Ministry of Higher Education and Scientific Research
Al-Furat Al-Awsat Technical University
Najaf Medical Technical Institute
Aesthetic and Laser Department

Anatomical terms

Lecture 1

Dr. Rabab Ali Al-Mosawi

Anatomy

Anatomy: a field in the biological sciences concerned with the identification and description of the body structures of living things.

Body Direction and Positions;

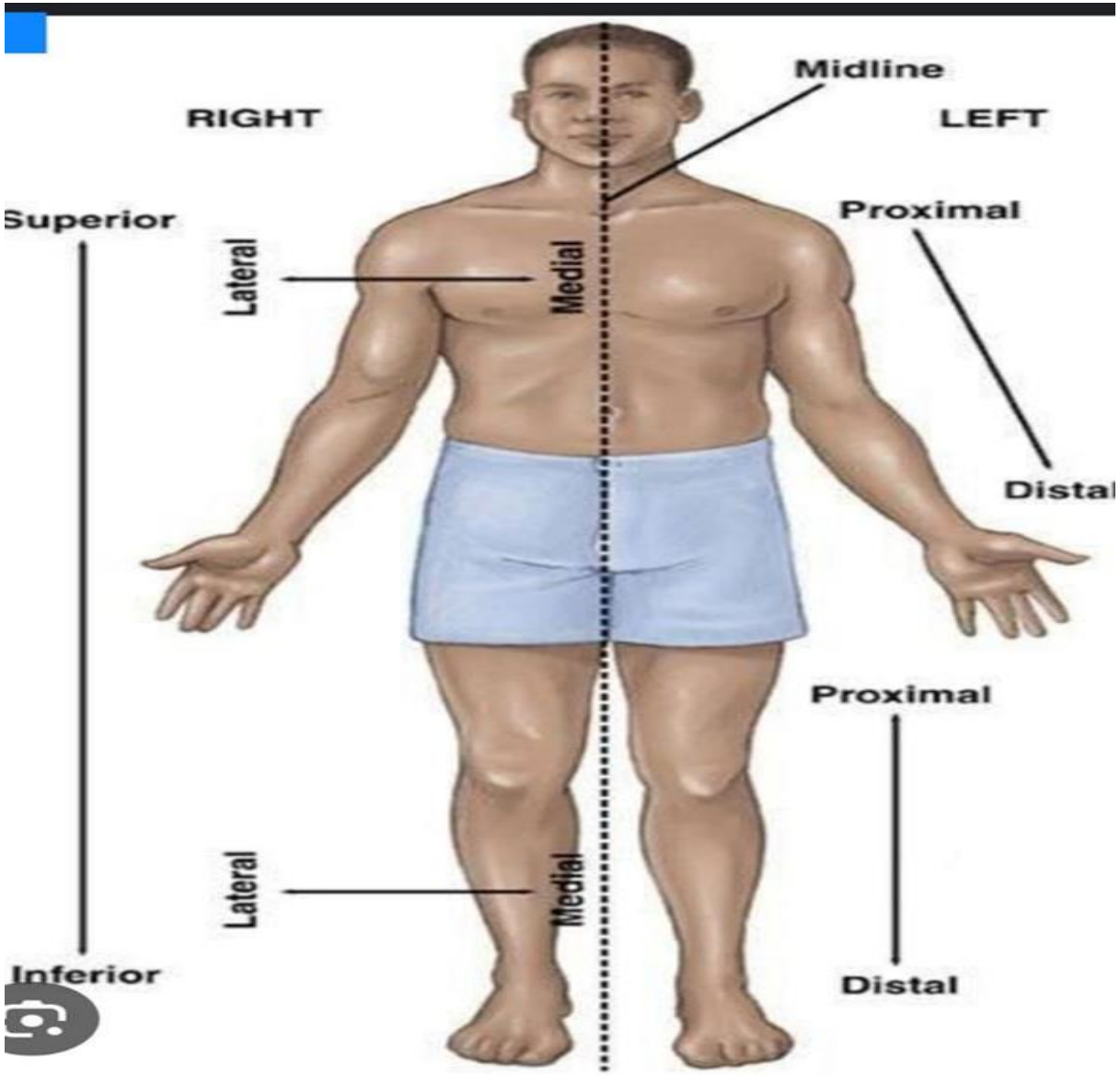
1. Anterior, Frontal, or Ventral: Toward the front of the body.
2. Posterior or Dorsal: Toward the back of the body.
3. Medial: Toward the midline of the body.
4. Lateral: Away from the midline of the body.
5. Superior, cephalic or cranial: Above or toward the head.
6. Inferior, caudal: Below or toward the feet.
7. Proximal: Nearer to the body trunk.

Anatomy

8. Distal: Further away from the body trunk.
9. Superficial: Close to the surface.
10. Deep: Away from the surface.
11. Internal: Inside the structure.
12. External: Outside the structure.
13. Ipsilateral: At the same side.
14. Contralateral: At the opposite side.
15. Afferent: Flow toward.
16. Efferent: Flow away.
17. Supine: Lying flat and face upward.
18. Prone: Lying flat and face downward.

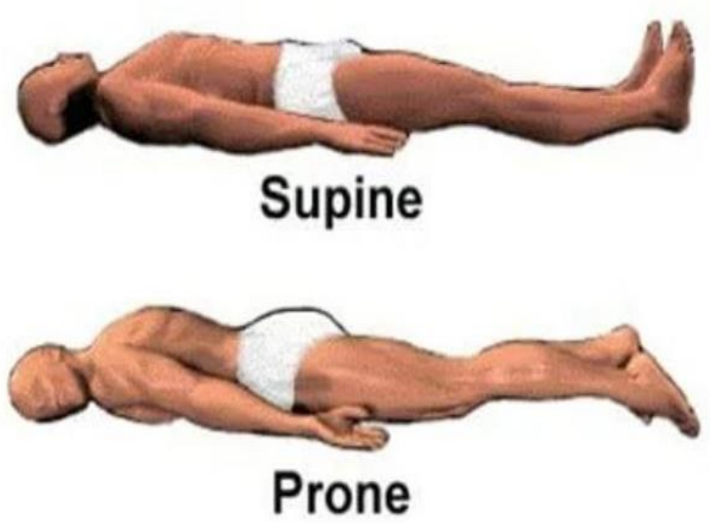
Anatomic position

Anatomic Position: The position is defined as if the body is standing erect (hips and knees extended), head facing forward, eyes open and looking directly forwards and mouth closed. The arms are by the sides (shoulders adducted), the palms are facing forward, and the feet parallel and together.

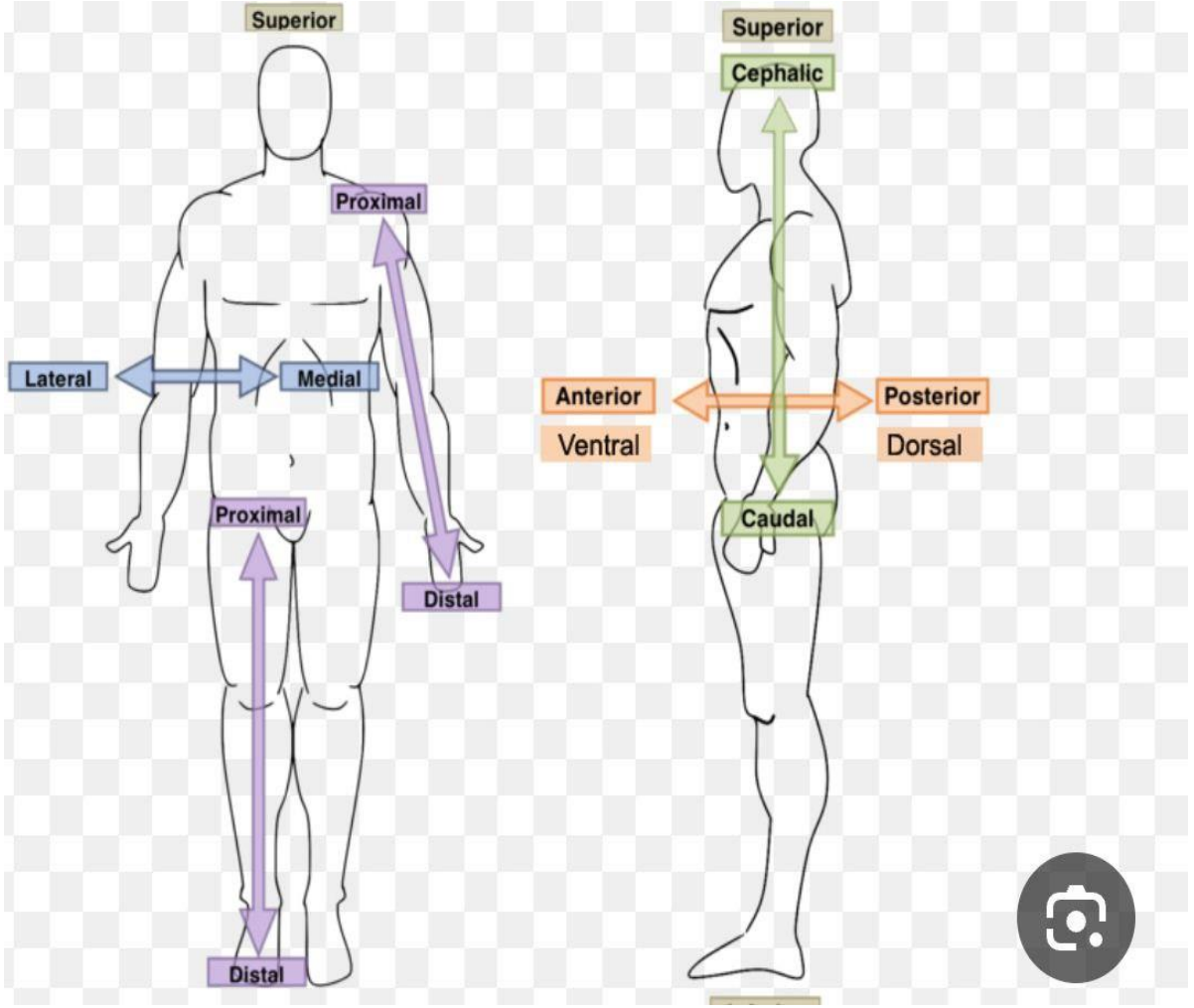


Supine: Lying flat and face upward.

Prone: Lying flat and face downward

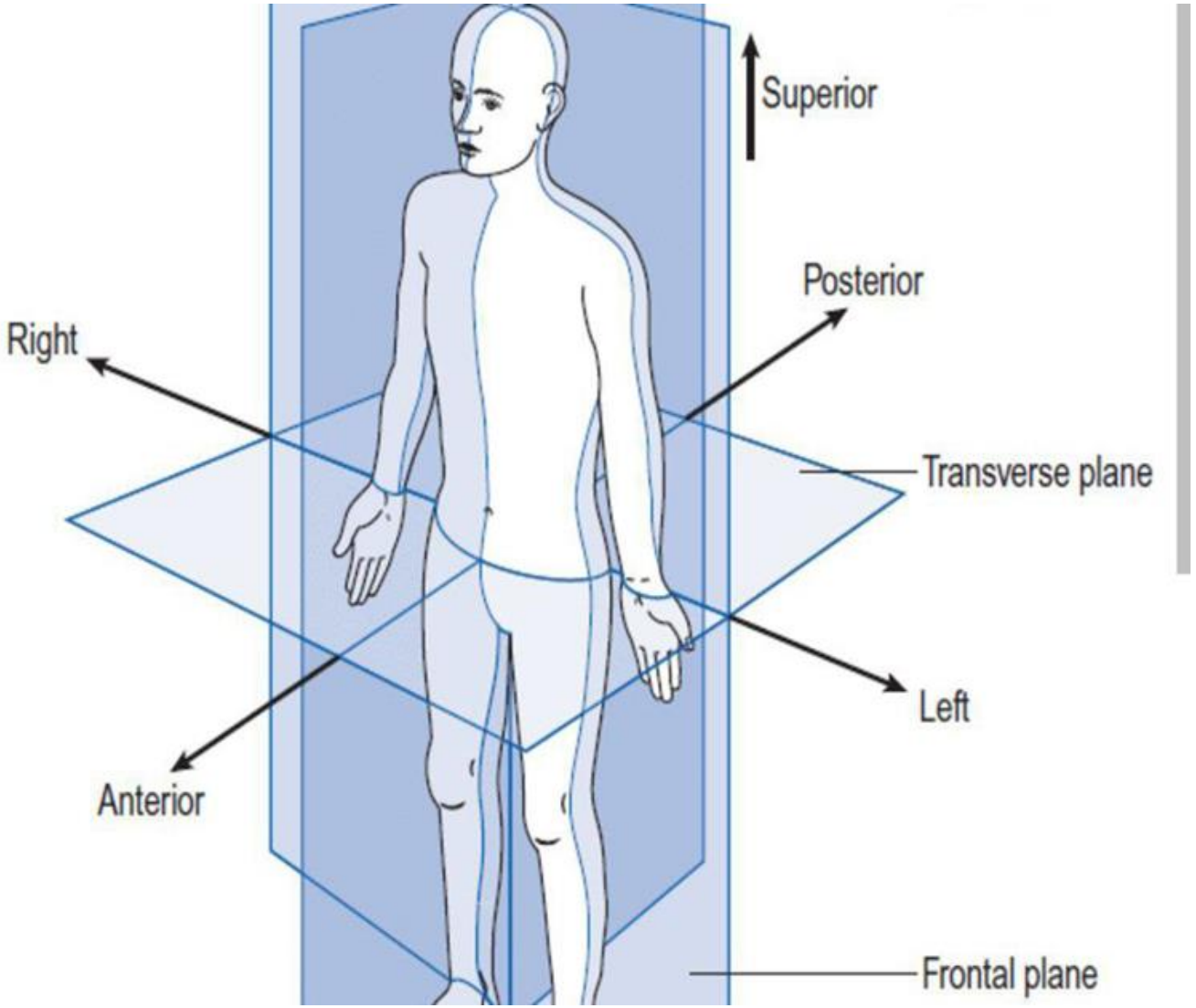


Body Directions

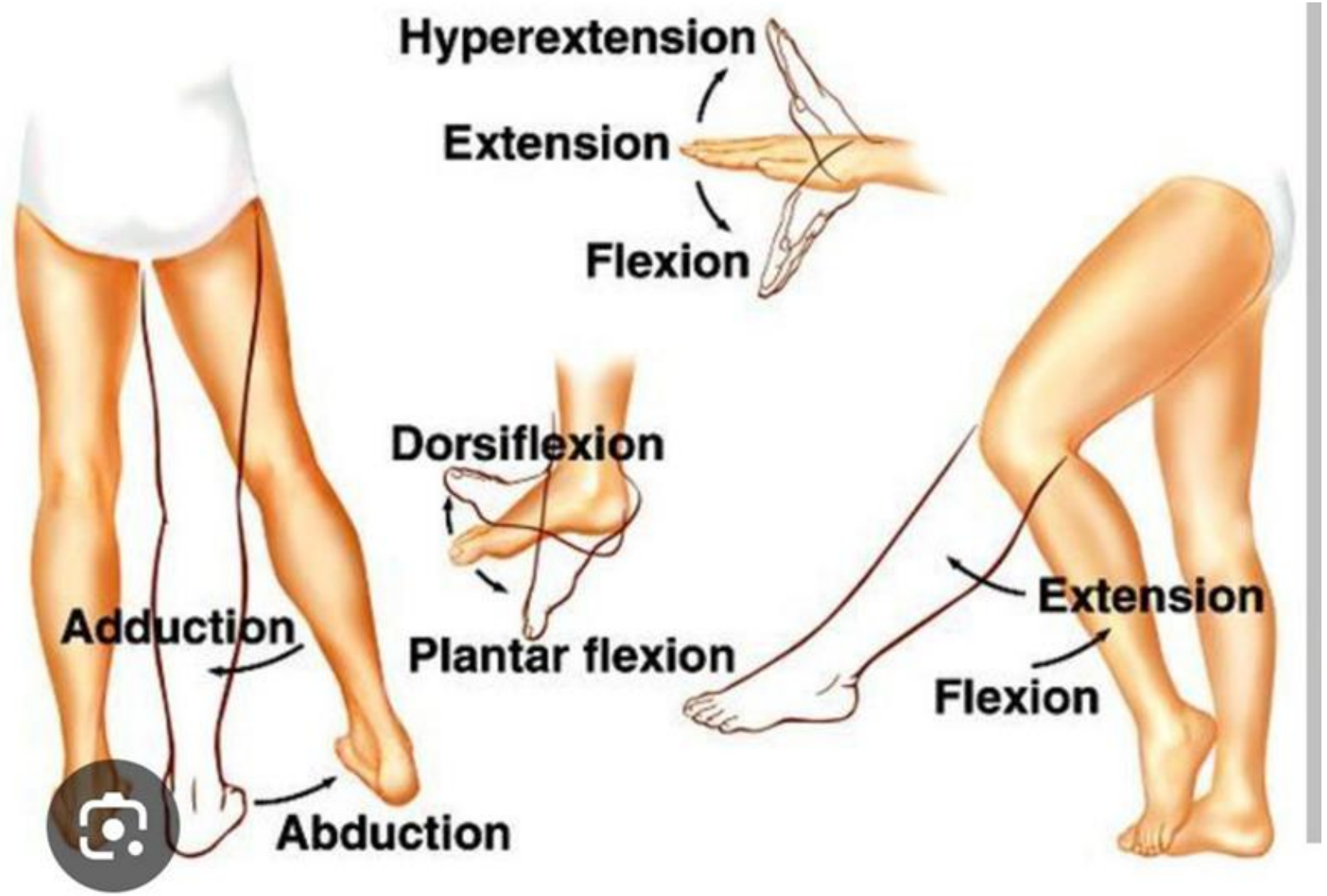


Body planes

- **Coronal (frontal) plane:** The plane dividing the body into front(anterior) and back (posterior) portion.
- **Sagittal plane**: The plane dividing the body into right and left portions **Midsagittal or median** are names for the plane dividing the body into equal right and left halves.
- **Transverse (horizontal) plane:** The plane separates the body into upper (superior) and lower (inferior) planes, cutting “across” the body.



Movements


Hyperextension
Extension
Flexion
Dorsiflexion
Plantar flexion
Adduction
Abduction
Extension
Flexion

Movements

In the musculoskeletal system, movement takes place at joints. A joint is a site where two or more bones articulate, or come together.

1. Flexion: Decrease the angle of a joint.

2. Extension: Increase the angle of a joint.

3. Abduction: Away from the midline of the body.

4. Adduction: Toward the midline of the body.





5. Pronation: Turning the forearm medially to make the palm posteriorly.

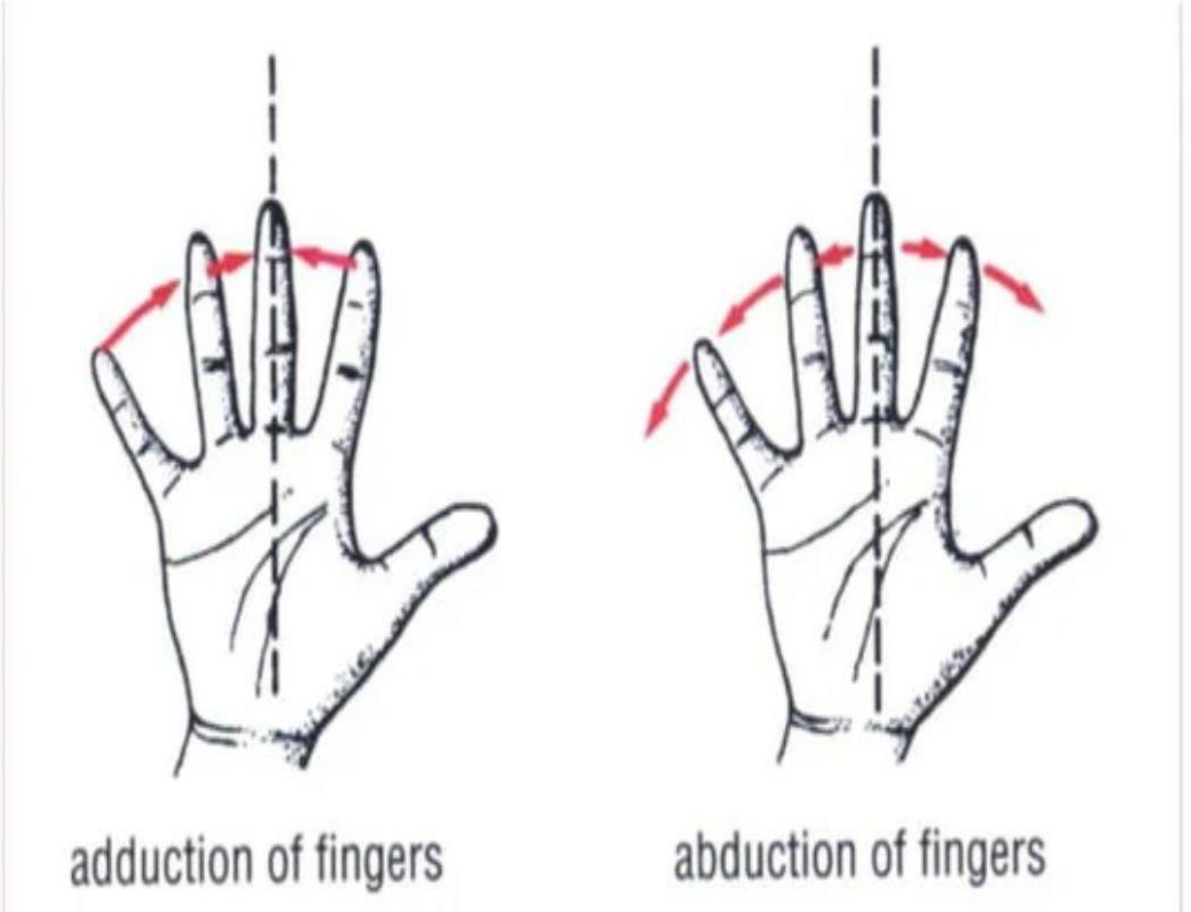
6. Supination: Turning the forearm laterally to make the palm anteriorly.

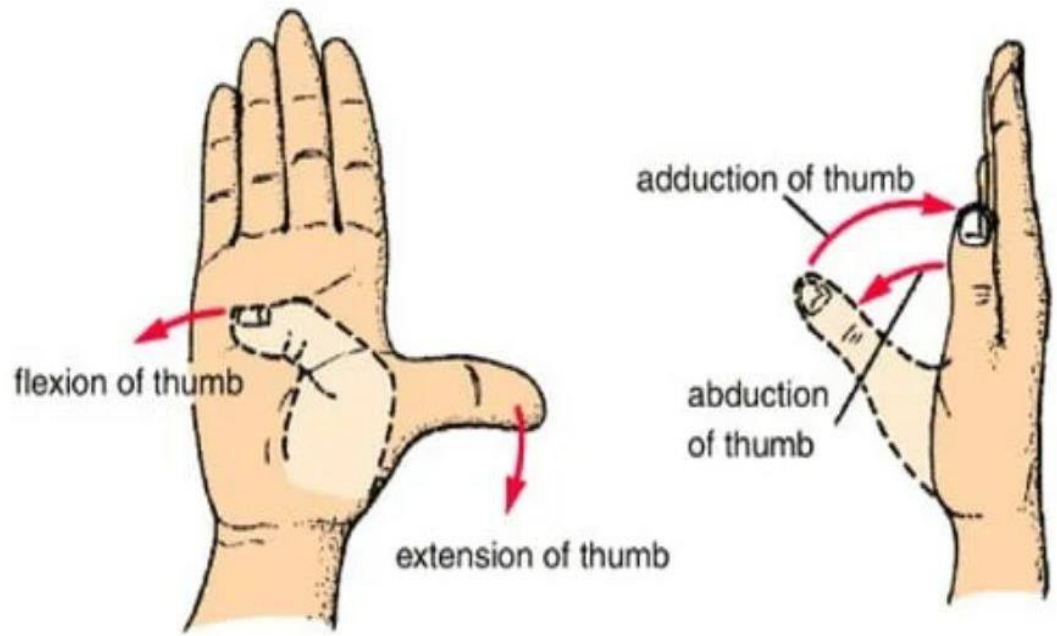
7. Inversion: Turning the sole of the foot medially.

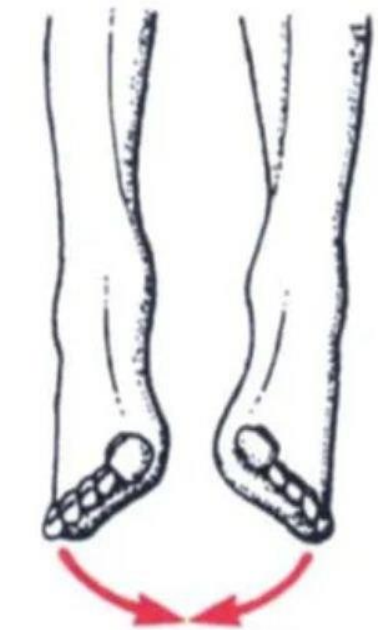
8. Eversion: Turning the sole of the foot laterally.

9. Rotation: Movement of a part of the body around its long axis; (e.g., medial

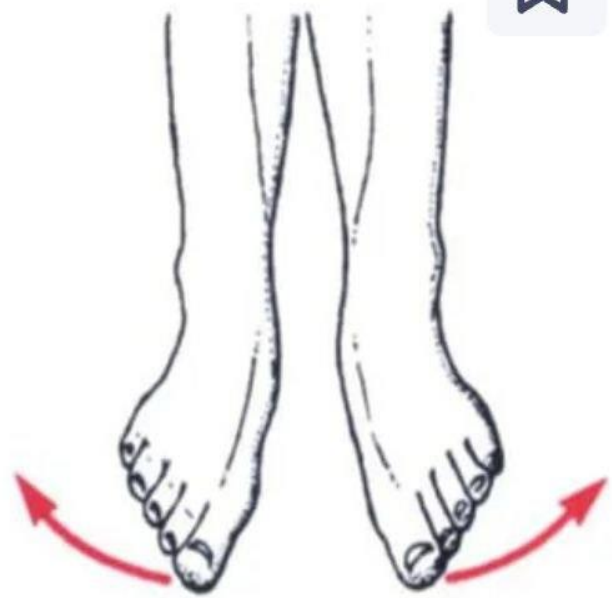
rotation and lateral rotation)



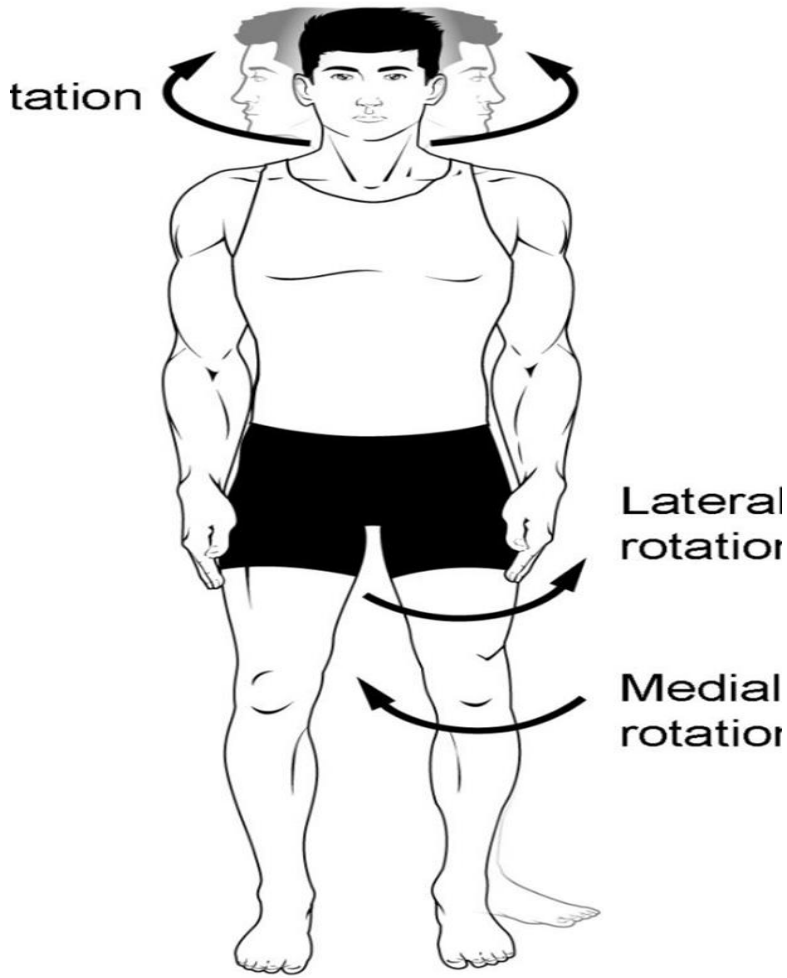

flexion of thumb
extension of thumb
adduction of thumb
abduction
of thumb



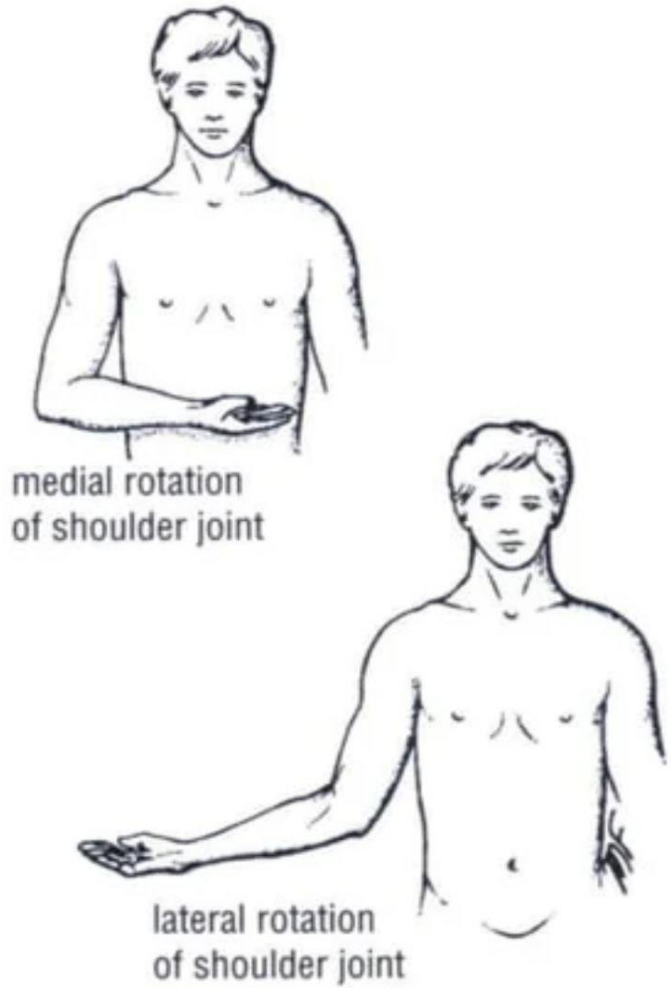
inversion of foot

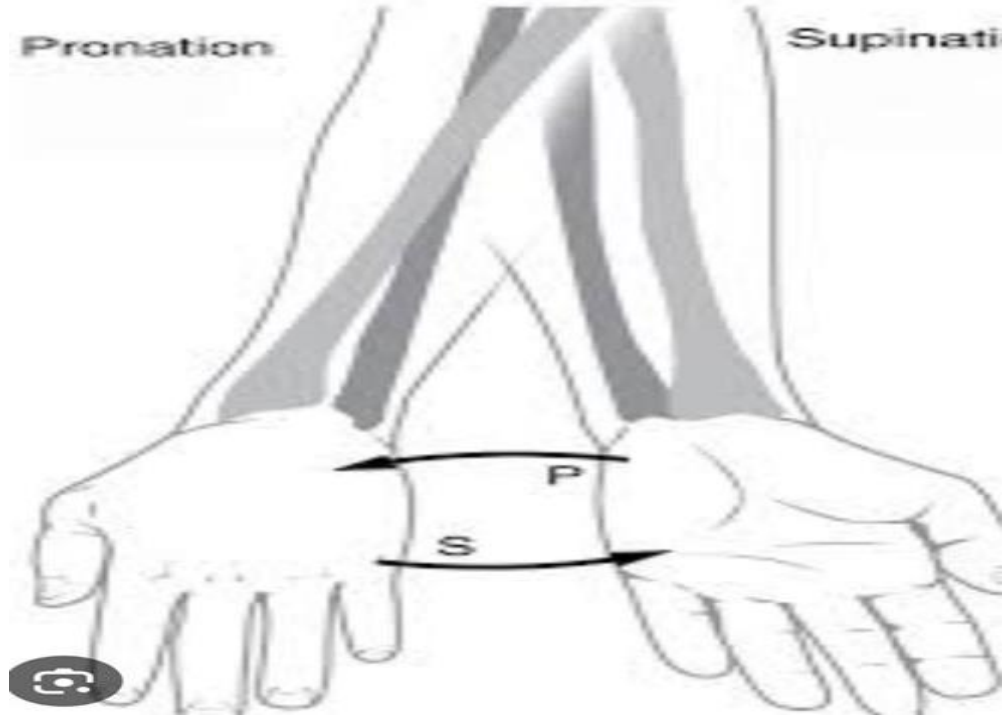


eversion of foot



Rotation of the head, neck, and lower limb


medial rotation
of shoulder joint
lateral rotation
of shoulder joint


Pronation
Supinati
P
S

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Histology and Anatomy

Body cavities and its organs

Lecture 2

Dr. Rabab Ali Al-Mosawi

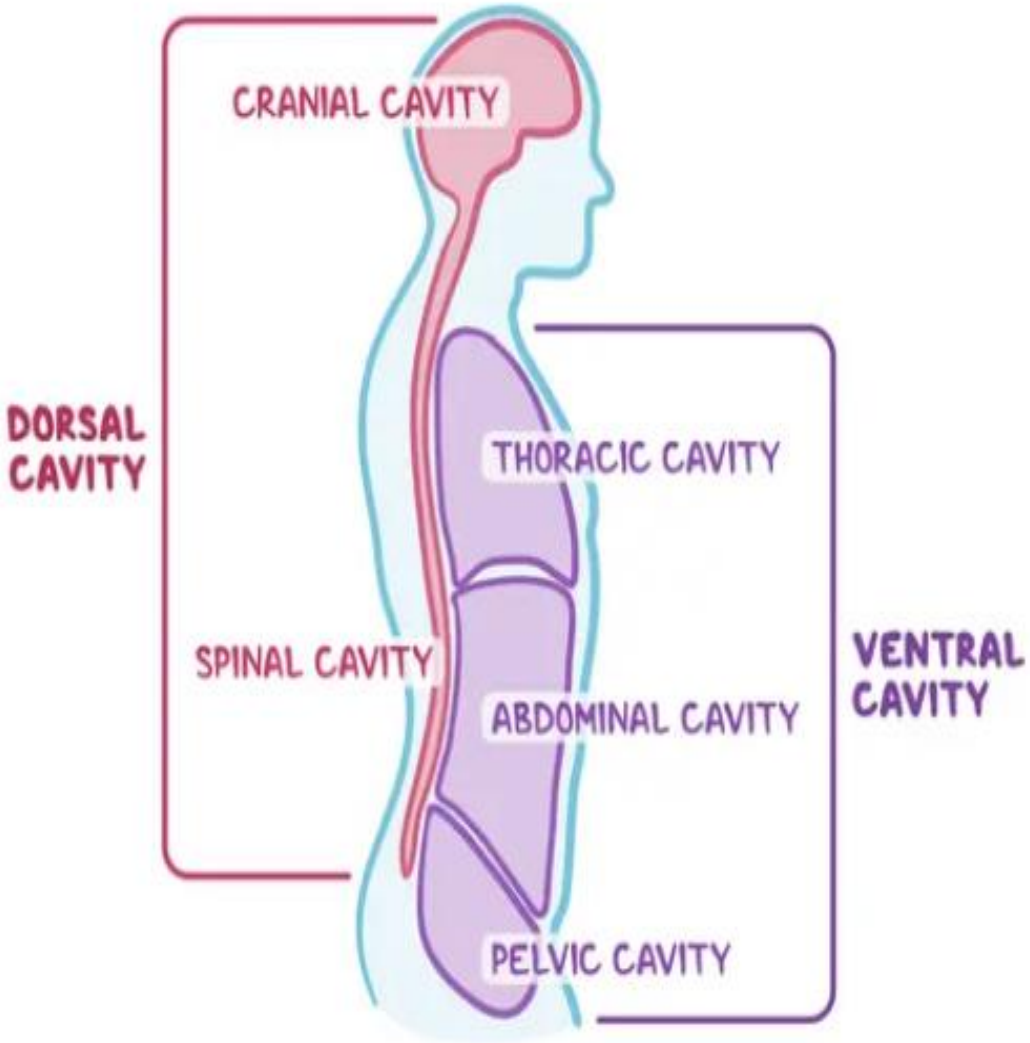
- Body cavity: Space or compartment in the body that houses organs and structures.

- There are two cavities which the largest body compartments in human body. These cavities contain and protect delicate internal organs.

1. Dorsal (posterior) cavity

a) Cranial cavity lies in the skull and encases the brain.

b) Vertebral cavity (Spinal cavity) Runs through the vertebral column to enclose the spinal.



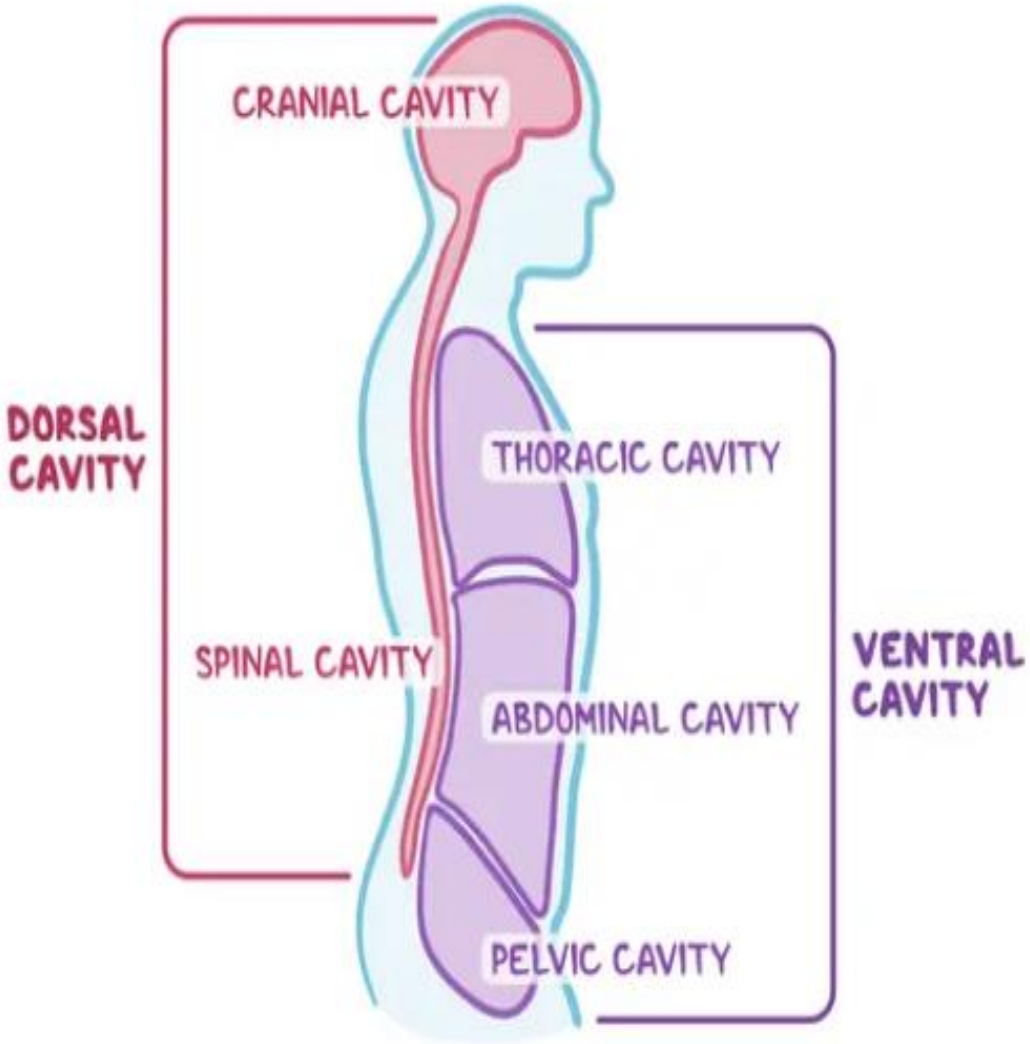
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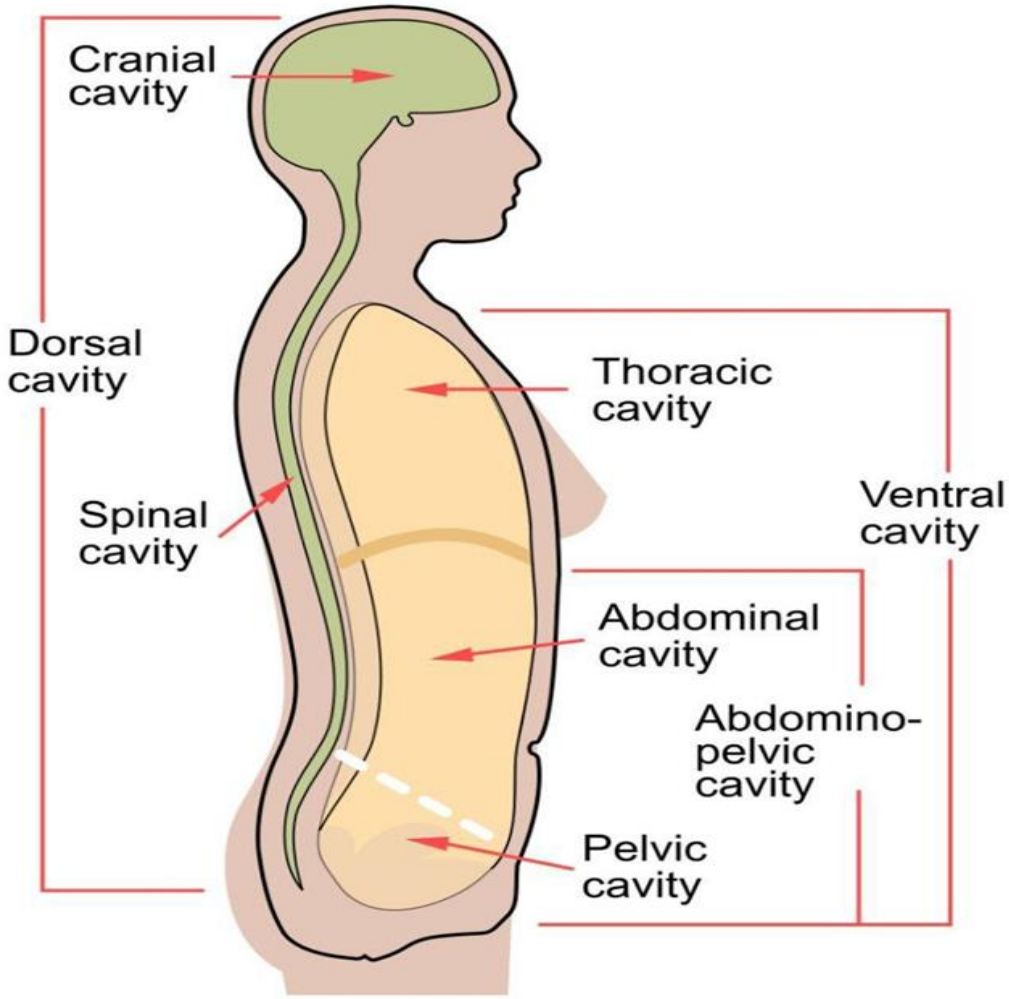
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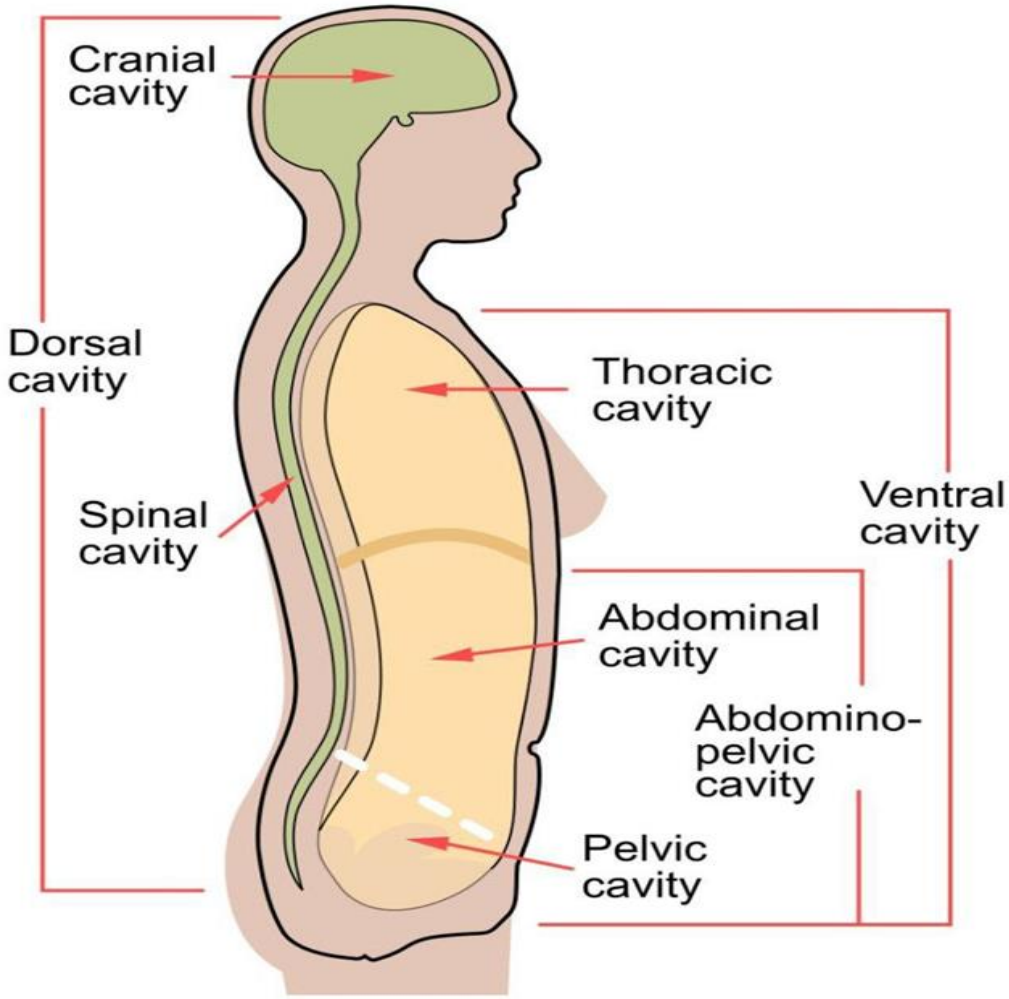
b) Vertebral cavity (Spinal cavity) Runs through the vertebral column to enclose the spinal.



The major body cavities shown in lateral view



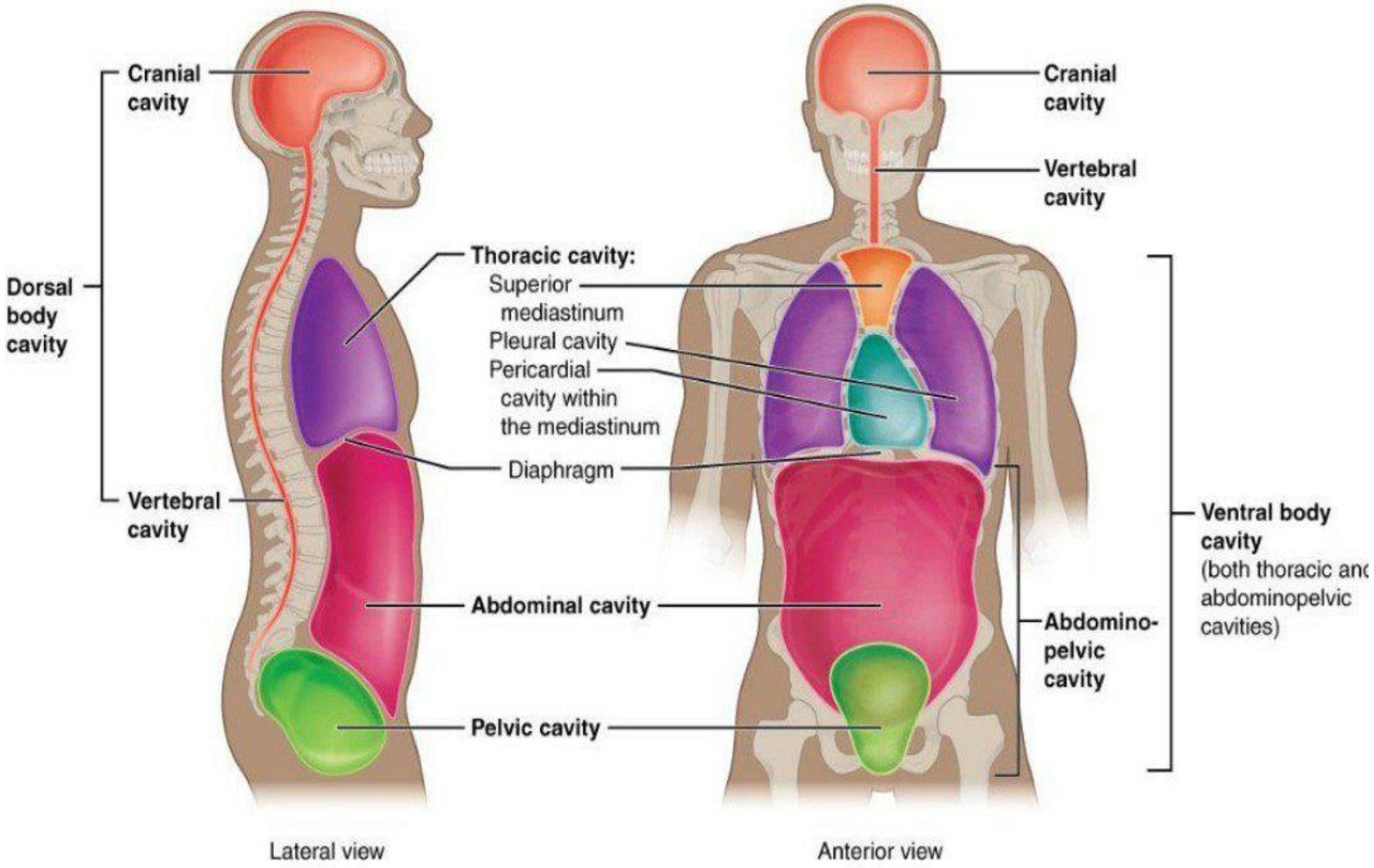
The major body cavities shown in lateral view



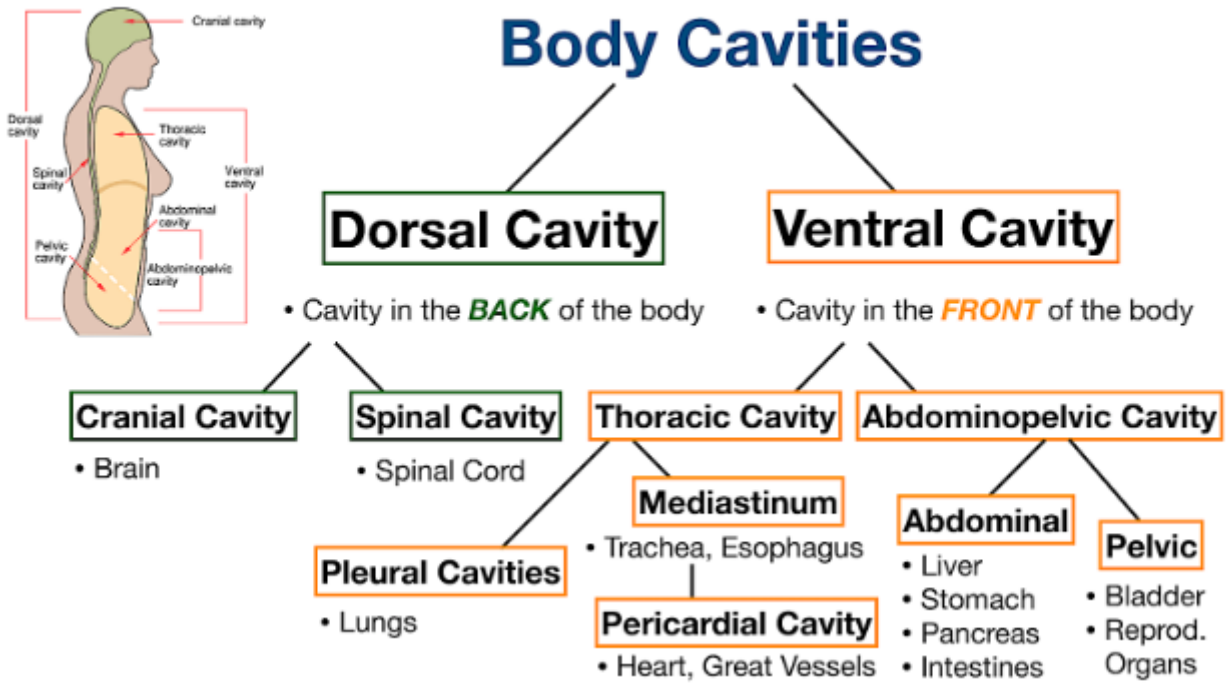
1. **2-The ventral (anterior) cavity subdivided:**

- Thoracic cavity
- Is more superior subdivision of the anterior cavity.
- enclosed by the rib cage.
- The diaphragm forms the floor of the thoracic cavity and separates it from the more inferior abdominopelvic cavity.
- It has 3 parts; 2 lateral containing the lungs surrounded by the pleura and one central 'Mediastinum' which contains the heart surrounded by pericardium. The mediastinum also houses esophagus and trachea.
- Abdominopelvic cavityThe largest cavity in the body, abdominal cavity, the division that houses the digestive organs, and the pelvic cavity, the division that houses the organs of reproduction.

The major body cavities shown in lateral view and Anterior view.

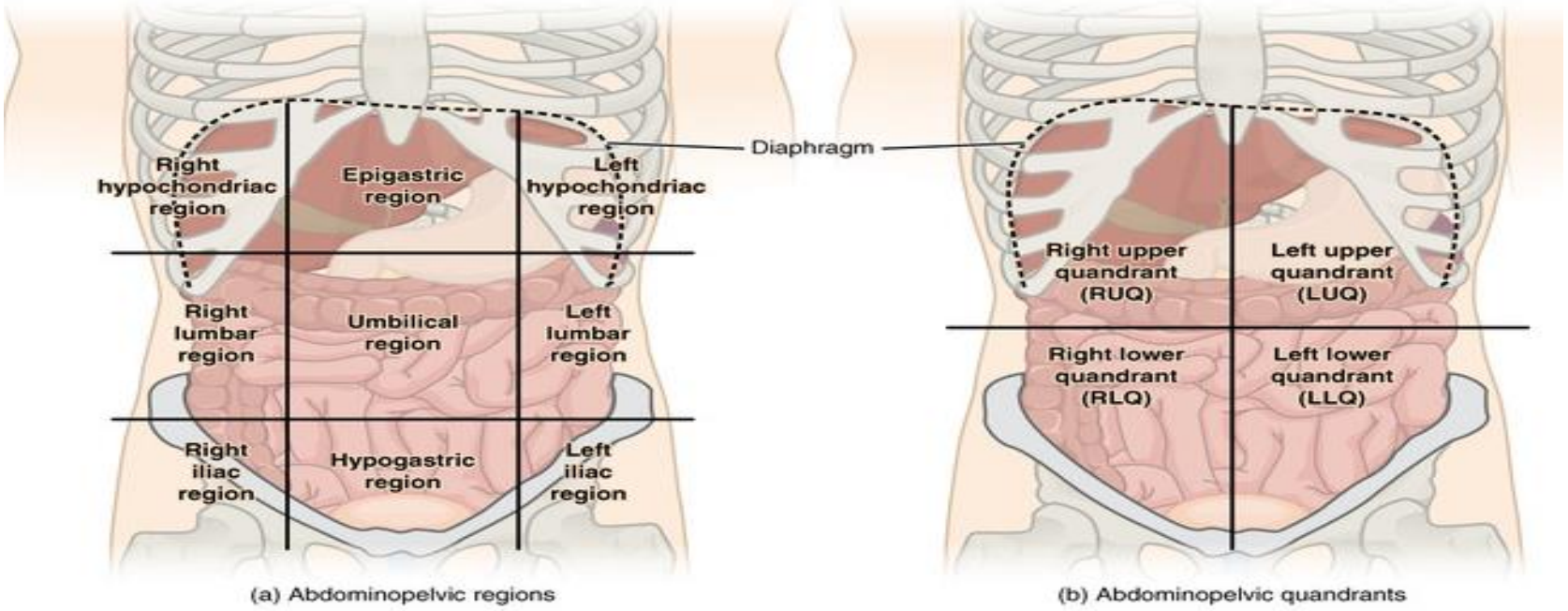


Body Cavities Labeled Diagram: Anatomy flow chart of the major body cavities and the main organs they house.



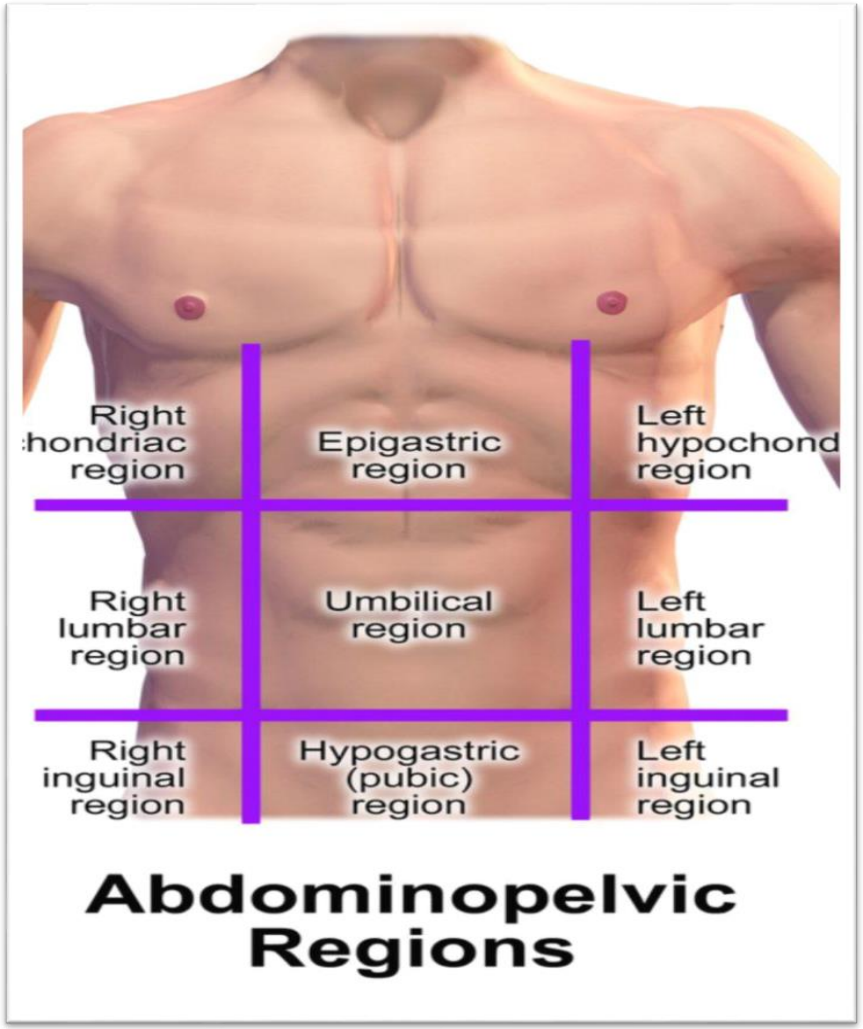
Clinical areas of the abdominopelvic cavity

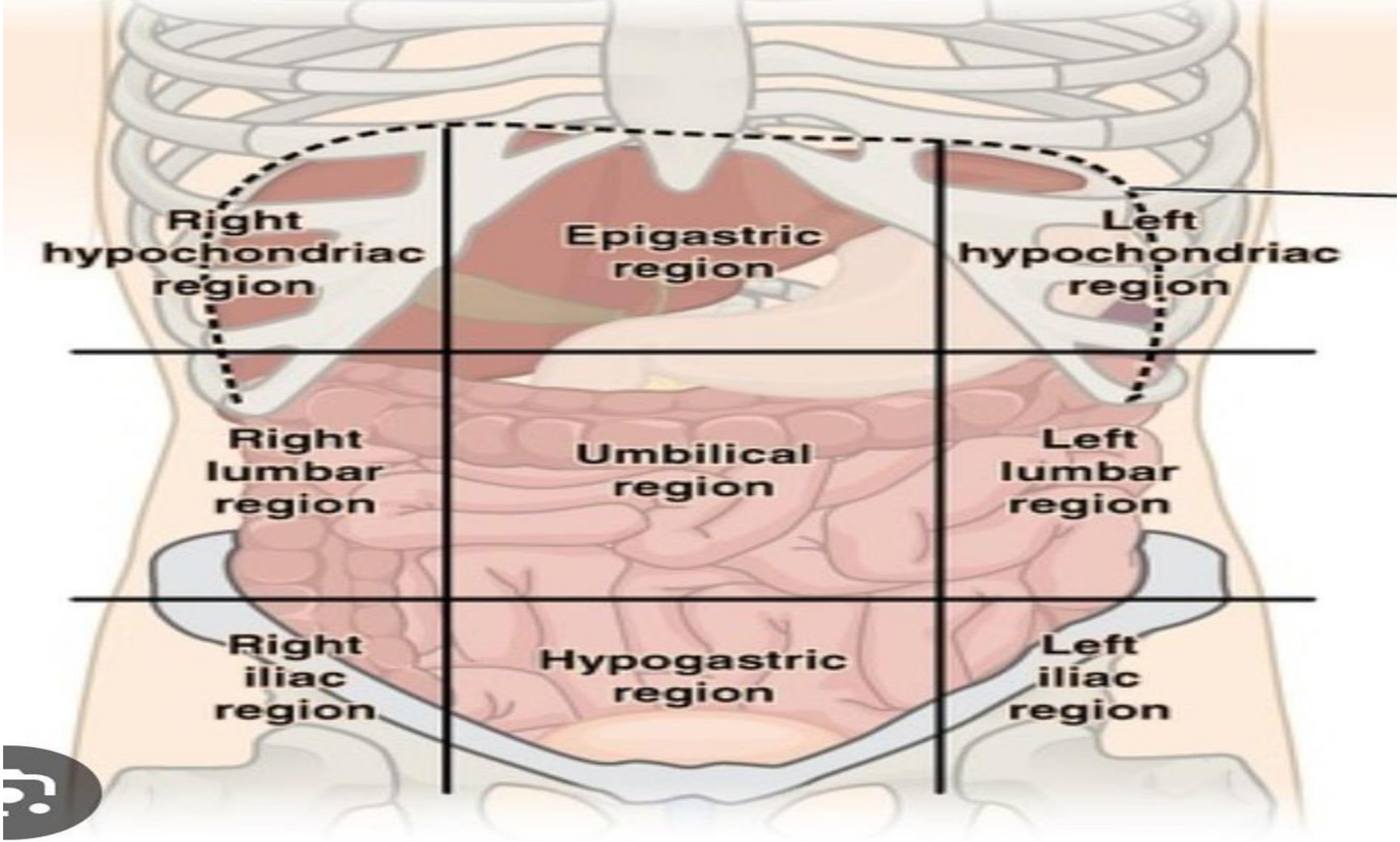
- A physician needs to describe the location of organs. To do this effectively, the abdominopelvic cavity is divided clinically into either **nine regions** or **four quadrants**.



The nine regions of the abdominopelvic cavity

- The abdomen is divided by
- **Two vertical midclavicular lines**
- **Two horizontal subcostal and trans-iliac lines** into nine regions. These are named as follows:

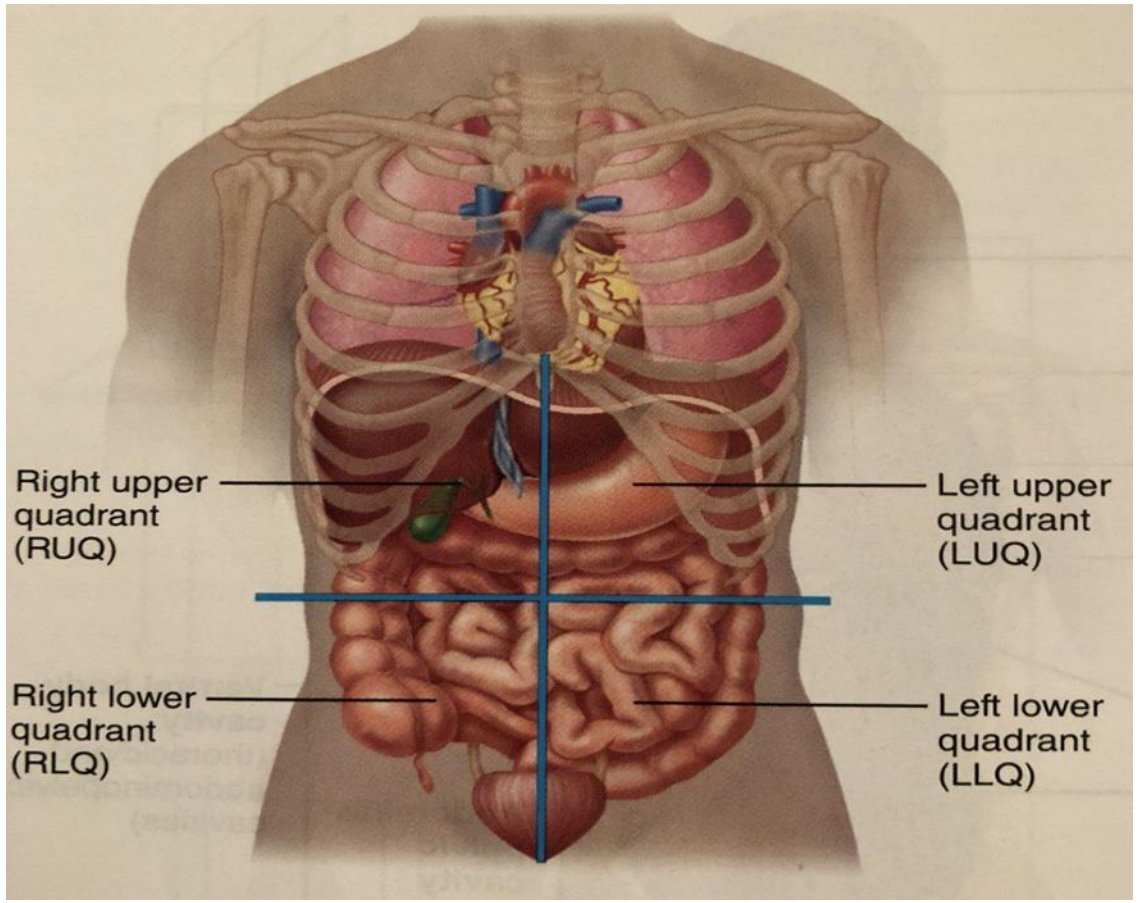




(a) Abdominopelvic regions

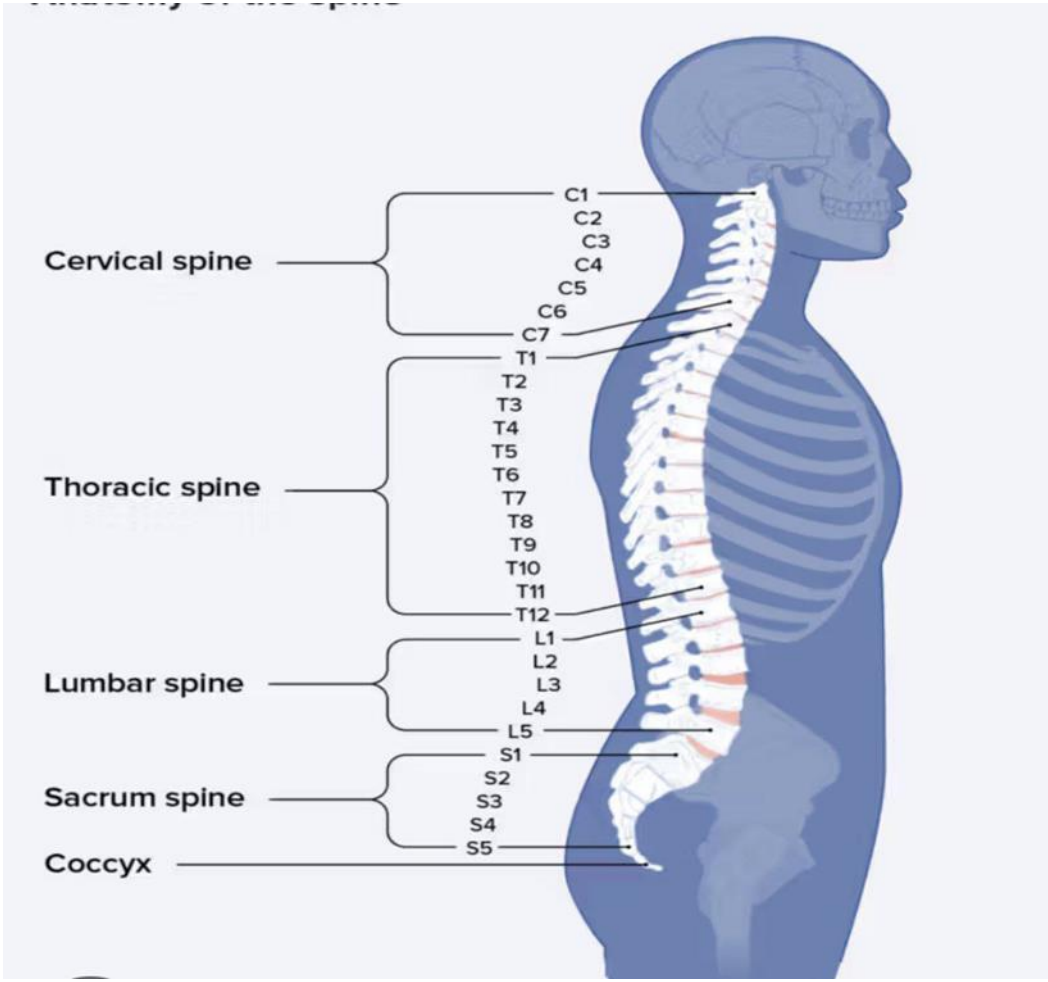
The quadrants in abdominopelvic cavity

The abdomen is divided by transected median and umbilical lines into four quadrants. The center point is the umbilicus.



Region of the spinal column

1. The cervical column (C); means neck, comprises 7 vertebrae.
2. The thoracic column (T); means chest, comprises 12 vertebrae.
3. The lumbar column (L); means loin, comprises 5 vertebrae.
4. The sacral column (S); means sacrum, comprises 5 fused vertebrae.
5. The coccyx (Co); means coccyx (tailbone), comprises 3-4fused vertebrae



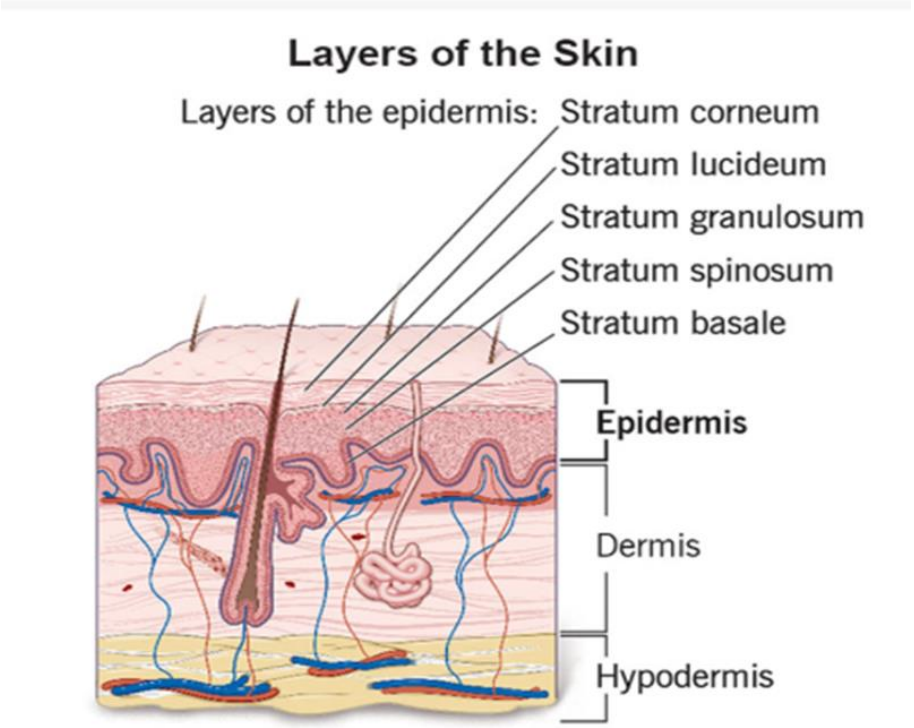
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Skin anatomy and its functions
Lecture 3&4

Dr. Rabab Ali Al-Mosawi

Skin anatomy and its functions skin

- **The skin** is the largest organ of the human body (1.75 m2), and the weight about 15% of the body**.**
- It provides a protective layer covering underlying structures of the body.
- It is the bodies first line of defense against bacteria - it prevents them entering the body.



- **The Skin layers 3 main areas:**

A. The Epidermis layer - surface of the skin (5 layers).

B. The Dermis layer - supports the epidermis and provides shape and elasticity.

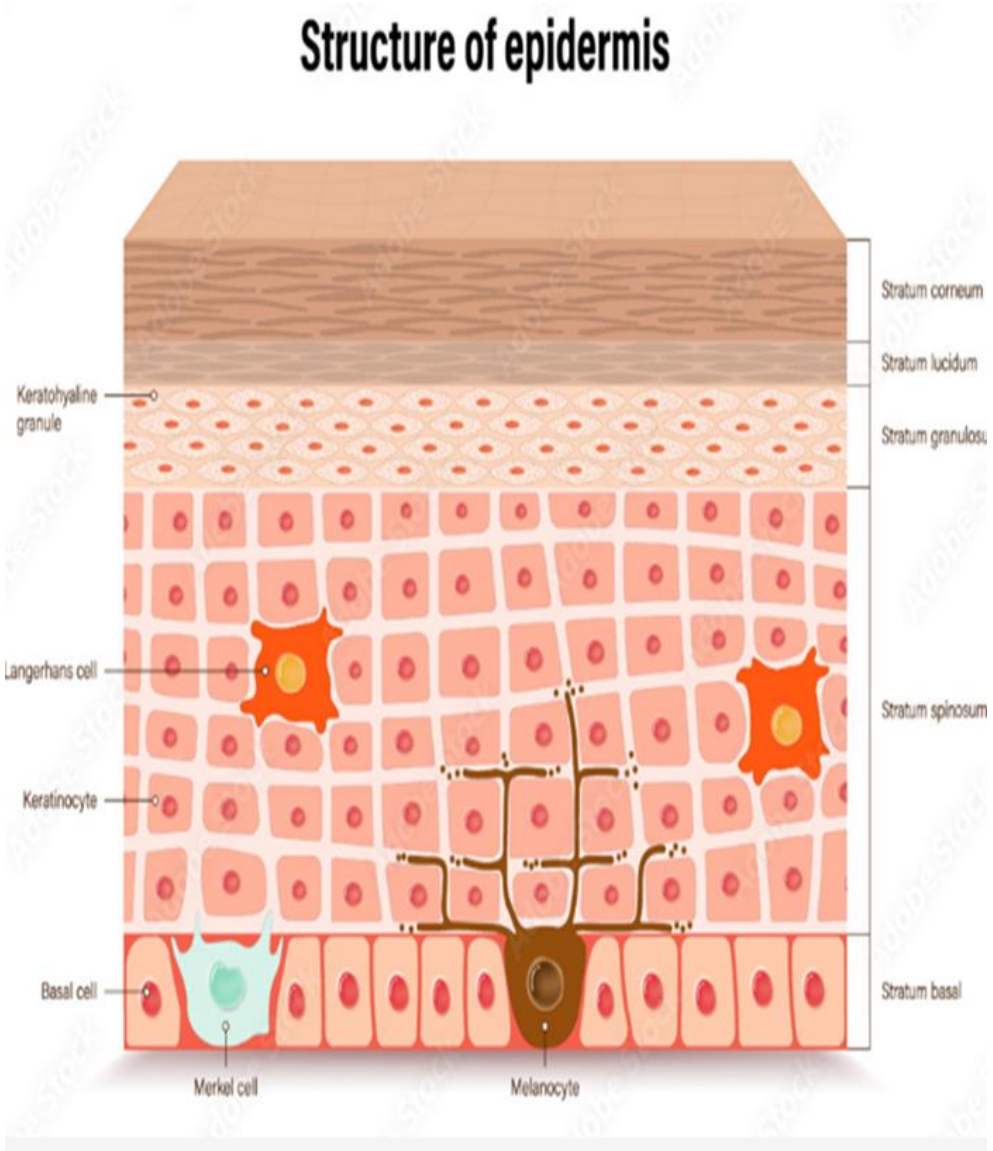
C. Hypodermis/subcutaneous layer - made of adipose tissue, muscles and blood vessels

A-Epidermis Layer

- Superficial layer of stratified epithelium. It does not have its own blood supply. Its thickness varies - thinnest on eyelids and thickest on the soles of the feet. There are five layers. The top 3 layers are dying - turning from living to dead cells. The bottom 2 layers are alive and active. Cell renewal occurs here.

1-Stratum germinativum (Basal cell layer)

- Deepest layer of the epidermis.
- Lower surface is attached to the dermis.
- Dermis supplies it with nutrients.
- Mitosis occurs here.
- Cells born here are pushed up into the next layer.
- Melanocytes are also found here. These are cells that produce the pigment melanin. This is the skin's natural protection from UV rays
- Merkel cell. Touch sence

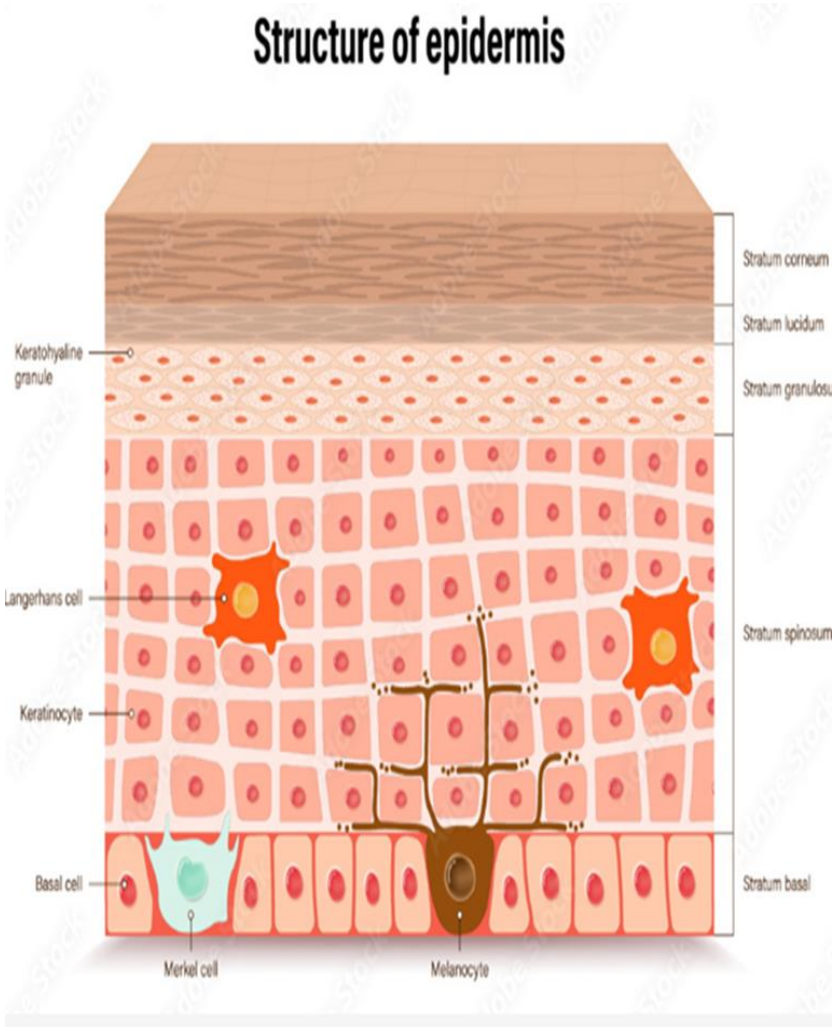


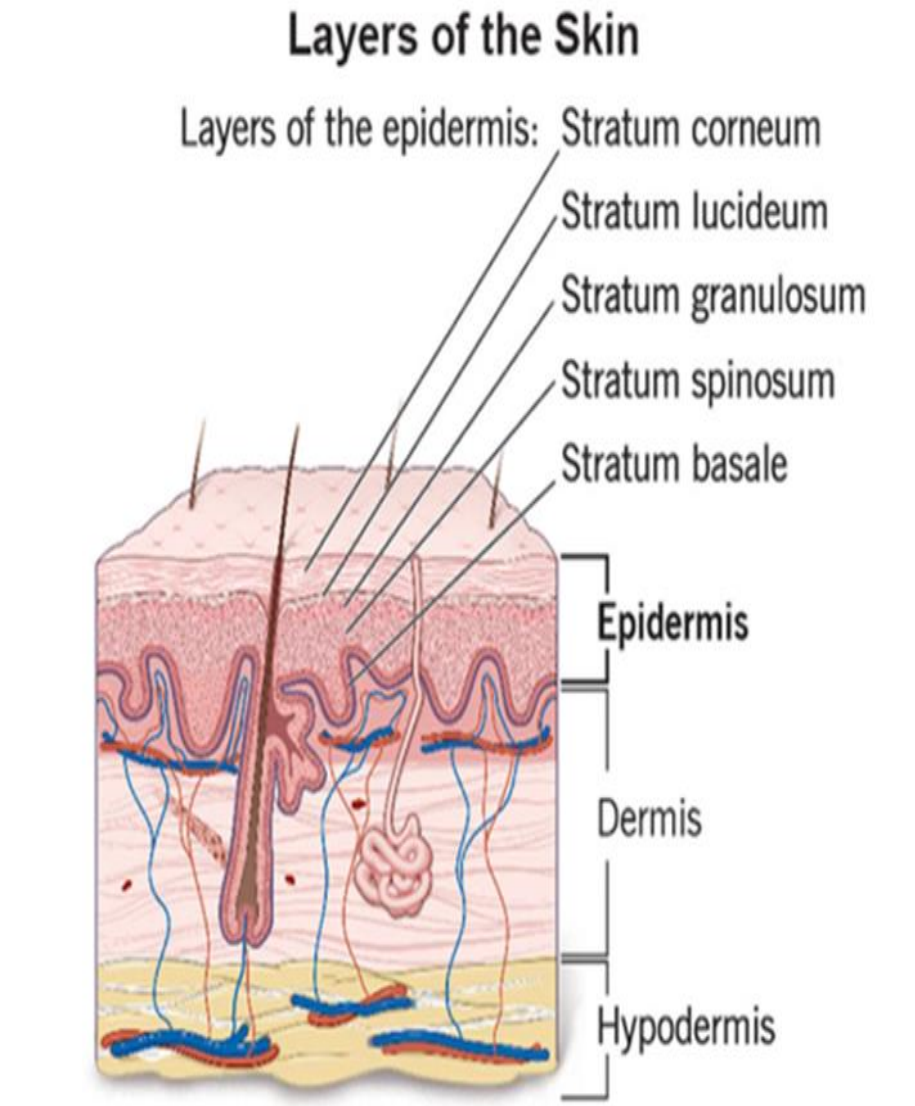
2-Stratum spinosum (Prickle cell layer)

- Next layer up containing living cells and also Langerhans cells.
- These are cells that engulf foreign particles to protect the skin.
- All cells in this layer are connected to each other by filaments.
- On the upper most layers of this section, keratinization begins. This is the change of living cells containing a nucleus into layers of flat cells composed of a hard durable protein called keratin.

3-Stratum granulosum (Granular layer)

- Cells from below have pushed up and are becoming flattened and full of keratin giving them a ‘grainy’ appearance. The nucleus dies = cells die.



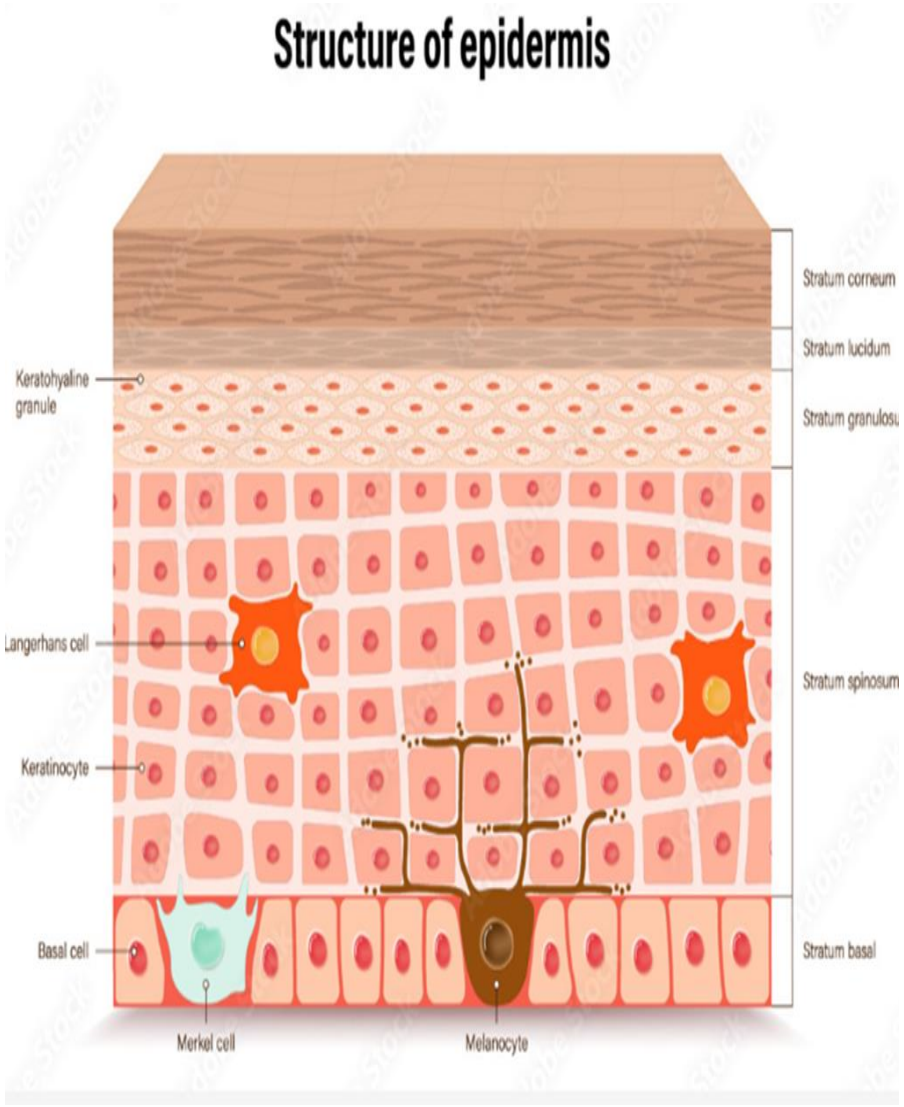


4-Stratum lucidum (Clear layer)

- At this stage all the cells are filled with keratin and therefore look clear as opposed to ‘grainy’.
- No nucleus is found here in any of the flattened cells.
- It is very evident in thick areas of skin (soles of feet).
- It is said to be very important in controlling the passage of water through the skin.

5-Stratum corneum (Horny layer)

- Several layers o f keratinised epithelial cells packed tightly together. Keratin has made them tough, dry, no nucleus and horny.
- The superficial layers are constantly being shed by a process known as desquamation.
- The cells below have a fatty substance that helps to prevent the skin from drying out and keeps it waterproof.



- The epidermis cells types:
- 1. The keratinocytes are the most common type of skin cells; these cells produce
- keratin. Keratin provides strength to skin, hair and nails. The keratinocytes are
- formed in the deep layer, migrating upwards, to reach the surface in four weeks.
- 2. Melanocytes are responsible for synthesizing the pigment, melanin, that gives
- color to the skin, and hair. Melanin protects the skin from the harmful effects of
- ultraviolet (UV) radiation. Pigmentation is heritable, regulated by genetic,
- environmental and endocrine factors.
- 3. The Langerhans cells. These cells work by ingesting antigens and bacteria that get
- into the skin.
- 4. The Merkel cells (touch receptor cells) – participate in the touch sense. The
- fingertips and the plantar aspects of the toes have a greater density than any other
- part of the body

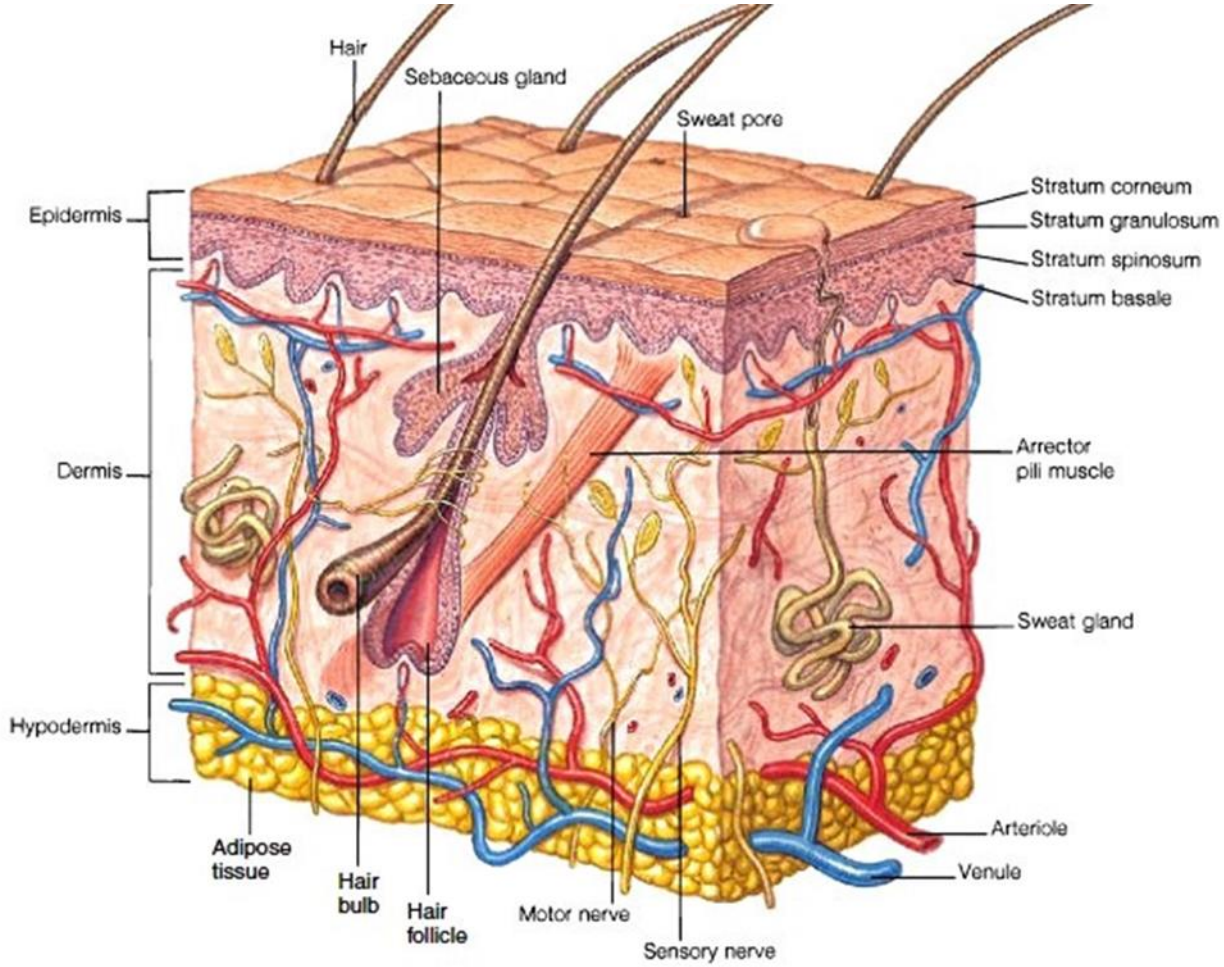
- **B. The dermis:**

- Unlike the epidermis, the dermis (sometimes also called the corium) contains blood vessels and nerves. The dermis also contains glands, hair follicle, nails, collagen and elastic fibers, which give the strength and elasticity to the skin. It made of dense connective tissue that is tough, elastic and flexible. It gives strength, shape, elasticity and smoothness to the skin. It is highly sensitive. It consists the following:

1. Collagen - protein collagen makes these white fibers. They run in parallel bundles with each other. Gives the skin strength and shape - they are inelastic but flexible.
2. Elastin - protein elastin makes up these yellow fibers. These are thinner than collagen fibers and are very elastic. They give the skin its elasticity.
3. Fibroblasts - these are cells that produce collagen and elastin fibers. Found in the dermis of the skin.
4. Mast cell - this produce heparin to thin the blood and histamine that is released during an allergic response. These cells are found very close to blood vessels.
5. Plasma cells - these cells produce anti-bodies to foreign particles, so help to fight infection in the skin.

- The dermis has 2 main areas:
- 1. Upper papillary layer: this layer is below the epidermis and the upper part of the dermis . It runs between these 2 in a wave-like manner with protrusions into the epidermis called papillae. Capillaries are found here delivering oxygen and nutrients to the skin and carrying away waste. Also nerve endings are found here sensitive to touch, cold, heat, pressure, pain.
- 2. Deep reticular layer: This layer provides elasticity and tone to the skin. It contains collagen and elastin fibers. Sweat and sebaceous glands are found here and other appendages of the skin. Many fine arteries and veins pass through here which connect up with the papillary capillaries.

C. Hypodermis/subcutaneous layer: An area where fats are made and stored. It is made of adipose tissue (energy reserve, support and protection). The hypodermis helps to insulate the body by preventing loss of heat through the skin.



The Skin Appendages

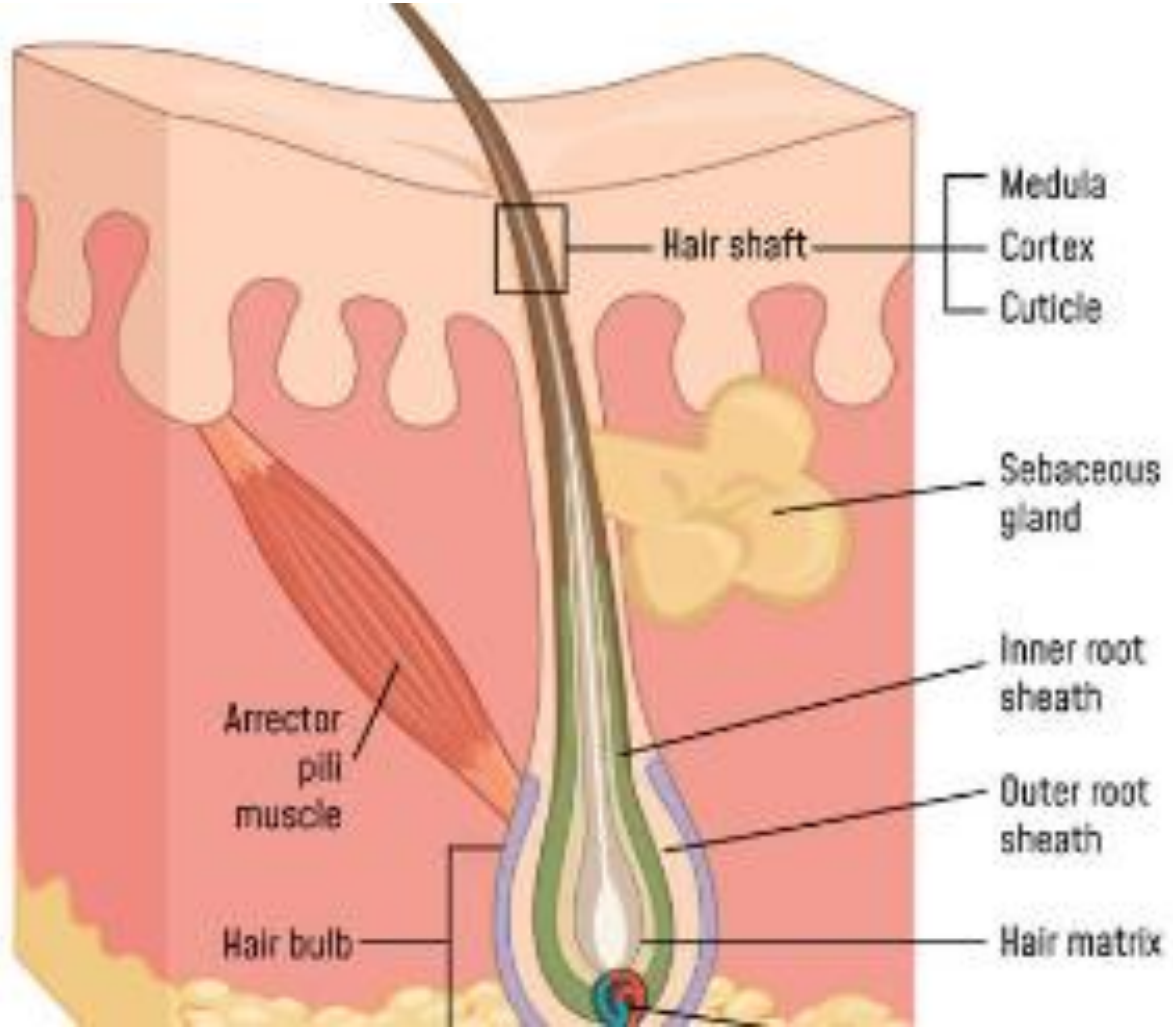
- These are referred as (derivatives of the integument). They include the hair, the nails and the glands.

The hair:

- The hair follicle is a small blind-ended tubular structure extending from the dermis through to the epidermis containing the hair root.
- Hair follicles are found all over the body except the palm and sole.
- Hair fibers are composed of a hard protein called keratin.
- Bundles of small smooth muscle fibers known as **erector pili** muscles, that are attached to the hair follicle pull the hairs erect, causing **goose** bumps responses to various stimuli including coldness, emotion and fright.
- Like skin, hair color is determined by the pigment melanin, that is produced by melanocytes surrounding the hair shaft. Gray hair occurs as melanin production decreases with the age.

Hair shaft is made up three layers:

- **Cuticle:** The cuticle is the outermost **layer**. Made of flattened cells that protects the inside of the **hair** shaft from damage
- **Cortex** Between hair cuticle and medulla It is the thickest **hair** layer. It also contains most of the **hair's** pigment, giving the **hair** its color.
- **Medulla** Innermost layer of hair shaft. This nearly invisible layer is the softest and fragile, and serves as marrow of the hair

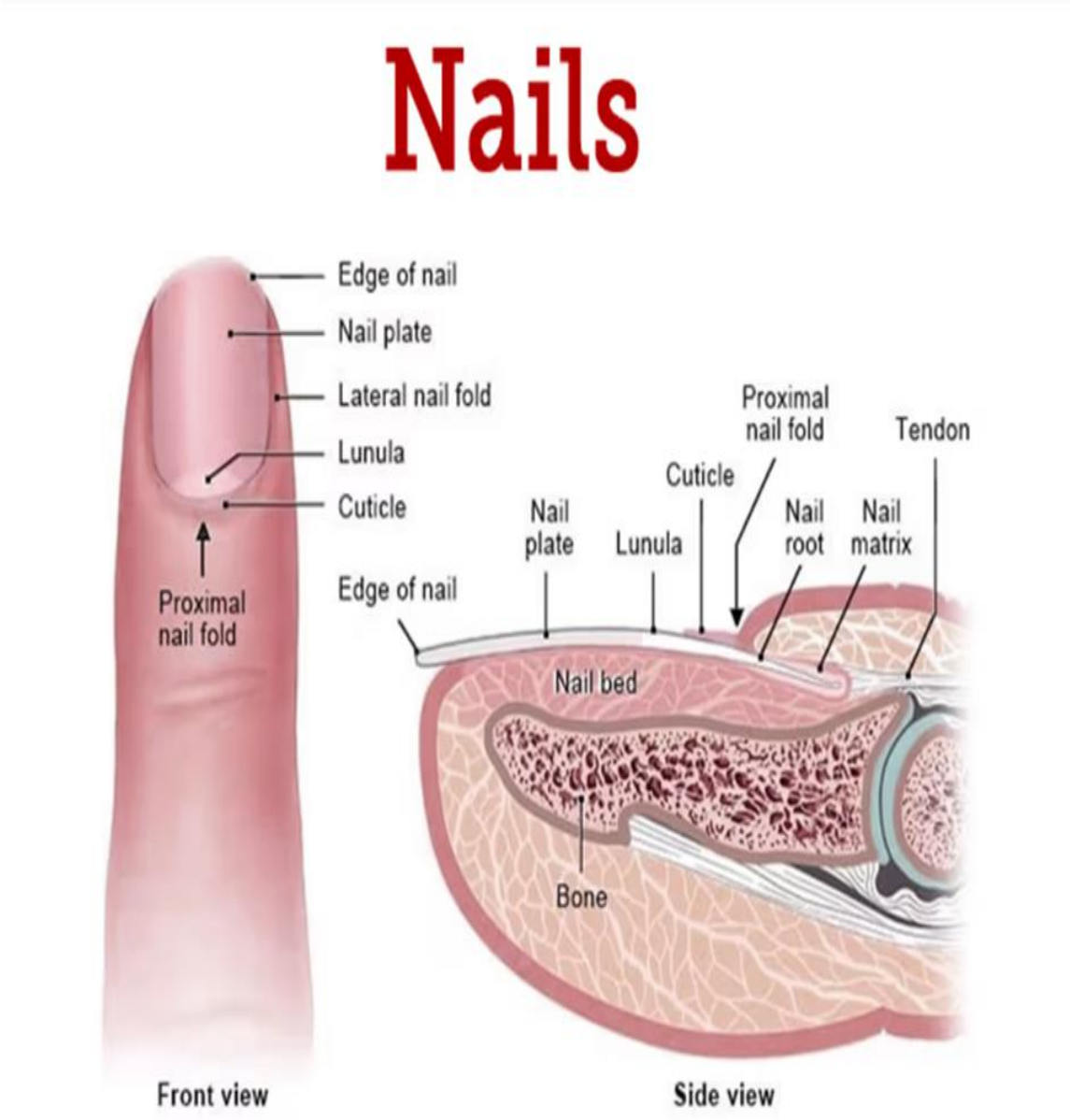


• 2- The nail:

- Nails develop from the thickened areas of epidermis located at the tips of fingers, thumbs and toes. They are composed of the protein keratin, growing continuously. Nails Keratinized plates at the dorsal surface of the tip of fingers

Parts of the nail

- .The proximal edge of the plate is the root of the nail. With the exception of the distal edge of the plate, the nail is surrounded and overlapped by folds of skin known as nail folds. The surface of skin covered by the nail is the nail bed.



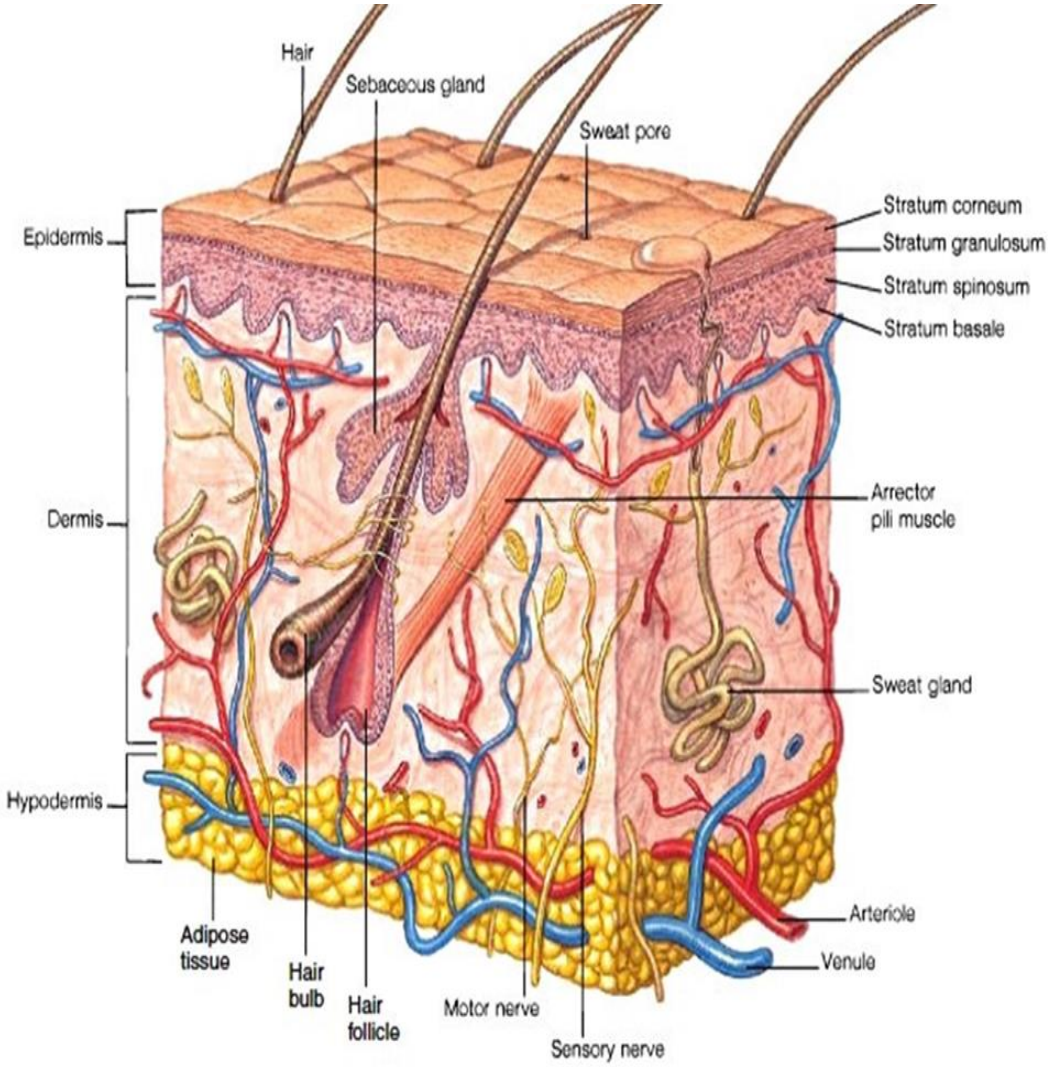
- 3- The glands:

- **1. The sebaceous glands:**

- These are oil-secreting glands located in the dermis which secrete sebum. Sebaceous glands are related to hair follicle by short ducts; so, absent on the palms or soles. Sebum lubricates both the skin and hair and preventing their dryness. It also restricts the growth and development of certain bacteria.

- **2. The sweat (sudoriferous) glands:**

- These glands are found in the dermis, and their key function is to regulate body temperature by evaporation. The sweat reaches the skin surface through an opening called a pore. These glands are found over most of the body but are most numerous in the palms, soles, forehead, and axilla.



3.The ceruminous(ear wax) glands:

- These glands are located in the subcutaneous tissue below the dermis; they secrete cerumen (ear wax) into the ear canal. Cerumen with the hairs in the outer ear, prevents foreign particles from getting into the ear itself; (e.g., dust, or sand)



Functions of The Skin

- 1. Protection against external physical, chemical and biological attacks: a. By the production of melanin against the harmful effects of UV light.
- b. By antibacterial activity: Antibacterial chemicals in the sebum, acidic PH of
- the sweat, and phagocytic macrophages present in the dermis have the ability
- to ingest and destroy viruses and bacteria.
- 2. Thermoregulation:
- It prevents water escaping from the body, so preventing dehydration, in addition
- to sweating regulates body temperature by evaporation.
- 3. Sensation:
- There are several sensory receptors on the skin which have the ability to sense;
- pain, temperature, pressure; vibration, tickling and irritations. Some areas of the
- body have more sensory receptors than others, for example, the lips, genitalia and
- tips of the fingers.
- 4. Excretion and absorption:
- a. Excretion: The skin has the ability to excrete substances from the body by
- sweating, such as; water, sodium, and urea.
- b. Absorption: The skin has the ability to absorb substances; such as, therapeutic
- medications, but toxic substances too.

Note: Your integumentary system is your body’s outer layer. It consists of your skin, hair, nails and glands. These organs and structures are your first line of defense against bacteria and help protect you from injury and sunlight. Your integumentary system works with other systems in your body to keep it in balance.

Ministry of Higher Education and Scientific Research
Al-Furat Al-Awsat Technical University
Najaf Medical Technical Institute
Aesthetic and Laser Department
Histology and Anatomy

Lecture 5
superficial anatomy

Dr. Rabab Ali Al-Mosawi

superficial anatomy of human body

- superficial anatomy (Surface Anatomy)A branch of gross anatomy that examines shapes and markings on the surface of the body as they relate to deeper structures. Health-care personnel use surface anatomy to help diagnose medical conditions and to treat patients.

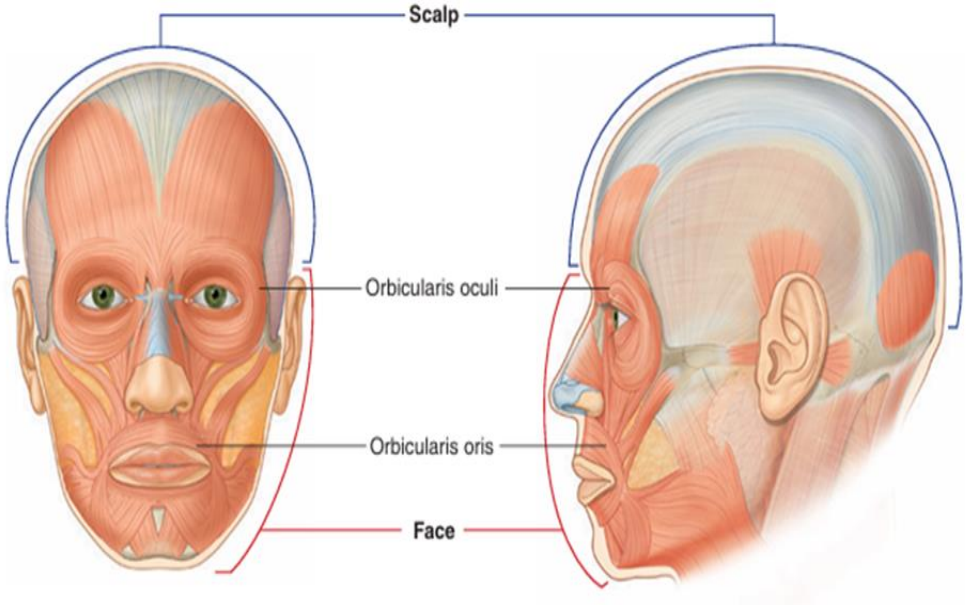
Surface Anatomy four techniques when examining

1. **Visual inspection** directly observes the structure and markings of surface features.
2. **Palpation** feeling with firm pressure or perceiving by the sense of touch) precisely locate and identify anatomic features under the skin.
3. **Percussion** taps sharply on specific body sites to detect resonating vibrations.
4. **Auscultation** listens to sounds omitted from organs.

Cranium

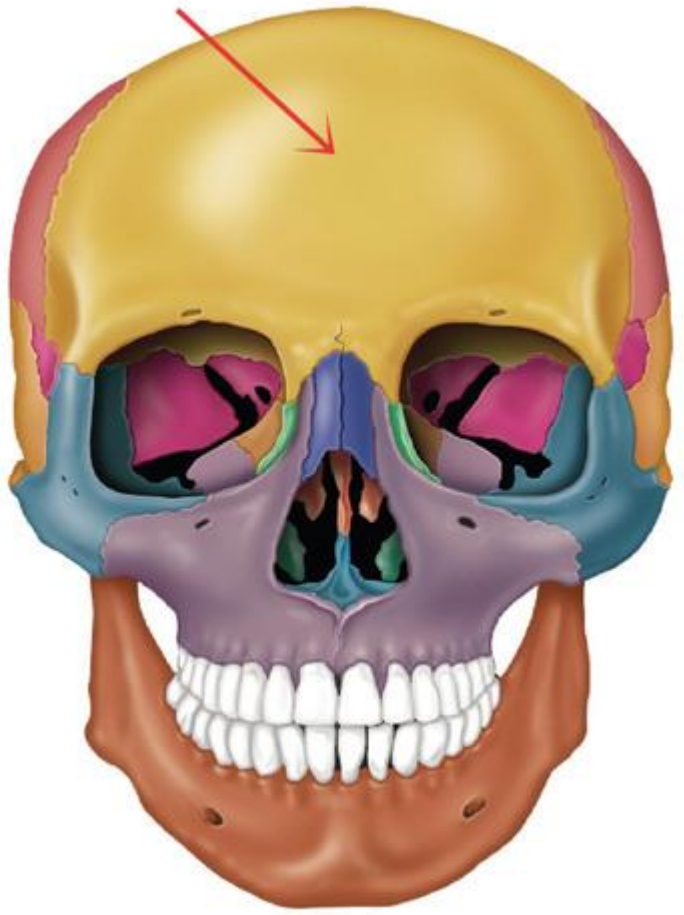
scalp

- (cranial region or brain case) is covered by the scalp, which is composed of skin and subcutaneous tissue.



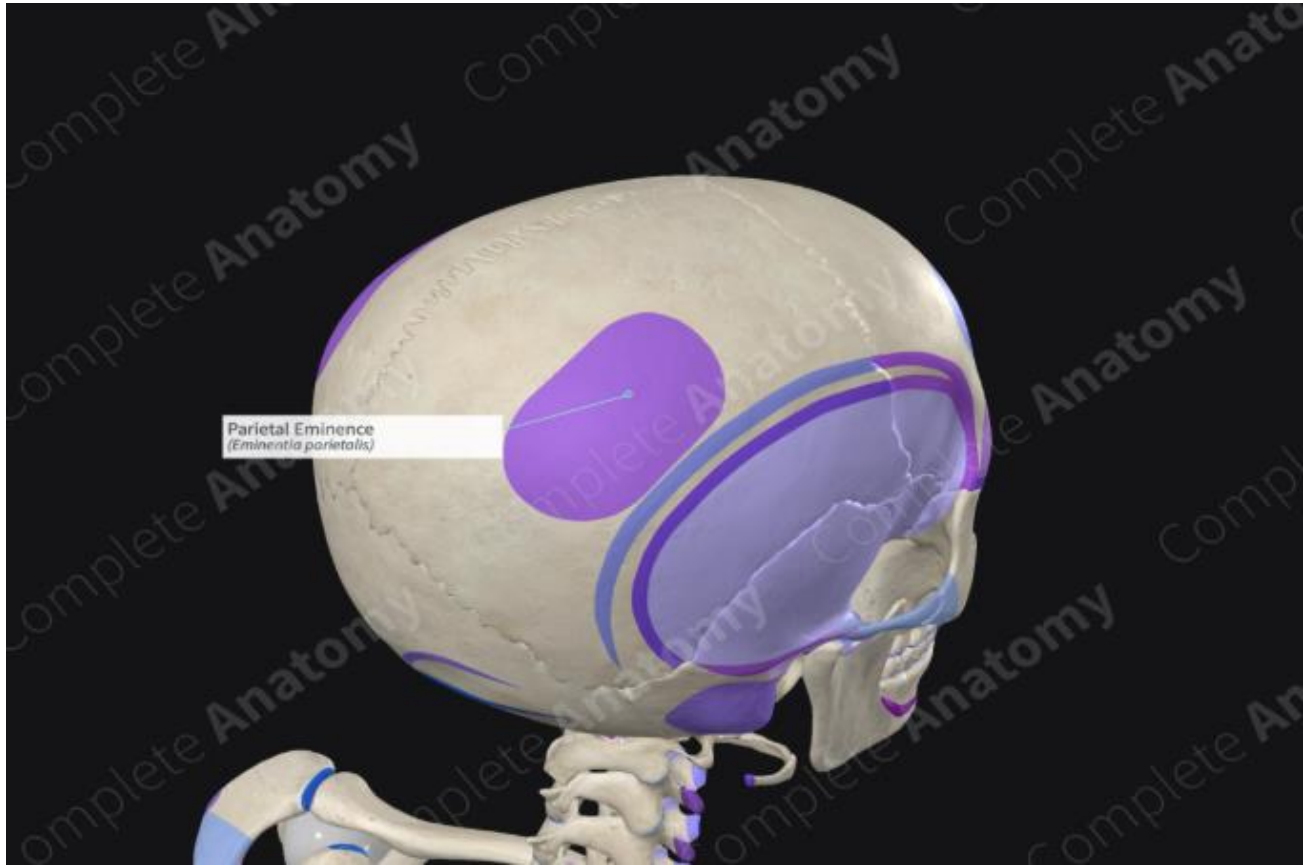
The cranium is divided into three regions:

1. **Frontal region**
   - Forms the forehead
   - Covered by the frontalis muscle
   - Lies over the frontal bone
   - Ends at the superciliary arches (eyebrows)



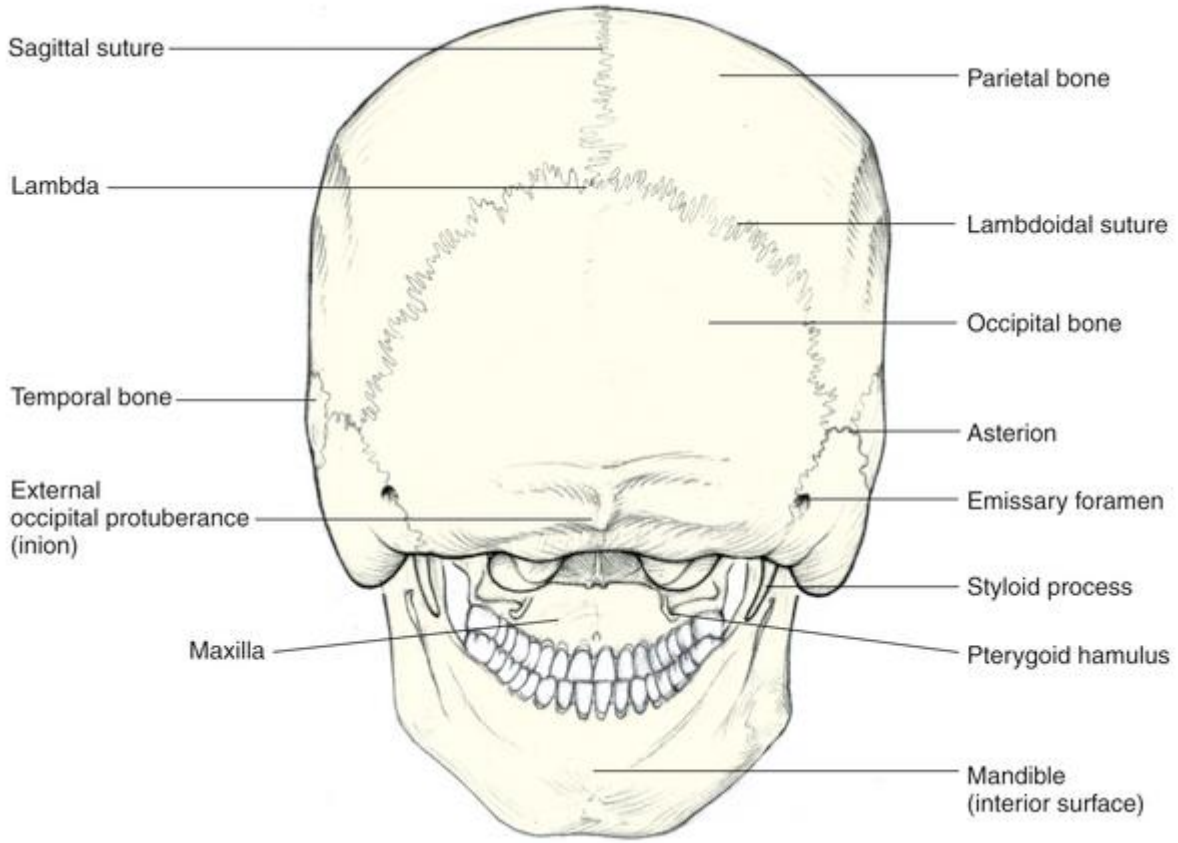
Parietal region

- Forms the sides and roof of the skull
- Covered by the parietal bones
- Important landmark: the parietal eminence



Occipital region

- Forms the back of the head
- Covered by the occipital bone
- Has a bony prominence called the external occipital protuberance



Face

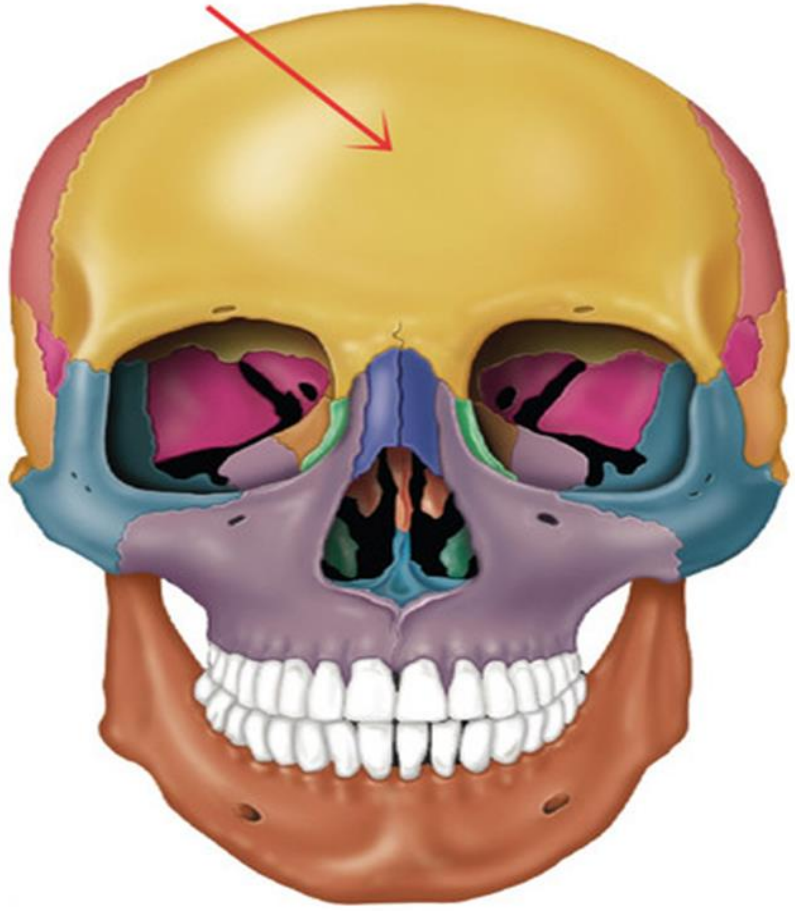
The face is divided into four regions:

The ocular region, which includes the eye and associated structures.

The auricular region, which includes the ear.

The nasal region, which includes the external and internal structures of the nose.

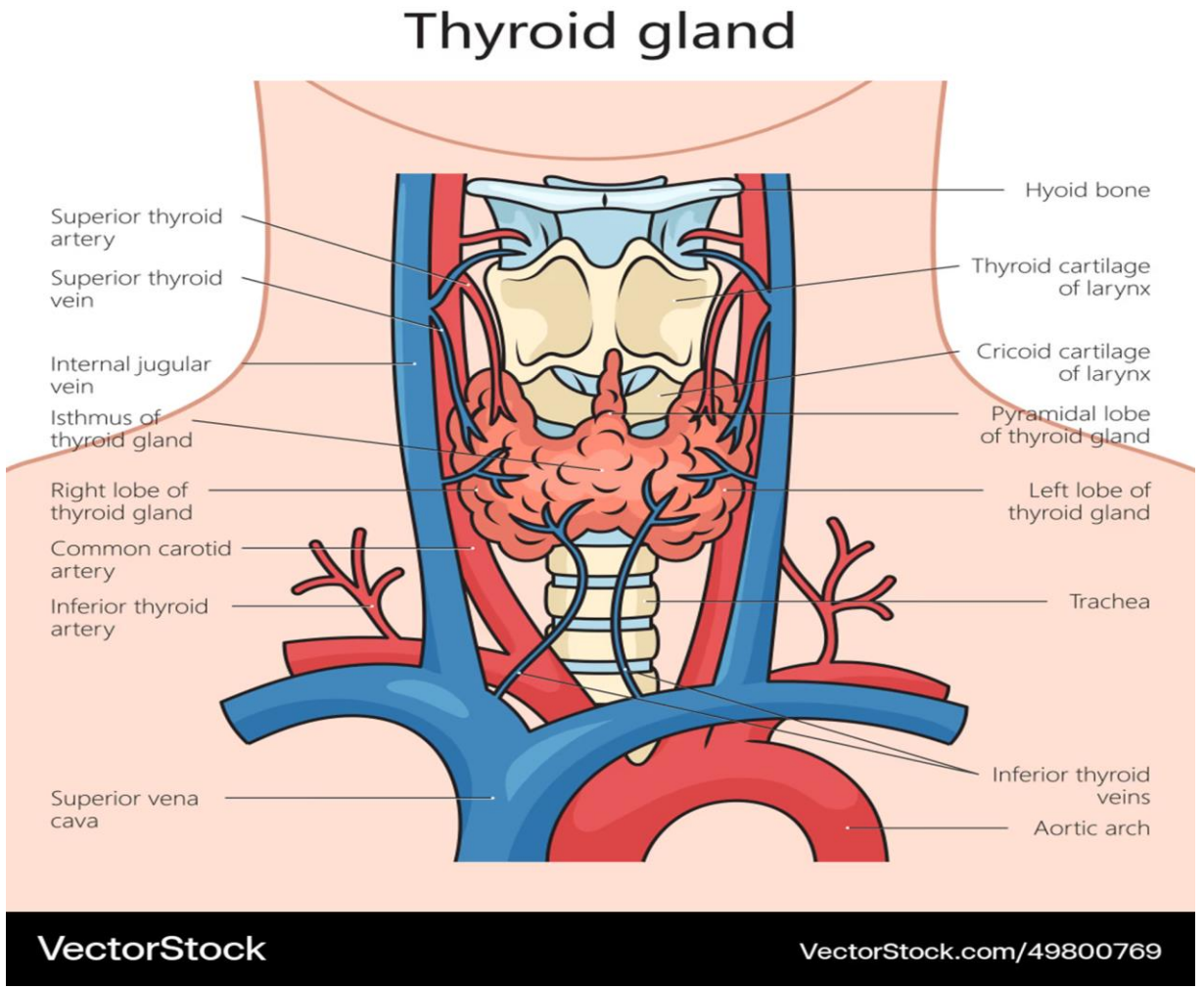
The oral region, which includes the mouth and associated structures.



Neck

Neck/cervical region: is a complex region that connects the head to the trunk. Spinal cord, nerves, trachea, esophagus, and major vessels traverse this highly flexible area. Neck contains other organs and several important glands.

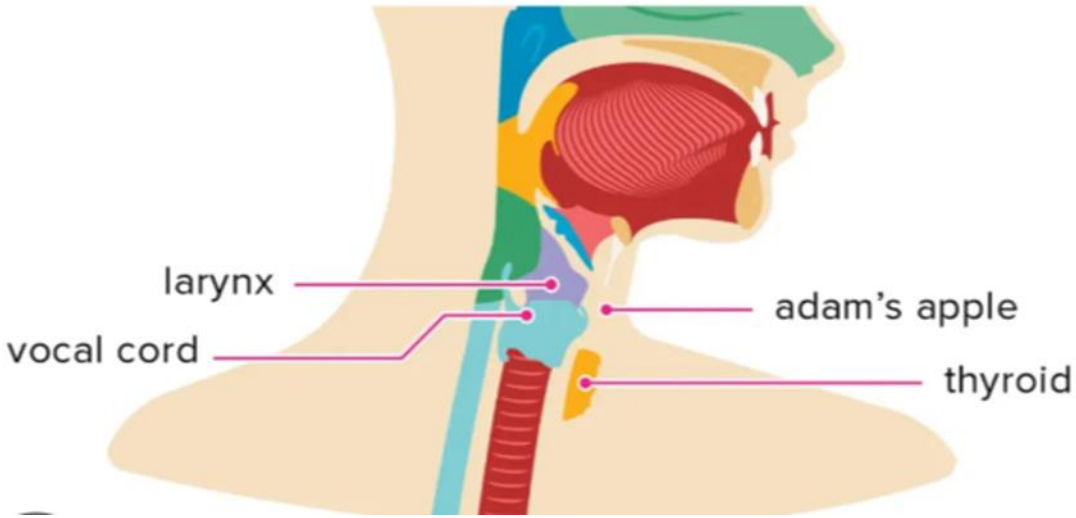
Neck can be subdivided into anterior, posterior, and lateral regions.



The Anterior Region of the Neck

Has several palpable landmarks, including the larynx, trachea, and sternal notch.

The larynx found in the middle of the neck composed of multiple cartilages, thyroid cartilage “Adam’s apple” Inferior to the larynx are the cricoid cartilage and trachea. Terminates at the sternal notch and the left and right clavicles.



The Nuchal Region

The posterior neck region Houses the spinal cord, cervical vertebrae, and associated structures.

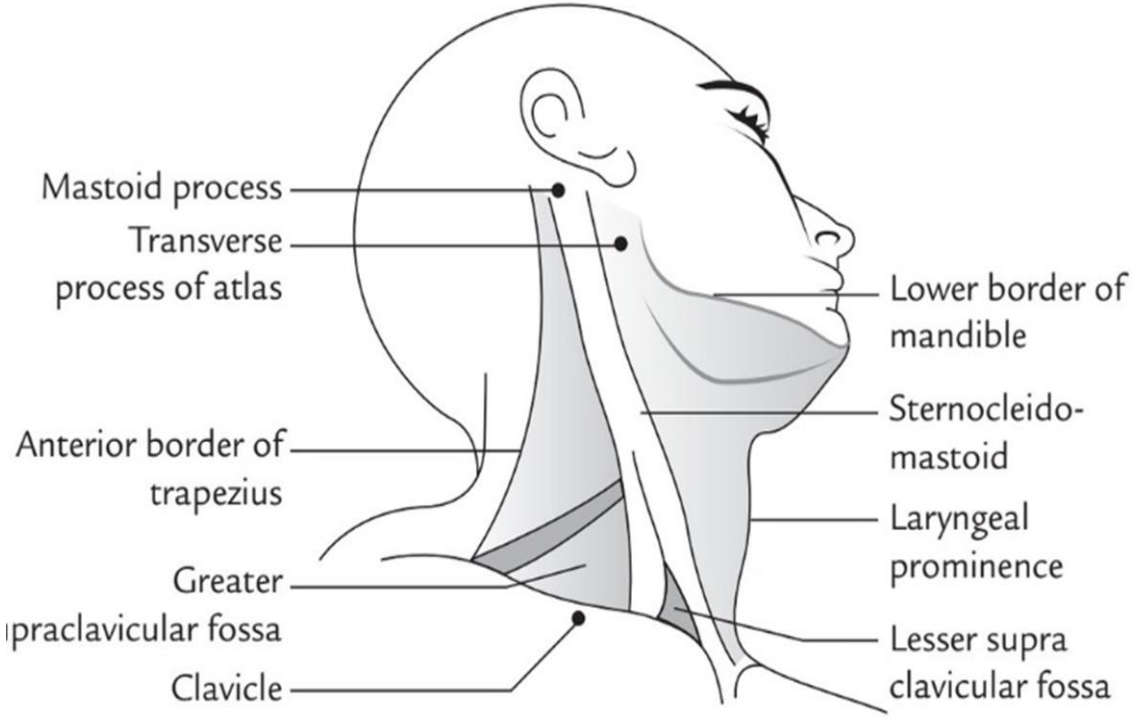
Left and Right Lateral Portions of the Neck
Triangles of the Neck

Contain the sternocleidomastoid muscles which partitions the neck into two clinically important triangles, an anterior triangle, and a posterior triangle.

Each triangle houses important structures that run through the neck

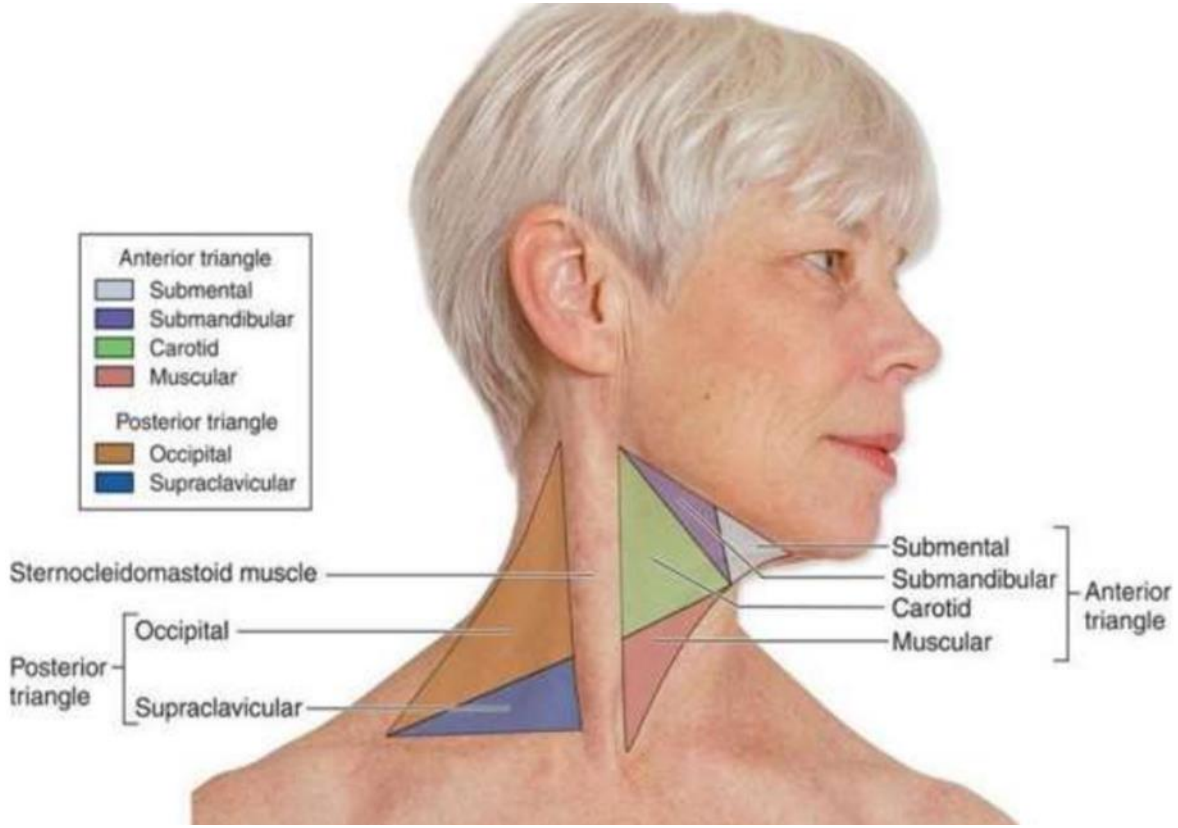
.**Anterior triangle** lies anterior to the sternocleidomastoid muscle and inferior to the mandible. subdivided into four smaller triangles: the submental, submandibular, carotid, and muscular triangles.

The Carotid Triangle The strong pulsation is the common carotid artery is palpated. Contains the internal jugular vein and some cervical lymph node.



Posterior triangle

is broken up into two smaller triangles. Occipital triangle and supraclavicular triangle



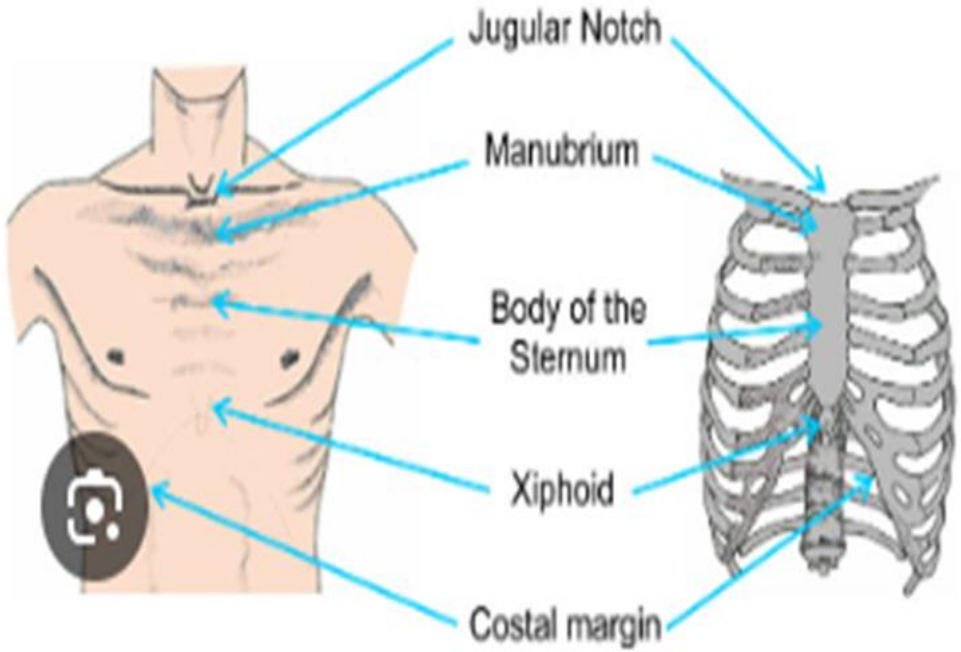
Thorax

- The superior portion of the trunk sandwiched between the neck superiorly and the abdomen inferiorly. Consists of the chest and the “upper back.” On the anterior surface of the chest are the two dominating surface features of the thorax.

The clavicles and the sternum

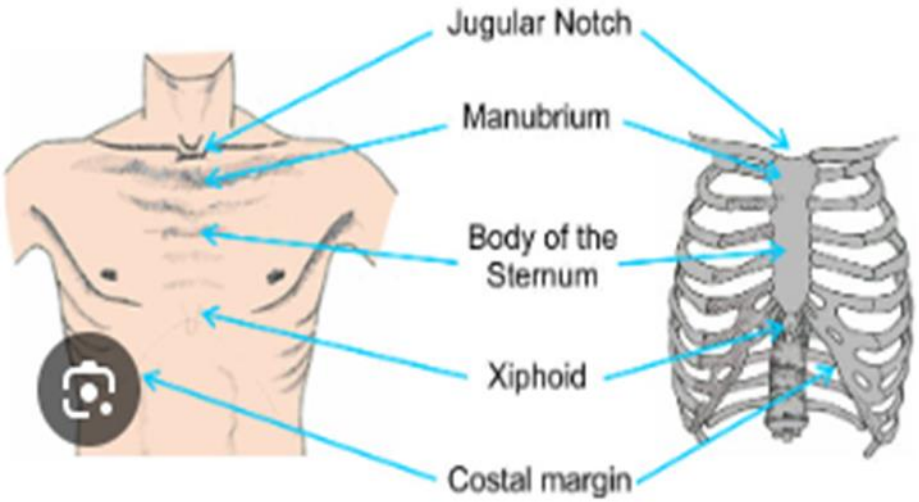
The Clavicles

Paired clavicles and the sternal (jugular) notch represent the border between the thorax and the neck. Left and right costal margins of the rib cage form the inferior boundary of the thorax. Costal angle (costal arch) is where the costal margins join to form an inverted V at the xiphoid process. Most of the ribs (except for the first one) can be palpated



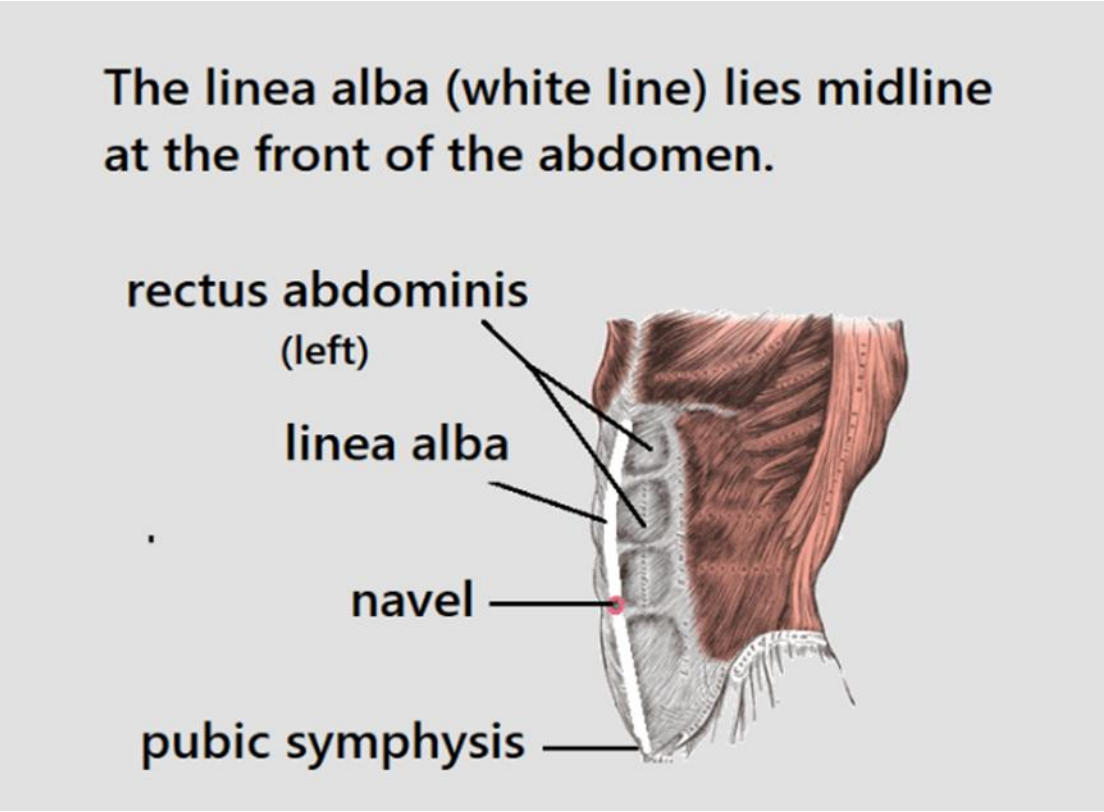
The Sternum

Palpated readily as the midline bony structure in the thorax. The manubrium, the body, and the xiphoid process may also be palpated. Sternal angle can be felt as an elevation between the manubrium and the body. Sternal angle is clinically important because it is at the level of the costal cartilage of the second rib. it is often used as a landmark for counting the ribs.



The Abdomen

On the anterior surface of the abdomen, the umbilicus (navel) is the prominent depression or projection in the midline of the abdominal wall. In the midline of the abdominal anterior surface is the Linea alba, a tendinous structure that extends inferiorly from the xiphoid process to the pubic symphysis. The superior aspect of the ilium (iliac crest) terminates anteriorly at the anterior superior iliac spine. Attached to the anterior superior iliac spine is the inguinal ligament, which forms the lower boundary of the abdominal wall.



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L6 &7
Human body tissues

Dr. Rabab Ali Al-Mosawi

Tissues

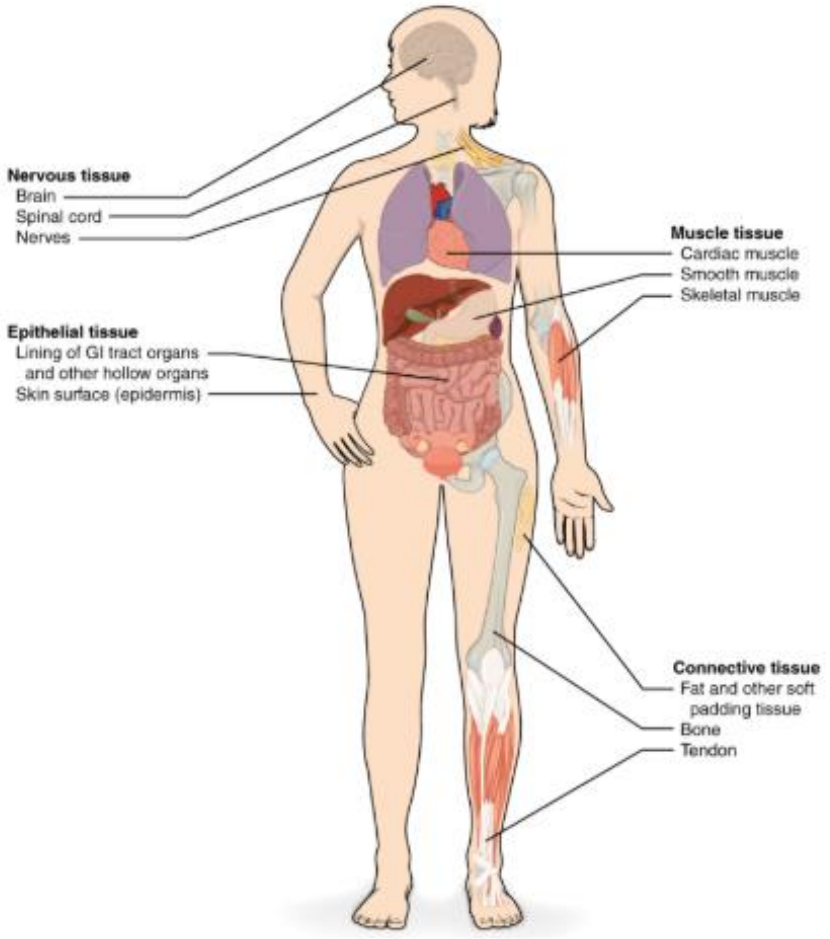
There are 4 basic types of tissue:

Epithelial tissue

Connective tissue

Muscle tissue

Nervous tissue.



Human body tissues; types and characteristic

- **Histology** (Gr. histo, web or tissue, + logos, study) is the study of the tissues of the body and of how these tissues are arranged to constitute organs.
- Tissues A level of organization in multicellular organisms; it consists of a group of structurally and functionally similar cells and their intercellular material.

Epithelial tissues:

- • An epithelium (pl., epithelia) is composed of one or more layers of closely aggregated polyhedral cells with very little extracellular substance(matrix) between these cells.
- • These cells have strong adhesion.
- These features allow the cells to form cellular sheets that cover the surface of the body and line its cavities or are arranged as three-dimensional secretory units
- No blood vessels penetrate an epithelium.
- The principal functions of epithelial tissues:

1. Covering, lining, and protecting surfaces (e.g. skin)
2. Absorption (e.g. the intestinal lining)
3. Secretion (e.g. glands)
4. Sensations: contain nerve endings to detect changes in the external environment at their surface

Classification of Epithelial Tissue

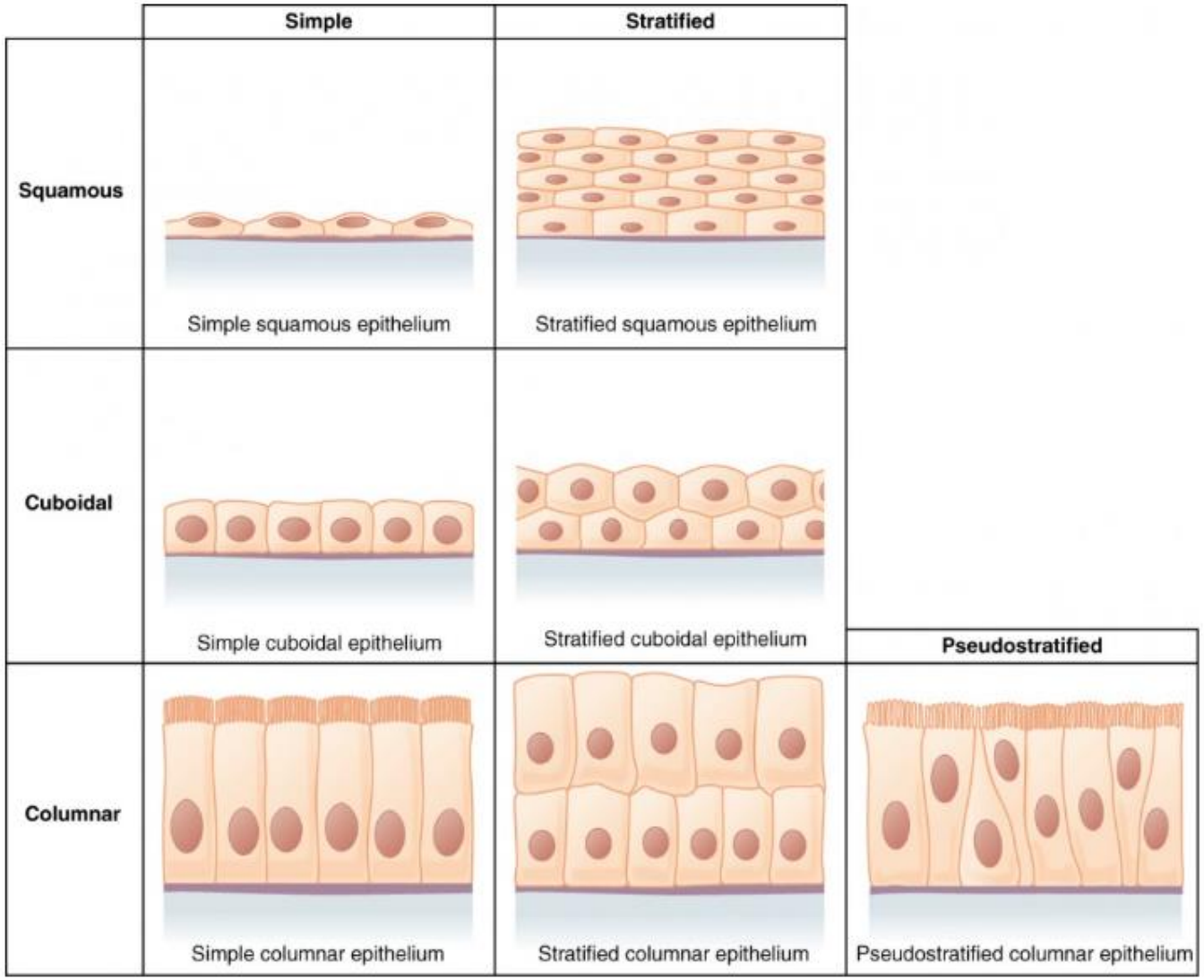
- Epithelia are divided into two main groups according to their structure and function:

1.Covering & lining epithelia form the outer layer of the skin; lines open cavities of the digestive and respiratory systems; covers the walls of organs of the closed ventral body cavity.

2. Glandular epithelia form the glands within the body.

Epithelial Tissue

A type of body tissue that forms the covering on all internal and external surfaces of your body, lines body cavities and hollow organs and is the major tissue in glands.

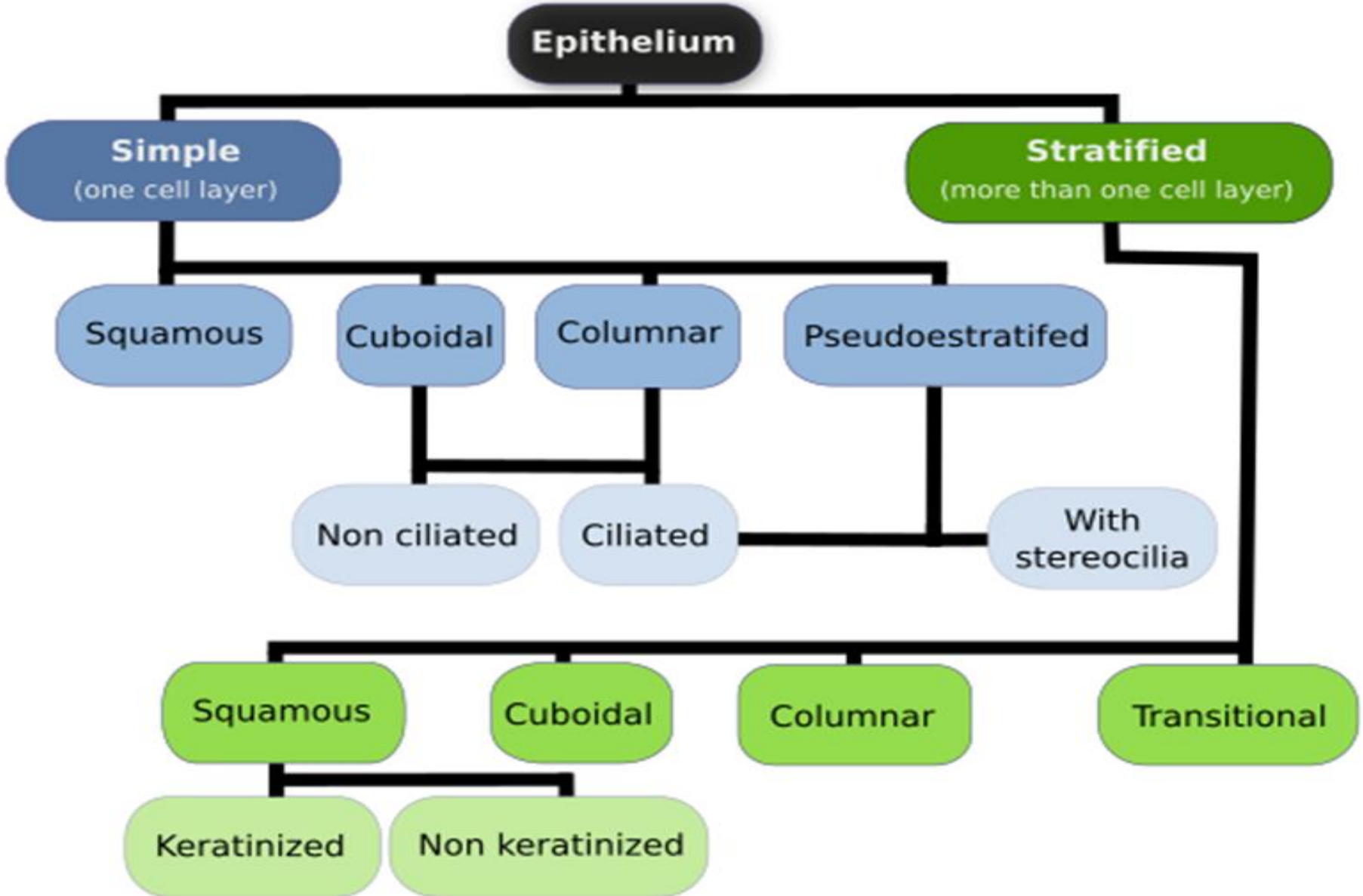


Covering & lining Epithelia:

They can be classified according to the number of cellular layers into:

A. Simple epithelium: a single layer of cells with every cell in direct contact with the basement membrane that separates it from the underlying connective tissue.

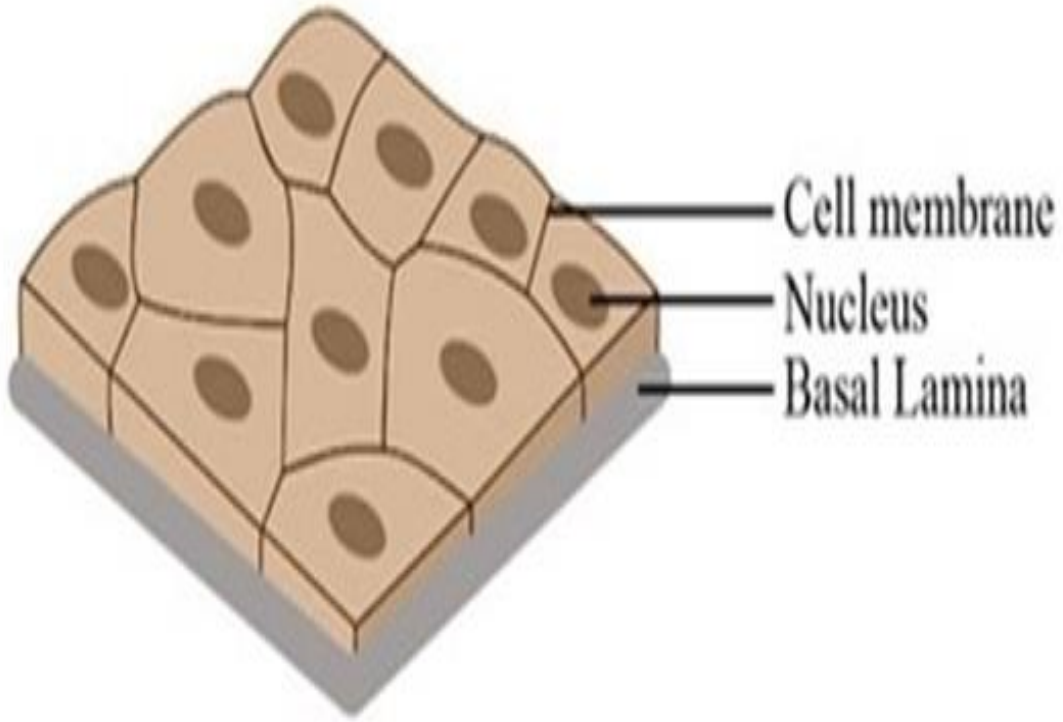
Basement membrane: • A thin, fibrous, extracellular matrix that separates the epithelial tissue from underlying connective tissue.


Epithelium
Simple
(one cell layer)
Stratified
(more than one cell layer)
Squamous
Cuboidal
Columnar
Pseudoestratifed
Non ciliated
Ciliated
With
stereocilia
Squamous
Cuboidal
Columnar
Transitional
Keratinized
Non keratinized

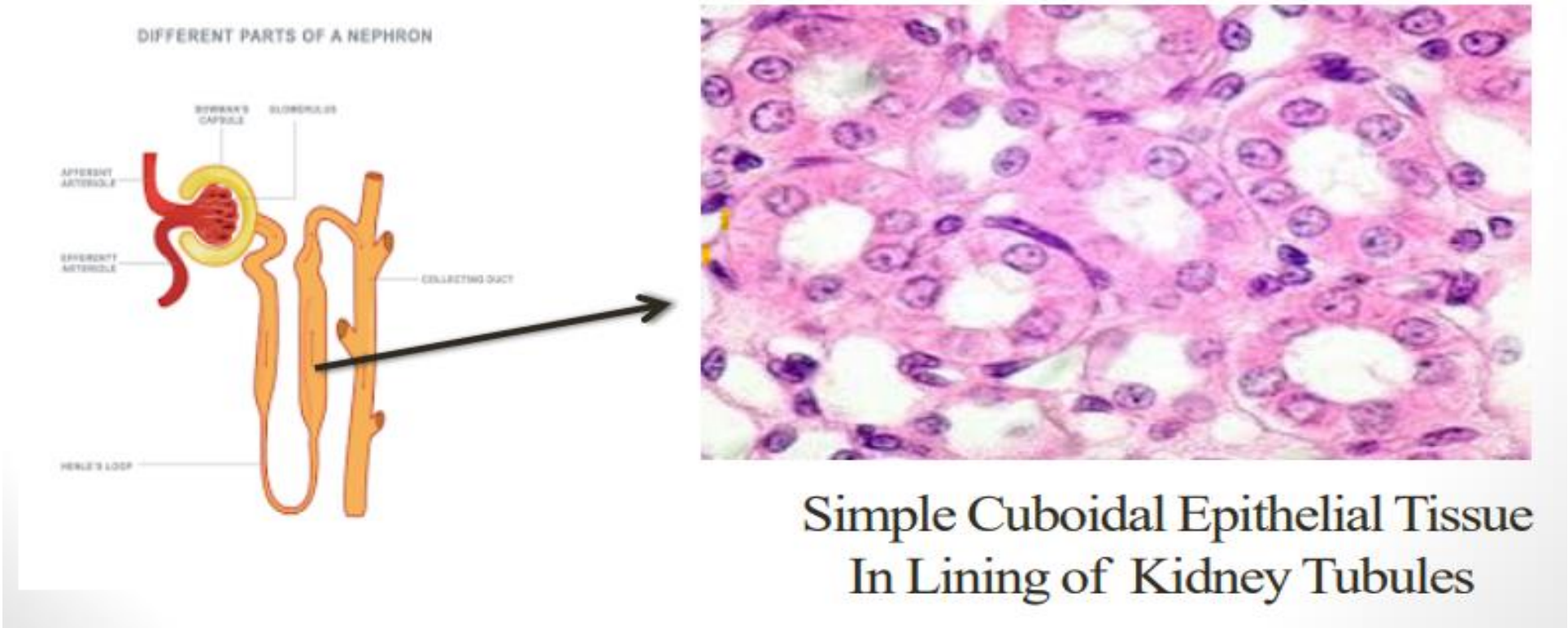
A. Simple epithelium

1-**Simple Squamous Epithelium**: • flat in shape (scales) and arranged in a single layer, the cell is irregular in shape and has a disk-shaped flattened nucleus.

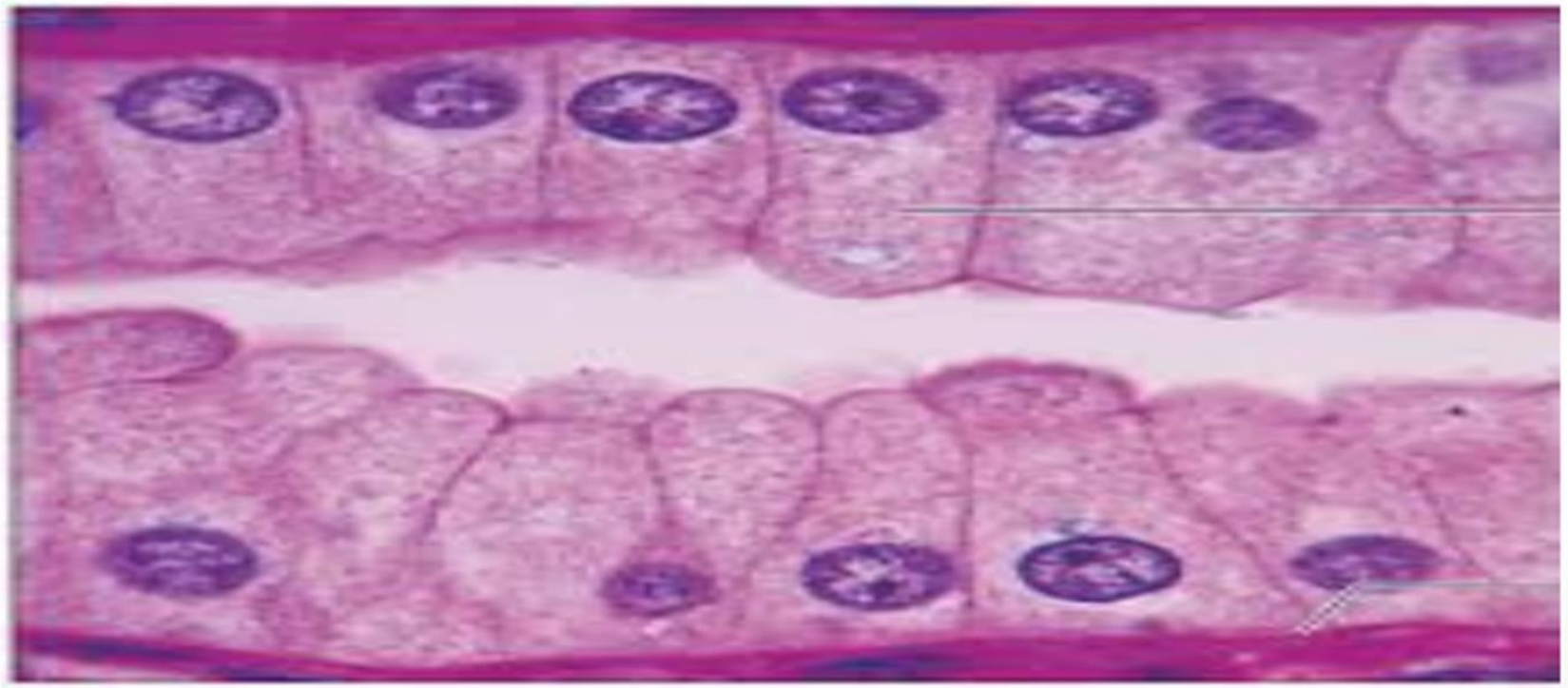
Both the endothelial lining of blood vessels and the mesothelial lining of the body cavities (pericardial, pleural and peritoneal) as well as the external surfaces of visceral organs are simple squamous epithelium.



Simple Cuboidal Epithelial Tissue • Single layer of cube-like cells. • With large, spherical central nuclei. Found in lining of Kidney tubules.



Simple Columnar Epithelial Tissue • Single layer of column-shaped cells with oval nuclei. • Some bear cilia at their apical surface • May contain goblet cells. • Function: Absorption; secretion of mucus, enzymes, and other substances • Divided to ciliated and non ciliated.

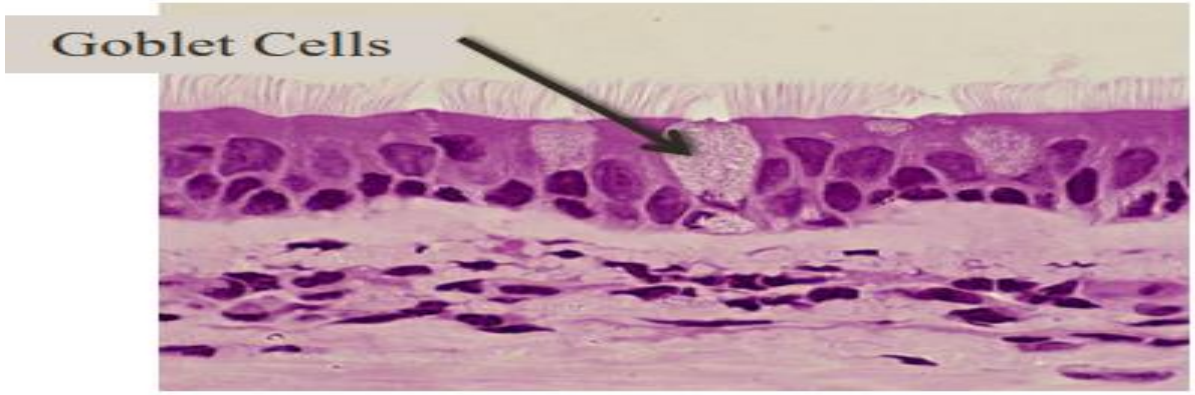


Simple Columnar Epithelial Tissue (non ciliated) In lining of stomach

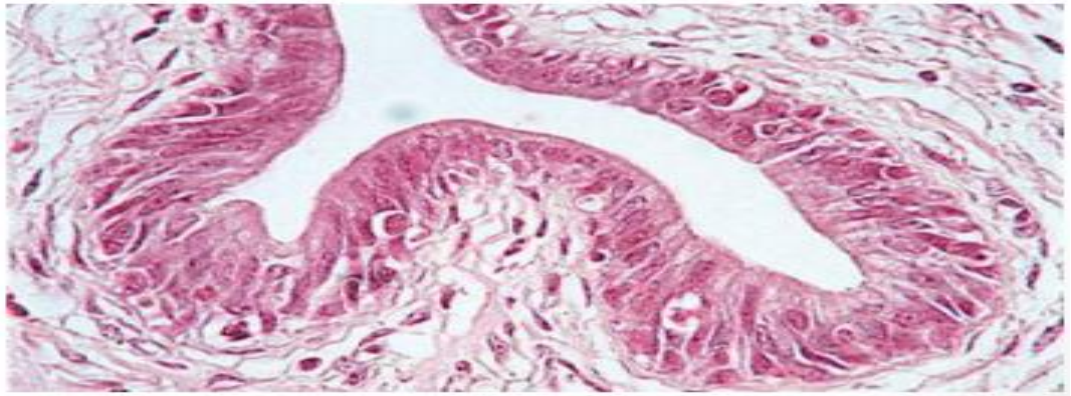
Pseudo stratified Columnar Epithelium

- All cells originate at basement membrane
- Only tall cells reach the apical surface
- May contain goblet cells and bear cilia
- Nuclei lie at varying heights within cells
- Gives false impression of stratification

- Pseudostratified Columnar Epithelium (ciliated) lines Trachea and most Upper respiratory tract
- Pseudostratified Columnar Epithelium (non-ciliated) line Duct of male reproductive tubes.



Pseudo stratified Columnar Epithelial Tissue (ciliated) Lines trachea and most of upper respiratory tract



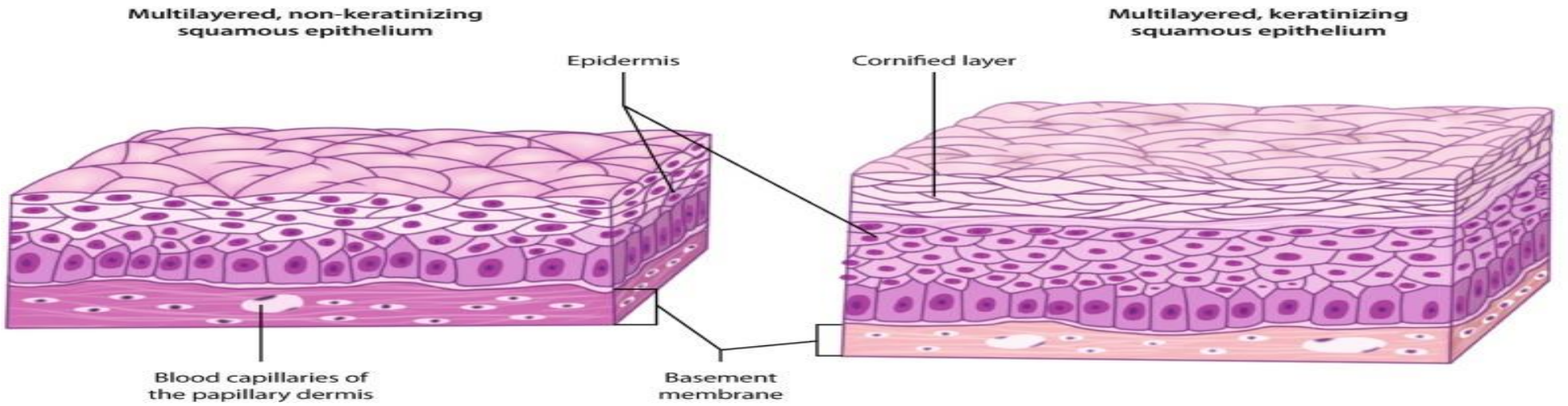
Pseudo stratified Columnar Epithelial Tissue (non ciliated) Line Ducts of male reproductive tubes

B. Stratified epithelium

- Stratified epithelia consist of two (or more) cell layers: basal layer, (intermediate layer or layers) and superficial or apical layer. The basal cells divide by mitosis and push apically to replace the older apical cells.
- The nomination of stratified epithelia depends on shape of the cells in the apical layer. The following tissues are known: -

1-Stratified Squamous Epithelium

- Many layers of cells – squamous in shape
- Deeper layers of cells appear cuboidal or columnar
- Thickest epithelial tissue – adapted for protection.
- Divided to Keratinized found in epidermis of skin and non-Keratinized epidermis of mouth



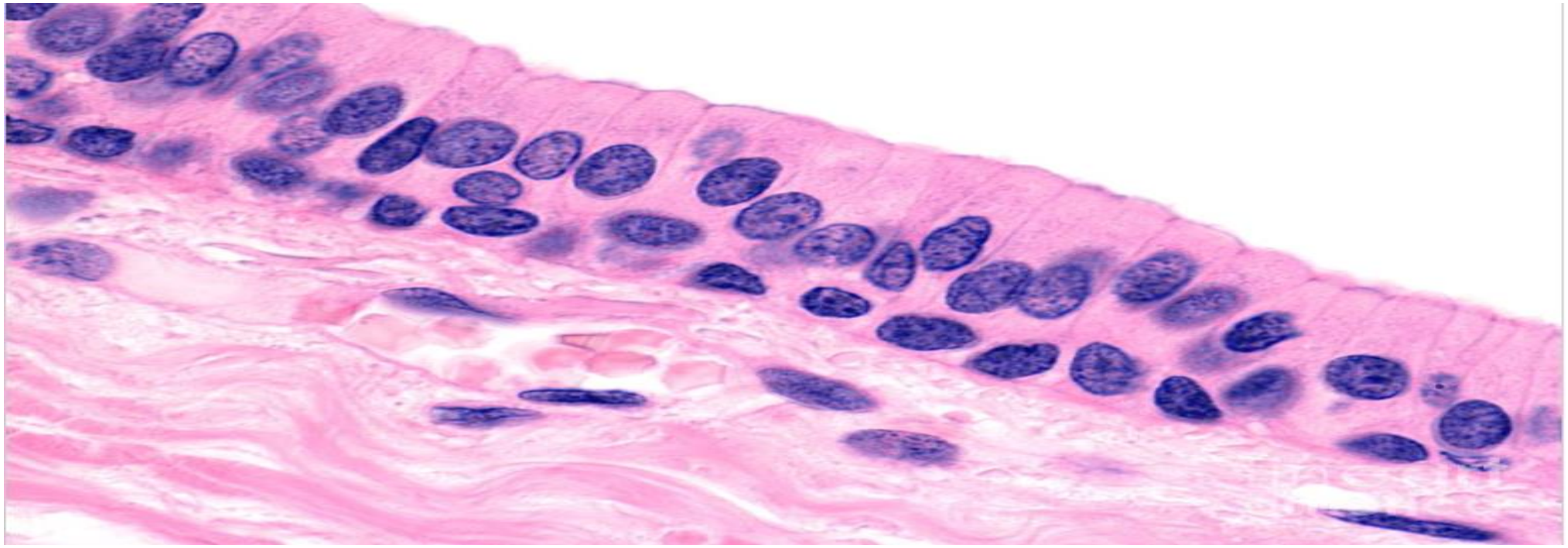
2-Stratified cuboidal epithelium:

- This type of epithelium is not as common Lines some ducts (sweat glands, mammary glands, and salivary glands)
- Typically composed of two to three layers of cells, with cuboidal cells forming the apical (surface) layer.



3-Stratified columnar epithelium

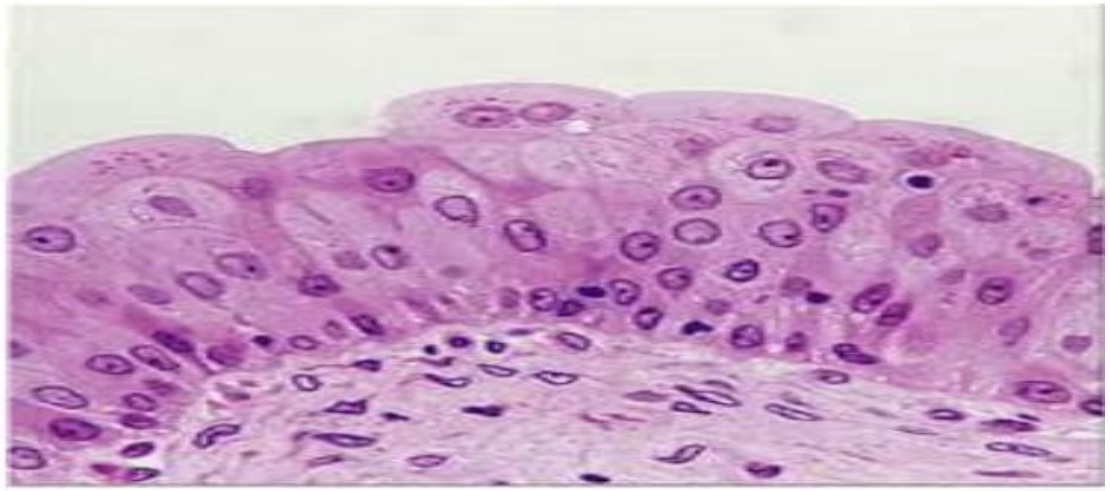
- is a rare type of epithelial tissue composed of column-shaped cells arranged in multiple layers. It is found in the con junctiva, pharynx, anus, and male urethra. It also occurs in embryo.

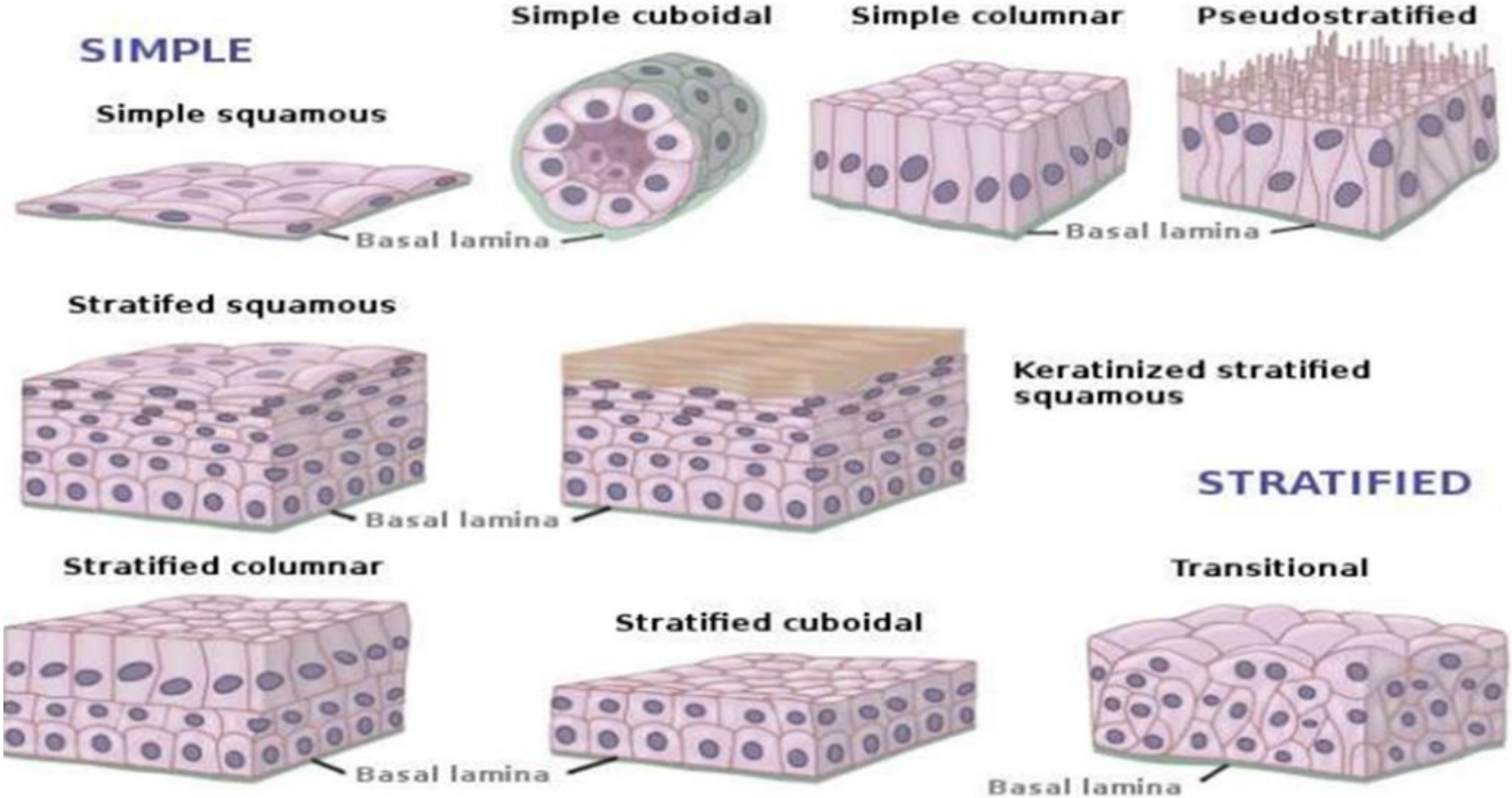


Transitional Epithelium

- Basal cells usually cuboidal or columnar
- Superficial cells dome-shaped or squamous
- Function: stretches and permits distension of urinary bladder
- Location :Lines ureters, urinary bladder and part of urethra.





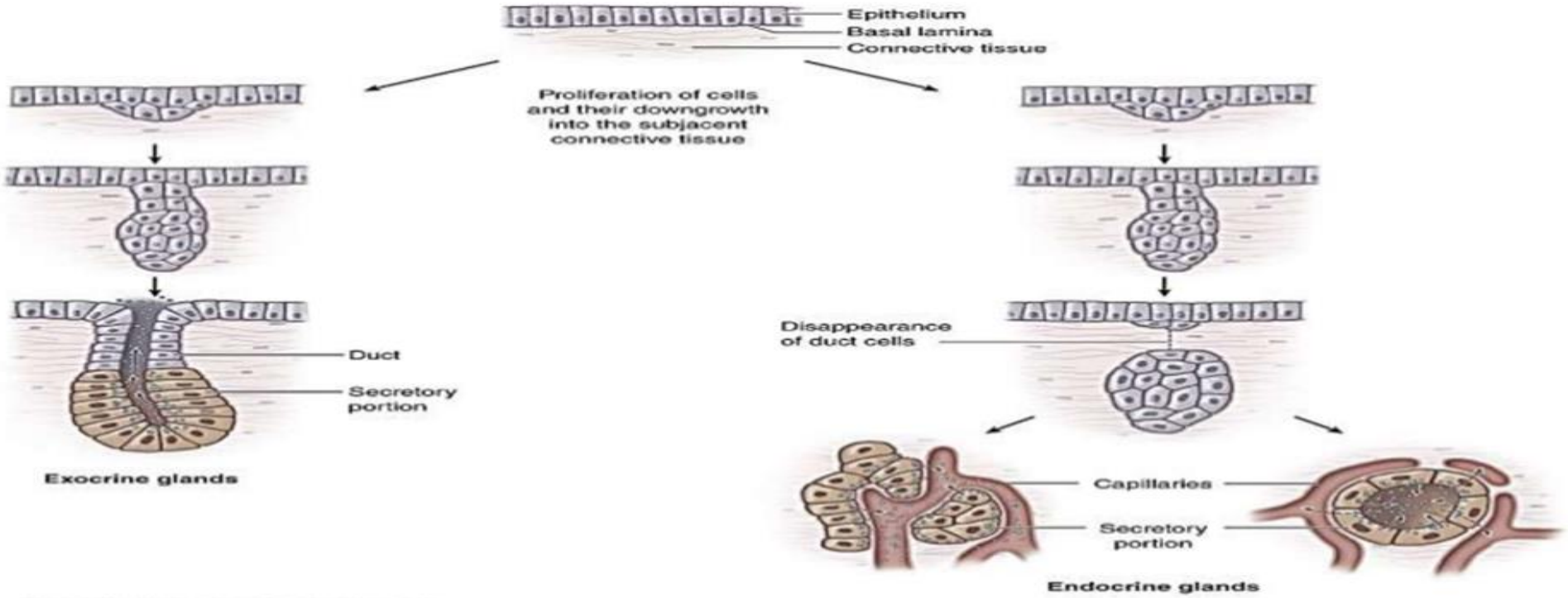

SIMPLE
Simple squamous
Simple cuboidal
Simple columnar
Pseudostratified
Basal lamina
Basal lamina
Stratifed squamous
Keratinized stratified squamous
STRATIFIED
Basal lamina
Stratified columnar
Stratified cuboidal
Transitional
Basal lamina
Basal lamina

2-Glandular Epithelial Tissue:

- Formed by cells specialized to produce secretion.
- As epithelial tissue develops in the embryo, small invaginations from this epithelium into the underlying connective tissue give rise to specialized structures called glands
- Glands are either individual cell (unicellular) or multicellular organs composed predominately of epithelial tissue.
- Glands perform a secretory function by producing substances either for use elsewhere in the body or for elimination from the body.
- Glandular secretions include mucin, hormones, enzymes, and waste products.
- Glands are classified as endocrine &exocrine depending upon whether they have a duct connecting the secretory cells to the surfaces of an epithelium.

• **Endocrine glands** lack ducts and secrete their products directly into the interstitial fluid and bloodstream.

• The secretions of the endocrine glands, called hormones, act as chemical messengers to influence cell activities elsewhere in the body .

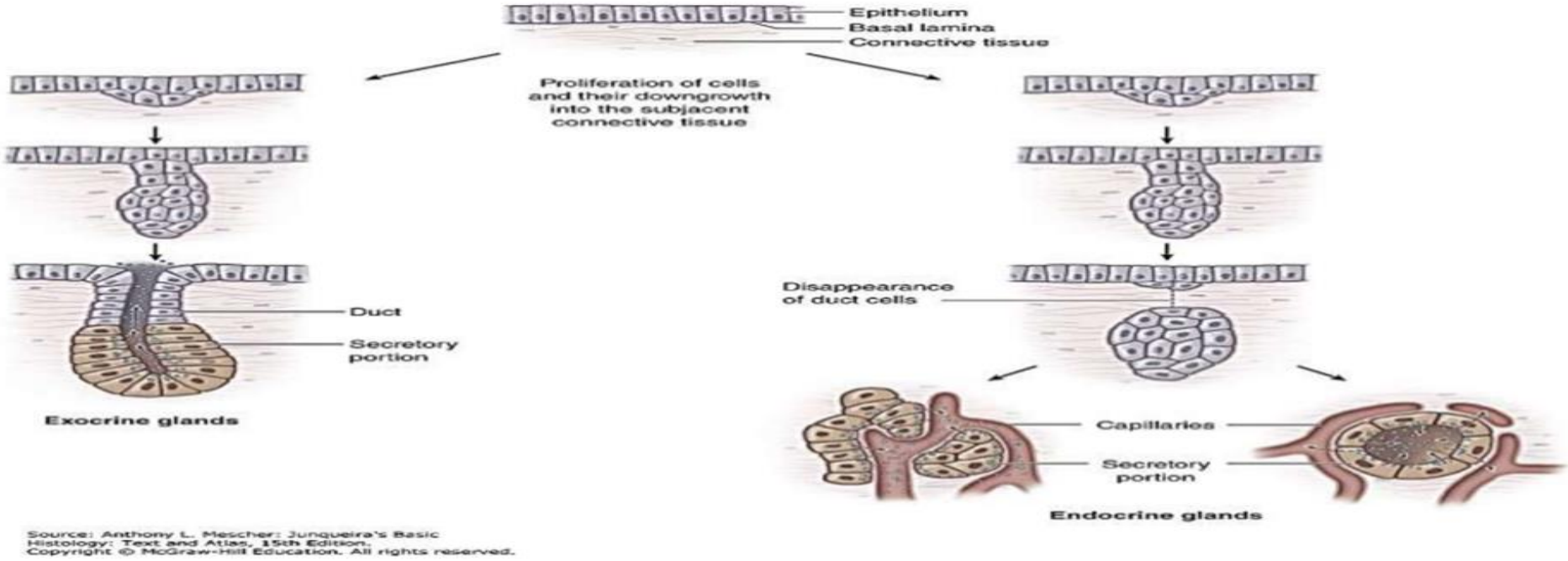


Source: Anthony L. Mescher: Junqueira's Basic Histology: Text and Atlas, 15th Edition.
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• **Exocrine glands:**

• These glands usually maintain their contact with the epithelial surface by means of a duct.

• A duct is an epithelium-lined tube through which secretions of the gland are discharged onto the epithelium surface.



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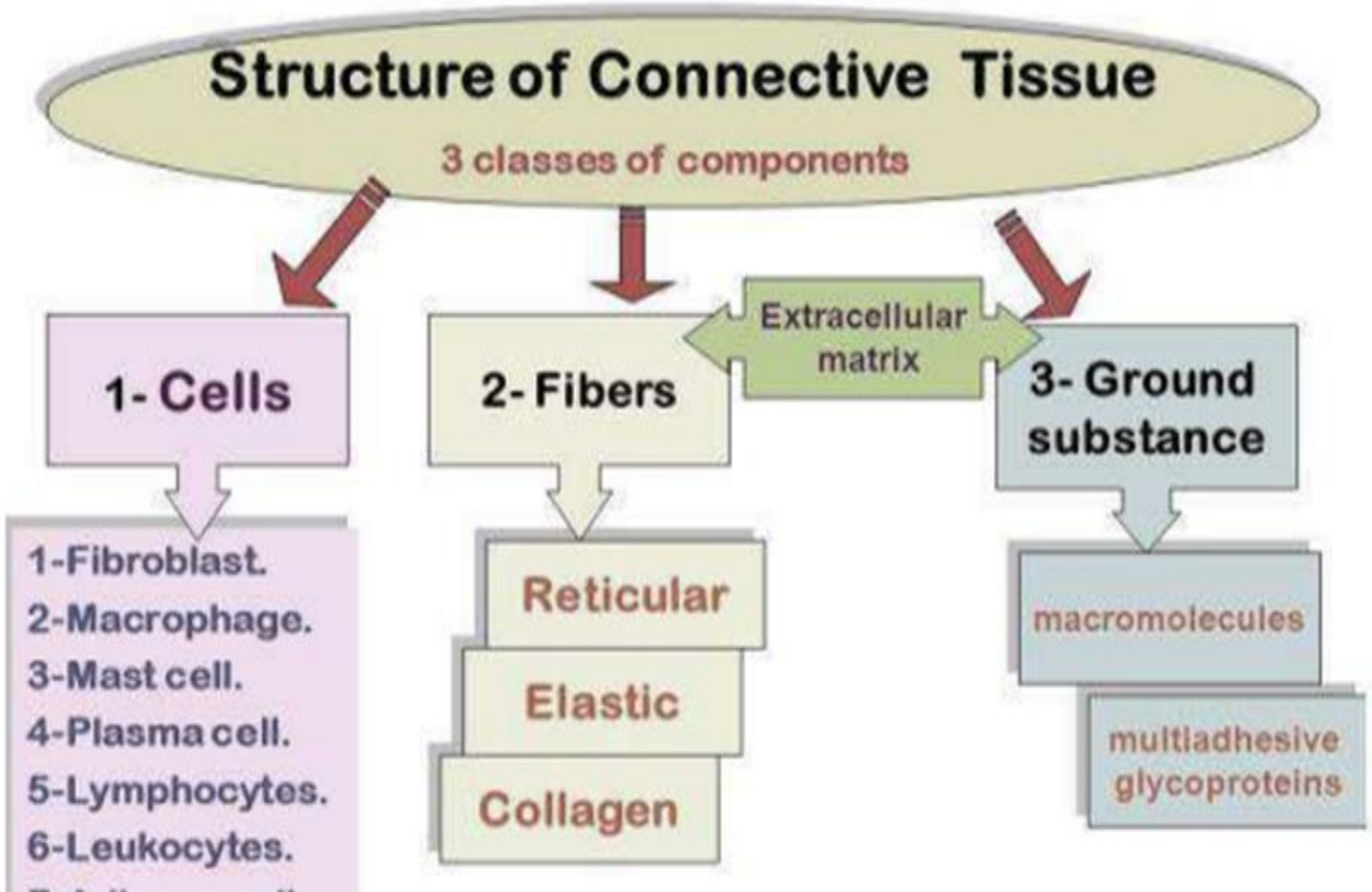
Connective Tissues

- The most diverse, abundant, widely distributed tissues.
- It is designed to support, protect, and bind organs.
- It is the "glue" that binds body structures together.

Structurally, connective tissue is formed by three classes of components:

Connective Tissue

The most diverse, abundant, widely distributed tissues.
• It is designed to support, protect, and bind organs.
• It is the "glue" that binds body structures together.
Structurally, connective tissue is formed by three classes of components



Functions of Connective Tissue:

1. Physical Protection
2. Support and Structural Framework
3. Binding of Structures: Ligaments bind bone to bone; tendons bind muscle to bone; dense irregular connective tissue binds skin to underlying muscle to bone.
4. Storage.
5. Transport
6. Immune Protection:

Classification of Connective Tissues

- The three broad categories of connective tissue are classified according to the characteristics of their ground substance and the types of fibers found within the matrix.

Connective tissue proper	Supportive connective tissue	Fluid connective tissue
Loose connective tissue **Areolar** **Adipose** **Reticular**	**Cartilage** **Hyaline** **Fibrocartilage** **Elastic**	**Blood**
Dense connective tissue **Regular elastic** **Irregular elastic**	**Bones** **Compact bone** **Cancellous bone**	**Lymph**

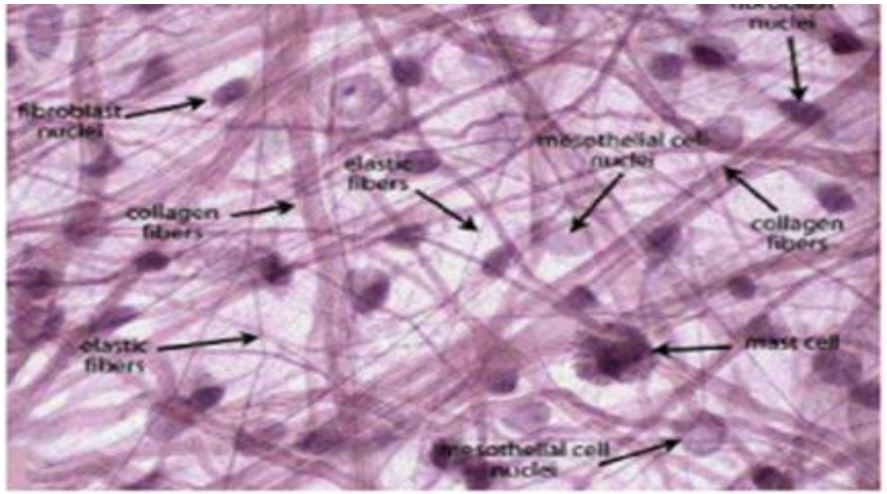
Connective tissue proper

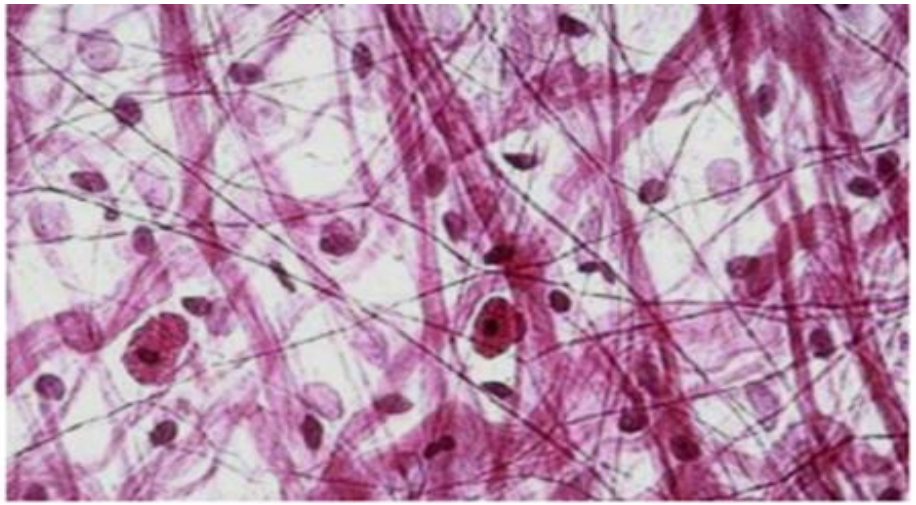
Loose **Connective tissue**

1-Areolar connective tissue Contains all of the cell types of connective tissue proper, although, the predominant cell is the fibroblast.

- a viscous ground substance occupies the spaces between fibers.
- found nearly everywhere in the body. It surrounds nerves, blood vessels,

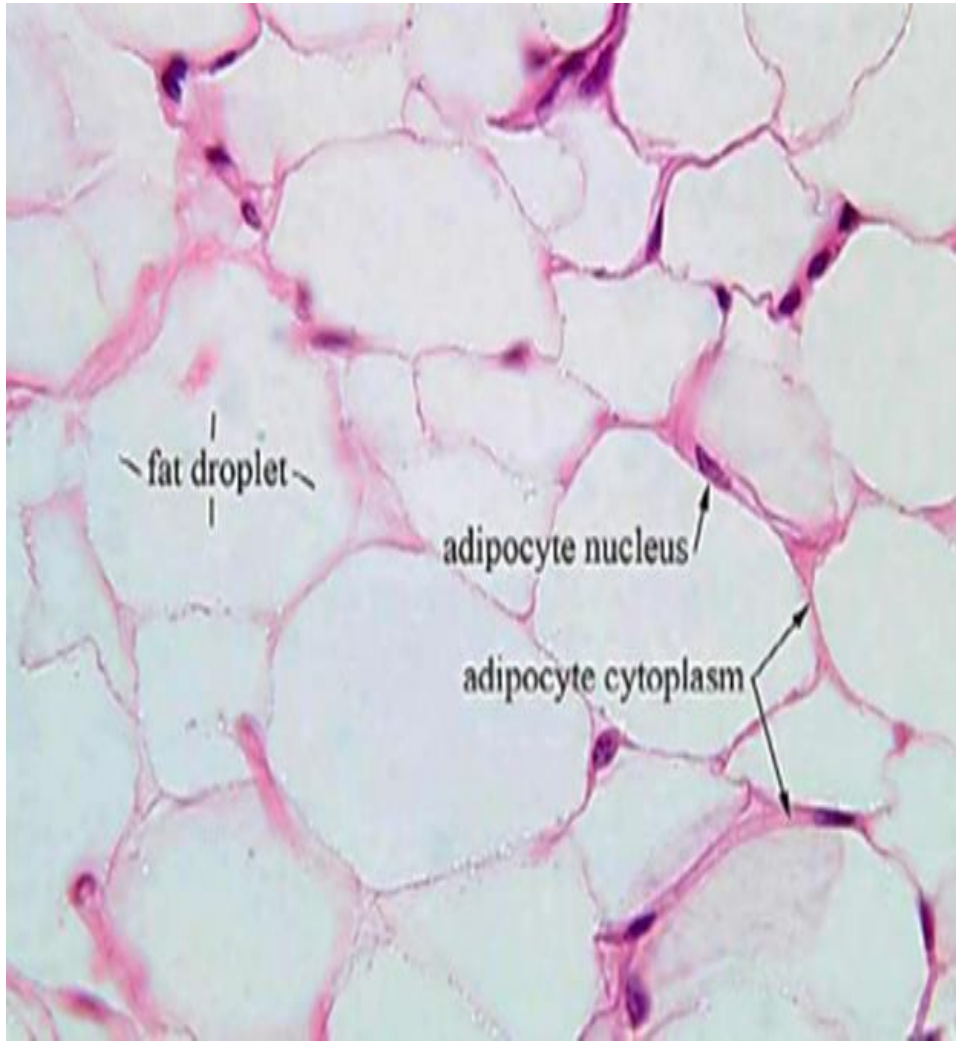
and individual muscle cells. It is also a major component of the subcutaneous layer deep to the skin.





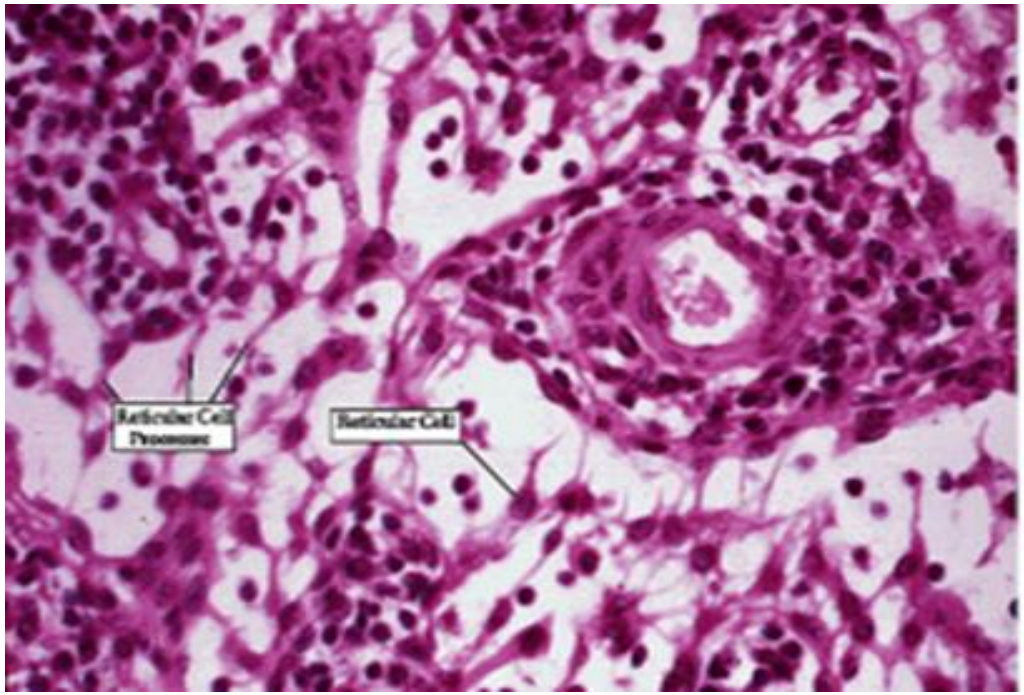
2-Adipose Tissue:

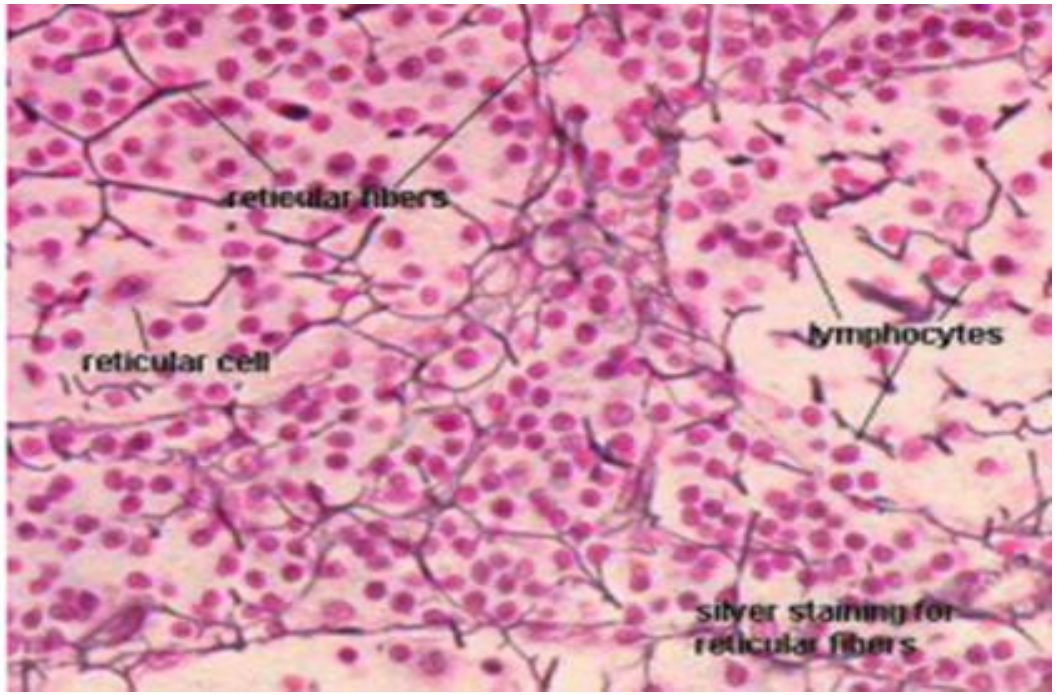
Adipose tissue, commonly referred to as "fat cells," stores energy, aids in insulating the body, and protects/cushions organs.



3-Reticular Tissue:

creates a supportive framework in soft organs like the liver, spleen, and lymph nodes.



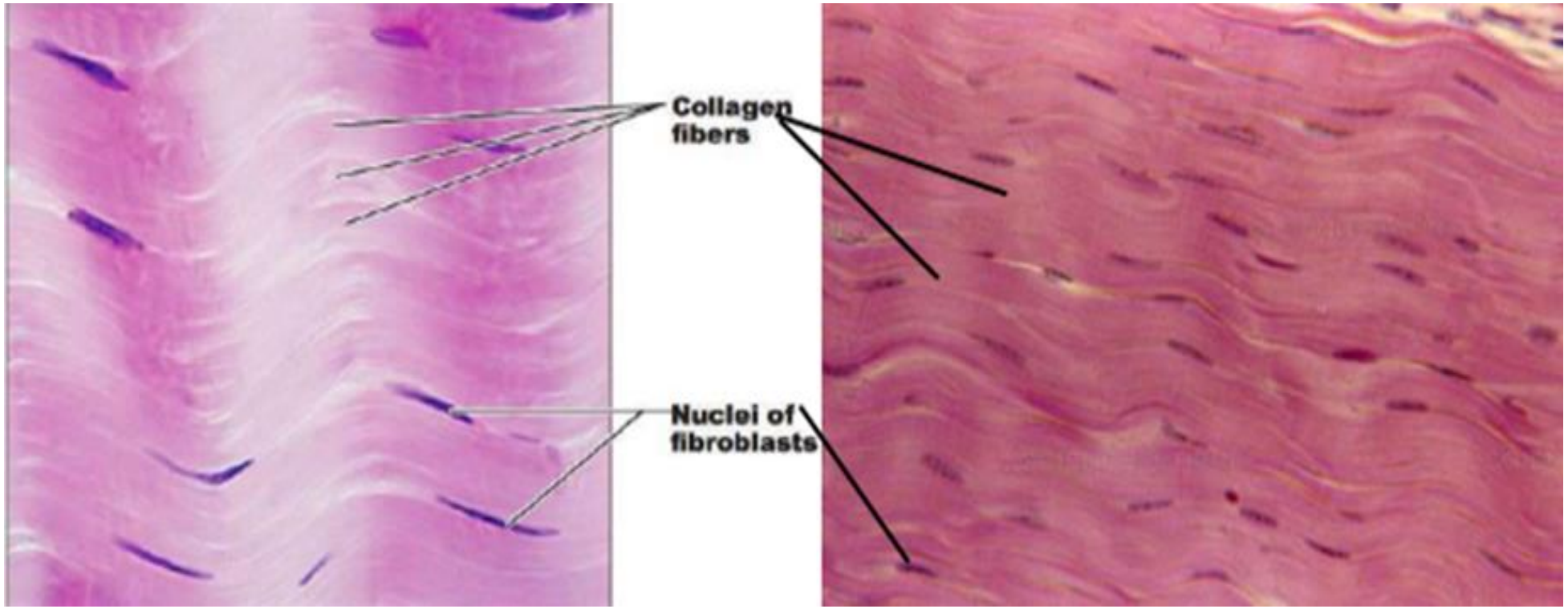


Dense Connective Tissue

- Composed primarily of protein fibers, and has proportionally less ground substance than loose connective tissue.
- Dense connective tissue is sometimes called collagenous tissue because collagen fibers are the dominant fiber type.
- There are 3 categories of dense connective tissue:

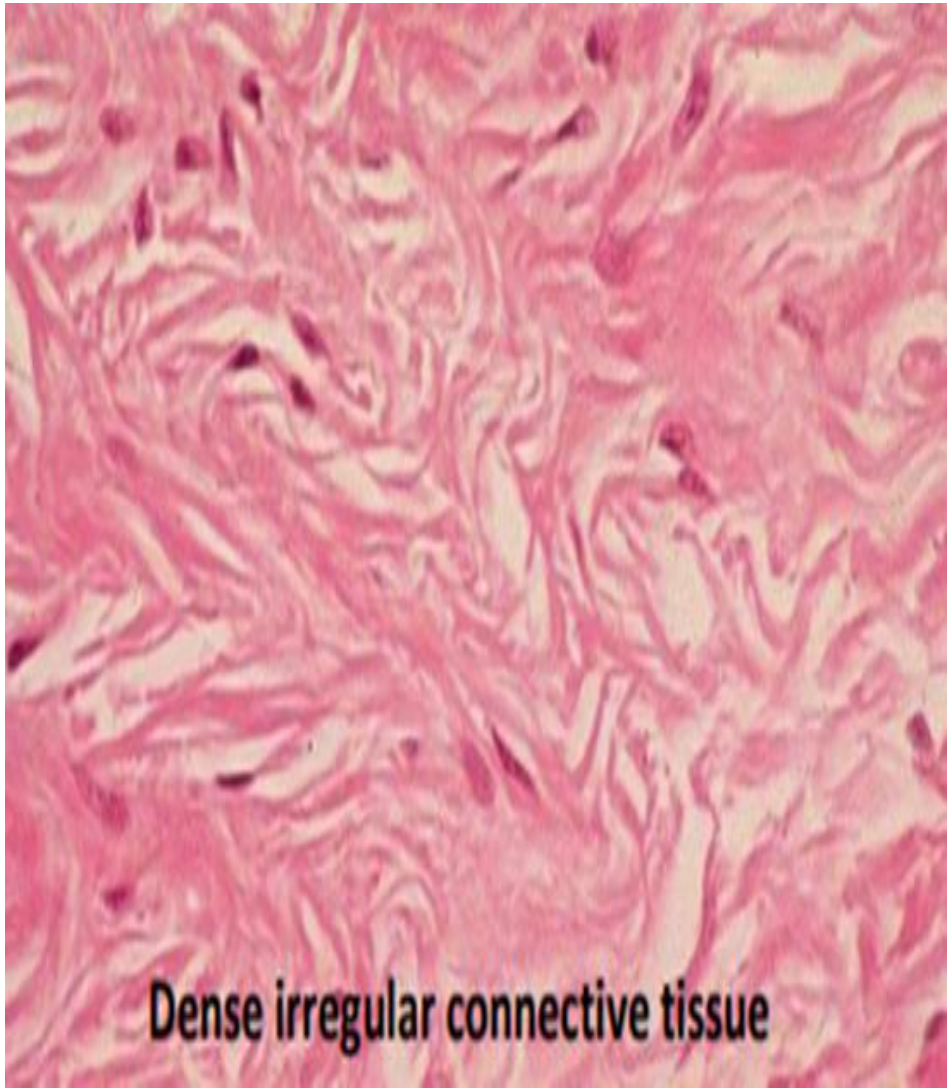
1. Dense regular connective tissue
2. Dense irregular connective tissue
3. The elastic connective tissue.

Dense Regular Tissue: These are strong fibers arranged primarily in parallel and are found in tendons, ligaments, and fascial sheaths



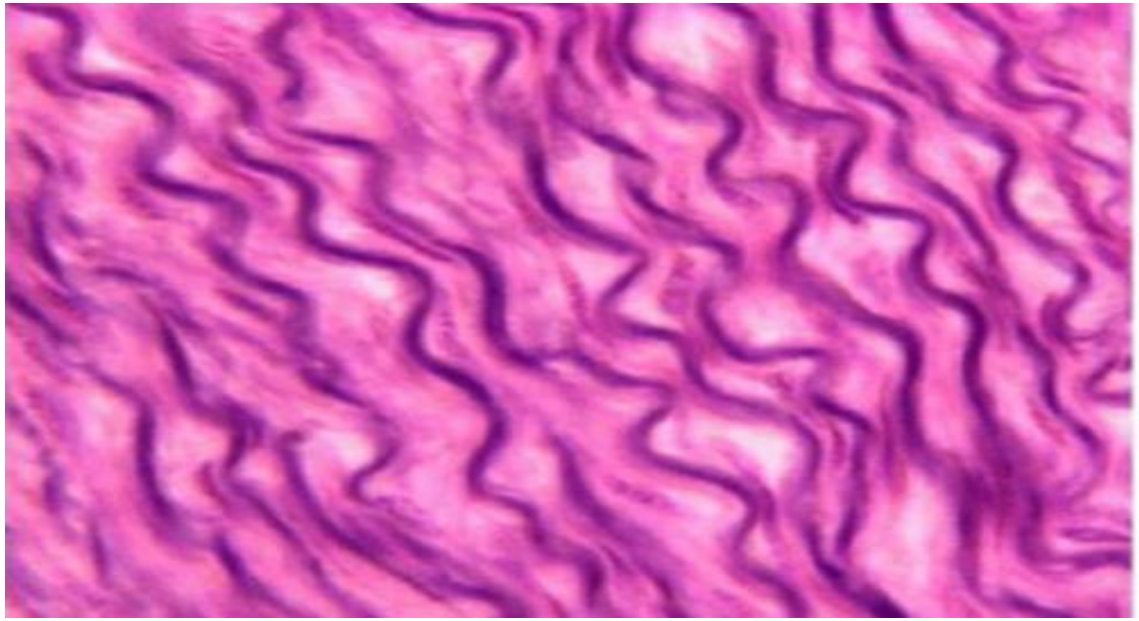
Dense Irregular Tissue:

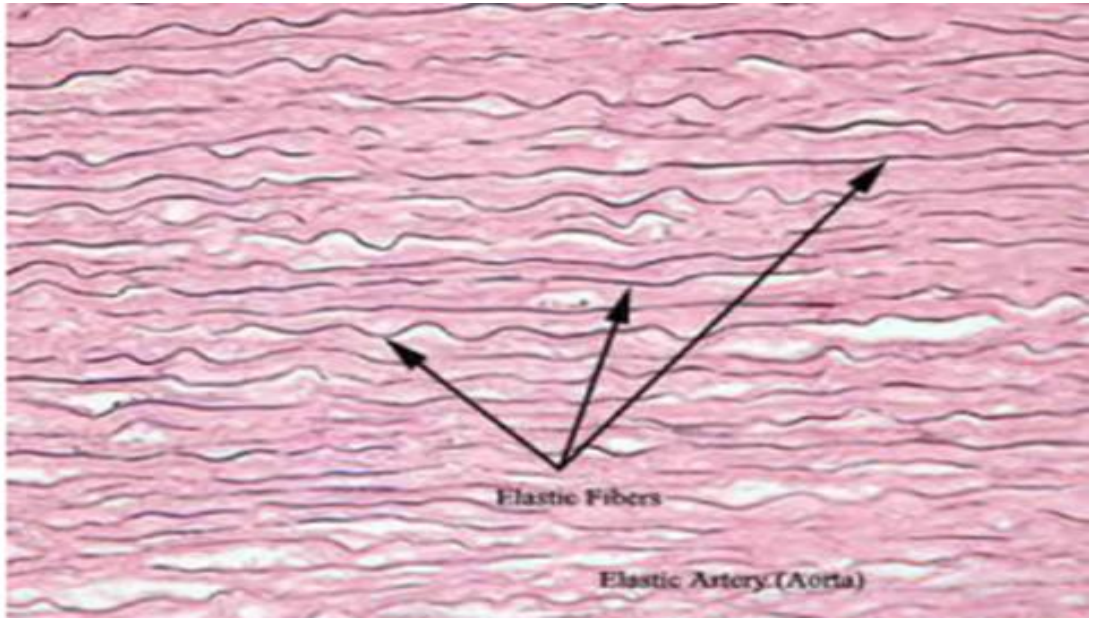
This is connective tissue with a higher proportion of collagen fibers arranged in a more random pattern, found in the dermis of the skin and the capsules around organ capsules. They add resistance to stretch.



Elastic Tissue:

This is connective tissue that contains a higher proportion of elastin fibers, resulting in more extensibility and elasticity, and can be found in large arteries, the vocal cords, and some ligaments of the spinal column.



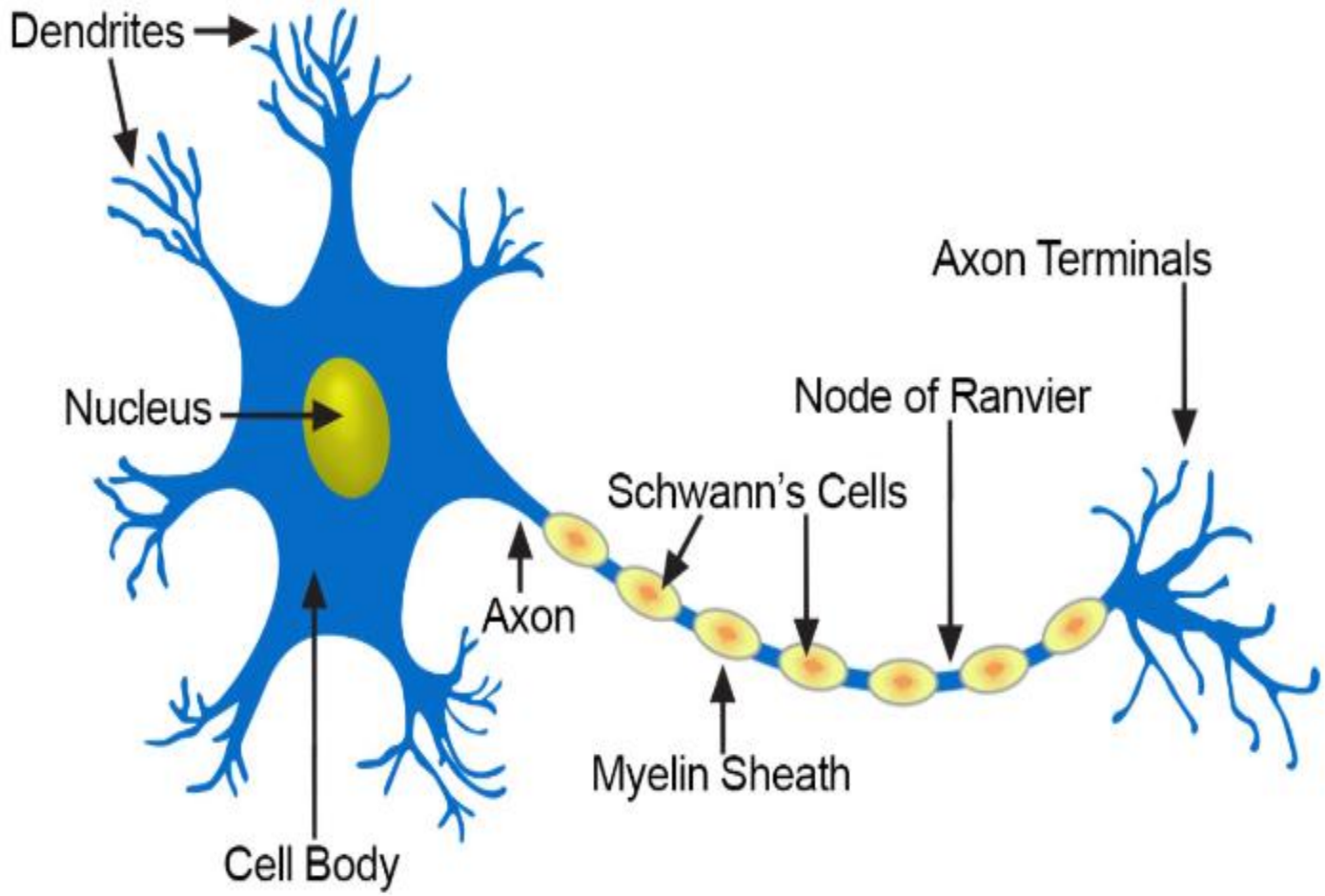


Nerve tissues

develop from embryonic ectoderm. The human nervous system, the most complex system in the human body, is formed by a network of more than 100 million nerve cells (neurons), assisted by many more glial cells.

- Each neuron has, on average, at least 1000 interconnections with other neurons, forming a very complex system for communication.
- The nervous system consists of the brain, spinal cord, sensory organs, and all of the nerves that connect these organs with the rest of the body.
- Together, these organs are responsible for the control of the body and communication among its parts.

Structure of a Typical Neuron



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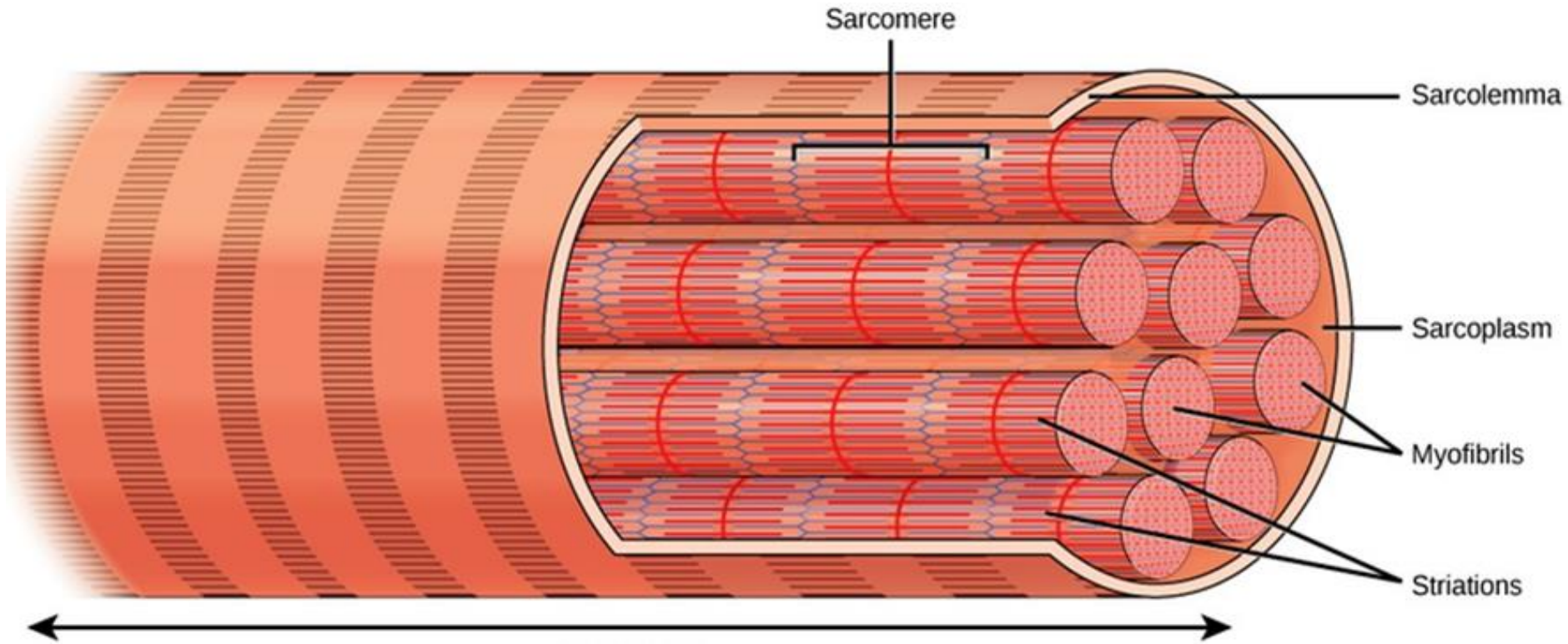
Lecture 8&9
Muscle Tissue

Dr. Rabab Ali Al-Mosawi

Muscle tissue

- is composed of differentiated cells containing contractile proteins that have the special ability to shorten or contract in order to produce movement of the body parts. Muscle tissues are derived from the mesodermal layer of embryonic germ cells.
- Muscle cells contain protein filaments of actin and myosin that slide past one another, producing a contraction that changes both the length and the shape of the cells.
- Muscles functions to produce force and motion. They are primarily responsible for maintaining of posture, locomotion, as well as movement of internal organ, such as the contraction of the heart and the movement of food through the digestive system, circulation of blood, and heat generation

- Muscle cells have specialized names for some of their organelles that differ from those in other cells. The cytoplasm of a muscle cell is called the sarcoplasm, while the smooth endoplasmic reticulum is known as the sarcoplasmic reticulum, which plays an important role in storing and regulating calcium ions. The cell membrane of a muscle cell is called the sarcolemma, which is equivalent to the plasma membrane in other cells.

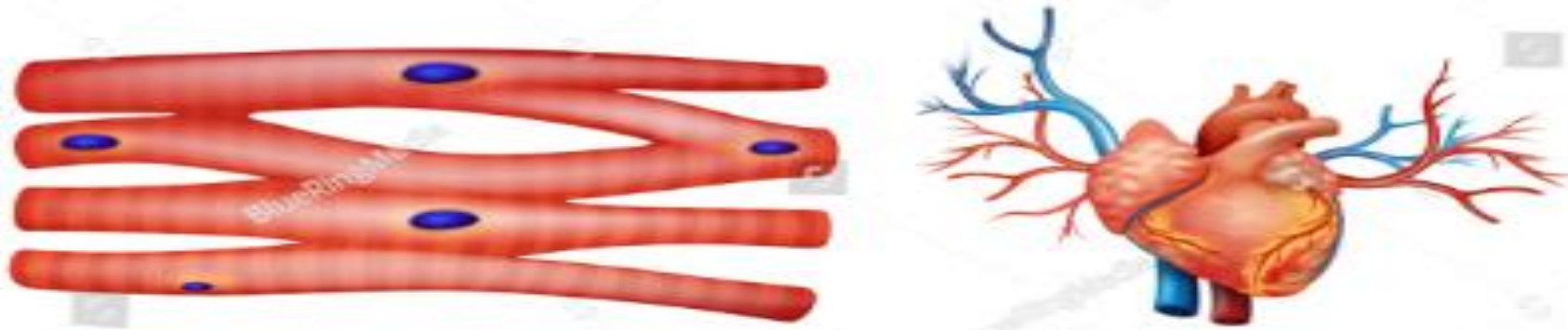


- Characteristics of all muscle tissues
- 1. Specialized cells: elongated, high density of myofilaments or cytoplasmic
- filaments of actin and myosin.
- 2. Excitability/irritability: ability to respond to stimuli.
- 3. Contractility: ability to contract.
- 4. Extensibility: ability of a muscle to be stretched.
- 5. Elasticity: ability to recoil and return to its normal shape after stretch.
- Types and functions of muscle
- There are three types of muscle tissues can be distinguished on the basis of morphologic and functional characteristics. These are including: skeletal or striated, cardiac and smooth muscles.

Types of Muscle Cells



skeletal muscle



cardiac muscle



smooth muscle

a- Skeletal muscles

These are voluntary, striated muscle. It is composed of bundles of very long, cylindrical, multinucleated cells, striated, and under voluntary control. Attached to bones producing locomotion, general support and posture and producing heat.

c- Smooth muscles

These are involuntary, no striated muscle. Consist of collection of fusiform cells, lack striations and involuntary control. It is found in the lining of blood vessels, urinary bladder, kidneys, esophagus and small intestine.

b- Cardiac muscles

These are involuntary, striated muscle. It is composed of elongated, branched individual cells that lie parallel to each other. At sites of end to end contact are the intercalated disks. Contraction of cardiac muscle is involuntary. Found only in the heart and responsible for contraction of cardiac tissue and distribution of blood.

Skeletal muscle



Smooth muscle



Cardiac muscle



Skeletal muscle

•long bundles of more or less parallel cells called muscles fibers

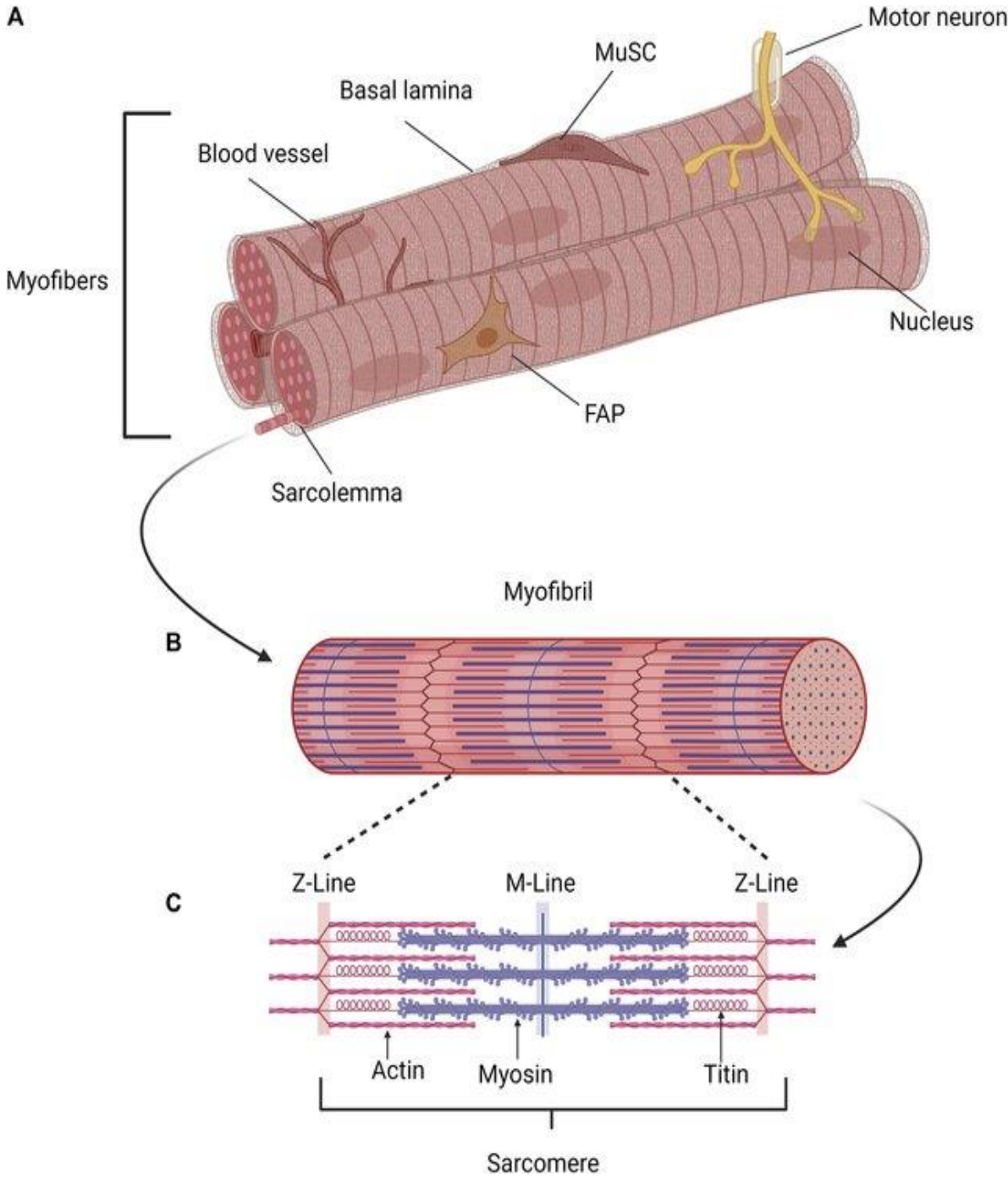
• in longitudinal section cylindrical these cells are marked by transverse striations

have multinucleated are located just beneath the cell membrane or sarcolemma (peripheral position)

•The fibers contain smaller parallel units the myofibril's which are also transversely striated and are composed of myofilaments that are visibly only in electron microscope the myofilaments are responsible for the striations because of their arrangements within the myofibril

•The sarcoplasm contain the sarcoplasmic reticulum and Golgi apparatus, glycogen, lipid droplets ,both lipid and glycogen provide metabolic fuel for the contractile machinery

•Skeletal muscles are attached to the bony structures (voluntary) by tendons which are continues with connective tissues.

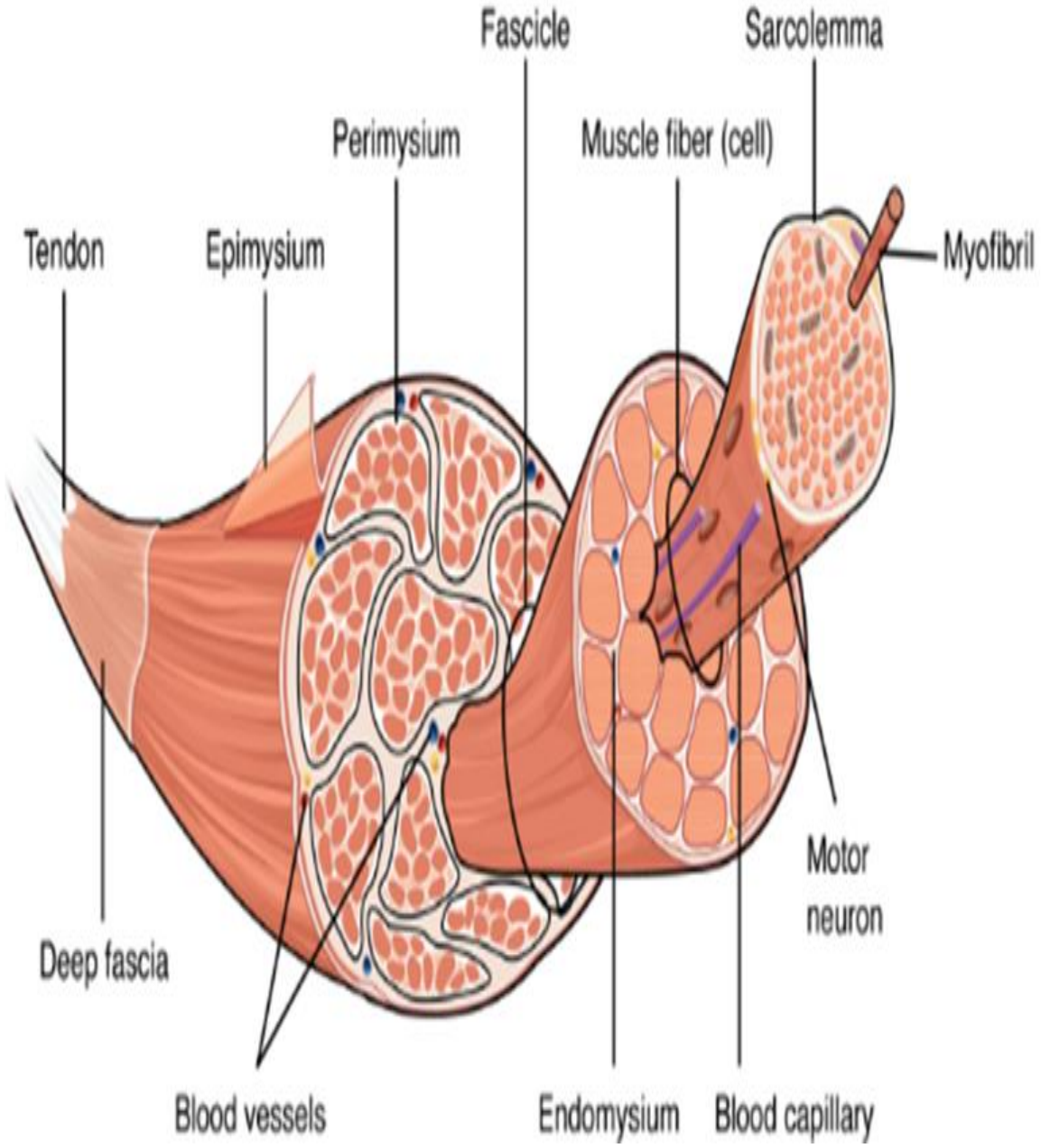


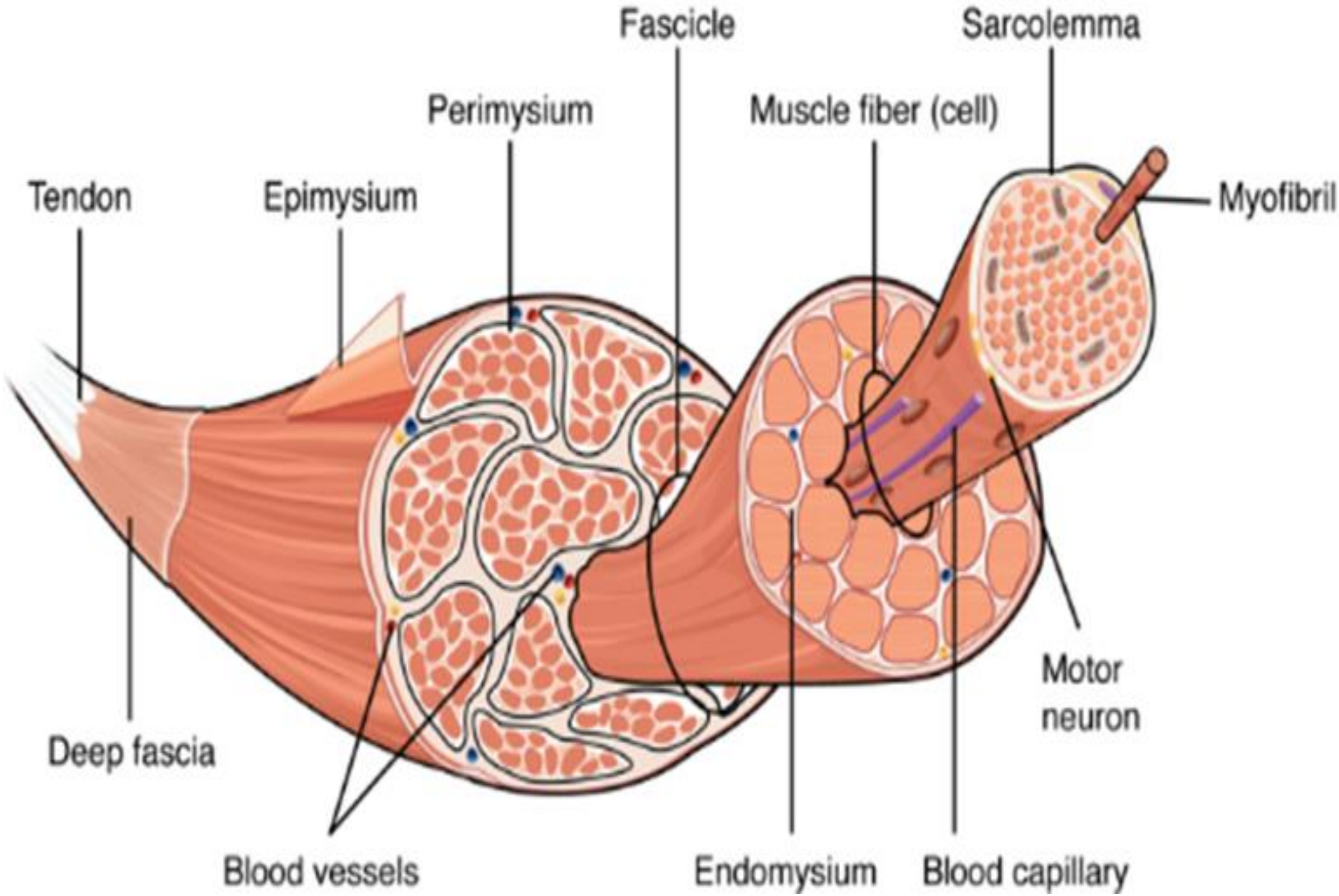
•Thin layers of connective tissue surround and organize the contractile fibers in all three types of muscle, and these layers are seen particularly well in skeletal muscle

■The epimysium, an external sheath of dense irregular connective tissue, surrounds the entire muscle. Septa of this tissue extend inward, carrying the larger nerves, blood vessels, and lymphatics of the muscle.

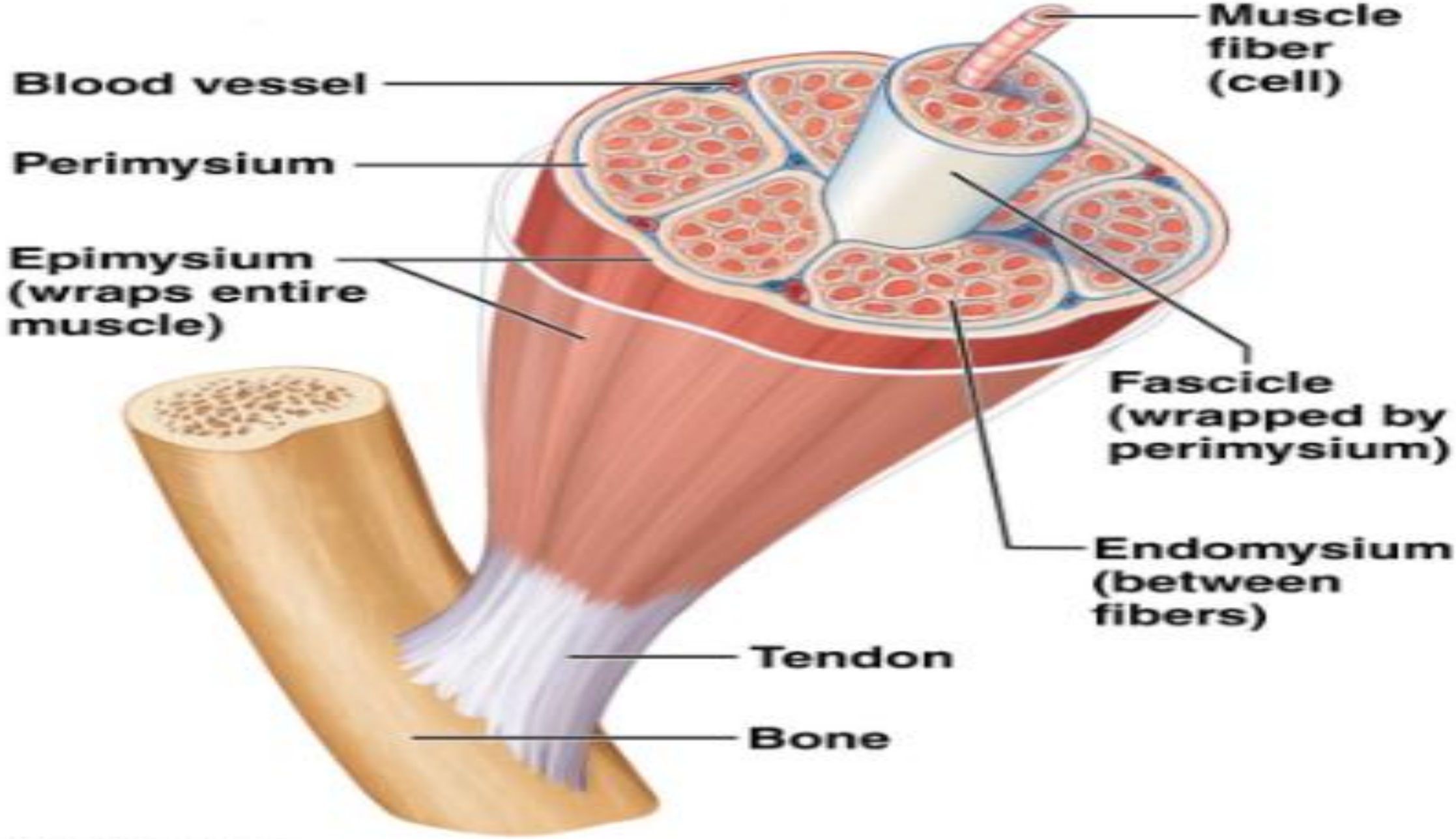
■The perimysium is a thin connective tissue layer that immediately surrounds each bundle of muscle fibers termed a fascicle. Each fascicle of muscle fibers makes up a functional unit in which the fibers work together. Nerves, blood vessels, and lymphatics penetrate the perimysium to supply each fascicle.

■Within fascicles a very thin, delicate layer of reticular fibers and scattered fibroblasts, the endomysium, surrounds the external lamina of individual muscle fibers.



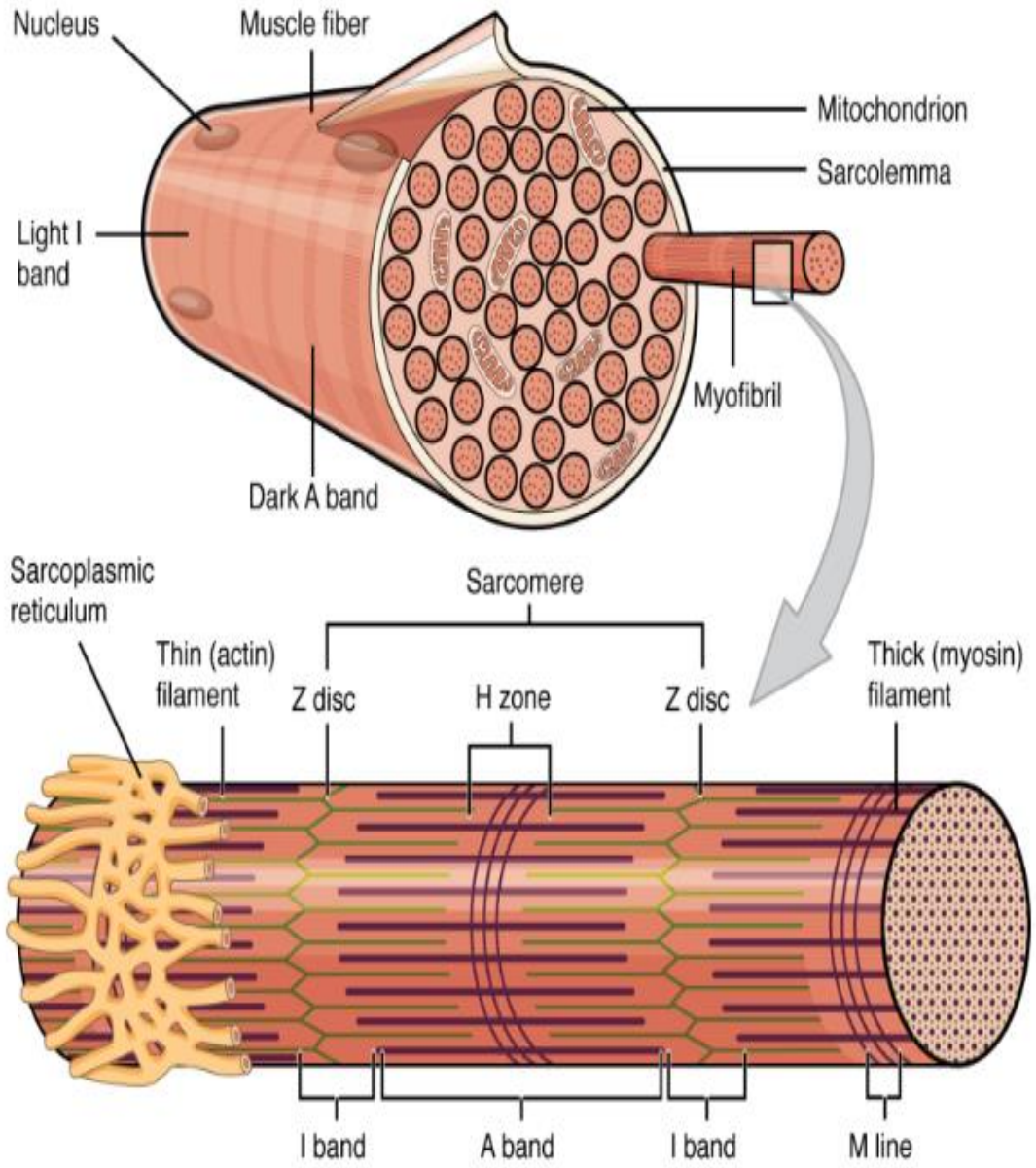

Fascicle
Sarcolemma
Perimysium
Muscle fiber (cell)
Tendon
Epimysium
Myofibril
Deep fascia
Motor neuron
Blood vessels
Endomysium
Blood capillary

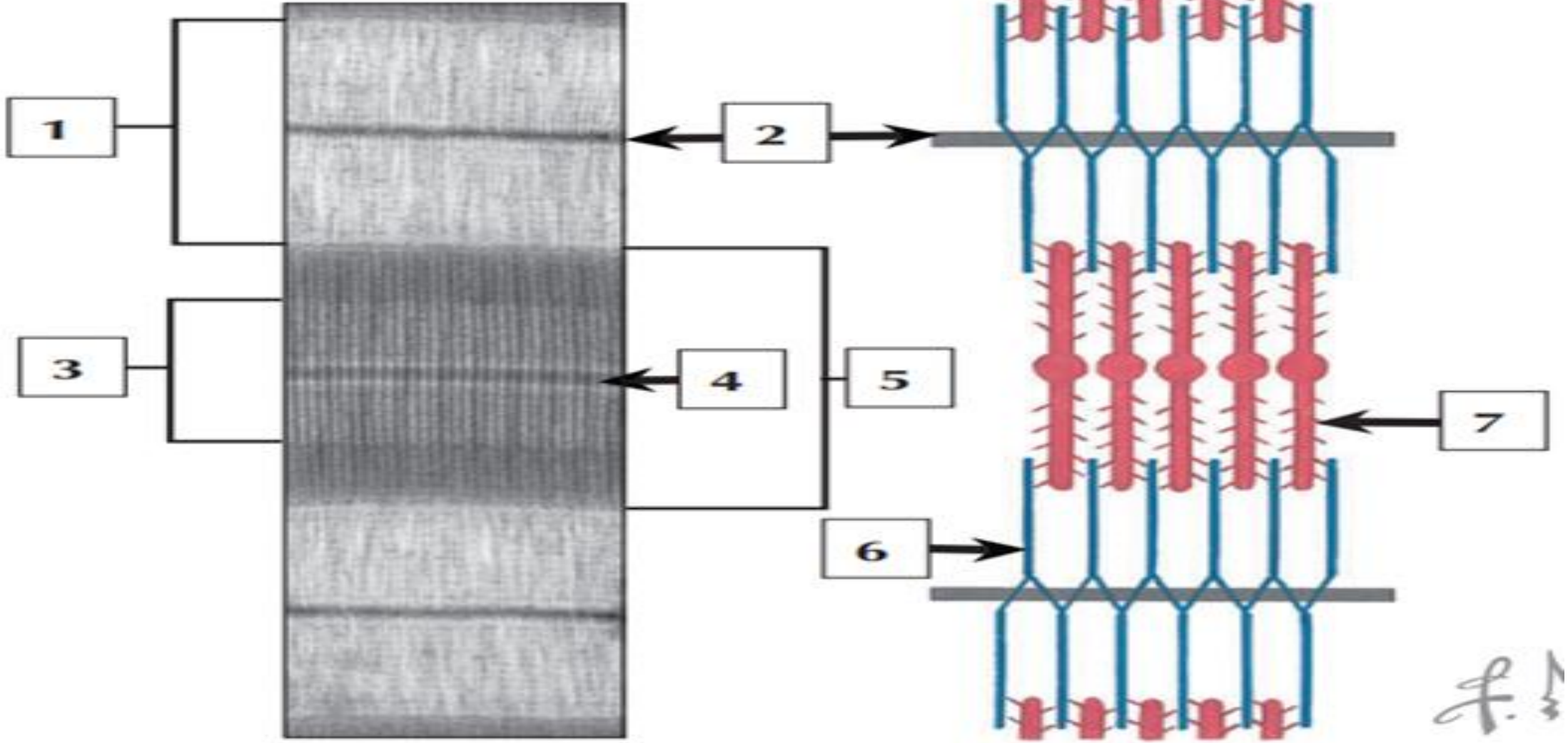
Blood vessels penetrate the muscle within the connective tissue septa and form a rich capillary network that runs between and parallel to the muscle fibers. The capillaries are of the continuous type, and lymphatic vessels are found in the connective tissue.


Muscle fiber (cell)
Blood vessel
Perimysium
Epimysium (wraps entire muscle)
Fascicle (wrapped by perimysium)
Endomysium (between fibers)
Tendon
Bone

Organization of Skeletal Mus

- Fibers as observed with the light microscope, longitude - inally sectioned muscle fibers show cross-striations of alternating light and dark bands. The darker bands are called A bands; the lighter bands are called I bands. The smallest repetitive subunit of the contractile apparatus, the sarcomere, extends from Z line to Z line.





1. I band 2. Z band 3. H zone 4. M band 5. A band 6. Thin fi lament 7. Thick fi lament

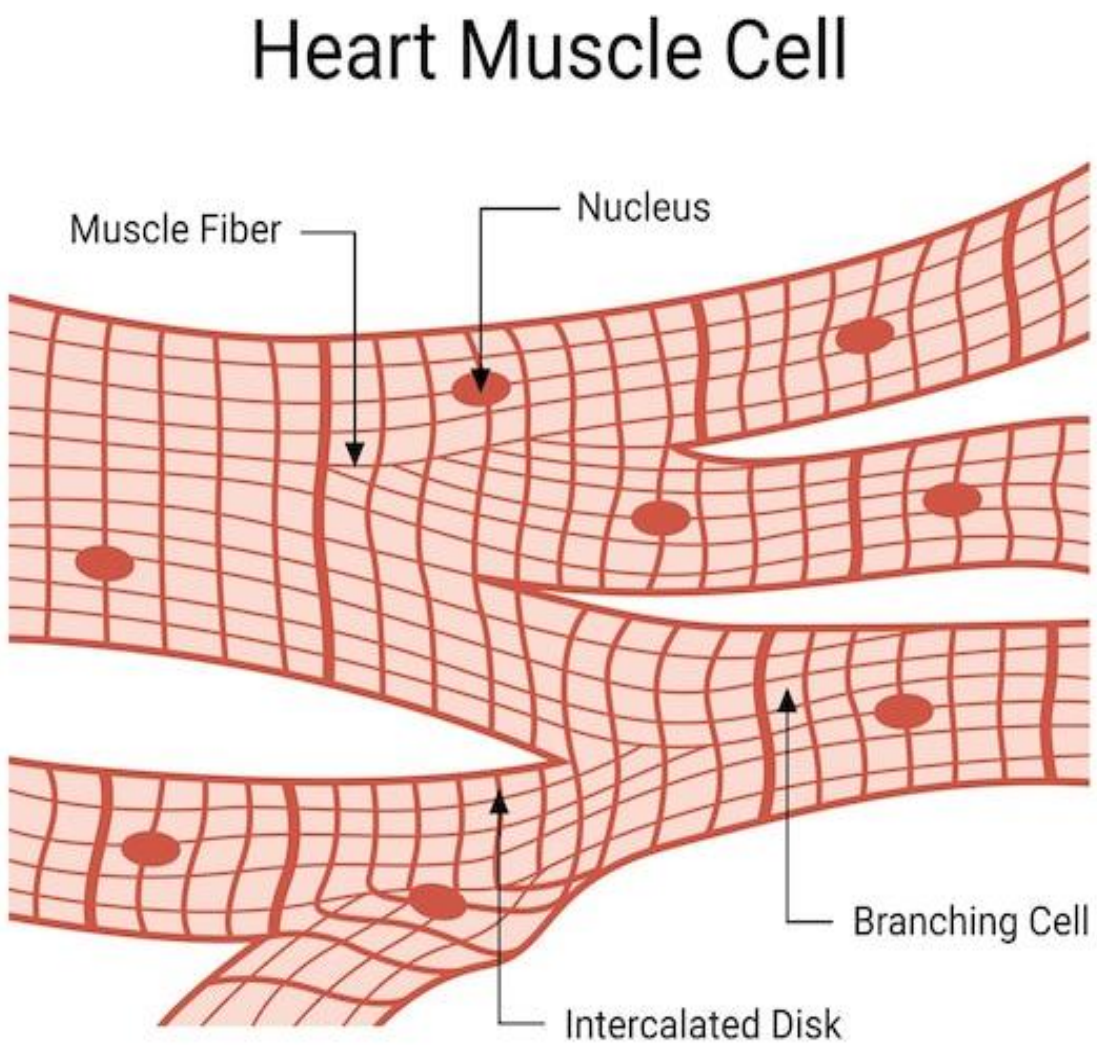
Cardiac Muscle

A unique and distinguishing characteristic of cardi muscle is the presence of dark-staining transverse lir that cross the chains of cardiac cells at irregular interval

These intercalated disks represent junctional complex found at the interface between adjacent cardiac musc cells.

The significance of ionic coupling is that chains individual cells act as a syncytium, allowing the signal contract to pass in a wave from cell to cell.

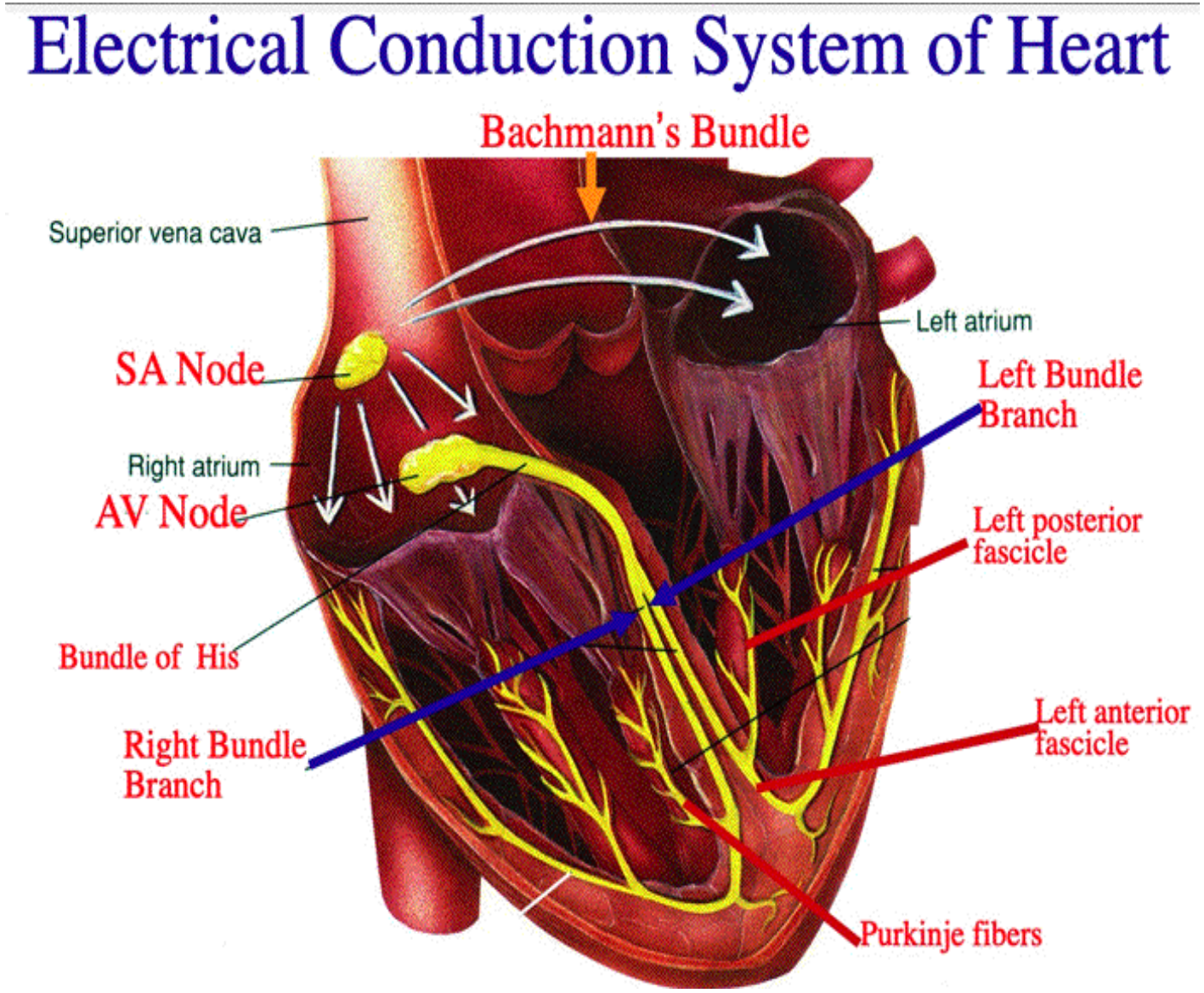
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Cardiac Muscle

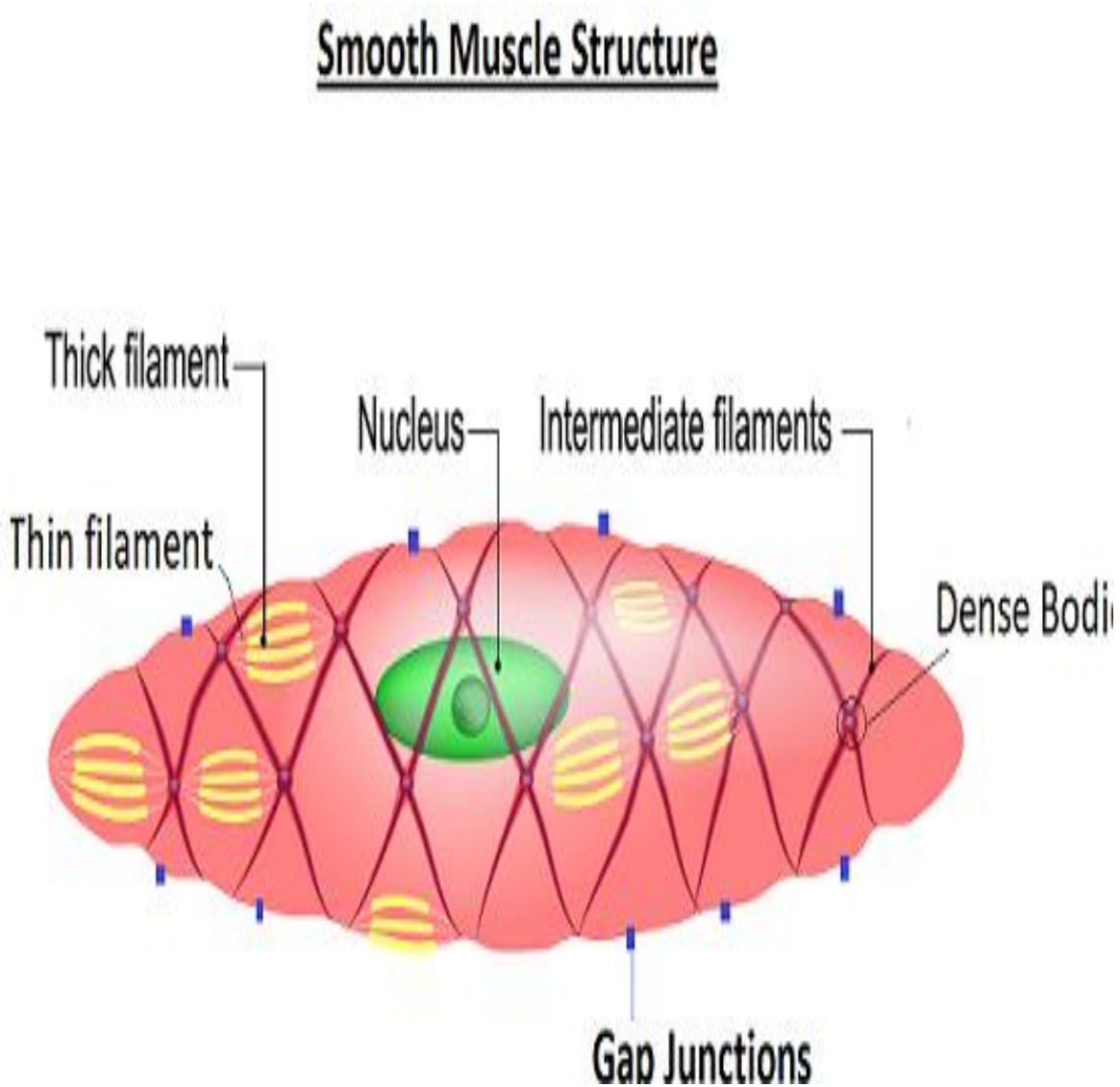
Purkinje fibers, which are modified cardiac muscle cells, are scattered along the innermost part of the myocardium adjacent to the endocardium. They are found especially in the interventricular septum, organized into discrete bundles and embedded in connective tissue. They are part of the cardiac conduction system, which includes fibers specialized for conduction of electrical impulses. Purkinje fibers are larger and thicker than ordinary cardiac muscle cells.

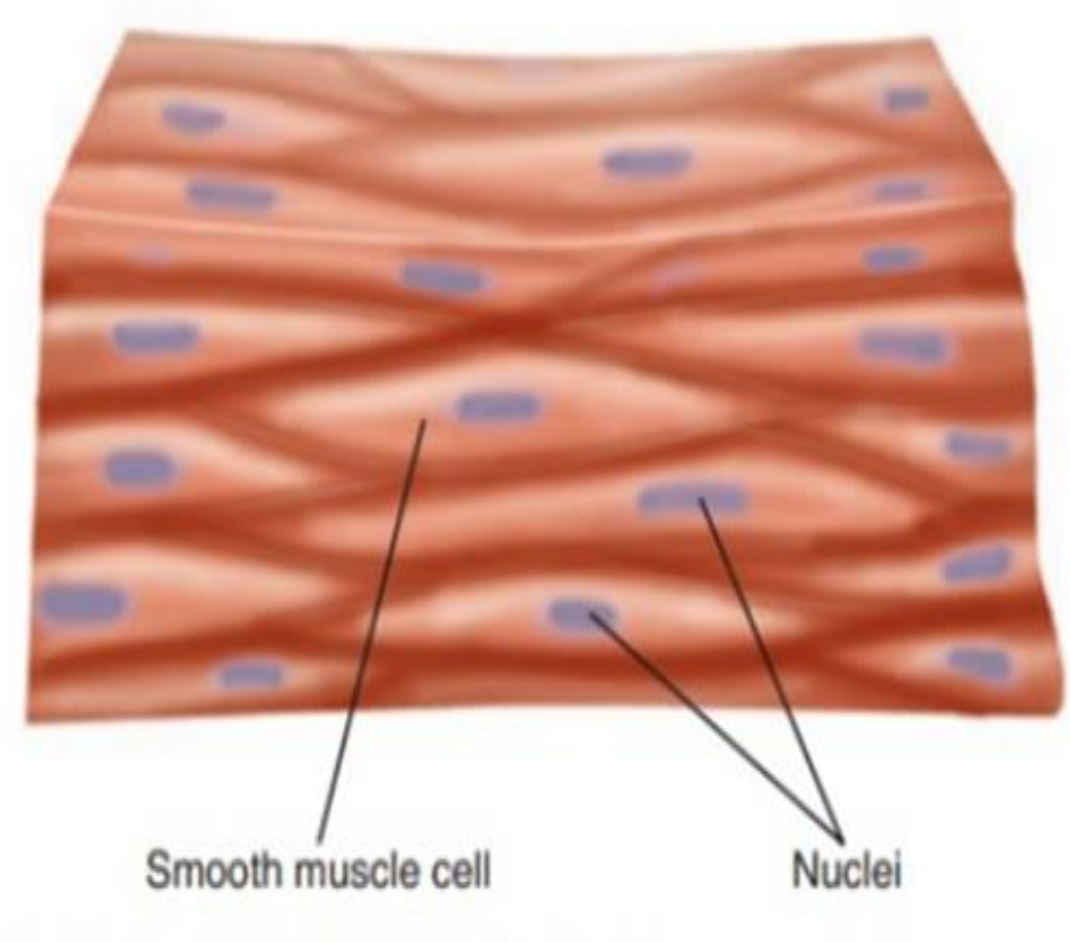
Cardiac muscle cells contain numerous mitochondria, which occupy 40% or more of the cytoplasmic volume, reflecting the need for continuous aerobic metabolism in heart muscle. By comparison, only about 2% of skeletal muscle fiber is occupied by mitochondria.



Smooth muscle

- It is composed of elongated, non-striated cells, fusiform, they are largest at their midpoints and taper toward their ends. Each cell has a single nucleus located in the center of the broadest part of the cell.
- The characteristic contractile activity of smooth muscle is related to the structure and organization of its actin and myosin filaments, which do not exhibit the paracrystalline organization present in striated muscles.
- The degree of innervation in a particular bundle of smooth muscle depends on the function and the size of that muscle. Smooth muscle is innervated by both sympathetic and parasympathetic nerves of nerve supply.




Smooth muscle cell
Nuclei

Important comparisons of the three types of muscle

	Skeletal Muscle	Cardiac Muscle	Smooth Muscle
Fibers	Single multinucleated cells	Aligned cell in branching arrangement	Single small, closely packed fusiform cells
Cell/fiber shape and size	Cylindrical,10-100µm diameter, many cm long	Cylindrical,10-20µm diameter, 50-100 µm long	Fusiform, diameter0.2-10µm,length 50-200 µm
Striations	Present	Present	Absent
Location of nuclei	Peripheral	Central	Central
Sarcoplasmic reticulum (SR)	Well-developed, with two terminal cisterns	Less well-developed, one small terminal cistern	Irregular smooth ER without distinctive organization
Major locations	Skeletal muscles, tongue, diaphragm, eyes, and upper esophagus	Heart	Blood vessels, digestive and respiratory tracts, uterus, bladder, and other organs
Key function	Voluntary movements	Automatic (involuntary) pumping of blood	involuntary movements

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Aesthetic and Laser Department
Histology and Anatomy

Bone Tissue
Lecture 10 & 11

Dr. Rabab Ali Al-Mosawi



Bone Tissue

- The skeletal system within our body consists of both fused and individual bones which are supported and supplemented by associated connective tissue, such as cartilage, tendons and ligaments.



Function

1. Bone is the primary structural framework for support and protection of the organs of the body, including the brain and spinal cord.
2. Movement of Body depends on joints and muscles attached to bones
3. Storage in the Body. Bone provides mineral storage in the body, mostly calcium and phosphorus.
4. Protection of more delicate tissue. For example, the bony thoracic cage protects the heart and lungs.
5. Blood cell Production. The red bone marrow (myeloid tissue) stored in the medullary cavity of some bones is responsible for making all the cells found in blood, a process called hematopoiesis.



Bone Matrix

- Inorganic Component

  65% of its dry weight, is composed mainly of calcium and phosphorus.

- Organic Component

constituting 35% of the dry weight of bone, includes fibers that are almost exclusively type I collagen, chondroitin sulfate and keratin sulfate.

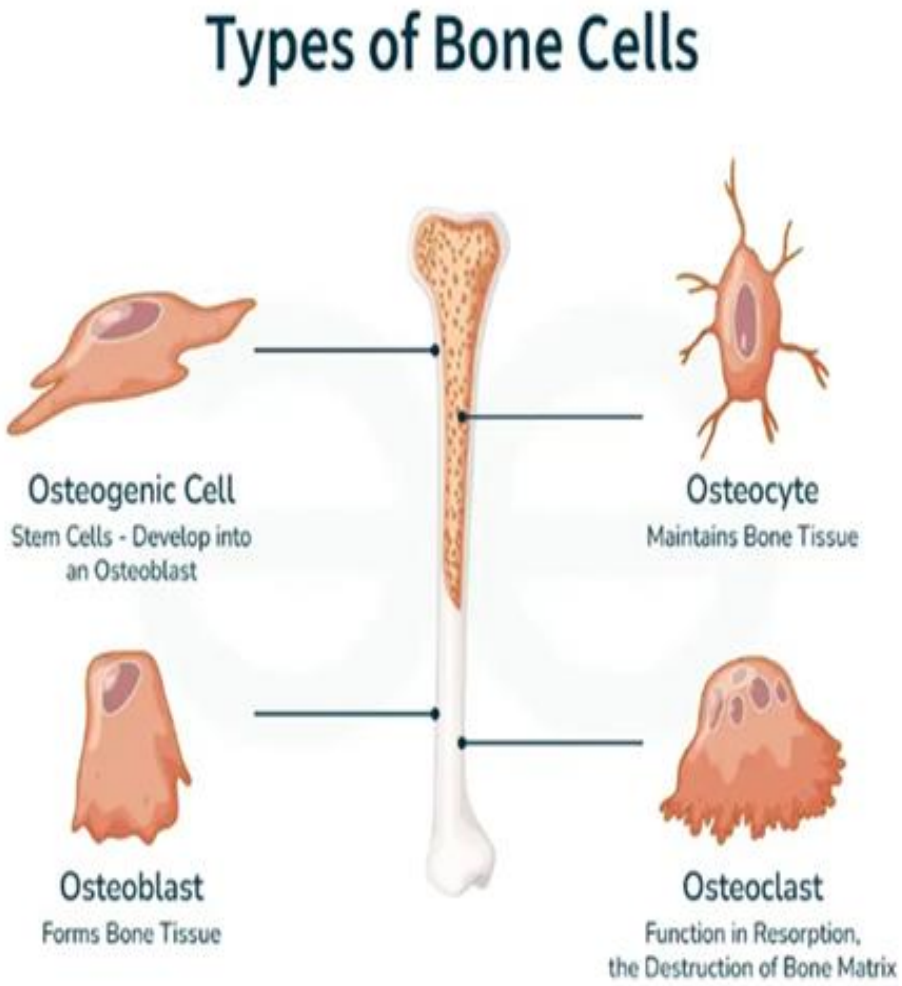
Types of bone cells

1-Osteoprogenitor Cells

- There are located in the inner cellular layer of the periosteum, lining Haversian canals, and in the endosteum.
- These cells, derived from embryonic mesenchyme, remain in place throughout postnatal life
- They can undergo mitotic division and have the potential to differentiate into osteoblasts.

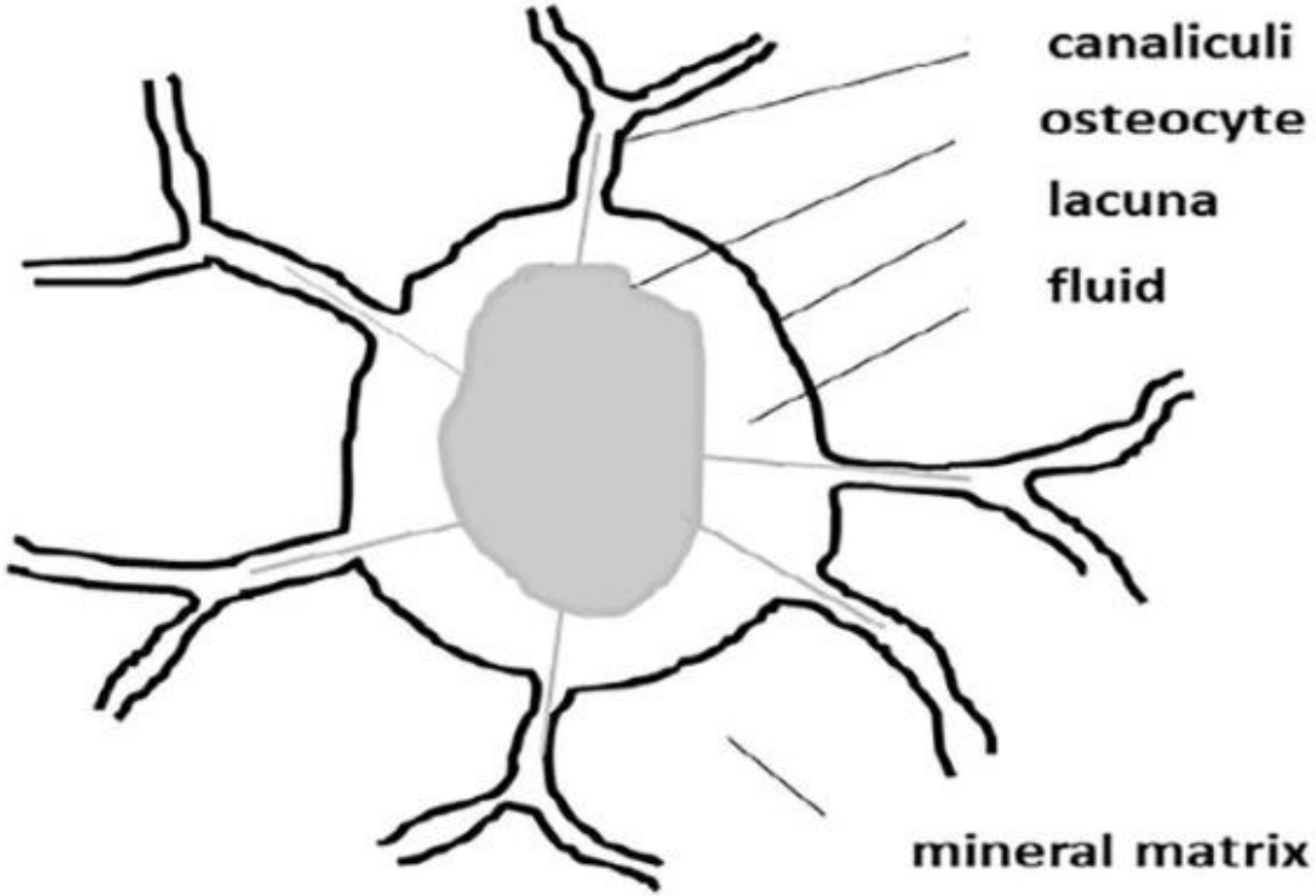
2- Osteoblasts

- derived from osteoprogenitor cells
- responsible for the synthesis of the organic protein components of the bone matrix.



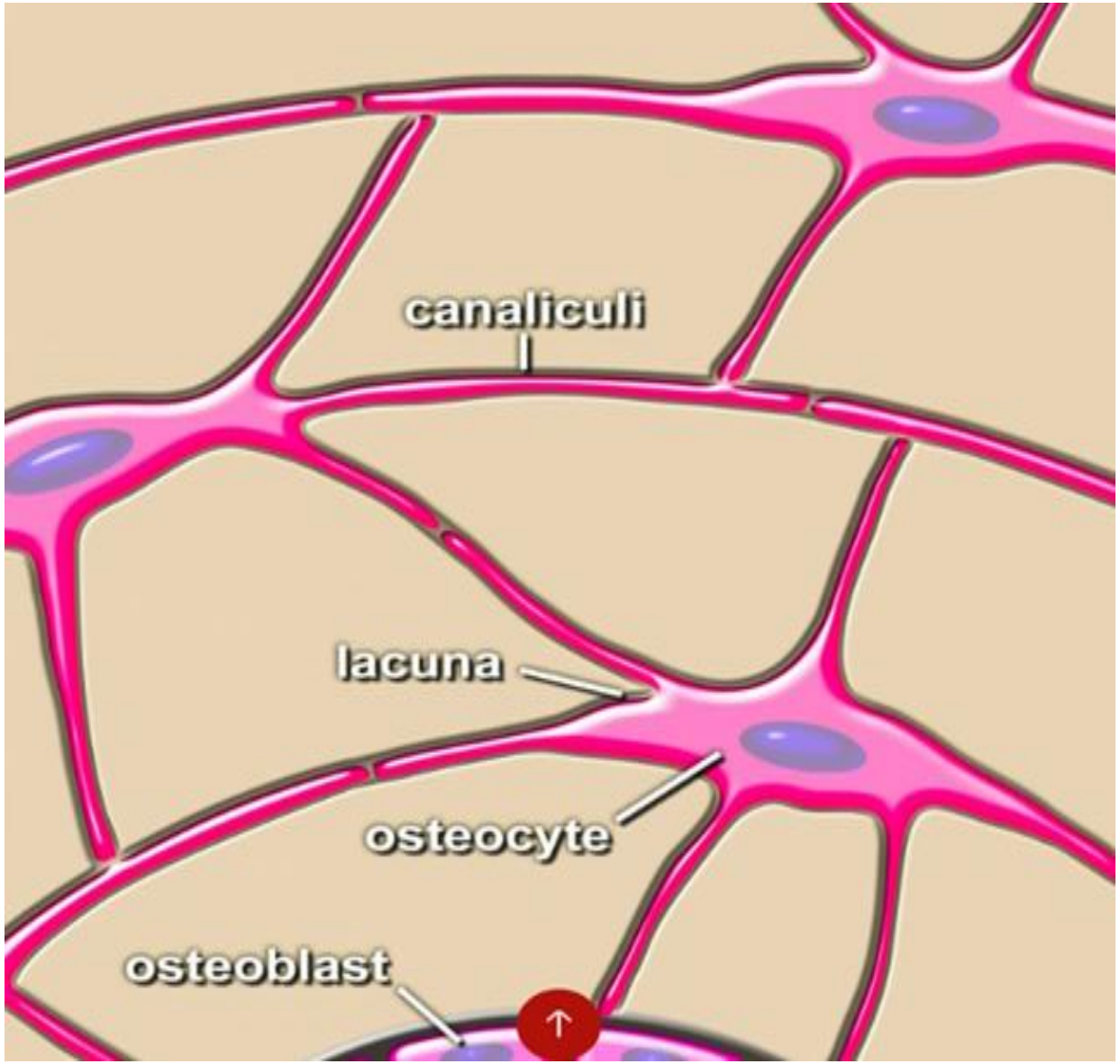
Osteocytes

- Derived from osteoblasts
- Osteocytes are mature bone cells,
- They are housed in lacunae, within the calcified bony matrix.
- They conform to the shape of their lacunae.



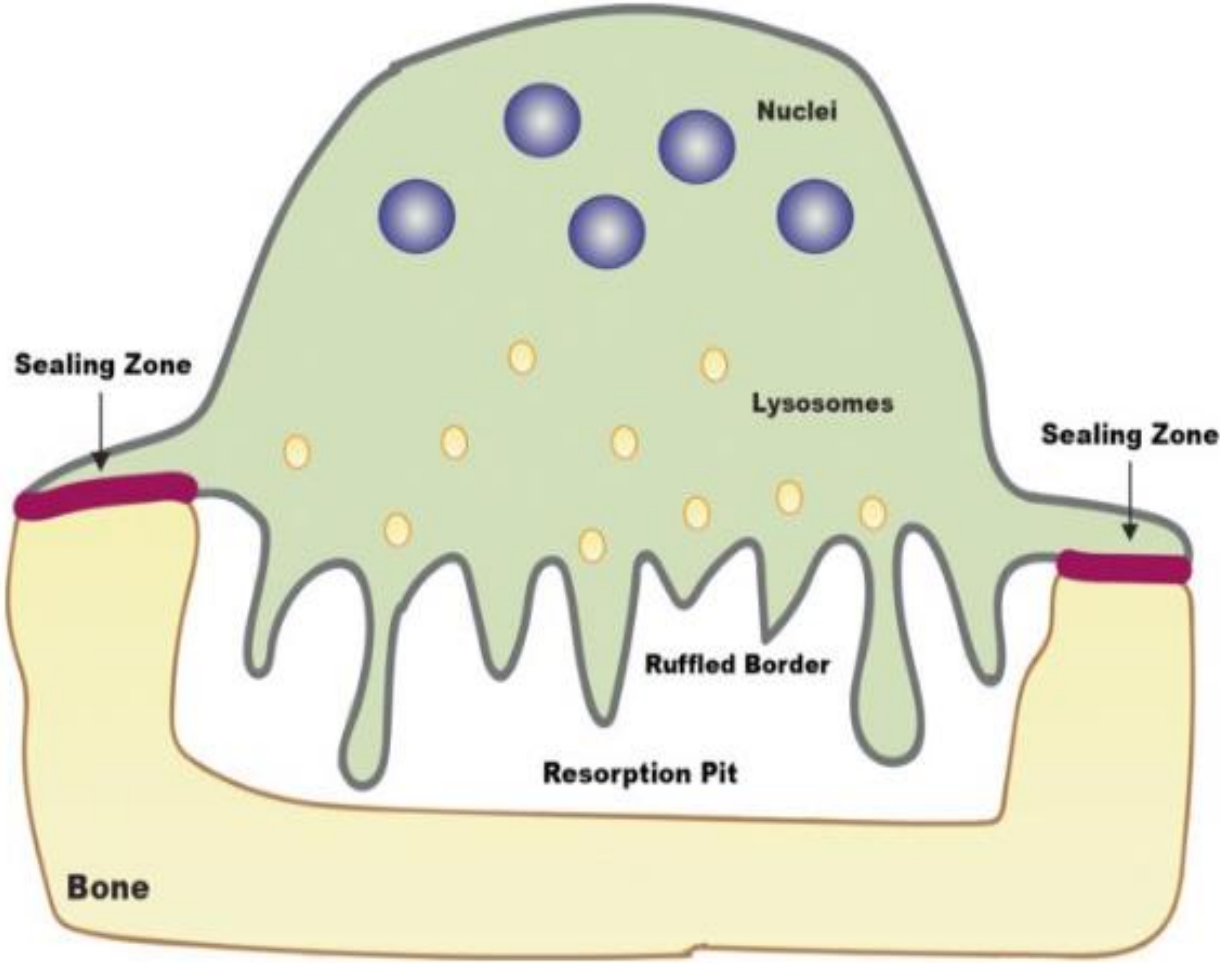
Osteocytes

- Radiating out in all directions from the lacunae are narrow canaliculi that house cytoplasmic processes of the osteocyte. These processes make contact with similar processes of neighboring osteocytes, forming gap junctions through which ions and small molecules can move between the cells.

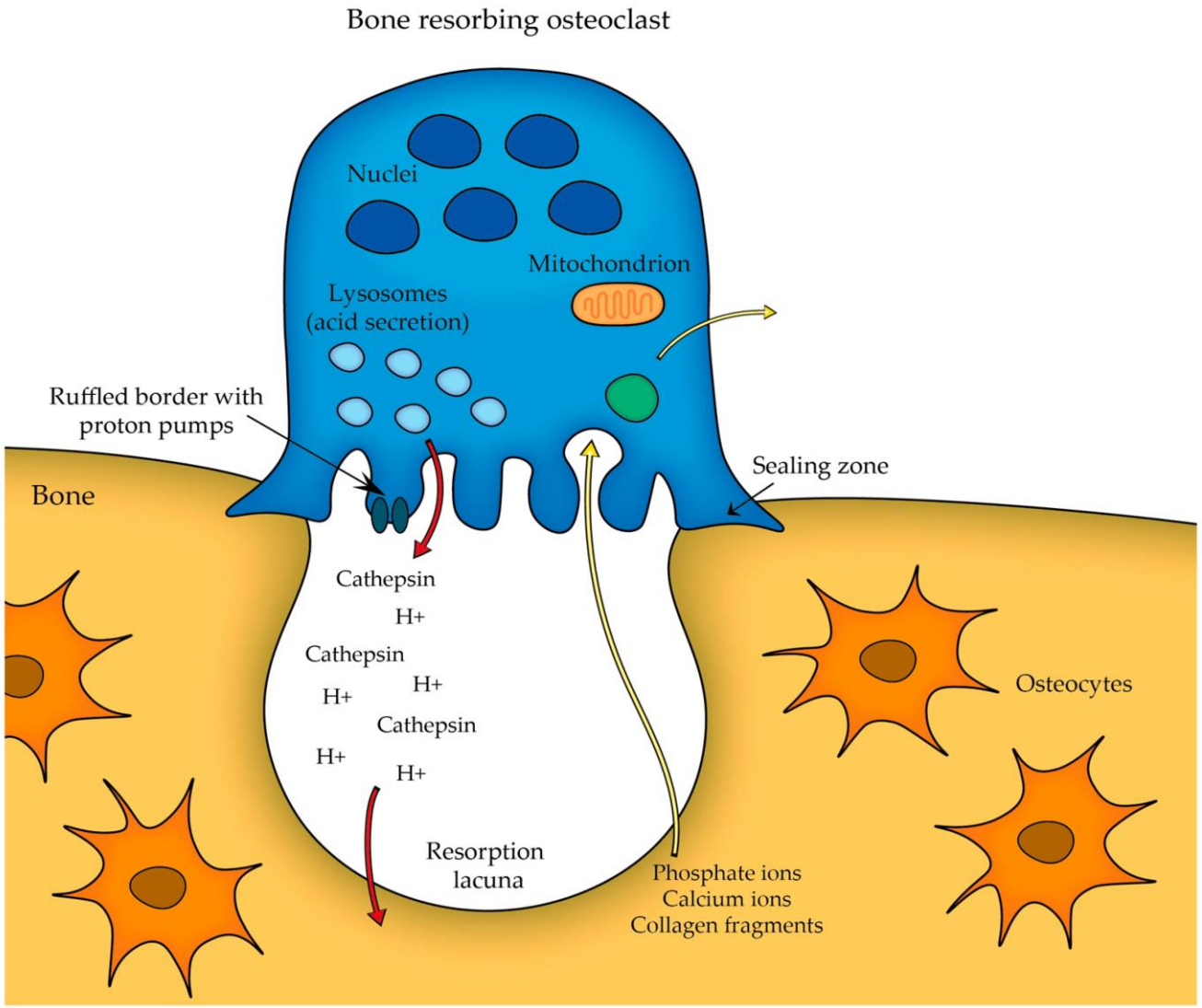


Osteoclasts

- The precursor of the osteoclast originates in the bone marrow.
- Osteoclasts are large, motile, multinucleated cells. often made from a fusion of up to 50 monocytes.
- They have a ruffle border on one aspect of the cell where they release their powerful degradative enzymes.
- These cells are dissolvers of bone matrix. By dissolving bone matrix, they liberate the calcium ions (Ca2+) stored.
- Osteoclasts are responsible for resorbing bone, and after they finish doing so, these cells probably undergo apoptosis.



- The activities of the osteoblasts (the bone maker) and the osteoclasts (the bone breaker) are how we change the shape and thickness of bone tissue in the body - a process referred to as remodeling of bone



Bone Types

Bones are classified according to their shape:

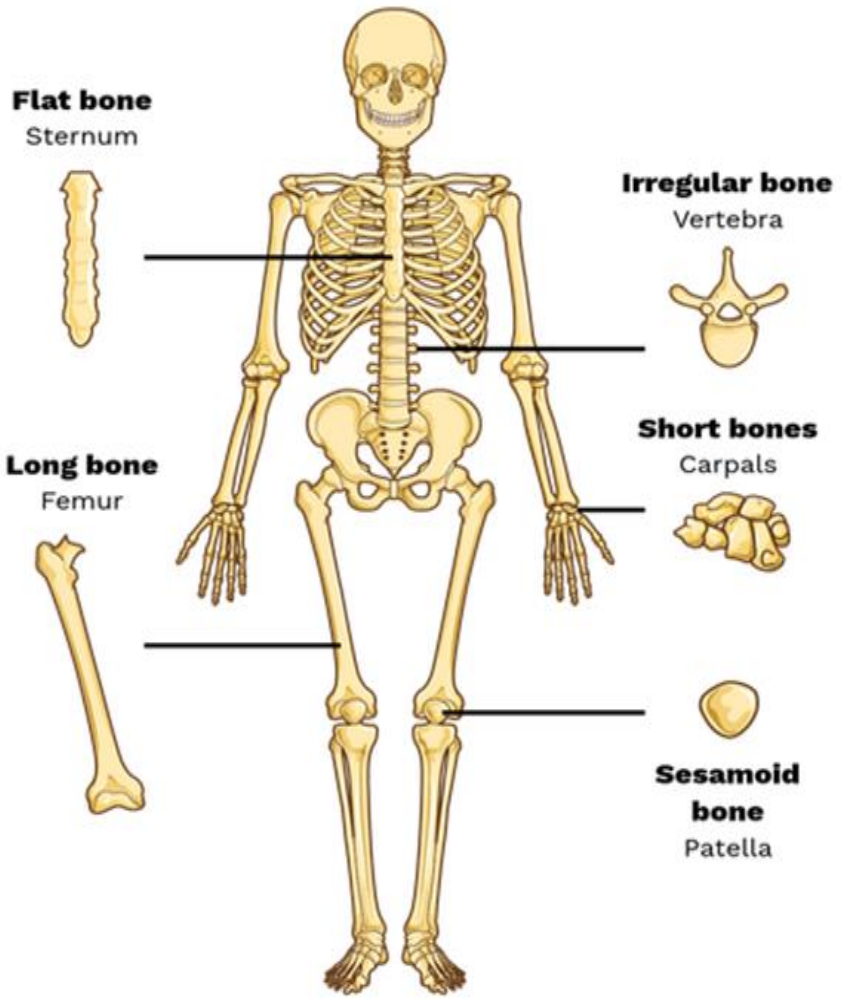
1-Long bones display a shaft located between two heads (femur).

2- Short bones have more or less the same width and length (carpal bones of the wrist).

3-Flat bones are flat, thin, and plate-like (sternum).

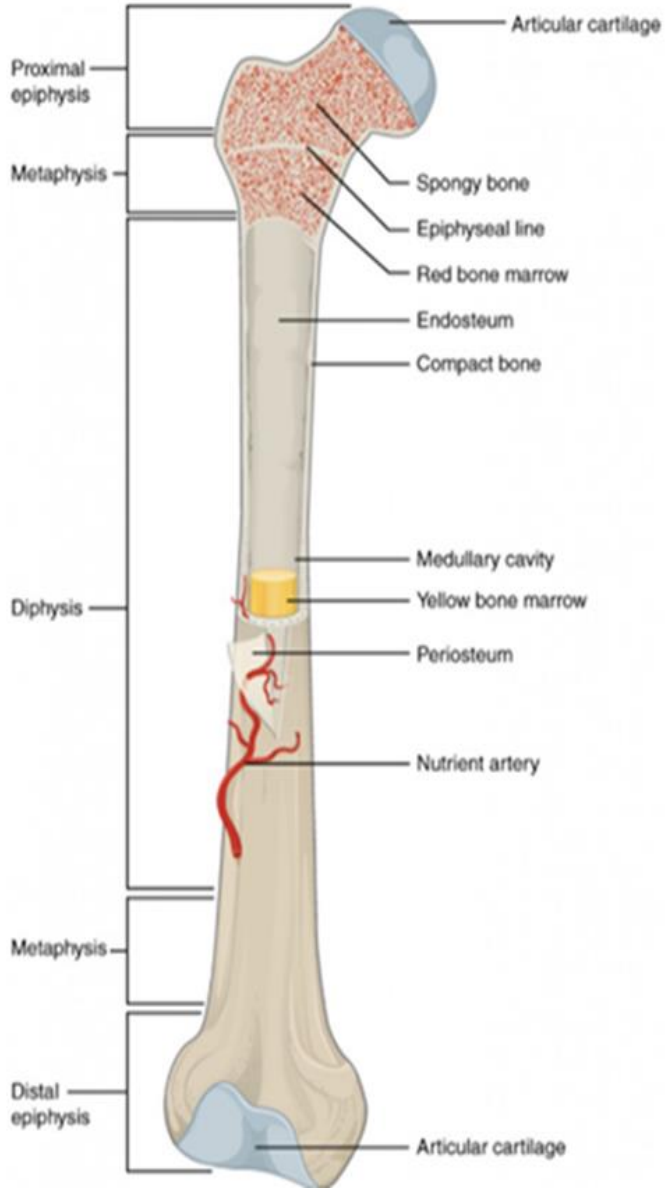
4- Irregular bones have an irregular shape that does not fit into the other classes (vertebrae).

5-Sesamoid bones are unique in that they are small bones that are embedded within tendons (Patella)



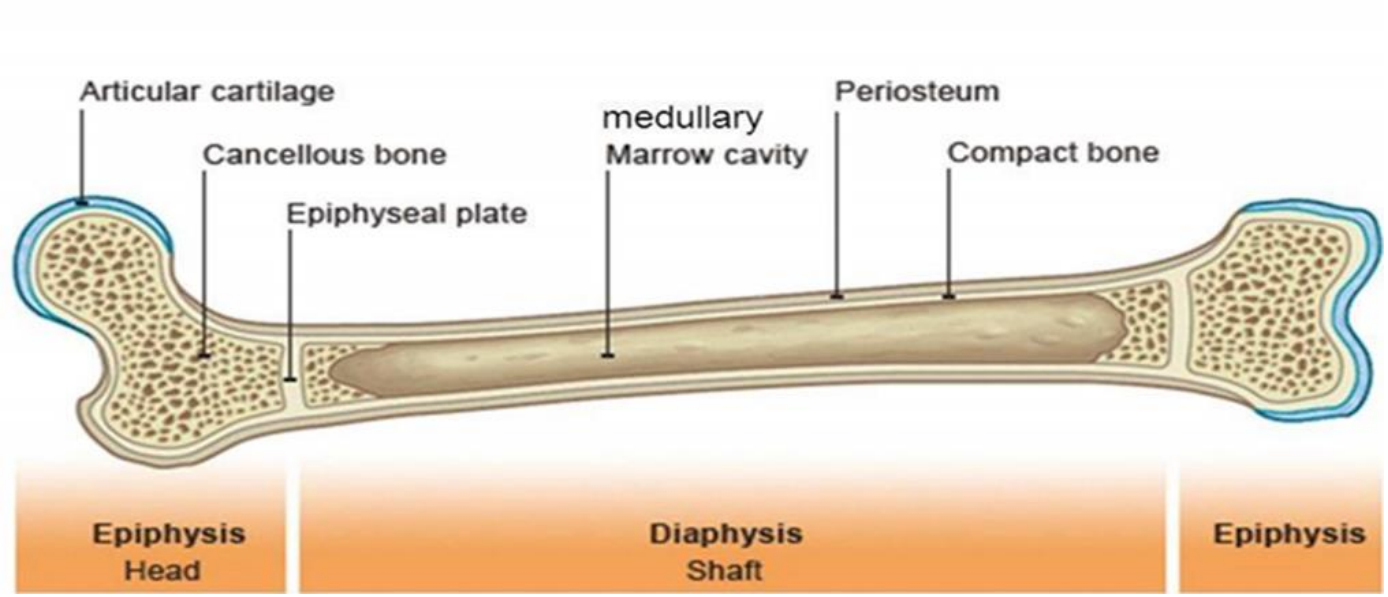
Gross Observation of Bone

- Gross observations of the femur (a long bone) cut in longitudinal section reveal two different types of bone structure.
- 1-The very dense bone on the outside surface is compact bone.
- 2-The porous portion lining the marrow cavity is cancellous or spongy bone.

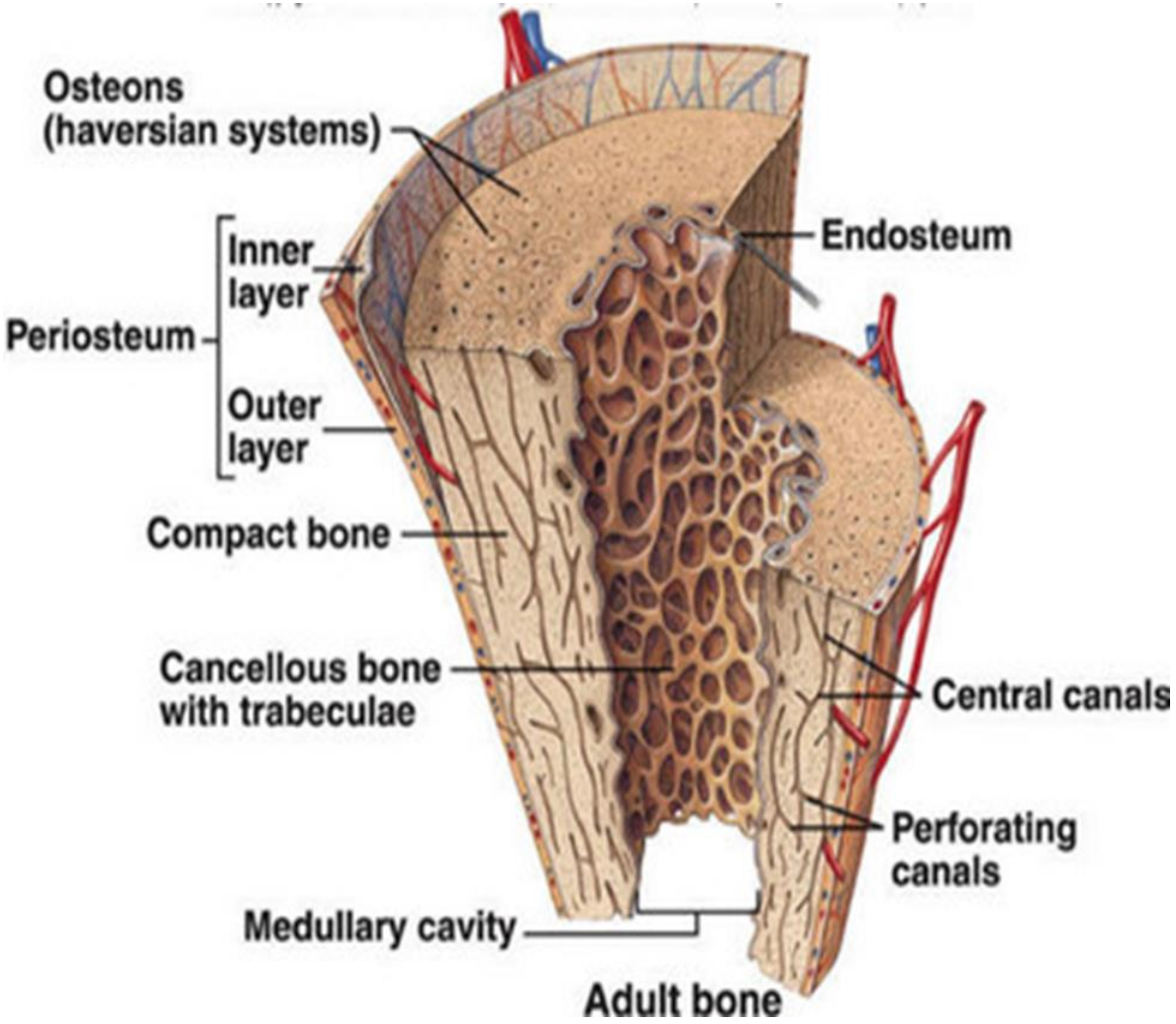


The Anatomy of a Long Bone

1. **Diaphysis** the long central shaft of the bone.
2. Epiphysis - the ends of the long bone.
3. **Metaphysis** -this is the area between the diaphysis and epiphysis and contains either the epiphyseal plate or the epiphyseal line. It is the site of length-wise growth of long bones.
4. **Articular Cartilage** -this is a special type of hyaline cartilage that covers the ends of epiphyses. This provides a smooth surface which forms a movable articulation (joint) with another bone, so that friction is minimized



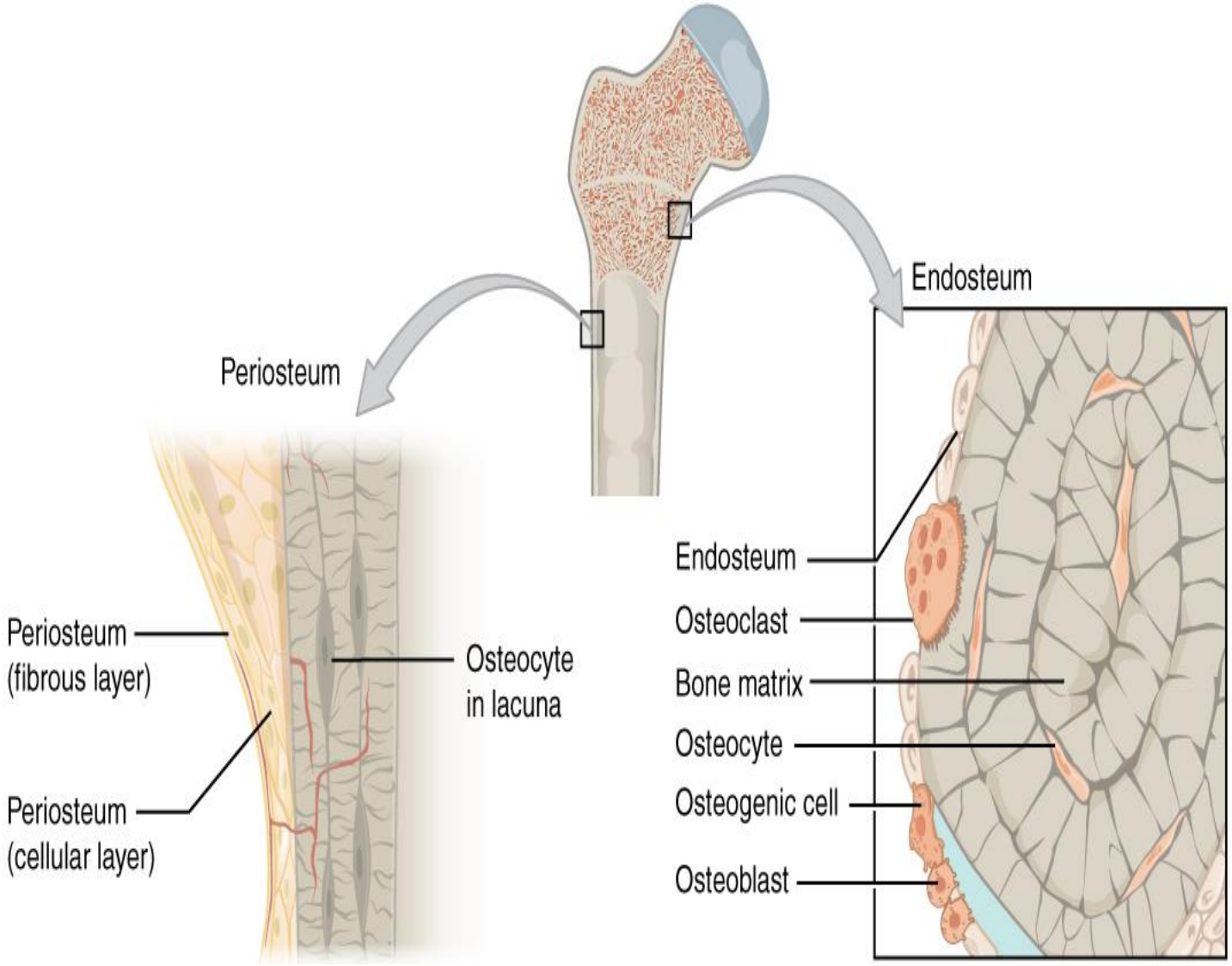
5- Medullary Cavity –. It is the central hollow area of the diaphysis (shaft) where red (myeloid tissue) and/or yellow bone marrow (adipose tissue) is stored. The medullary cavity has walls composed of spongy (cancellous) bone.

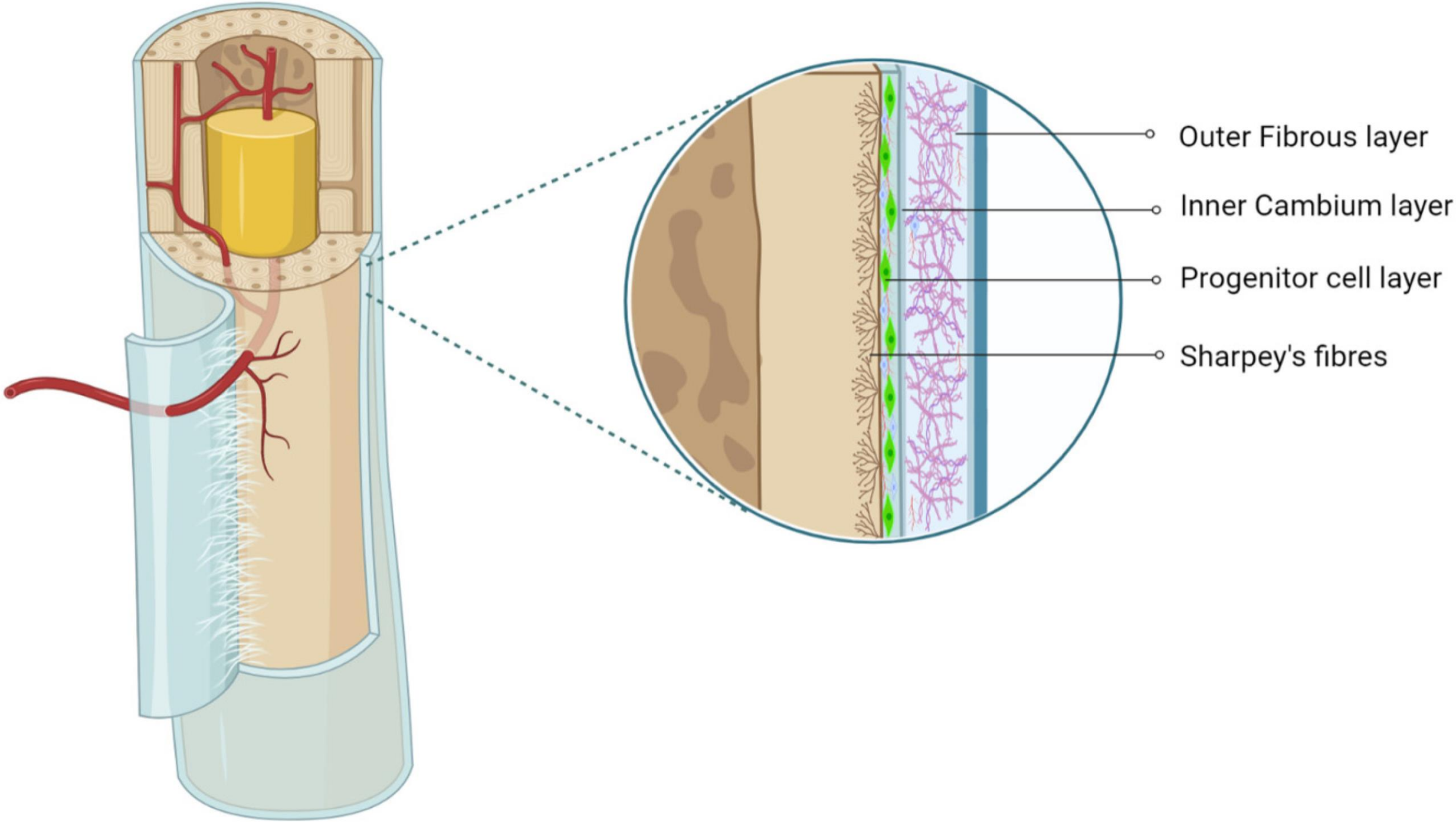


6- Endosteum - the inner lining of the medullary cavity of long bone. It is in contact with the bone marrow.

7- Periosteum - is the outer covering around bone. It has **2 layers**: An outer fibrous layer composed mostly of fibroblasts that make collagen fibers; and an inner cellular layer, composed mostly of **osteoprogenitor** The periosteum provides a good blood supply to the bone and a point for muscular attachment.

8- Sharpey's fibers, also known as perforating fibers or bone fibers, are bundles of collagen fibers which connect periosteum to bone. They originate in the periosteum and penetrate deeply into the bone matrix, anchoring the periosteum to the underlying bone.

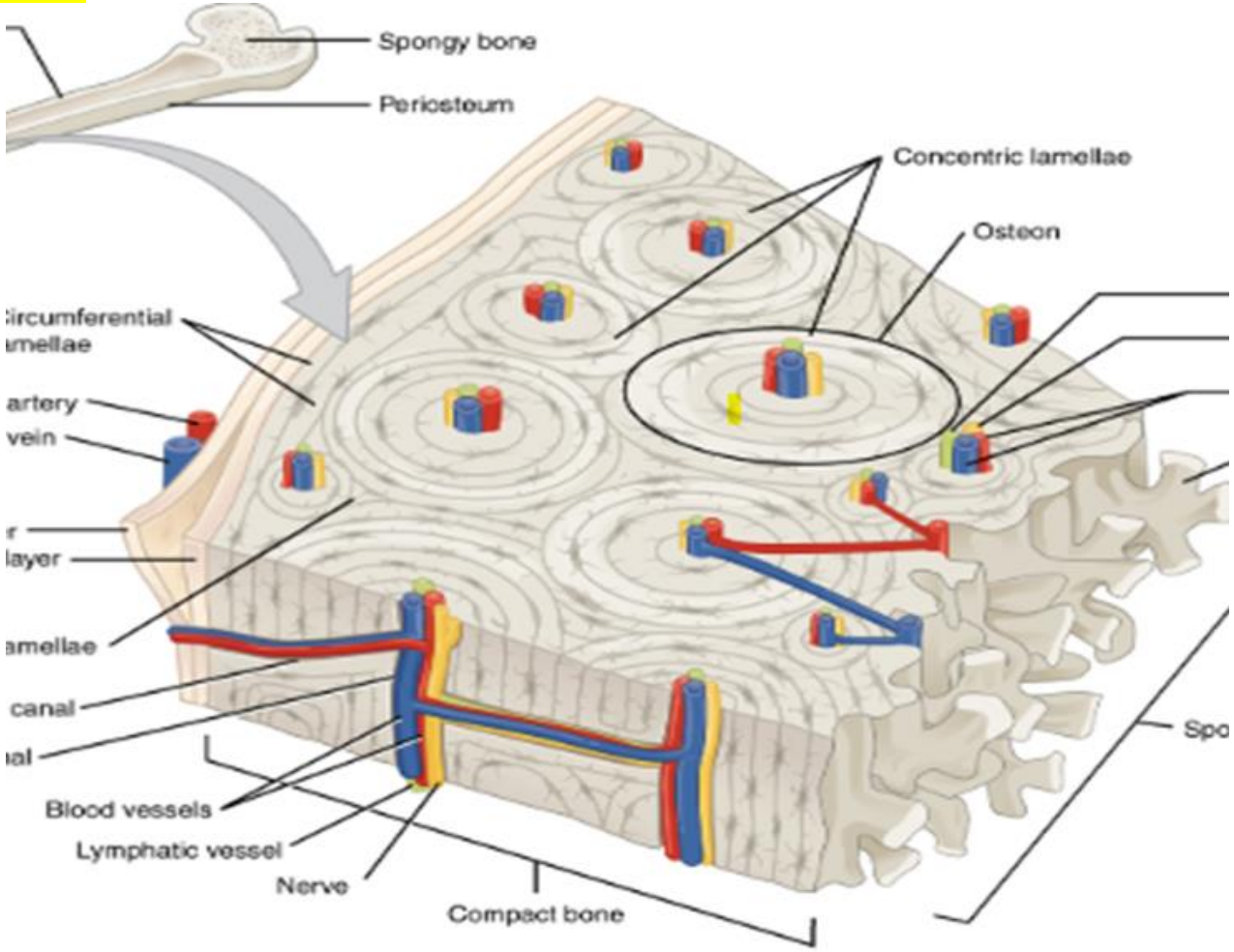


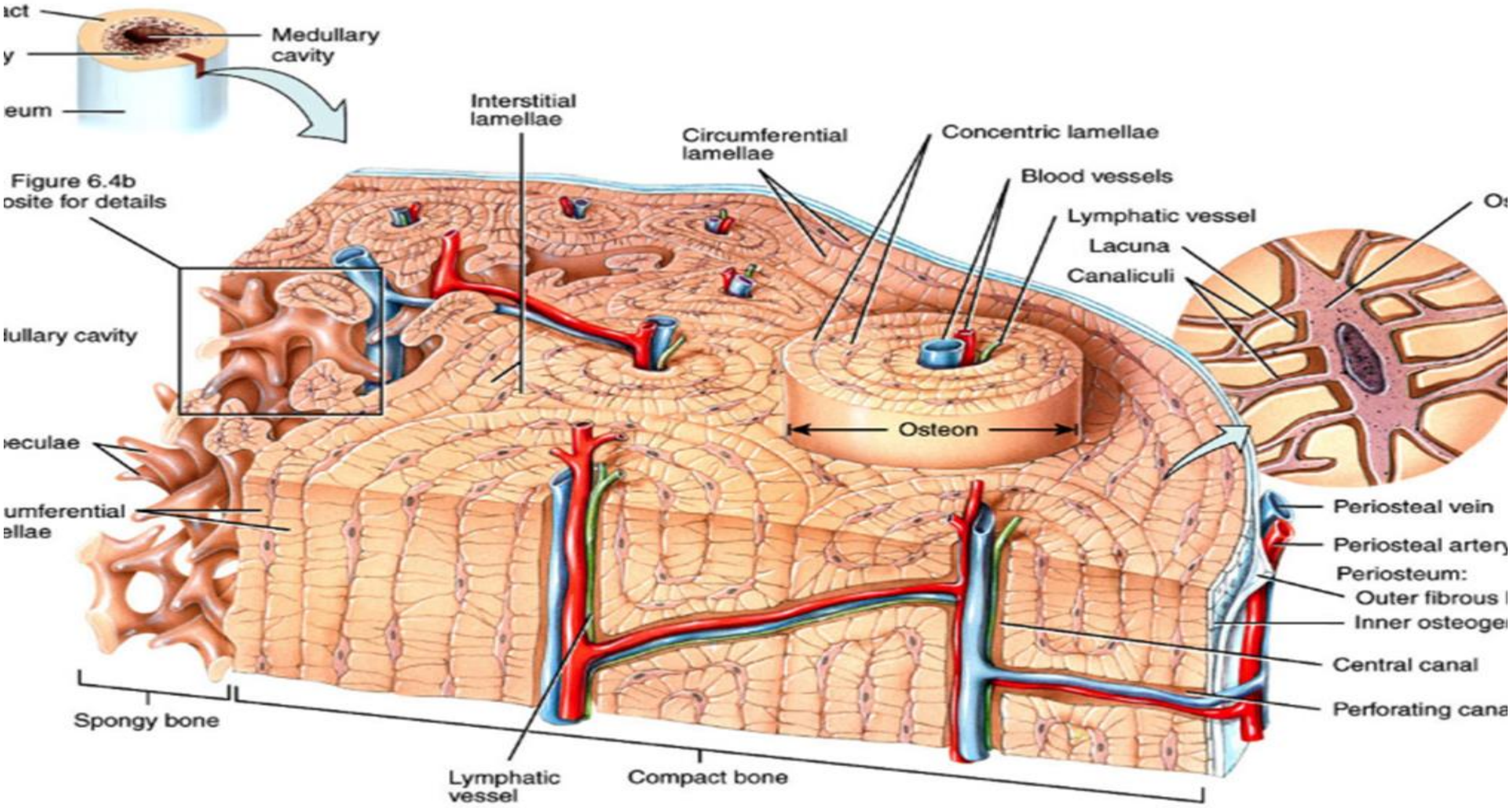

Outer Fibrous layer
Inner Cambium layer
Progenitor cell layer
Sharpey's fibres

Bone Histology
Bone Types Based on Microscopic Observations
Lamellar Systems of Compact Bone

1. **outer and inner circumferential lamellae**

- **The outer circumferential** are just deep to the periosteum, forming the outermost region of the diaphysis, and contain Sharpey's fibers anchoring the periosteum to the bone.
- **The inner circumferential** analogous to but not as extensive as outer circumferential lamellae, completely encircle the marrow cavity. Trabeculae of spongy bone extend from the inner circumferential lamellae into the marrow cavity, interrupting he endosteal lining of the inner circumferential lamellae.



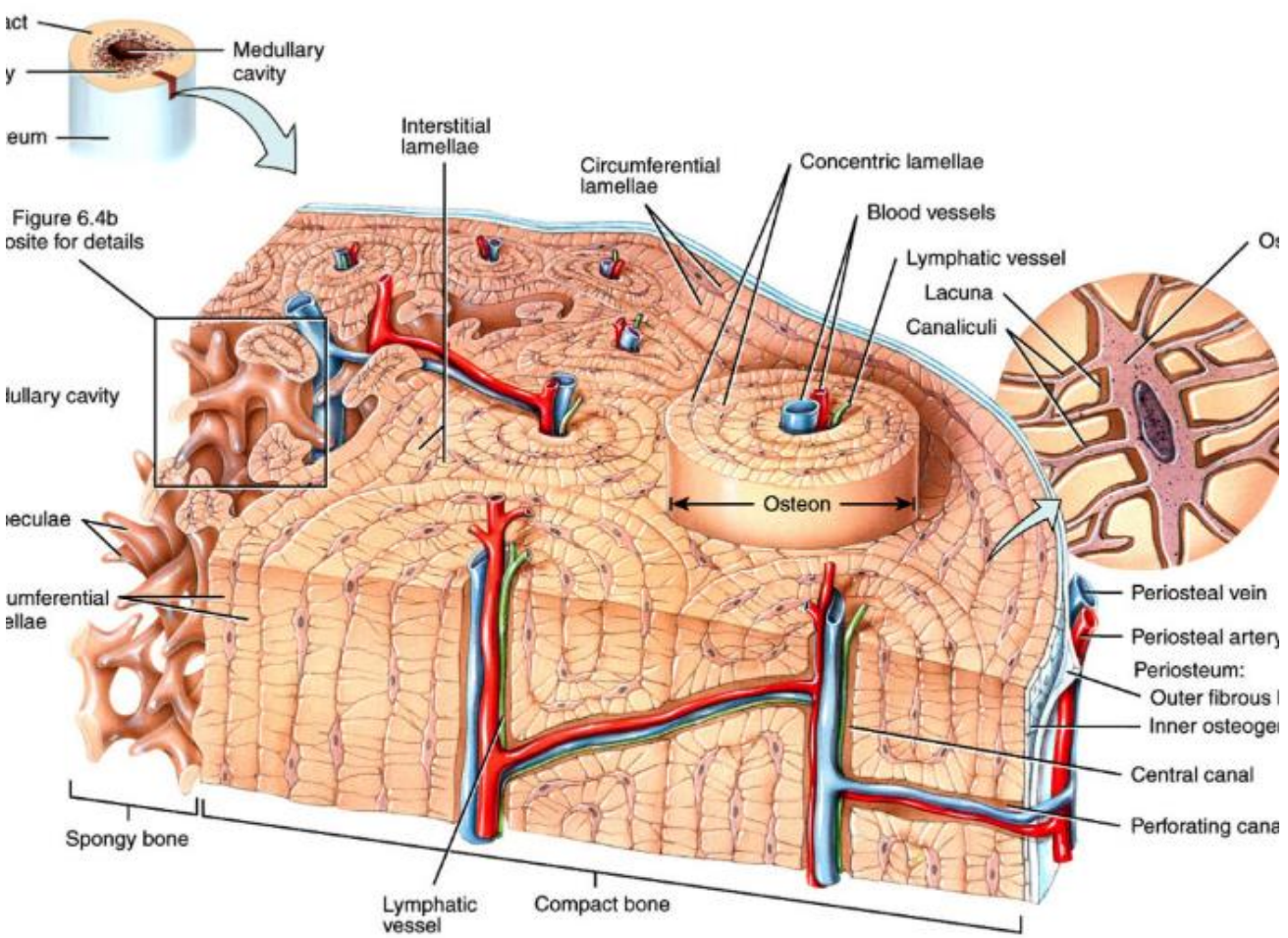

Medullary cavity
Interstitial lamellae
Circumferential lamellae
Concentric lamellae
Blood vessels
Lymphatic vessel
Lacuna
Canaliculi
Osteon
Periosteal vein
Periosteum:
Central canal
Spongy bone
Lymphatic vessel
Compact bone

2- Interstitial lamellae The intervals between Haversian system are filled with interstitial or intermediate lamellae.

3- Haversian Canal Systems (Osteon units)

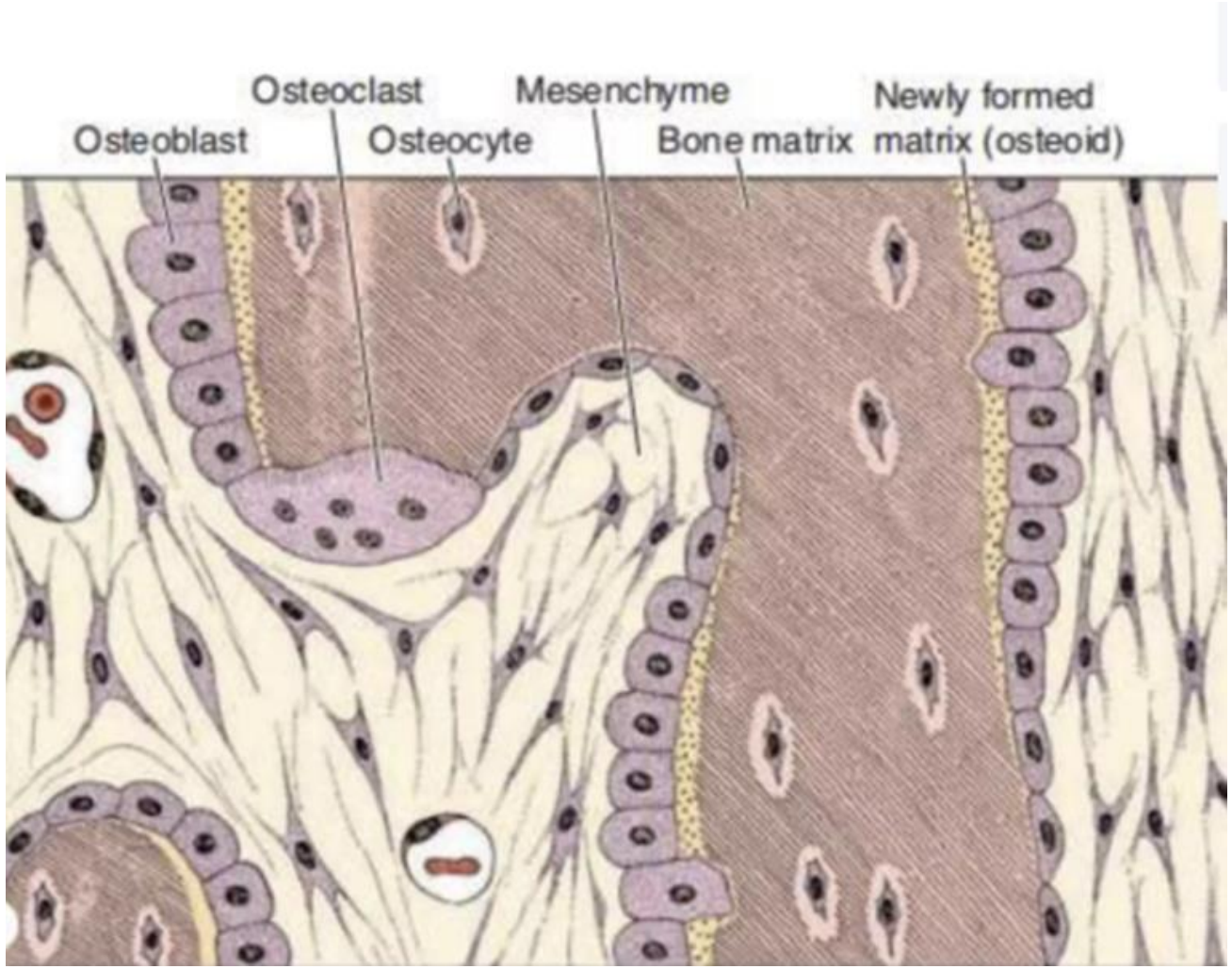
They are composed of cylinders of lamellae, concentrically arranged around a vascular space known as the Haversian canal.

Haversian canals of adjacent osteons are connected to each other by perforating (Volkmann's) canals.



Spongy (or Cancellous) Bone

- It is the bone tissue that is made first and the trabeculae are the functional unit of spongy bone.
- Osteocytes are still located in lacunae in spongy bone
- The osteoblasts are found on the surface of the trabeculae within the endosteum. This is also where osteoclasts are located.
- The trabeculae provide internal spaces in bone which can contain red bone marrow which function as a hemopoietic compartment, producing blood.



Osteogenesis of Bone

- Bone formation during embryonic development may be of two types:
- **1-Intramembranous Bone Formation**
- Most flat bones are formed by intramembranous bone formation.

A. Mesenchymal Condensation and Centers of Ossification:

- One or more centers of ossification form in condensed mesenchyme.
- These centers are marked by high vascularity and mesenchymal cells differentiating into osteoblasts.

B. Formation of Osteoid Matrix and Calcification:

- Osteoblasts secrete an uncalcified gelatinous matrix (osteoid) containing collagen fibers.
- Calcium salts deposit in the osteoid, converting it into mineralized matrix.
- Osteoblasts trapped in the matrix become osteocytes.

Osteogenesis of Bone

C. Formation of Spongy (Trabecular) Bone:

- Bony lamellae form around blood vessels and arrange as trabeculae.
- Trabeculae are separated by marrow spaces containing blood cells, leading to the formation of spongy bone.

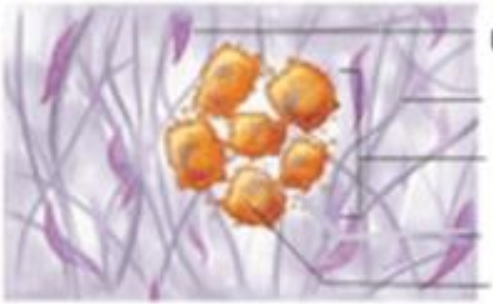
D. Formation of Compact Bone and Periosteum:

- Peripheral osteoblasts lay down concentric bony lamellae to form osteons (Haversian systems), transforming spongy bone into compact bone.
- Mesenchymal cells outside the compact bone form the periosteum.

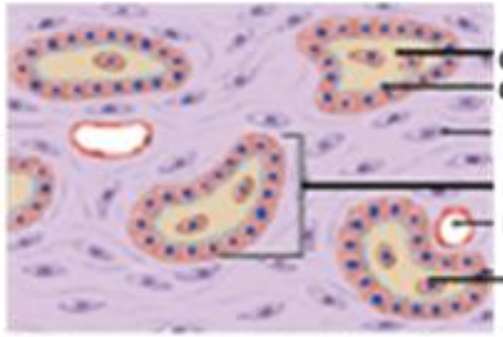
Osteogenesis of Bone



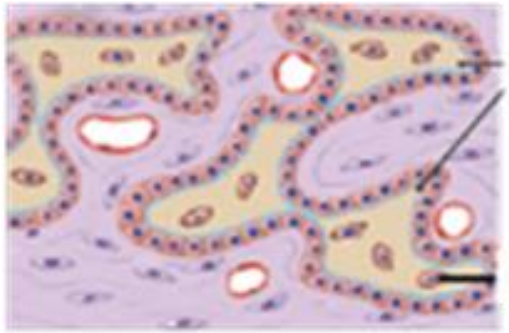
Bones formed by intramembranous ossification



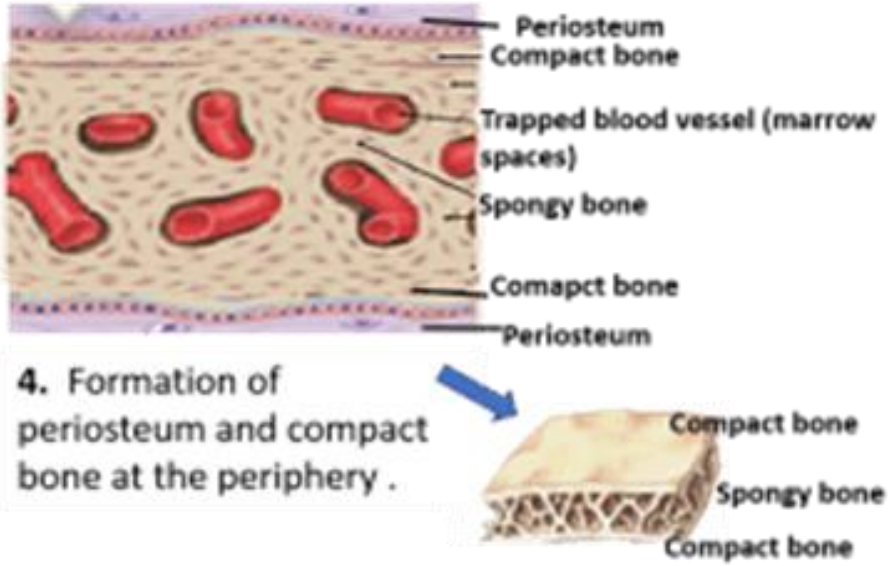
1. Condensation of mesenchymal tissue and appearance of ossification center.



2. Formation of osteoid and its mineralization.



3. Formation of trabecular bone (spongy bone)



4. Formation of periosteum and compact bone at the periphery .

2- Endochondral Bone Formation

- Most long bones are formed by endochondral ossification, which involving hyaline cartilage serving as a cartilage model, cartilage proliferation and calcification, and gradual replacement by bone. Long bone formation includes the following steps:

1. Cartilage Model Formation:

- Mesenchymal cells condense to form a small piece of hyaline cartilage, which outlines the future bone structure.
- The outer layer of mesenchyme differentiates into a perichondrium.

2. Developing Cartilage Model:

- The cartilage grows and assumes the shape of the future bone, establishing a structural template.

Formation of the Bone Collar:

- In the central shaft (diaphysis), the perichondrium transitions into periosteum.
- Osteoprogenitor cells in the periosteum differentiate into osteoblasts, which produce a periosteal bone collar through intramembranous ossification.

3. Primary Ossification Center Formation:

- The cartilage in the middle shaft proliferates and calcifies, leading to the development of a primary ossification center.
- Blood vessels invade this region, creating a primary marrow cavity, and osteoblasts begin depositing bone matrix.

4.Bony Trabeculae Formation:

•Osteoprogenitor cells migrate into the calcified cartilage matrix with invading blood vessels.

•These cells differentiate into osteoblasts, depositing osteoid on the calcified cartilage matrix.

•Concurrently, osteoclasts remove dead chondrocytes and excess calcified cartilage, forming bony trabeculae.

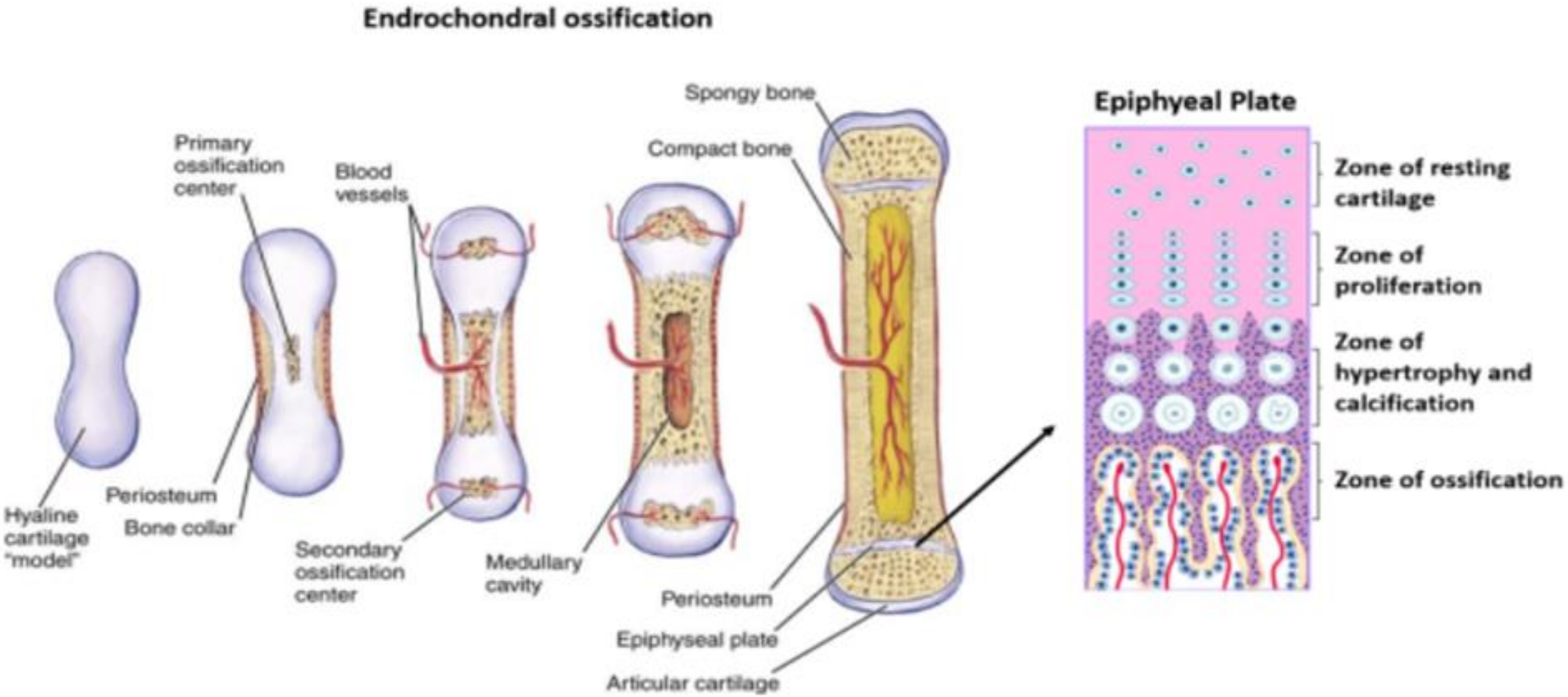
5. **Secondary Ossification Centers**:

- Similar ossification processes occur at the distal ends (epiphyses) of the bone, leading to the formation of secondary ossification centers.

6. **Continuation of Ossification**:

- Both primary and secondary ossification centers expand through repeated cycles of cartilage absorption and bone deposition.
- Eventually, around age 20 in humans, the cartilage in the epiphyseal plates disappears, and the primary and secondary ossification centers merge, signifying the completion of long bone development.

2- Endochondral Bone Formation

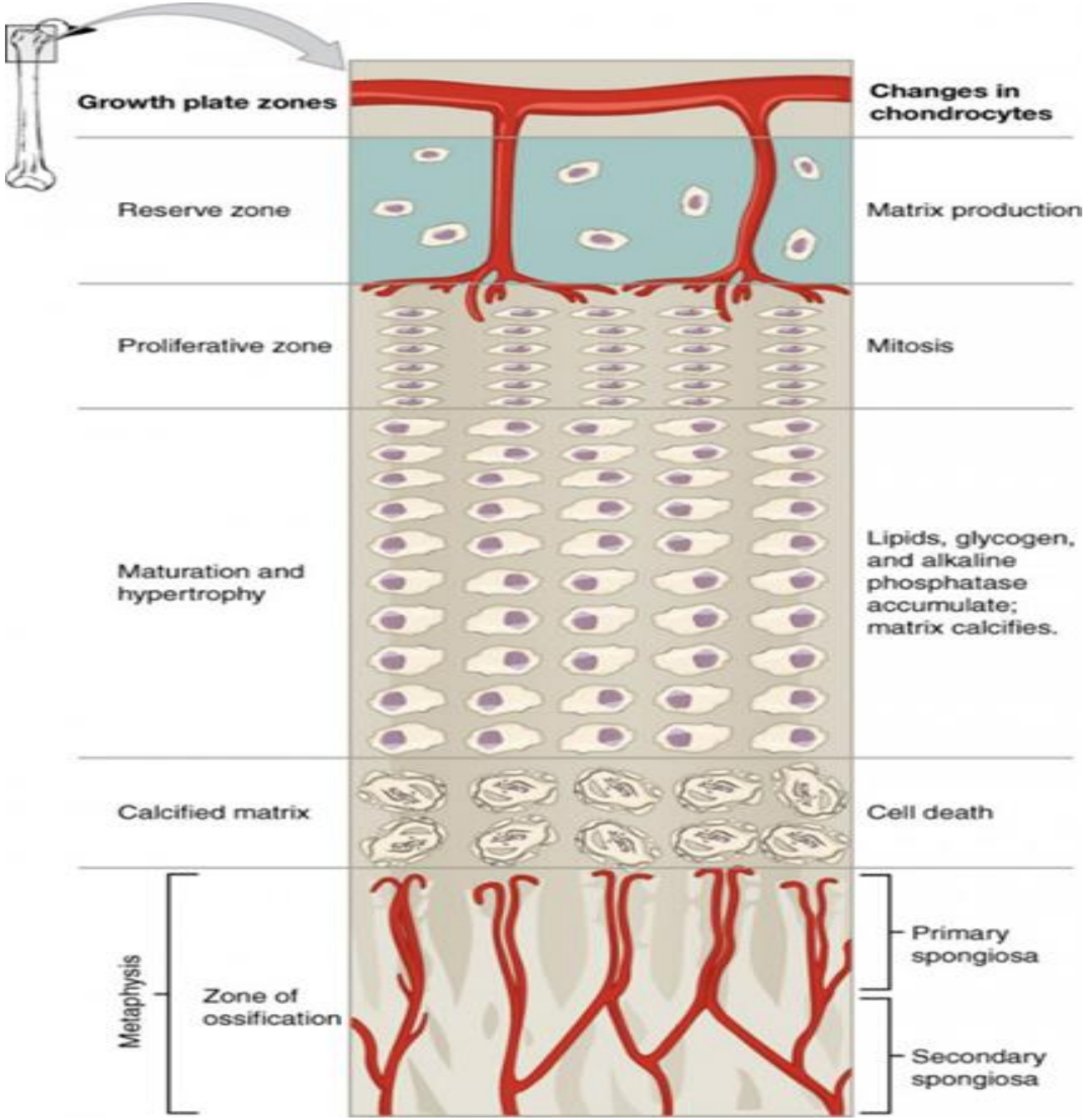


Bone Growth in Length

The chondrocytes of the epiphyseal plate proliferate and participate in the process of endochondral bone formation. Histologically, the epiphyseal plate is divided into five recognizable zones, beginning at the epiphyseal side, are as follows:

A. Zone of reserve cartilage: Chondrocytes randomly distributed throughout the matrix are mitotically active.
B. Zone of proliferation: Chondrocytes, rapidly proliferating, form rows of is isogenous cells that parallel the direction of bone growth.
C. Zone of maturation and hypertrophy: Chondrocytes mature, hypertrophy, and accumulate glycogen in their cytoplasm. The matrix between their lacunae narrows with a corresponding growth of lacunae.
D. Zone of calcification: Lacunae become confluent, hypertrophied chondrocytes die, and cartilage matrix becomes calcified.
E. Zone of ossification: Osteoprogenitor cells invade the area and differentiate into osteoblasts, which elaborate matrix that becomes calcified on the surface of calcified cartilage. This is followed by resorption of the calcified cartilage.

Bone Growth in Length



Bone Repair

The repair of a fractured bone is a complex process that progresses through four distinct stages:

1-Formation of Fracture Hematoma:

Blood vessels torn during the fracture release blood, which clots to form a **fracture hematoma**.

This hematoma provides an initial framework and signals for the repair process.

2-Formation of Procallus (Soft Callus):

Macrophages remove the hematoma over time.

The area is replaced by a **soft fibrocartilage-like mass**, known as the **procallus**.

This procallus is rich in **collagen** and **fibroblasts**, acting as a temporary scaffold.

The **periosteum**, if disrupted, regains continuity over the procallus tissue.

Bone Repair

3-Hard Callus Formation:

The procallus is invaded by regrowing **blood vessels** and **osteoblasts** (bone-forming cells).

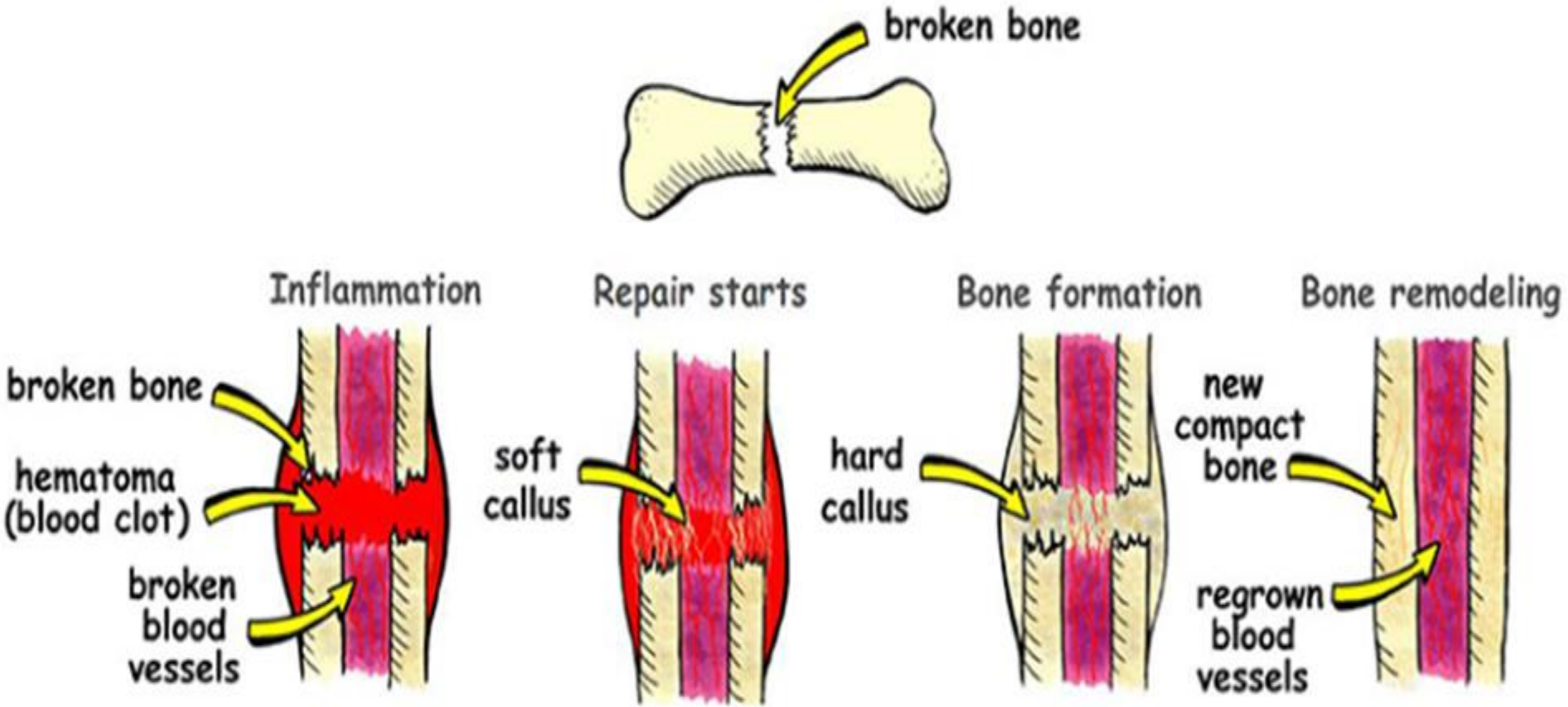
Over a few weeks, the **fibrocartilage of the procallus** is replaced by trabeculae of **primary bone**.

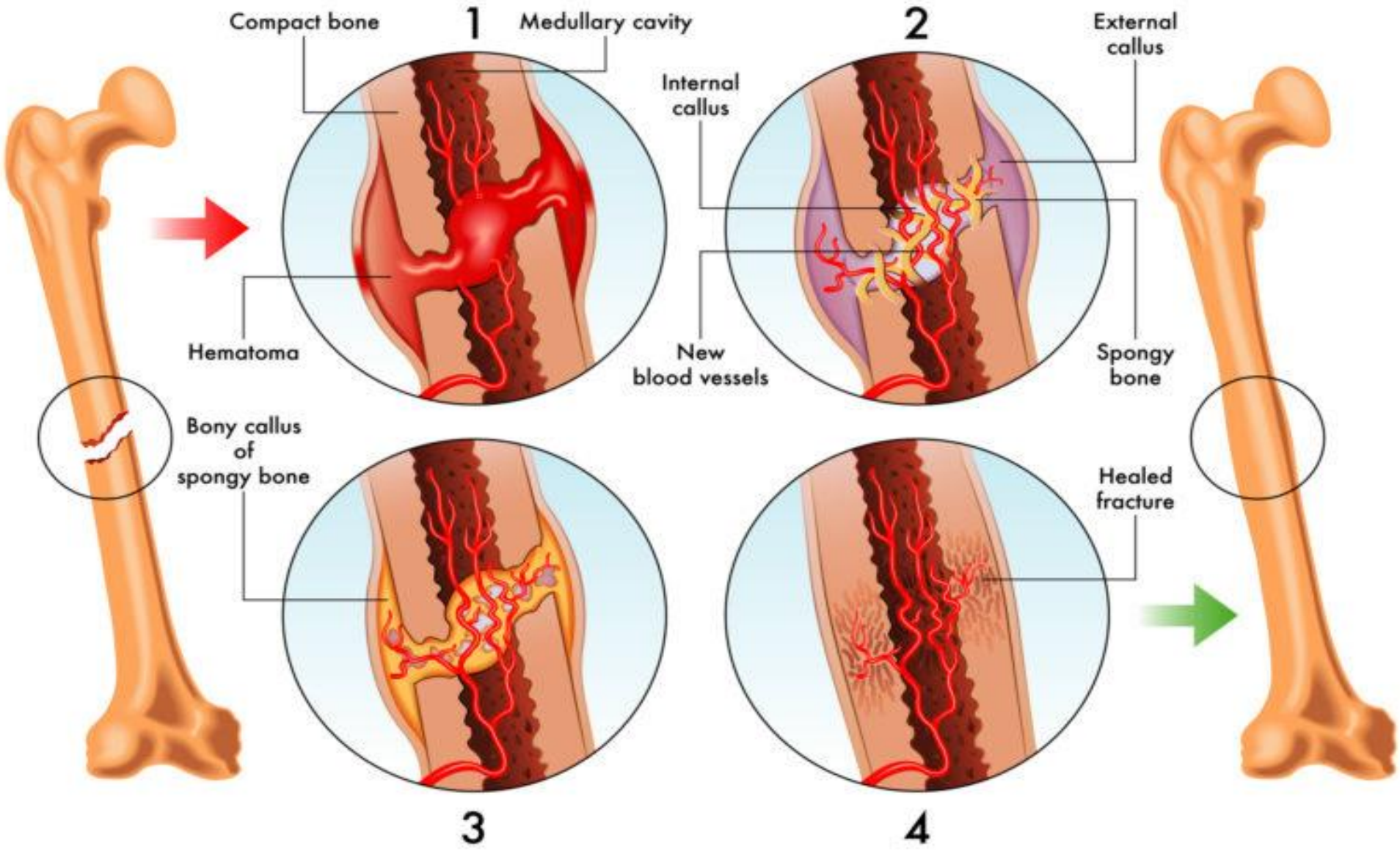
This results in the formation of a **hard callus** that spans the fracture site

4-Bone Remodeling:

- The primary bone is gradually remodeled into compact bone and cancellous bone, restoring the bone's original architecture.
- This phase re-establishes full continuity with uninjured areas and restores a functional blood supply.

Bone Repair


broken bone
Inflammation
Repair starts
Bone formation
Bone remodeling
broken bone
hematoma
(blood clot)
broken
blood
vessels
soft
callus
hard
callus
new
compact
bone
regrown
blood
vessels


Compact bone
1
Medullary cavity
Hematoma
Bony callus
of
spongy bone
2
Internal
callus
New
blood vessels
External
callus
Spongy
bone
Healed
fracture
3
4

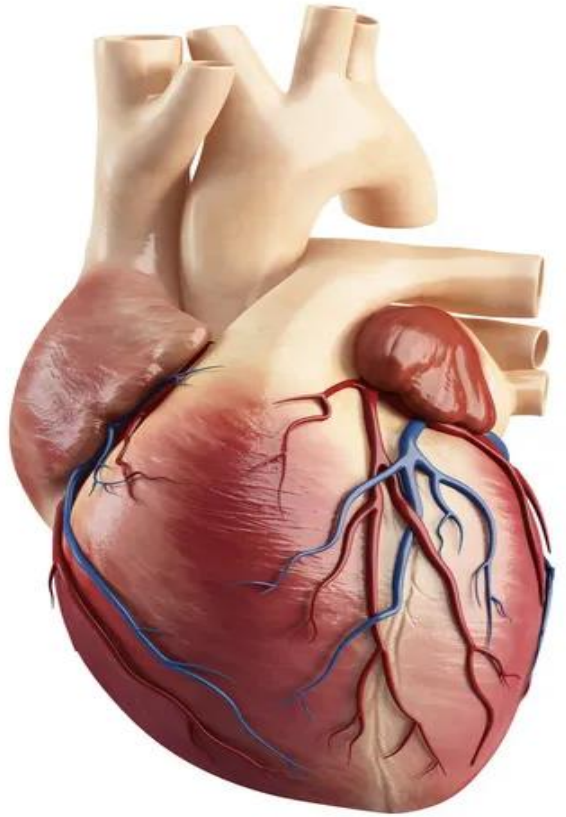

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Aesthetic and Laser Department
Histology and Anatomy

Lecture 12&13

Circulatory system

Dr. Rabab Ali Al-Mosawi



THE MEDIASTINUM

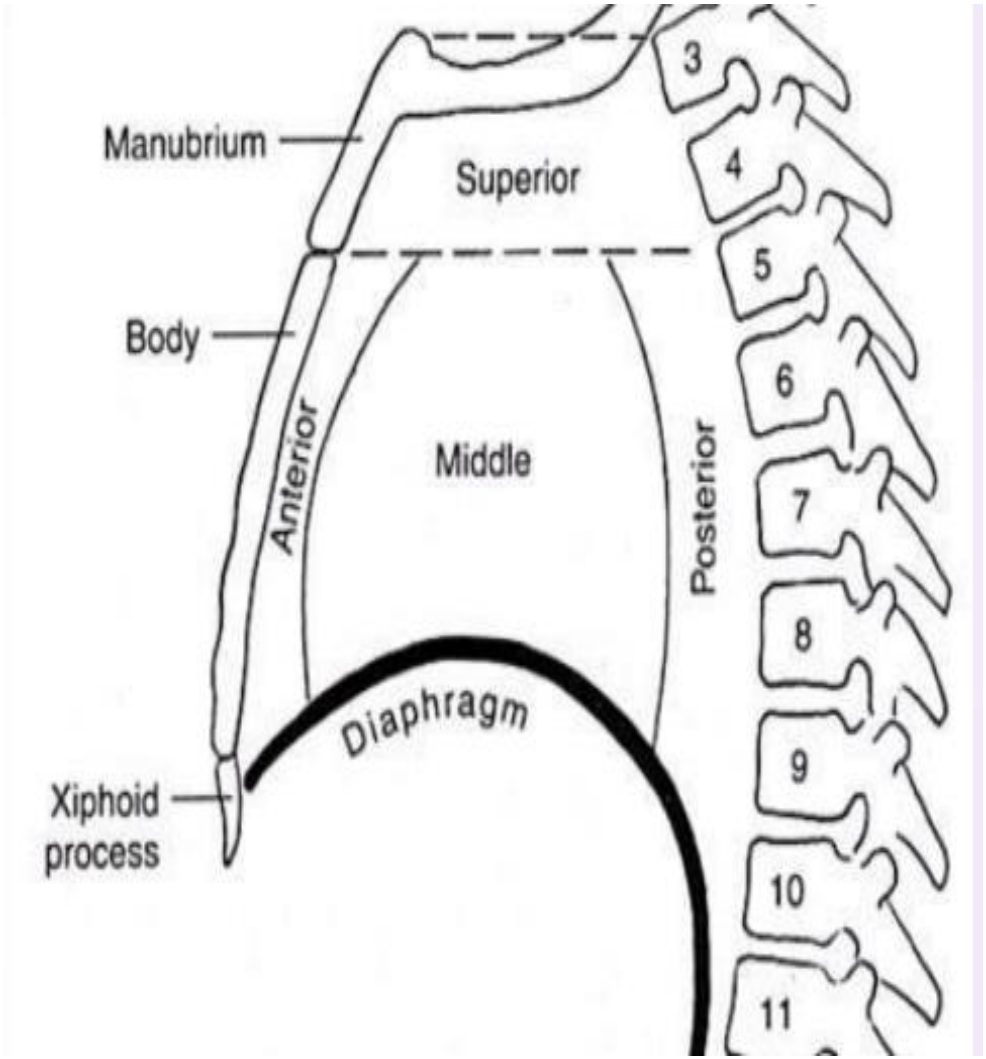
1. The superior mediastinum extends from the superior thoracic aperture to the transverse thoracic plane, that passes from the sternal angle anteriorly to the junction of T4 and T5 vertebrae posteriorly (IV disc).

2. The inferior mediastinum extends between the transverse thoracic plane and the diaphragm. It is further subdivided by the pericardium and heart into:

a. Anterior mediastinum; anterior to the heart.

b. Middle mediastinum; it is occupied by the pericardium and its contents (heart and roots of its great vessels).

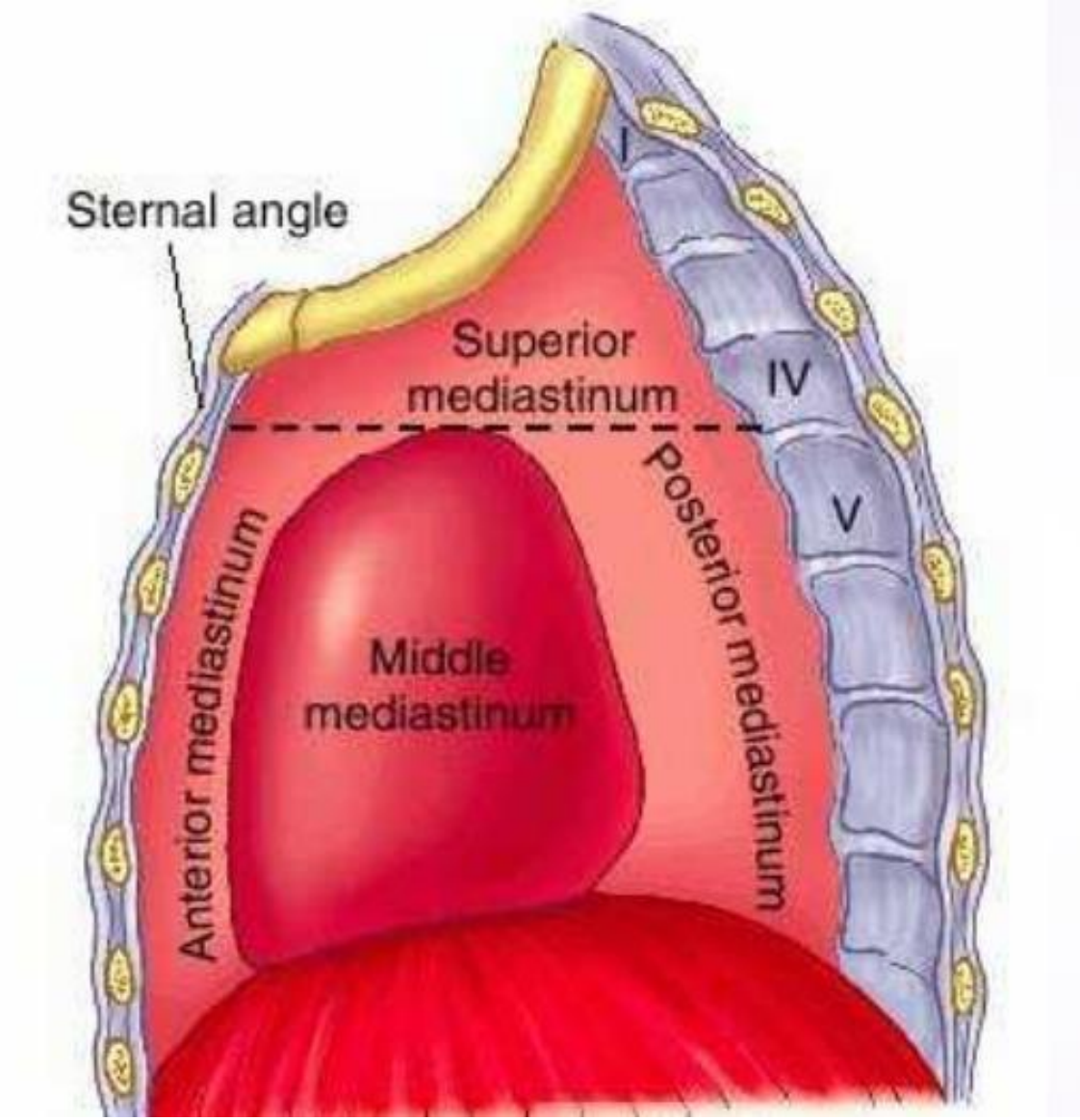
c. Posterior mediastinum; posterior to the heart.



THE HEART

The heart is located in the thoracic cavity in the middle mediastinum, rests on the

diaphragm, between the lungs, behind and to the left of the sternum. It is a little larger than the owner’s closed fist.

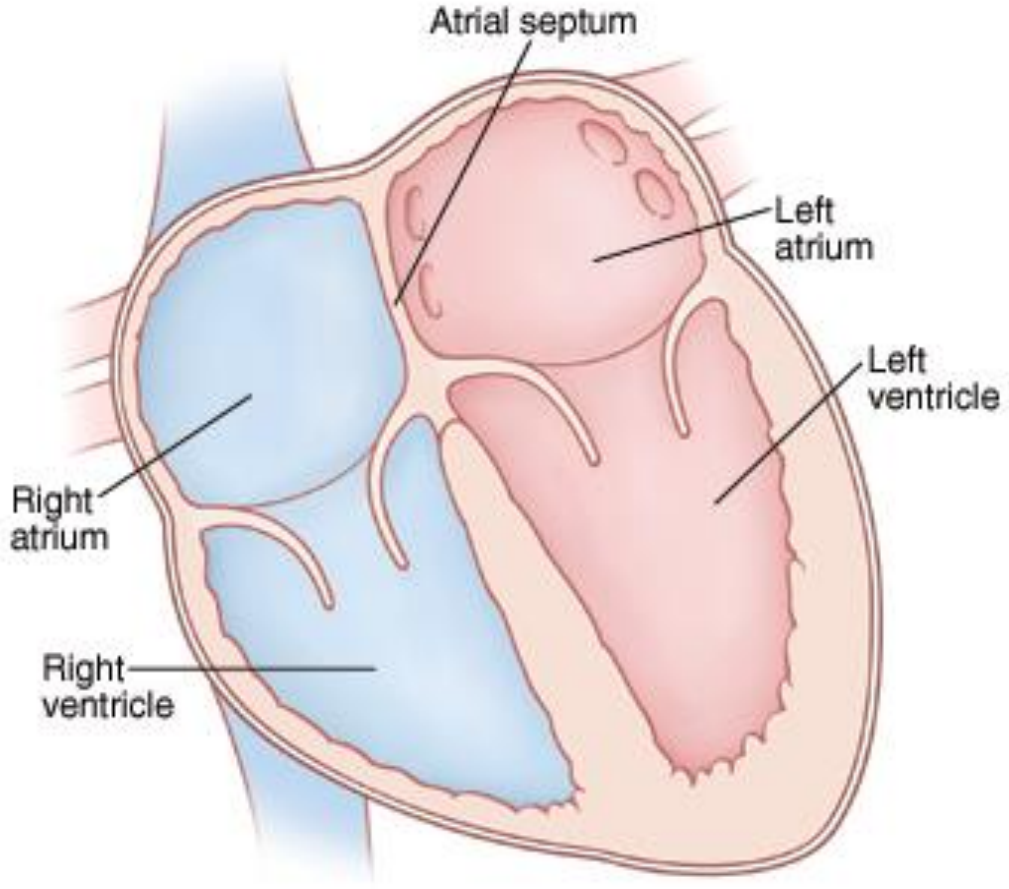


CHAMBERS OF THE HEART

- The heart has four chambers, two atria (right and left) and two ventricles (right and left).

There are two dividing walls between the atria and ventricles;

- the interatrial septum and the interventricular septum.
- Thus, with these septa there is no mixing of blood between the two sides.



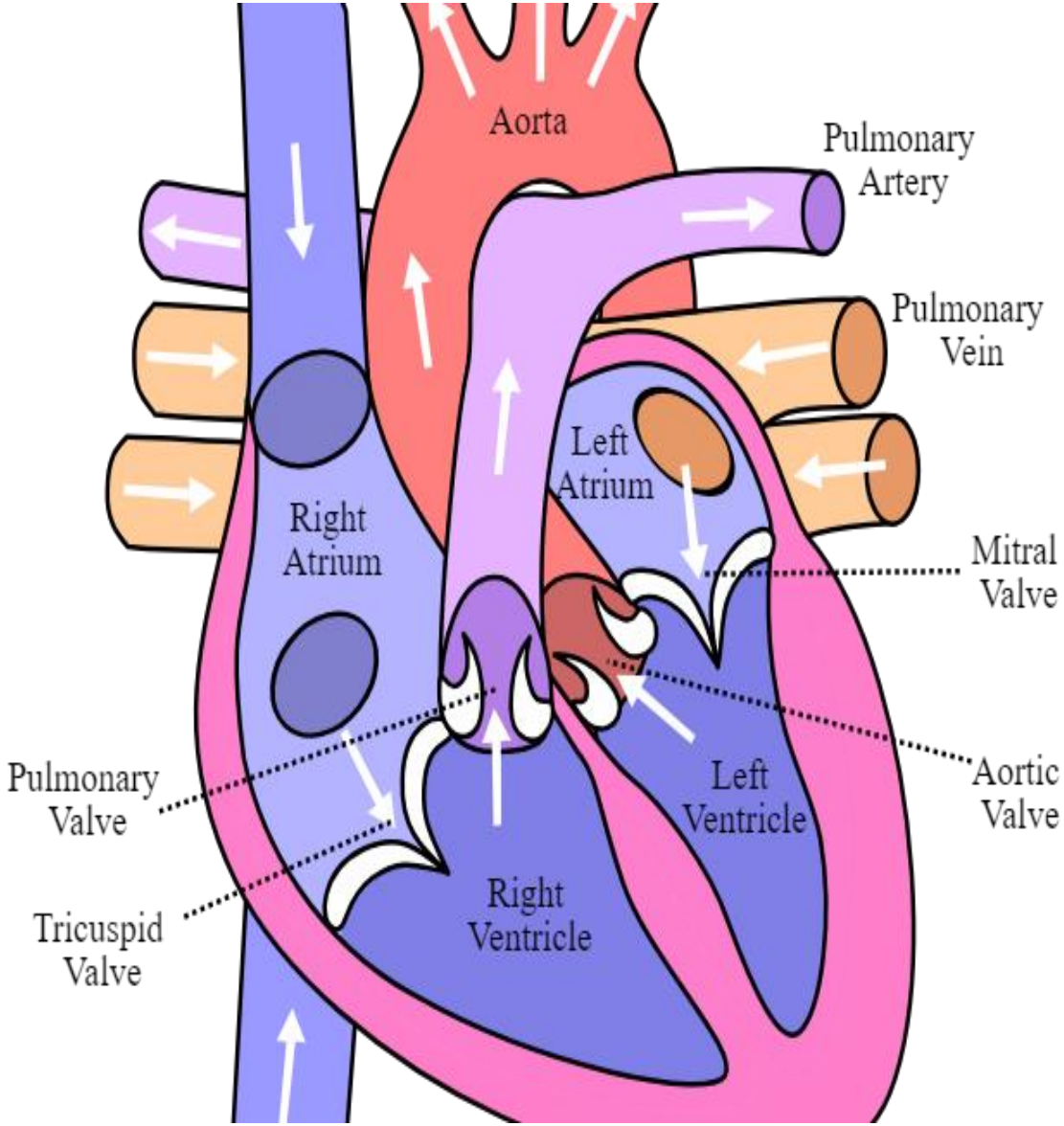
VALVES OF THE HEART

Between the atria and the ventricles are two valves (the atrioventricular valves), which are attached by chordae tendineae to the papillary muscles of the ventricles:

1. The tricuspid valve: This is made up of three cusps and lies between the right atrium and the right ventricle.

2. The bicuspid (mitral) valve: This is made up of two cusps and lies between the left atrium and the left ventricle.

The purpose of the atrioventricular valves is to prevent the backward flow of blood from the ventricles into the atria.

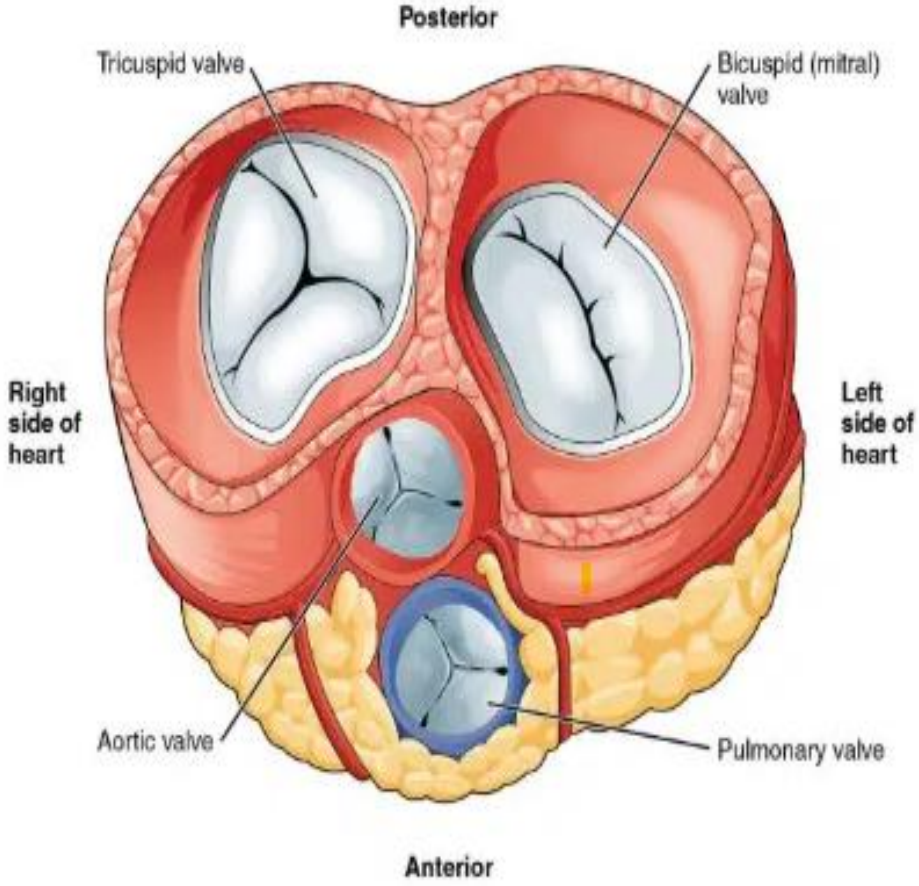


There are two semilunar valves between ventricles and great arteries

1. Aortic valve: This is made up of three cusps and lies between the aorta and the left ventricle

2. Pulmonary valve: This is made up of three cusps and lies between the pulmonary trunk(artery) and right ventricle

The purpose of the semilunar valves is to prevent the backward flow of blood from the great arteries into the ventricles during diastole.



WALLS OF THE HEART

- **1. Pericardium:**

- The heart is surrounded by a membrane called the pericardium (peri = around). This is divided into two parts forming two sacs surrounding the heart: the fibrous pericardium and the serous pericardium, that are closely connected to each other.

- a. Fibrous pericardium:

- A tough layer is made up of dense fibrous tissue. The role of this layer is to prevent the overstretching of the heart. It also provides protection to the heart and fixes it in place on the diaphragm.

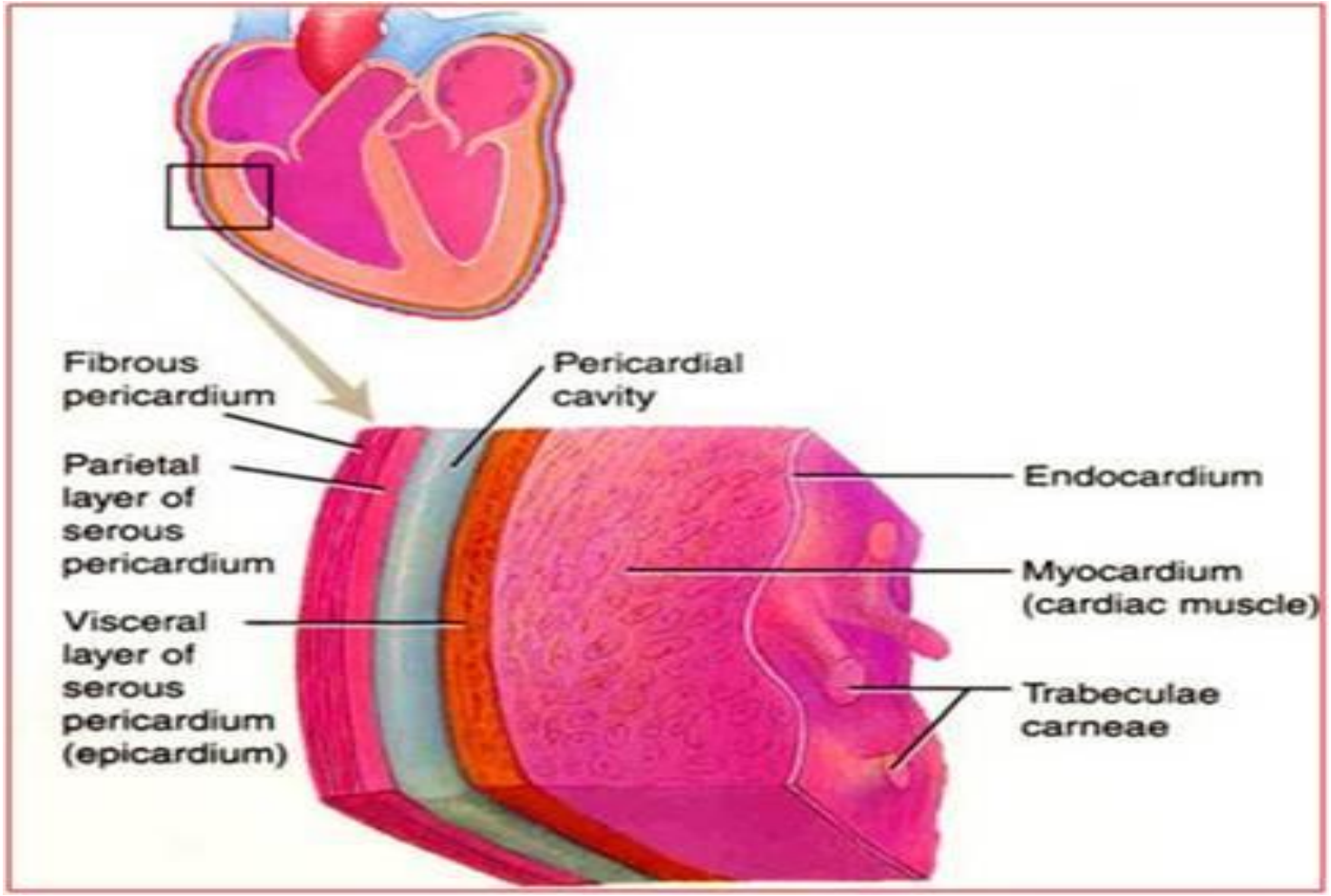
- b. Serous pericardium:

- The serous pericardium is a thinner, more delicate, epithelial layer surrounding the heart. It consists of two layers:

- □ Parietal pericardium: This outer layer is fused to the fibrous pericardium.

- □ Visceral pericardium (also known as the epicardium): This inner layer adheres tightly to the surface of the heart.

- Between the parietal and visceral pericardium is a space called the pericardial cavity contains a thin film of fluid (pericardial fluid) which reduces the friction between the membranes as the heart contracts and relaxes



2. Myocardium:

Underlying the pericardium is the heart muscle known as the myocardium (myo = muscle).

Myocardial thickness varies between the four chambers.

The ventricles have thicker walls than the atria; however, the left ventricle has the thickest myocardial wall. This is because the left ventricle pumps blood great distances to different parts of the body.

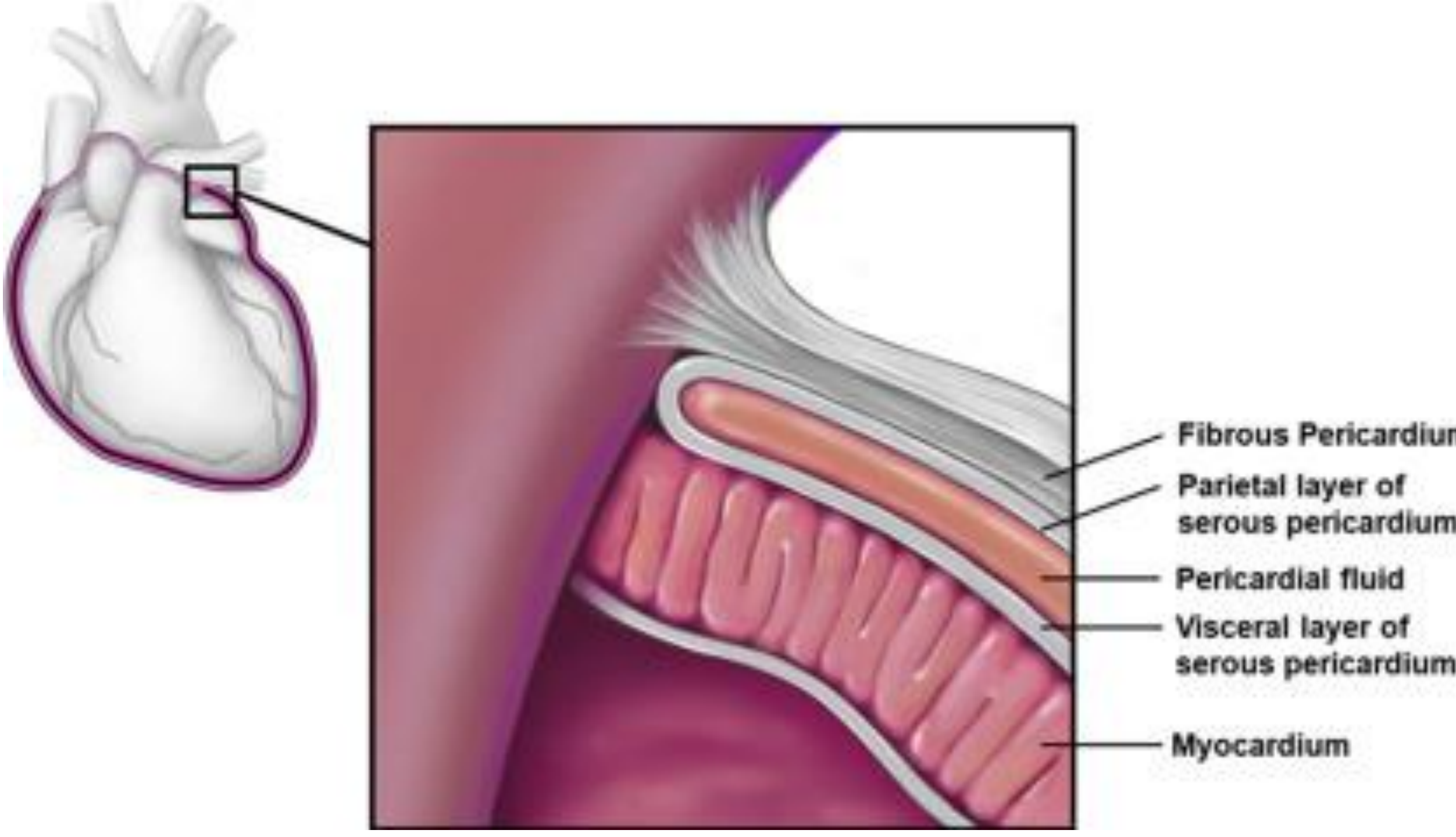
They are divided into two categories:

a. The contracting muscles: These form the majority of the myocardium which perform the mechanical work of the heart (contraction).

b. The electrical muscles: These form the remainder of the myocardium which initiate and conduct the electrical impulses to the contracting cardiac muscles.

3. Endocardium:

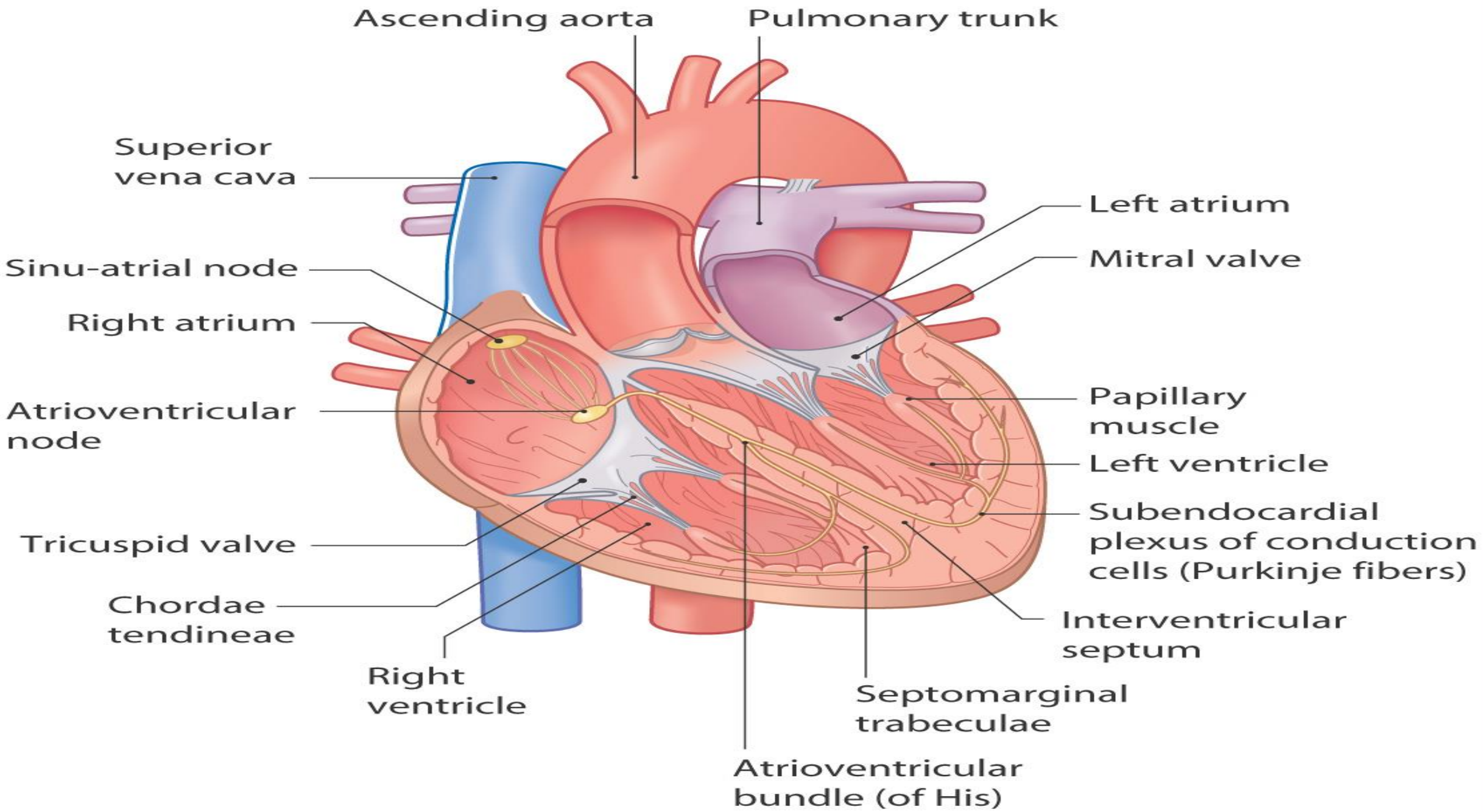
The endocardium (endo = within) is the innermost layer of the heart, made up of simple epithelium lining the inside of the heart and its valves. It provides a smooth lining for the blood to flow through the chambers.


Fibrous Pericardium
Parietal layer of serous pericardium
Pericardial fluid
Visceral layer of serous pericardium
Myocardium

BLOOD VESSELS OF THE HEART

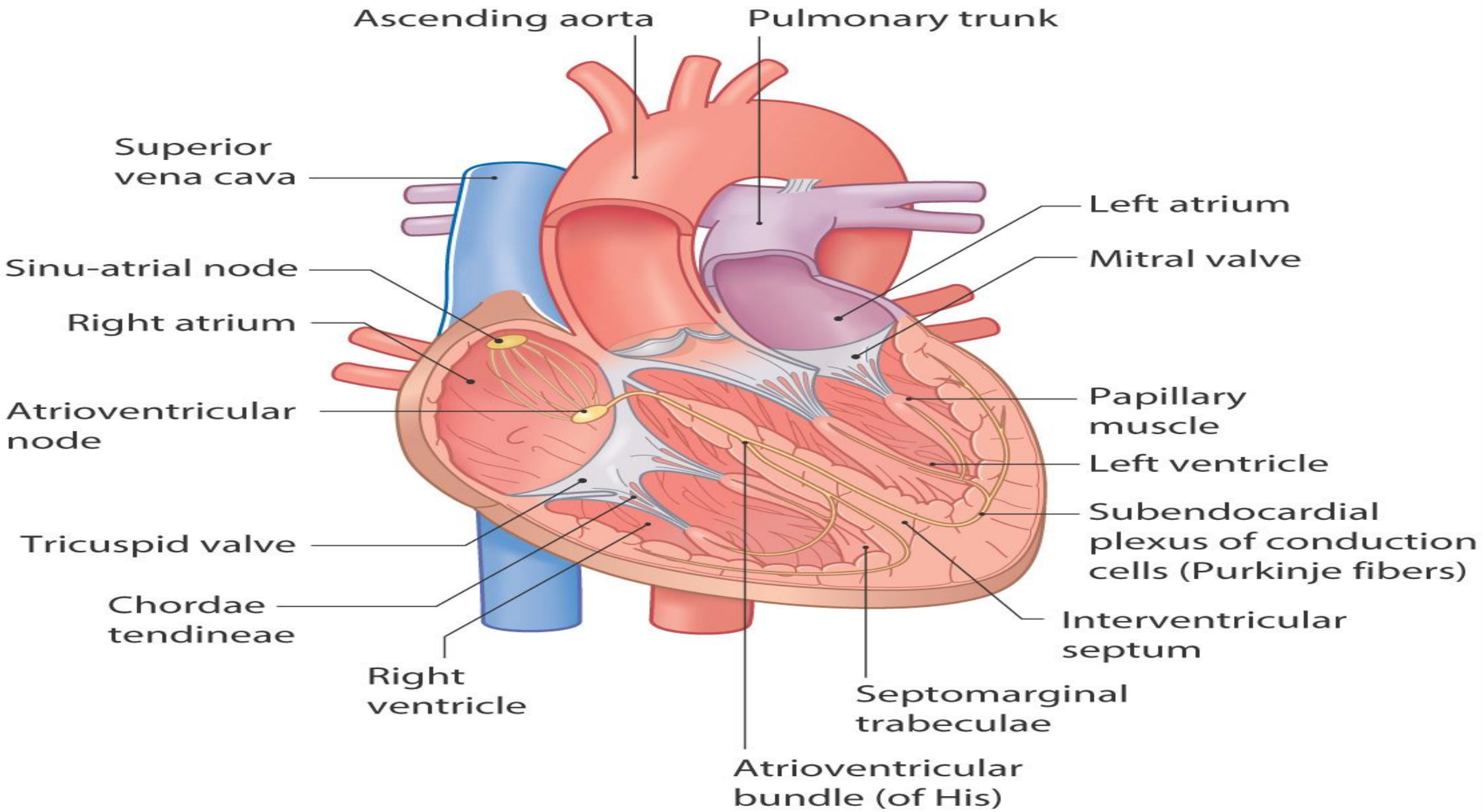
1. The aorta and coronary arteries:

- This is the largest blood vessel arises from the left ventricle of the heart.
- The aorta carries and distributes oxygen-rich blood to all of the body.
- The coronary arteries are the first blood vessels that branch from the aorta, just above the aortic valve.
- There are two main coronary arteries: the right coronary artery and left coronary artery, forming a net of blood vessels encircling the heart like a crown.
- The coronary veins return deoxygenated blood and waste products from the cardiac muscle and capillaries to the right atrium. This blood then flows to the lungs for reoxygenation and removal of carbon dioxide. Coronary veins contain valves preventing back flow of the blood.


Ascending aorta
Pulmonary trunk
Superior vena cava
Left atrium
Sinu-atrial node
Mitral valve
Right atrium
Atrioventricular node
Papillary muscle
Left ventricle
Subendocardial plexus of conduction cells (Purkinje fibers)
Tricuspid valve
Chordae tendineae
Interventricular septum
Right ventricle
Septomarginal trabeculae
Atrioventricular bundle (of His)

2.The pulmonary arteries and veins:

- The pulmonary trunk arises from the right ventricle of the heart
- They divided into two pulmonary arteries; one goes for each lung.
- The pulmonary arteries are unique in that unlike most arteries which carry oxygenated blood to other parts of the body, they carry de-oxygenated blood to the lungs.
- After picking up oxygen, the oxygen-rich blood is returned via four pulmonary veins from the lungs to the left atrium.


Ascending aorta
Pulmonary trunk
Superior vena cava
Left atrium
Sinu-atrial node
Mitral valve
Right atrium
Atrioventricular node
Papillary muscle
Left ventricle
Subendocardial plexus of conduction cells (Purkinje fibers)
Tricuspid valve
Chordae tendineae
Interventricular septum
Right ventricle
Septomarginal trabeculae
Atrioventricular bundle (of His)

3. The superior and inferior venae cavae:

- These are the two largest veins in the body carrying de-oxygenated blood from various regions of the body to the right atrium of the heart.
- As the de-oxygenated blood is returned to the heart
- it is transported to the lungs by pulmonary arteries where it becomes oxygenated.
- The blood then travels back to the left side of heart
- is pumped out to the rest of the body via the aorta.
- Oxygen depleted blood is returned to the heart again via the venae cavae.

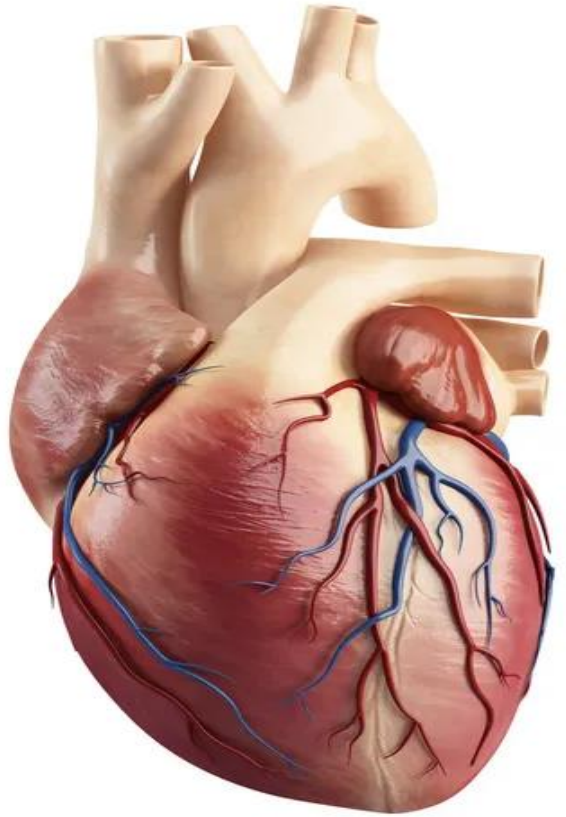

Thank You

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Histology and Anatomy

Lecture 14&15

Blood vessels

Dr. Rabab Ali Al-Mosawi

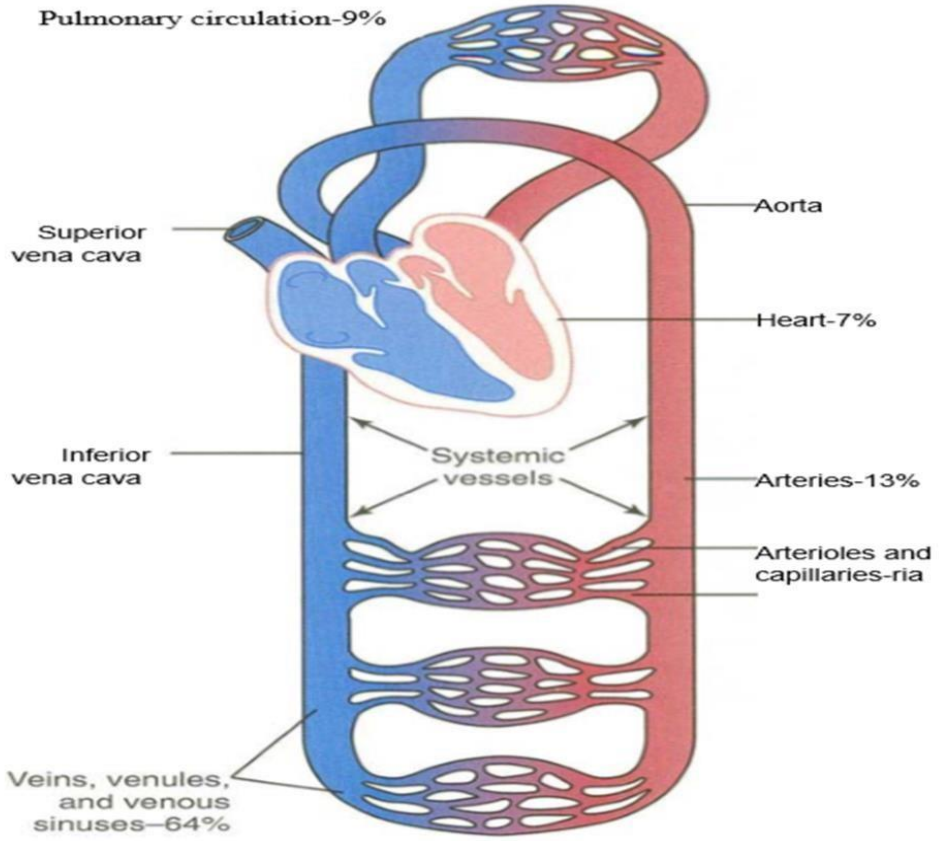


•blood vessels are the part of the circulatory system, and microcirculation, that transports blood through`out the human body.

- These vessels are designed to transport nutrients and oxygen to the tissues of the body.
- They also take waste and carbon dioxide and carry them away from the tissues and back to the heart.

types of blood vessels:

- Arteries
- Capillaries
- Veins



Distribution of blood (in percentage of total blood) in the different parts of the circulatory system.

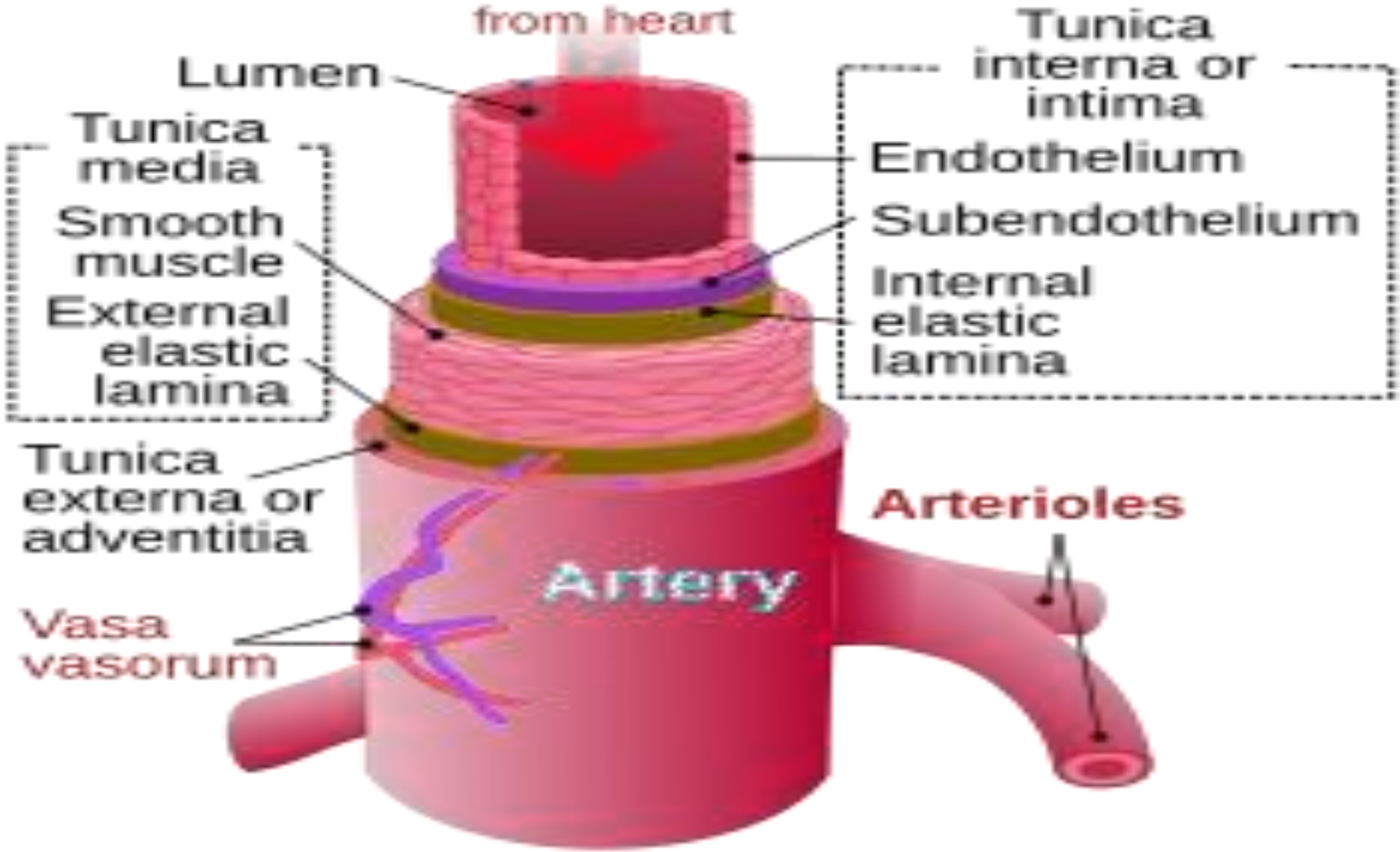
Arteries:

- is a blood vessel that takes blood away from the heart to all parts of the body (tissues, lungs, etc).
- Most arteries carry oxygenated blood.
- the two exceptions are the pulmonary and the umbilical arteries, which carry deoxygenated blood to the organs that oxygenate it.
- It is responsible for the delivery of oxygen and nutrients to all cells.

structure:

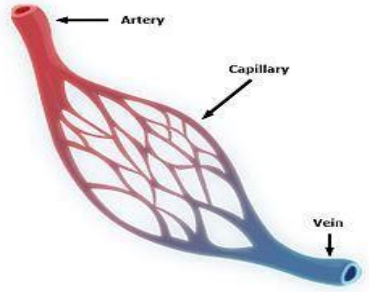
The arterial system of the human body is divided into :

- **systemic arteries**, carrying blood from the heart to the whole body,
- **pulmonary arteries**, carrying deoxygenated blood from the heart to the lungs.

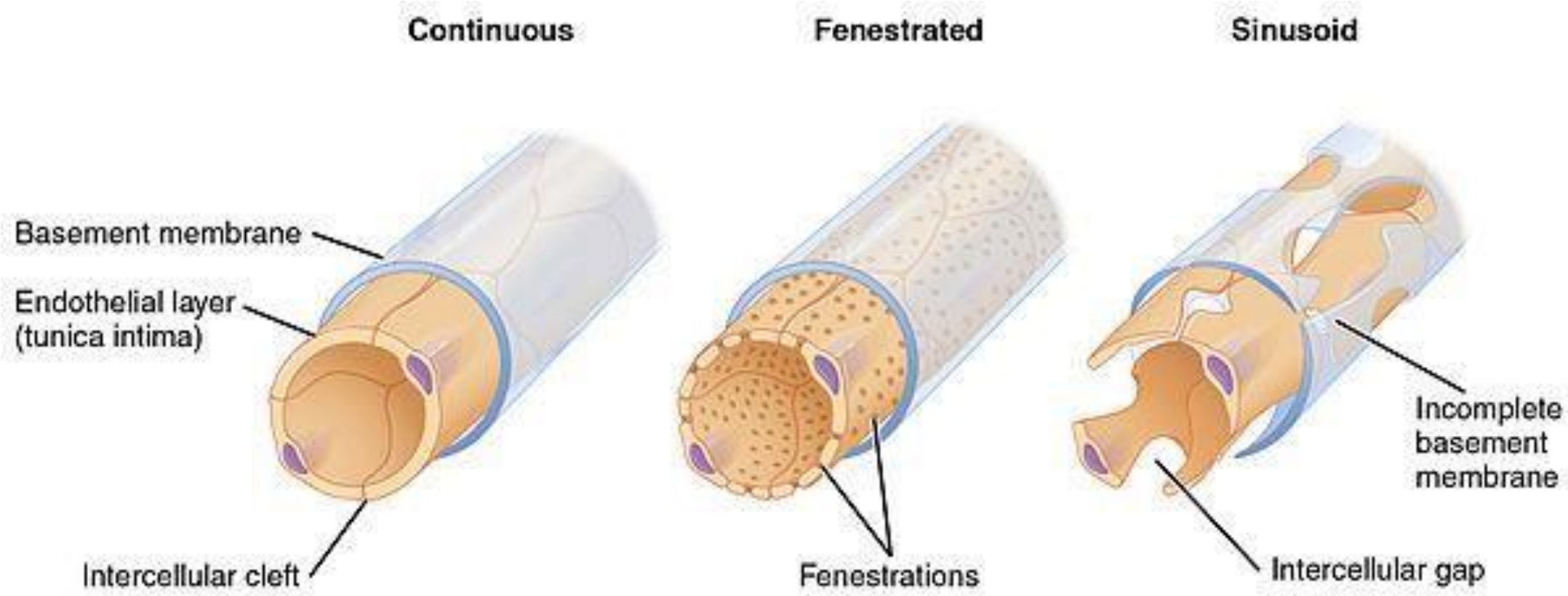

from heart
Lumen
Tunica media
Smooth muscle
External elastic lamina
Tunica externa or adventitia
Vasa vasorum
Tunica interna or intima
Endothelium
Subendothelium
Internal elastic lamina
Arterioles
Artery

A capillary:

- A capillary is a small blood vessel from 5 to 10 micrometres (μm) in diameter, and having a wall one endothelial cell thick. They are the smallest blood vessels in the body.
- The capillary wall performs an important function by allowing nutrients and waste substances to pass across it. Molecules larger than 3 nm such as albumin and other large proteins pass through transcellular transport carried inside vesicles, a process which requires them to go through the cells that form the wall.



Type of capillaries:



Structure:

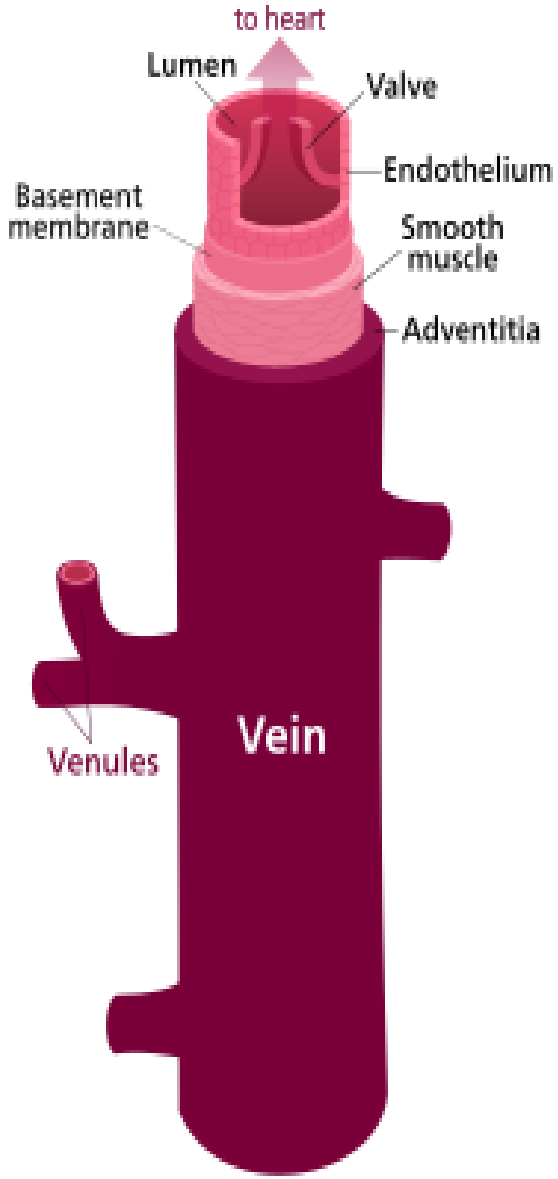
There are two types of capillaries:

- true capillaries, which branch from arterioles and veins provide exchange between tissue and the capillary blood.

- metarterioles, found only in the mesenteric circulation. They are short vessels that directly connect the arterioles and venules at opposite ends of the beds.

veins:

- Veins are blood vessels that carry blood toward the heart.
- Most veins carry deoxygenated blood from the tissues back to the heart. They have valves necessary to keep blood flowing toward the heart against the gravity preventing back flow of the blood.



structure:

- Veins are present throughout the body as tubes that carry blood back to the heart. Veins are classified in a number of ways, including superficial vs. deep, pulmonary vs. systemic, and large vs. small.
- **Superficial veins** are those closer to the surface of the body, and have no corresponding arteries.
- **Deep veins** are deeper in the body and have corresponding arteries.
- **Perforator veins** drain from the superficial to the deep veins. These are usually referred to in the lower limbs and feet.
- **Communicating veins** are veins that directly connect superficial veins to deep veins.
- **Pulmonary veins** are a set of veins that deliver oxygenated blood from the lungs to the heart.
- **Systemic veins** drain the tissues of the body and deliver deoxygenated blood to the heart.

Layer of blood vessels:

- The arteries and veins have three layers. The middle layer is thicker in the arteries than it is in the veins:
- **The inner layer(tunica intima)**, is the thinnest layer. It is a single layer of flat cells (simple squamous epithelium) glued by a polysaccharide intercellular matrix, surrounded by a thin layer of subendothelial connective tissue interlaced with a number of circularly arranged elastic bands called the internal elastic lamina. A thin membrane of elastic fibers in the tunica intima run parallel to the vessel.
- **The middle layer (tunica media)** is the thickest layer in arteries. It consists of circularly arranged elastic fiber, connective tissue, polysaccharide substances, the second and third layer are separated by another thick elastic band called external elastic lamina. The tunica media may (especially in arteries) be rich in vascular smooth muscle, which controls the caliber of the vessel. Veins don't have the external elastic lamina, but only an internal one. The tunica media is thicker in the arteries rather than the veins.
- **The outer layer is the(tunica adventitia)** and the thickest layer in veins. It is entirely made of connective tissue. It also contains nerves that supply the vessel as well as nutrient capillaries (vasa vasorum) in the larger blood vessels.
- Capillaries consist of little more than a layer of endothelium and occasional connective tissue.

Blood Vessel Structure enables specific functions:

- **Aorta**

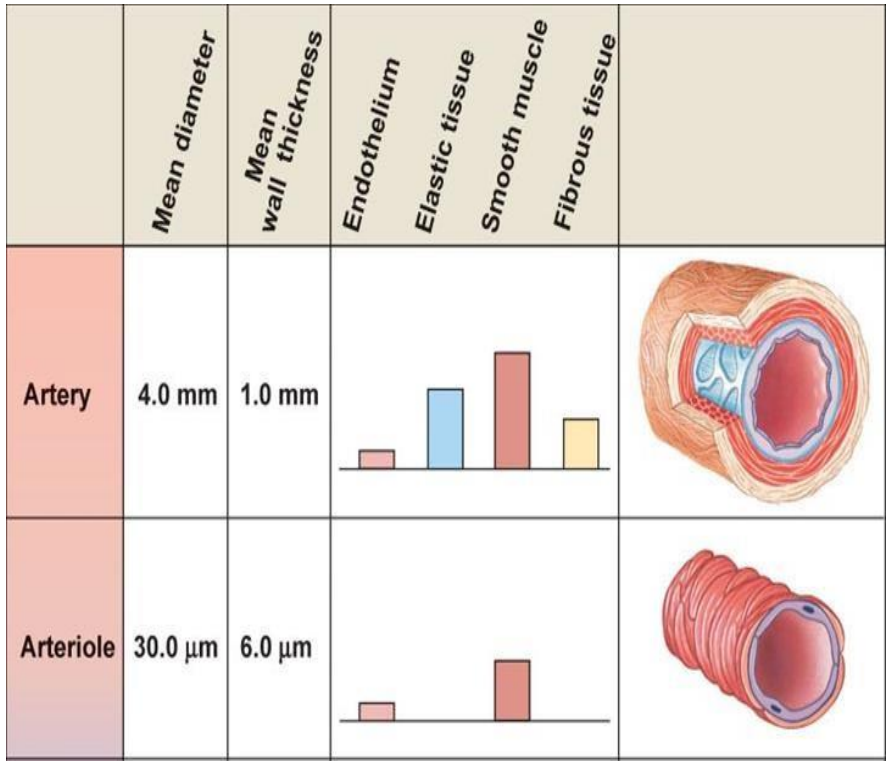
absorb pulse pressure (systolic pressure – diastolic pressure)

- **Large arteries**

conduct and distribute blood to regional areas

- **Arterioles**

Regulate flow to tissues and regulate MAP (mean arterial pressure)



Blood Vessel Structure enables specific functions:

- Capillaries

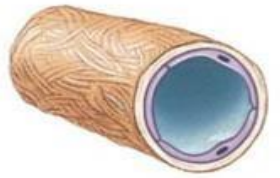
Allow for exchange

- Venules

Collect and direct blood to the veins

- Veins

Return blood to heart and act as a blood reservoir

	Mean diameter	Mean wall thickness	Endothelium	Elastic tissue	Smooth muscle	Fibrous tissue	
Capillary	8.0 μm	0.5 μm					
Venule	20.0 μm	1.0 μm					
Vein	5.0 mm	0.5 mm					