



# Chapter :1

## **Brief introduction to human body and organization of human body**

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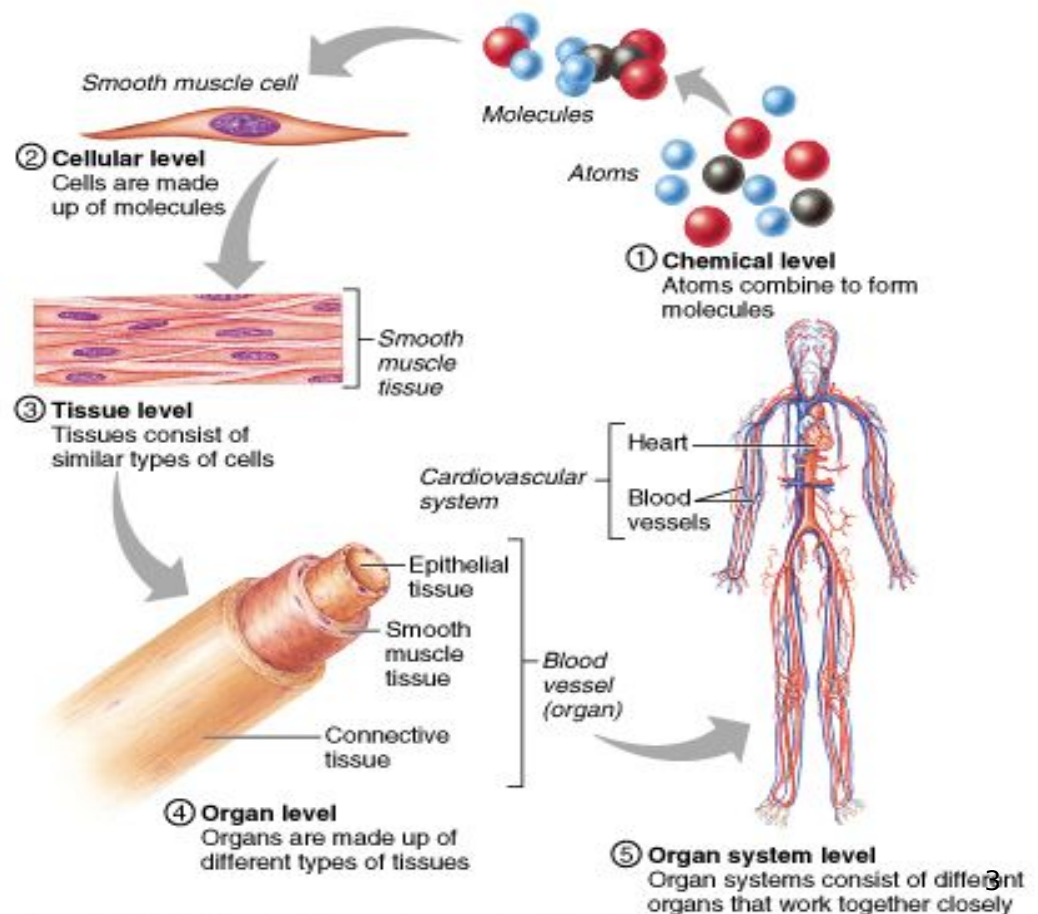
# Definatioos.....

1. **Anatomy** is the study of the structure of the body and the physical relationships involved between body parts.
2. **Physiology** is the study of how the parts of the body work, and the ways in which they cooperate together to maintain life and health of the individual.
3. **Pathology** is the study of abnormalities and how they affect body functions, often causing illness. Building on the normal anatomy and physiology, relevant illnesses are considered at the end of the later chapters.

# STRUCTURAL ORGANIZATION

- Life is characterized by hierarchical orders of organization

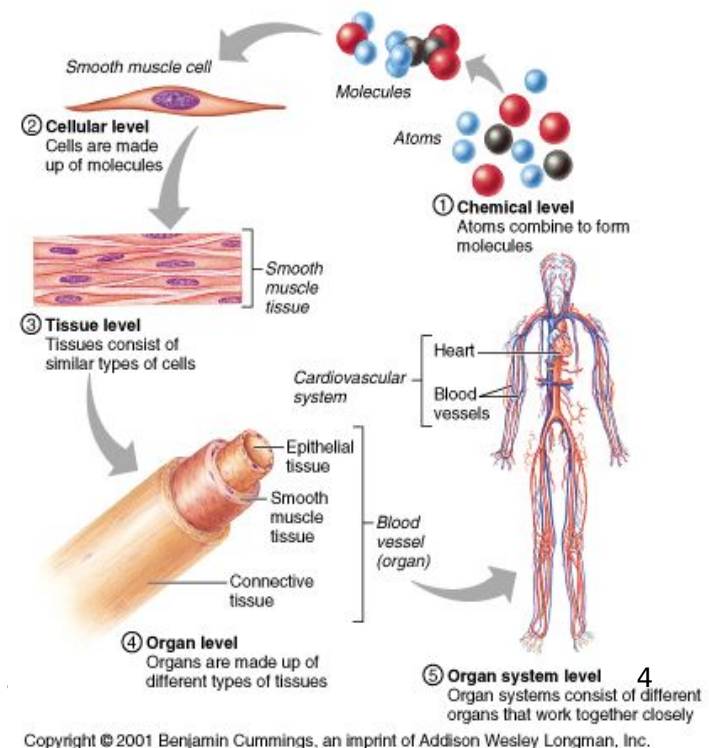
- ◉ Atoms
- ◉ Molecules
- ◉ Organelles
- ◉ Cells
- ◉ Tissues
- ◉ Organs
- ◉ Organ systems
- ◉ Organism
- ◉ (Population)
- ◉ (Community)
- ◉ (Ecosystem)



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# STRUCTURAL ORGANIZATION

- In multicellular organisms, specialized cells are grouped into **tissues**
  - A **tissue** is a group of cells similar in structure and performing a common function
- Organs are comprised of combinations of various tissues
- Organ systems include multiple organs working together

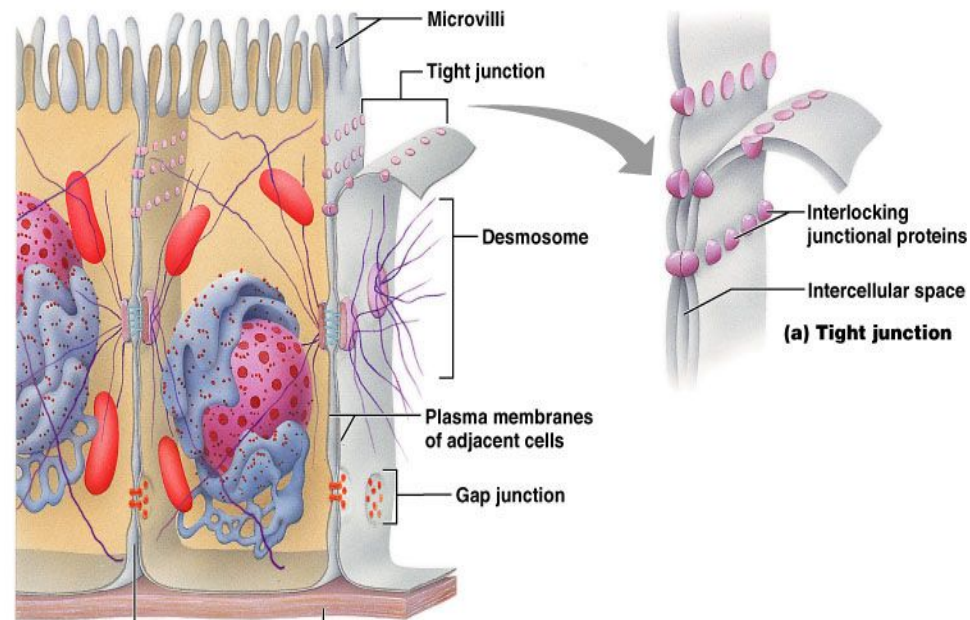


# INTERCELLULAR JUNCTIONS

- Neighboring cells within a multicellular organism often adhere, interact, and communicate through intracellular junctions
  - Tight junctions
  - Desmosomes
  - Gap junctions

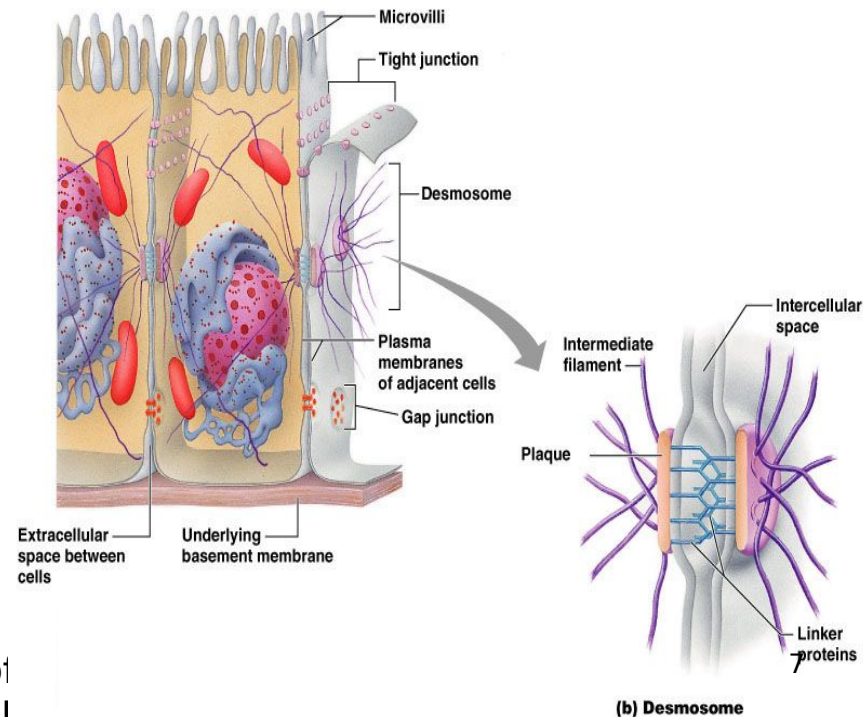
# TIGHT JUNCTIONS

- Integral membrane proteins of adjacent cells fuse together
  - Membranes of adjacent cells are fused
  - Form continuous belts around cells
  - Impermeable barrier
  - Some tight junctions are somewhat leaky
    - “Not-so-tight junctions”



# DESMOSOMES

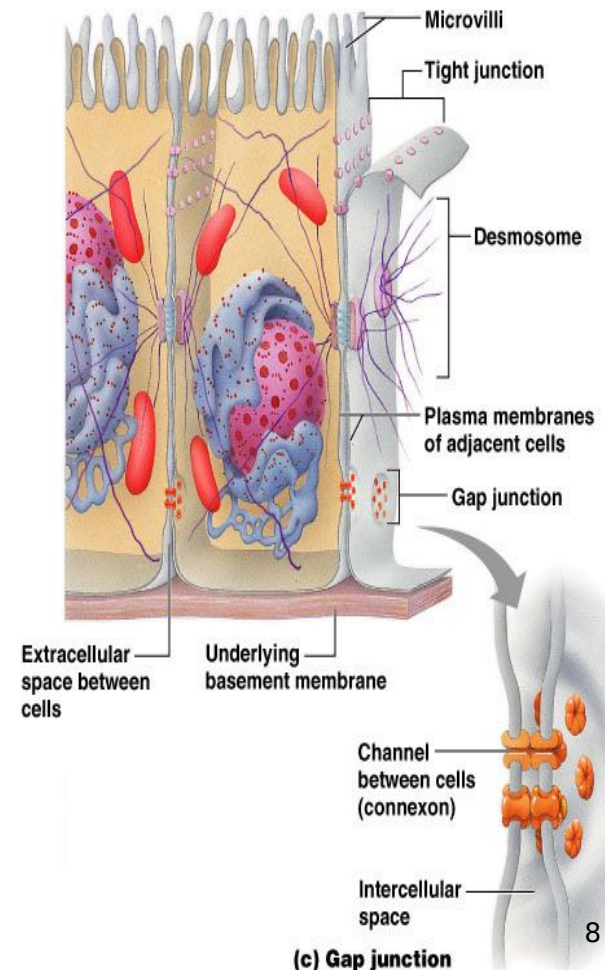
- Anchoring junctions
  - Rivets keeping adjacent cells from separating
- Composition
  - Button-like plaque on cytoplasmic face of membrane
  - Thin linker protein filaments interdigitate
  - Desmosomes on opposite sides of the same cell connected through intermediate filaments





# GAP JUNCTIONS

- Communicating junction connecting cytoplasm of adjacent cells
- Composition
  - Transmembrane proteins form “connexons”
    - Hollow tubes
  - Connexons of adjacent cells fuse
- Chemical substances travel through these channels
  - Different connexons have different specificities



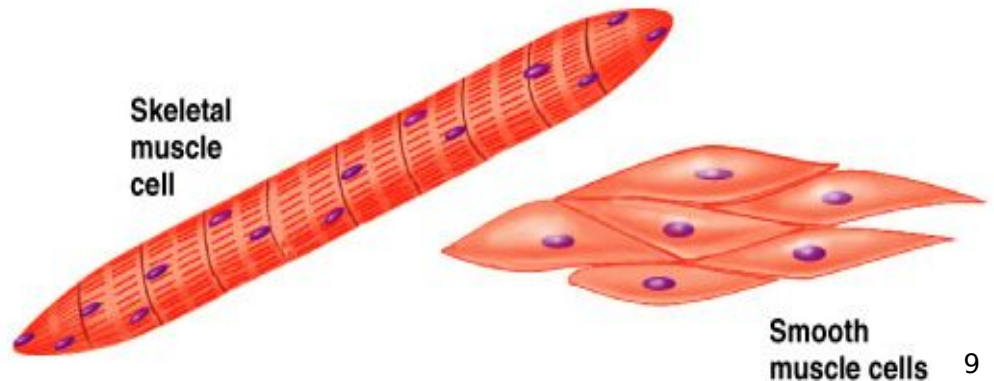
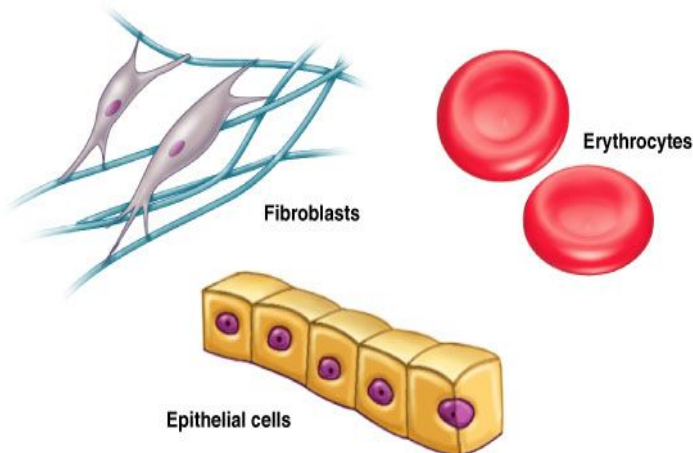
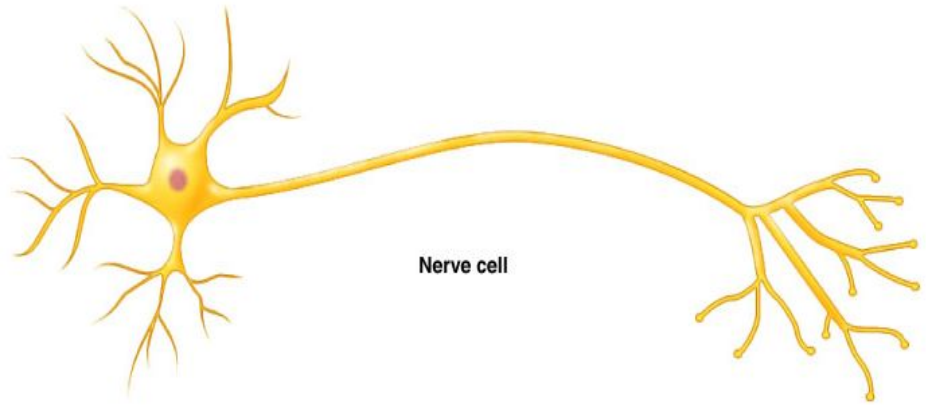
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# TISSUE TYPES

## Four major tissue types

1. Epithelial tissue
2. Connective tissue
3. Muscle tissue
4. Nervous tissue

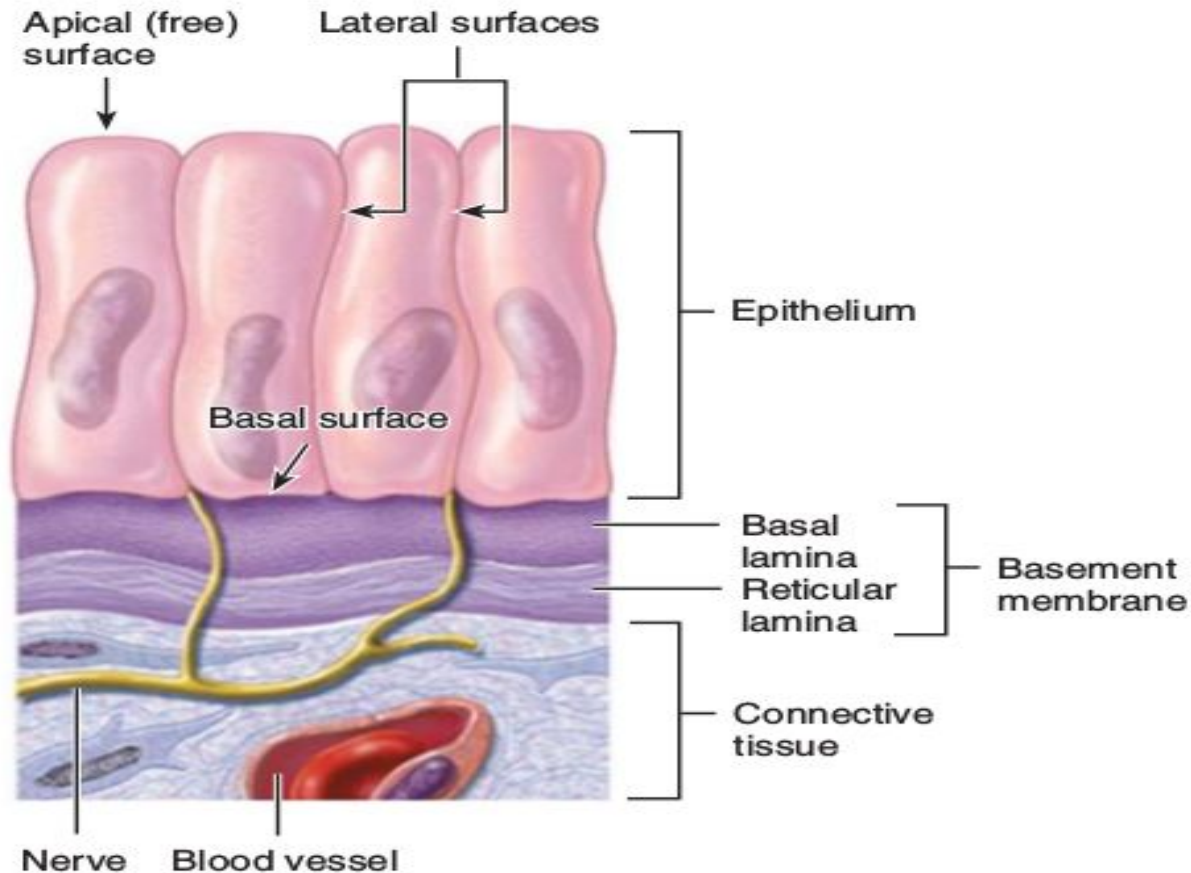


# 1. Epithelial tissue

**Figure 4.2** Surfaces of epithelial cells and the structure and location of the basement membrane.




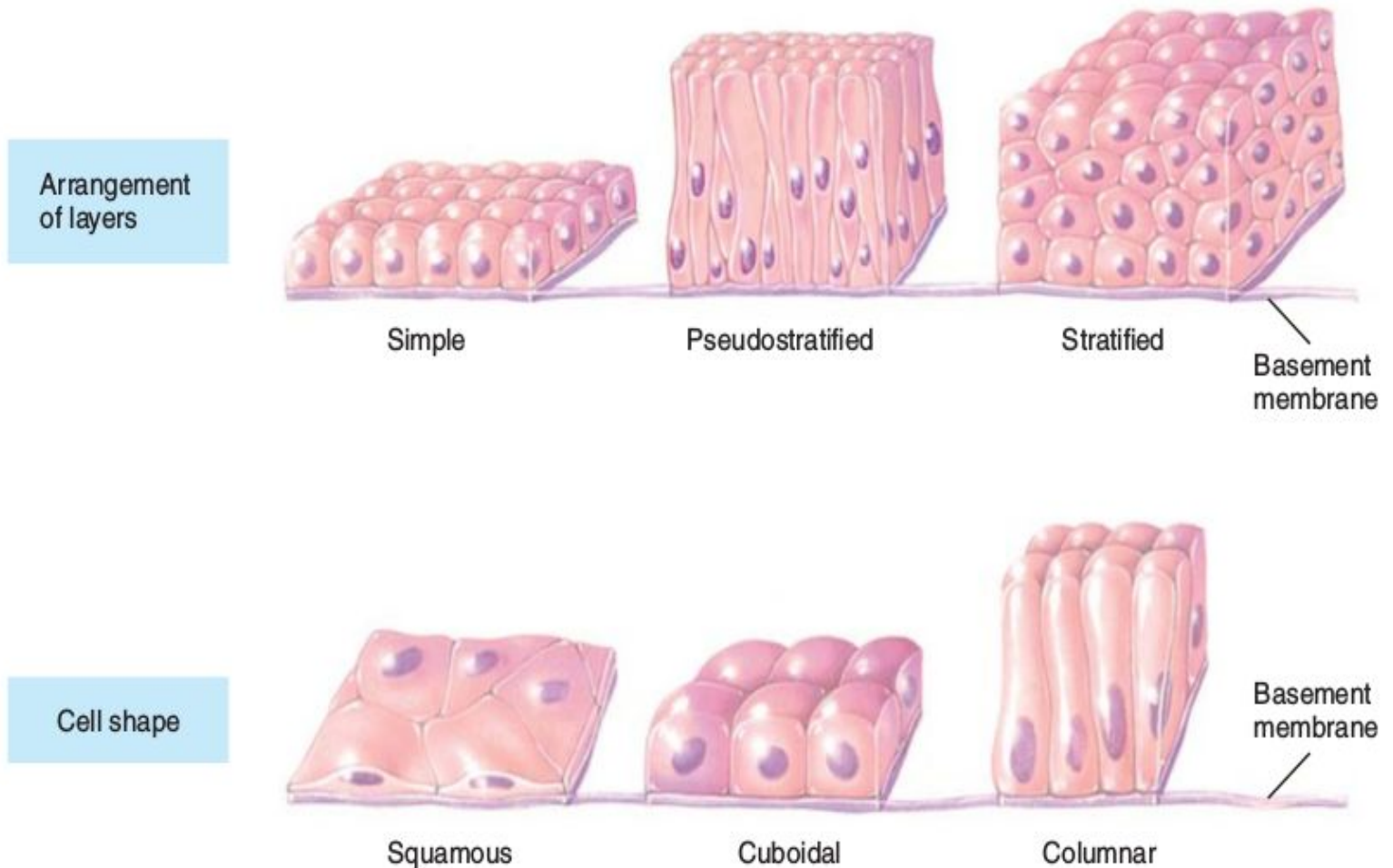
The basement membrane is found between epithelium and connective tissue.



# Cell shapes and arrangement of layers:

**Figure 4.3** Cell shapes and arrangement of layers for covering and lining epithelium.

 Cell shapes and arrangement of layers are the bases for classifying covering and lining epithelium.



# Epithelial Tissues: Covering and Lining Epithelia

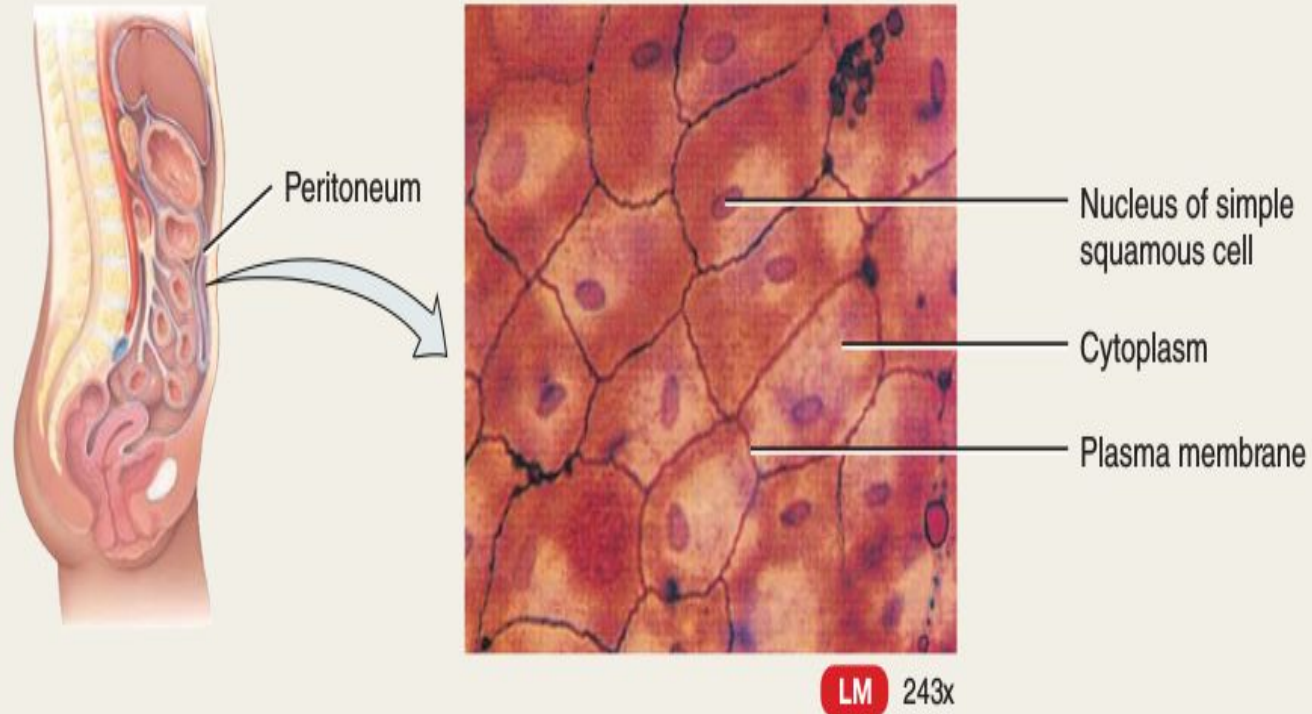
## SIMPLE EPITHELIUM

### A. Simple squamous epithelium

**Description:** Single layer of flat cells; centrally located nucleus.

**Location:** Lines heart, blood vessels, lymphatic vessels, air sacs of lungs, glomerular (Bowman's) capsule of kidneys, and inner surface of the tympanic membrane (eardrum); forms epithelial layer of serous membranes, such as the peritoneum, pericardium, and pleura.

**Function:** Filtration, diffusion, osmosis, and secretion in serous membranes.



Surface view of simple squamous epithelium of mesothelial lining of peritoneum



# Epithelial Tissues: Covering and Lining Epithelia

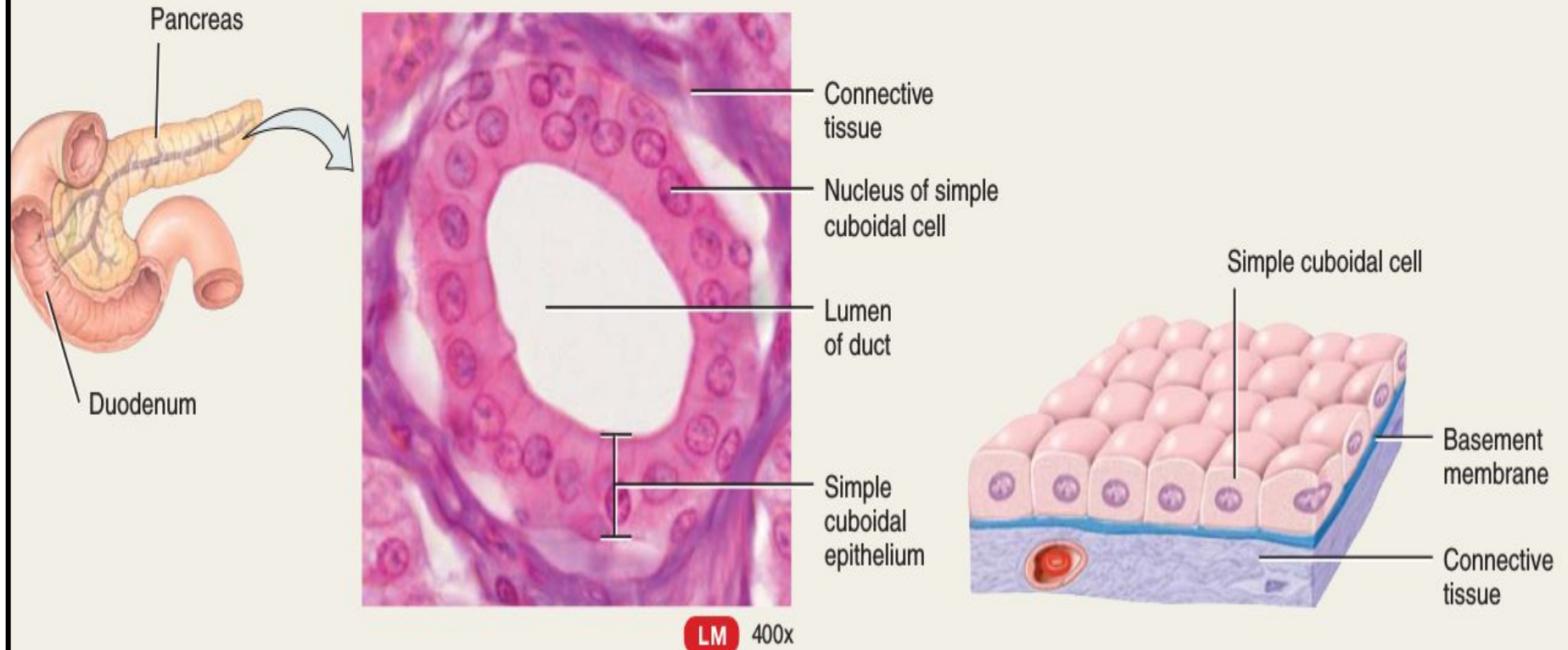
## SIMPLE EPITHELIUM

### B. Simple cuboidal epithelium

**Description:** Single layer of cube-shaped cells; centrally located nucleus.

**Location:** Covers surface of ovary, lines anterior surface of capsule of the lens of the eye, forms the pigmented epithelium at the posterior surface of the eye, lines kidney tubules and smaller ducts of many glands, and makes up the secreting portion of some glands such as the thyroid gland and the ducts of some glands such as the pancreas.

**Function:** Secretion and absorption.

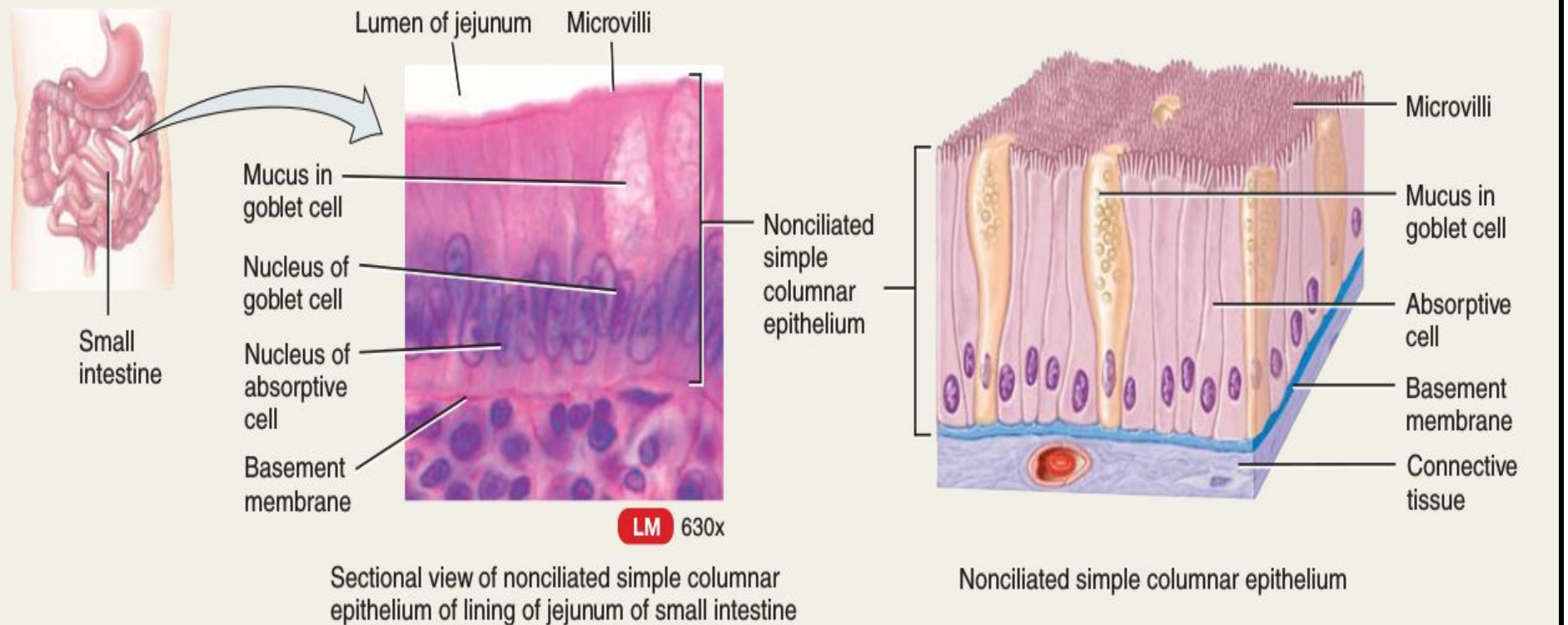


C. Nonciliated simple columnar epithelium

**Description:** Single layer of nonciliated column-like cells with nuclei near base of cells; contains goblet cells and cells with microvilli in some locations.

**Location:** Lines the gastrointestinal tract (from the stomach to the anus), ducts of many glands, and gallbladder.

**Function:** Secretion and absorption.



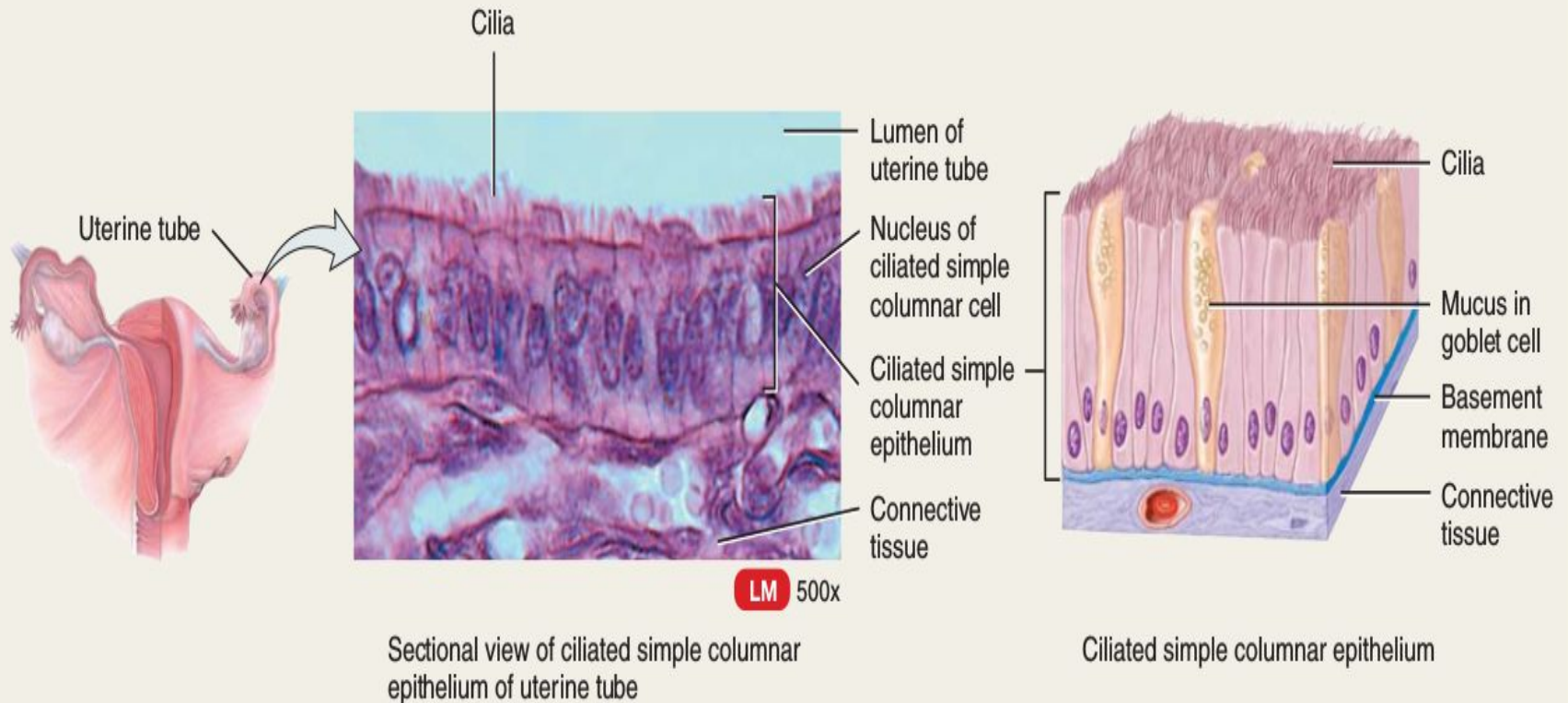


**D. Ciliated simple columnar epithelium**

**Description:** Single layer of ciliated column-like cells with nuclei near base; contains goblet cells in some locations.

**Location:** Lines some bronchioles (small tubes) of respiratory tract, uterine (fallopian) tubes, uterus, efferent ducts of the testes, some paranasal sinuses, central canal of spinal cord, and ventricles of the brain.

**Function:** Moves mucus and other substances by ciliary action.

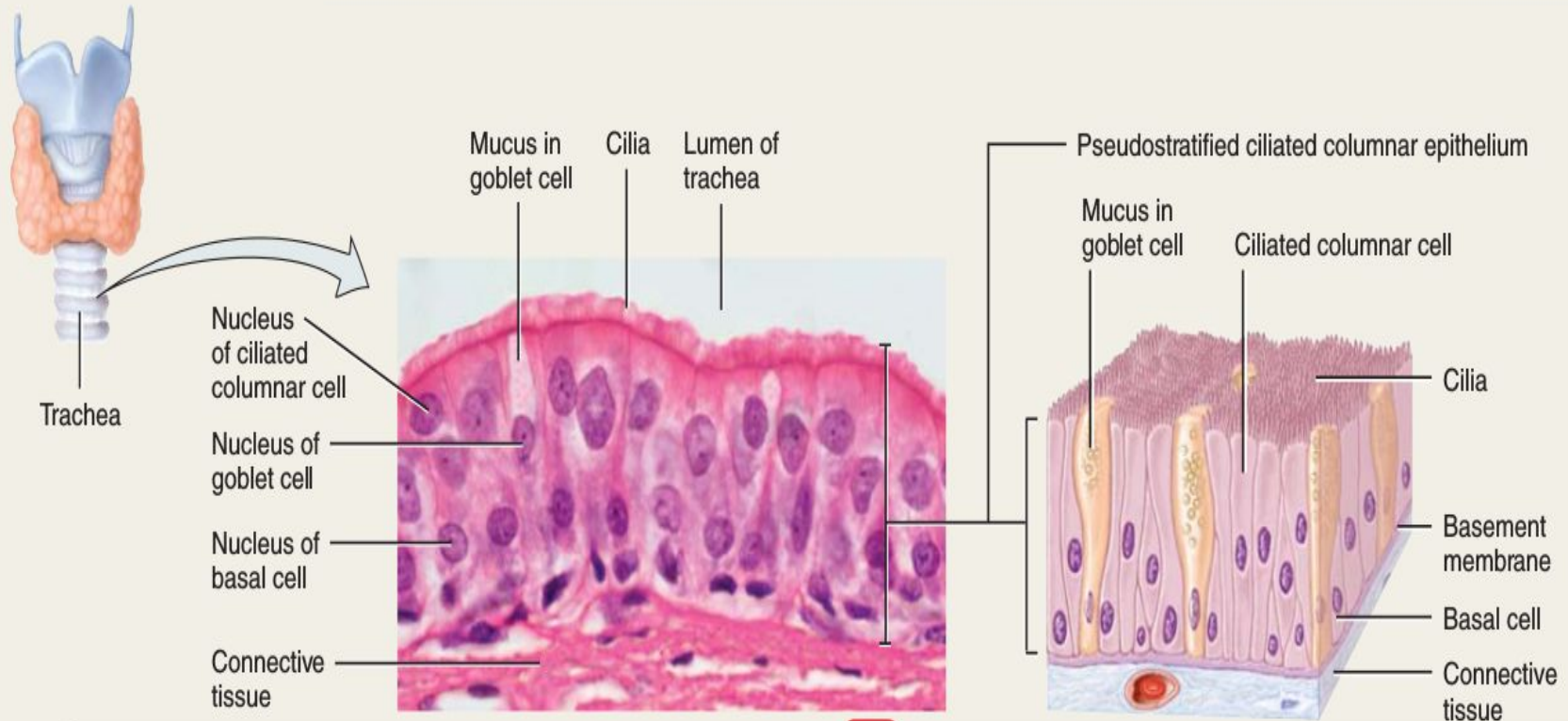


### E. Pseudostratified columnar epithelium

**Description:** Not a true stratified tissue; nuclei of cells are at different levels; all cells are attached to basement membrane, but not all reach the apical surface.

**Location:** Pseudostratified ciliated columnar epithelium lines the airways of most of upper respiratory tract; pseudostratified nonciliated columnar epithelium lines larger ducts of many glands, epididymis, and part of male urethra.

**Function:** Secretion and movement of mucus by ciliary action.

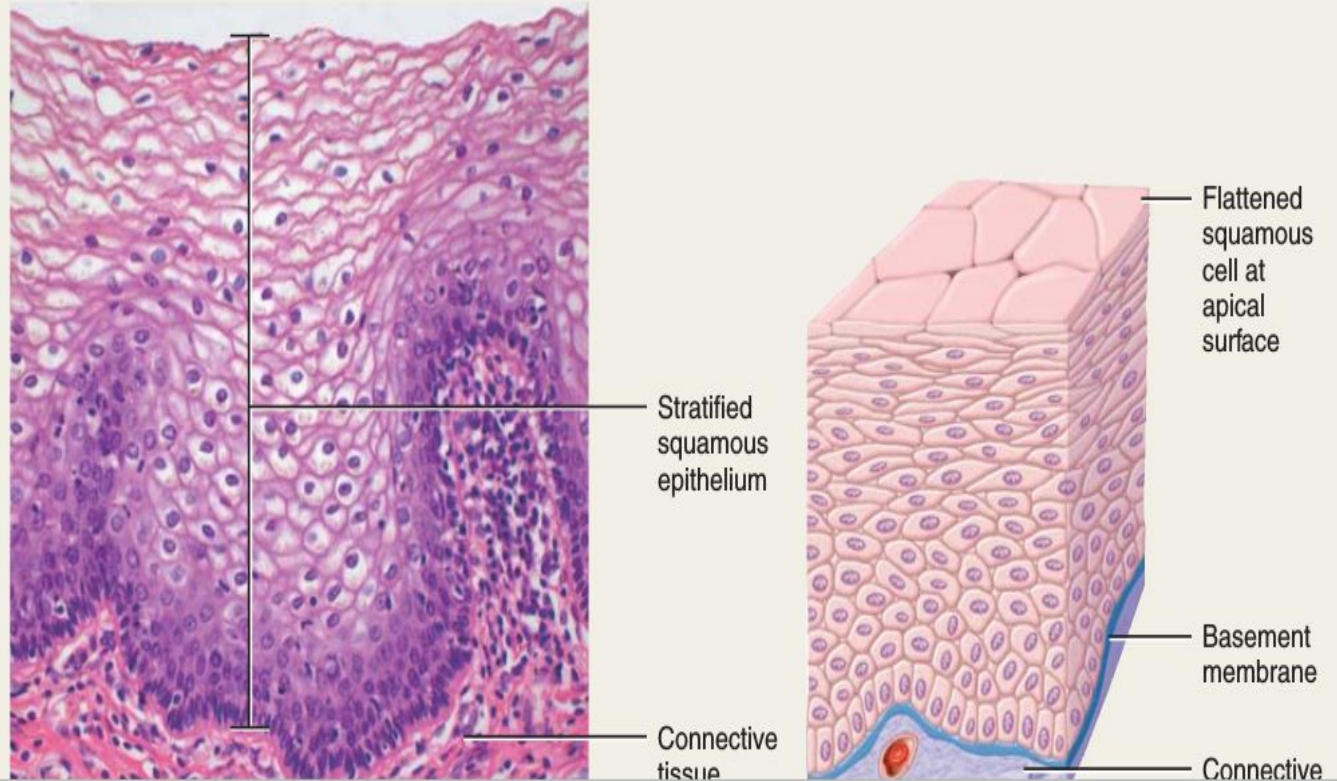
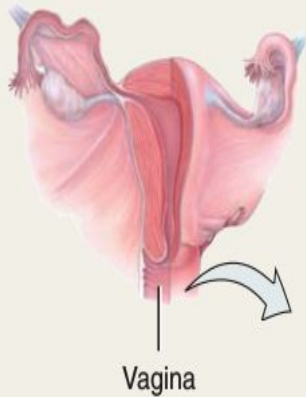


## F. Stratified squamous epithelium

**Description:** Several layers of cells; cuboidal to columnar shape in deep layers; squamous cells form the apical layer and several layers deep to it; cells from the basal layer replace surface cells as they are lost.

**Location:** Keratinized variety forms superficial layer of skin; nonkeratinized variety lines wet surfaces, such as lining of the mouth, esophagus, part of larynx, part of pharynx, and vagina, and covers the tongue.

**Function:** Protection.



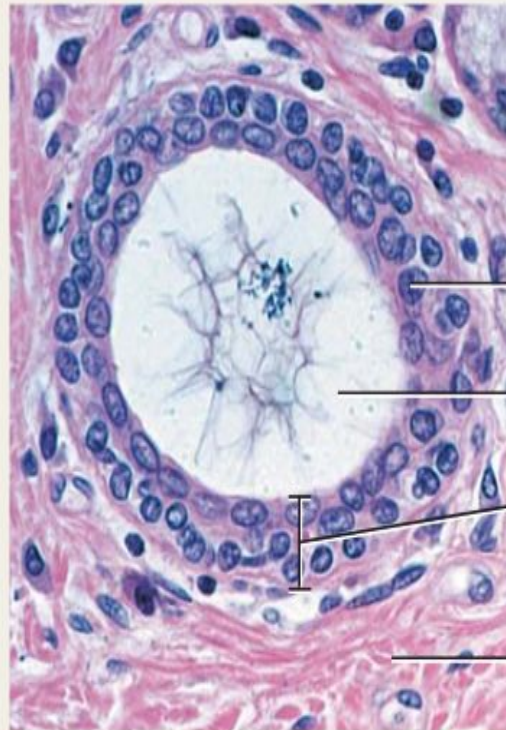
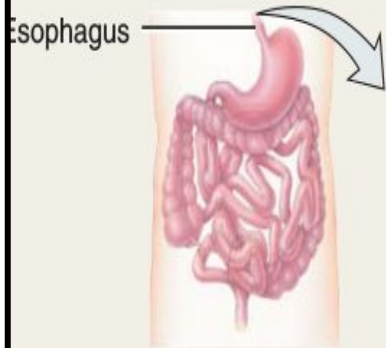


## G. Stratified cuboidal epithelium

**Description:** Two or more layers of cells in which the cells in the apical layer are cube-shaped.

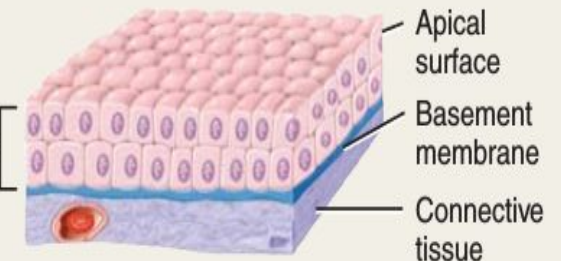
**Location:** Ducts of adult sweat glands and esophageal glands and part of male urethra.

**Function:** Protection and limited secretion and absorption.



LM 380x

Sectional view of stratified cuboidal epithelium of the duct of an esophageal gland



Stratified cuboidal epithelium

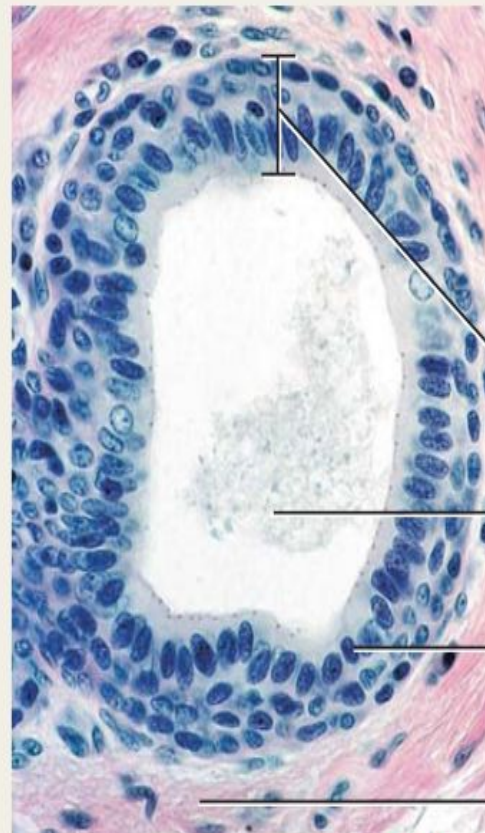
## H. Stratified columnar epithelium

**Description:** Several layers of irregularly shaped cells; only the apical layer has columnar cells.

**Location:** Lines part of urethra, large excretory ducts of some glands, such as esophageal glands, small areas in anal mucous membrane, and part of the conjunctiva of the eye.

**Function:** Protection and secretion.

Esophagus



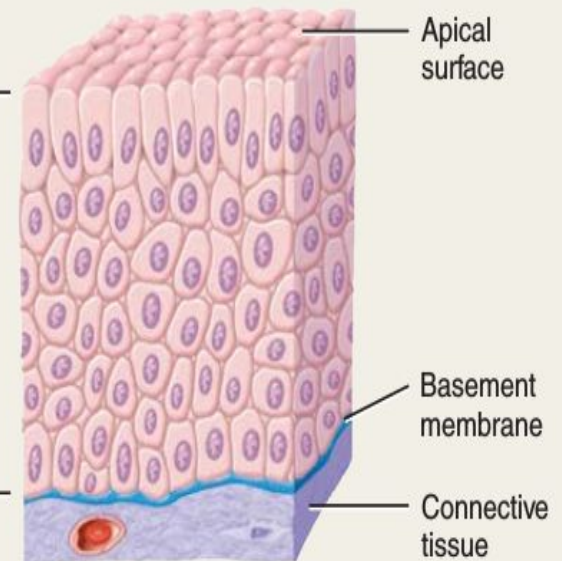
Stratified columnar epithelium

Lumen of duct

Nucleus of stratified columnar cell

Connective tissue

LM 300x



Apical surface

Basement membrane

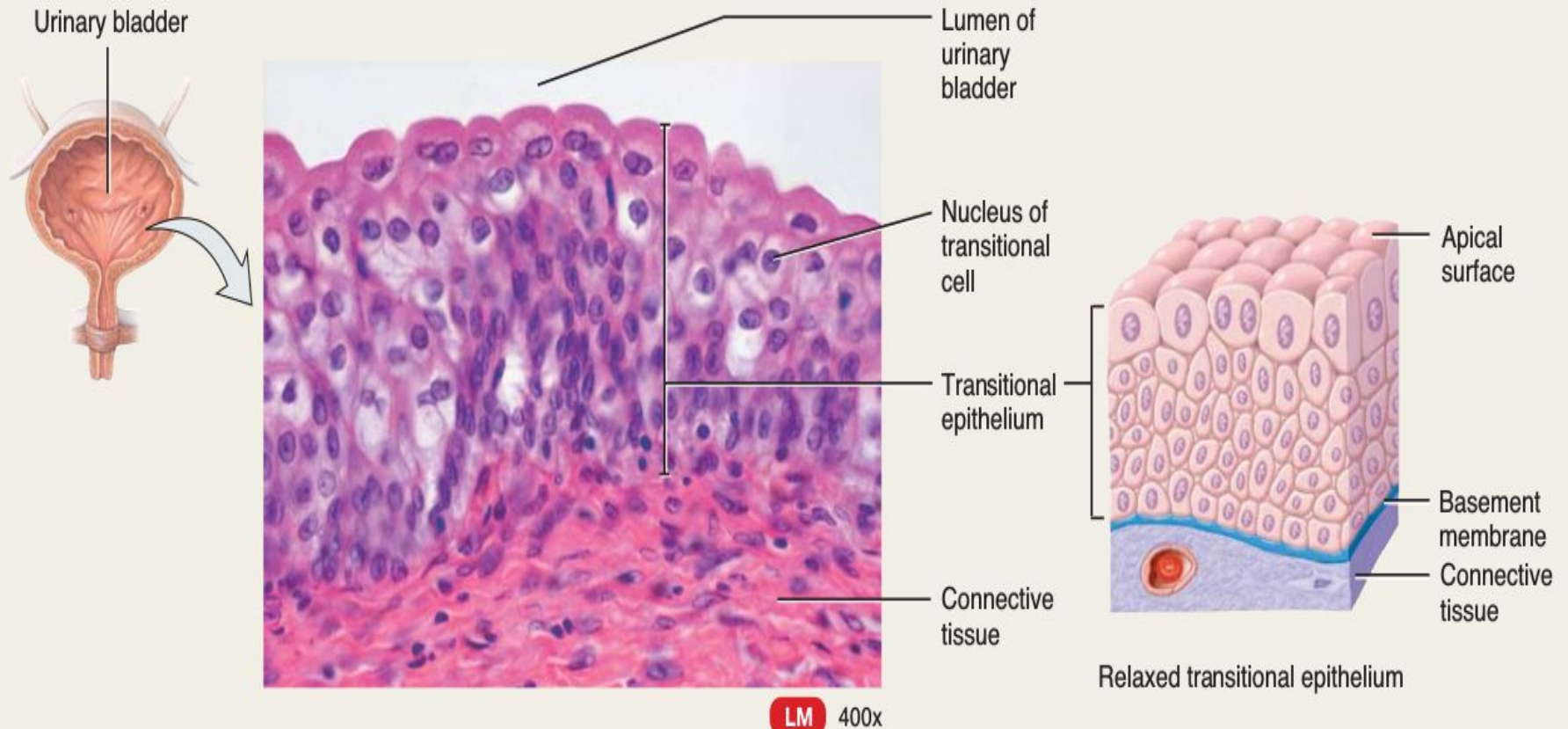
Connective tissue

## I. Transitional epithelium

**Description:** Appearance is variable (transitional); shape of cells in apical layer ranges from squamous (when stretched) to cuboidal (when relaxed).

**Location:** Lines urinary bladder and portions of ureters and urethra.

**Function:** Permits distension.





**TABLE 4.2**

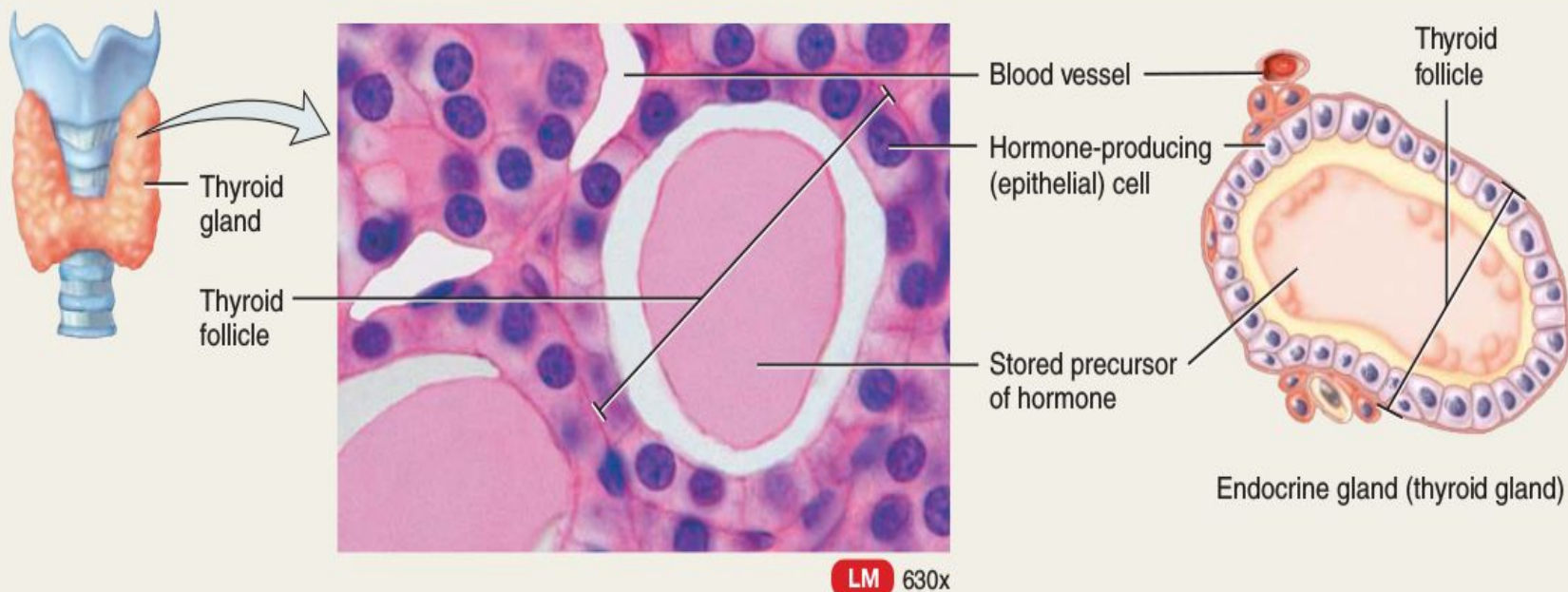
## Epithelial Tissue: Glandular Epithelium

### A. Endocrine glands

**Description:** Secretory products (hormones) diffuse into blood after passing through interstitial fluid.

**Location:** Examples include pituitary gland at base of brain, pineal gland in brain, thyroid and parathyroid glands near larynx (voice box), adrenal glands superior to kidneys, pancreas near stomach, ovaries in pelvic cavity, testes in scrotum, and thymus in thoracic cavity.

**Function:** Produce hormones that regulate various body activities.

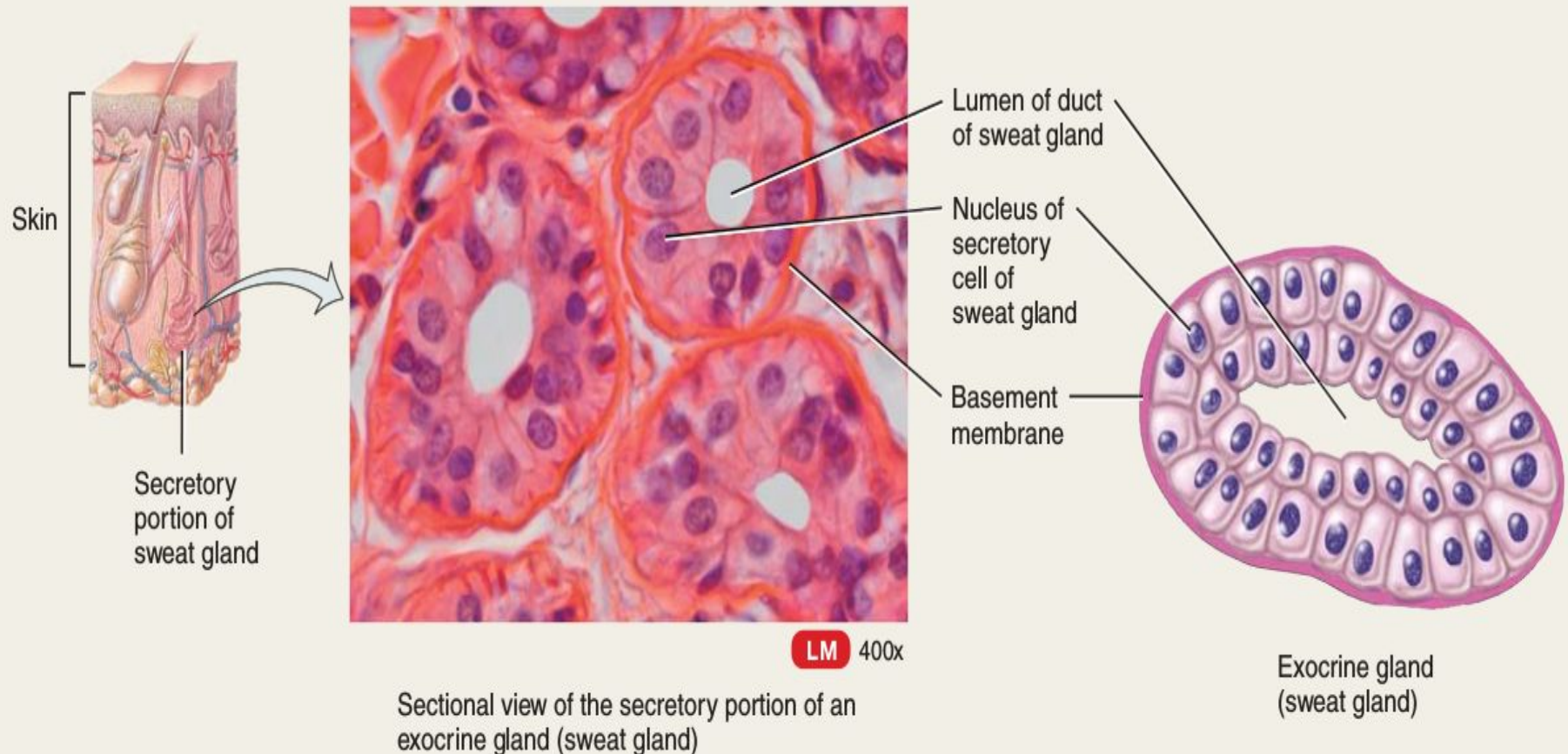


## B. Exocrine glands

**Description:** Secretory products released into ducts.

**Location:** Sweat, oil, and earwax glands of the skin; digestive glands such as salivary glands, which secrete into mouth cavity, and pancreas, which secretes into the small intestine.

**Function:** Produce substances such as sweat, oil, earwax, saliva, or digestive enzymes.



**TABLE 4.3**

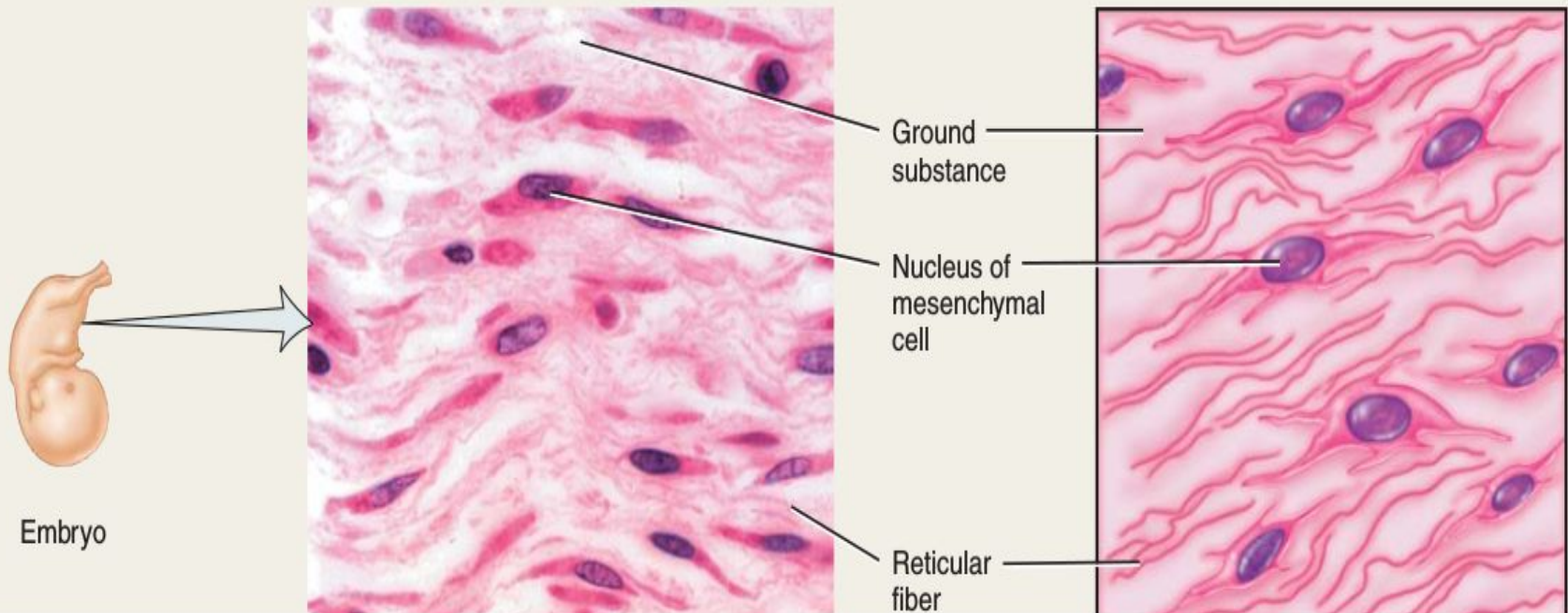
## Embryonic Connective Tissues

### A. Mesenchyme

**Description:** Consists of irregularly shaped mesenchymal cells embedded in a semifluid ground substance that contains reticular fibers.

**Location:** Under skin and along developing bones of embryo; some mesenchymal cells are found in adult connective tissue, especially along blood vessels.

**Function:** Forms all other types of connective tissue.



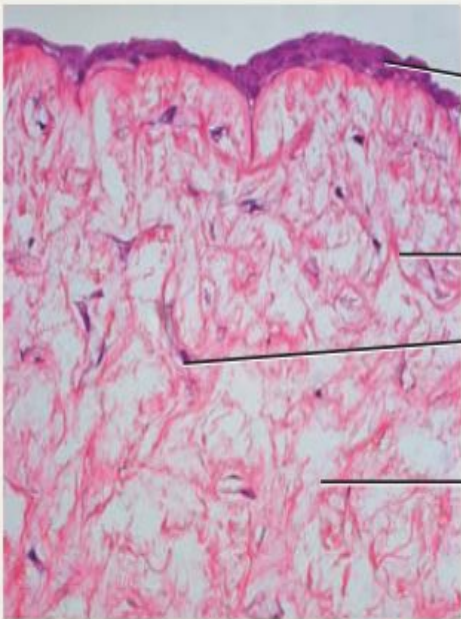
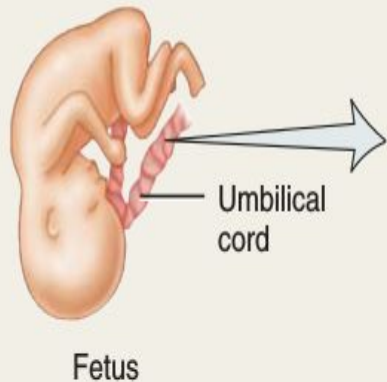


**B. Mucous connective tissue**

**Description:** Consists of widely scattered fibroblasts embedded in a viscous, jellylike ground substance that contains fine collagen fibers.

**Location:** Umbilical cord of fetus.

**Function:** Support.



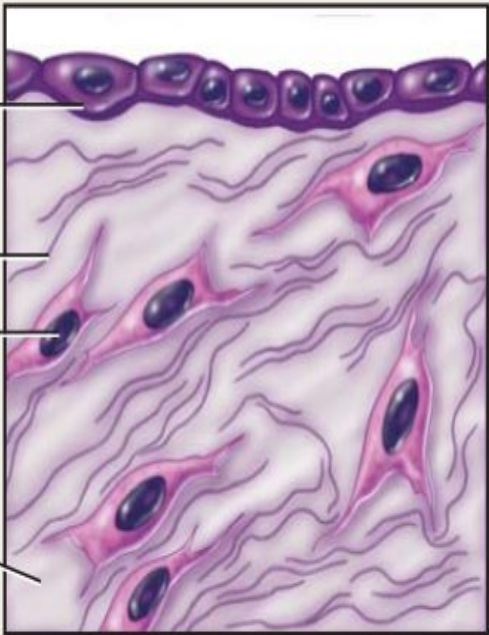
Sectional view of mucous connective tissue of the umbilical cord

Epithelial surface cell of umbilical cord

Collagen fiber

Nucleus of fibroblast

Ground substance



**TABLE 4.4**

## Mature Connective Tissues

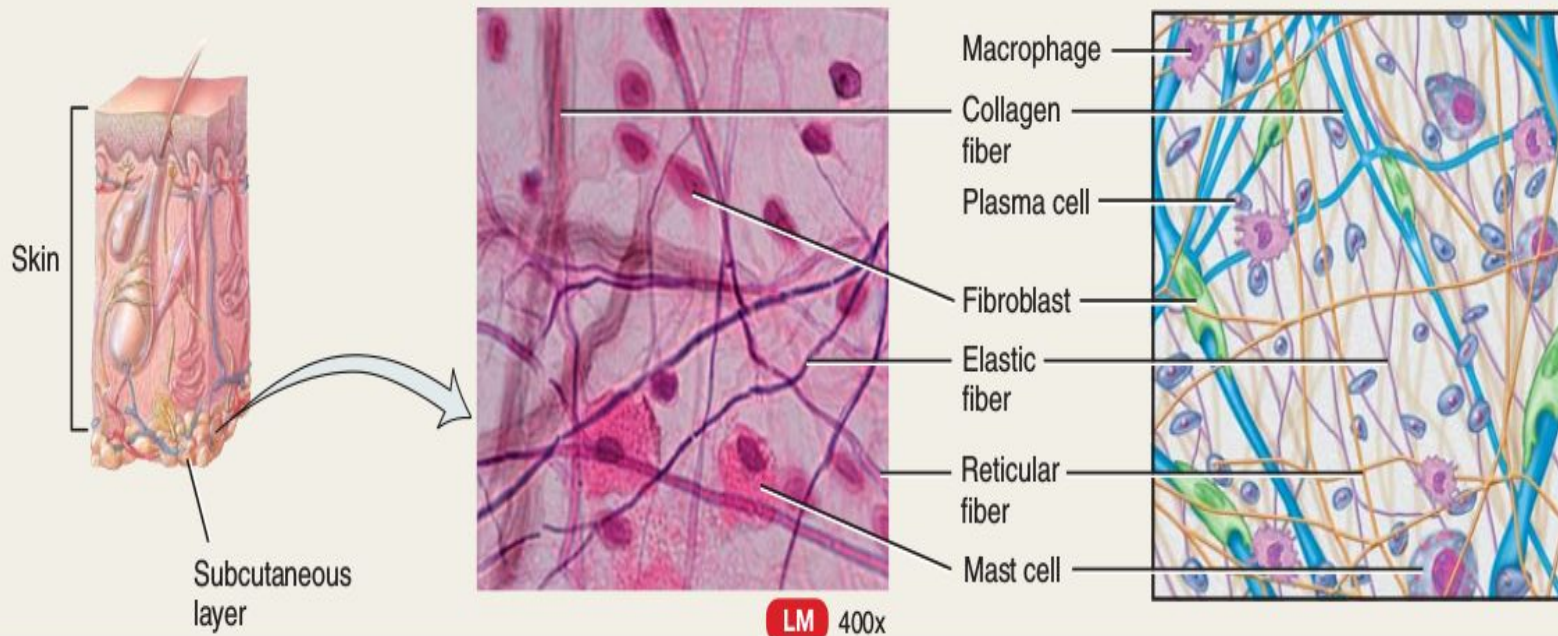
### LOOSE CONNECTIVE TISSUE

#### A. Areolar connective tissue

**Description:** Consists of fibers (collagen, elastic, and reticular) and several kinds of cells (fibroblasts, macrophages, plasma cells, adipocytes, and mast cells) embedded in a semifluid ground substance.

**Location:** Subcutaneous layer deep to skin; papillary (superficial) region of dermis of skin; lamina propria of mucous membranes; and around blood vessels, nerves, and body organs.

**Function:** Strength, elasticity, and support.



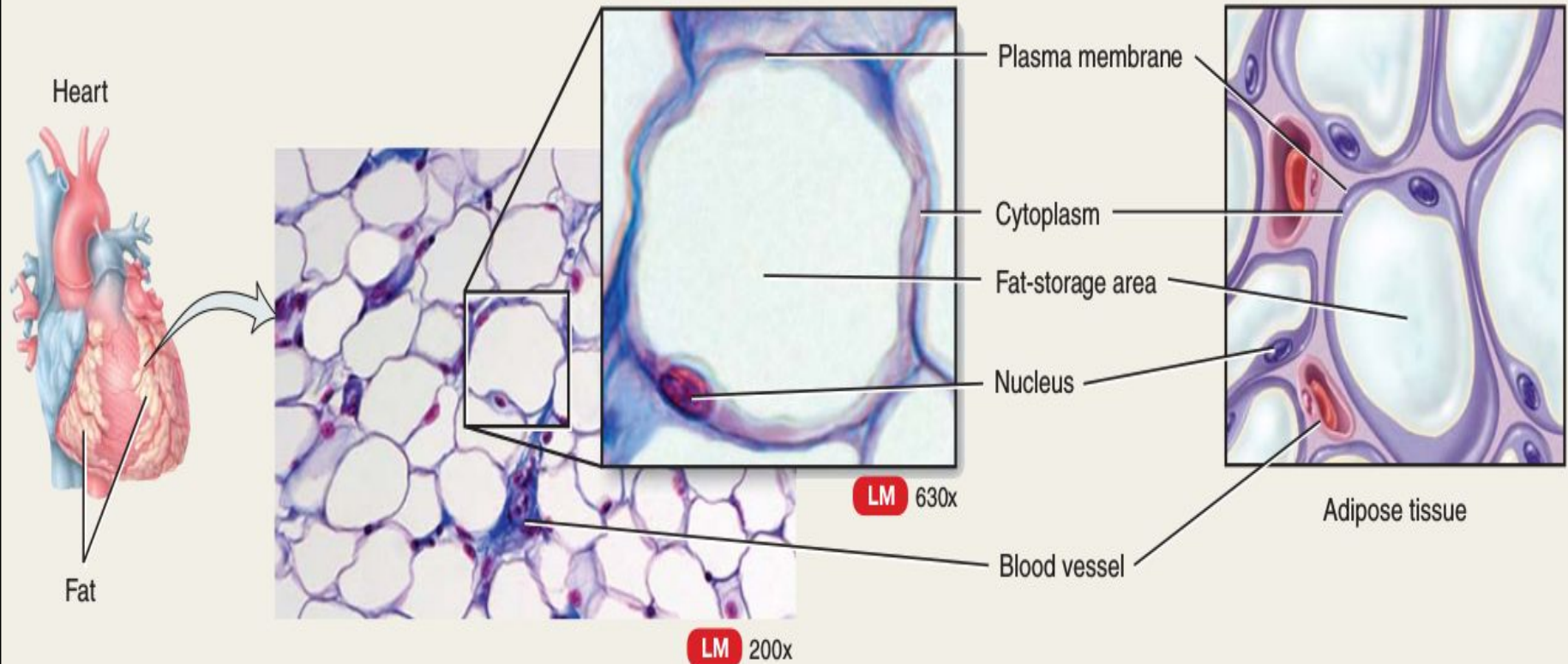


## B. Adipose tissue

**Description:** Consists of adipocytes, cells specialized to store triglycerides (fats) as a large centrally located droplet; nucleus and cytoplasm are peripherally located.

**Location:** Subcutaneous layer deep to skin, around heart and kidneys, yellow bone marrow, and padding around joints and behind eyeball in eye socket.

**Function:** Reduces heat loss through skin, serves as an energy reserve, supports, and protects. In newborns, brown adipose tissue generates considerable heat that helps maintain proper body temperature.





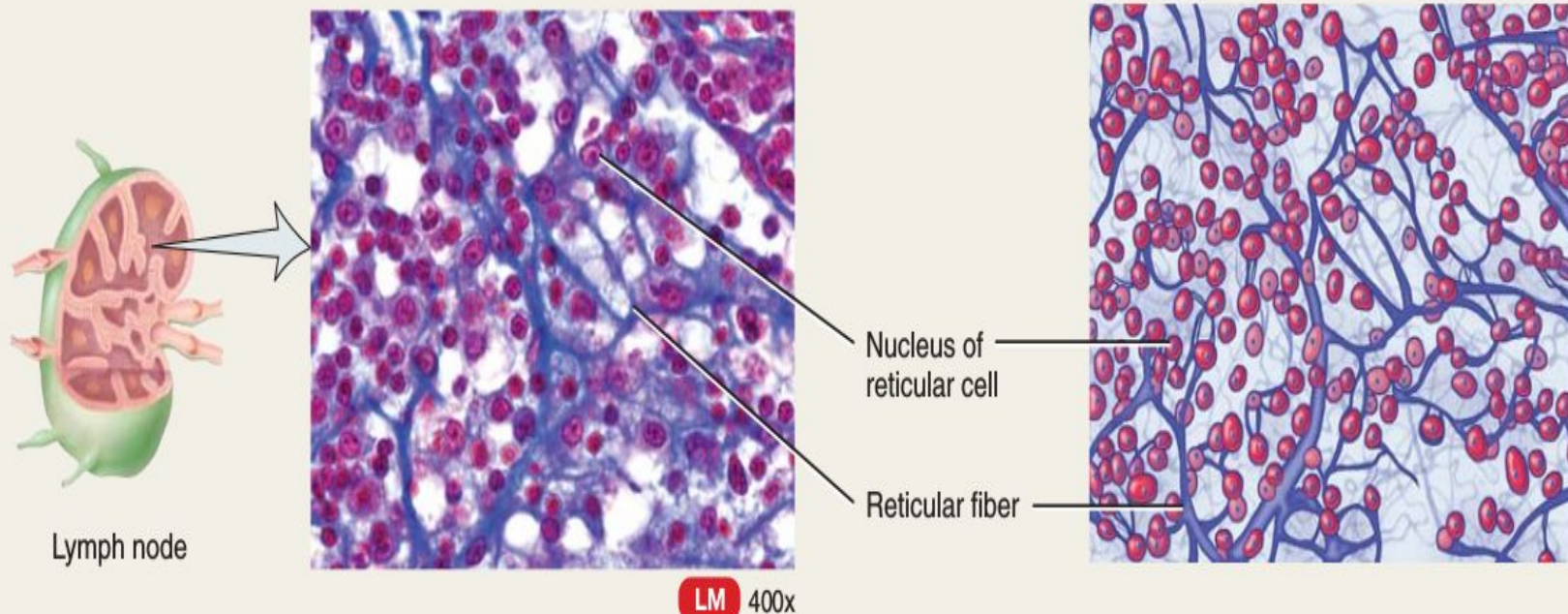
## LOOSE CONNECTIVE TISSUE

### C. Reticular connective tissue

**Description:** A network of interlacing reticular fibers and reticular cells.

**Location:** Stroma (supporting framework) of liver, spleen, lymph nodes; red bone marrow, which gives rise to blood cells; reticular lamina of the basement membrane; and around blood vessels and muscles.

**Function:** Forms stroma of organs; binds together smooth muscle tissue cells; filters and removes worn-out blood cells in the spleen and microbes in lymph nodes.



Sectional view of reticular connective tissue  
of a lymph node

Reticular connective tissue

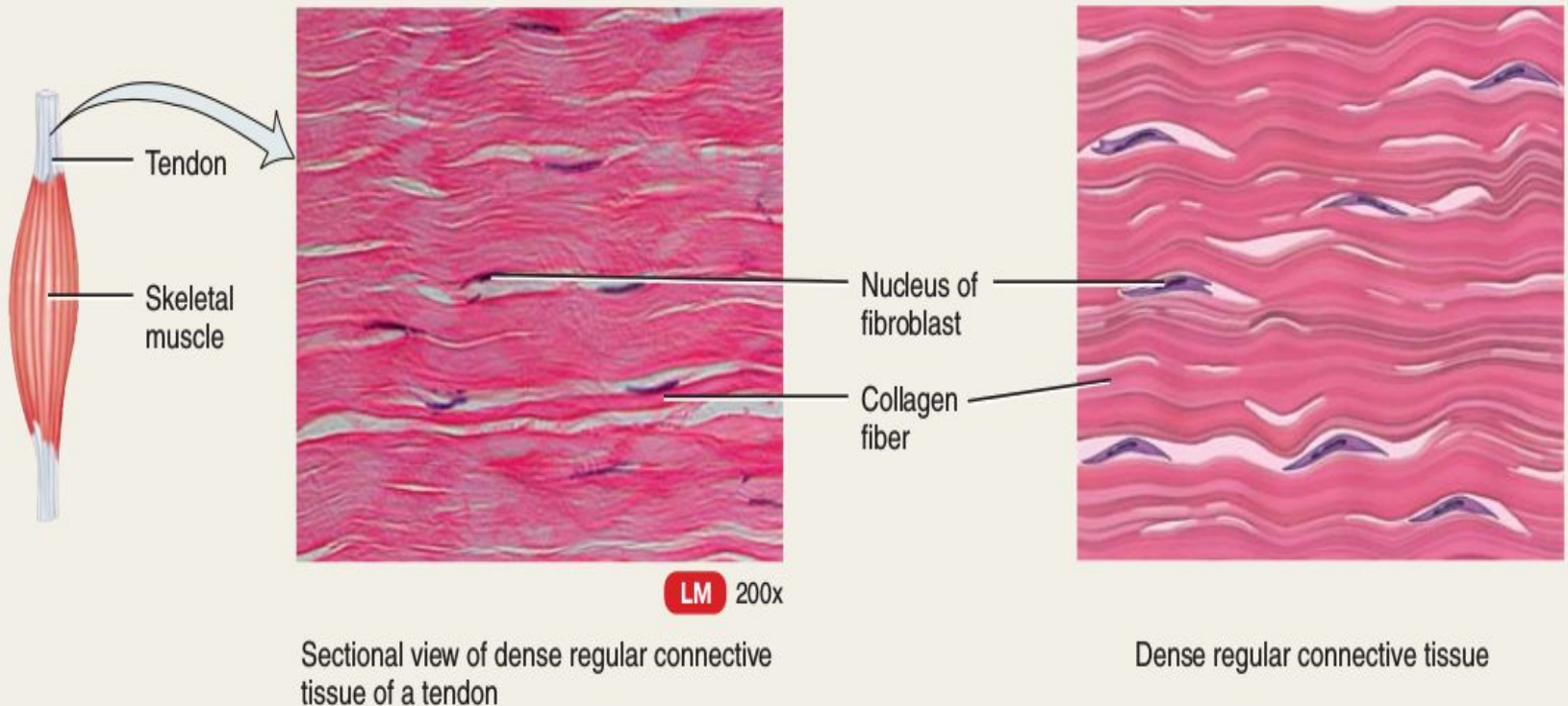
## DENSE CONNECTIVE TISSUE

### D. Dense regular connective tissue

**Description:** Extracellular matrix looks shiny white; consists mainly of collagen fibers regularly arranged in bundles; fibroblasts present in rows between bundles.

**Location:** Forms tendons (attach muscle to bone), most ligaments (attach bone to bone), and aponeuroses (sheetlike tendons that attach muscle to muscle or muscle to bone).

**Function:** Provides strong attachment between various structures.





# Mature Connective Tissues

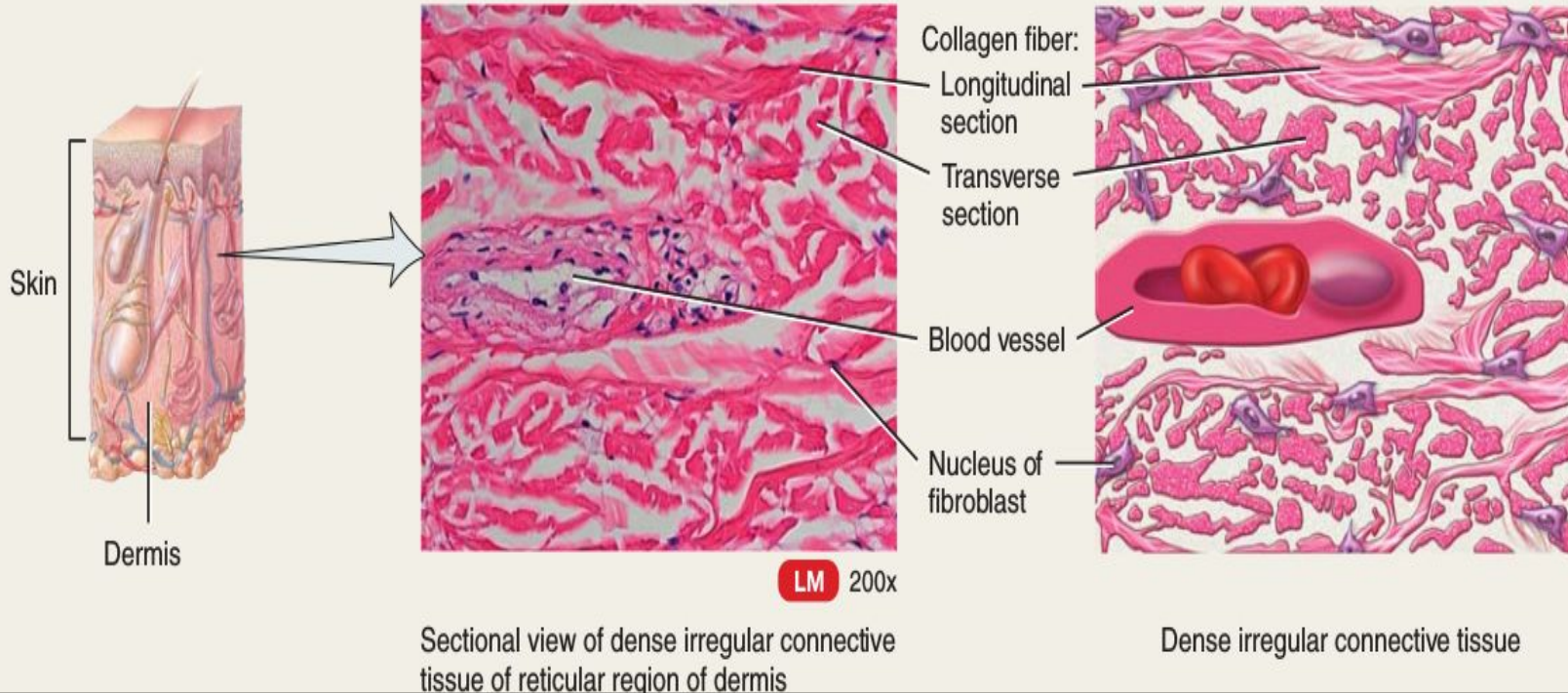
## DENSE CONNECTIVE TISSUE

### E. Dense irregular connective tissue

**Description:** Consists predominantly of collagen fibers randomly arranged and a few fibroblasts.

**Location:** Fasciae (tissue beneath skin and around muscles and other organs), reticular (deeper) region of dermis of skin, periosteum of bone, perichondrium of cartilage, joint capsules, membrane capsules around various organs (kidneys, liver, testes, lymph nodes), pericardium of the heart, and heart valves.

**Function:** Provides strength.

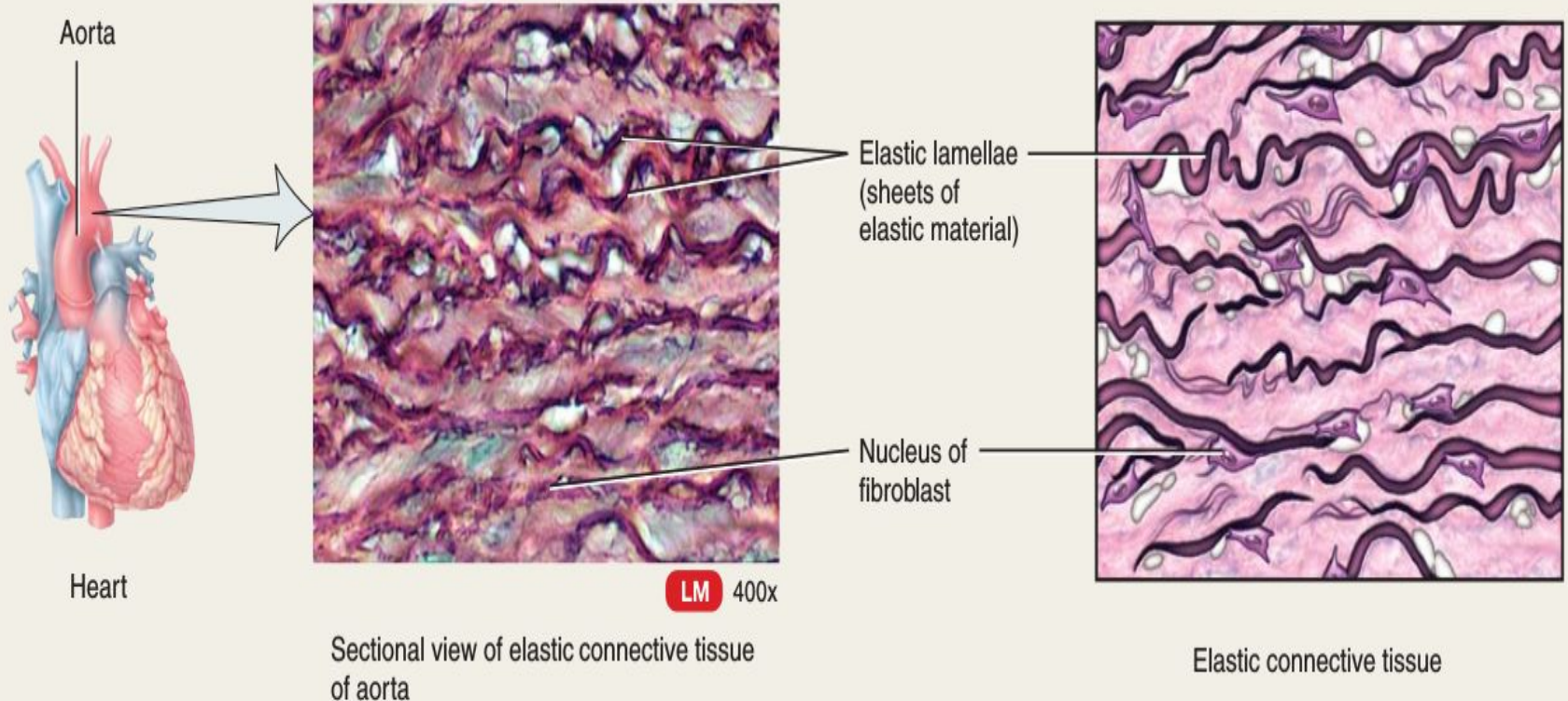


## F. Elastic connective tissue

**Description:** Consists predominantly of freely branching elastic fibers; fibroblasts are present in spaces between fibers.

**Location:** Lung tissue, walls of elastic arteries, trachea, bronchial tubes, true vocal cords, suspensory ligament of penis, and some ligaments between vertebrae.

**Function:** Allows stretching of various organs.



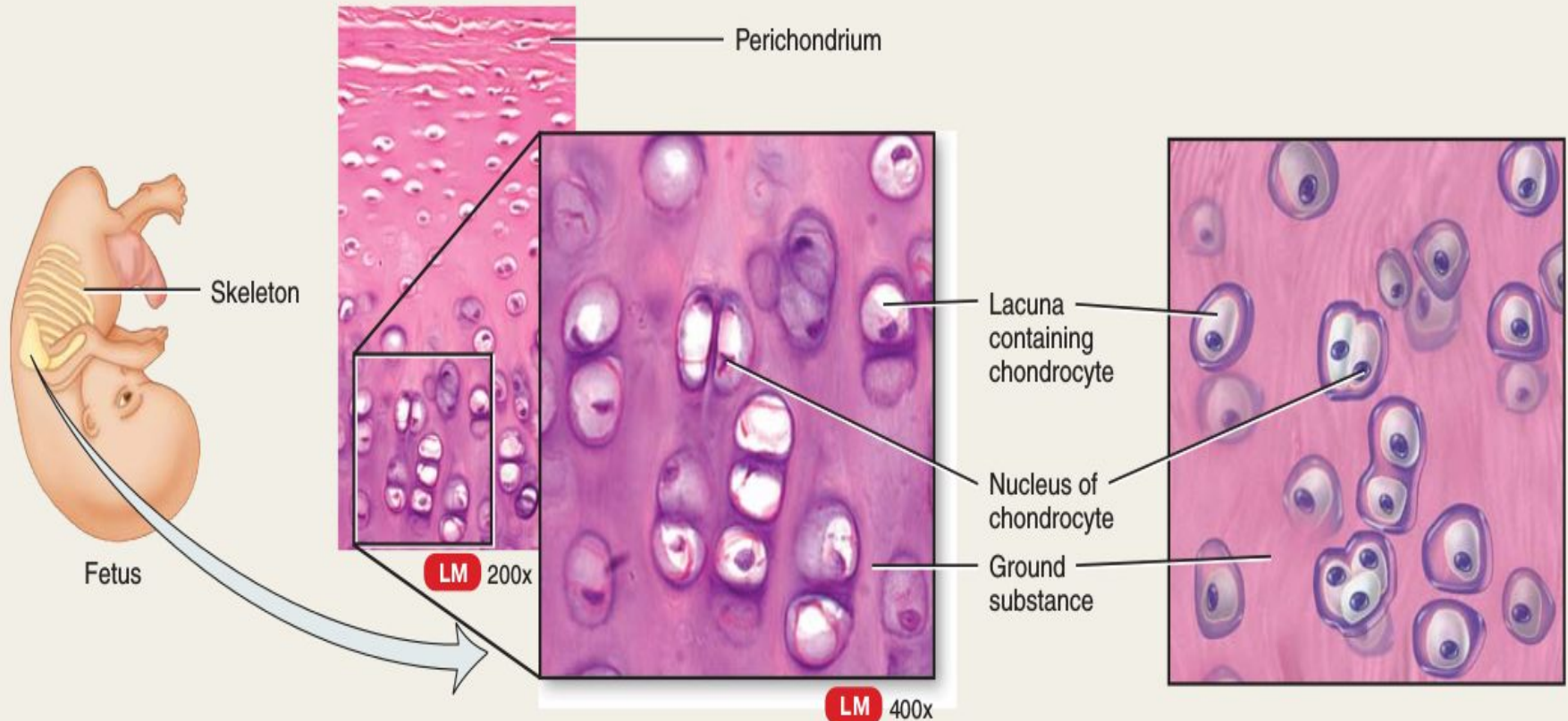


## G. Hyaline cartilage

**Description:** Consists of a bluish-white, shiny ground substance with thin, fine collagen fibers and many chondrocytes; most abundant type of cartilage.

**Location:** Ends of long bones, anterior ends of ribs, nose, parts of larynx, trachea, bronchi, bronchial tubes, and embryonic and fetal skeleton.

**Function:** Provides smooth surfaces for movement at joints, as well as flexibility and support.

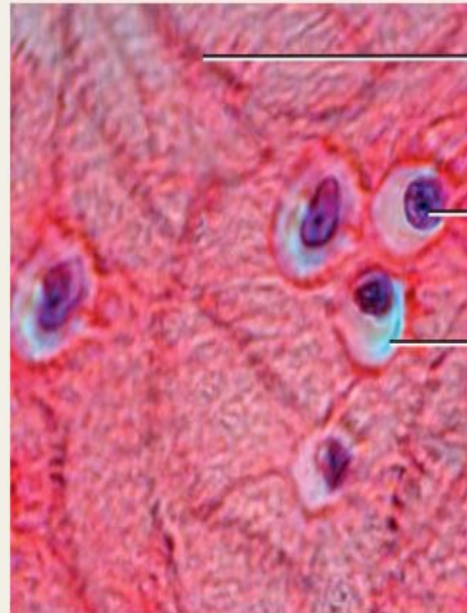
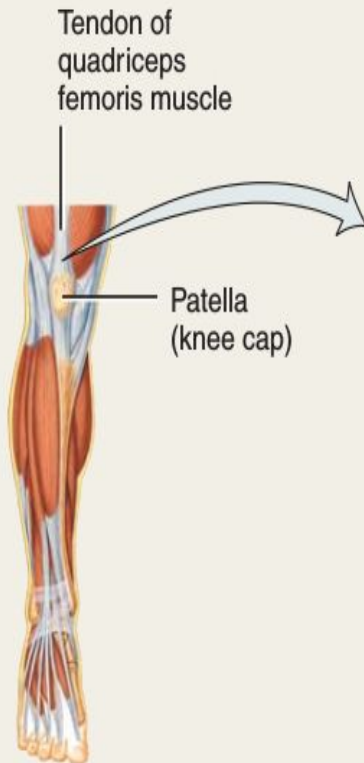


## H. Fibrocartilage

**Description:** Consists of chondrocytes scattered among thick bundles of collagen fibers within the extracellular matrix.

**Location:** Pubic symphysis (point where hip bones join anteriorly), intervertebral discs (discs between vertebrae), menisci (cartilage pads) of knee, and portions of tendons that insert into cartilage.

**Function:** Support and fusion.

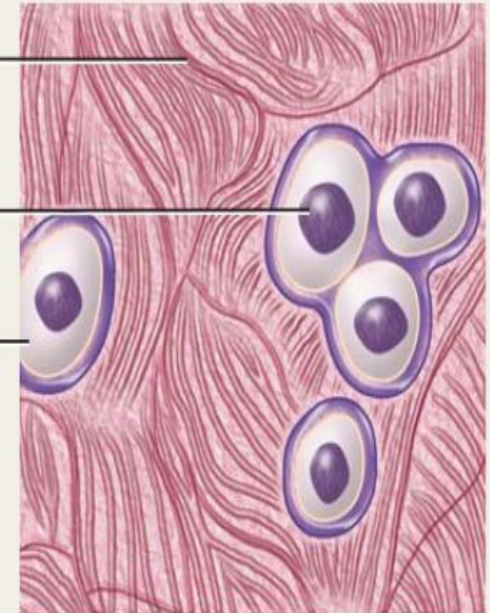


Sectional view of fibrocartilage of tendon

Collagen fiber in ground substance

Nucleus of chondrocyte

Lacuna containing chondrocyte



Fibrocartilage

TABLE 4.4 CONTINUES



# Mature Connective Tissues

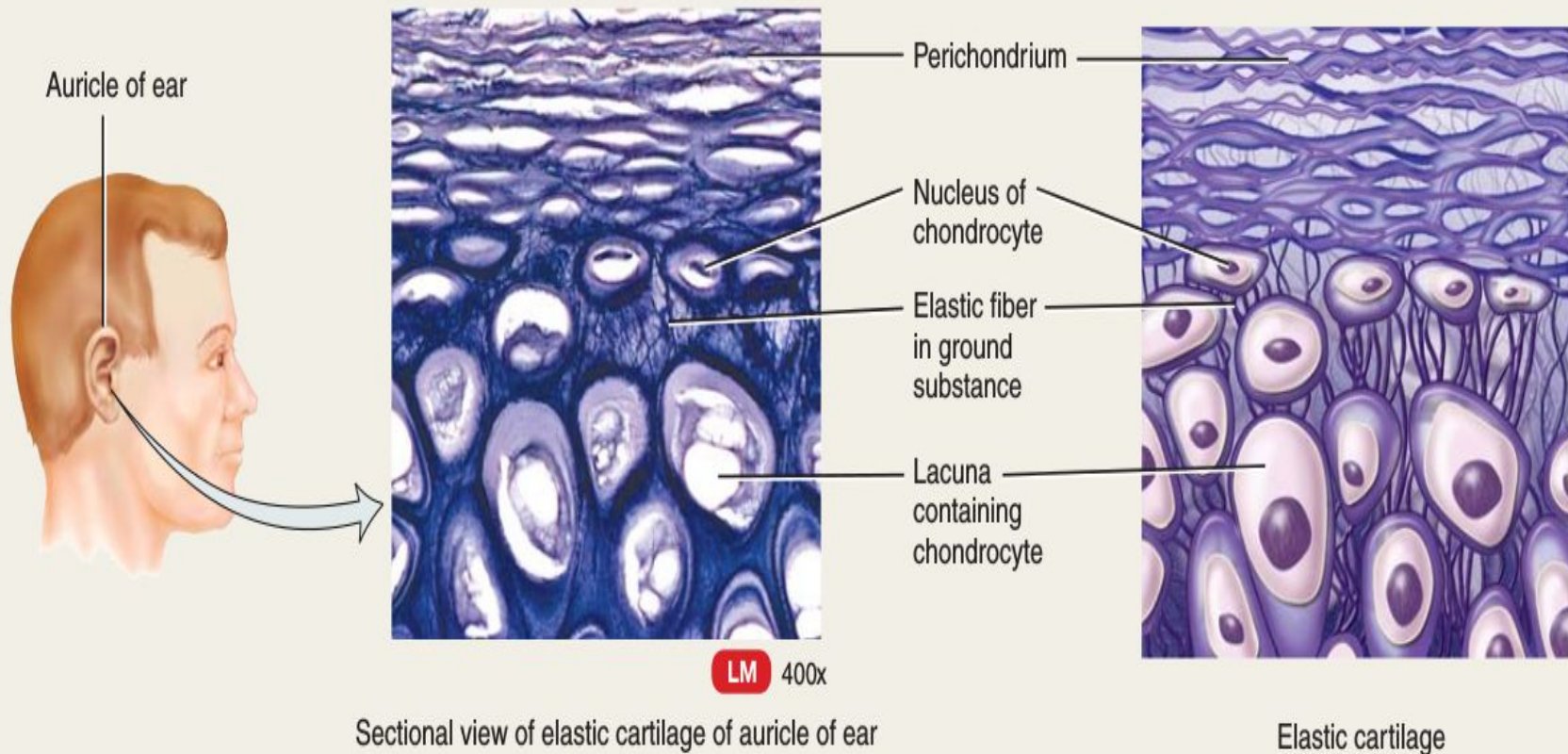
## CARTILAGE

### I. Elastic cartilage

**Description:** Consists of chondrocytes located in a threadlike network of elastic fibers within the extracellular matrix.

**Location:** Lid on top of larynx (epiglottis), part of external ear (auricle), and auditory (eustachian) tubes.

**Function:** Gives support and maintains shape.

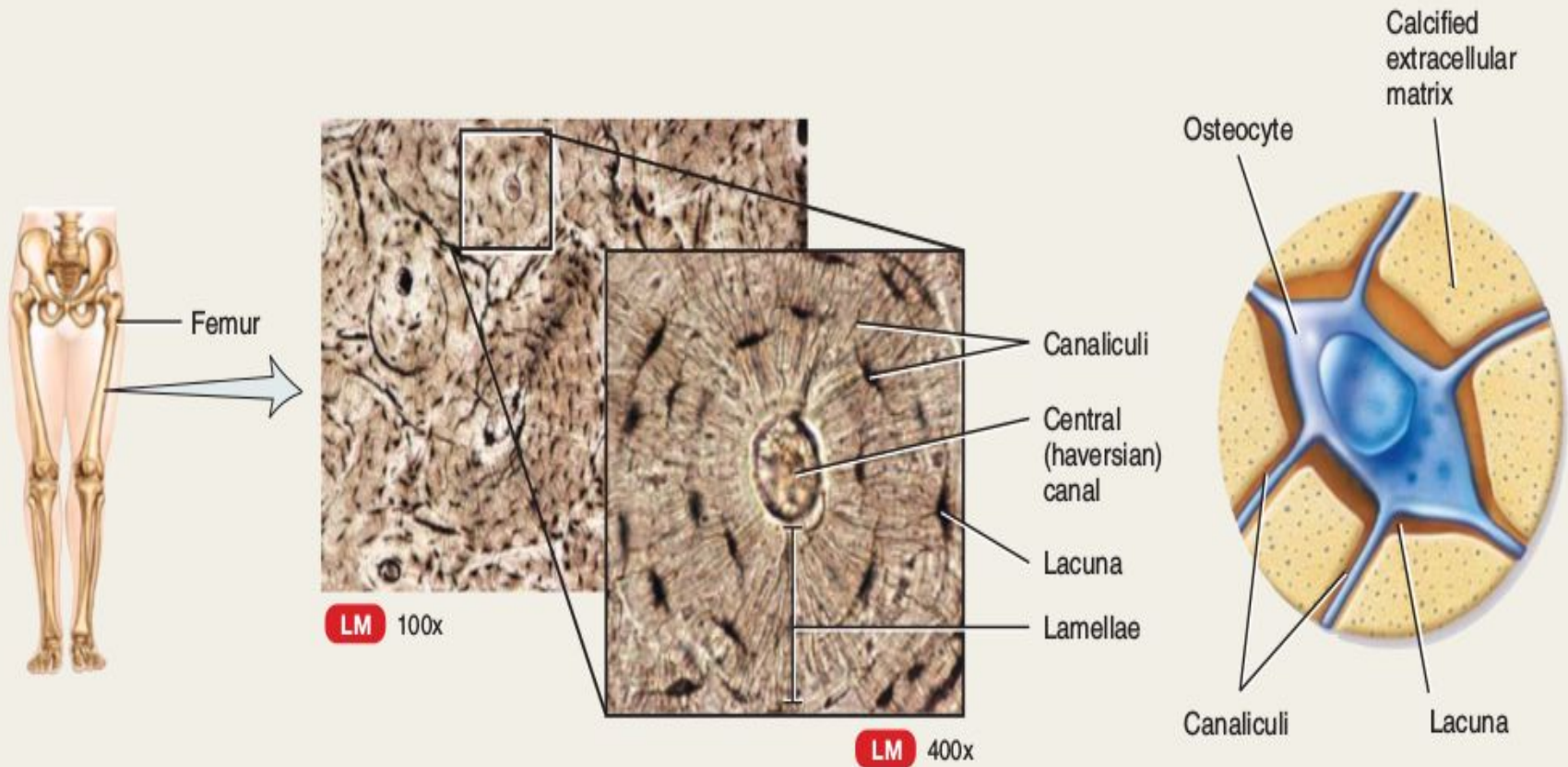


## J. Compact bone

**Description:** Compact bone tissue consists of osteons (haversian systems) that contain lamellae, lacunae, osteocytes, canaliculi, and central (haversian) canals. By contrast, spongy bone tissue (see [Figure 6.3](#) on page 180) consists of thin columns called trabeculae; spaces between trabeculae are filled with red bone marrow.

**Location:** Both compact and spongy bone tissue make up the various parts of bones of the body.

**Function:** Support, protection, storage; houses blood-forming tissue; serves as levers that act with muscle tissue to enable movement.



Sectional view of several osteons (haversian systems) of femur (thigh bone) and details of one osteon

Details of an osteocyte



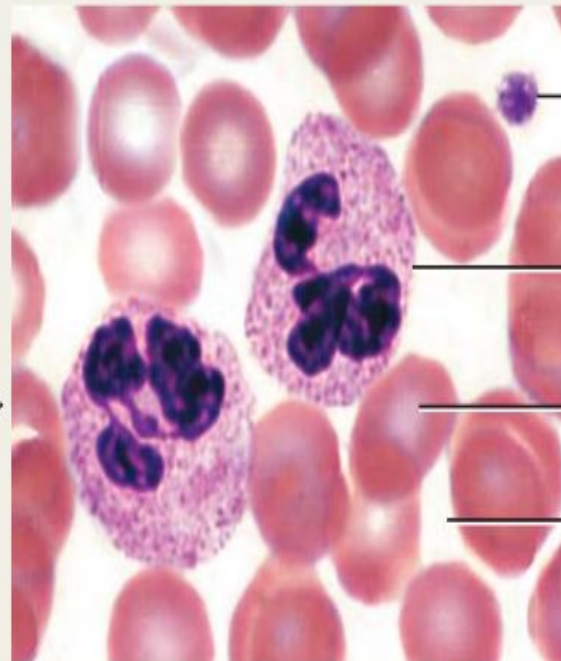
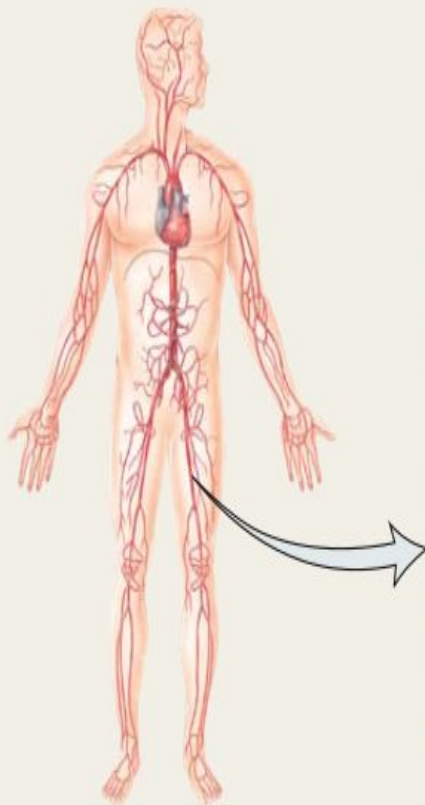
## LIQUID CONNECTIVE TISSUE

### K. Blood

**Description:** Consists of blood plasma and formed elements: red blood cells (erythrocytes), white blood cells (leukocytes), and platelets (thrombocytes).

**Location:** Within blood vessels (arteries, arterioles, capillaries, venules, and veins) and within the chambers of the heart.

**Function:** Red blood cells transport oxygen and some carbon dioxide; white blood cells carry on phagocytosis and are involved in allergic reactions and immune system responses; platelets are essential for the clotting of blood.



LM 1230x

Platelet

White blood cell  
(leukocyte)

Red blood cell  
(erythrocyte)

Blood plasma



Red blood cells



White blood cells



Platelets



**TABLE 4.5**

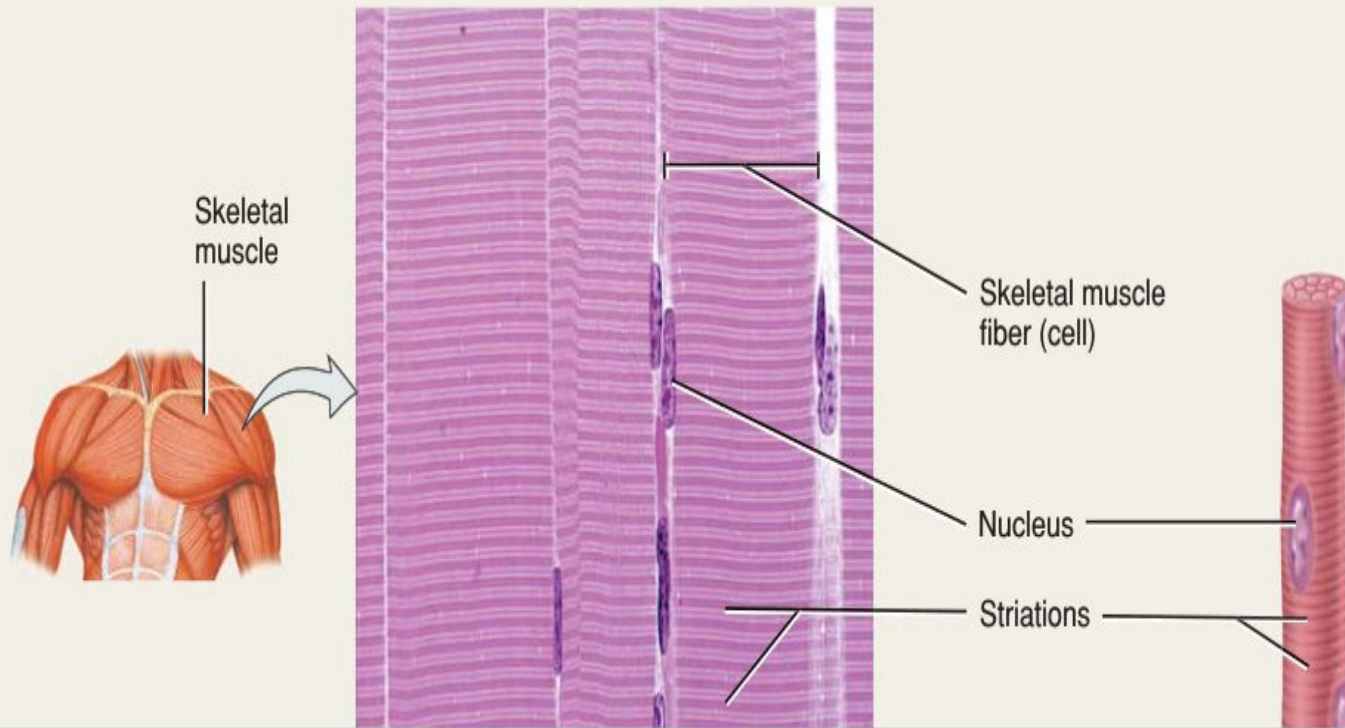
## Muscular Tissues

### A. Skeletal muscle tissue

**Description:** Long, cylindrical, striated fibers with many peripherally located nuclei; voluntary control.

**Location:** Usually attached to bones by tendons.

**Function:** Motion, posture, heat production, and protection.



## TABLE 4.5 CONTINUED

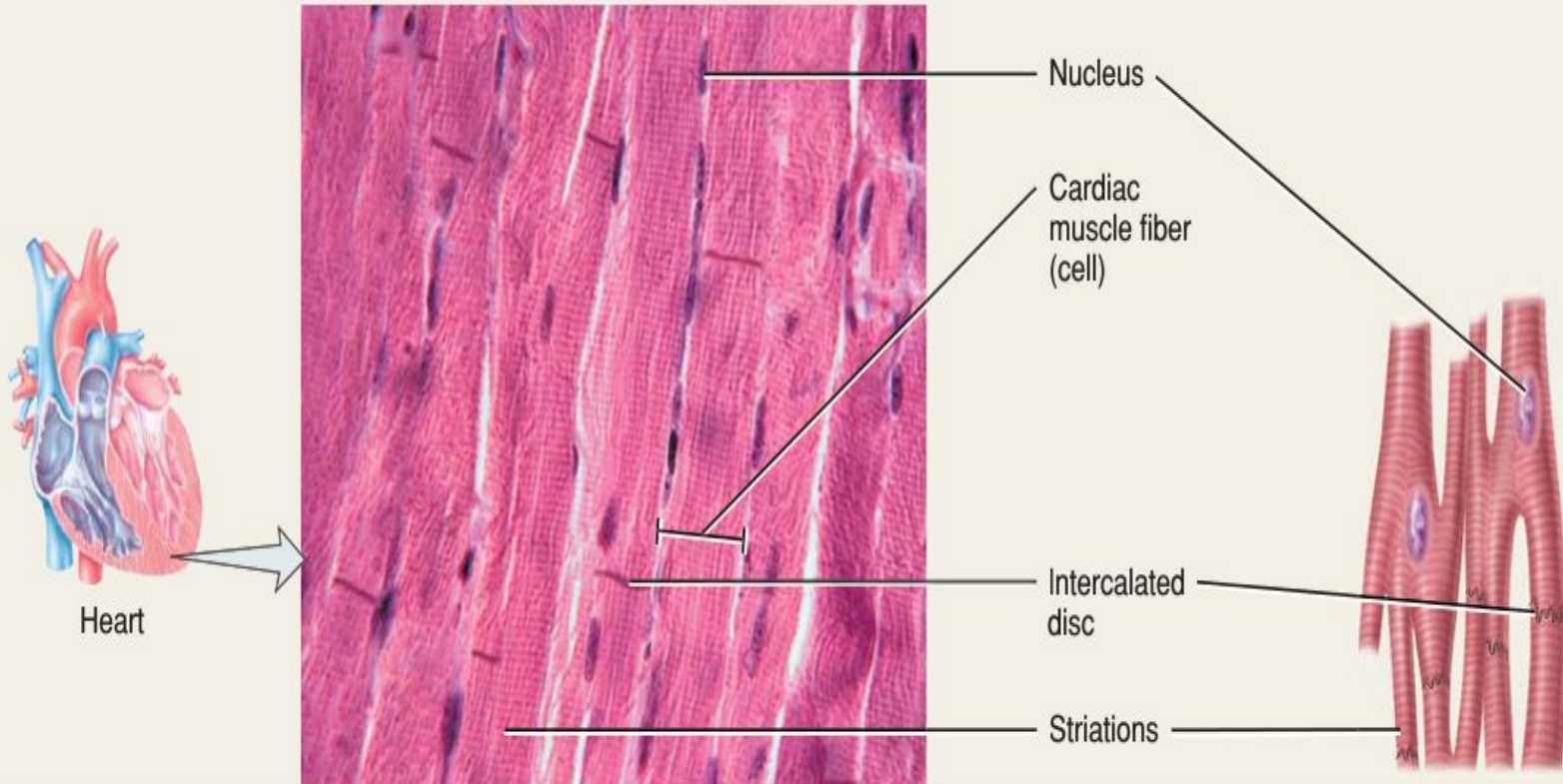
### Muscular Tissues

#### B. Cardiac muscle tissue

**Description:** Branched striated fibers with one or two centrally located nuclei; contains intercalated discs; involuntary control.

**Location:** Heart wall.

**Function:** Pumps blood to all parts of the body.

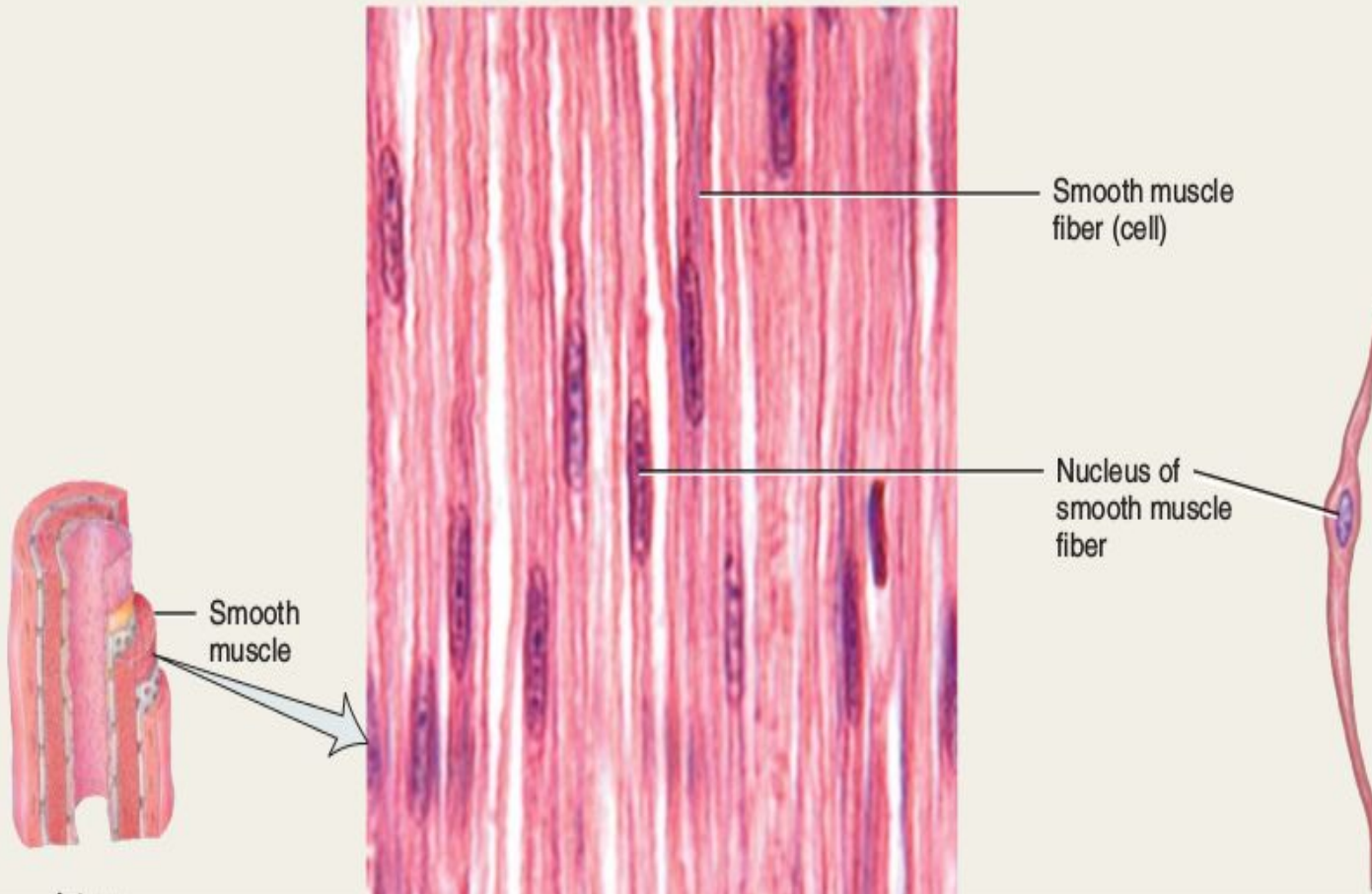


### C. Smooth muscle tissue

**Description:** Spindle-shaped (thickest in middle and tapering at both ends), nonstriated fibers with one centrally located nucleus; involuntary control.

**Location:** Iris of the eyes, walls of hollow internal structures such as blood vessels, airways to the lungs, stomach, intestines, gallbladder, urinary bladder, and uterus.

**Function:** Motion (constriction of blood vessels and airways, propulsion of foods through gastrointestinal tract, contraction of urinary bladder and gallbladder).





**TABLE 4.6**

## Nervous Tissue

**Description:** Consists of neurons (nerve cells) and neuroglia. Neurons consist of a cell body and processes extending from the cell body (multiple dendrites and a single axon). Neuroglia do not generate or conduct nerve impulses but have other important supporting functions.

**Location:** Nervous system.

**Function:** Exhibits sensitivity to various types of stimuli, converts stimuli into nerve impulses (action potentials), and conducts nerve impulses to other neurons, muscle fibers, or glands.

