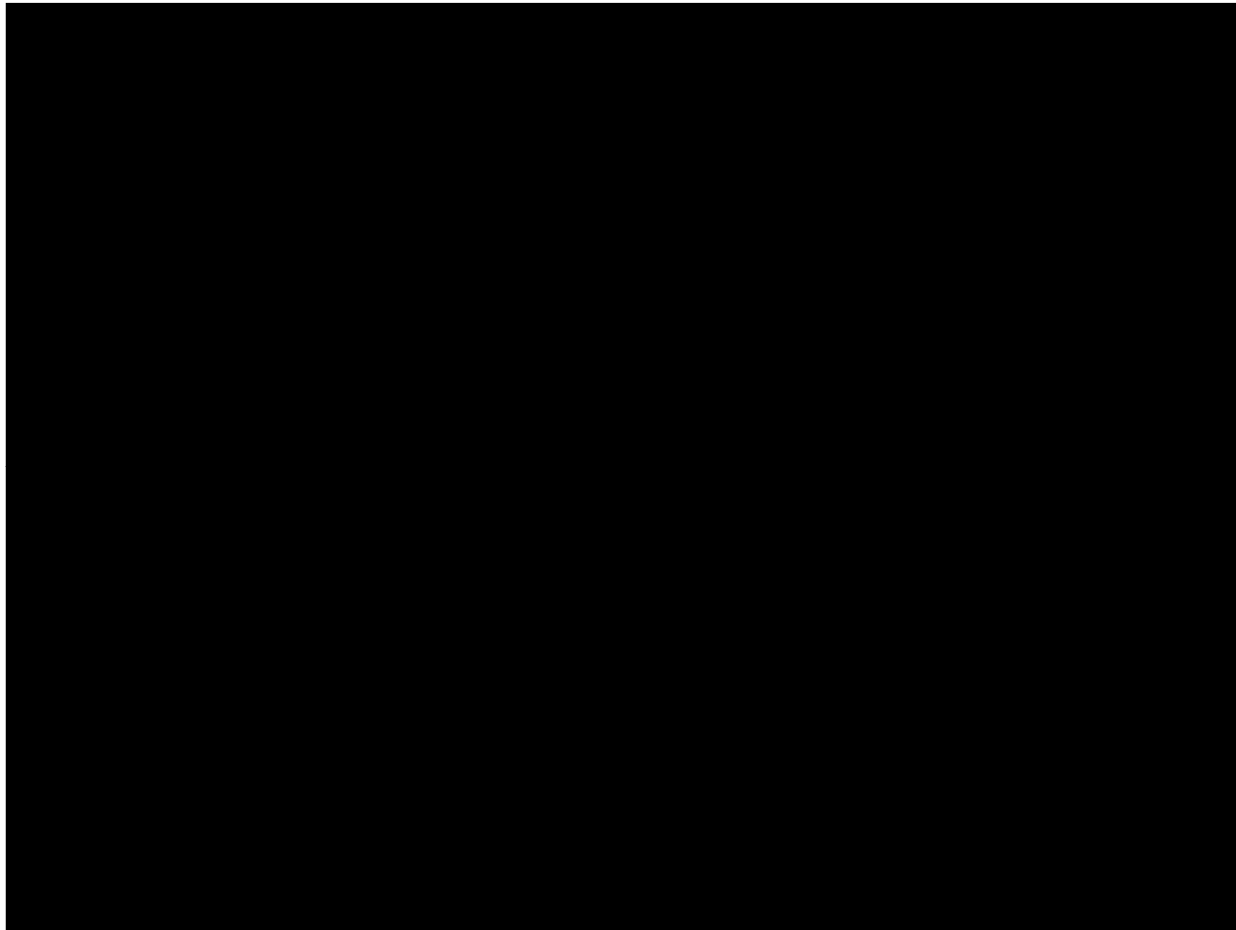
Tissue repair is when damaged cells are replaced by new cells; the replacement of viable cells for dead cells

2 Types of Repair

1. Regeneration
2. Replacement

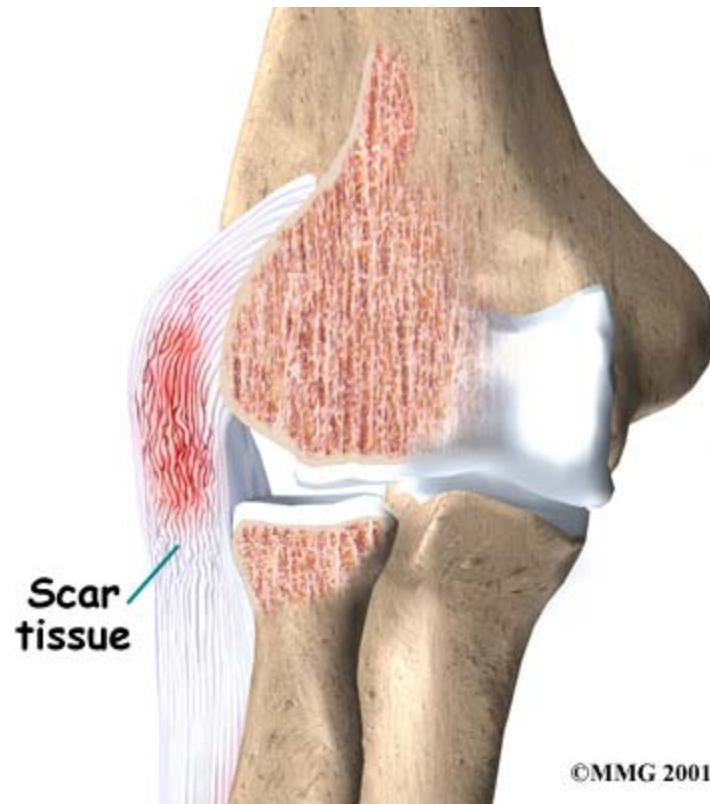
VII. Tissue Repair- Regeneration

In **tissue regeneration**, damaged cells are replaced with same type of cell and function is restored.



VII. Tissue Repair- Replacement

Tissue replacement is when damaged cells are replaced by a new type of cell and there is loss of some tissue function.



VII. Tissue Repair- Cell Types

Cells of tissue repair are classified on their ability to divide and produce new cells.

3 Types of Tissue Repair Cells

1. **Labile cells**- divide throughout life, repair by **regeneration**
2. **Stable cells**- do not actively divide after growth ceases, but have the ability to divide after injury, repair by **regeneration**
3. **Permanent cells**- little or no ability to divide, can recover from limited damage, repair by **replacement**

VII. Tissue Repair- How it Works

1. Inflammation brings cells needed for tissue repair into damaged area.
2. Fibrin forms a clot and scab.
3. Macrophages and neutrophils fight pathogens in wound.
4. Epithelial cells regenerate.
5. Fibroblasts make collagen and extracellular matrix.
6. Clot is replaced by granulation tissue.
7. Granulation tissue replaced by connective tissue.
8. Scar?