

General Anatomy

INTRODUCTION OF ANATOMY

Anatomy Group

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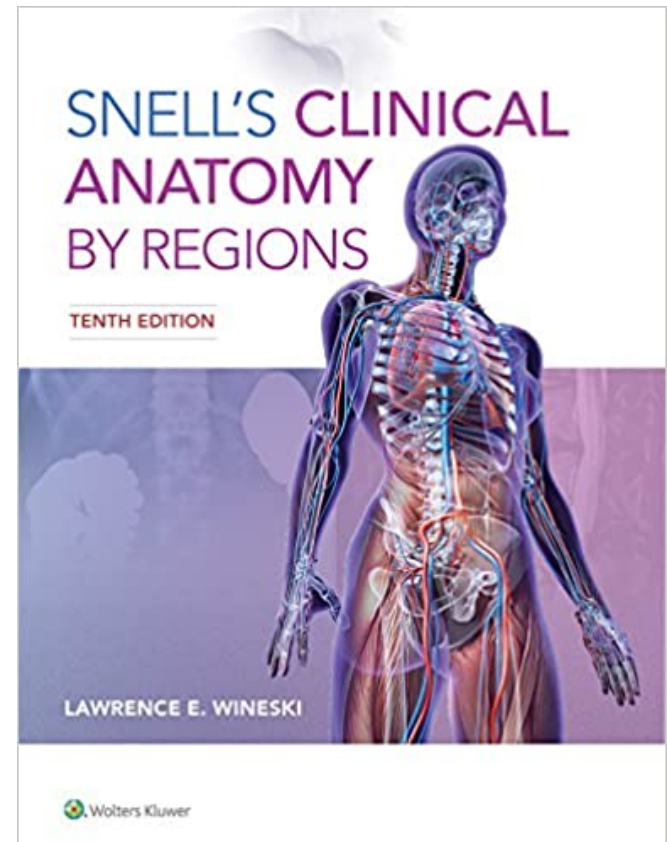


How to Learn Anatomy

RECOMMENDED TEXTBOOKS:

1- CLINICAL ANATOMY, Richard S. Snell

2- GRANTS ATLAS OF ANATOMY, Grants



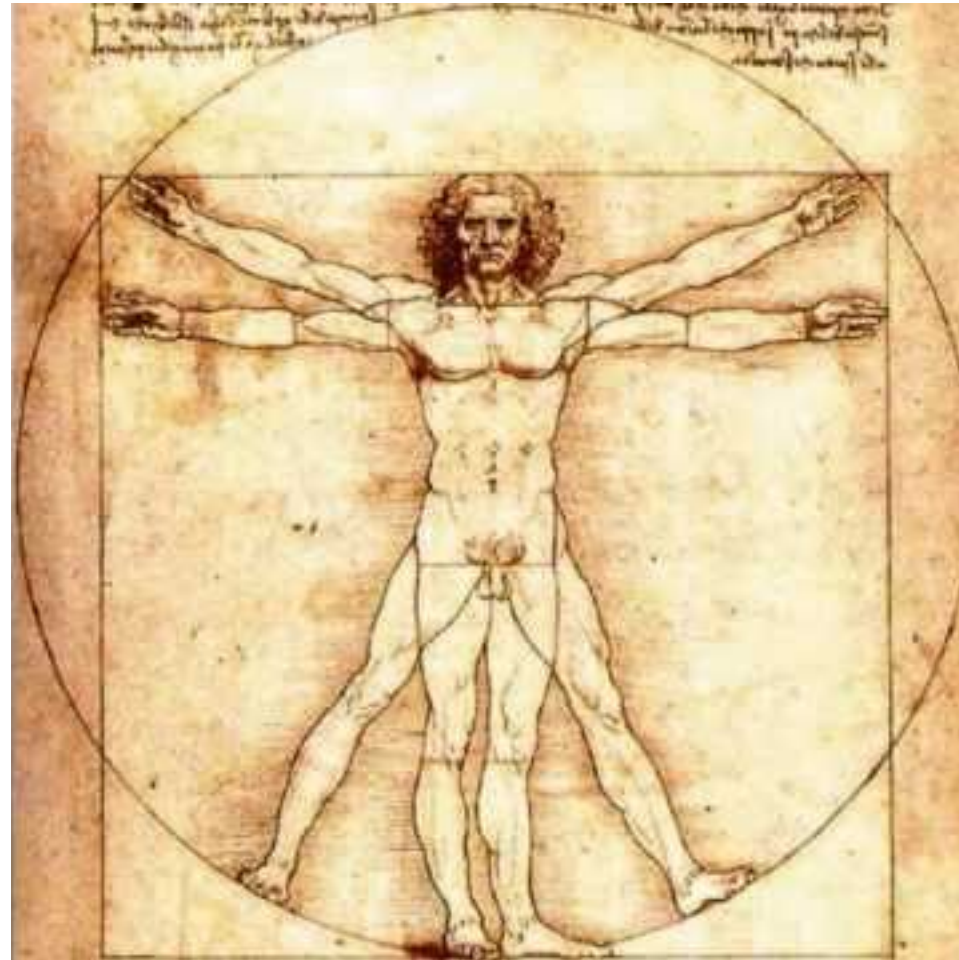
Course outline

Lect. No.	Lecture title
1	Introduction to anatomy and Basic terminology
2	Basic structures : skin , fascia , muscle , joints , bone , cartilage
3	Thoracic wall
4	Abdominal wall (1)
5	Abdominal wall (2)
6	Inguinal region
7	Pelvic wall
8	Abdominal Cavity : general concept , omentum , peritoneum
9	Neck (1)
10	Neck (2)
11	Skull
12	Face
13	Cardiovascular system
14	Nervous system + Vertebral column

Definition

It is a Greek word
(**Ana-Tome**) : meaning
cutting up.

Anatomy :
the study of the structure
of body parts and their
relationships to one
another.



Subdivisions of anatomy

- Gross anatomy
- Microscopic anatomy
 - Cytology (study of cells)
 - Histology (study of tissues)
- Developmental anatomy (Embryology)
- Comparative anatomy

Gross anatomy

- **Regional :**
all structures in one part of the body (such as the abdomen or leg)
- **Systemic :**
gross anatomy of the body studied by system
- **Surface :**
study of internal structures as they relate to the overlying skin.

Parts of human body

1. Head & Neck

2. Trunk : thorax

abdomen

pelvis

3. Extremities

upper limb

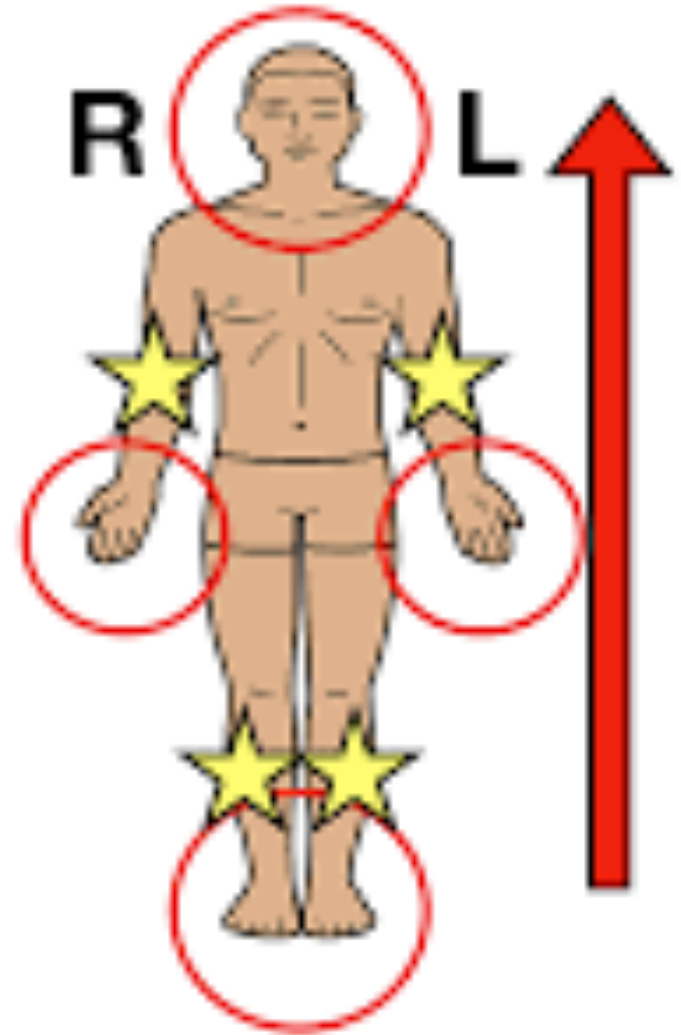
lower limb



Descriptive Anatomic Terms

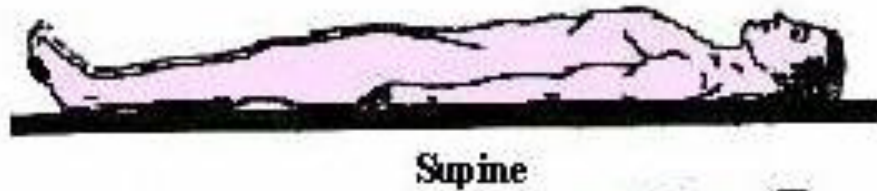
Anatomic position

- **The body is assumed to be:**
 - ✓ Standing.
 - ✓ Feet together.
 - ✓ Arms to the side.
 - ✓ Head and eyes and palms of the hands facing forwards.

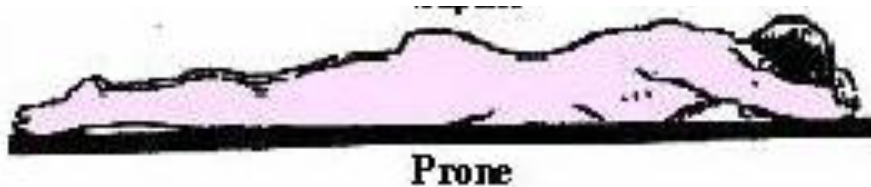


Anatomic position

- **Supine position** : the body is lying in the back

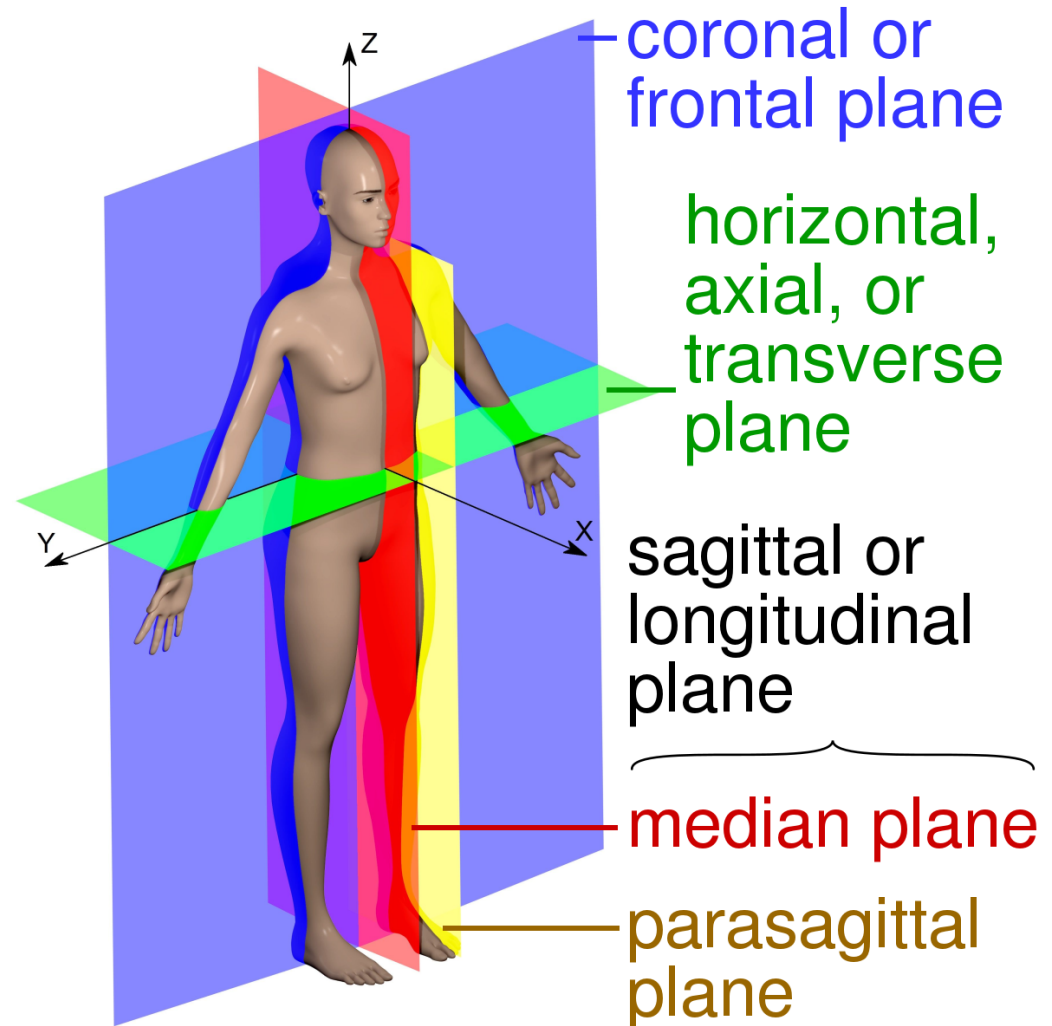


- **Prone position** : the body is lying on the front with face downwards



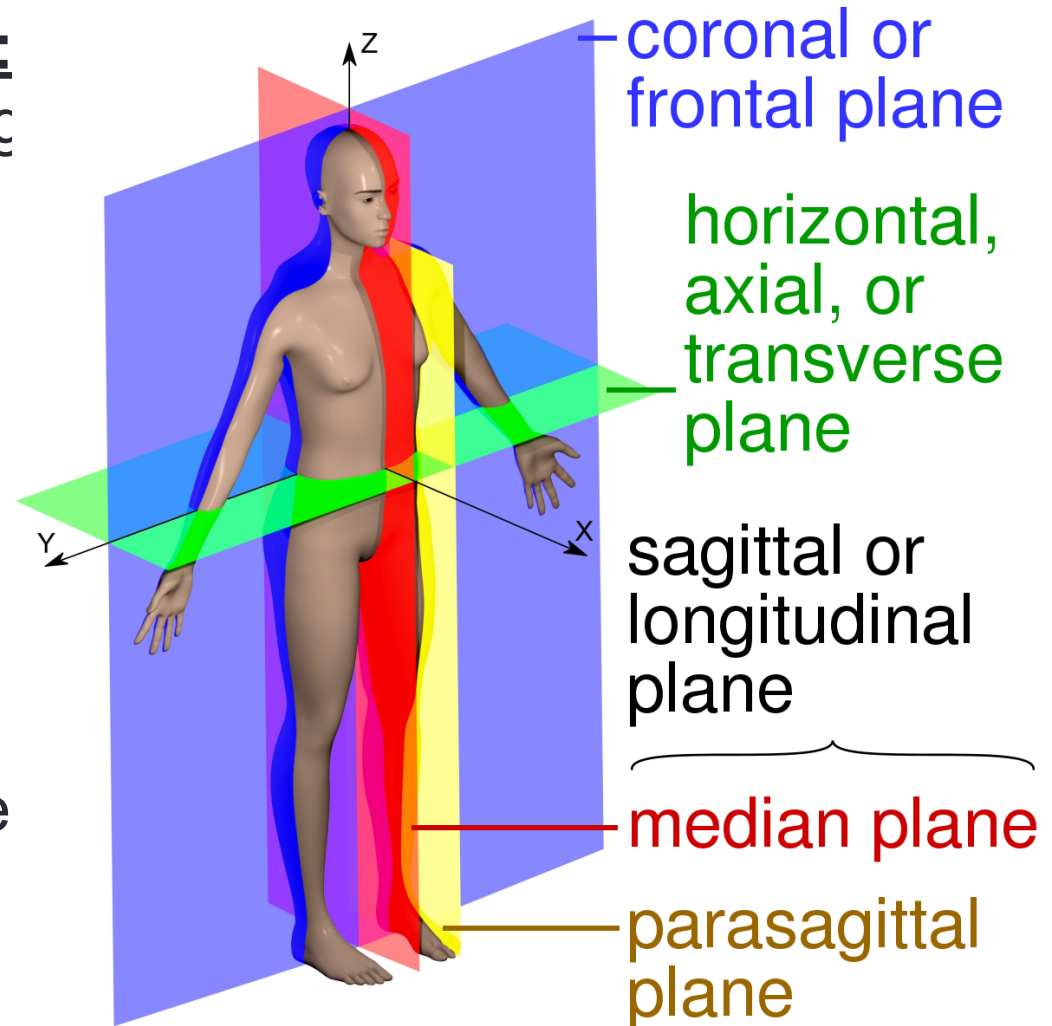
Anatomical Planes

- **Coronal** (or **Frontal**) separates the body into Anterior and Posterior parts
- **Horizontal** (or **Transverse**) separates the body into Superior and inferior parts



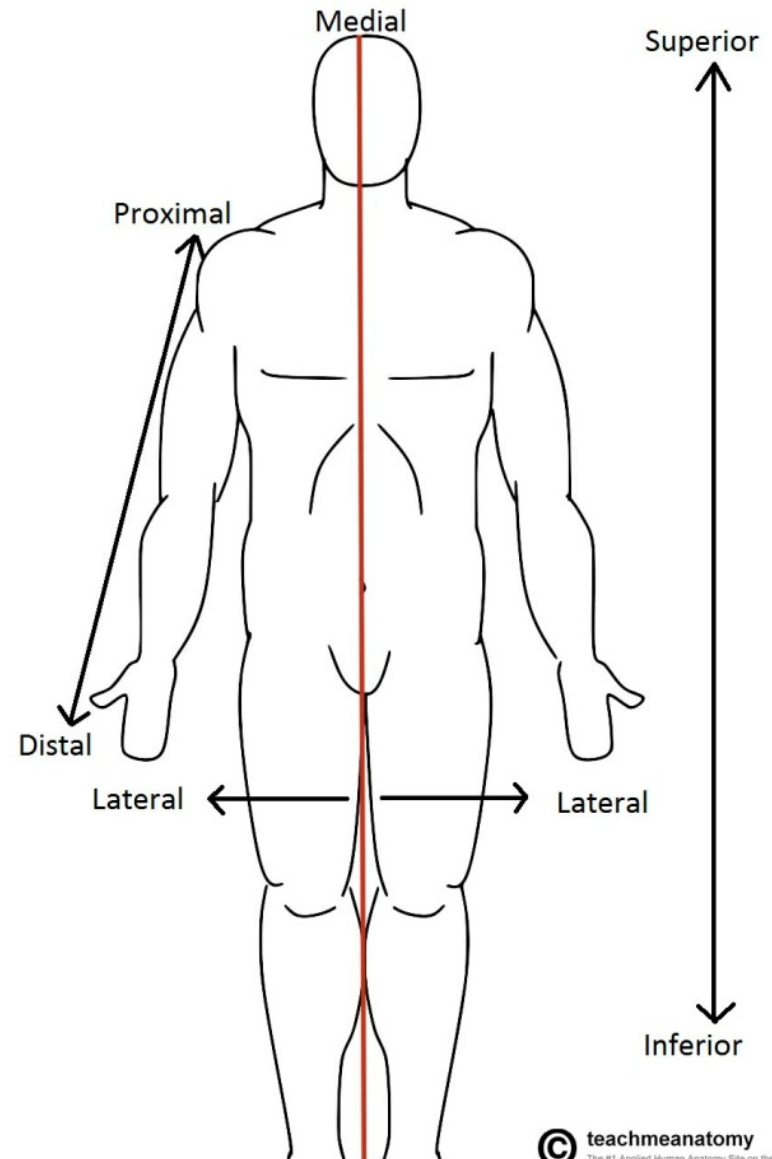
Anatomical Planes

- **Median (Sagittal) Plane:**
is a vertical plane passing through the center of the body, dividing it into equal right and left halves.
- **Paramedian Plane:**
is planes situated to one or the other side of the median plane and parallel to it.



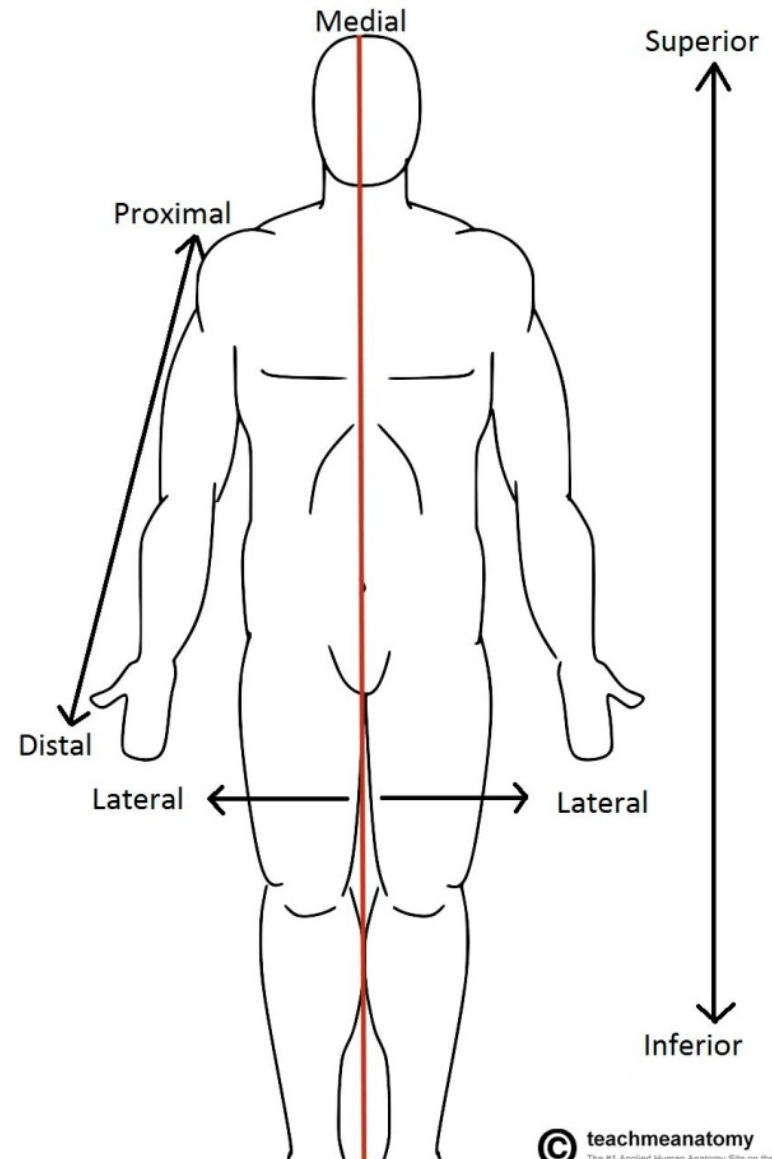
Anatomical terms

- **Medial** : means **towards** the median plane
- **Lateral** : means **away** from the median plane



Anatomical terms

- **Superior** (cranial = cephalic):
means **towards** head .
- **Inferior** (caudal):
means **towards** the feet



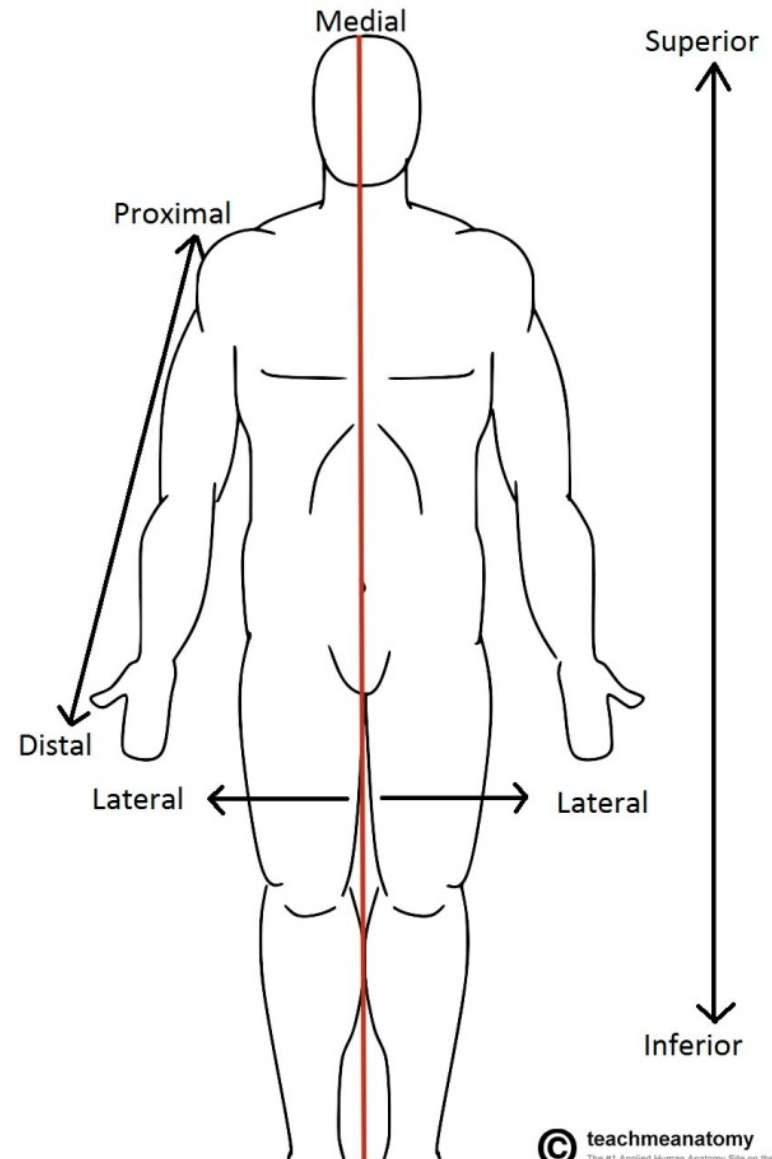
Anatomical terms

- Proximal:

means near (**towards**) the trunk.

- Distal:

means (**away**) far from the trunk.



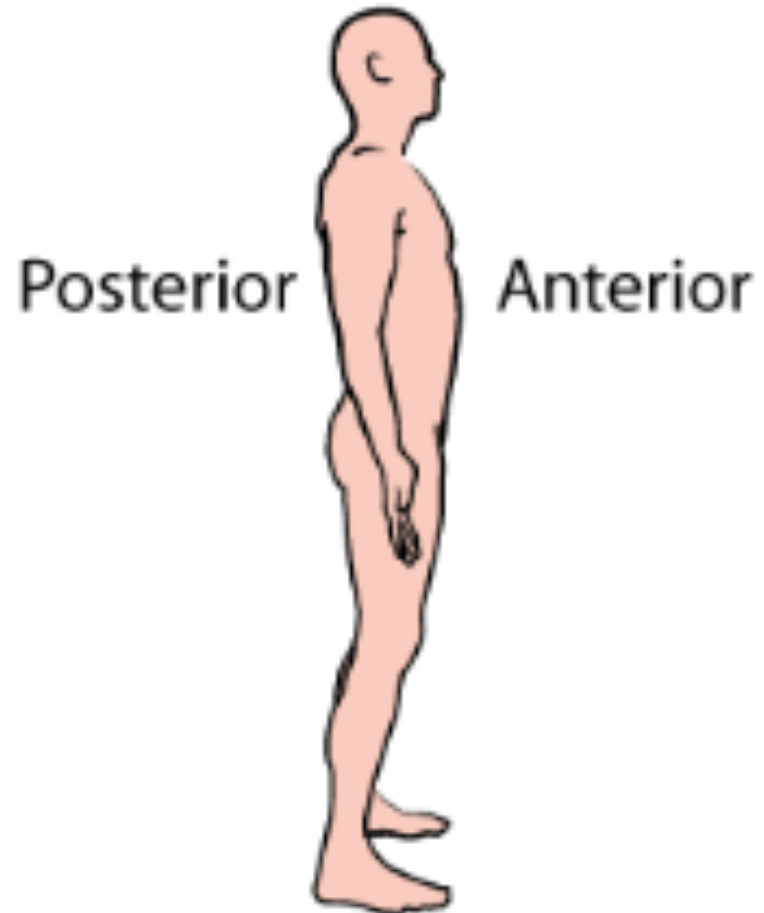
Anatomical terms

- **Anterior (ventral) :**

means **towards** the front of the body

- **Posterior (dorsal):**

means **towards** the back of the body



Anatomical terms

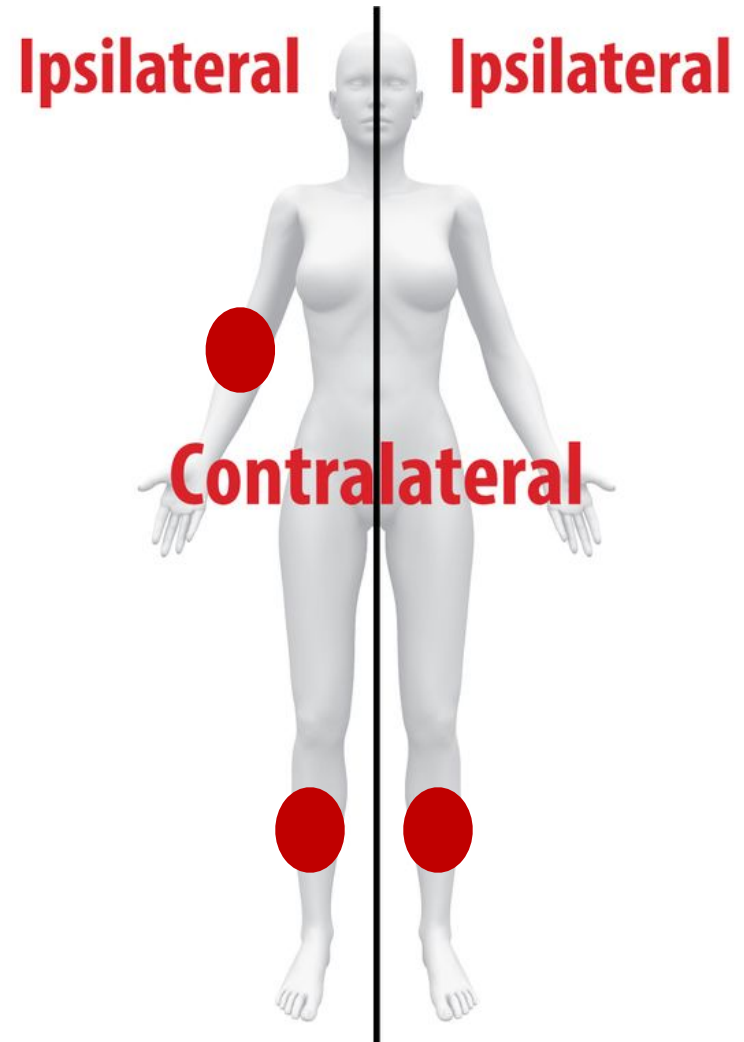
- **Superficial:** means towards the surface of the body.
سطحي

- **Deep:** means away from the surface of the body.
عميق.

Internal and external are used to describe the relative distance of the structure from the center of and organ or cavity.

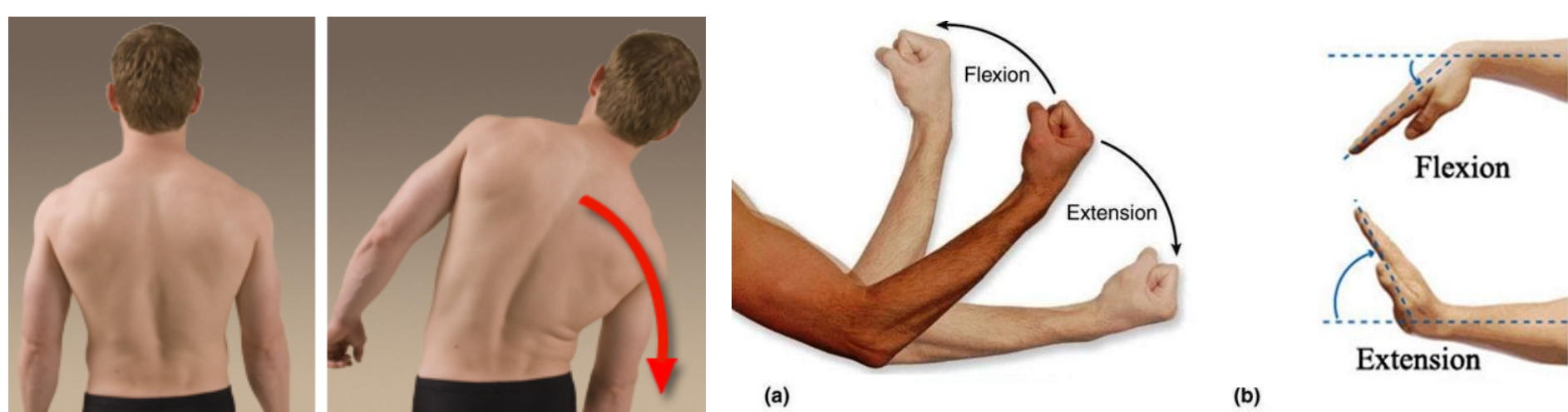
Anatomical terms

- **Ipsilateral** refers to the same side of the body
- **Contralateral** refers to opposite sides of the body



Terms related to movement

- **Flexion** : is a movement that takes place in a sagittal plane. (it is usually anterior movement, but it is occasionally posterior , as in the case of the knee joint)
- **Extension** : is straightening the joint and usually takes place in posterior direction.
- **Lateral flexion** : is a movement of the trunk or neck

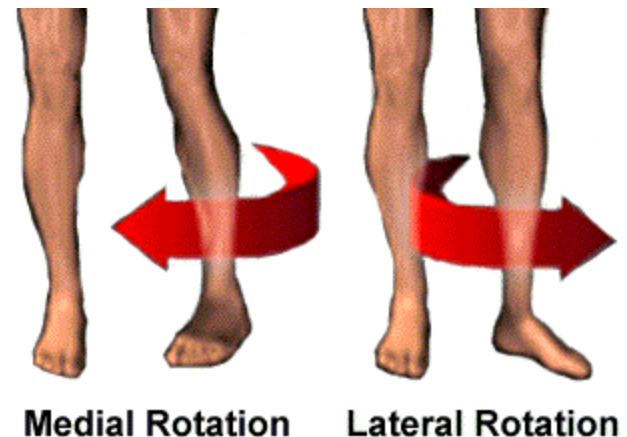


Terms related to movement

Rotation : is the movement of a part of the body around its long axis.

Medial rotation : results in the anterior surface of the part facing medially .

Lateral rotation : results in the anterior surface of the part facing laterally.

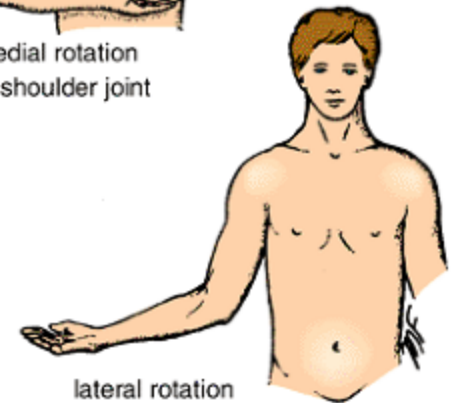


Terms related to movement

- **Pronation** of the forearm is a medial rotation of the forearmthe palm of the hand faces posteriorly.
- **Supination** of the forearm is a lateral rotation of the forearm from the pronated position so that the palm of the hand comes to face anteriorly



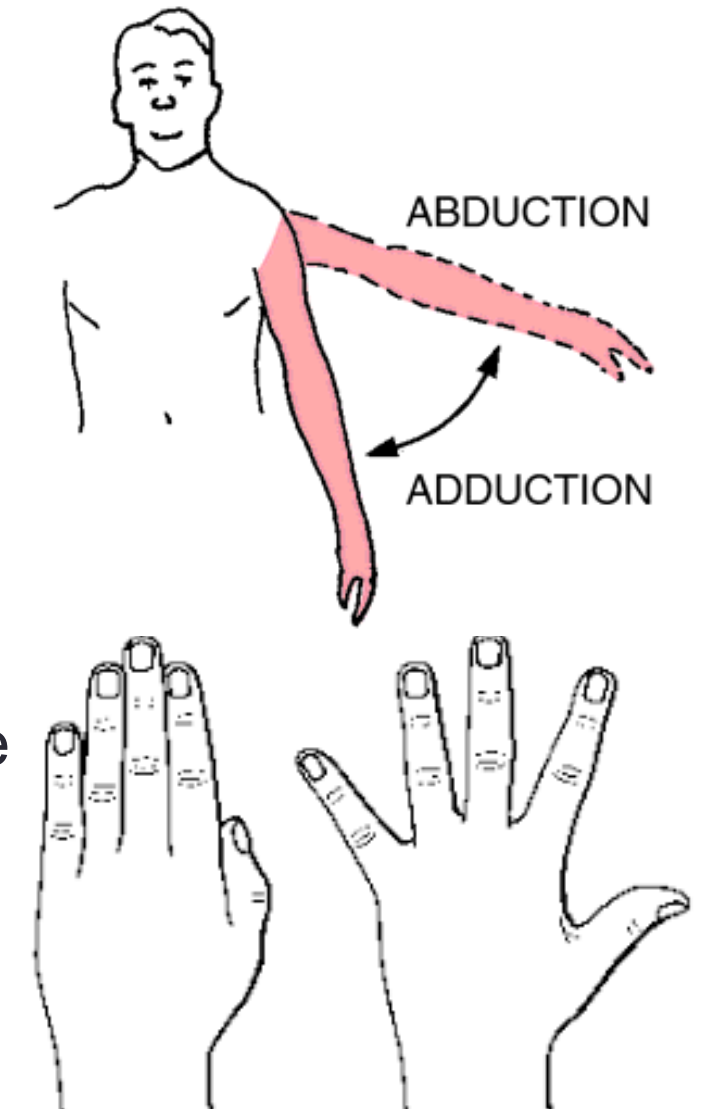
medial rotation
of shoulder joint



lateral rotation
of shoulder joint

Terms related to movement

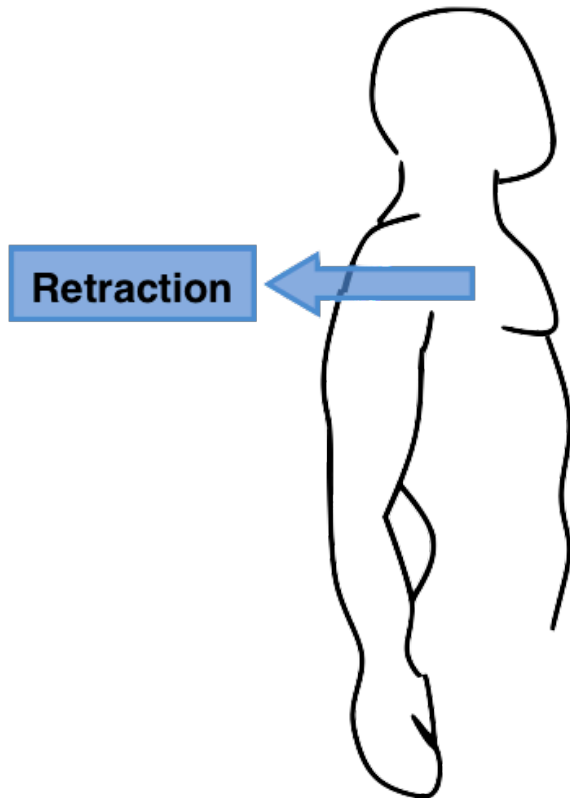
- **Abduction** : is a movement of limb away from the midline of the body in coronal plane
- **Adduction** : is a movement of a limb toward the body in the coronal plane



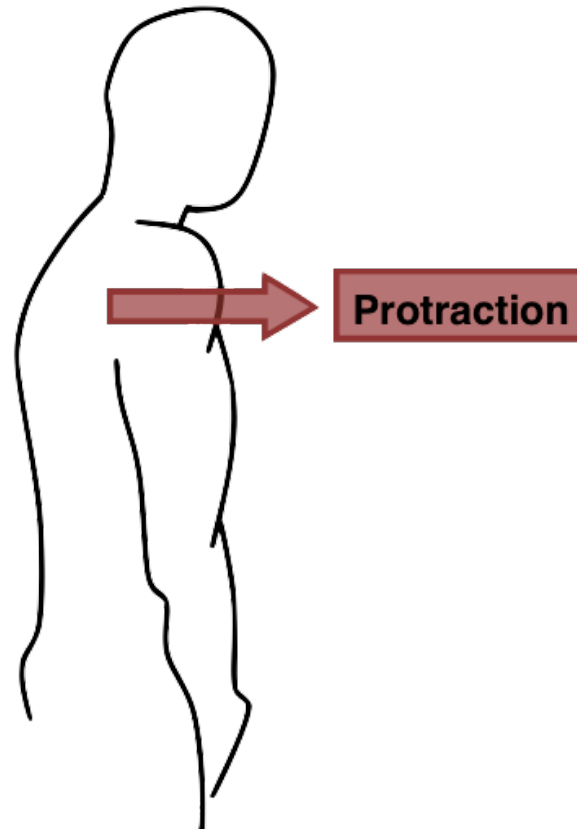
In the **fingers and toes**, abduction is applied to the **spreading** of these structures and adduction is applied to the **drawing together** of these structures .

Terms related to movement

- **Retraction :**
is to move backward



- **Protraction :**
is to move forward



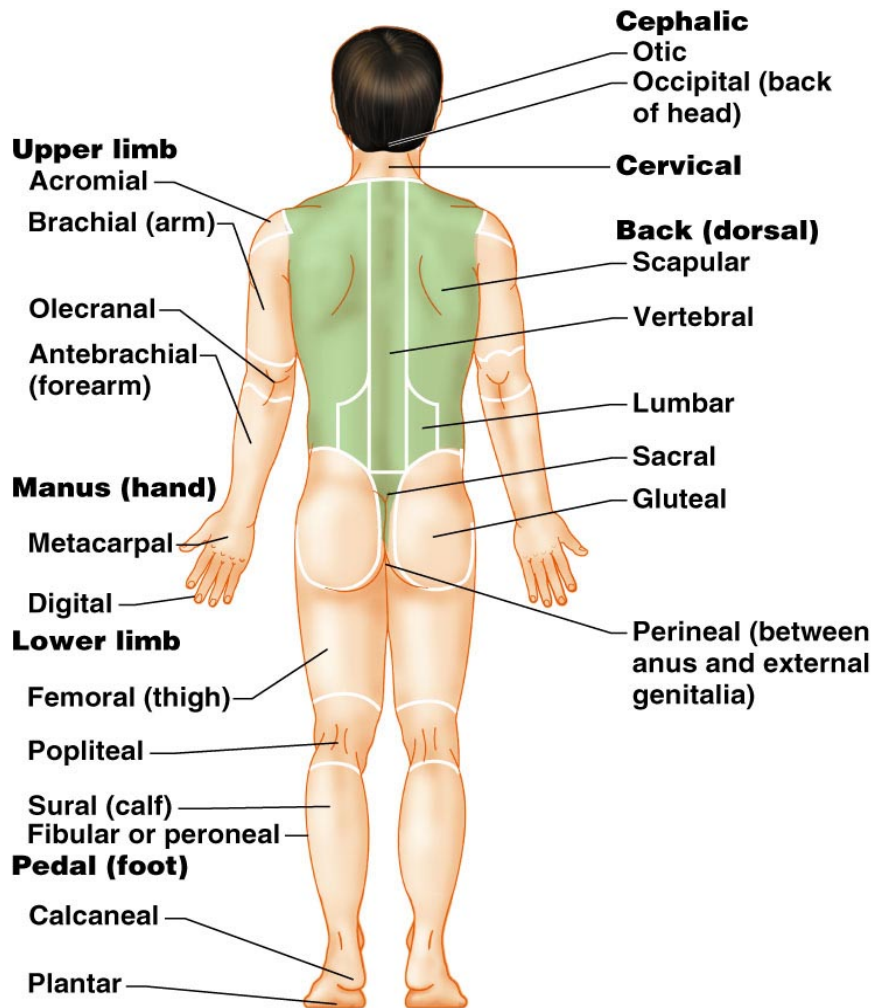
Terms related to movement

- **Inversion :**
is the movement of the foot so that the sole faces in a medial direction
- **Eversion :**
is the opposite movement of the foot so that the sole faces in a lateral direction

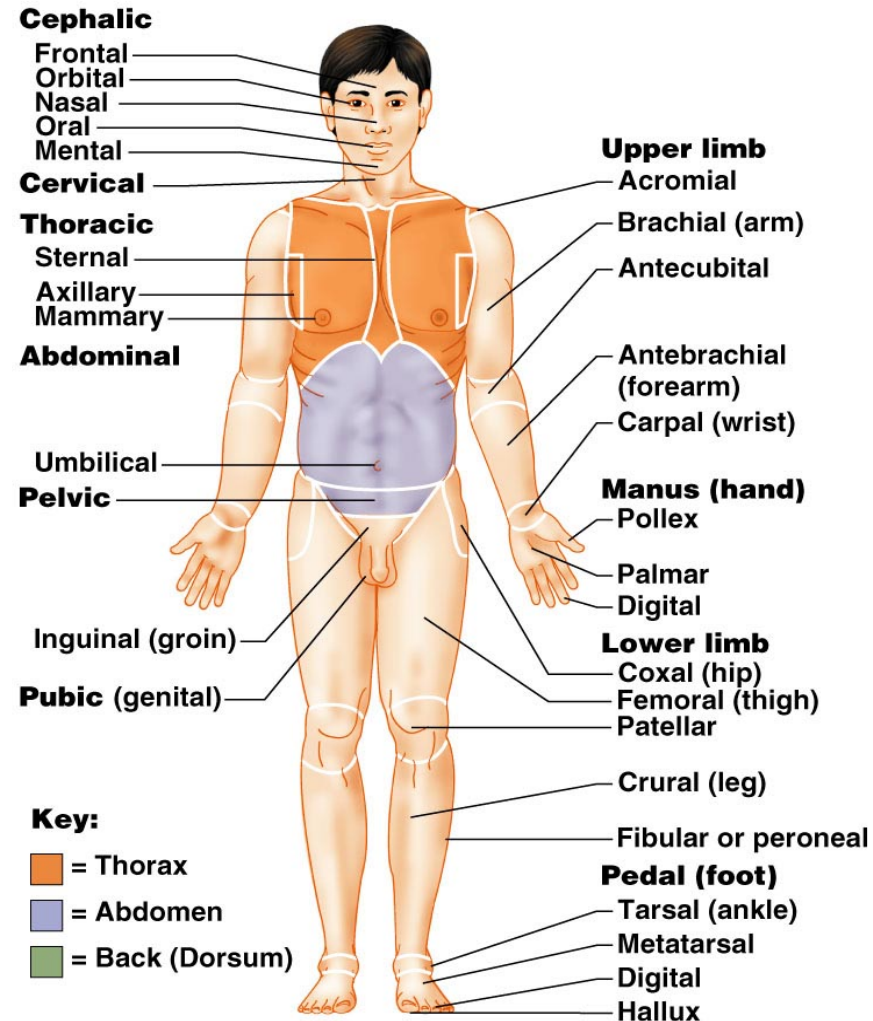


Regional terms

There are many visible landmarks on the surface of the body:



(b) Posterior/Dorsal



(a) Anterior/Ventral

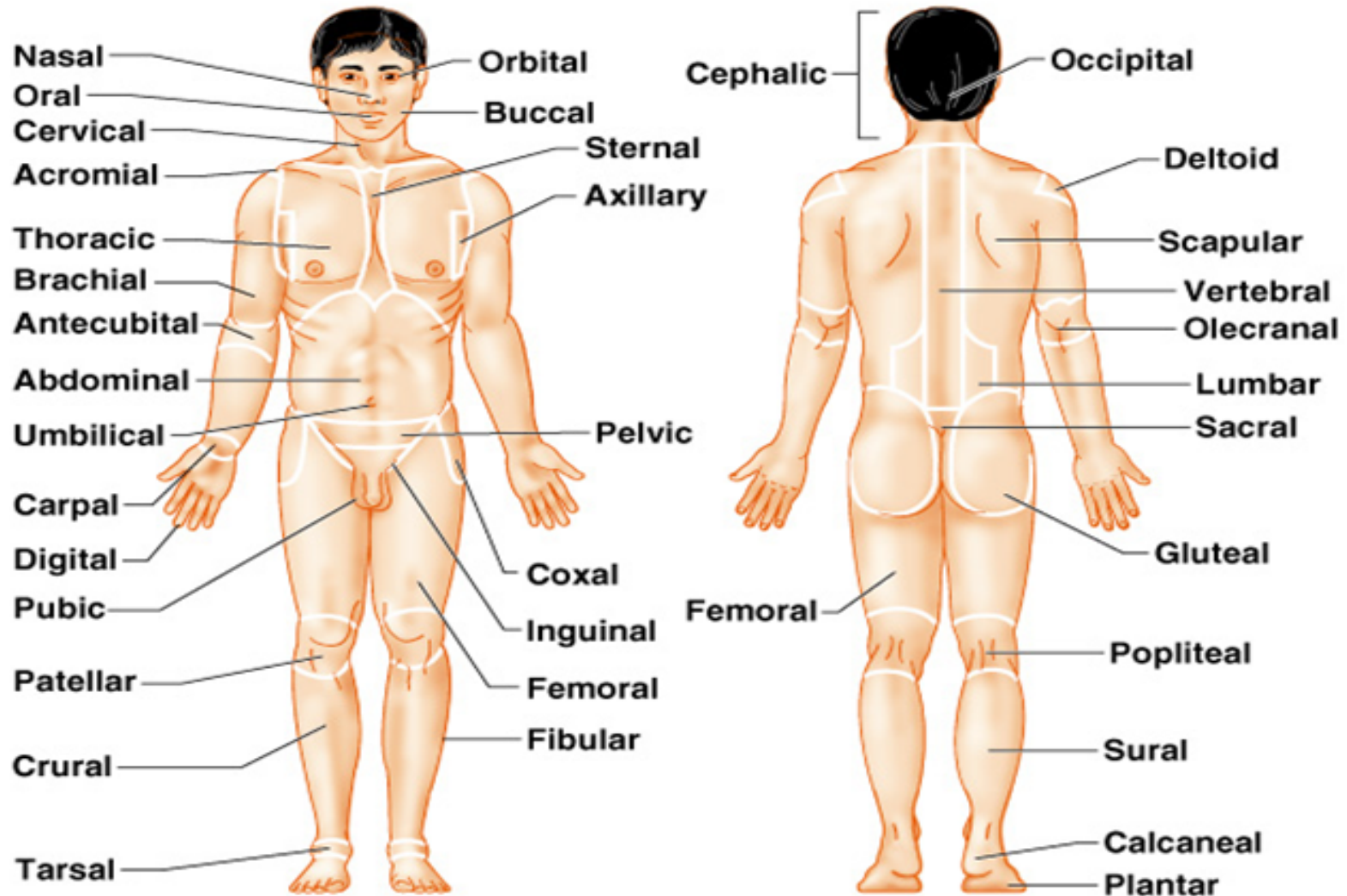
Key:

Orange = Thorax

Purple = Abdomen

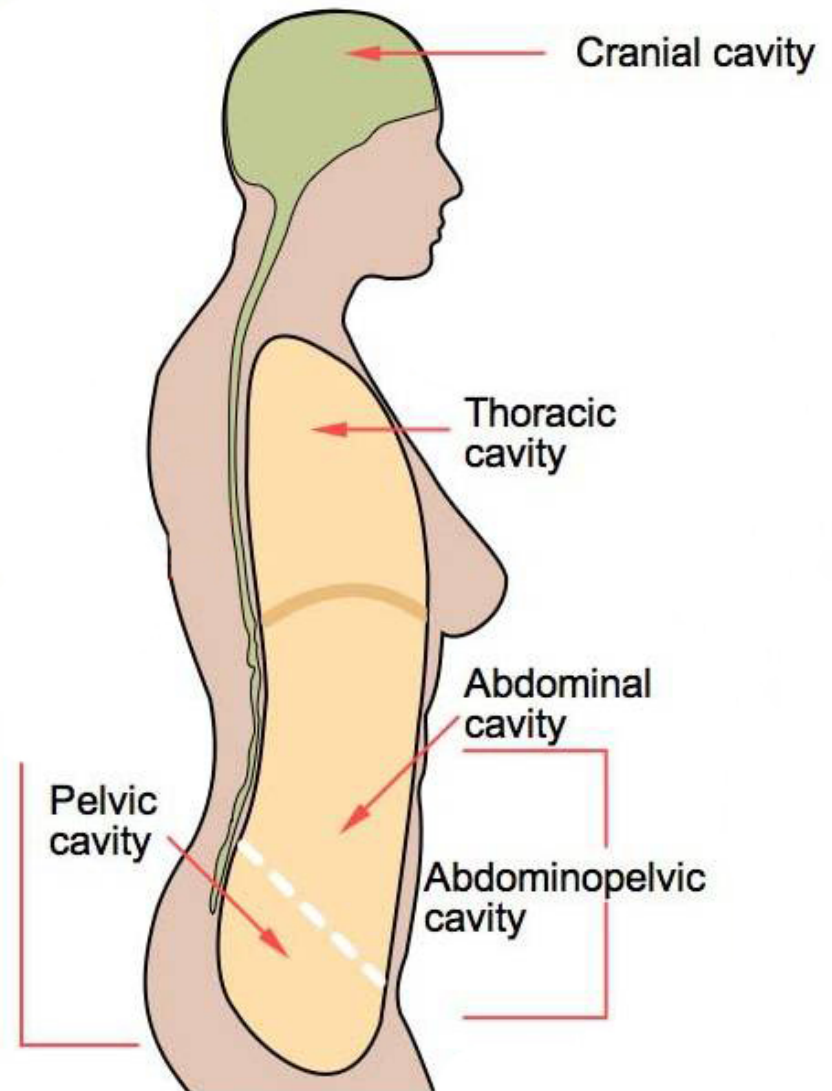
Green = Back (Dorsum)

Regional terms



Body cavities

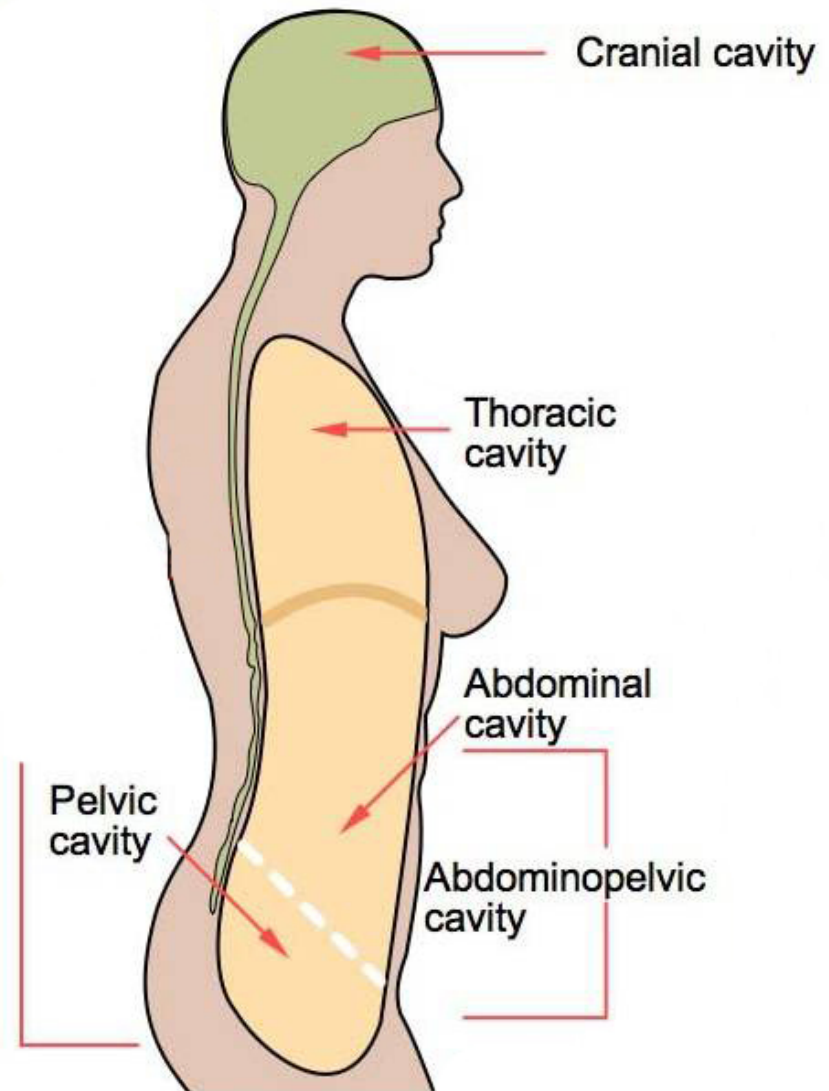
- 2 internal body cavities :
 - Dorsal body cavity
 - Ventral body cavity



Body cavities

Dorsal body cavity

- **Cranial cavity** : in the skull , encases the brain
- **Vertebral or spinal cavity** : runs within the bony vertebral column , encloses the delicate spinal cord .

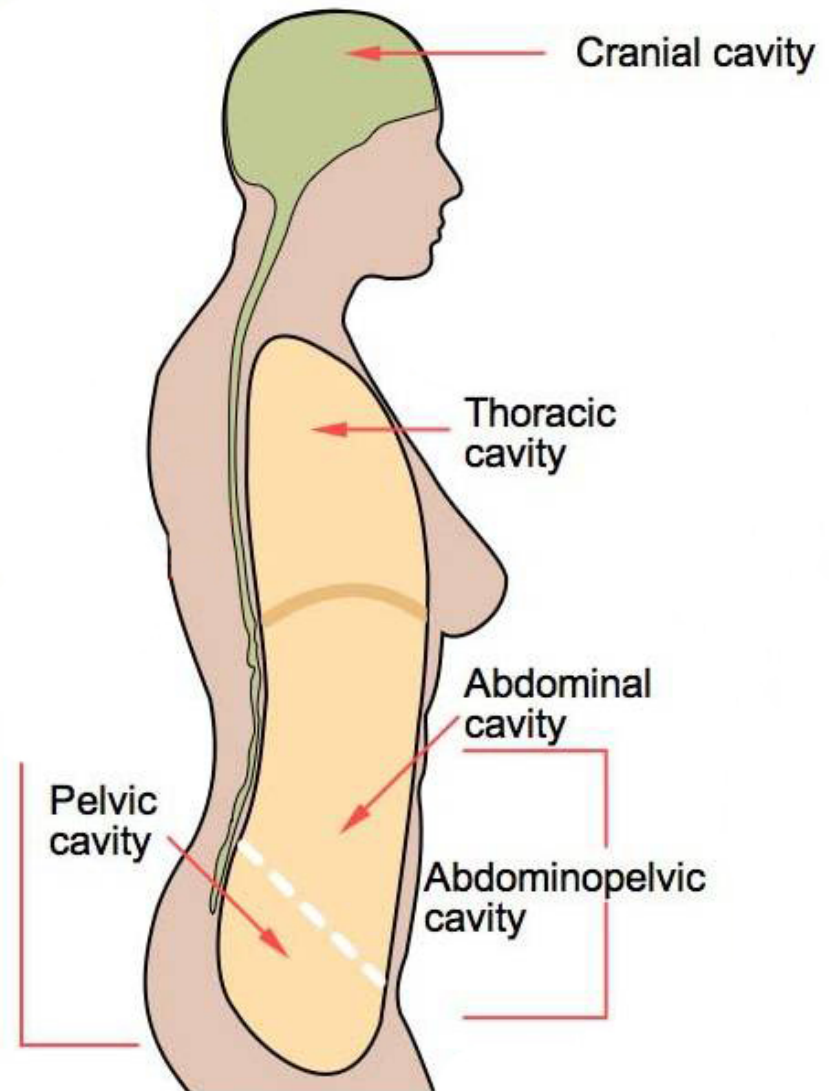


Body cavities

Ventral body cavity

The more anterior and larger of the closed body cavities.

- **Thoracic cavity**
- **Abdomino-pelvic cavity :**
it houses internal organs collectively called the viscera
- There are separated by diaphragm , a dome-shaped muscle important in breathing.



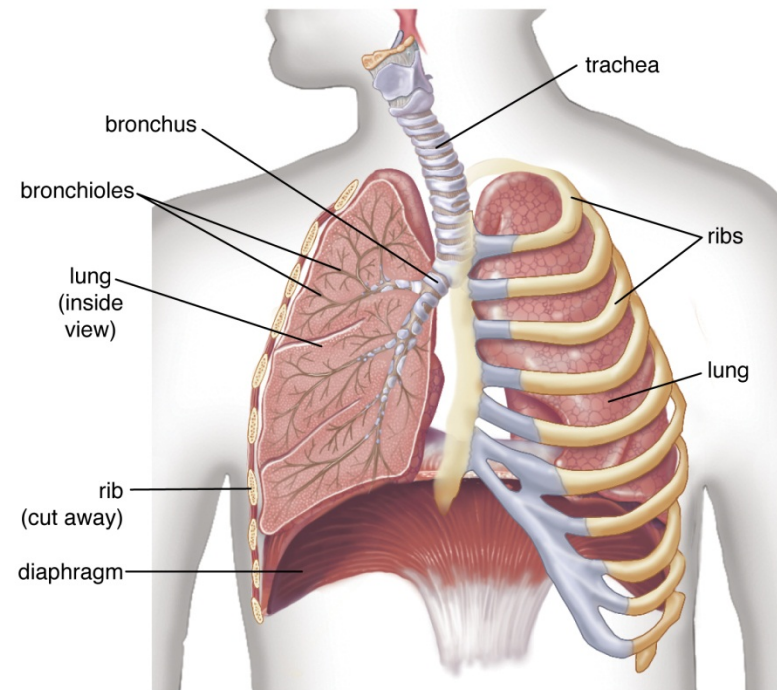
- **Thoracic cavity :**

Surrounded by chest wall and diaphragm
subdivided into :

Right pleural cavity : surround right lung

Mediastinum : contains the trachea , esophagus and major vessels

Left pleural cavity : surround left lung
also contain , pericardial cavity : surrounds heart

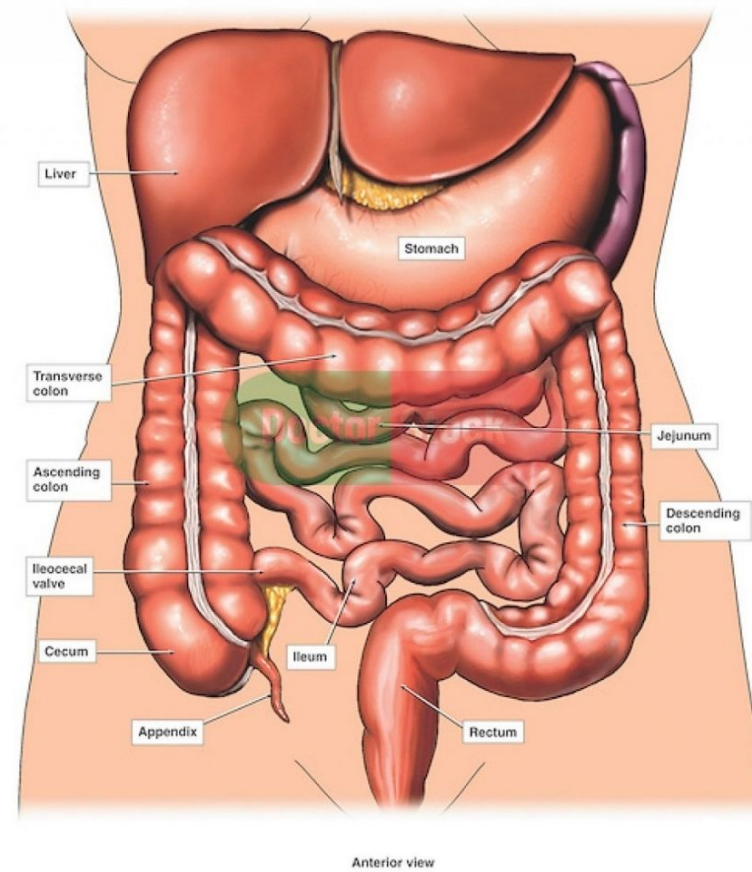


- **Abdomino-Pelvic cavity**

Contains the peritoneal cavity

Include:

- **Abdominal cavity** : contains many digestive glands and organs
- **Pelvic cavity** : contains urinary bladder m reproductive organs m last portion of digestive tract





General Anatomy

Basic Structures

Anatomy Group

Dr Naser Radwan, MD

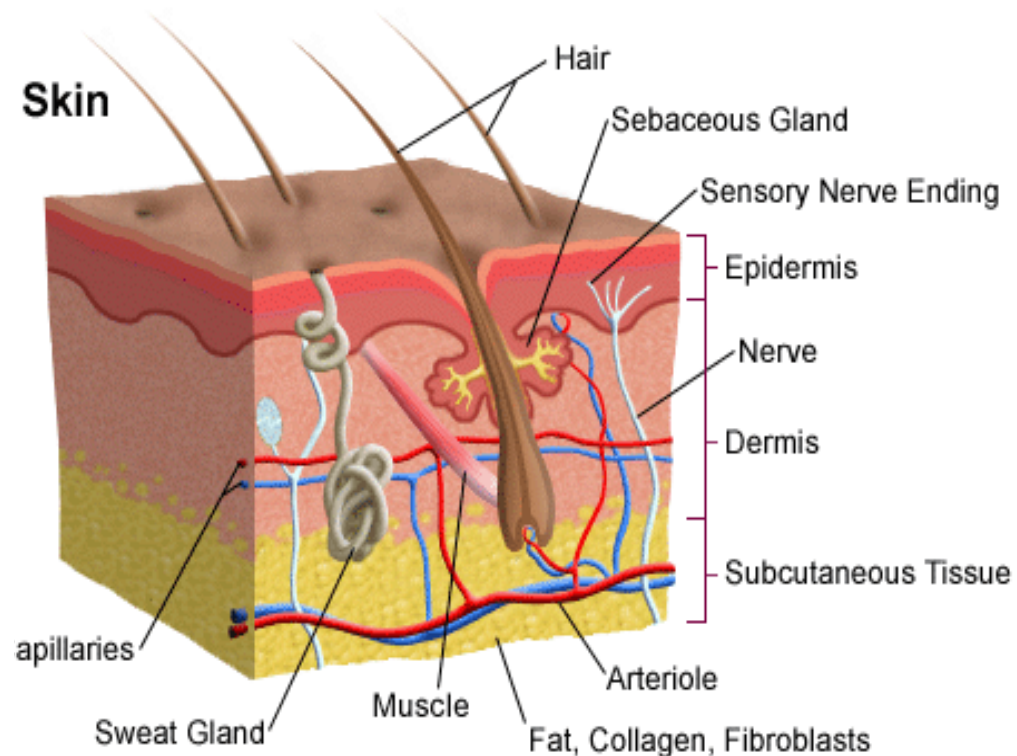
Dr Amjad Abu Alqumboz, MD

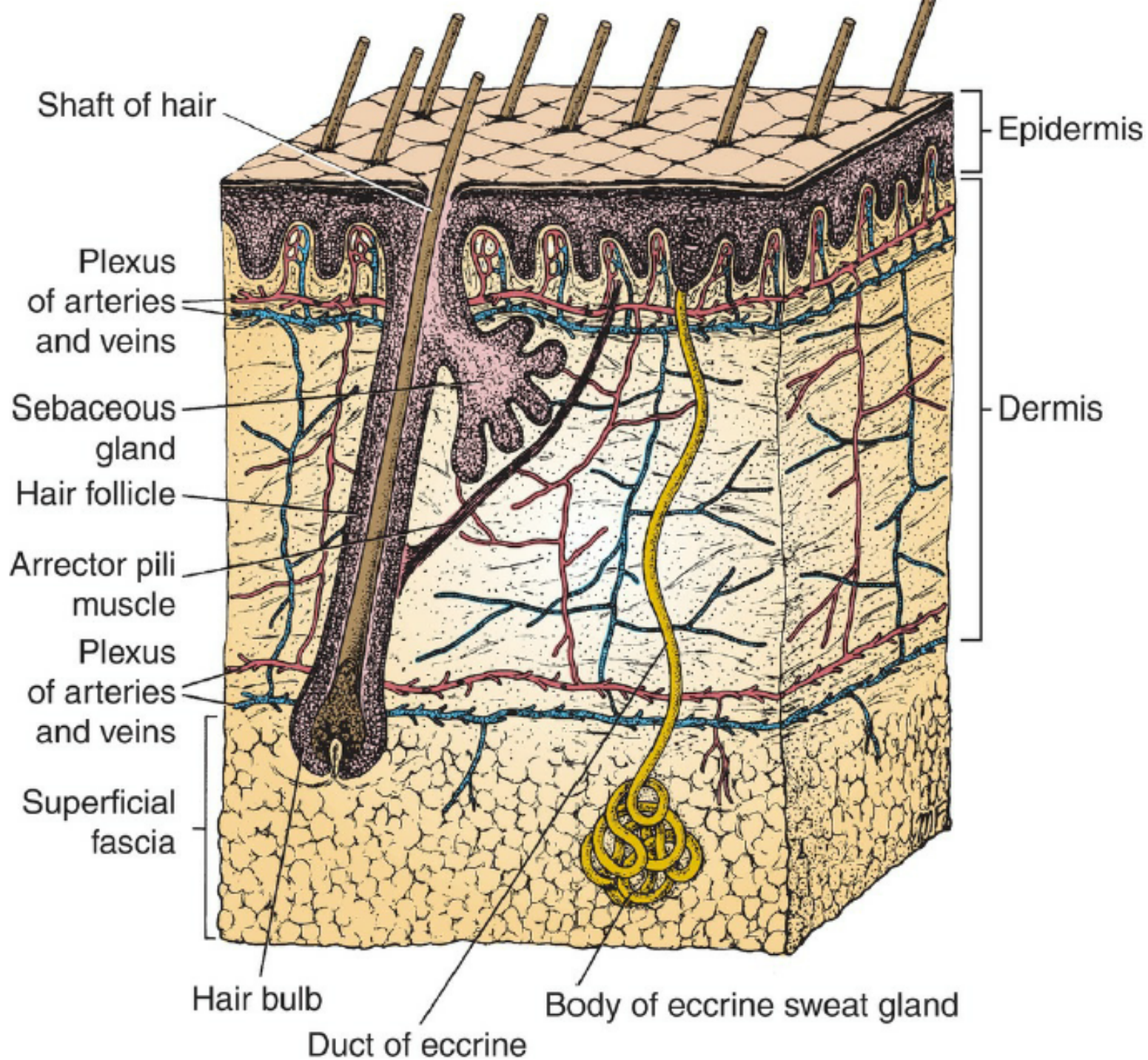
Dr Adham AlZanoun, MD



The Skin

- Divided into **two parts**:
 - The superficial part,
The Epidermis.
 - The deep part,
The Dermis.
- The skin over joints always folds in the same place, the **skin creases.**

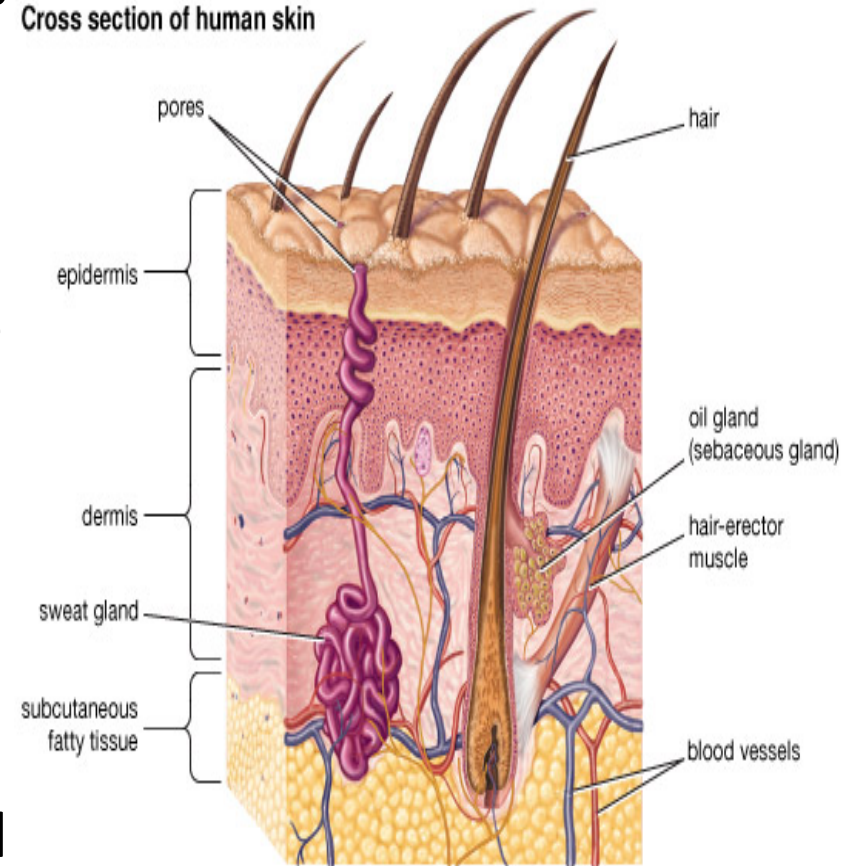




The Epidermis

- It is a **stratified epithelium**, its cells become flattened as they mature and rise to the surface.
- **The epidermis is extremely thick on the palms of the hands and the soles of the feet**, to withstand the wear and tear occurs in these regions.
- **The epidermis is thin in other areas** of the body, for example, on the anterior surface of the arm and forearm.

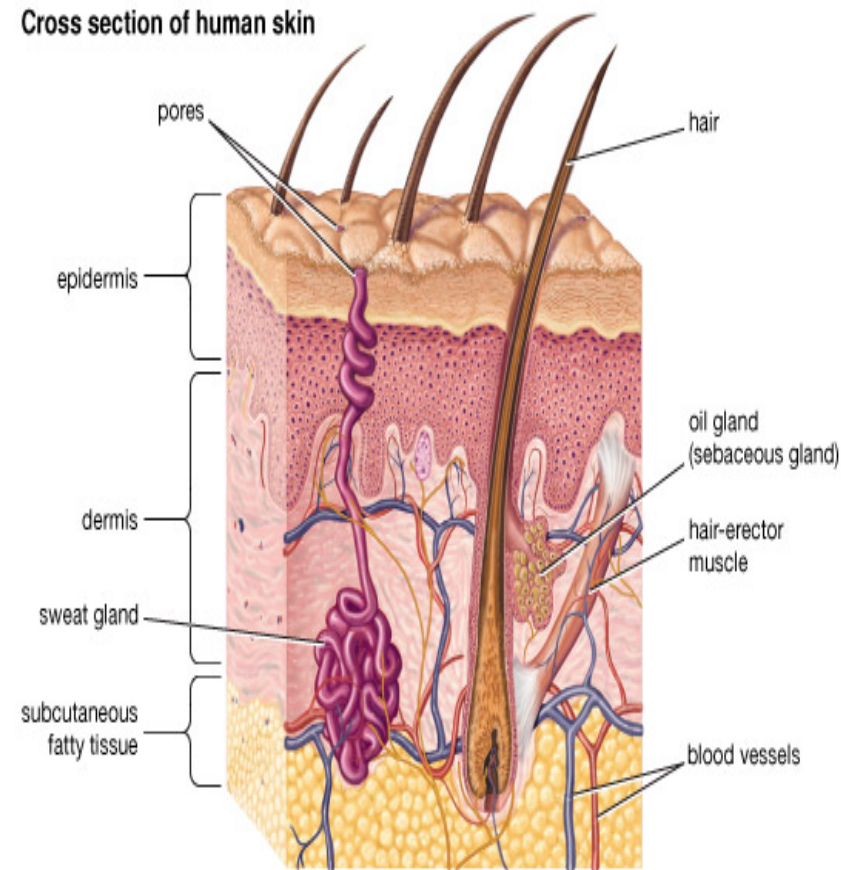
Cross section of human skin



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The Dermis

- Composed of **connective tissue** containing many **blood vessels**, **lymphatics** and **nerves**.
- The dermis of the skin is **connected to the underlying deep fascia** or bones by the superficial fascia, otherwise known as subcutaneous tissue.
- It is **thinner in women** than in men.

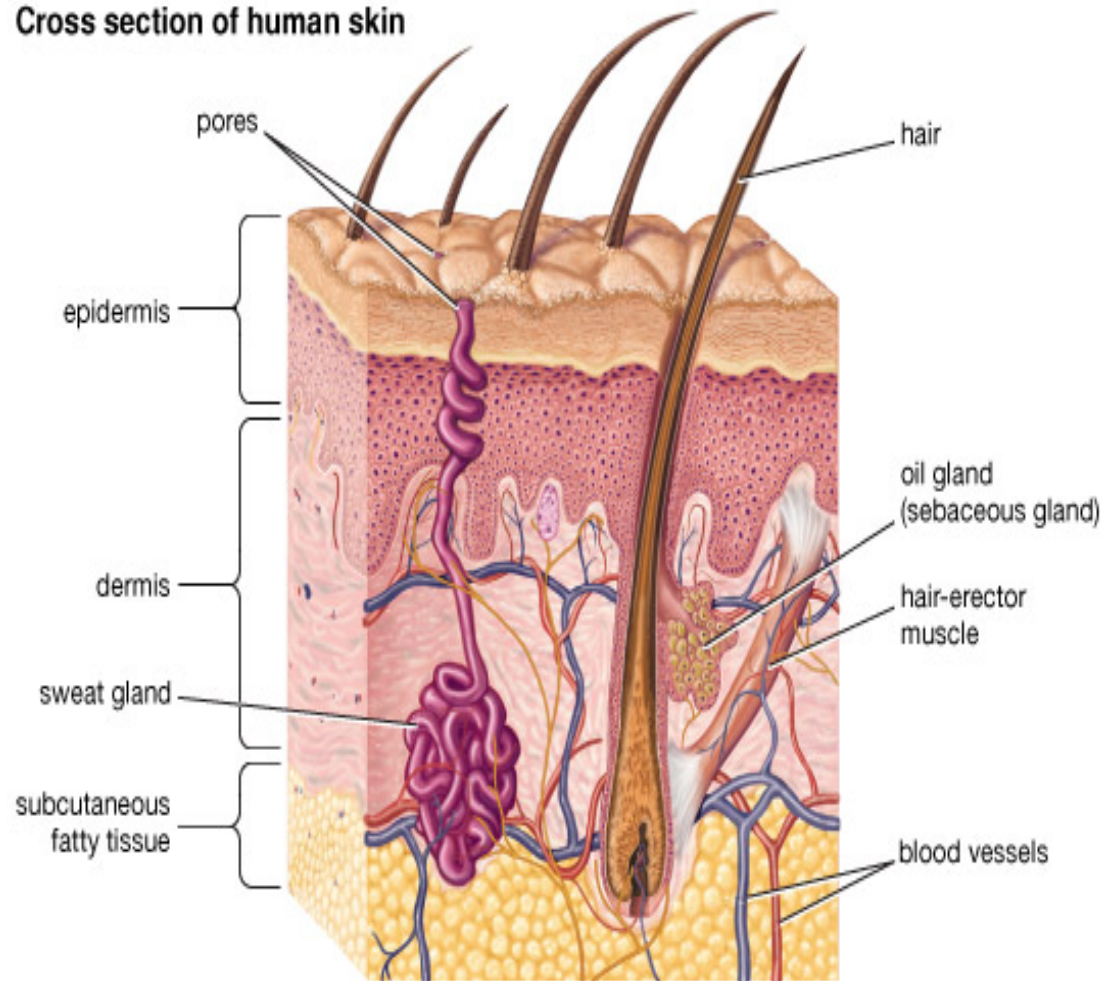


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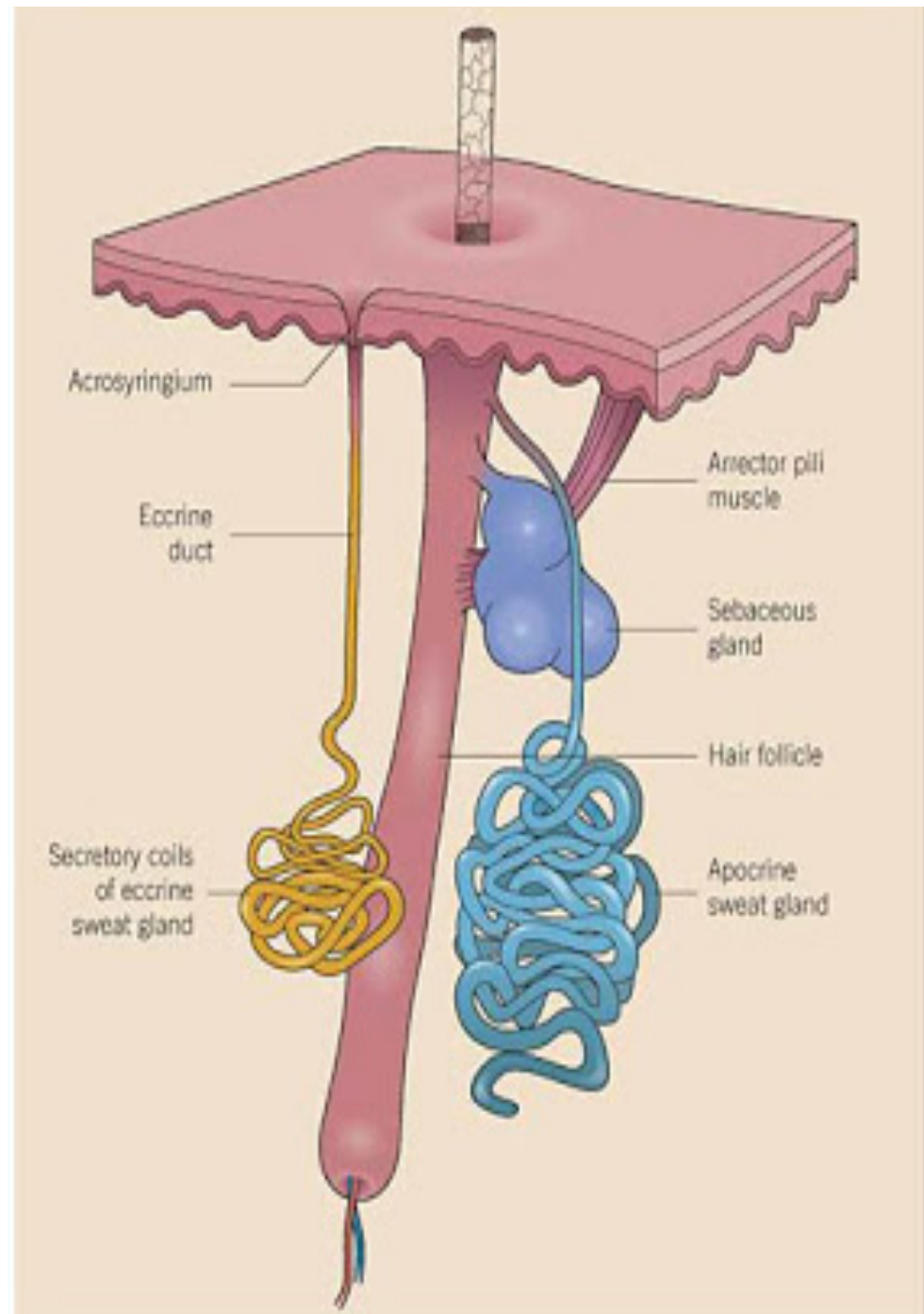
The appendages of the skin

- ✓ Nails.
- ✓ Hair follicles.
- ✓ Sebaceous glands
- ✓ Sweat glands.

Cross section of human skin

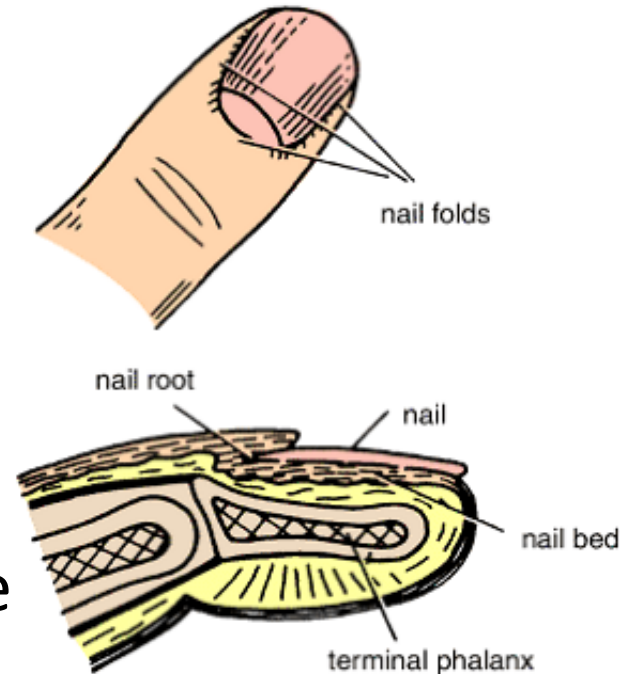


appendages of the skin



The nails

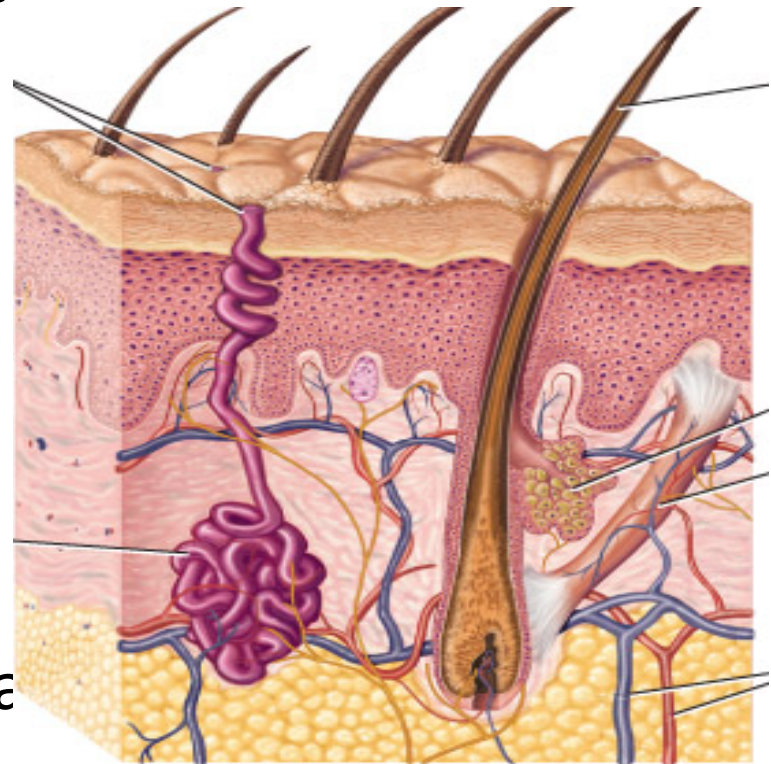
- They are **keratinized plates** on the dorsal surfaces of the tips of the fingers and toes.
- The proximal edge of the plate **is the root of the nail**.
- The **nail folds** is folds of skin that surround and overlap the nail (With the exception of the distal edge of the plate)
- The **nail bed** is the surface of skin covered by the nail.



Hair Follicles

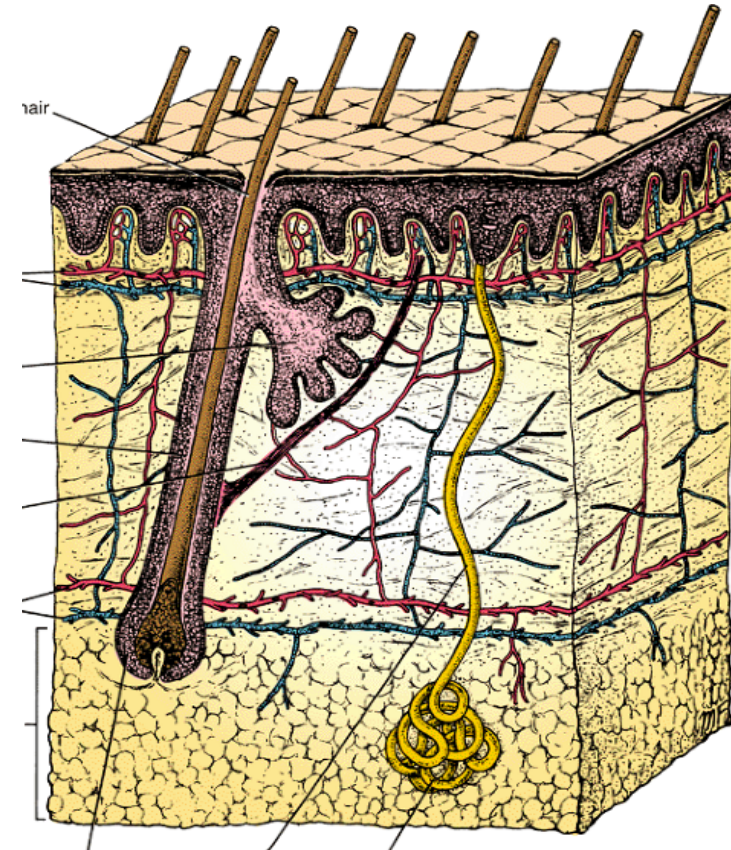
➤ Hairs are distributed in various numbers over the whole surface of the body, **except:**

- ✓ The lips.
- ✓ The palms of the hands, the sides of the fingers.
- ✓ The soles and sides of the feet and the sides of the toes.
- ✓ Glans penis and clitoris, the labia minora and the internal surface of the labia majora.



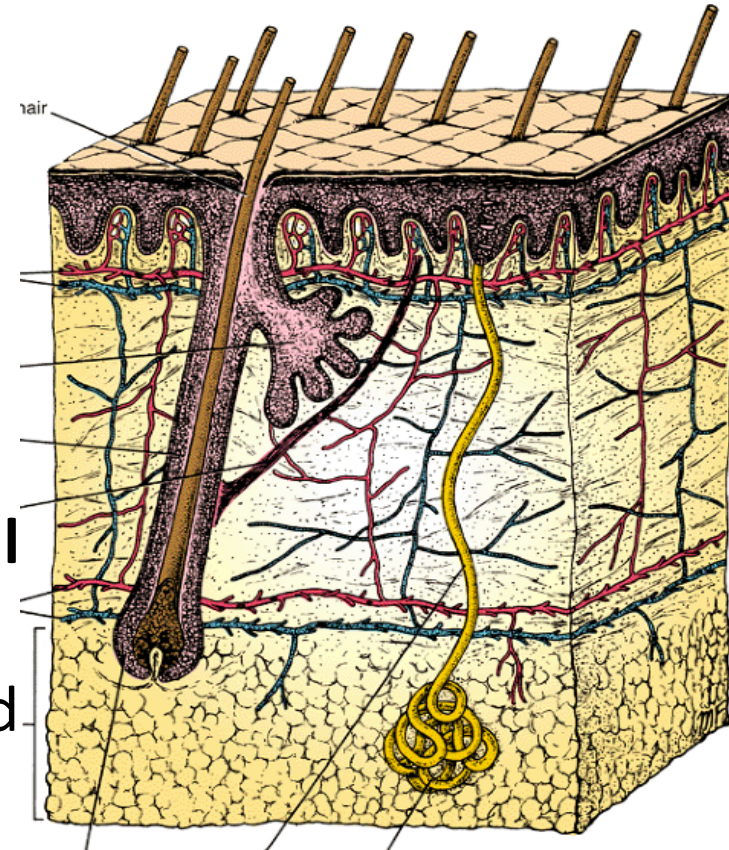
Hair Follicles

- **Follicles** are invaginations of the epidermis into the dermis from which hairs grow out.
- The follicles lie **obliquely** to the skin surface, and their expanded extremities, called **hair bulbs**, penetrate to the deeper part of the dermis.
- Each hair bulb is concave at its end, and the concavity is occupied by vascular connective tissue called **hair papilla**.



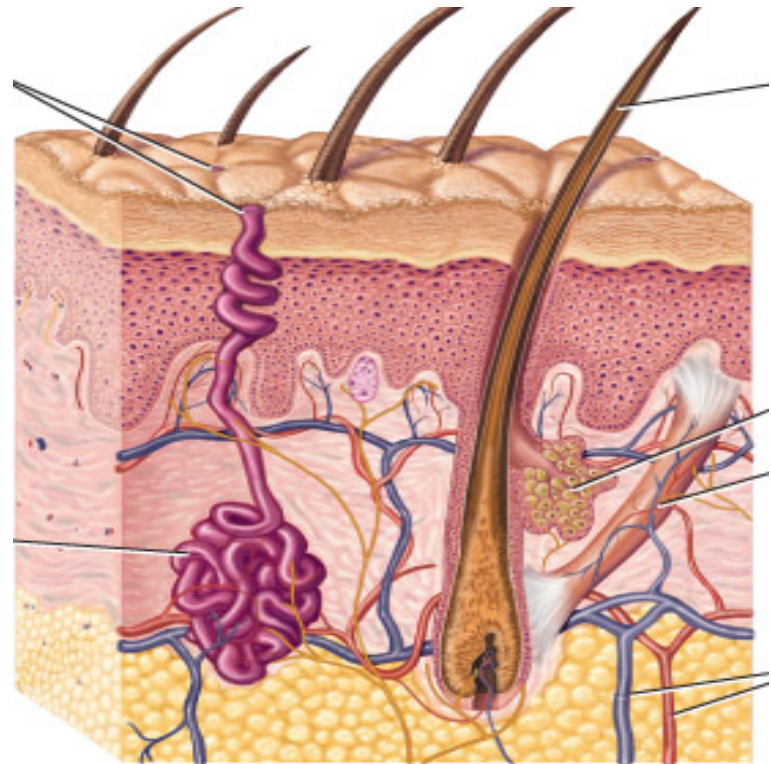
Hair Follicles

- **Arrector pili is** A band of smooth muscle, that connects the undersurface of the follicle to the superficial part of the dermis.
- **The muscle is innervated by sympathetic nerve fibers,**
- **Arrector Pili** contraction causes:
 1. The hair to move into a more **vertical position**.
 2. **Compression of the sebaceous** gland and causes it to extrude some of its secretion.
 3. **Dimpling of the skin** surface, so-called gooseflesh.



Sebaceous Glands

- They are situated on the undersurface of the follicles and lie **within the dermis**.
- Their secretion, **the sebum**, pour onto the shafts of the hairs.
- Sebum is an **oily material** that helps preserve the **flexibility of the emerging hair**.
- It also oils the surface epidermis around the mouth of the follicle.



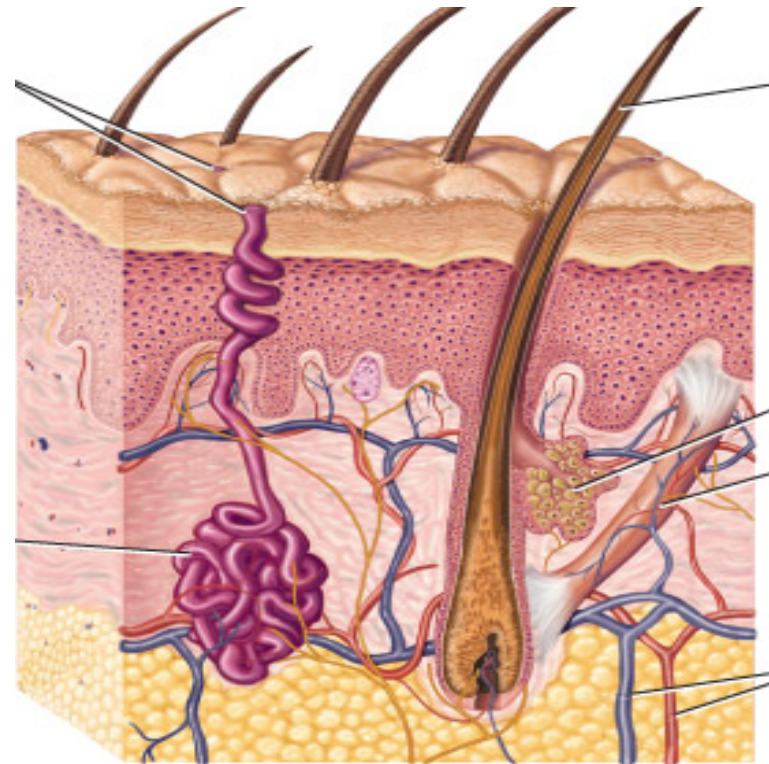
CLINICAL : Sebaceous cyst

- is caused by obstruction of the mouth of a sebaceous duct and may be caused by damage from a comb or by infection.
- It occurs most frequently on the scalp.



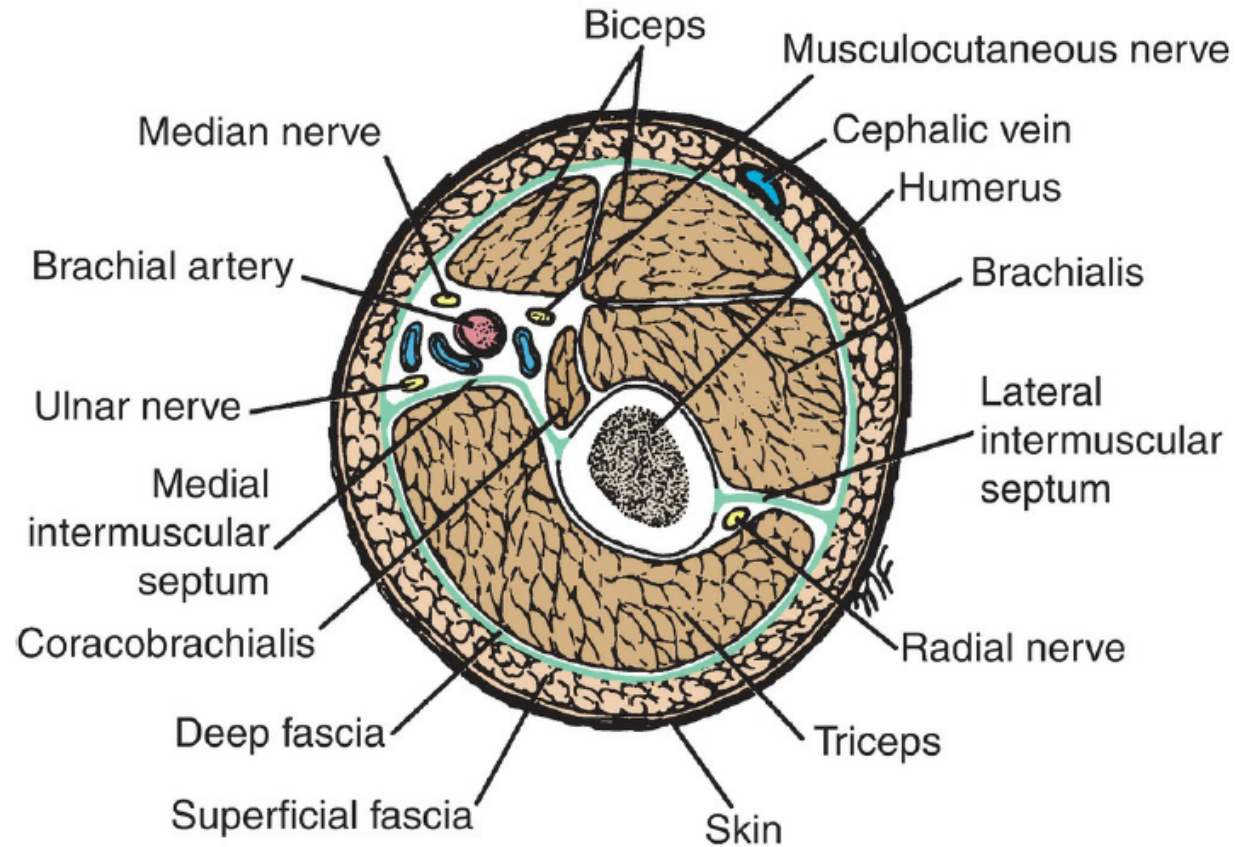
Sweat glands

- They are **long, spiral, tubular glands**
- Distributed over the surface of the body, **except** on the red margins of the **lips**, the **nail** beds, and the **glans penis** and **clitoris**.
- These glands extend through the **full thickness of the dermis**, and their **extremities may lie in the superficial fascia**.
- The sweat glands are the **most deeply penetrating structures** of all the epidermal appendages.



The Fascia

- The fascia of the body can be divided into: “**superficial and deep**”
- It lies **between** the skin and the underlying muscles and bones.



The Superficial Fascia

- The **superficial fascia**, or **subcutaneous tissue**, unites the dermis of the skin to the underlying deep fascia.
- In the **scalp**, the **back of the neck**, the **palms** of the hands, and the **soles** of the feet, it contains **numerous bundles of collagen fibers** that hold the skin firmly to the deeper structures.

The Deep Fascia

- The **deep fascia** is a **membranous layer** of connective tissue that invests the muscles & other deep structures.
- **In the neck**, it forms well-defined layers that may play an important role in determining the path taken by organisms during spread of infection.
- **In the thorax and abdomen**, it is a thin film of areolar tissue covering the muscles and aponeuroses.
- **In the limbs**, it forms a definite sheath around the muscles and other structures, holding them in place.

Muscle

- The three types of muscle are:

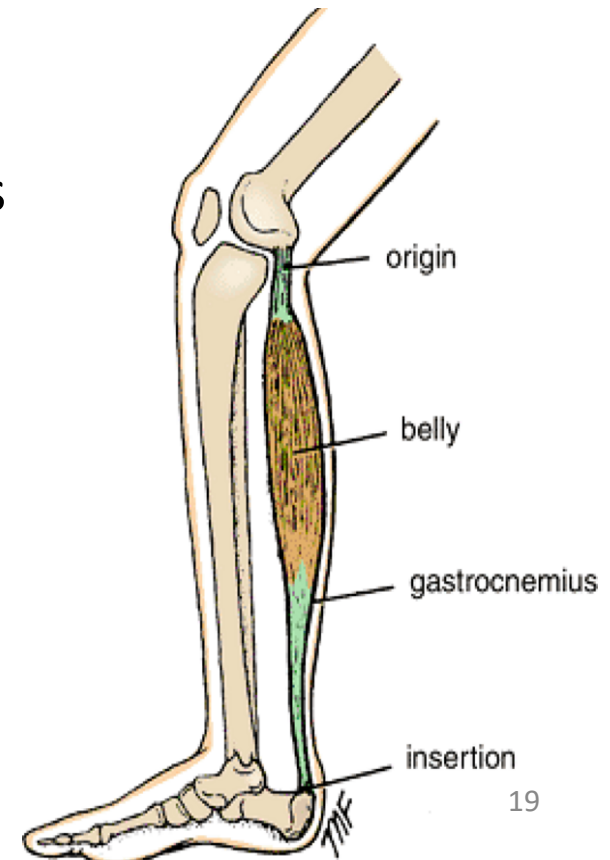
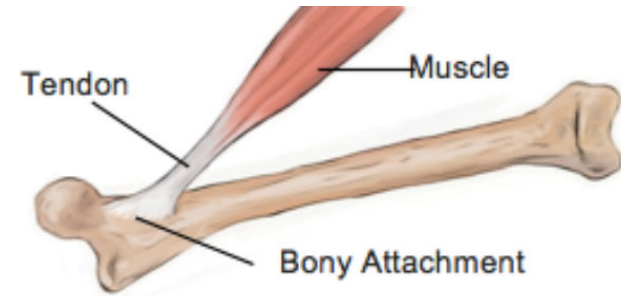
- **Skeletal.**

- **Smooth.**

- **Cardiac.**

Skeletal Muscle

- They **produce the movements** of the skeleton;(called **voluntary muscles**)
- Made up of striped **muscle fibers**.
- Has two or more **attachments**:-
 - ✓ **The origin** is the attachment that moves the least.
 - ✓ **The insertion** is the attachment that moves the most.
 - **The belly** is the fleshy part of the muscle.
 - **Tendons** is a **cords of fibrous** tissue that attache the end of muscles to bones, cartilage, or ligaments.
 - **Aponeurosis** is a **strong sheet of fibrous tissue** that attached **flattened** muscles to there origin or insertion.



Naming of Skeletal Muscles

Individual muscles are named according to their:

➤ Shape

- ✓ Deltoid :Triangular
- ✓ Teres: Round
- ✓ Rectus :Straight

➤ Size

- ✓ Major :Large
- ✓ Latissimus :Broadest
- ✓ Longissimus :Longest

➤ Number of heads or bellies

- ✓ Biceps: Two heads
- ✓ Quadriceps: Four heads
- ✓ Digastric: Two bellies

➤ Position

- ✓ Pectoralis: Of the chest
- ✓ Supraspinatus: above spine of scapula
- ✓ Brachii: Of the arm

Naming of Skeletal Muscles

Individual muscles are named according to their:

➤ Depth

- ✓ Profundus: Deep
- ✓ Superficialis: Superficial
- ✓ Externus: External

➤ Actions

- ✓ Extensor: Extend
- ✓ Flexor: Flex
- ✓ Constrictor: Constrict

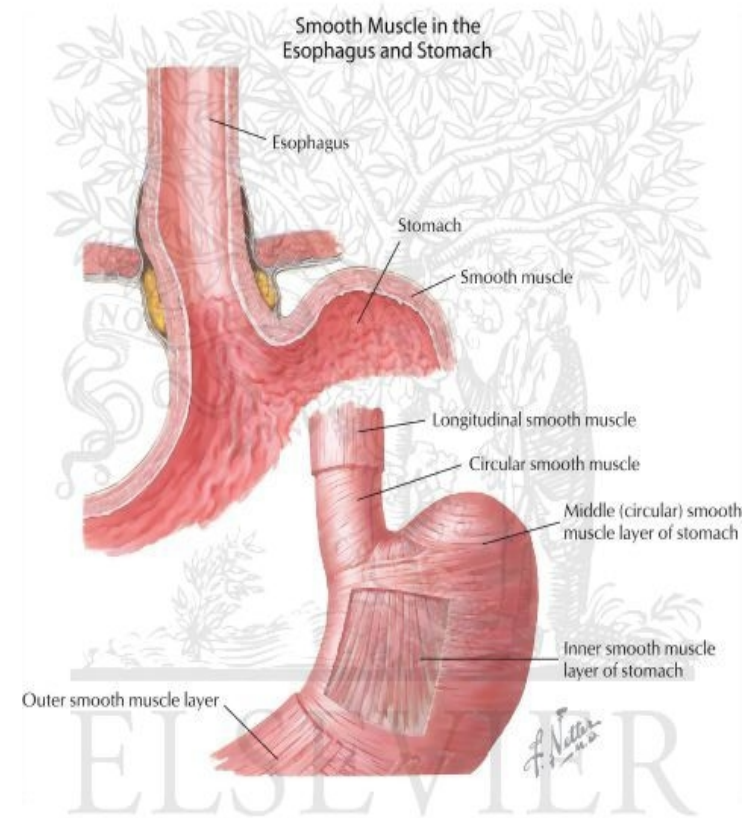
➤ Attachments

- ✓ Sternocleidomastoid: From sternum and clavicle to mastoid process.
- ✓ Coracobrachialis: From coracoid process to arm

These names are commonly used in combination, for example, flexor pollicis longus (long flexor of the thumb).

Smooth Muscle

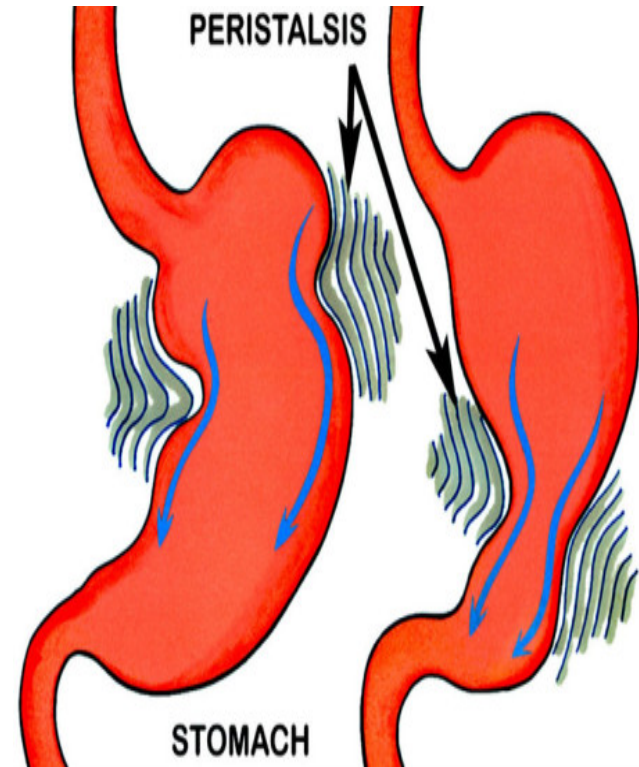
- Smooth muscle **consists of long, spindle-shaped cells** closely arranged **in bundles or sheets**.
- In the **tubes of the body** it provides the **motive power for propelling the contents through the lumen**.
- In the **digestive system** it causes
 - The ingested food to be thoroughly **mixed** with the digestive juices.
 - Milking the contents onward.
- This method of propulsion is referred to as **peristalsis**.



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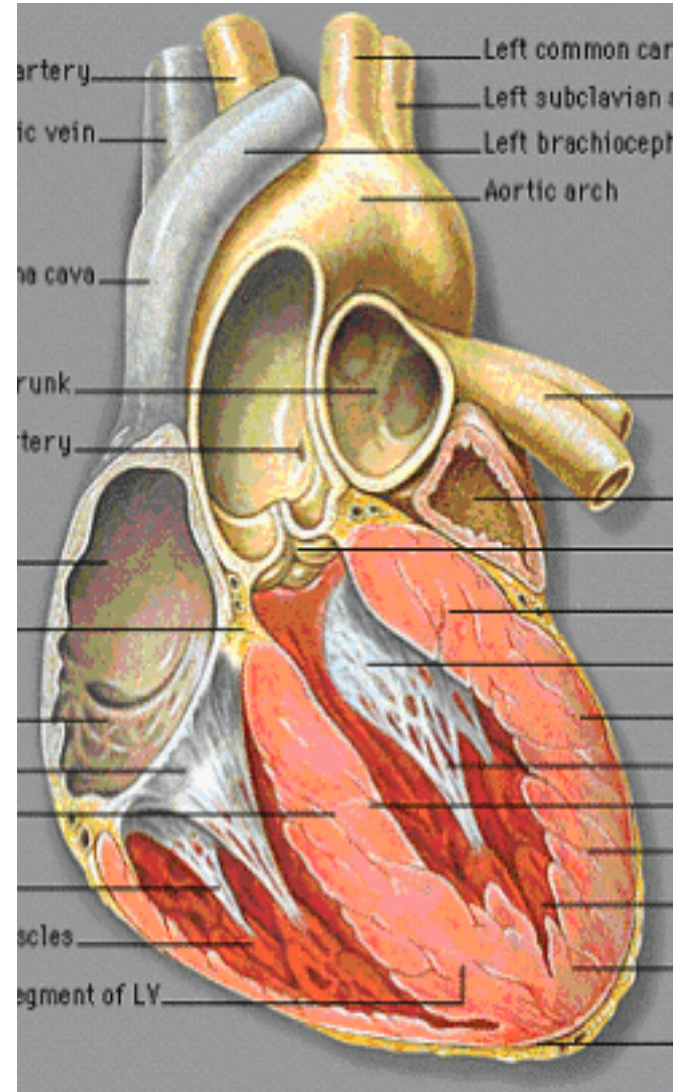
Smooth Muscle

- In **storage organs** such as the **urinary bladder and the uterus**, their contraction is slow and sustained and brings about expulsion of the contents of the organs.
- In **the walls of the blood vessels** the smooth muscle fibers are arranged circularly and serve to modify the caliber of the lumen.
- **Depending on the organ**, smooth muscle fibers may contract by:
 - ✓ **local stretching** of the fibers.
 - ✓ **nerve impulses** from autonomic nerves.
 - ✓ **hormonal stimulation**.



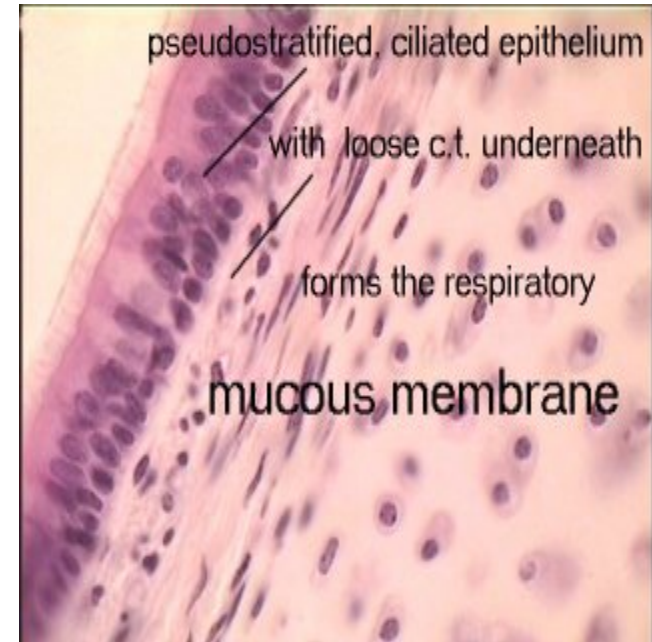
Cardiac Muscle

- Cardiac muscle consists of **striated muscle fibers** that branch and unite with each other.
- It forms **the myocardium** of the heart.
- Its fibers have the property of **spontaneous** and **rhythmic** contraction.
- Cardiac muscle is supplied by **autonomic nerve fibers**.



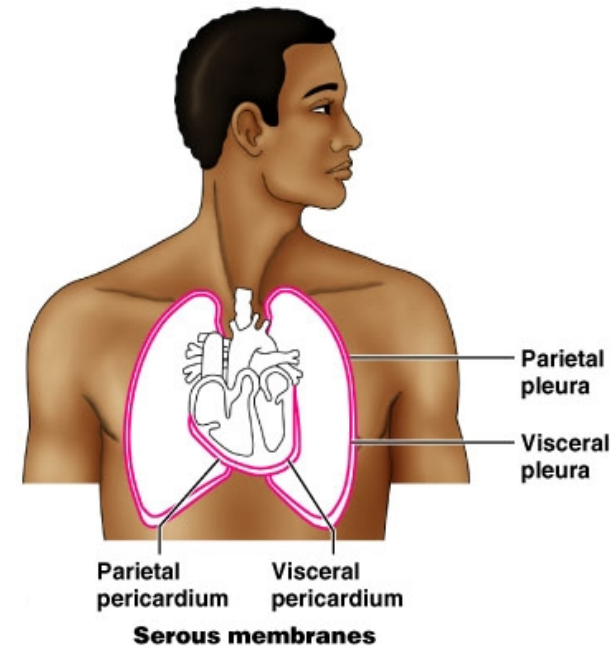
Mucous Membranes

- **Mucous membrane** is the name given to the lining of organs or passages that communicate with the surface of the body.
- A mucous membrane **consists of:**
 - ✓ **A layer of epithelium.**
 - ✓ **The lamina propria** which is a layer of connective tissue that supports the epithelium.
 - ✓ The muscularis mucosa consists of smooth muscle fibers.
- A mucous membrane may or may not secrete mucus on its surface.



Serous Membranes

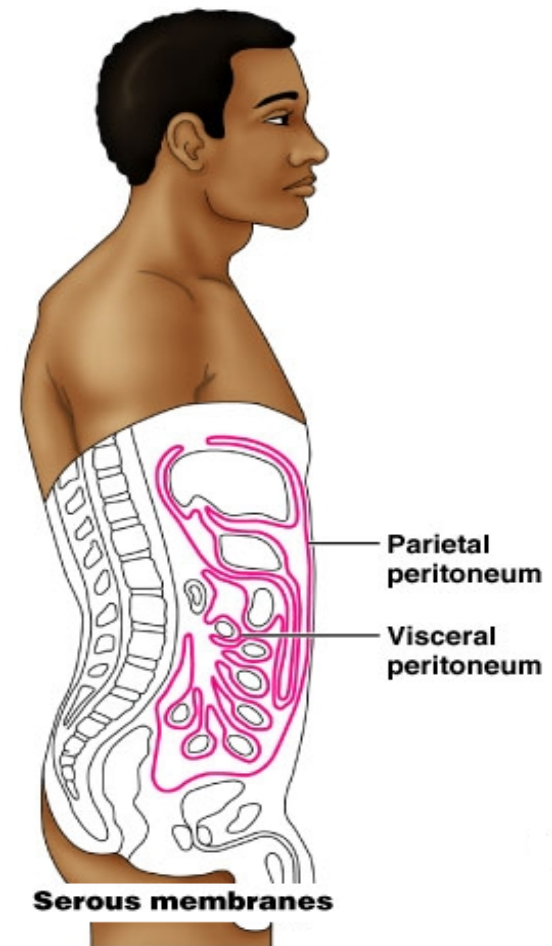
- It lines the cavities of the trunk and reflected onto the viscera & **consist of:**
 - ✓ A smooth layer of mesothelium.
 - ✓ A thin layer of connective tissue.
- The serous membranes divided into:
 - ✓ **Parietal layer** lining the wall of a cavity
 - ✓ **Visceral layer** covering the viscera.
- **The cavity** is the narrow slitlike that separates these layers and contains a small amount of serous liquid, **the serous exudate** that lubricates the surfaces of the membranes and **allows** the two layers to **slide** on each other.



- Pleural cavity
- Pericardial cavity
- peritoneal cavity

Serous Membranes

- ❑ **The parietal layer** of a serous membrane is developed from the **somatopleure** (inner cell layer of mesoderm) and is richly supplied by spinal nerves.
 - It is **sensitive to all common sensations** such as touch and pain.
- ❑ **The visceral layer** is developed from the **splanchnopleure** (inner cell layer of mesoderm) and is supplied by autonomic nerves.
 - It is **insensitive** to touch & temperature but **very sensitive to stretch**.

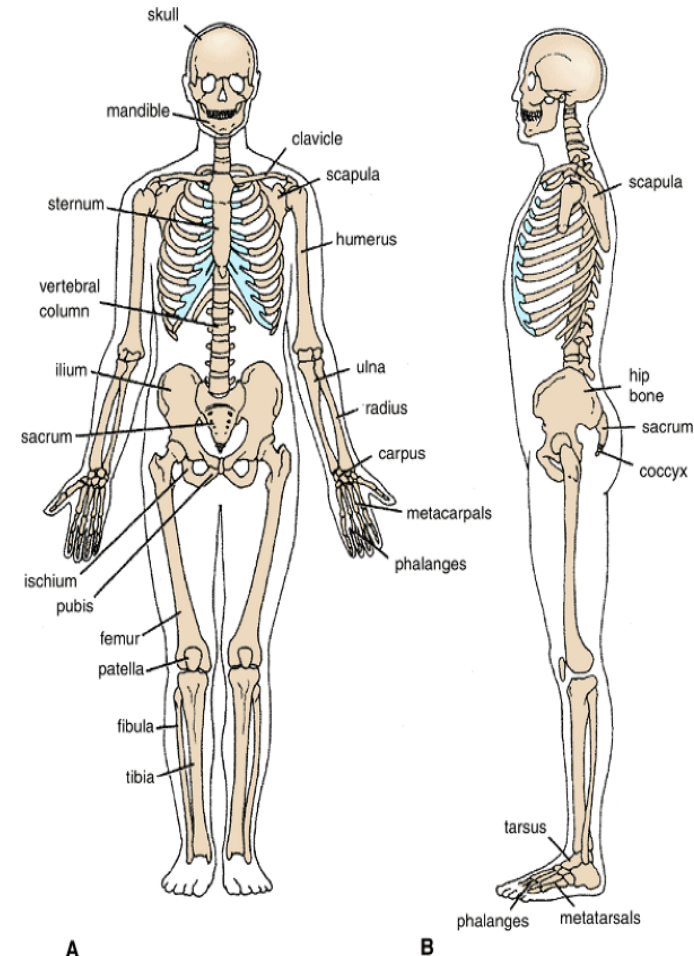


Bone

- Bone is a **living tissue** which **consists** of cells, fibers, and matrix.
- It is **hard** because of the **calcification** of its extracellular matrix & possesses a **degree of elasticity** because of the presence of **organic fibers**.

❖ Functions of bones:

- ✓ Protective function.
- ✓ It serves as a **lever**, as seen in the long bones of the limbs.
- ✓ Locomotor system.
- ✓ Storage area for calcium salts.
- ✓ It houses and protects within its cavities the **bone marrow**.



Bone

➤ **Bone exists in two forms:**

❑ **Compact bone** appears as a solid mass.

❑ **Cancellous bone** consists of a branching network of trabeculae.

➤ **Classification of Bones**

• Bones may be classified according to:

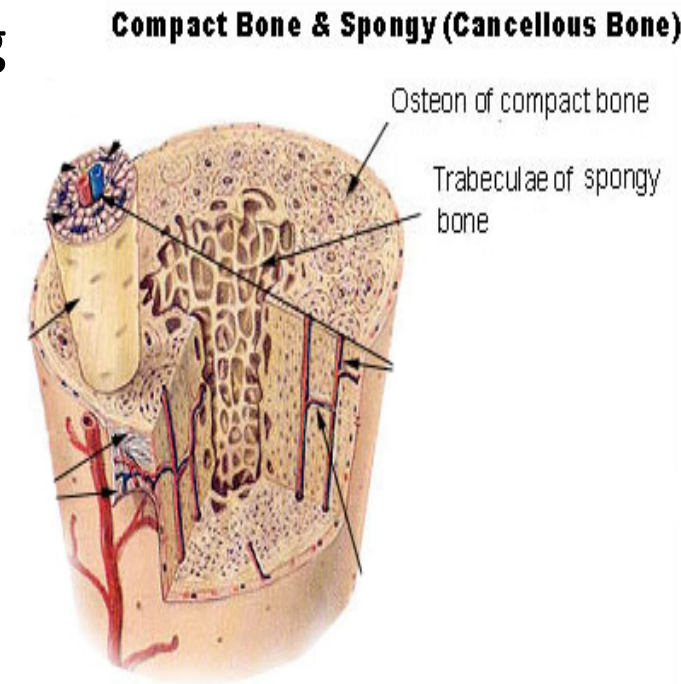
❑ **Regional classification.**

❑ **General shape classification.**

1) Long Bones. 2) Short Bones.

3) Flat Bones. 4) Irregular Bones.

5) Sesamoid Bones.



Regional classification

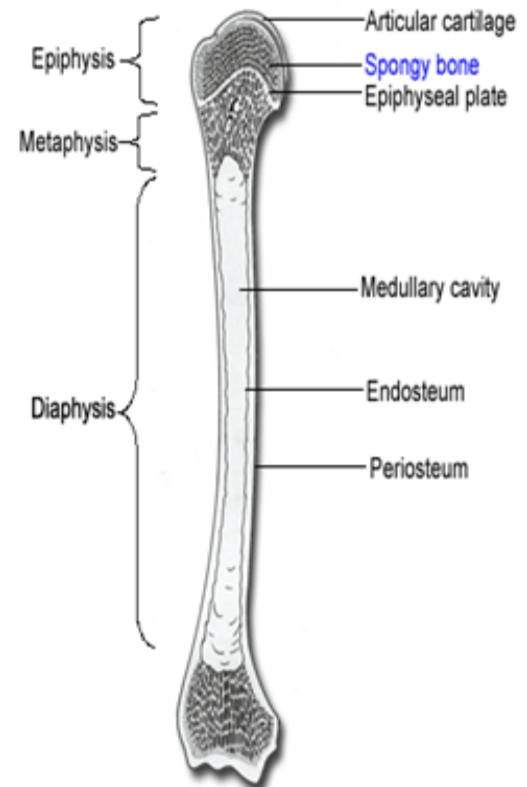
Region of Skeleton	Number of Bones	Region of Skeleton	Number of Bones
Axial skeleton		Upper extremities	
Skull		Humerus	2
Cranium	8	Radius	2
Face	14	Ulna	2
Auditory ossicles	6	Carpals	16
Hyoid	1	Metacarpals	10
Vertebrae	26	Phalanges	28
Sternum	1	Pelvic girdle	
Ribs	24	Hip bone	2
		Lower extremities	
		Femur	2
		Patella	2
		Fibula	2

Appendicular skeleton	
Shoulder girdles	
Clavicle	2
Scapula	2

Tarsals	14
Metatarsals	10
Phalanges	28
	206

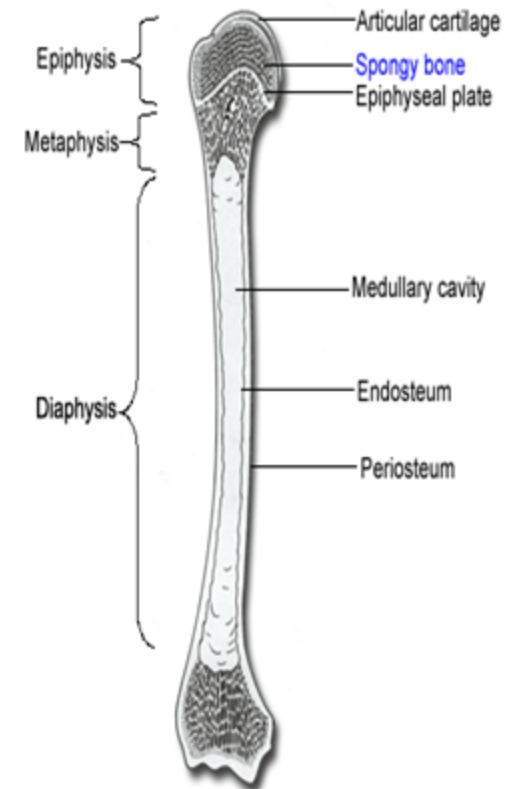
Long Bones

- Found in **the limbs** (e.g., the humerus, femur, metacarpals, metatarsals, and phalanges).
- Their **length is greater than their breadth**.
- They have a **tubular shaft**, the **diaphysis**, and usually an **epiphysis** at each end.
- During the growing phase, the diaphysis is separated from the epiphysis by an **epiphyseal cartilage (epiphyseal plate)**.
- The part of the diaphysis that lies adjacent to the epiphyseal cartilage is called the **metaphysis**.



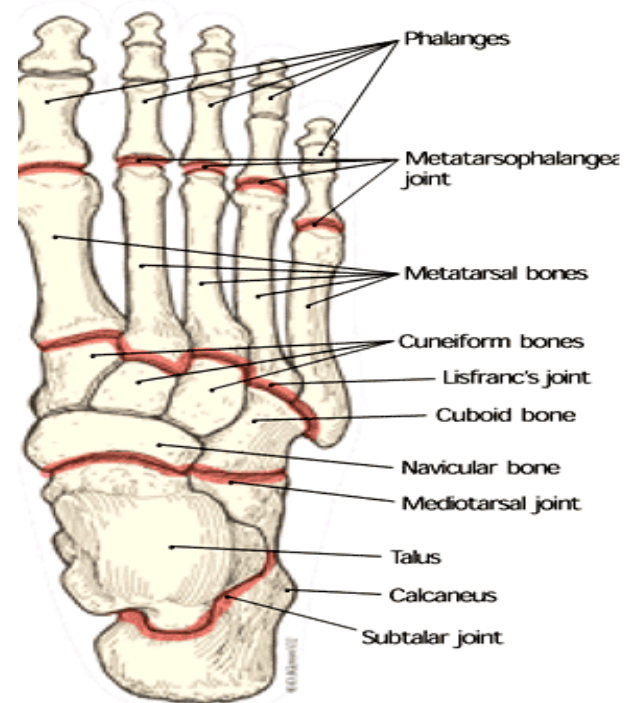
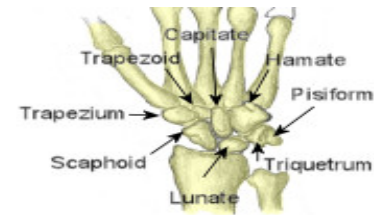
Long Bones

- The shaft has a **central marrow cavity** containing **bone marrow**.
- The outer part of the shaft is composed of compact bone that is covered by a connective tissue sheath, **the periosteum**.
- The **articular surfaces** of the ends of the bones are covered by **hyaline cartilage**.



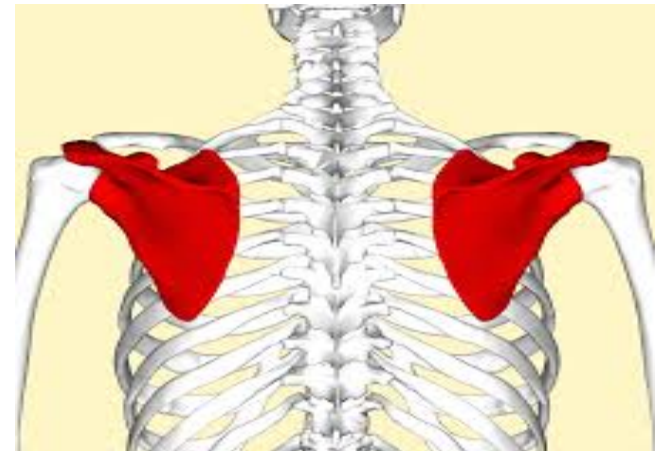
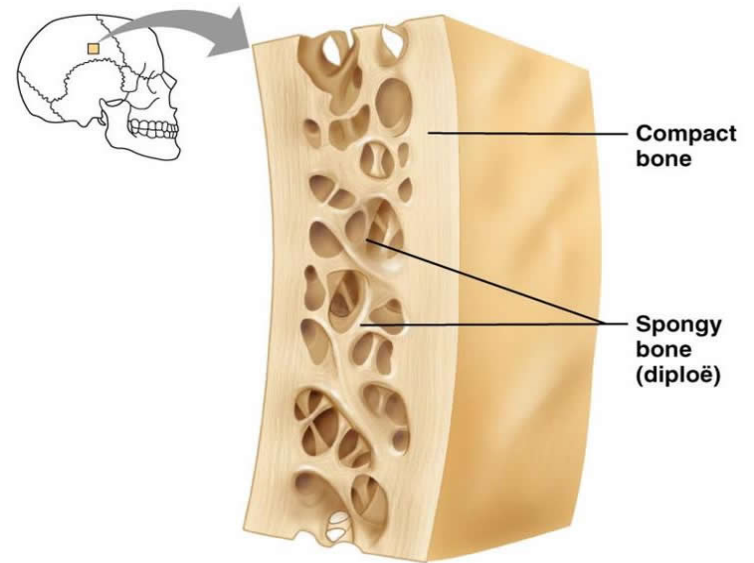
Short Bones

- Short bones are found in the **hand and foot** (e.g., the scaphoid, lunate, talus, and calcaneum).
- They are roughly **cuboidal** in shape and are composed of **cancellous bone** surrounded by a thin **layer of compact bone**.
- Short bones are covered with periosteum, and the articular surfaces are covered by hyaline cartilage.



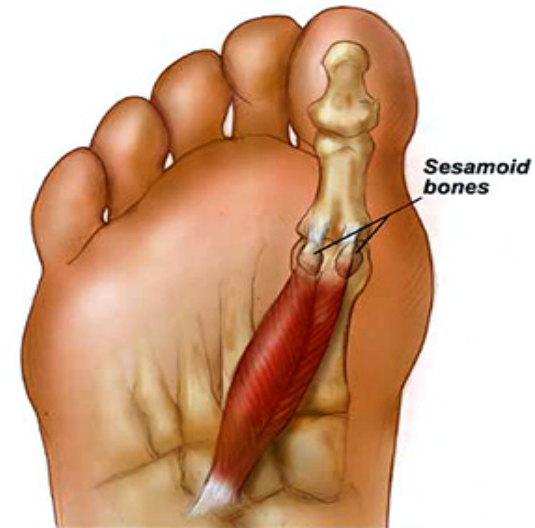
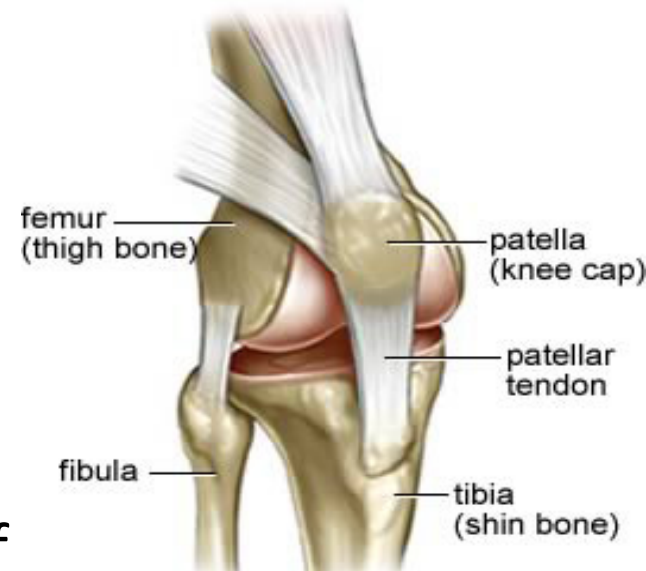
Flat Bones

- Flat bones are found in the **vault of the skull** (e.g., the frontal and parietal bones).
- They are composed of thin inner and outer layers of compact bone, **the tables**, separated by a layer of cancellous bone, **the diplo**.
- The scapulae & irregular are included in this group.



Sesamoid Bones

- Sesamoid bones are **small nodules of bone** that are found **in certain tendons** where they rub over bony surfaces.
- The greater part of a sesamoid bone is **buried in the tendon**, and the free surface is **covered with cartilage**.
- The largest **sesamoid bone is the patella**, which is located in the tendon of the **quadriceps femoris**.
- The **function** of a sesamoid bone is
 - **Reduce friction on the tendon.**
 - **Alter the direction of pull of a tendon.**



Irregular Bones

- Irregular bones include those not assigned to the previous groups (e.g., the bones of the skull, the vertebrae, and the pelvic bones).
- They are **composed of** a thin shell of compact bone with an interior made up of cancellous bone.



Bone Marrow

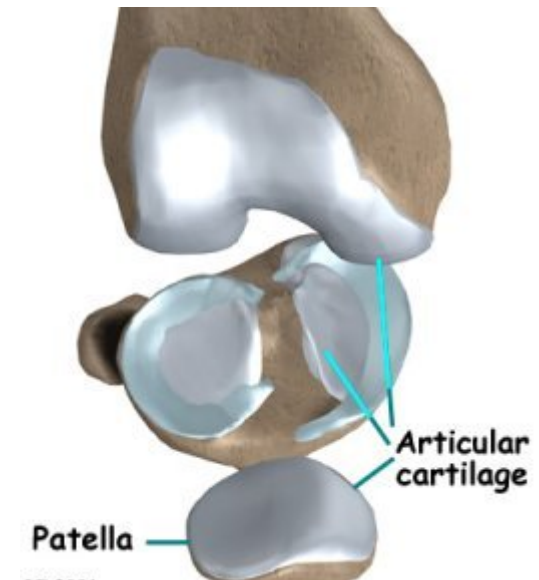
- It occupies the **marrow cavity** in long and short bones and the interstices of the cancellous bone in flat & irregular bones.
- At birth, the marrow of all the bones of the body is red and **hematopoietic**.
- This blood-forming activity **gradually lessens with age**, and the **red marrow is replaced by yellow marrow**.
- At 7 years of age, yellow marrow begins to appear in the distal bones of the limbs.
- In adult, red marrow is restricted to the bones of the skull, the vertebral column, the thoracic cage, the girdle bones, and the head of the humerus and femur.



Cartilage

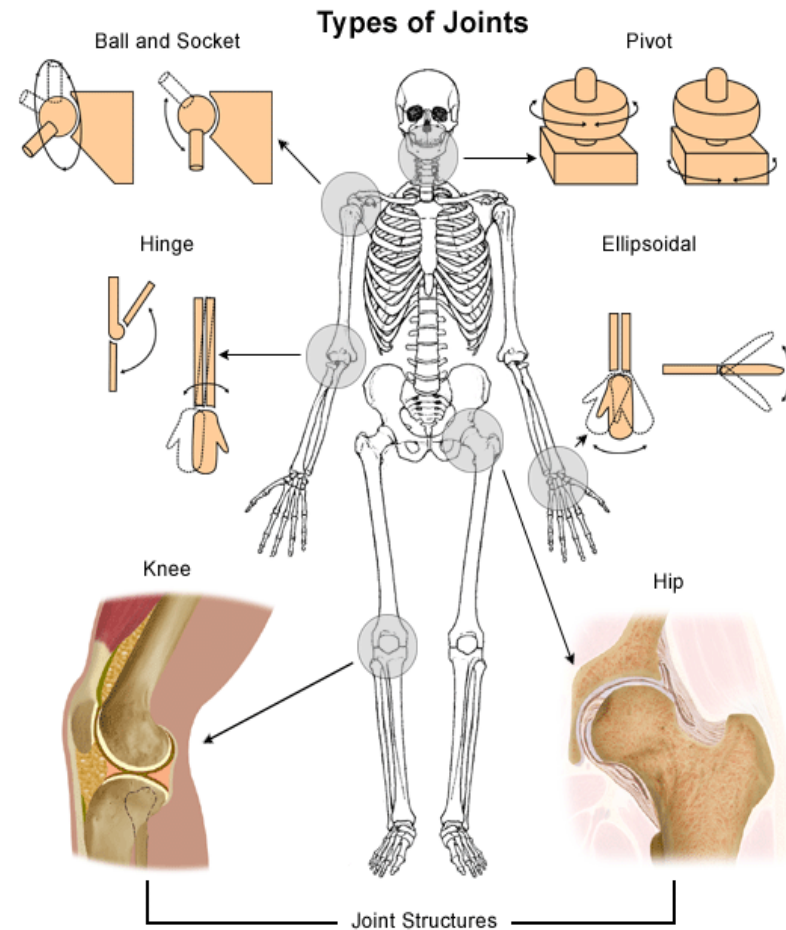
Cartilage is a **form of connective tissue** in which the cells and fibers are embedded in a gel-like matrix.

- **Hyaline cartilage** has a great resistance to wear **and covers the articular surfaces** of nearly all synovial joints.
- **Fibrocartilage** is found in the **discs within joints** and on the articular surfaces of the clavicle and mandible.
- **Elastic cartilage** it is flexible and is found in the **auricle of the ear**, the **external auditory meatus**, the **auditory tube**, and the **epiglottis**.



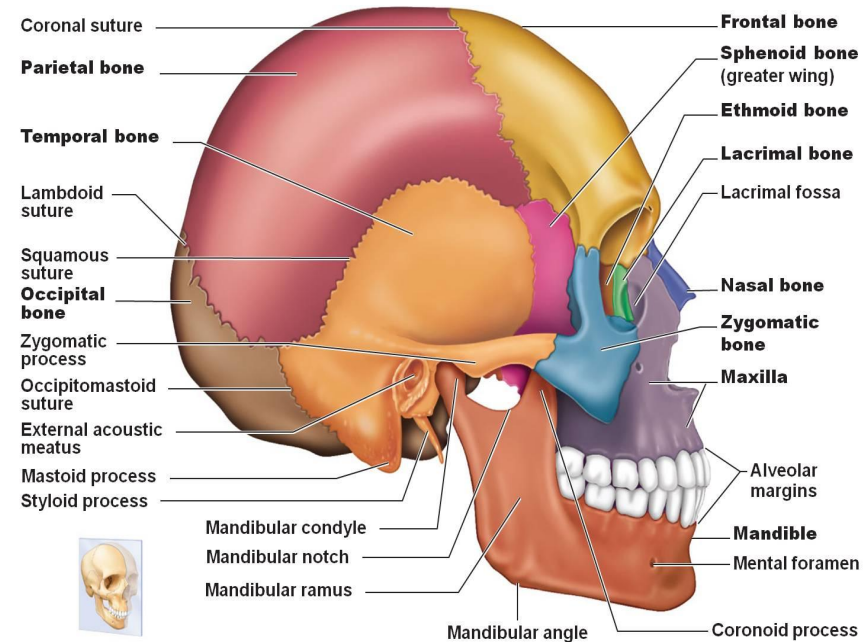
Joints

- **Joint is:** A site where two or more bones come together, whether or not movement occurs between them.
- Joints are classified **according to the tissues that lie between the bones:**
 - Fibrous joints.
 - Cartilaginous joints.
 - Synovial joints.



Fibrous Joints

- The articulating surfaces of the bones are joined by **fibrous tissue**
 - The sutures of the vault of the skull.
 - The inferior tibiofibular joints.
- ❑ **Very little movement is possible.**



(a) External anatomy of the right side of the skull

Cartilaginous Joints

- Cartilaginous joints can be **divided into two types**: primary and secondary.

❑ **A primary cartilaginous joint** : the bones are united by a **plate of hyaline cartilage**.

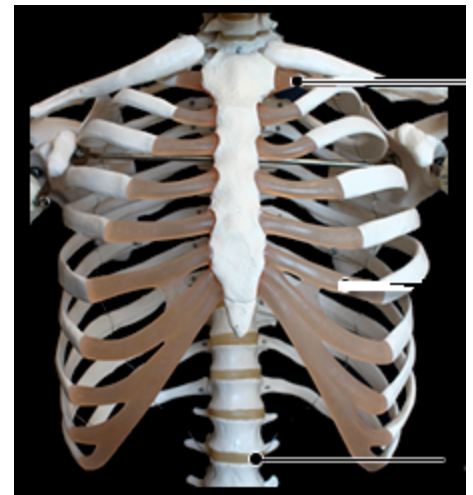
➤ The union between first rib and the manubrium sterni.

➤ **No movement** is possible.

❑ **A secondary cartilaginous joint**: the bones are united by a **plate of fibrocartilage** and the articular surfaces of the bones are covered by a thin layer of **hyaline cartilage**.

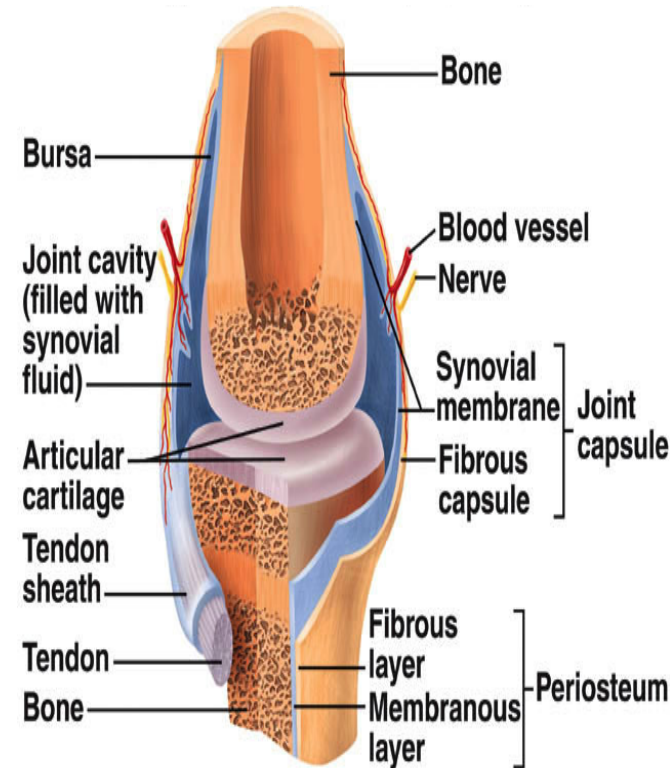
➤ Joints between the **vertebral bodies** and the **symphysis pubis**.

➤ A **small amount** of movement is possible.



Synovial Joints

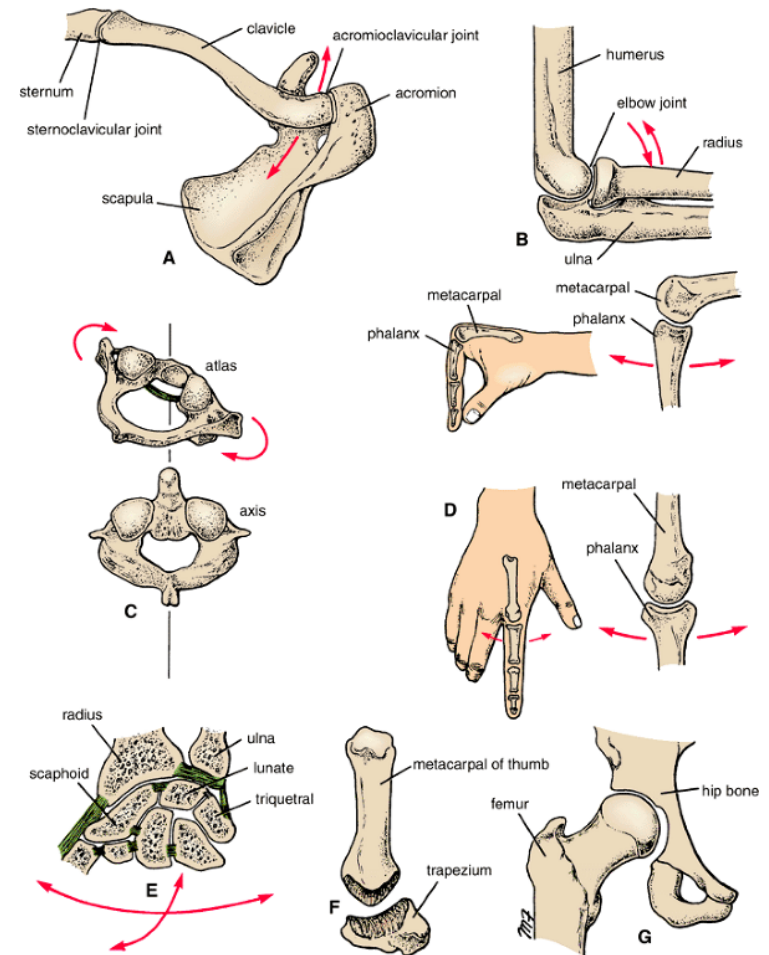
- The articular surfaces of the bones are covered by a thin **layer of hyaline cartilage** separated by a **joint cavity**.
- This arrangement permits a **great degree of freedom of movement**.
- The cavity of the joint is **lined by synovial membrane**.
- The synovial membrane is protected on the outside by a tough fibrous membrane “**the capsule of the joint**”.
- The articular surfaces are lubricated by a viscous fluid called **synovial fluid**, produced by the **synovial membrane**..



Synovial Joints

- Synovial joints can be classified according to the **arrangement of the articular surfaces** and the **types of movement** that are possible:

- 1) Plane joints.
- 2) Hinge joints.
- 3) Pivot joints.
- 4) Condyloid joints.
- 5) Ellipsoid joints.
- 6) Saddle joints.
- 7) Ball-and-socket joints.



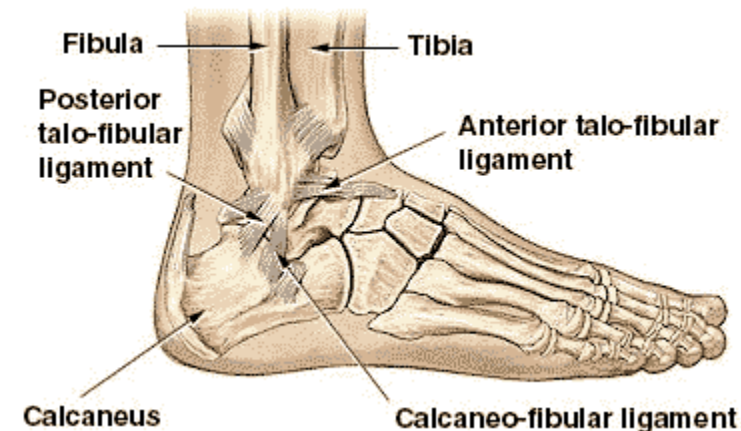
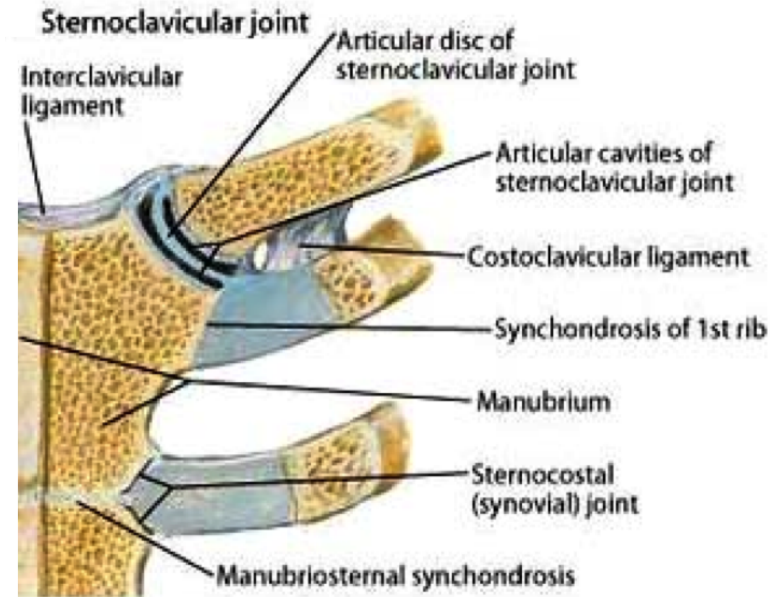
Synovial Joints

➤ **Plane joints:** The apposed articular surfaces **are flat or almost flat**, and this permits the bones to slide on one another.

✓ Sternoclavicular joint

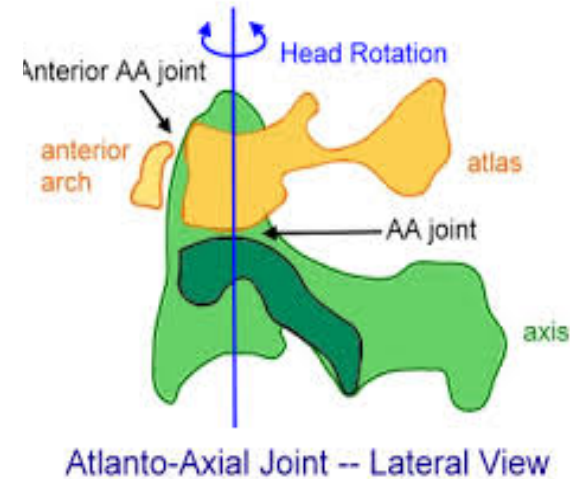
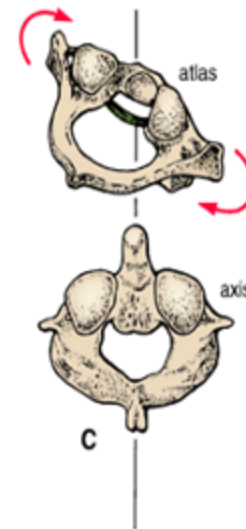
➤ **Hinge joints:** Resemble the hinge on a **door**, so that flexion and extension movements are possible.

✓ Elbow, and ankle joints



Synovial Joints

➤ **Pivot joints:** a central bony pivot is surrounded by a bony “ligamentous ring” and **rotation is the only movement possible.**



✓ The atlantoaxial joint.

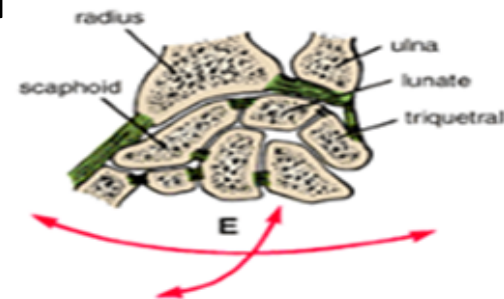
➤ **Condyloid joints:** have two **distinct convex surfaces** that **articulate with two concave surfaces.**

✓ Metacarpophalangeal joints.



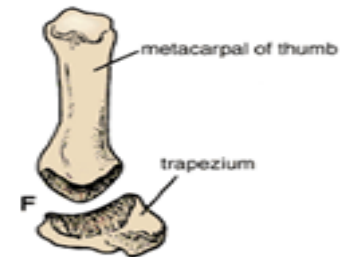
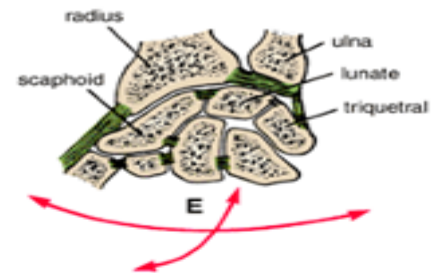
Synovial Joints

- **Ellipsoid joints:** elliptical convex articular surface fits into an elliptical concave articular surface (rotation is impossible).
 - ✓ The wrist joint.
- **Saddle joints:** The articular surfaces are reciprocally concavoconvex and resemble a **saddle on a horse's back**. flexion, extension, abduction, adduction, and rotation.
 - ✓ Carpometacarpal joint of the thumb.
- **Ball-and-socket joints:** A ball-shaped head of one bone fits into a socketlike concavity of another.
 - ✓ The shoulder and hip joints.



Stability of Joints

- The stability of a joint depends on **three main factors**:
 - The shape, size, and arrangement of the articular surfaces.
 - The ligaments.
 - The tone of the muscles around the joint.

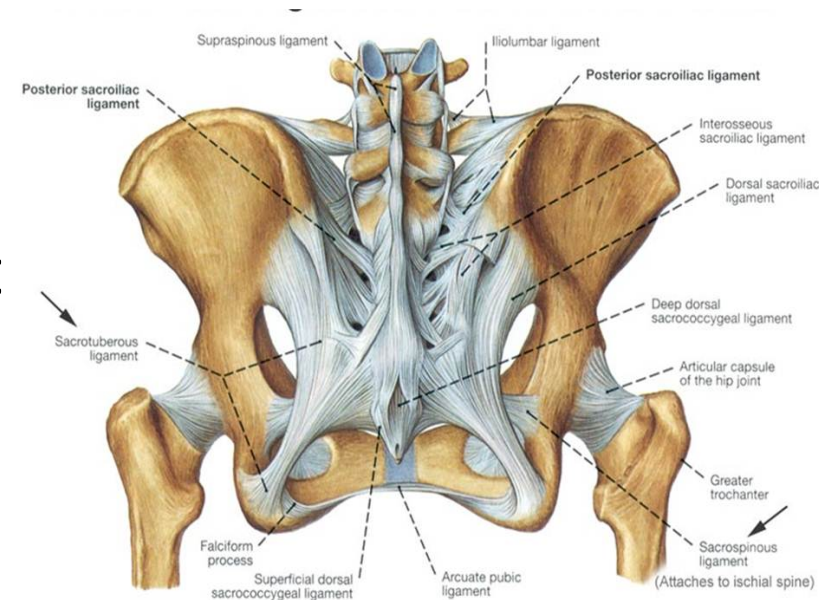


Ligaments

A ligament is a **cord or band** of connective tissue uniting two structures.

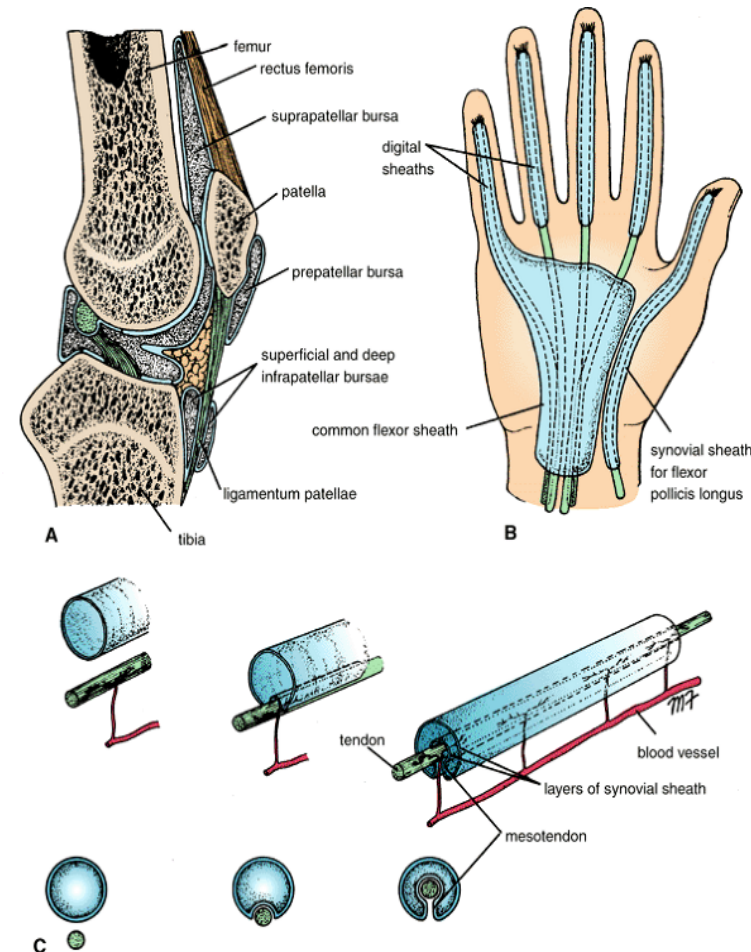
ligaments are of two types.

- **Fibrous ligaments** prevent excessive movement in a joint
- **Elastic ligaments**, conversely, return to their original length after stretching.



Bursae and Synovial Sheath

- ❑ **Bursa** is a **lubricating device** consisting of a closed fibrous sac lined with a delicate smooth membrane.
- **Bursae are found wherever tendons rub against bones, ligaments, or other tendons.**
- ❑ **Synovial Sheath** is a **tubular bursa** that **surrounds a tendon**.
 - The tendon invaginates the bursa from one side.
- ✓ Their function is to **reduce friction**.



General Anatomy

THORACIC WALL

Anatomy Group

Dr Naser Radwan, MD

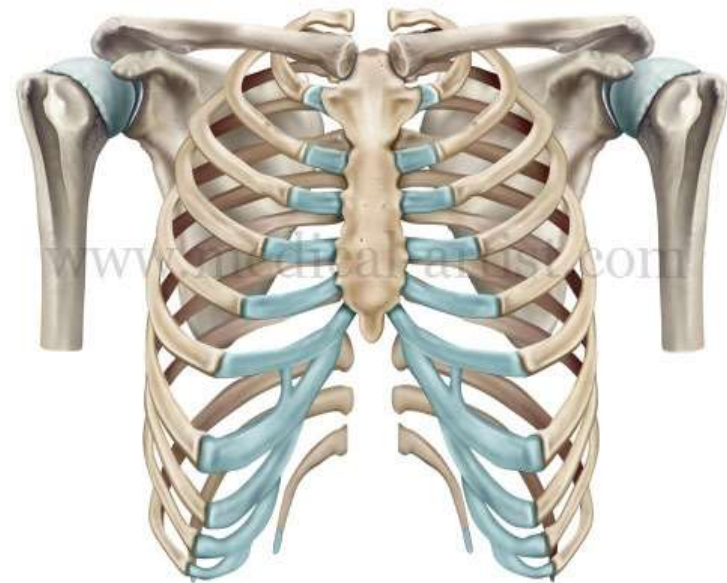
Dr Amjad Abu Alqumboz, MD

Dr Adham AlZanoun, MD



Basic Anatomy

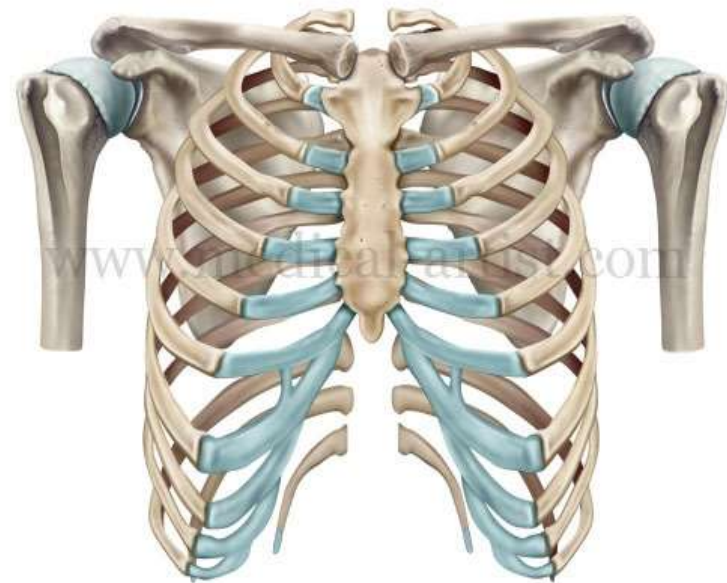
- The **thorax (or chest)** is the region of the body **between** the neck and the abdomen.
- **Superiorly** the thorax communicates with the neck.
- **Inferiorly** it is separated from the abdomen by the diaphragm.



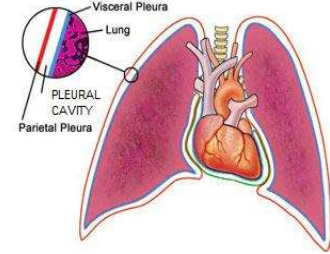
Basic Anatomy

Function of thoracic cage:

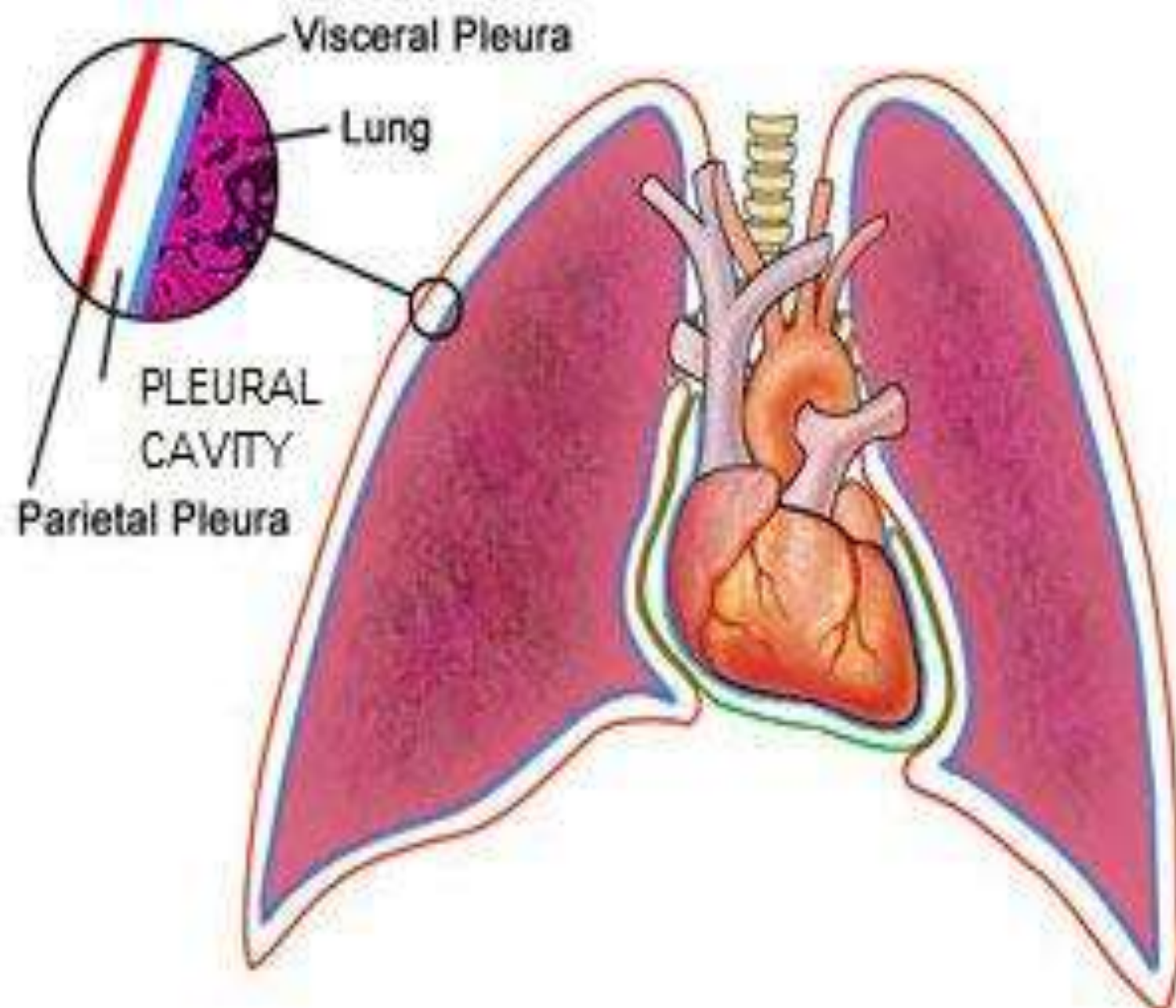
- **Protects** the lungs and heart
- **Affords attachment for the muscles** of the thorax, upper extremity, abdomen, and back
- Provides the **mechanical function of breathing**



Basic Anatomy

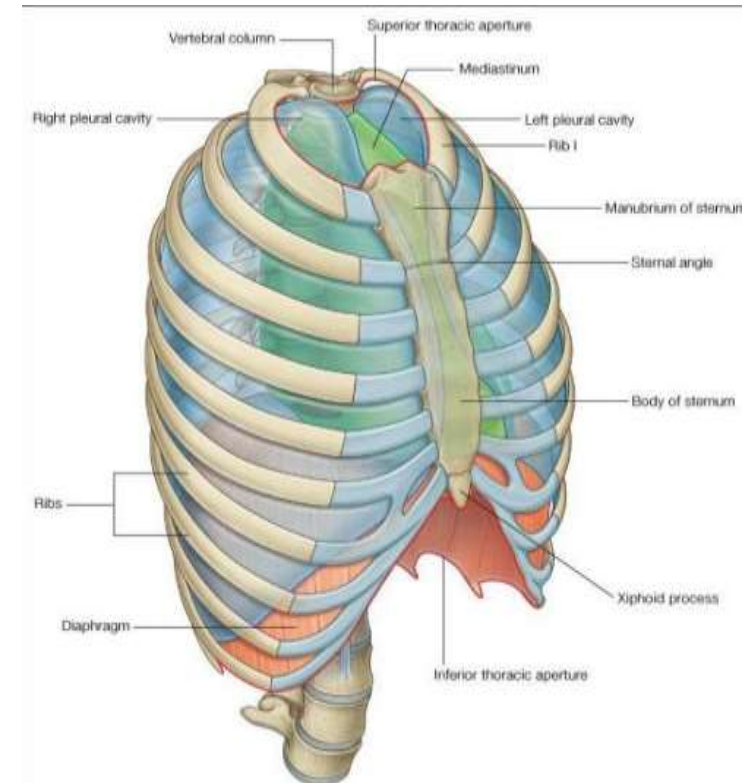


- The **cavity** of the thorax can be divided into:
 - **Median partition** : called the **mediastinum**.
 - **Lateral partition** : the **pleurae and lungs**.
- The lungs are covered by a **thin membrane** called the **visceral pleura**.
- The inner surface of the chest wall, is lined by the **parietal pleura**.
- The sacs between the two membranes called the **pleural cavities**.



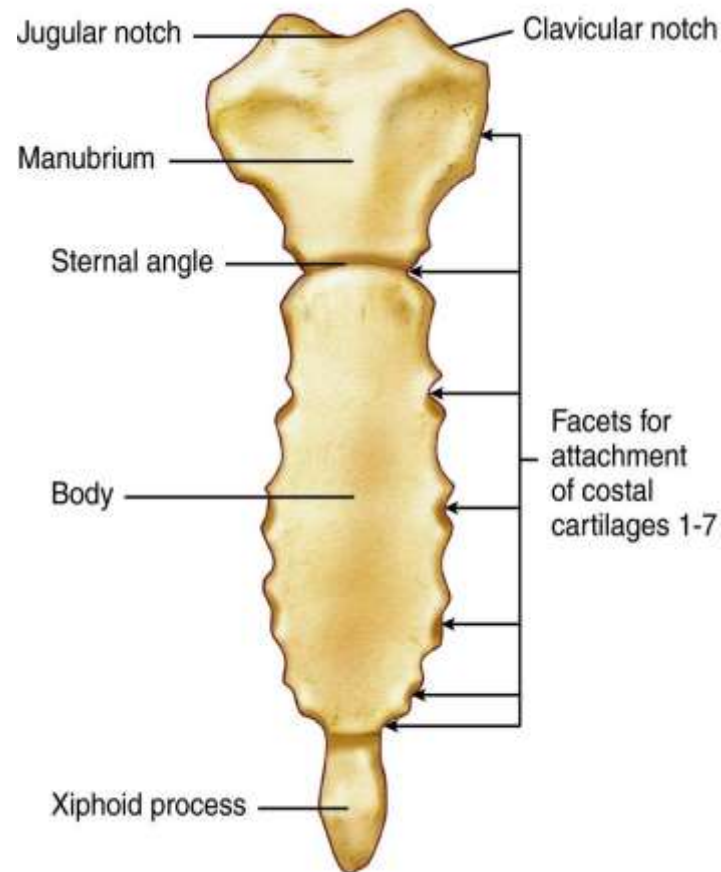
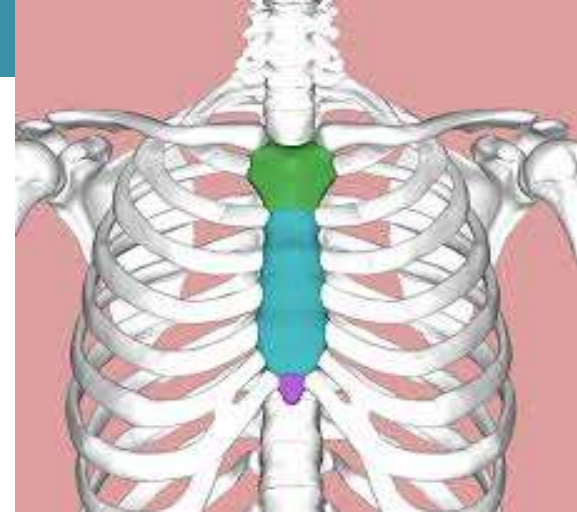
Structure of the Thoracic Wall

- The thoracic wall is **covered** by **skin** and **muscles**.
- **The thoracic wall is formed:**
 - **Posteriorly** by the thoracic part of the vertebral column.
 - **Anteriorly** by the sternum & costal cartilages.
 - **laterally** by the ribs & intercostal spaces.
 - **Superiorly** by the suprapleural membrane.
 - **Inferiorly** by the diaphragm.



Sternum

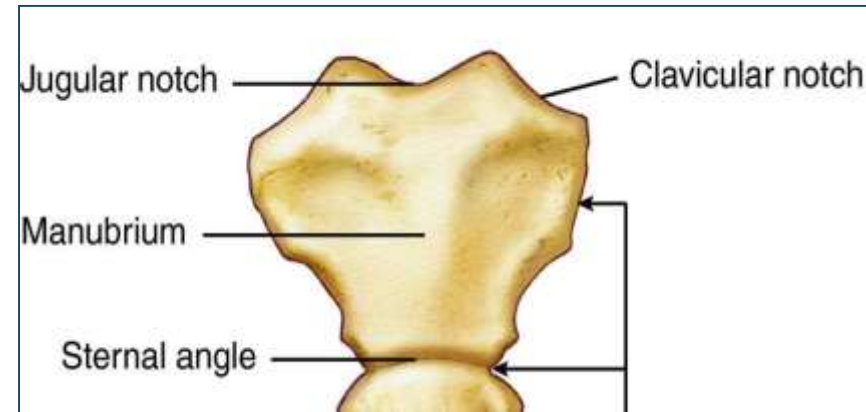
- It is a **flat bone** lies in the **midline** of the **anterior chest wall**.
- Can be divided into **three parts**:
 1. **Manubrium** (2 inch long)
 2. **Body** (4 inch long)
 3. **Xiphoid process** (1 inch)



Sternum

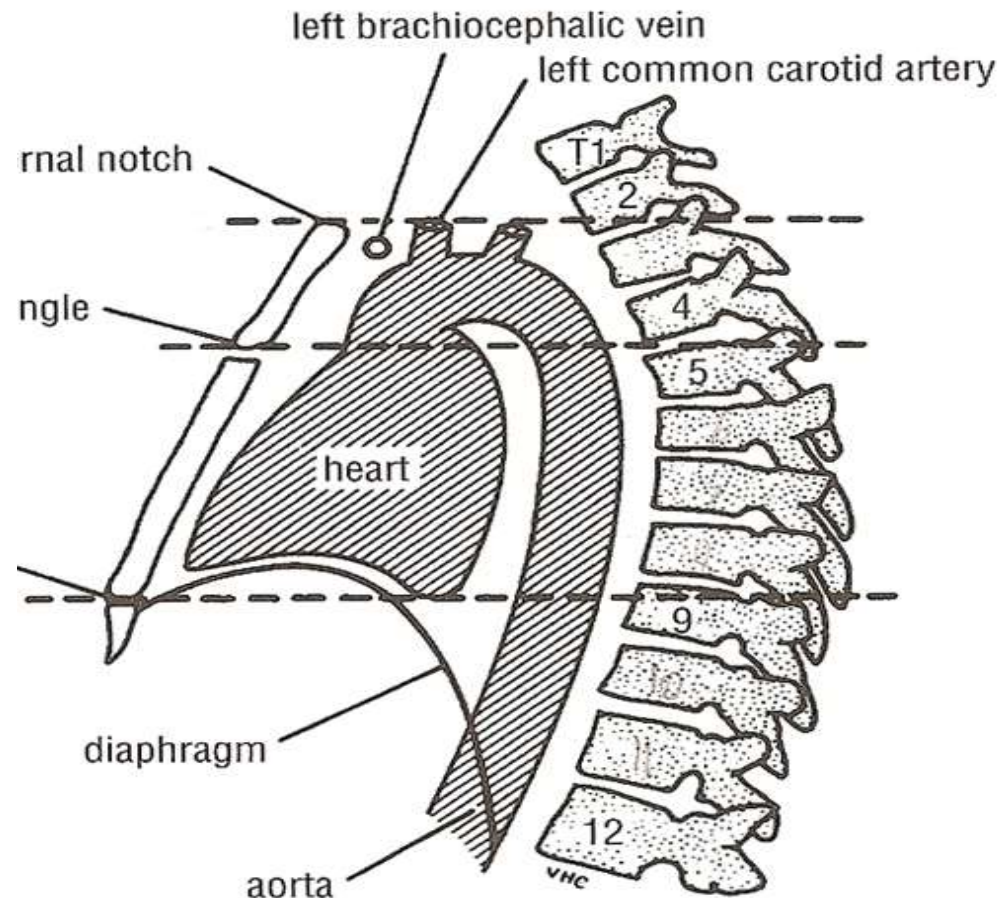
1. Manubrium:

- Is the **upper part** of the sternum.
- **Lies opposite the 3rd & 4th thoracic vertebrae.**
- It articulates with:
 - The body of the sternum at the **manubrio-sternal joint** ([Sternal Angle](#))
 - **The clavicles** on each side.
 - **The first costal cartilage** and the **upper part of the second costal** cartilages on each side.



Sternal Angle = Angle of Lewis

- Manubrio-sternal joint
- Easily palpated
- Opposite to T4-T5 intervertebral disc
- It marks the point at which the **costal cartilages of the second rib** articulate with the sternum

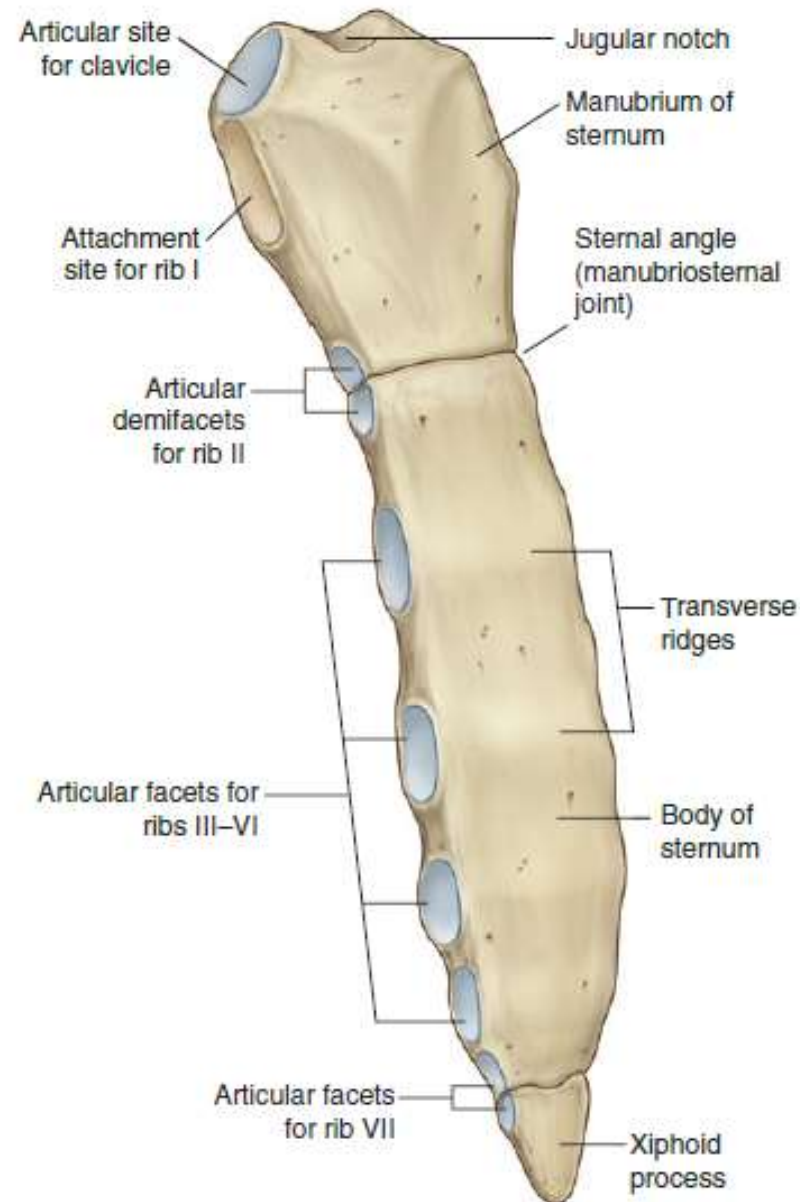


Sternum

2. Body of the sternum:

➤ Articulates:

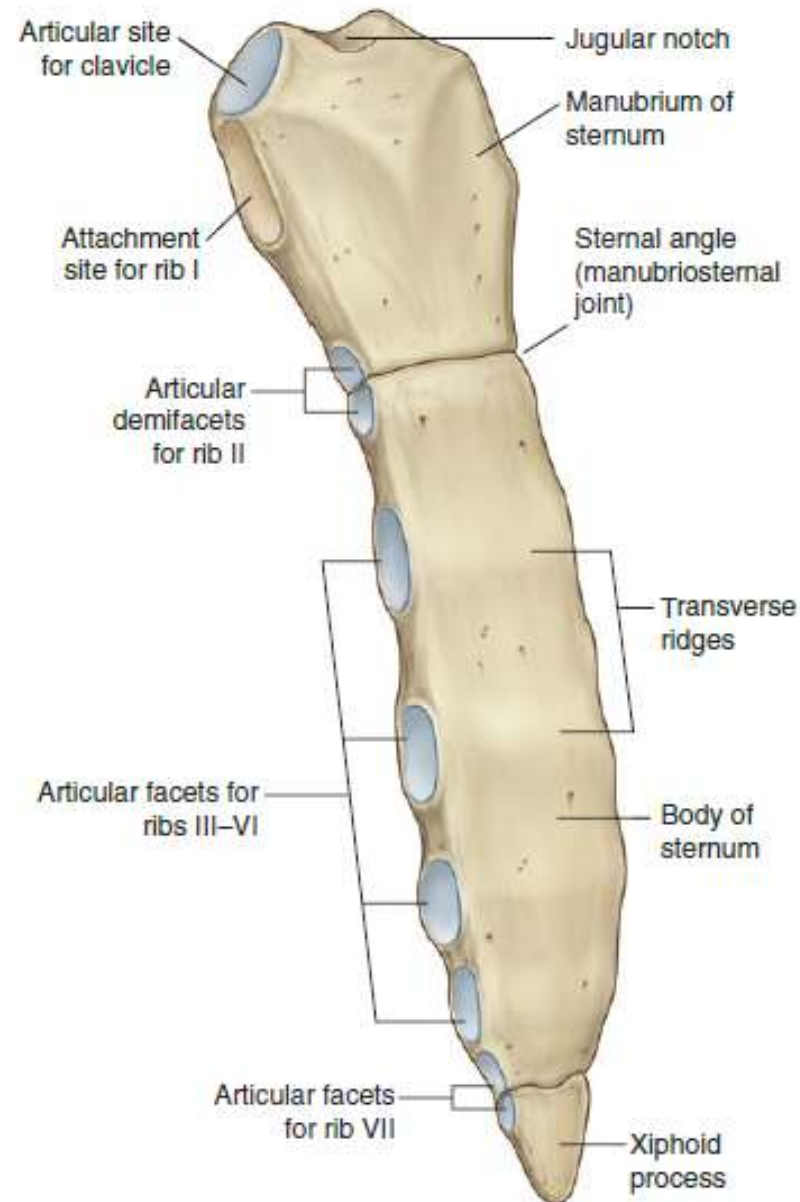
- **Above** with the manubrium at the **manubriosternal joint**.
- **Below** with the xiphoid process at the **xiphisternal joint**.
- **On each side** with the **2nd – 7th costal cartilages**.



Sternum

3. Xiphoid process:

- Thin plate of cartilage that **ossified** at its **proximal end during adult life**.
- No ribs or costal cartilages attachment.
- The **xiphisternal joint** lies opposite the body of the **9th thoracic vertebra**



CLINICAL : Sternum Puncture

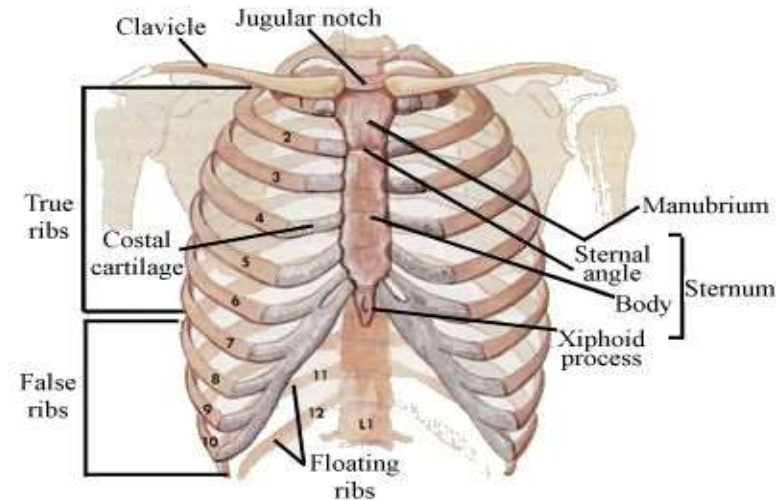
Specimen of bone marrow can be taken from sternum.

- It lies Subcutaneously.

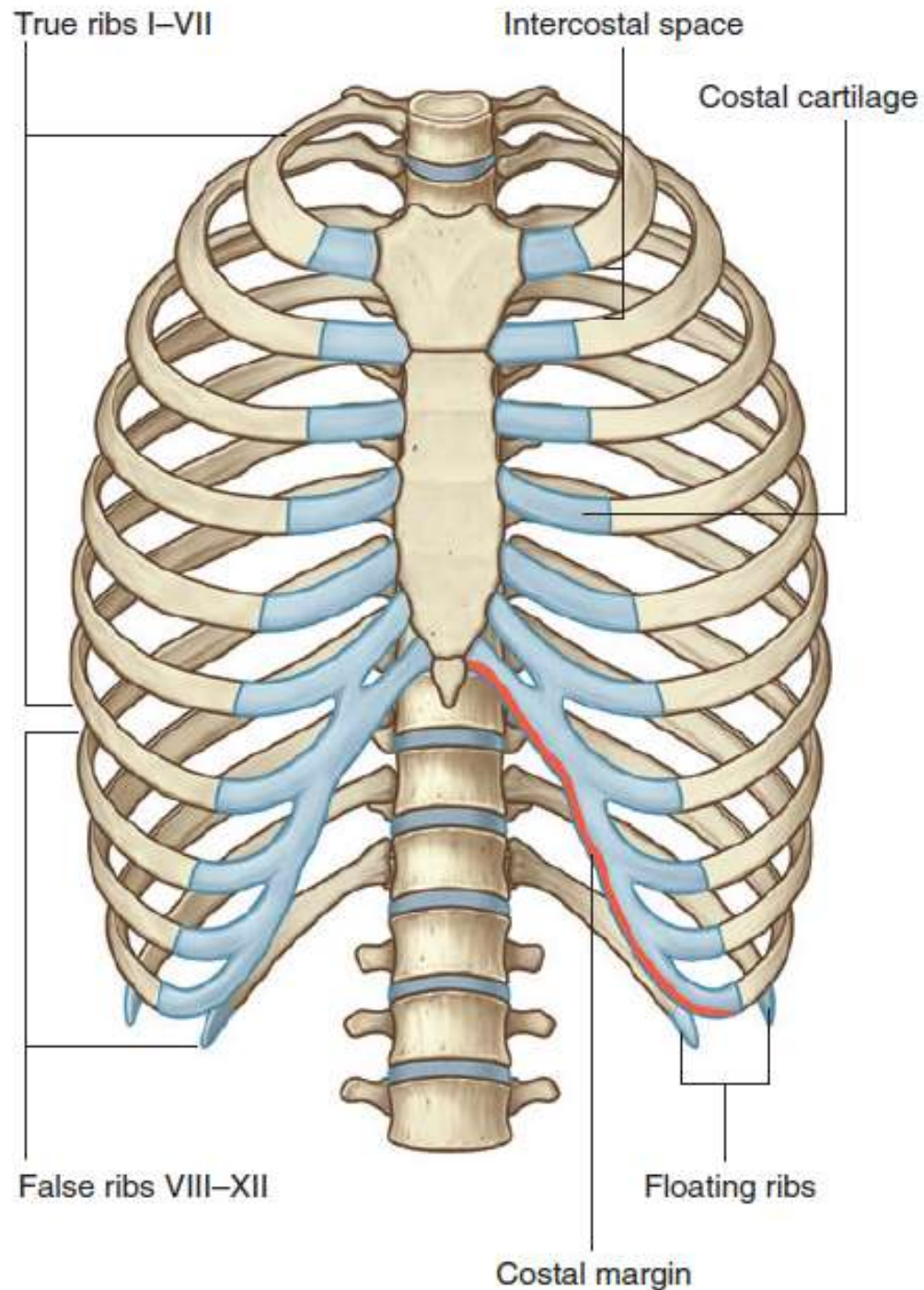


Ribs

- There are **12 pairs** of ribs.
- All of them are **attached to the thoracic vertebrae**.
- Divided into three categories:
 - **True ribs**: (1-7) are attached anteriorly **to the sternum** by their costal cartilages.
 - **False ribs**: the 8th, 9th, and 10th pairs of ribs are attached anteriorly to each other and to the 7th rib by means of their **costal cartilages**.
 - **Floating ribs**: The 11th and 12th pairs have **NO** anterior attachment.

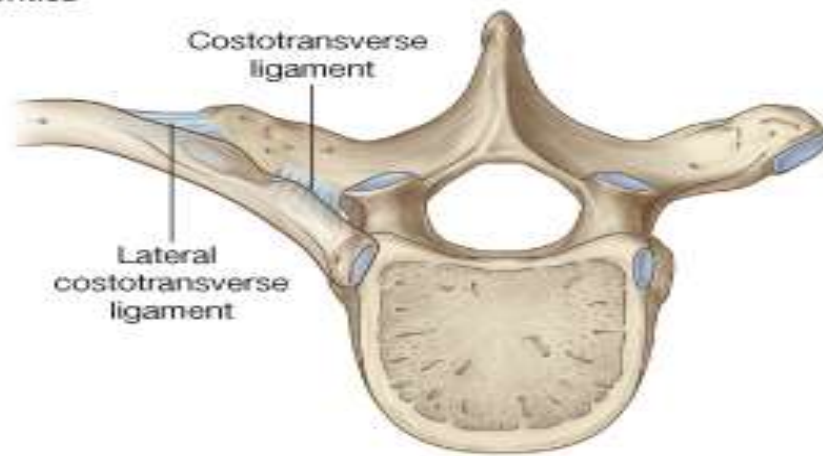
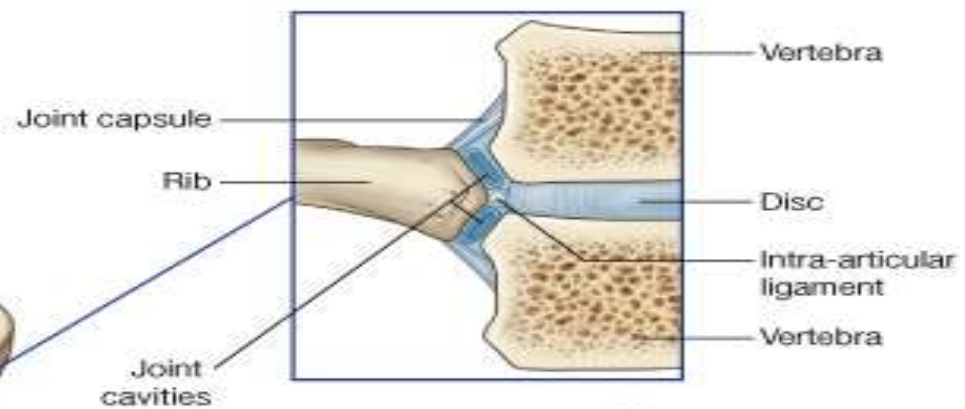
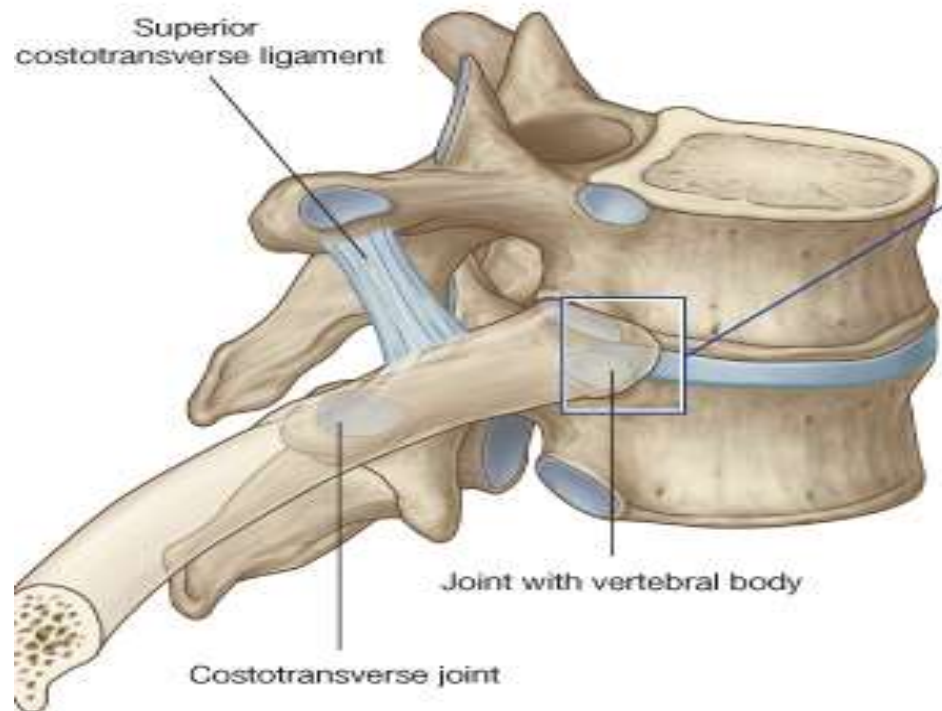


Ribs



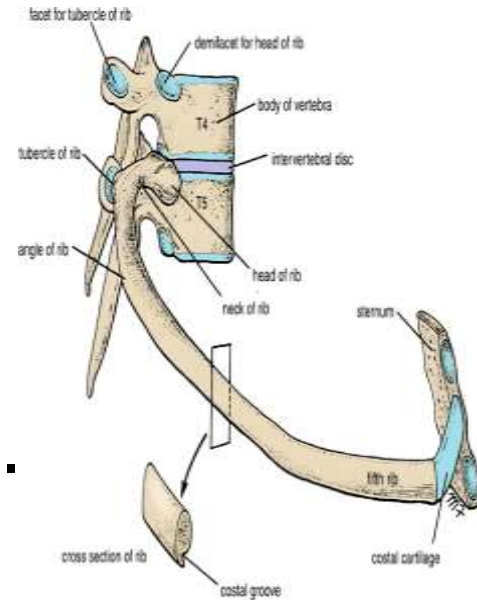
Typical & Atypical Ribs

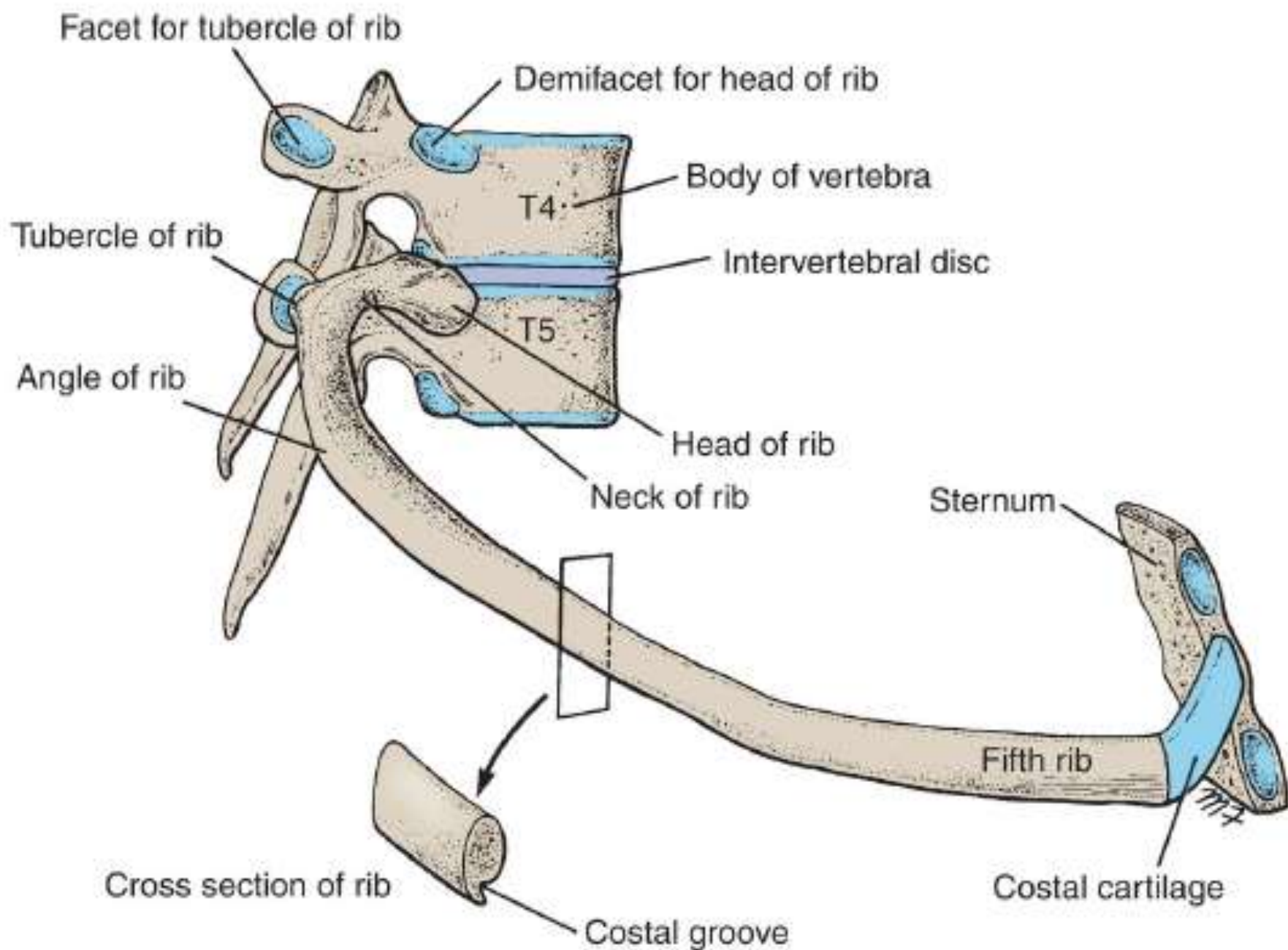
- **Typical ribs** are 3 - 9,
are made up of 2 articular facets, a superior costal facet, and an inferior costal facet.
- **Atypical ribs** are 1, 2 , 10, 11, and 12,
they are atypical because they are only articulate with their own vertebra via one FULL facet.



Typical Rib

- A long, twisted, flat bone.
- **Superior border** is rounded & smooth.
- **Inferior border** is sharp & thin.
- The **inferior border** overhangs and forms the costal groove, which accommodates the **intercostal vessels and nerve**.
- The **anterior end** of each rib is attached to the corresponding costal cartilag.



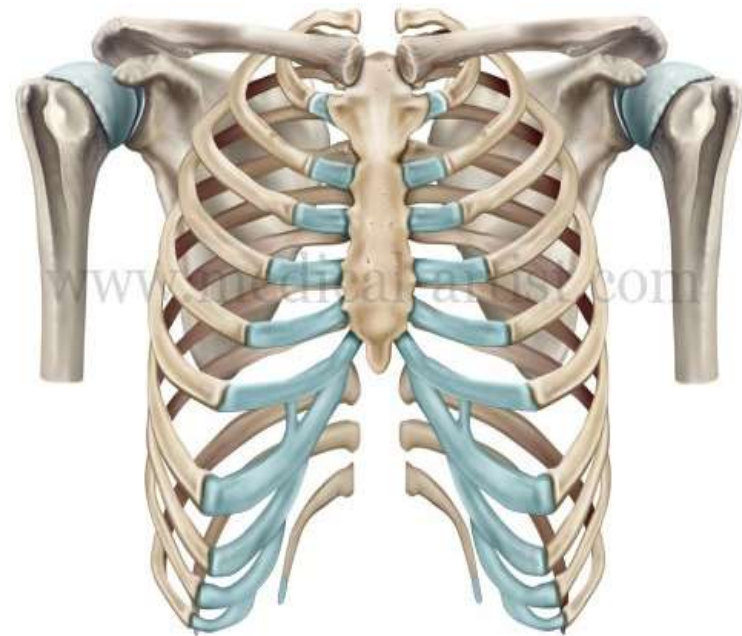


Typical Rib

The posterior end is higher than anterior end ,
except for (1-2- 11-12) rib run Downwards ,
Costal Cartilage upward.

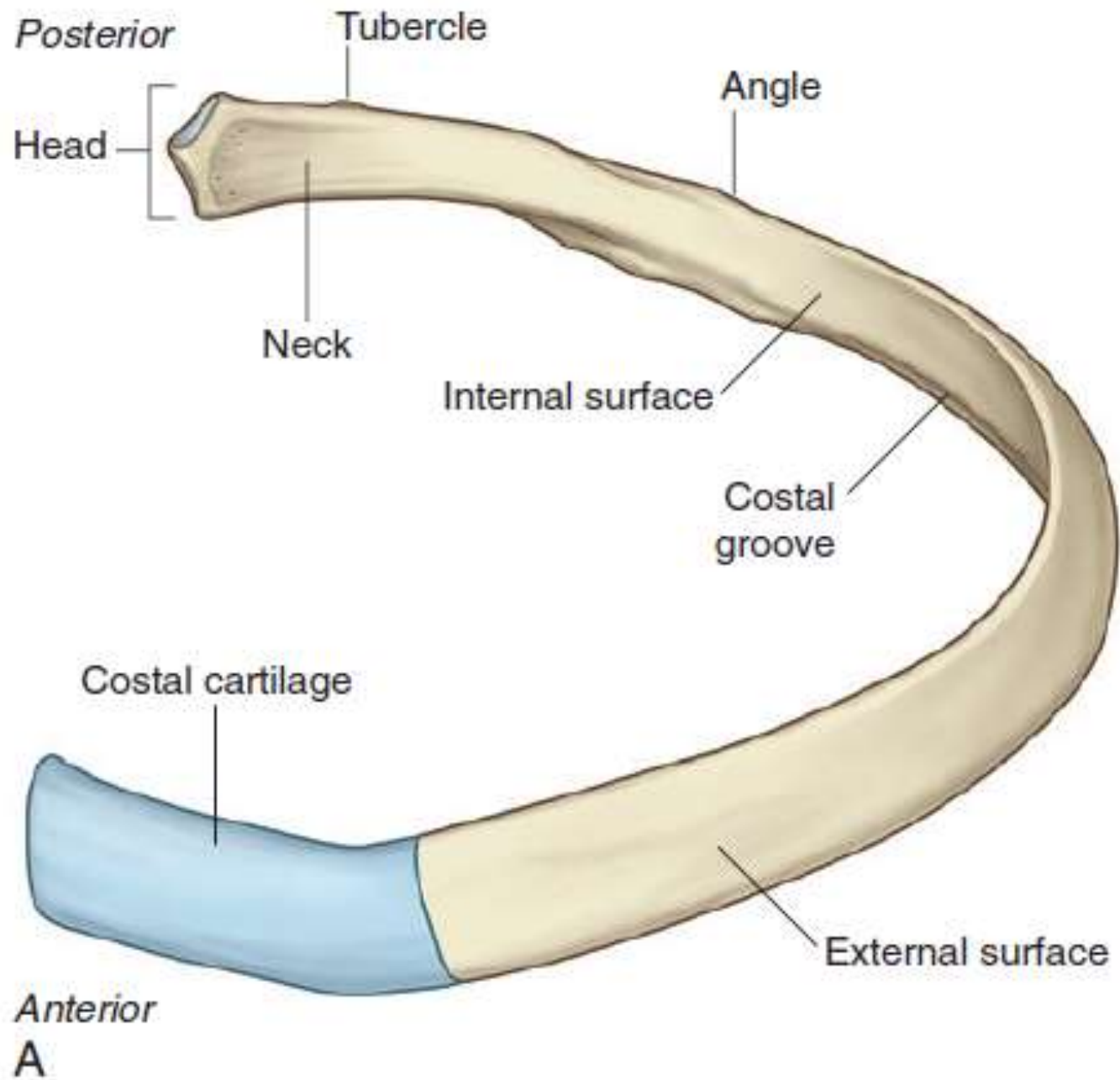
A rib has a :

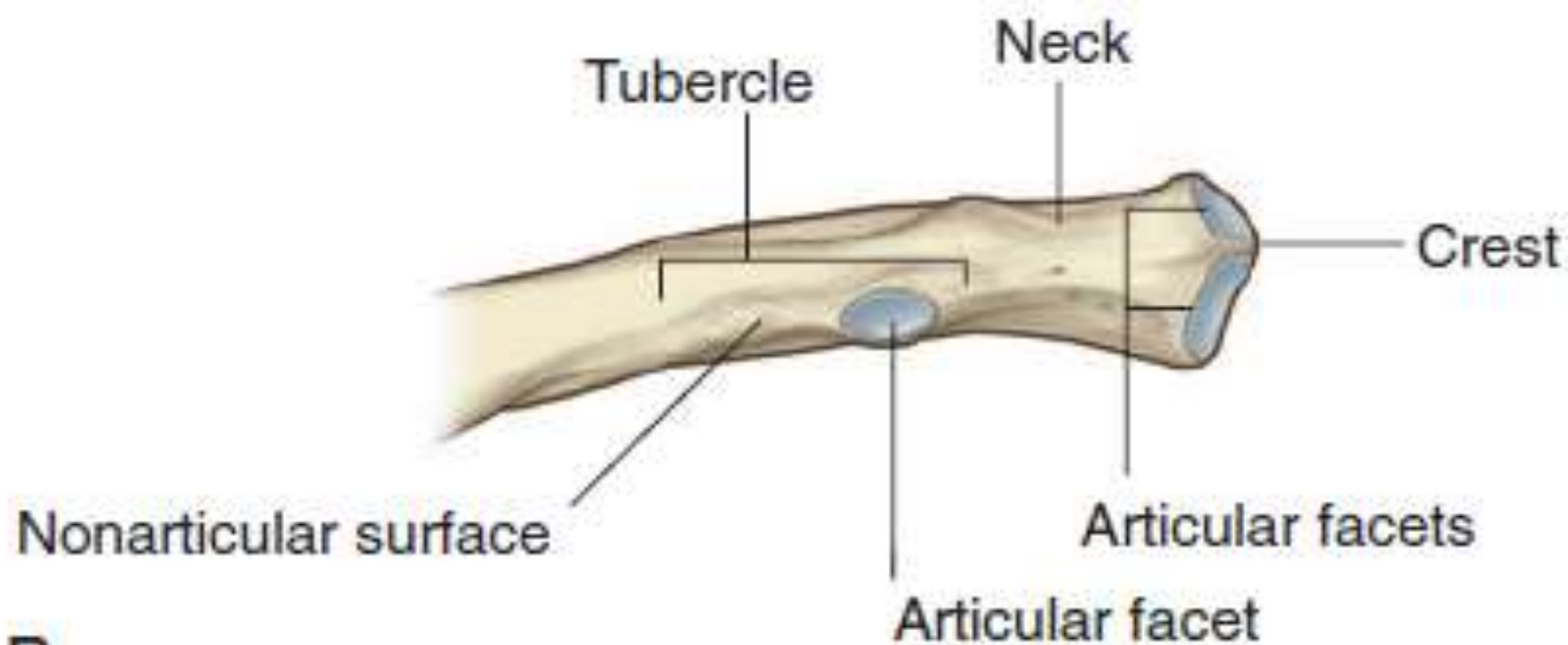
head , neck , tubercle ,
body , angle , costal groove.



Typical Rib

1. Head: the posterior end with 2 articular facets
2. Neck: connects the head with the tubercle.
3. Tubercle: is a prominence on the **outer surface of the rib** at the junction of the neck with the shaft , has a facet for articulation with the **transverse process** of corresponding vertebra
4. Shaft (Body): is thin , flattened and twisted
5. Angle : is where the shaft bends sharply forward





B

Special Features

- ♦ Ribs and costal cartilage increase in length 1-7.

Rib 7 is the longest rib.

- ♦ Transverse diameter of thorax increase 1-8.

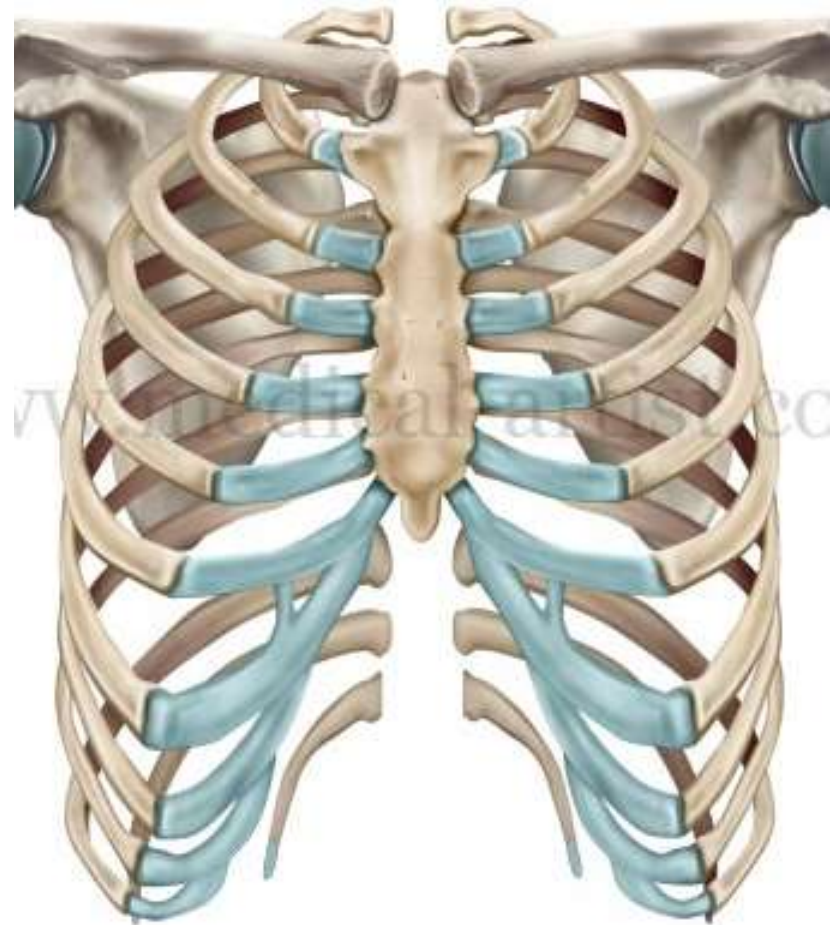
Rib 8 has greatest lateral projection.

- ♦ Ribs increase in obliquity 1-9

Rib 9 is most oblique.

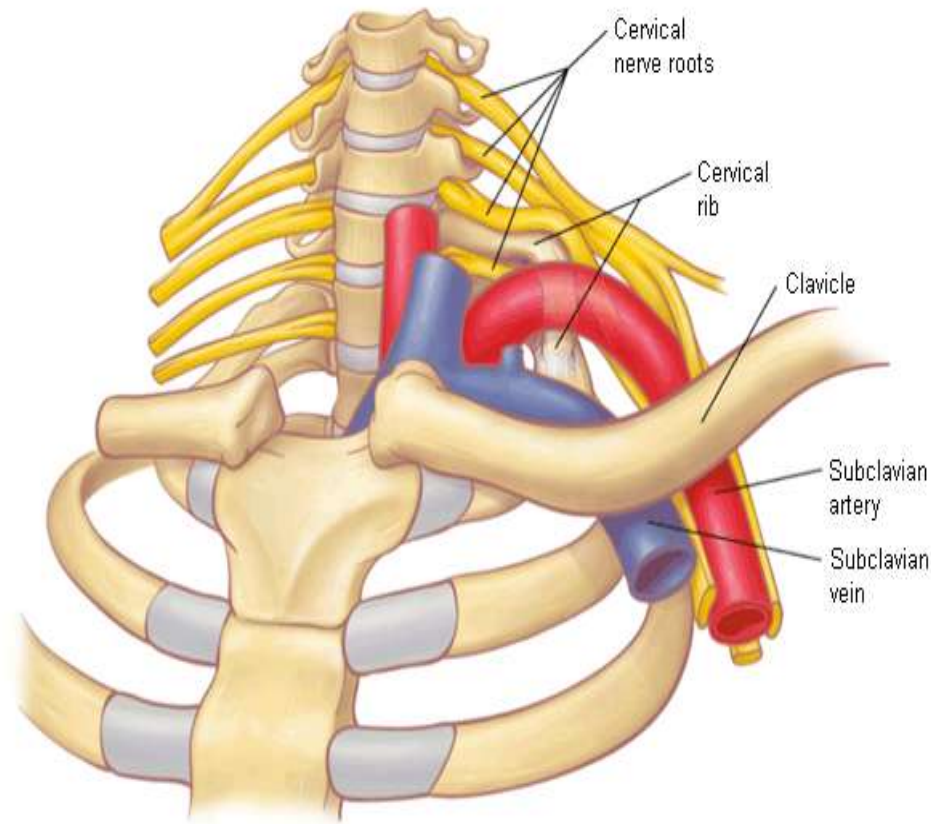
- ♦ Cartilage of rib 10 is lowest point when palpated from front

- ♦ Tip of 11th cartilage is lowest cartilage.



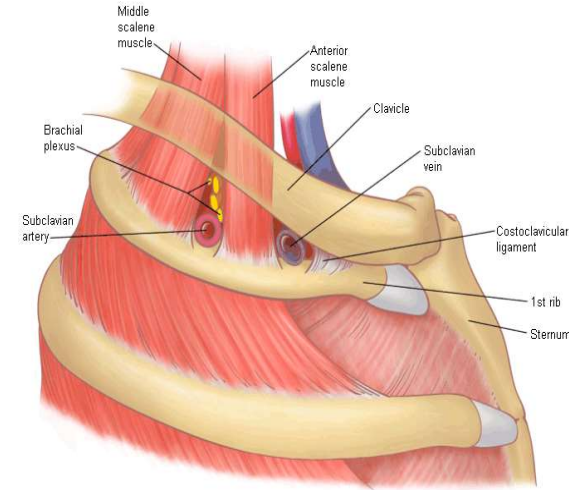
First Rib

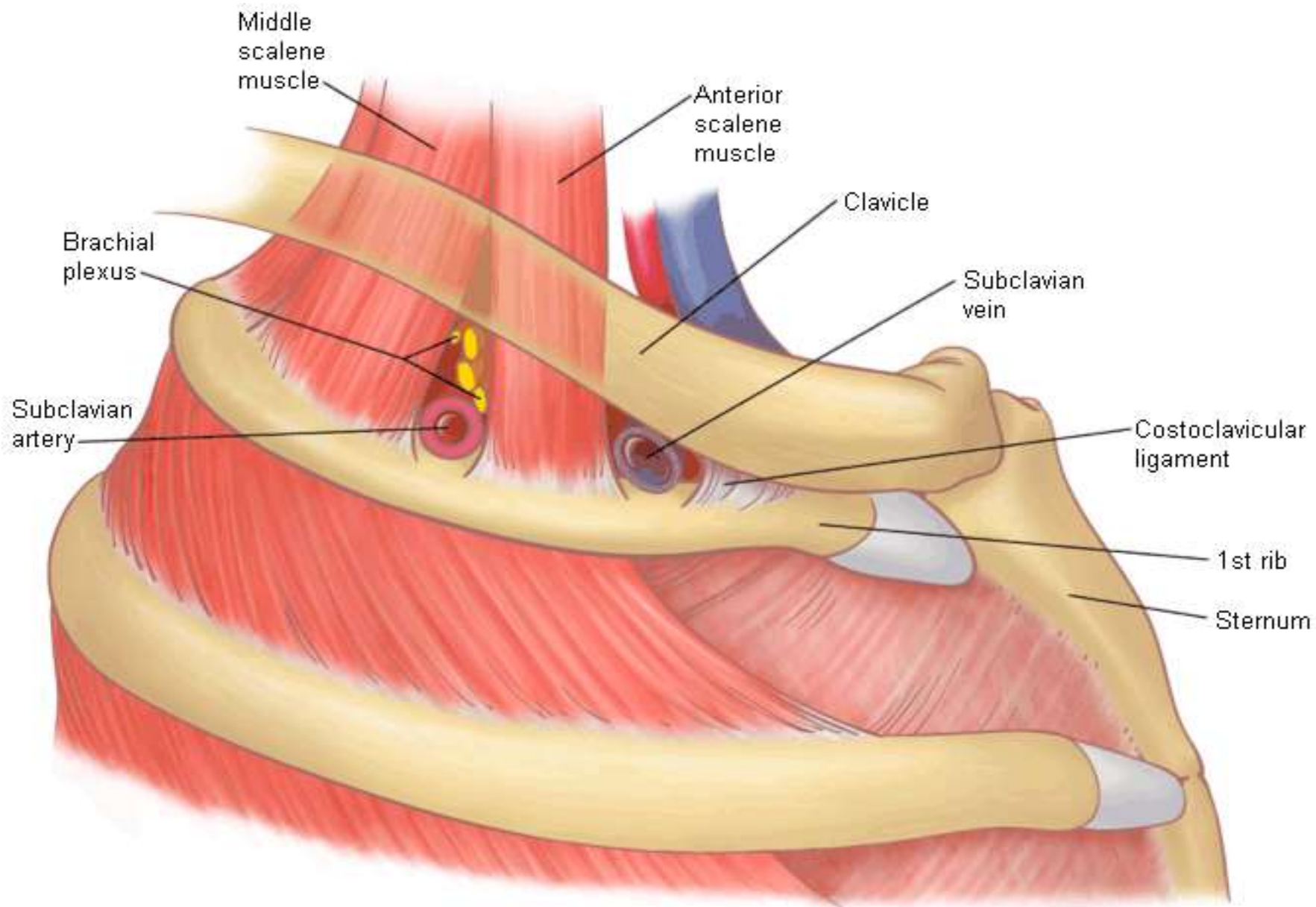
- This rib is **small and flattened** from above downward.
- The first rib is important clinically because of its close relationship:
 - To the lower nerves of the **brachial plexus**.
 - The main vessels to the arm, namely, **the subclavian artery and vein**.



First Rib

- The **scalenus anterior** muscle is attached to its upper surface and inner border.
- The **subclavian vein** crosses the rib anterior to the scalenus anterior muscle.
- The **subclavian artery** and the lower trunk of the **brachial plexus** cross the rib posterior to the scalenus anterior muscle.



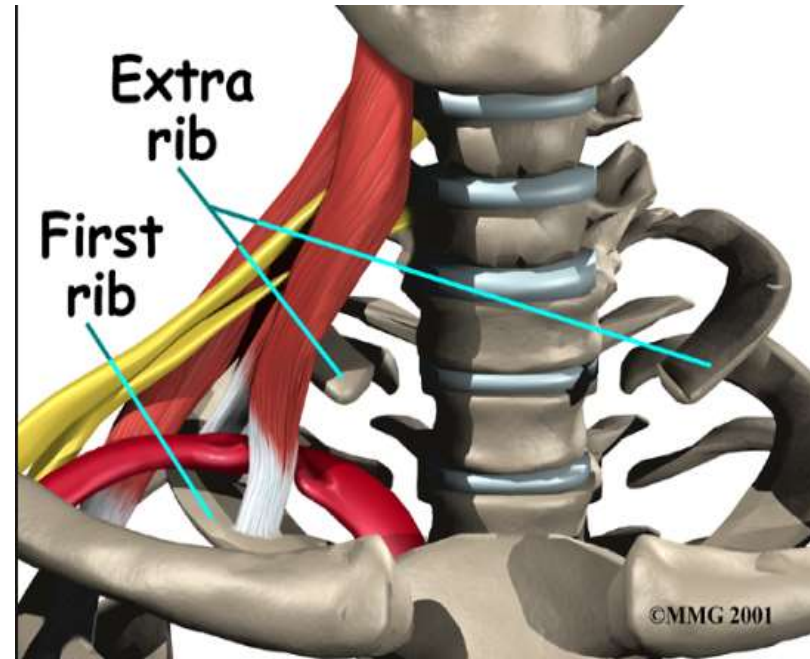


CLINICAL: Cervical Rib

- Extra rib arise from C7 vertebra
- Present in ~0.5% of people

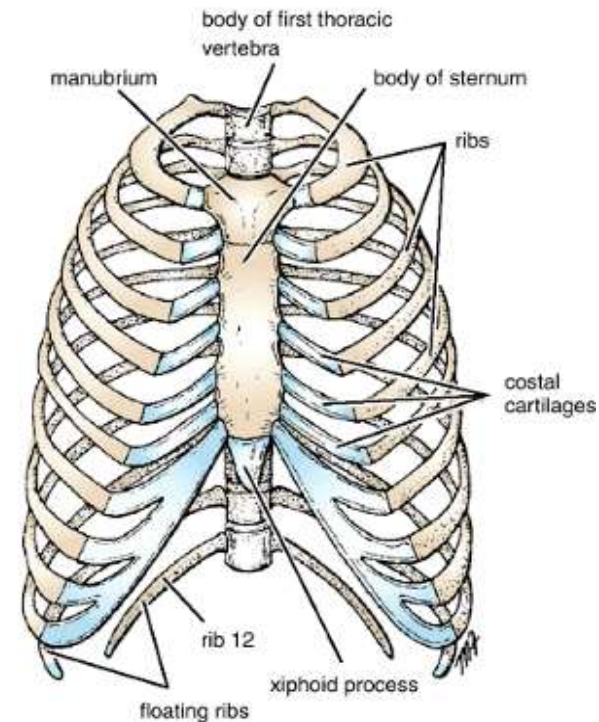
■ Complications:

- Pressure on Nerves & Arteries supplying upper limb.
Tingling & Numbness → Partial paralysis
Ischemic muscle pain (pallor-coldness).



Costal Cartilages

- Costal cartilages **are bars of cartilage** connecting:
 - The upper seven ribs to the lateral edge of the sternum.
 - The 8th, 9th, and 10th ribs to the cartilage immediately above.
- The cartilages of the 11th and 12th ribs end in the abdominal musculature.
- The costal cartilages contribute significantly to the **elasticity and mobility** of the thoracic walls.

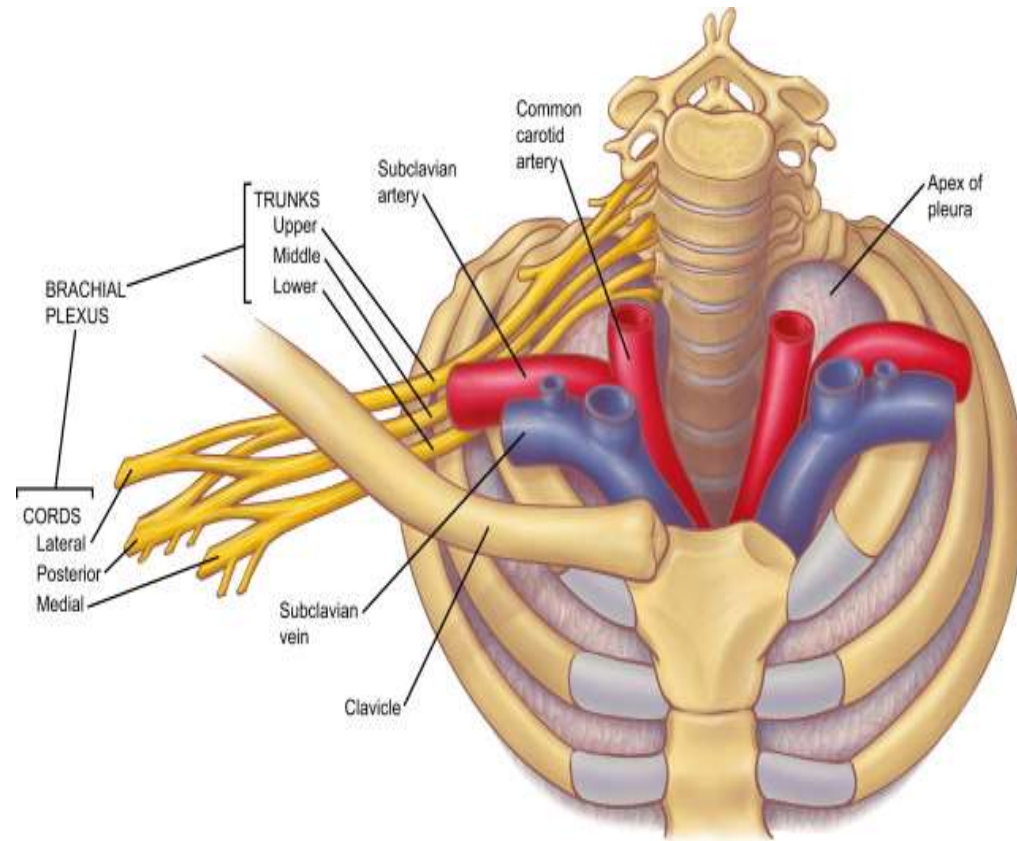


Openings of the Thorax

Superior thoracic aperture (Thoracic outlet)

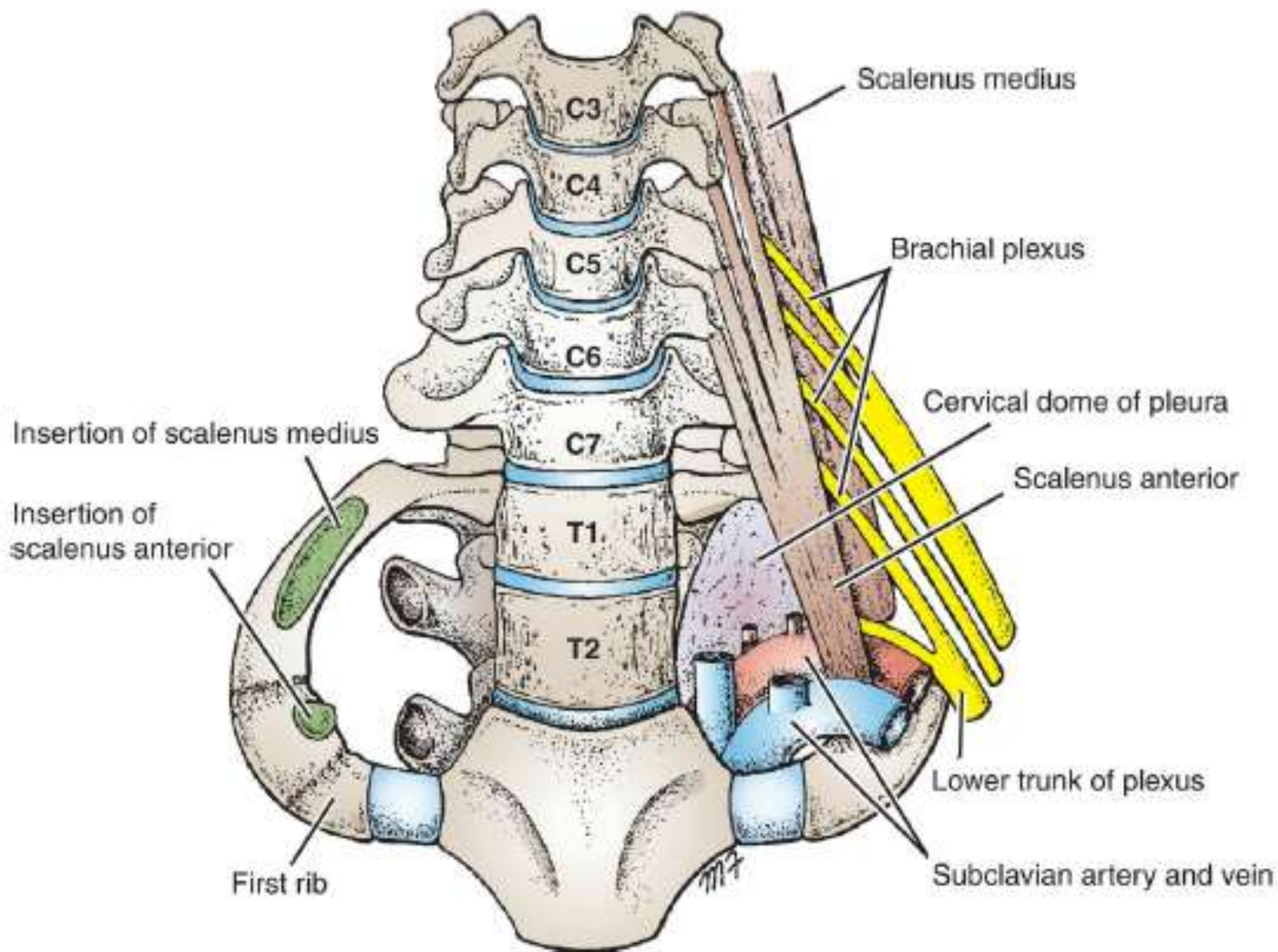
is the opening communicates the chest cavity with the root of the neck.

- It is called an **outlet** **because** important vessels and nerves emerge from the thorax here to enter the neck and upper limbs.



Openings of the Thorax

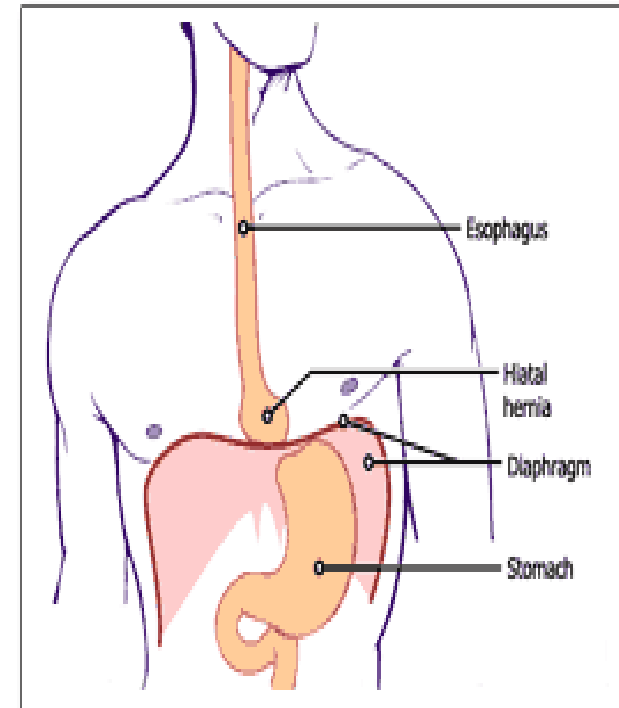
- **Boundaries of thoracic outlet:**
 - **Posterior** : first thoracic vertebra (T1)
 - **Lateral** : medial borders of first ribs and their costal cartilages
 - **Anterior** : superior border of manubrium sterni.
- The opening is **obliquely placed** facing upward and forward.
- The **esophagus, trachea** and many **vessels and nerves** pass through this small opening.



Openings of the Thorax

Inferior thoracic aperture

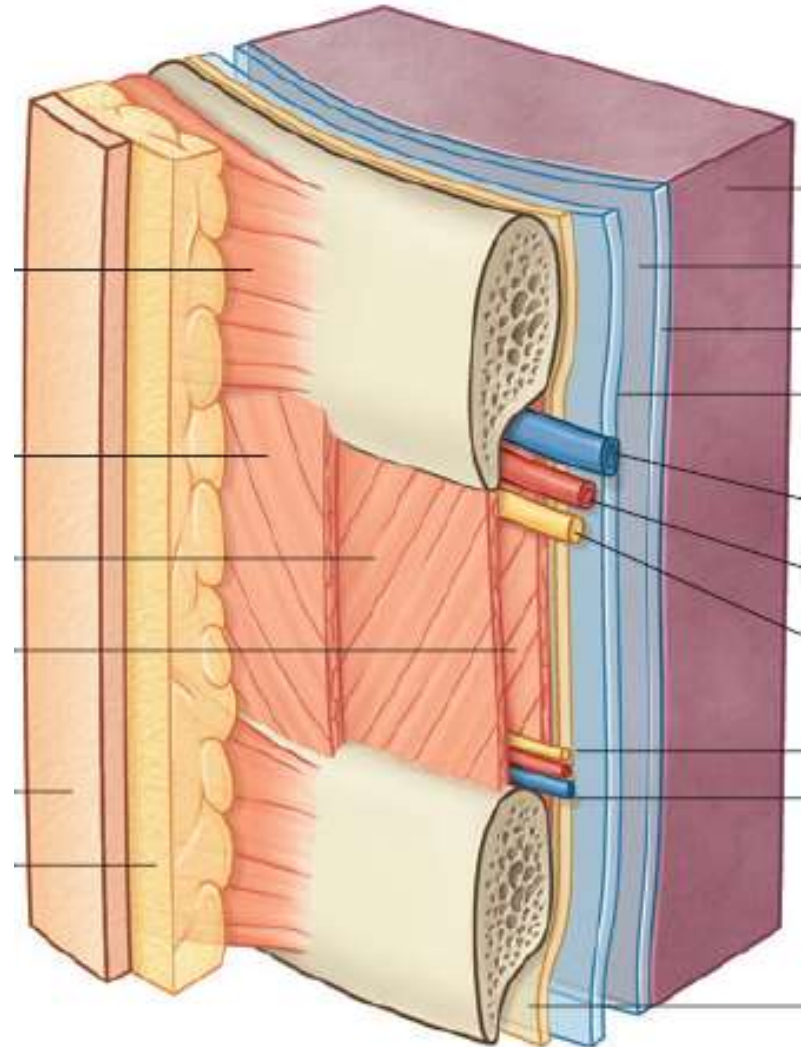
- Thoracic cavity communicates with abdomen through a large opening which is **closed** by the diaphragm
The opening is bounded:
 - **Posterior** : 12th Thoracic vertebra
 - **Lateral** : curving costal margin.
 - **Anterior**: xiphisternal joint.
- The **esophagus** and **many large vessels and nerves** pass through the diaphragm.

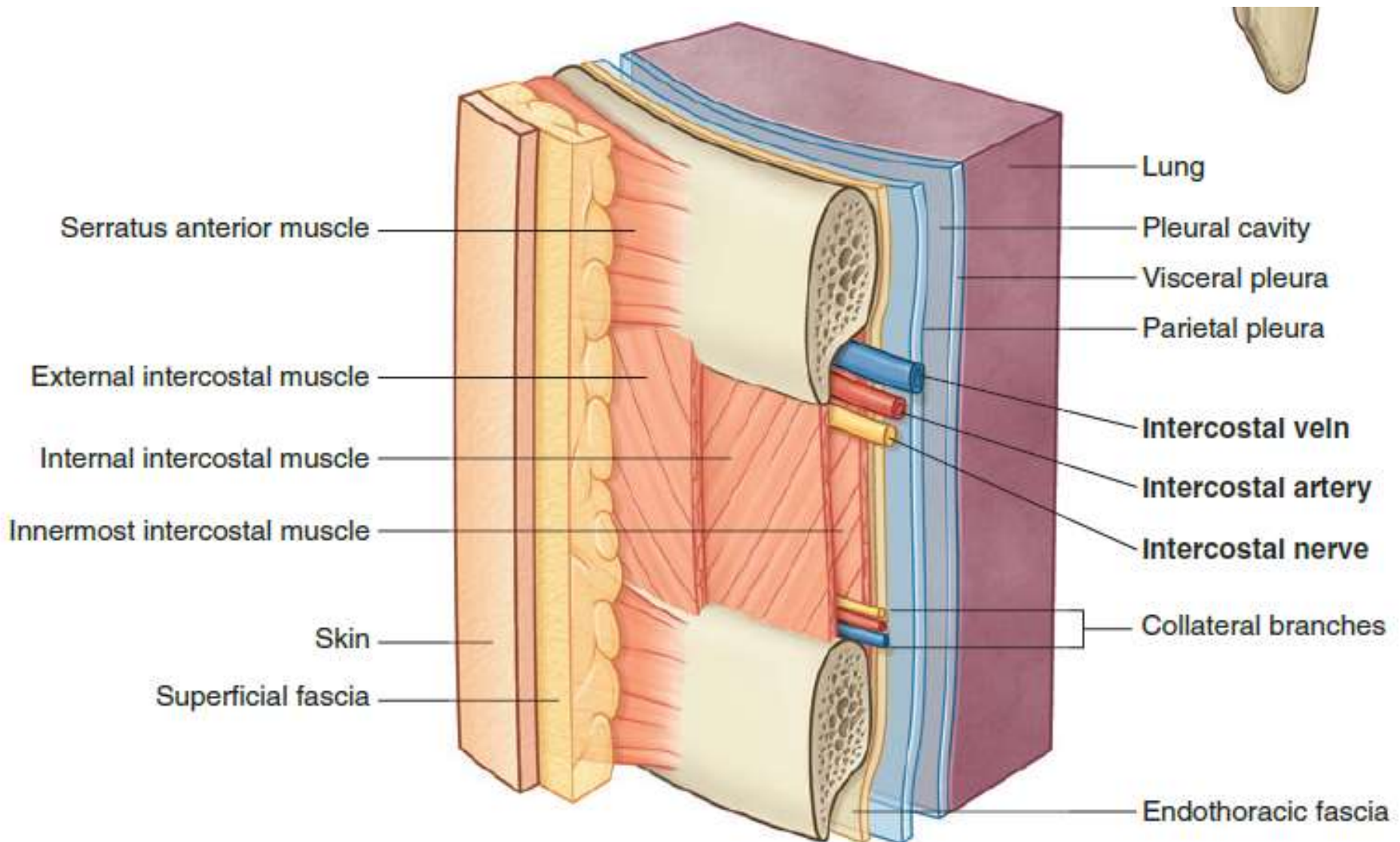


Intercostal Spaces

Thoracic wall layers

1. Skin
2. Superficial fascia
3. Deep fascia
4. Intercostal muscles
5. Endothoracic fascia
6. Extrapleural fatty layer
7. Parietal pleura



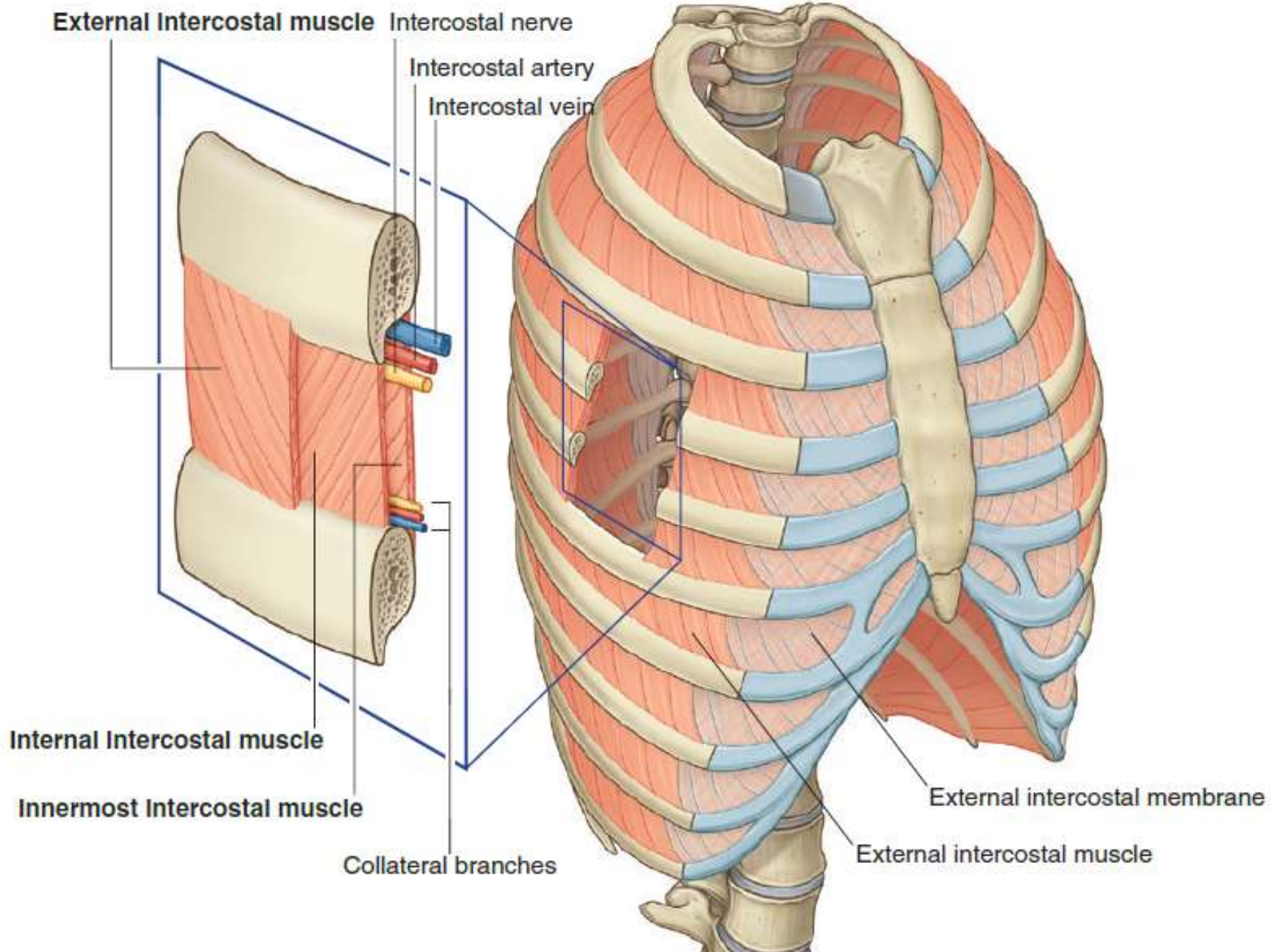


Intercostal Spaces

❑ The spaces between the ribs contain **three muscles** of respiration:

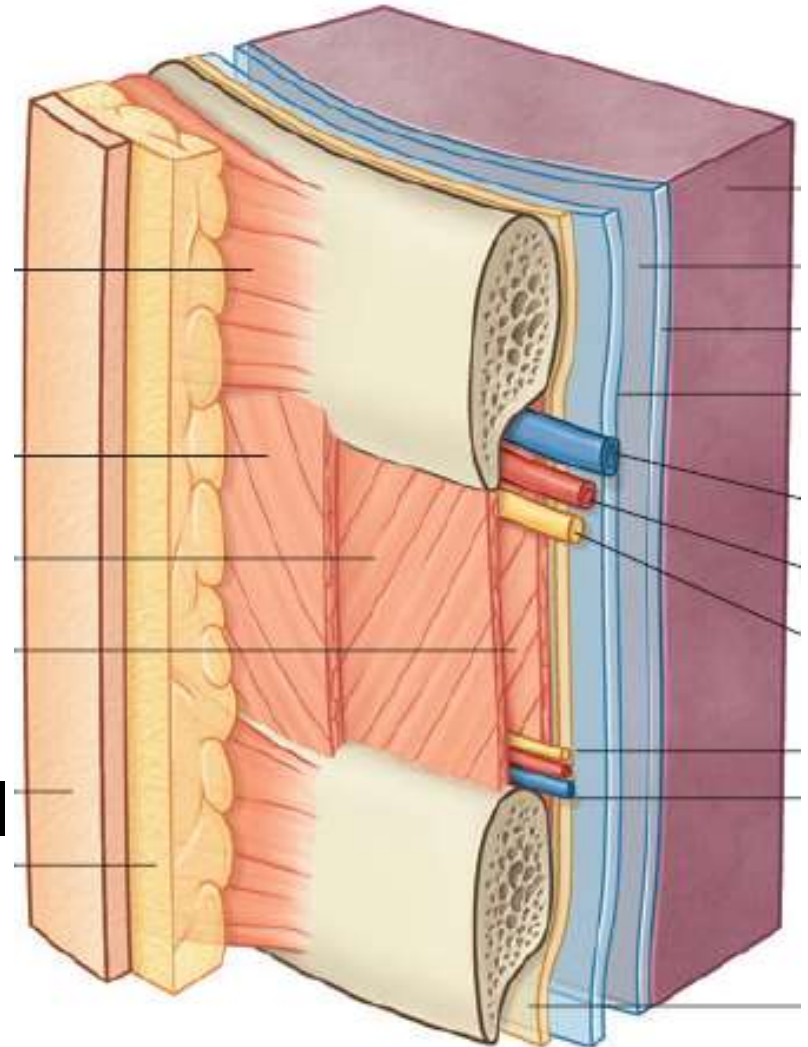
1. The external intercostal muscle.
2. The internal intercostal muscle.
3. The innermost intercostal muscle

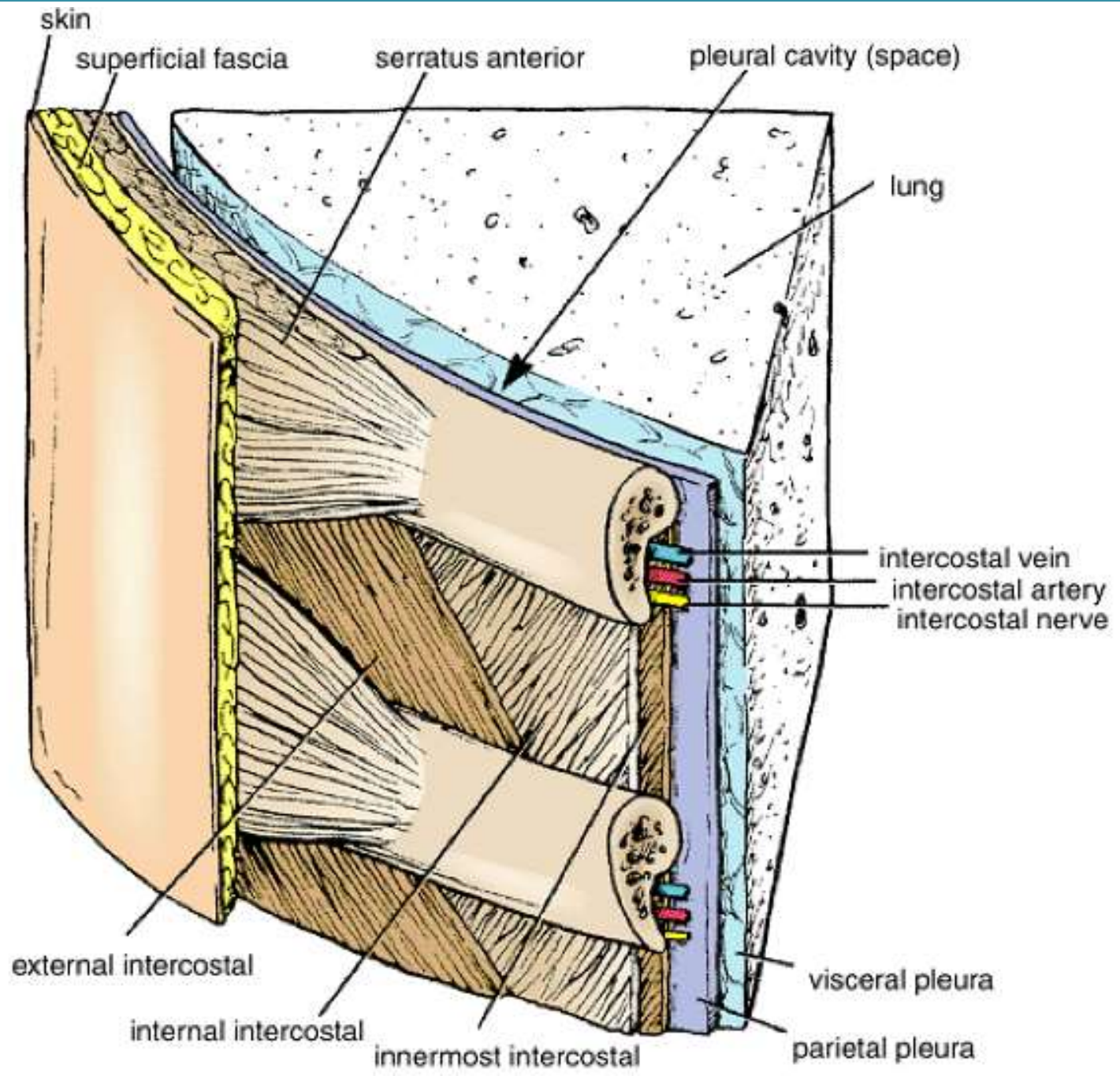
Intercostal muscles **are supplied by** the corresponding intercostal nerves.

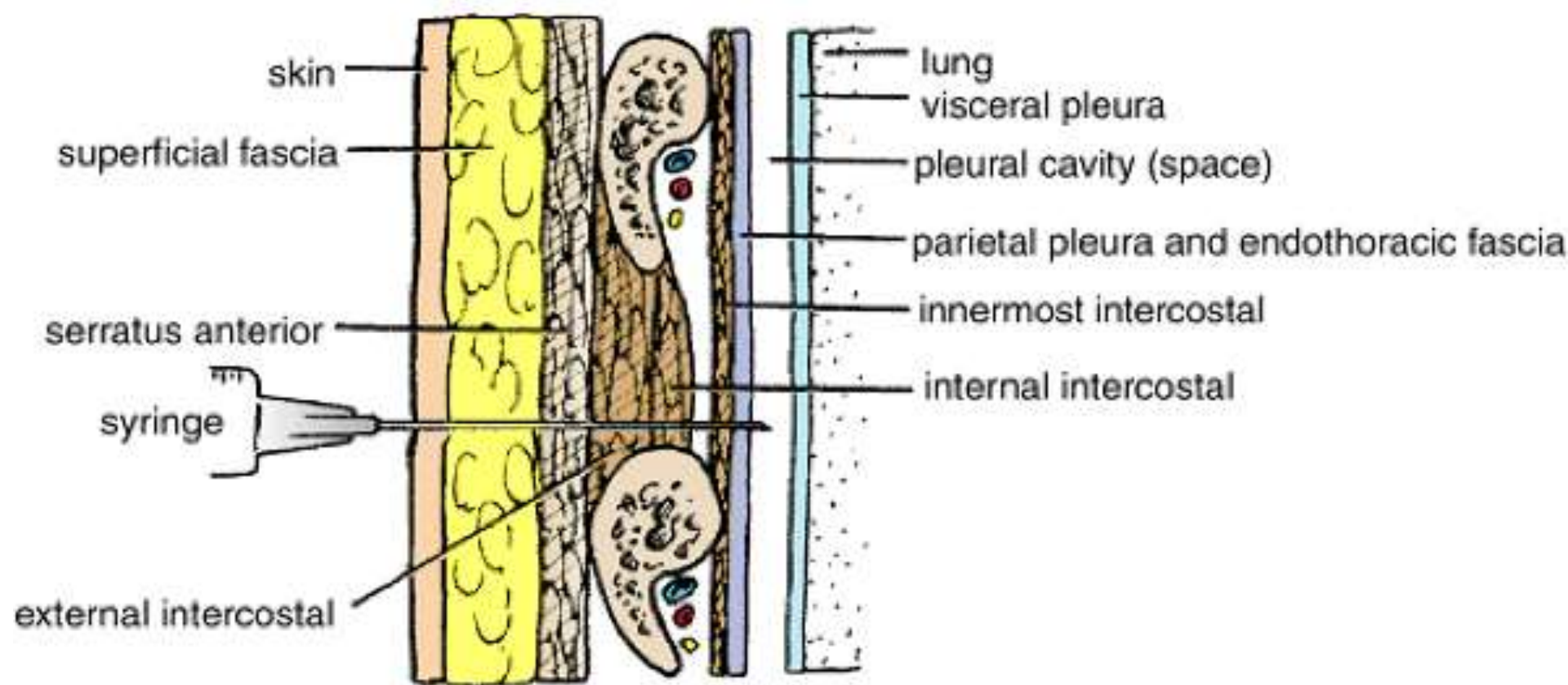


Intercostal Spaces

- ❑ The **intercostal nerves and blood vessels** run between the intermediate and deepest layers of muscles
- They are arranged in the following order **from above downward**: intercostal vein, intercostal artery, and intercostal nerve (i.e., **VAN**).

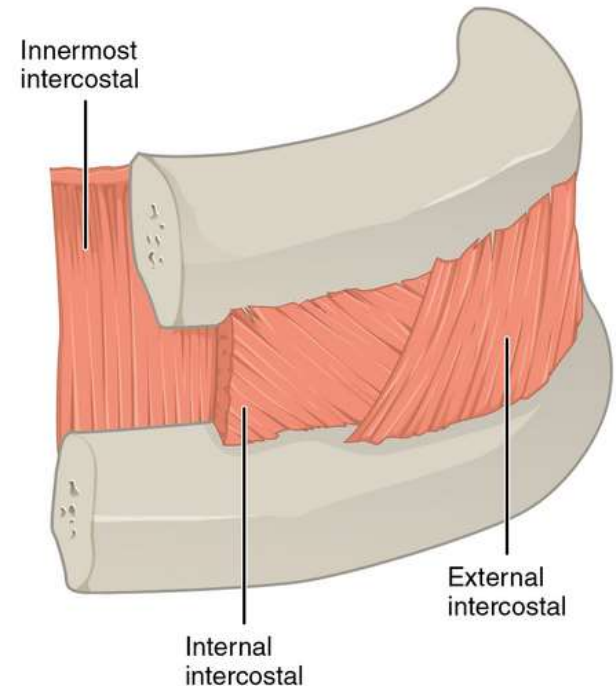






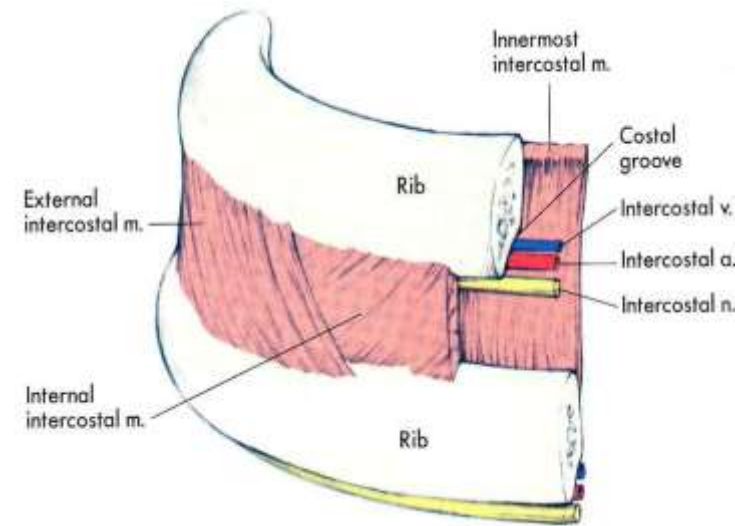
External intercostal muscle

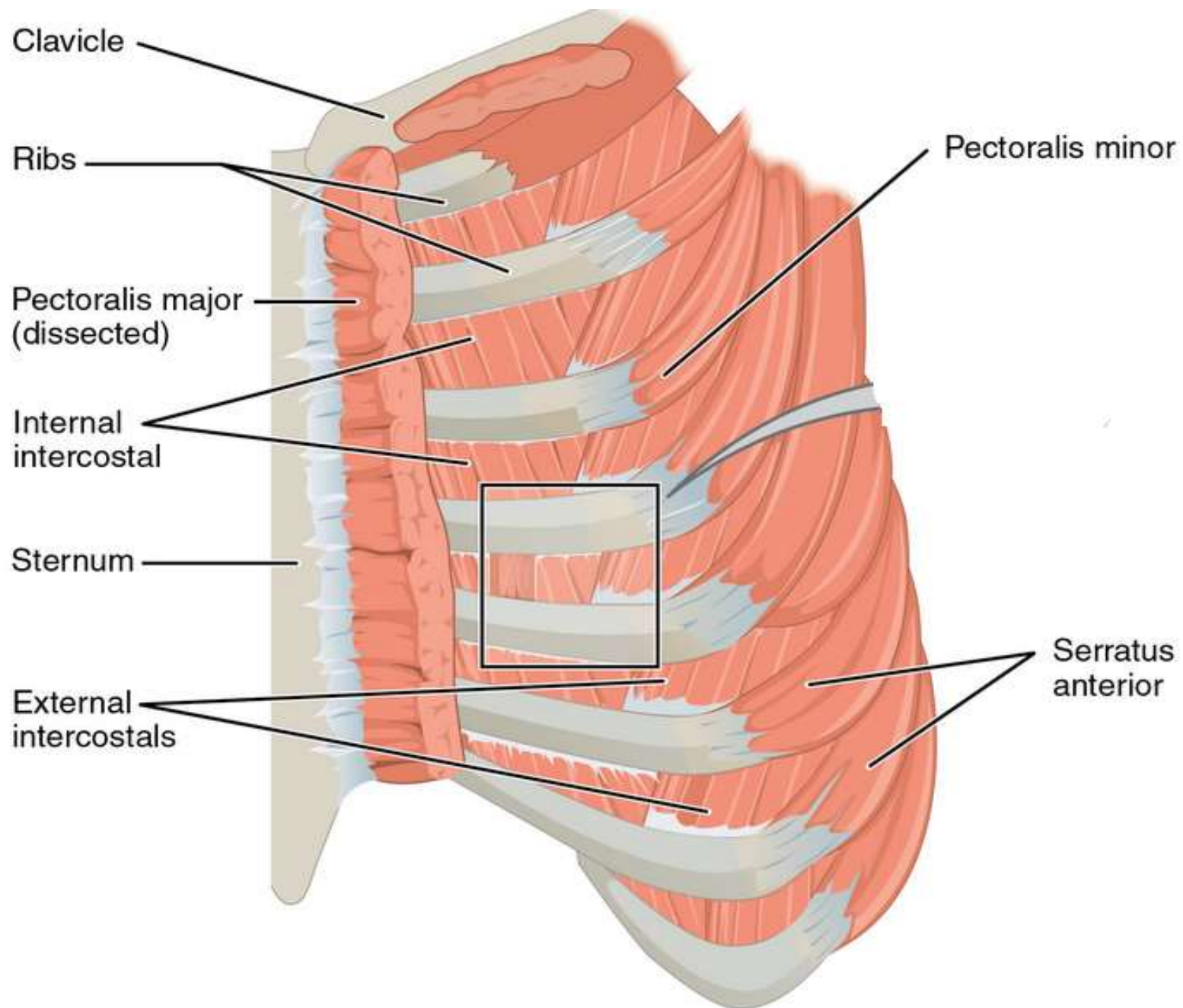
- The most superficial layer.
- Its fibers are directed **downward and forward**.
- **From** inferior border of the rib above.
- **To** superior border of the rib below.
- The muscle extends forward to the costal cartilage where it is replaced by an aponeurosis, **“the anterior (external) intercostal membrane”**



Internal intercostal muscle

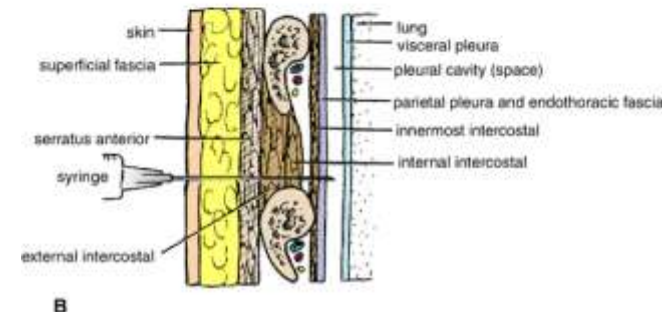
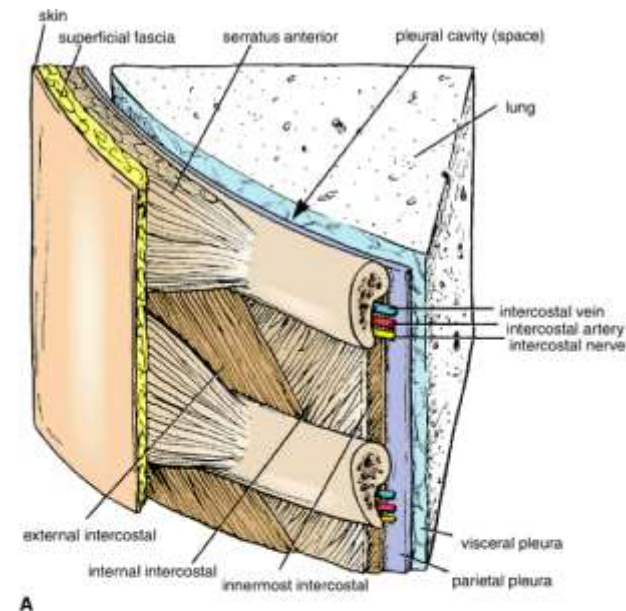
- The intermediate layer.
- Its fibers are directed **downward and backward**.
- **From** subcostal groove of the rib above.
- **To** upper border of the rib below.
- The muscle extends backward from the sternum in front to the angles of the ribs behind, where the muscle is replaced by an aponeurosis, **“the posterior (internal) intercostal membrane”**.





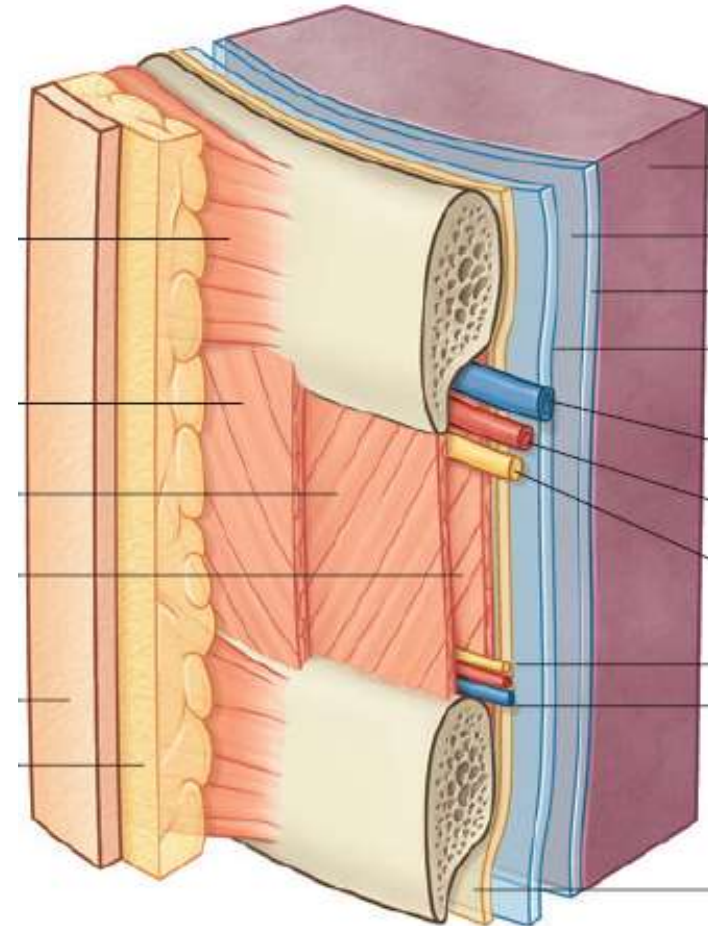
Innermost intercostal muscle

- The deepest layer.
- It is an incomplete muscle layer and **crosses more than one intercostal space within the ribs.**
- It is related internally to fascia (endothoracic fascia) and parietal pleura and externally to the intercostal nerves and vessels.



Innermost intercostal muscle

- It can be divided into three portions :
 1. Anterior portion is named the **transversus thoracis** muscle,
 2. Lateral portion is the **innermost intercostal** muscle.
 3. Posterior portion is the **subcostalis** muscle.

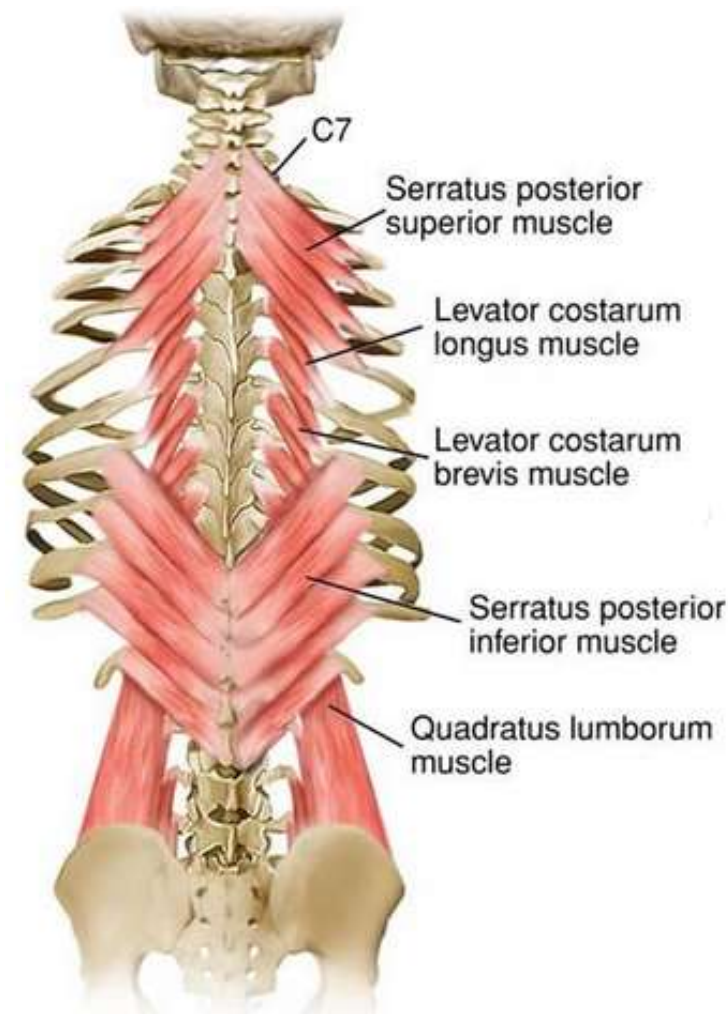


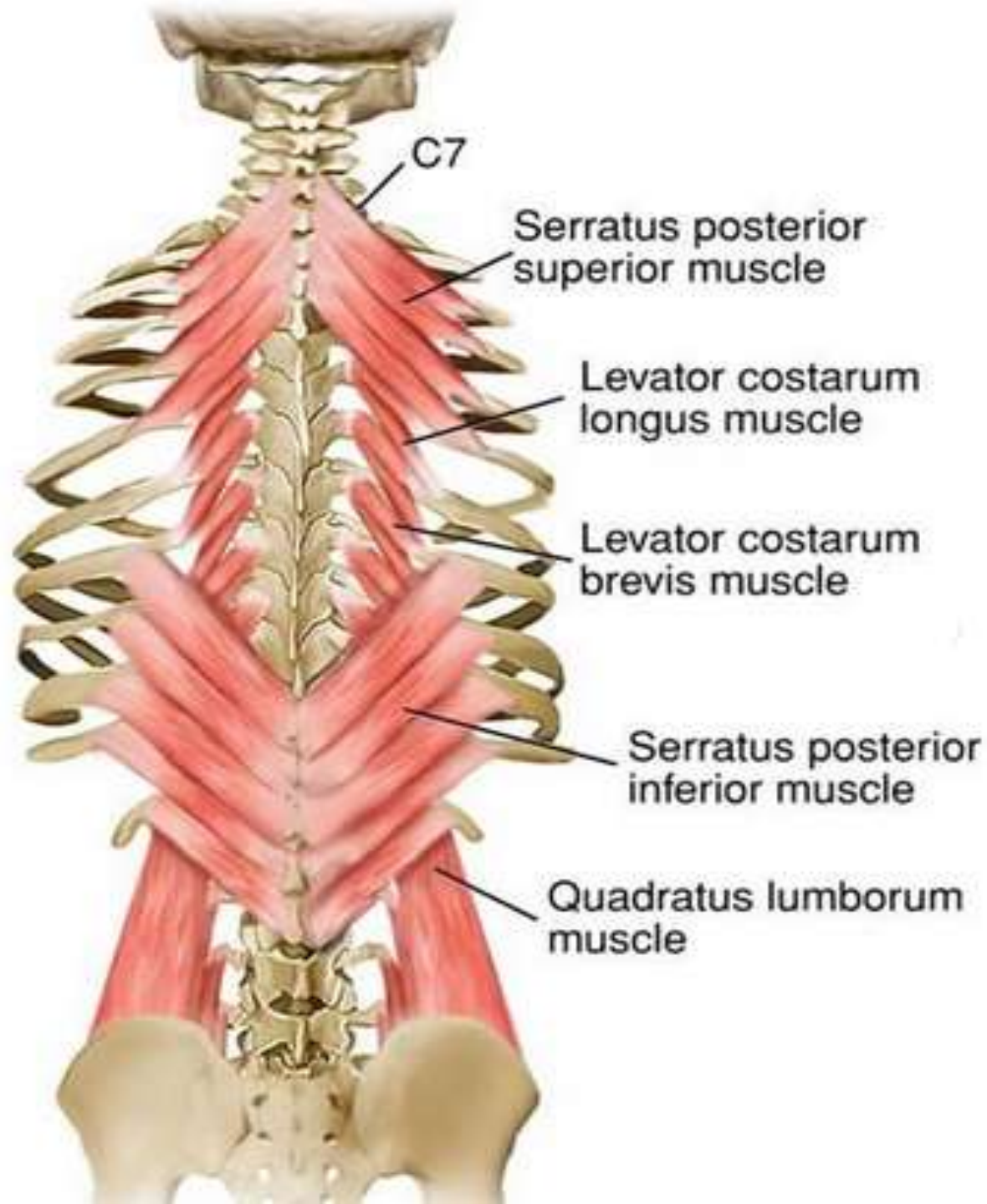
Intercostal Muscles Action

- The primary function of the intercostal muscles during respiration appears to be to stabilize the position of the ribs to maintain the intercostal spaces.
- Their actions in elevation (external intercostals) and depression (internal intercostals) of the ribs are most likely to occur during forced respiration.
- preventing the sucking in or the blowing out of the tissues with changes in
- intrathoracic pressure.

Levatores Costarum

- There are **12 pairs** of muscles.
- Each levator costa is triangular in shape.
- **Arises** by its apex from the **tip of the transverse process**.
- **Inserted** into the **rib below**.
- **Action**: Each **raises** the rib below and is therefore an **inspiratory muscle**.
- **Nerve supply**: Posterior rami of thoracic spinal nerves.





Serratus Posterior Superior Muscle

- **Arises from lower cervical and upper thoracic spines.**
- **inserted into the upper ribs.**
- **Action:** It elevates the ribs and is therefore **an inspiratory muscle.**
- **Nerve supply:** Intercostal nerves.

Serratus Posterior Inferior Muscle

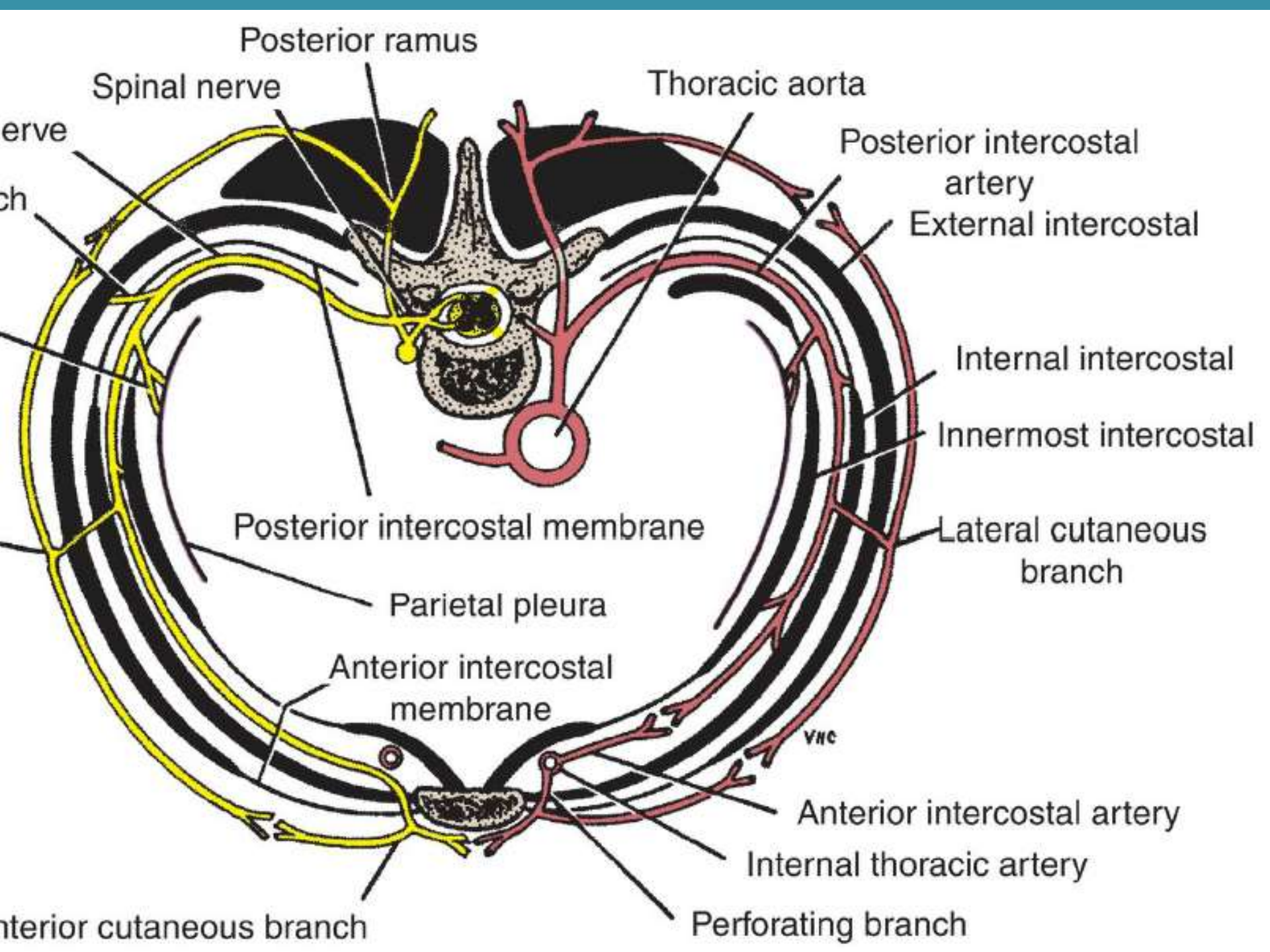
- **Arises from lower thoracic and upper lumbar spines**
- **inserted into the lower ribs.**
- **Action:** It depresses the ribs and is therefore **an expiratory muscle.**
- **Nerve supply:** Intercostal nerves.

Arterial supply of thorax

1) Subclavian artery gives
superior intercostal art. & internal thoracic art.

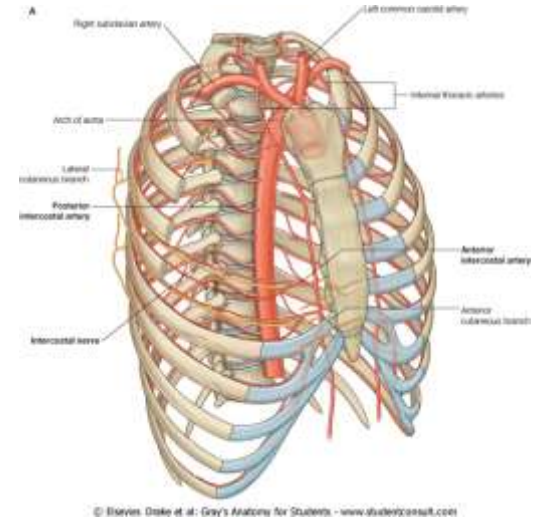
2) Axillary artery gives
superior thoracic art. & lateral thoracic art.

3) Thoracic aorta gives
posterior intercostal art. & subcostal art.

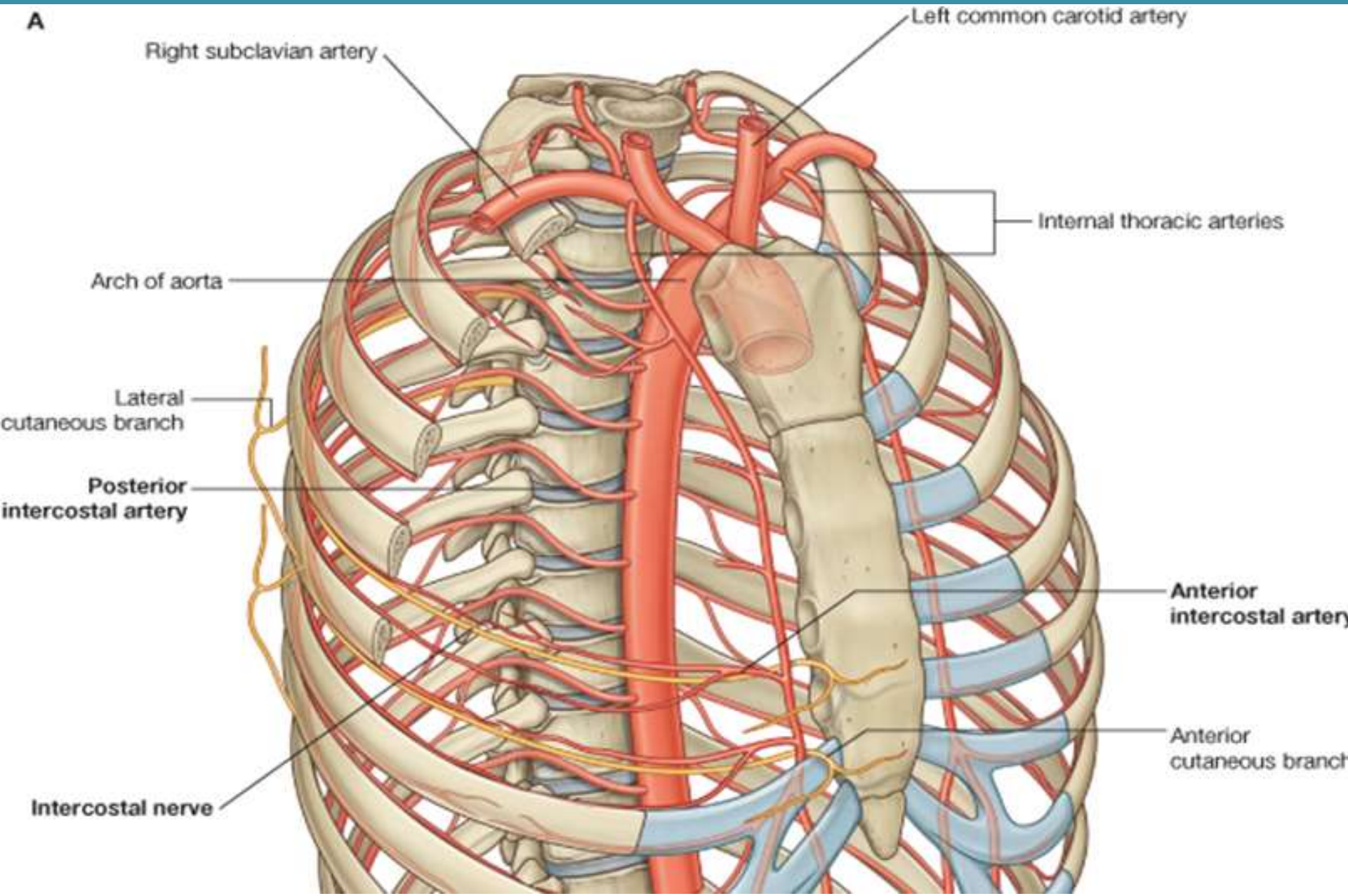


Internal Thoracic Artery

- It is a branch of the first part of the **subclavian artery** in the neck.
- It descends vertically on the pleura **behind the costal cartilages**, a fingerbreadth lateral to the sternum.
- Ends in the 6th intercostal space by **dividing into:**
 - ✓ **The superior epigastric.**
 - ✓ **Musculophrenic arteries.**
 - The internal thoracic artery supplies the anterior wall of the body **from the clavicle to the umbilicus.**



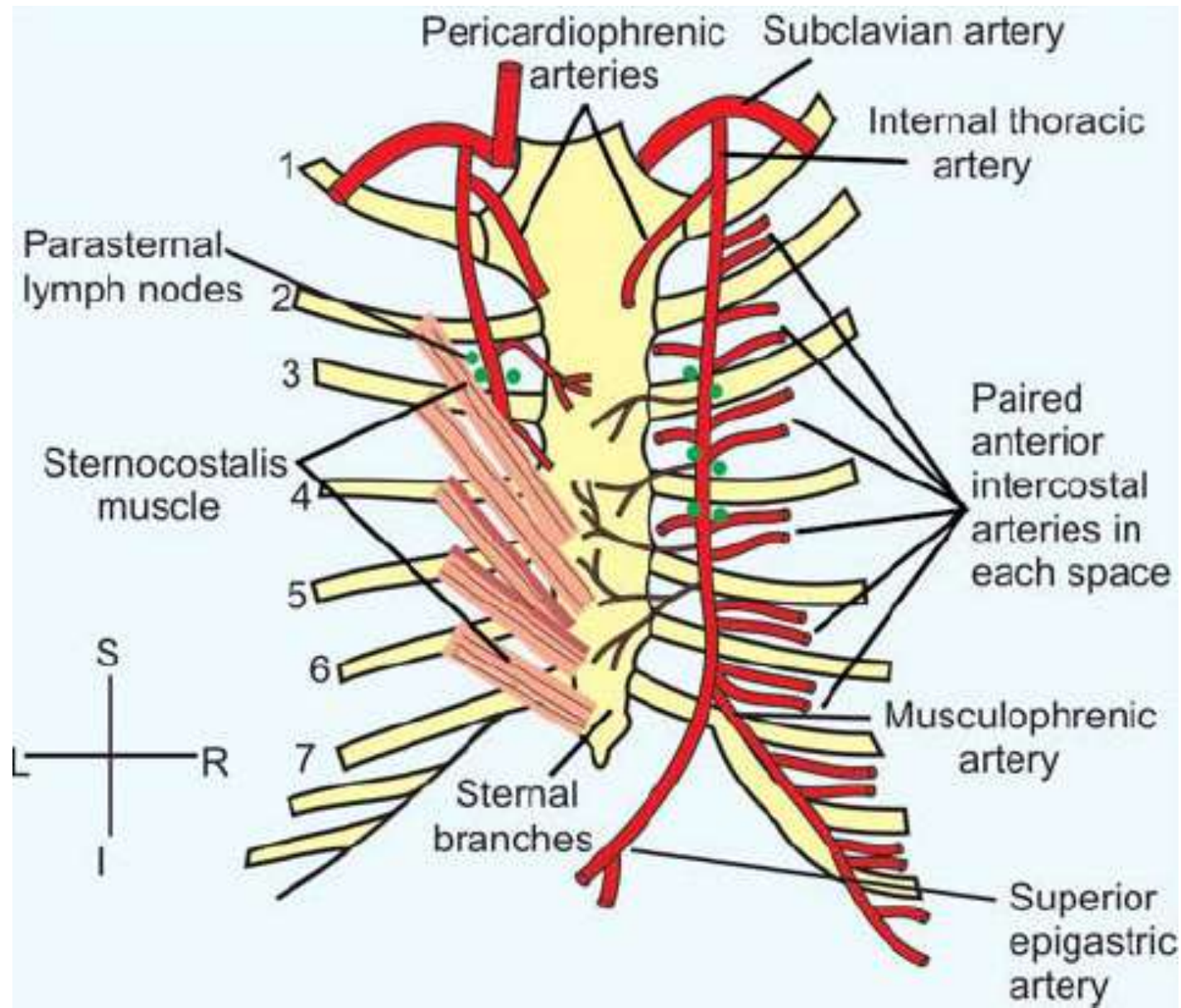
A



Branches of Internal Thoracic Artery

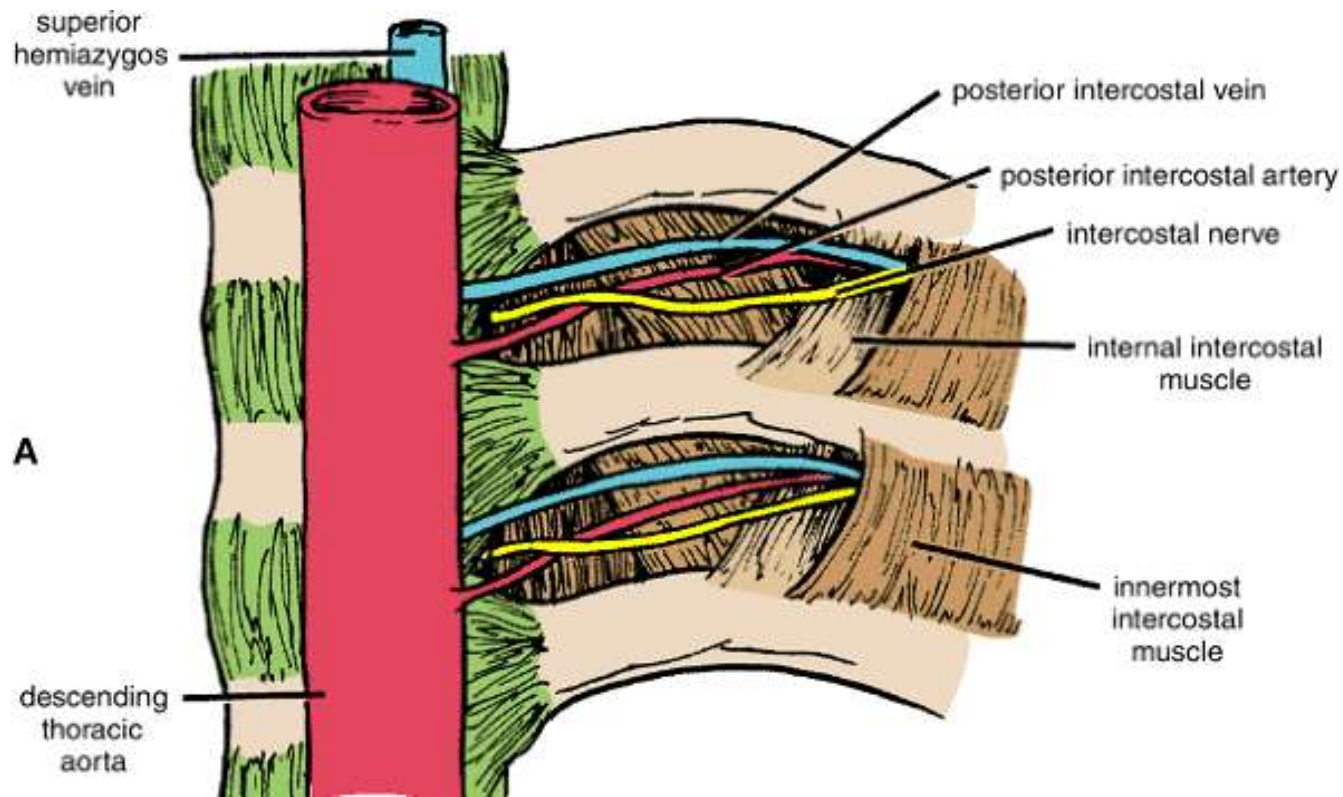
- **Two anterior intercostal arteries** for upper 6 intercostal spaces.
- **Perforating arteries**, which accompany the terminal branches of the corresponding intercostal nerves.
- **The pericardiophrenic artery**, accompanies the phrenic nerve & supplies the pericardium
- **Mediastinal arteries** to the contents of the anterior mediastinum (e.g., the thymus).
- **The superior epigastric artery**, which enters the rectus sheath of the anterior abdominal wall and supplies the rectus muscle as far as the umbilicus.
- **The musculophrenic artery**, runs around the costal margin of the diaphragm & supplies the lower intercostal spaces & diaphragm.

Branches of Internal Thoracic Artery



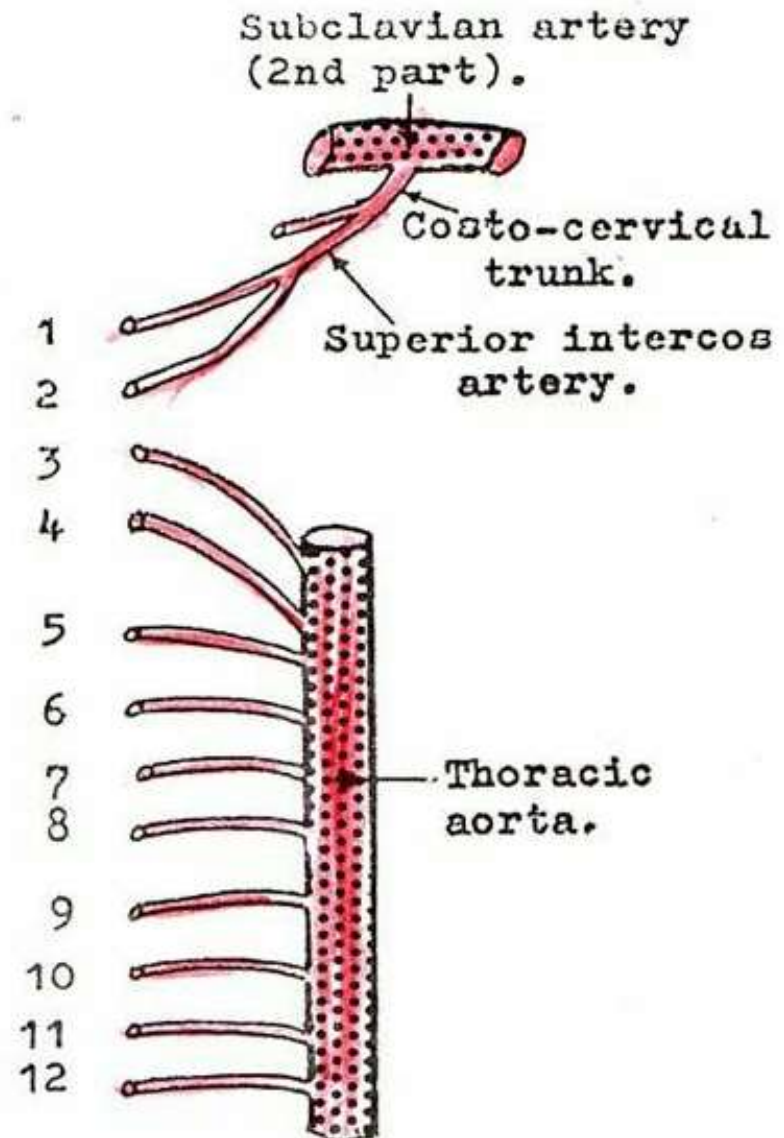
Intercostal Arteries

- Each intercostal space contains:
 - **Posterior intercostal artery** (large & single artery)
 - **Anterior intercostal arteries** (small & double arteries)



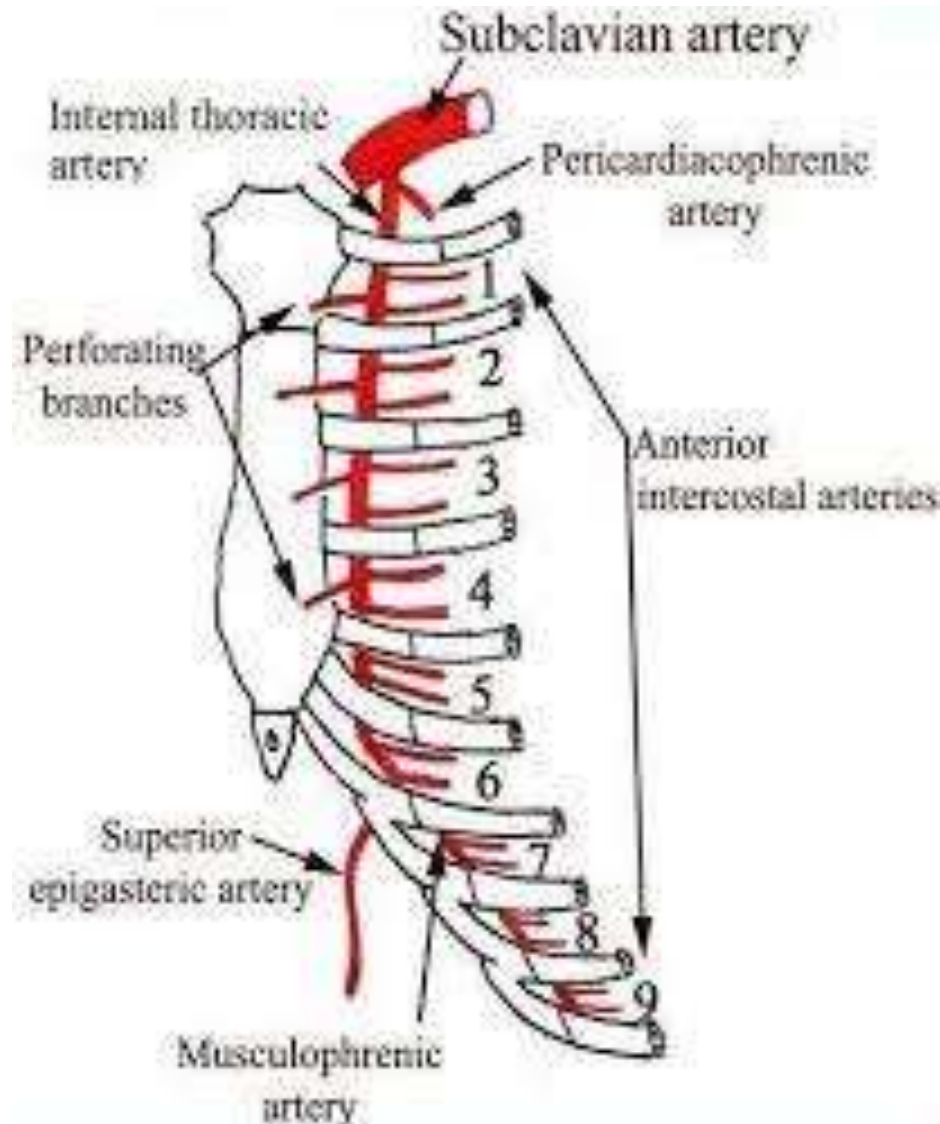
Posterior Intercostal Arteries

- For the first two spaces are branches from the **superior intercostal artery**, a branch of the **costocervical trunk** of the **subclavian artery**.
- For the lower nine spaces are branches of the **descending thoracic aorta**.
- Each intercostal artery gives off branches to the **muscles, skin, and parietal pleura**.



Anterior Intercostal Arteries

- For the **first six spaces** are branches of **internal thoracic artery** which arises from the first part of the **subclavian artery**.
- For the **lower spaces** are branches of **the musculophrenic artery**, one of the terminal branches of **internal thoracic artery**.



Venous drainage of thorax

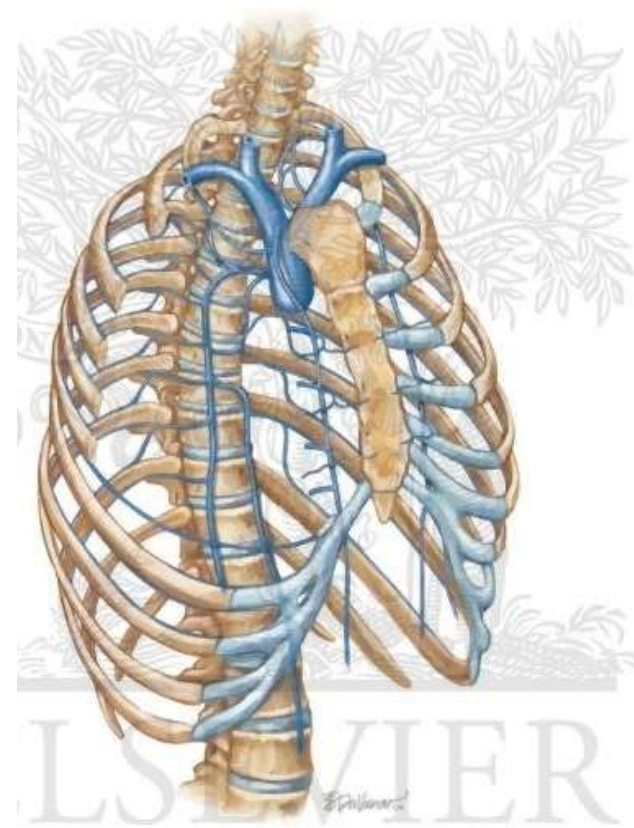
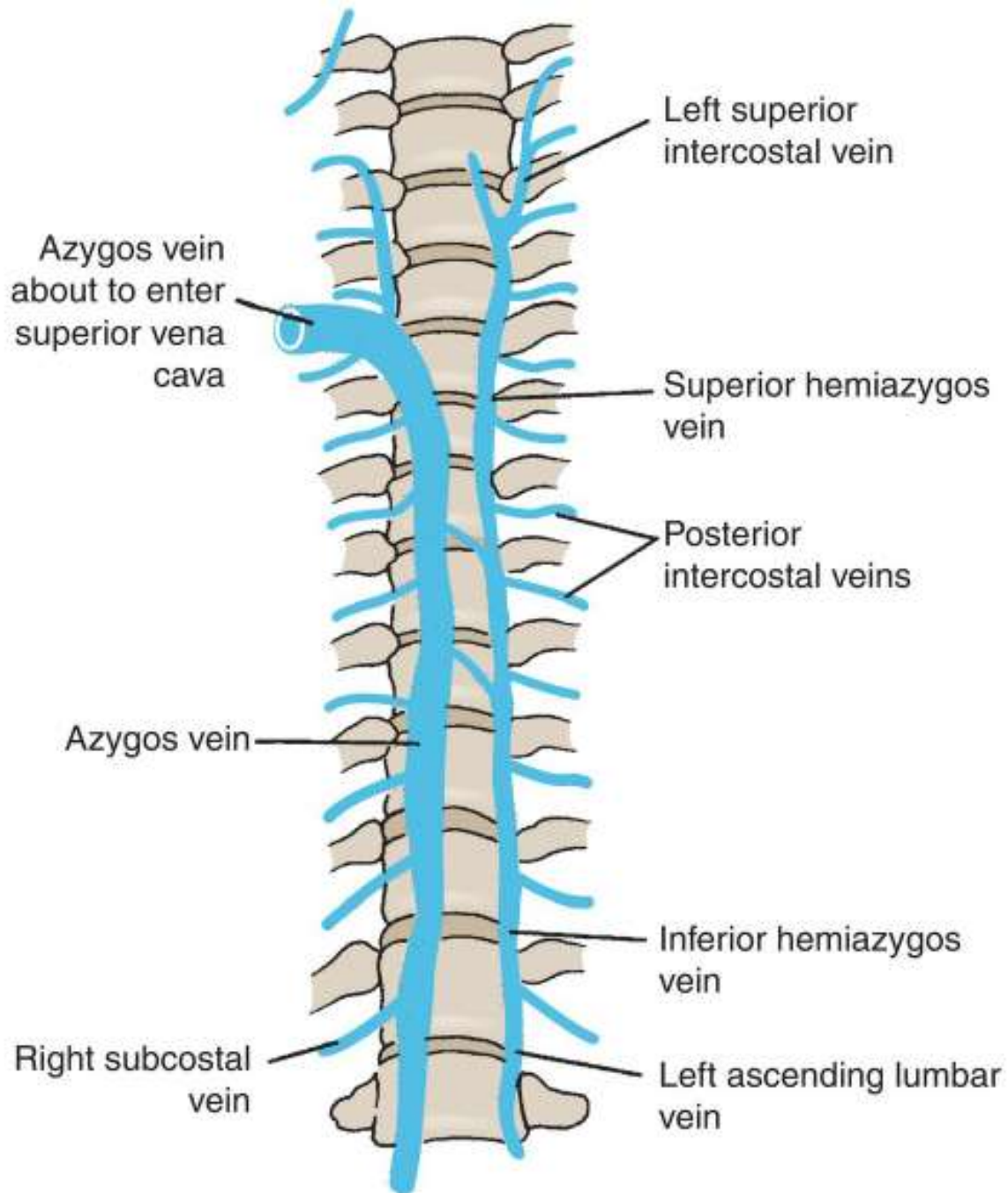
- **Intercostal Veins**

>> **posterior intercostal veins** (single & large)
drain into the **azygos** or **hemiazygos veins**

>> **anterior intercostal veins** (double & small)
drain into internal thoracic and musculophrenic veins.

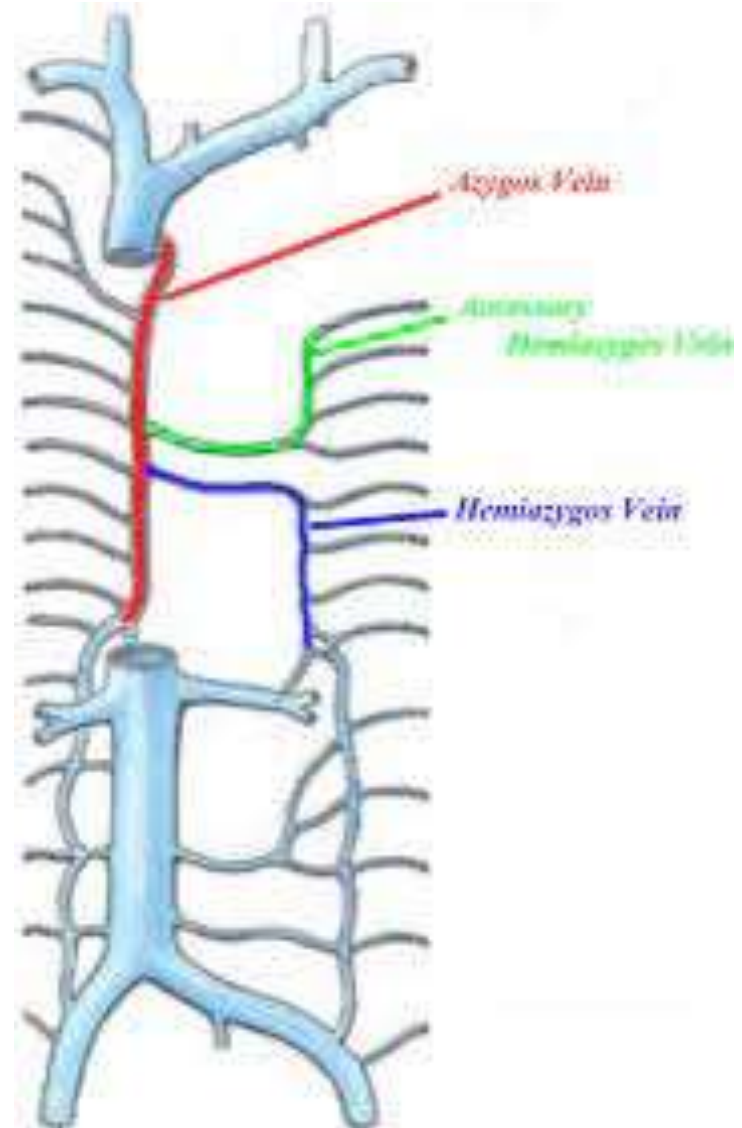
- **Internal Thoracic Vein**

It accompanies the internal thoracic artery and drains into the brachiocephalic vein on each side



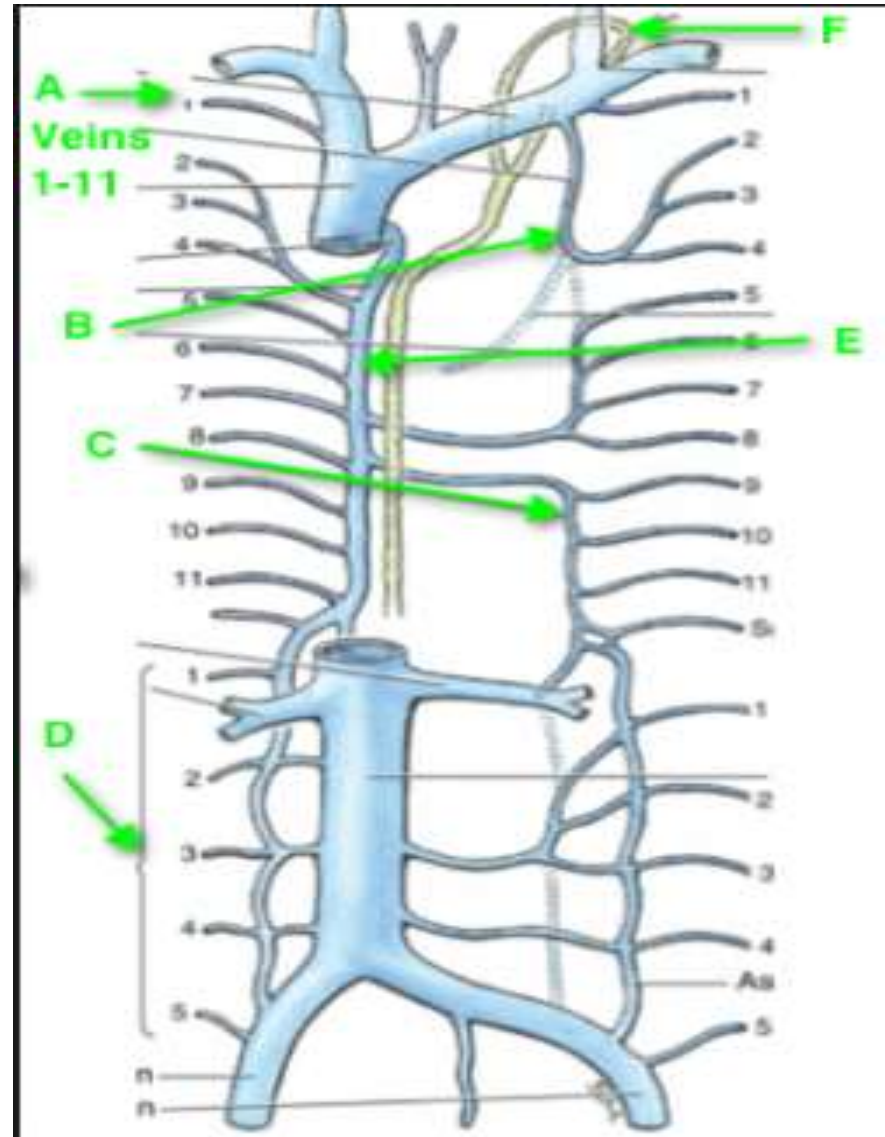
Azygos Vein

- It is formed by union of ascending **lumber veins** with **right subcostal veins** at level of T12.
- Connects SVC & IVC
- Enters thorax through aortic opening of diaphragm.
- It ascend first in posterior mediastinum till disc between T4-T5, then superior mediastinum.



Azygos Vein tributaries

- ◆ Rt ascending lumbar vein.
- ◆ Rt subcostal vein.
- ◆ Rt posterior intercostal vein 11-5 end separately.
- ◆ Rt superior intercostal vein union of 2-3-4 , post intercostal veins, end in arch of azygos.
- ◆ Superior hemiazygos T8 .
- ◆ Inferior hemiazygos T9 .
- ◆ Bronchial , pericardial veins

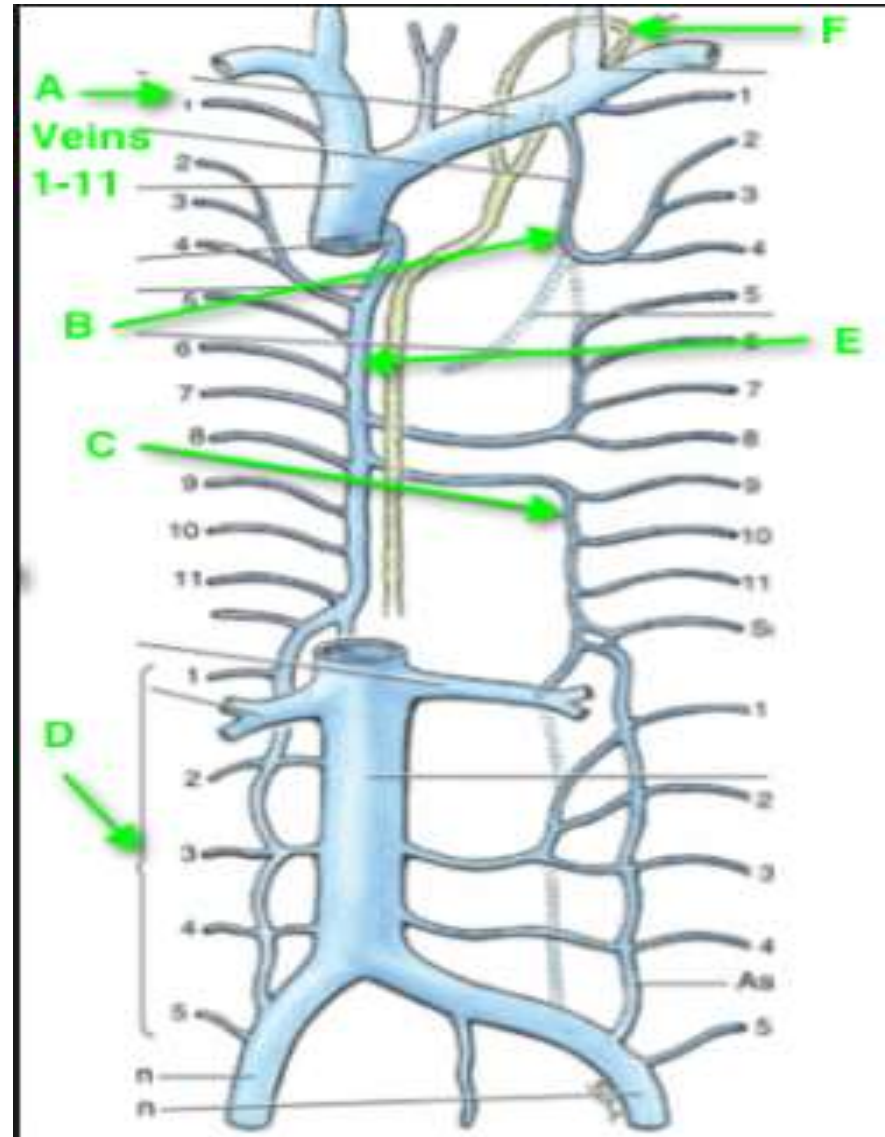


Hemiazygos Vein

- ◆ It arises on Left side , junction of left subcostal and ascending lumbar veins.
- ◆ it receives the inferior 3 intercostal veins & the inferior esophageal vein.

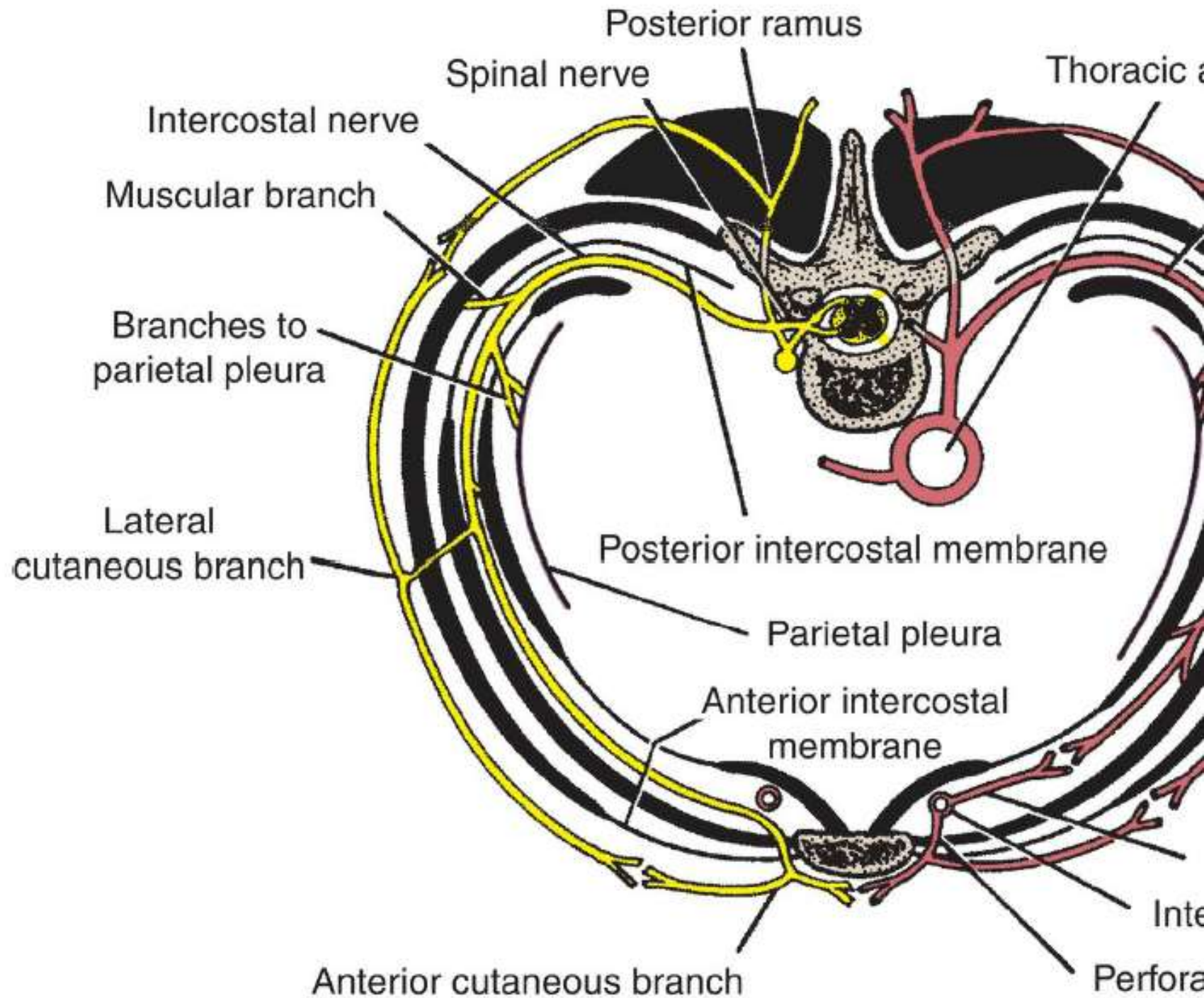
- ◆ **ACCESSORY
HEMIAZYGOS VEIN**

It receive from 4 – 8 intercostal veins .



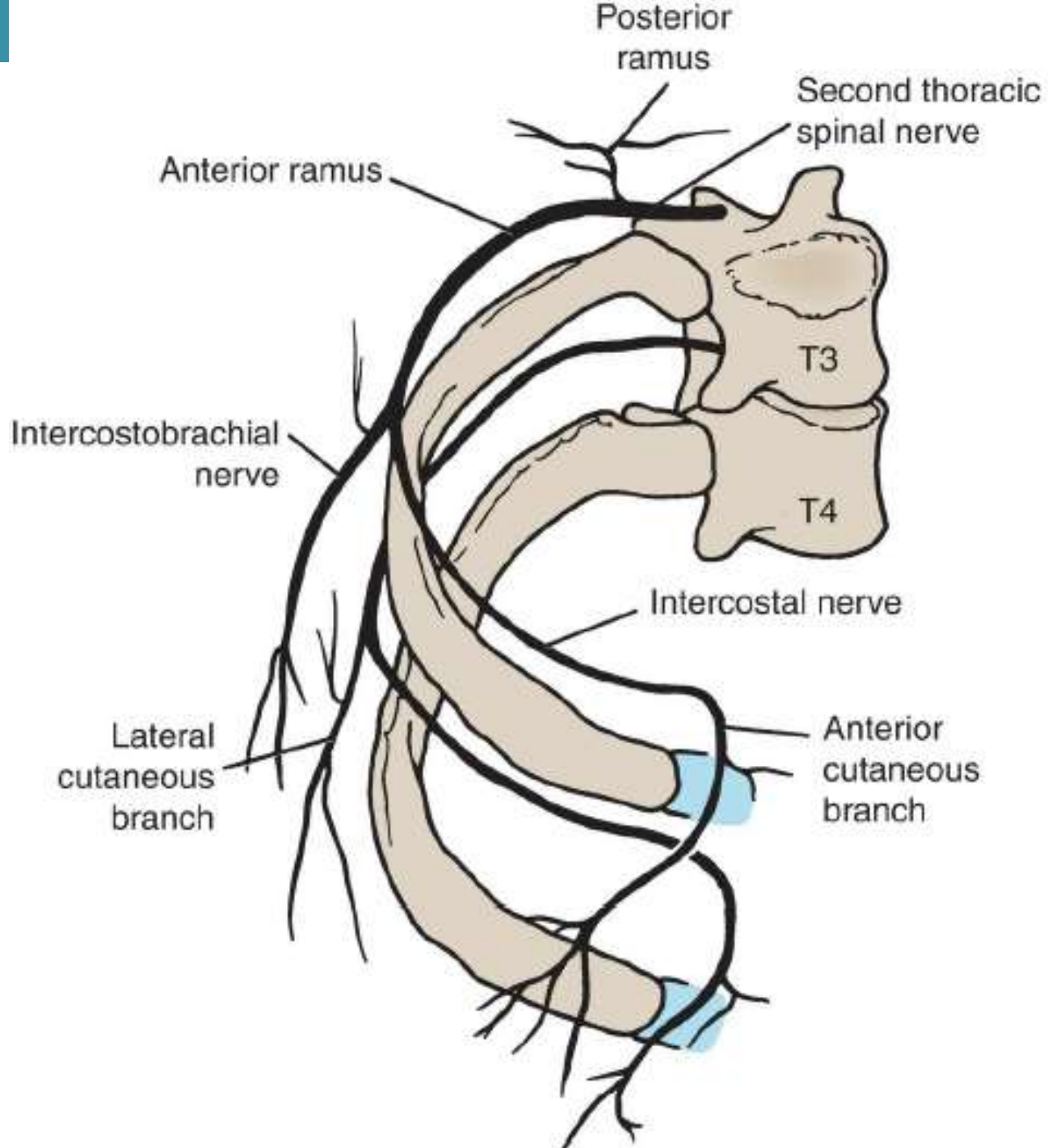
Intercostal Nerves

- The intercostal nerves are the **anterior rami of the first 11 thoracic** spinal nerves.
- The anterior ramus of the **12th thoracic** nerve lies in the abdomen and runs forward in the abdominal wall as the **subcostal nerve**.
- **Each intercostal nerve:**
 - Enters an intercostal space.
 - Runs forward **inferior to the intercostal vessels** in the **subcostal groove of the corresponding rib**.
 - Between the **innermost intercostal and internal intercostal muscle**.

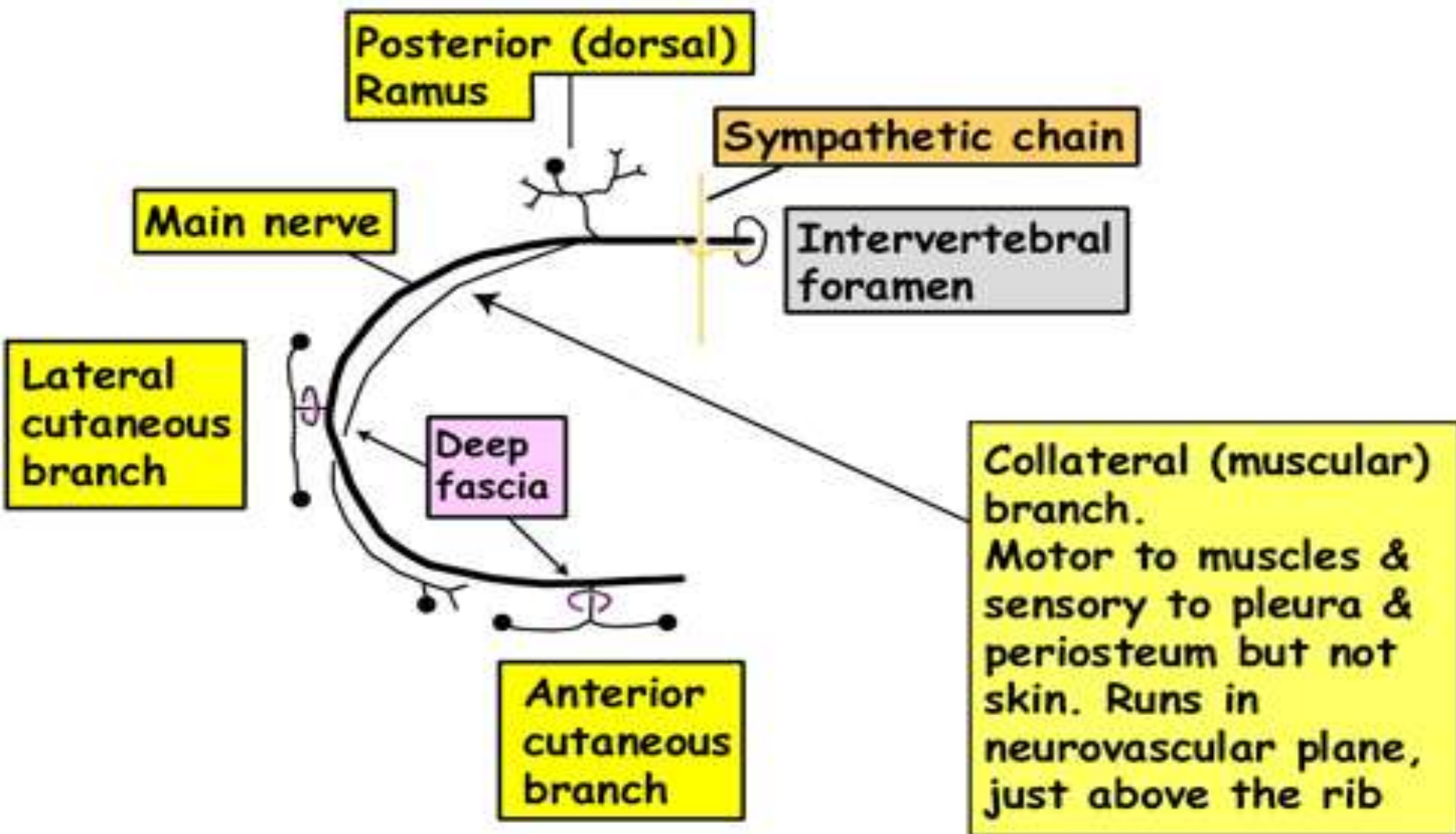


Branches of Intercostal Nerves

- **Rami communicantes** connect the intercostal nerve to a ganglion of the sympathetic trunk.
- **The collateral branch** runs forward on the upper border of the rib below.
- **The lateral cutaneous branch** reaches the skin on the side of the chest.
- **The anterior cutaneous branch**, reaches the skin near the midline.
- **Muscular branches** run to the intercostal muscles.
- **Pleural sensory branches** to the parietal pleura.
- **Peritoneal sensory branches** (7th-11th intercostal nerves only) run to the parietal peritoneum.

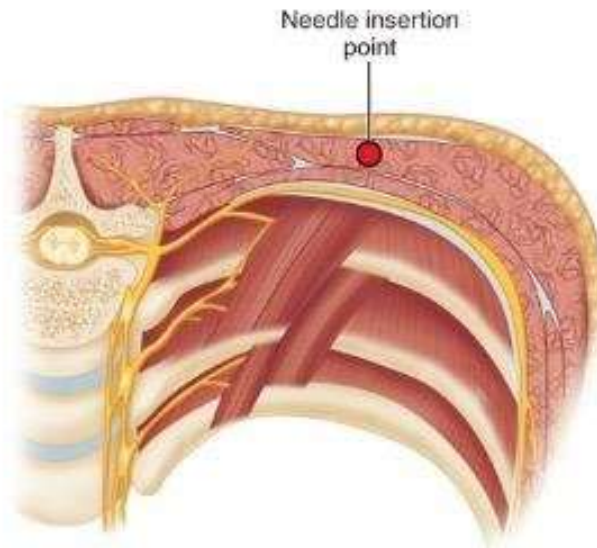
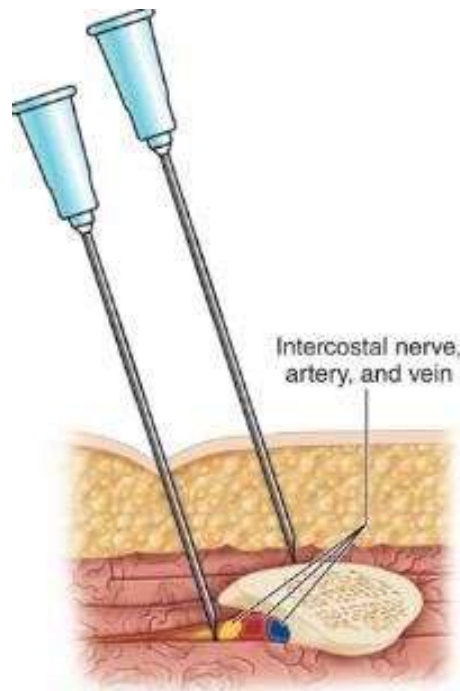


TYPICAL INTERCOSTAL NERVE



CLINICAL : Intercostal Nerve Block

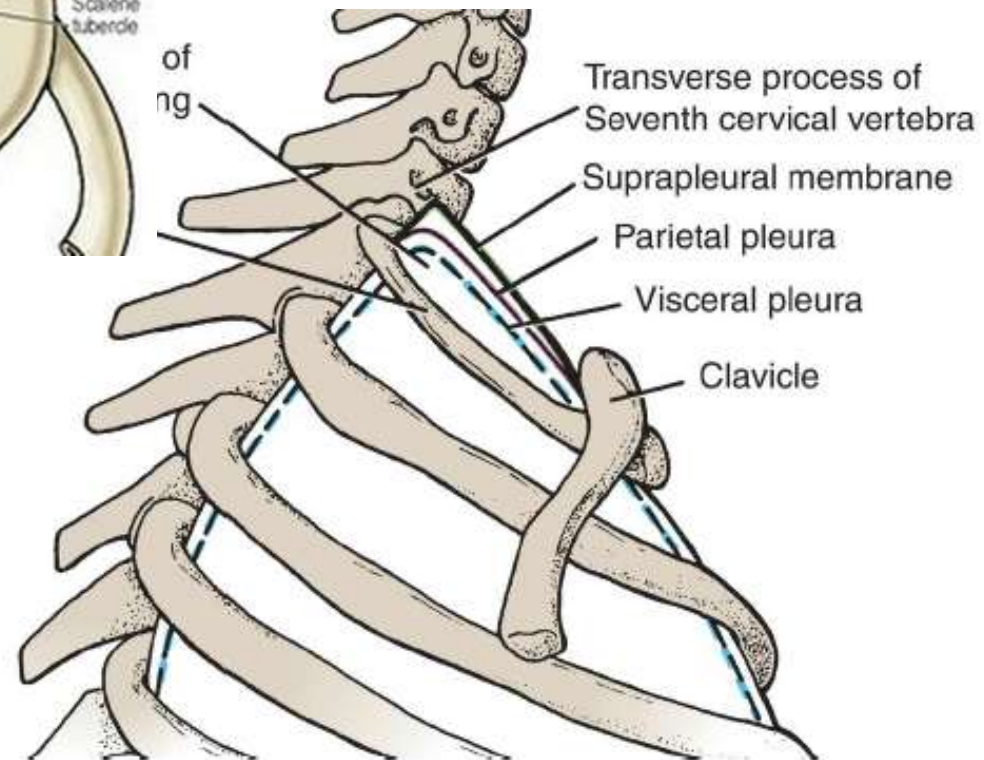
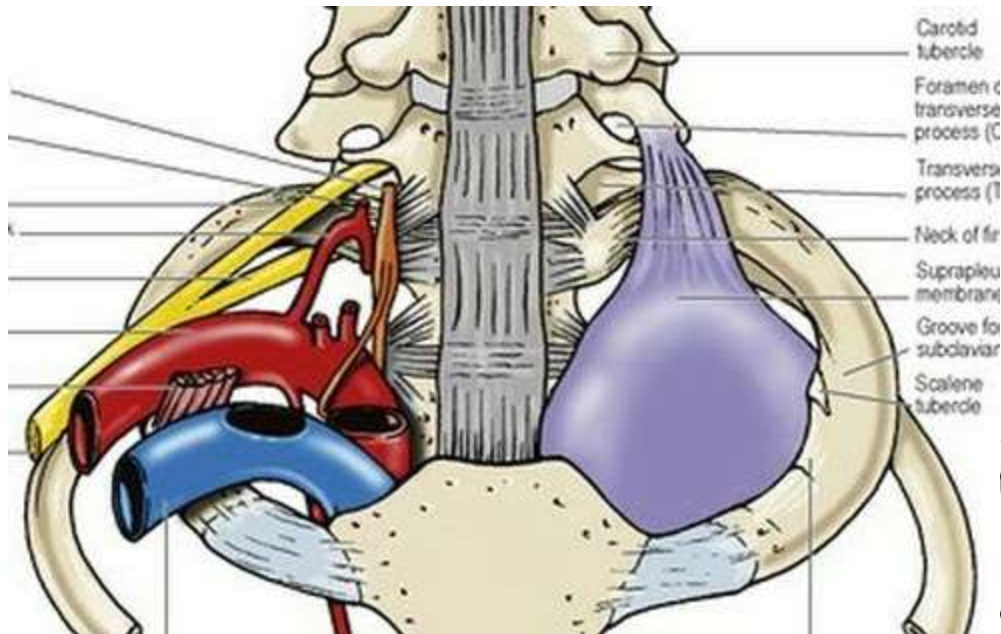
- is indicated for repair of lacerations of the thoracic and abdominal walls, for relief of pain in rib fractures, and to allow pain free respiratory movements.



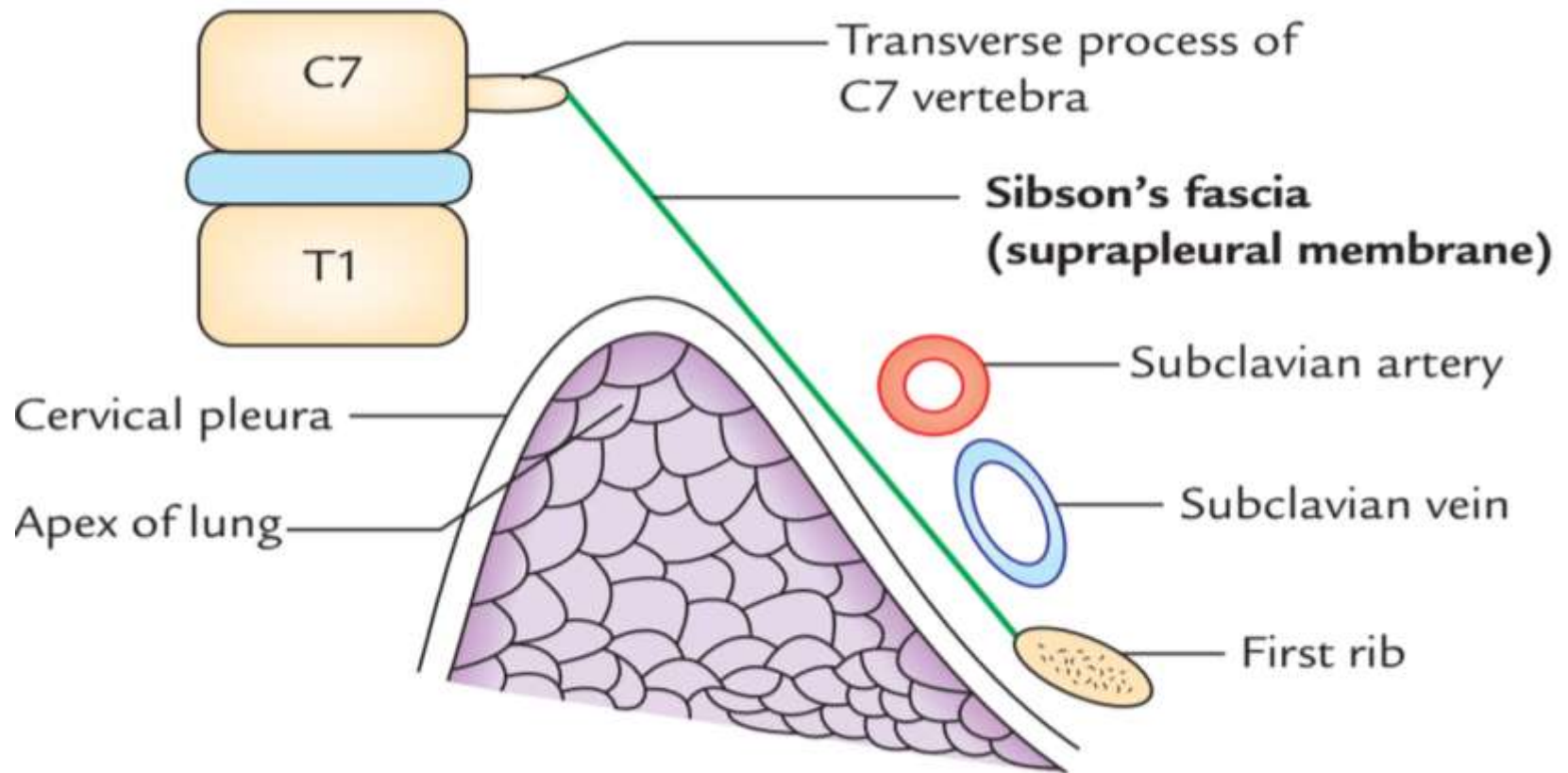
Suprapleural Membrane

- is a dense fascial layer that closes the thoracic outlet.
- This **tent-shaped** fibrous sheet **is attached**:
 - **Laterally** to the medial border of the first rib and costal cartilage.
 - **Superiorly**: to the tip of the transverse process of the seventh cervical vertebra
 - **Medially** to the fascia investing the structures passing from the thorax into the neck.
- It **protects the underlying** cervical pleura.
- Resists the changes in intrathoracic pressure occurring during respiratory movements.

Suprapleural Membrane



Suprapleural Membrane



Endothoracic Fascia

- It is a **thin layer of loose connective tissue** that **separates the parietal pleura from the thoracic wall.**

Surface Anatomical Lines

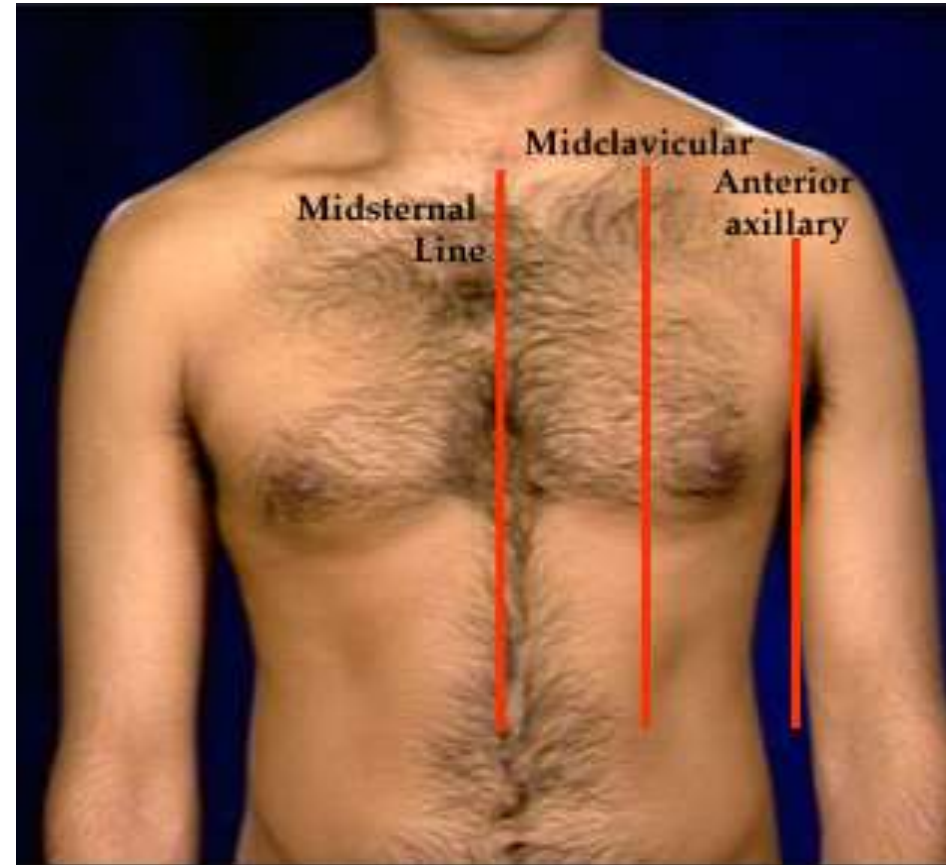
Anterior

1. Median sagittal line:

- intersection of median plane with anterior chest wall

2. Midclavicular lines:

- Midpoints of clavicles
- to inguinal region



Surface Anatomical Lines

Lateral

1. Ant. axillary line:

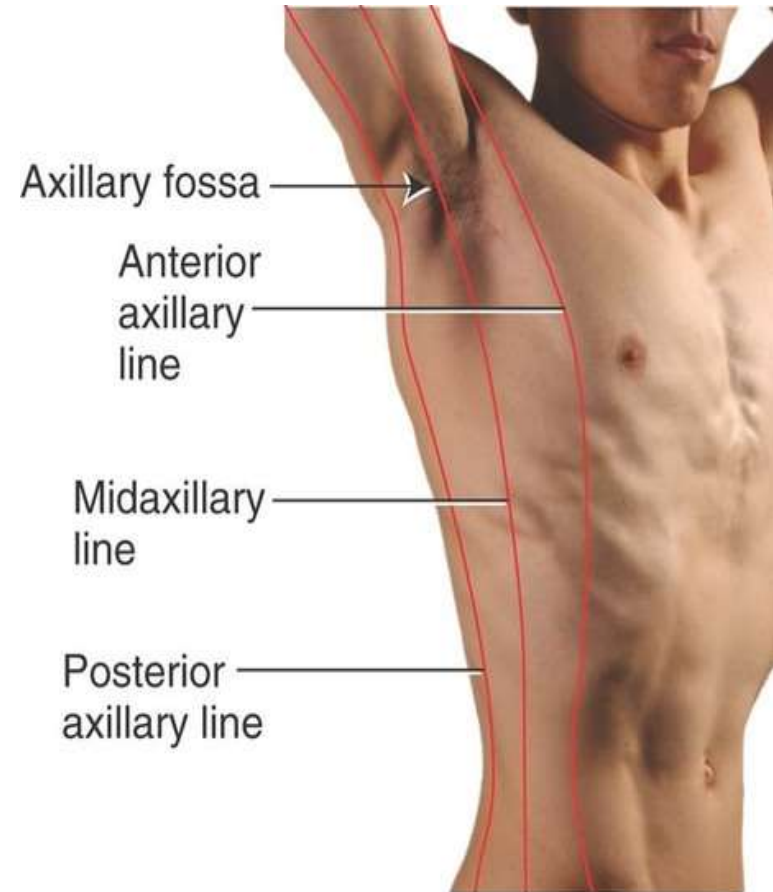
- Along ant. axillary fold
- (formed by border of Pec. Major m.)

2. Post. axillary line:

- Along post. axillary fold
- (formed by latissimus dorsi & teres major M.)

3. Mid axillary line:

- Runs from the apex of axilla
- Parallel to ant. & post. lines



Surface Anatomical Lines

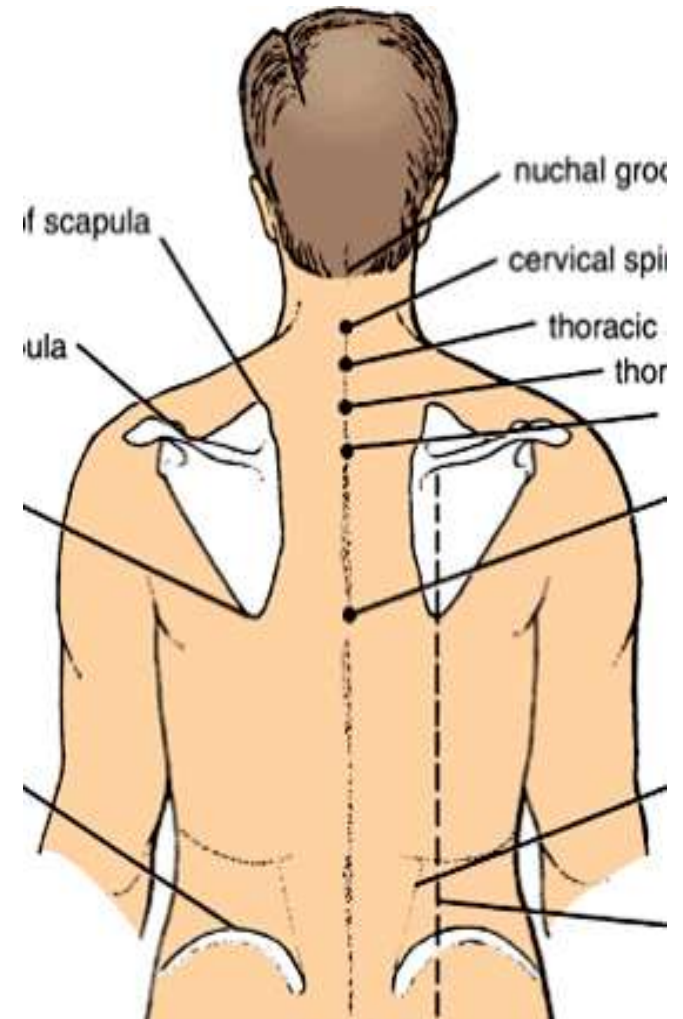
Posterior

1. Posterior median line:

- Over the tips of spinous processes of all vertebrae

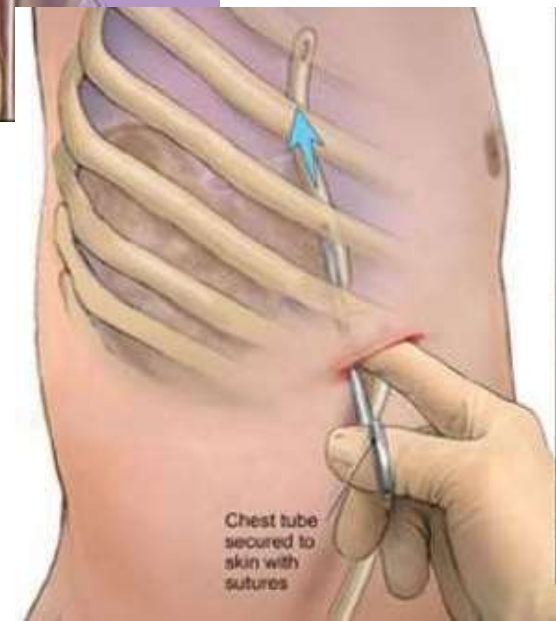
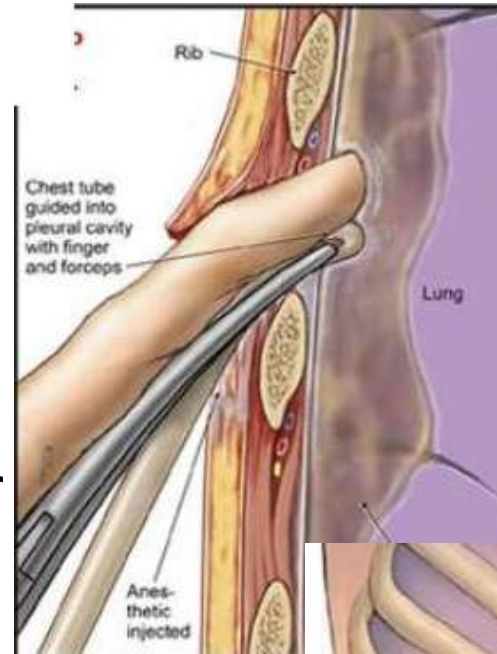
2. Scapular lines:

- Through **superior & inferior angles** of the scapula when arms at anatomical position



CLINICAL: Thoracostomy (chest) tube

- is indicated to relieve air or fluid trapped in thorax between lung and chest wall (pleural cavity).
- is done for pneumothorax or hemothorax.
- Is inserted between the anterior axillary and midaxillary lines and in either the 4th or 5th intercostal space.
- should be applied to the **superior** border of the **rib** (i.e., at the lowest position in the intercostal space).



General Anatomy

ABDOMINAL WALL

Anatomy Group

Dr Naser Radwan, MD

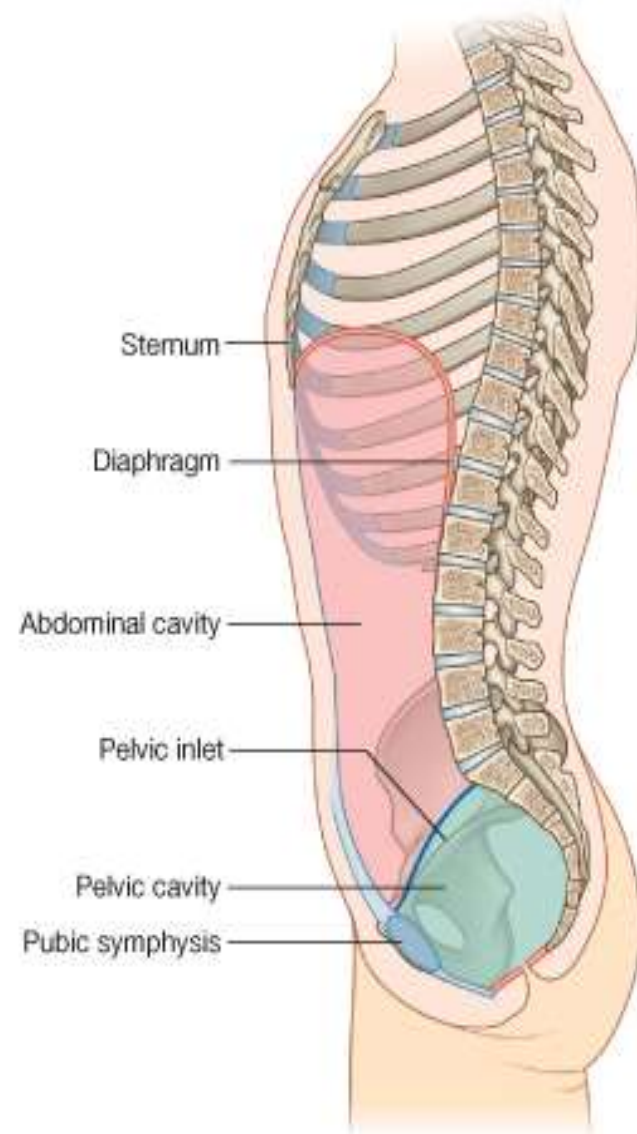
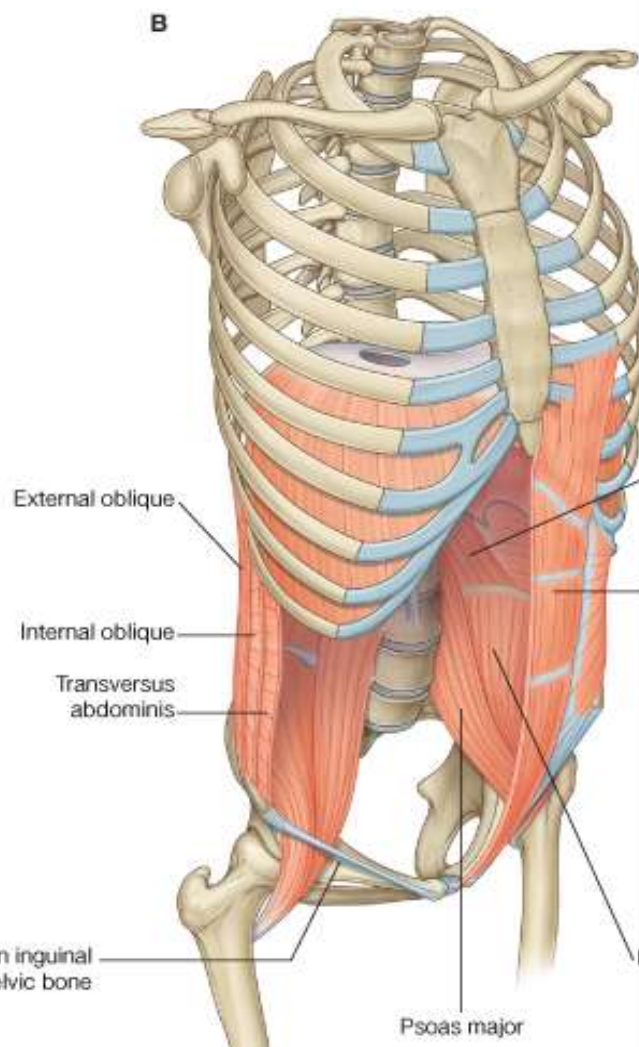
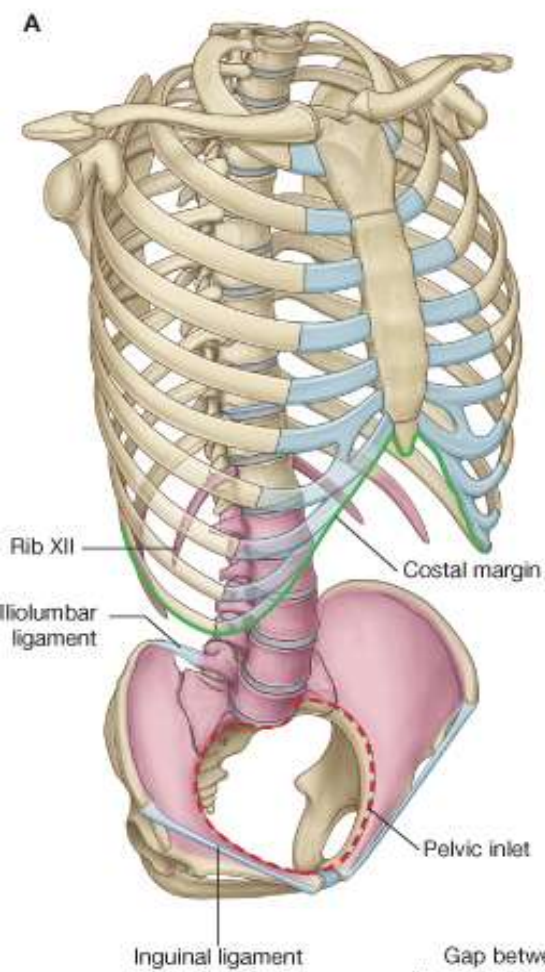
Dr Amjad Abu Alqumboz, MD

Dr Adham AlZanoun, MD



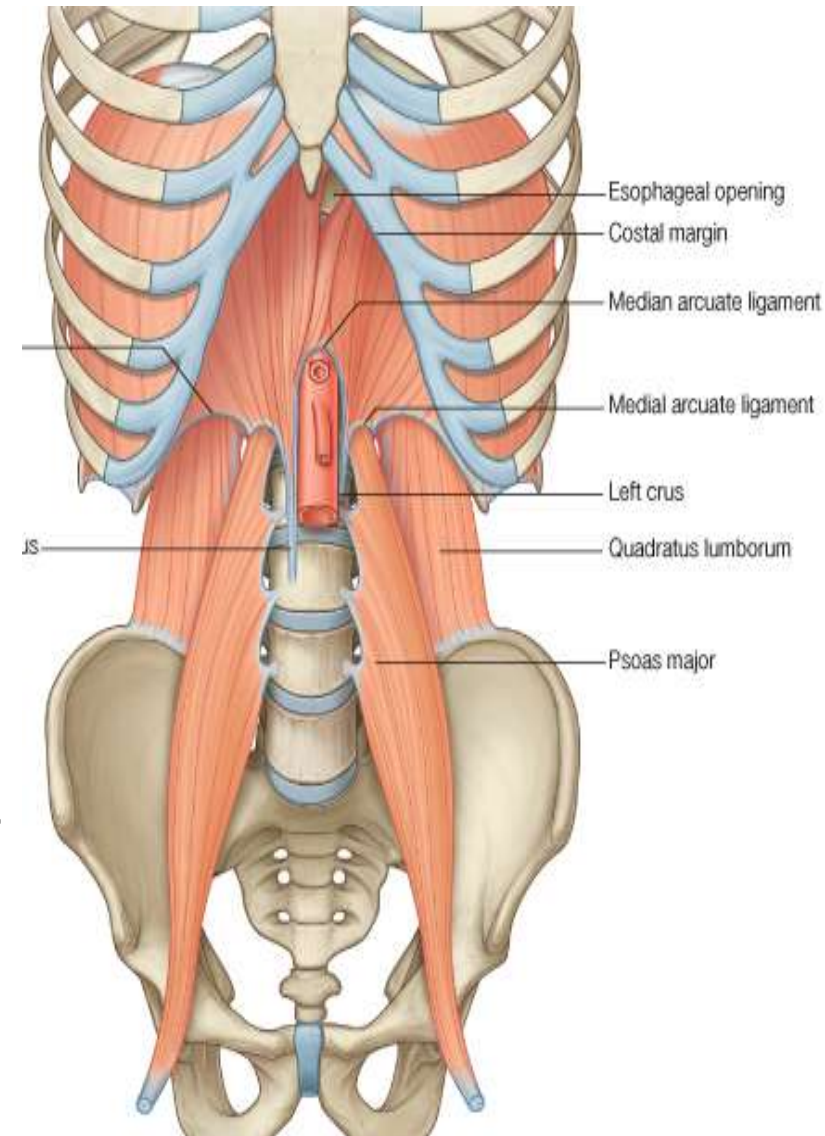
Abdomen

- The region of the trunk that lies between the diaphragm above and the inlet of the pelvis below.



Structure of the abdominal wall

- **Superiorly** diaphragm separates the abdomen from the chest.
- **Inferiorly** The abdomen is continuous with the pelvis.
- **Anteriorly** anterior abdominal wall
- **Posteriorly** abdominal wall is made by the lumbar vertebrae, twelfth rib, muscles, and upper part of bony pelvis.
- Note these walls are lined by fascia and parietal peritoneum.



Structure of the abdominal wall

ANTERIOR ABDOMINAL WALL

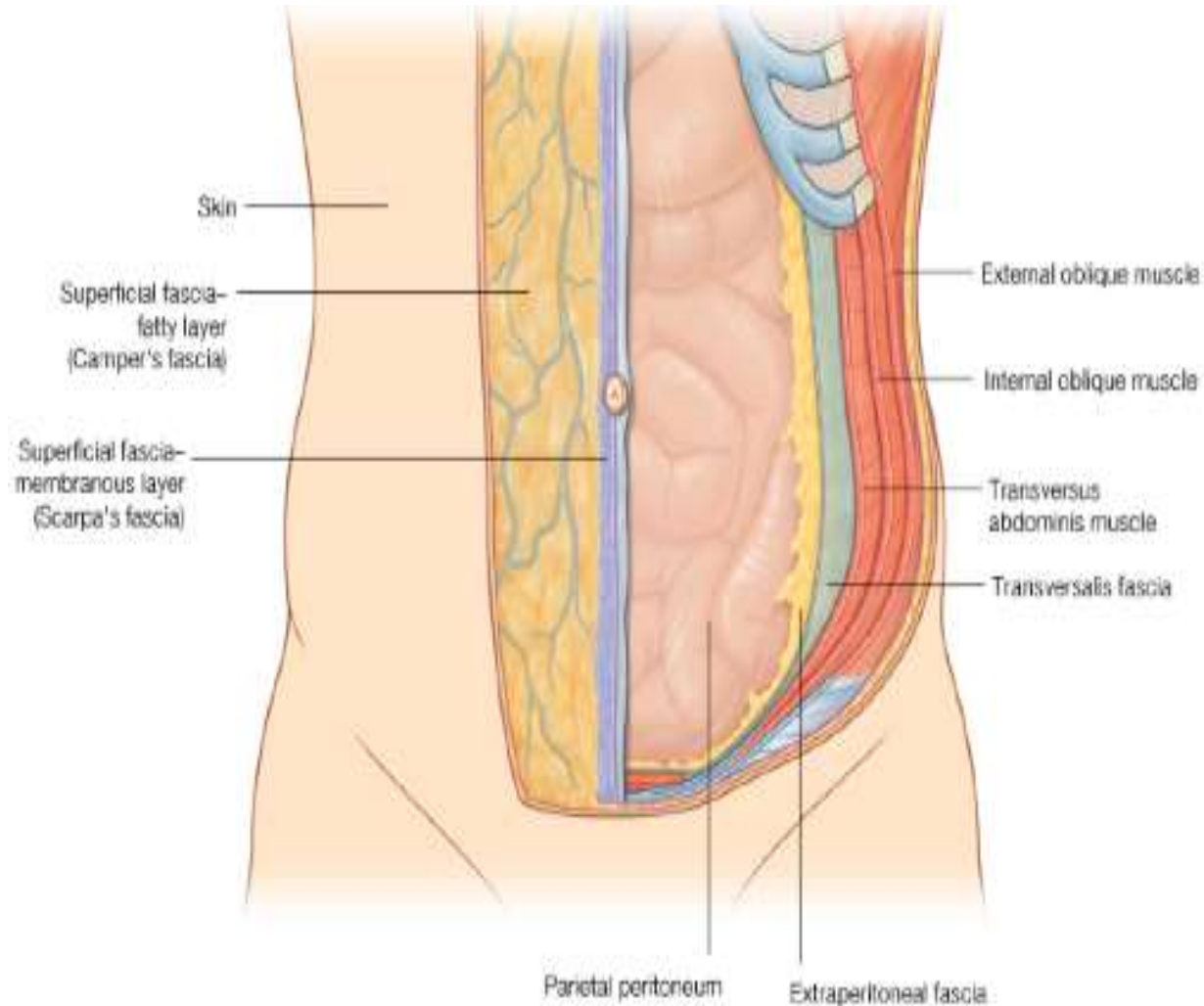
skin

superficial
fascia

muscles

Extra- peritoneal
fascia

parietal
peritoneum



Anterior abdominal wall

SKIN

- The skin is loosely attached to the underlying structures Except at the umbilicus, where it is tethered to the scar tissue of linea alba .
- Umbilicus lies at level of L3-L4, Half way between Xiphoid and Symphysis pubis.
- The Natural lines of cleavage in the skin are constant and run downward and forward almost Horizontally around the trunk.

SURGICAL INCISIONS

- If possible, all surgical incisions should be made in the lines of cleavage where the bundles of collagen fibers in the dermis run in parallel rows.
- An incision along a cleavage line will heal as a narrow scar, whereas one that crosses the lines will heal as wide or heaped-up scars.



Anterior abdominal wall

Superficial Fascia

Superficial Fascia

```
graph TD; A[Superficial Fascia] --> B[Superficial Fatty layer<br/>(Fascia of Camper)]; A --> C[Deep Membranous layer<br/>(Scarpa's fascia).];
```

Superficial Fatty
layer
(Fascia of Camper)

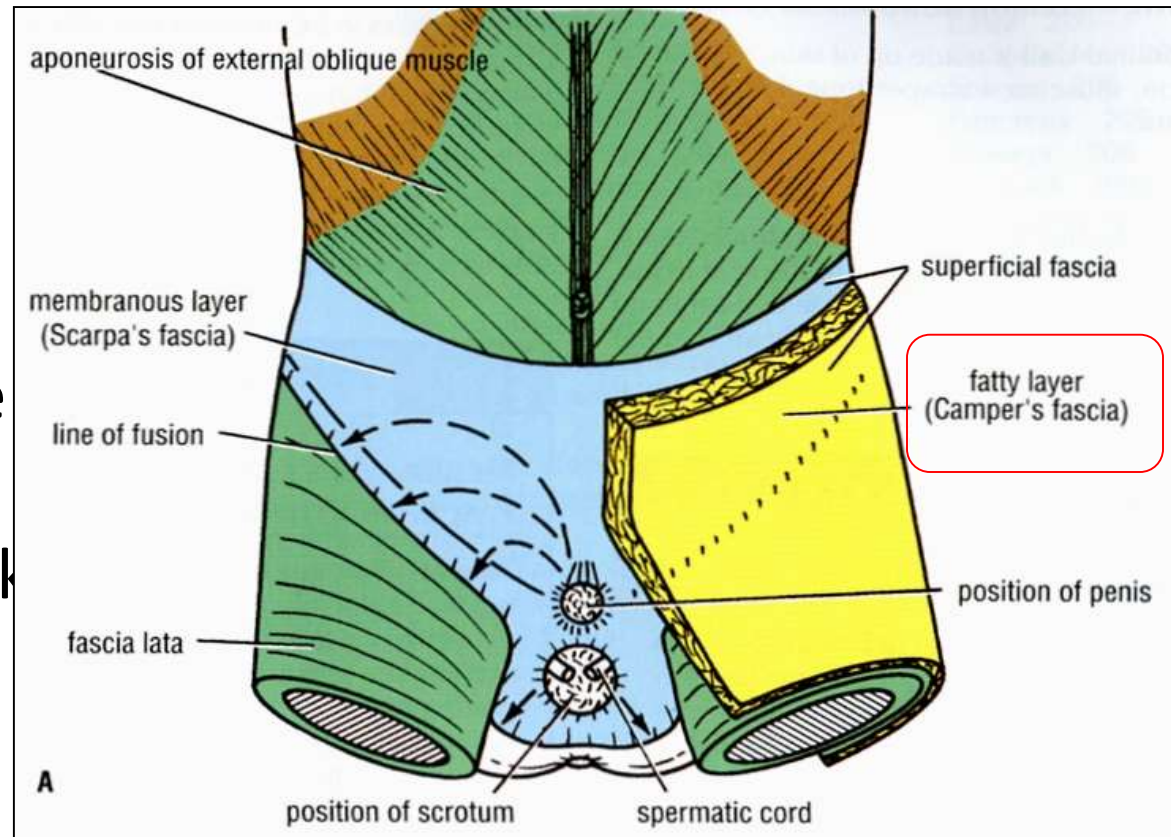
Deep Membranous
layer
(Scarpa's fascia).

Anterior abdominal wall

Superficial Fascia

- **The Fatty Layer**
(Camper's fascia)

is continuous with the superficial fat over the rest of the body and may be extremely thick (3 in.) or more in obese patients.

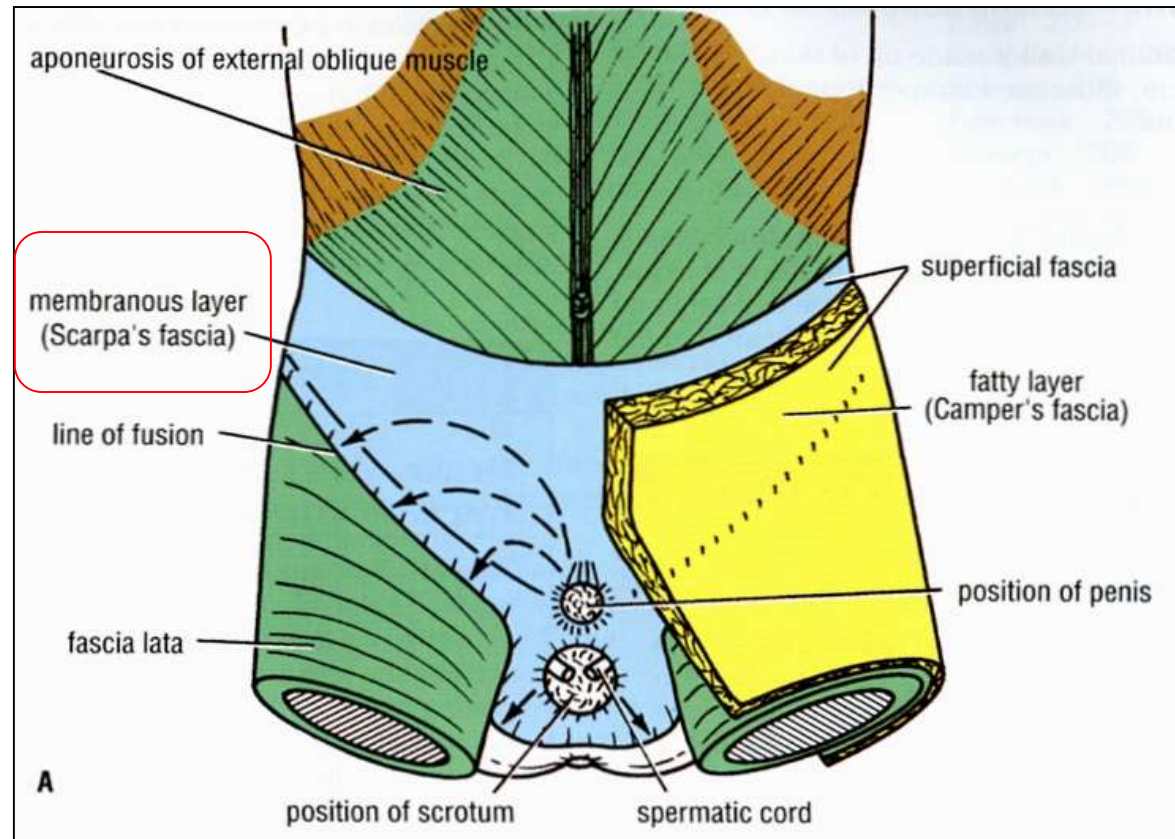


Anterior abdominal wall

Superficial Fascia

Membranous Layer (Scarpa's fascia)

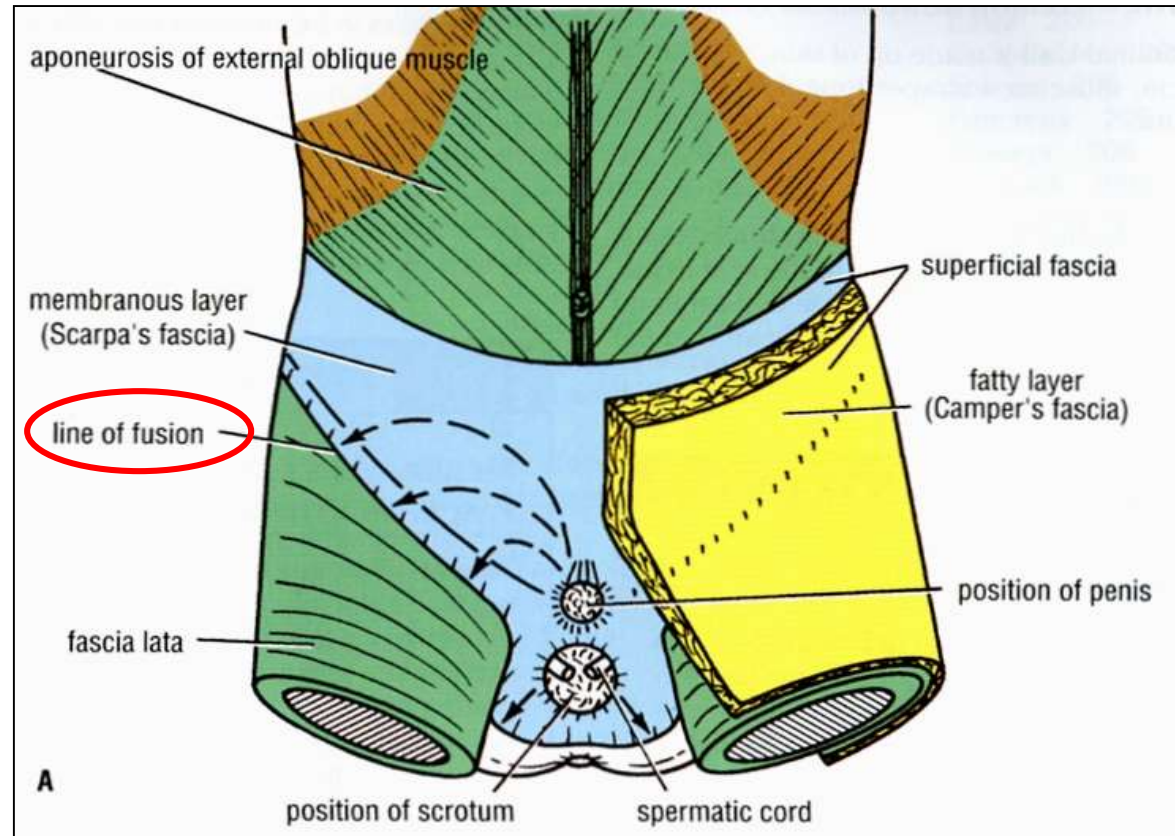
is thin and fades out laterally and above, where it becomes continuous with the superficial fascia of the back and the thorax, respectively.



Anterior abdominal wall

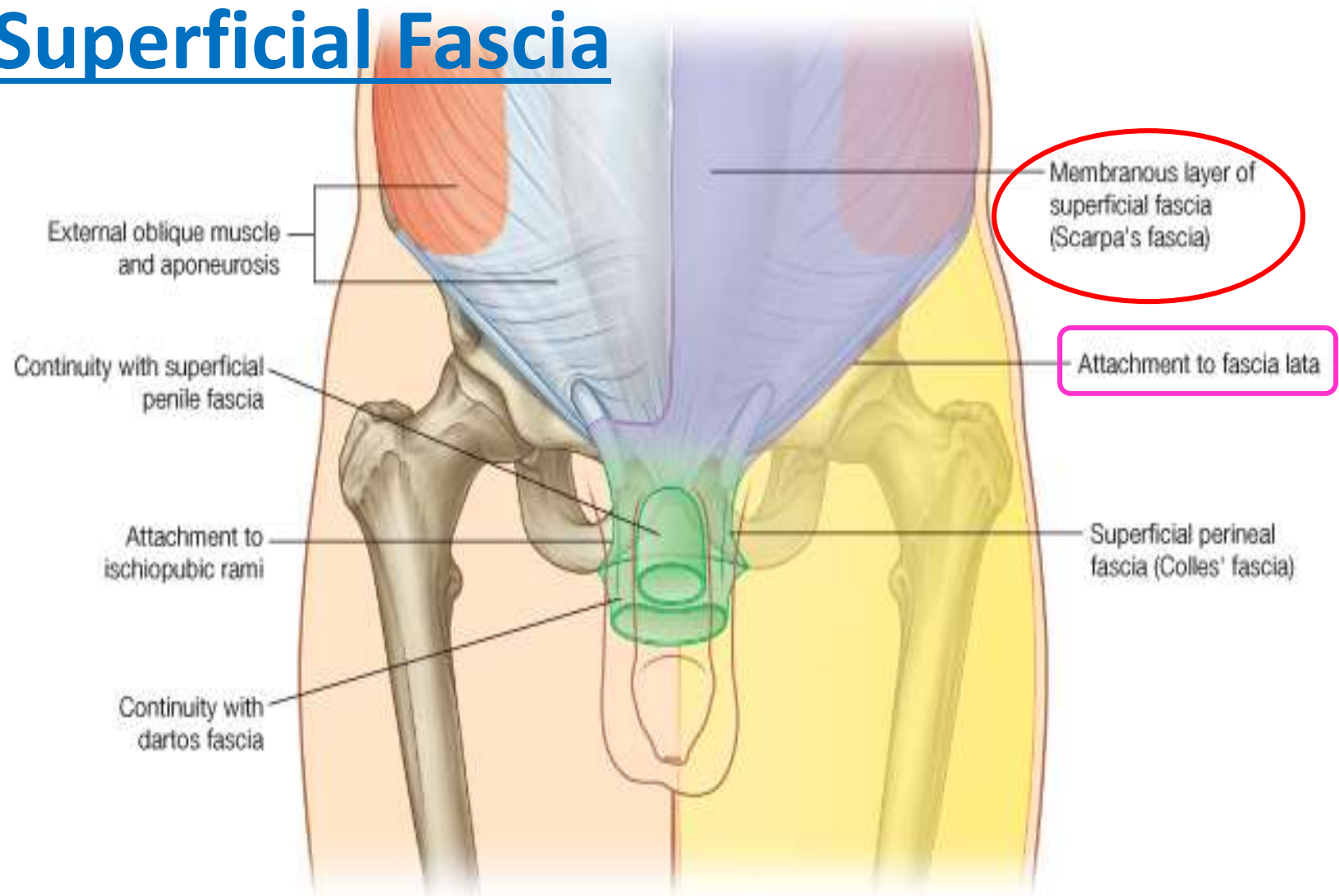
Superficial Fascia

- Inferiorly, the Membranous layer passes onto the front of the thigh, where it fuses with the Deep Fascia one Finger Breadth below the inguinal ligament.



Anterior abdominal wall

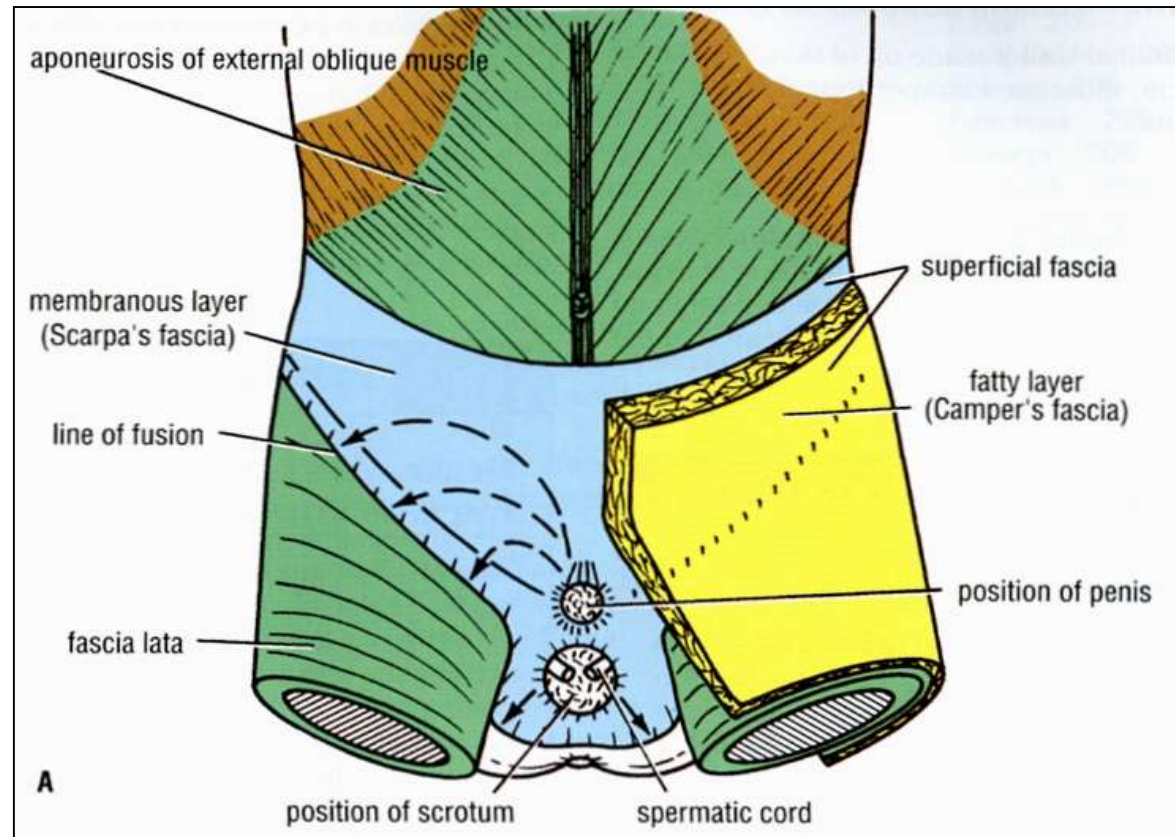
Superficial Fascia



Anterior abdominal wall

Superficial Fascia

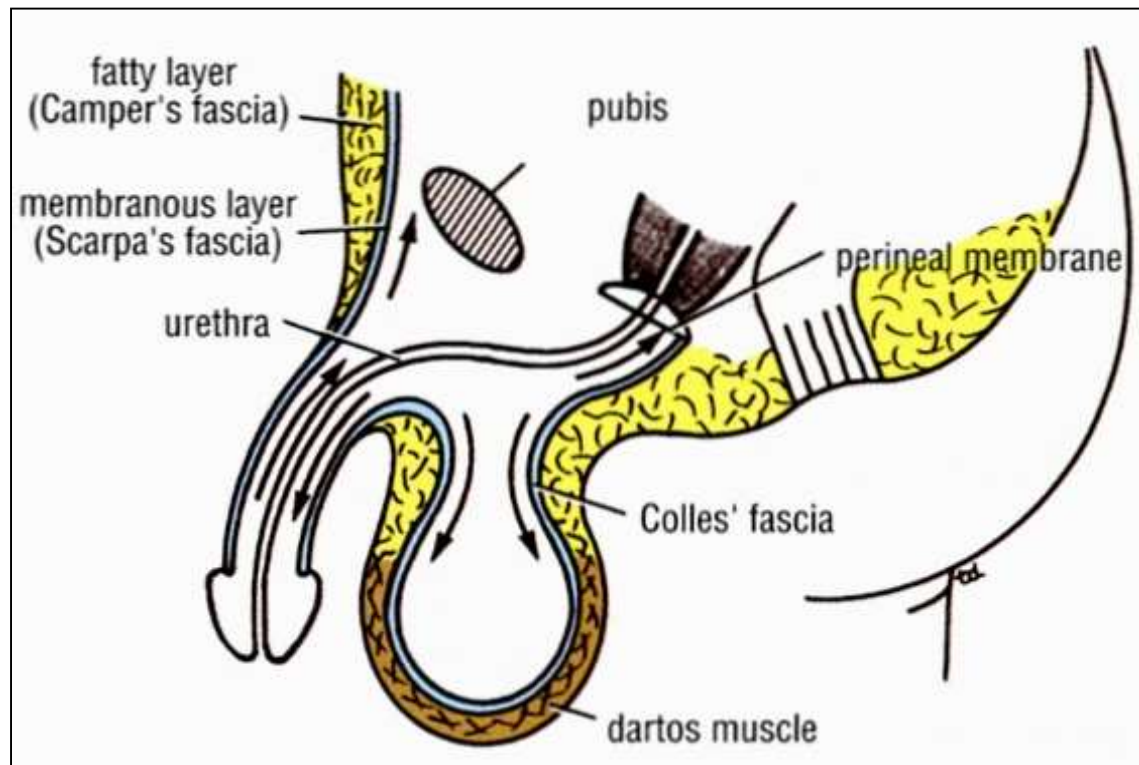
- In the midline inferiorly, the **Membranous layer** of fascia is not attached to the pubis but forms a tubular sheath for the penis (or clitoris).



Anterior abdominal wall

Superficial Fascia

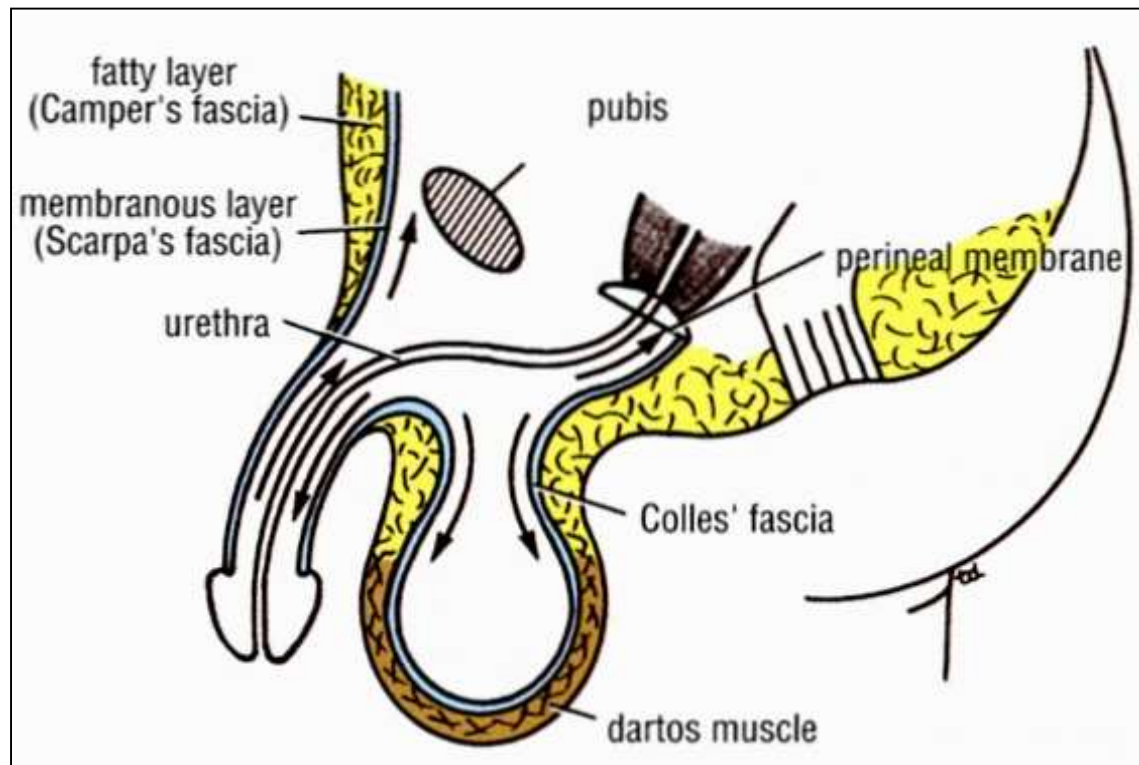
- Below in perineum, it enters the wall of scrotum (or labia majora).
- From there it passes to be attached on each side to the margins of the pubic arch; it is here referred to as Colles' fascia.



Anterior abdominal wall

Superficial Fascia

- Posteriorly, it fuses with the perineal body and the posterior margin of the perineal membrane.



GENERAL APPEARANCES OF ABDOMINAL WALL

- The normal abdominal wall is soft and pliable and undergoes inward and outward excursion with respiration.
- The Contour : is subject to considerable variation and depends on the tone of its muscles and the amount of fat in the subcutaneous tissue.
- Well-developed muscles or an abundance of fat can prove to be a severe obstacle to the palpation of the abdominal viscera.

Abdominal Contour

Abdominal profiles



Flat



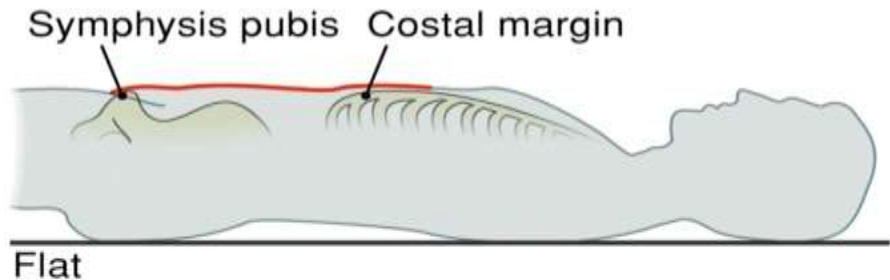
Rounded



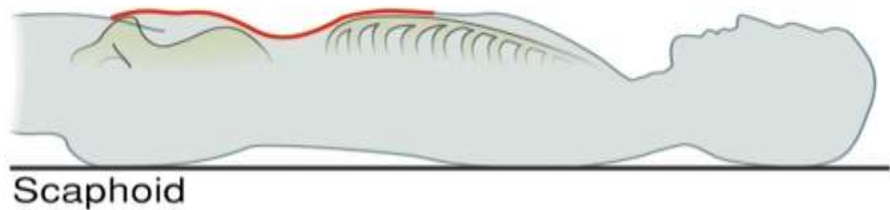
Scaphoid



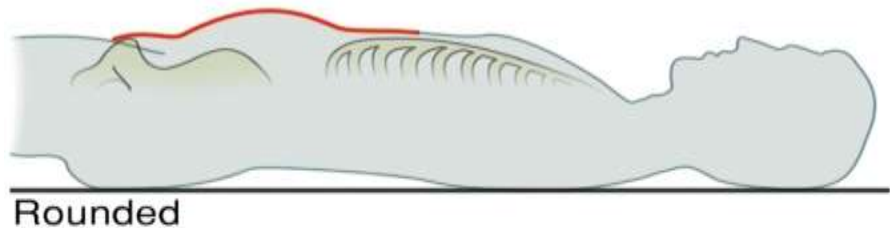
Protruberant



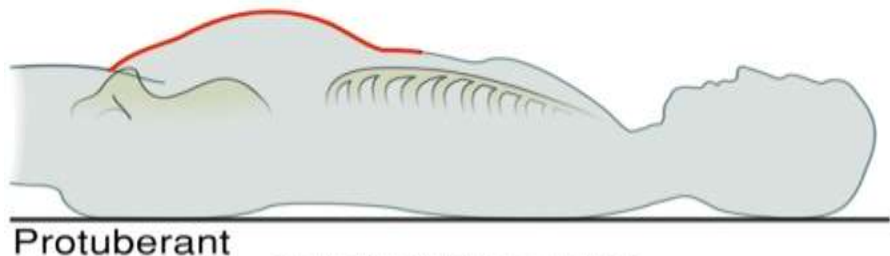
Flat



Scaphoid



Rounded

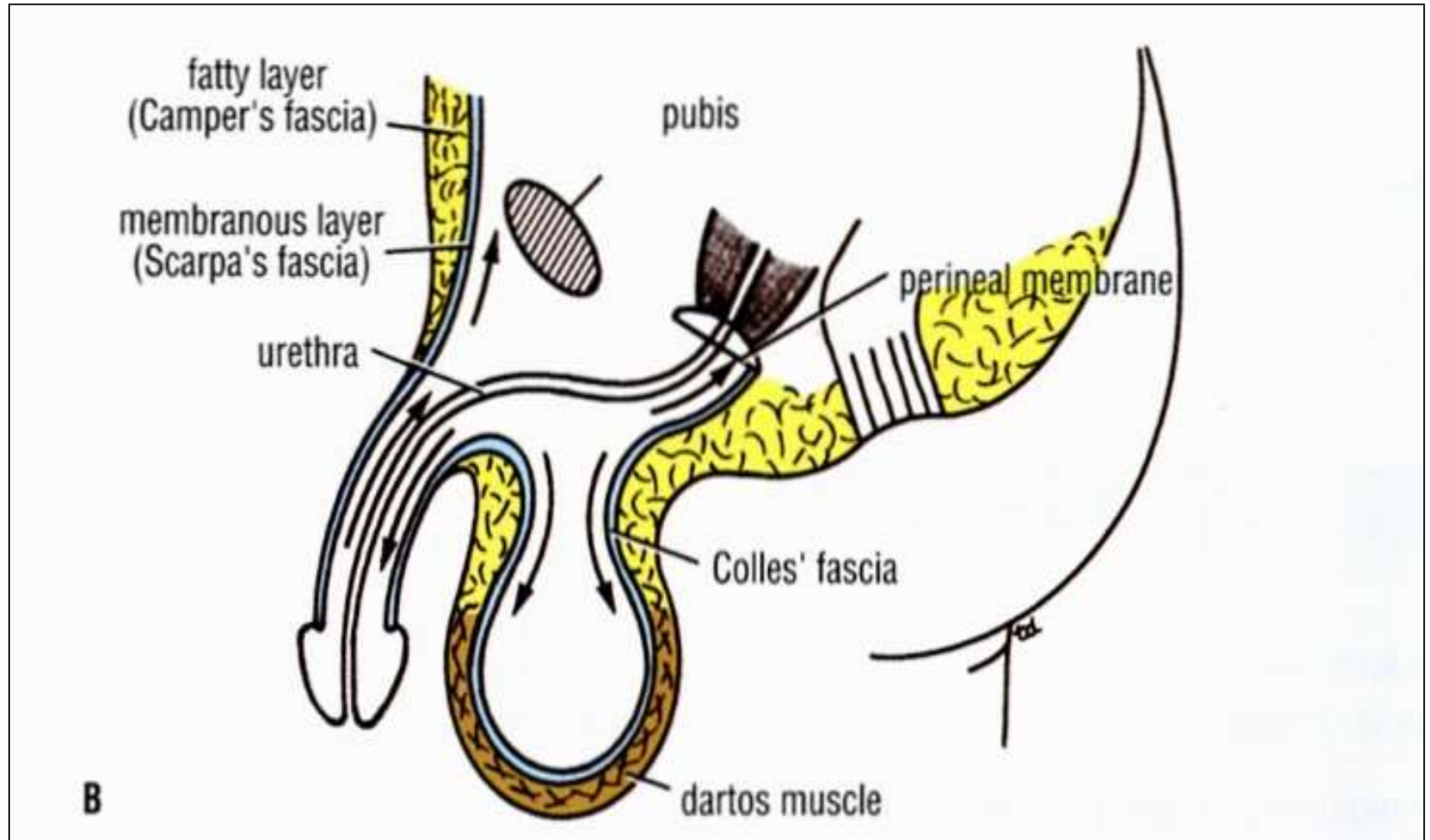


Protuberant

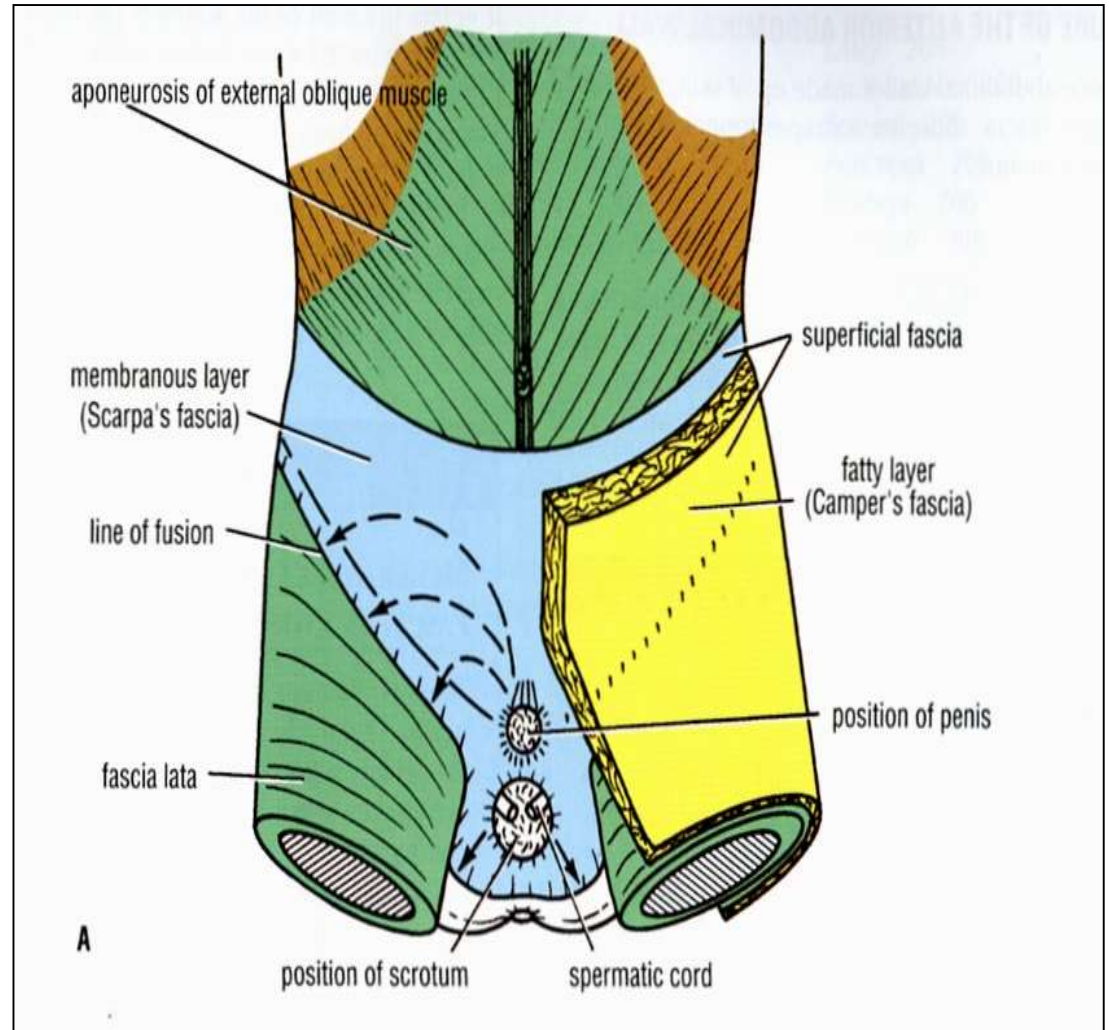
CLINICAL SIGNIFICANCE OF MEMBRANOUS LAYER OF SUPERFICIAL FASCIA

- It is important clinically because beneath it is a potential closed space that does not open into the thigh but is continuous with the superficial perineal pouch via the penis and scrotum.
- Rupture of the penile urethra may be followed by extravasations of urine into the Scrotum, Perineum and Penis and then up into the lower part of the anterior abdominal wall deep to the membranous layer of fascia.

MEMBRANOUS LAYER OF SUPERFICIAL FASCIA AND THE EXTRAVASATION OF URINE



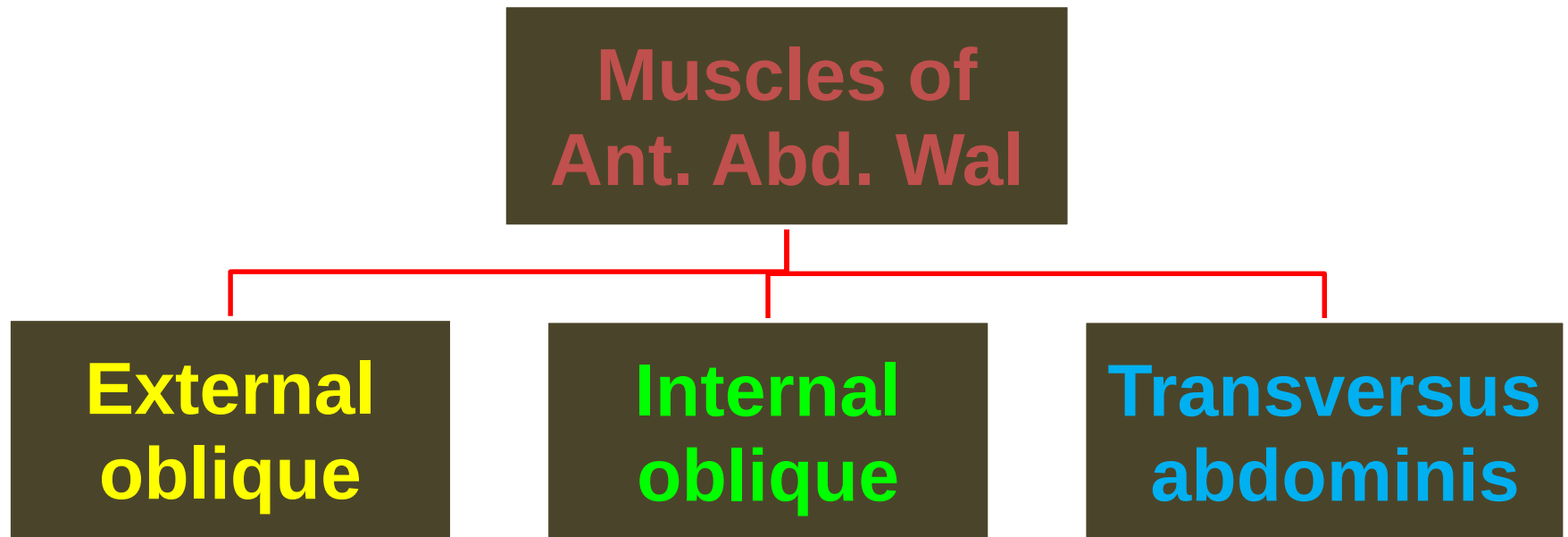
- The urine is excluded from the thigh because of the attachment of the fascia to the fascia lata.



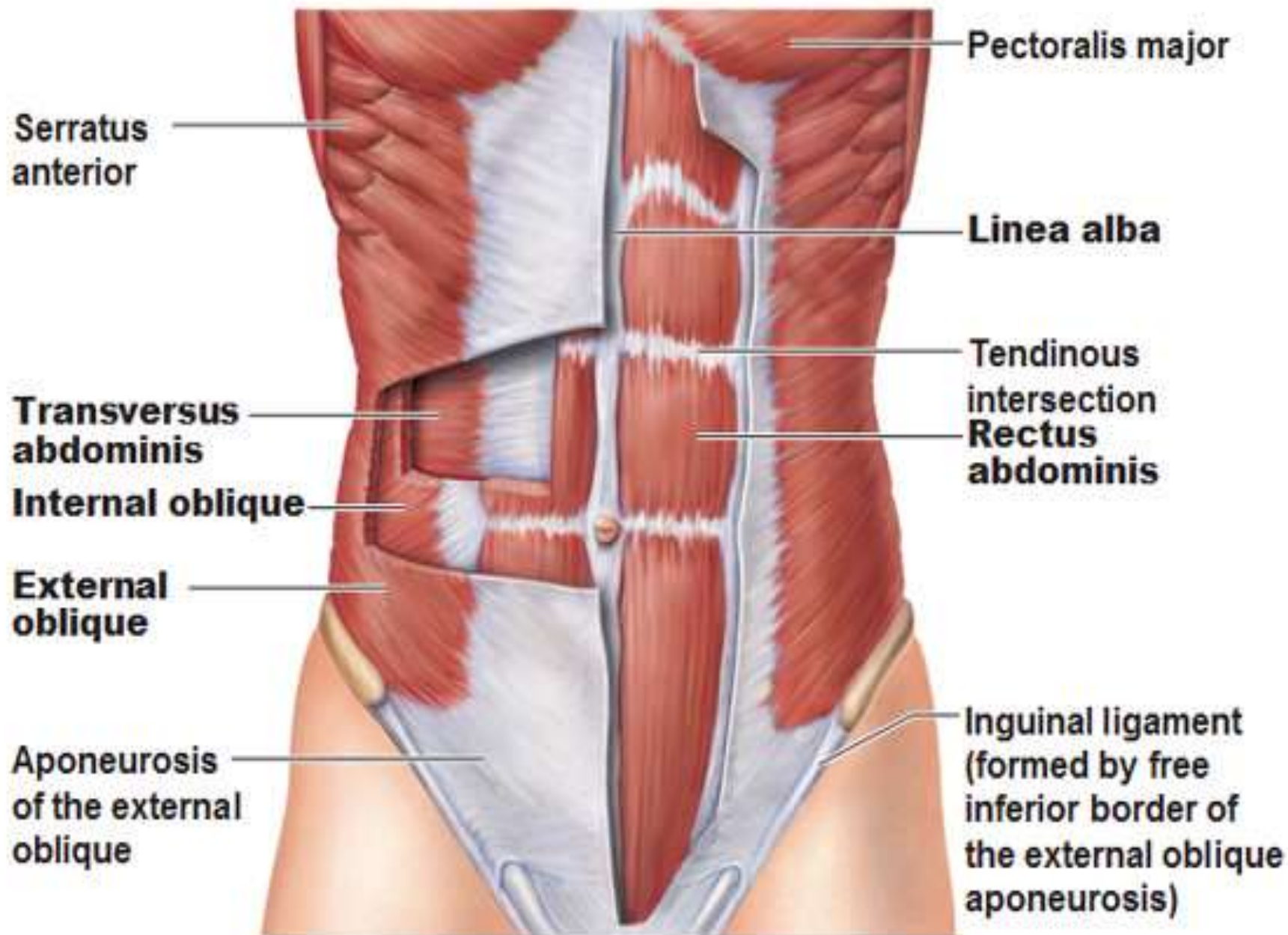
Deep Fascia (NO deep Fascia??)

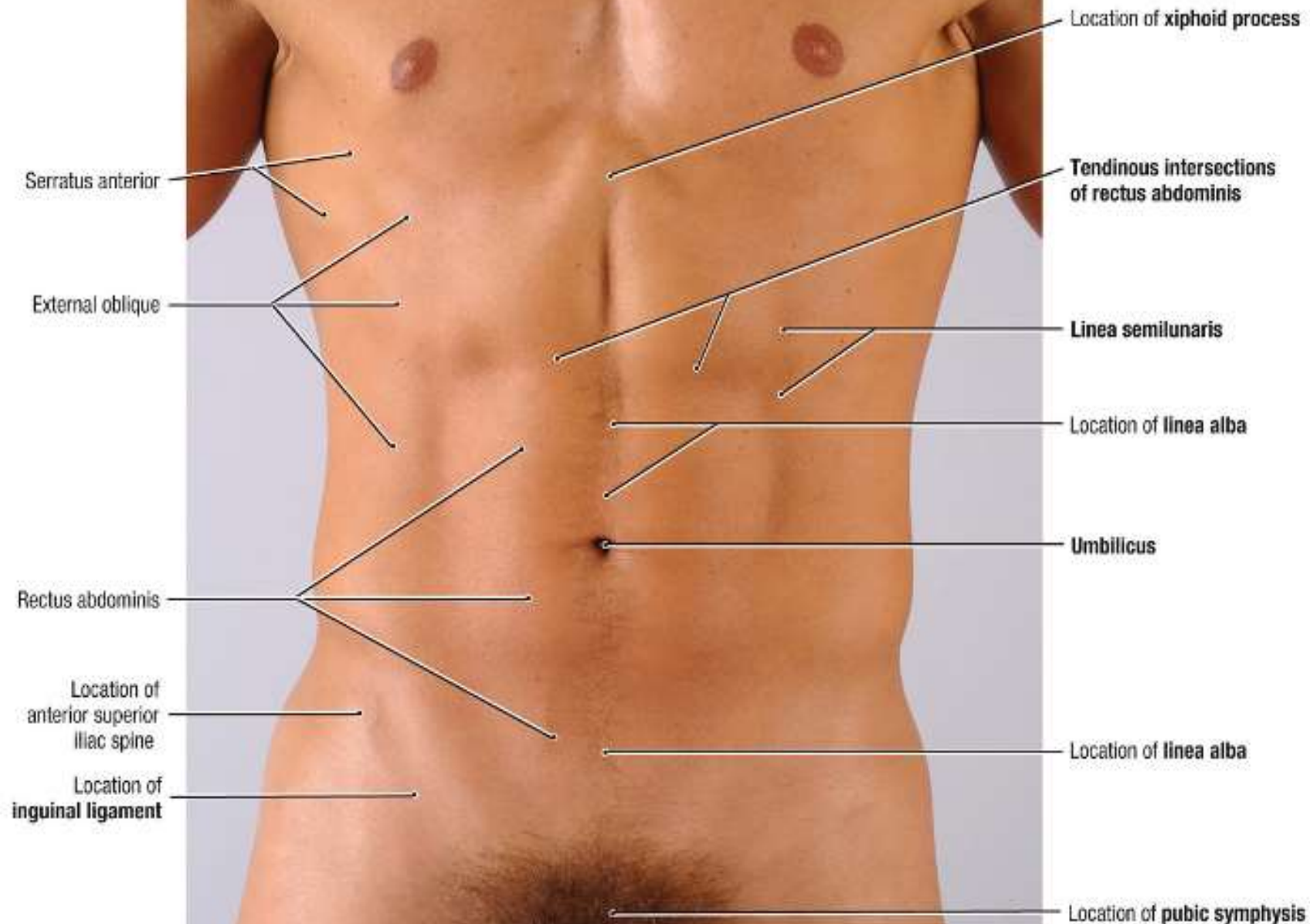
- The deep fascia in the anterior abdominal wall is merely a thin layer of connective tissue covering the muscles; it lies immediately deep to the membranous layer of superficial fascia .

Muscles of Anterior Abdominal Wall



In addition to the Rectus Abdominis in the midline a small muscle called Pyramidalis

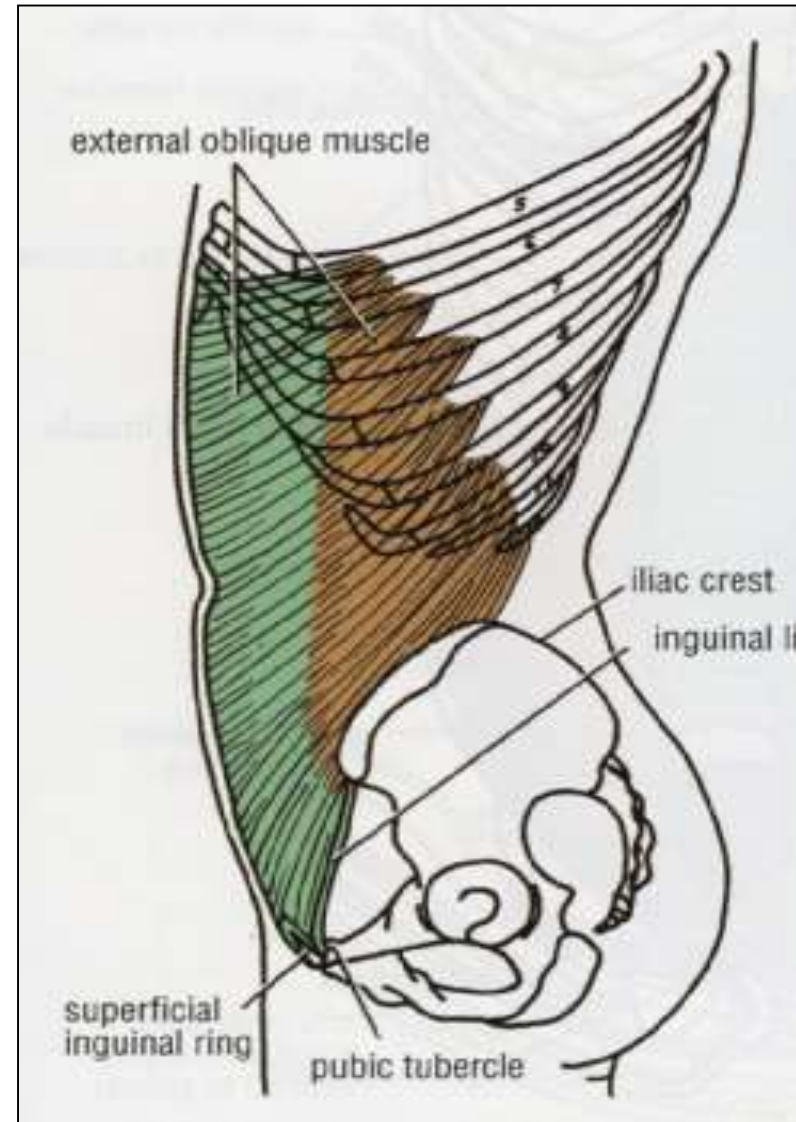




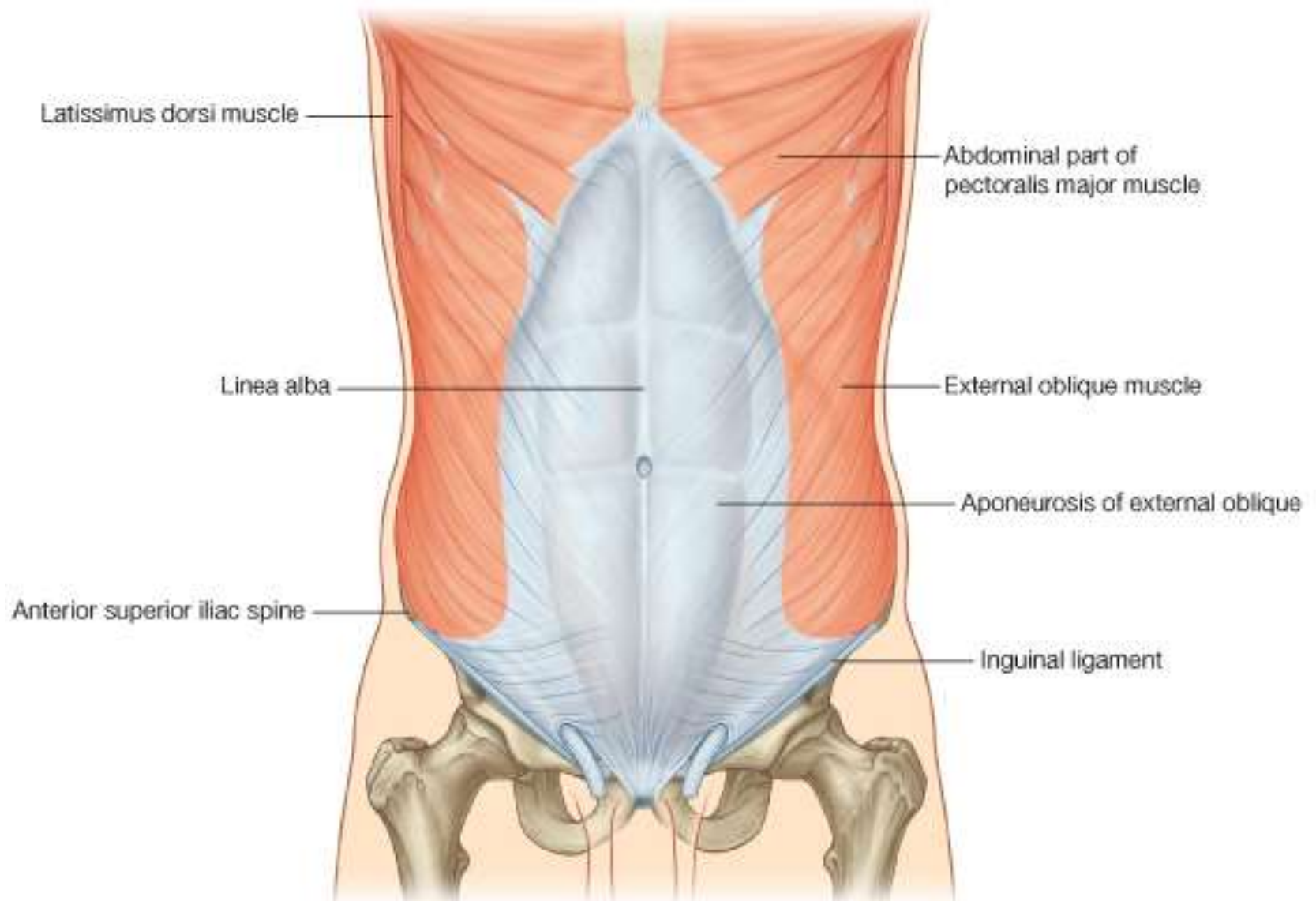
Anterior View

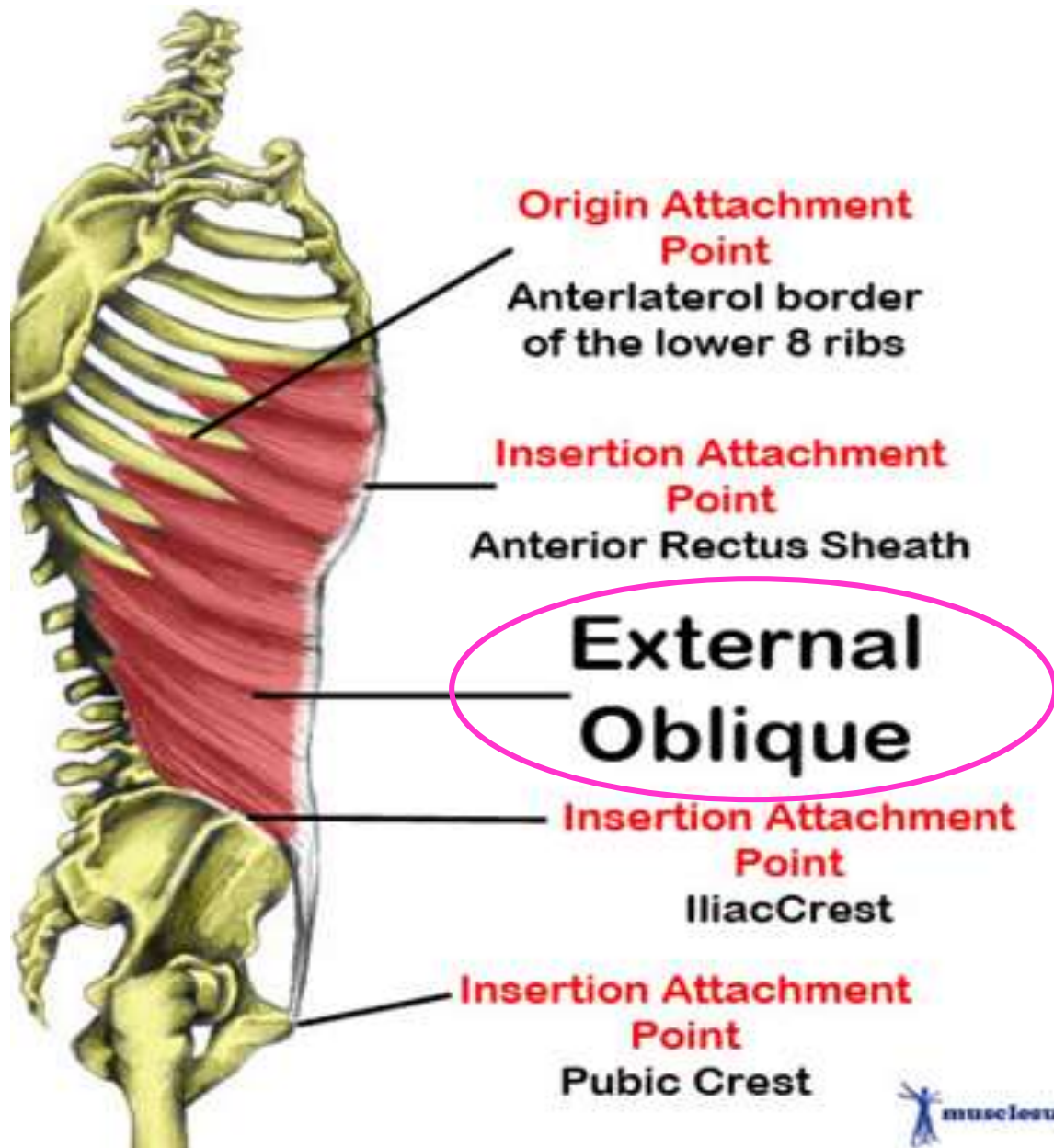
External Oblique

- Is a broad, thin, muscular sheet.
- Origin : From the outer surfaces of the lower eight ribs by 8 Fleshy Digitations.
- Fibers runs Downward, Forwards and Medially.
- Inserted: by a broad aponeurosis into the:
 - Xiphoid process.
 - Linea alba.
 - Pubic crest.
 - Pubic tubercle.
 - ASIS.
 - Anterior half of the iliac crest (Fleshy).



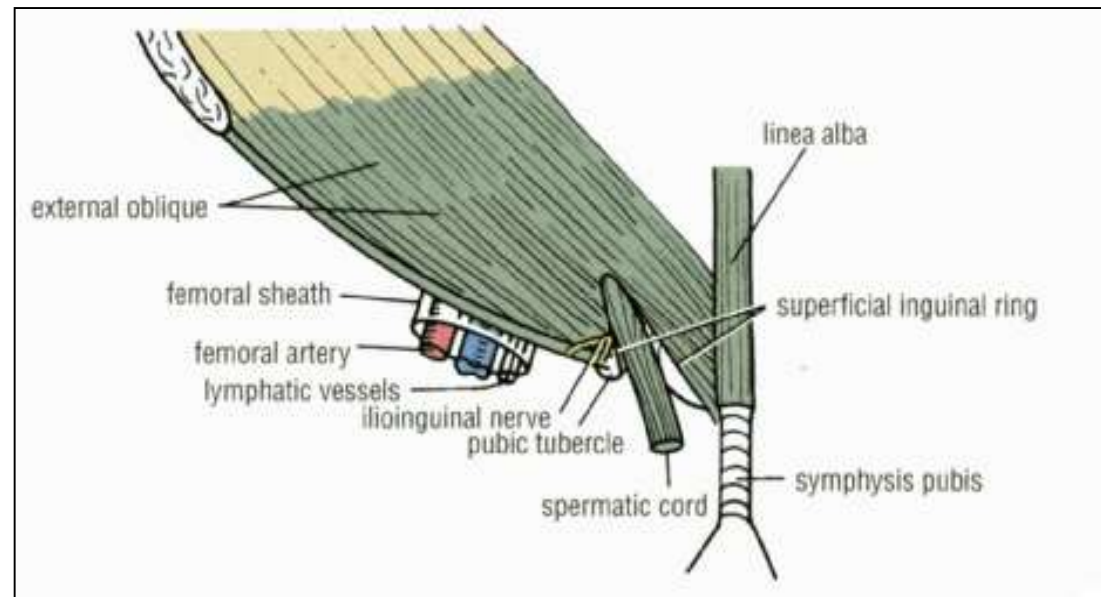
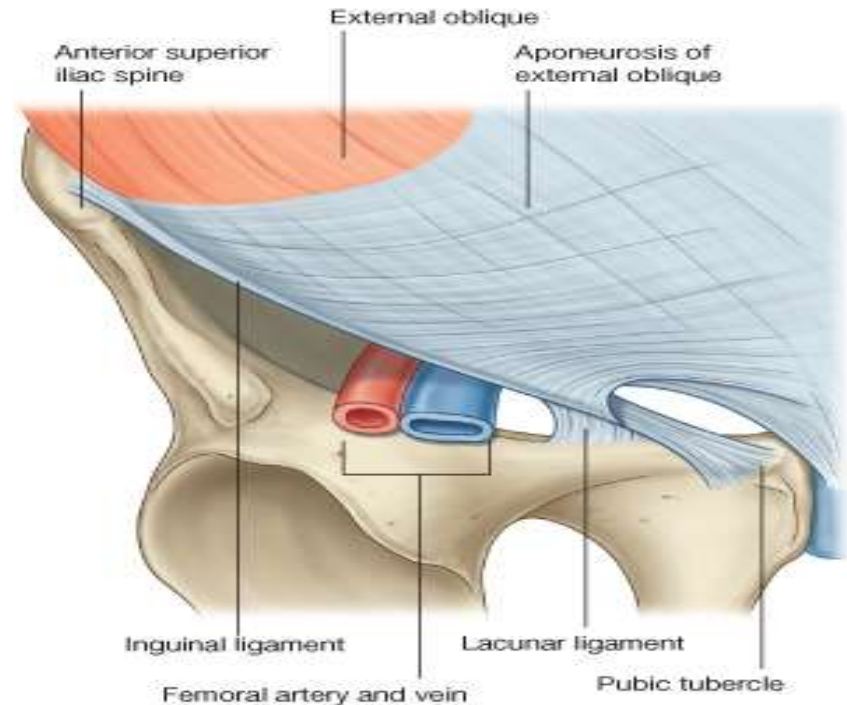
External Oblique

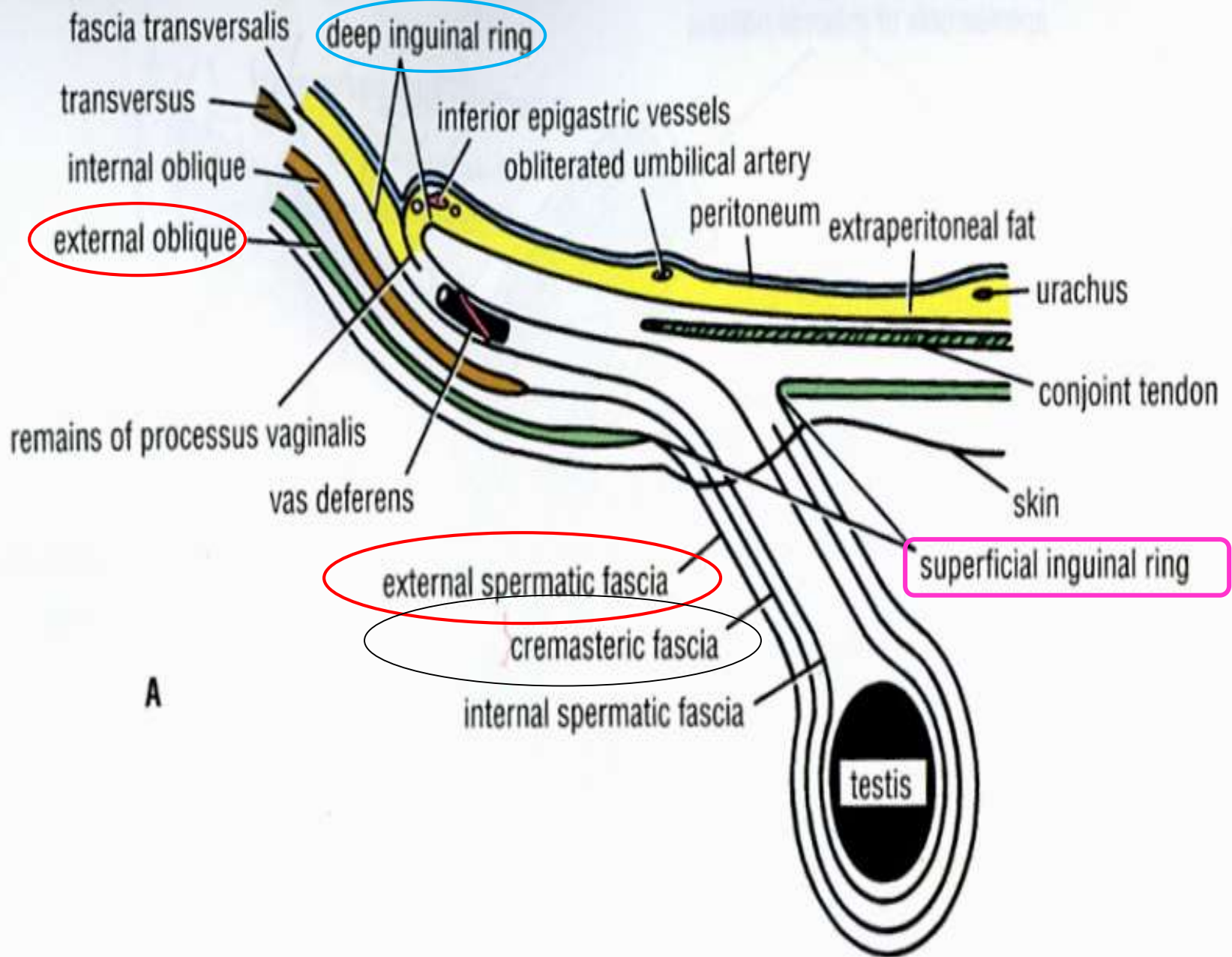




Superficial (External) Inguinal Ring :

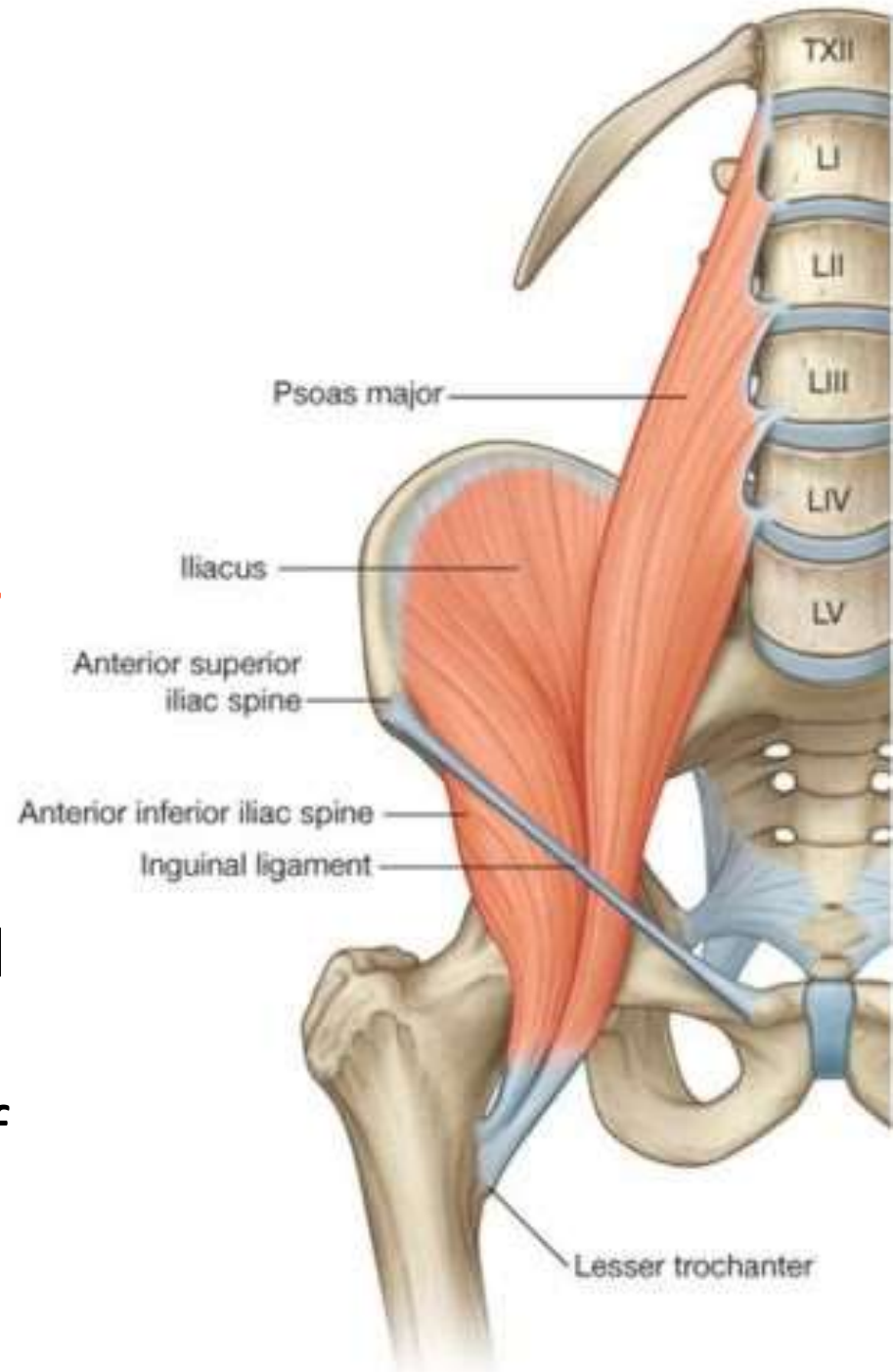
- is a Triangular shaped defect in the external oblique aponeurosis lies immediately above and medial to the Pubic Tubercle.
- It transmits the Spermatic Cord (or Round ligament of the uterus) in females.

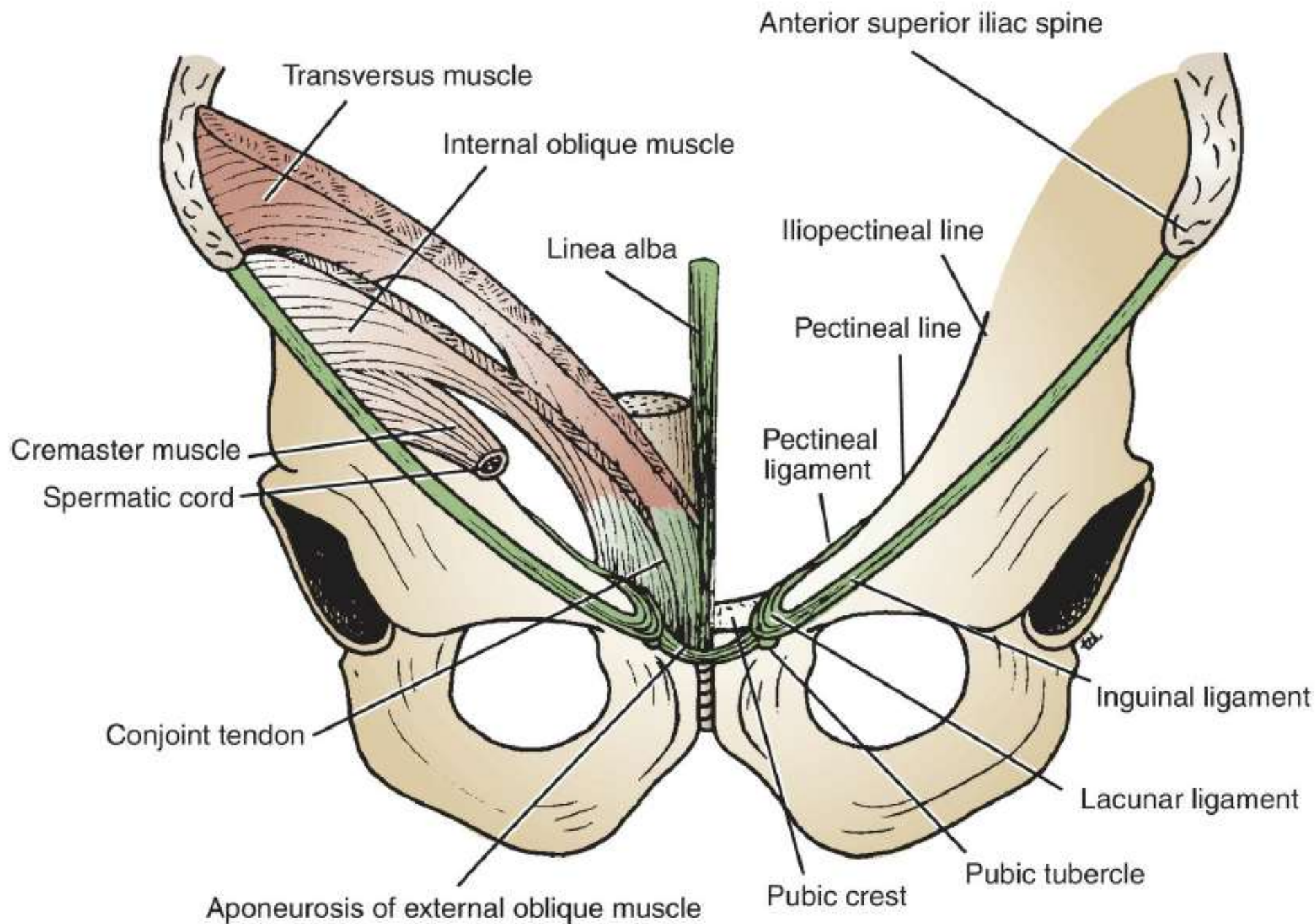




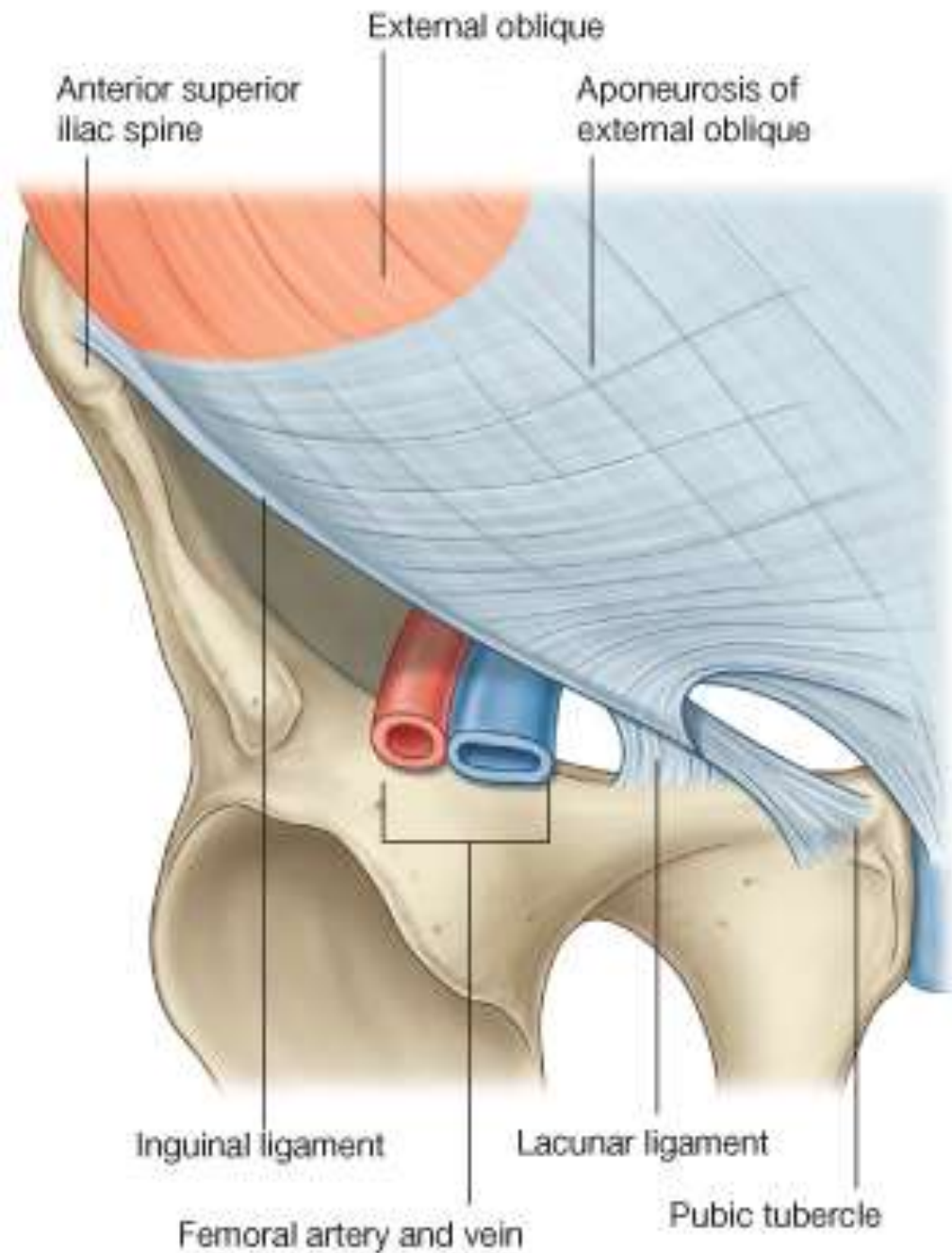
■ Between the anterior superior iliac spine and the pubic tubercle the lower border of the aponeurosis is folded backward on itself, forming Inguinal ligament

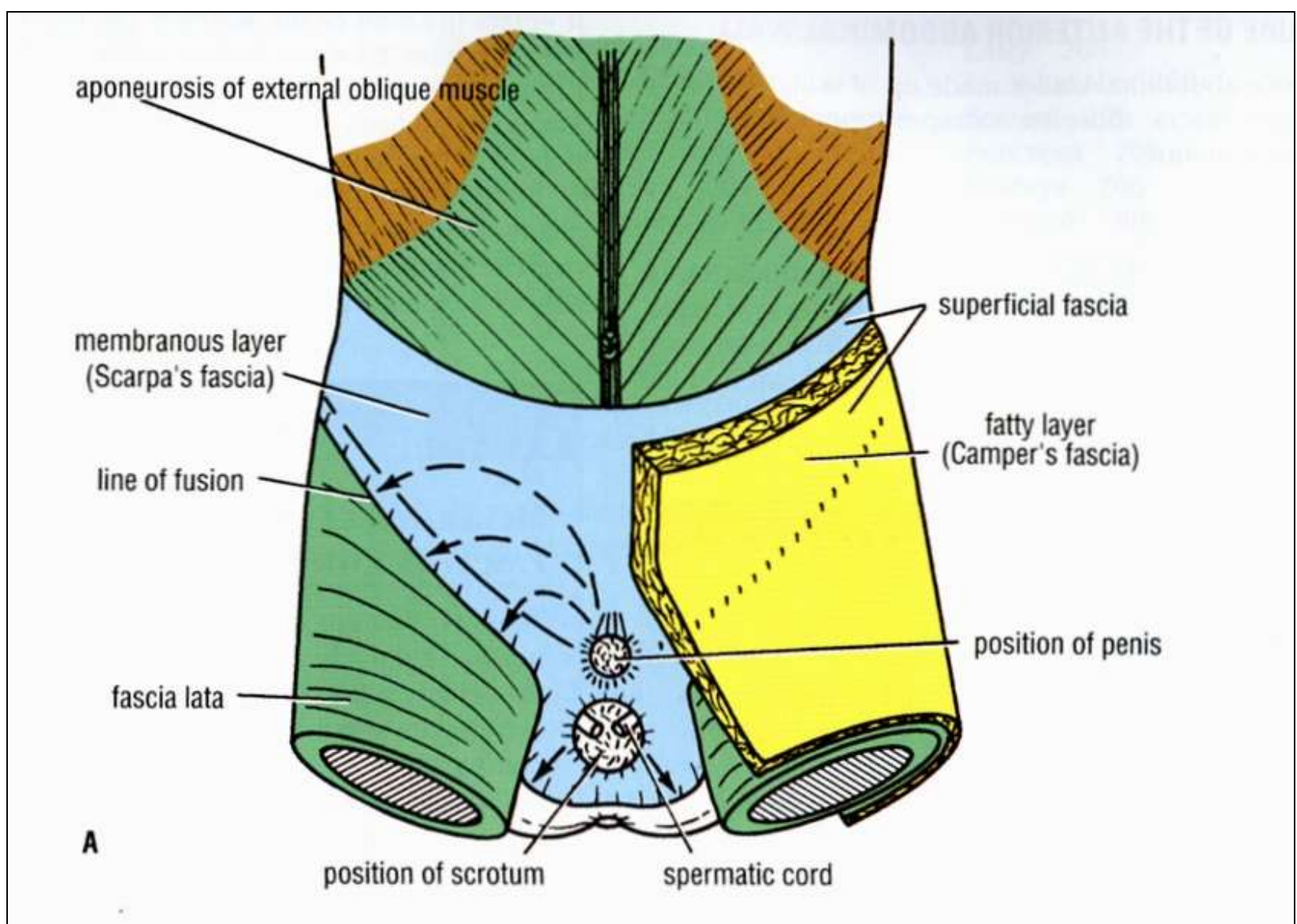
■ From the medial end of the ligament, the lacunar ligament extends backward and upward to the *pectineal line* on the superior ramus of the pubis.





- The sharp, free crescentic edge of the lacunar ligament forms the Medial Margin of the Femoral ring .
- On reaching the pectineal line, the lacunar ligament becomes continuous with a thickening of the periosteum called the pectineal ligament.

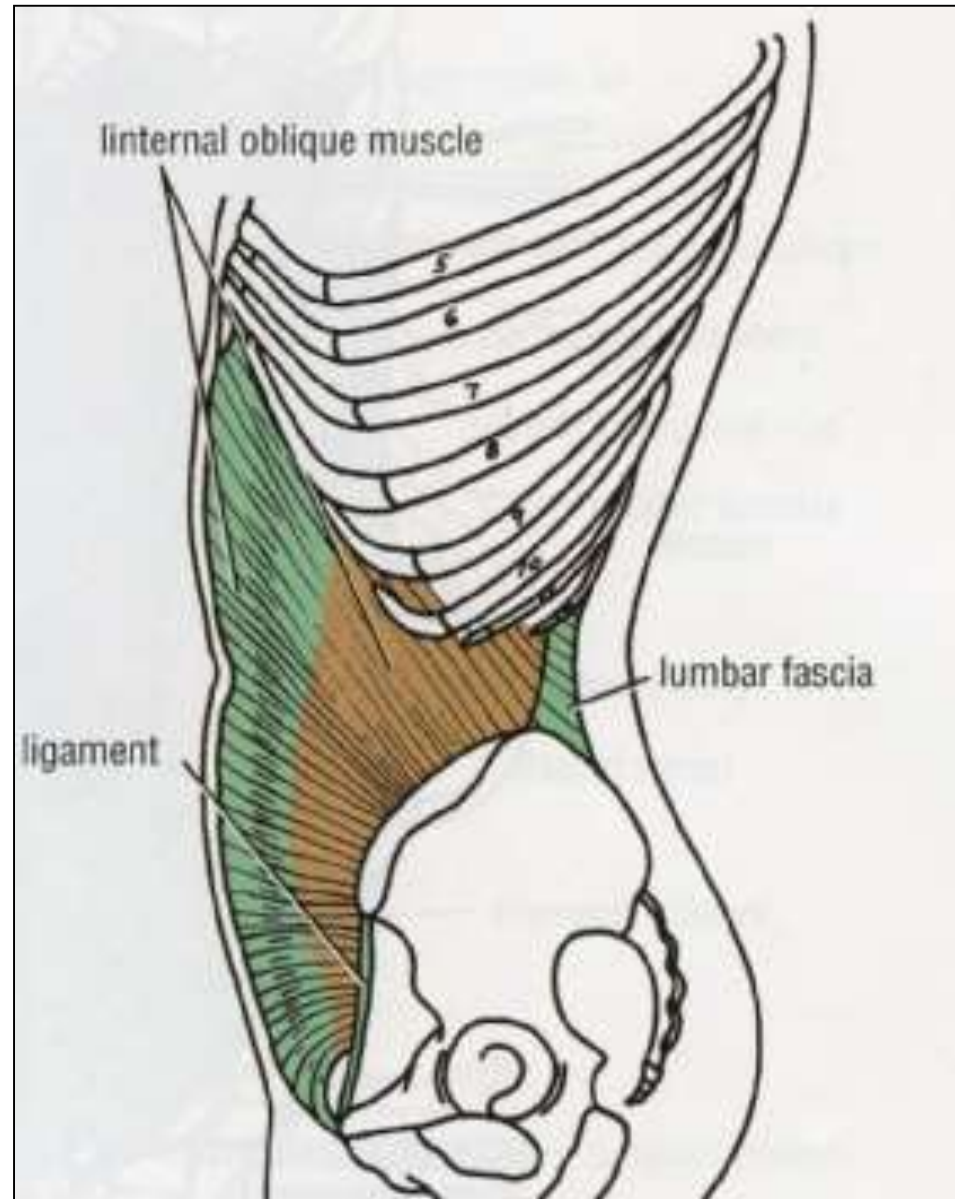




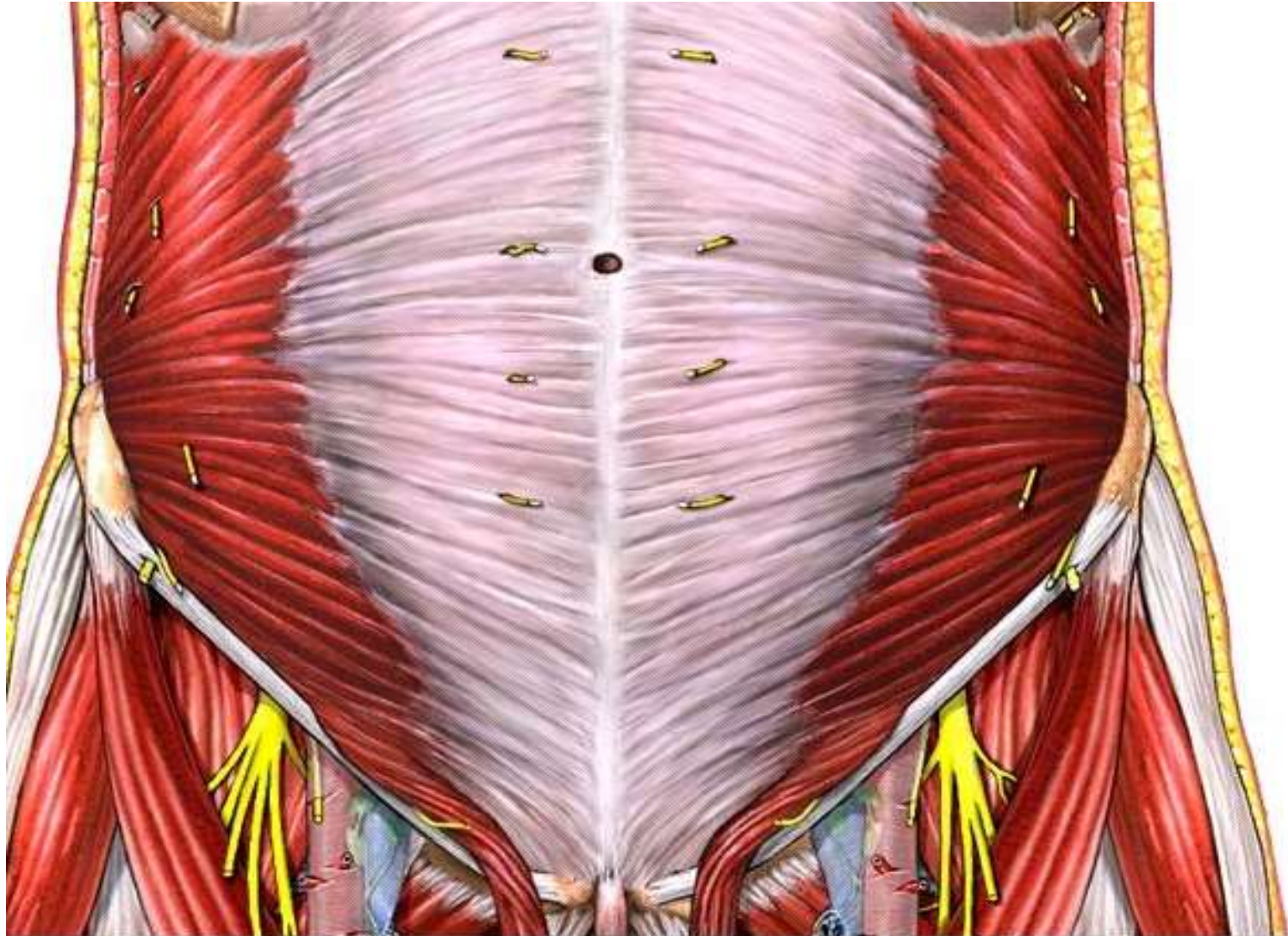
- To the inferior rounded border of the inguinal ligament is attached the deep fascia of the thigh, the Fascia Lata.

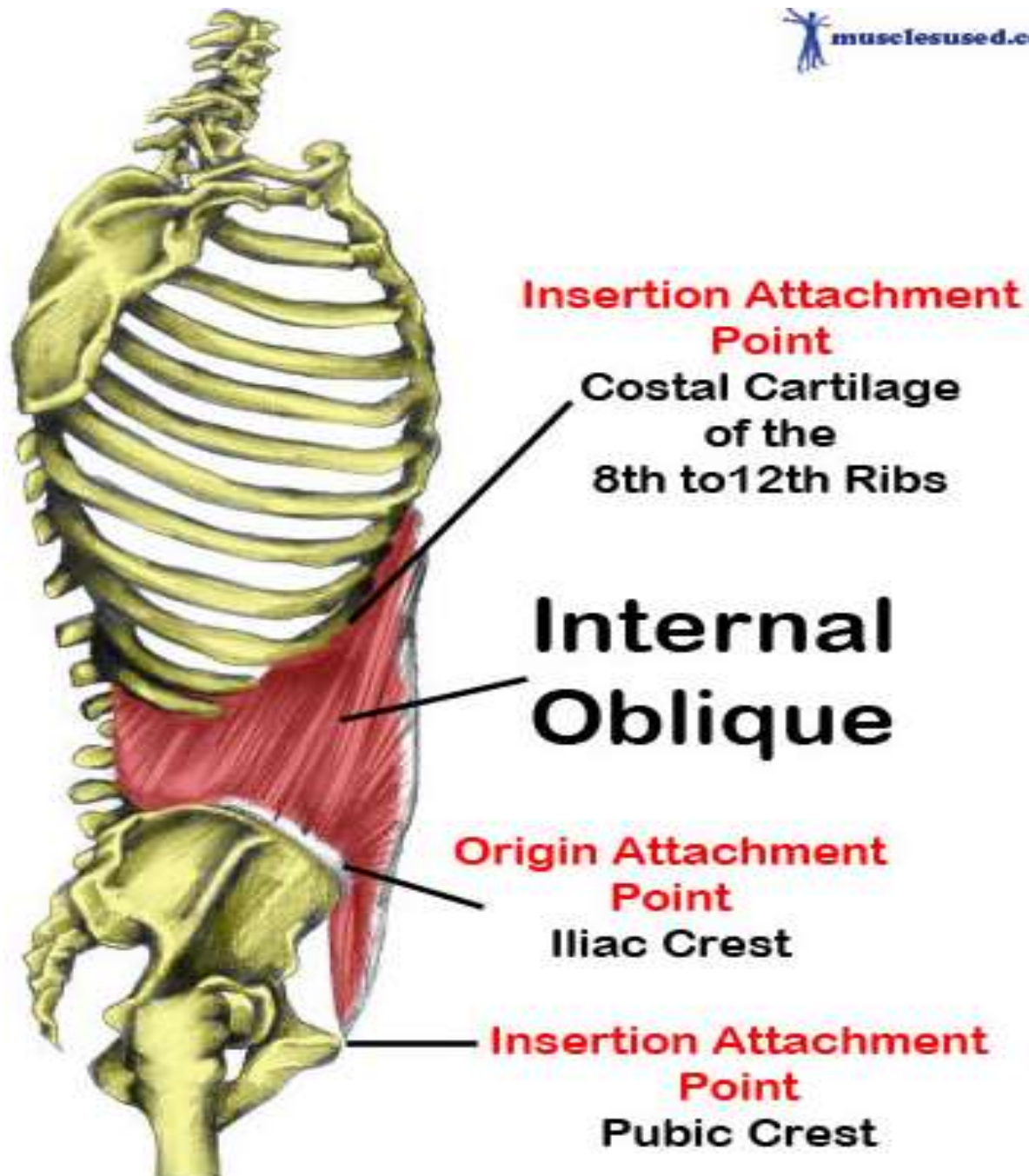
Internal Oblique muscle

- A broad, thin, muscular sheet that lies Deep to the external oblique; most of its fibers run (Upward Forward and Medially).
- It arises from:
 - Lumbar fascia.
 - Anterior 2/3 of iliac crest.
 - Lateral 2/3 of inguinal ligament.



Internal Oblique muscle

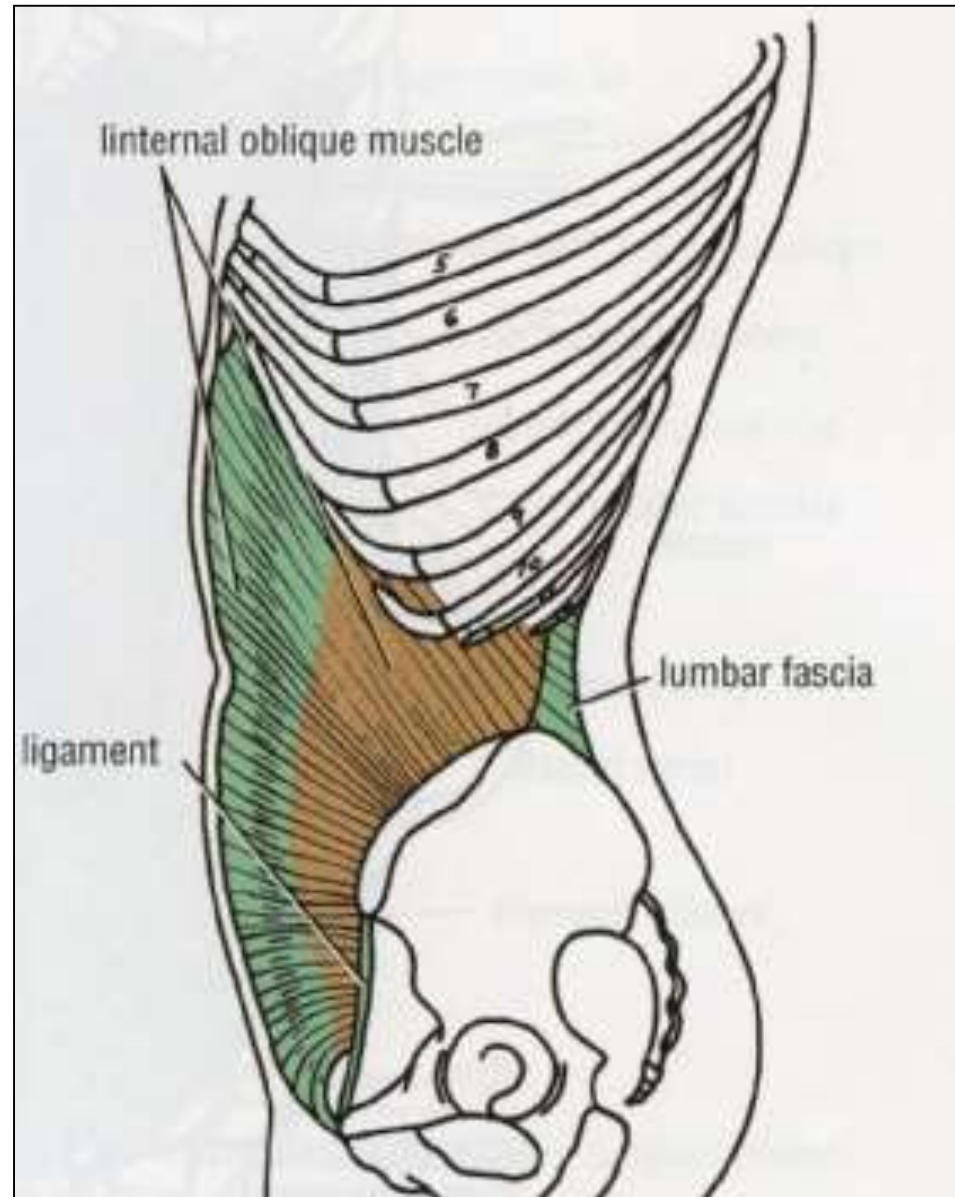


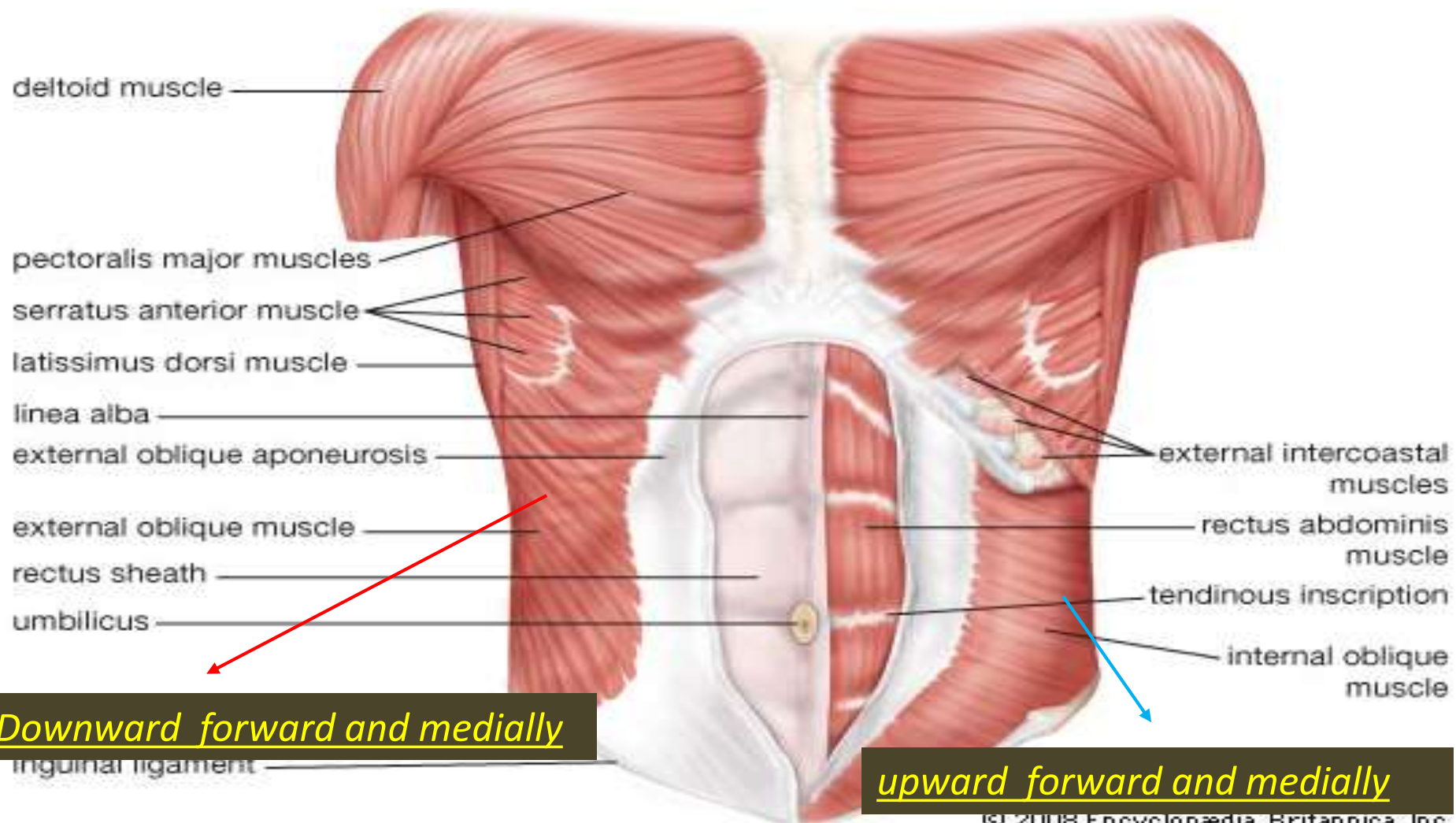


Internal Oblique muscle

The muscle is Inserted into:

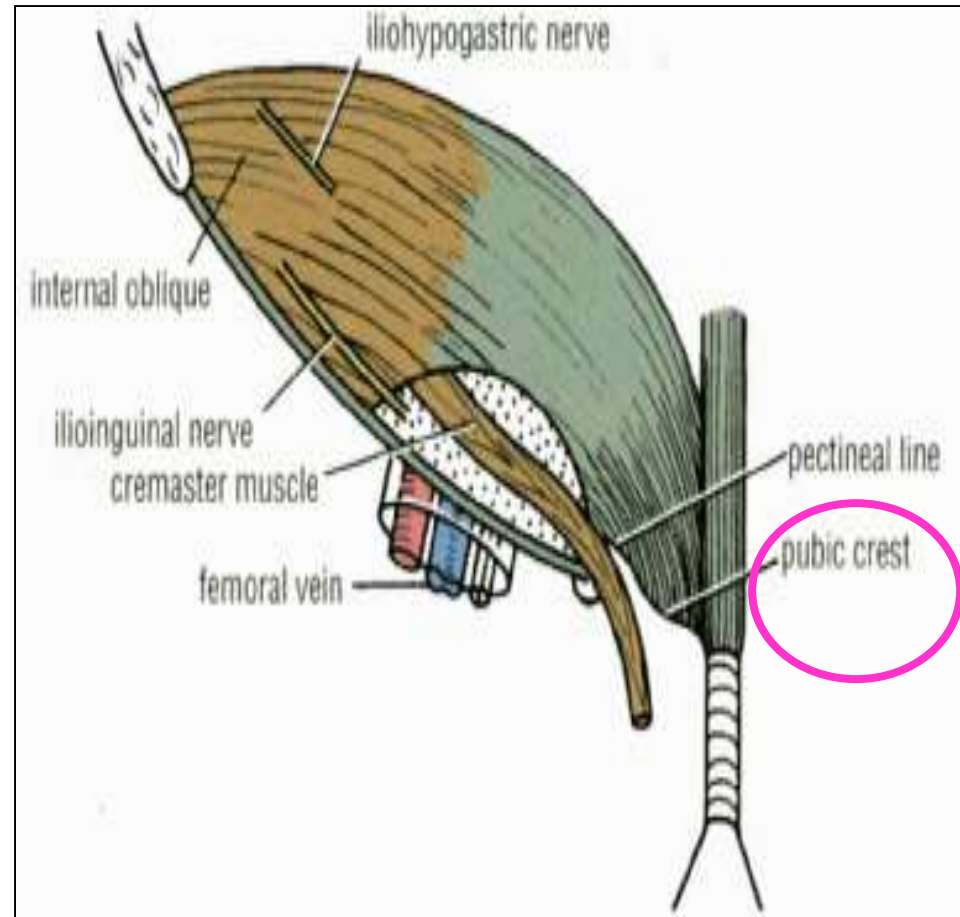
- Lower border of the lower 3 - 4 ribs (Fleshy fibers)
- Xiphoid process
- Linea alba
- Symphysis pubis.





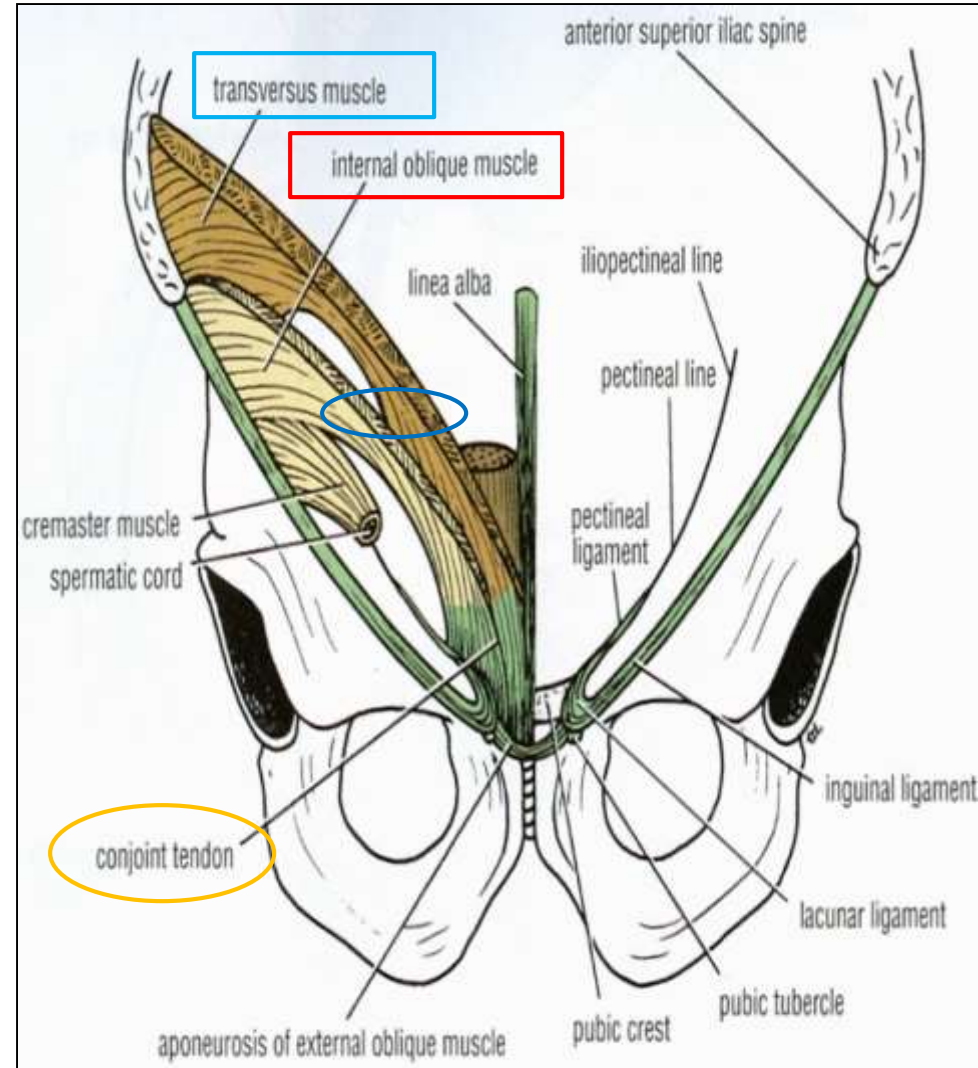
Internal Oblique muscle

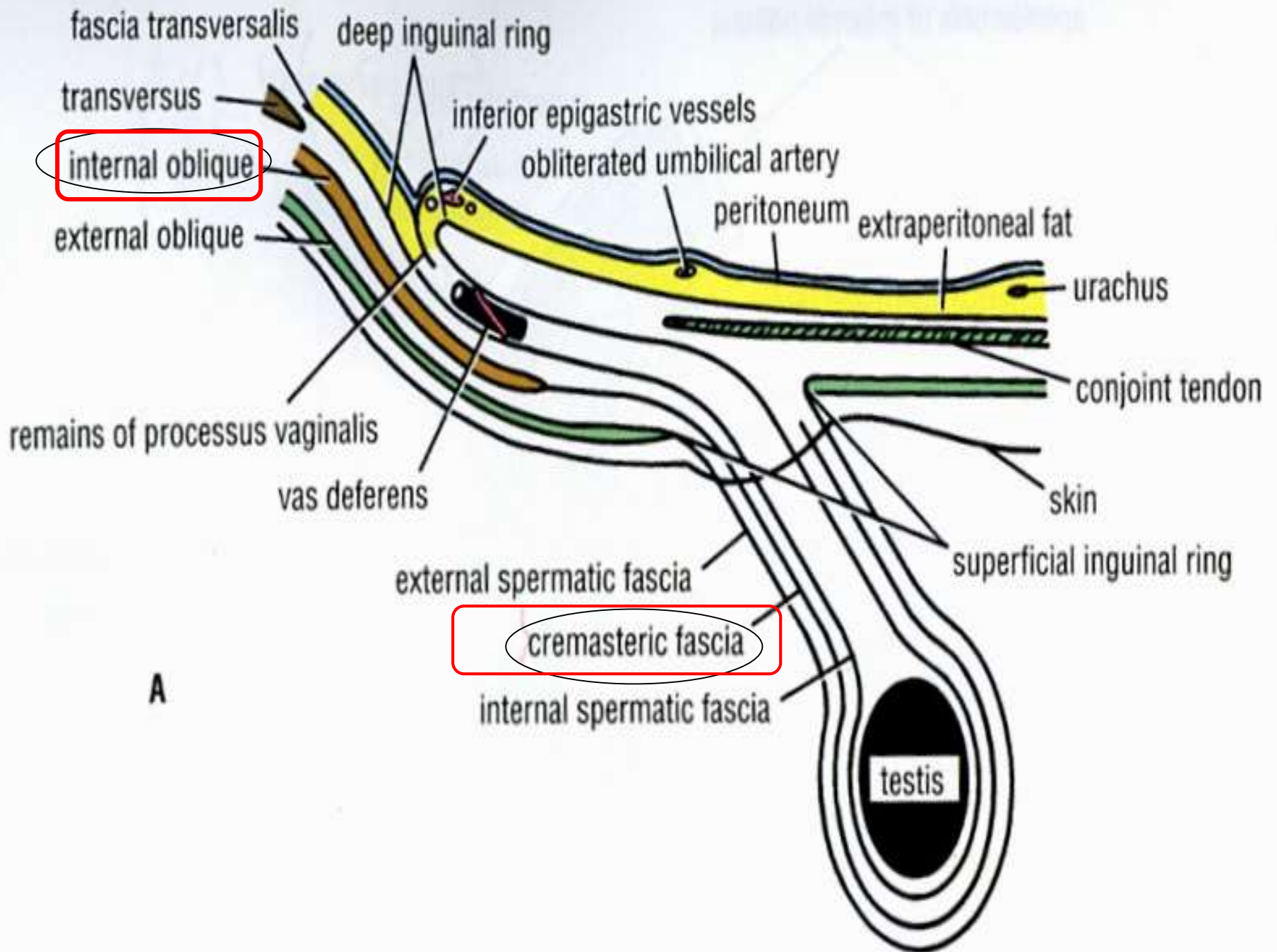
■ It has a lower free border that arches over (Roof) the spermatic cord (or round ligament of the uterus) and then descends behind (posterior) it to be attached to the pubic crest and the pectineal line.



■ Near their insertion, the lowest tendinous fibers are joined by similar fibers from the transversus abdominis to form the **Conjoint Tendon**.

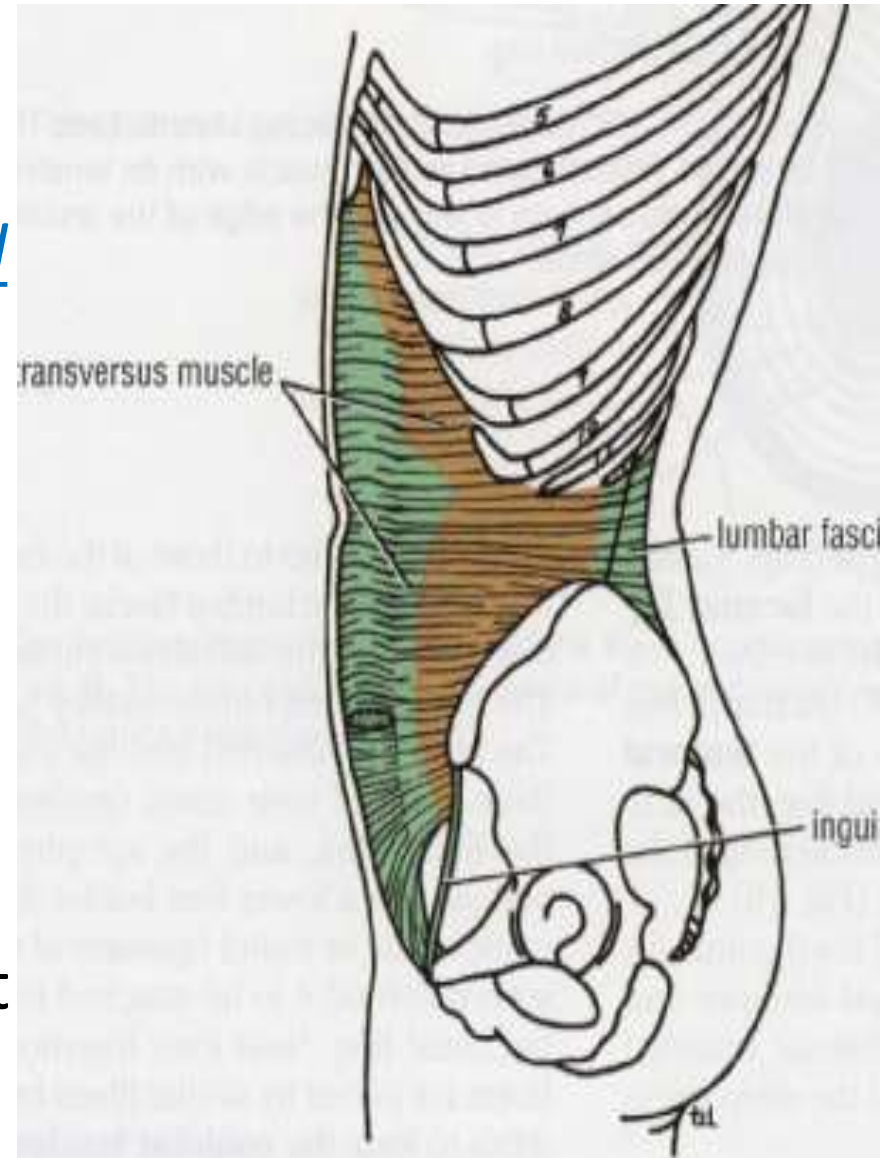
■ The conjoint tendon is attached medially to the linea alba, but it has a lateral free border.



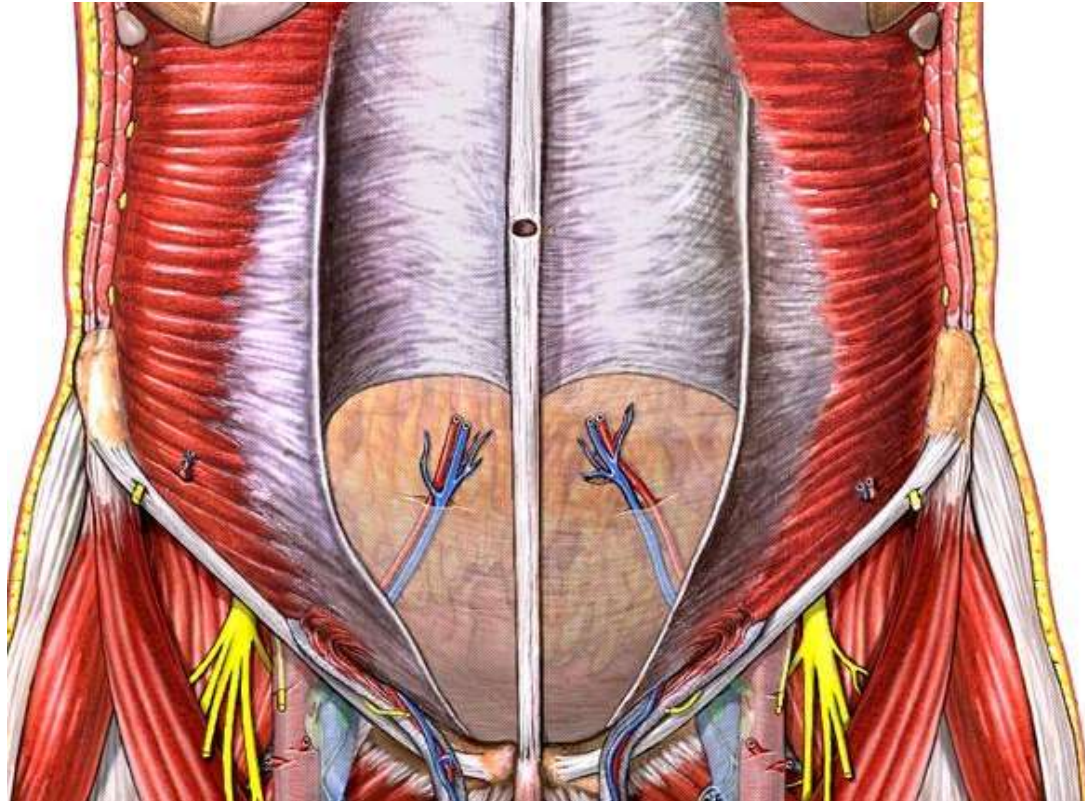


Transversus abdominis muscle

- A thin sheet of muscle that lies deep to internal oblique, & its fibers run Horizontally Forward
- It Arises from:
 - ✓ Deep surface of lower 6 costal cartilages (interdigitating with the Diaphragm).
 - ✓ Lumbar fascia.
 - ✓ Anterior 2/3 of iliac crest.
 - ✓ Lateral 1/3 of inguinal ligament

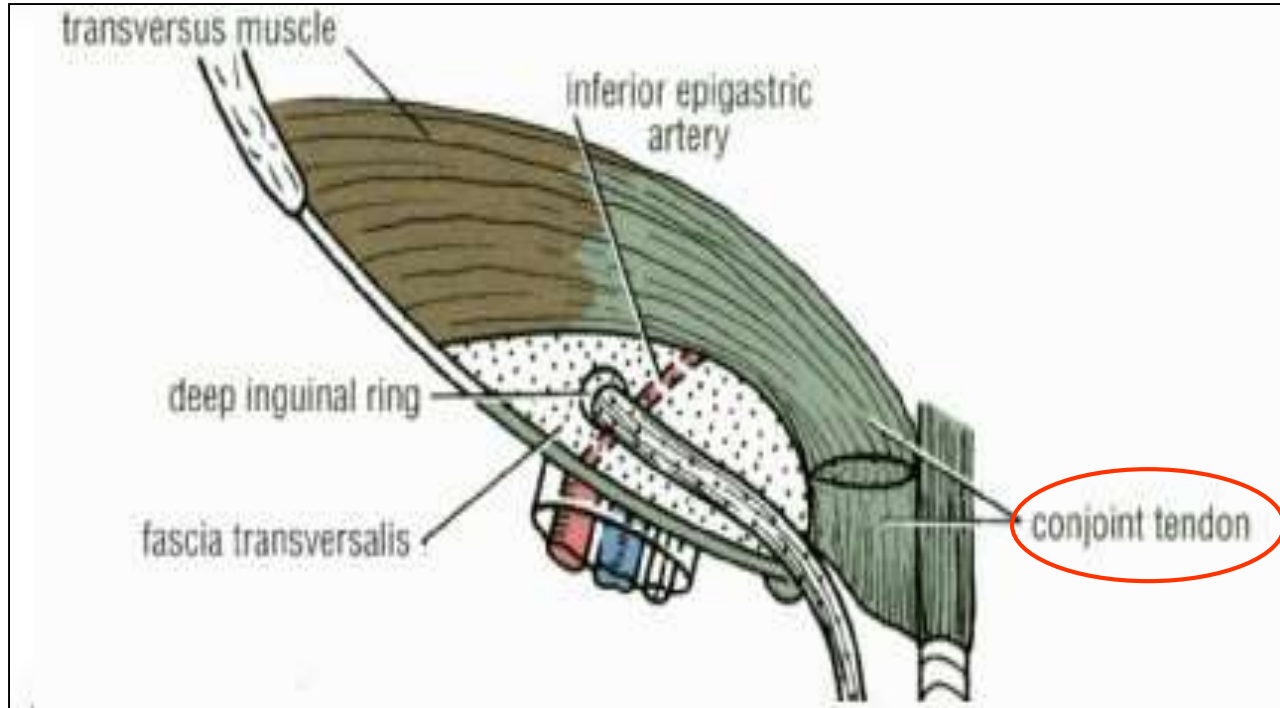


Transversus abdominis muscle

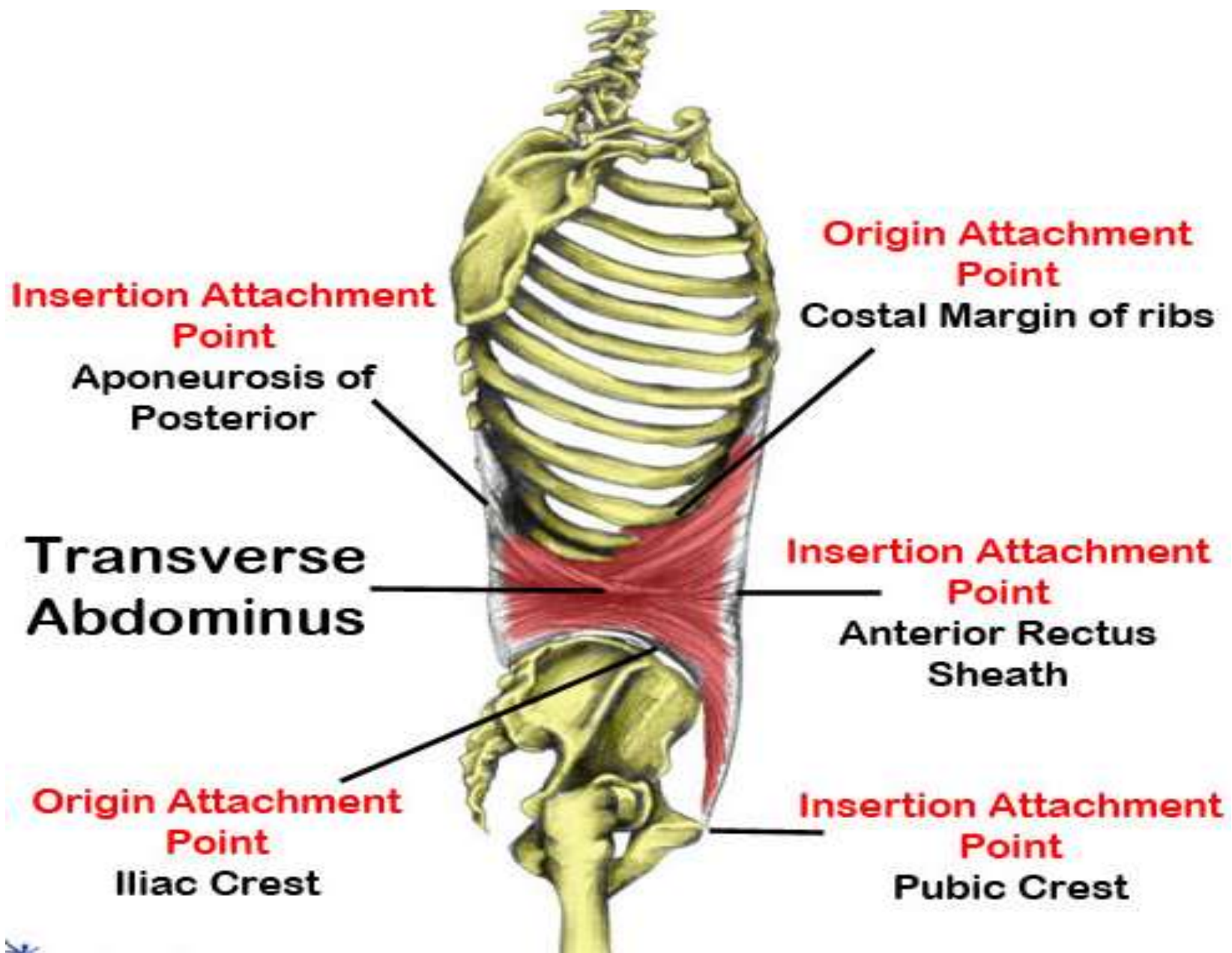


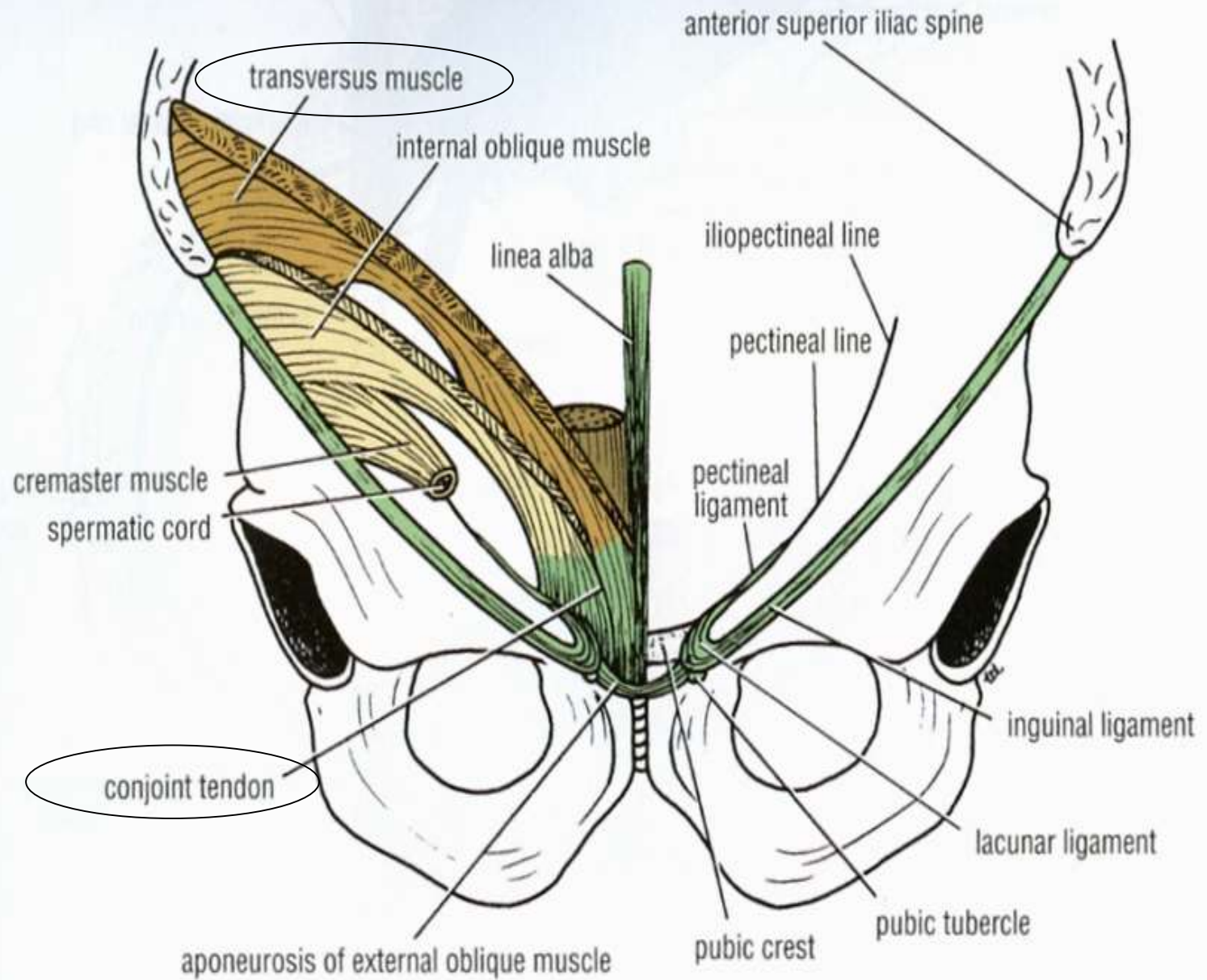
The muscle is Inserted into:
Xiphoid process , linea alba & symphysis pubis.

Transversus abdominis muscle



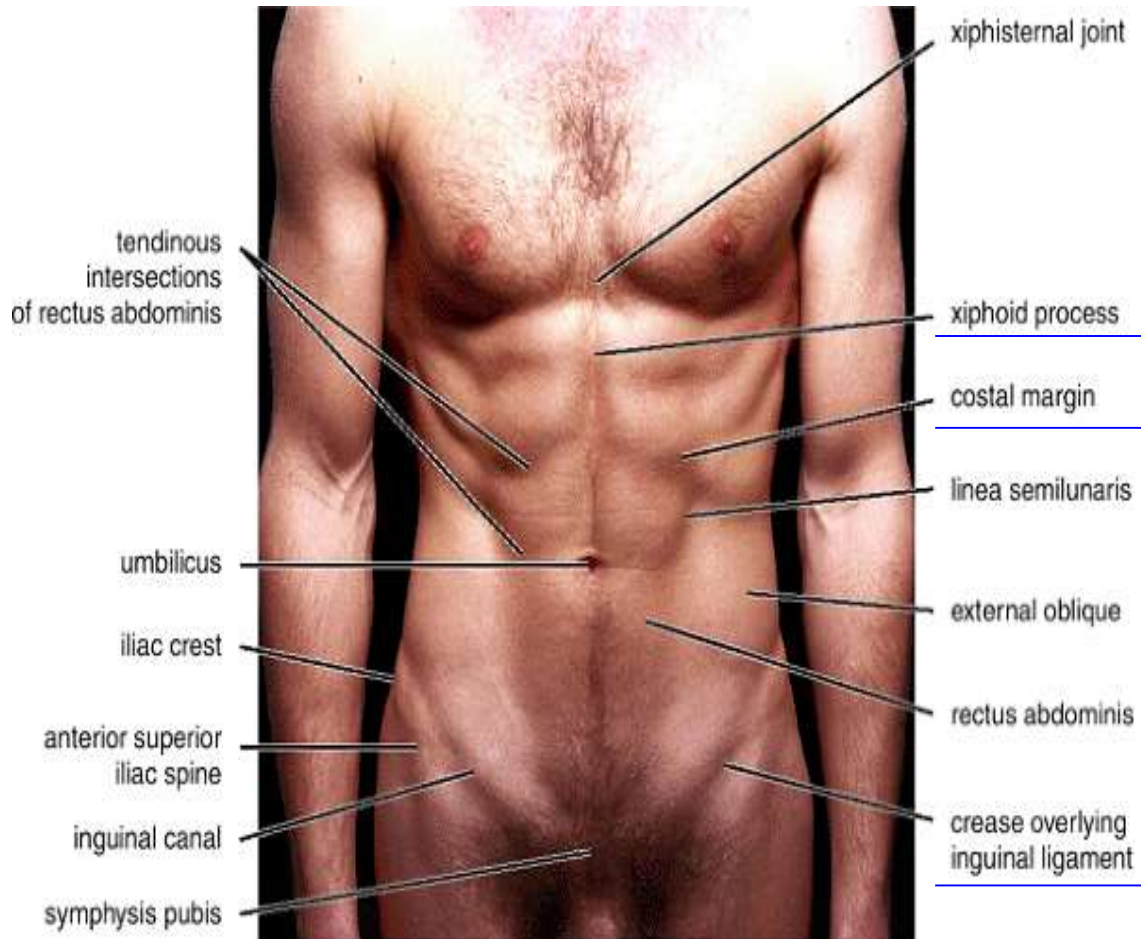
- The lowest tendinous fibers join similar fibers from the internal oblique to form the conjoint tendon, which is fixed to the pubic crest and the pectineal line.



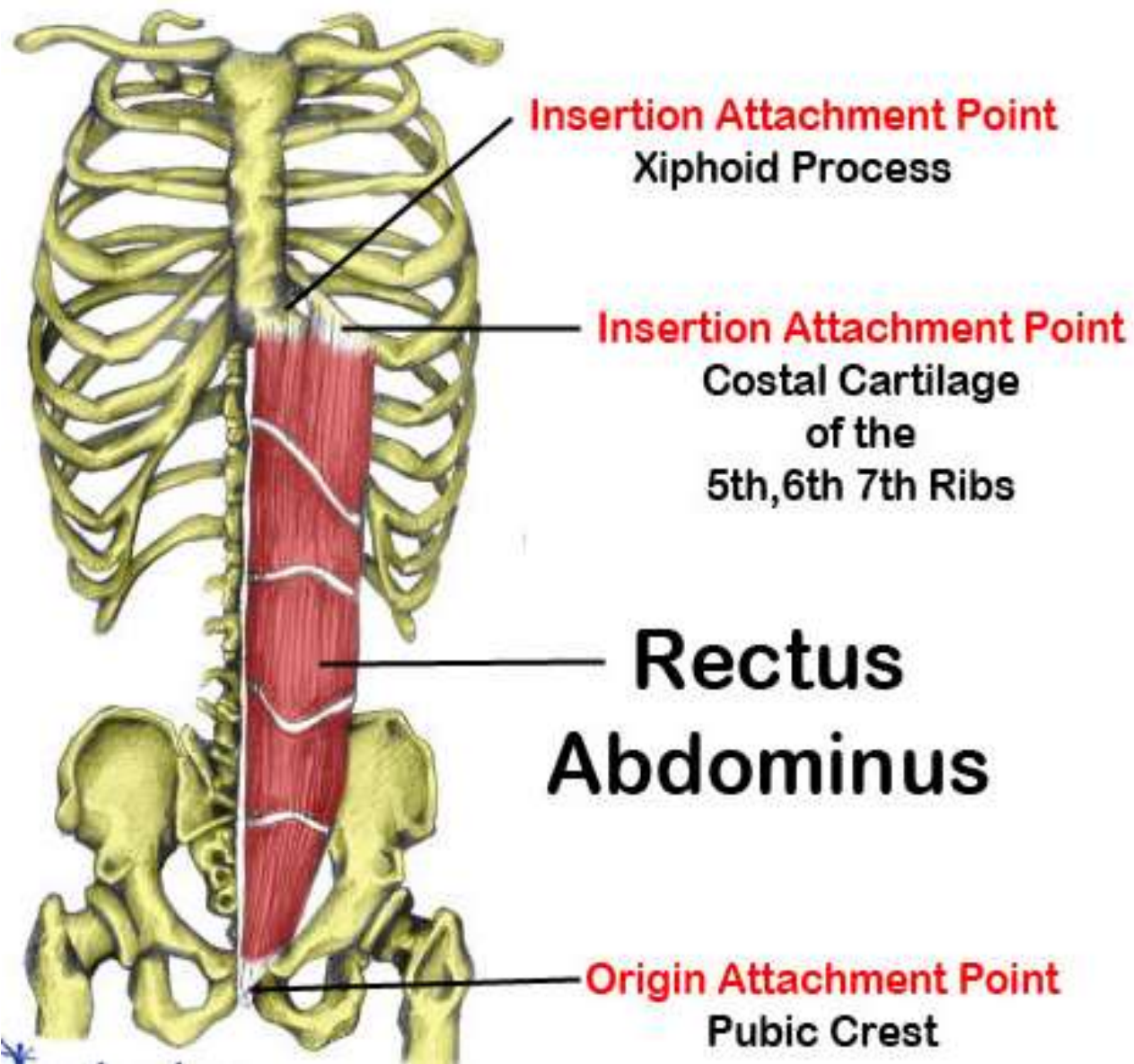


Rectus abdominis muscle

- A long strap muscle that extends along the whole length of the anterior abdominal wall, it is broader above and lies close to the midline below, being separated from its fellow by linea Alba.



Rectus abdominis muscle

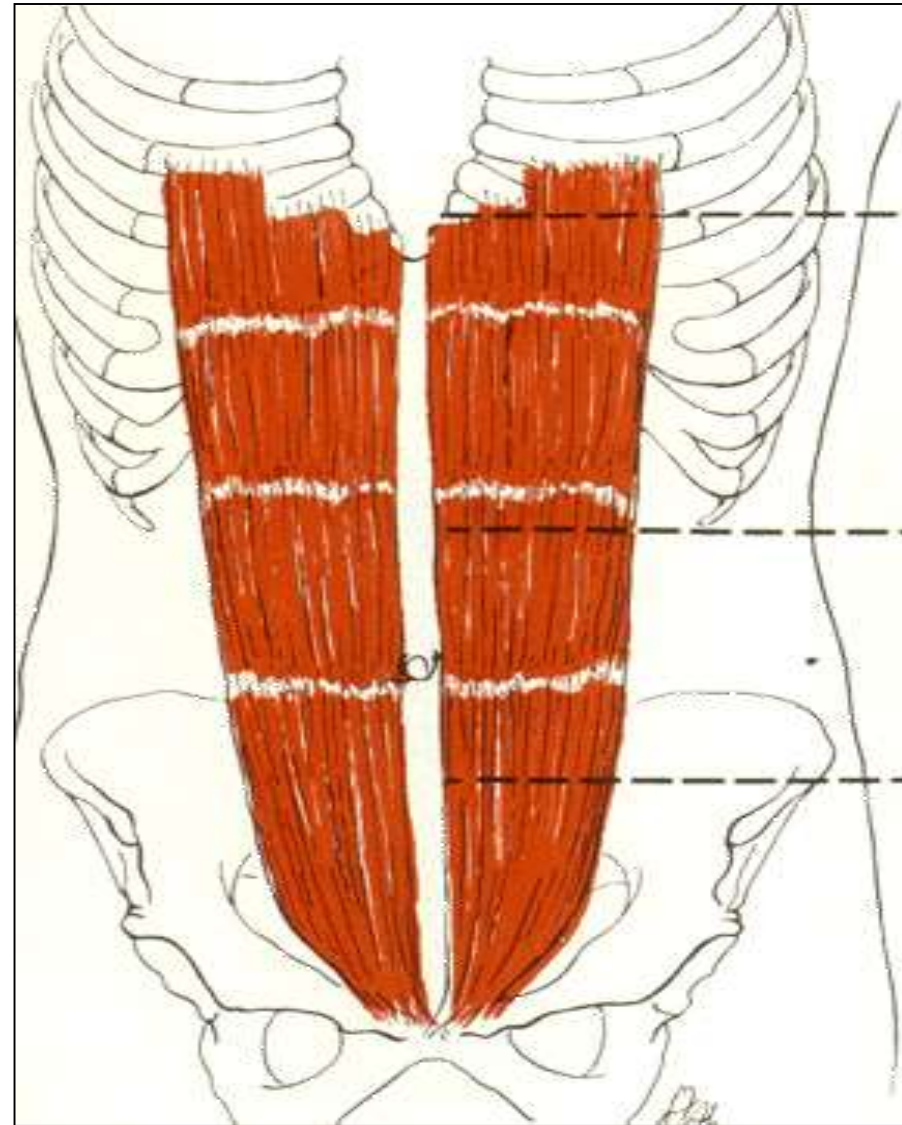


Rectus abdominis muscle

Boundaries:

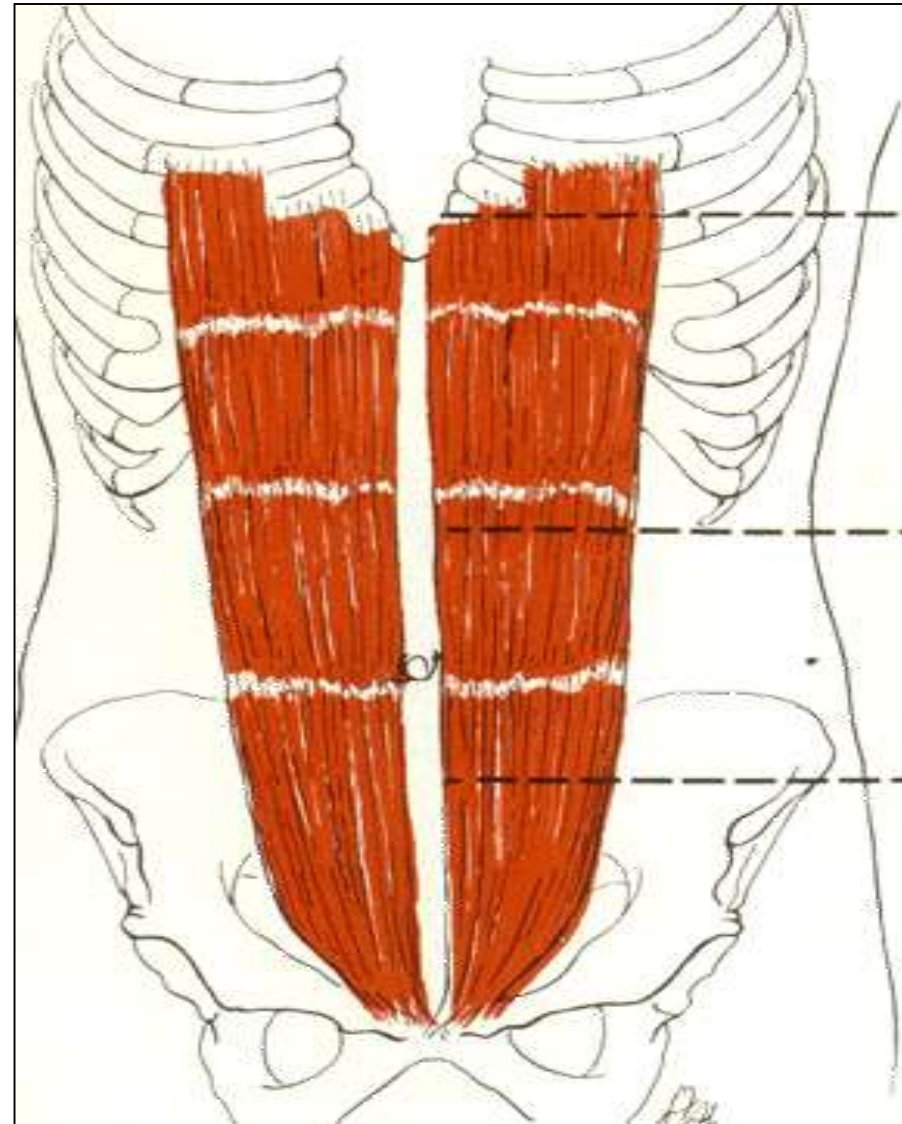
Superior: Xiphoid process & costal margin (7th-10th CC)

Inferior: Inguinal Ligament : Which is *C.T. ligament extends from anterior superior iliac spine → Pubic Tubercle.*



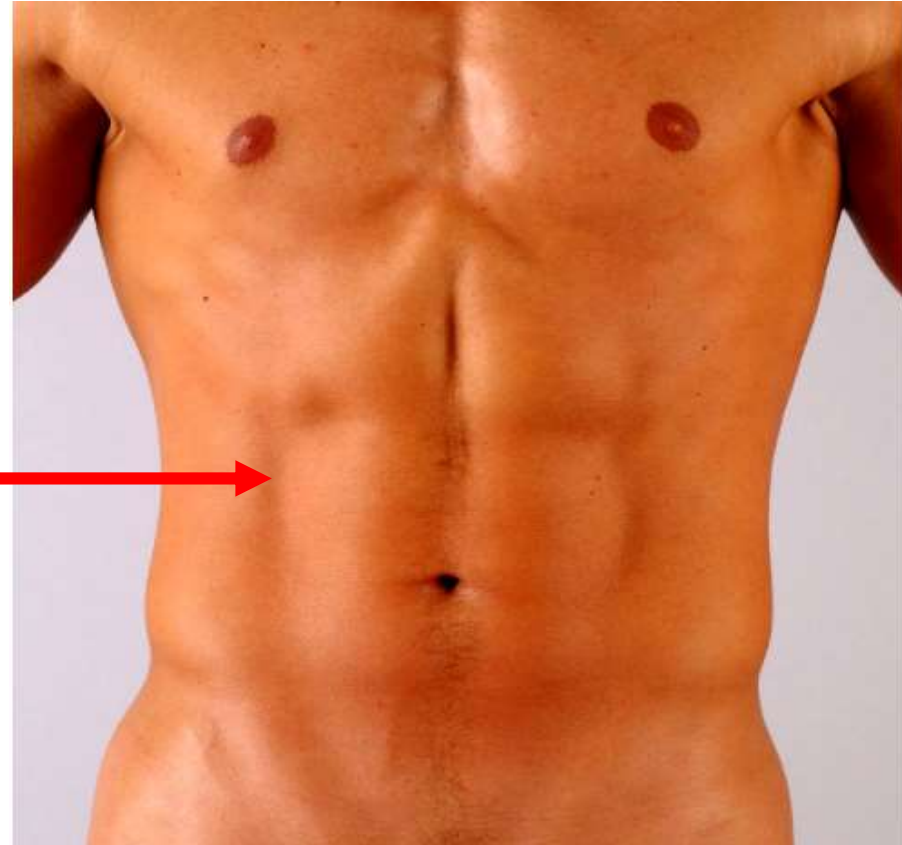
Rectus abdominis muscle

- **Origin:** by two heads, from the front of *Symphysis Pubis* and from *Pubic Crest*.
- **insertion:** into *5-6-7* *costal cartilage* and the xiphoid process.



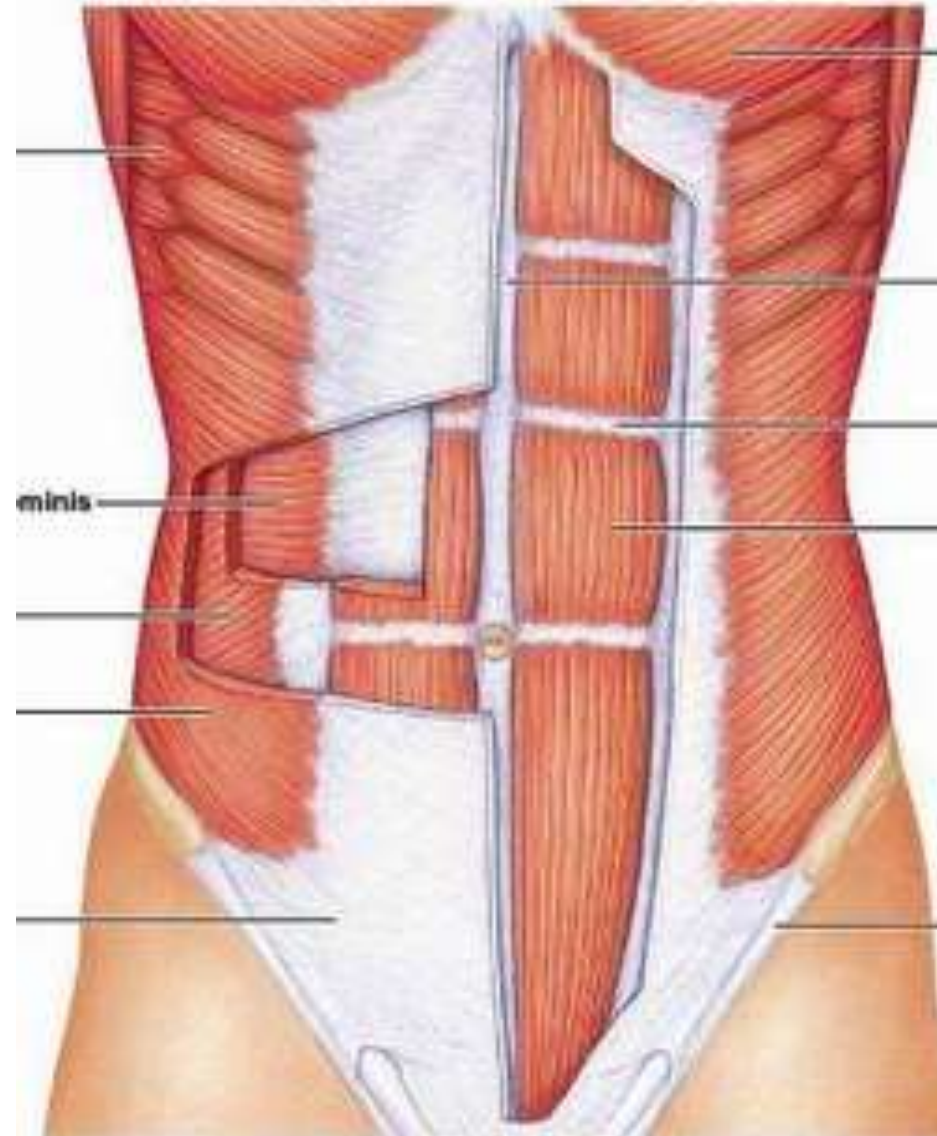
Rectus abdominis muscle

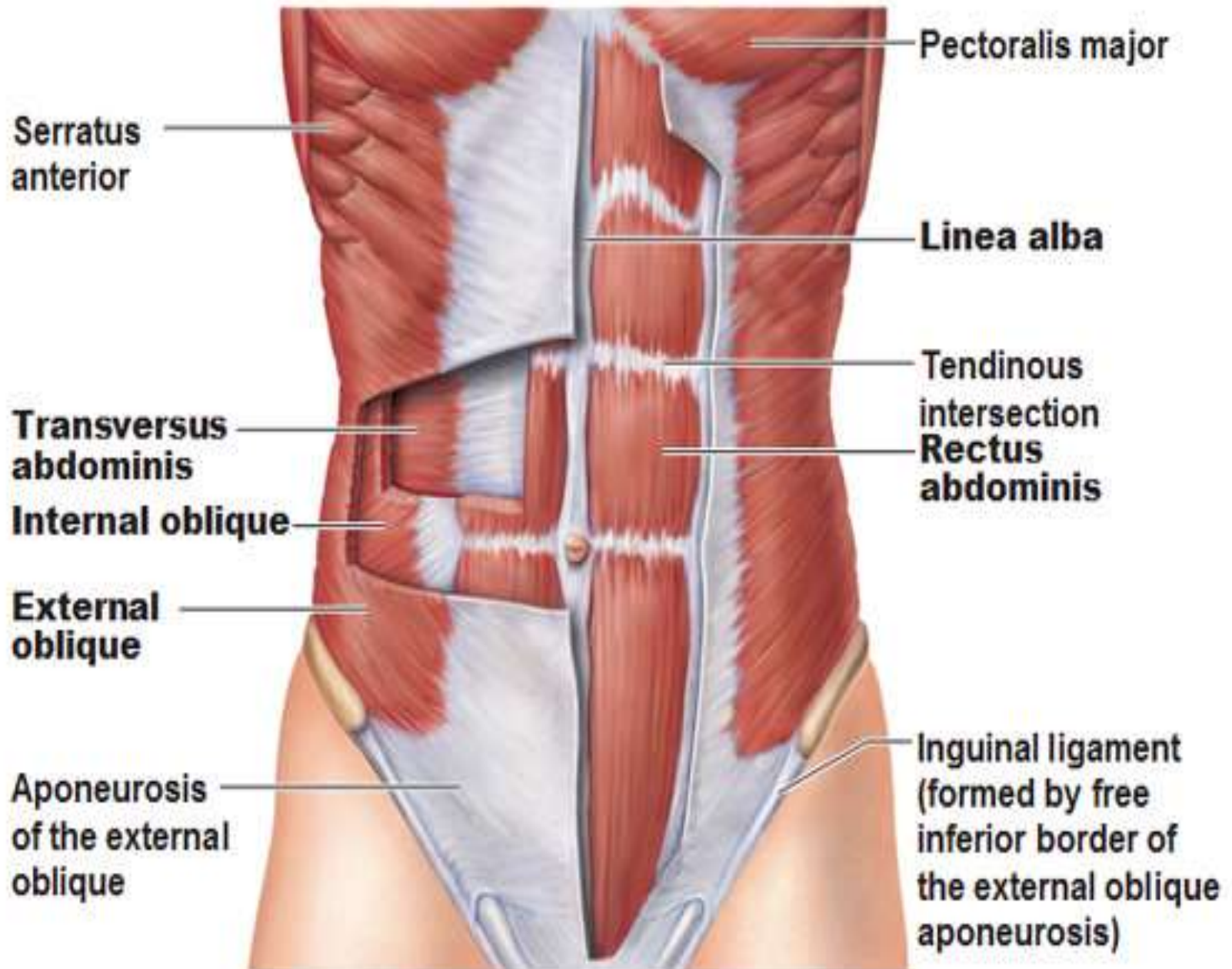
✚ When it contracts, its lateral margin forms a curved ridge that can be palpated and often seen and is termed The Linea Semilunaris. This extends from the tip of the ninth costal cartilage to the pubic tubercle.



Rectus abdominis muscle

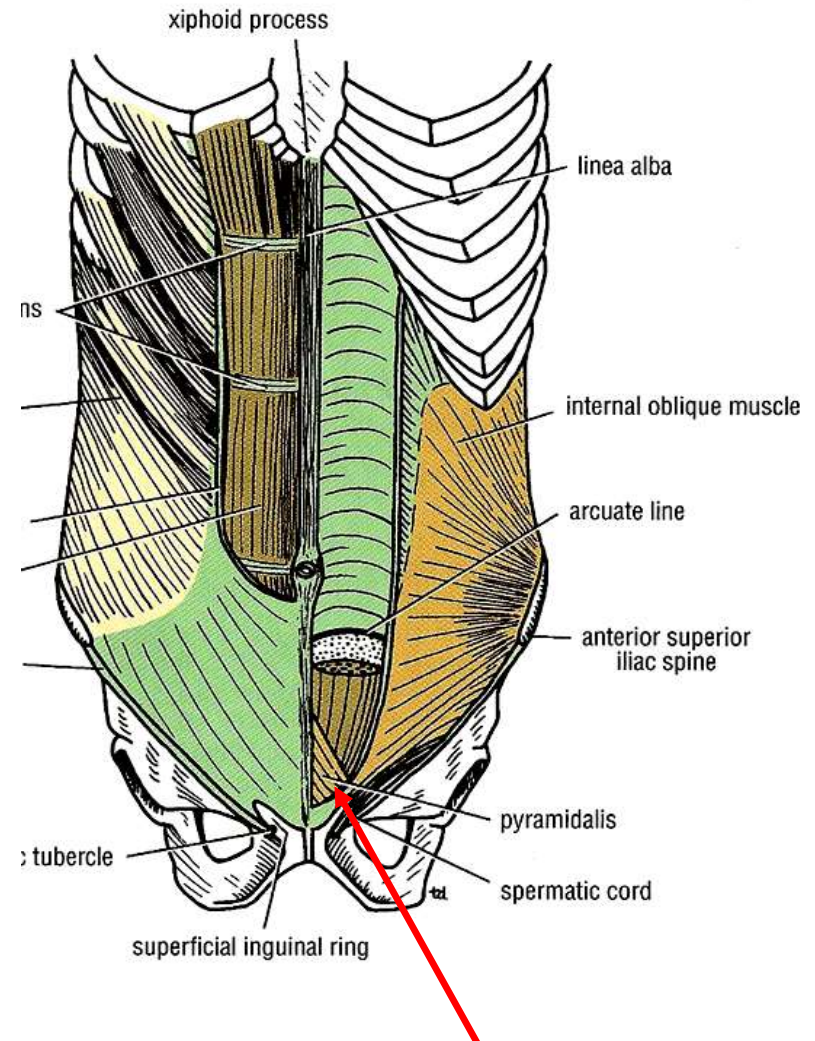
- The Rectus Abdominis muscle is divided into distinct segments by three transverse *Tendinous Intersections:* *at the :*
 - Xiphoid process.
 - Umbilicus.
 - One halfway between these two.

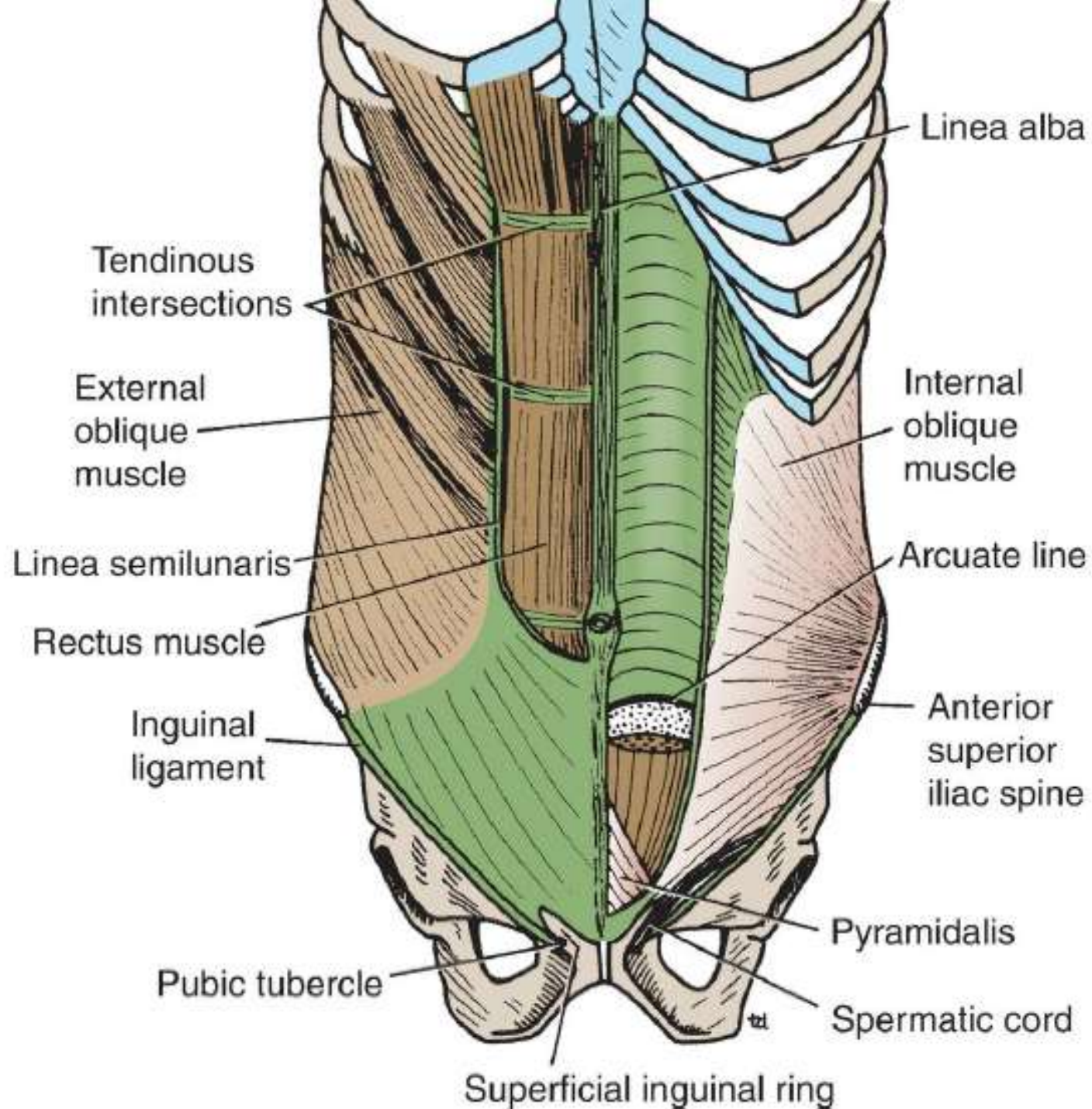




Pyramidalis muscle

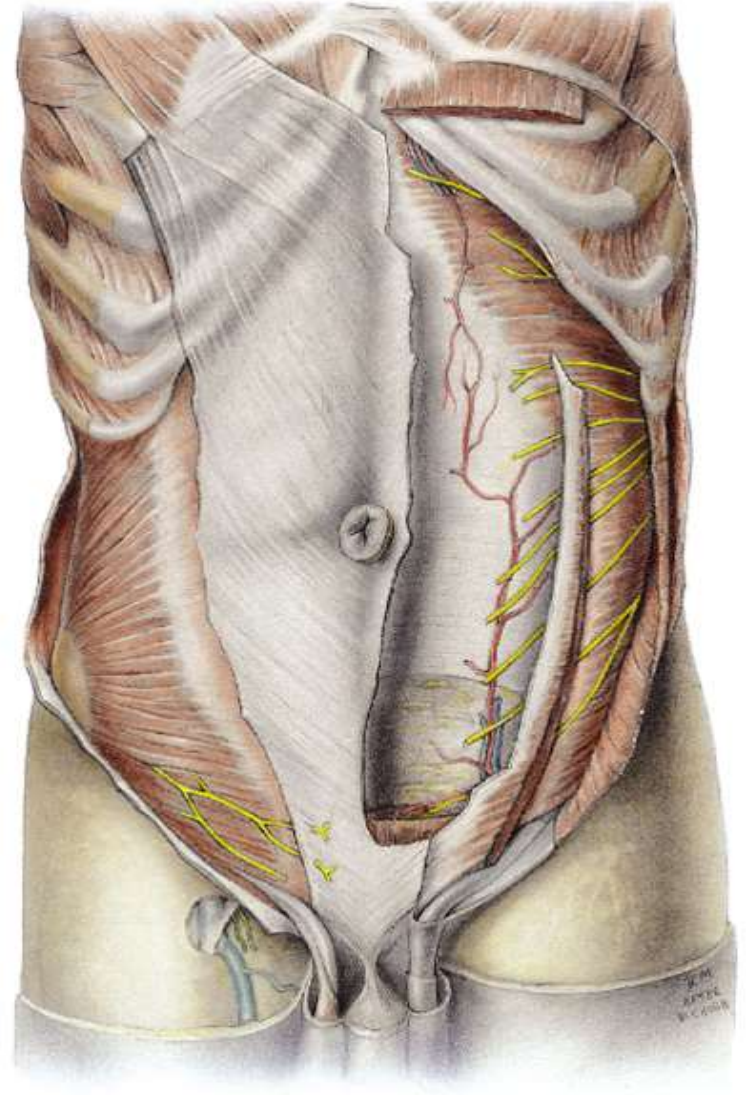
- It is often absent, it arises by its base from the anterior surface of the pubis and is inserted into the linea alba.
- It lies in front of the lower part of the rectus abdominis.
- It stretches the linea alba





Rectus sheath

- + is a long fibrous sheath that encloses Rectus abdominis muscle and Pyramidalis muscle (if present).
- + It is formed mainly by the aponeurosis of the three lateral abdominal muscles.
- + contains the:
 - Anterior rami of lower 6 thoracic nerves.
 - Superior and inferior epigastric vessels.
 - lymph vessels.



Rectus sheath

Starts from linea
Semilunaris in both sides.

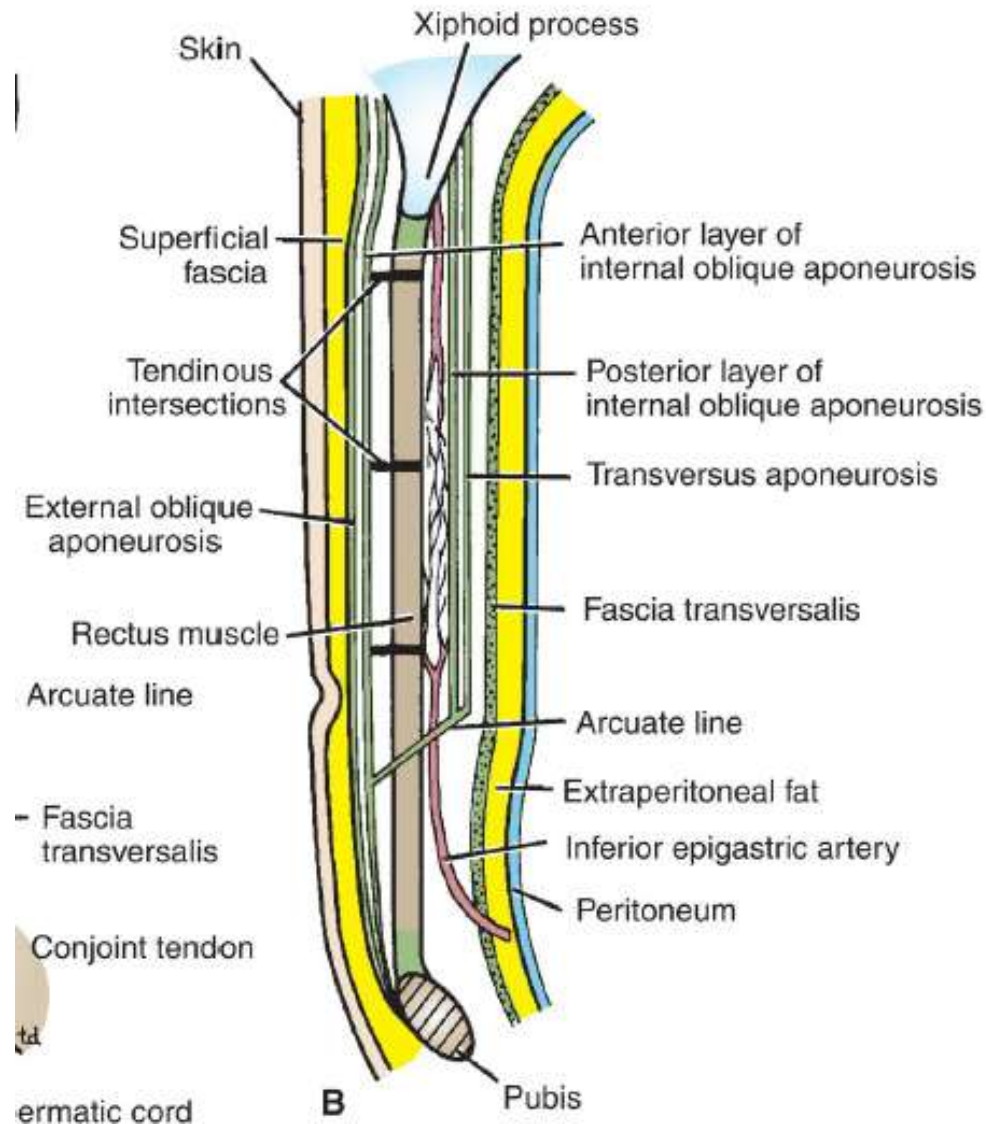
Splits into 2 parts:

- Ant. to rectus abdominis

■ Ext. oblique + $\frac{1}{2}$ of
internal oblique

- Post. to rectus abdominis

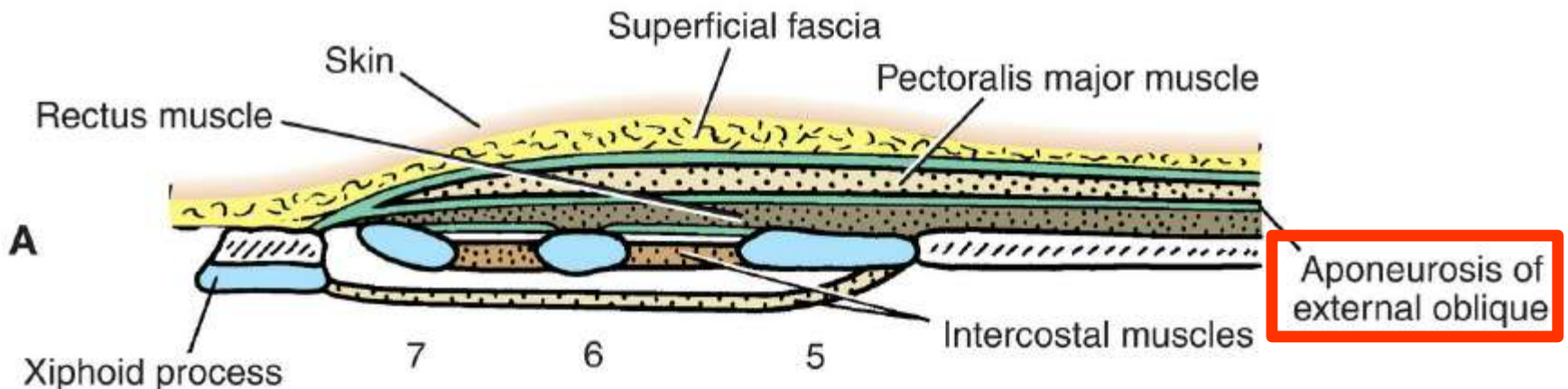
■ Transverses + $\frac{1}{2}$ of
internal oblique



Rectus sheath

Above the costal margin:

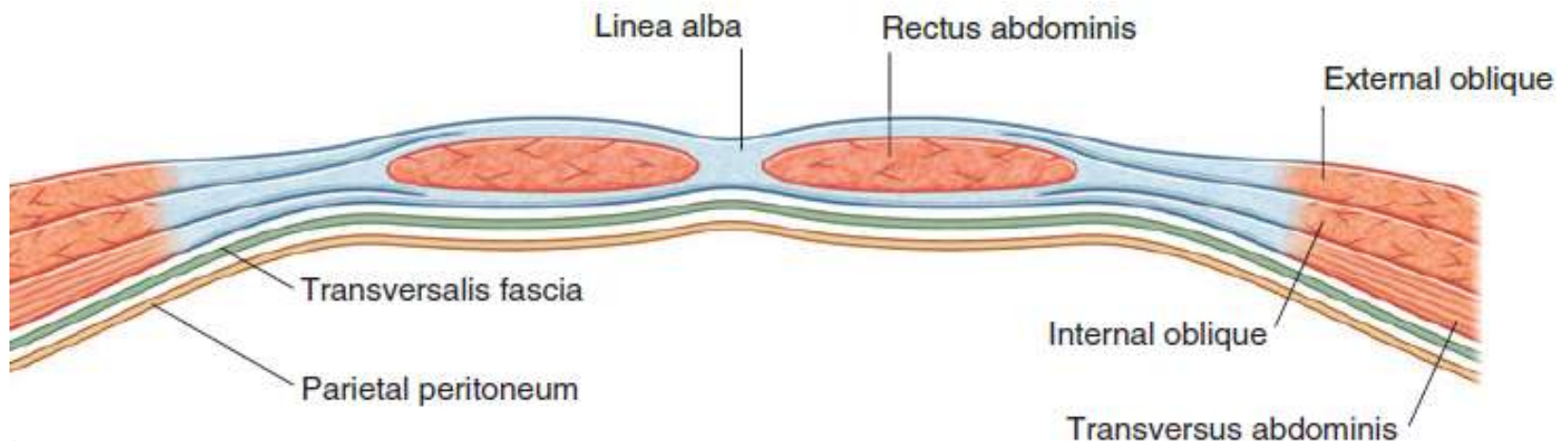
- Anterior wall is formed by the aponeurosis of the External Oblique.
- Posterior wall is formed by the thoracic wall (5th , 6th , 7th costal cartilages and intercostal spaces).



Rectus sheath

 Between costal margin and level of ASIS

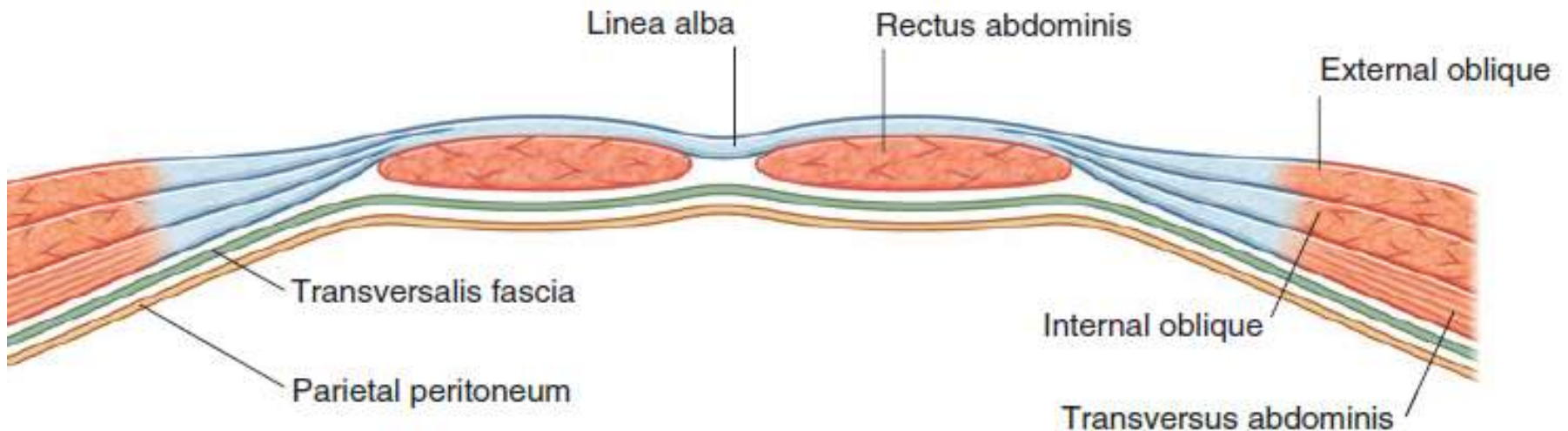
- ❑ Internal Oblique aponeurosis Splits to enclose the rectus muscle;
- ❑ External oblique aponeurosis is directed in front of the muscle,
- ❑ Transversus aponeurosis is directed behind the muscle.

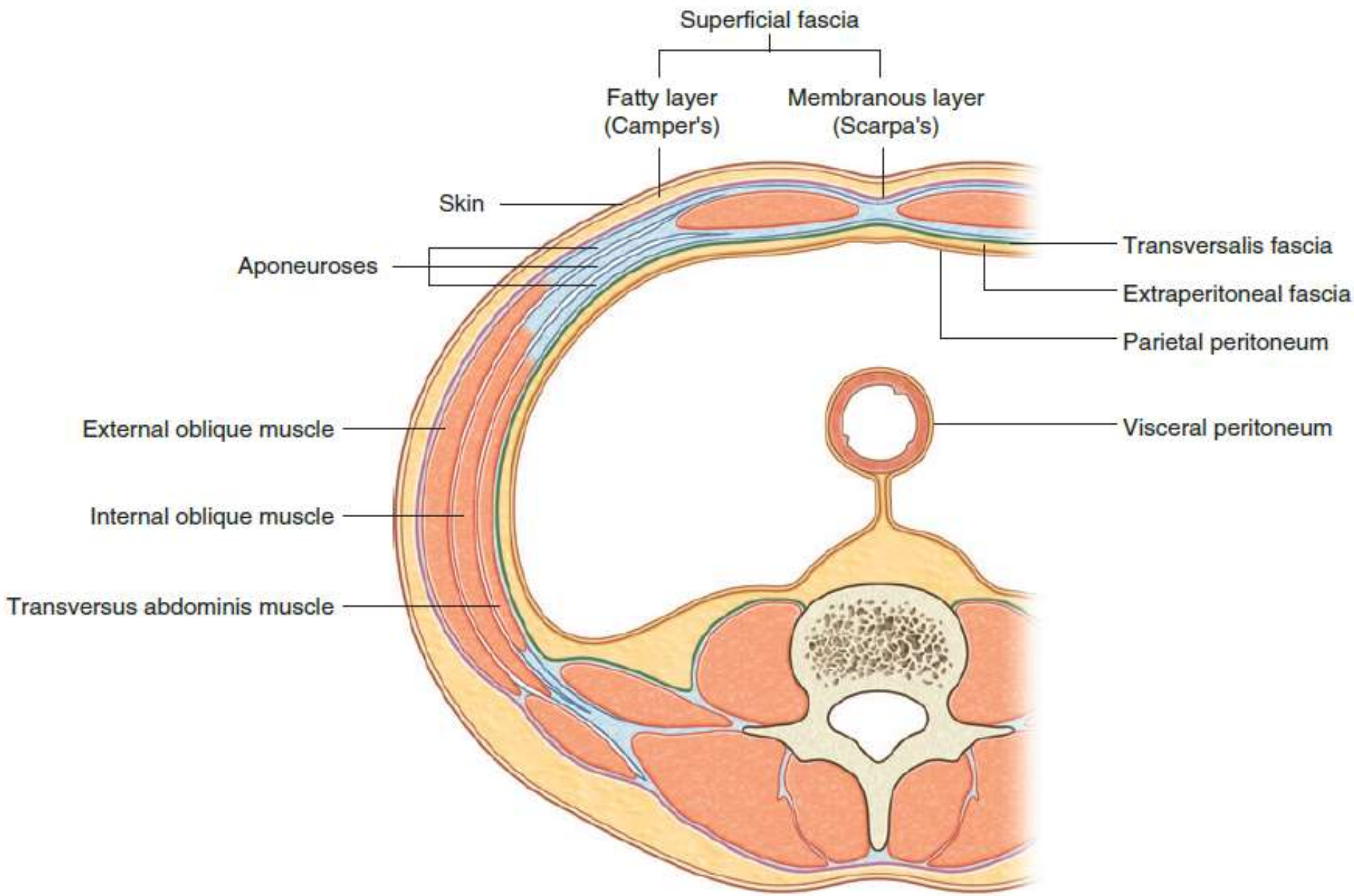


Rectus sheath

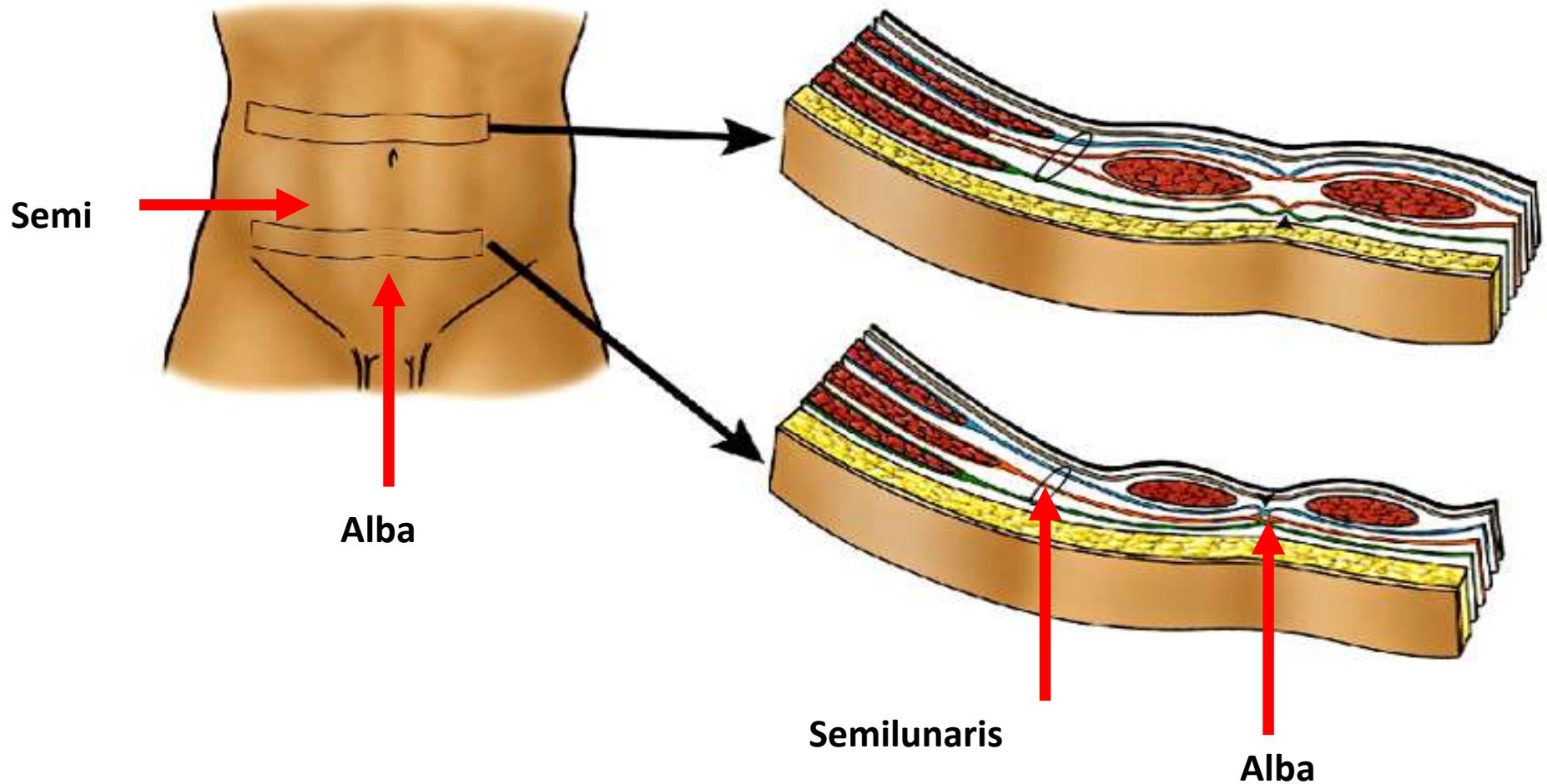
 *Between level of ASIS and Pubis:*

- Anterior wall by the aponeurosis of all three muscles.
- Posterior wall is **absent**, and the rectus muscle lies in contact with the fascia transversalis.



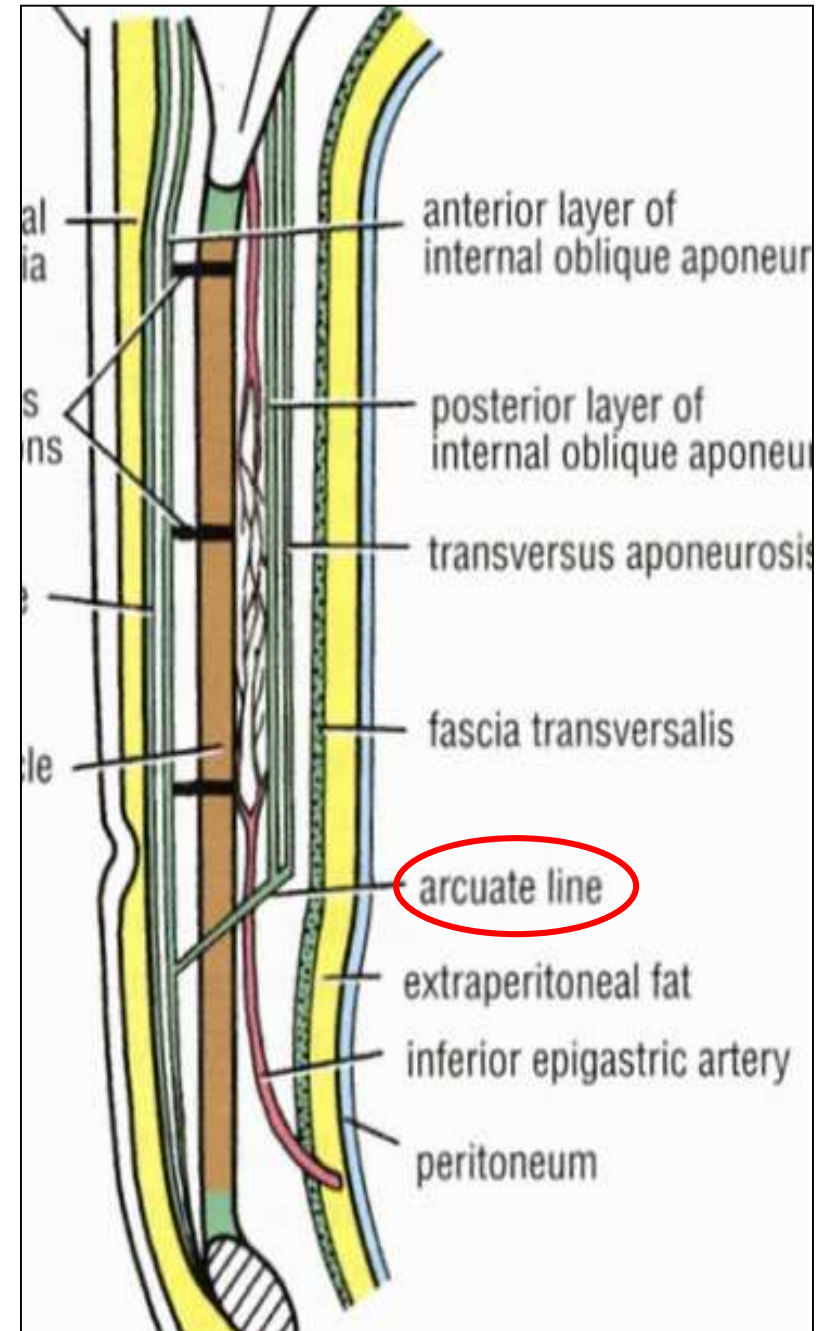


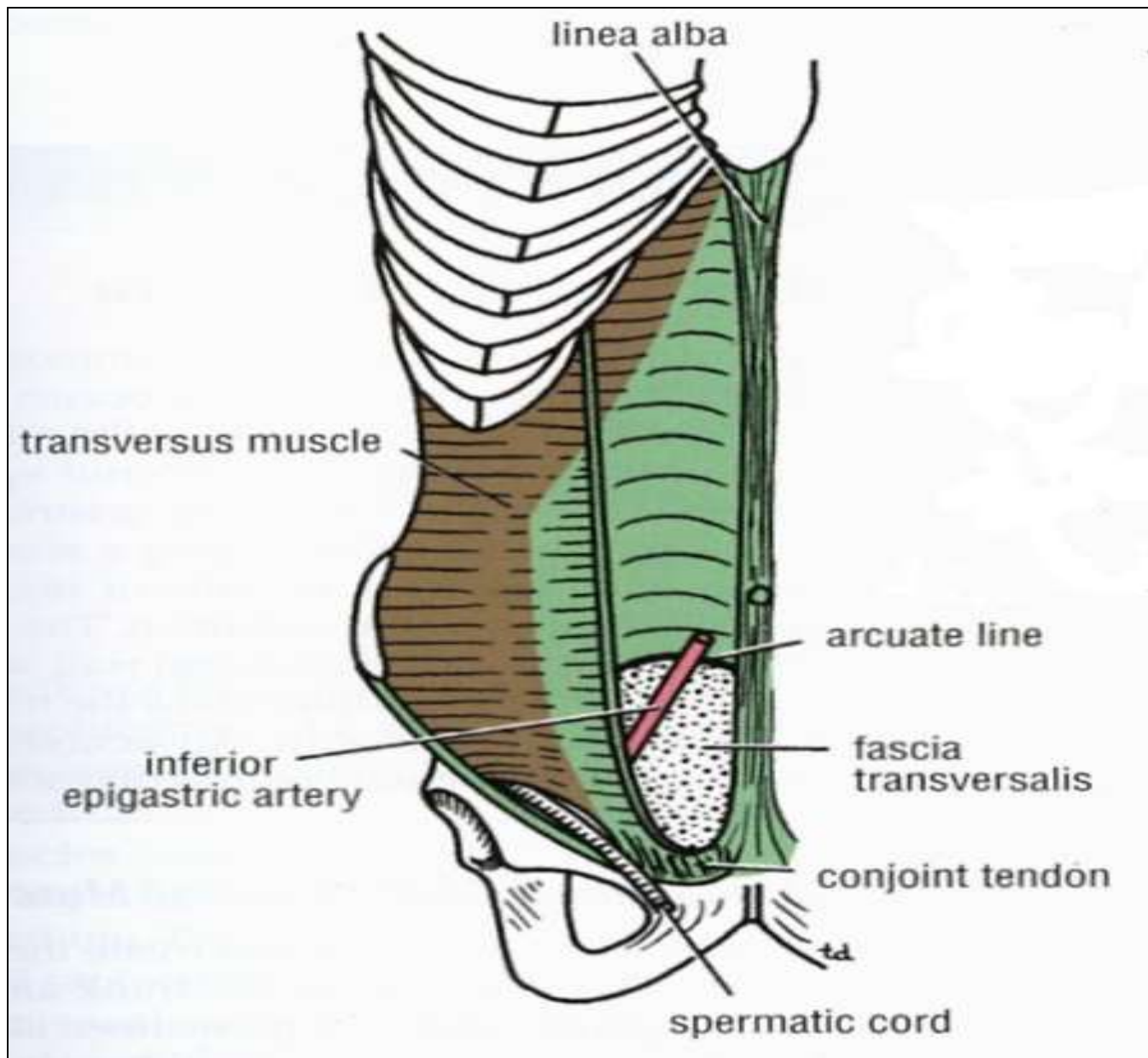
Linea Semilunaris & Linea Alba



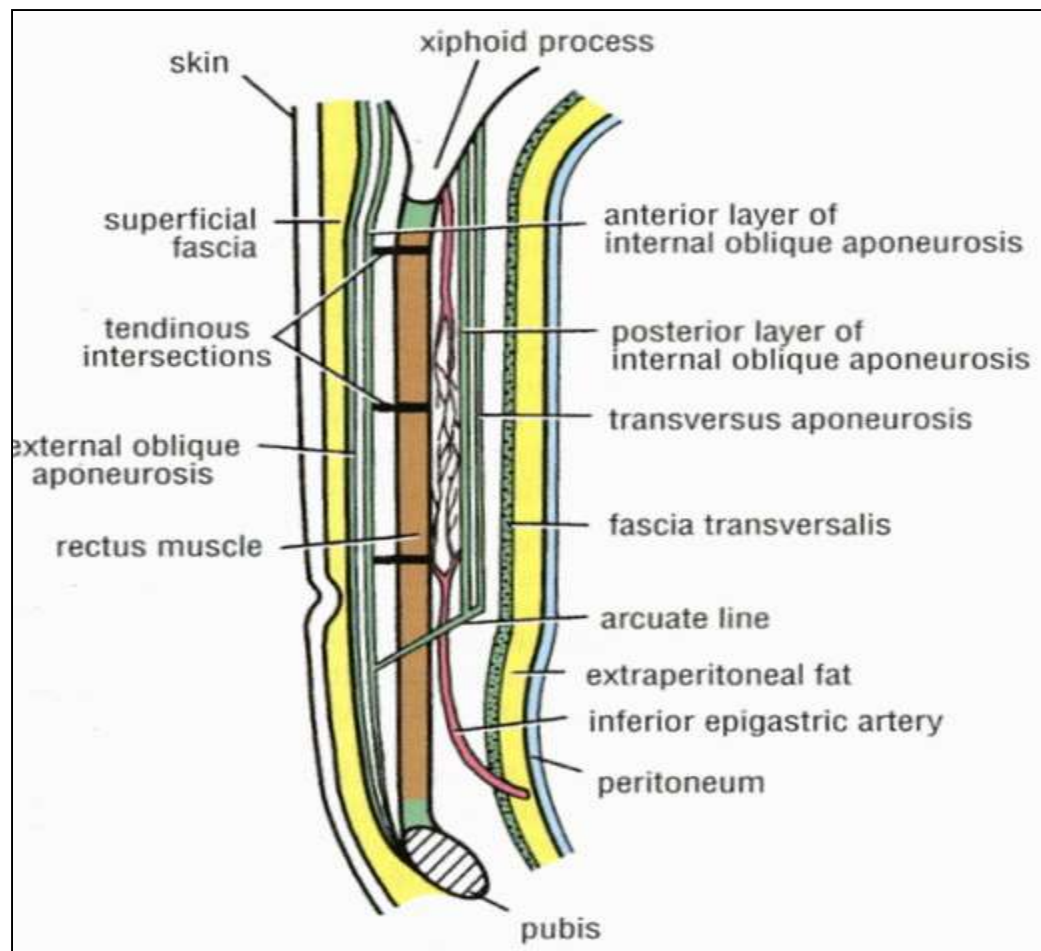
✚ It should be noted that where the aponeurosis forming the posterior wall pass in front of the rectus at the level of the anterior superior iliac spine, the posterior wall has a free, curved lower border called the *Arcuate line*

✚ At this site, the *Inferior Epigastric Vessels* enter the rectus sheath and pass upward to Anastomose with the *Superior Epigastric Vessels*.





■ The Posterior wall of the rectus sheath is Not attached to the rectus abdominis muscle. The anterior wall is firmly attached to it by the muscle's *Tendinous Intersections*.



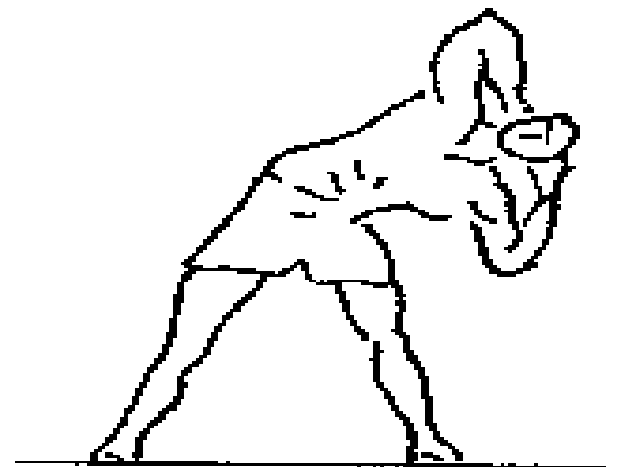
CLINICAL: HEMATOMA OF RECTUS SHEATH

- It is uncommon but Important, since it is often overlooked.
- It occurs most often on the right side below the level of the umbilicus.
- The source of the bleeding is the *Inferior epigastric vein* or, more rarely, *Inferior epigastric artery*.
- History of trauma, pregnancy, anticoagulants.



Action of Anterior Abdominal Wall Muscles

- The Oblique Muscles laterally Flex and Rotate the trunk.
- The Rectus Abdominis Flexes the trunk and stabilizes the pelvis, and the pyramidalis keeps the linea alba taut during the process.



Action of Anterior Abdominal Wall Muscles

- They assist diaphragm during Inspiration by relaxing as the diaphragm descends so that the abdominal viscera can be accommodated.
- The muscles assist in the act of Forced Expiration that occurs during coughing and sneezing by pulling down the ribs and sternum. Their tone plays an important part in supporting and protecting the abdominal viscera.
- By contracting simultaneously with the diaphragm, with the glottis of the larynx closed, They Increase The Intra-Abdominal Pressure and help in micturition, defecation, vomiting, and labour.

Nerve Supply of Anterior Abdominal Wall Muscles

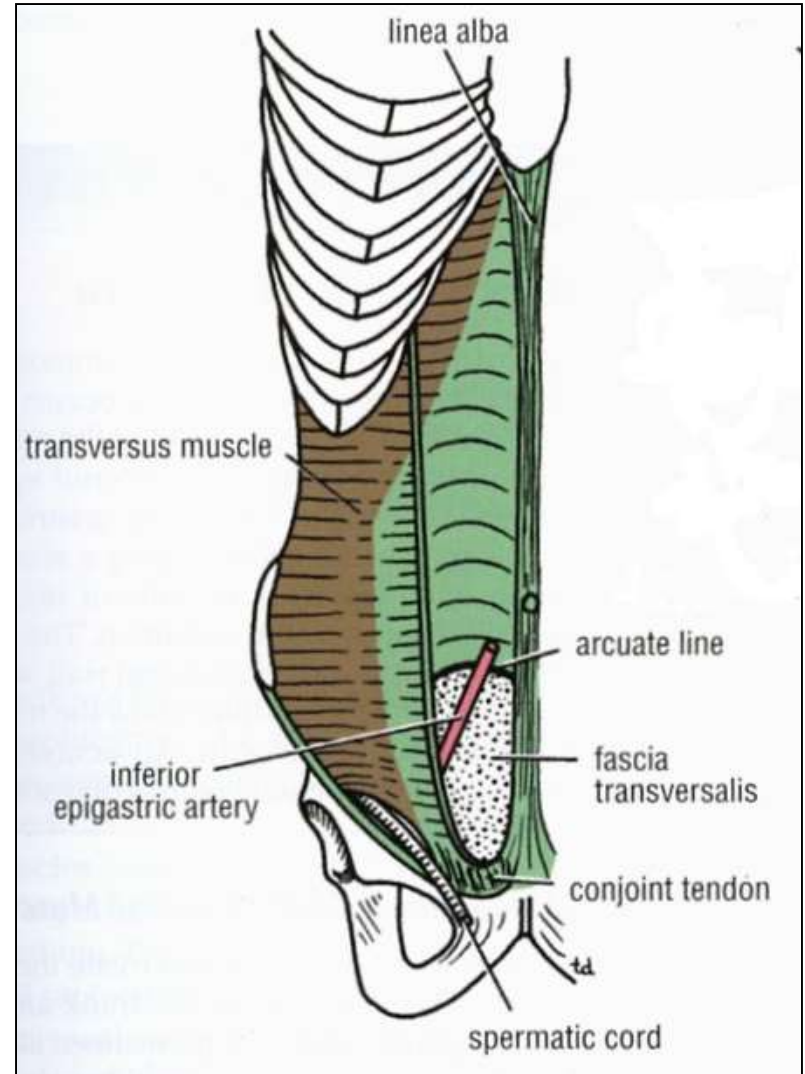
- The **obliques and transversus abdominis** muscles are supplied by the lower six thoracic nerves and the Iliohypogastric and Ilioinguinal nerves (L1).
- The **Rectus** Muscle(lower six thoracic nerves) .
- The **pyramidalis** (The twelfth thoracic nerve).

Anterior Abdominal Wall Muscle

Muscle	Origin	Insertion	Innervation	Function
External oblique	Muscular slips from the outer surfaces of the lower eight ribs (ribs V to XII)	Lateral lip of iliac crest; aponeurosis ending in midline raphe (linea alba)	Anterior rami of lower six thoracic spinal nerves (T7 to T12)	Compress abdominal contents; both muscles flex trunk; each muscle bends trunk to same side, turning anterior part of abdomen to opposite side
Internal oblique	Thoracolumbar fascia; iliac crest between origins of external and transversus; lateral two-thirds of inguinal ligament	Inferior border of the lower three or four ribs; aponeurosis ending in linea alba; pubic crest and pectineal line	Anterior rami of lower six thoracic spinal nerves (T7 to T12) and L1	Compress abdominal contents; both muscles flex trunk; each muscle bends trunk and turns anterior part of abdomen to same side
Transversus abdominis	Thoracolumbar fascia; medial lip of iliac crest; lateral one-third of inguinal ligament; costal cartilages lower six ribs (ribs VII to XII)	Aponeurosis ending in linea alba; pubic crest and pectineal line	Anterior rami of lower six thoracic spinal nerves (T7 to T12) and L1	Compress abdominal contents
Rectus abdominis	Pubic crest, pubic tubercle, and pubic symphysis	Costal cartilages of ribs V to VII; xiphoid process	Anterior rami of lower seven thoracic spinal nerves (T7 to T12)	Compress abdominal contents; flex vertebral column; tense abdominal wall
Pyramidalis	Front of pubis and pubic symphysis	Into linea alba	Anterior ramus of T12	Tenses the linea alba

Fascia Transversalis

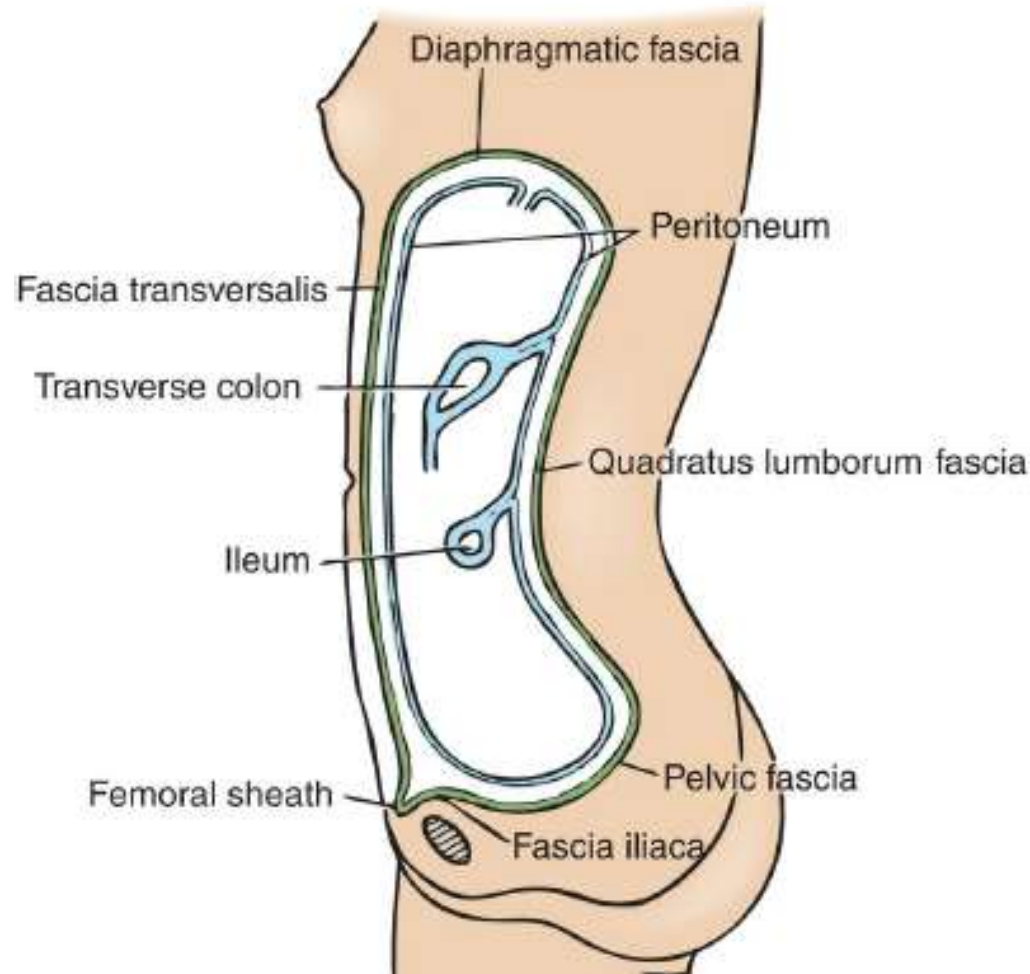
■ Is a thin layer of fascia that lines the transversus abdominis muscle and is continuous with a similar layer lining the diaphragm and iliacus muscle.



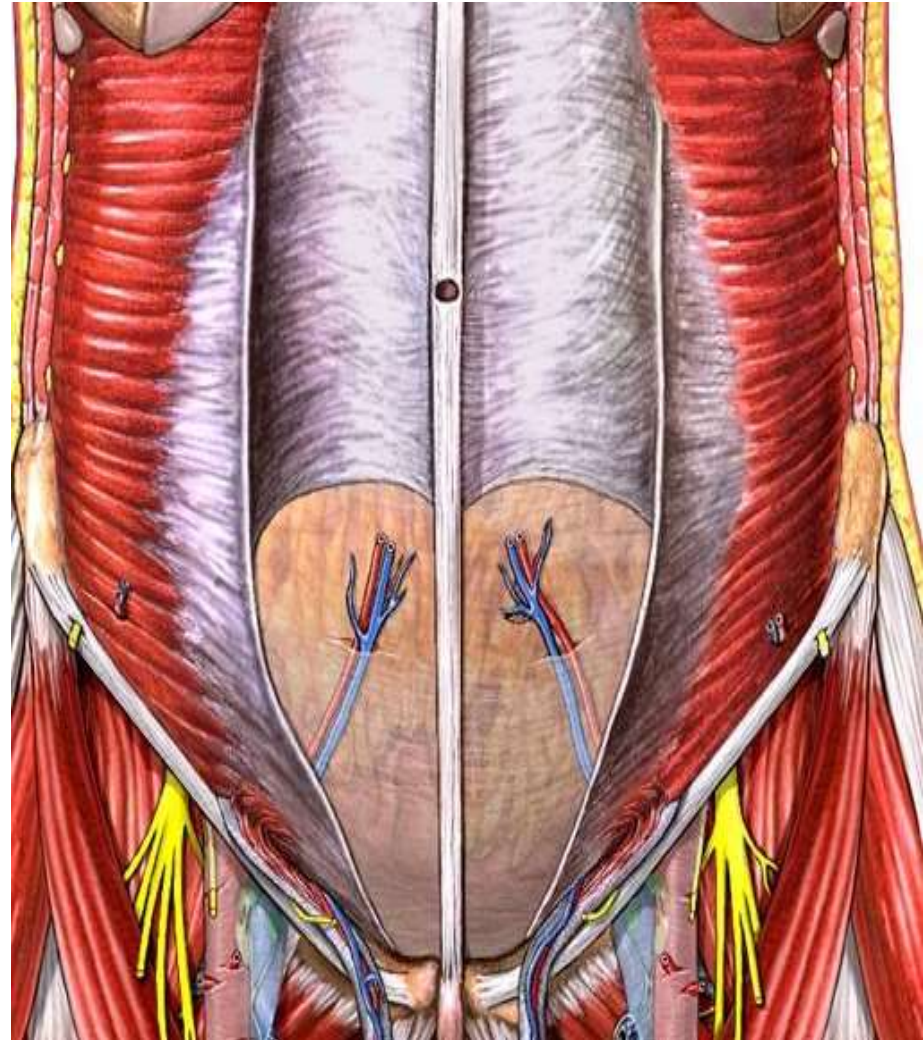
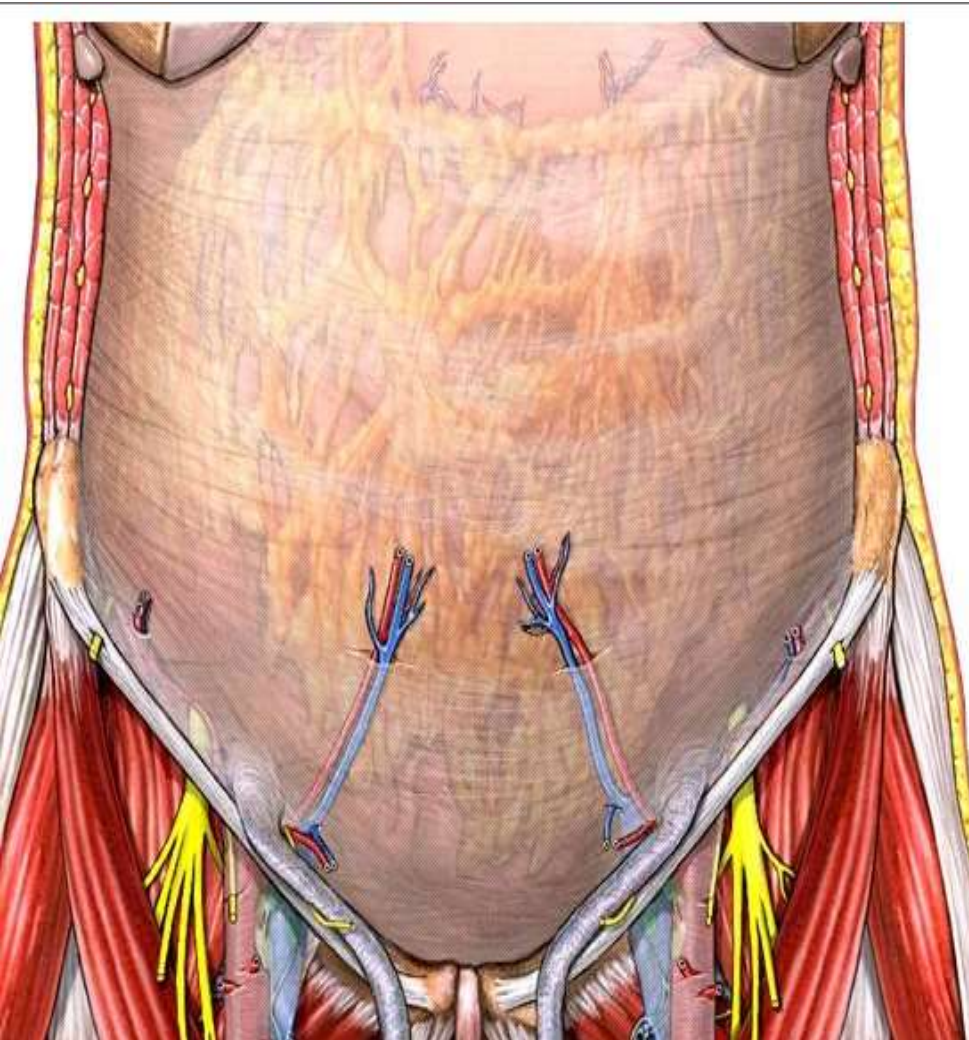
Fascia Transversalis

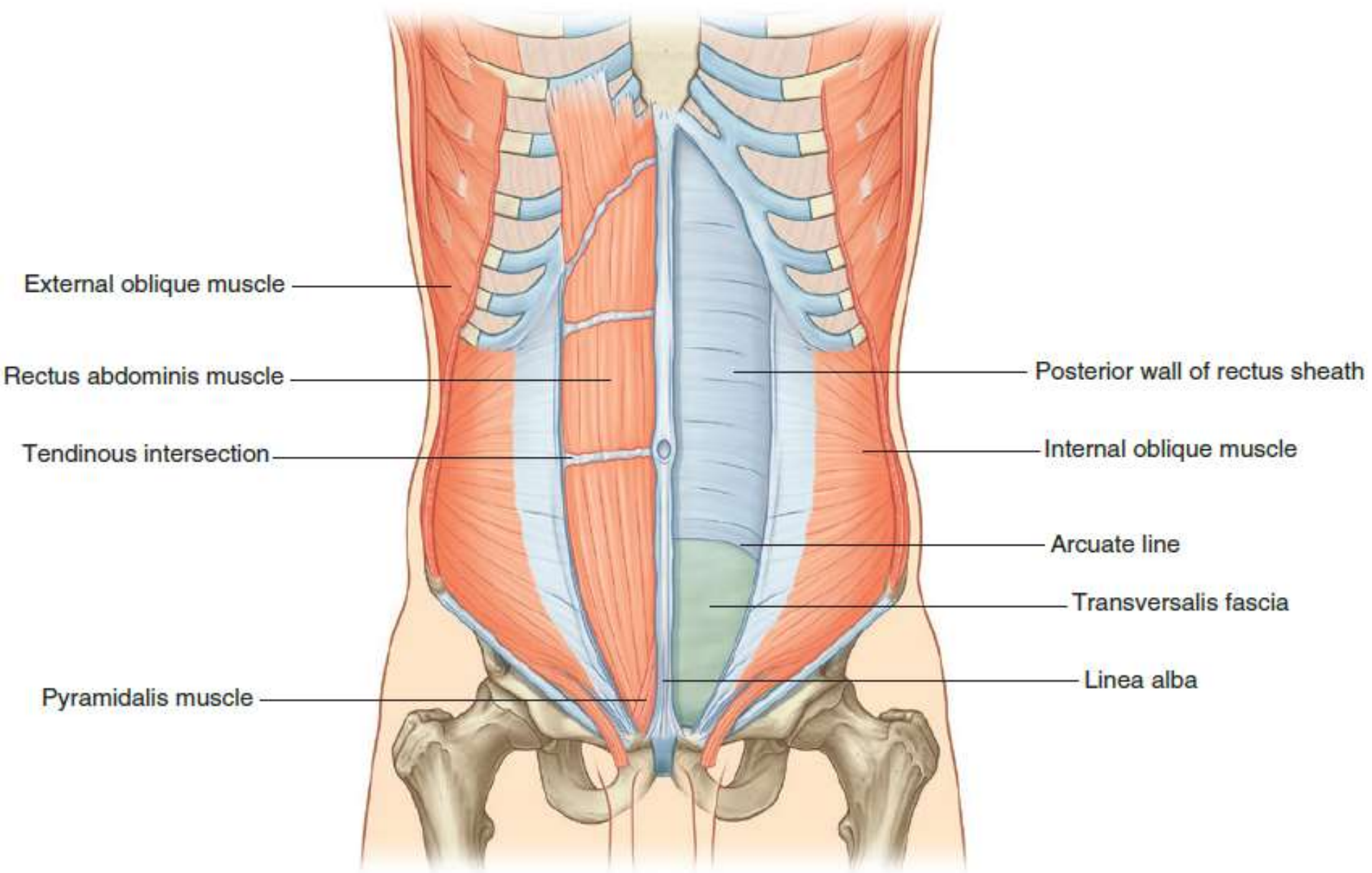
■ Fascia Transversalis,
Diaphragmatic
Fascia, Iliacus Fascia ,
& Pelvic fascia

form **one continuous**
lining to the
abdominal and pelvic
cavities.



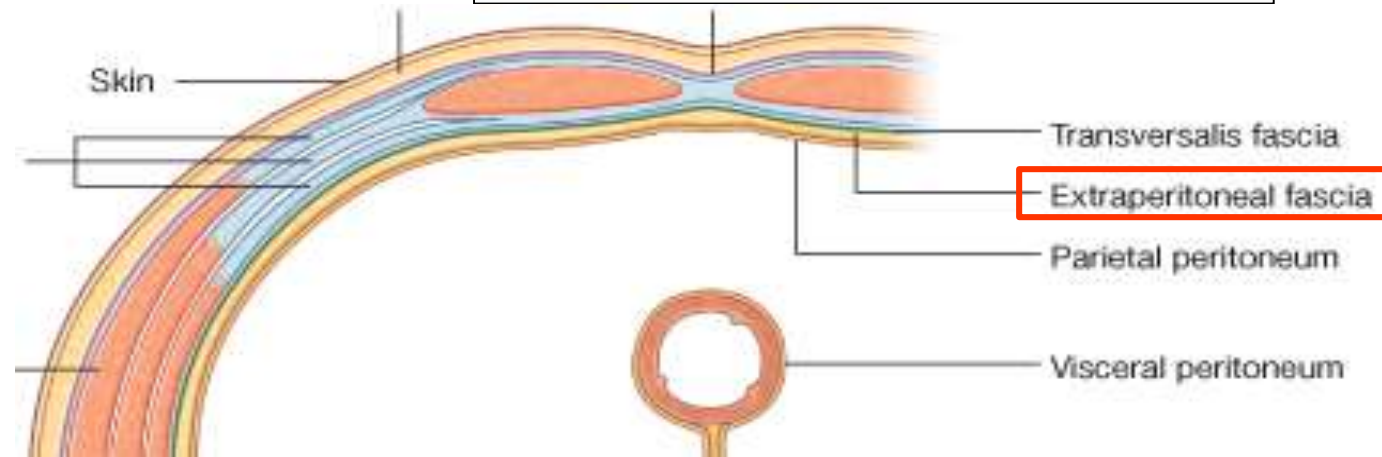
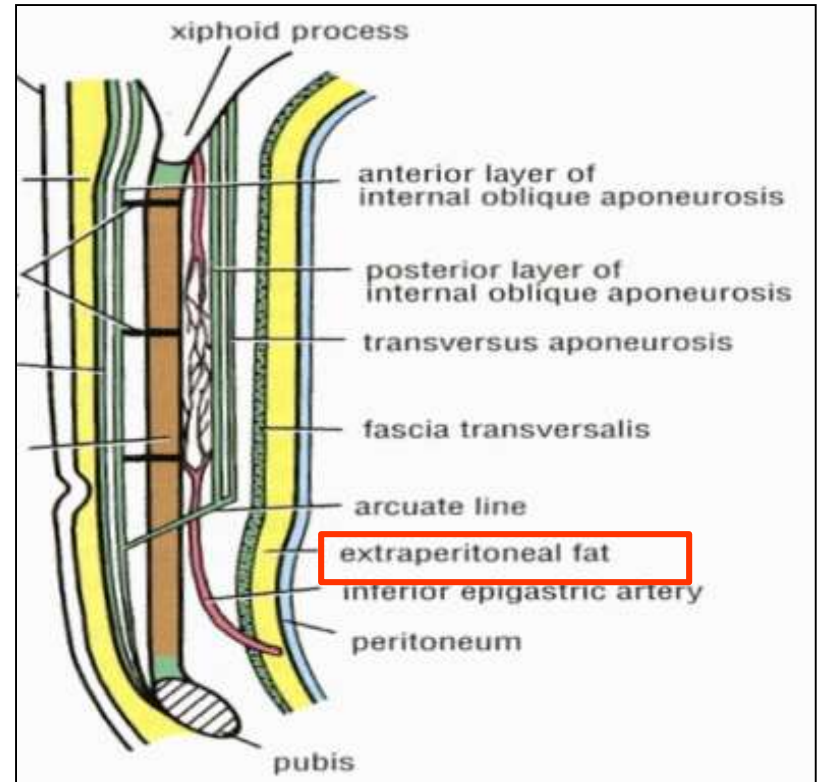
Fascia Transversalis





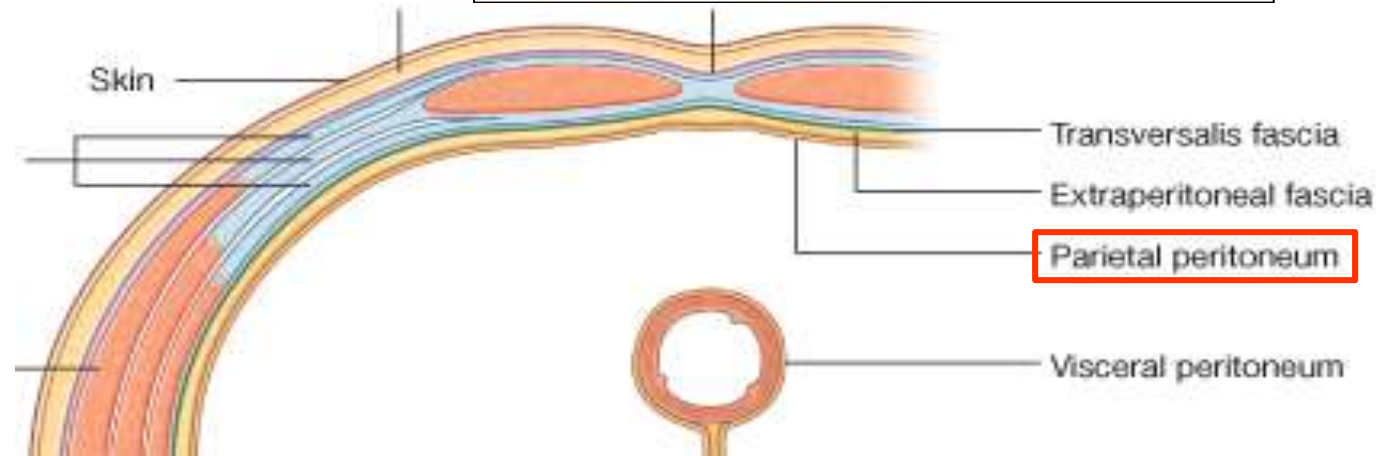
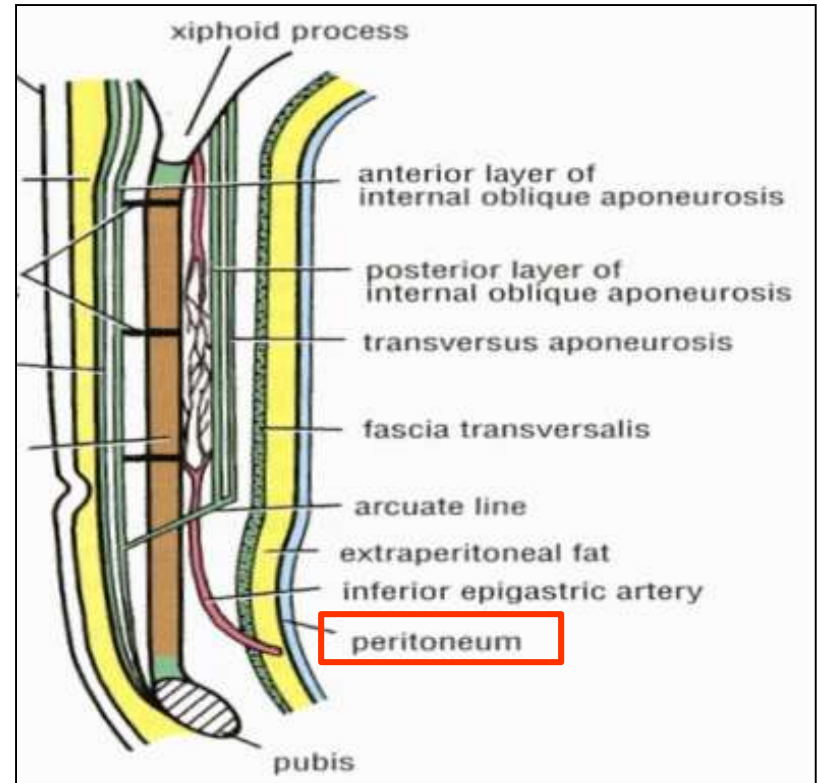
Extraperitoneal Fat

- It is a thin layer of connective tissue that contains a variable amount of fat and lies between fascia transversalis and the parietal peritoneum.



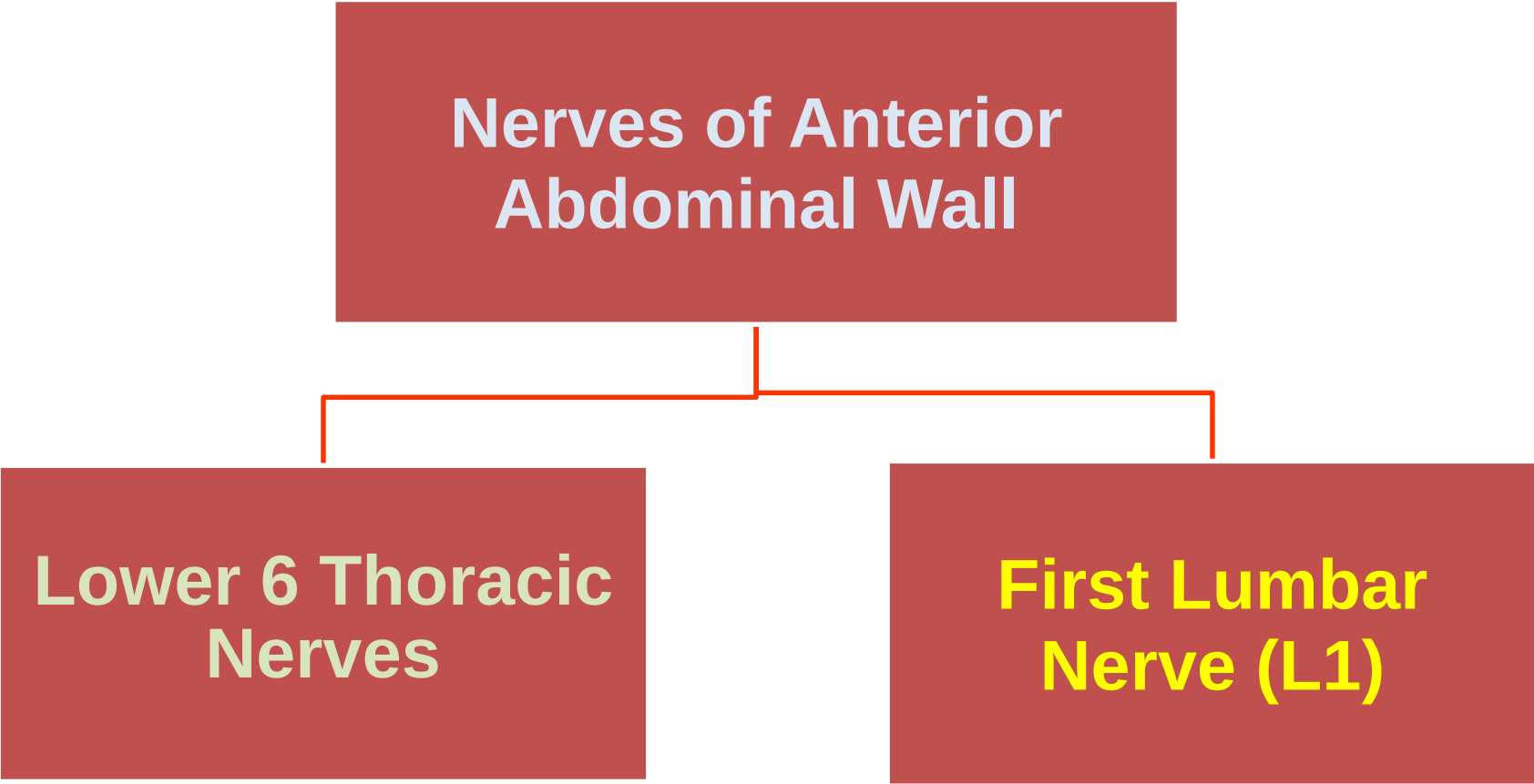
Parietal Peritoneum

+ This is a thin serous membrane and is continuous below with the parietal peritoneum lining the pelvis.



Nerves of Anterior Abdominal Wall

**Nerves of Anterior
Abdominal Wall**



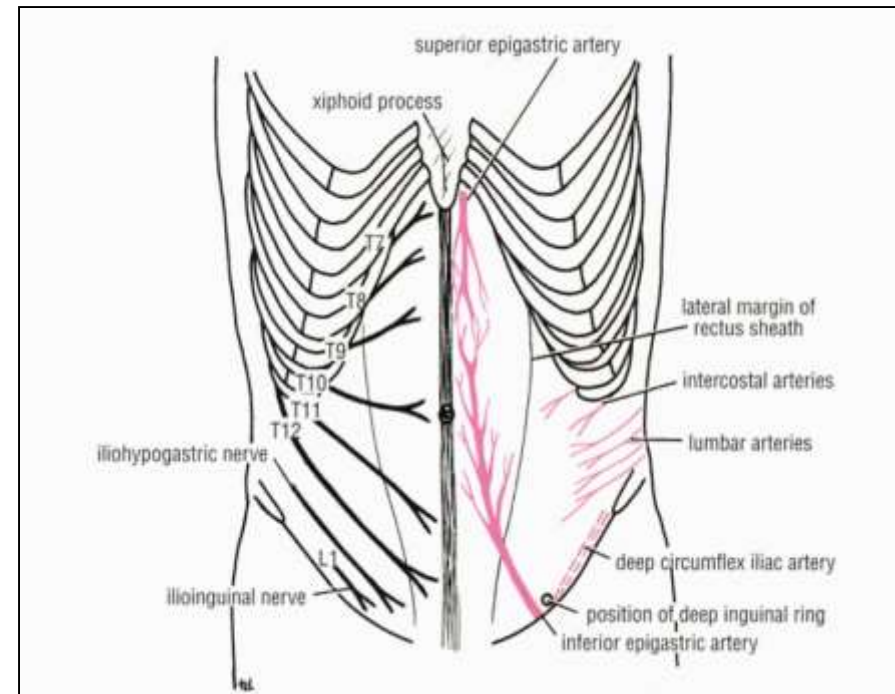
```
graph TD; A[Nerves of Anterior Abdominal Wall] --> B[Lower 6 Thoracic Nerves]; A --> C[First Lumbar Nerve (L1)]
```

**Lower 6 Thoracic
Nerves**

**First Lumbar
Nerve (L1)**

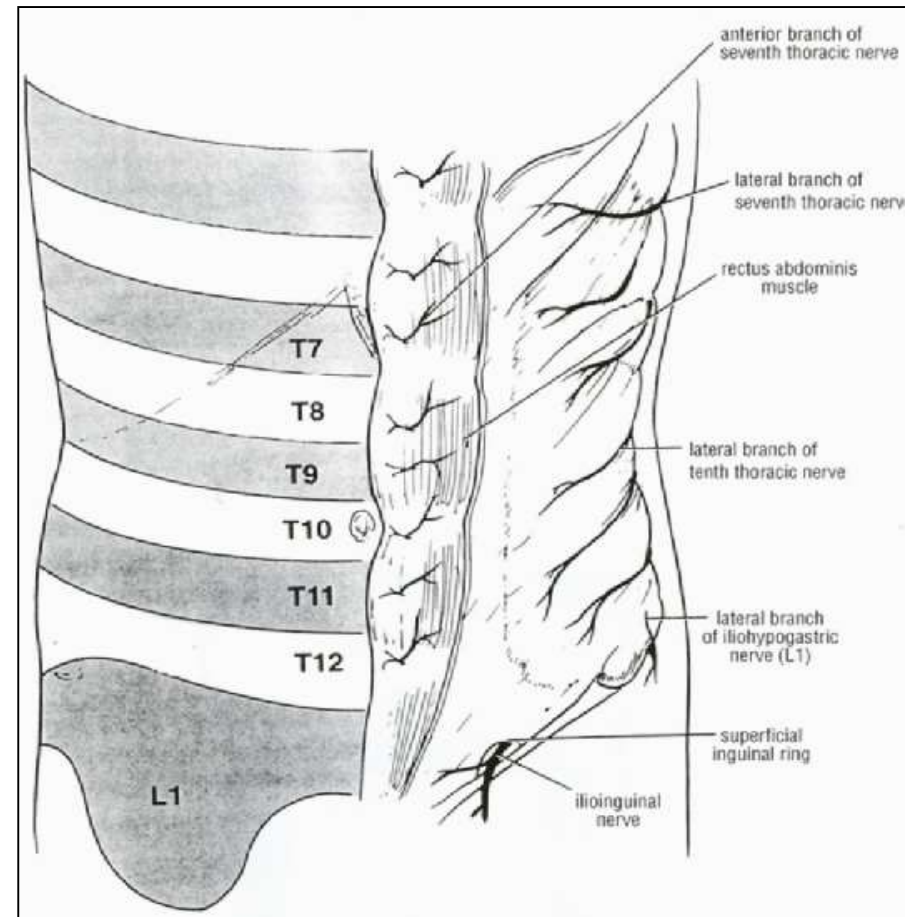
Nerves of Anterior Abdominal Wall

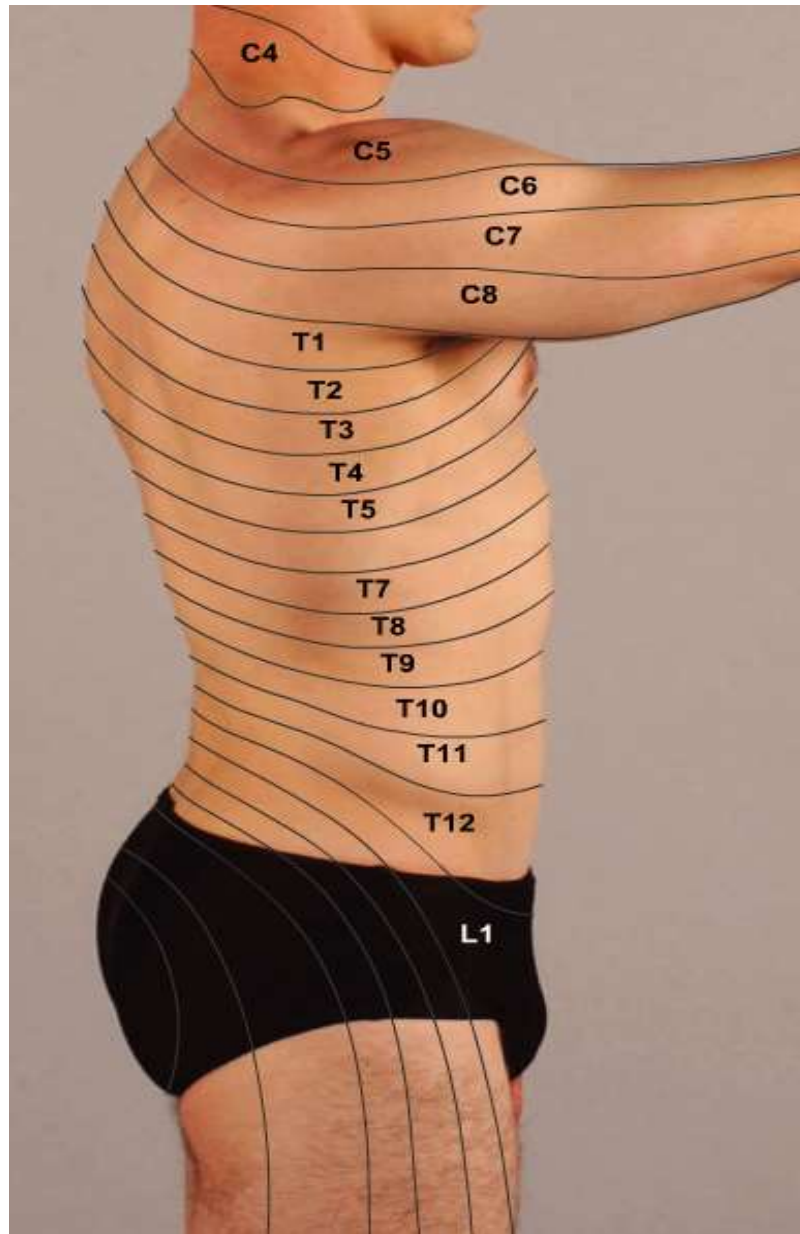
- The anterior rami of the lower six thoracic nerves.
- The first lumbar nerve (L1) (Iliohypogastric and Ilioinguinal nerves).
- They supply the skin of the anterior abdominal wall, the muscles, and the parietal peritoneum.
- They pass forward in the interval between the internal oblique and the transversus muscles.



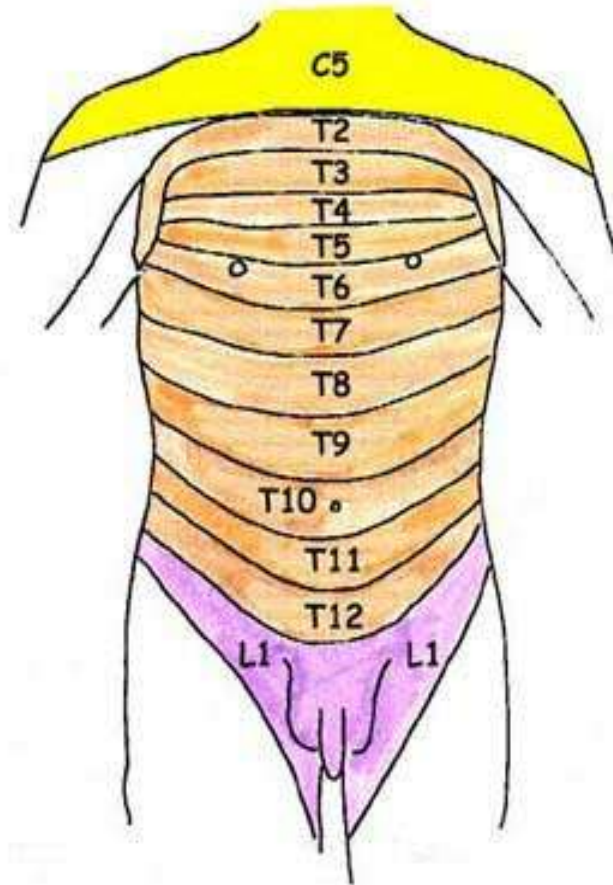
Nerves of Anterior Abdominal Wall

- ✚ The lower six thoracic nerves pierce the posterior wall of the rectus sheath to supply the rectus muscle and the pyramidalis (T12 only).
- ✚ They terminate by piercing the anterior wall of the sheath and supplying the skin.





DERMATOMES OF THORAX AND ABDOMEN



Arteries of Anterior Abdominal Wall

```
graph TD; A[Arteries of Anterior Abdominal Wall] --- B[superior epigastric artery]; A --- C[inferior epigastric artery]; A --- D[deep circumflex iliac artery]; A --- E[lower 2 posterior intercostal arteries]; A --- F[4 lumbar arteries];
```

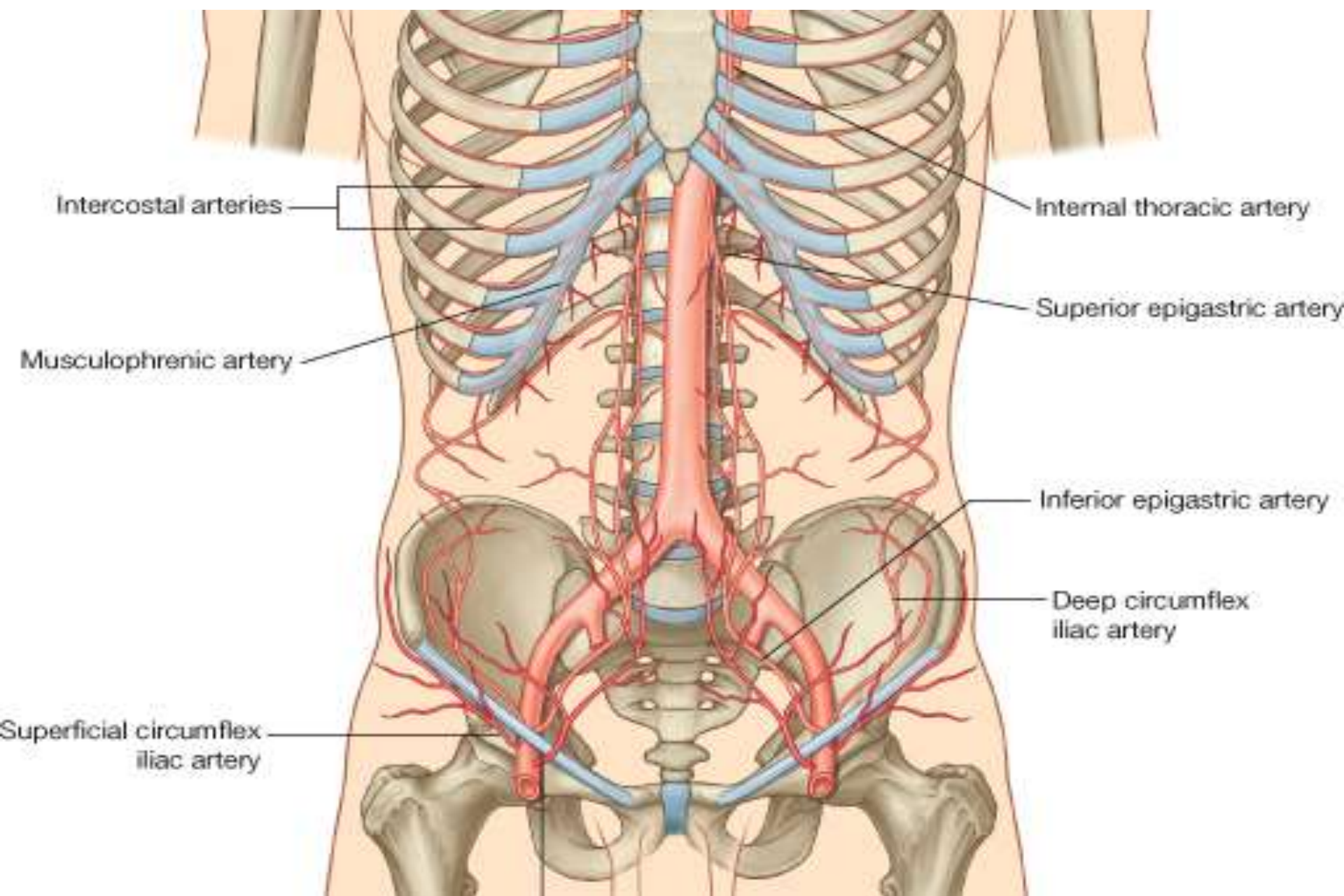
superior
epigastric
artery

inferior
epigastric
artery

deep circumflex
iliac
artery

lower 2 posterior
intercostal
arteries

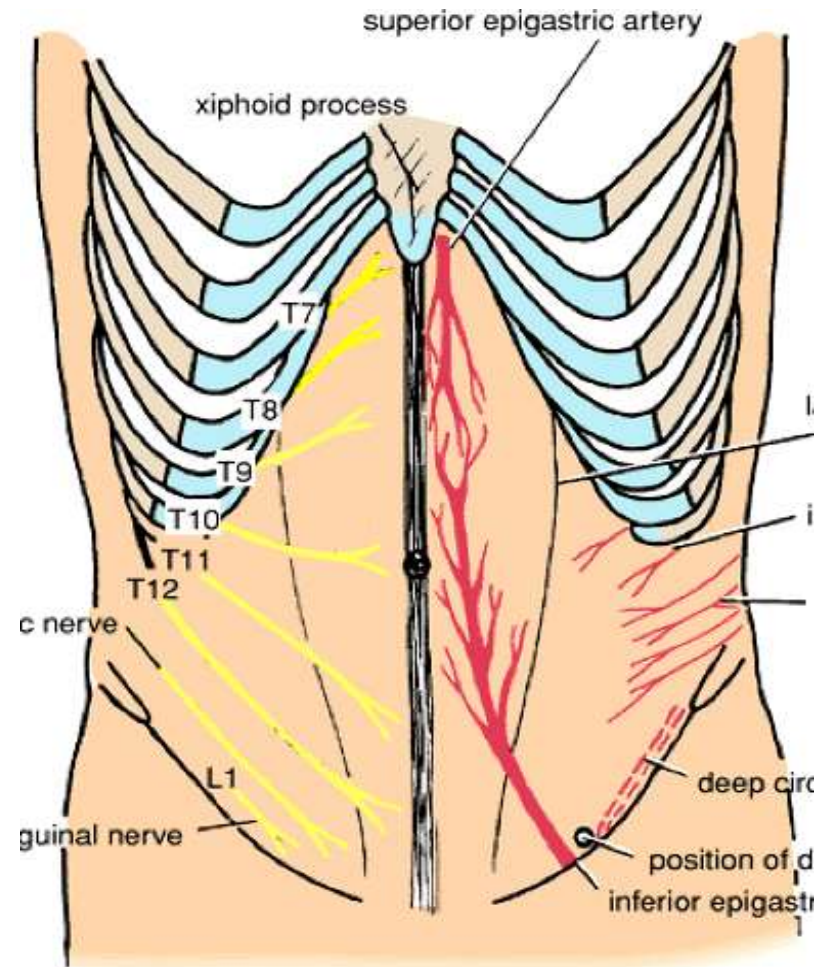
4 lumbar
arteries



Arteries of Anterior Abdominal Wall

■ Superior Epigastric Artery,

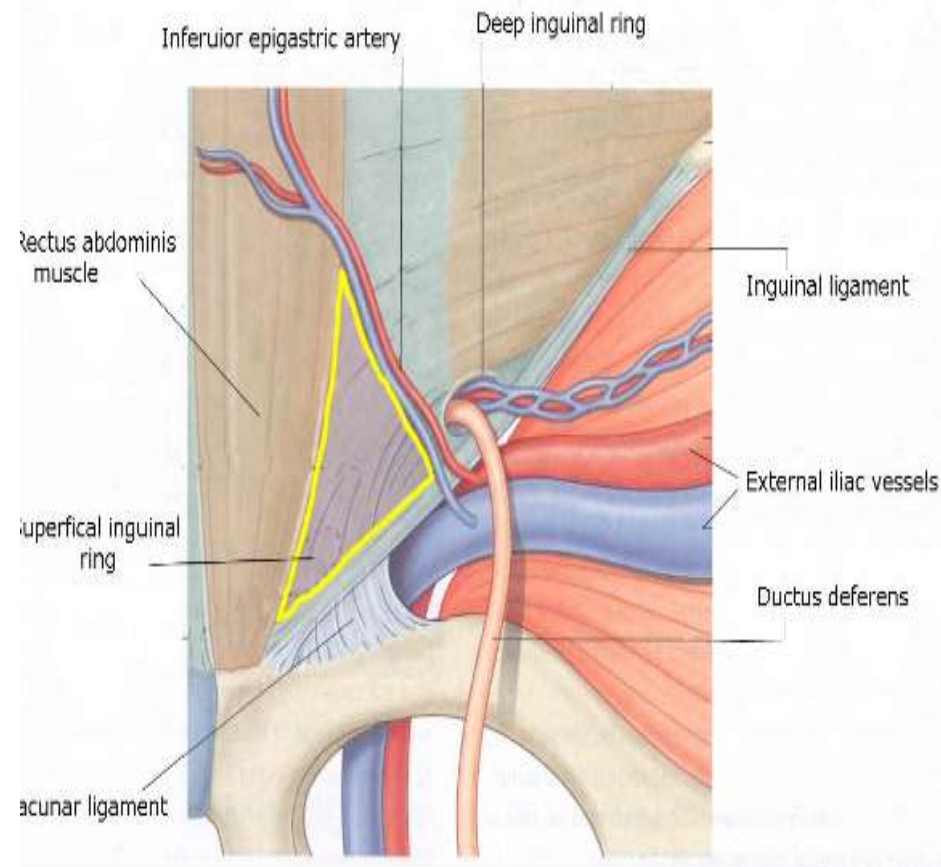
- ❖ one of the terminal branches of the Internal Thoracic Artery, enters the upper part of the rectus sheath between the sternal and costal origins of the diaphragm.
- ❖ It descends behind the rectus muscle, supplying the **upper central part of anterior abdominal wall**, and anastomosis with the inferior epigastric artery.



Arteries of Anterior Abdominal Wall

■ Inferior epigastric artery

- ❖ is a branch of External Iliac Artery just above the inguinal ligament. It runs upward and medially along the Medial side of the Deep Ring.
- ❖ It pierces the fascia transversalis to enter the rectus sheath anterior to the arcuate line.
- ❖ It ascends behind the rectus muscle, supplying the ***lower central part of the anterior abdominal wall***, and anastomose with the superior epigastric artery.



Arteries of Anterior Abdominal Wall

- + Deep circumflex iliac artery is a branch of the External iliac artery just above the inguinal ligament. It runs upward and laterally toward the ASIS and then continues along the iliac crest, It supplies **lower lateral part** of the abdominal wall.
- + Lower two posterior intercostal arteries, branches of the Descending thoracic aorta, and the four lumbar arteries, branches of the Abdominal Aorta, pass forward between the muscle layers and supply the **lateral part** of the abdominal wall.

Veins of Anterior Abdominal Wall

**Veins of the Anterior
Abdominal Wall**

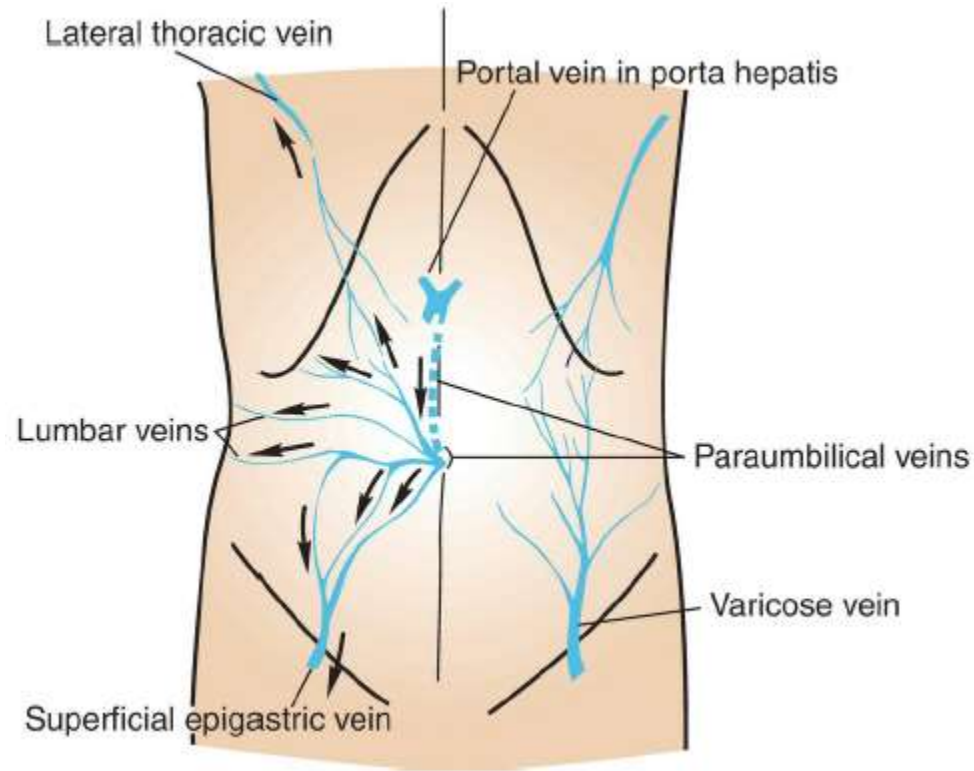
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graph TD; A[Veins of the Anterior Abdominal Wall] --> B[Superficial Veins]; A --> C[Deep Veins];
```

Superficial Veins

Deep Veins

Superficial Veins

- Form a network that radiates out from the umbilicus.
- **Above**, the network is drained into the Axillary vein via the lateral thoracic vein.
- **Below**, into the Femoral vein via the superficial epigastric and great saphenous veins.



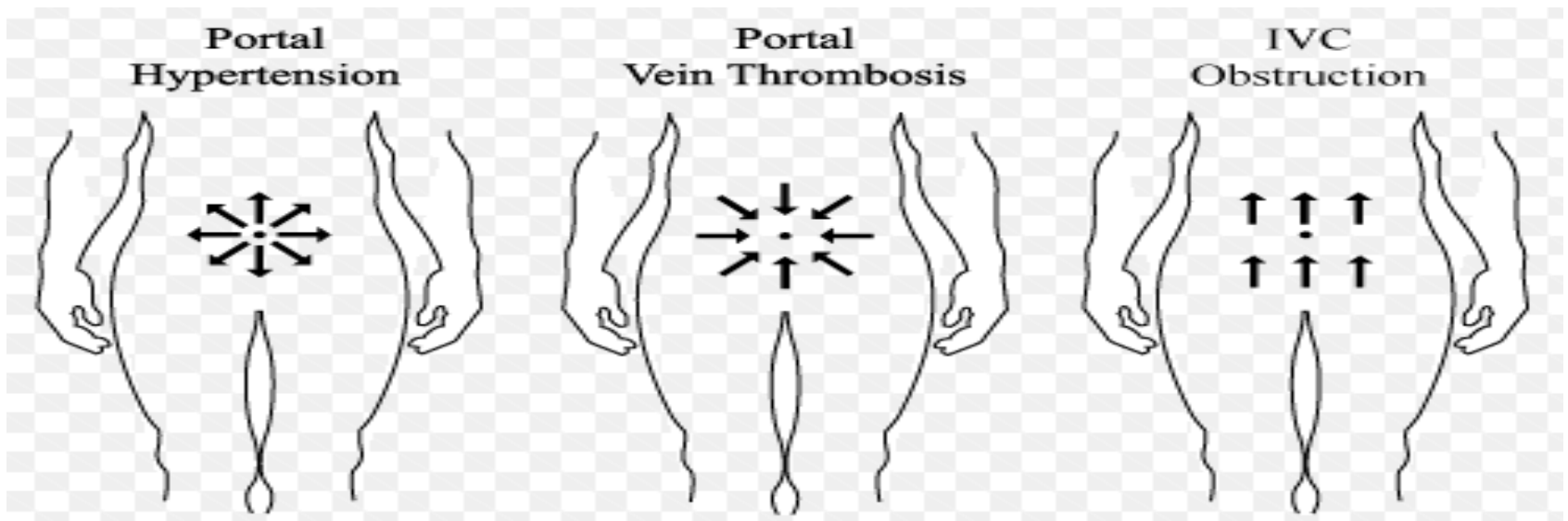
- A few small veins (paraumbilical veins) , connect the network through the umbilicus and along the ligamentum teres to the portal vein.
- This forms **porto - systemic venous anastomosis**.

Deep Veins

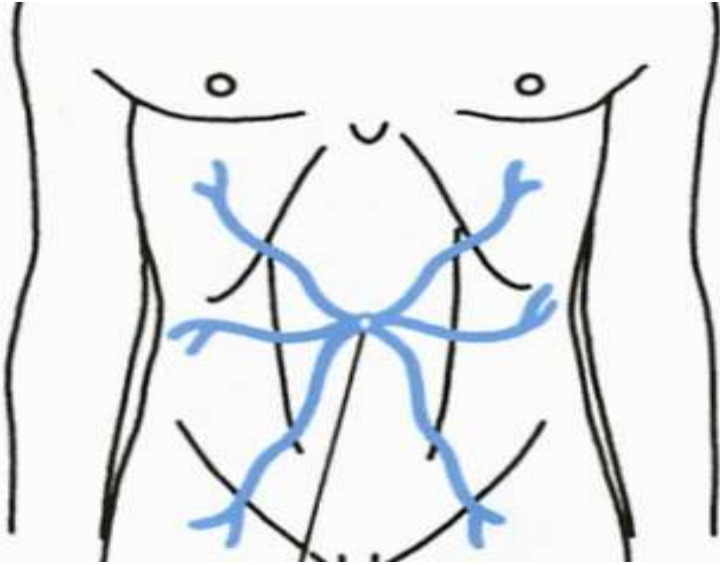
- The deep veins of the abdominal wall, the superior epigastric, inferior epigastric, and deep circumflex iliac veins, follow the arteries of the same name and drain into the Internal thoracic and External iliac veins.
- The posterior intercostal veins drain into the Azygos Veins, and the lumbar veins drain into the *inferior vena cava*.

Clinical: PORTAL VEIN OBSTRUCTION

- In cases of portal vein obstruction, the superficial veins around the umbilicus and the paraumbilical veins become grossly distended.
- The distended subcutaneous veins radiate out from the umbilicus, producing in severe cases the clinical picture referred to as caput medusae.

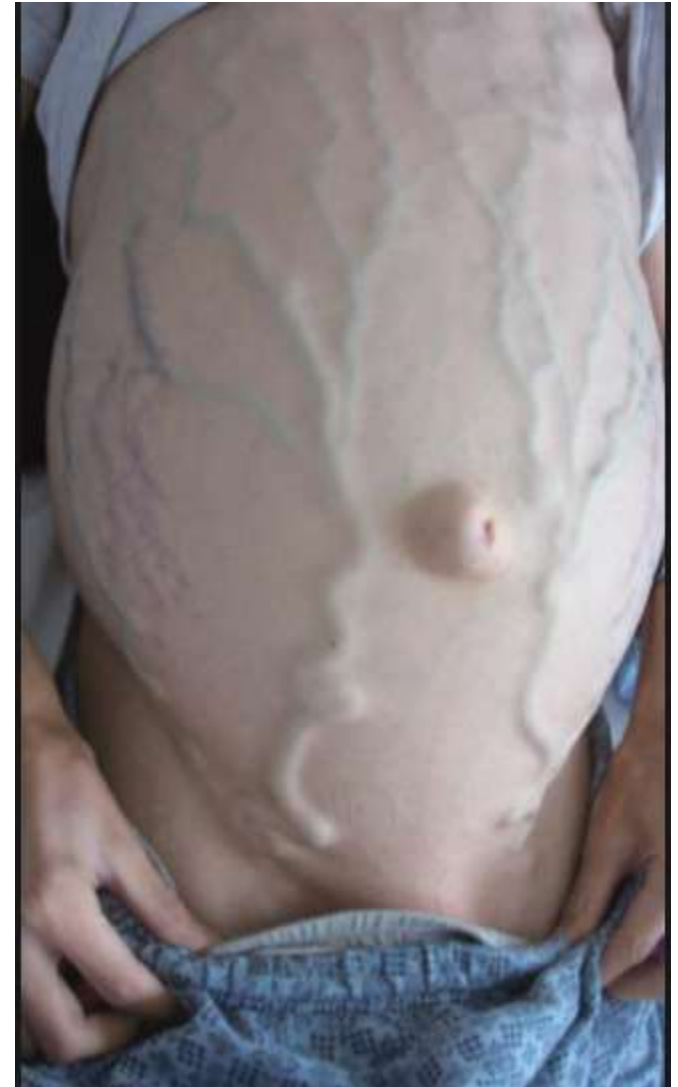


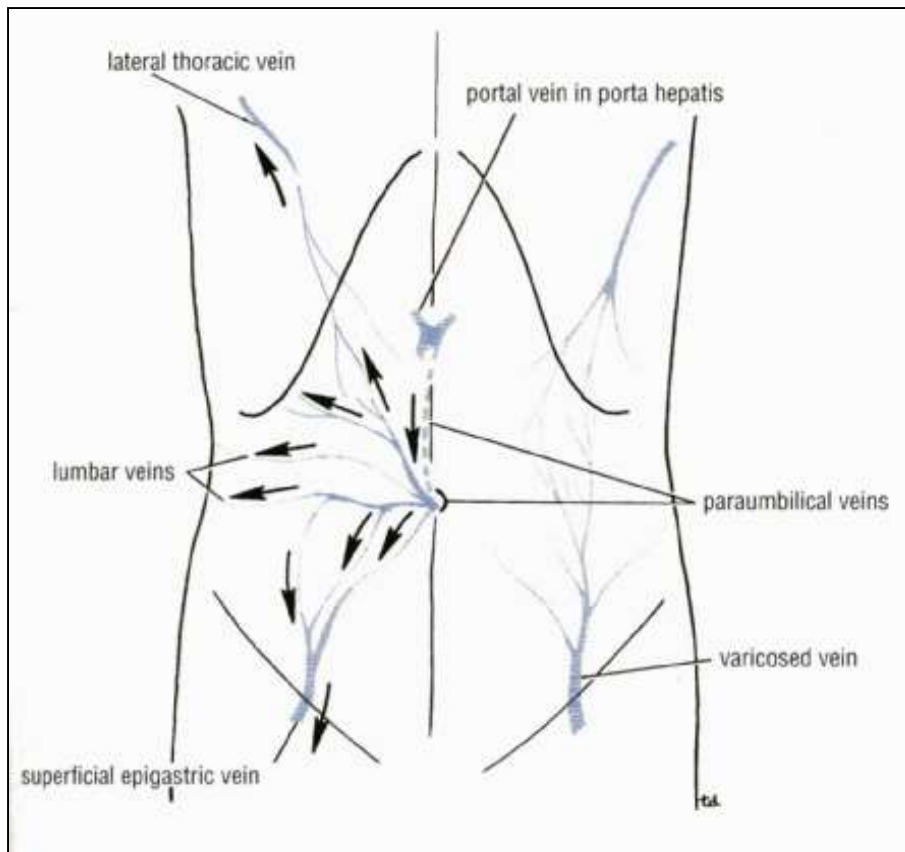
Clinical: PORTAL VEIN OBSTRUCTION



Clinical: CAVAL OBSTRUCTION

- If the superior or inferior vena cava is obstructed, the venous blood causes distension of the veins running from the anterior chest wall to the thigh.
- The *lateral thoracic vein* anastomoses with the *superficial epigastric vein*, a tributary of the great saphenous vein of the leg. In these circumstances, a tortuous varicose vein may extend from the axilla to the lower abdomen





Lymph Drainage of Anterior Abdominal Wall

**Lymph Drainage of the
Anterior Abdominal Wall**

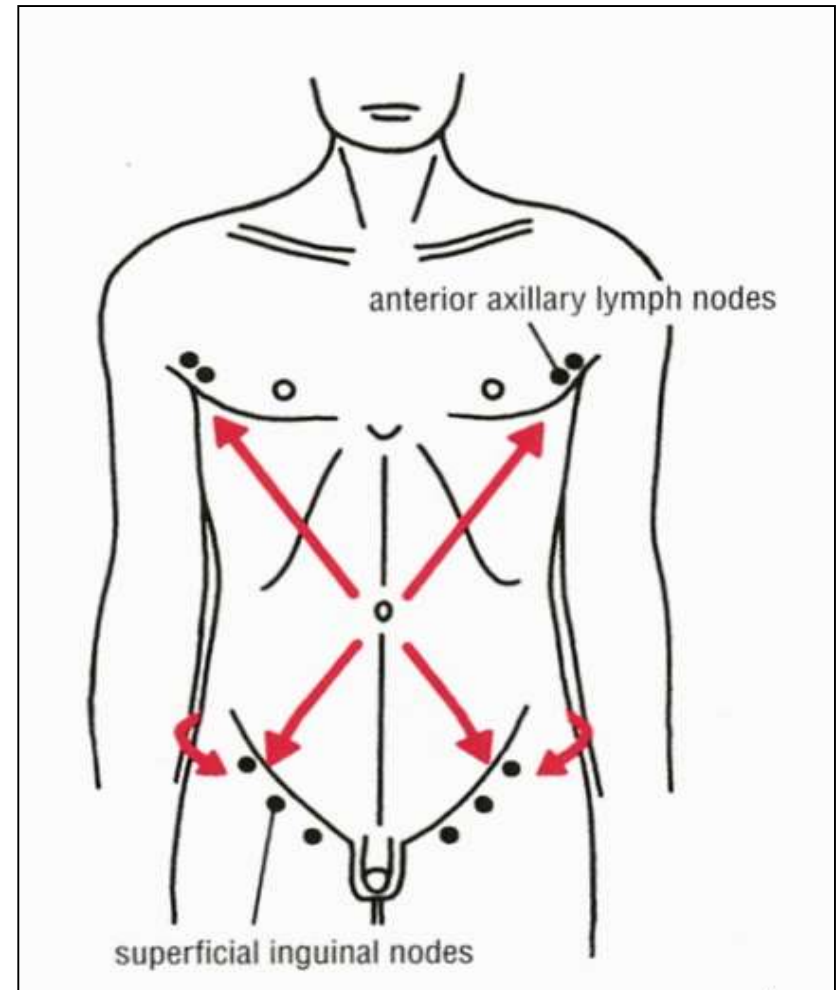
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graph TD; A[Lymph Drainage of the Anterior Abdominal Wall] --> B[Superficial lymph vessels]; A --> C[Deep lymph vessels];
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Superficial lymph vessels

Deep lymph vessels

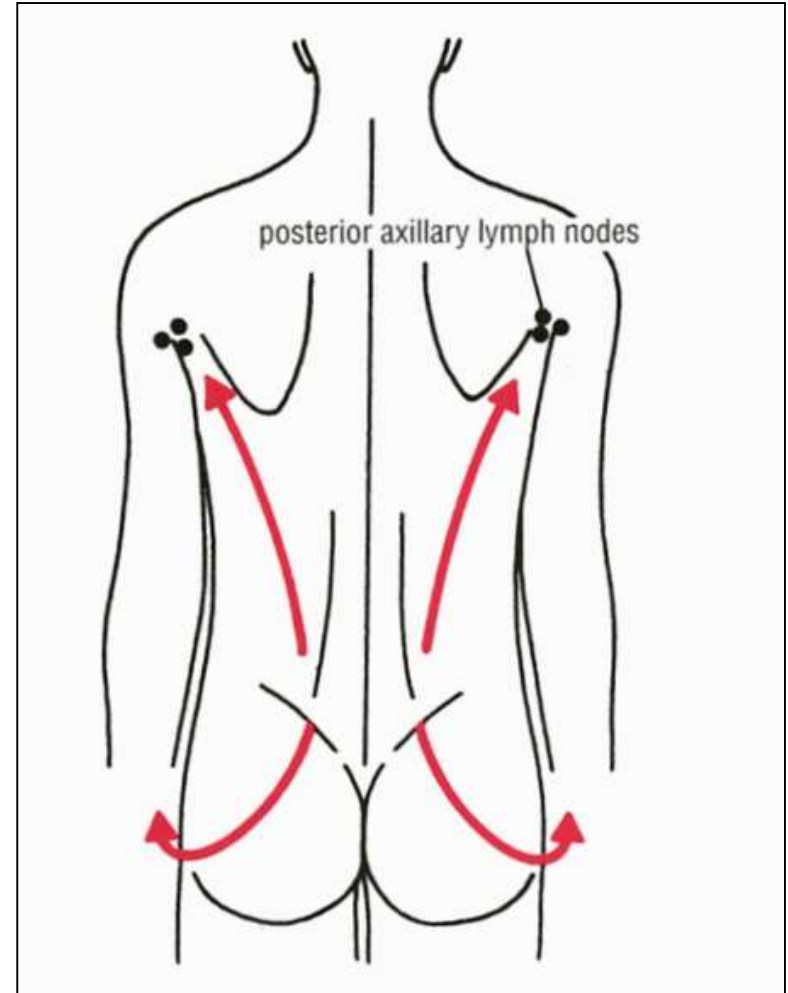
Superficial Lymph Vessels

- The lymph drainage of the skin of the anterior abdominal wall above the level of the umbilicus is upward to Anterior Axillary Nodes.
- Below the level of the umbilicus, the lymph drains downward and laterally to Superficial Inguinal Nodes.



Superficial Lymph Vessels

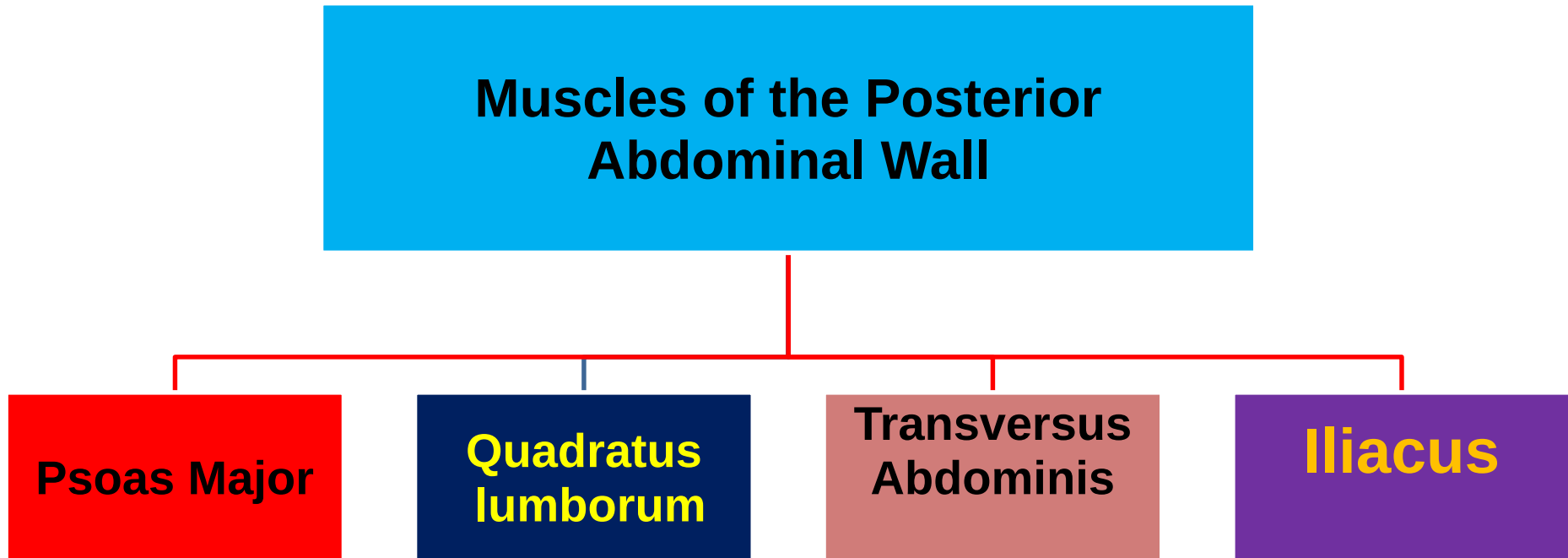
- The lymph of the skin of the back above the level of the iliac crests is drained upward to Posterior Axillary Nodes
- Below the level of the iliac crests, it drains downward to the Superficial Inguinal Nodes



Deep Lymph Vessels

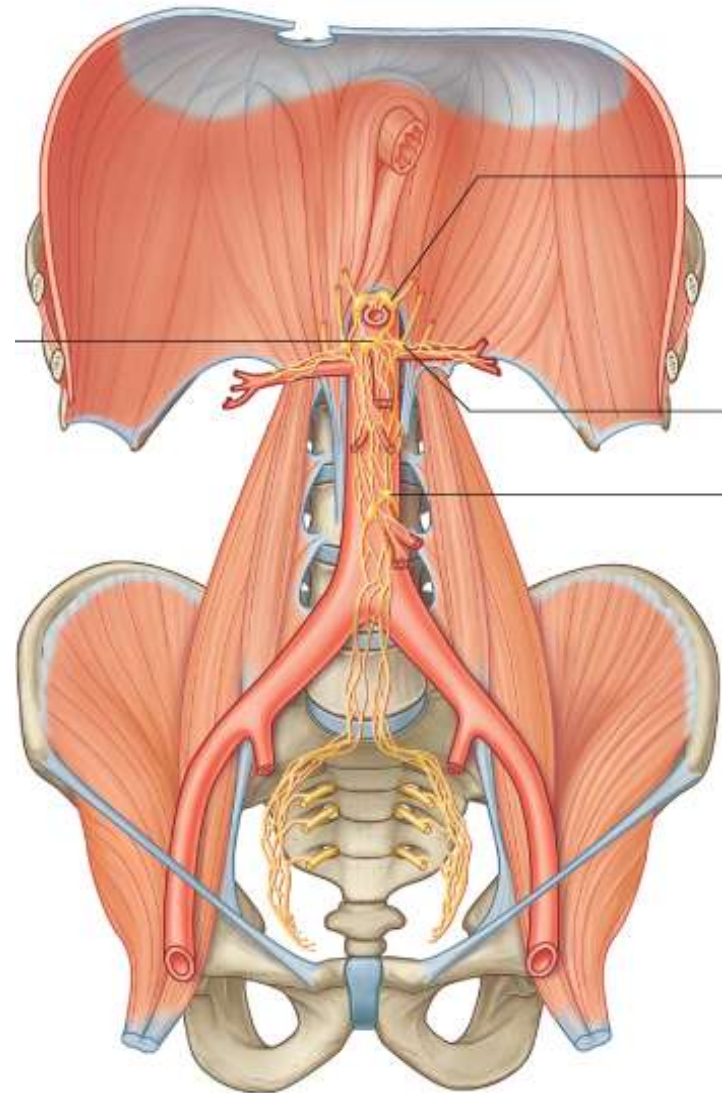
- ✚ The Deep lymph vessels follow the arteries and drain into the internal thoracic, external iliac, posterior mediastinal, and para-aortic (lumbar) nodes.

Muscles of Posterior Abdominal Wall



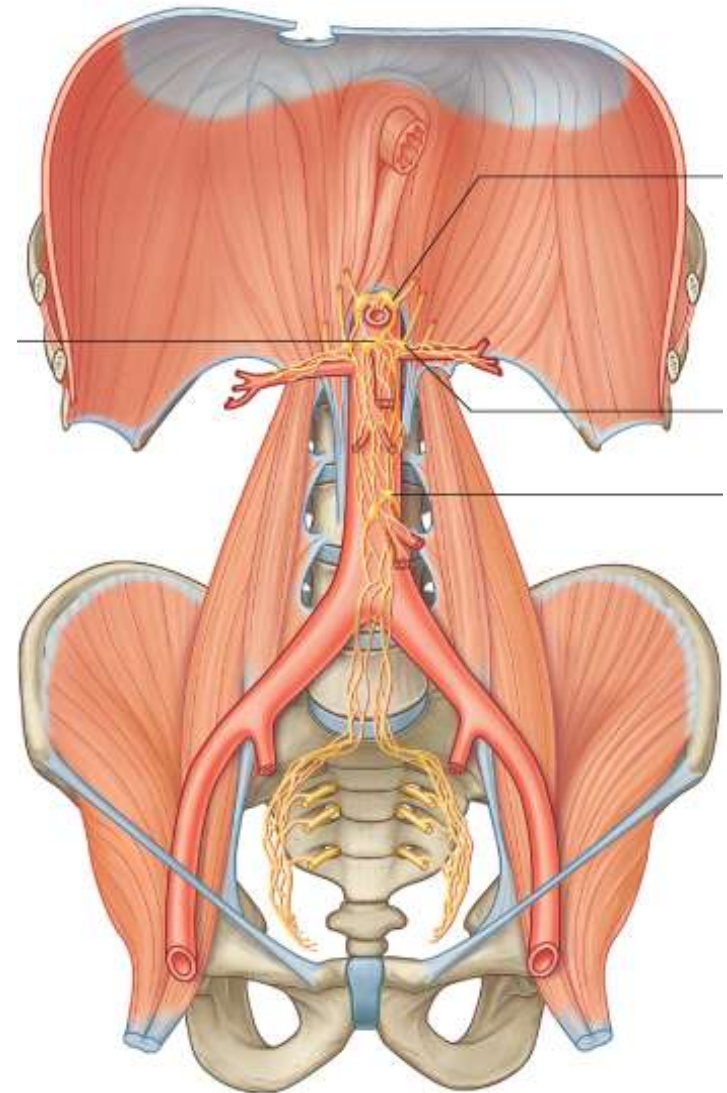
Psoas Major muscle

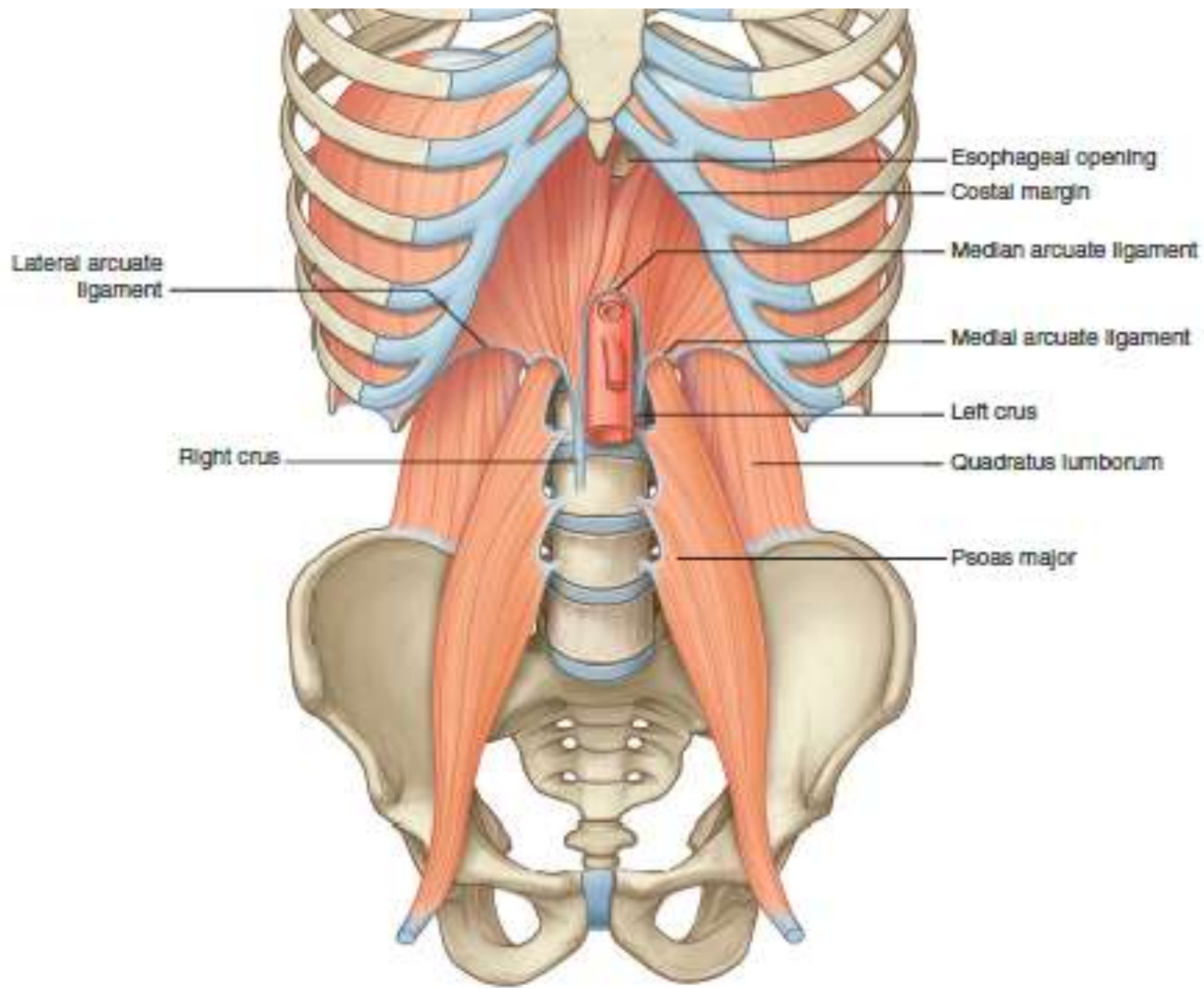
- Arises from :
 - Roots of transverse processes of all lumbar vertebra.
 - Sides of the vertebral bodies, and the intervertebral discs.
 - Twelfth thoracic to the fifth lumbar vertebrae.
- The fibers run downward and laterally and leave the abdomen to enter the thigh by passing behind (posterior to) the inguinal ligament.
- The muscle is inserted into the lesser trochanter of the femur.



Psoas Major muscle

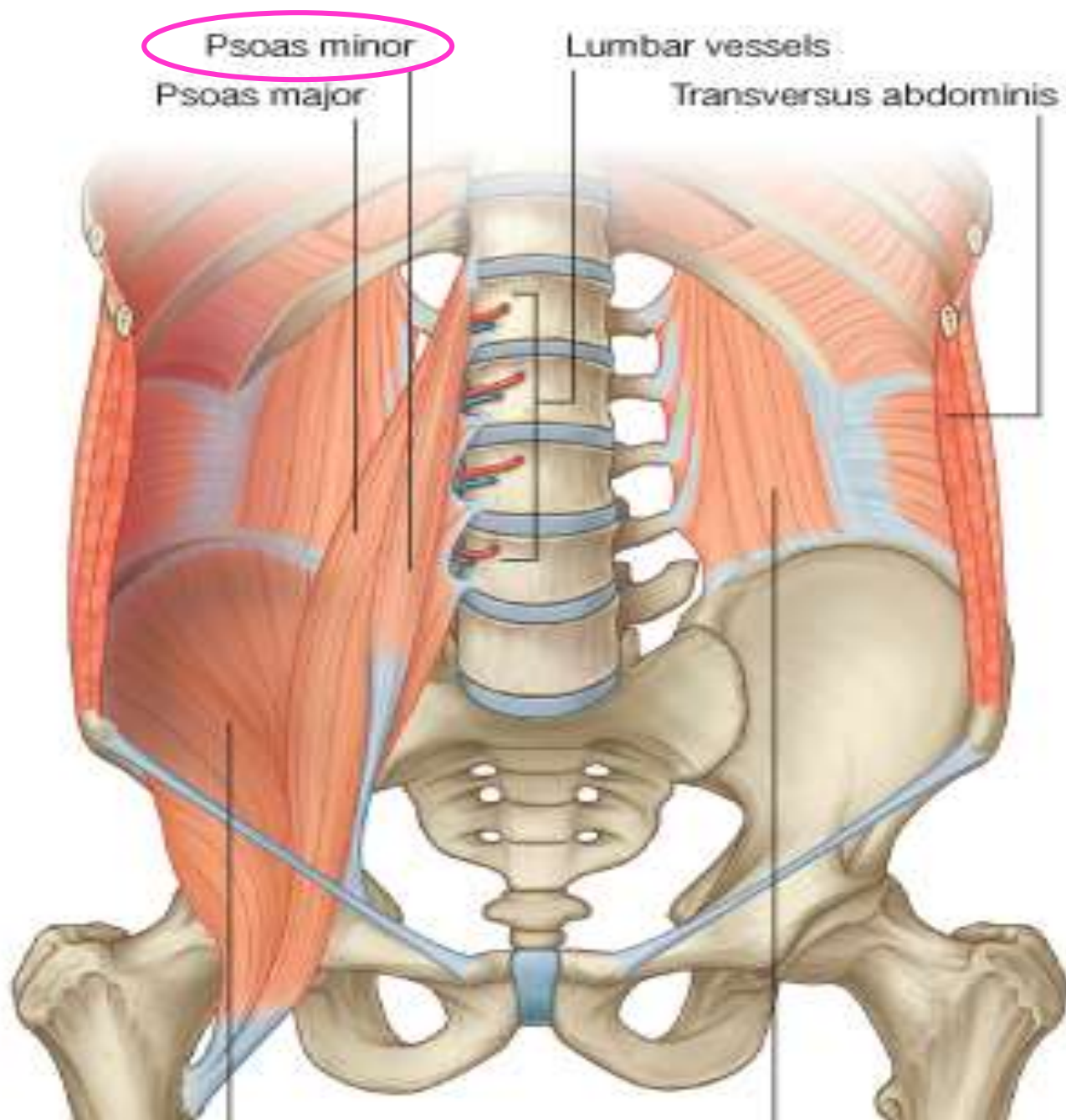
- It is enclosed in a fibrous sheath that is derived from the lumbar fascia. The sheath is thickened above to form the **Medial arcuate ligament**.
- Nerve supply by lumbar Plexus
- Action : flexes the thigh at the hip joint on the trunk; or if the thigh is fixed, it flexes the trunk on the thigh, as in sitting up from a lying position.





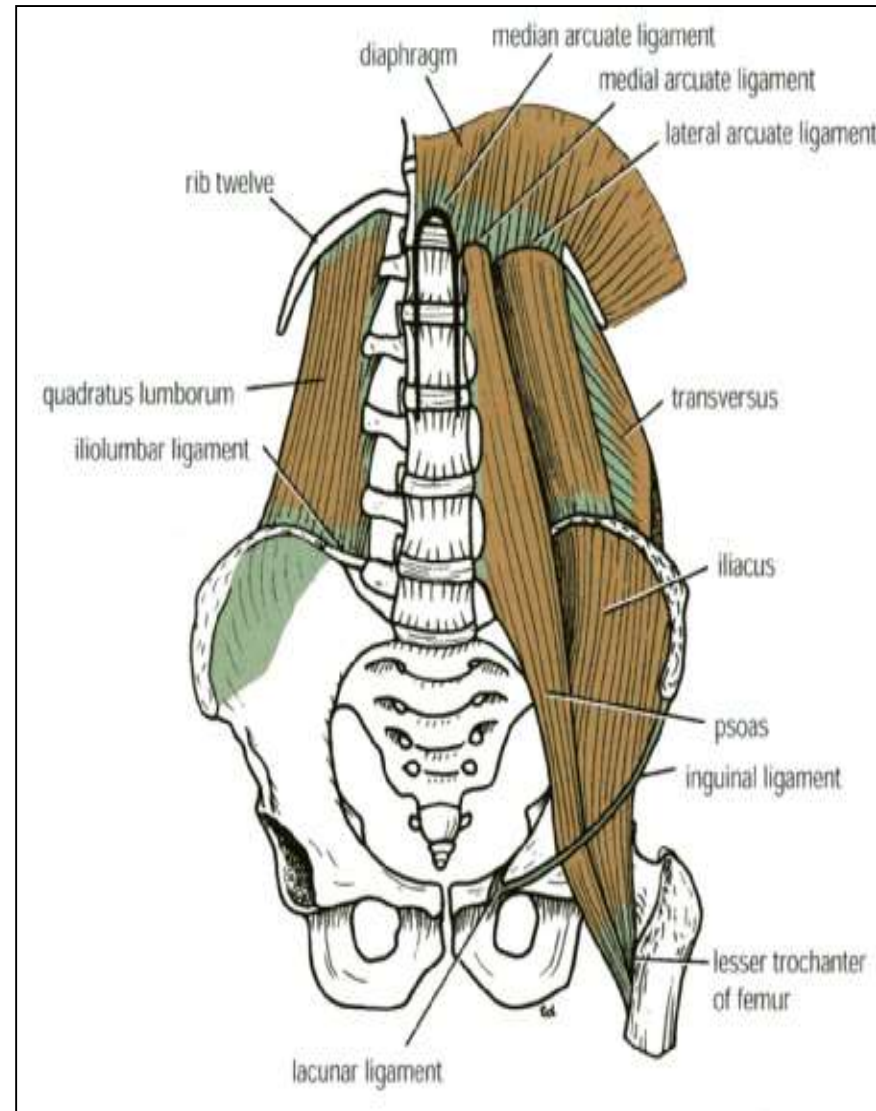
Psoas Minor muscle

It is a small muscle with along tendon that lies anterioromedially to the psoas major. It is unimportant and is absent in 40% of patients.



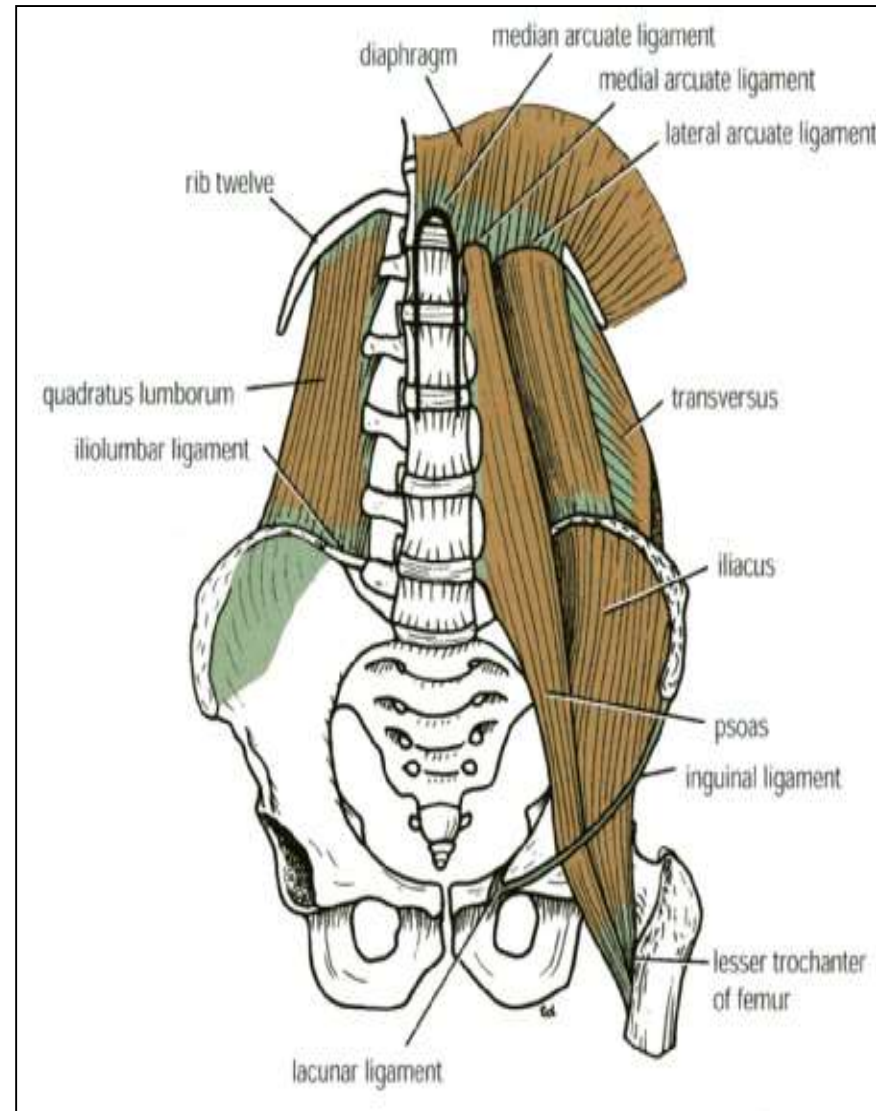
Quadratus Lumborum Muscle

- is a flat, quadrilateral-shaped muscle that lies alongside the vertebral column.
- origin below from the :
 - Iliolumbar ligament.
 - adjoining part of iliac crest.
 - tips of the transverse processes of the lower 4 lumbar vertebrae.



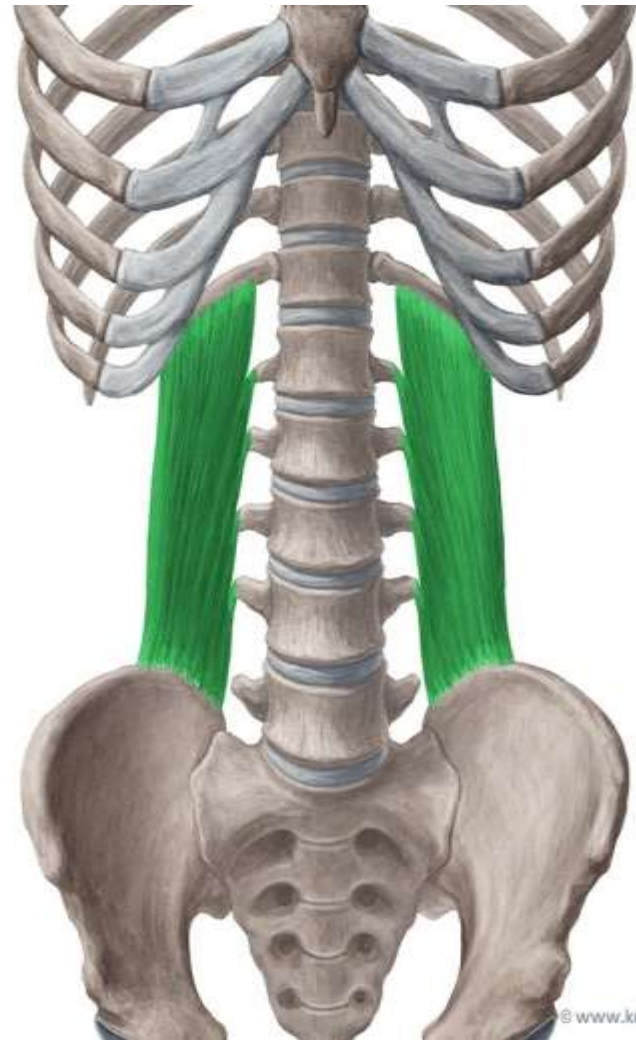
Quadratus Lumborum Muscle

- The fibers run upward and medially
- insertion: into the lower border of the 12th rib and the transverse processes of the upper four lumbar vertebra
- Anterior surface of the muscle is covered by lumbar fascia, which is thickened above to form the lateral arcuate ligament and below to form iliolumbar ligament



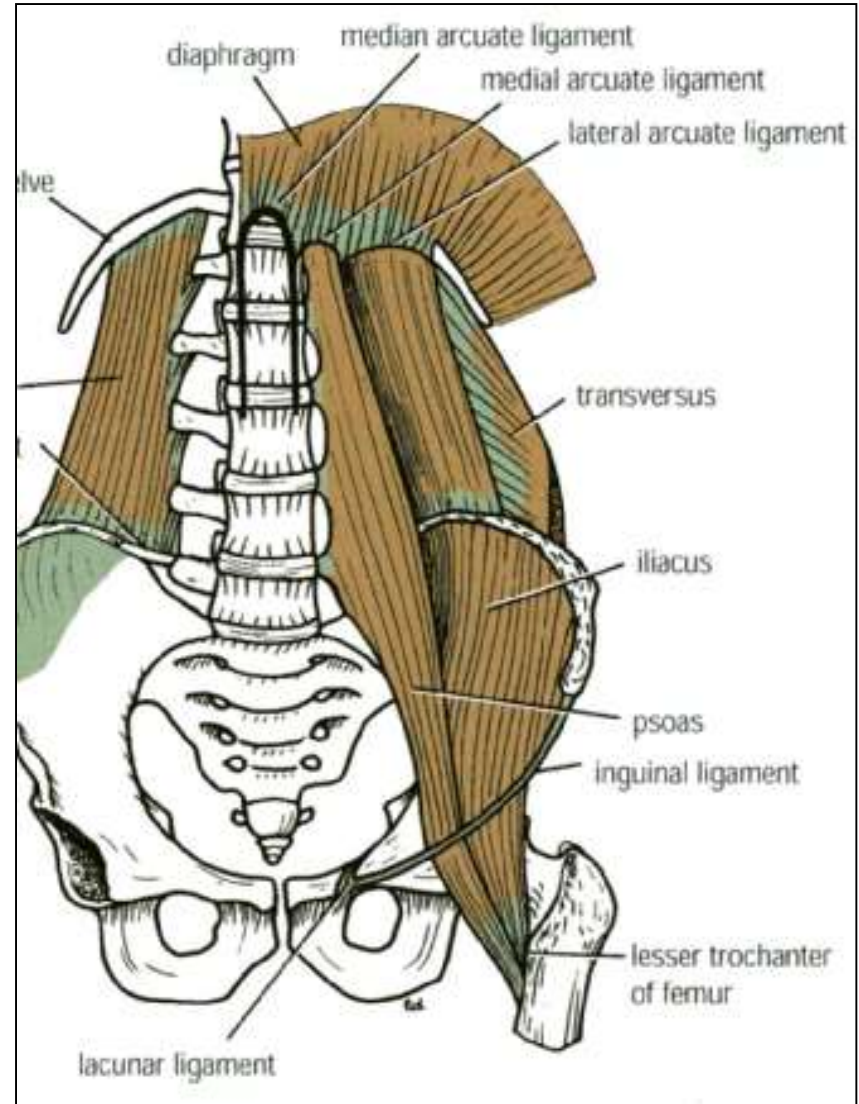
Quadratus Lumborum Muscle

- Nerve supply :
lumbar plexus.
- Action:
fixes or depresses the
twelfth rib during
respiration and
laterally flexes the
vertebral column to
the same side.



Iliacus muscle

- It is fan shaped
- Origin: from the upper part of the iliac fossa.
- Its fibers join the lateral side of the psoas tendon to be Inserted into the lesser trochanter of the femur.
- The combined muscles are often referred to as the *Iliopsoas* (the major flexor of the thigh, or the major flexor of the trunk against the thigh)

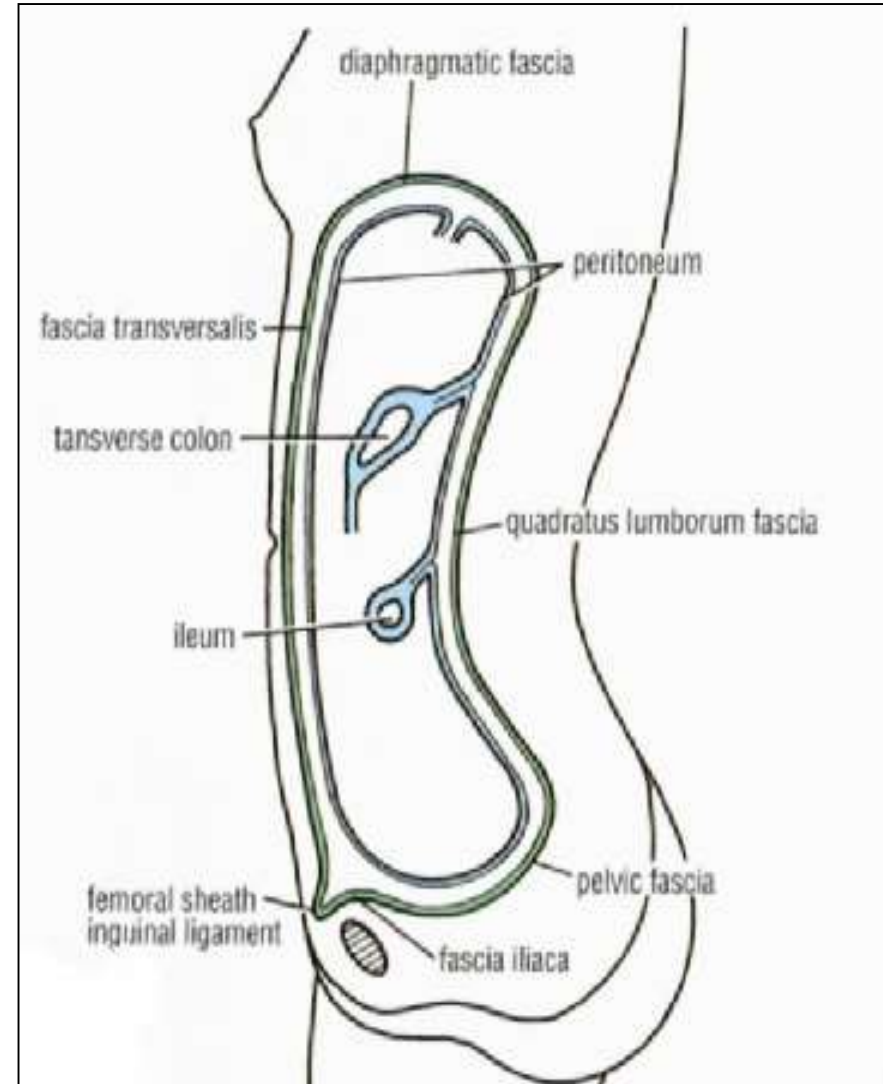


Posterior Abdominal Wall Muscles

Muscle	Origin	Insertion	Innervation	Function
Psoas major	Lateral surface of bodies of TXII and LI to LV vertebrae, transverse processes of the lumbar vertebrae, and the intervertebral discs between TXII and LI to LV vertebrae	Lesser trochanter of the femur	Anterior rami of L1 to L3	Flexion of thigh at hip joint
Psoas minor	Lateral surface of bodies of TXII and LI vertebrae and intervening intervertebral disc	Pectineal line of the pelvic brim and iliopubic eminence	Anterior rami of L1	Weak flexion of lumbar vertebral column
Quadratus lumborum	Transverse process of LV vertebra, iliolumbar ligament, and iliac crest	Transverse processes of LI to LIV vertebrae and inferior border of rib XII	Anterior rami of T12 and L1 to L4	Depress and stabilize rib XII and some lateral bending of trunk
Iliacus	Upper two-thirds of iliac fossa, anterior sacro-iliac and iliolumbar ligaments, and upper lateral surface of sacrum	Lesser trochanter of femur	Femoral nerve (L2 to L4)	Flexion of thigh at hip joint

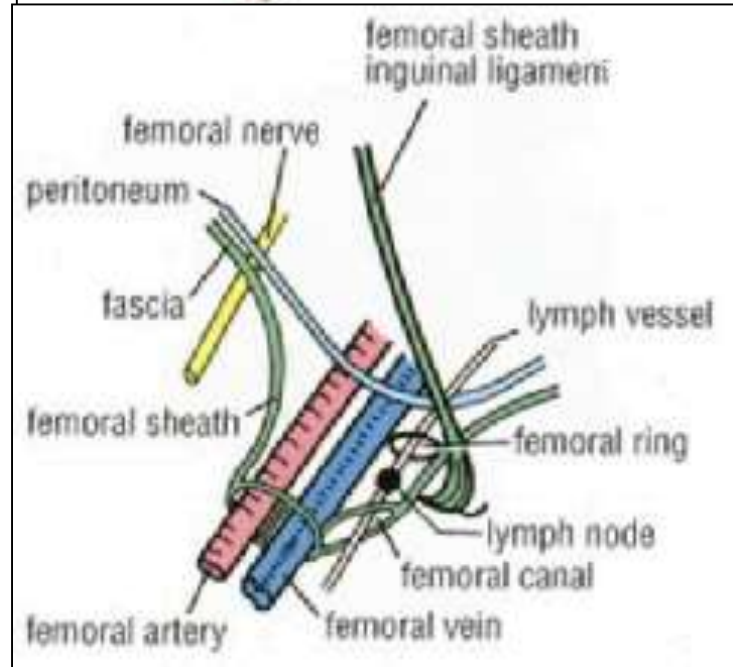
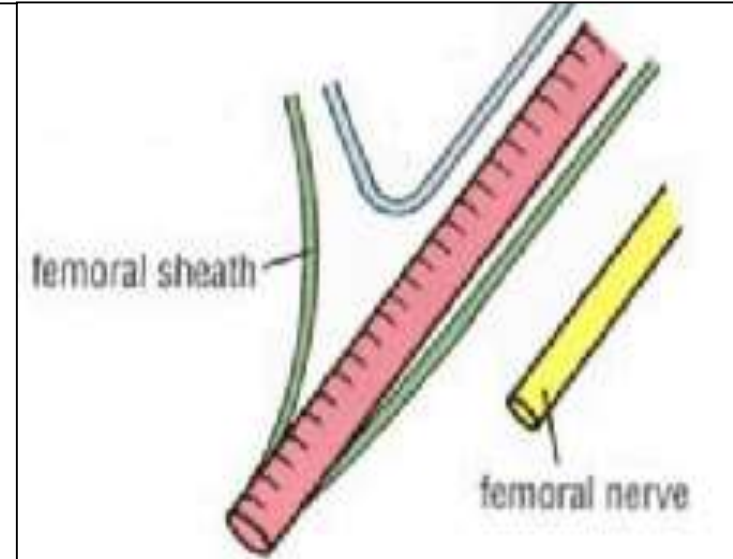
Fascia Lining of Abdominal Walls

- The abdominal walls are lined by one continuous layer of connective tissue that lies between the parietal peritoneum and the muscles.
- It is continuous below with a similar fascial layer lining the pelvic walls.
- It is customary to name the fascia according to the structure it overlies.



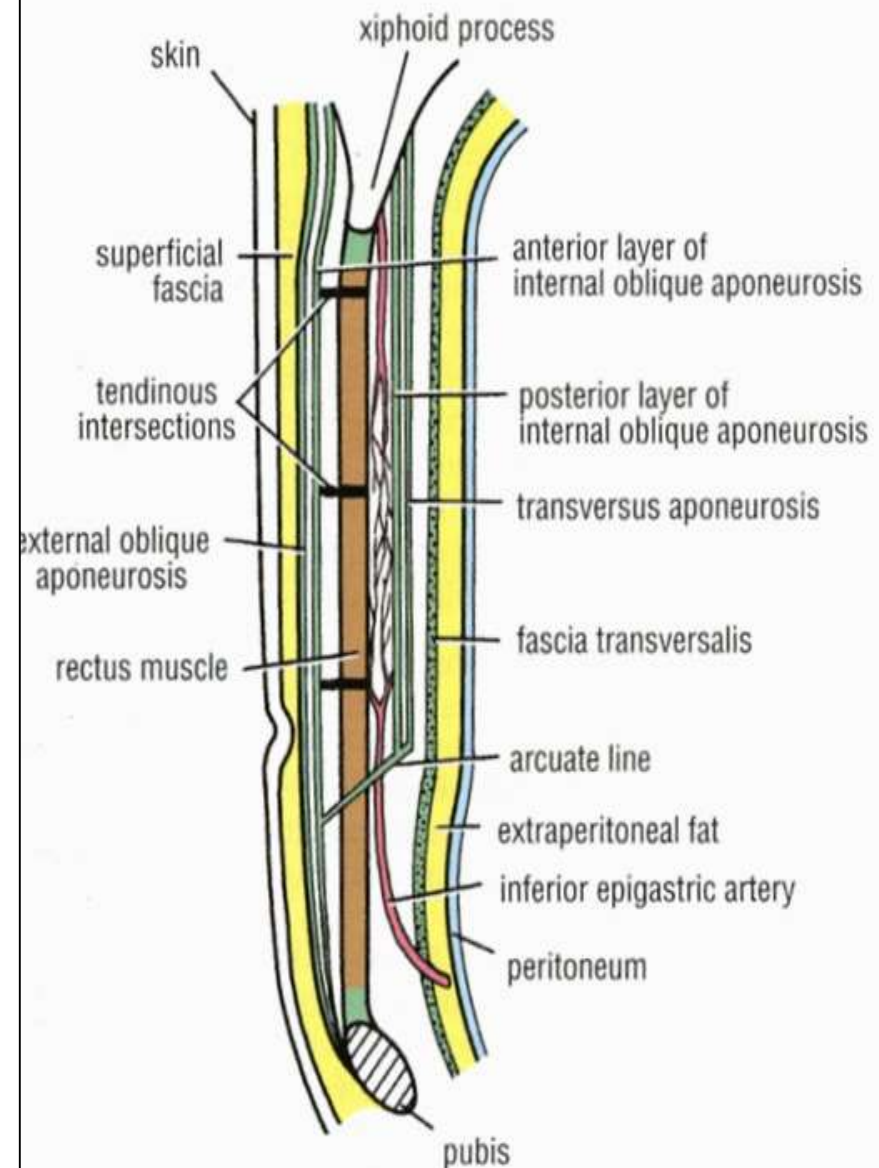
Fascia Lining of Abdominal Walls

- The abdominal blood and lymph vessels lie within this fascial lining, whereas the Principal nerves lie outside the fascia.
- This fact is important in the understanding of the femoral sheath.
- This is simply a downward prolongation of the fascial lining around the femoral vessels and lymphatics, for about (4 cm) into the thigh, behind the inguinal ligament.
- Because the femoral nerve lies outside the fascial envelope, it has no sheath.



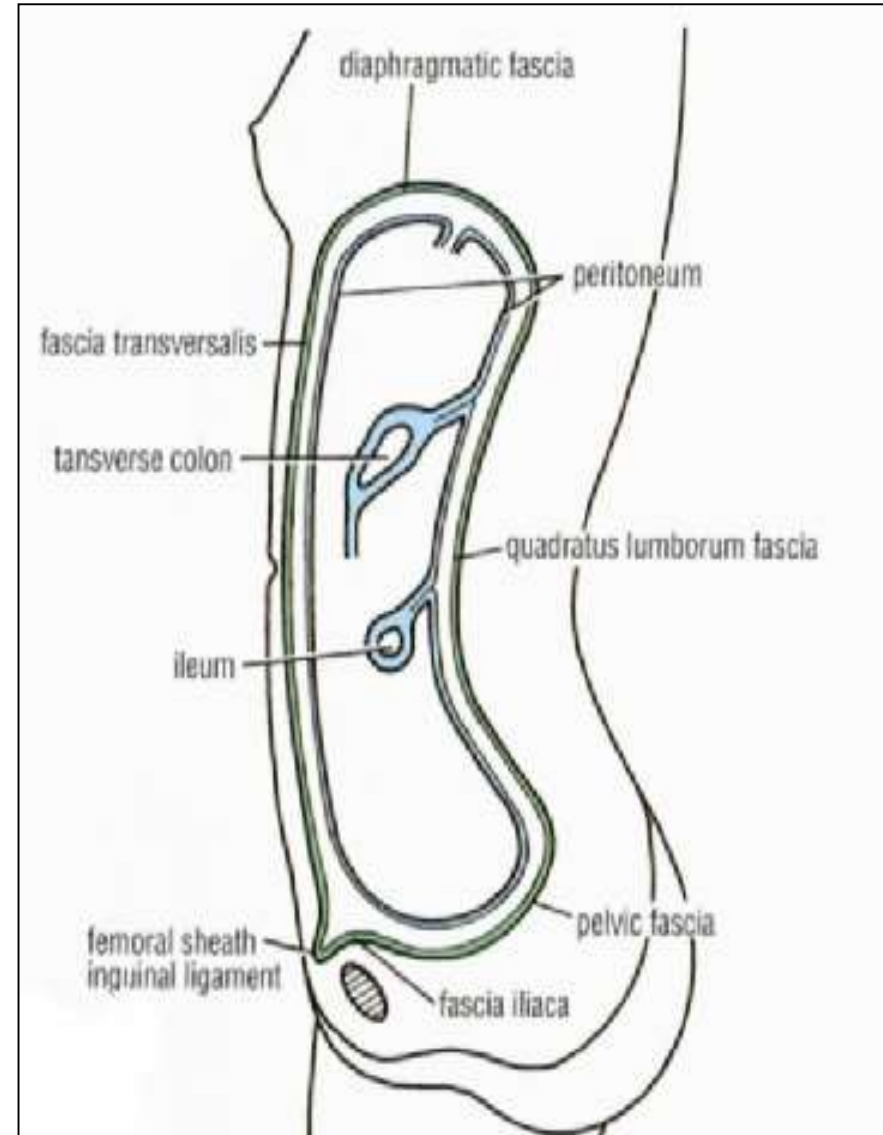
Fascia Lining of Abdominal Walls

- In certain areas of the abdominal wall, the fascial lining performs particularly important functions.
- Inferior to the level of the anterior superior iliac spines, the posterior wall of the rectus sheath is devoid of muscular aponeurosis and is formed by the fascia transversalis (the deep inguinal ring) and peritoneum only.



Fascia Lining of Abdominal Walls

- The walls of the abdomen are lined with parietal peritoneum.
- This is a thin serous membrane consisting of a layer of mesothelium resting on connective tissue.
- It is continuous below with the parietal peritoneum lining the pelvis.



Peritoneal Lining of the Abdominal Walls

NERVE SUPPLY

- The central part of the diaphragmatic peritoneum is supplied by the Phrenic Nerves.
- The peripheral part is supplied by the lower intercostal nerves.
- The peritoneum lining the anterior and posterior abdominal walls is supplied segmentally by intercostal and lumbar nerves, which also supply the overlying muscles and skin.

Divercation of Recti



ABDOMINAL STAB WOUNDS



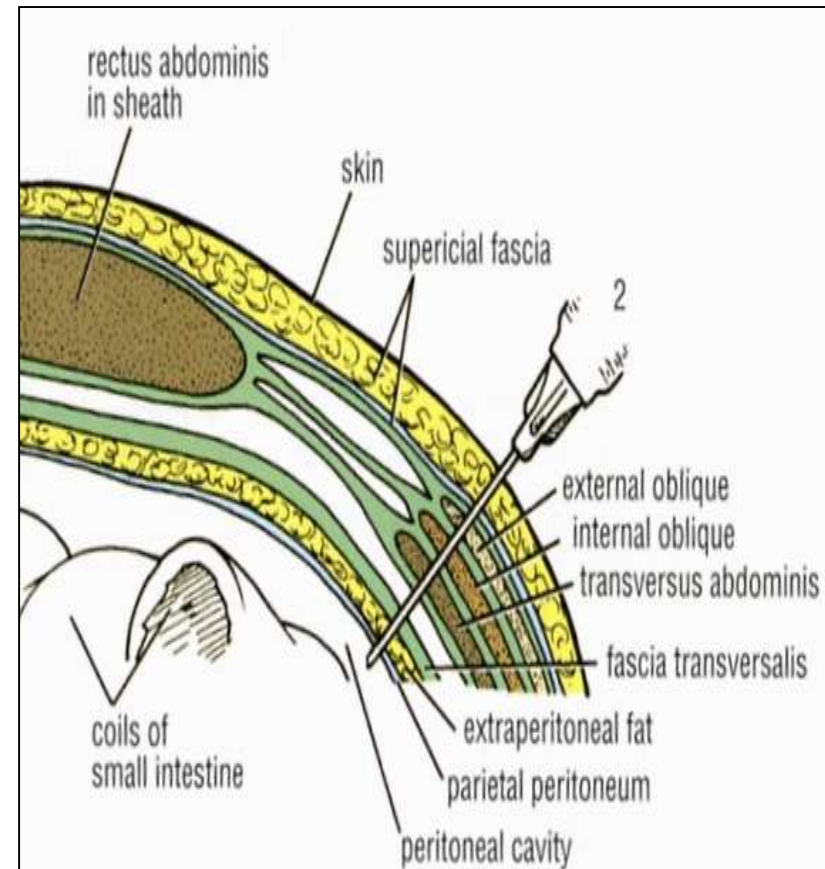
- Abdominal stab wounds may or may not penetrate the parietal peritoneum and violate the peritoneal cavity and consequently may or may not significantly damage the abdominal viscera.
- The structures in the various layers through which an abdominal stab wound penetrates depend on the anatomic location.

ABDOMINAL STAB WOUNDS



Lateral to rectus sheath are the following:

- Skin,
- Fatty layer of superficial fascia,
- Membranous layer of superficial fascia.
- External oblique muscle or aponeurosis.
- Internal oblique muscle or aponeurosis.
- Transversus abdominis muscle or aponeurosis,
- Fascia transversalis,
- Extraperitoneal connective tissue (often fatty),
- Parietal peritoneum.

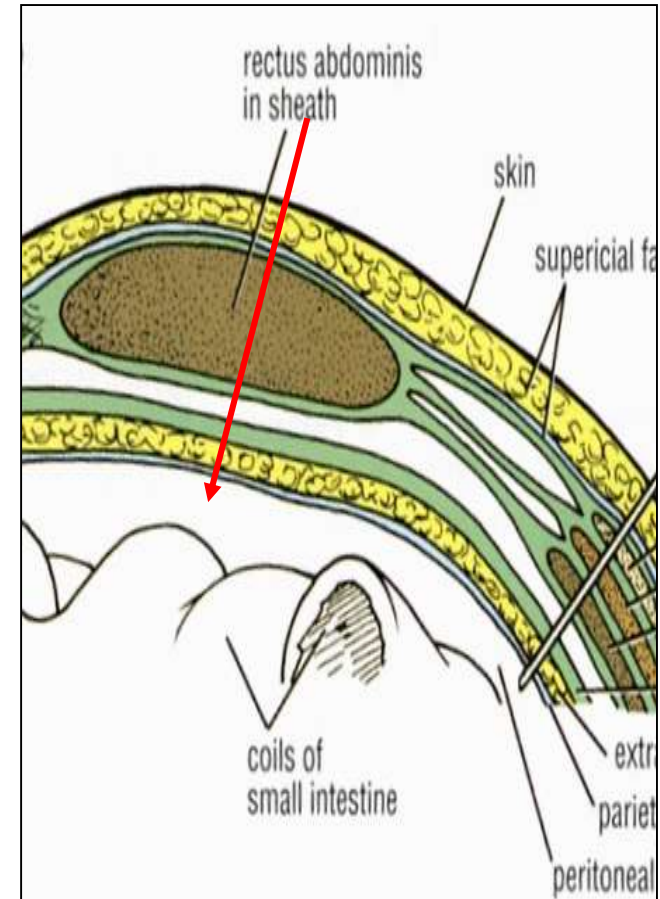


ABDOMINAL STAB WOUNDS



Anterior to rectus sheath are the following:

- Skin,
- Fatty layer of superficial fascia,
- Membranous layer of superficial fascia,
- Anterior wall of rectus sheath,
- Rectus abdominis muscle with segmental nerves and epigastric vessels lying behind the muscle.
- Posterior wall of rectus sheath.
- Fascia transversalis,
- Extraperitoneal connective tissue (often fatty).
- Parietal peritoneum.

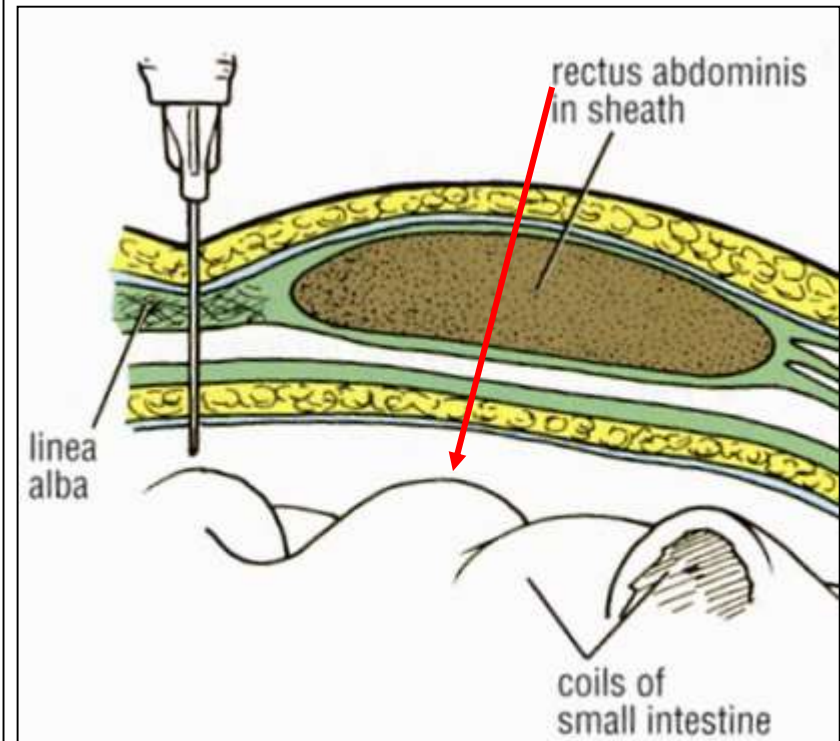


ABDOMINAL STAB WOUNDS



In the midline are the following:

- Skin.
- Fatty layer of superficial fascia,
- Membranous layer of superficial fascia,
- Fibrous linea alba.
- Fascia transversalis.
- Extraperitoneal connective tissue (often fatty).
- parietal peritoneum.



General Anatomy

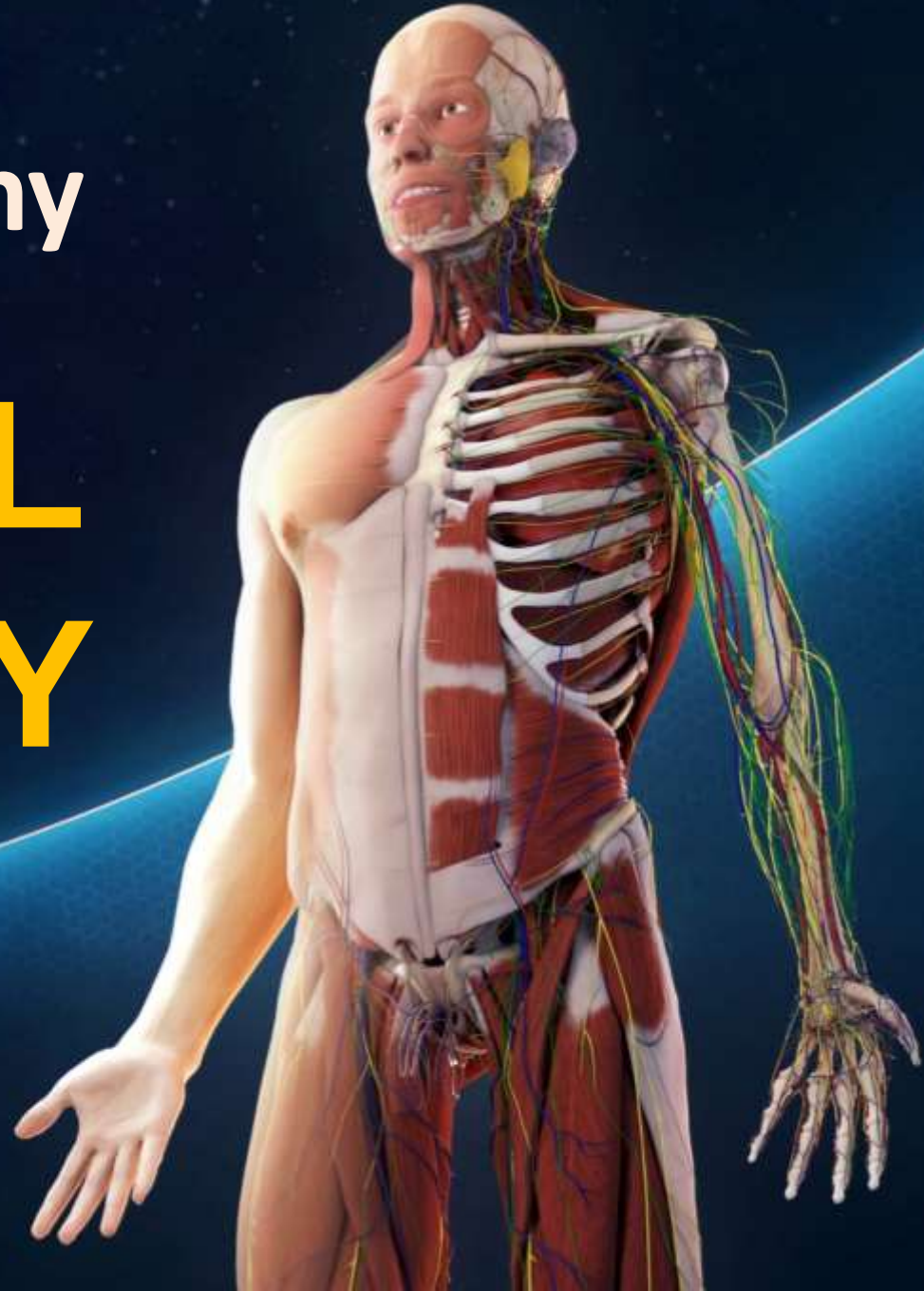
INGUINAL ANATOMY

Anatomy Group

Dr Naser Radwan, MD

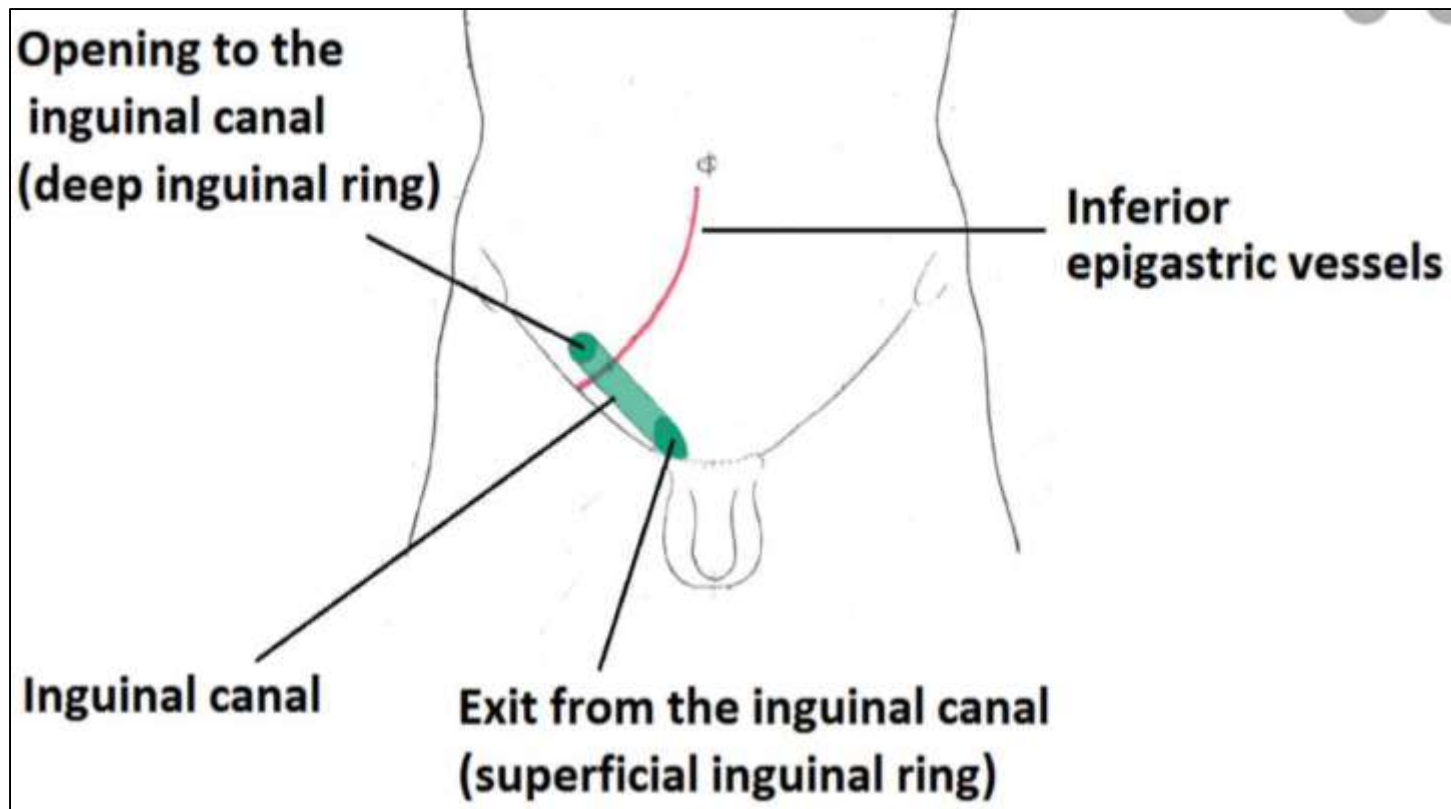
Dr Amjad Abu Alqumboz, MD

Dr Adham AlZanoun, MD



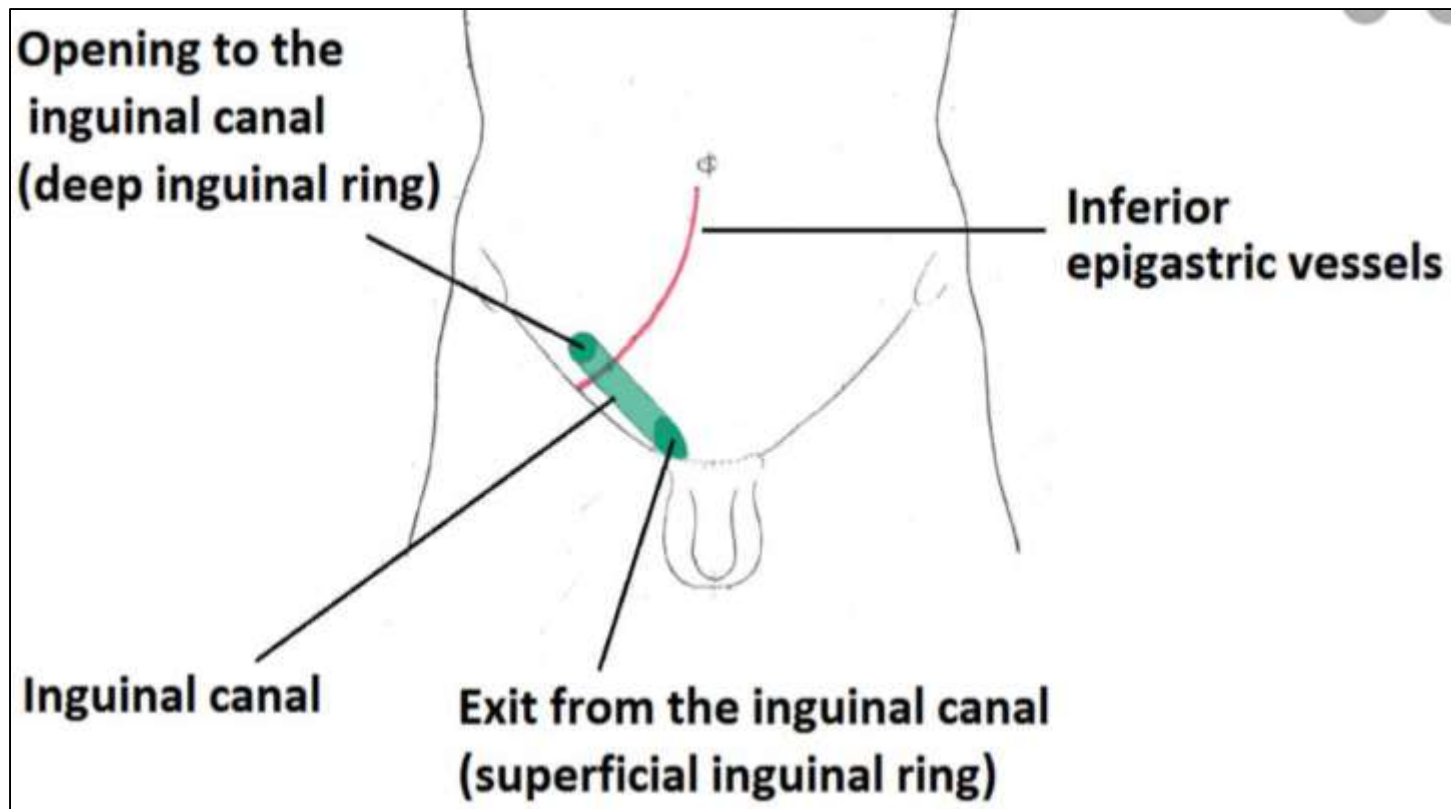
INGUINAL CANAL

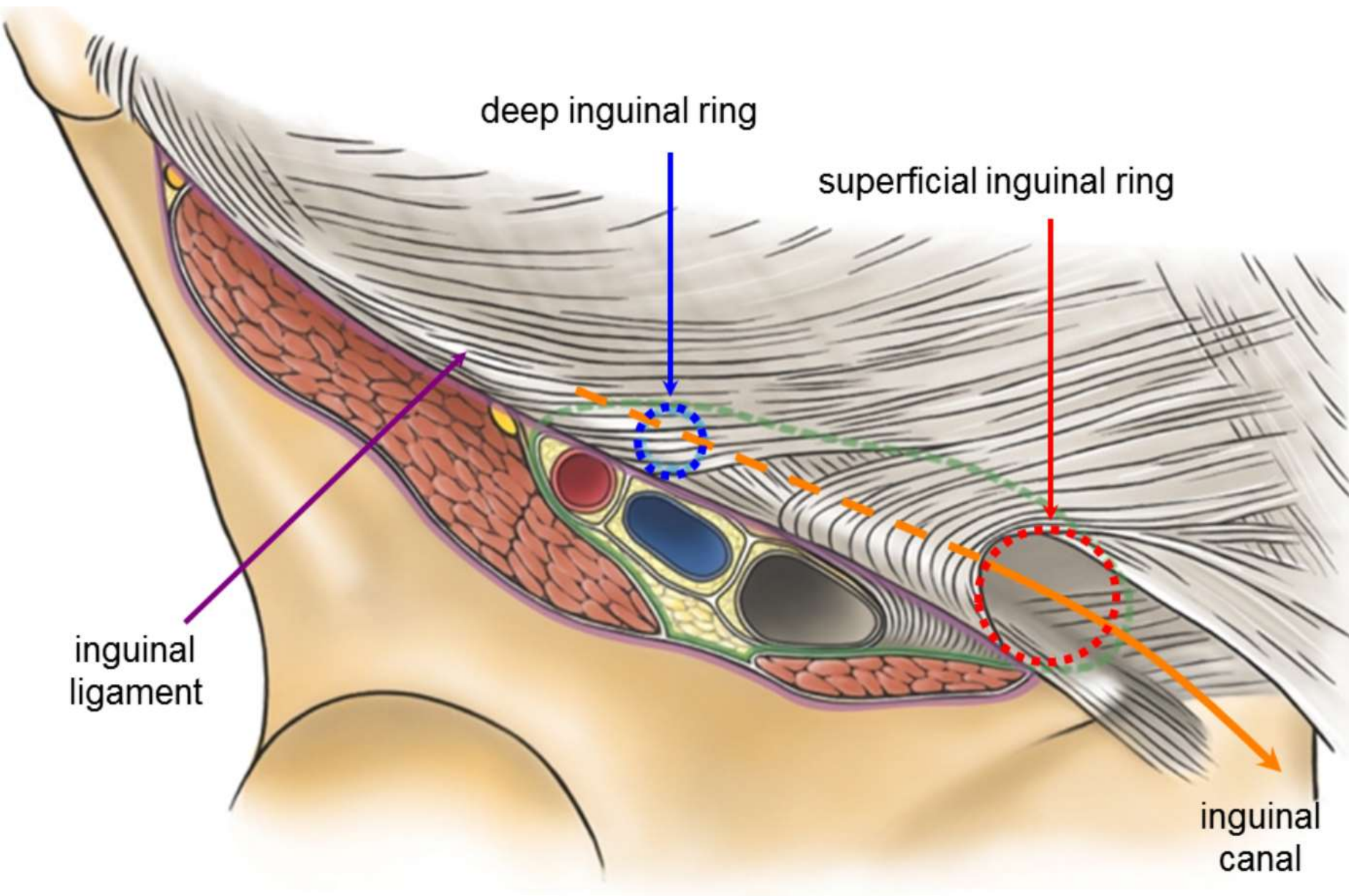
- Is an Oblique passage through the lower part of the anterior abdominal wall and is present in *both sexes*.
- It allows structures to pass to and from the testis to the abdomen in males.



INGUINAL CANAL

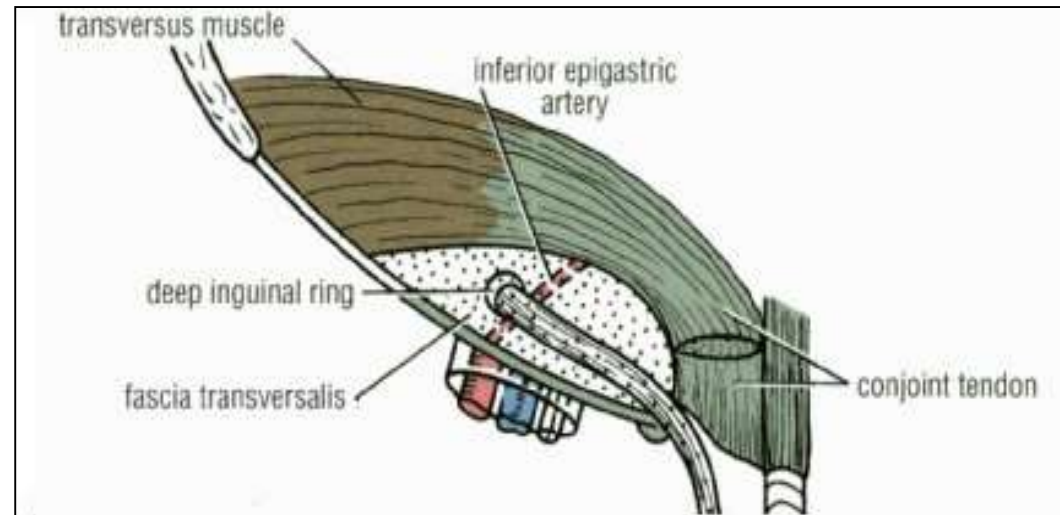
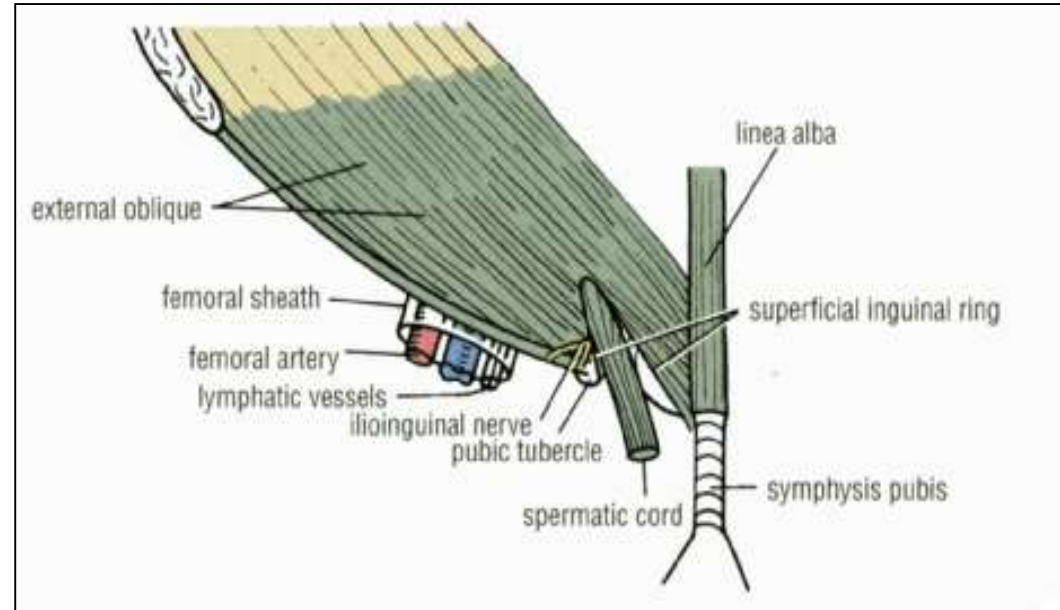
- In females it permits the passage of the Round Ligament of Uterus (from uterus to labium magus).
- It transmits the ilioinguinal nerve L1 in both sexes.



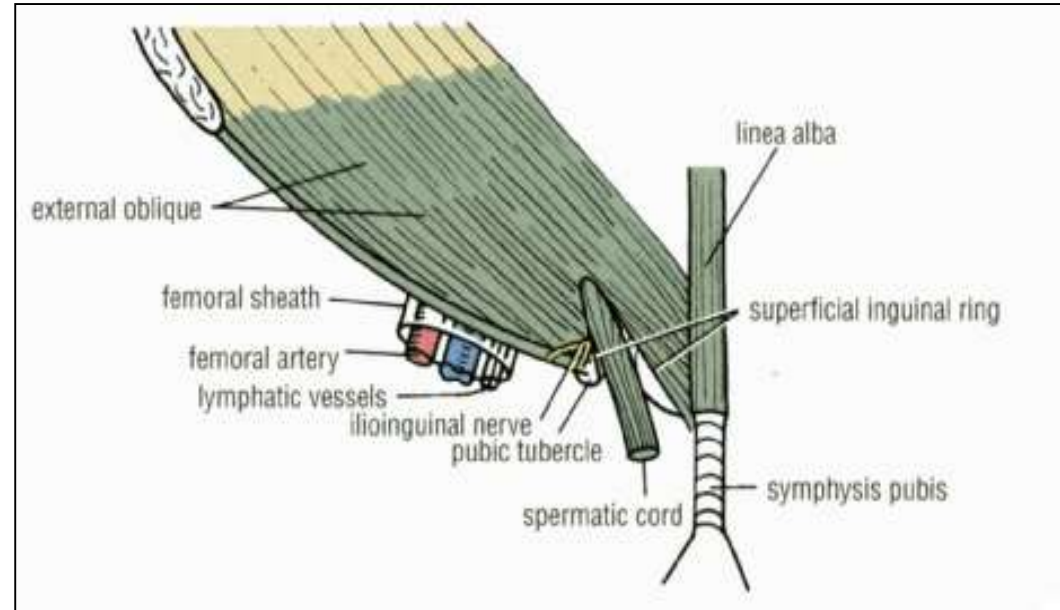


■ The canal is about (4 cm) long in adult and extends from Deep Inguinal Ring downward and medially to the Superficial Inguinal Ring.

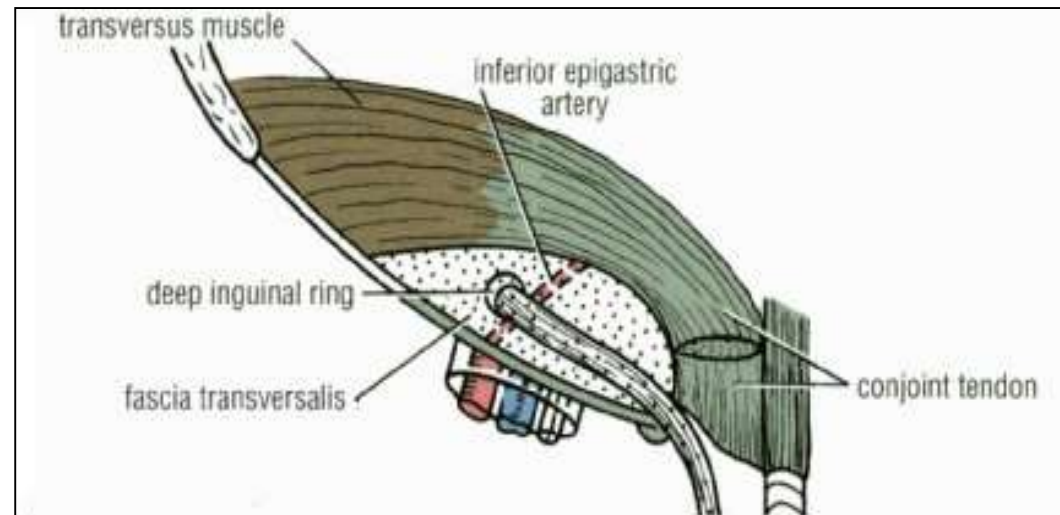
■ It lies parallel to and immediately above the inguinal ligament.

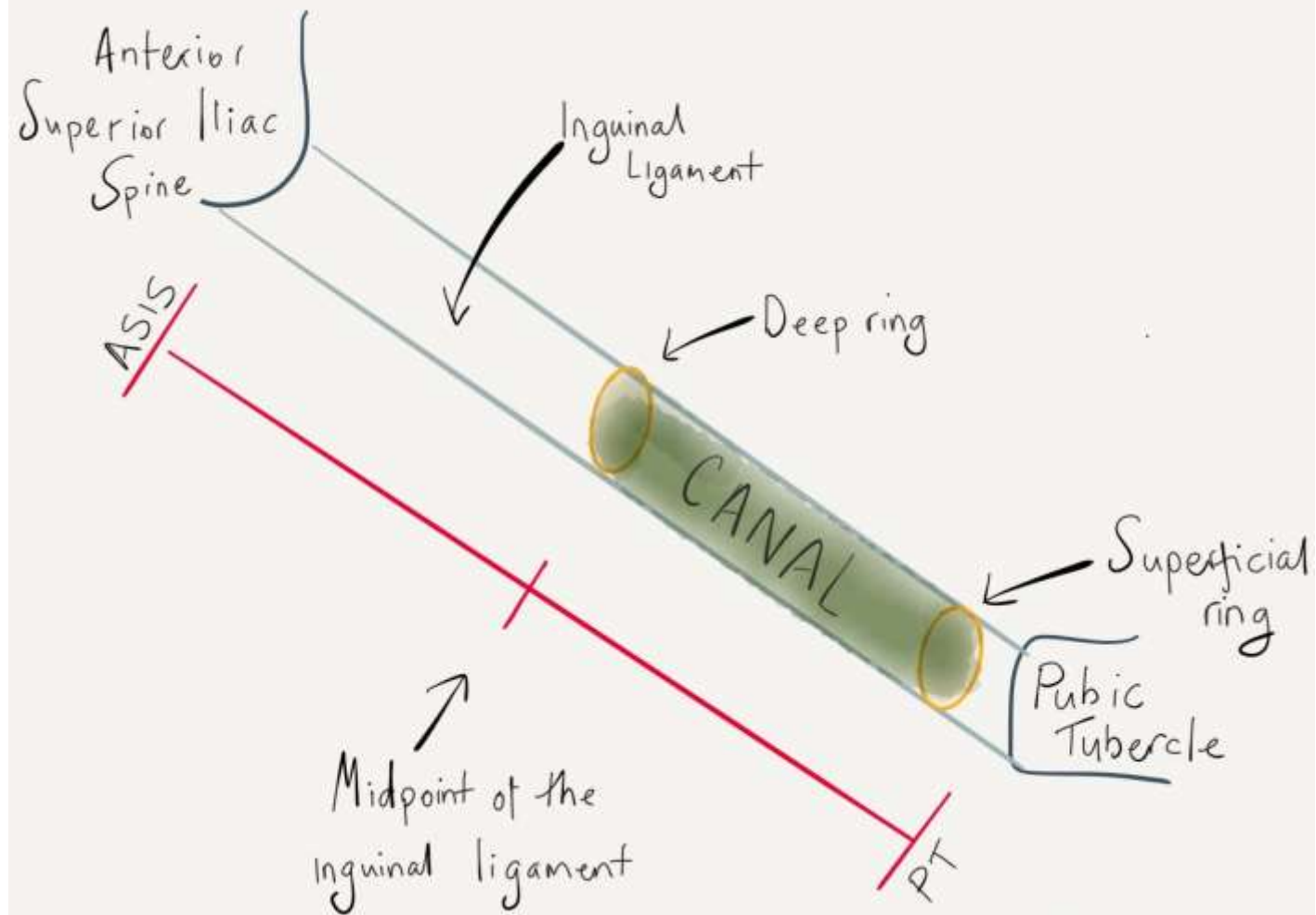


■ In the newborn child, the deep ring lies almost directly posterior to the superficial ring so that the canal is considerably *shorter* at this age.



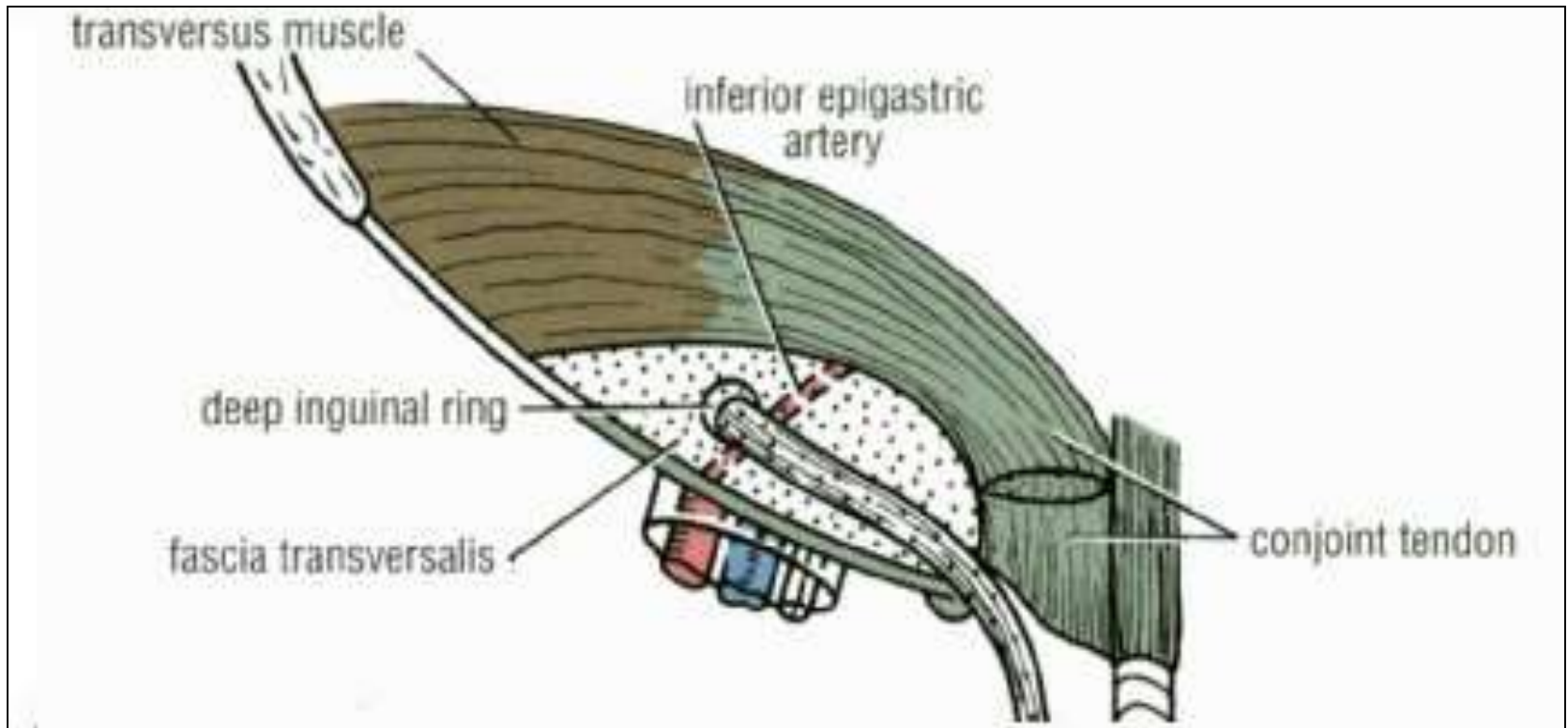
■ Later, as the result of growth, the deep ring moves laterally.



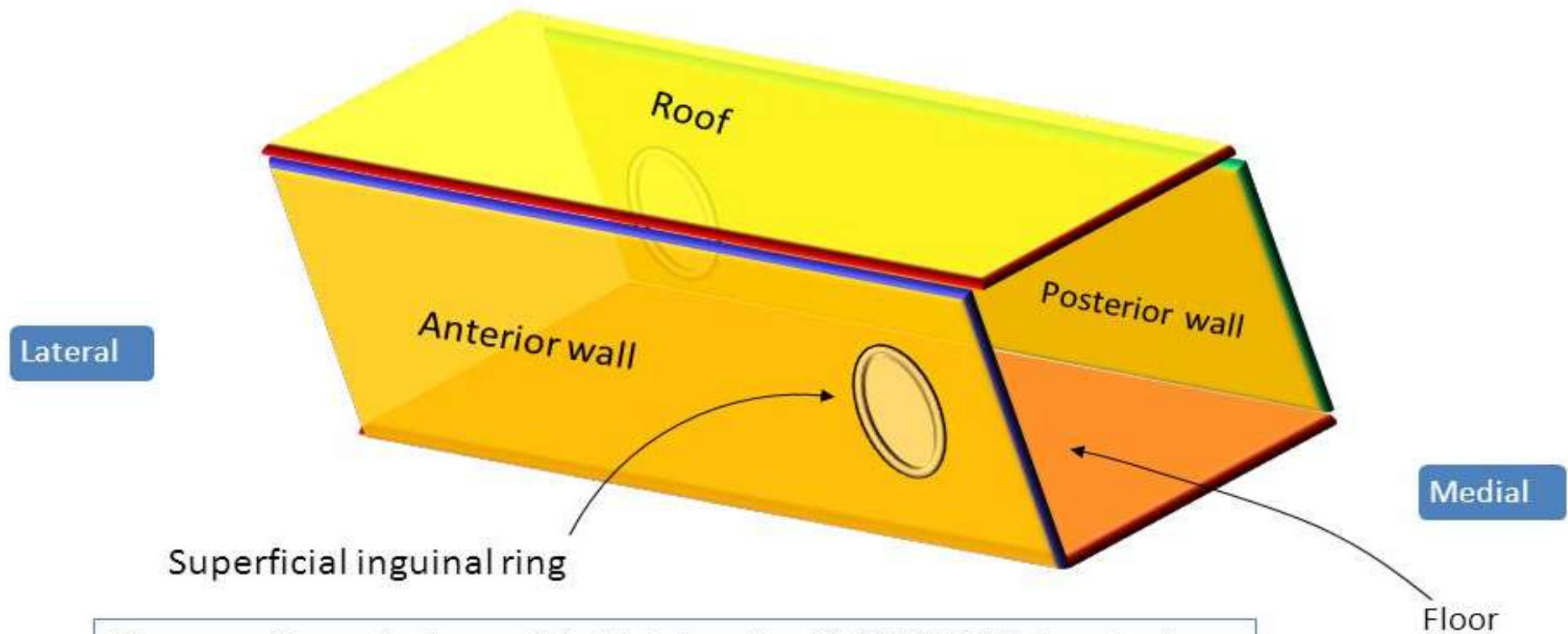


- The deep inguinal ring, an oval opening in the Fascia Transversalis, lies about (1.3 cm) **0.5 inch** above the inguinal ligament *midway* between the anterior superior iliac spine and the pubic tubercle.

- **Medial** to deep ring are Inferior Epigastric Vessels, which pass upward from the external iliac vessels.
- The margins of the ring give attachment to the internal spermatic fascia.



Inguinal canal

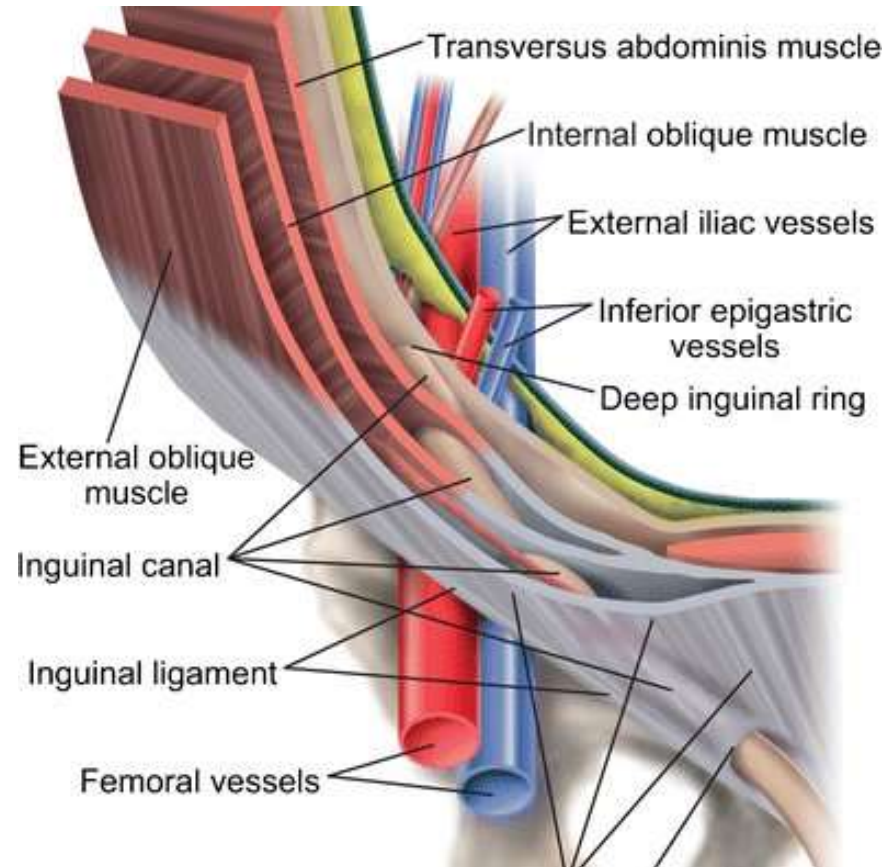


Here are the anterior wall (which has the SUPERFICIAL inguinal ring situated medially), and the roof.

Walls of inguinal Canal

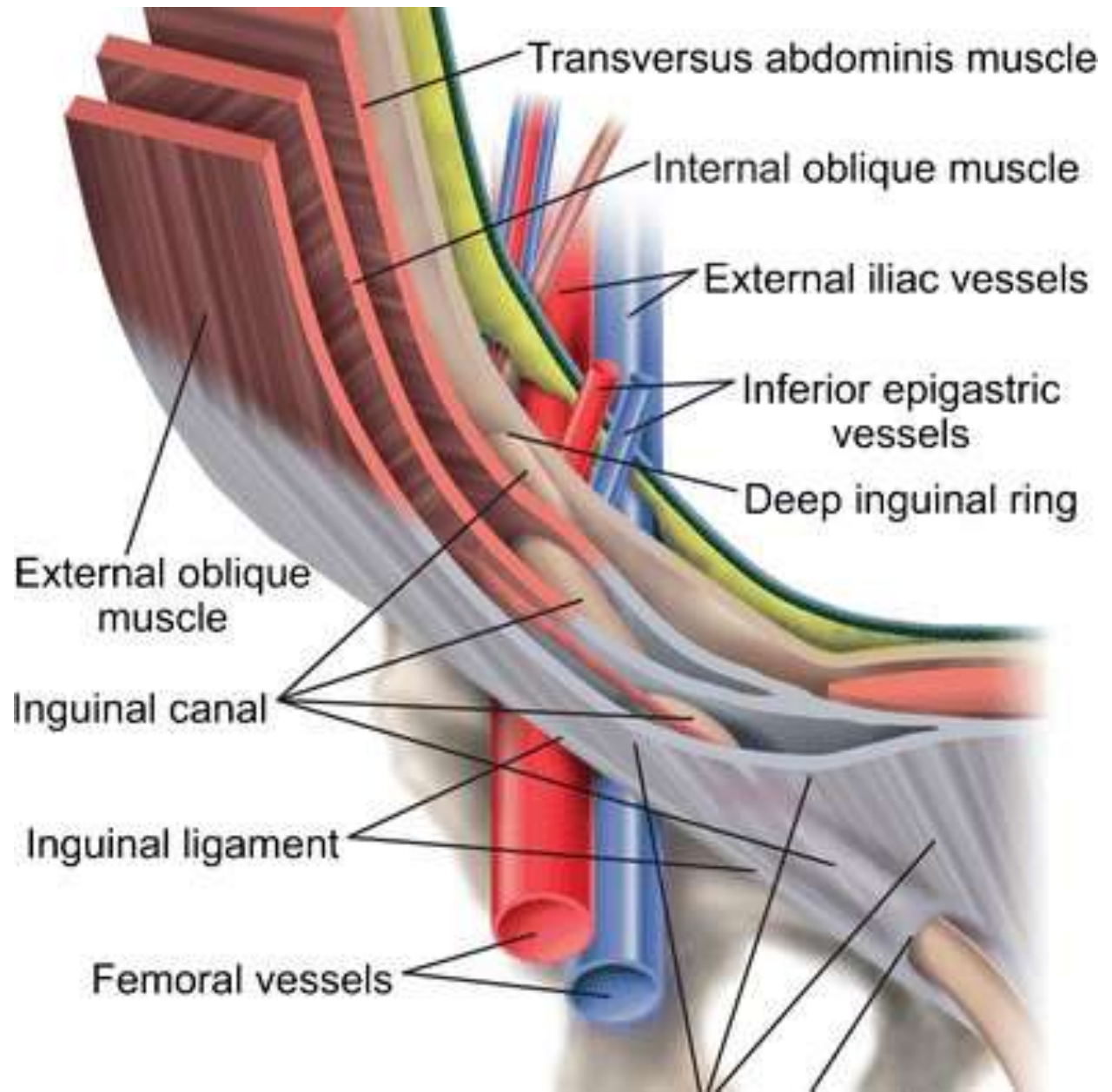
Anterior wall of canal

- Is formed along its entire length by the aponeurosis of *External Oblique Muscle*.
- It is reinforced in its lateral third by the origin of the *Internal Oblique* from the inguinal ligament.
- This wall is therefore strongest where it lies opposite the weakest part of the posterior wall, namely, the deep inguinal ring.



Walls of inguinal Canal

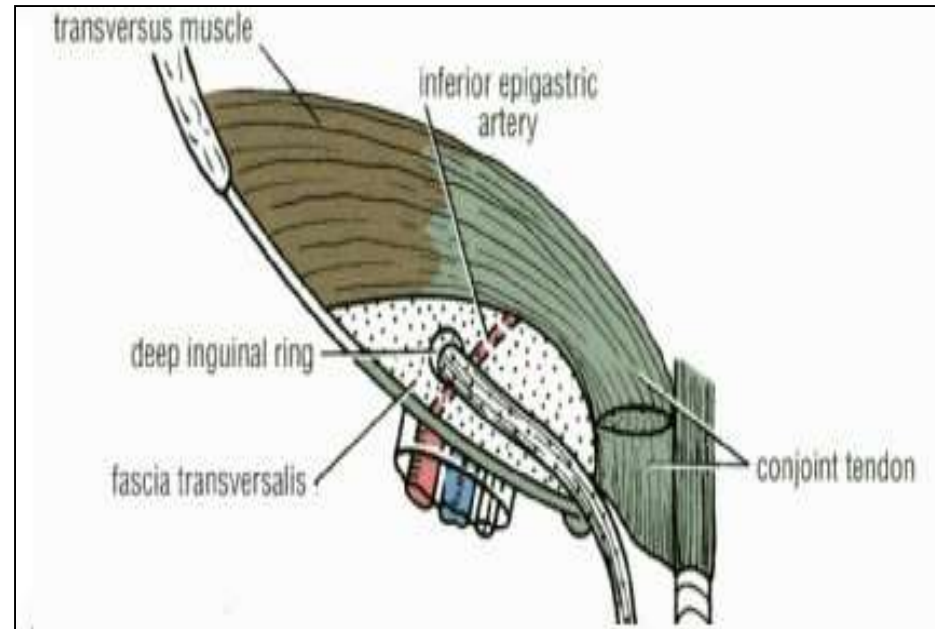
Anterior
wall of
canal

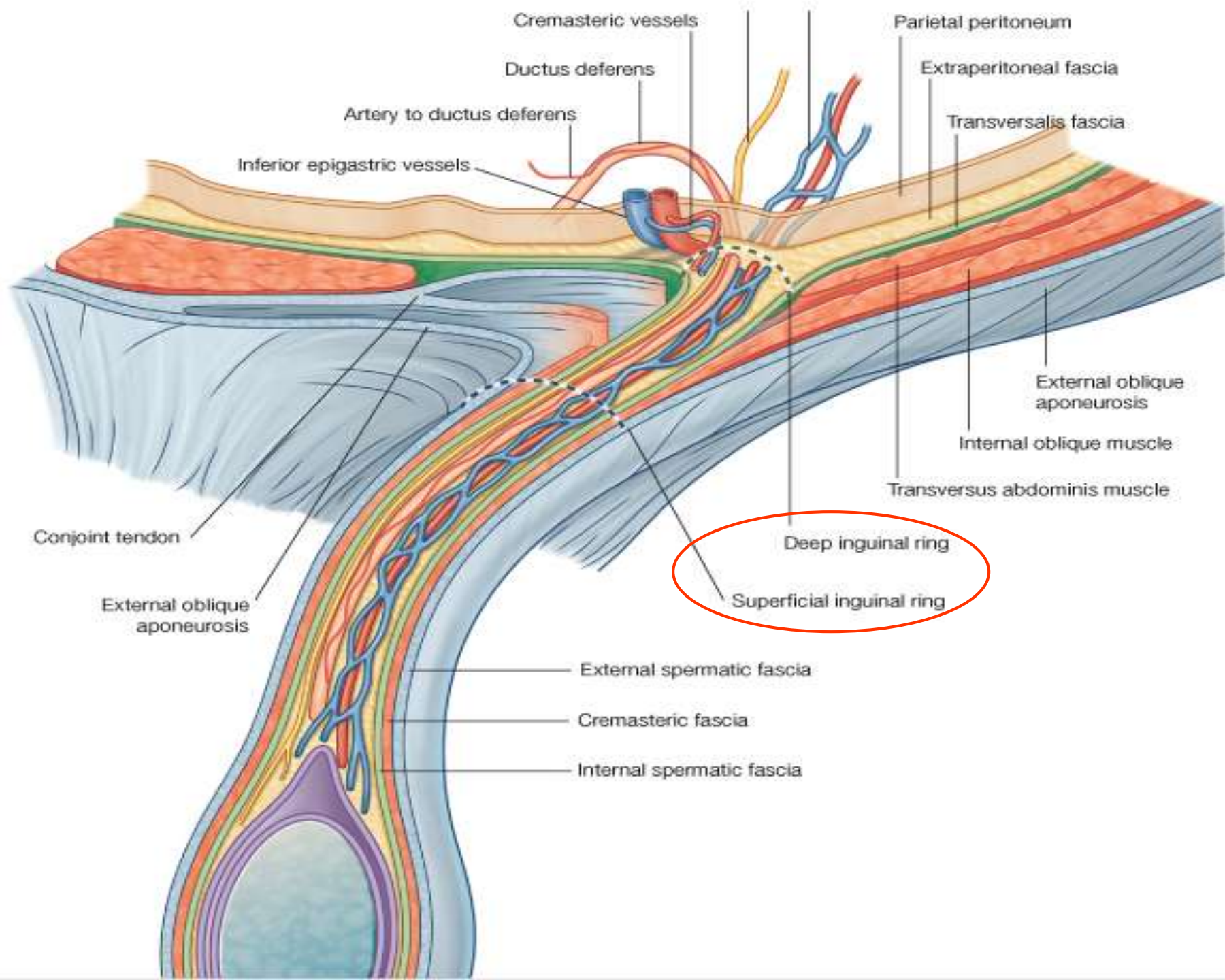


Walls of inguinal Canal

Posterior wall of canal

- Is formed along its entire length by Fascia Transversalis
 - It is reinforced in its medial third by Conjoint Tendon.
- This wall is therefore strongest where lies opposite the weakest part of the anterior wall, namely, the superficial inguinal ring.

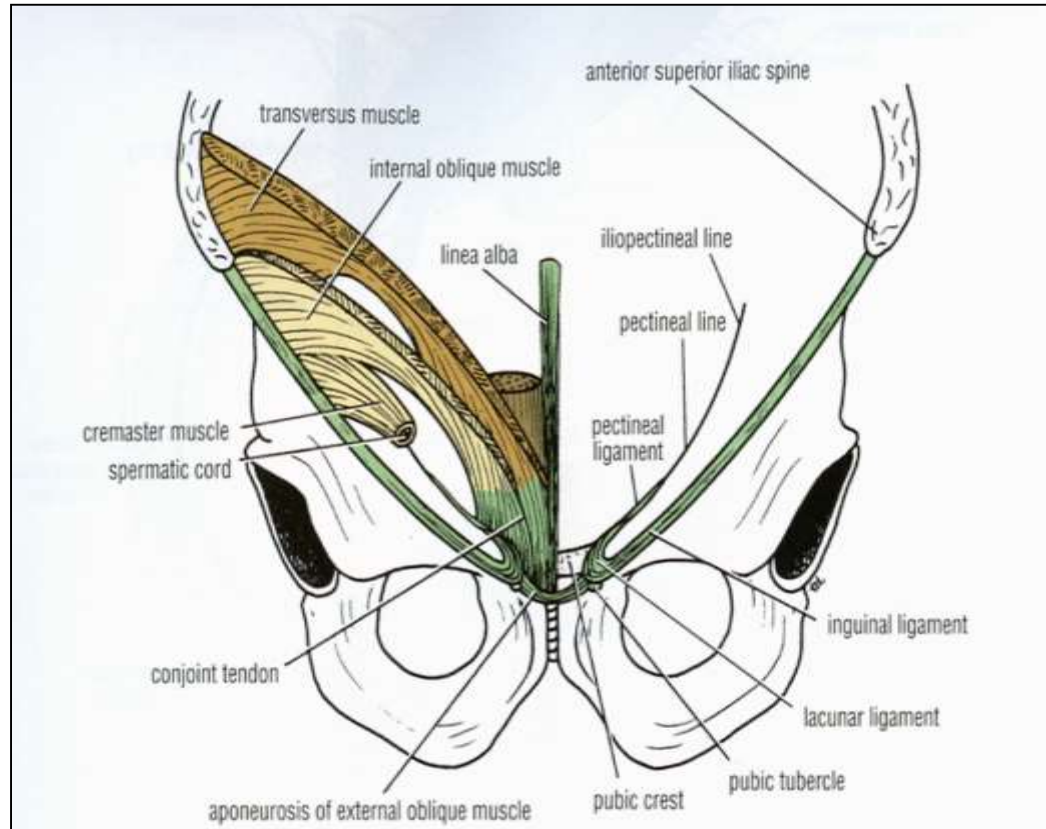




Walls of inguinal Canal

Inferior wall of cana (Floor)

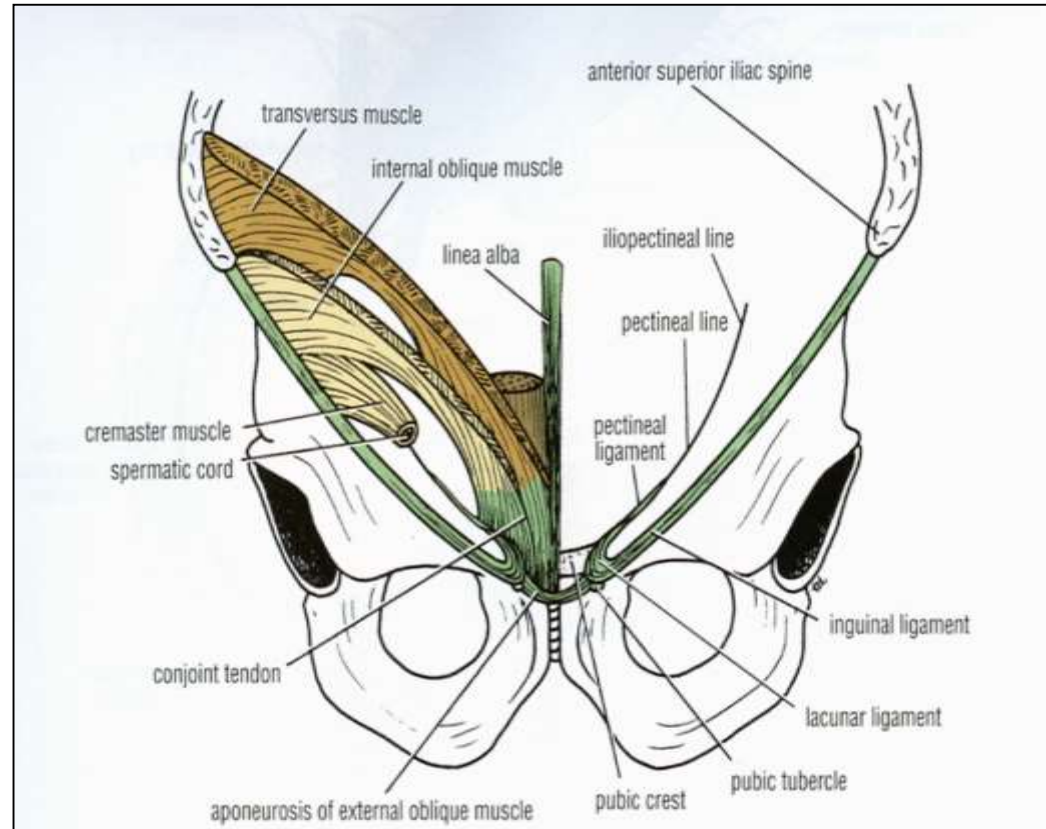
✚ Is formed by the Inguinal ligament and, at its medial end, the lacunar ligament.



Walls of inguinal Canal

Superior wall of canal (Roof)

- Is formed by the arching lowest fibers of the internal oblique and transversus abdominis muscles.



Walls of inguinal Canal/SUMMARY

- **Anterior wall:** External oblique aponeurosis, origin of the internal oblique, inguinal ligament.
- **Posterior wall:** Conjoint tendon medially, fascia transversalis laterally.
- **Superior wall (Roof):** Arching lowest fibers of the internal oblique and transversus abdominis muscles.
- **Inferior wall (floor):** Upturned lower edge of the inguinal ligament and, at its medial end, the lacunar ligament.

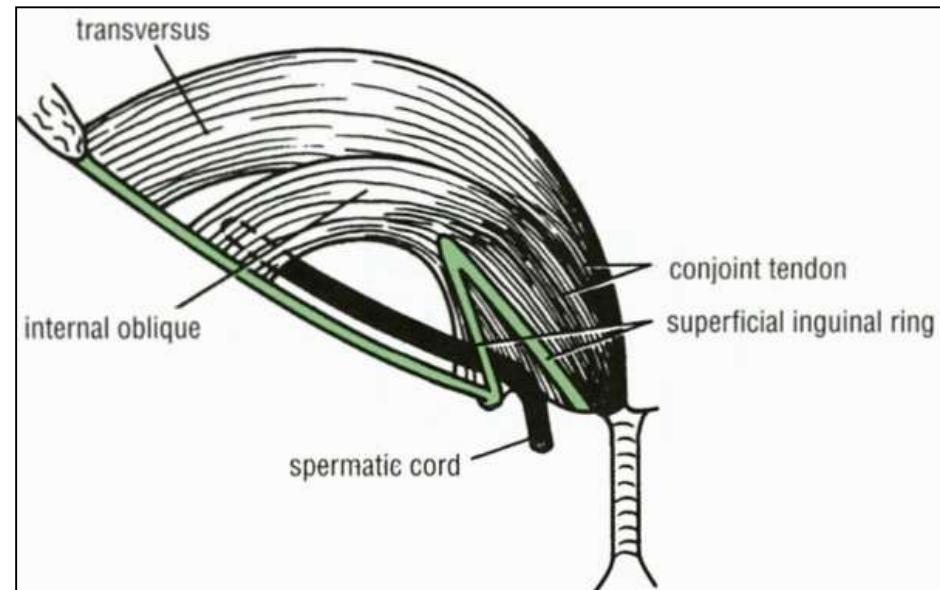
Function of the inguinal Canal

- The inguinal canal allows *structures of the Spermatic Cord* to pass to and from the testis to the abdomen in the male.
- Normal spermatogenesis takes place only if the testis leaves the abdominal cavity to enter a cooler environment in the scrotum.
- In the female, the smaller canal permits the passage of the Round ligament of the uterus from the uterus to the labium majus.
- In both sexes, the canal transmits Ilioinguinal Nerve.

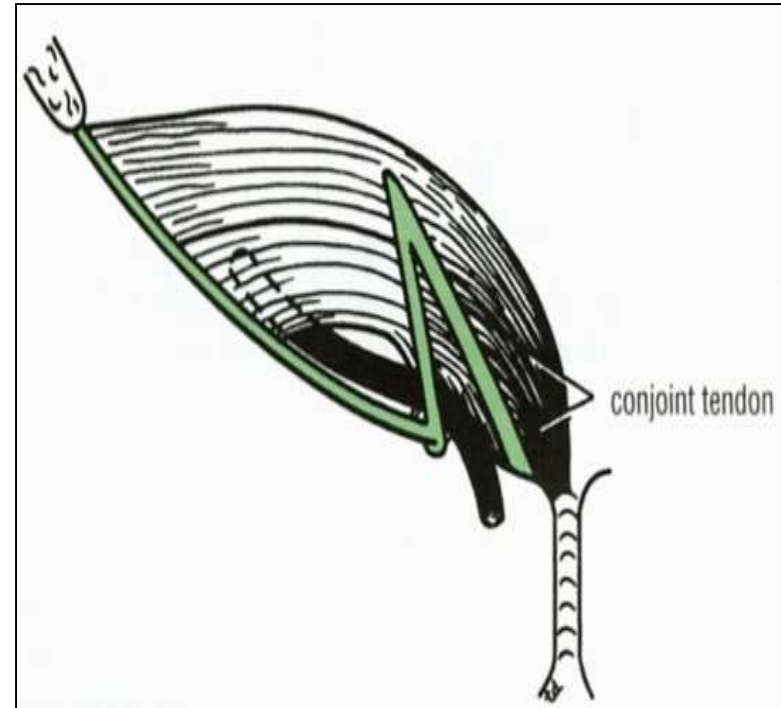
Mechanics of the Inguinal Canal

The presence of the inguinal canal in the lower part of the anterior abdominal wall in both sexes constitutes a potential weakness, It is interesting to consider how the design of this canal attempts to decrease this weakness.

- Except in the Newborn infant, the canal is an oblique passage with the weakest areas, namely, the superficial and deep rings, lying some distance apart.
- The anterior wall of the canal is reinforced by the fibers of the internal oblique muscle immediately in front of the deep ring.



- The posterior wall of the canal is reinforced by the Strong Conjoint Tendon immediately behind the superficial ring.
- On coughing and straining, the arching lowest fibers of the internal oblique and transversus abdominis muscles contract, flattening out the arched roof so that it is lowered toward the floor. The roof may actually compress the contents of the canal against the floor so that the canal is virtually closed.



Structures which pass through the canal

- **In males:** spermatic cord & its coverings + ilioinguinal nerve.
- **In females:** round ligament of uterus + ilioinguinal nerve.
- **The classic description of contents of spermatic cord in males:**
- **3 arteries:** artery to vas deferens , testicular artery , cremasteric artery
- **3 fascial** layers: external spermatic, cremasteric , and internal spermatic fascia
- **3 other structures:** pampiniform plexus, vas deferens(ductus deferens), testicular lymphatics;
- **3 nerves:** genital branch of the genitofemoral nerve(L1/2), sympathetic and visceral afferent fibers, ilioinguinal nerve (N.B. **outside spermatic cord but travels next to it**)
- Ilioinguinal nerve passes through the superficial ring to descend into the scrotum, does not formally run through the canal.

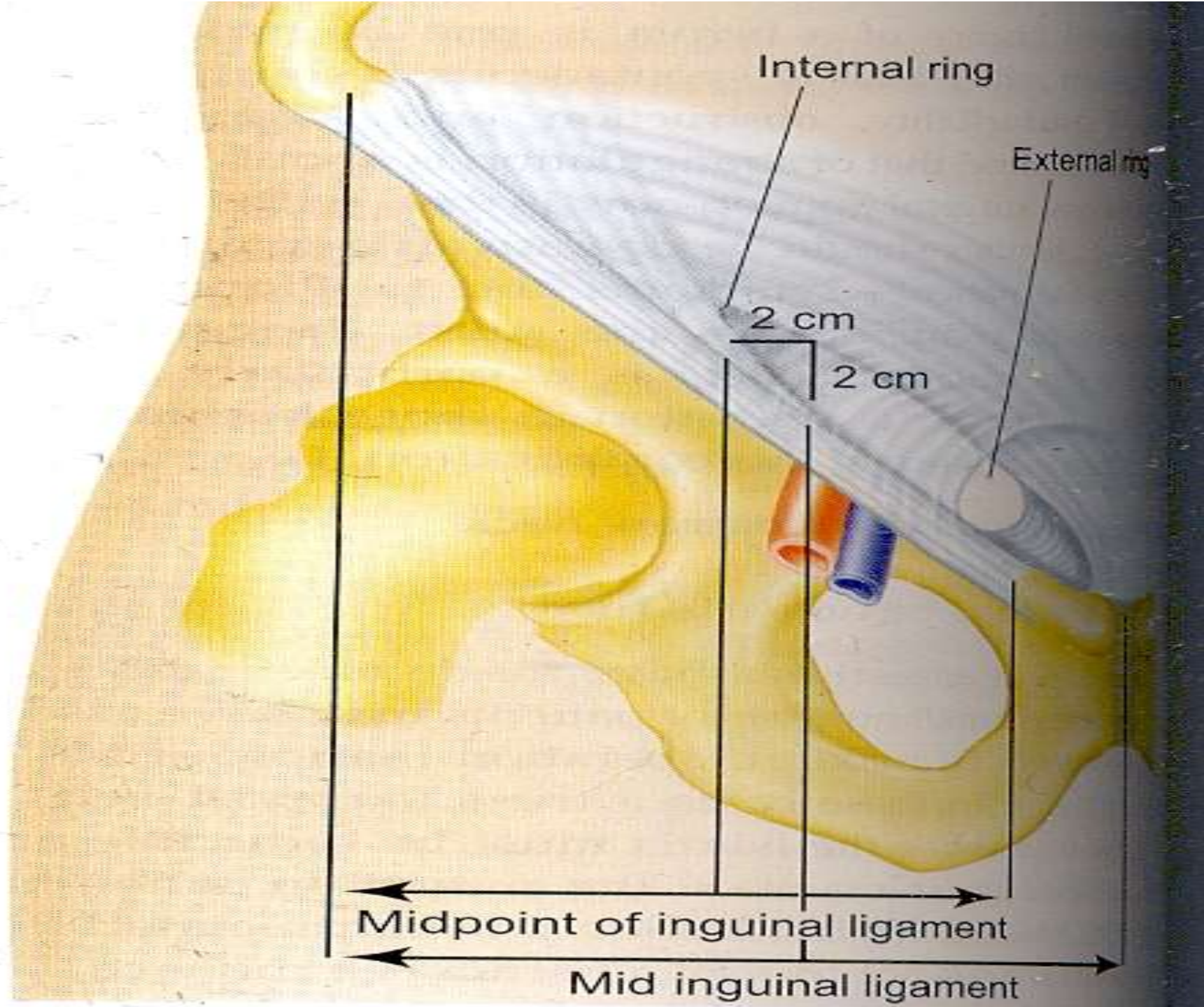
Important surface anatomy

- **Mid point of inguinal ligament:**

- Midway between ASIS and pubic tubercle.
- It is an important surgical landmark of the deep inguinal ring, that lies 0.5 inches above it.

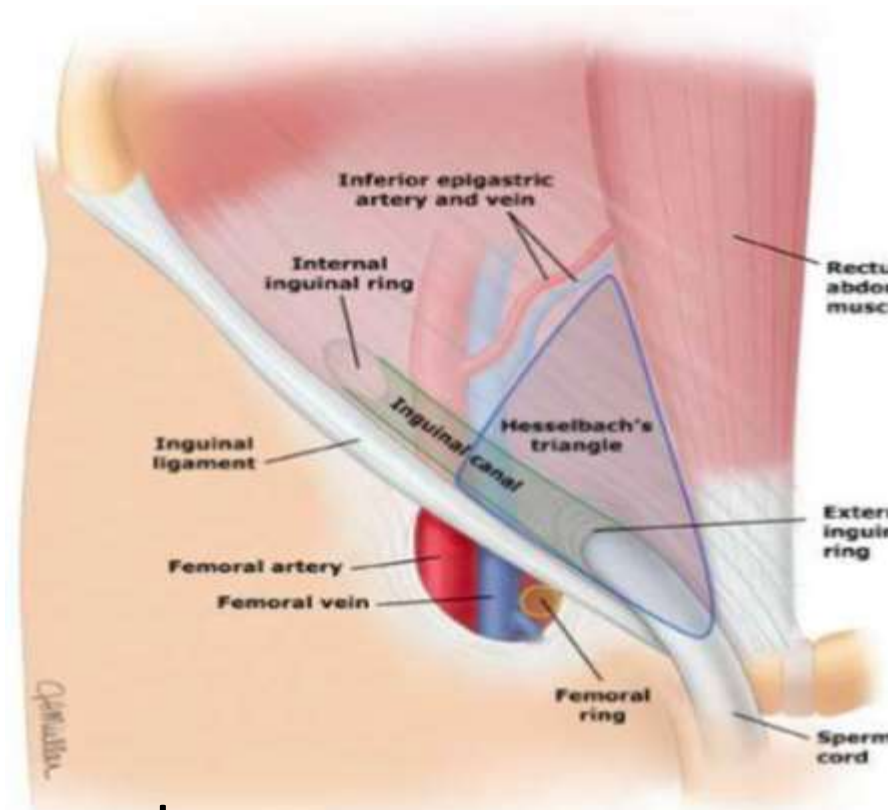
- **Mid-inguinal point:**

- This is half way between ASIS and symphysis pubis
- It is the landmark for the femoral artery.



Hesselbach's Triangle

- It is a part of the posterior wall of the inguinal canal.
- It is the triangle through which direct inguinal hernia passes.
- It is bounded by:
 - **Laterally:** inferior epigastric vessels.
 - **Medially:** Lateral border of rectus sheath.
 - **Inferior:** inguinal ligament (only medial ½)



ABDOMINAL HERNIA

 A Hernia is the protrusion of part of the abdominal contents beyond the normal confines of the abdominal wall.

Parts of hernia

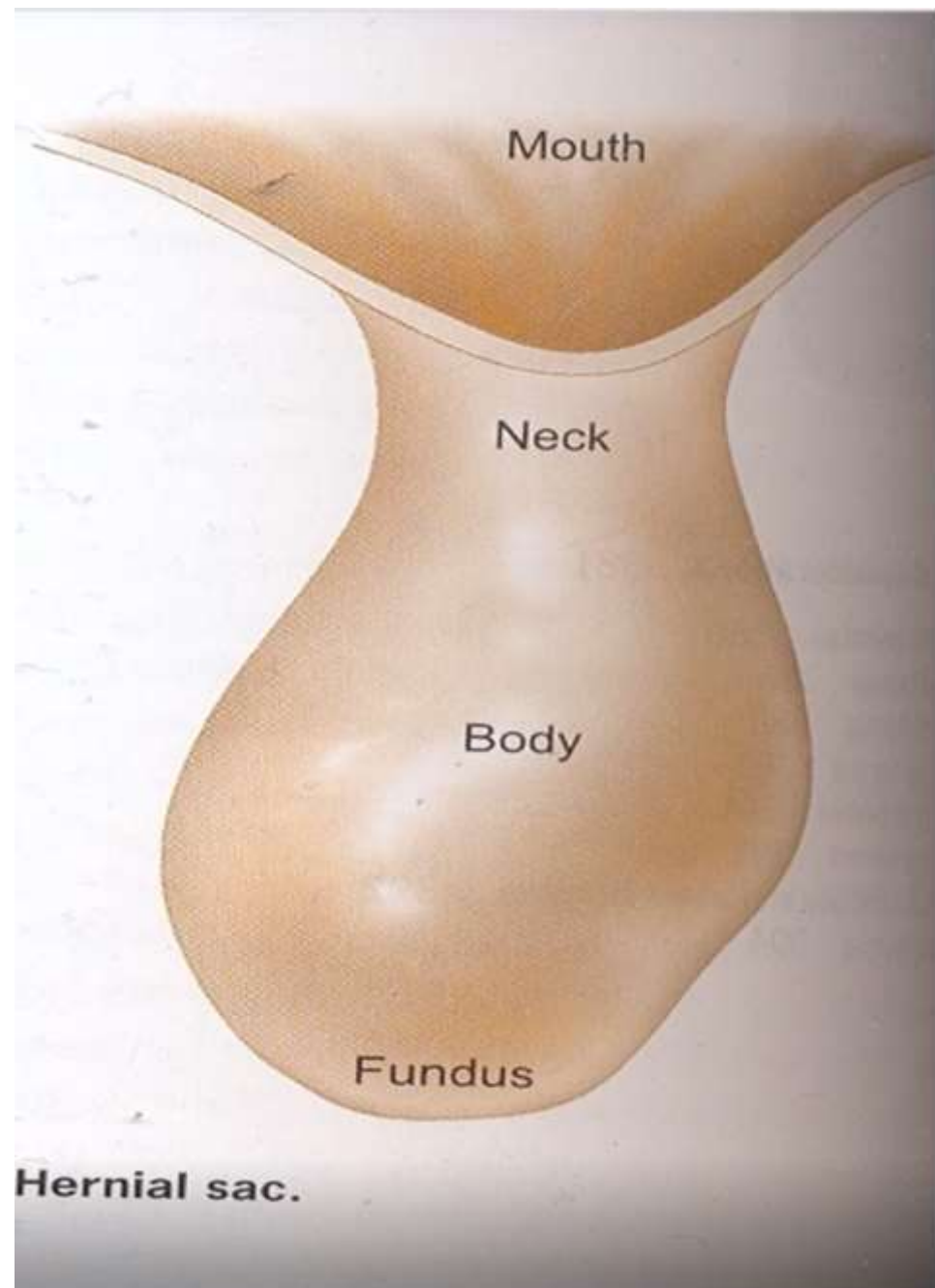
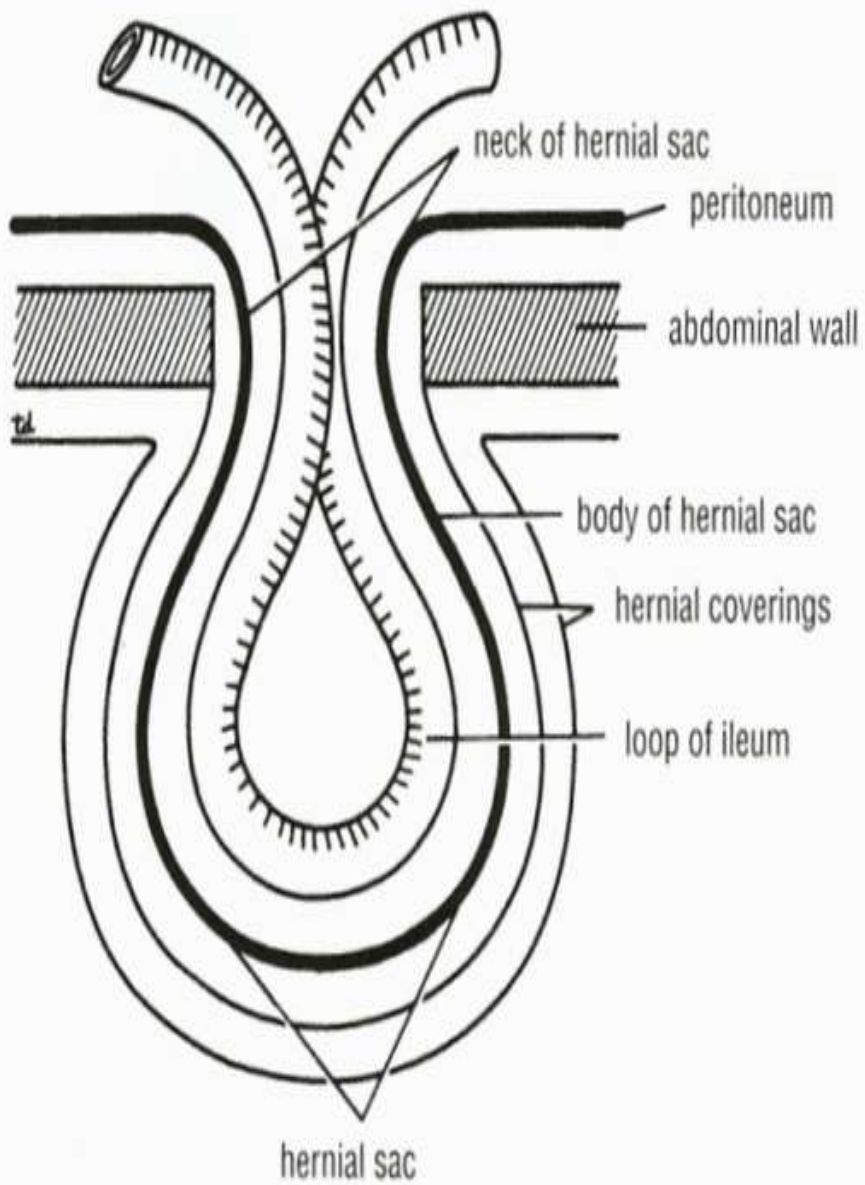
sac

contents of
the sac

coverings of
the sac

neck

body



ABDOMINAL HERNIA

■ Groin Hernia

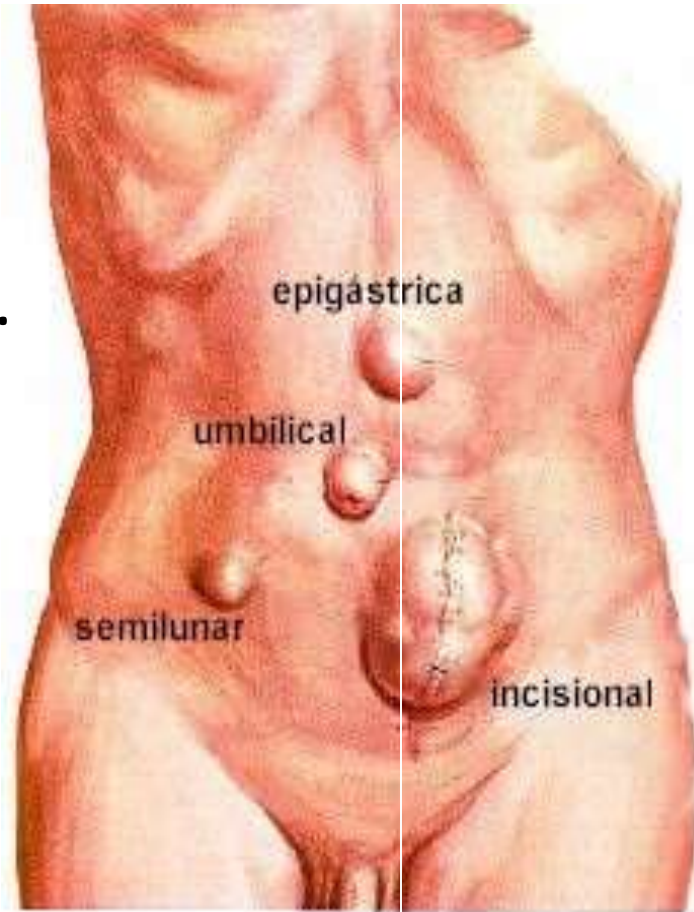
- Inguinal (indirect or direct).
- Femoral.

■ Ventral hernias

- Umbilical (congenital or acquired).
- Epigastric.
- Separation of the recti abdominis.
- Incisional hernia.
- Hernia of the linea Semilunaris
(**Spigelian hernia**).

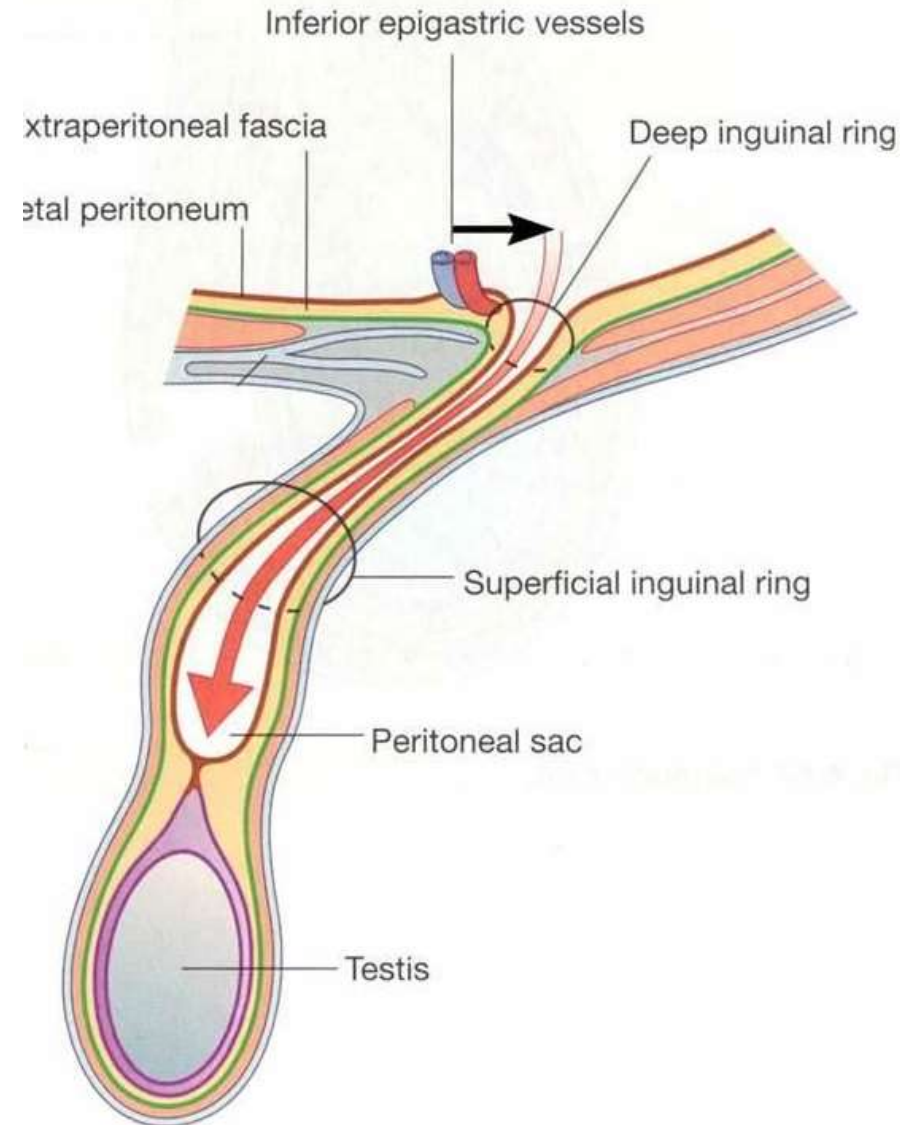
■ Internal hernia.

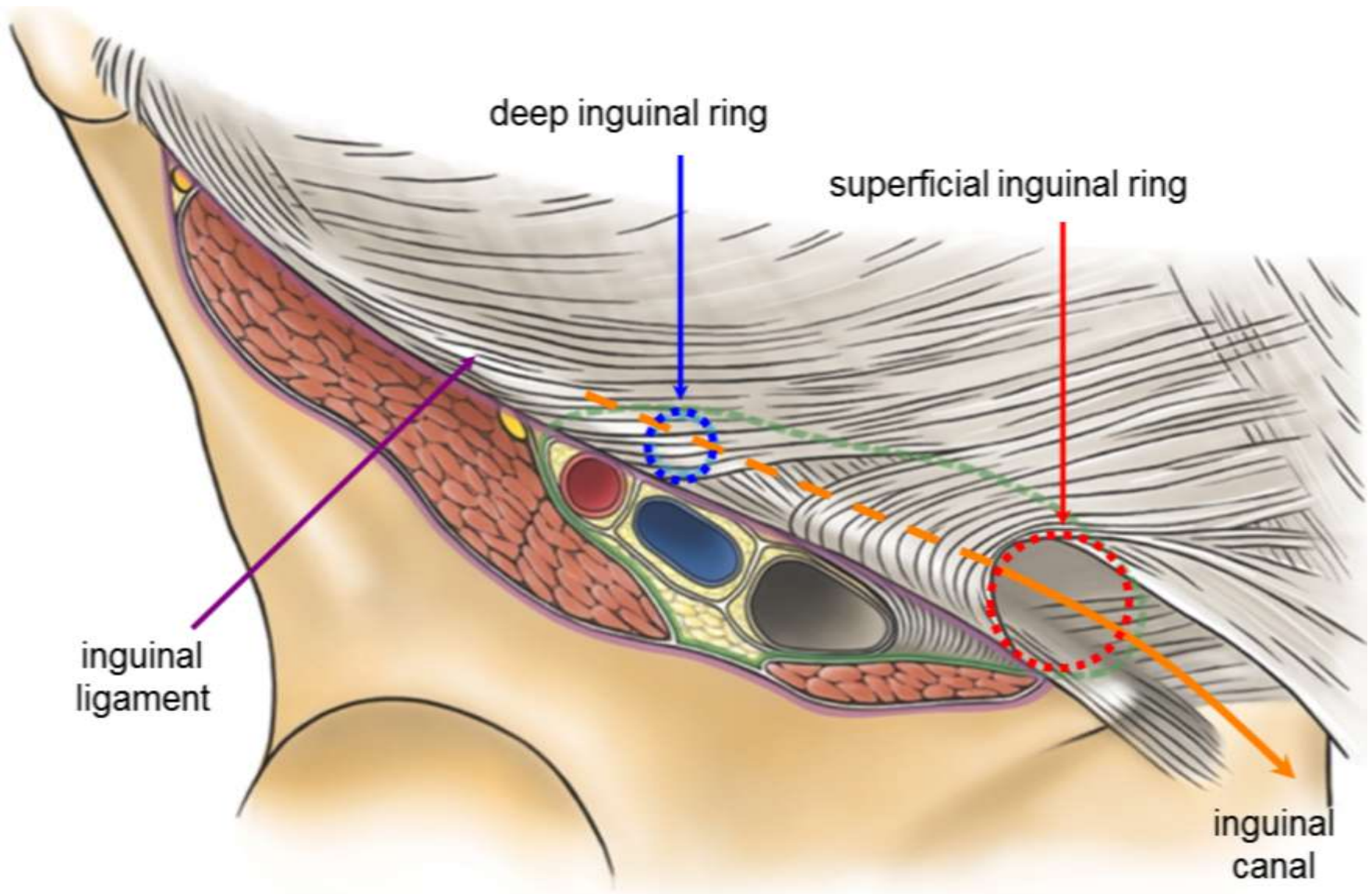
- Diaphragmatic



INDIRECT INGUINAL HERNIA

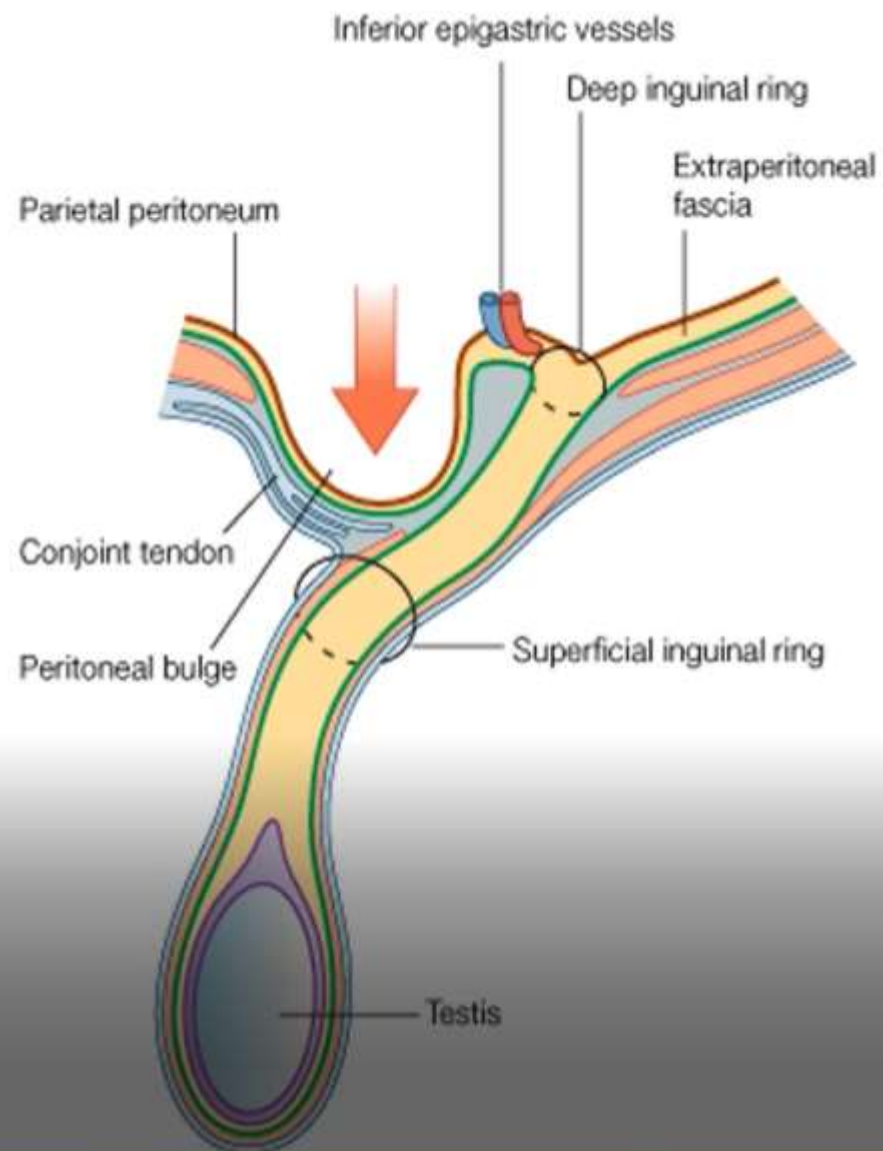
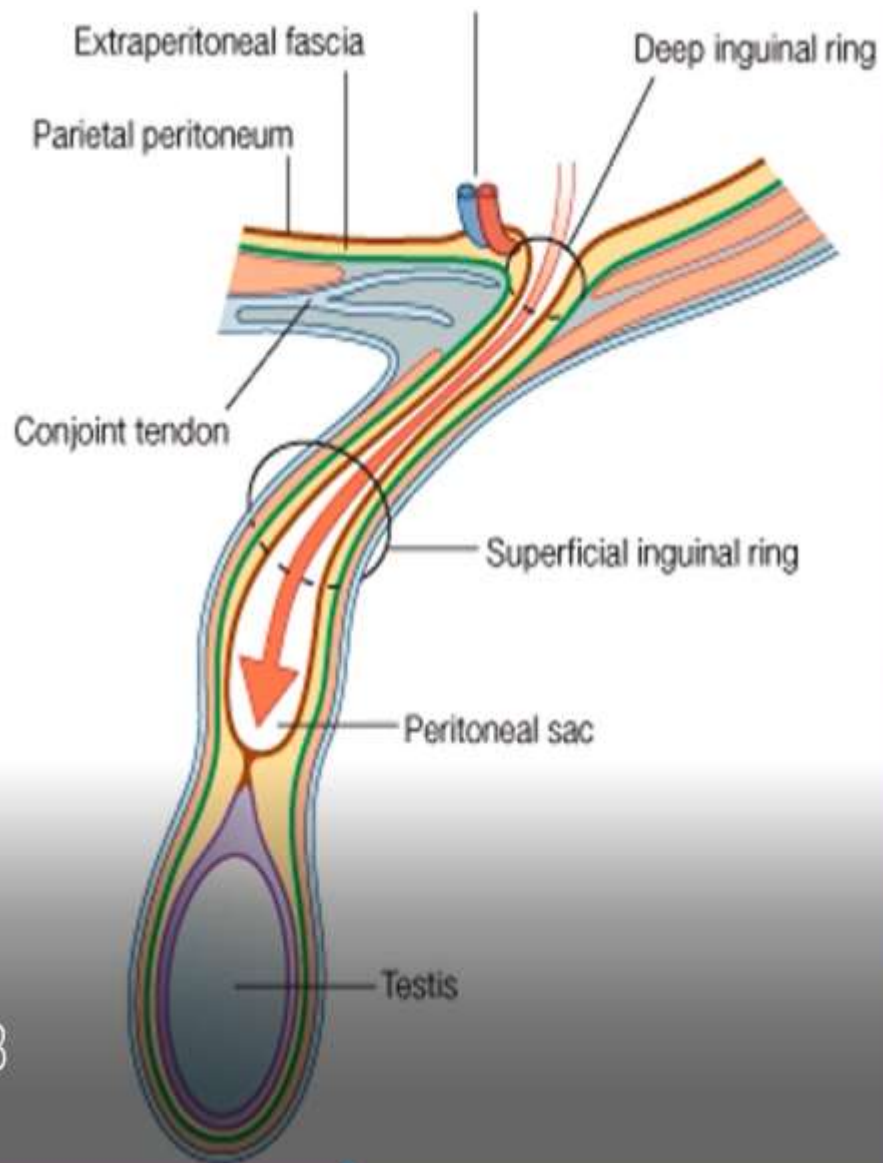
- *is the most common form of hernia* and is believed to be congenital in origin.
- The Hernial sac is the remains of the processus vaginalis.
- It follows that the sac enters the inguinal canal through the Deep Inguinal Ring lateral to the Inferior epigastric vessels .





INDIRECT INGUINAL HERNIA

- It may extend part of the way along the canal or the full length, as far as the superficial inguinal ring.
- If the processus vaginalis has undergone no obliteration, then the hernia is complete and extends through the superficial inguinal ring (above and medial to the pubic tubercle) down into the scrotum.
- Under these circumstances the neck of the hernial sac lies at the deep inguinal ring lateral to the inferior epigastric vessels.



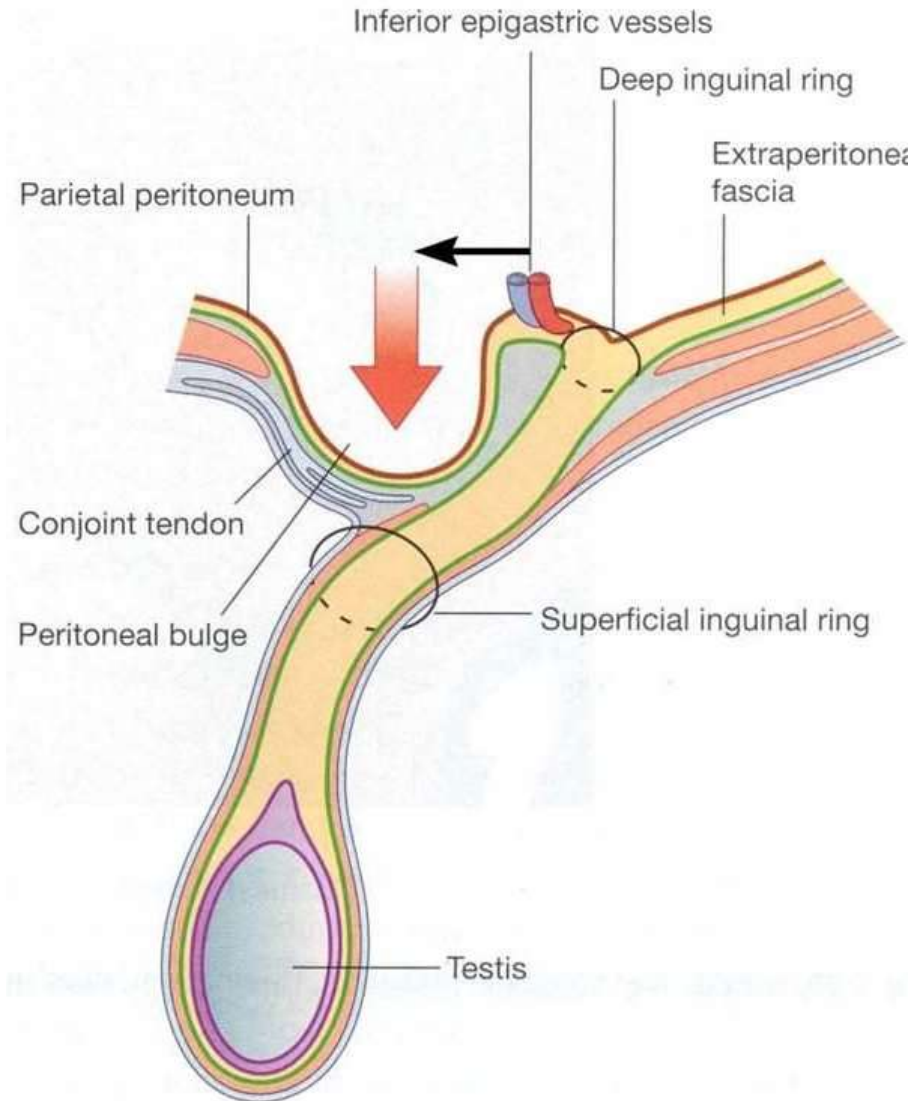


Rt and Lt indirect Inguinal Hernia

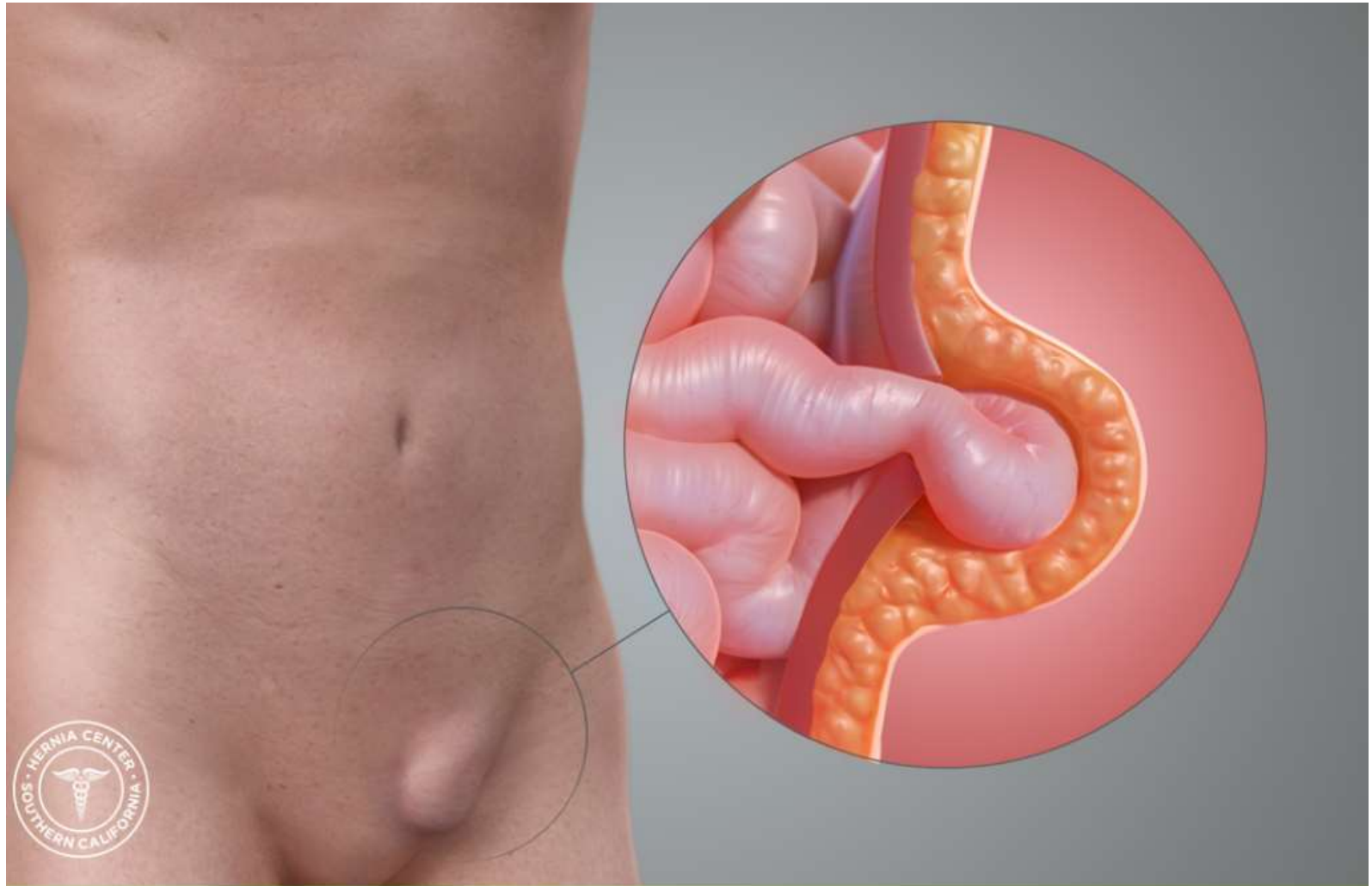


DIRECT INGUINAL HERNIA

- About 15% of all inguinal hernias.
- The sac of a direct hernia bulges directly anteriorly through the posterior wall of the inguinal canal medial to the *inferior epigastric vessels*.
- Because of the presence of the strong conjoint tendon this hernia is usually nothing more than a **Generalized bulge**; therefore, the Neck of the hernia sac is *wide*.



DIRECT INGUINAL HERNIA

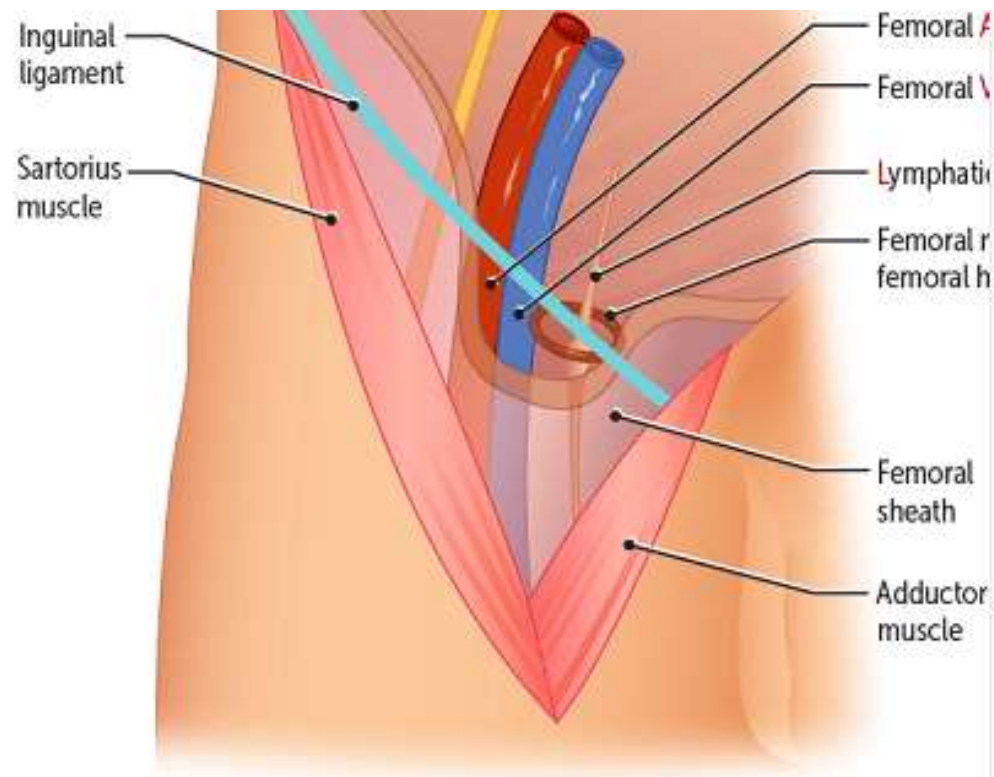


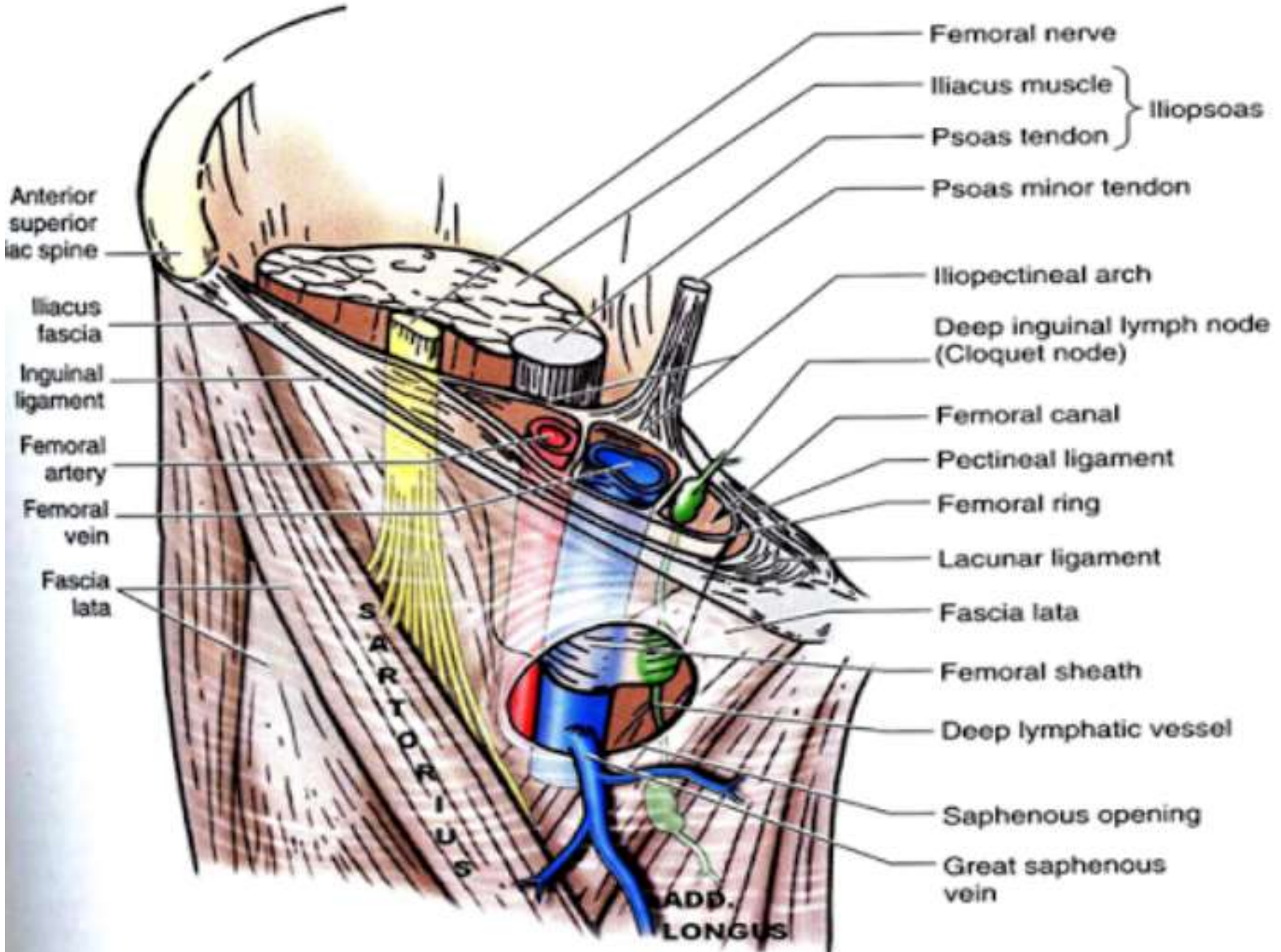
	INDIRECT	DIRECT
Age	Usually young	Old
Cause	May be congenital	Acquired
Bilateral	20%	50%
Protrusion on cough	oblique	Straight
Appearance on standing	Does not reach full size immediately	Does reach
Reduction on lying down	May not reduce	Reduce

	INDIRECT	DIRECT
Neck of sac	Narrow	Wide
strangulation	Not uncommon	Unusual
Relation to inferior epigastric	lateral	Medial
Descent to scrotum	Common	Rare
Internal ring test	Control	No control

FEMORAL SHEATH

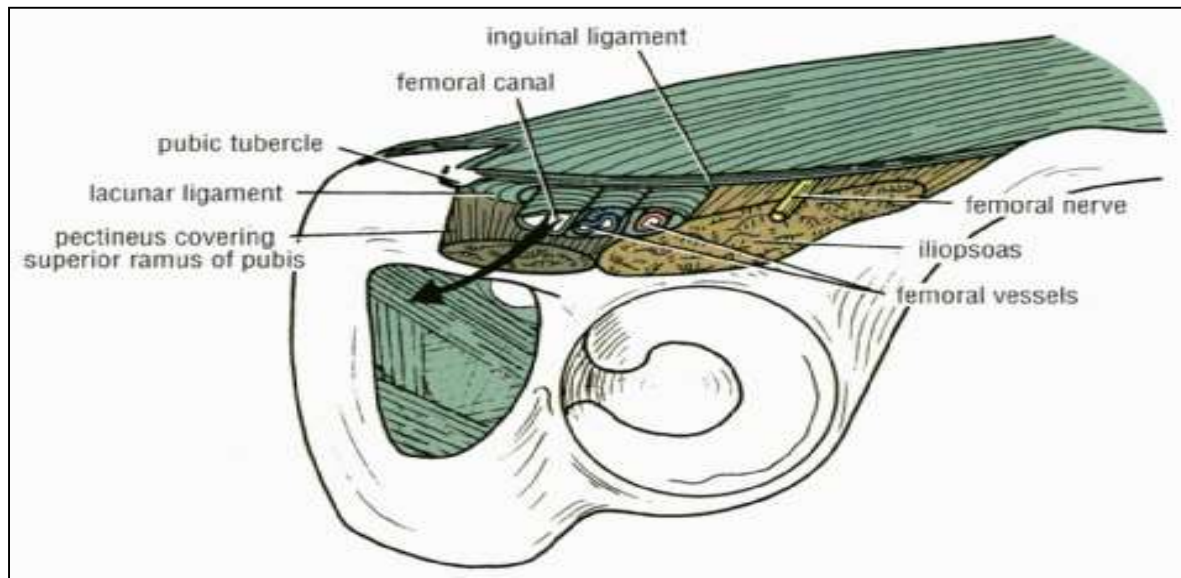
is a protrusion of the fascial envelope lining the abdominal walls and surrounds the femoral vessels and lymphatics for about (2.5 cm) below the inguinal ligament.





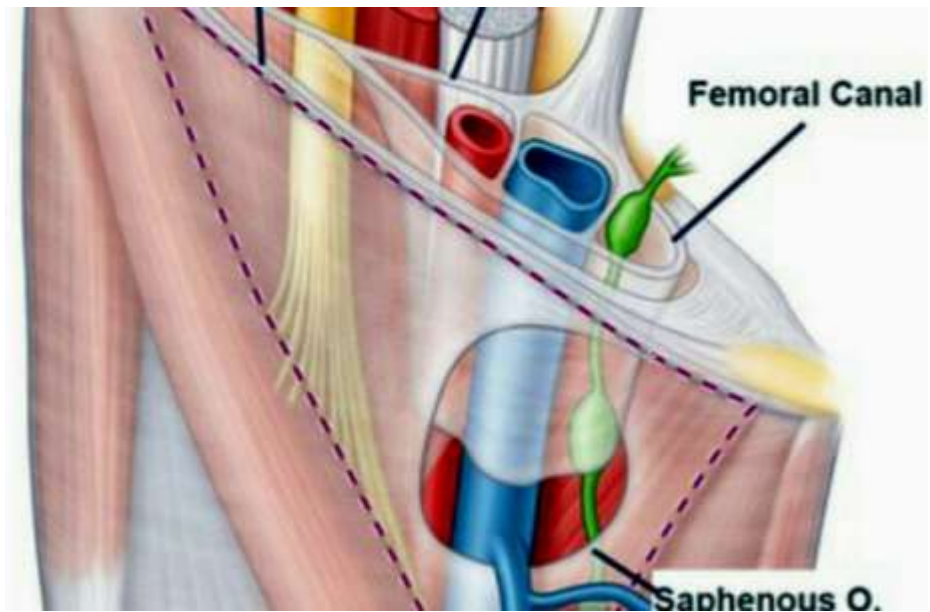
FEMORAL SHEATH

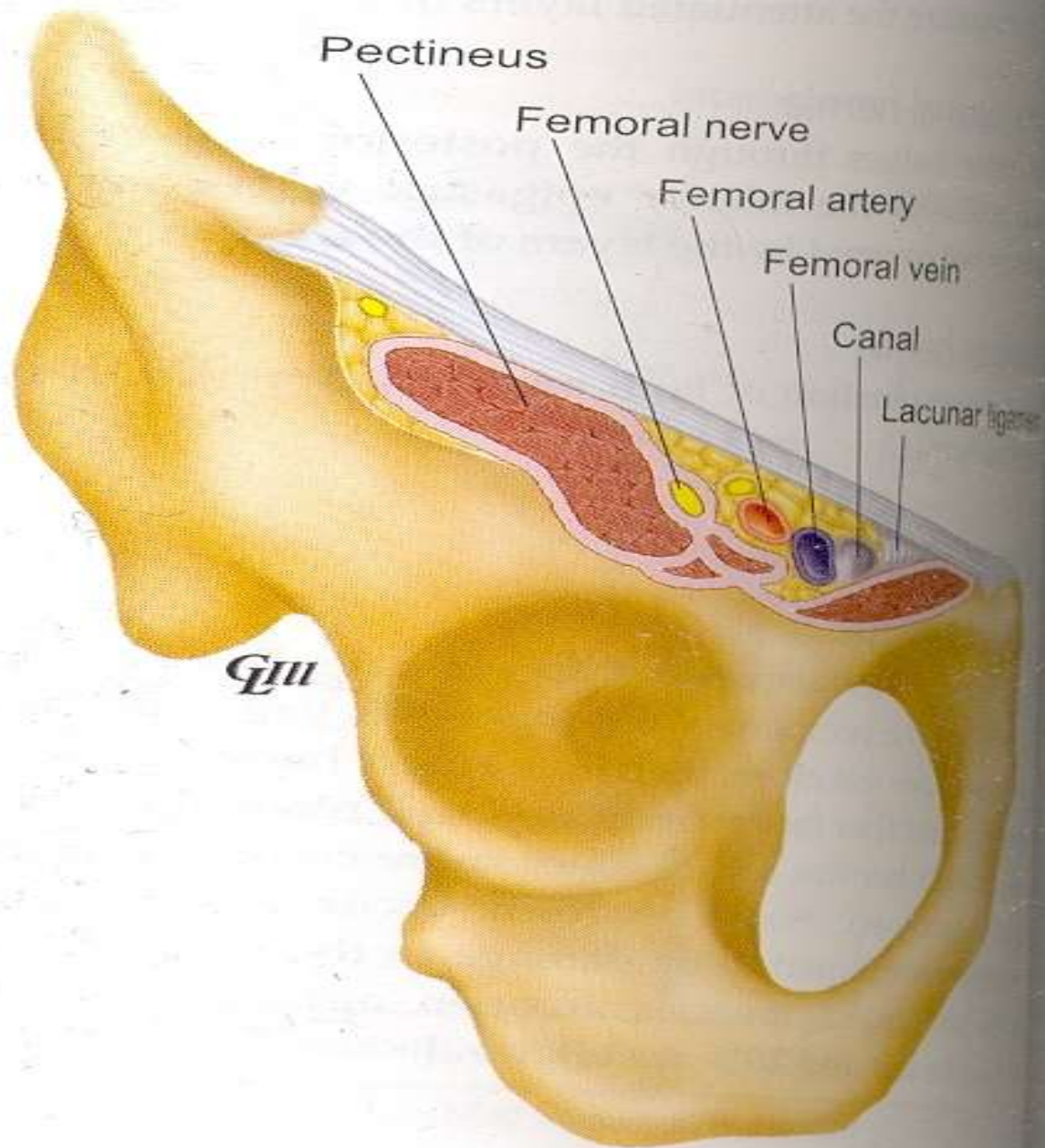
- The femoral artery, as it enters the thigh below the inguinal ligament, occupies the lateral compartment of the sheath.
- The femoral vein, which lies on its medial side and is separated from it by a fibrous septum, occupies the intermediate compartment.
- The lymph vessels, which are separated from the vein by a fibrous septum, occupy the most medial compartment.



FEMORAL CANAL

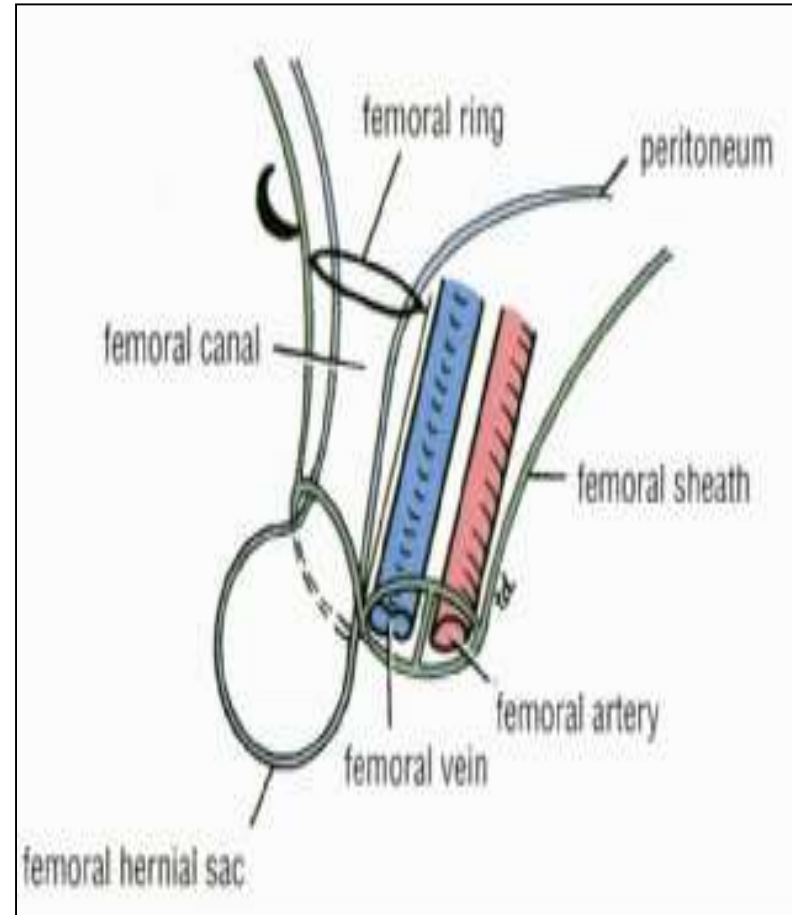
- The femoral canal, the compartment for the lymphatics, occupies the medial part of the sheath.
- It is about (1.3 cm) long, and its upper opening is referred to as the Femoral Ring.

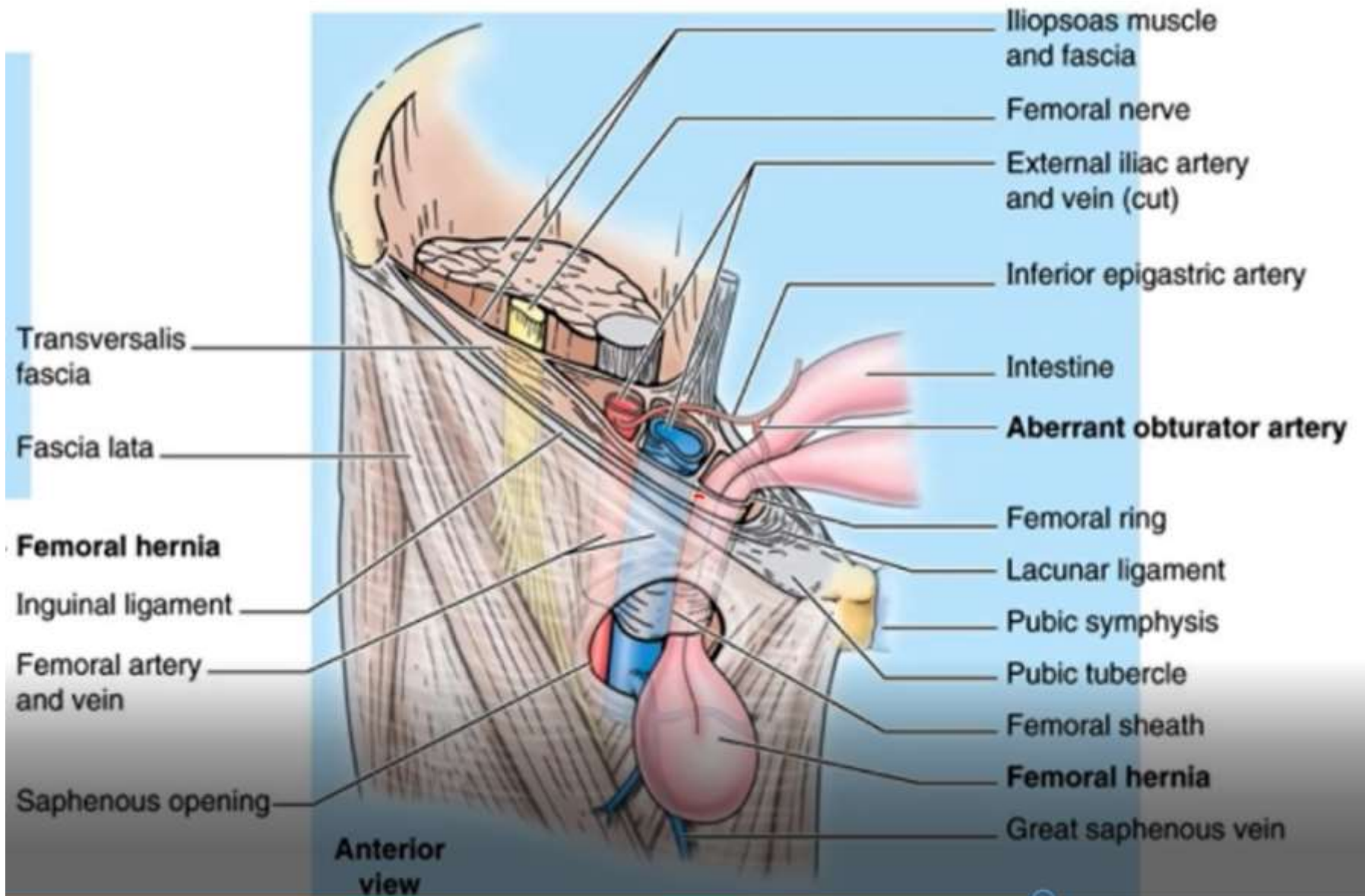




FEMORAL HERNIA

- The hernia sac descends through the femoral canal within the femoral sheath, creating a femoral hernia.
- A femoral hernia is More Common in Women than in men (possibly because of a wider pelvis and femoral canal).
- The hernial sac passes down the femoral canal, pushing the femoral septum before it.

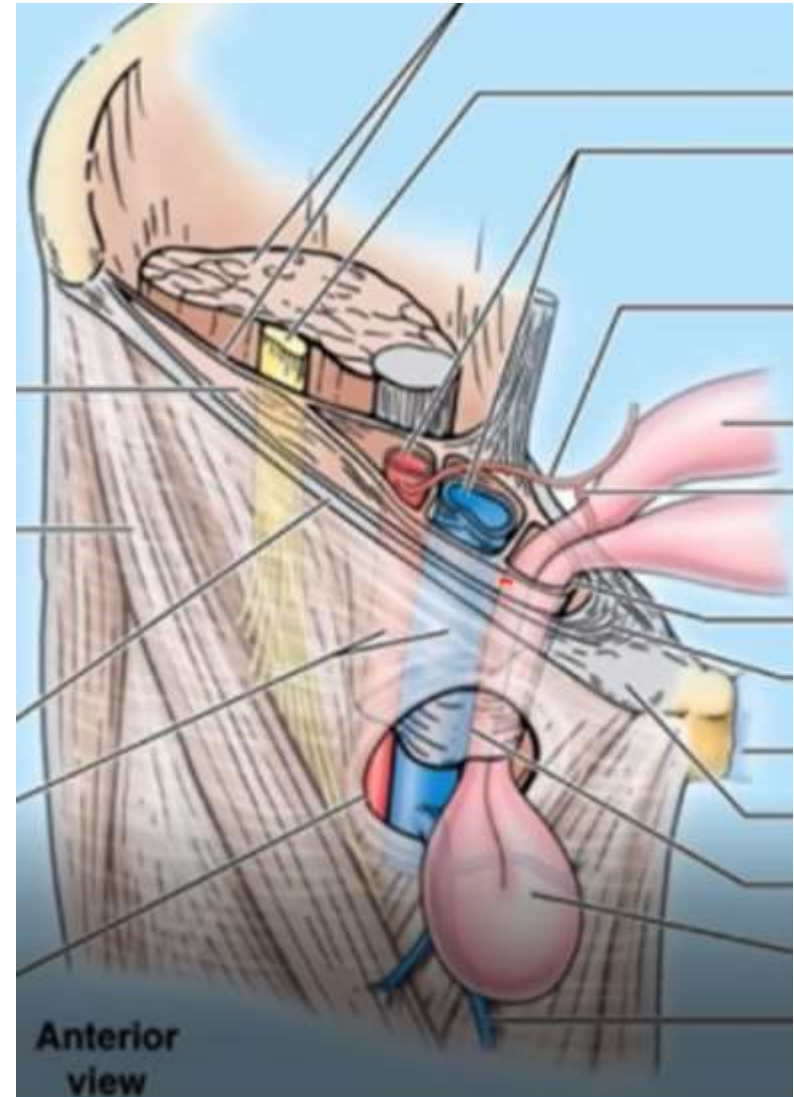




FEMORAL HERNIA

On escaping through the lower end, it expands to form a swelling in the upper part of the thigh deep to the deep fascia.

With further expansion, the hernial sac may turn upward to cross the anterior surface of the inguinal ligament.



FEMORAL HERNIA

- The neck of the sac is Narrow and lies at femoral ring.
- Once an abdominal viscus has passed through the neck into the body of the sac, it may be difficult to push it up and return it to the abdominal cavity (**Irreducible Hernia**).
- Furthermore, after straining or coughing, a piece of bowel may be forced through the neck and its blood vessels may be compressed by the femoral ring, seriously impairing its blood supply (**Strangulated hernia**).
- A femoral hernia is a dangerous disease and Should Always be Treated Surgically.

General Anatomy

PELVIC WALL

Anatomy Group

Dr Naser Radwan, MD

Dr Amjad Abu Alqumboz, MD

Dr Adham AlZanoun, MD



Pelvis

- The pelvis is the region of the trunk that lies below the abdomen.

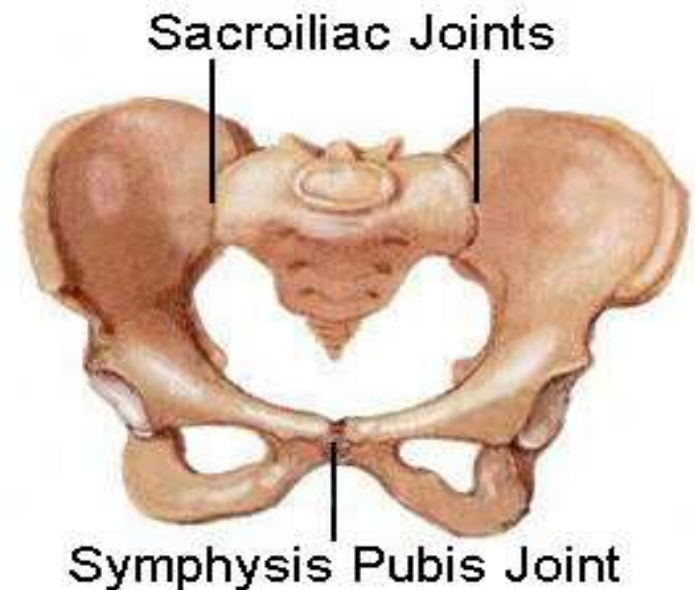
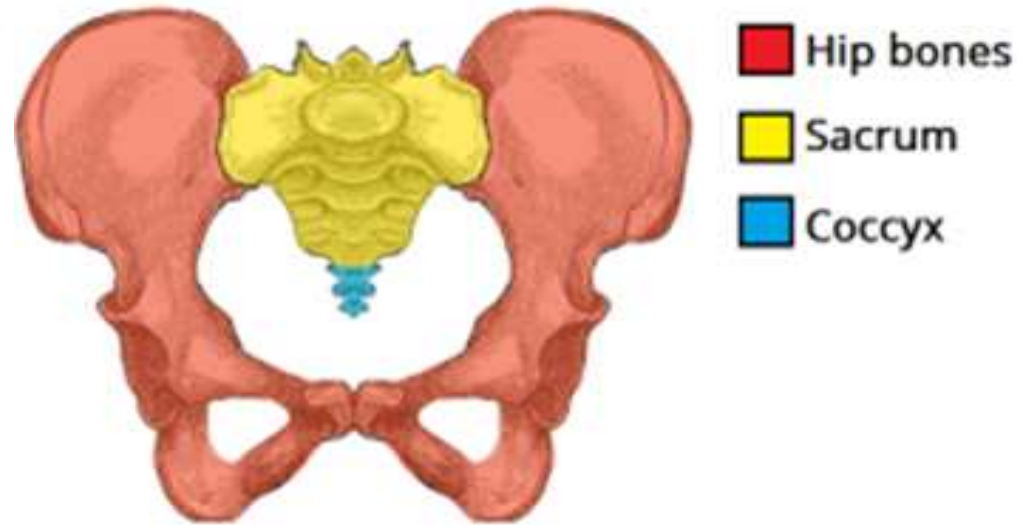
The bony pelvis's main function:

- Contains, supports, and protects the pelvic viscera, the lower parts of the intestinal tract, the urinary tracts & the internal organs of reproduction.
- Transmit the weight of the body from the vertebral column to the femurs.
- Provides attachment for trunk and lower limb muscles.



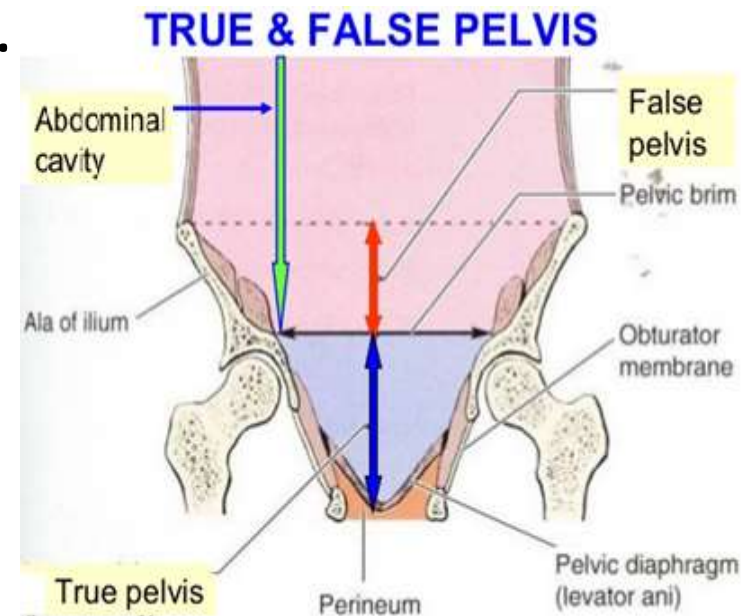
Bony Pelvis

- The bony pelvis forms a **strong basin-shaped structure**.
- Composed of **4 bones**:
 - The **2 hip bones**, which form the lateral and anterior walls.
 - The **sacrum** and the **coccyx**, form the back wall.

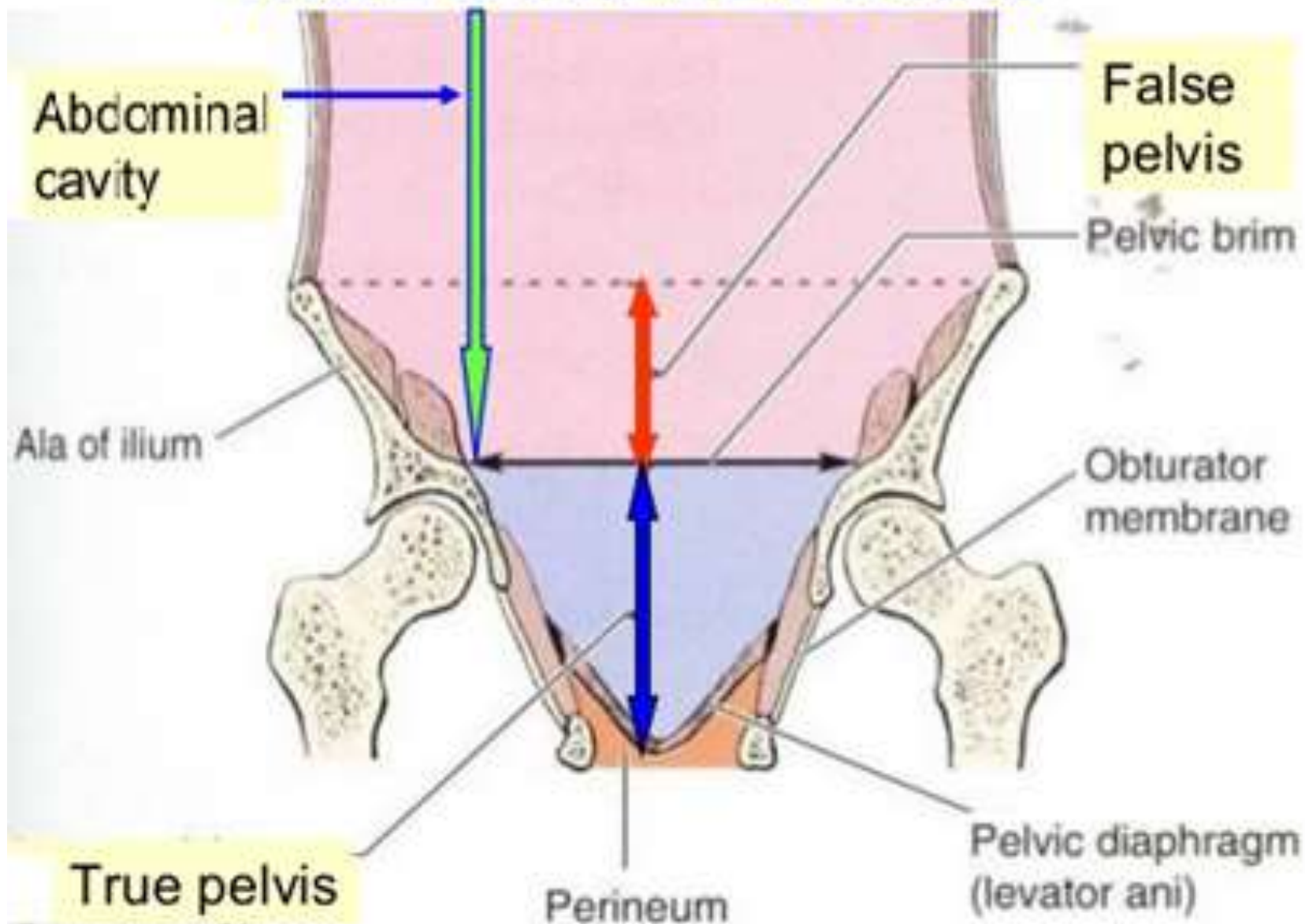


False Pelvis

- It is of little clinical importance.
- It is bounded:
 - ✓ **Behind** by the lumbar vertebrae.
 - ✓ **Laterally** by the iliac fossae and the iliacus muscles.
 - ✓ **In front** by the lower part of the anterior abdominal wall.
- The false pelvis **supports** the abdominal contents and after the third month of pregnancy helps support the gravid uterus.



TRUE & FALSE PELVIS



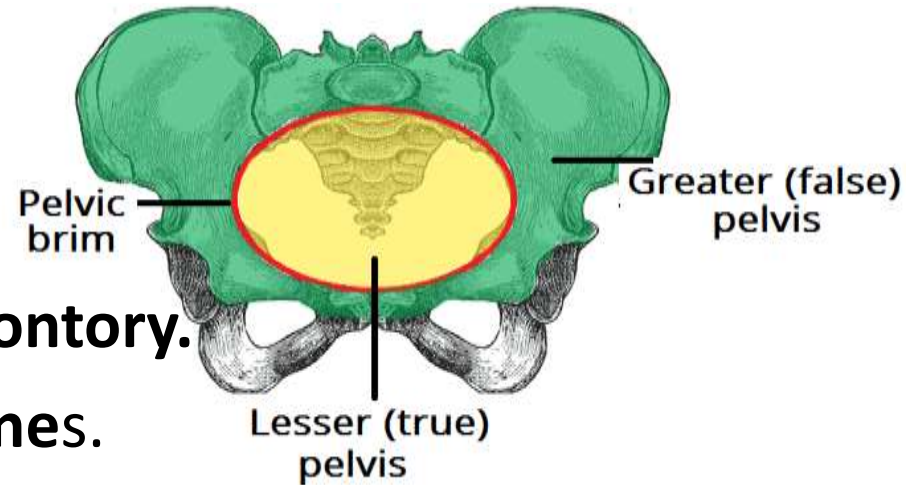
True Pelvis

- The true pelvis has an
1) inlet 2) outlet 3) cavity
- The **pelvic cavity** lies **between the inlet and the outlet**. It is a **short, curved canal**, with a **shallow anterior wall** and a **deeper posterior wall**.
- The female pelvis is of great importance because it is the **bony canal** through which the **child passes during birth**.

Pelvic inlet

The pelvic inlet, or pelvic brim is bounded:

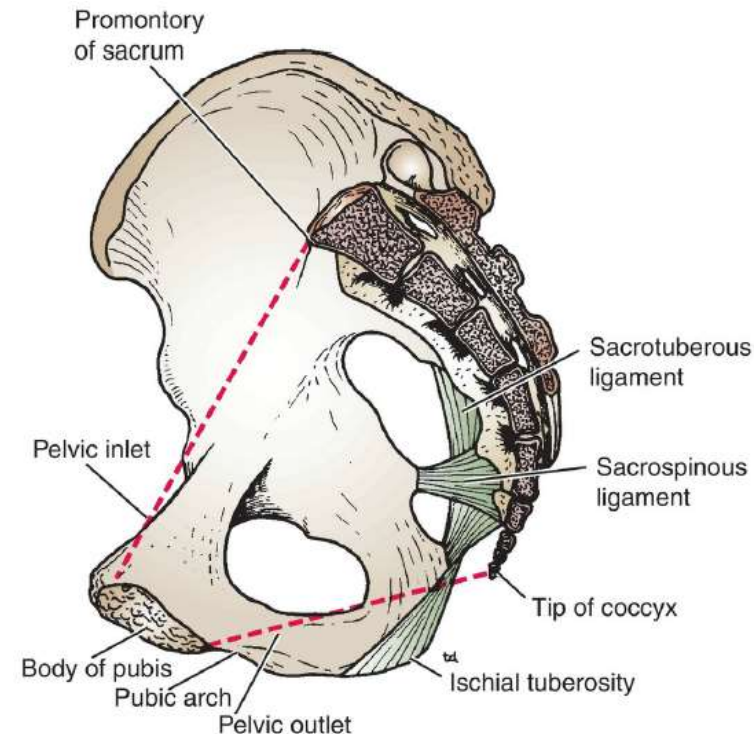
- **Posteriorly** by the sacral promontory.
- **Laterally** by the iliopectineal lines.
- **Anteriorly** by the symphysis pubis.



Pelvic outlet

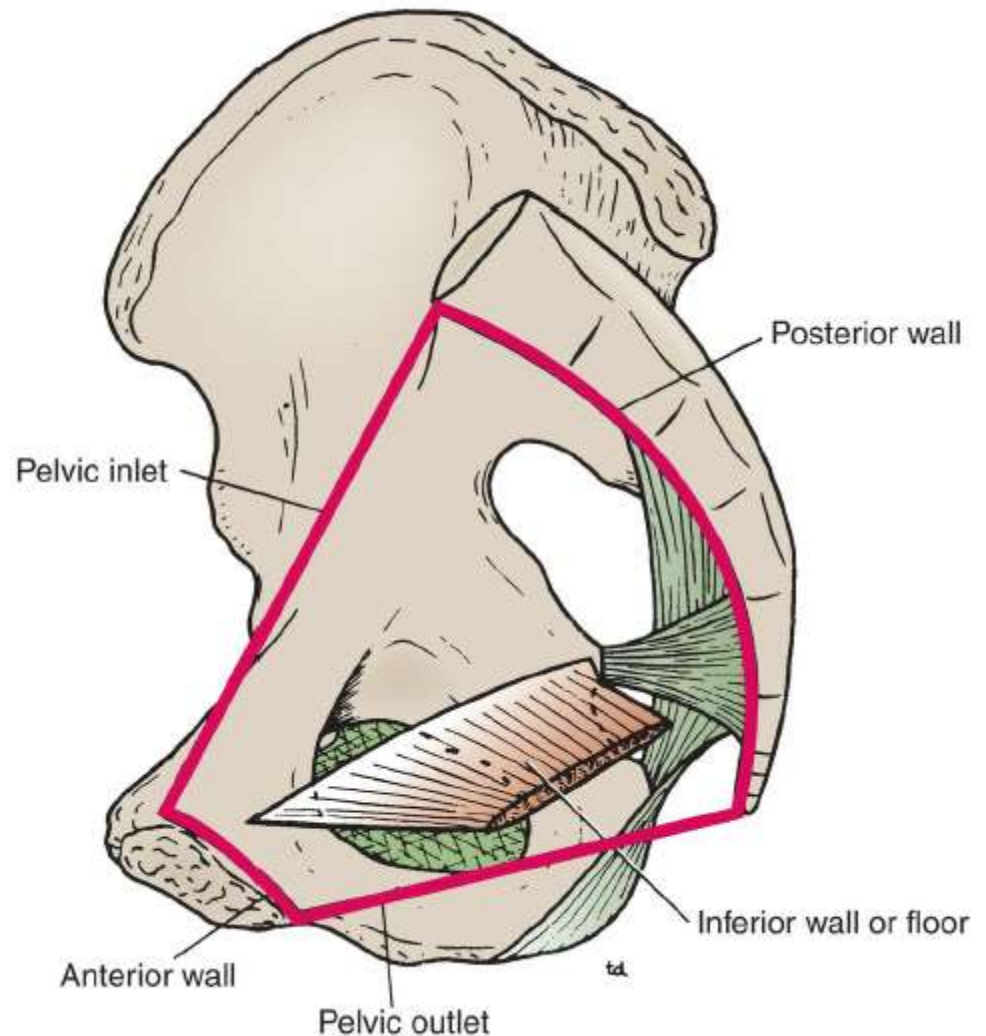
The pelvic outlet is bounded

- **Posteriorly** by the coccyx.
- **Laterally** by the ischial tuberosities.
- **Anteriorly** by the pubic arch.



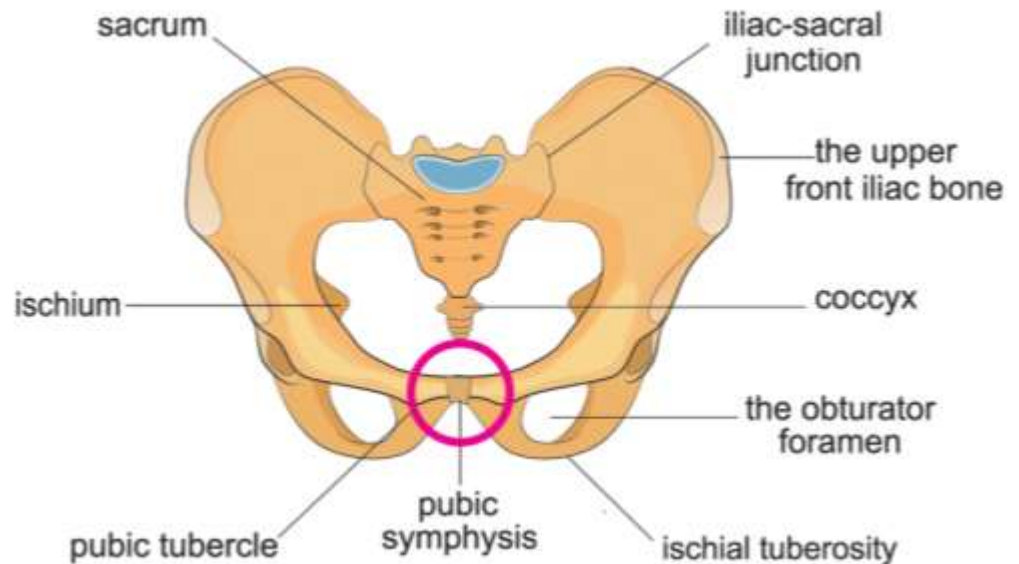
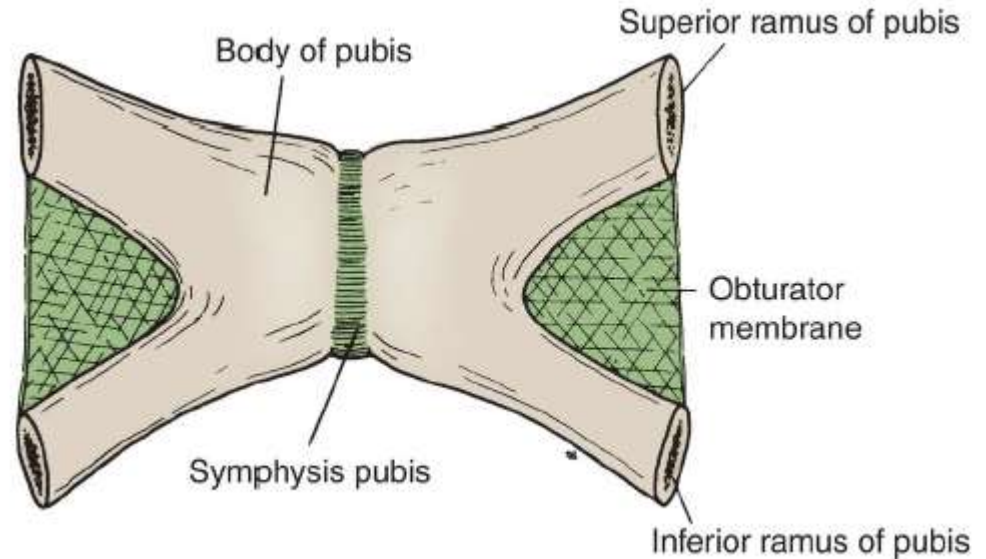
Pelvic Walls

The pelvis has anterior, posterior, and lateral walls and an inferior wall or floor



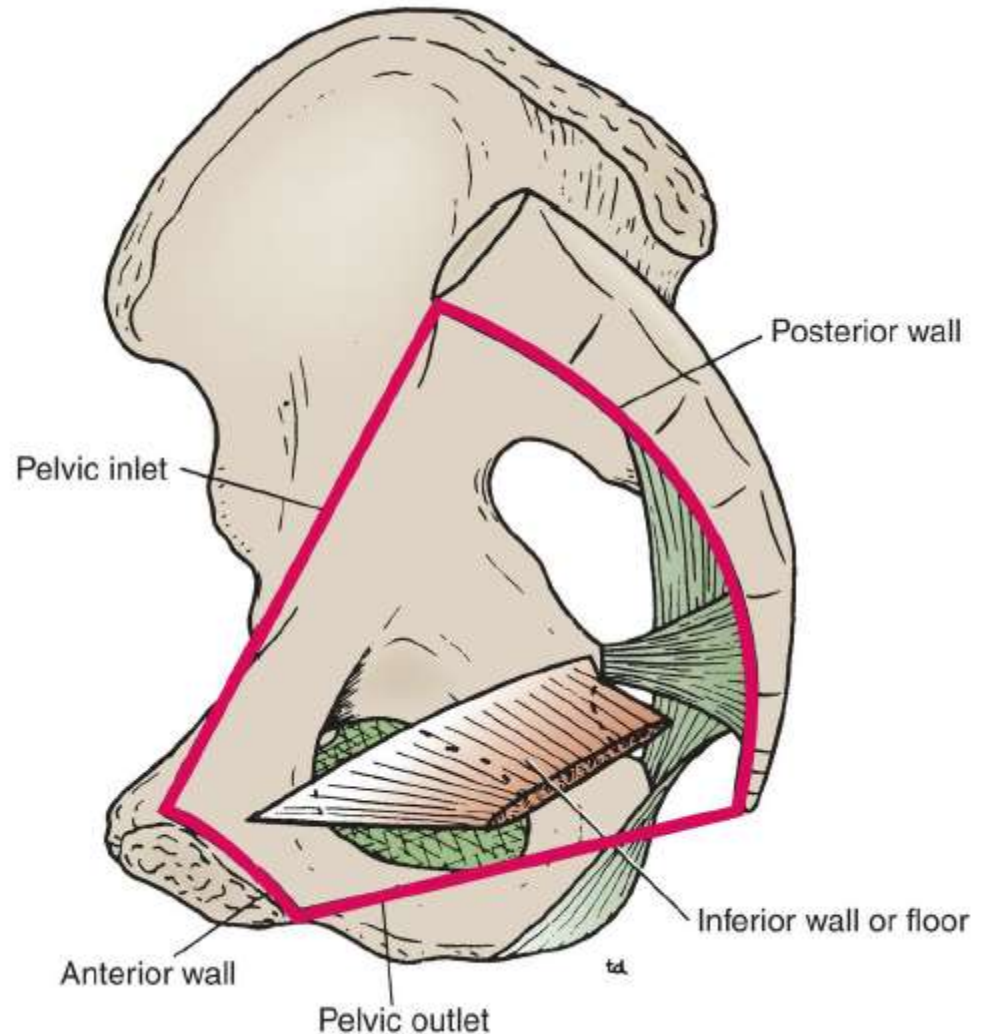
Anterior Pelvic Wall

- is the shallowest wall and is formed by the bodies of
- the pubic bones, the pubic rami, and the symphysis pubis



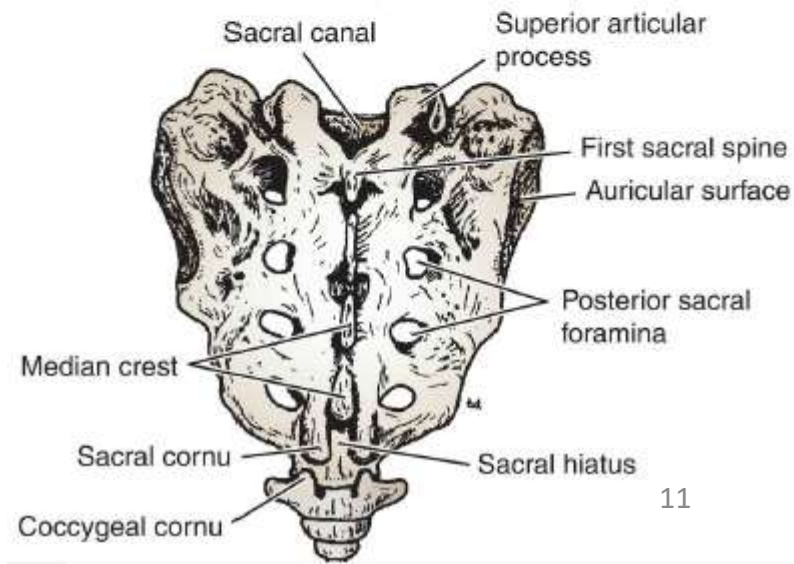
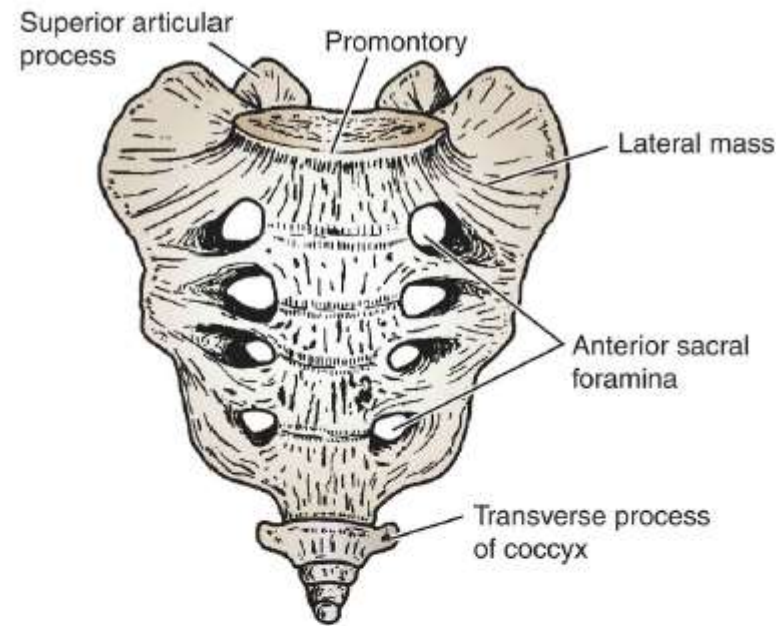
Posterior Pelvic Wall

- is extensive and is formed by the sacrum and coccyx and by the piriformis muscles and their covering of parietal pelvic fascia



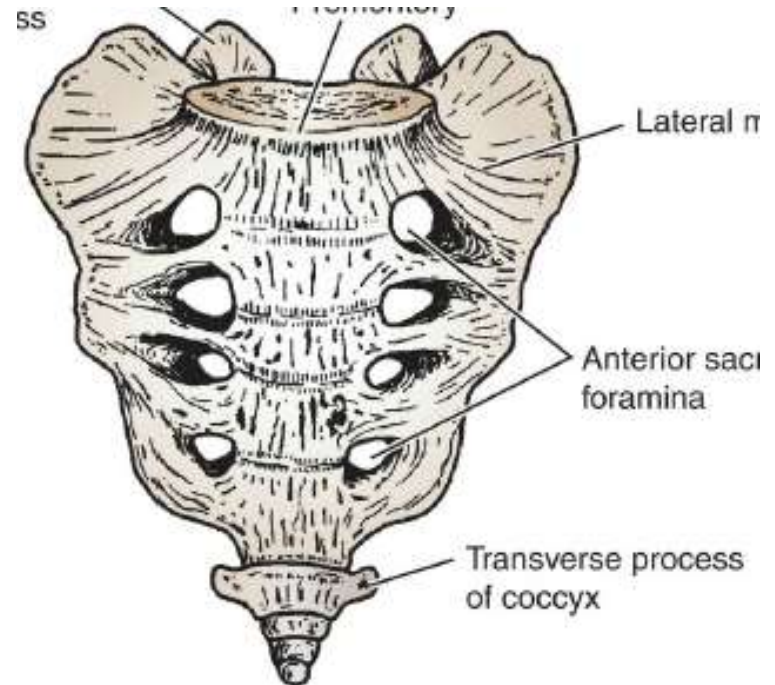
Sacrum

- Consists of **5** rudimentary vertebrae **fused** together to form a single **wedge-shaped bone** with a **forward concavity**.
- The **upper border** or base of the bone **articulates** with the **5th lumbar vertebra**.
- The **narrow inferior border** articulates with the **coccyx**.
- **Laterally**, the sacrum articulates with the two **iliac bones** to form **sacroiliac joints**.



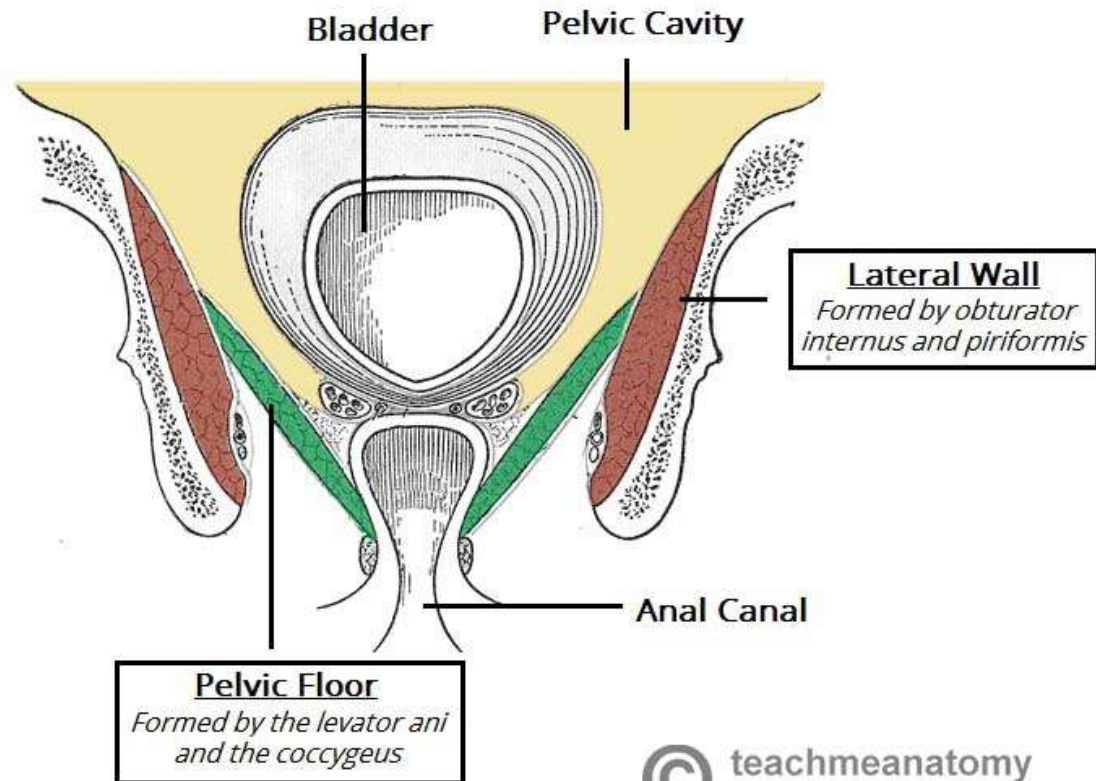
Coccyx

- It consists of **four vertebrae** fused together to form a small **triangular bone**.
- It articulates at its base with the **lower end of the sacrum**.
- The **coccygeal vertebrae** consist of **bodies only**.



Lateral Pelvic Wall

- is formed by part of hip bone below the pelvic inlet, obturator membrane, sacrotuberous and sacrospinous ligaments, and the obturator internus muscle and its covering fascia.



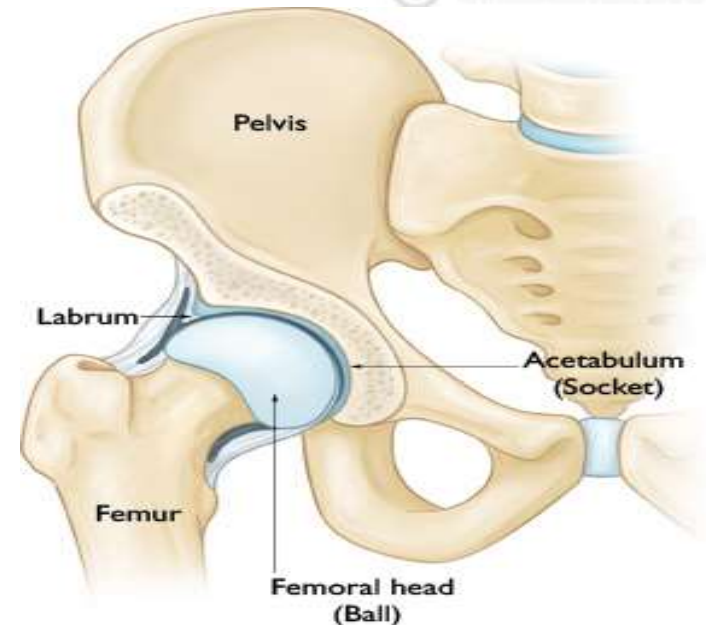
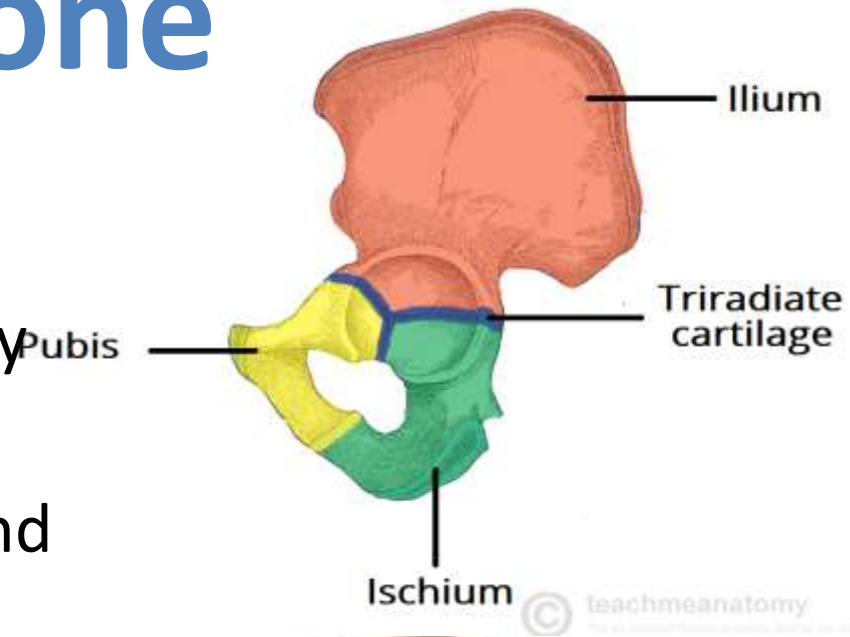
teachmeanatomy

The #1 Applied Human Anatomy Site on the Web.

Hip Bone

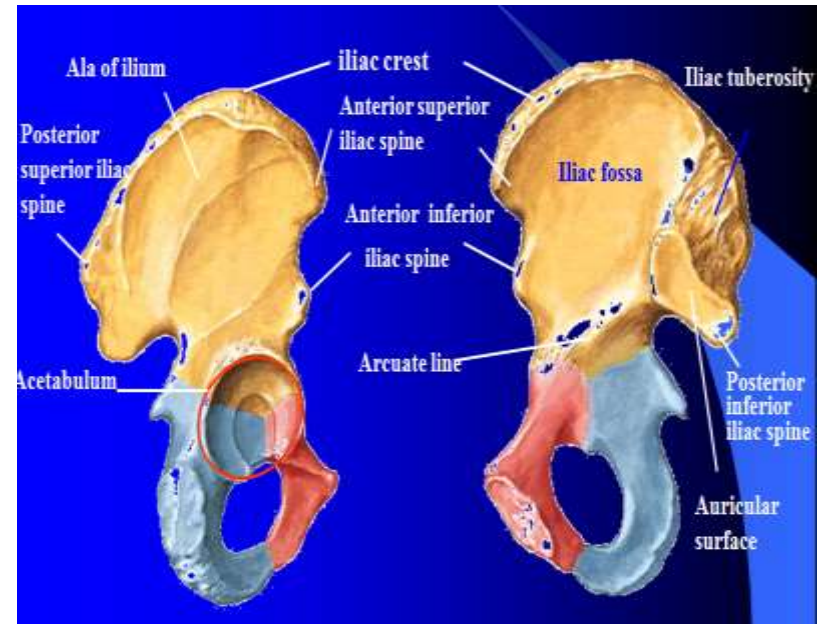
Each hip bone consists of:

- **Ilium**, which lies superiorly.
- **Ischium**, which lies posteriorly and inferiorly.
- **Pubis**, which lies anteriorly and inferiorly.
- The three separate bones are **joined** at the **acetabulum**.
- **Acetabulum** is a deep **depression** on the outer surface of the hip bone which articulates with the head of the femur.



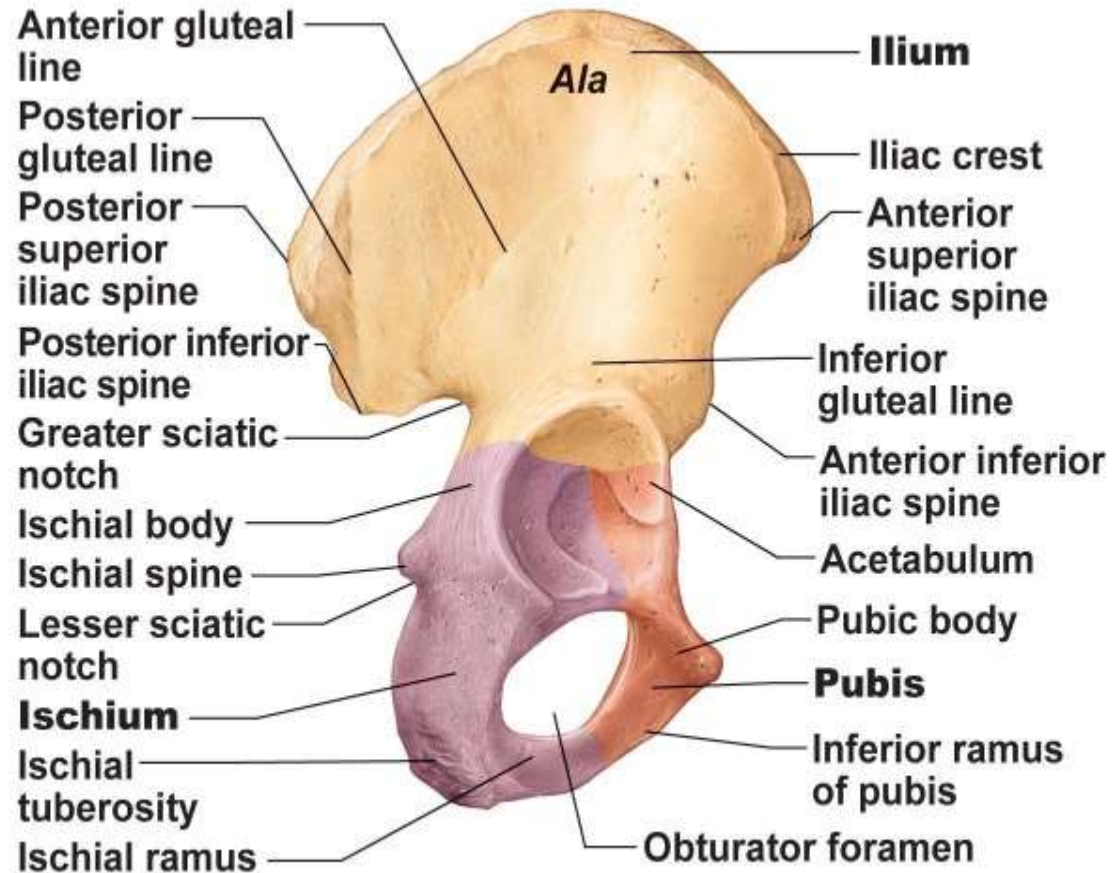
The ilium

- It is the **upper flattened part** of the hip bone
- It possesses the **iliac crest**.
- The **iliac crest** runs between the **anterior and posterior superior iliac spines**.
- Below these spines are the corresponding anterior and posterior **inferior iliac spines**.
- On the **inner surface** of the ilium is a surface for articulation with the **sacrum**.



The ischium

- The ischium is the inferior and posterior part of the hip bone.
- It possesses an ischial spine and an ischial tuberosity.

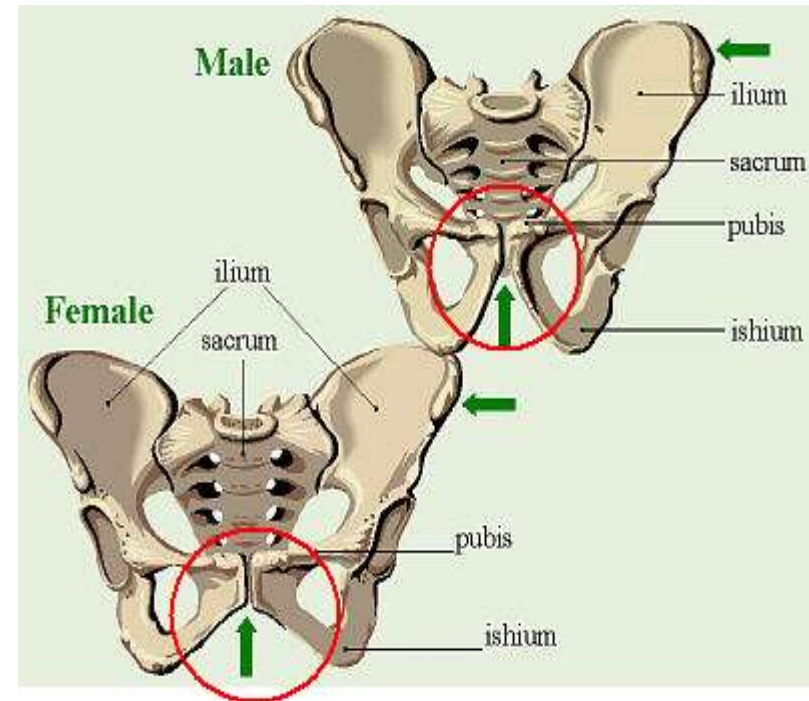


(a) Lateral view, right hip bone

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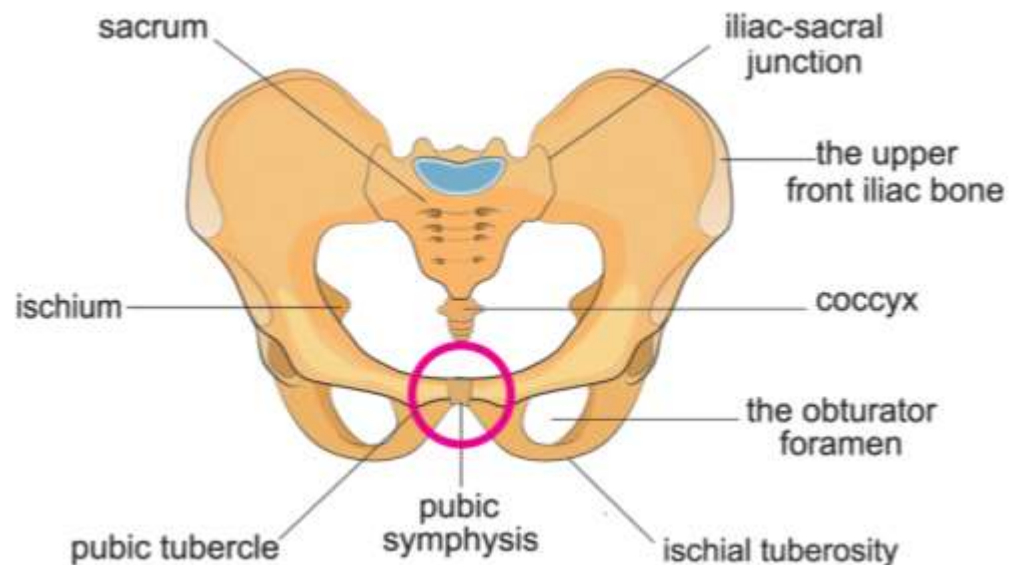
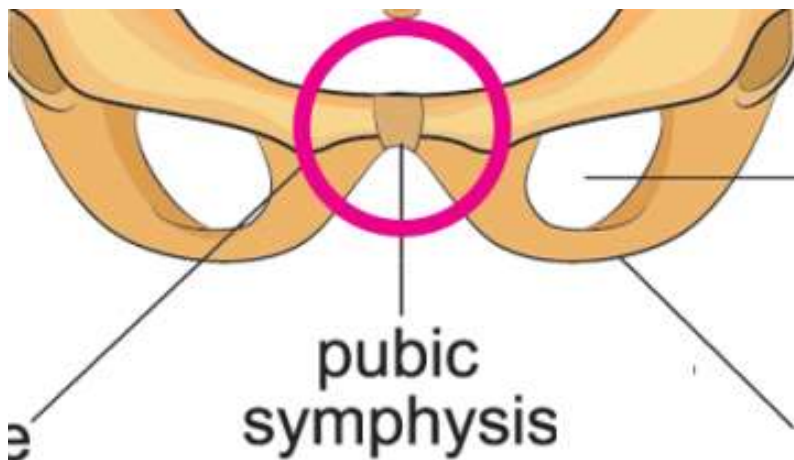
The pubis

- The pubis is the **anterior and inferior part** of the hip bone
- It has a body and superior and inferior pubic rami.
- The **body** of the pubis bears the **pubic crest** and the **pubic tubercle**.
- It articulates with the pubic bone of the opposite side at the **symphysis pubis**.



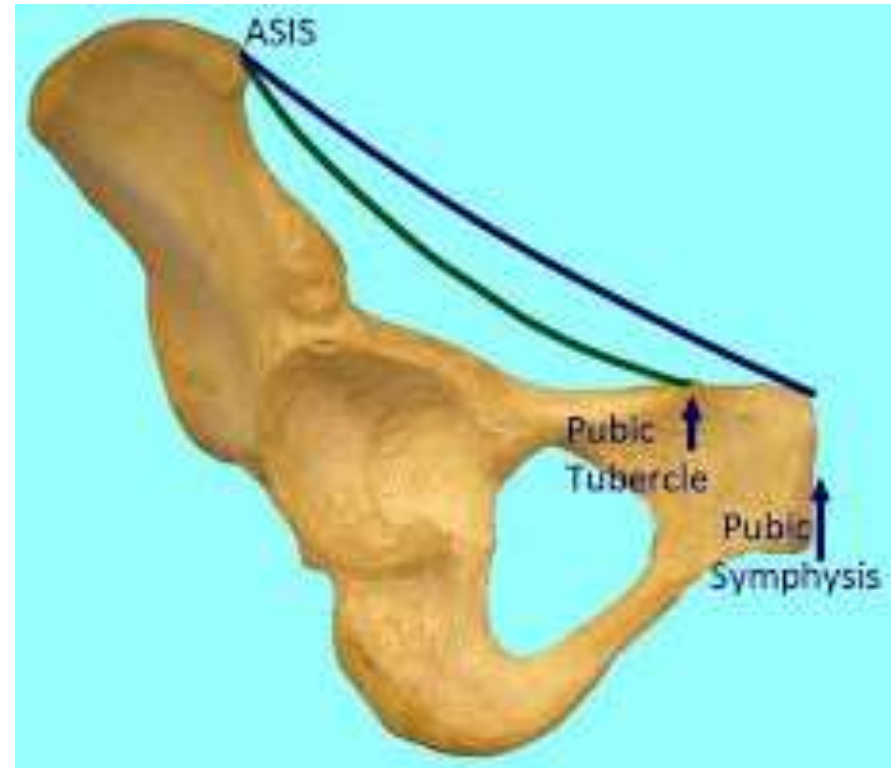
Symphysis Pubis

- is a cartilaginous joint between the two pubic bones.
- The articular surfaces are covered by a layer of hyaline cartilage and are connected together by a fibrocartilaginous disc.
- Almost no movement is possible at this joint.

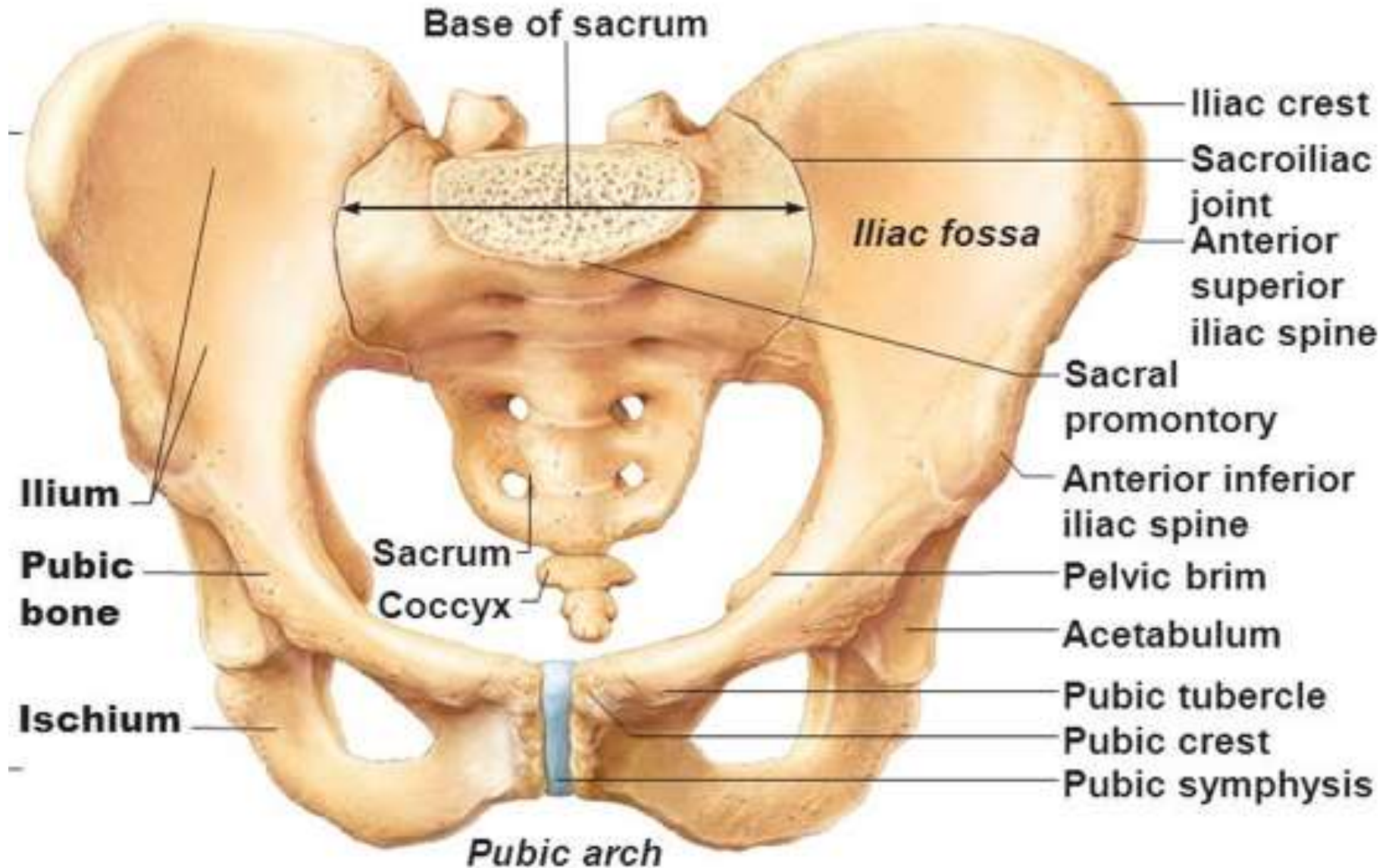


pubic tubercle

- It can be felt on the upper border of the pubis .
- The medial end of the inguinal ligament is attached to it.
- The tubercle can be palpated easily in the male by invaginating the scrotum from below with the examining finger.
- In the female, the pubic tubercle can be palpated through the lateral margin of the labium majus.

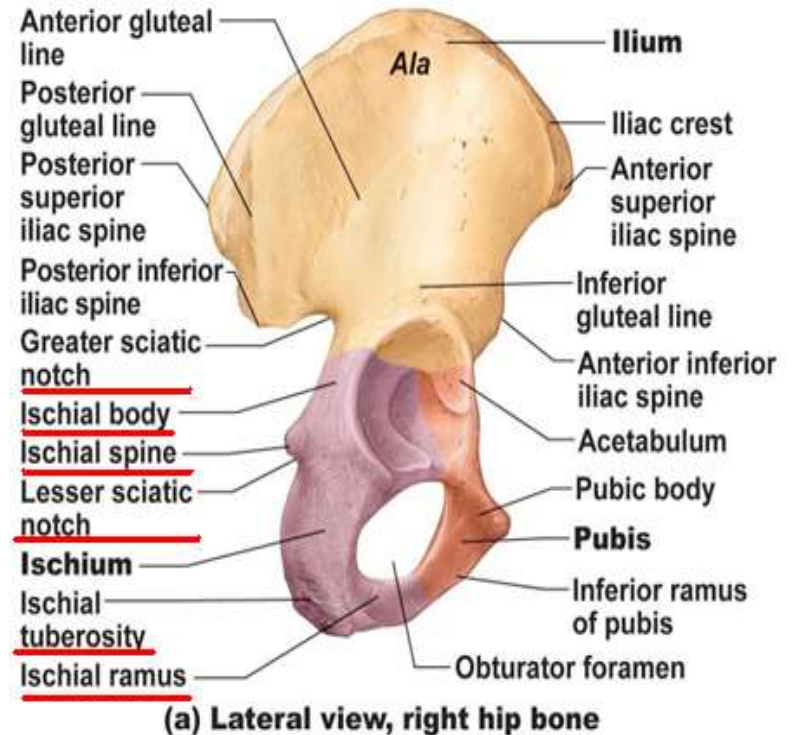


- **pubic crest** is the ridge of the bone on the superior surface of the pubic bone, medial to the pubic tubercle



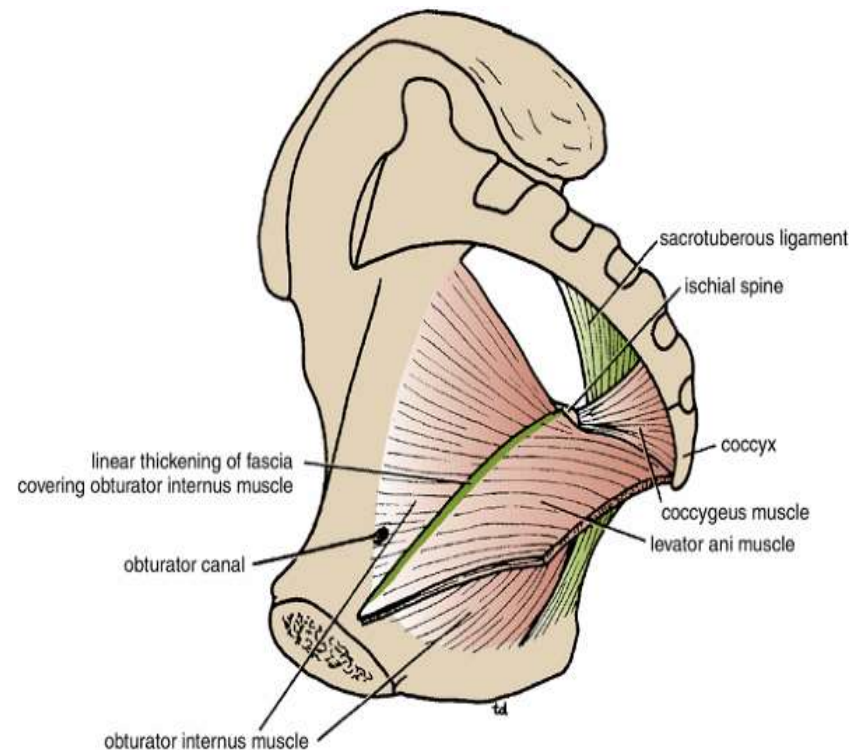
Sciatic Notch

- Behind the acetabulum is a large notch, the **greater sciatic notch**, which is separated from the **lesser sciatic notch** by the spine of the ischium.
- The sciatic notches are converted into the **greater and lesser sciatic foramina** by the presence of the **sacrospinous** and **sacrotuberous** ligaments.



Inferior Pelvic Wall (Pelvic Floor)

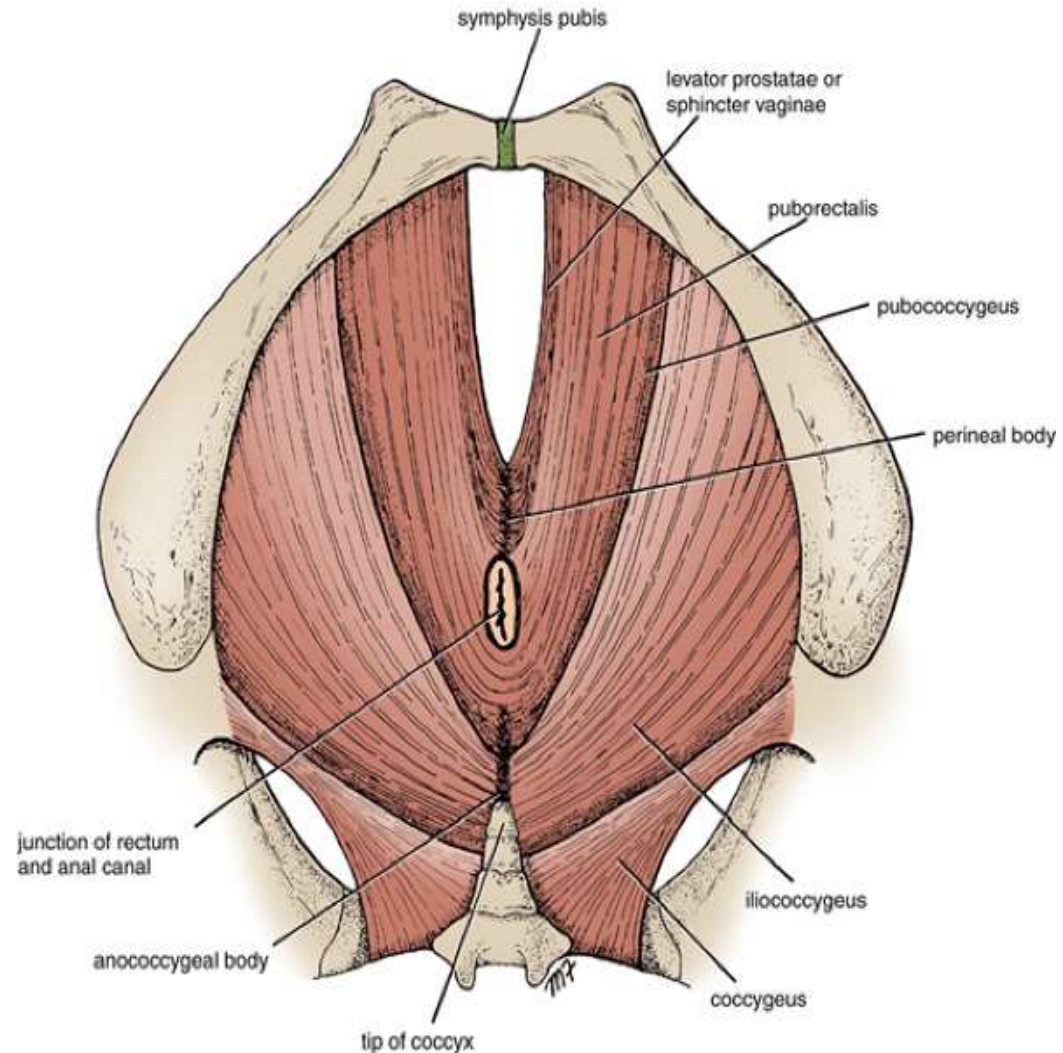
- It **supports** the pelvic viscera
- It is formed by the **pelvic diaphragm**.
- The pelvic floor stretches across the pelvis and divides it into:
 - The **main pelvic cavity** above, which contains the pelvic viscera.
 - The **perineum** below.



Inferior Pelvic Wall (Pelvic Floor)

Pelvic Diaphragm

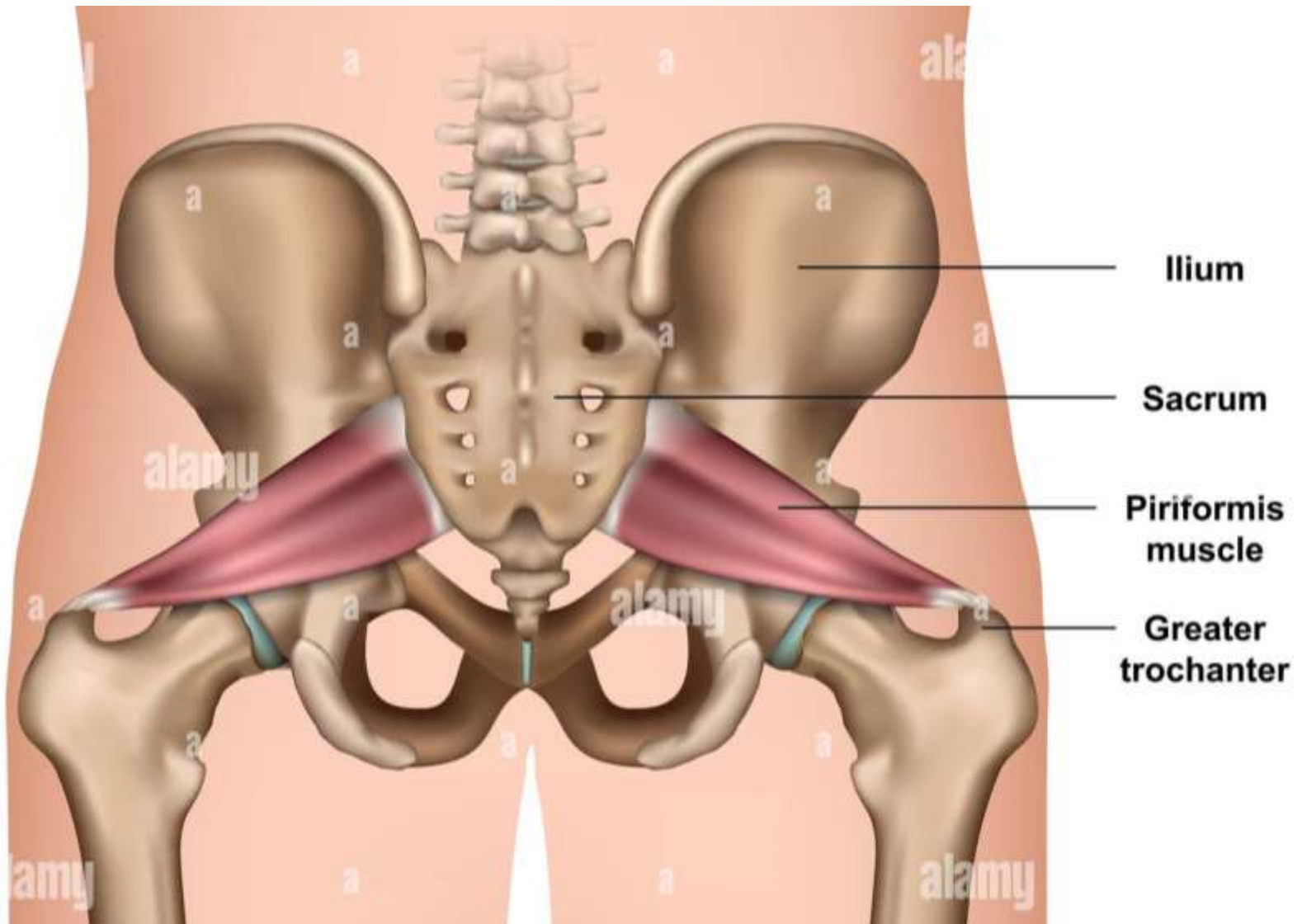
- It is formed by the important **levator ani** muscles and the small **coccygeus** muscles and their covering **fasciae**.



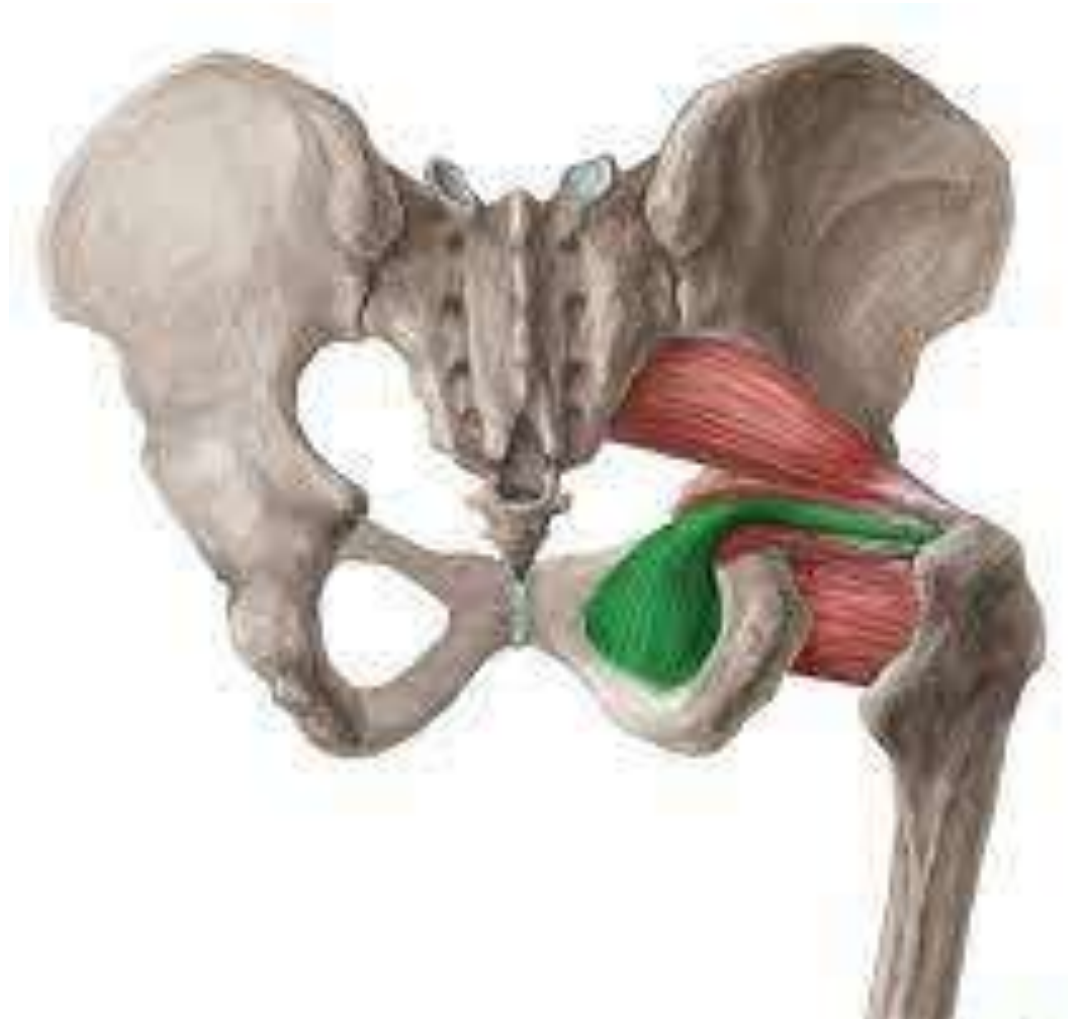
Pelvic Walls and Floor Muscles

NAME OF THE MUSCLE	ORIGIN	INSERTION	NERVE SUPPLY	ACTION
Piriformis	Front of lateral mass of the sacrum	Greater trochanter of the femur	Sacral plexus	Lateral rotator of the femur at the hip joint
Obturator internus	Obturator membrane and adjoining part of the hip bone	Greater trochanter of the femur	Nerve to obturator internus from sacral plexus	Lateral rotator of the femur at the hip joint
Levator ani	Body of the pubis, fascia of obturator internus, and spine of ischium	Perineal body; anococcygeal body; walls of the prostate, vagina, rectum, and anal canal	Fourth sacral nerve, pudendal nerve	Supports pelvic viscera; sphincter to the anorectal junction and vagina
Coccygeus	Spine of the ischium	Lower end of the sacrum; coccyx	Fourth and fifth sacral nerve	Assists levator ani to support the pelvic viscera; flexes coccyx

Piriformis muscle



obturator internus muscle



Levator Ani Muscle

- **Origin:**

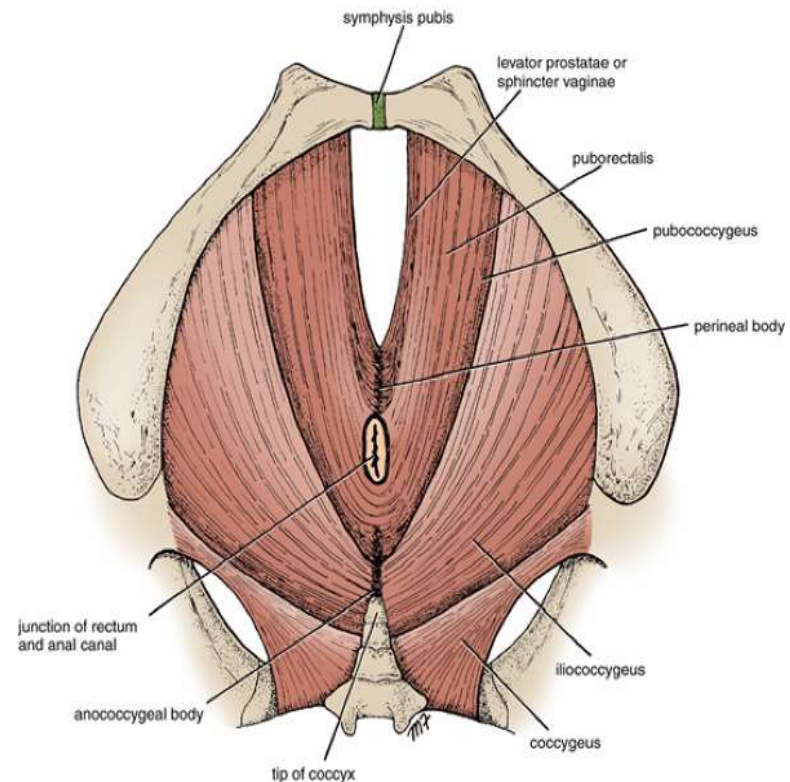
1. Anterior fibers: inner surface of body of pubis.

2. Middle fibers: white line of thickened obturator fascia.

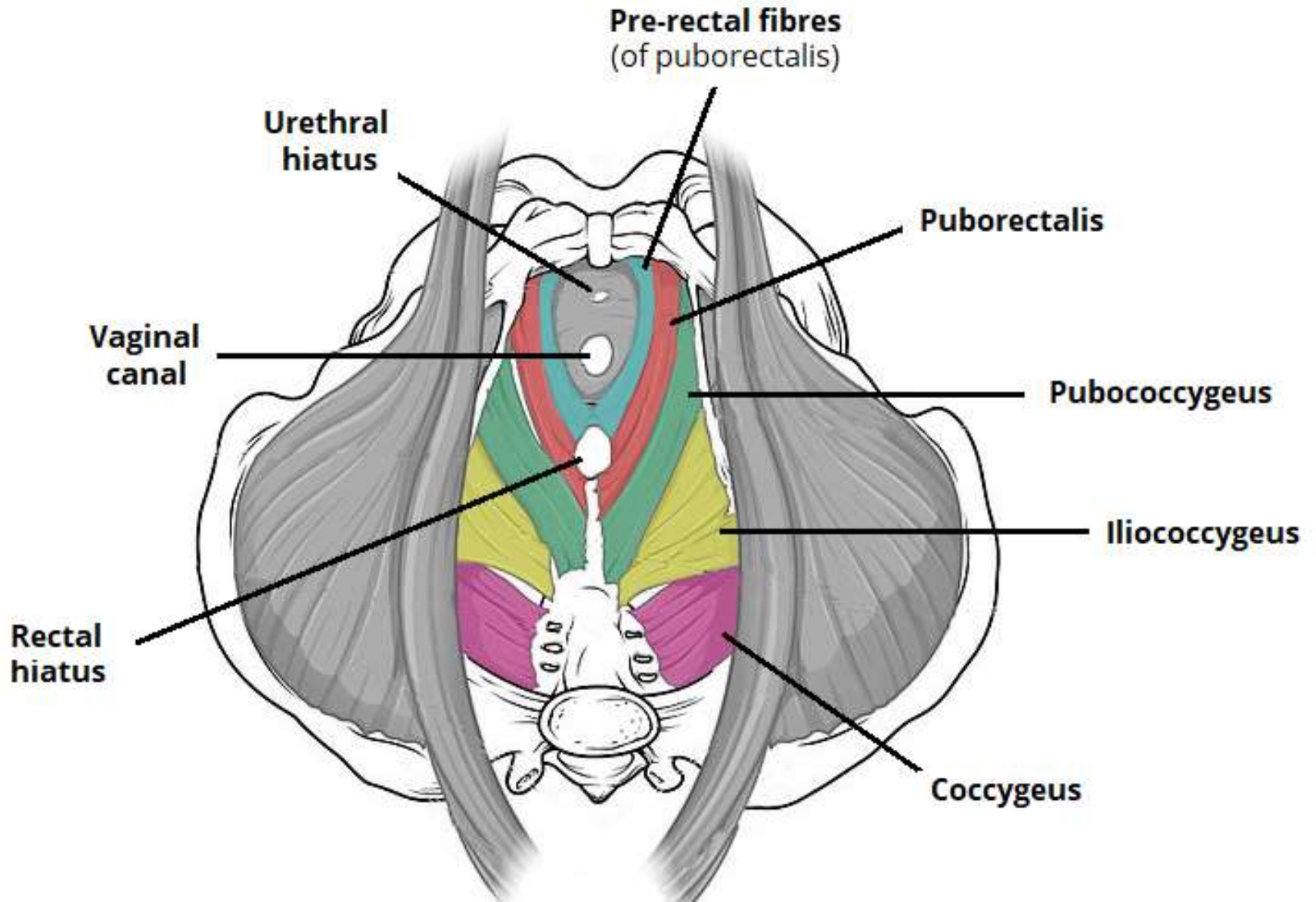
3. Posterior fibers: inner surface of the ischial spine.

- **Course of fibers:**

Downwards, backwards and medially.



Levator Ani Muscle



Levator Ani Muscle

- **Insertion:**

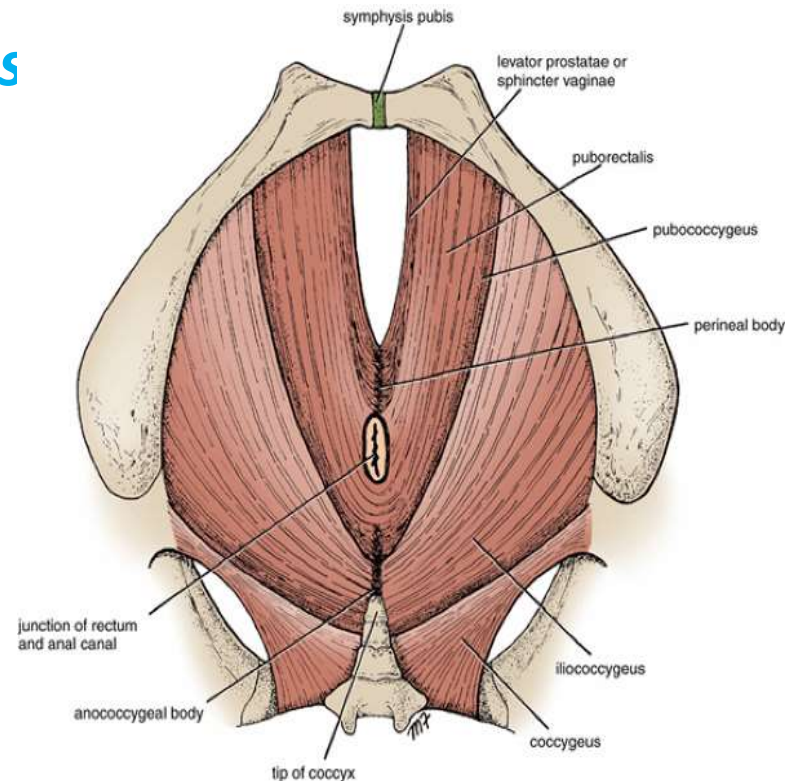
The muscle consists of three parts:

1. Anterior fibers of *pubococcygeus*

Runs below and lateral to prostate in male (*levator prostatae*) & around vagina in female (*sphincter vaginae*). It is inserted in the perineal body.

2. Middle fibers (*puborectalis*), encircles rectum at recto-anal junction. It is inserted in anococcygeal body.

3. Posterior fibers (*iliococcygeus*), are inserted in last 2 coccygeal segments & anococcygeal raphe.



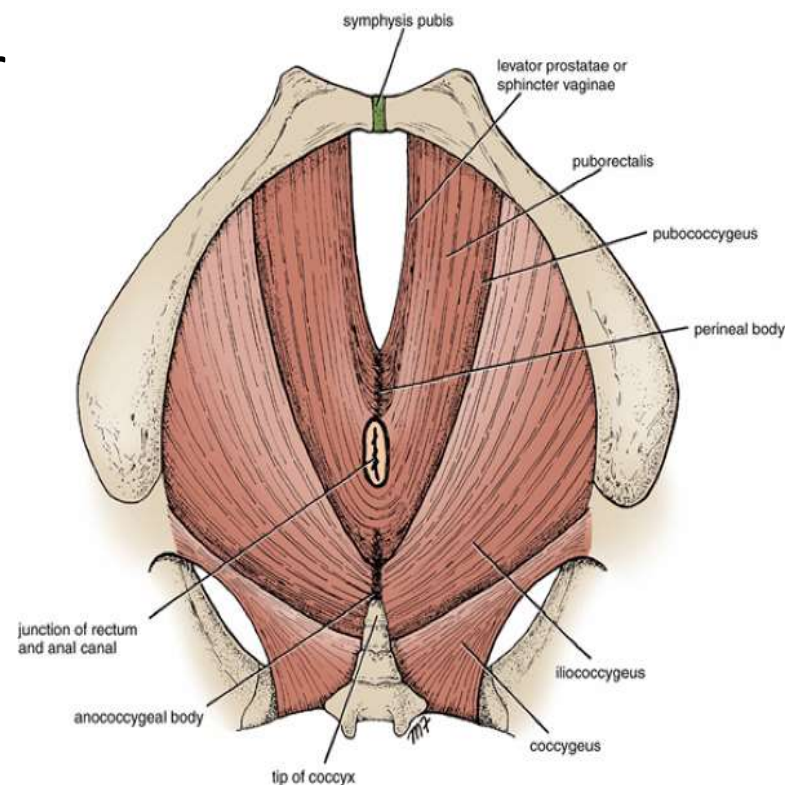
Levator Ani Muscle

- **Nerve supply:**

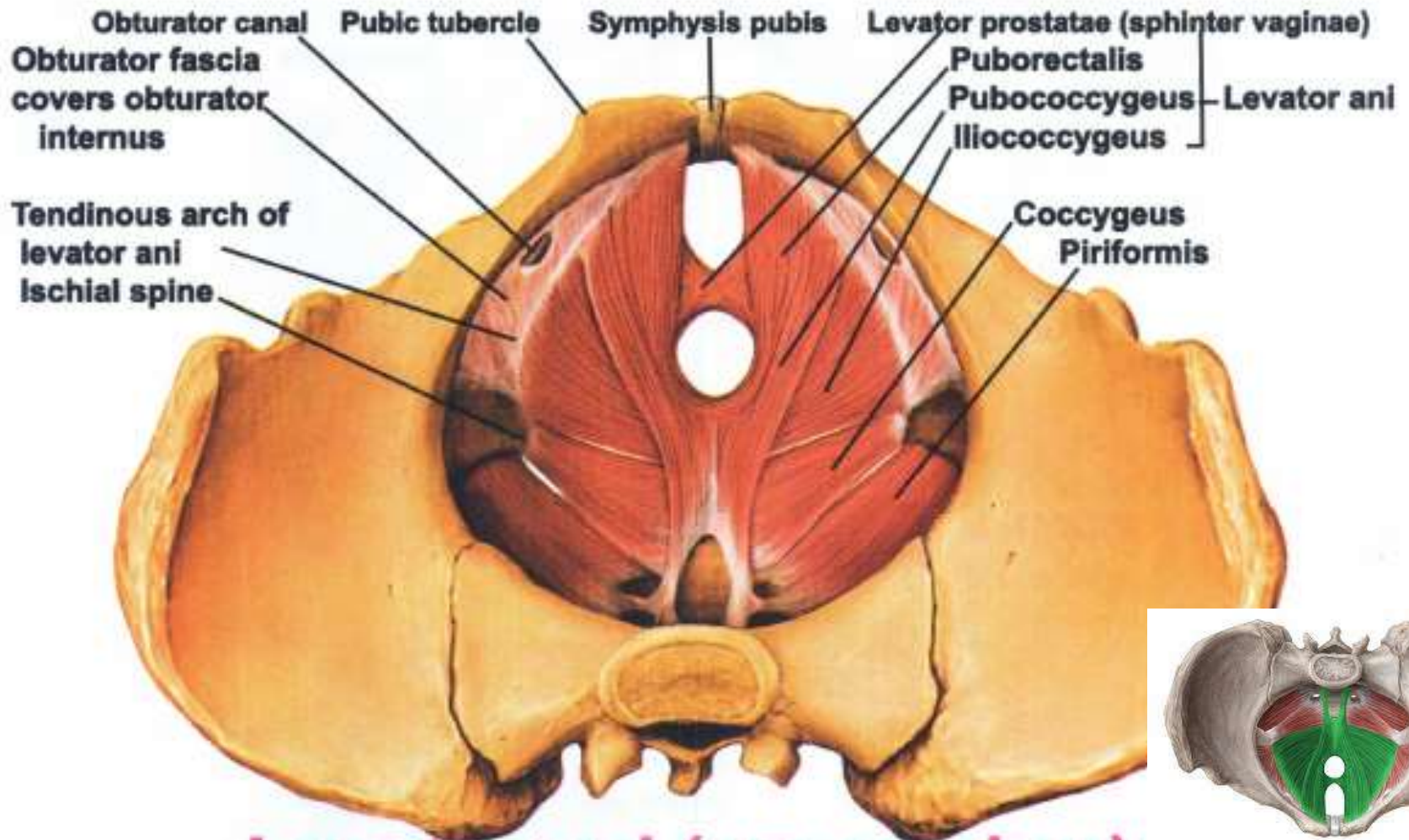
1. Upper (pelvic) surface: S4 nerve.
2. Lower (perineal) surface: Inferior rectal N.

- **Actions:**

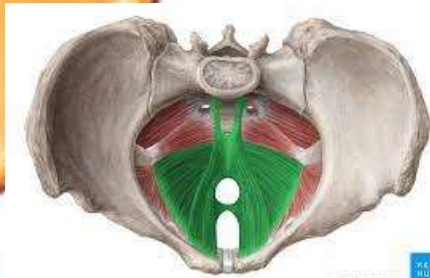
1. It supports the pelvic viscera.
2. It increases the intra-abdominal pressure, so it's used in defecation, micturition & labour.
3. The puborectalis is an additional anal sphincter.
4. It is a sphincter for the vagina.



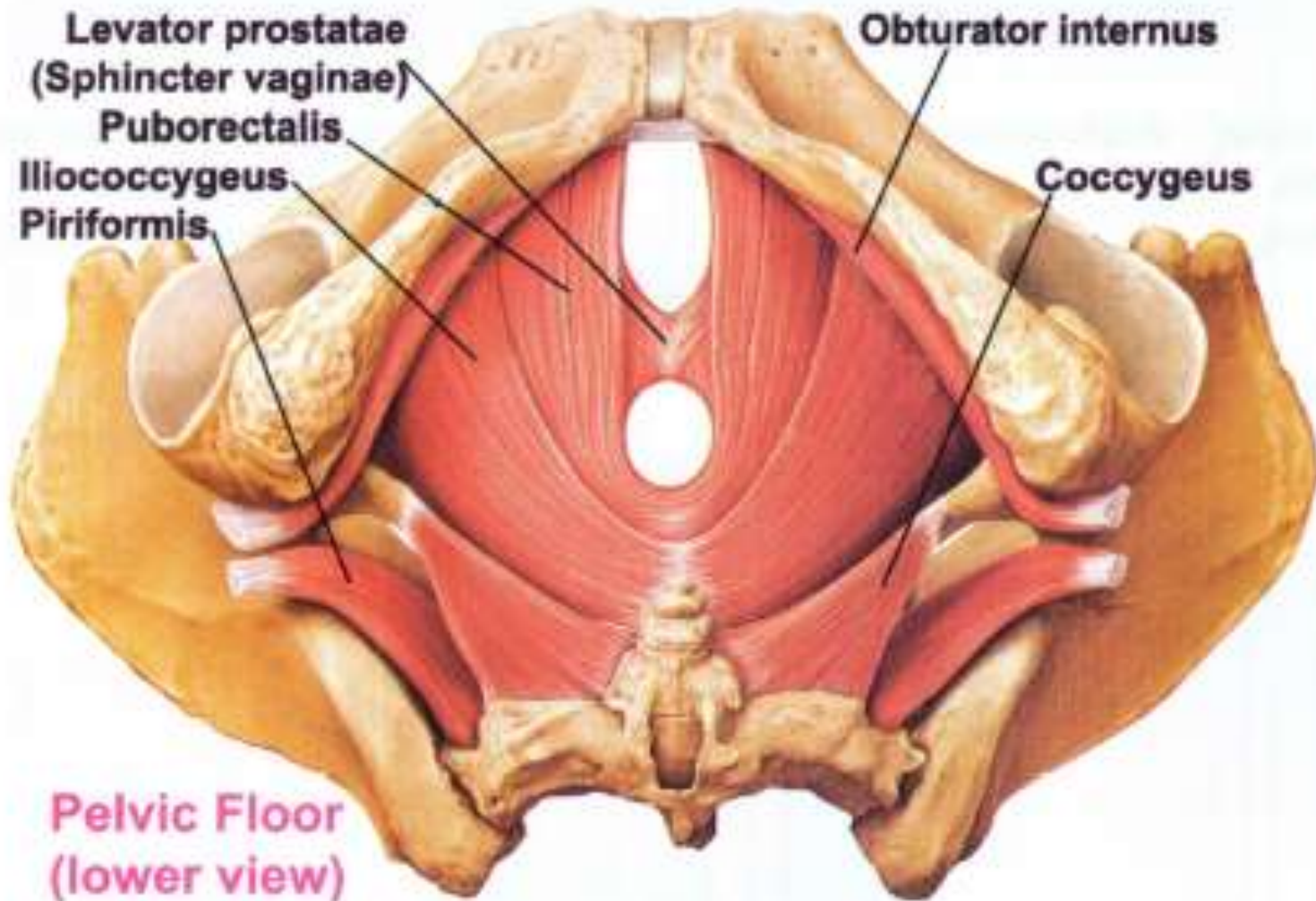
Levator Ani Muscle



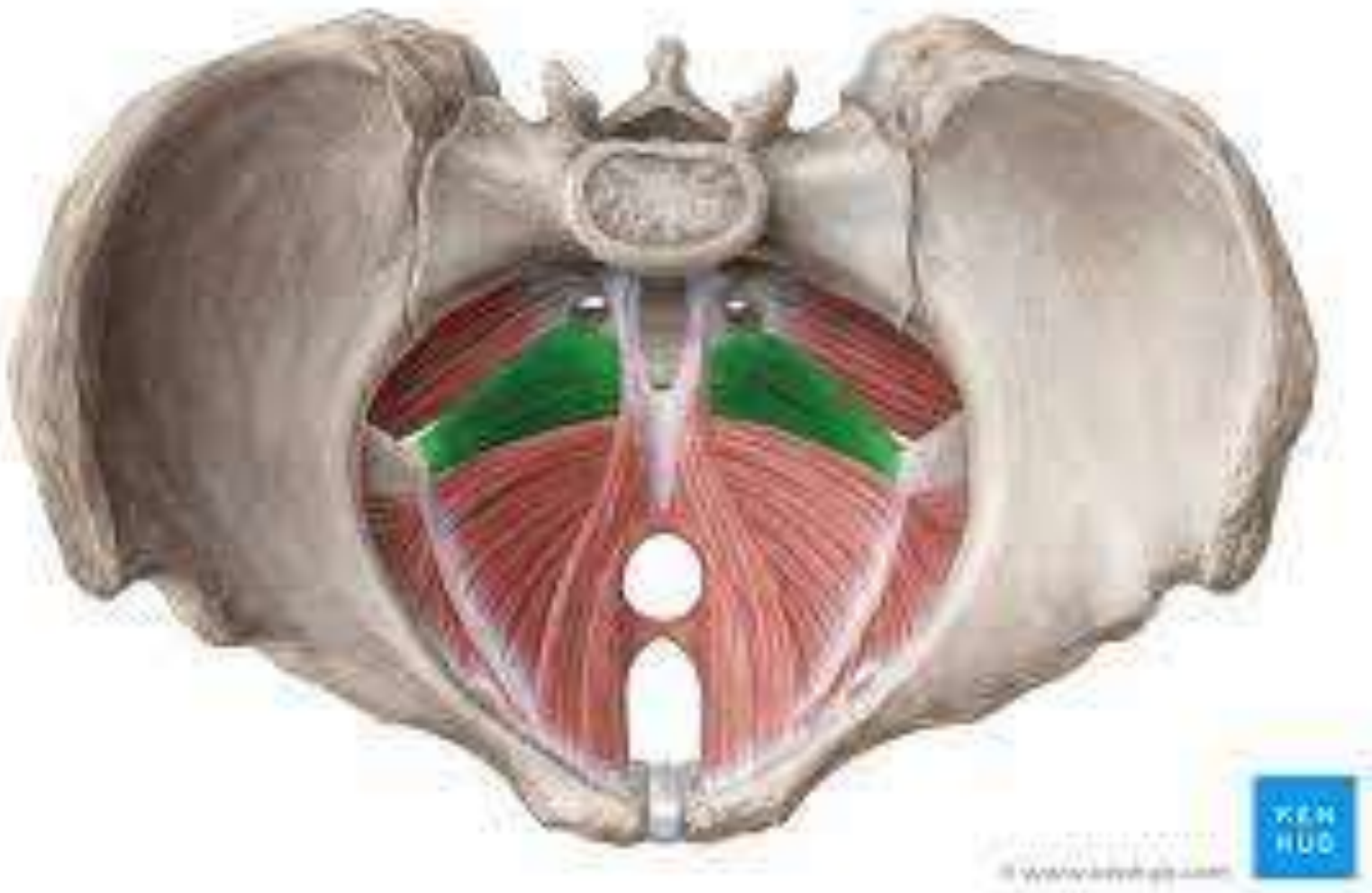
Levator ani (upper view)



Levator Ani Muscle

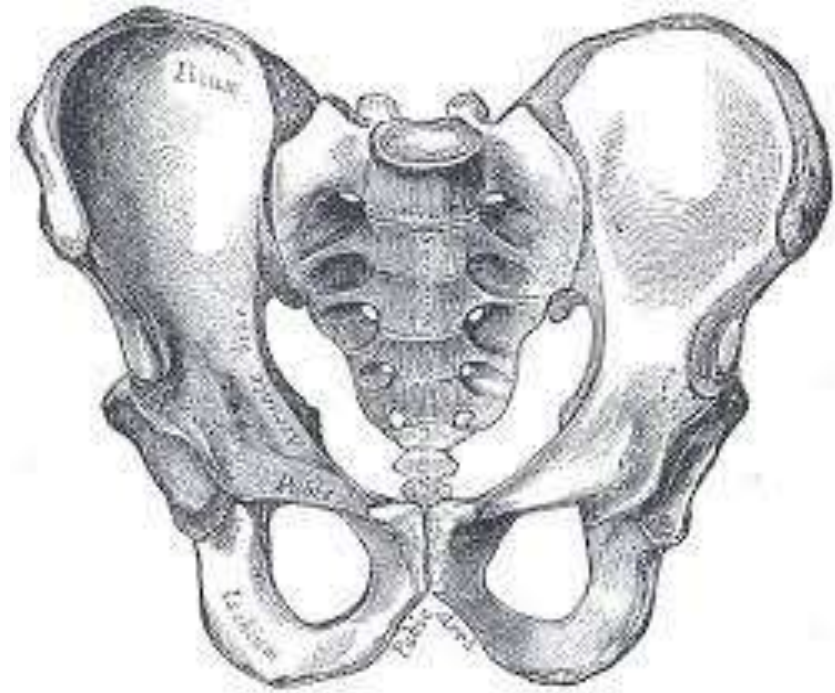


Coccygeus muscle



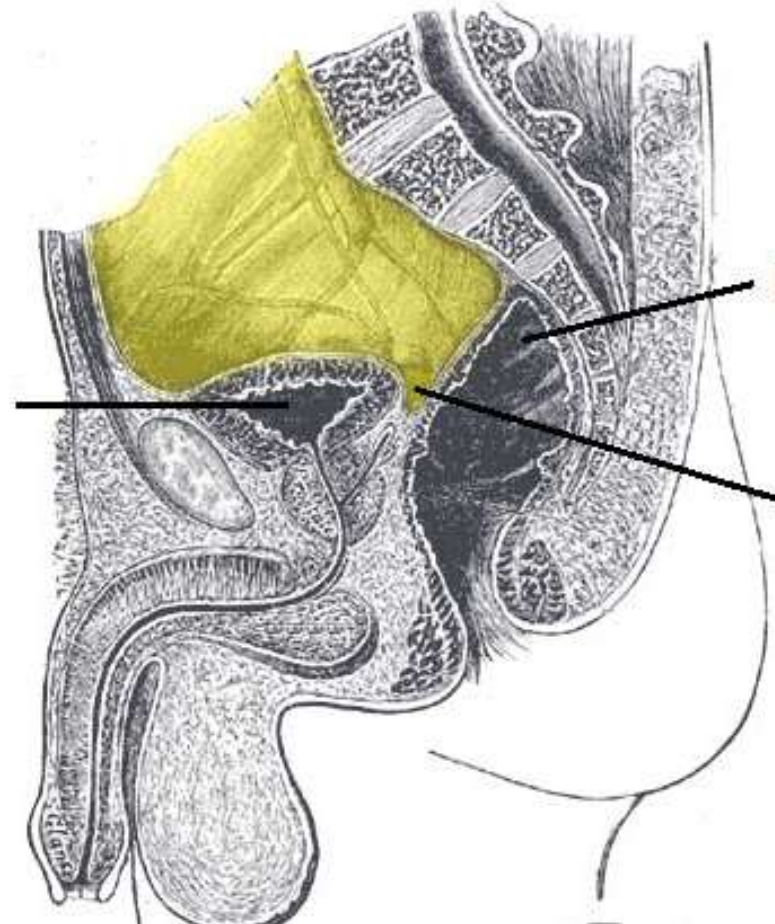
Joints of the Pelvis

- Sacroiliac joint
- Symphysis Pubis
- Sacrococcygeal Joint

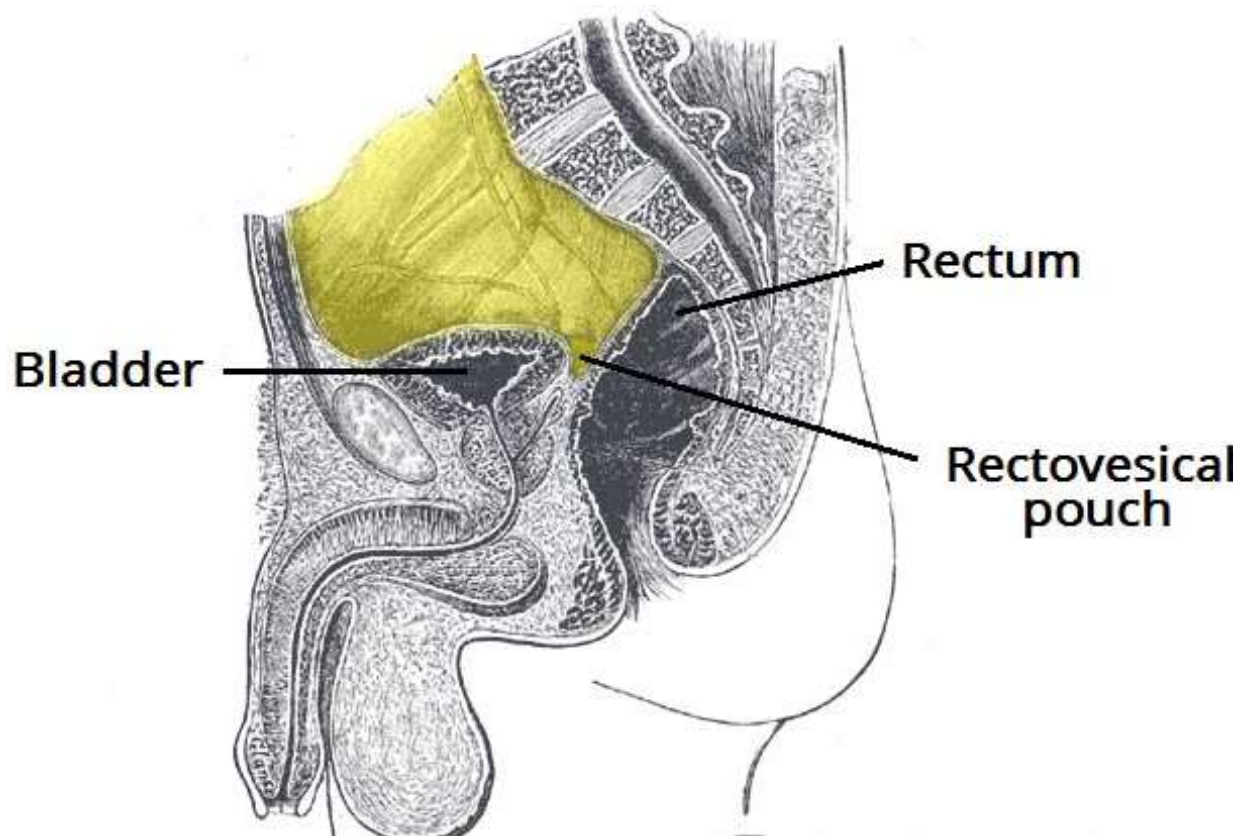


Pelvic Peritoneum (male)

- The peritoneum lining the lower part of the anterior abdominal wall is reflected backwards to cover the upper surface of the urinary bladder
- The peritoneum is then reflected backwards & downwards above the seminal vesicle forming recess called **(Recto-vesical pouch)**



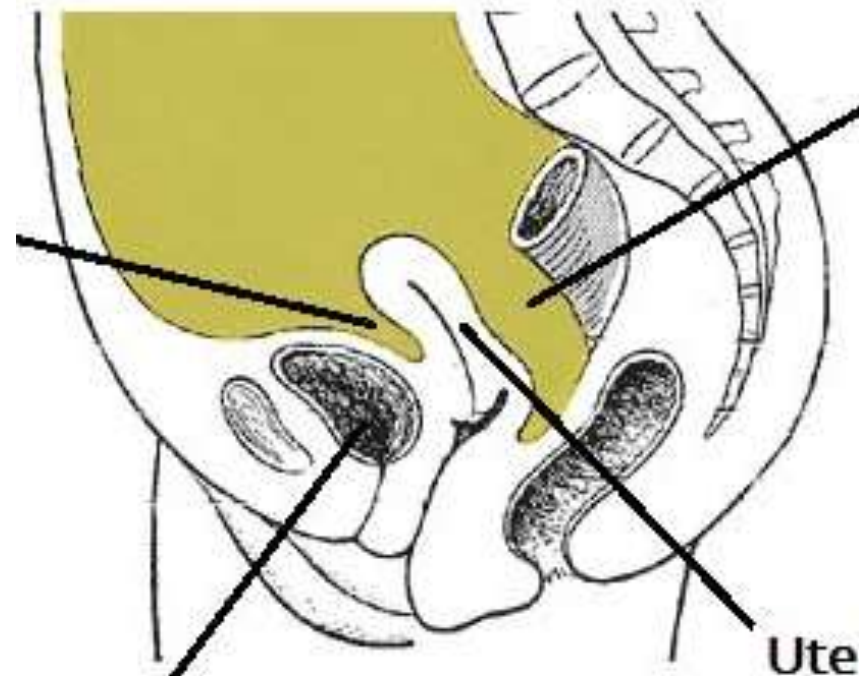
Pelvic Peritoneum (male)



- Then it is reflected upwards to cover the front of the middle 1/3 of the rectum then covers the front & sides of the upper 1/3 of rectum.

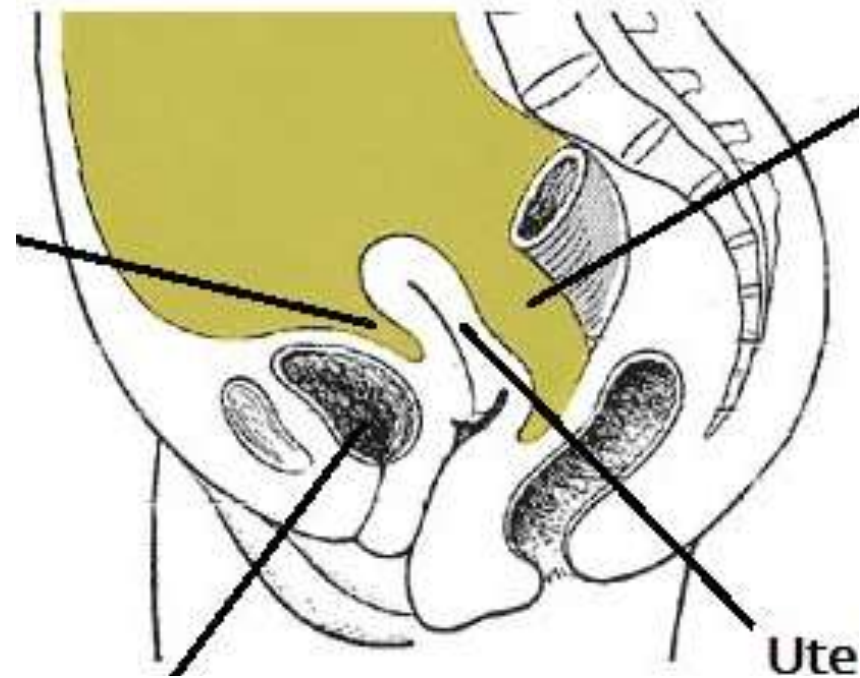
Pelvic Peritoneum (female)

- The peritoneum is reflected from the lower part of the anterior abdominal wall to cover the upper surface of urinary bladder (as in male).
- from the upper surface of urinary bladder the peritoneum passes backwards to the front of uterus at the junction of the body with the cervix of uterus.

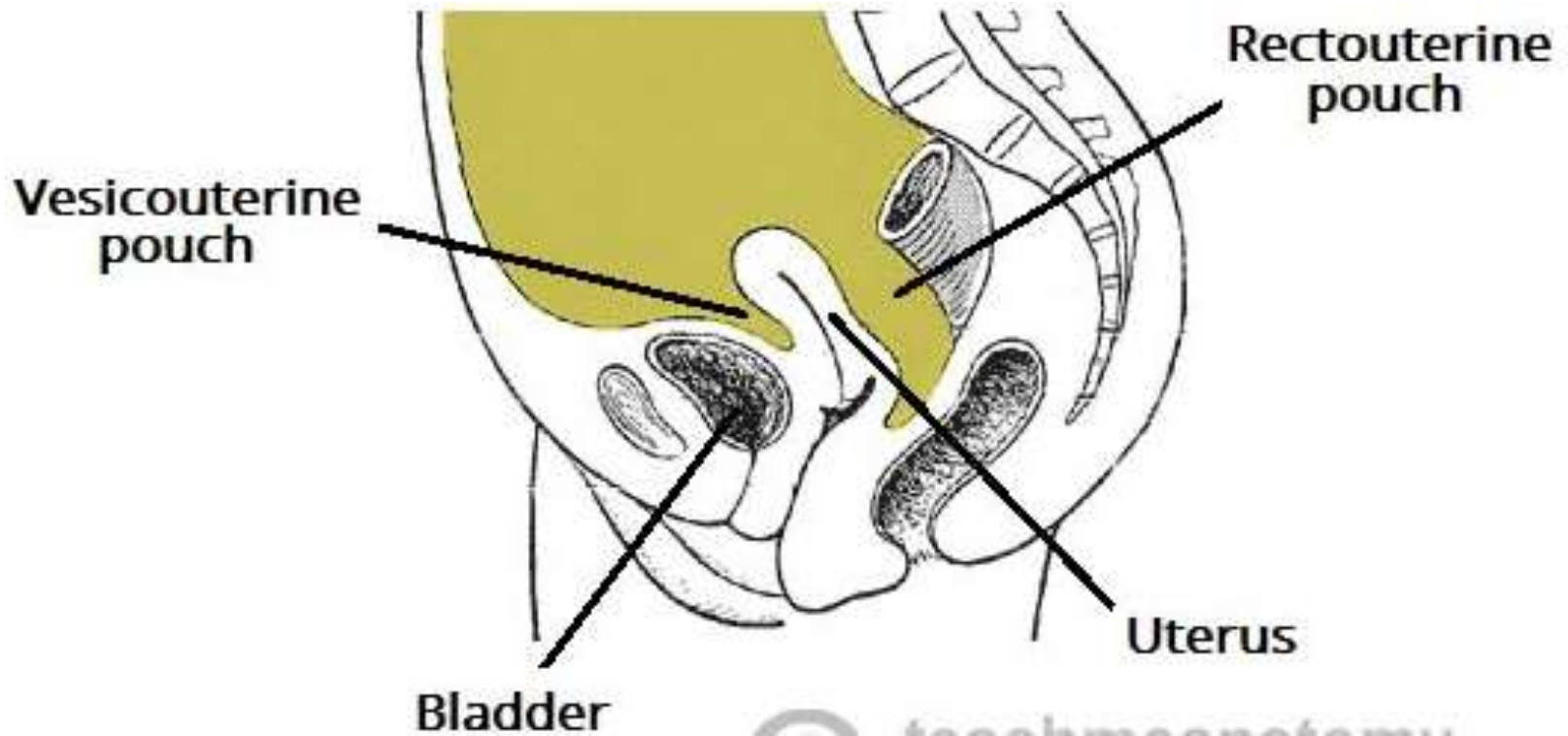


Pelvic Peritoneum (female)

- Then it is reflected forwards on the undersurface of uterus forming recess (**Utero-vesical pouch**).
- Then peritoneum covers the following surfaces :
 - Anterior surface of body uterus
 - Fundus of uterus
 - Posterior surface body and cervix of uterus
 - Upper $\frac{1}{4}$ the posterior surface of the vagina



Pelvic Peritoneum (female)

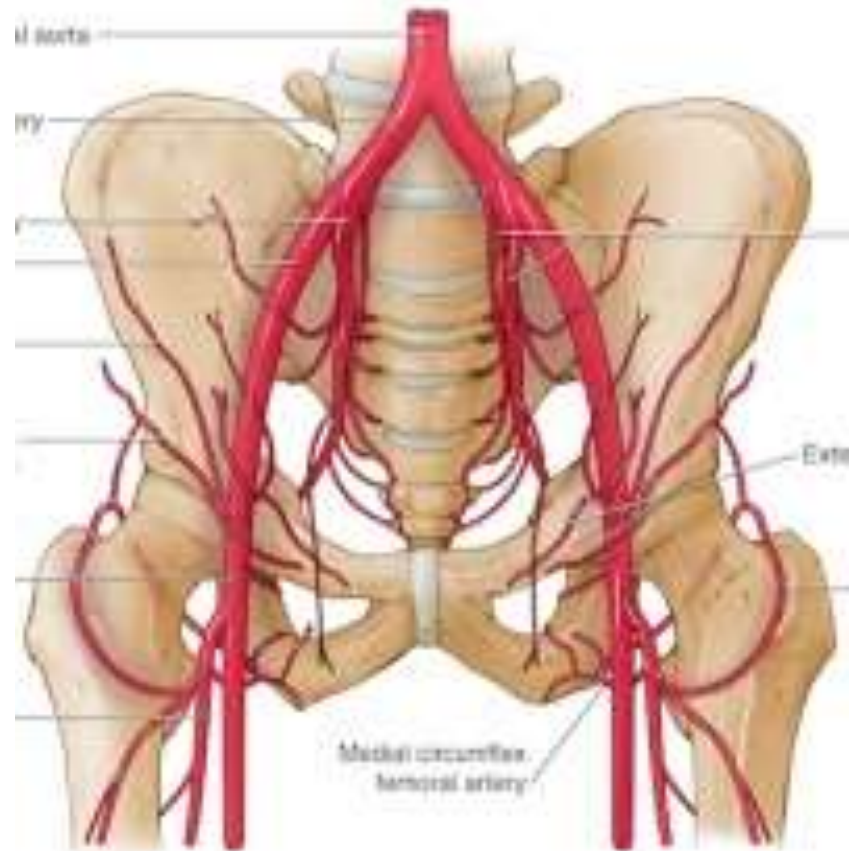


- Then it is reflected on to the front of the middle 1/3 of rectum forming deep recess (**Recto-uterine pouch = Douglas pouch**)

Arterial Supply of Pelvis

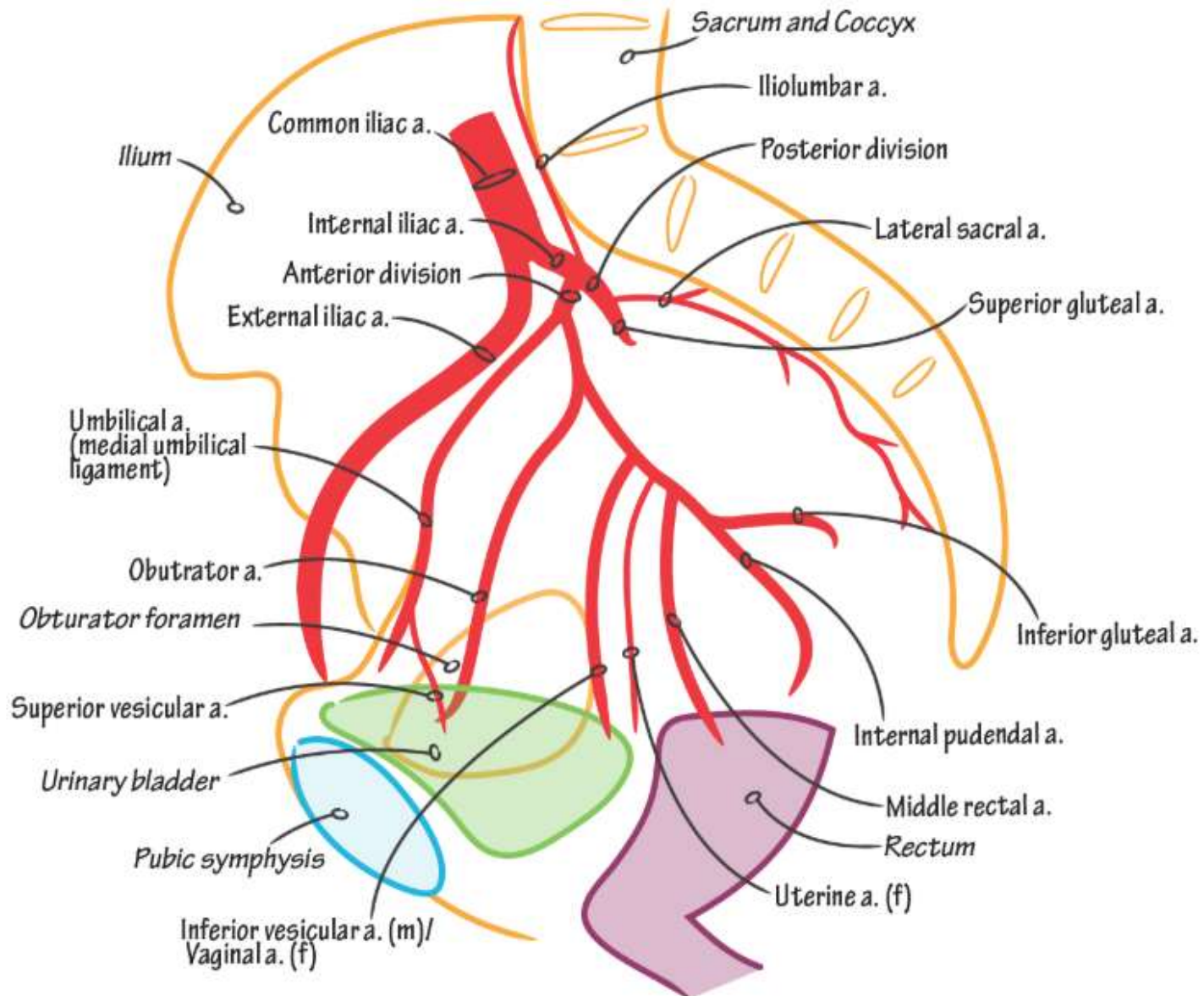
Internal iliac artery

- **ORIGIN** : At sacroiliac joint as the smaller of the 2 terminal branch of common iliac artery
- It divides into **anterior** & **posterior** divisions which gives the terminal branches



Arterial Supply of Pelvis

Branches of Internal iliac artery



General Anatomy

ABDOMINAL CAVITY

Anatomy Group

Dr Naser Radwan, MD

Dr Amjad Abu Alqumboz, MD

Dr Adham AlZanoun, MD

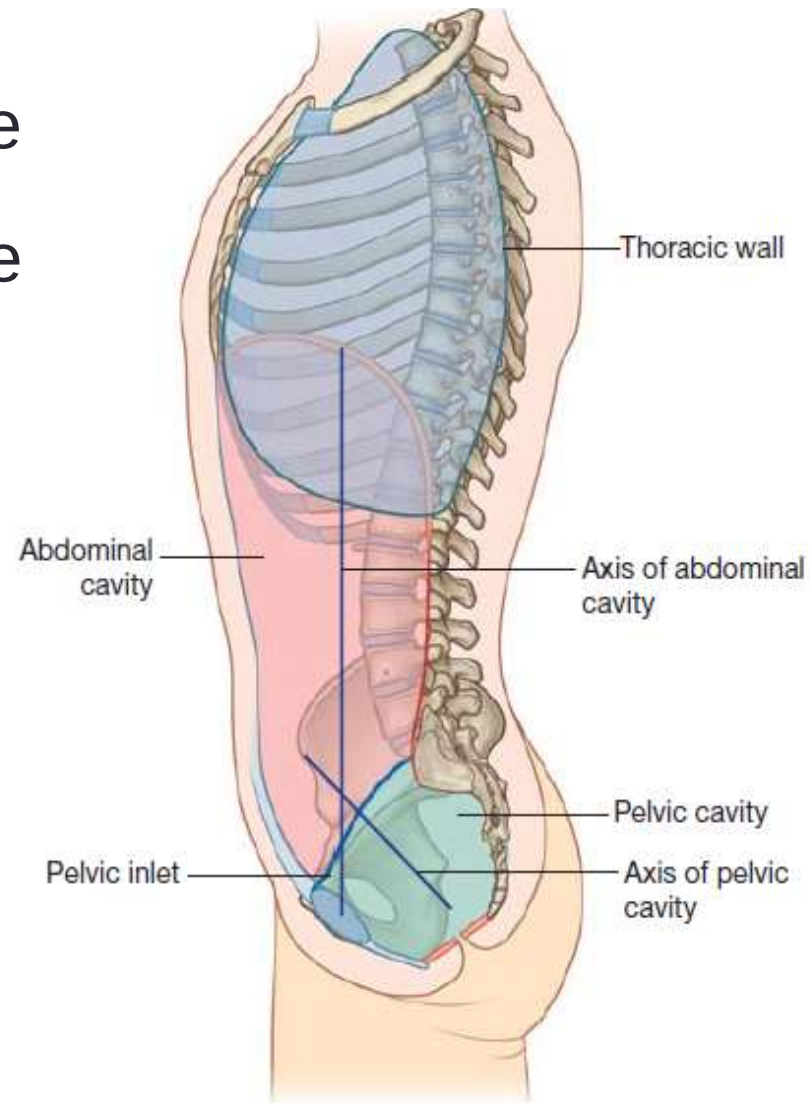


Definition

The abdominopelvic cavity is the region of the trunk that extends from the diaphragm above to the pelvic floor below.

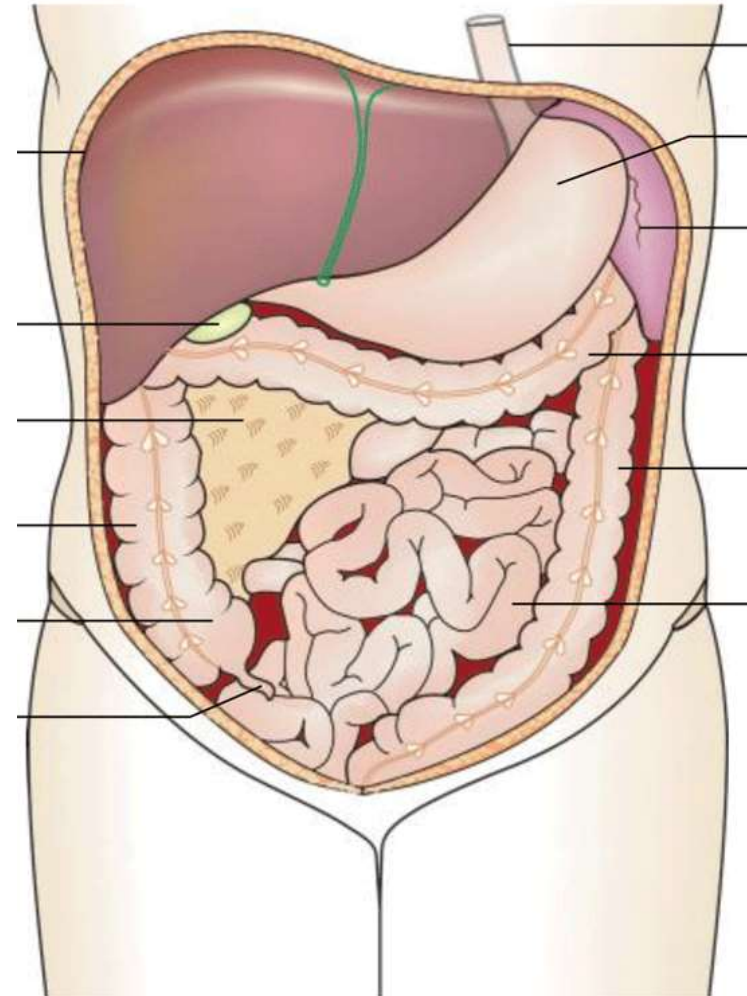
The pelvic inlet marks the anatomically arbitrary boundary line that demarcates the upper abdominal cavity from the lower pelvic cavity.

Note that the regions are, in reality, a single, continuous space.



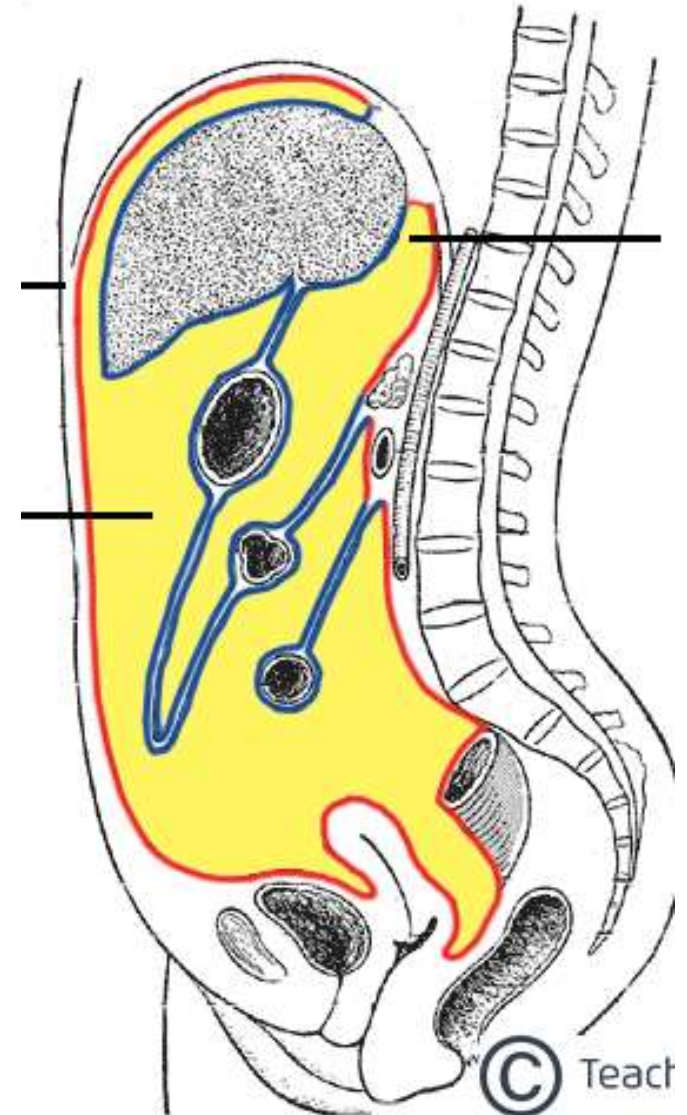
Clinical significance

- ❑ The abdominal cavity contains many vital organs, including the gastrointestinal (GI) tract, liver, biliary ducts, pancreas, spleen, and parts of the urinary system.
- ❑ These structures are closely packed within the abdominal cavity.
- ❑ Therefore, disease of one can easily involve another.
- ❑ The aorta and its branches, the inferior vena cava and its tributaries, and the portal vein also lie within the abdomen.



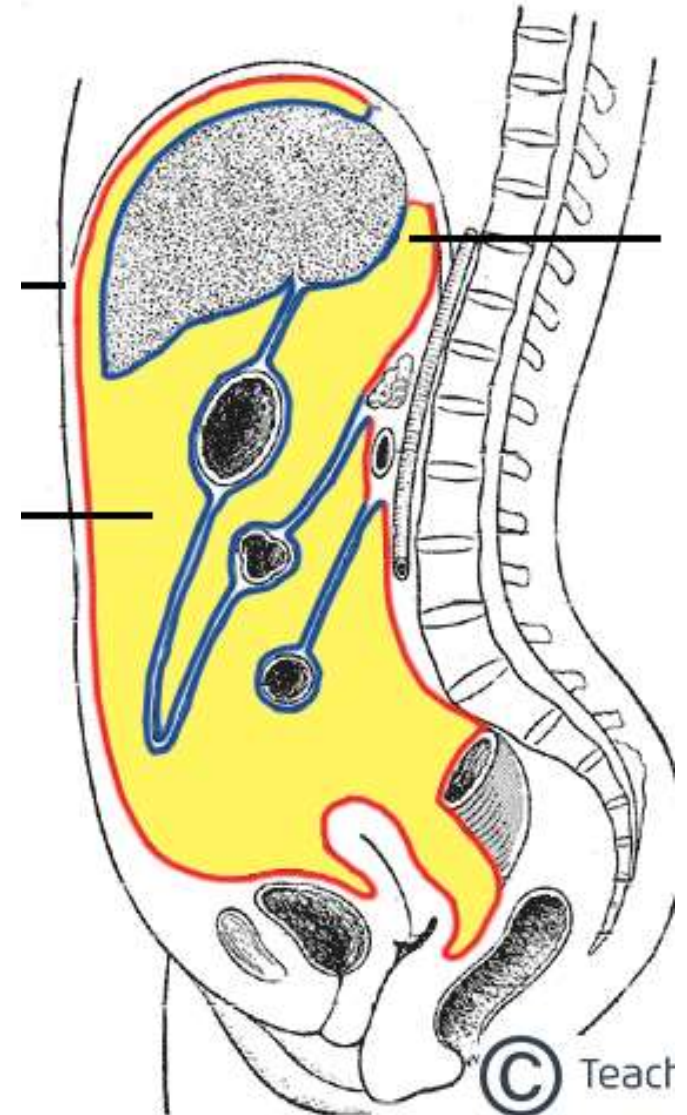
PERITONEUM

- ❖ The peritoneum is a thin serous membrane that lines the walls of the abdominal and pelvic cavities and clothes the viscera .
- ❖ The peritoneum can be regarded as a balloon against which organs are pressed from outside.



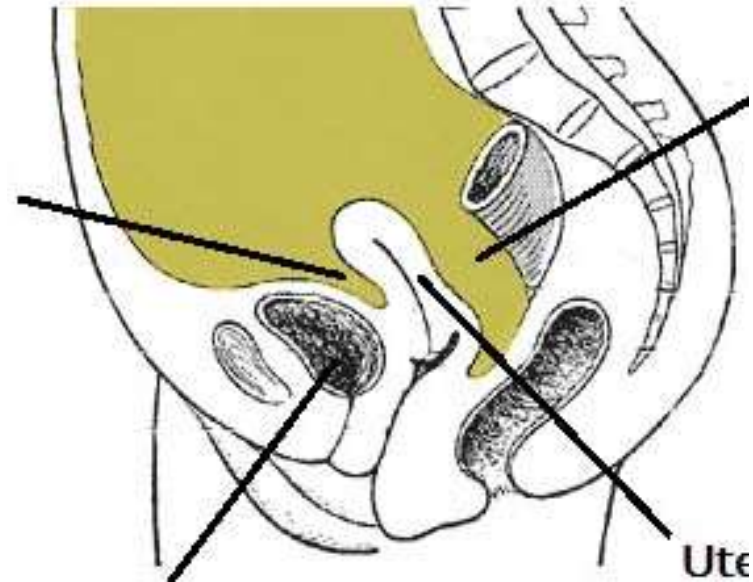
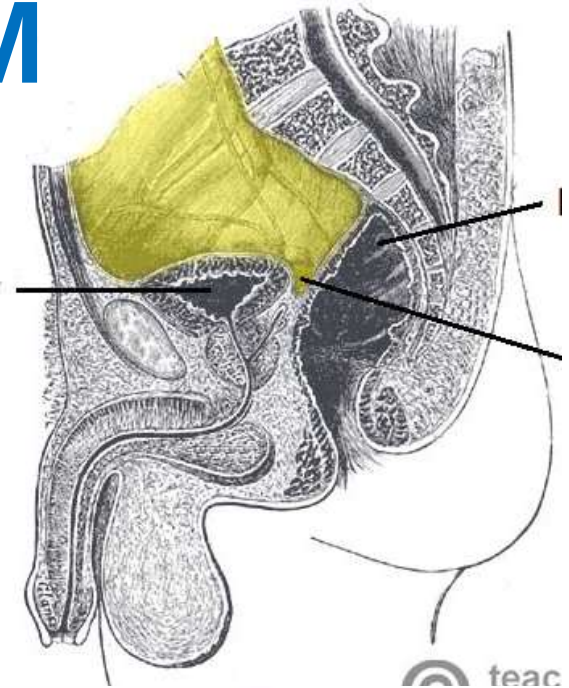
PERITONEUM

- **Parietal peritoneum** lines the walls of the abdominopelvic cavity, and **Visceral peritoneum** covers the organs.
- The potential space between the parietal and visceral layers, which is in effect the inside space of the balloon, is called the **peritoneal cavity**.



PERITONEUM

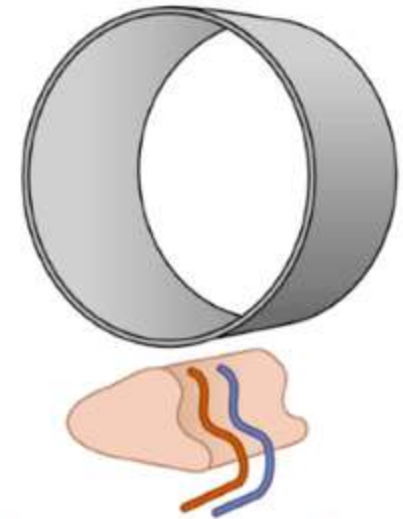
- ✓ In **males**, this is a closed cavity, but communication with the exterior occurs in **females** through the uterine tubes, the uterus, and the vagina.
- ✓ The peritoneum reflects off the abdominal wall to become a component of the mesenteries that suspend the viscera.



Extraperitoneal tissue

A layer of connective tissue that lies between the parietal peritoneum and the fascial lining of the abdominal and pelvic walls.

In the area of the kidneys, this tissue contains a large amount of fat, which supports the kidneys.



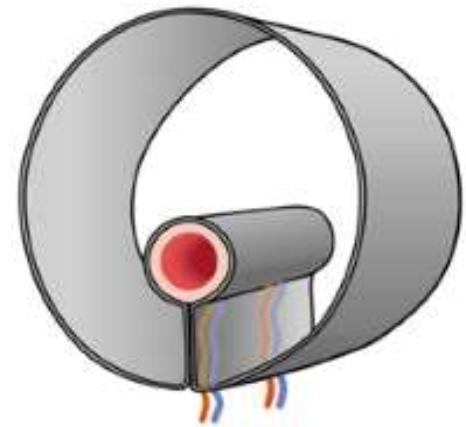
**Extraperitoneal:
Retroperitoneal,
Subperitoneal**

Branches of the neurovascular structures that pass to parts of the gastrointestinal system are **unpaired**, originate from the anterior aspects of their parent structures, and travel in mesenteries or pass retroperitoneally in areas where the mesenteries secondarily fuse to the wall.

Generally, vessels, nerves, and lymphatic to the abdominal wall and to organs that originate as retroperitoneal structures branch laterally from the central neurovascular structures and are usually **paired**, one on each side.

Intraperitoneal & Retroperitoneal

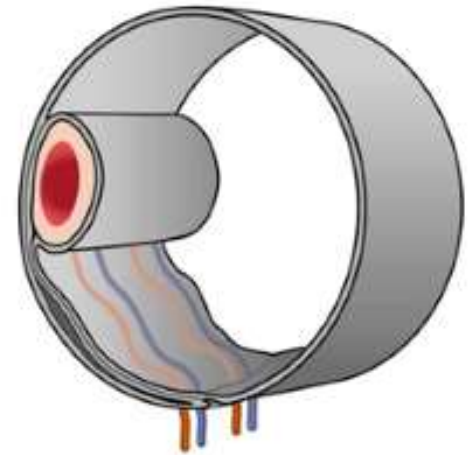
- An organ is **intraperitoneal** when it is almost totally covered with visceral peritoneum.
- The stomach, jejunum, ileum, and spleen are good examples of intraperitoneal organs.



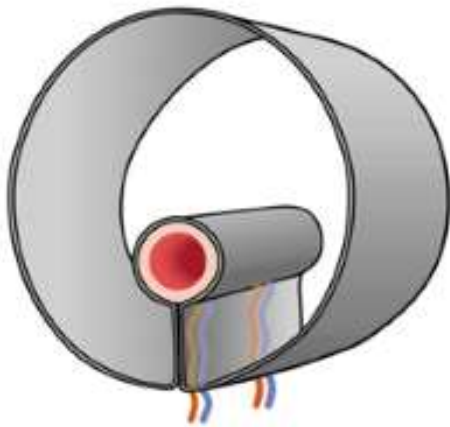
Intraperitoneal

Intraperitoneal & Retroperitoneal

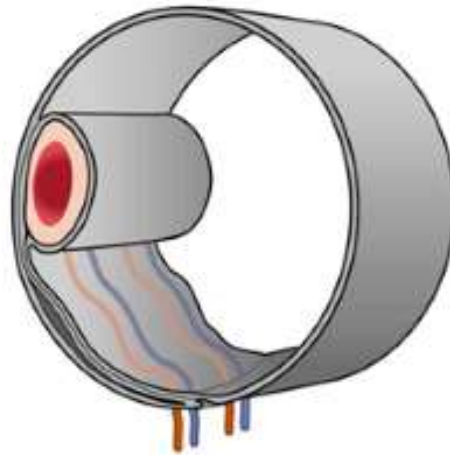
- **Retroperitoneal** organs lie behind the peritoneum and are only partially covered with visceral peritoneum.
- The pancreas and the ascending and descending parts of the colon are examples of retroperitoneal organs.



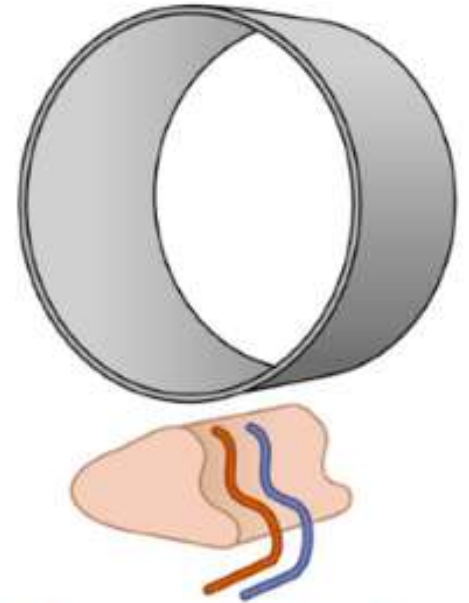
Secondary
retroperitoneal



Intraperitoneal



**Secondary
retroperitoneal**



**Extraperitoneal:
Retroperitoneal,
Subperitoneal**

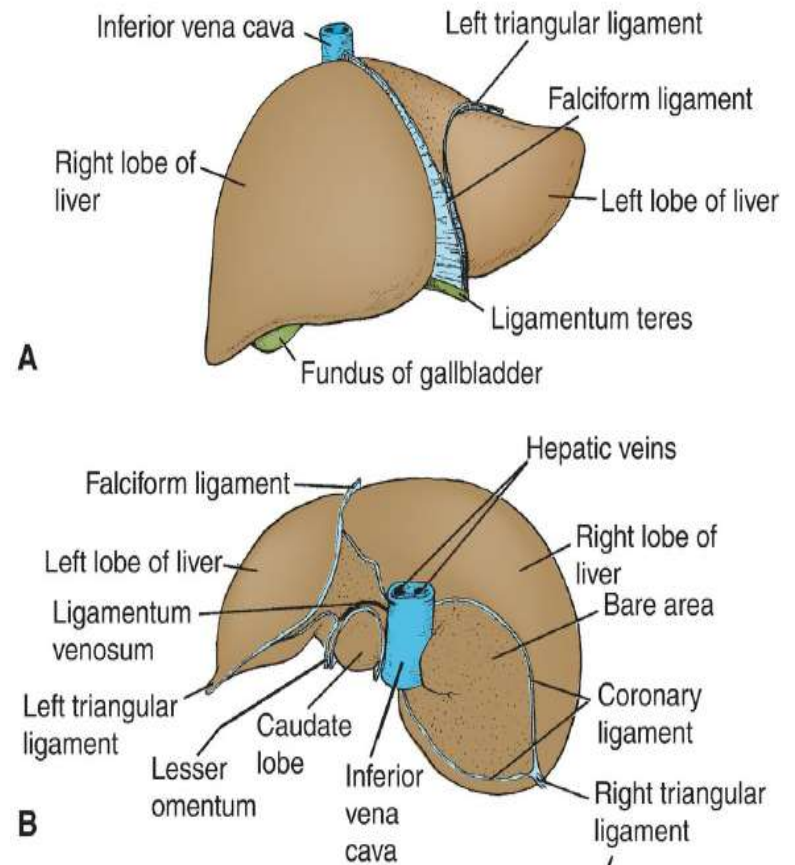
Functions of Peritoneum

- Peritoneal fluid, which is pale yellow and viscid, ensures that the mobile viscera glide easily on one another.
- Large amounts of fat are stored in the peritoneal ligaments and mesenteries, especially in the greater omentum.
- Peritoneal folds play an important part in suspending the various organs within the peritoneal cavity and conveying the blood vessels, lymphatics, and nerves to these organs.

Peritoneal Ligaments

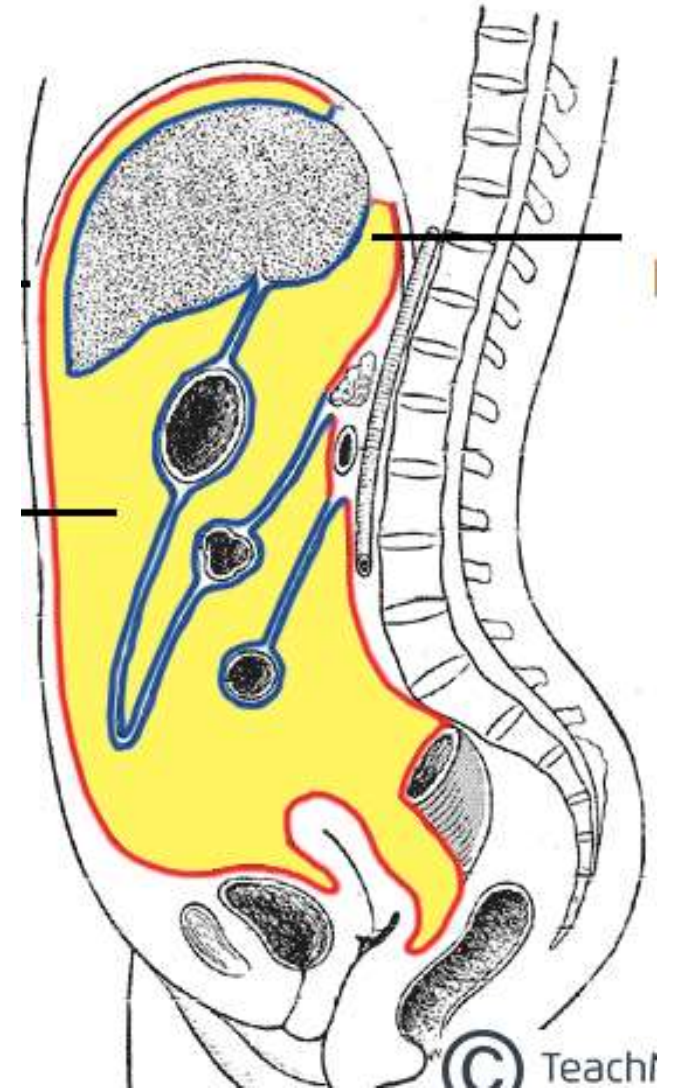
Peritoneal ligaments are two-layered folds of the peritoneum that connect solid viscera to the abdominal walls.

The liver, for example, connects to the diaphragm by the falciform ligament, the coronary ligament, and the right and left triangular ligaments



Subdivisions of Peritoneum

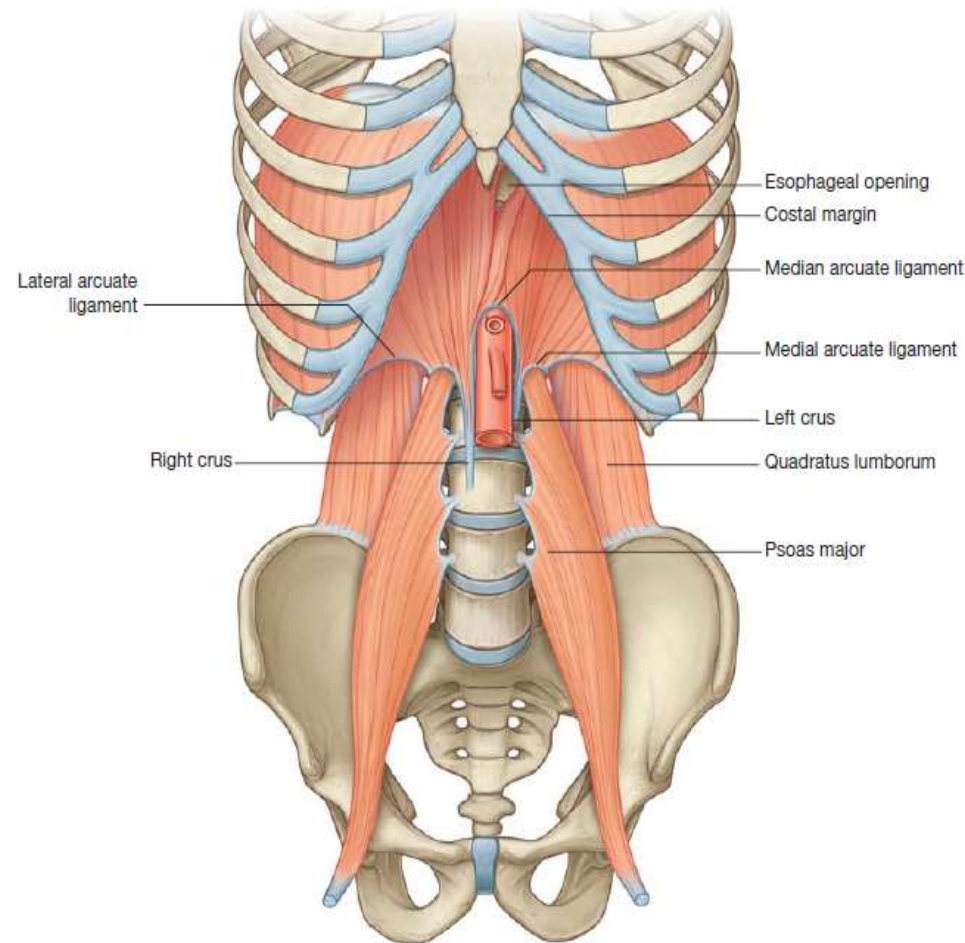
- There are two main regions of the peritoneum, connected by the epiploic foramen:
 - **Greater sac**
(general cavity of abdomen)
 - **Lesser sac** (omental bursa)



Inferior thoracic aperture

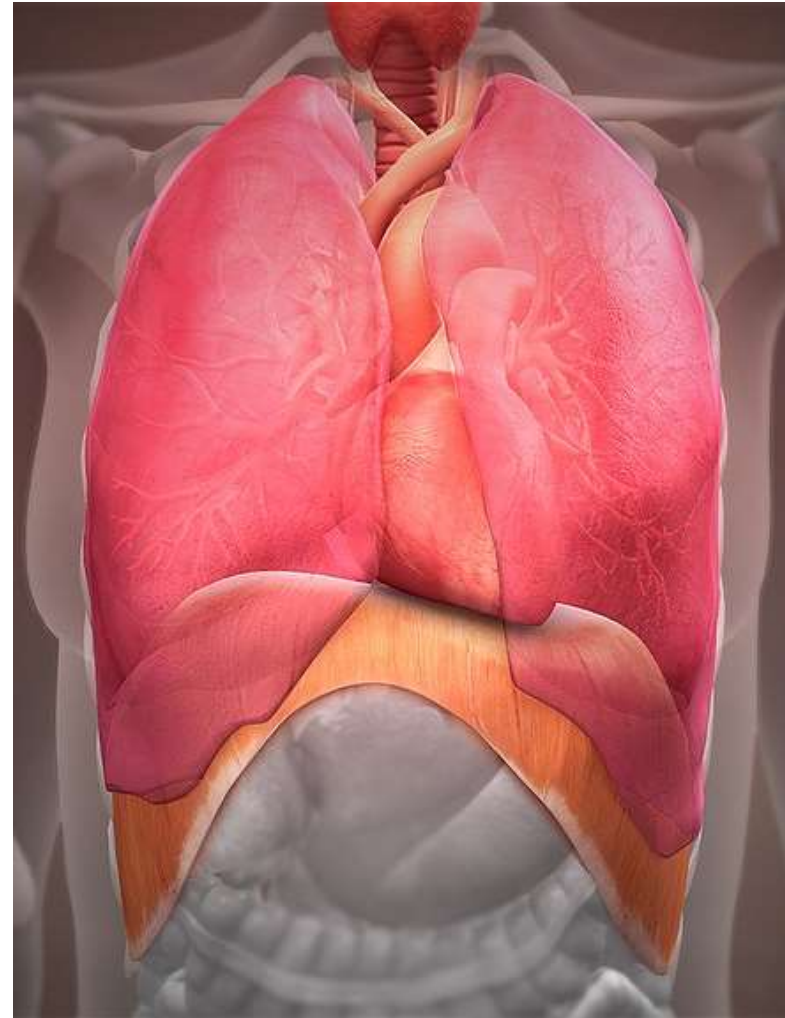
is closed by diaphragm

The margin of the inferior thoracic aperture consists of vertebra T12, rib 12, the distal end of rib 11, the costal margin, and the xiphoid process of the sternum



Diaphragm

- is a sheet of internal **skeletal muscle** (the most important muscle of respiration)
- is an upward curved, C-shaped structure of muscle and fibrous tissue that separates the thoracic cavity from the abdomen.
- The superior surface of the dome forms the floor of the thoracic cavity, and the inferior surface the roof of the abdominal cavity.



Diaphragm

- **Origin:**

- a- **Sternal:** back of xiphoid process.

- b- **Costal:** lower 6 costal cartilages.

- c- **Vertebral:**

- **2 crura**

- Rt. crus from front of upper 3 lumbar vertebrae.

- Lt. crus from front of upper 2 lumbar vertebrae.

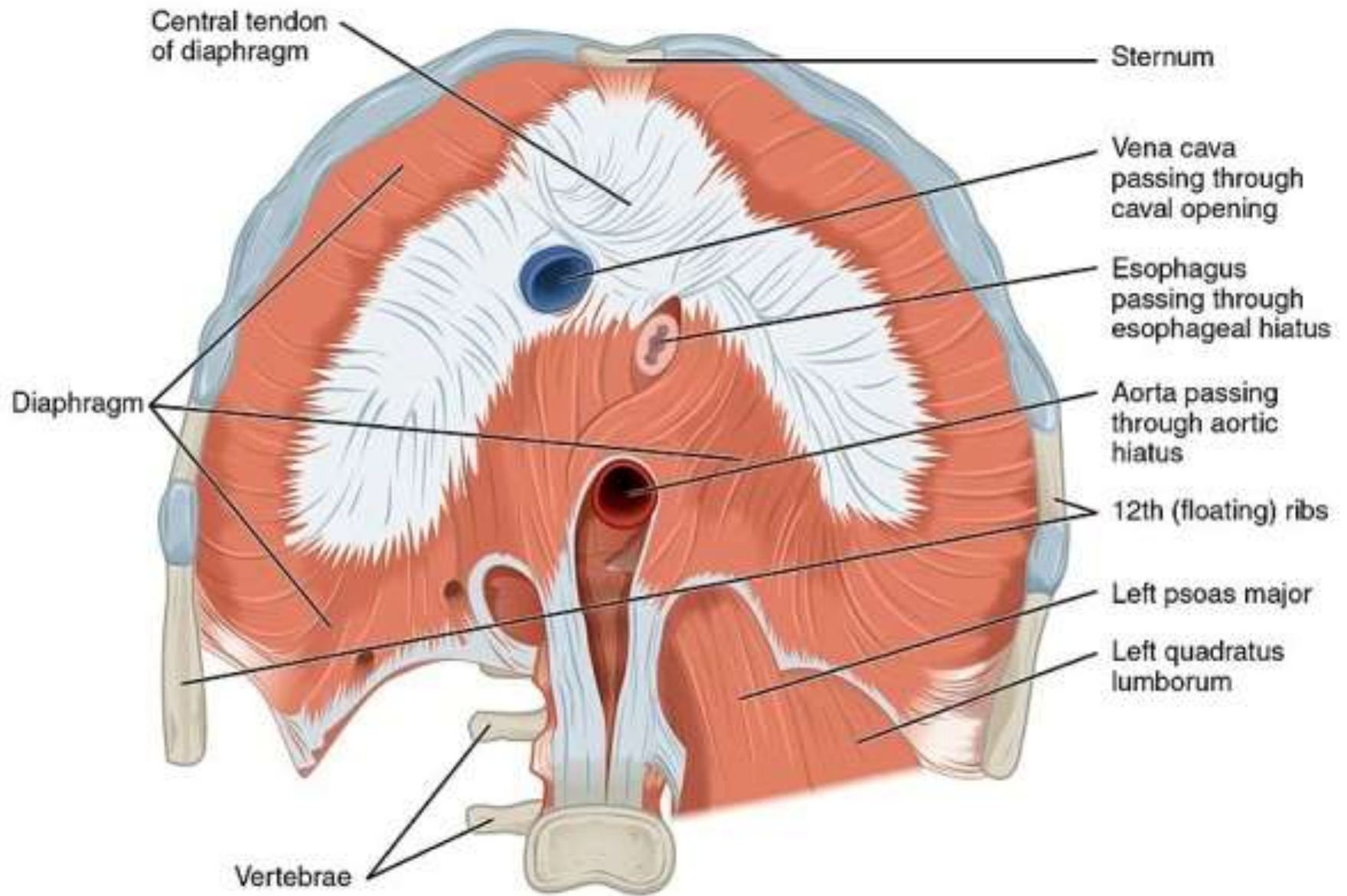
- **5 arcuate ligaments**

- 2 lateral >> bridges over quadratus lumborum muscle

- 2 medial >> bridges over psoas major muscle

- 1 median

- **Insertion:** central tendon



Diaphragm (inferior view)

Openings of Diaphragm

Opening	Level	Structures traversing
Caval opening	T 8, 1 inch to the Rt. inside central tendon	- IVC - Rt. phrenic n - Lymph vessels
Esophageal opening	T 10, 1 inch to the Lt. inside Rt. crus	- Esophagus - 2 vagi nerves - Esophageal vessels
Aortic opening	T 12, Midline behind median arcuate ligament	From Lt. to Rt. - Abd. Aorta - Azygos vein - Thoracic duct

Functions Diaphragm

- It is the chief (involuntary) muscle of inspiration (contraction) central tendon descends & intra-thoracic pressure decreases).
- It can also be used voluntarily to increase pressure in the abdomen.
- Contraction of diaphragm assists in venous return to the heart.
- Contraction of Rt. crus helps in preventing regurgitation of food from stomach into esophagus.

Omentum

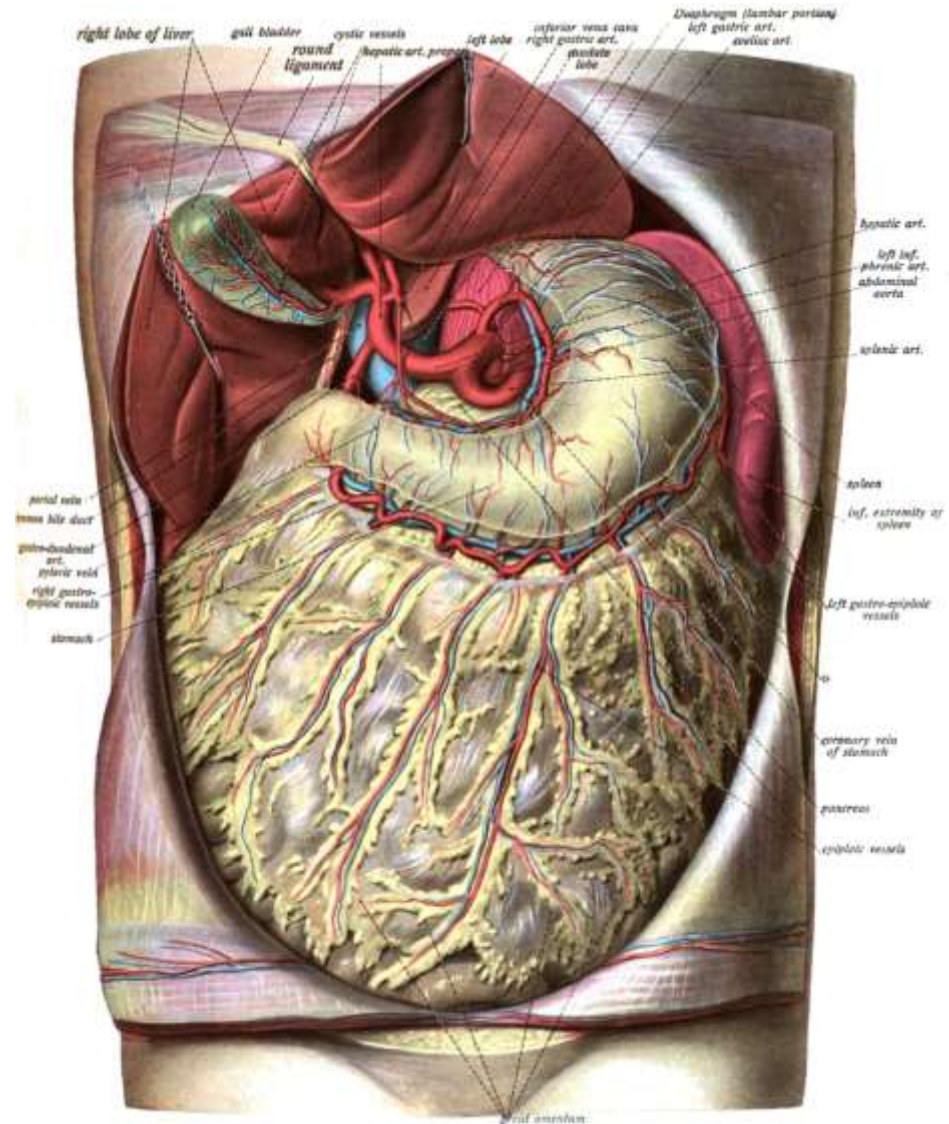
- are two-layered folds of peritoneum that connect the stomach to another viscus.

- **TYPES :**

Greater omentum

Lesser omentum

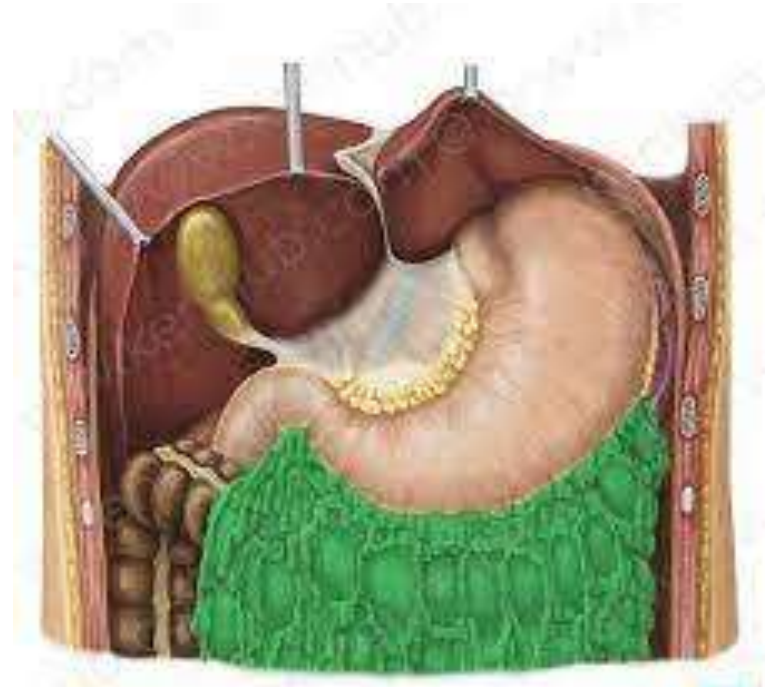
Gastrosplenic omentum



Omentum

- **Greater omentum**

connects the greater curvature of the stomach to the transverse colon. It hangs down like an apron in front of the coils of the small intestine and folds back on itself to attach to the transverse colon.

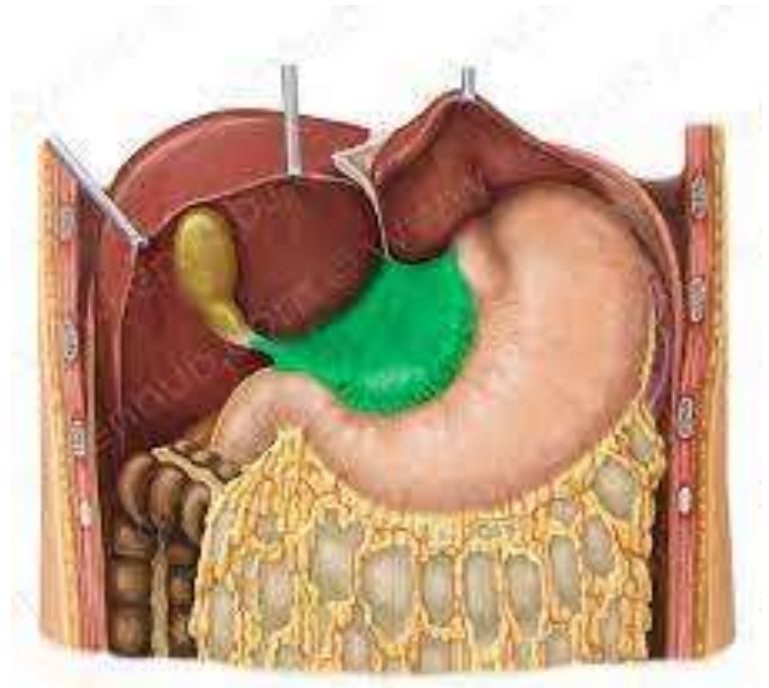


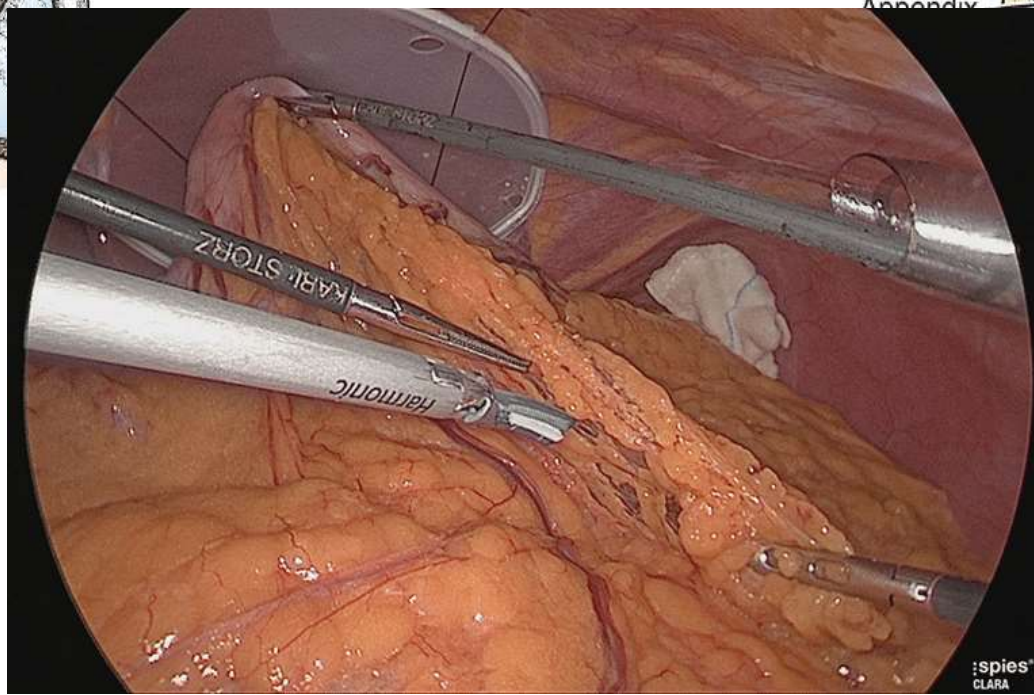
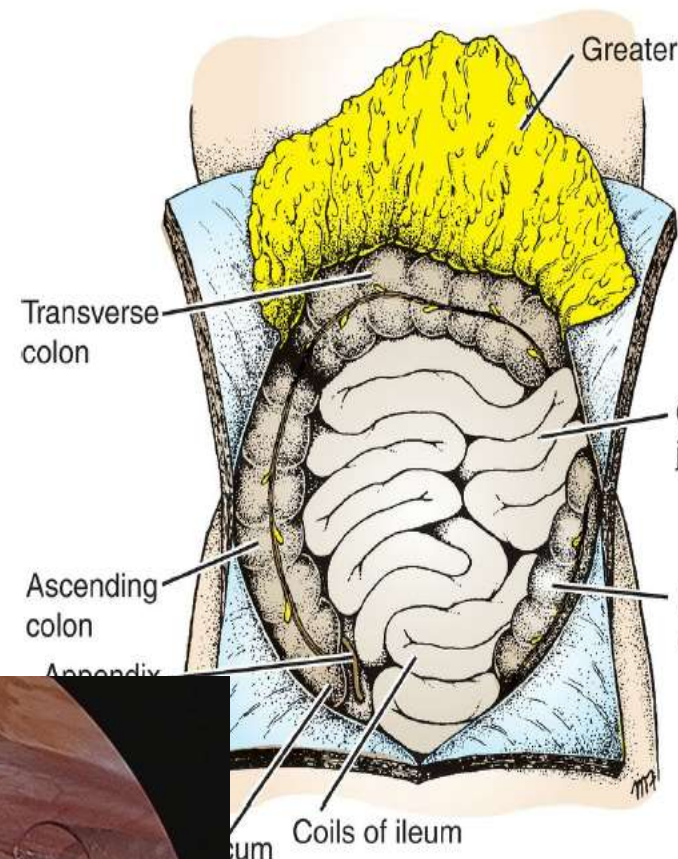
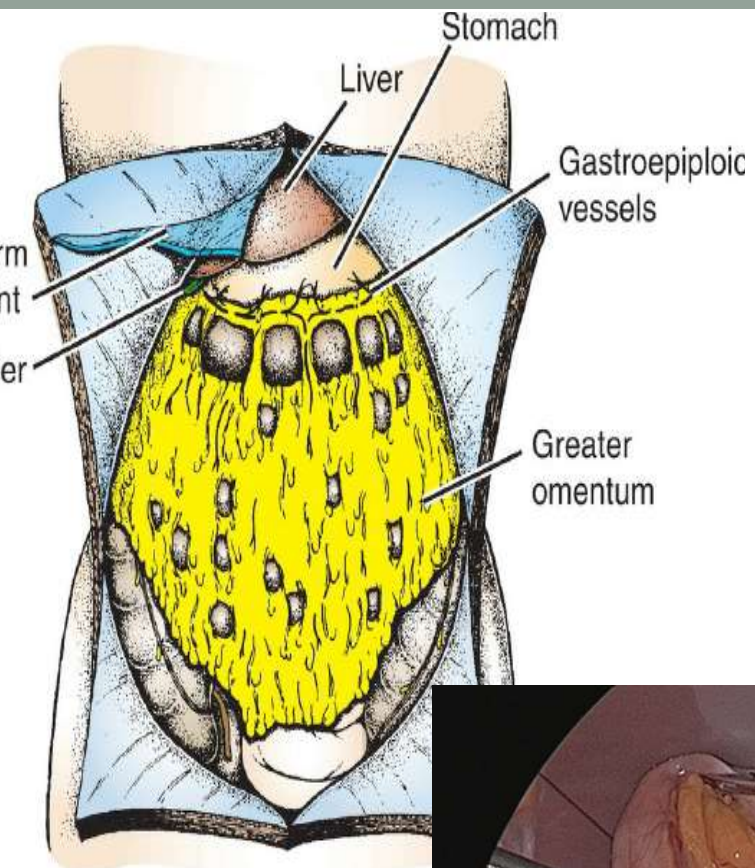
Omentum

- **Lesser omentum**

suspends the lesser curvature of the stomach and the proximal duodenum from the fissure of the ligament venosum and the porta hepatis on the undersurface of the liver.

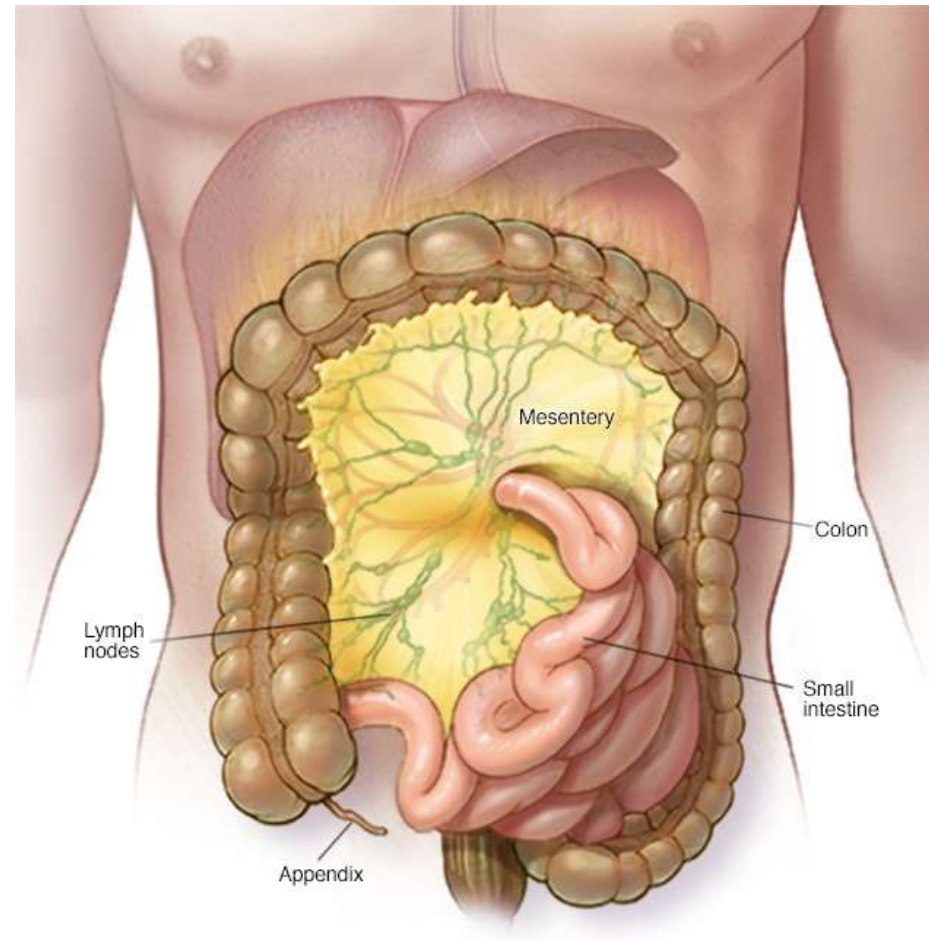
- **Gastrosplenic omentum** (ligament) connects the stomach to the hilum of the spleen.





Mesentery

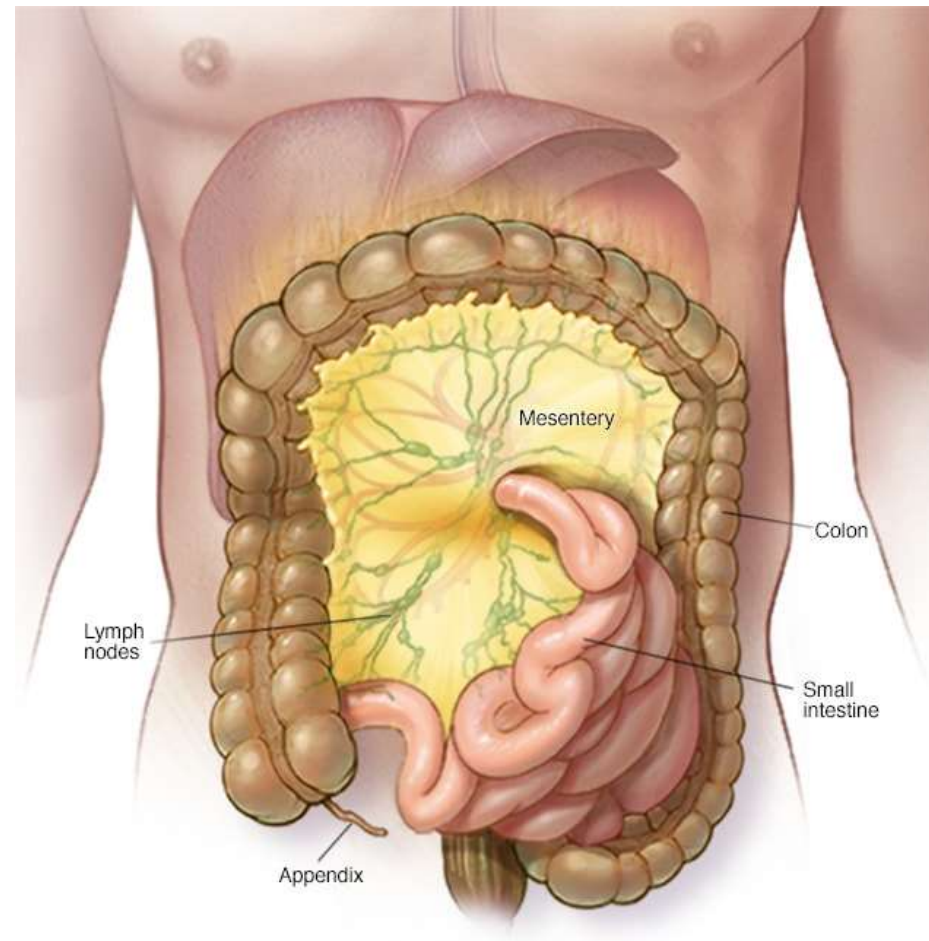
- are two-layered folds of the peritoneum connecting parts of the intestines to the posterior abdominal wall, for example, the mesentery of the small intestine, the transverse mesocolon, and the sigmoid mesocolon.



Mesentery

The peritoneal ligaments, (omentum and mesentery)

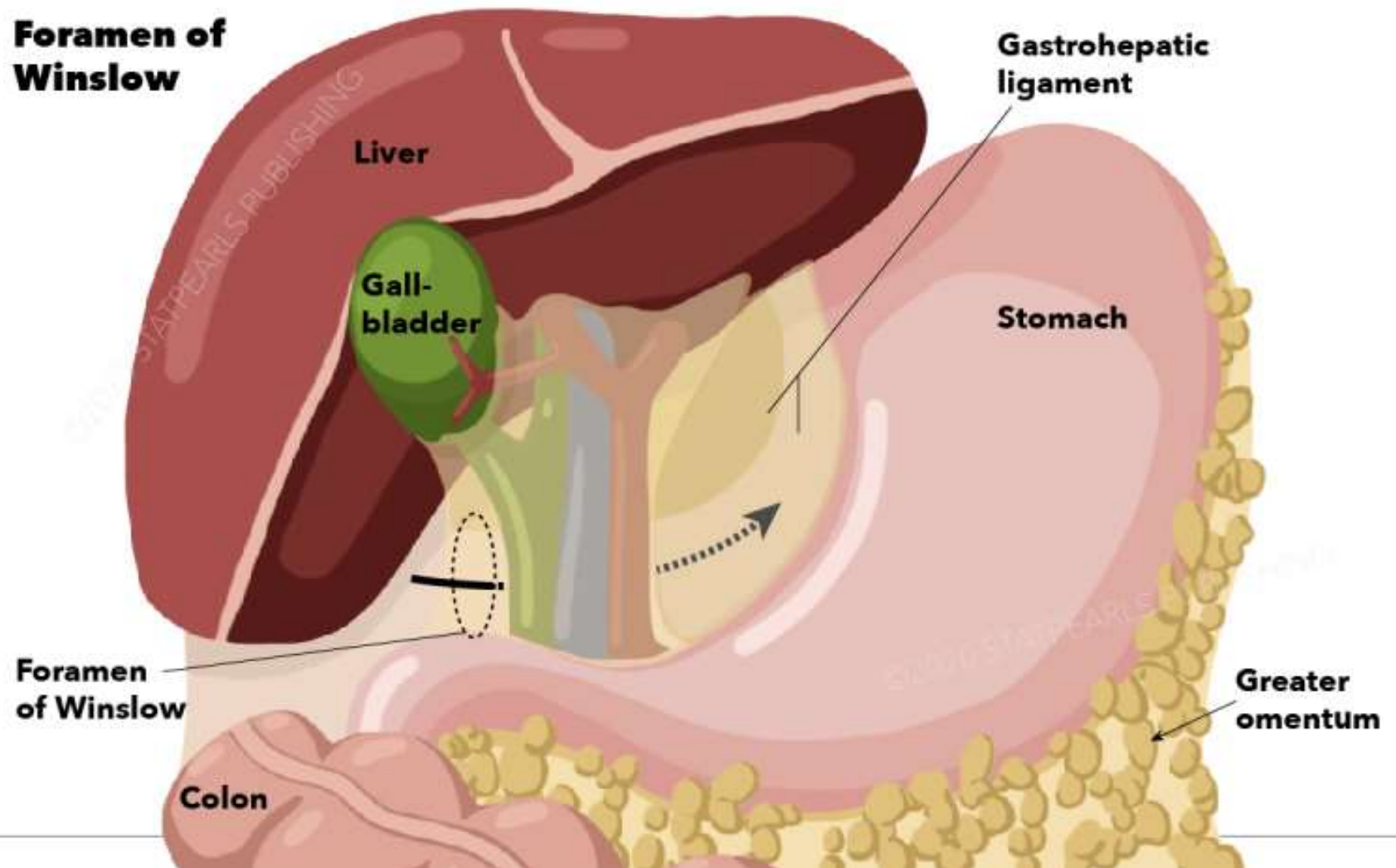
serve as bridges that permit blood, lymph vessels, and nerves to reach the viscera



Lesser Sac (omental bursa)

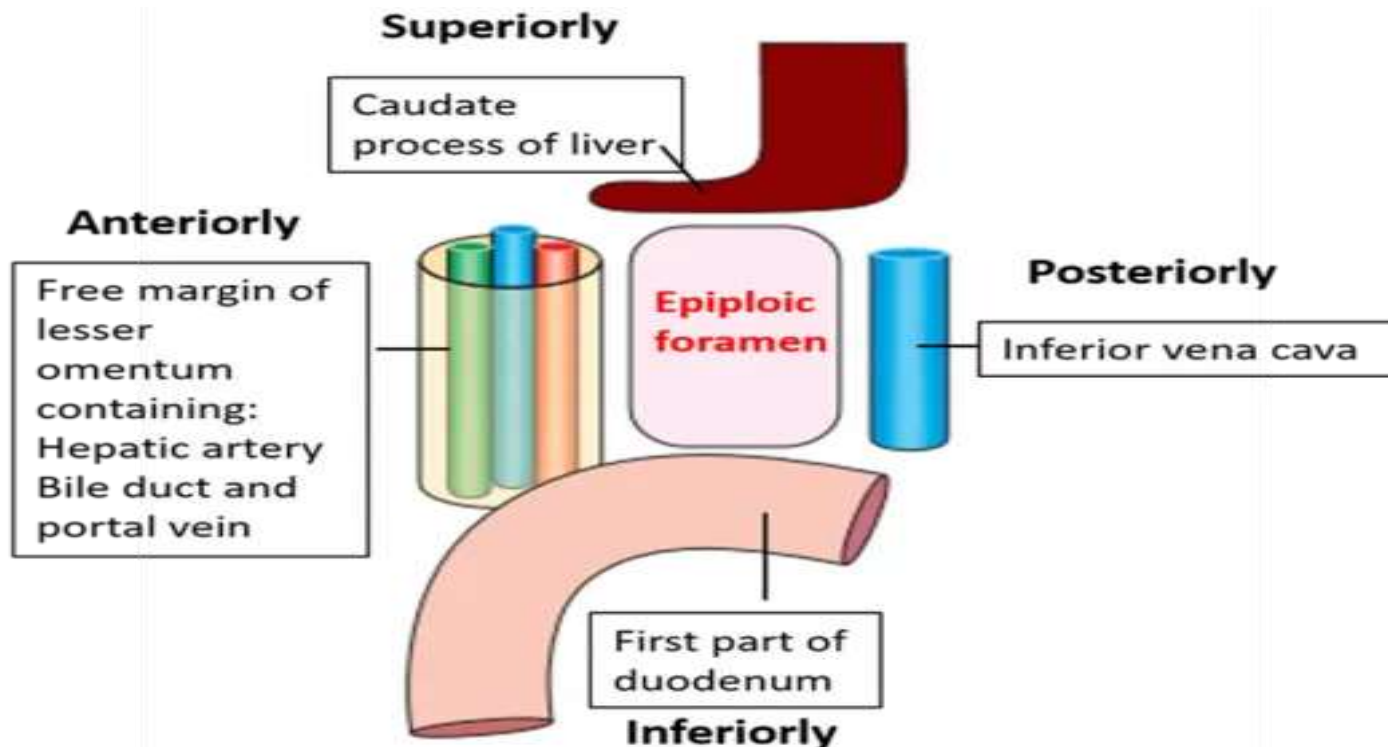
- It lies behind the stomach and lesser omentum.
- It extends upward as far as the diaphragm and downward between the layers of the greater omentum.
- The spleen, the gastrosplenic omentum, and the splenorenal ligament form the left margin of the sac.
- The right margin opens into the greater sac (the main part of the peritoneal cavity) through the **opening of the lesser sac, or**
(epiploic foramen) = (foramen of Winslow)

Foramen of Winslow



Epiploic oramen boundaries

- **Anterior** : Free border of the lesser omentum, the bile duct, the hepatic artery, and the portal vein
- **Posterior**: Inferior vena cava
- **Superior**: Caudate process of the caudate lobe of the liver
- **Inferior**: First part of the duodenum



Subphrenic Spaces

- These are peritoneal spaces lying below the diaphragm & may become sites for collection of pus (subphrenic abscess).

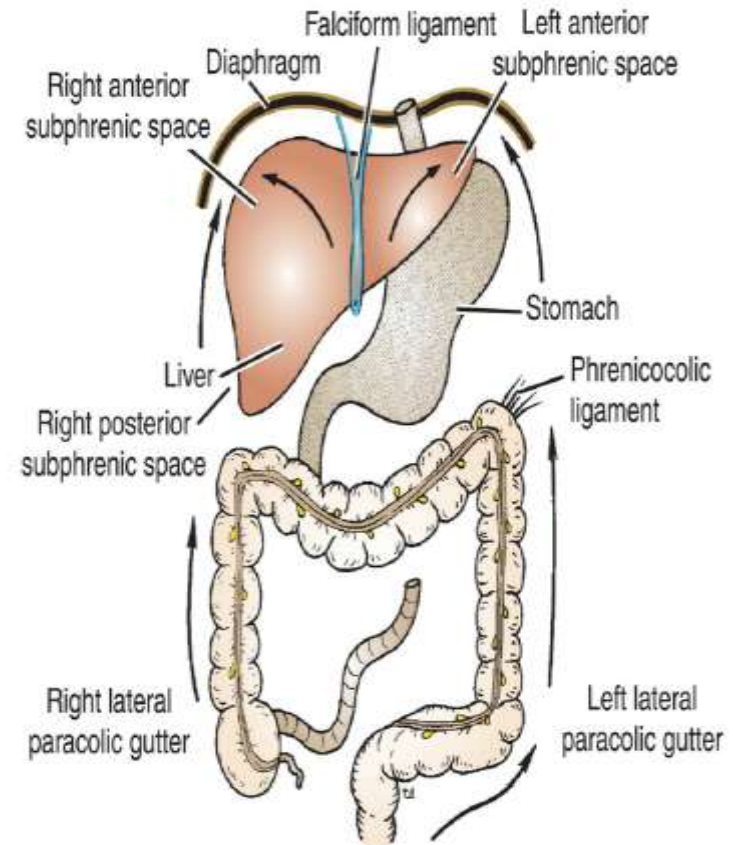


Figure 7.14 Normal direction of flow of the peritoneal fluid from different parts of the peritoneal cavity to the subphrenic spaces.

Subphrenic Spaces

- ❖ **Right and left anterior subphrenic spaces**

lie between the diaphragm and the liver, on each side of the falciform ligament.

- ❖ **Right posterior subphrenic space**
(Morrison pouch = Hepato renal pouch)

lies between the right lobe of the liver, the right kidney, and the right colic flexure.

- ❖ **Right extraperitoneal space**

lies between the layers of the coronary ligament.

- To avoid the accumulation of infected fluid in the subphrenic spaces and to delay the absorption of toxins from intraperitoneal infections, common nursing practice is to sit a patient up in bed with the back at an **angle of 45°**.
- In this position, the infected peritoneal fluid tends to gravitate downward into the pelvic cavity, where the rate of toxin absorption is slow

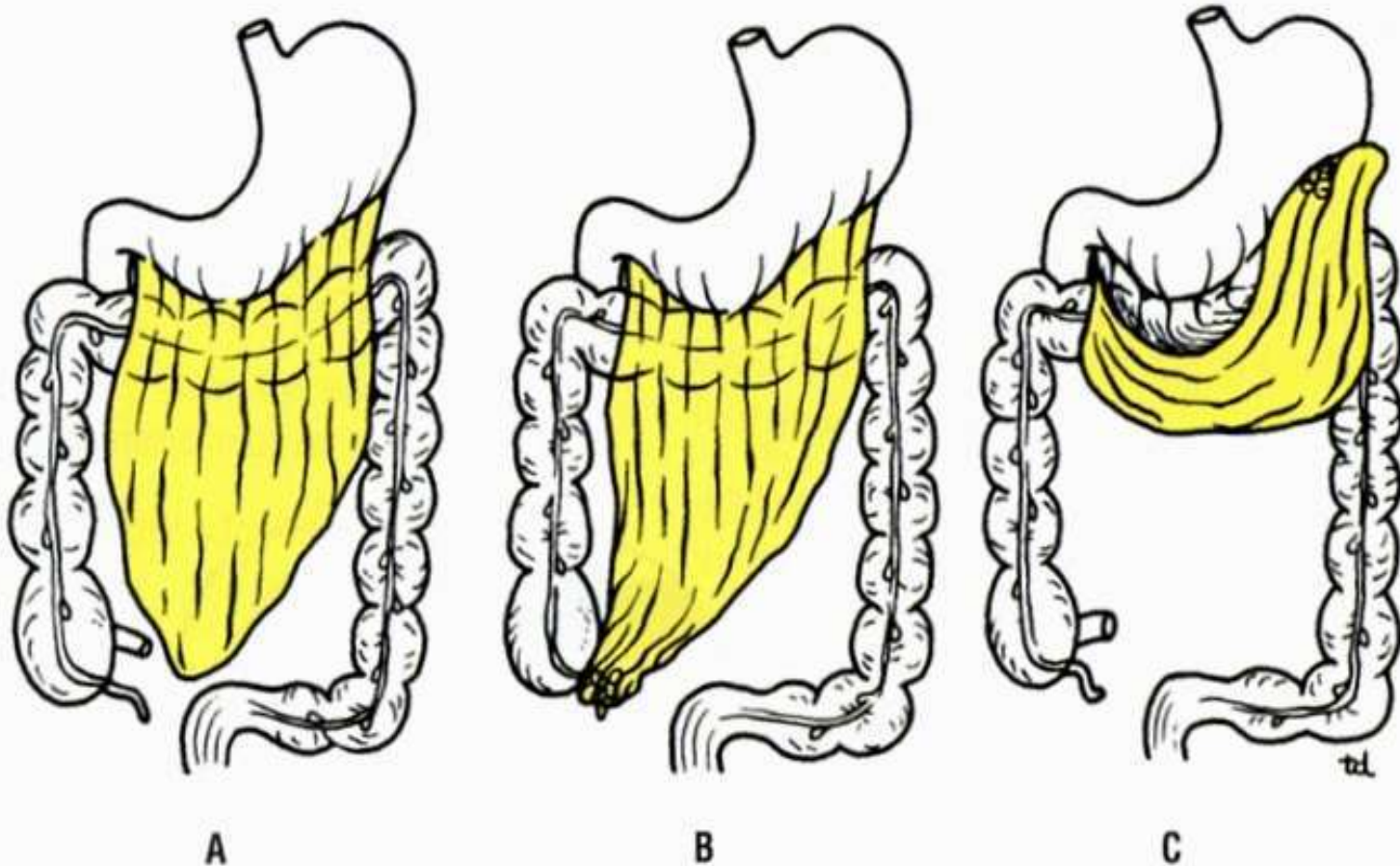
GRAETER OMENTUM

LOCALIZATION OF INFECTION

- It is often referred to by the surgeons as the **Abdominal Policeman**.
- The lower and right and left margins are free
- In the first 2 years of life it is poorly developed and thus is less protective in a young child.
- Later, however, in an acutely inflamed appendix, for example, the inflammatory causes the omentum adhere to the appendix and wrap itself around the infected organ.
- By this means, the infection is often localized to a small area of the peritoneal cavity, thus saving the patient from a serious diffuse peritonitis.

GRAETER OMENTUM

LOCALIZATION OF INFECTION



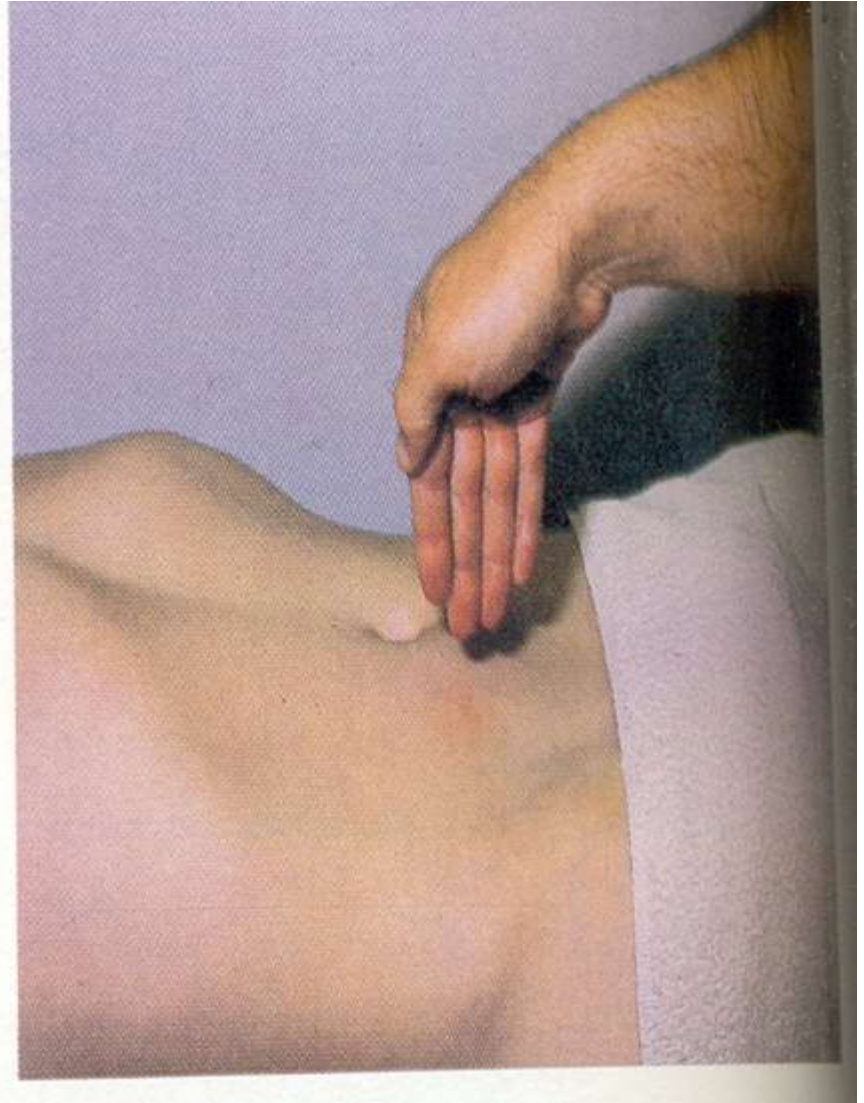
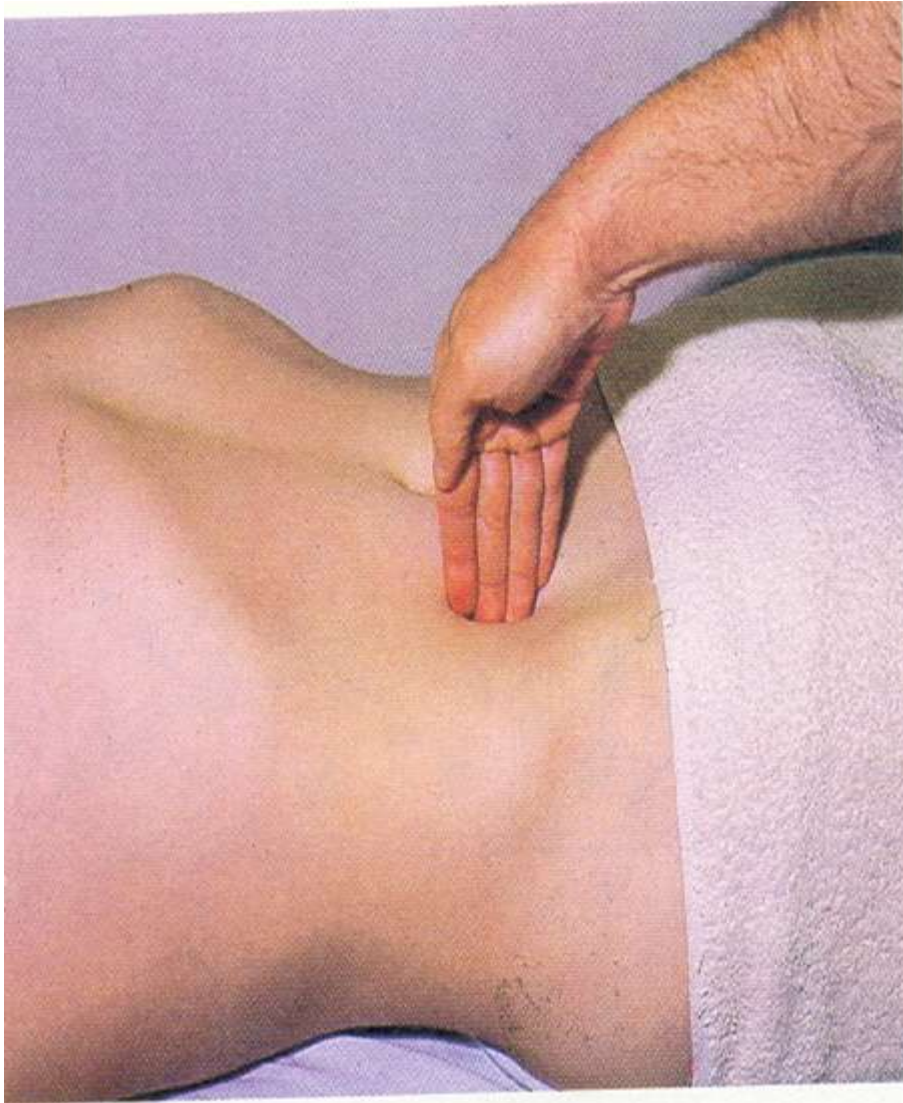
CLINICAL: Omentum

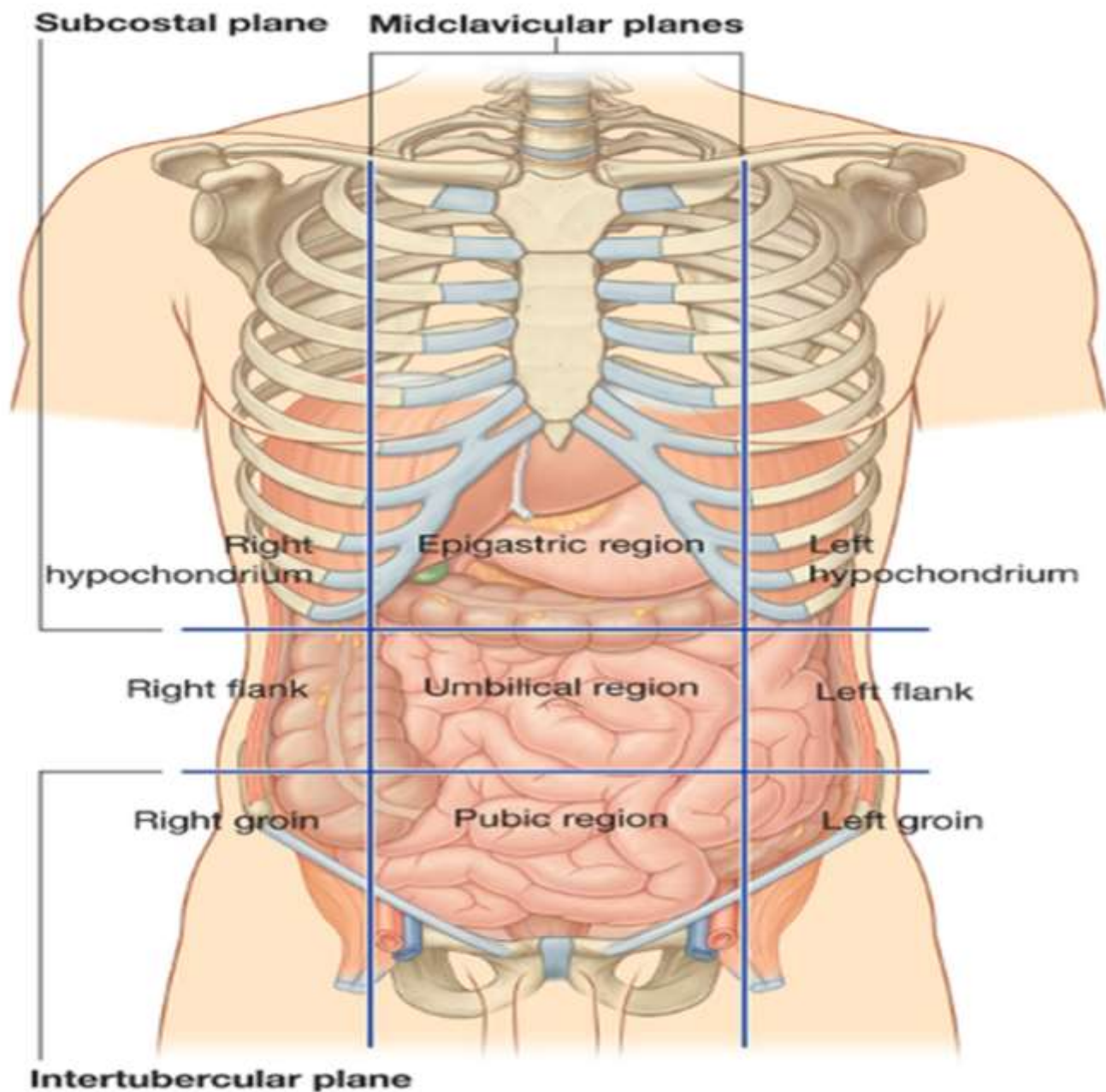
- Greater omentum has been found to plug the **neck of a hernia sac** and prevent entrance of coils of small intestine.
- Surgeons sometimes use the omentum to buttress an intestinal anastomosis or in the **closure of a perforated** gastric or duodenal ulcer.
- Greater omentum may undergo **torsion**, and if extensive, the blood supply to a part of it may be cut off, causing necrosis

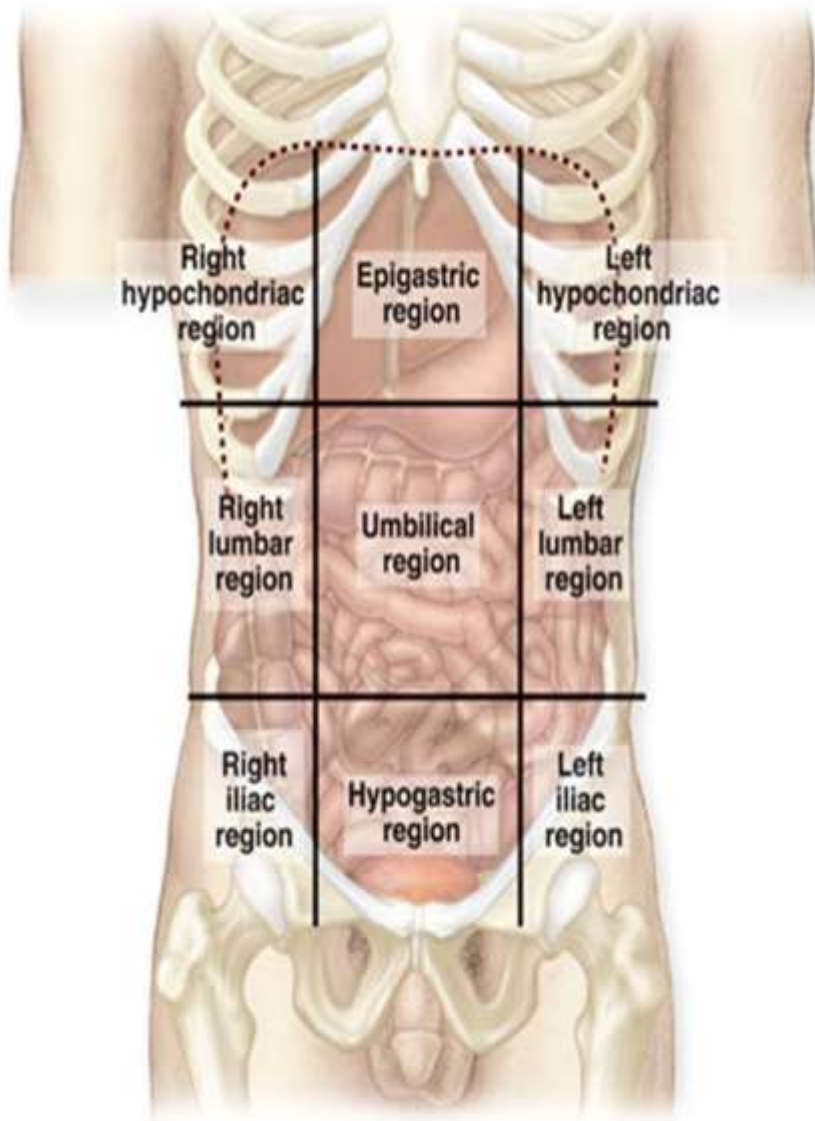
Peritoneal Pain

- The lower 6 thoracic nerves and the first lumbar nerve supply the parietal peritoneum lining the anterior abdominal wall.
- Abdominal pain originating from the parietal peritoneum is therefore of the somatic type and can be precisely localized. It is usually severe.
- An inflamed parietal peritoneum is extremely sensitive to stretch. This fact is made use of clinically in diagnosing peritonitis.
- Pressure is applied to the abdominal wall with a single finger over the site of the inflammation.
- The pressure is then removed by suddenly withdrawing the finger. The abdominal wall rebounds, resulting in extreme local pain, which is known as **rebound tenderness**.

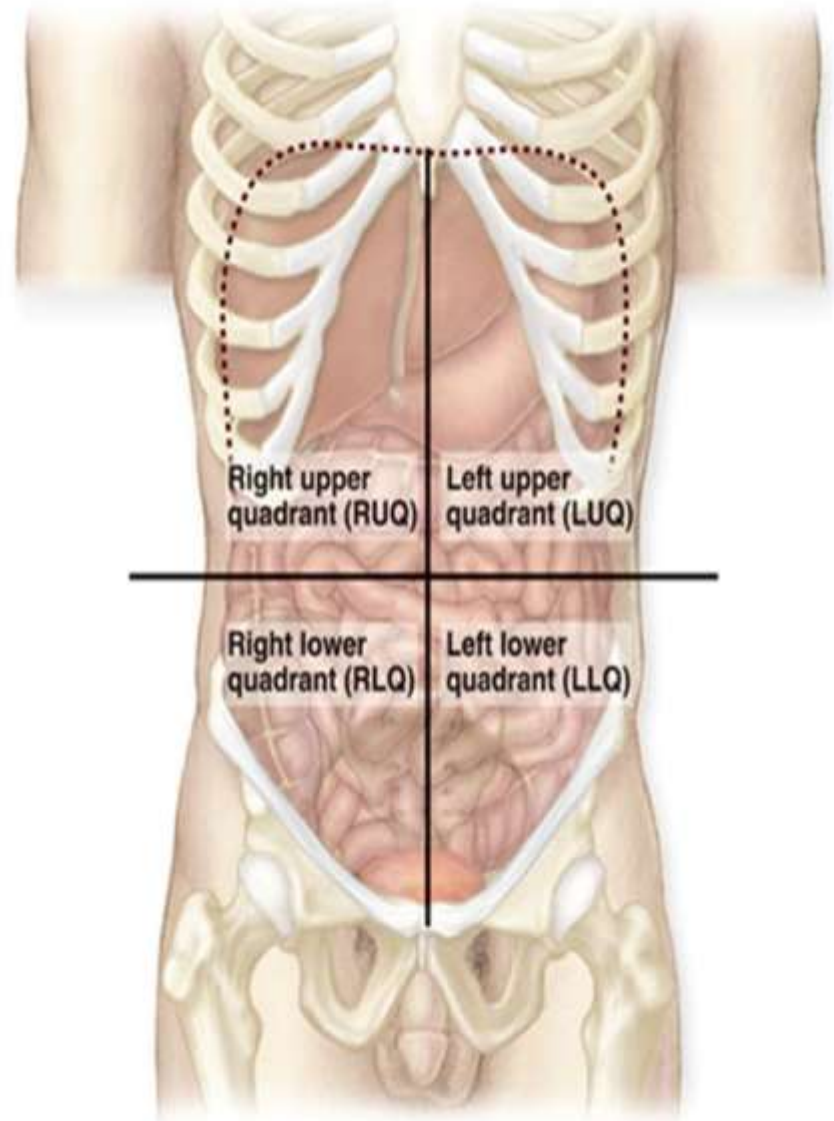
Rebound Tenderness







(a) Abdominopelvic regions



(b) Abdominopelvic quadrants

General Anatomy

NECK

Anatomy Group

Dr Naser Radwan, MD

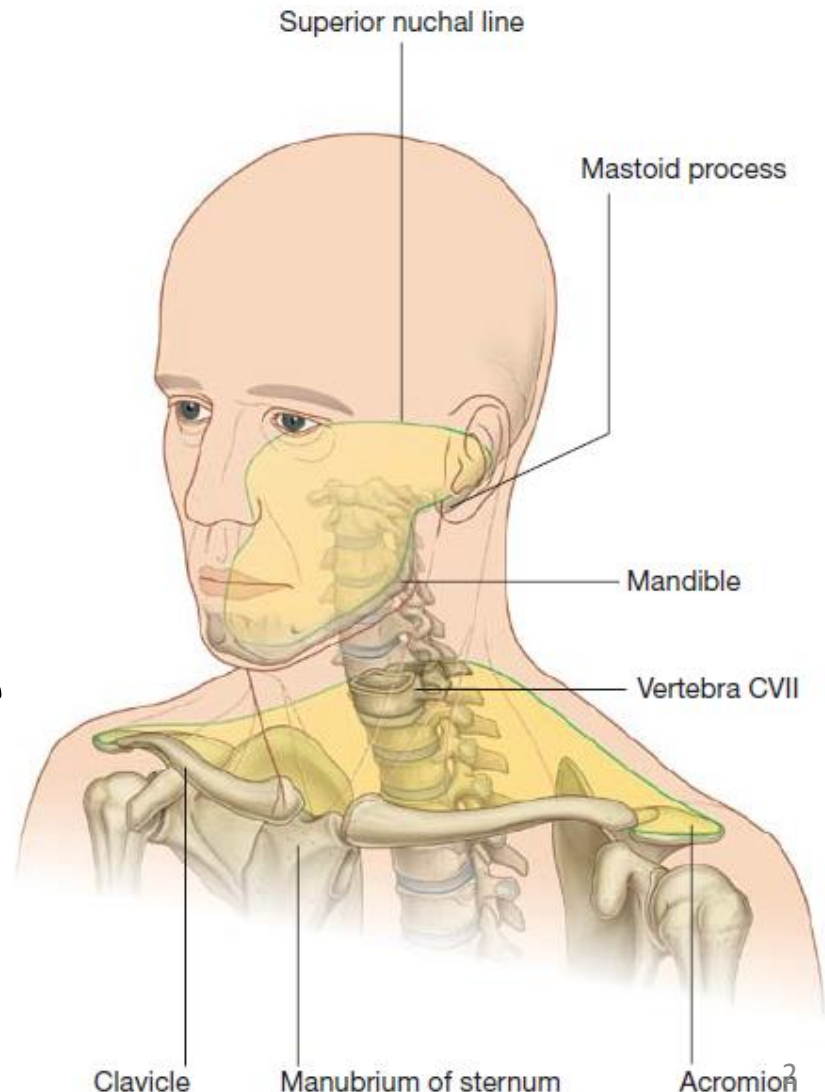
Dr Amjad Abu Alqumboz, MD

Dr Adham AlZanoun, MD



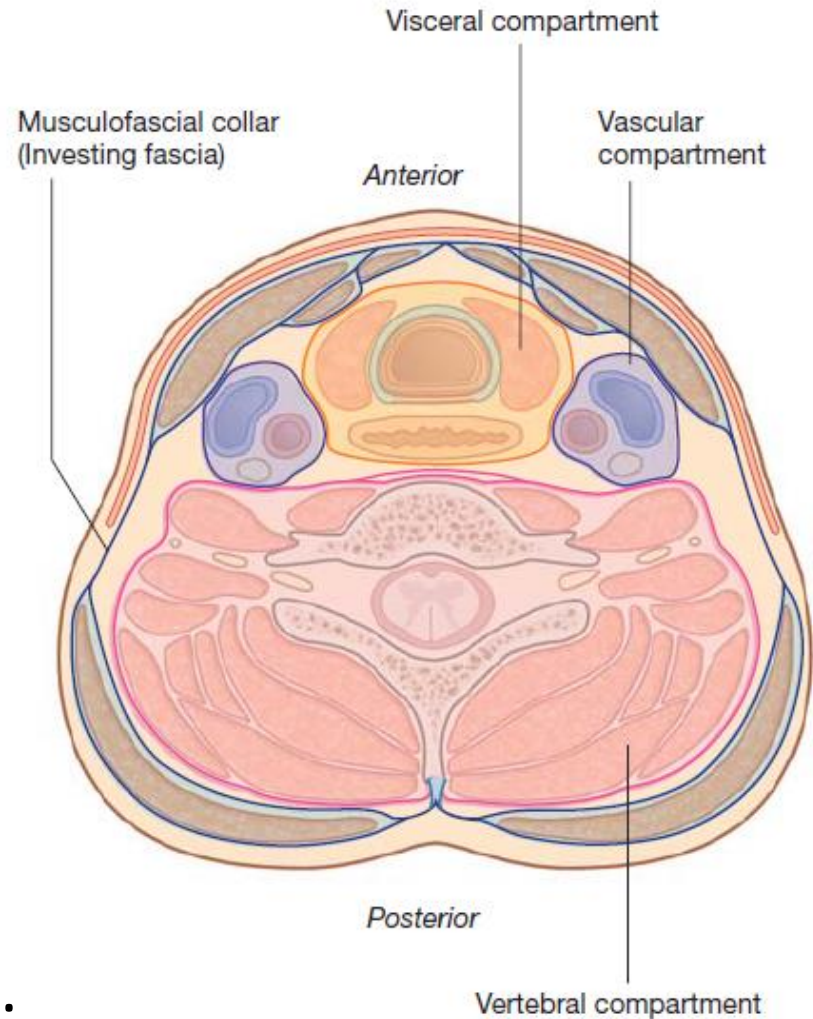
The Neck

- The neck is a tube providing continuity from the head to the trunk, It extends:
- ✓ **anteriorly** from the lower border of the mandible to the upper surface of the manubrium of sternum
 - ✓ **posteriorly** from the superior nuchal line on the occipital bone of the skull to the intervertebral disc between the C 7 and T1 vertebrae.



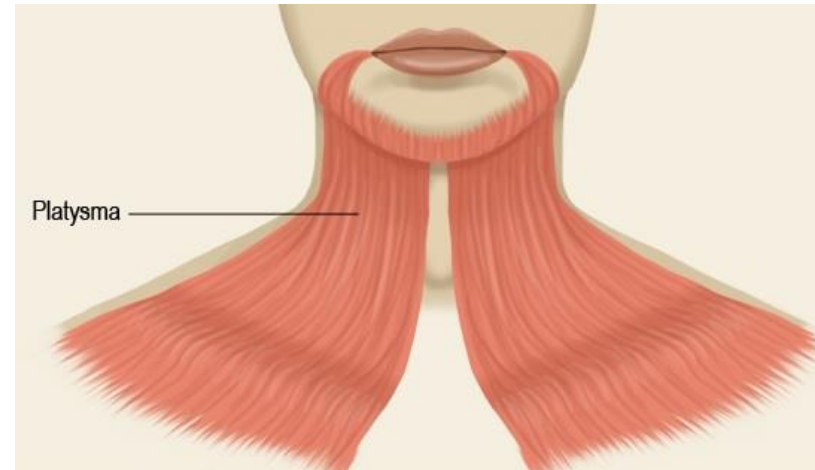
The Neck

- **Compartments:**
4 major compartments
 - ✓ **Vertebral compartment** contains the cervical vertebrae and associated postural muscles;
 - ✓ **Visceral compartment** contains important glands (thyroid, parathyroid, and thymus), and parts of the respiratory and digestive tracts that pass between the head and thorax; and
 - ✓ Two **vascular compartments**, one on each side, contain the major blood vessels and the vagus nerve.



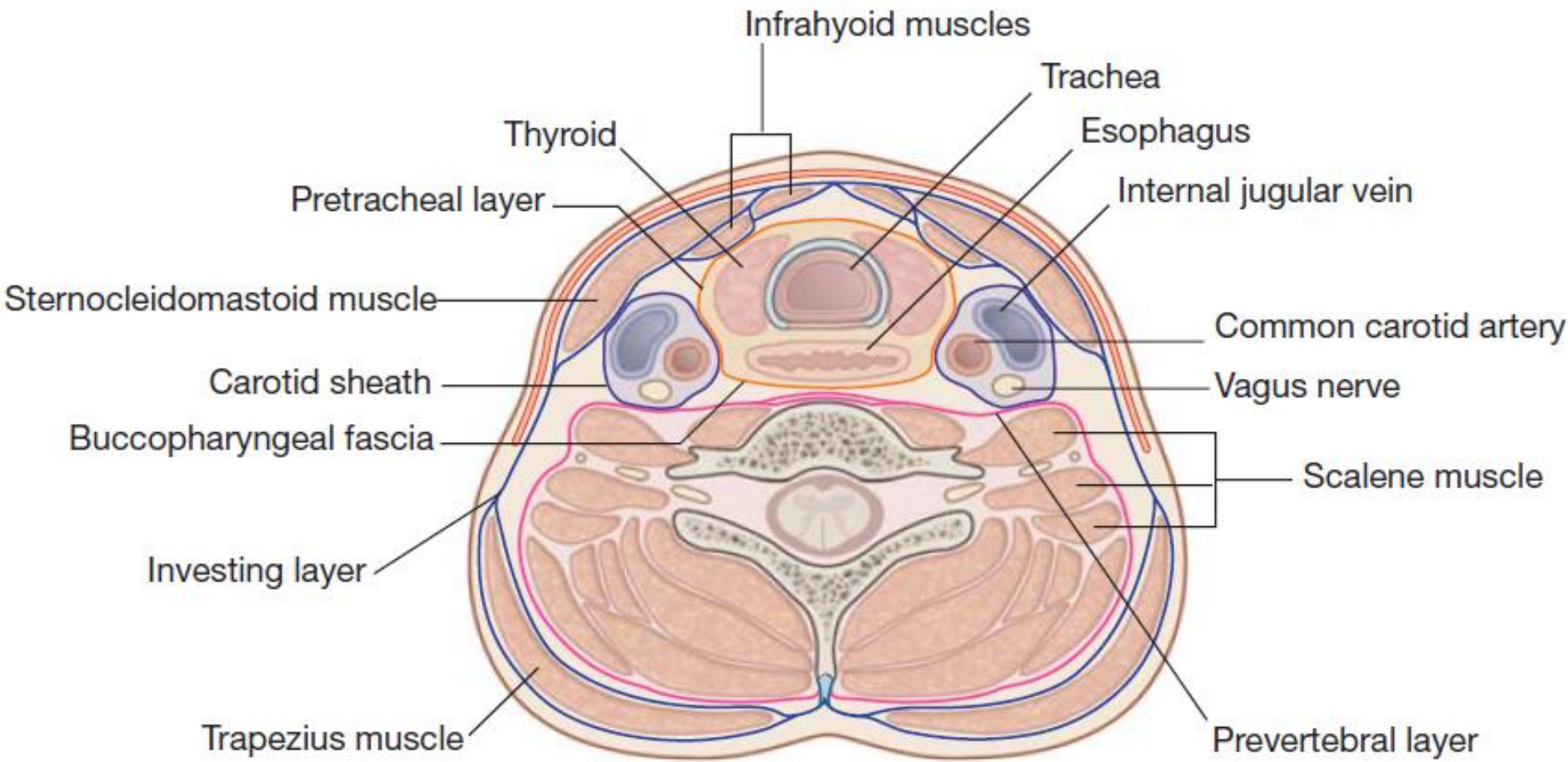
Superficial Fascia

- It forms a thin layer that encloses platysma muscle.
- The cutaneous nerves, the superficial veins, and the superficial lymph nodes are embedded in it.
- **Platysma muscle** is a thin **but clinically important**.
 - ✓ **Origin:** Deep fascia over pectoralis major and deltoid.
 - ✓ **Insertion:** Body of mandible and angle of mouth.
 - ✓ **Nerve Supply:** cervical branch of Facial n.
 - ✓ **Action:** Depresses mandible and angle of mouth.



Deep Cervical Fascia

- The deep cervical fascia **supports** the muscles, the vessels & viscera of the neck.
- In certain areas, it is **condensed** to form **well-defined, fibrous sheets**:
 - ✓ **Investing** layer: surrounds all structures in the neck
 - ✓ **Prevertebral** layer: surrounds the vertebral column and the deep muscles associated with the back
 - ✓ **Pretracheal** layer :encloses the viscera of the neck
- It is also condensed to form the **Carotid sheath**.



Deep Cervical Fascia

➤ **Investing fascia** is attached:

- ✓ Superior : to the external occipital protuberance and the superior nuchal line;
- ✓ Lateral : to the mastoid process and zygomatic arch; and
- ✓ Inferior : to the spine of the scapula, the acromion, the clavicle, and the manubrium of sternum.

➤ **Structures pierce the investing fascia :**

- ✓ External and anterior jugular veins
- ✓ Lesser occipital n.
- ✓ Great auricular n.
- ✓ Transverse cervical n.
- ✓ Supraclavicular n.
- ✓ all branches of the cervical plexus

Deep Cervical Fascia

- **Prevertebral layer** is a cylindrical layer of fascia that surrounds the vertebral column and the muscles associated with it.
- Muscles in this group include the prevertebral muscles, the anterior, middle, and posterior scalene muscles, and the deep muscles of the back.
- **Attachment**
 - ✓ posteriorly along the length of the ligamentum nuchae
 - ✓ superiorly forms a continuous circular line attaching to the base of the skull.
 - ✓ Anteriorly, is attached to the anterior surfaces of the transverse processes and vertebral bodies C1 to C7.

Deep Cervical Fascia

➤ Pretracheal fascia

- ✓ begins superiorly at the hyoid bone
- ✓ ends inferiorly in the upper thoracic cavity.
- ✓ Laterally, this fascia continues and covers the thyroid gland and the esophagus.
- ✓ Posteriorly, the pretracheal layer is referred to as **the buccopharyngeal** fascia and separates the pharynx and the esophagus from the prevertebral layer

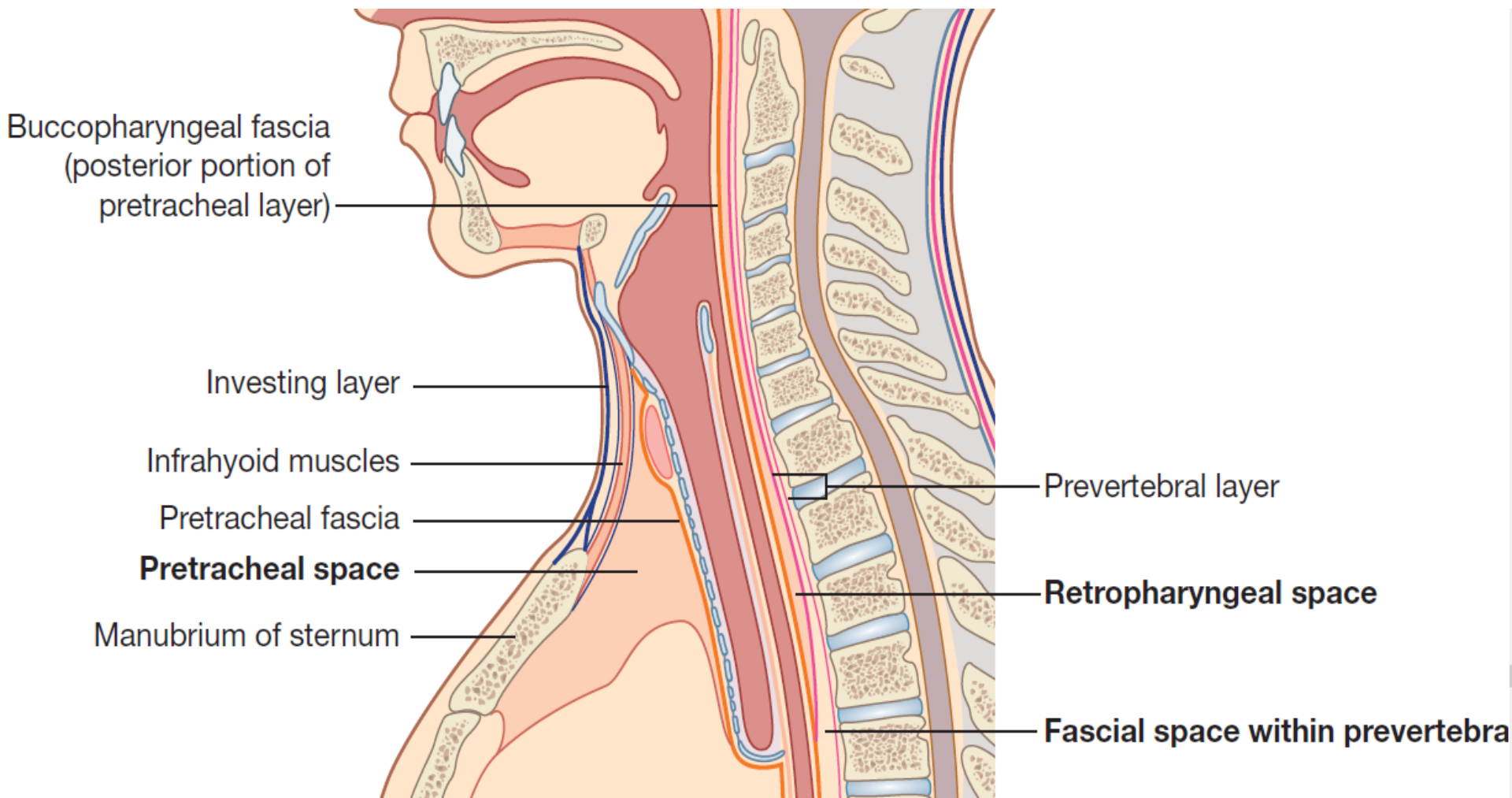
Deep Cervical Fascia

➤ Carotid sheath

- Each **carotid sheath** is a column of fascia that **surrounds** the common carotid artery, the internal carotid artery, the internal jugular vein, and the vagus nerve as these structures pass through the neck .
- It receives contributions from the investing prevertebral, and pretracheal layers, though the extent of each layer.

Fascial spaces

- Infection can be transmitted from the neck to mediastinum through three neck Fascial spaces :
 - ✓ **Pretracheal space** : passes between the neck and the **superior** mediastinum
 - ✓ **Retropharyngeal space** : extends from the base of the skull to the upper part of the **posterior** mediastinum
 - ✓ **Third space** is within the prevertebral layer extends through the **posterior** mediastinum to the diaphragm.



Fascia of the neck, sagittal view.

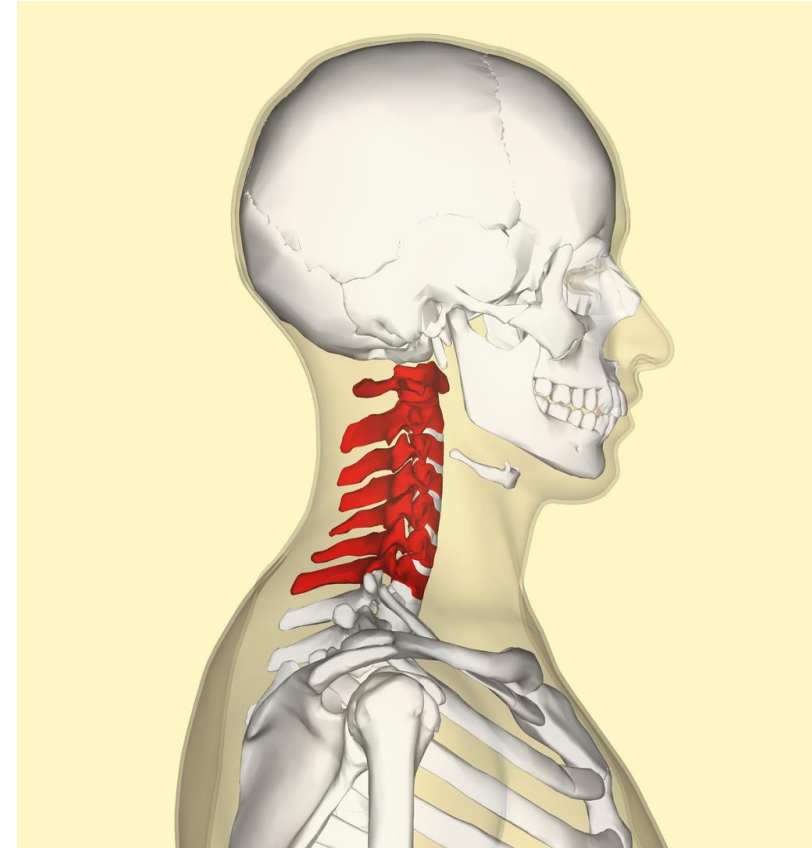
Bones of the Neck

❑ Cervical Vertebrae

- The cervical part of the vertebral column.

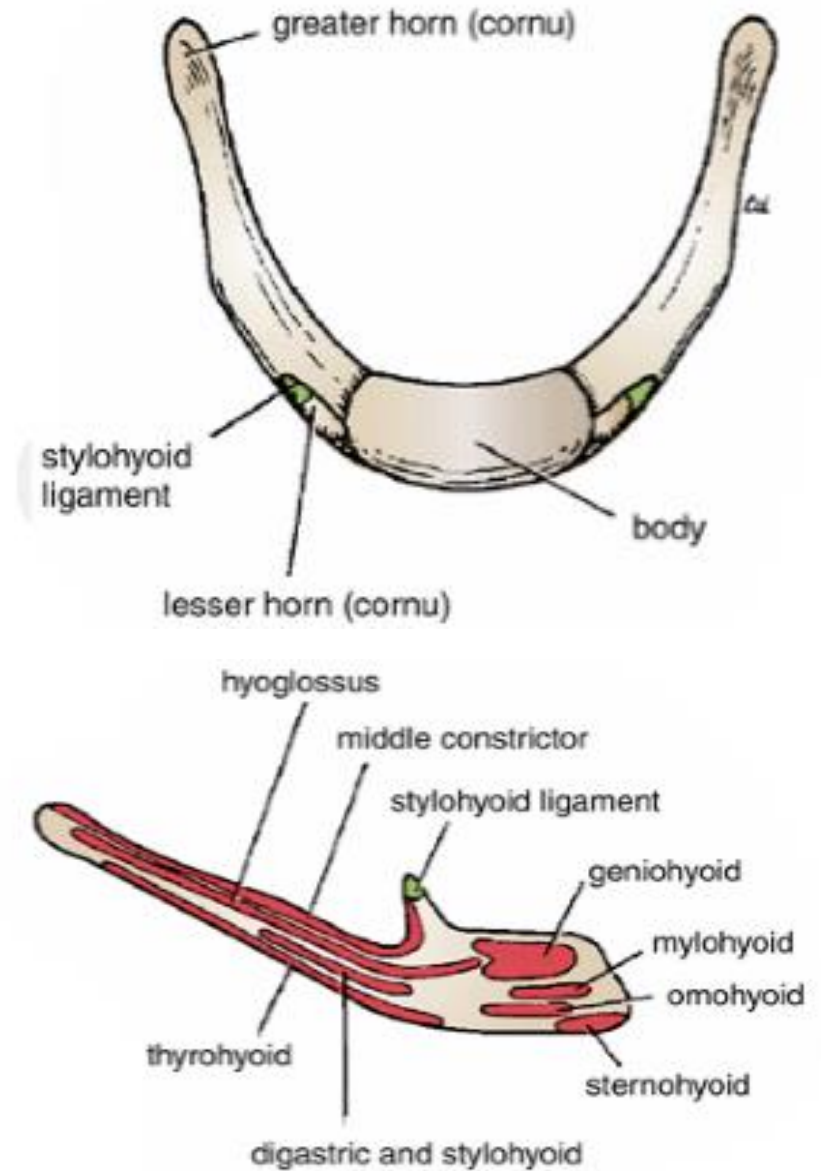
❑ Hyoid Bone.

- A single mobile bone found in the midline of the neck below the mandible.



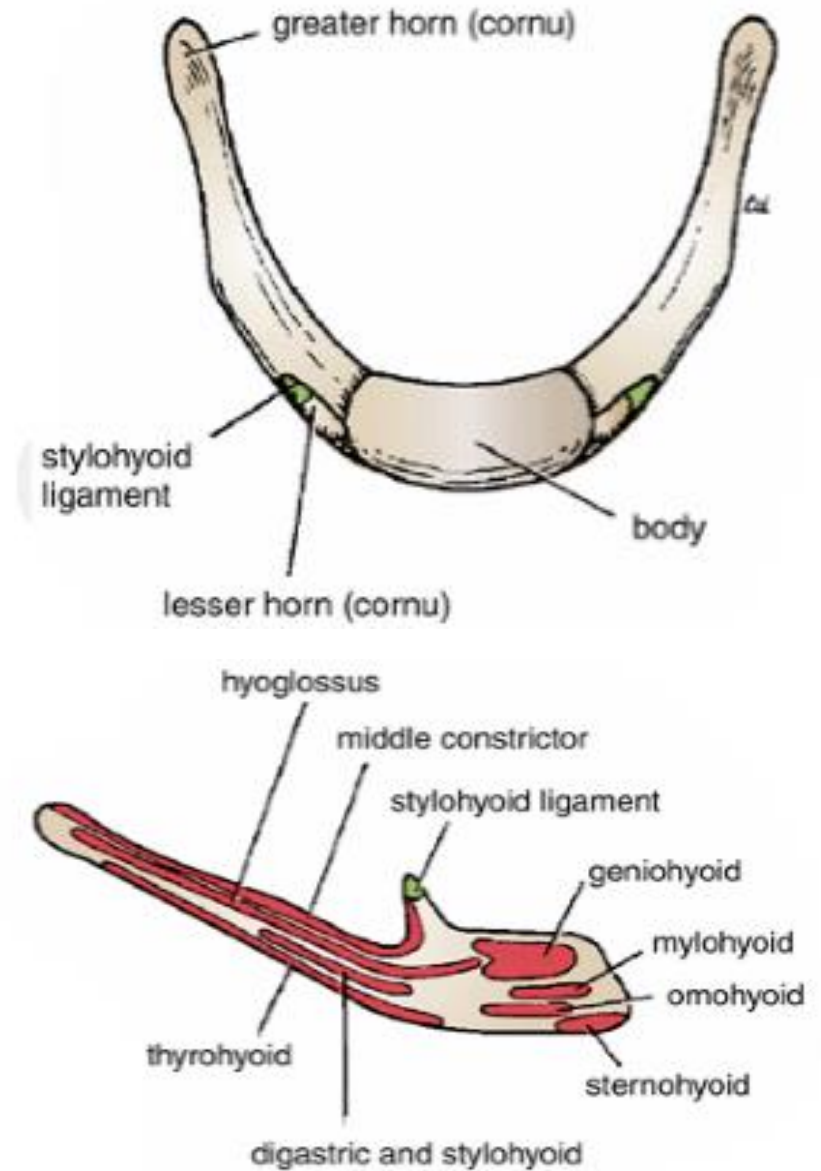
Hyoid Bone

- Does **not** articulate with any other bones.
- **U shaped** & consists of a **body** & two **greater** & two **lesser cornua**.
- **Attached to**
 - ✓ Skull by the **stylohyoid ligament**
 - ✓ Thyroid cartilage by **thyrohyoid membrane**

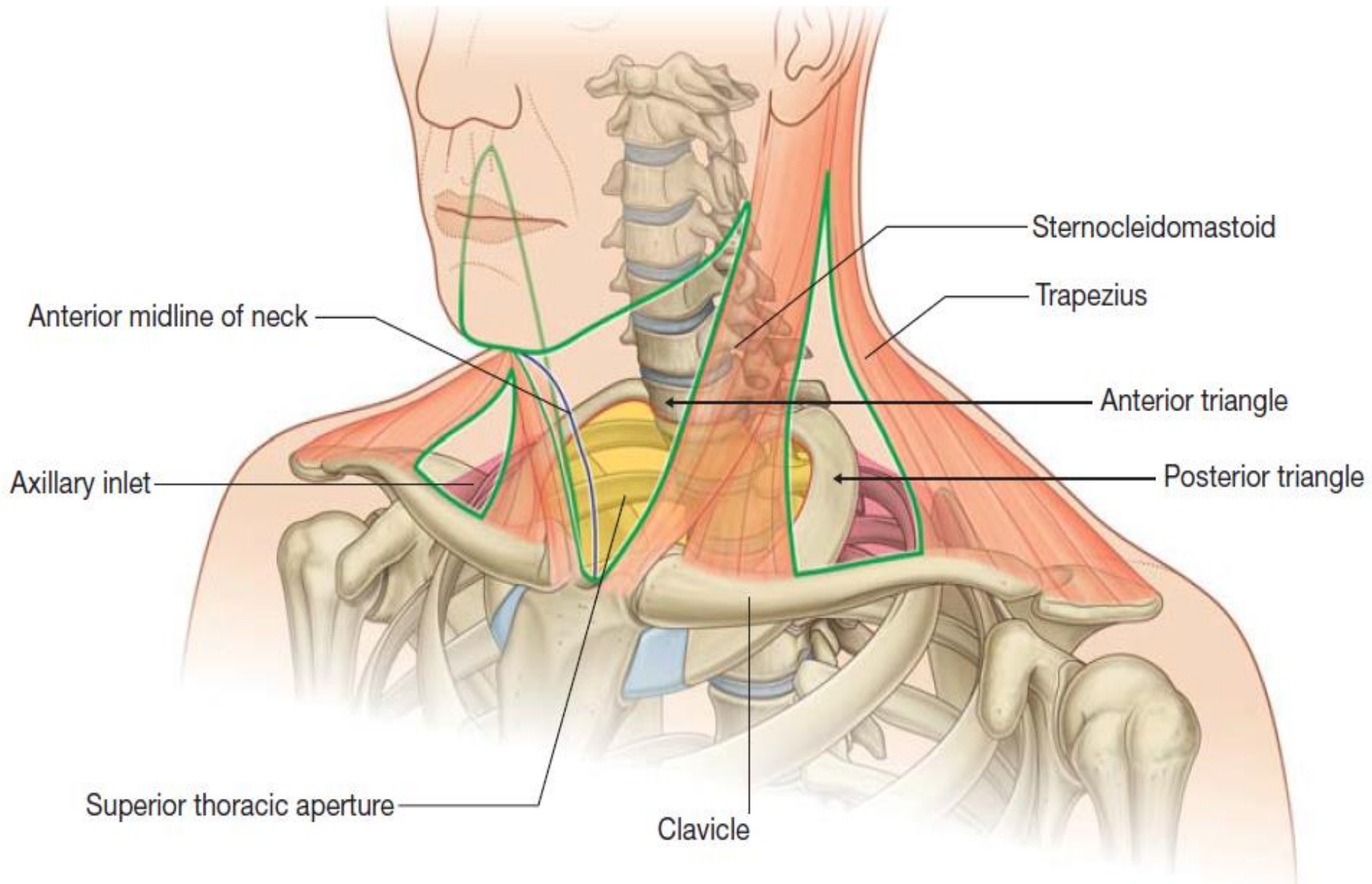


Hyoid Bone

- It forms a base for the tongue.
- It is **suspended in position** by muscles that connect it to the **mandible**, to the **styloid process** of temporal bone, to the **thyroid cartilage**, to the **sternum** & to the **scapula**.

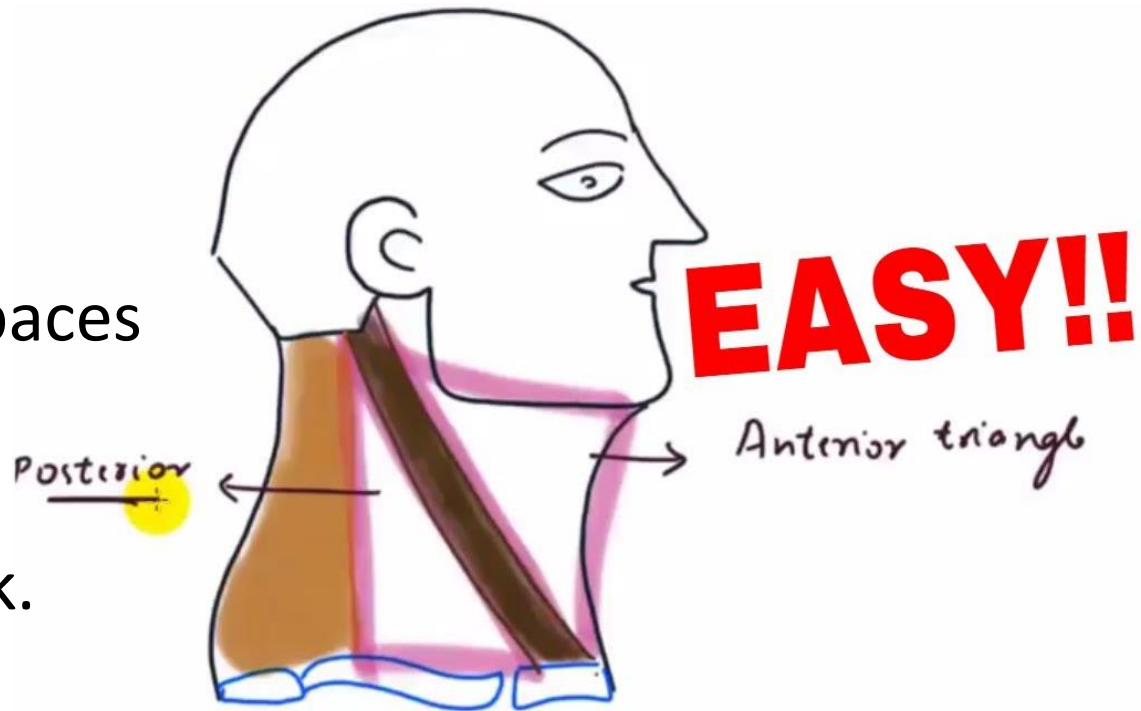


Muscular Triangles of Neck



Muscular Triangles of Neck

- The sternocleidomastoid muscle divides the neck into large **anterior** and **posterior** triangles
- The **strap muscles** divide the neck into several triangular spaces that are useful in organizing the contents of the neck.



Muscular Triangles of Neck

Anterior triangle

- **Above** : body of mandible
- **Laterally** : SCM muscle.
- **Anteriorly** : the midline.

❑ Subdivided into:

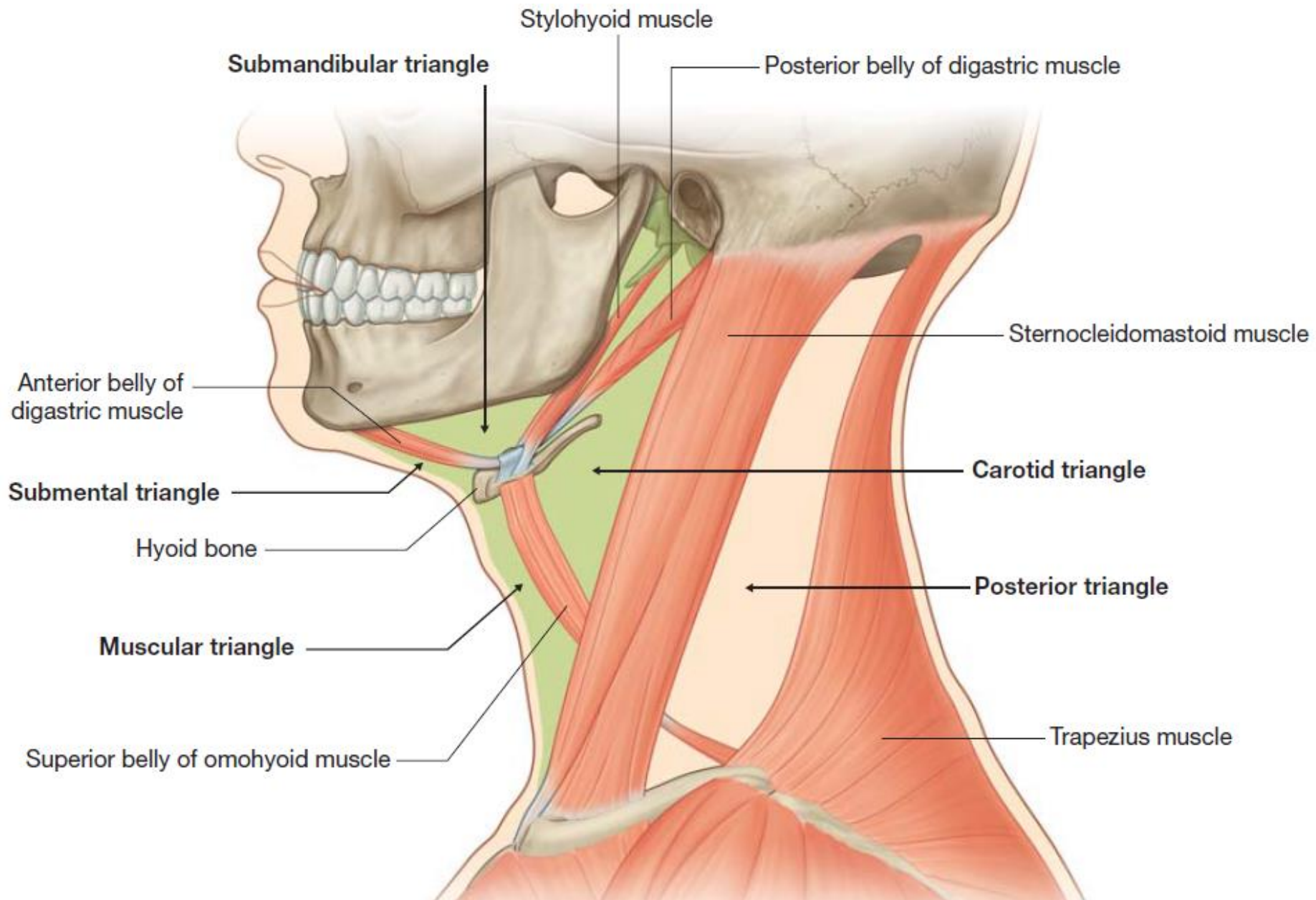
- Carotid triangle.
- Digastric triangle.
- Submental triangle.
- Muscular triangle.

Posterior triangle

- **Anterior** : SCM muscle.
- **Posterior** : trapezius muscle.
- **Inferior**: middle 1/3 of clavicle.
- **Apically** : occipital bone just posterior to mastoid process

❑ Subdivided by **the inferior belly of omohyoid muscle** into:

- Large **occipital** triangle above
- Small **omoclavicular** triangle below.



❑ The muscles in the anterior triangle can be grouped according to their location **relative to the hyoid bone:**

➤ **Suprahyoid muscles**

- ✓ Stylohyoid
- ✓ Digastric
- ✓ Mylohyoid
- ✓ geniohyoid

➤ **Infrahyoid muscles**
(strap muscles)

- ✓ Omohyoid
- ✓ Sternohyoid
- ✓ Thyrohyoid
- ✓ sternothyroid

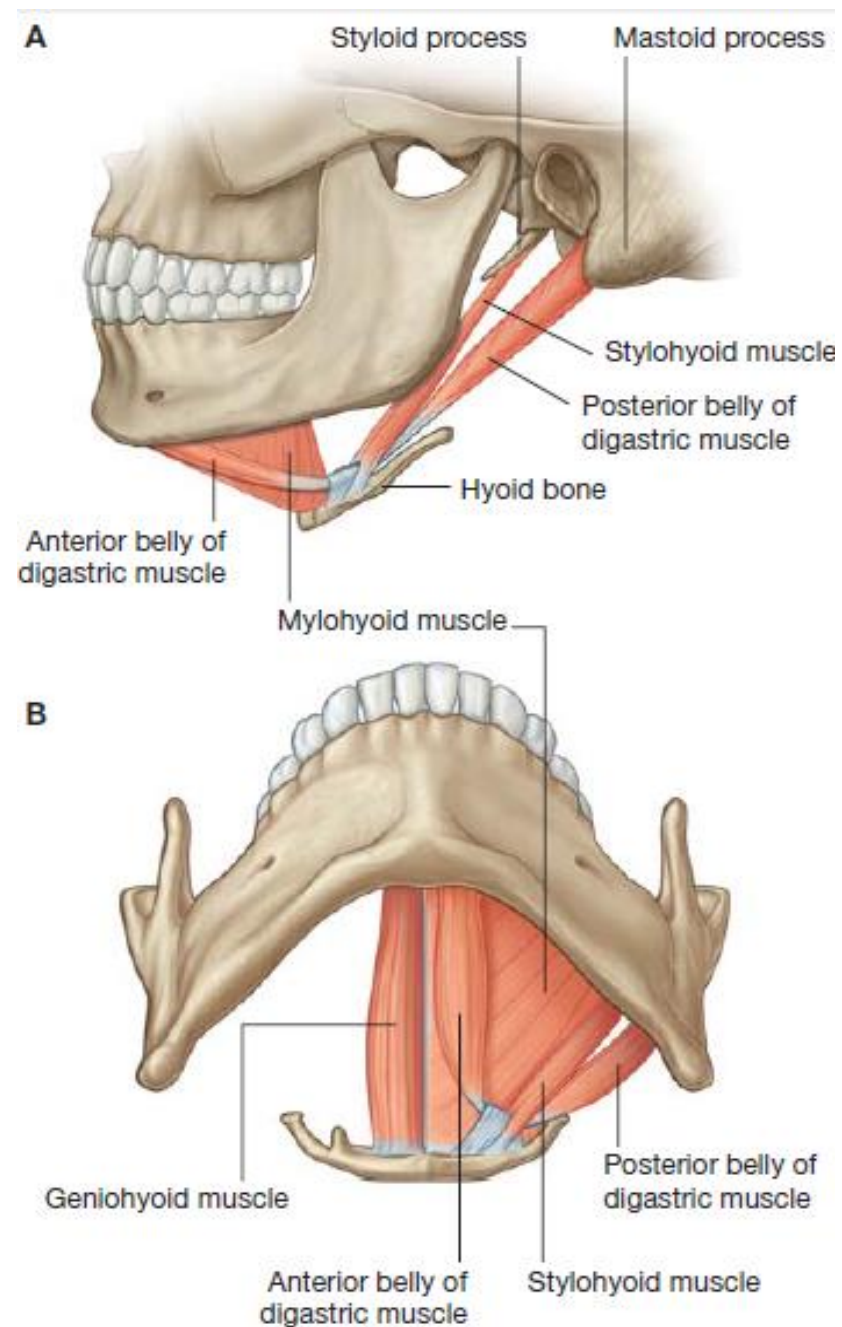
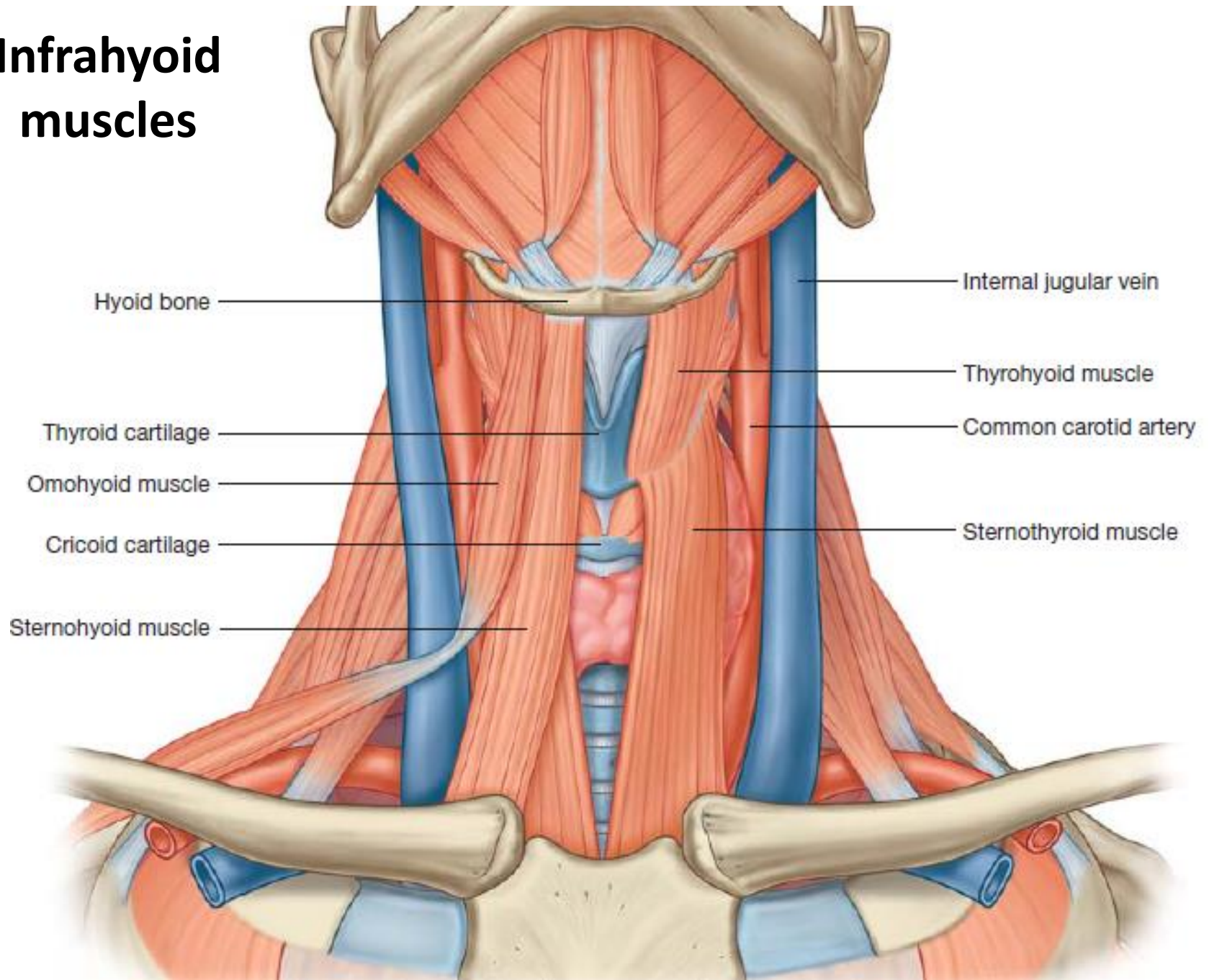
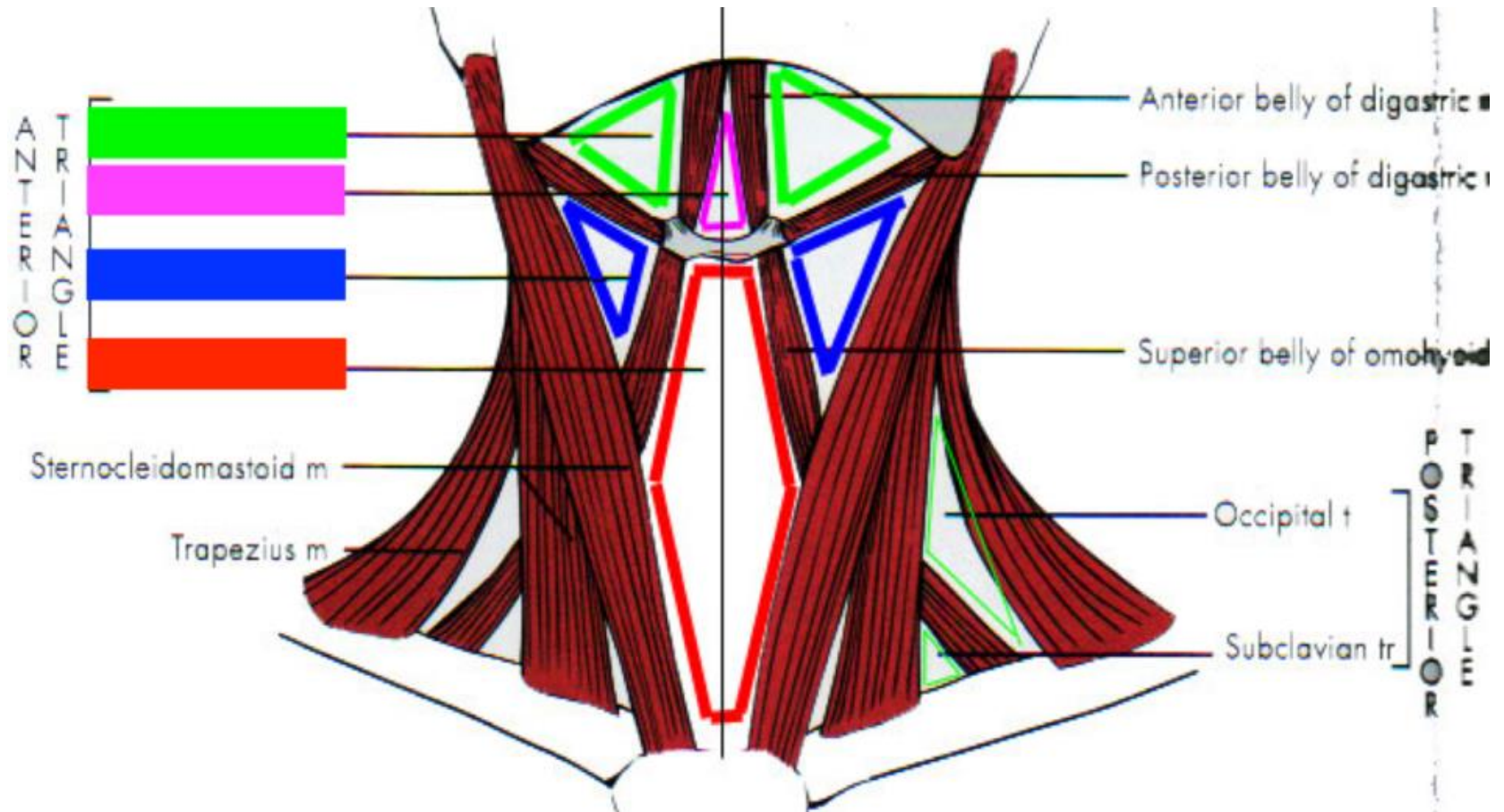


Fig. 8.158 Suprahyoid muscles. A. Lateral view. B. Inferior view.

Infrahyoid muscles



Anterior Neck Triangle

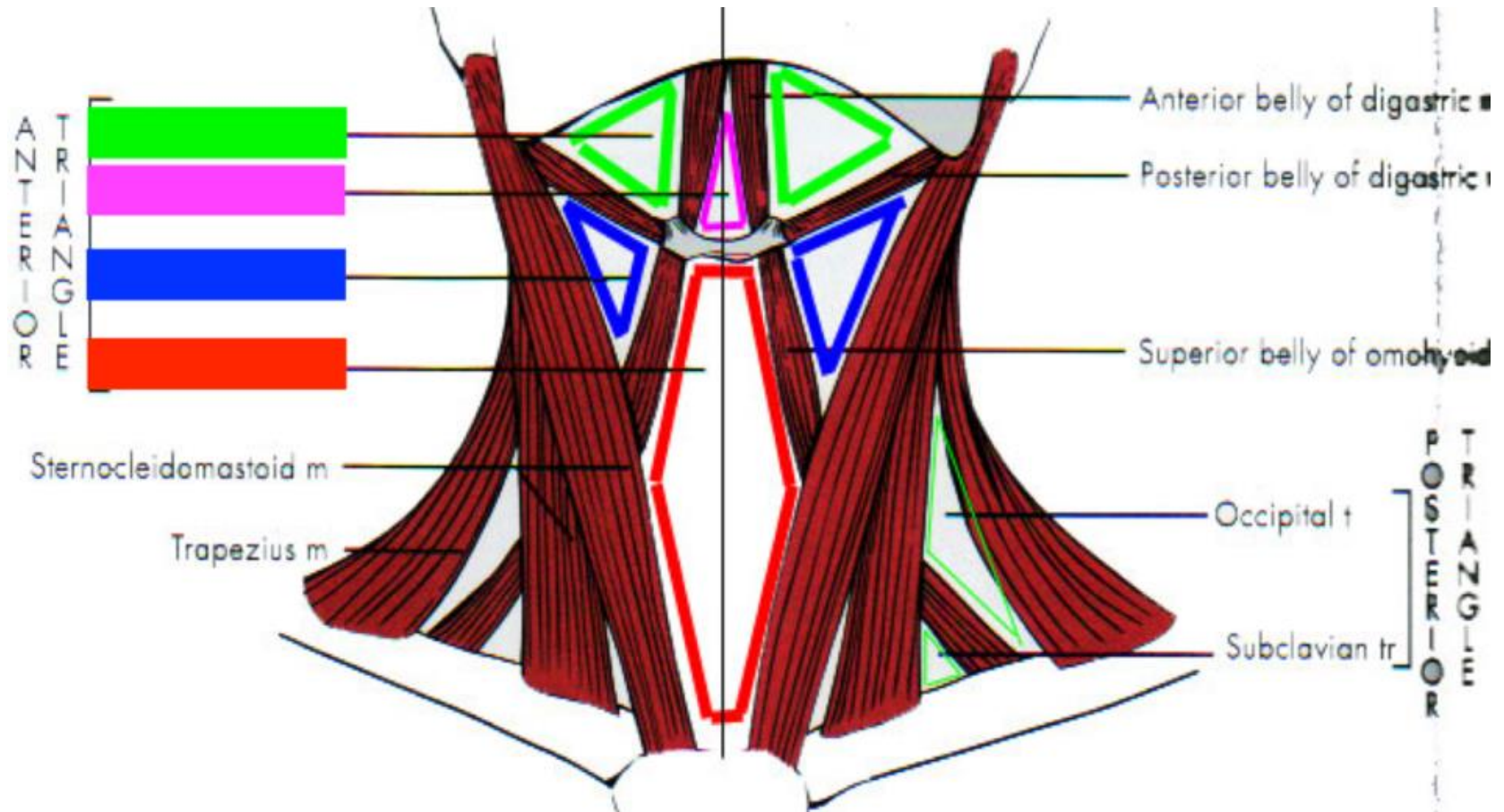


Anterior Neck Triangle

Subdivisions and boundaries:

- **Muscular triangle:** Anterior midline, anterior edge of sternocleidomastoid, superior belly of the omohyoid
- **Carotid triangle:** Superior belly of the omohyoid, anterior edge of sternocleidomastoid, posterior belly of digastric
- **Submental triangle:** Anterior midline, hyoid bone, anterior belly of digastric
- **Submandibular (digastric) triangle:** Lower margin of body of the mandible, anterior belly of digastric, posterior belly of digastric

Posterior Neck Triangle



Posterior Neck Triangle

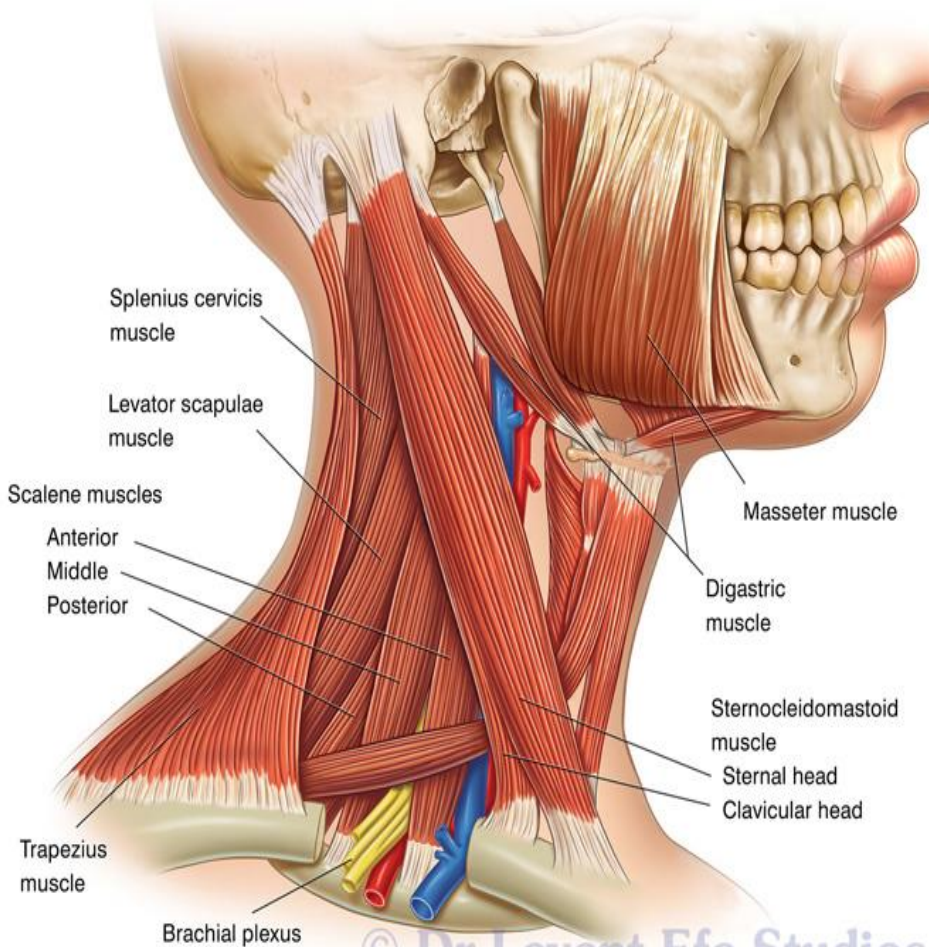
Subdivisions and boundaries:

- **Occipital triangle:** Sternocleidomastoid, trapezius, inferior belly of omohyoid
- **Omoclavicular (subclavian) triangle:** Sternocleidomastoid, inferior belly of omohyoid, clavicle

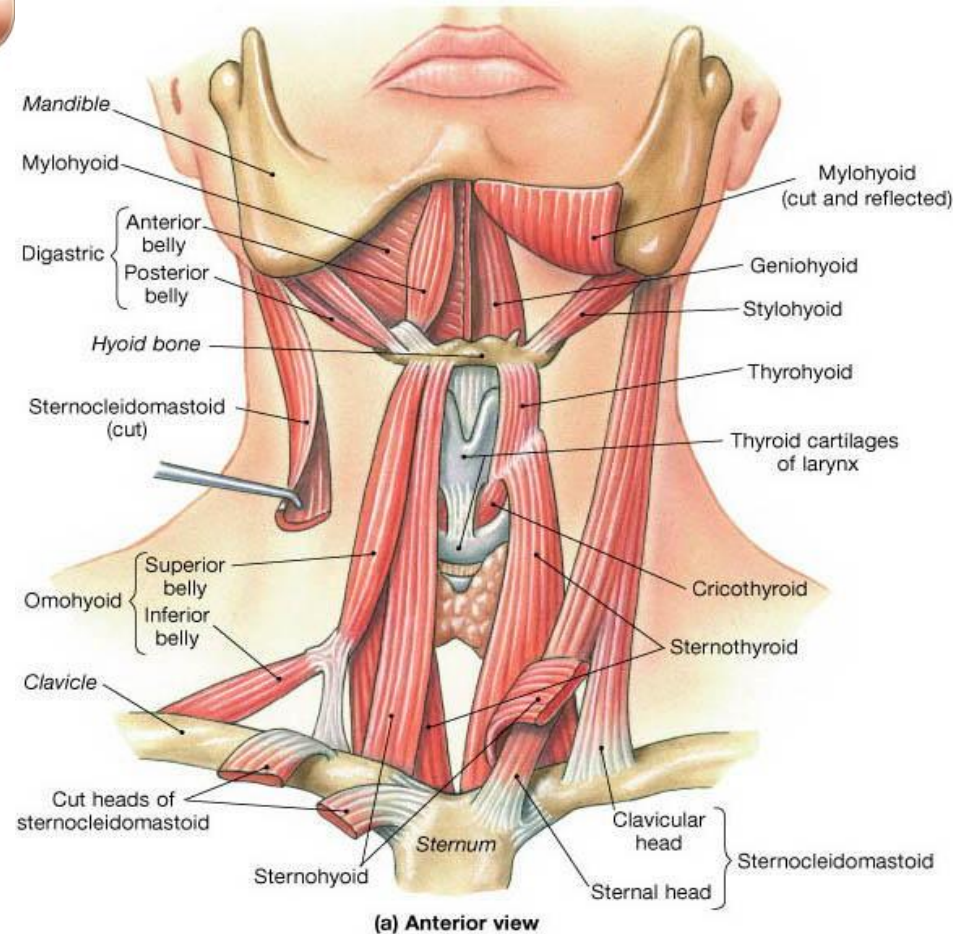
Major Triangle Contents

- **Muscular triangle:** Infrahyoid muscles, thyroid and parathyroid glands
- **Carotid triangle:** Common carotid artery, carotid sinus, carotid body
- **Submental triangle:** Submental lymph nodes, anterior jugular vein
- **Submandibular triangle:** Submandibular gland
- **Occipital triangle:** Occipital artery, spinal accessory nerve (CN XI), brachial plexus (trunks)
- **Omoclavicular triangle:** Subclavian artery (3rd part)

Muscles of the Neck



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Muscles of the Neck

MUSCLE	ORIGIN	INSERTION	NERVE SUPPLY	ACTION
Platysma	Deep fascia over pectoralis major and deltoid	Body of the mandible and angle of the mouth	Facial nerve cervical branch	Depresses the mandible and angle of the mouth
Sternocleidomastoid	Manubrium sterni and medial third of the clavicle	Mastoid process of the temporal bone and occipital bone	Spinal part of accessory nerve and C2 and 3	Two muscles acting together extend the head and flex the neck; one muscle rotates the head to the opposite side
Digastric				
Posterior belly	Digastric notch on the mastoid process of the temporal bone	Intermediate tendon (held to hyoid by fascial sling)	Facial nerve	Depresses the mandible or elevates hyoid bone
Anterior belly	Body of the mandible		Nerve to mylohyoid	
Stylohyoid	Styloid process	Body of hyoid bone	Facial nerve	Elevates hyoid bone
Mylohyoid	Mylohyoid line of body of the mandible	Body of hyoid bone and fibrous raphe	Inferior alveolar nerve	Elevates floor of the mouth and hyoid bone or depresses the mandible
Geniohyoid	Inferior mental spine of the mandible	Body of hyoid bone	First cervical nerve	Elevates hyoid bone or depresses mandible

Muscles of the Neck

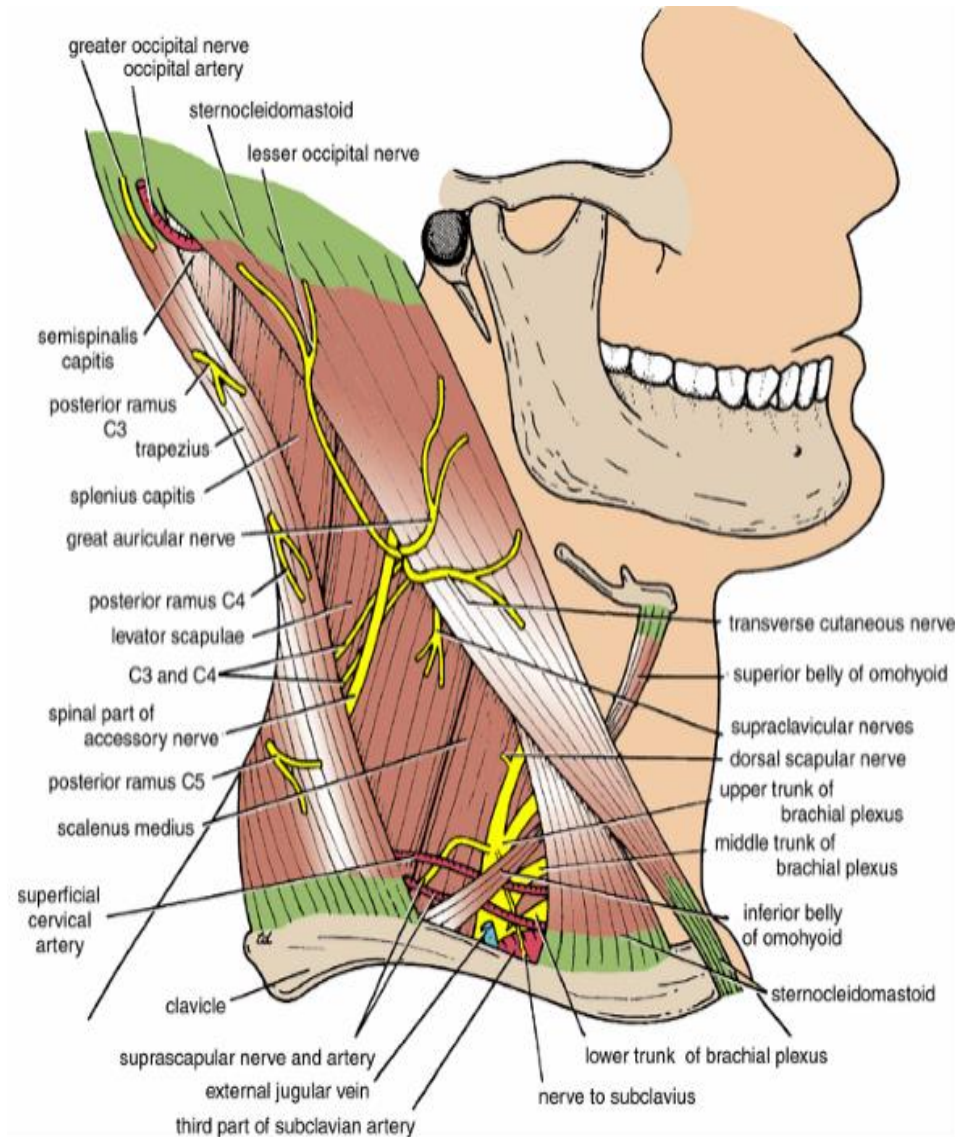
MUSCLE	ORIGIN	INSERTION	NERVE SUPPLY	ACTION
Sternohyoid	Manubrium sterni and clavicle	Body of hyoid bone	Ansa cervicalis; C1, 2, and 3	Depresses hyoid bone
Sternothyroid	Manubrium sterni	Oblique line on lamina of thyroid cartilage	Ansa cervicalis; C1, 2, and 3	Depresses the larynx
Thyrohyoid	Oblique line on lamina of thyroid cartilage	Lower border of body of hyoid bone	First cervical nerve	Depresses hyoid bone or elevates the larynx
Omohyoid				
Inferior belly	Upper margin of scapula and suprascapular ligament	Intermediate tendon (held to clavicle and first rib by fascial sling)	Ansa cervicalis; C1, 2, and 3	Depresses hyoid bone
Superior belly	Lower border of body of hyoid bone			

Muscles of the Neck

MUSCLE	ORIGIN	INSERTION	NERVE SUPPLY	ACTION
Scalenus anterior	Transverse processes of third, fourth, fifth, and sixth cervical vertebrae	First rib	C4, 5, and 6	Elevates first rib; laterally flexes and rotates cervical part of the vertebral column
Scalenus medius	Transverse processes of upper six cervical vertebrae	First rib	Anterior rami of cervical nerves	Elevates first rib; laterally flexes and rotates cervical part of the vertebral column
Scalenus posterior	Transverse processes of lower cervical vertebrae	Second rib	Anterior rami of cervical nerves	Elevates second rib; laterally flexes and rotates cervical part of the vertebral column

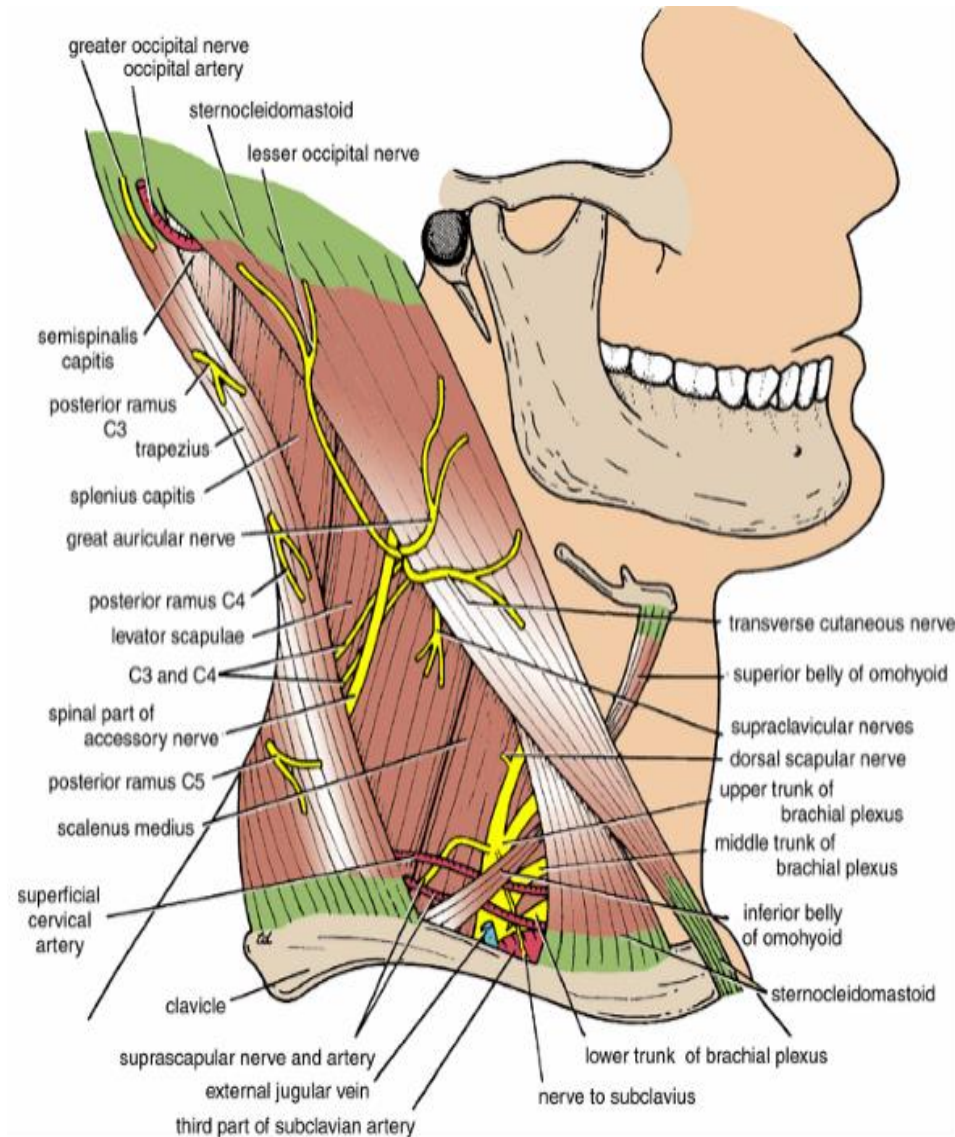
Sternocleidomastoid Muscle

- it appears as an oblique band crossing the side of the neck.
- It divides the neck into anterior & posterior triangles.
- The muscle is covered superficially by skin, fascia, the platysma muscle, & the external jugular vein.



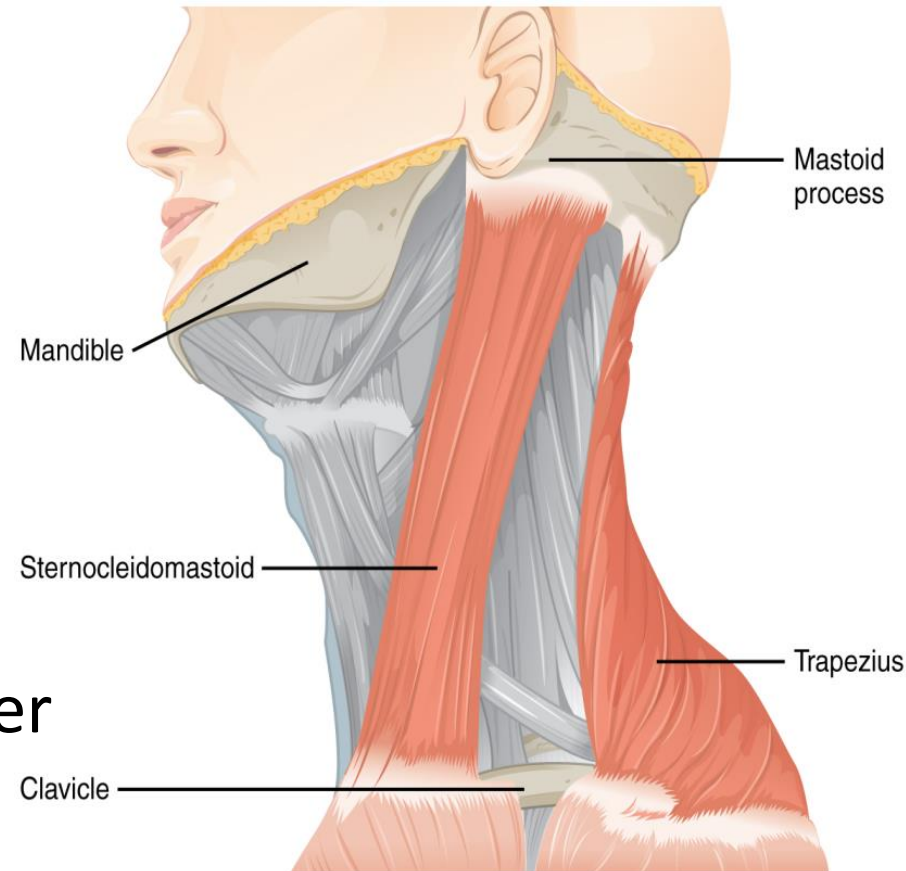
Sternocleidomastoid Muscle

- The anterior border covers carotid arteries, internal jugular vein & the deep cervical lymph nodes; it also overlaps the thyroid gland.
- The posterior border is related to the cervical plexus, the phrenic nerve & the upper part of the brachial plexus.



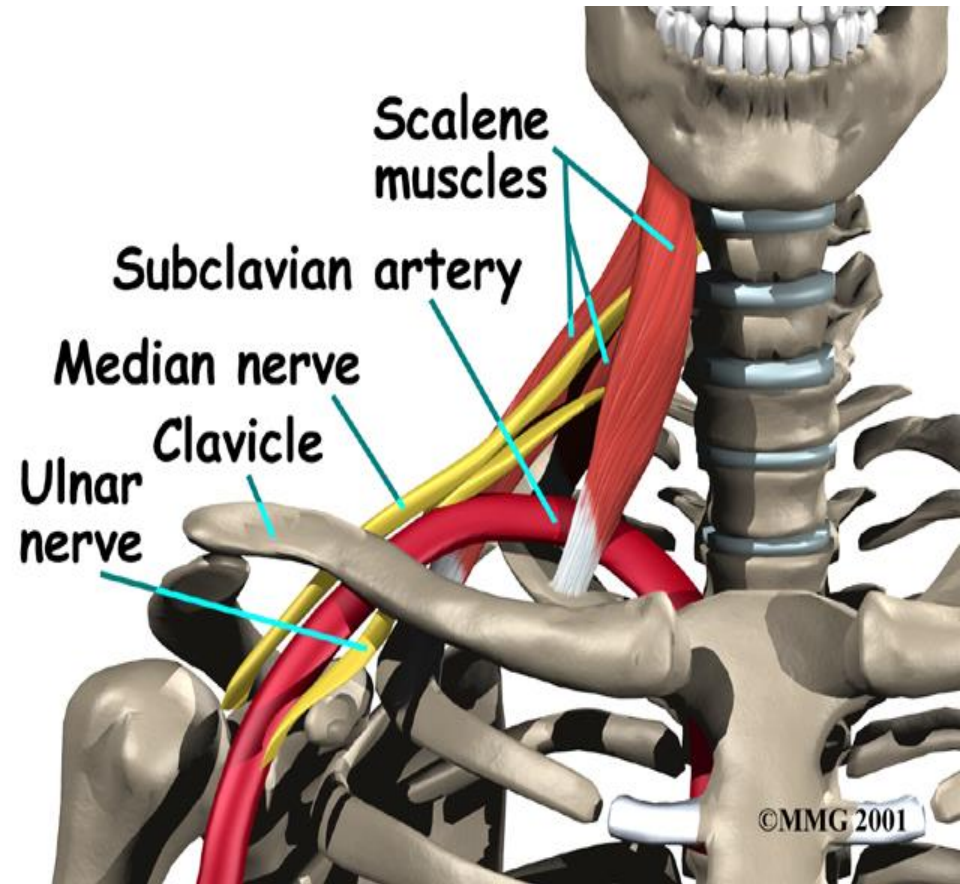
Sternocleidomastoid Muscle

- **Origin:** Manubrium sterni and medial third of clavicle
- **Insertion:** Mastoid process of temporal bone and occipital bone
- **Nerve Supply:** Spinal part of accessory nerve and C2 and 3
- **Action:**
 - ✓ Two muscles acting together extend head and flex neck
 - ✓ one muscle rotates head to opposite side



Scalenus Anterior Muscle

- **Origin:** Transverse processes of third, fourth, fifth, and sixth cervical vertebrae
- **Insertion:** First rib
- **Nerve Supply:** C4, 5, 6
- **Action:** Elevates first rib; laterally flexes and rotates cervical part of vertebral column.



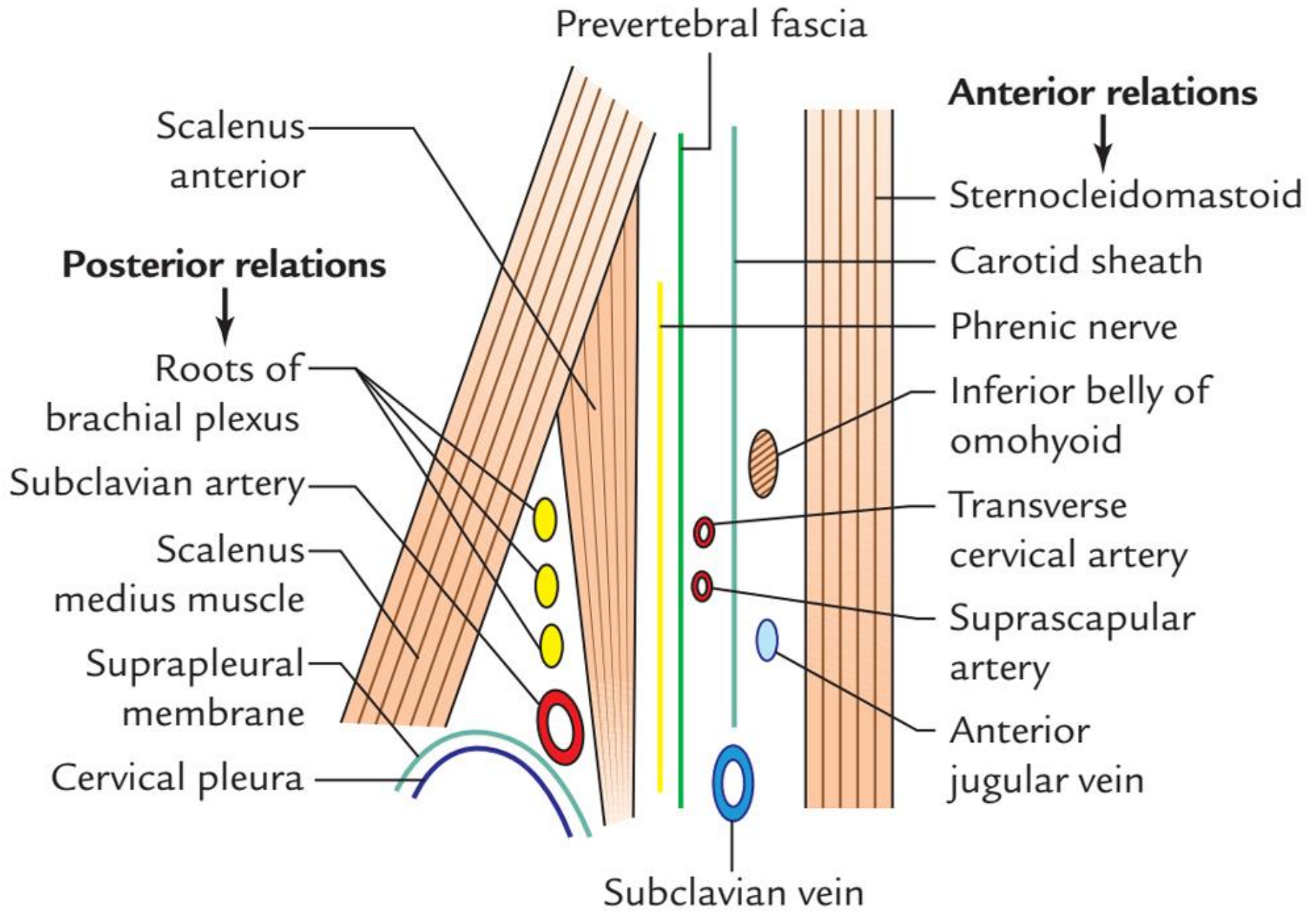
Scalenus Anterior Muscle

- Deeply placed, descends vertically from the vertebral column to the 1st rib.

❖ Important Relations:

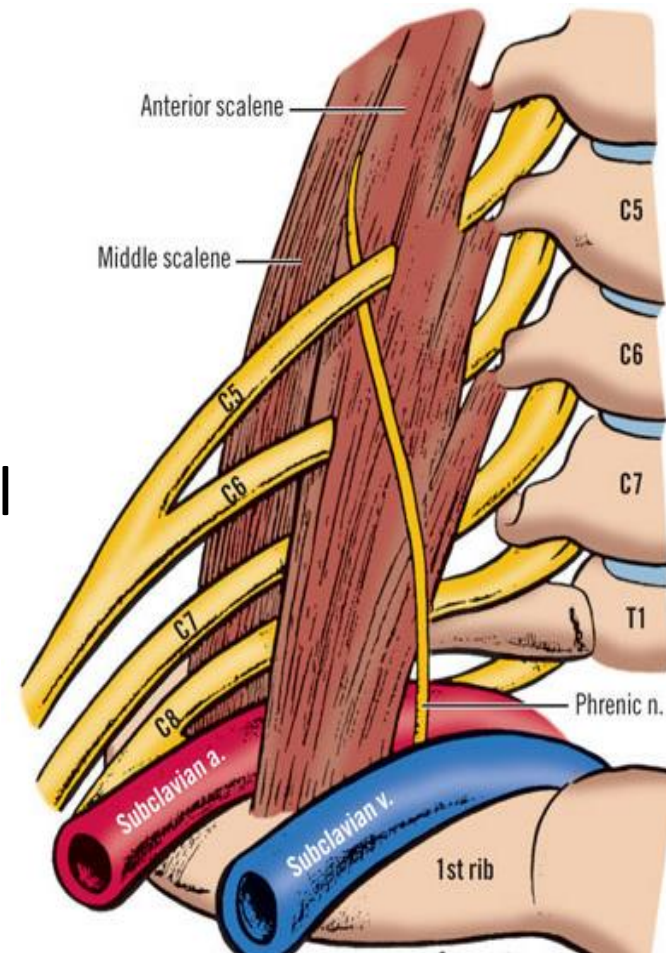
- **Anteriorly:** carotid arteries, vagus nerve, internal jugular vein & deep cervical lymph nodes.
- **Posteriorly:** the pleura, the origin of the brachial plexus, & the 2nd part of the subclavian artery.
- **Medially:** the vertebral artery & vein & the sympathetic trunk. On the left side, the medial border is related to the thoracic duct.
- **Laterally:** emerging branches of cervical plexus, roots of brachial plexus, & the 3rd part of subclavian artery.

Scalenus Anterior Muscle



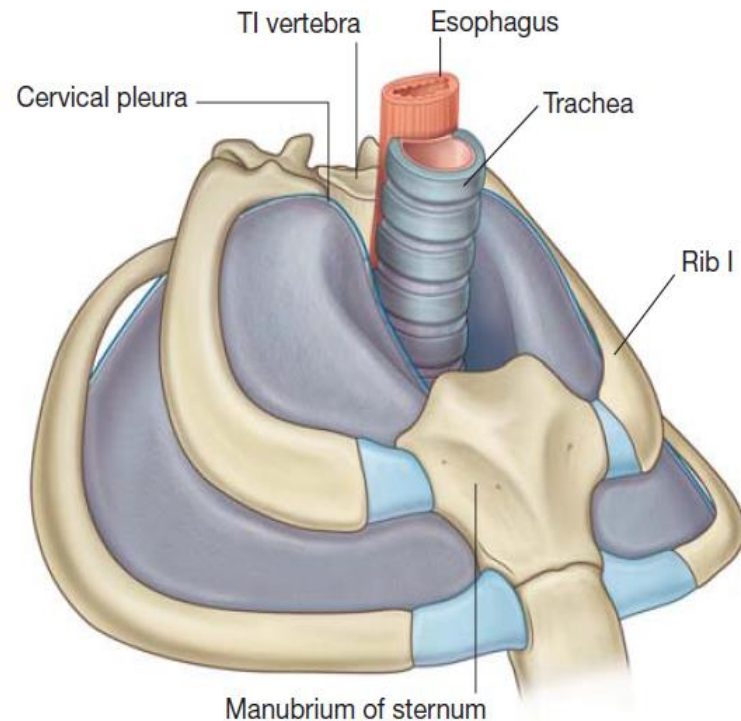
Scalenus Medius Muscle

- Lies behind the scalenus anterior.
- **Origin:** the transverse process of the upper 6 cervical vertebrae.
- **Insertion:** upper surface of the 1st rib behind the groove for subclavian artery.
- **Nerve Supply:** anterior rami of cervical nerves.
- **Action:** Elevates first rib; laterally flexes & rotates cervical vertebral column.
- The muscle lies behind the **roots** of brachial plexus & subclavian artery.



Root of the Neck

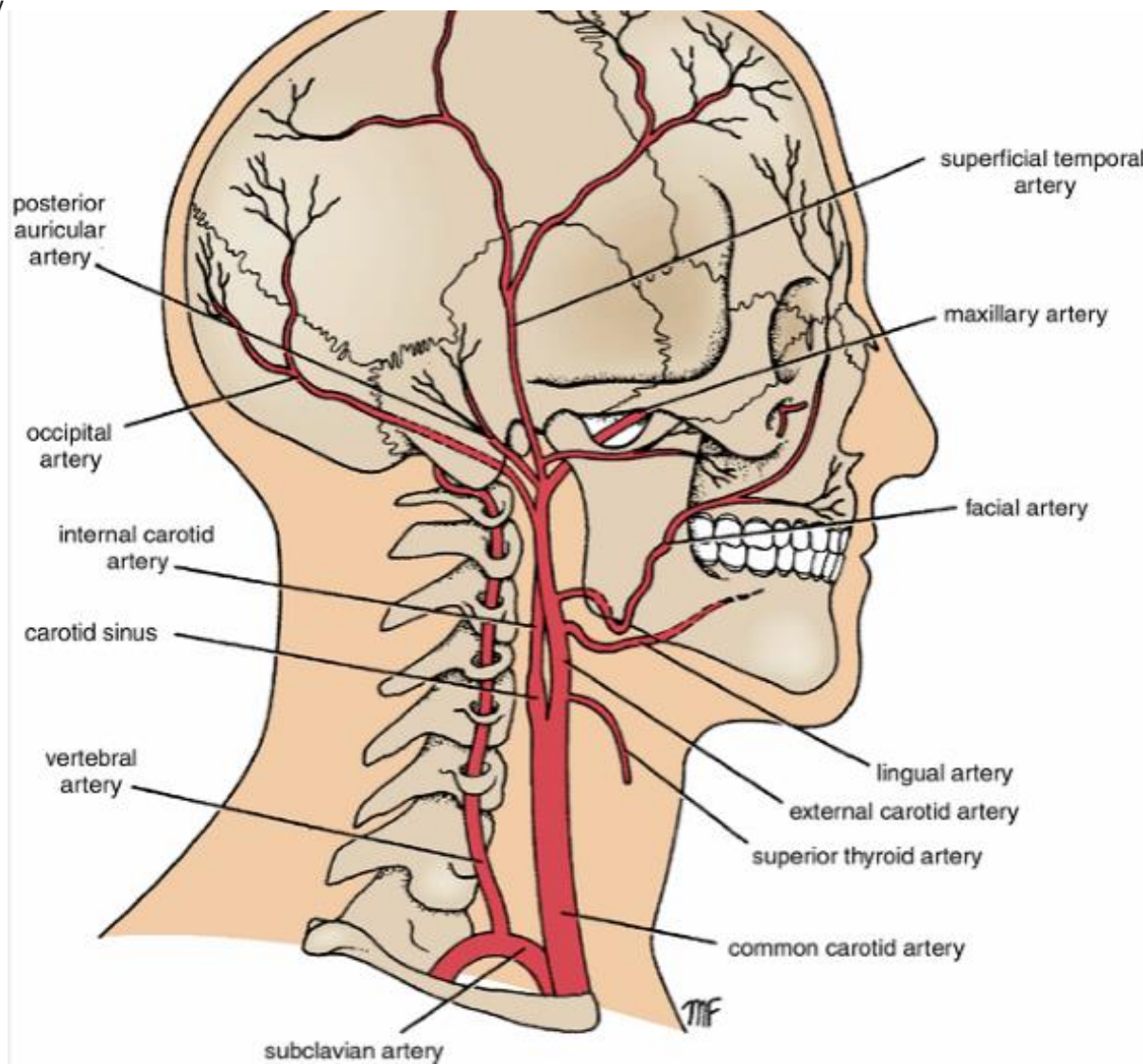
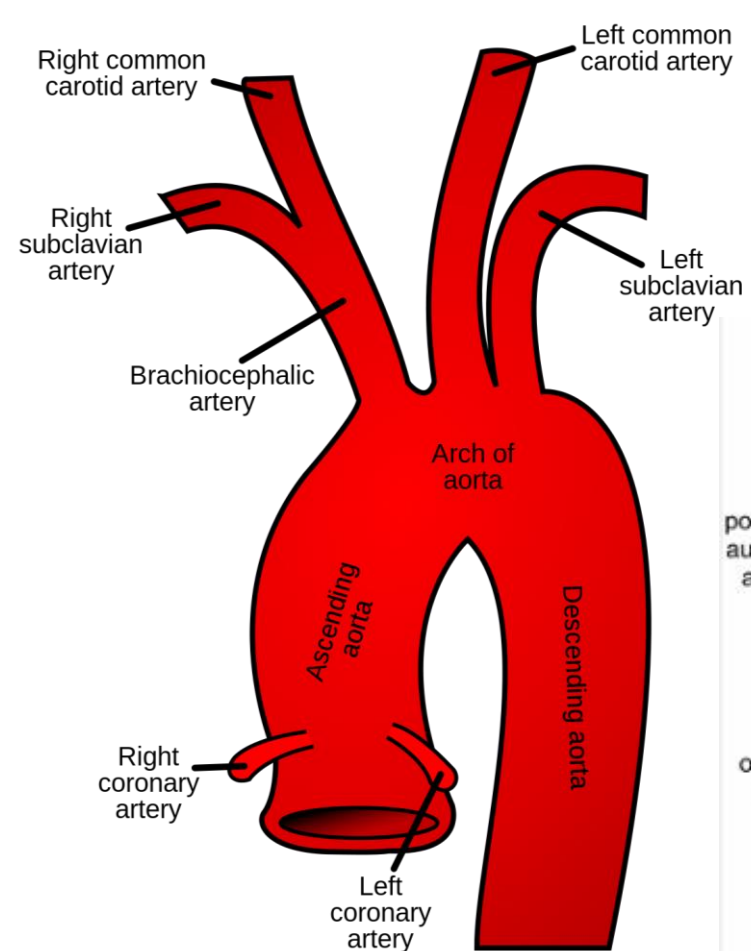
- The area immediately superior to upper thoracic aperture and axillary inlets
- It is **bounded by**:
 - ✓ **Anterior**: top of manubrium of sternum and superior margin of the clavicle.
 - ✓ **Posterior**: top of thoracic vertebra T1 and the superior margin of the scapula to the coracoid process.
- **It contains**:
 - ✓ structures passing between the neck, thorax, and upper limb.
 - ✓ the cervical part of the parietal pleura .
 - ✓ the superior lobe of each lung.

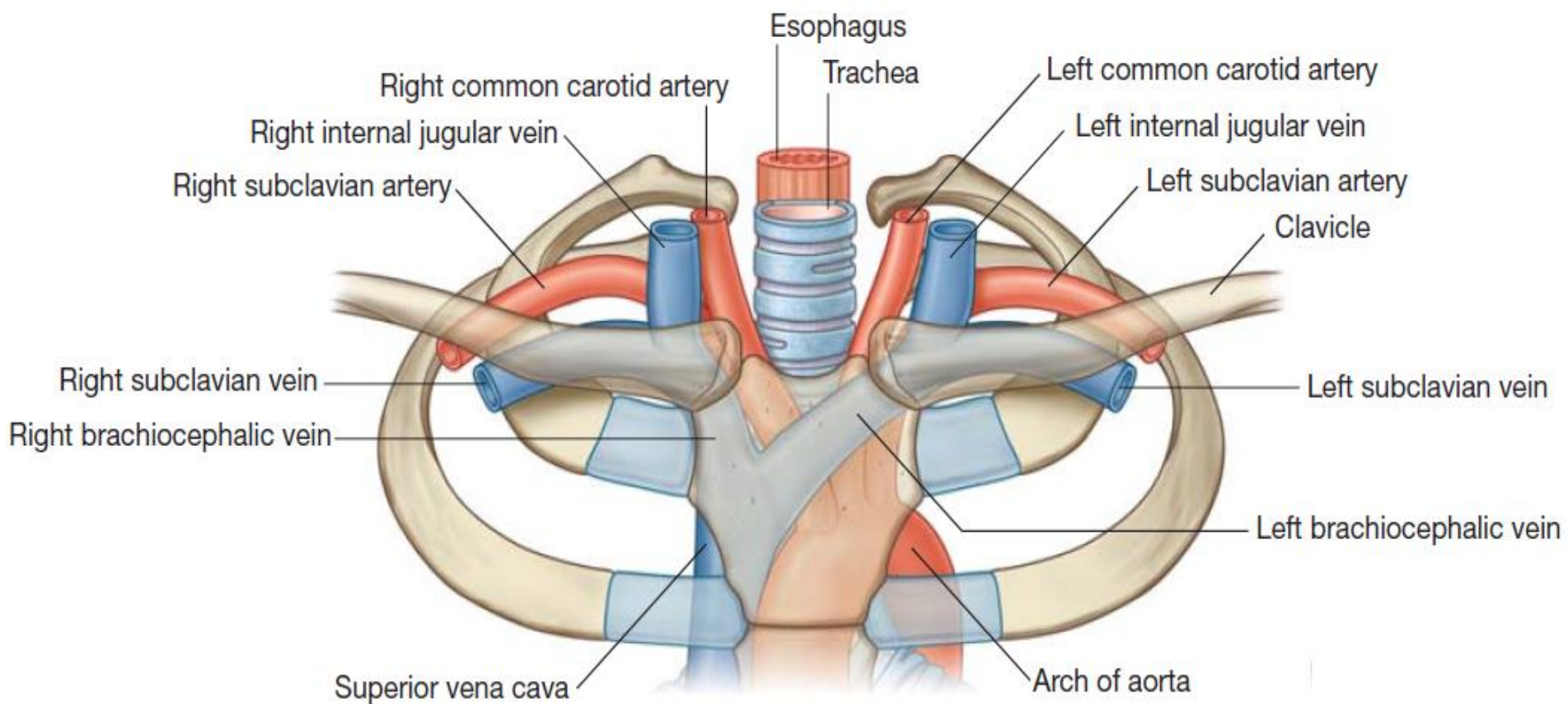


Arteries of Head & Neck

Common Carotid Artery CCA

- **Right CCA** arises from the **brachiocephalic artery** behind the sternoclavicular joint.
- **Left CCA** arises from the **arch of the aorta** in the superior mediastinum.
- Both CCA ascend through the neck lateral to the trachea and esophagus, within the carotid sheath.
- They give off **no** branches as they pass through the neck.
- Near the superior edge of the thyroid cartilage each CCA **divides** into its two **terminal** branches in the carotid triangle , **external** and **internal carotid**





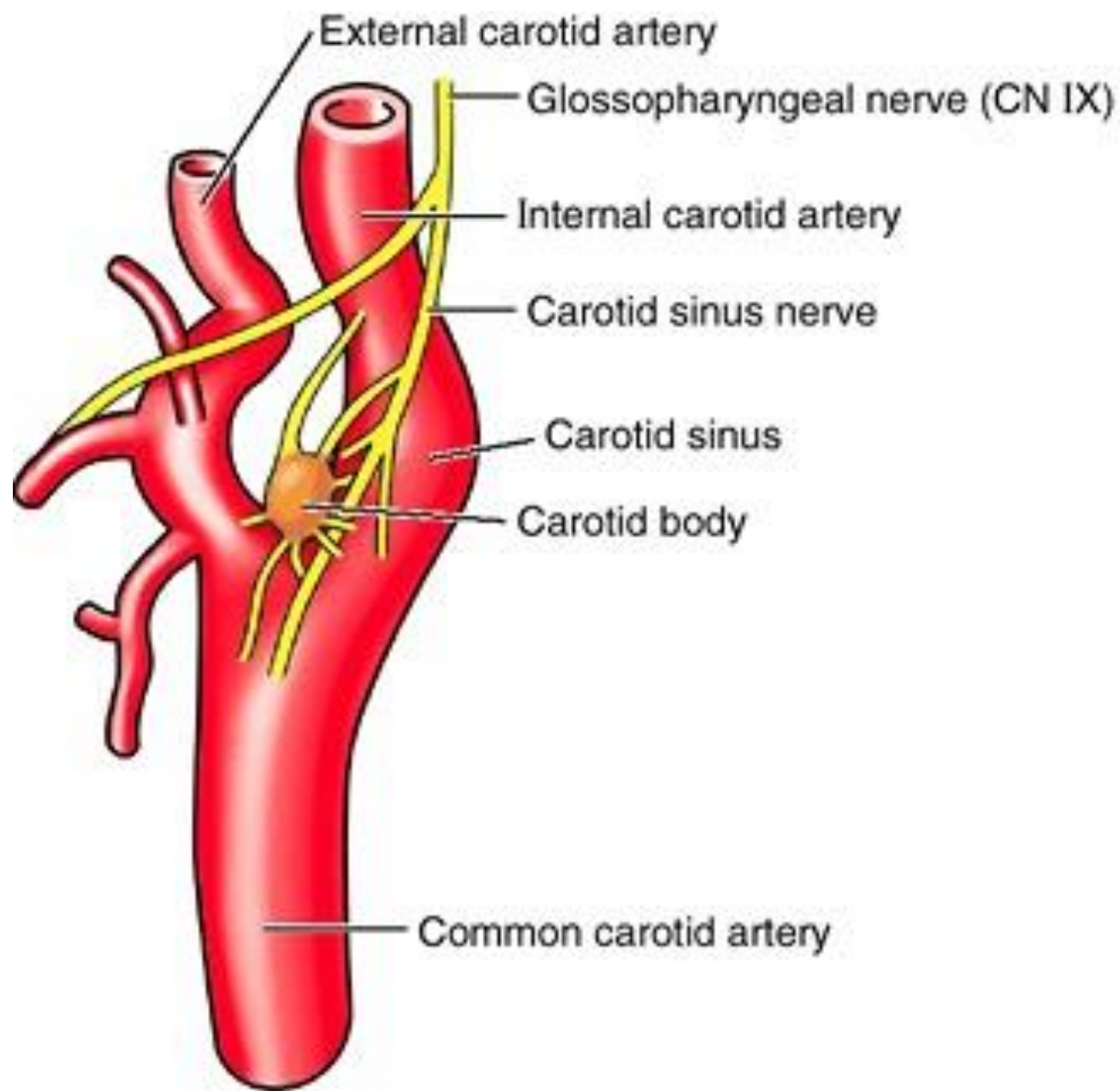
160 Origin of common carotid arteries.

Carotid Sinus

- Is **localized dilatation** at the terminal part of the CCA or the beginning of the internal carotid artery.
- It is innervated by the **glossopharyngeal nerve**.
- It **serves as** a reflex **pressoreceptor mechanism**
- contains receptors that monitor changes in blood pressure

Carotid Body

- Is a small structure that lies **posterior to the point of bifurcation** of the CCA.
- It is innervated by the **glossopharyngeal nerve & Vagus**.
- The carotid body is a **chemoreceptor**, responsible for detecting changes in blood chemistry, primarily oxygen & CO2 content.

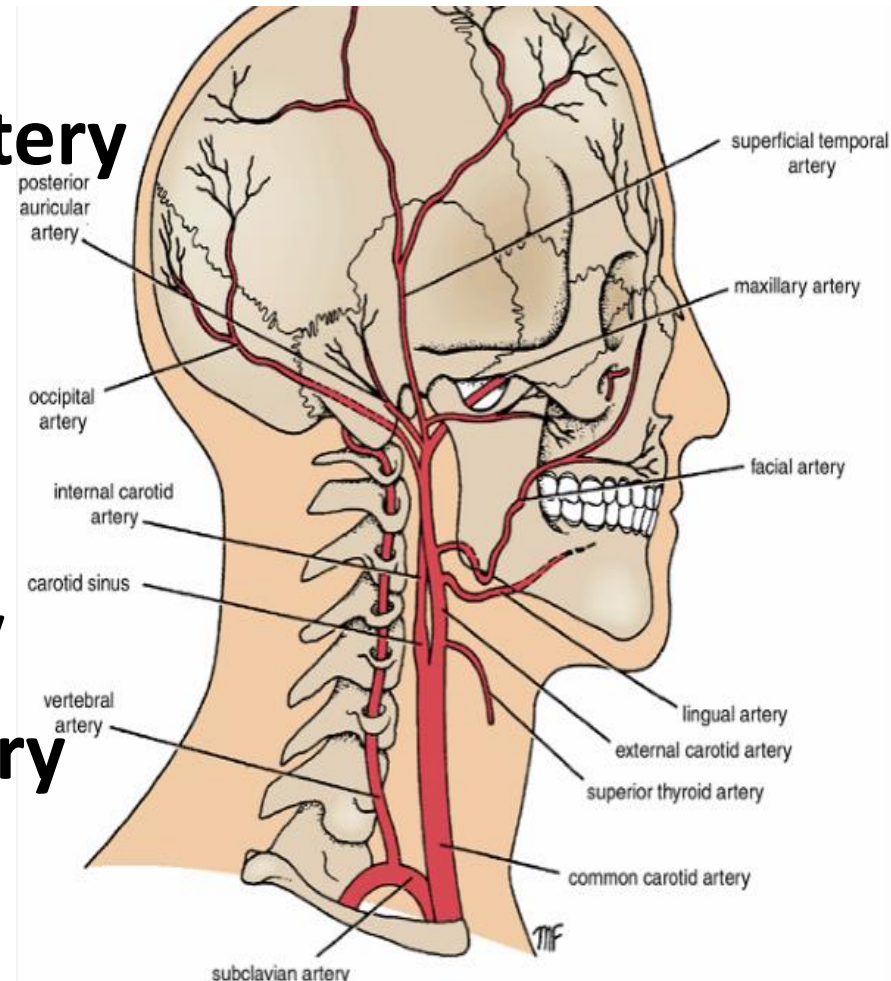


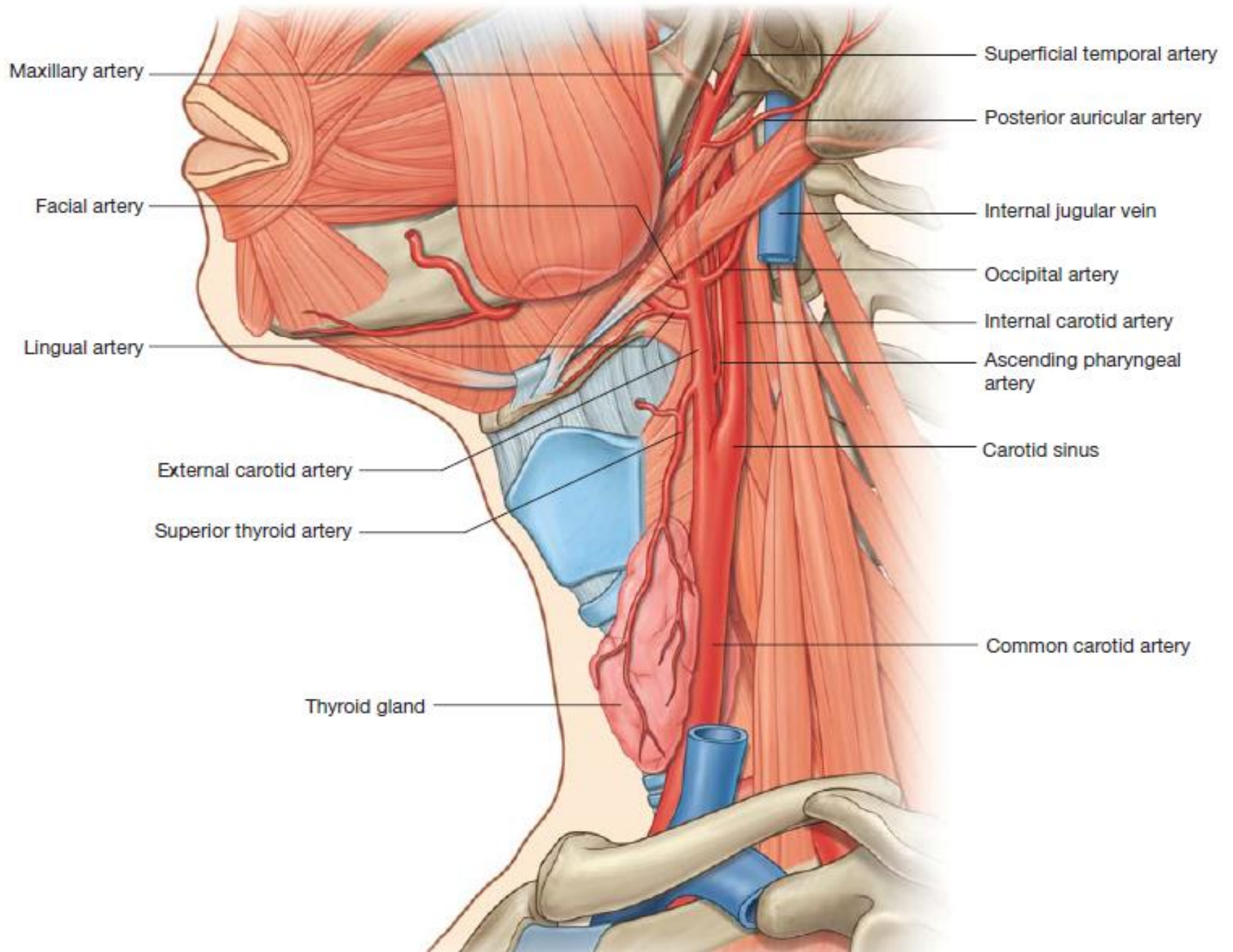
External Carotid Artery ECA

- **Begins at** level of upper border of thyroid cartilage.
- **Terminates** in the substance of the parotid gland behind the neck of the mandible by **dividing into superficial temporal & maxillary arteries**.
- **It supplies** structures in the neck, face & scalp, the tongue & the maxilla.
- Close to its origin, the artery emerges from undercover of the SCM muscle, where its **pulsations can be felt**.
- At first, it lies medial to the internal carotid artery, but as it ascends in the neck, it passes backward & lateral.

Branches of the ECA

- Superior thyroid artery
- Ascending pharyngeal artery
- Lingual artery
- Facial artery
- Occipital artery
- Posterior auricular artery
- Superficial temporal artery
- Maxillary artery





Branches of the ECA

Mnemonic : “Some Angry Ladies Fight Off PMS.”

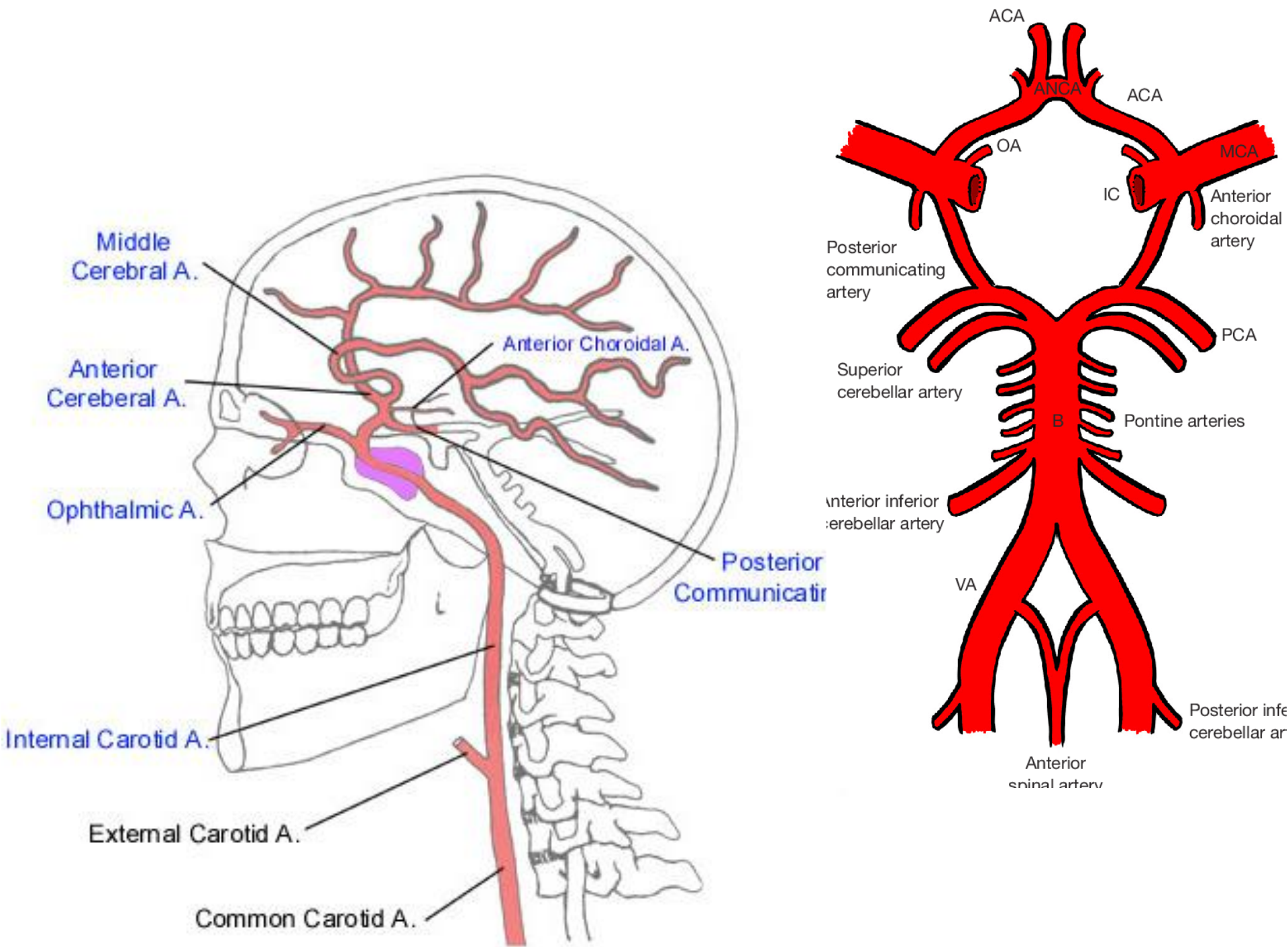
Branch	Supplies
Superior thyroid artery	Thyrohyoid muscle, internal structures of the larynx, sternocleidomastoid and cricothyroid muscles, thyroid gland
Ascending pharyngeal artery	Pharyngeal constrictors and stylopharyngeus muscle, palate, tonsil, pharyngotympanic tube, meninges in posterior cranial fossa
Lingual artery	Muscles of the tongue, palatine tonsil, soft palate, epiglottis, floor of mouth, sublingual gland
Facial artery	All structures in the face from the inferior border of the mandible anterior to the masseter muscle to the medial corner of the eye, the soft palate, palatine tonsil, pharyngotympanic tube, submandibular gland
Occipital artery	Sternocleidomastoid muscle, meninges in posterior cranial fossa, mastoid cells, deep muscles of the back, posterior scalp
Posterior auricular artery	Parotid gland and nearby muscles, external ear and scalp posterior to ear, middle and inner ear structures
Superficial temporal artery	Parotid gland and duct, masseter muscle, lateral face, anterior part of external ear, temporalis muscle, parietal and temporal fossae
Maxillary artery	External acoustic meatus, lateral and medial surface of tympanic membrane, temporomandibular joint, dura mater on lateral wall of skull and inner table of cranial bones, trigeminal ganglion and dura in vicinity, mylohyoid muscle, mandibular teeth, skin on chin, temporalis muscle, outer table of bones of skull in temporal fossa, structures in infratemporal fossa, maxillary sinus, upper teeth and gingivae, infra-orbital skin, palate, roof of pharynx, nasal cavity

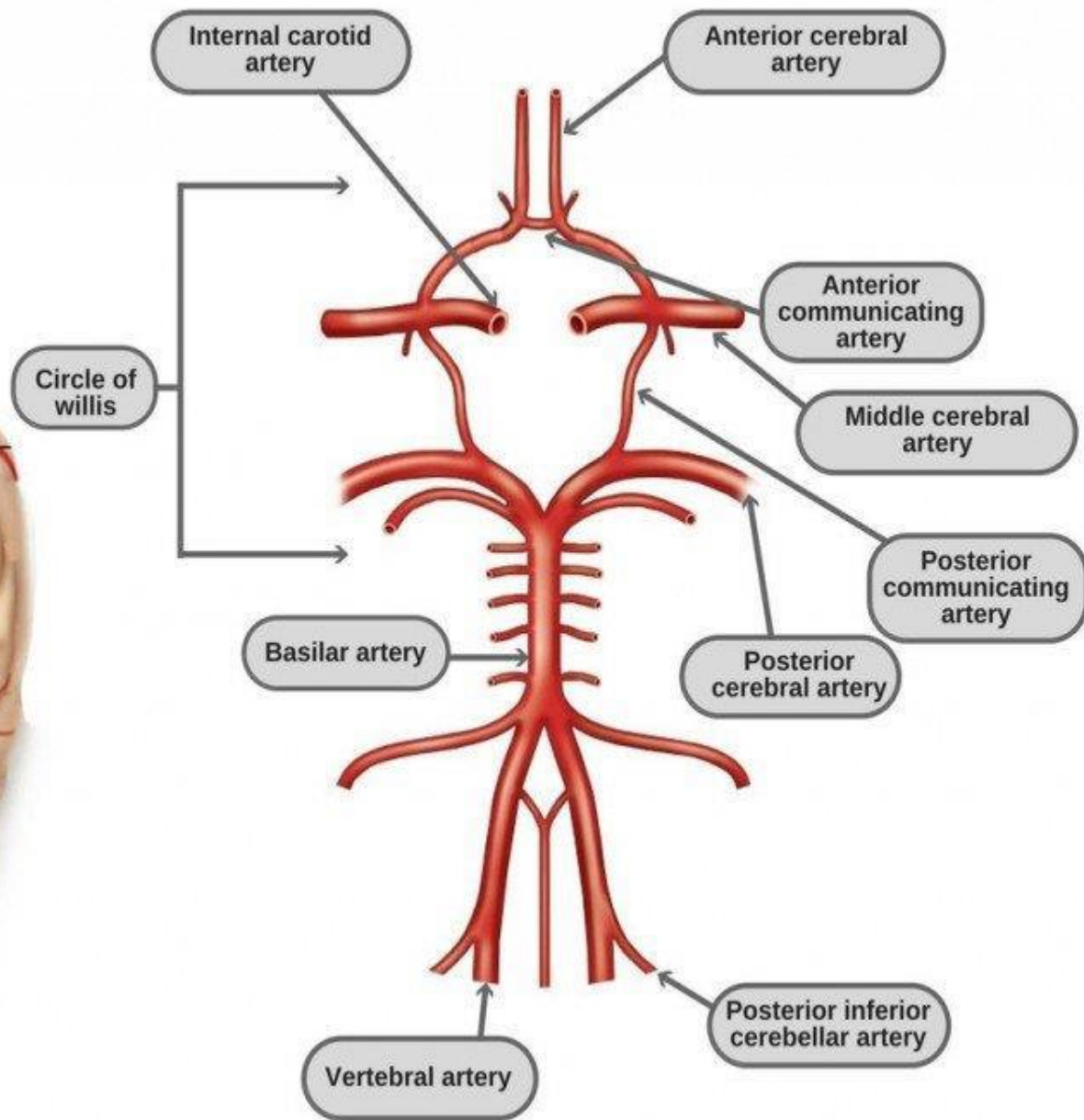
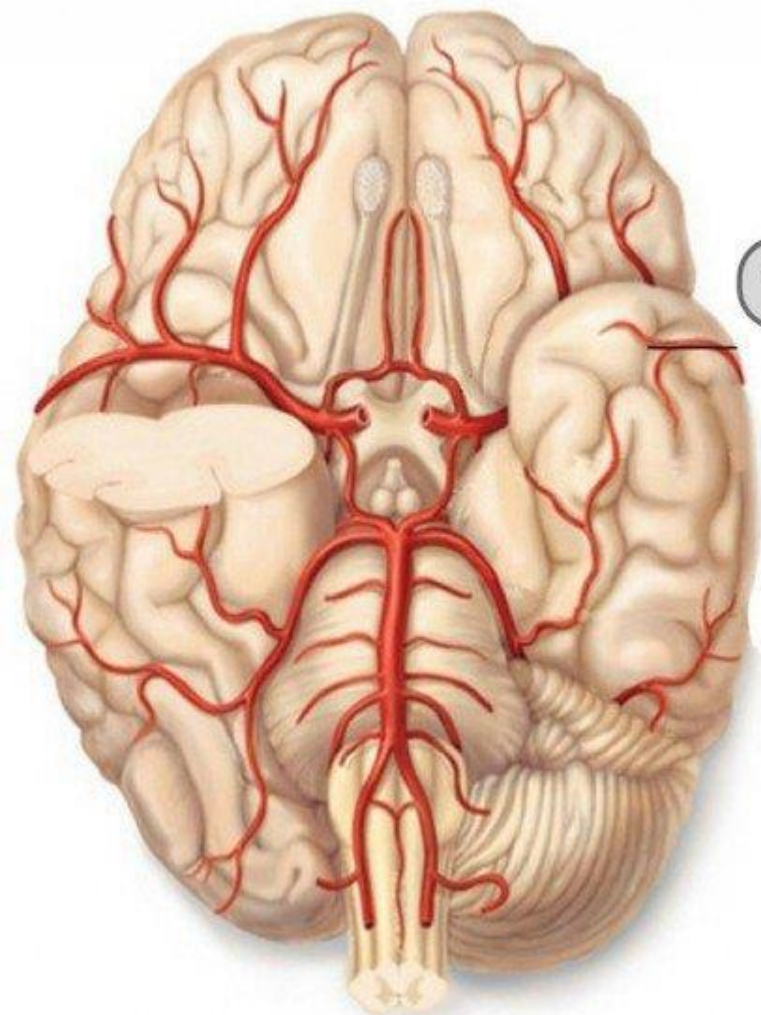
Internal Carotid Artery ICA

- It ascends in the neck embedded in the carotid sheath
- At first it lies superficially; then passes deep to **parotid gland**.
- **leaves the neck** by passing into the **cranial cavity** through the **carotid canal** in the petrous part of the temporal bone.
- **Terminates by** dividing into the **anterior & the middle cerebral arteries**.
- **It supplies** the brain, eye, forehead & part of the nose.

➤ Branches of ICA

- ✓ No branches in the neck.
- ✓ Ophthalmic Artery
- ✓ Posterior Communicating Artery
- ✓ Anterior Cerebral Artery
- ✓ Middle Cerebral Artery





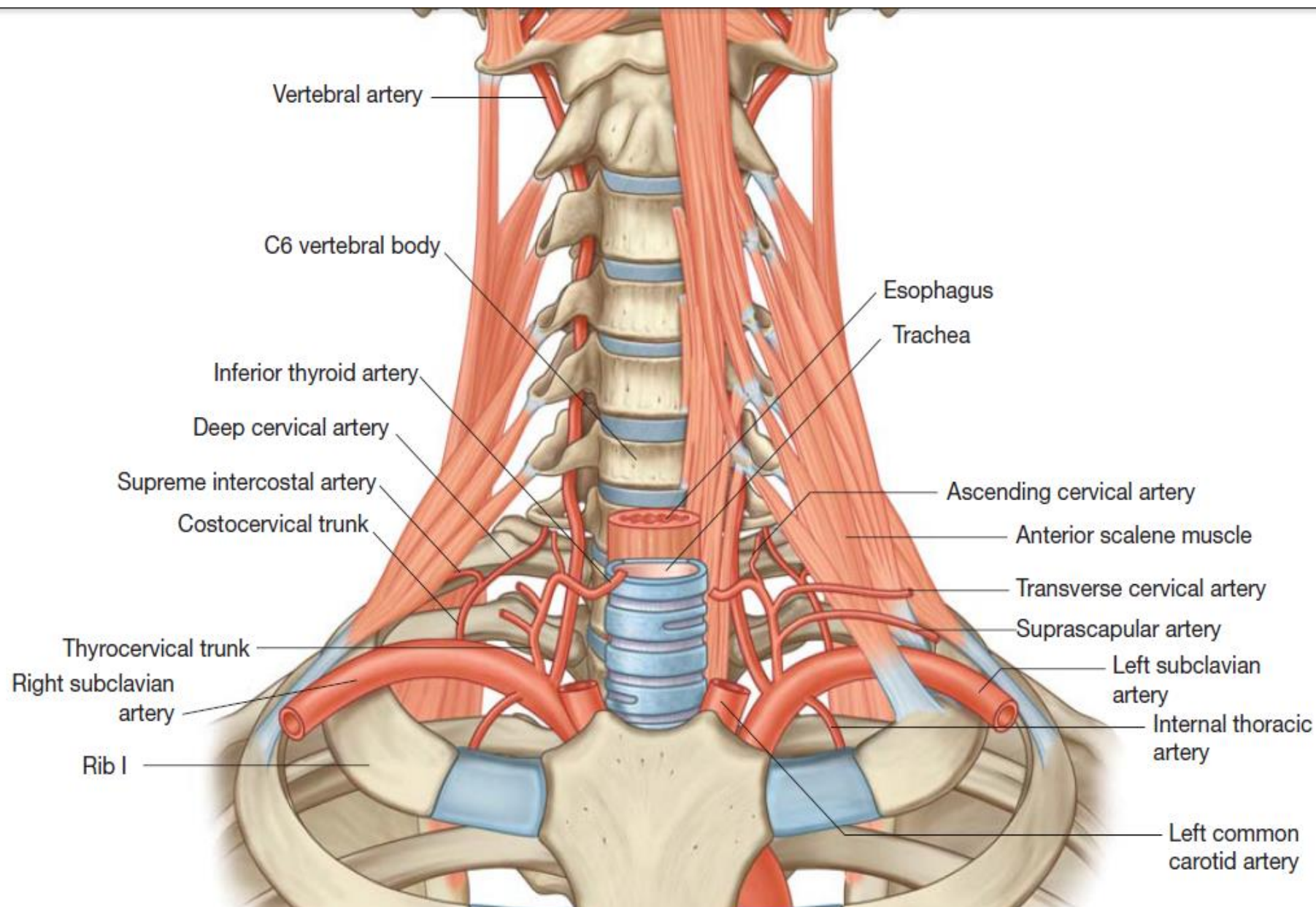
Subclavian Arteries

Right Subclavian Artery

- ✓ Arises from the **brachiocephalic artery**, behind the right sternoclavicular joint.
- ✓ Arches upward & laterally over the pleura & between the scalenus anterior & medius.
- ✓ At the outer border of 1st rib, it becomes the **axillary artery**.

Left Subclavian Artery

- ✓ Arises from the **arch of aorta**.
- ✓ Ascends to the root of the neck & arches laterally in a manner similar to that of the right subclavian artery.
- ✓ **The scalenus anterior muscle** passes anterior to the artery on each side & divides it into **three parts, the 1st, 2nd & 3rd parts**.



Parts of Subclavian Artery

□ 1st part :

- Extends from the origin of the subclavian artery to the medial border of the **scalenus anterior muscle**.

➤ **Branches :**

- ✓ Vertebral artery.
- ✓ Thyrocervical trunk.
- ✓ Internal thoracic artery gives
 - Inferior thyroid a
 - Transverse cervical a

□ 2nd part

- passes posterior to the anterior scalene muscle
- Give **One** branch **Costocervical trunk**
divide into
 - ✓ Deep cervical
 - ✓ Superior intercostal artery

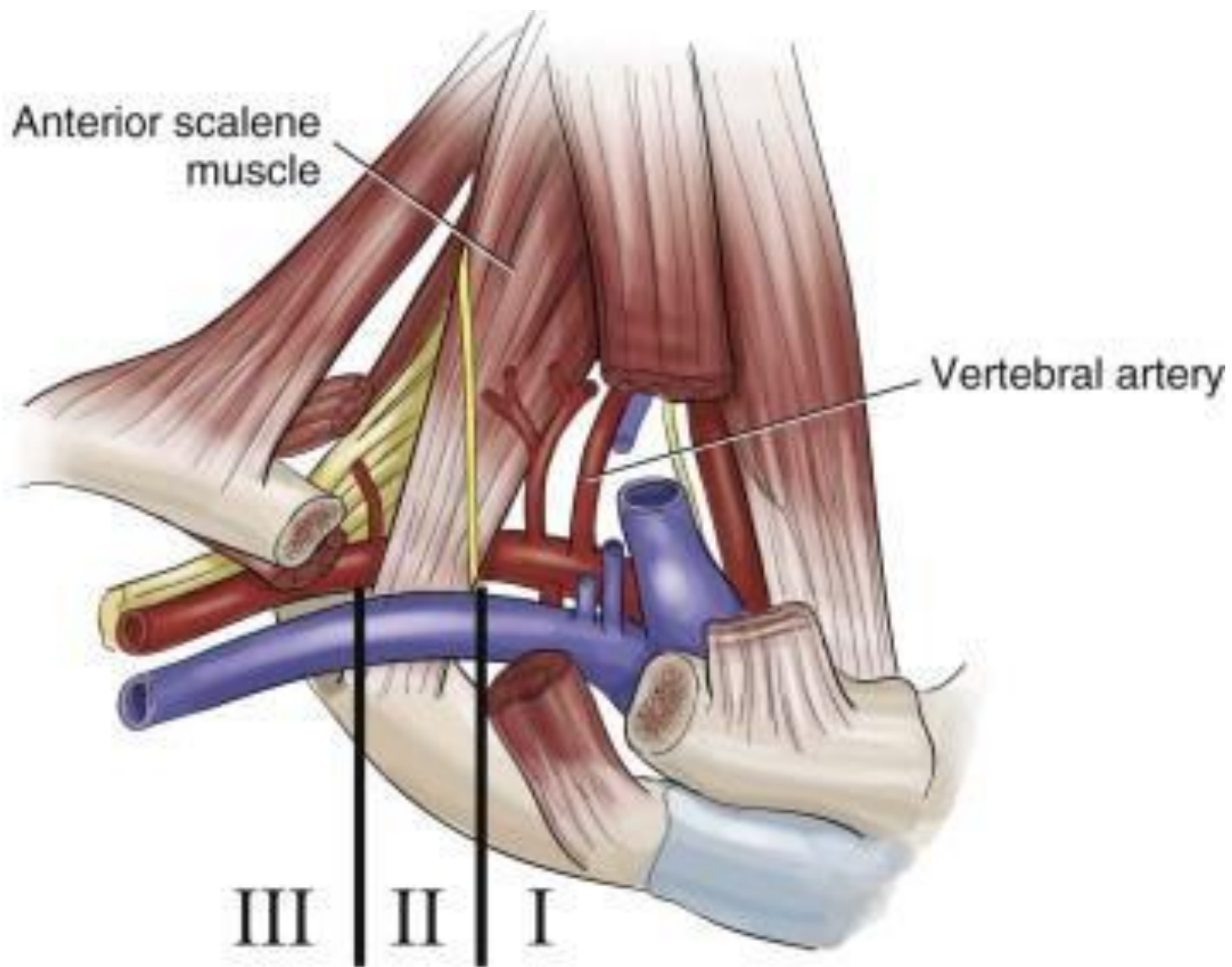
□ 3rd part

- It extends from the lateral border of the anterior scalene muscle to the lateral border of rib I where it becomes the **axillary artery** and continues into upper limb.
- Give **no** branches

Anterior scalene
muscle

Vertebral artery

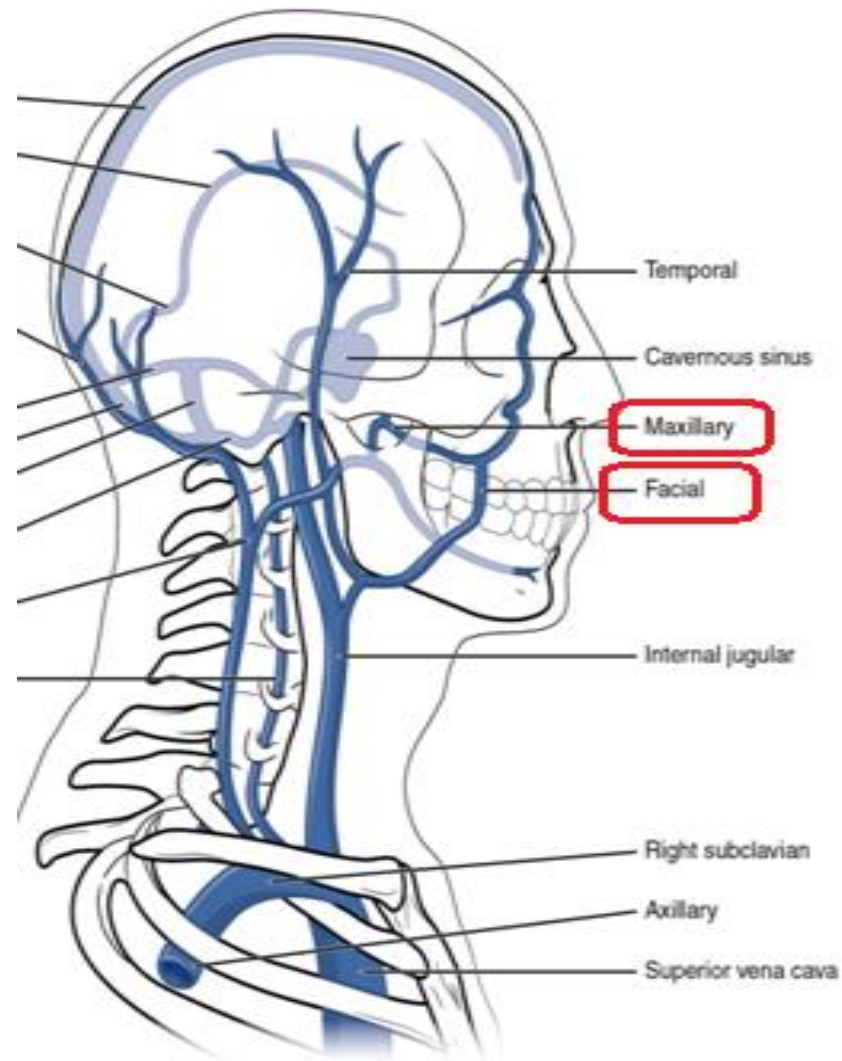
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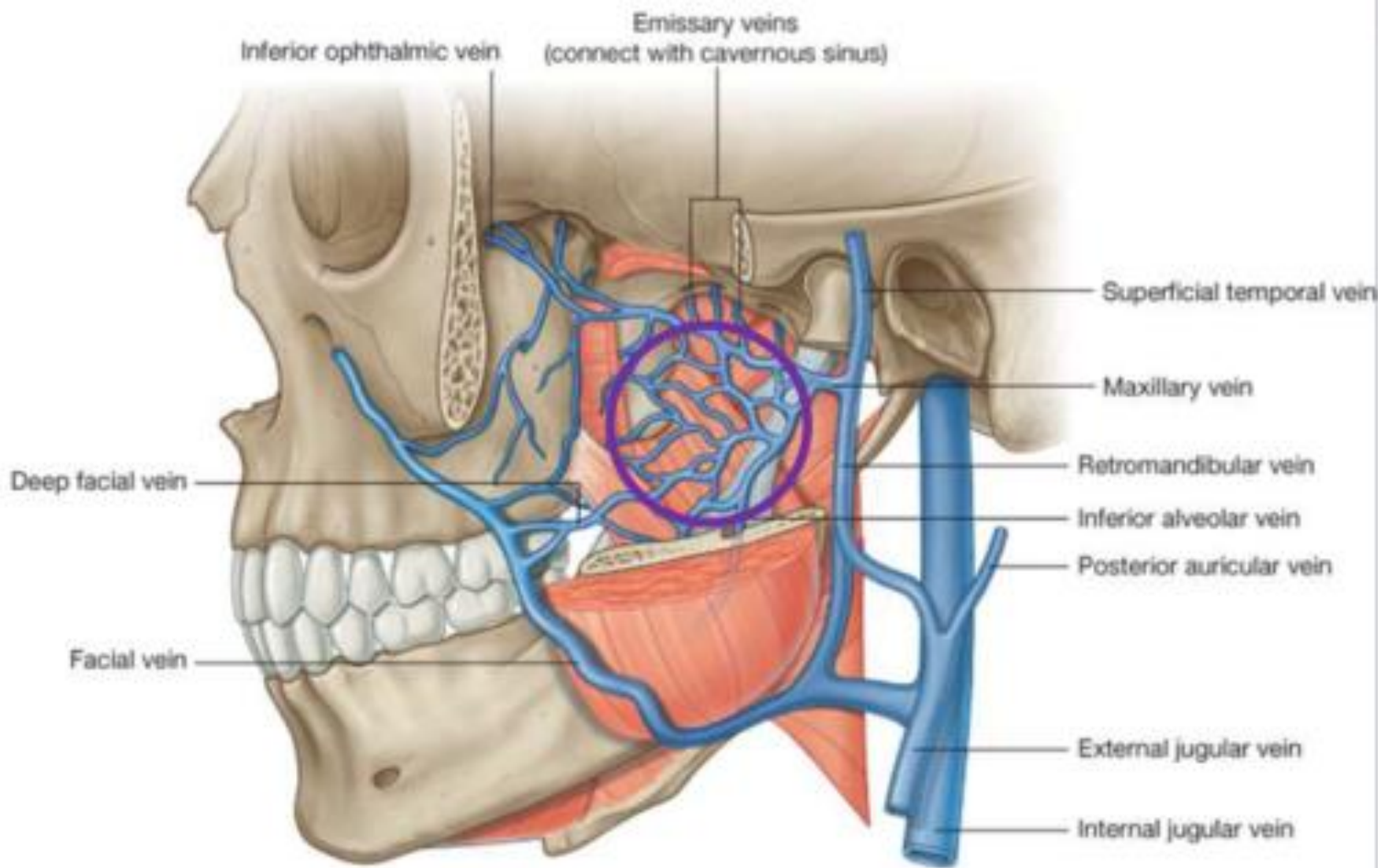


Veins of Head & Neck

Facial Vein

- **Formed at** the medial angle of eye by **union of supraorbital & supratrochlear** veins.
- It is connected through the **ophthalmic veins** with the **cavernous sinus**.
- Descends down the face with the facial artery & passes around the lateral side of the mouth & crosses the mandible.
- **Joined by** the anterior division of the retromandibular vein & **drains into** the internal jugular vein.



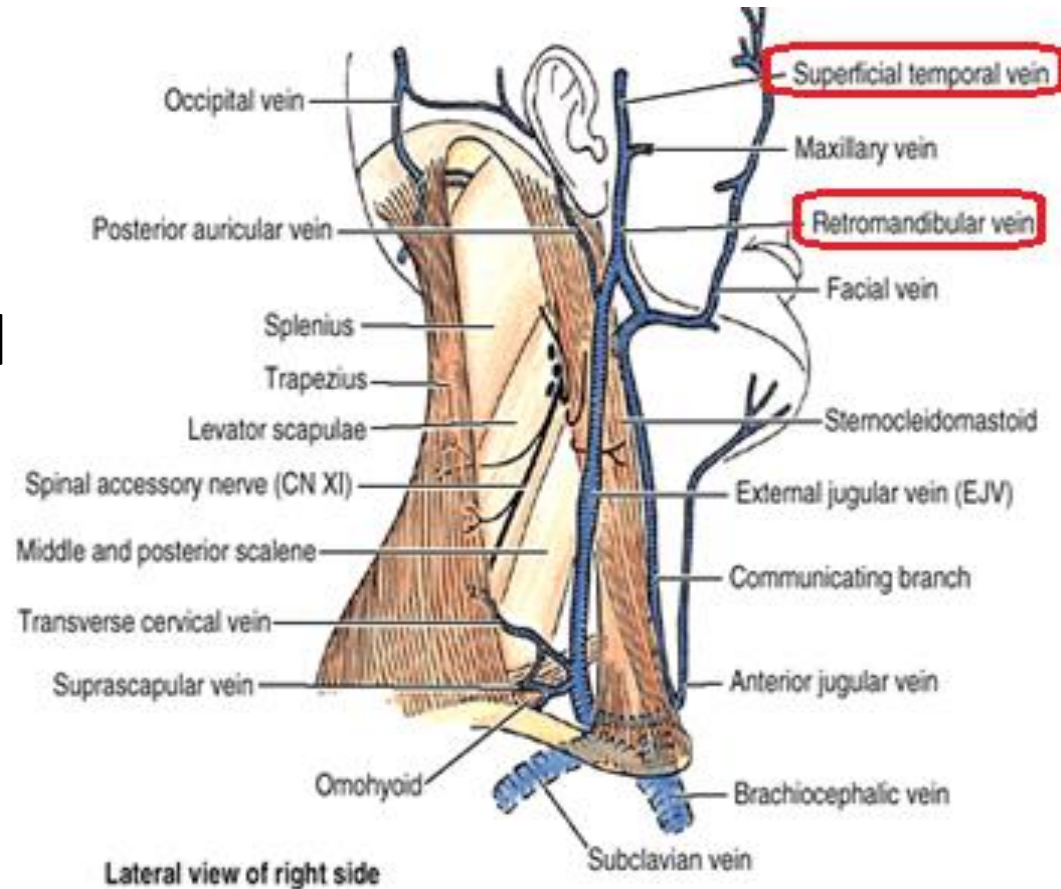


Maxillary Vein

- **Formed** in the infratemporal fossa from **pterygoid venous plexus**.
- **Joins** superficial temporal vein to **form** retromandibular vein.

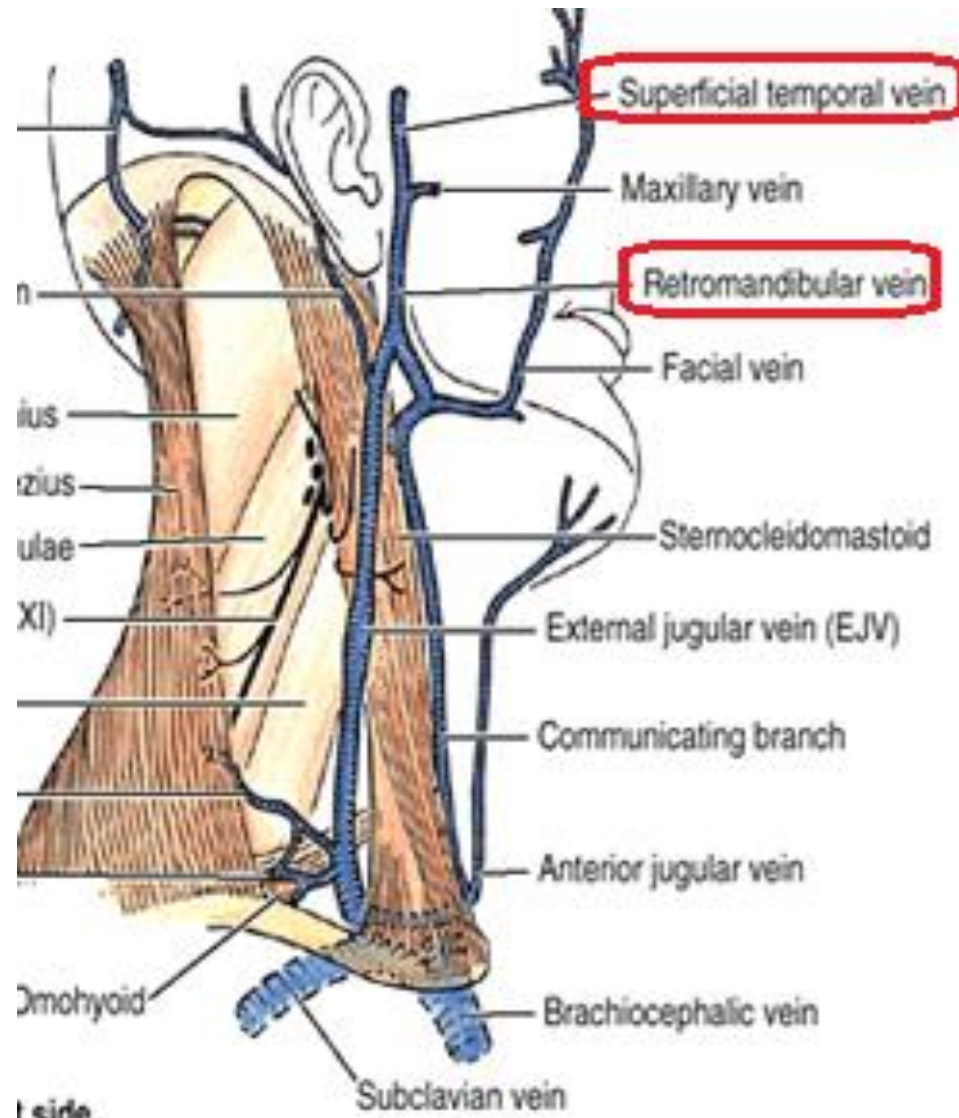
Superficial Temporal Vein

- **Formed on** the side of the scalp.
- It follows the superficial temporal artery & the auriculotemporal nerve & then enters the parotid salivary gland, where it **joins the maxillary vein to form the retromandibular vein.**



Retromandibular Vein

- **Formed** by the **union** of superficial temporal & maxillary veins.
- On leaving the parotid salivary gland, it **divides into** an anterior branch, which joins the facial vein & posterior branch, which joins the posterior auricular vein to **form** the **external jugular vein**.



➤ External Jugular Vein

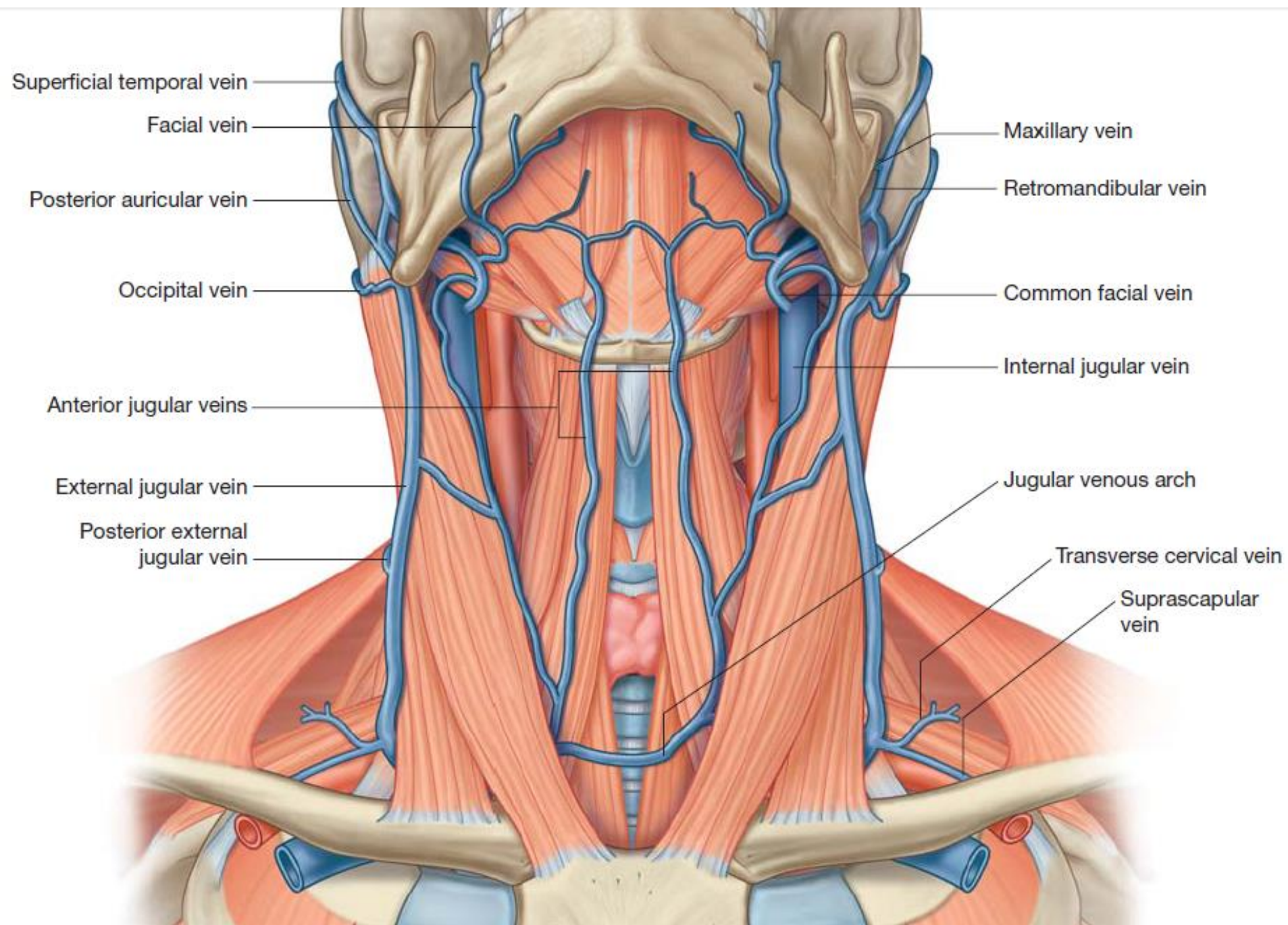
- **Formed** behind the angle of the jaw by the **union** of the posterior auricular with the posterior division of retromandibular vein
- It descends across the SCM muscle & beneath the platysma muscle & **drains into** the **subclavian** vein behind the clavicle.

➤ Tributaries

- Posterior external jugular vein.
- Transverse cervical vein.
- Suprascapular vein & Anterior jugular vein.

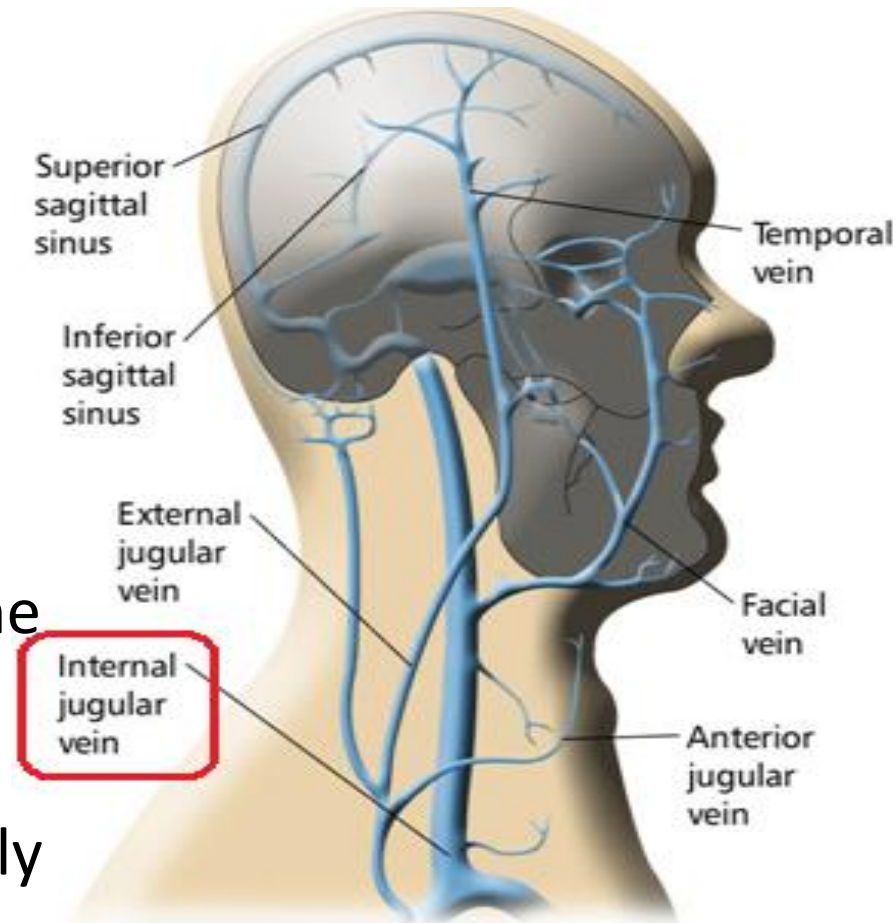
➤ Anterior Jugular Vein

- The anterior jugular vein descends in the front of the neck close to the midline.
- Just above the sternum, it is **joined to the opposite vein by the jugular arch**.
- It joins the **external jugular** vein deep to the SCM muscle.



Internal Jugular Vein

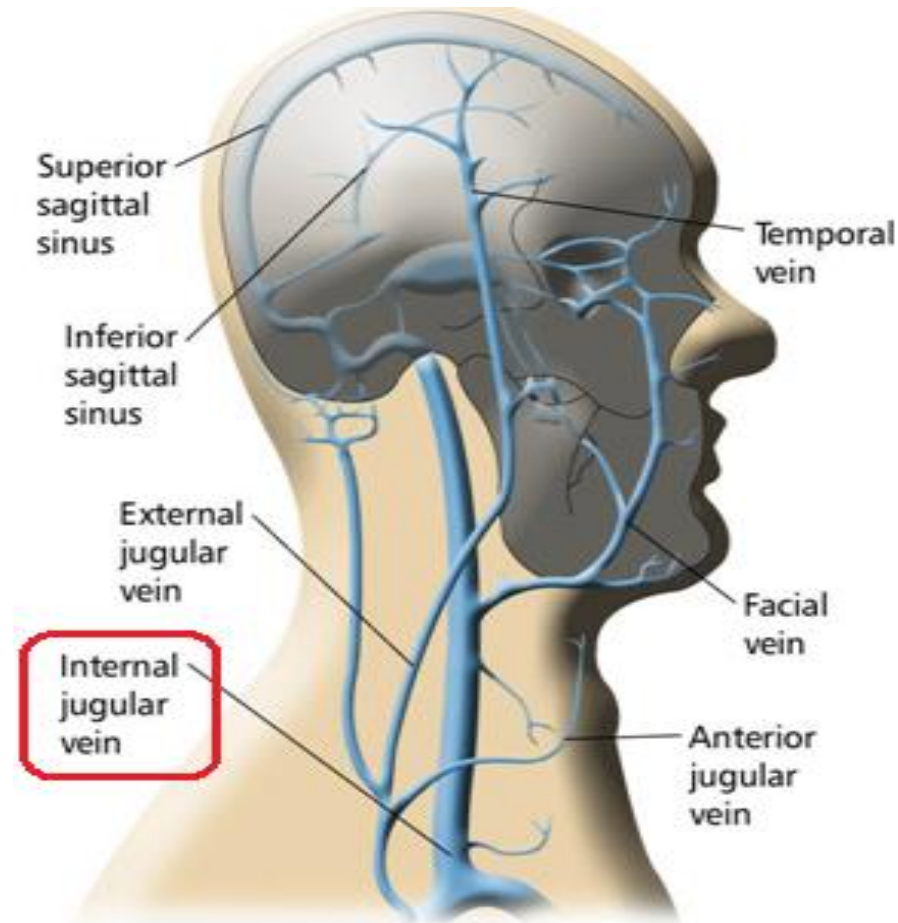
- **Receives blood from the brain, face & neck.**
- **It starts as a continuation of the sigmoid sinus & leaves the skull through the jugular foramen.**
- **Descends in the carotid sheath.**
- **It ends by joining the subclavian vein behind the medial end of the clavicle to form the brachiocephalic vein.**
- **Throughout its course, it is closely related to the deep cervical lymph nodes.**

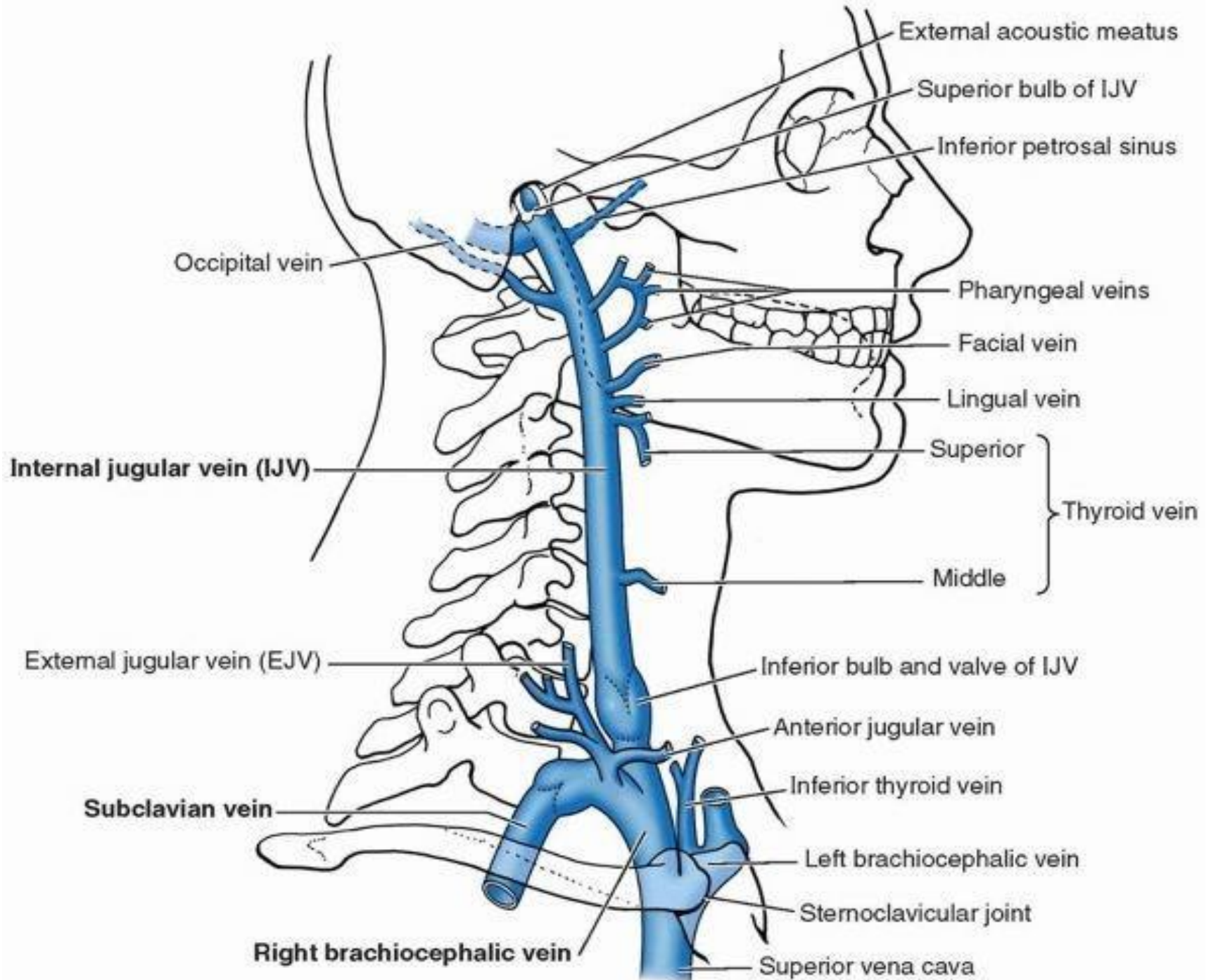


Internal Jugular Vein

➤ Tributaries

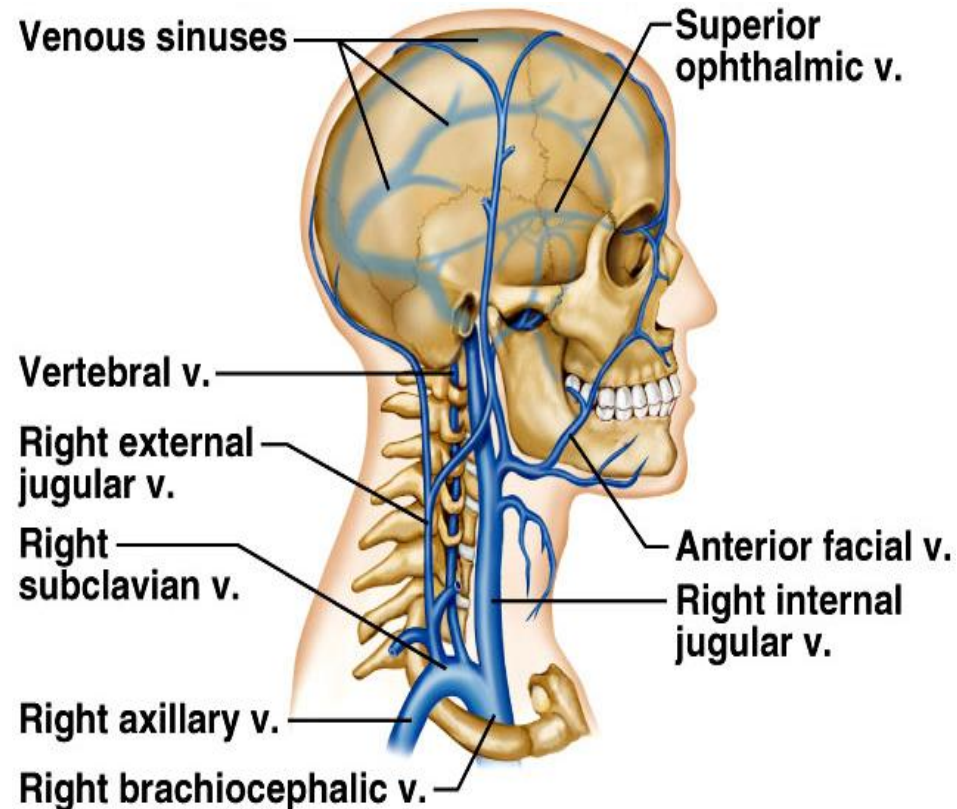
- ✓ Inferior petrosal sinus.
- ✓ Facial vein.
- ✓ Pharyngeal veins.
- ✓ Lingual vein.
- ✓ Superior thyroid vein
- ✓ Middle thyroid vein.





Subclavian Vein

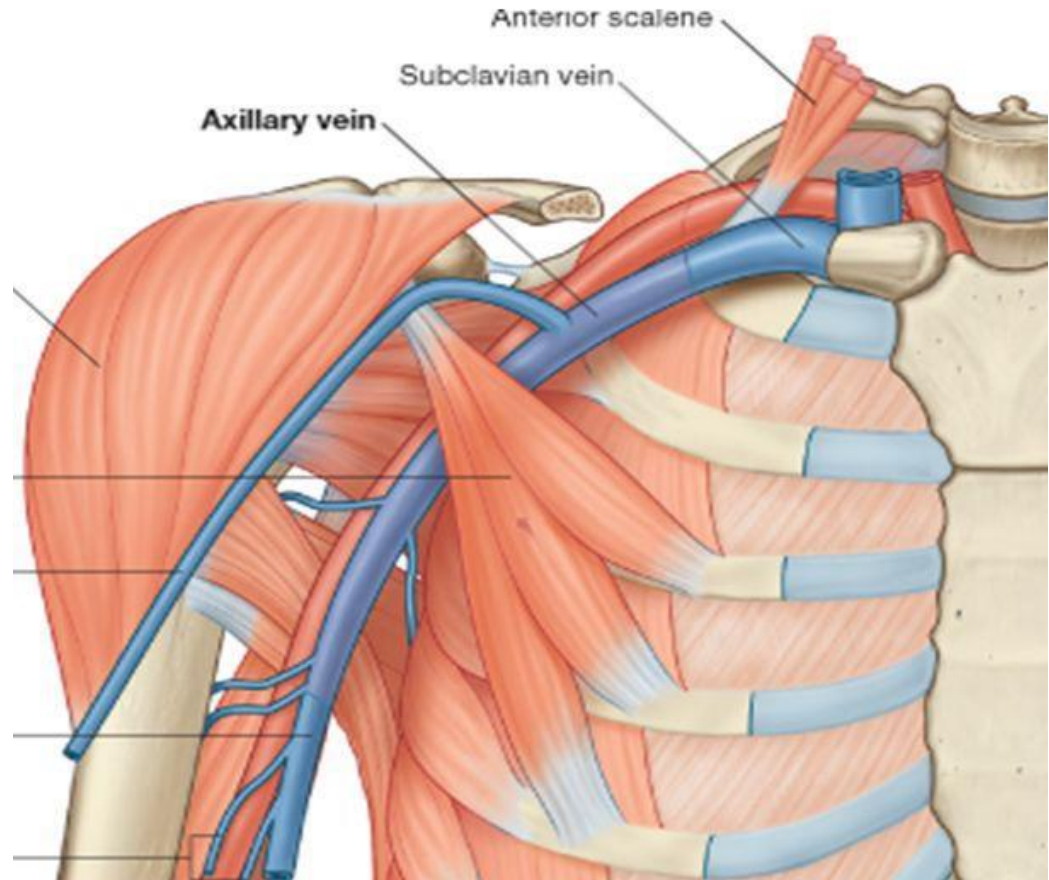
- Is a **continuation** of the **axillary vein** at the outer border of 1st rib.
- **It joins** the internal **jugular vein** to form the **brachiocephalic vein** & it receives the external jugular vein.
- In addition, it often receives the thoracic duct on the left side & the right lymphatic duct on the right.

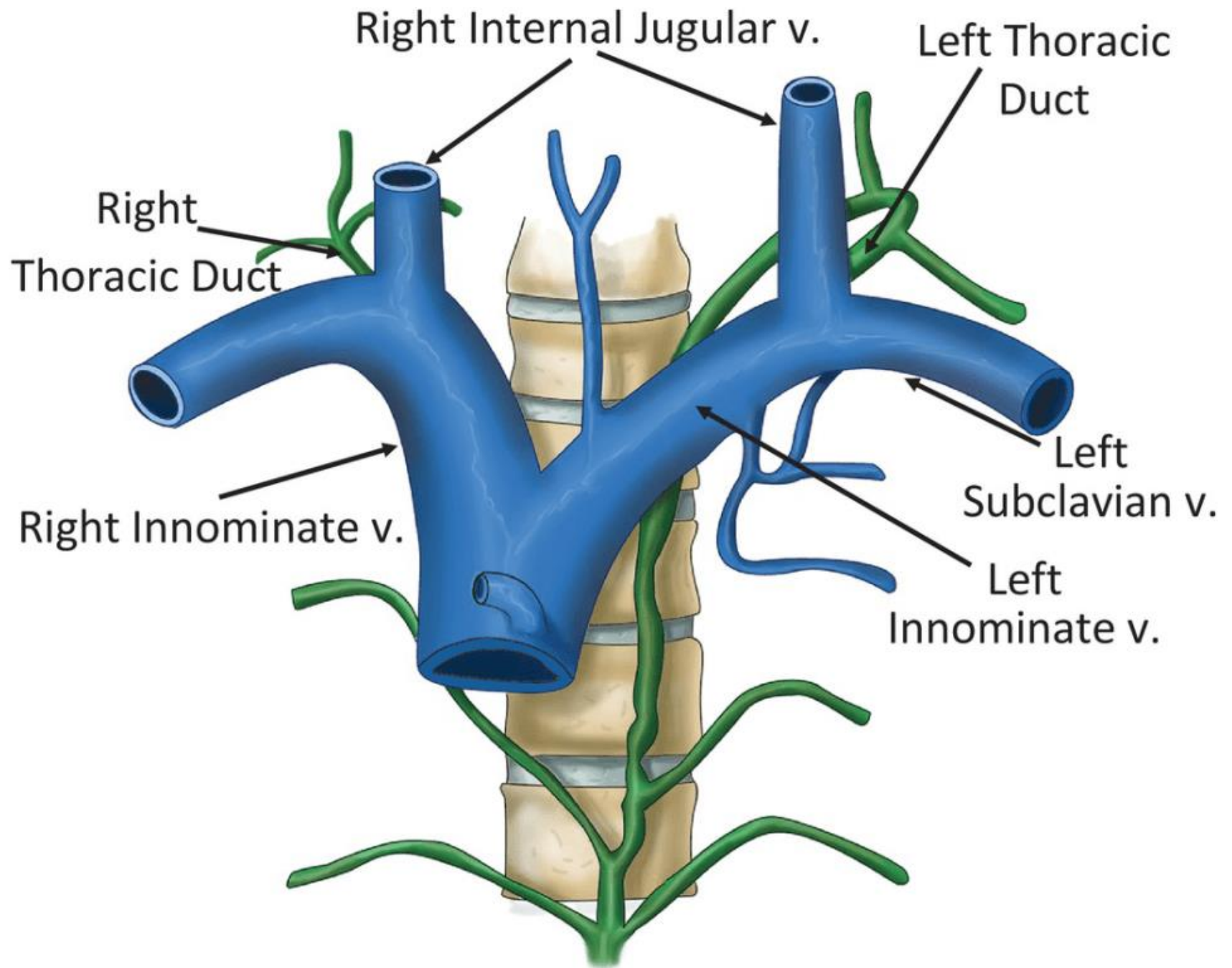


Subclavian Vein

➤ Relations

- ✓ **Anteriorly:** The clavicle
- ✓ **Posteriorly:** scalenus anterior muscle & the phrenic nerve
- ✓ **Inferiorly:** The upper surface of the first rib.





Lymph Nodes of head & neck

❑ Horizontal group level I

- **Submental** : Tip of tongue floor of mouth, incisor teeth, gum, central part of lower lip.
- **Submandibular** : Front of scalp , upper , lower lip , sinuses , upper , lower teeth, anterior two thirds of tongue, floor of mouth , vestibule, gum.
- **Parotid**: Scalp , Ear , Eyelid.
- **Pre auricular**: ear , antro lateral scalp
- **Post auricular**: scalp, ear
- **Occipital** : apex of post trang back of scalp and neck

Lymph Nodes of head & neck

❑ Vertical group

- **Anterior cervical**: skin, superficial tissue of front of neck.
- **Superficial cervical** : skin of mandible , parotid , ear lobule.
- **Posterior cervical** : posterior triangle.
- **Laryngeal, and tracheal nodes** : larynx pre, para tracheal nodes from trachea, thyroid.
- **Deep cervical from skull** : root of neck Upper, middle lower jugular.
- **Jugulodigastric** : Tonsil.
- **jugulo-omohyoid** : Tongue

Pre-auricular/parotid nodes

Submental nodes

Submandibular nodes

Omohyoid muscle

Jugulo-omohyoid node

Occipital nodes

Mastoid nodes

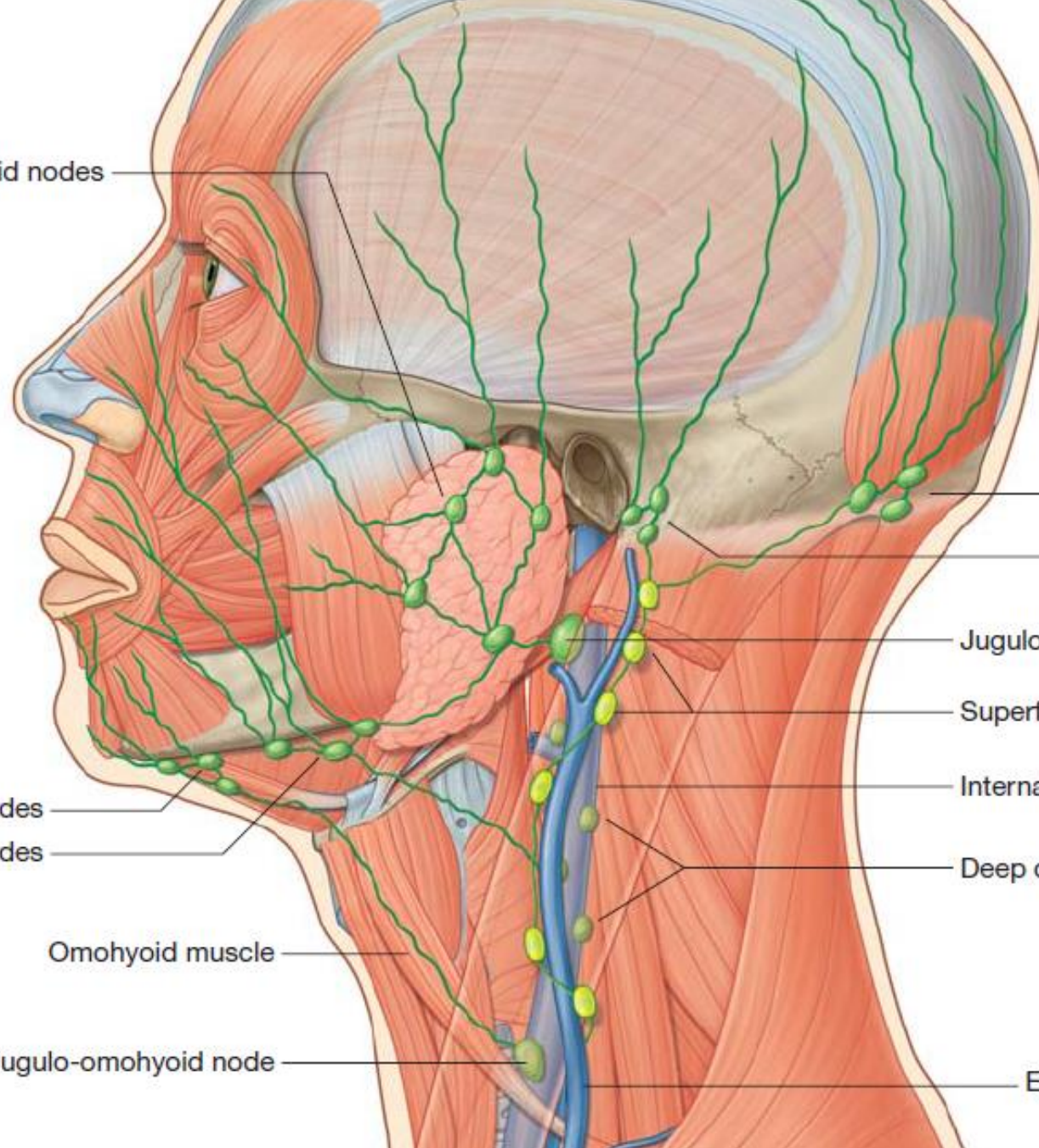
Jugulodigastric node

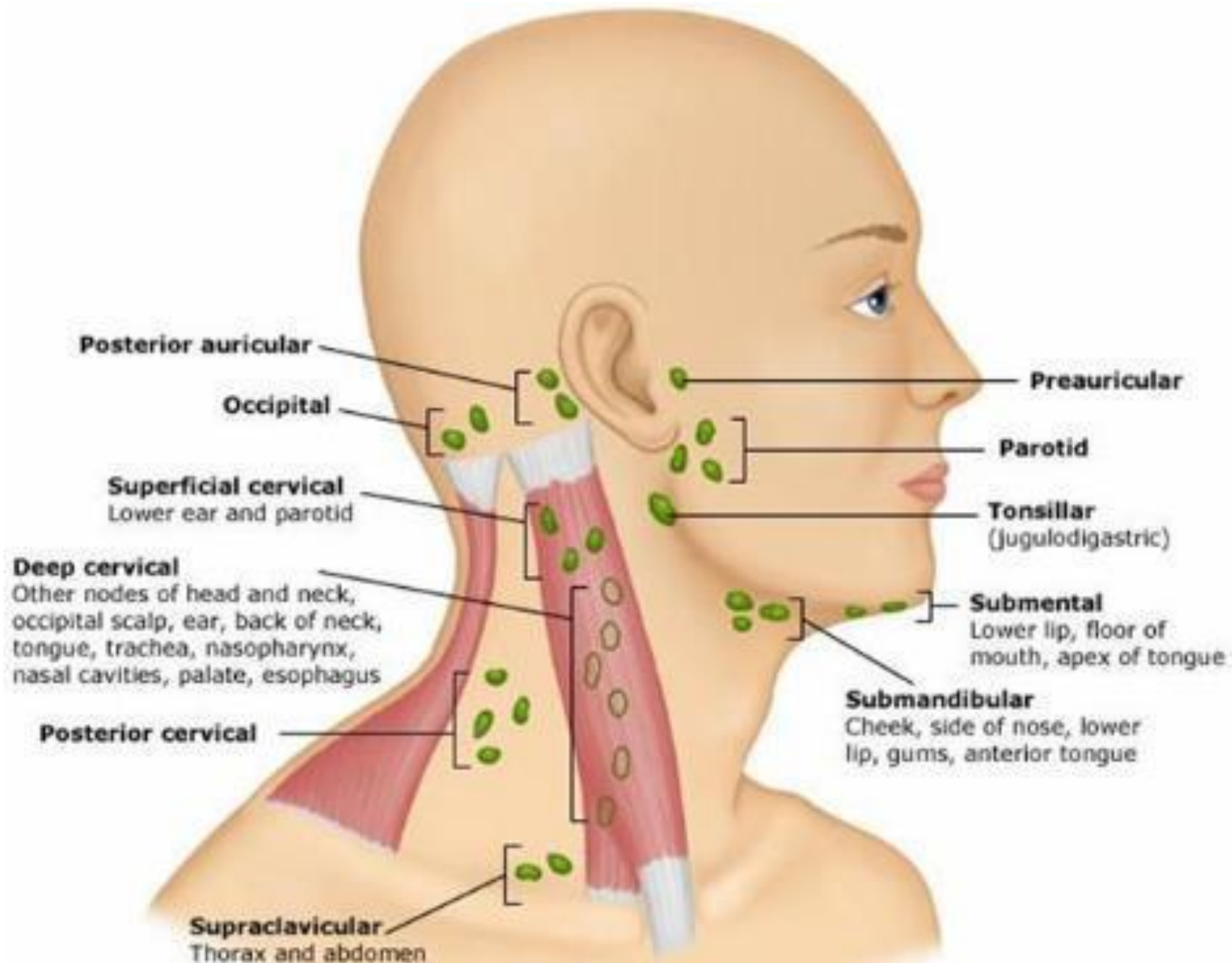
Superficial cervical nodes

Internal jugular vein

Deep cervical nodes

External jugular vein

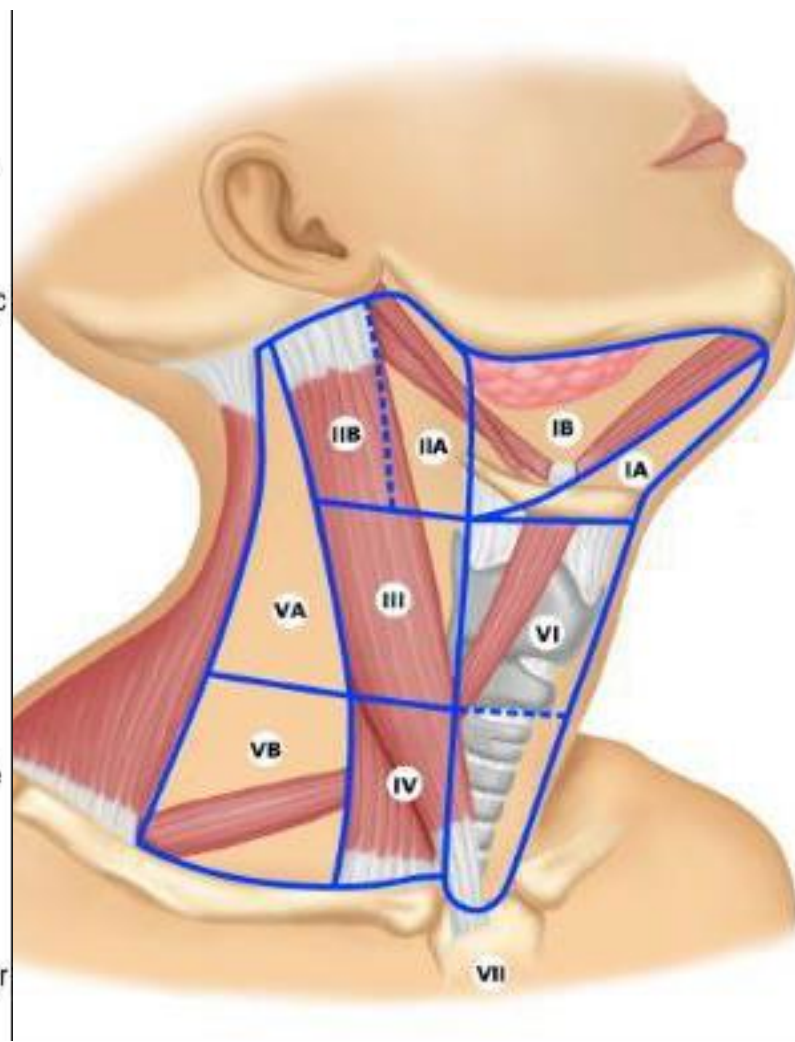
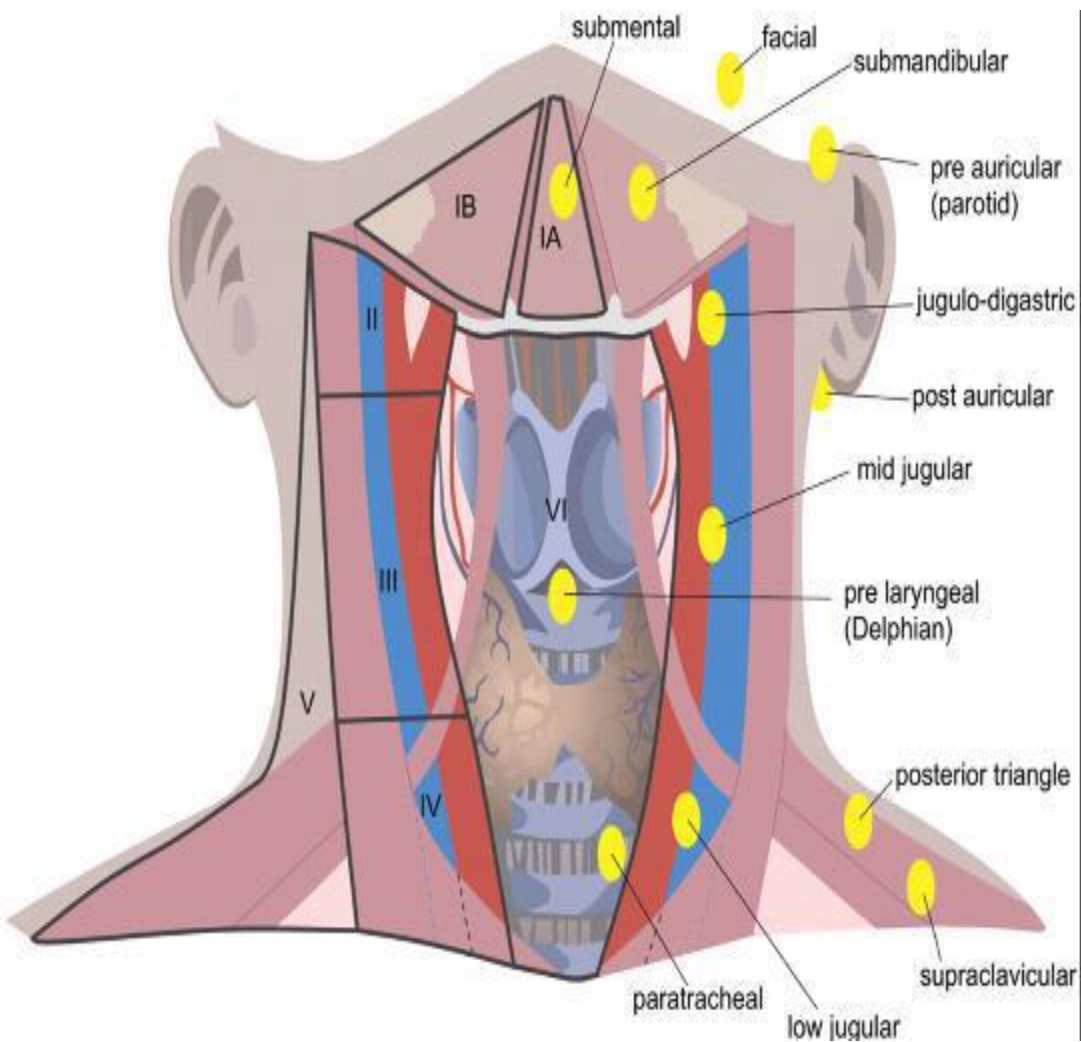




Lymph Nodes of head & neck

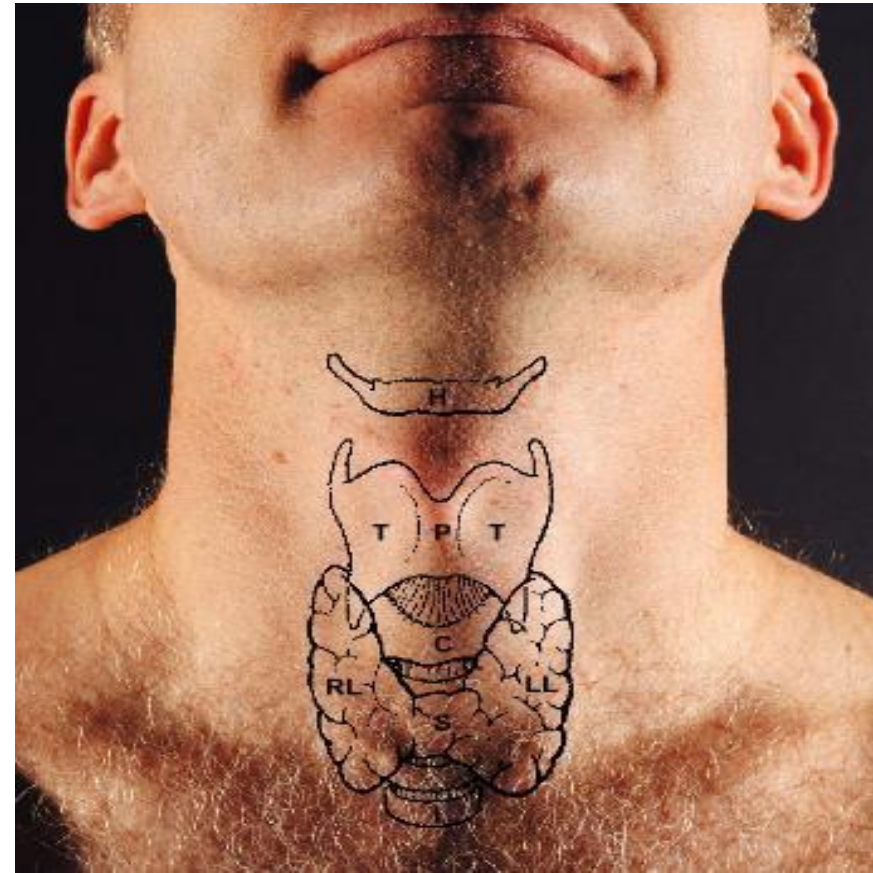
□ Levels of LN in neck

- **Level I** : from mid Submental triangle, to Submandibular gland (IA-IB)
- **Level II** : From skull base to hyoid bone.
- **Level III** : From inf hyoid to bottom of cricoid cartilage.
- **Level IV** : From bottom of cricoid to sternal notch.
- Level 2,3,4, From posterior border of SCM muscle ,anteriorly i.e in anterior triangle to just anterior to anterior border SCM muscle.
- **Level V** : Posterior triangle.
- **Level VI**: Below hyoid above sternal notch midline



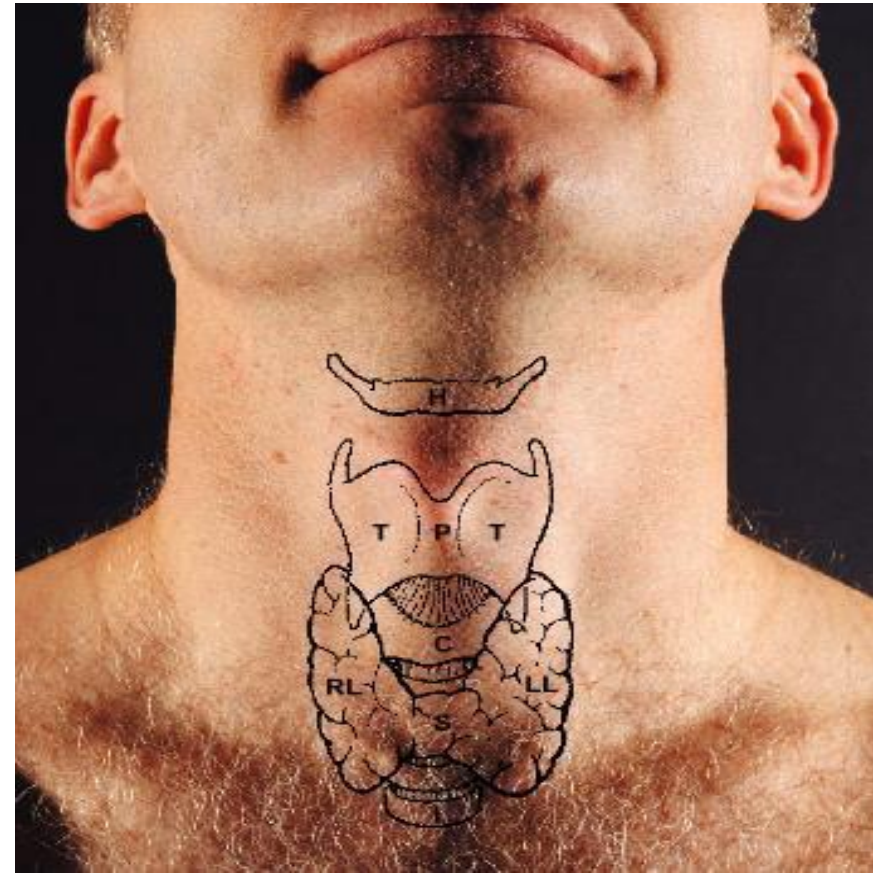
Thyroid gland

- It consists of two lateral **lobes & isthmus** , Lying deep to strap muscles
- **isthmus** that connects both lobes and crosses the 2nd and 3rd tracheal cartilages.
- The apex of each lobe rests on the thyroid cartilage, reaching its oblique line.
- The base of each lobe reaches the level of 5th or 6th tracheal ring.



Thyroid gland

- It has 2 capsules :
 - ✓ **True fibrous capsule:**
Enclosing the gland.
 - ✓ **False facial capsule:**
Derived from the pretracheal
 - ✓ The attachment of the fascial capsule to larynx(Thyroid cartilage) causes the movement of the gland up and down during the deglutition.

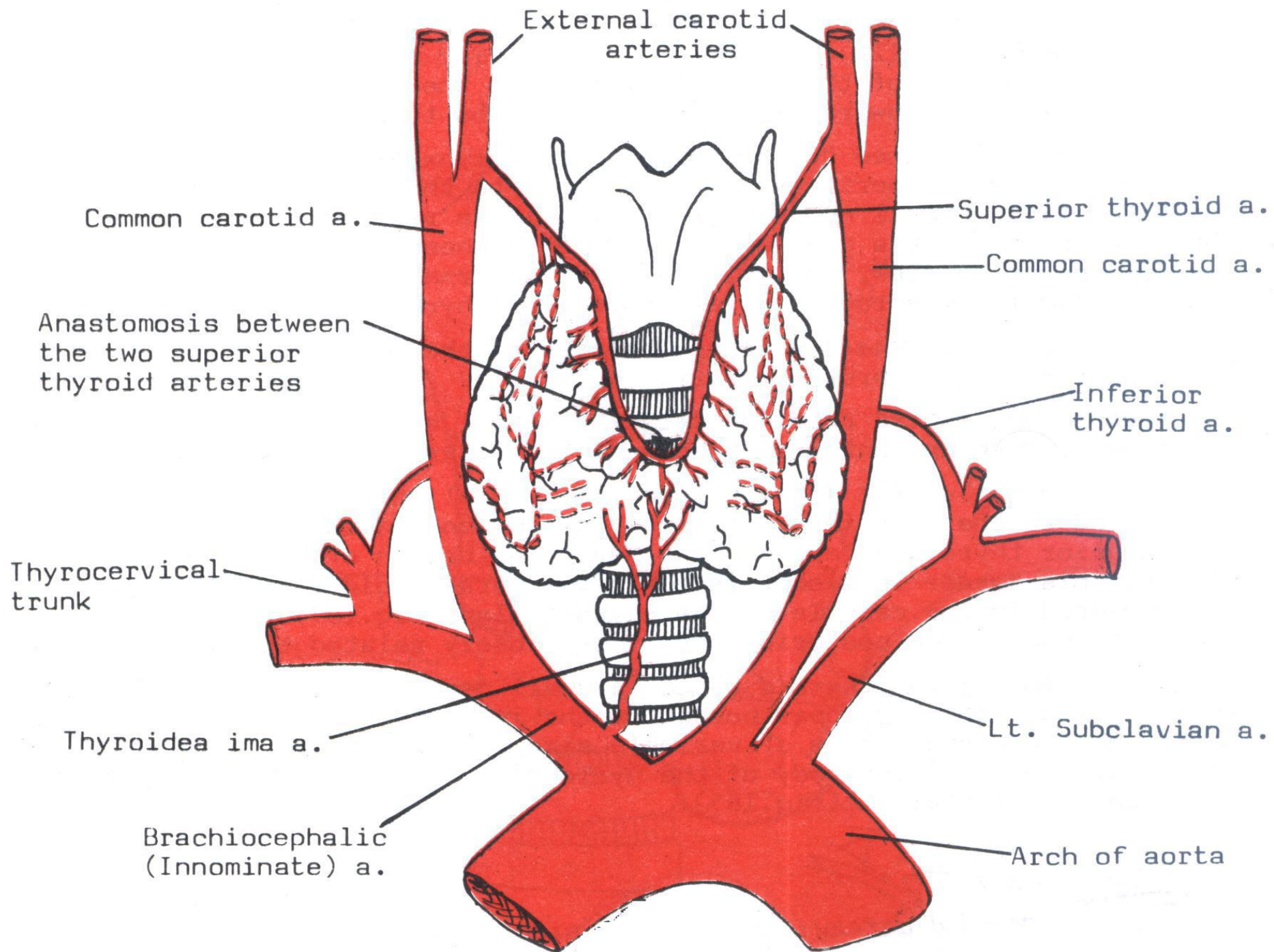


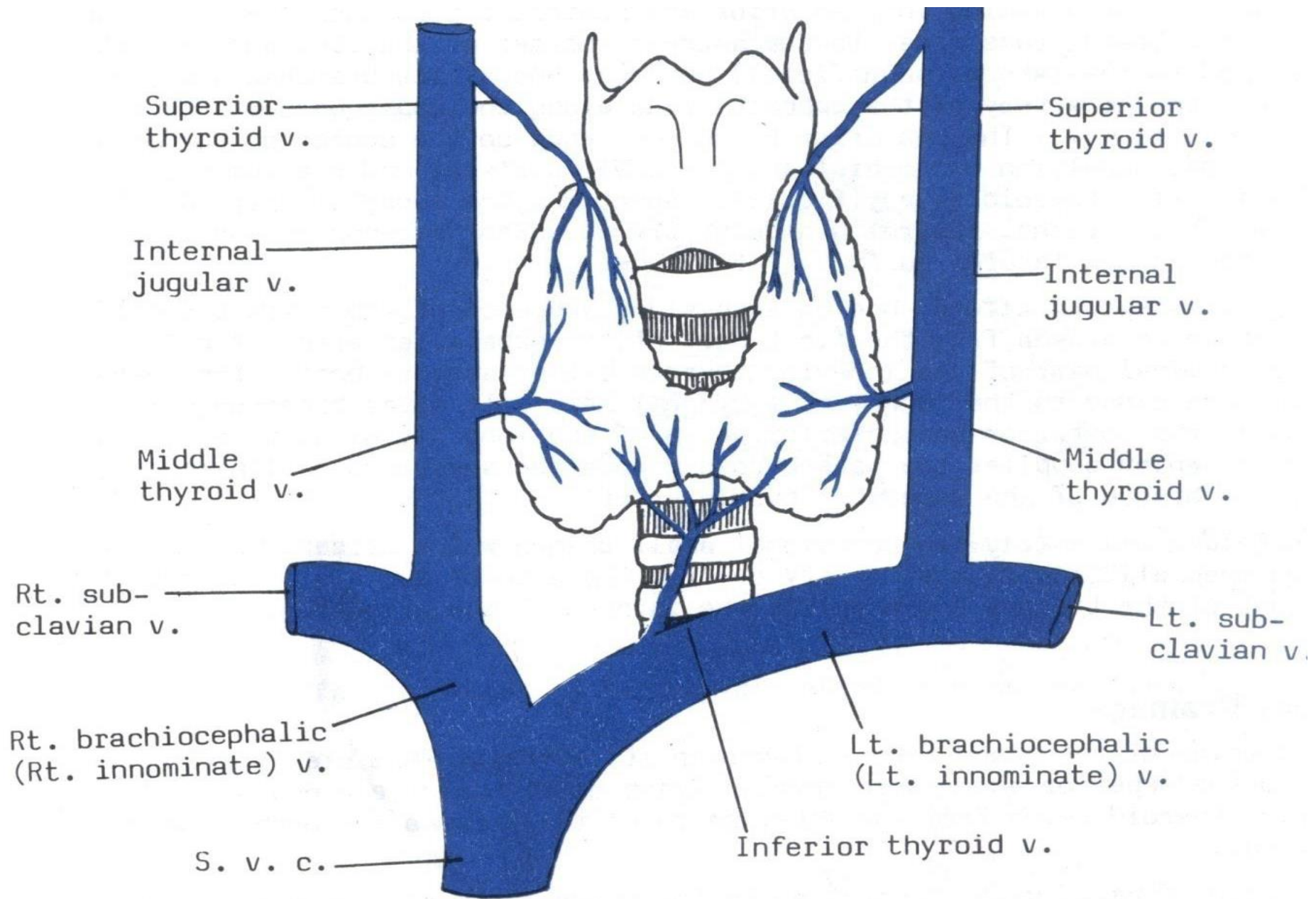
➤ Arterial supply of thyroid gland

- ✓ ***Superior thyroid artery***. The first branch of the external carotid artery
- ✓ **Inferior thyroid artery** is a branch of the **thyrocervical trunk**, which arises from the first part of the subclavian artery.
- ✓ **Thyroid ima artery** arises from the **brachiocephalic trunk** or the arch of the aorta

➤ Venous drainage of thyroid gland:

- ✓ **Superior and middle thyroid veins** drain into the internal jugular vein
- ✓ **Inferior thyroid veins** empty into the right and left brachiocephalic veins





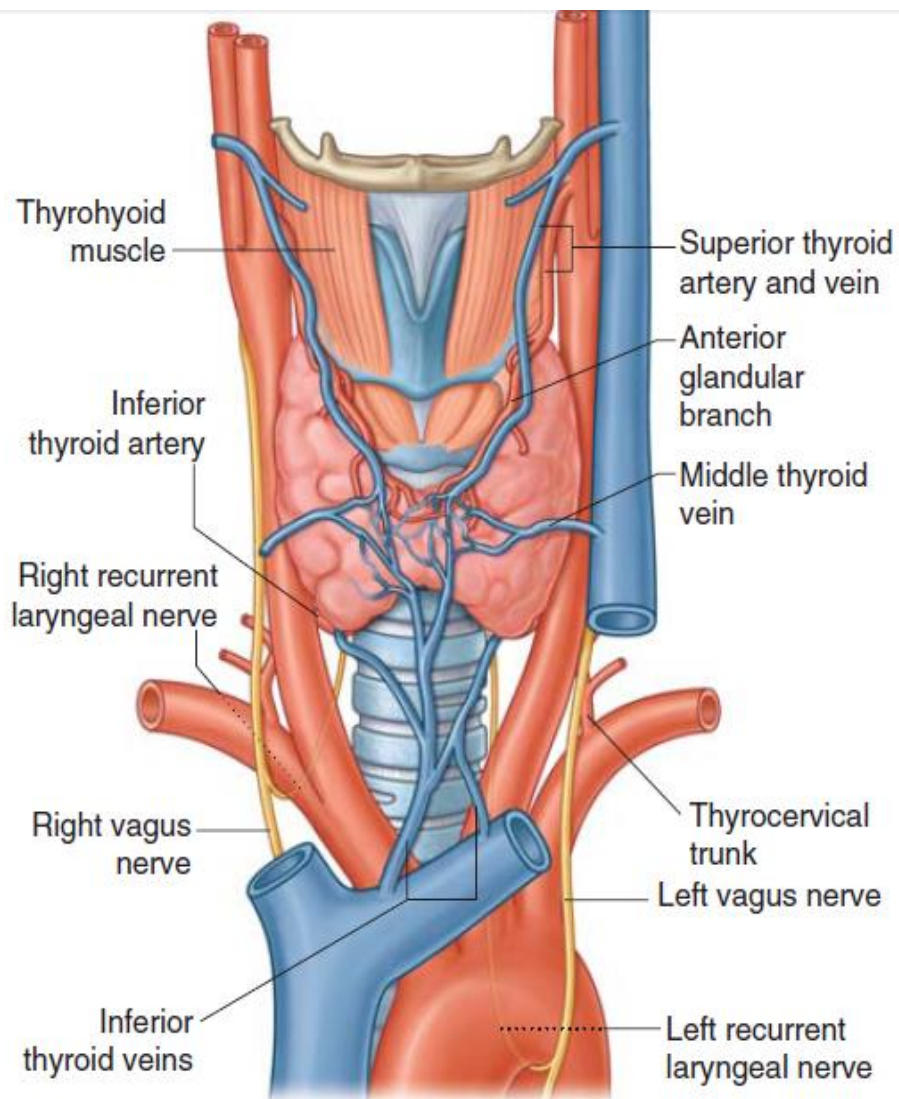


Fig. 8.170 Vasculature of the thyroid: anterior view.

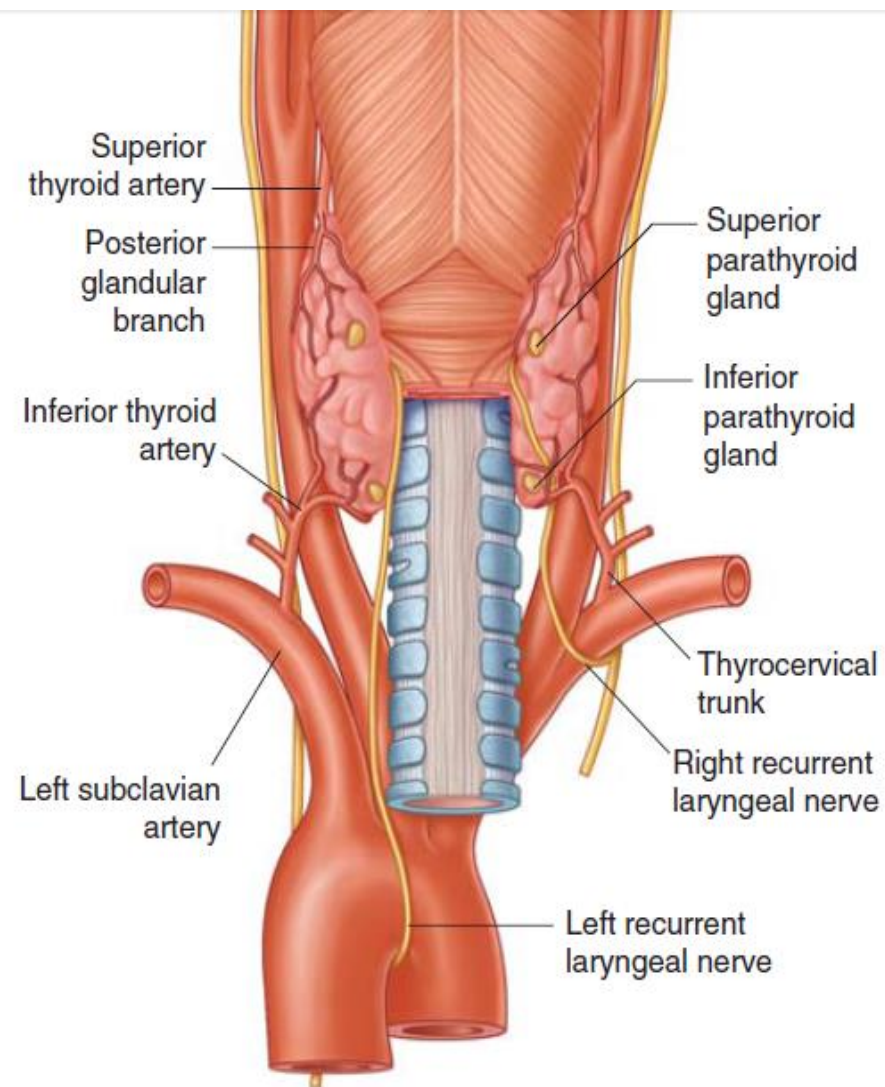


Fig. 8.171 Superior and inferior thyroid arteries and left and right recurrent laryngeal nerve: posterior view.

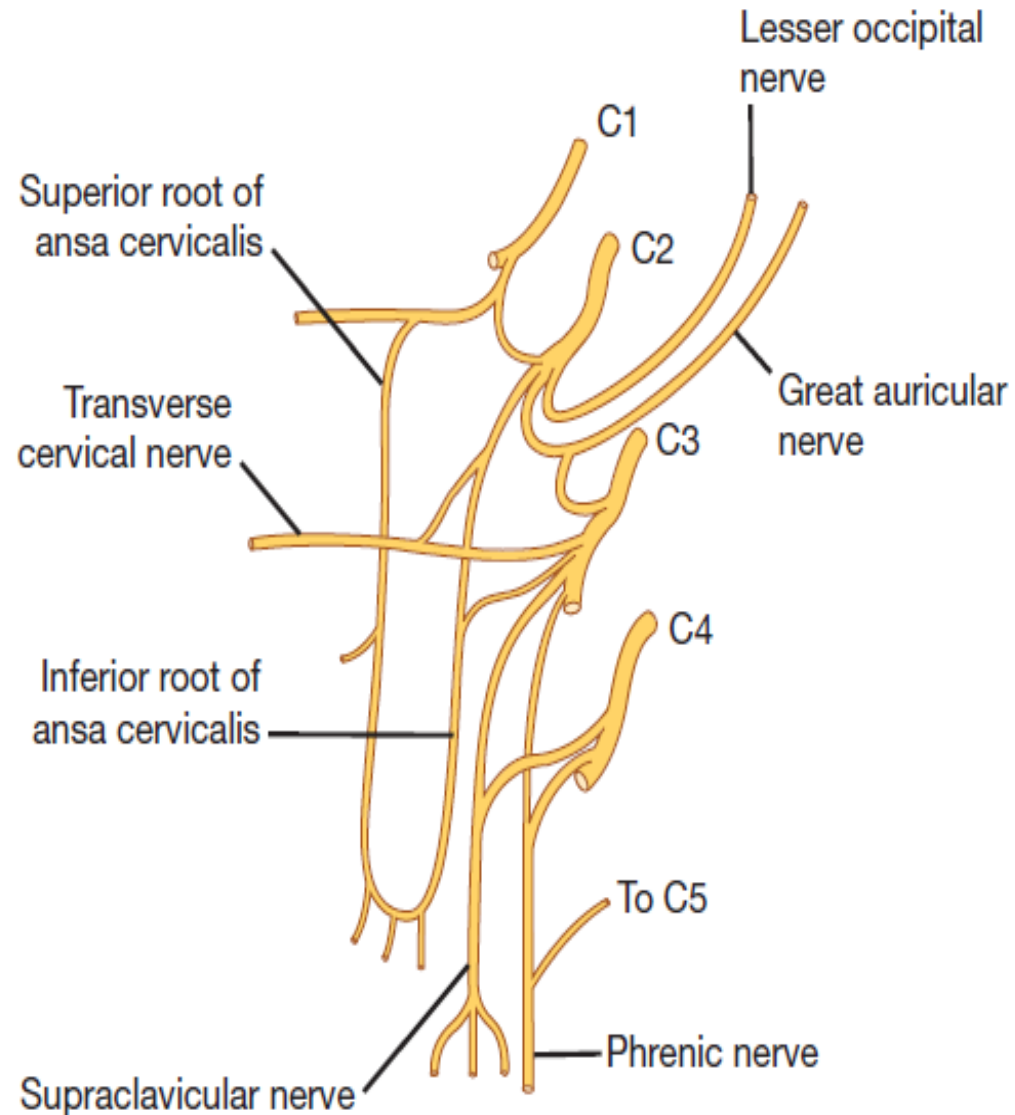
Cervical plexus

- ❑ Formed by the anterior rami of cervical nerves C2 to C4, and possibly a contribution from the anterior ramus of cervical nerve C1.
- ❑ Site: in the muscles of the floor of the posterior triangle within prevertebral layer of cervical fascia
- ❑ Consists of:
 - **muscular (or deep) branches** :
 - ✓ A major branch is the **phrenic nerve**
 - ✓ Several branches supply prevertebral and lateral vertebral muscles, including the rectus capitis anterior, rectus capitis lateralis, longus colli, and longus capitis

➤ Cutaneous (or superficial) branches

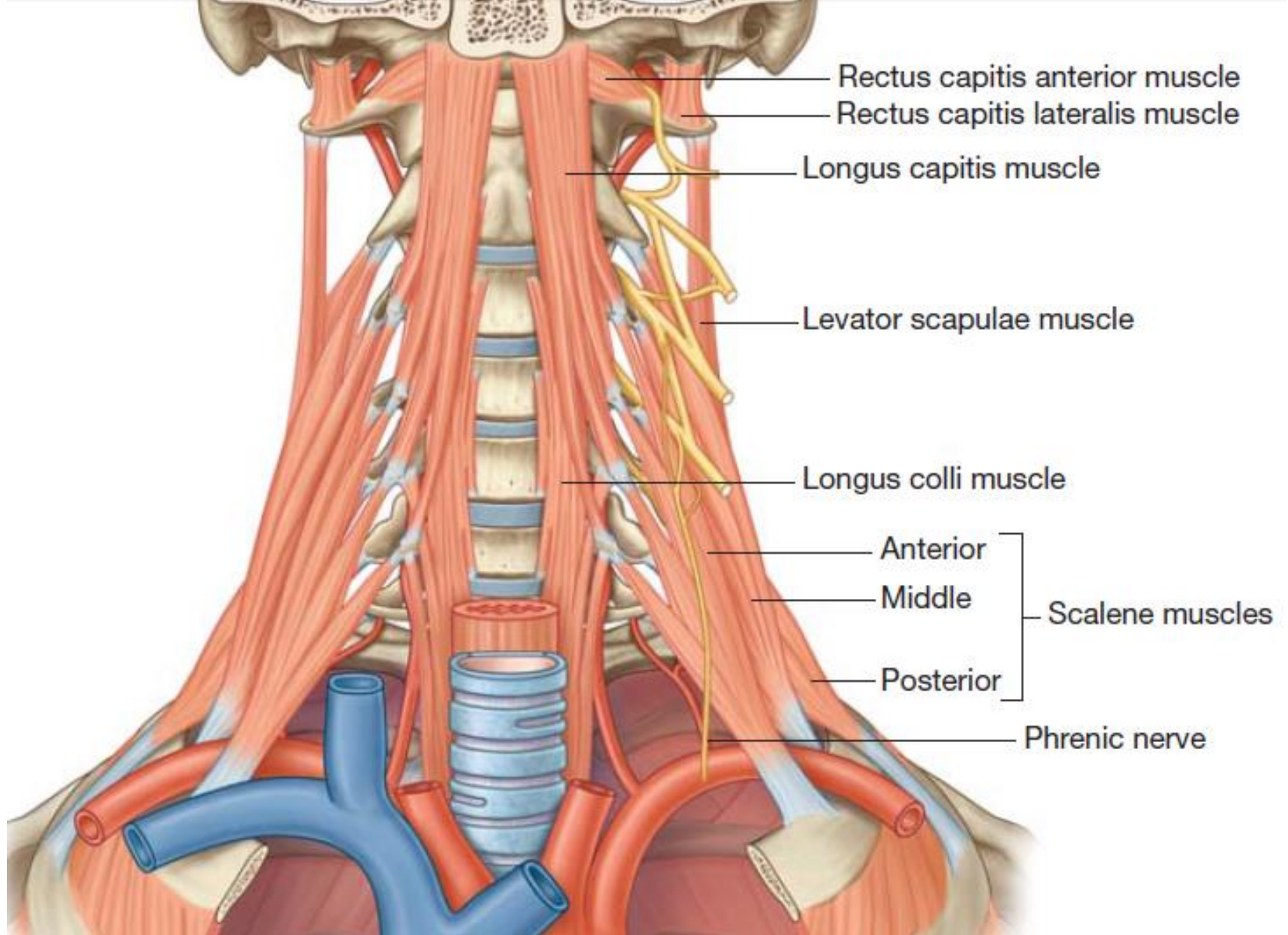
- ✓ the lesser occipital nerve
- ✓ the great auricular nerve
- ✓ the great auricular nerve
- ✓ the supraclavicular nerves

❑ The cervical plexus also contributes to the formation of the superior and inferior roots of the ansa cervicalis



Phrenic nerve

- **Arise** on each side as contributions from the **anterior rami** of cervical nerves C3 to C5.
- Passing around the upper lateral border of each anterior scalene muscle, then continue inferiorly across the anterior surface of each anterior scalene muscle within the prevertebral layer of cervical fascia.
- Leaving the lower edge of the anterior scalene muscle each phrenic nerve passes between the subclavian vein and artery to enter the thorax and continue to the diaphragm.
- **supplies** the diaphragm (both sensory and motor)



Vagus Nerve

- **It is the 10th cranial nerve** & longest of the cranial nerves.
- is composed of motor and sensory fibers and has the most extensive distribution of all the cranial nerves.
- It emerges from the anterior surface of the medulla oblongata between the olive and inferior cerebellar peduncle
- The nerve passes laterally through the posterior cranial fossa and leaves the skull through the jugular foramen.
- Vagus nerve has both **superior** and **inferior sensory ganglia**.
- Below the inferior ganglion, the **cranial root of the accessory nerve** joins the vagus nerve and distributes mainly in its pharyngeal and recurrent laryngeal branches.

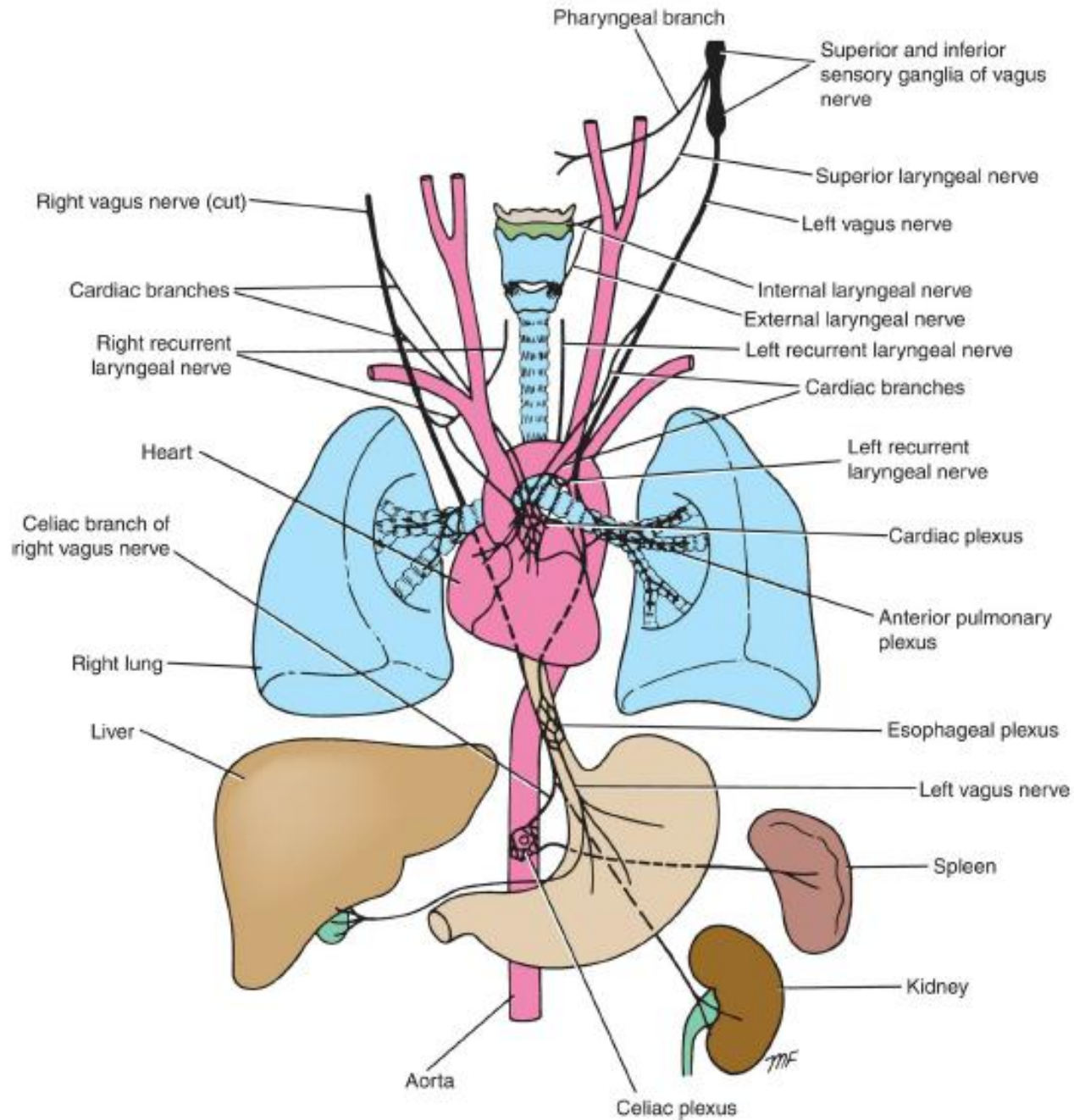


Figure 12.65 Distribution of the vagus nerve.

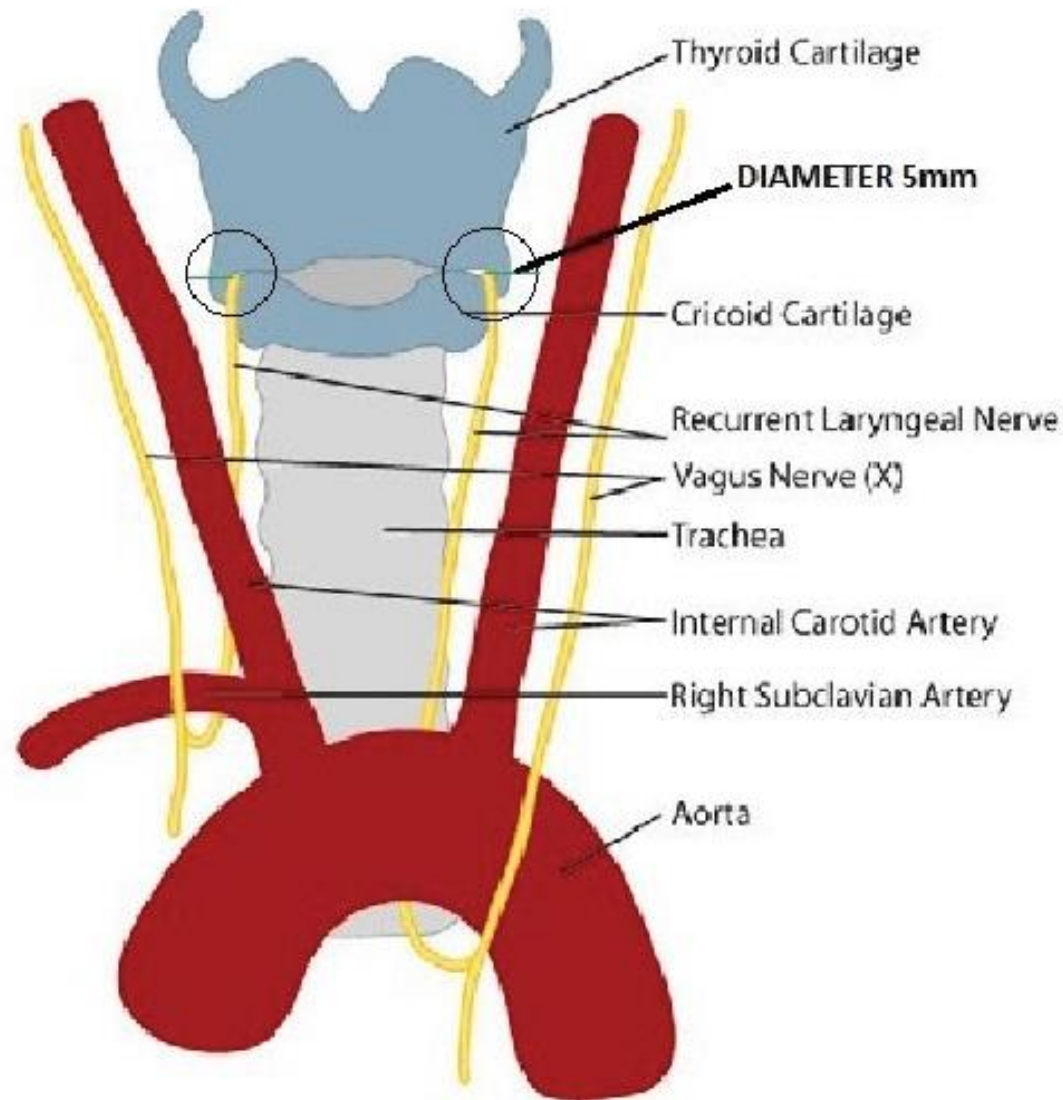
Vagus Nerve

- It innervates the external ear, pharynx, larynx, trachea, and cervical esophagus.
- Below the neck, Vagus supplies parasympathetic fibers to the thoracic viscera and much of the alimentary tract, from the esophagus to the splenic flexure of the colon.
- It also supplies glands associated with the alimentary tract, such as the liver and pancreas.

Recurrent laryngeal nerve

- **On right side** , it hooks around the **first part of the subclavian artery** and then ascends in the groove between the trachea and the esophagus.
- **On left side**, the nerve hooks around the **arch of the aorta** and then ascends into the neck between the trachea and the esophagus.
- The nerve is closely related to the inferior thyroid artery, and it supplies all the muscles of the larynx (**except the cricothyroid muscle**), the mucous membrane of the larynx below the vocal cords, and the mucous membrane of the upper part of the trachea.

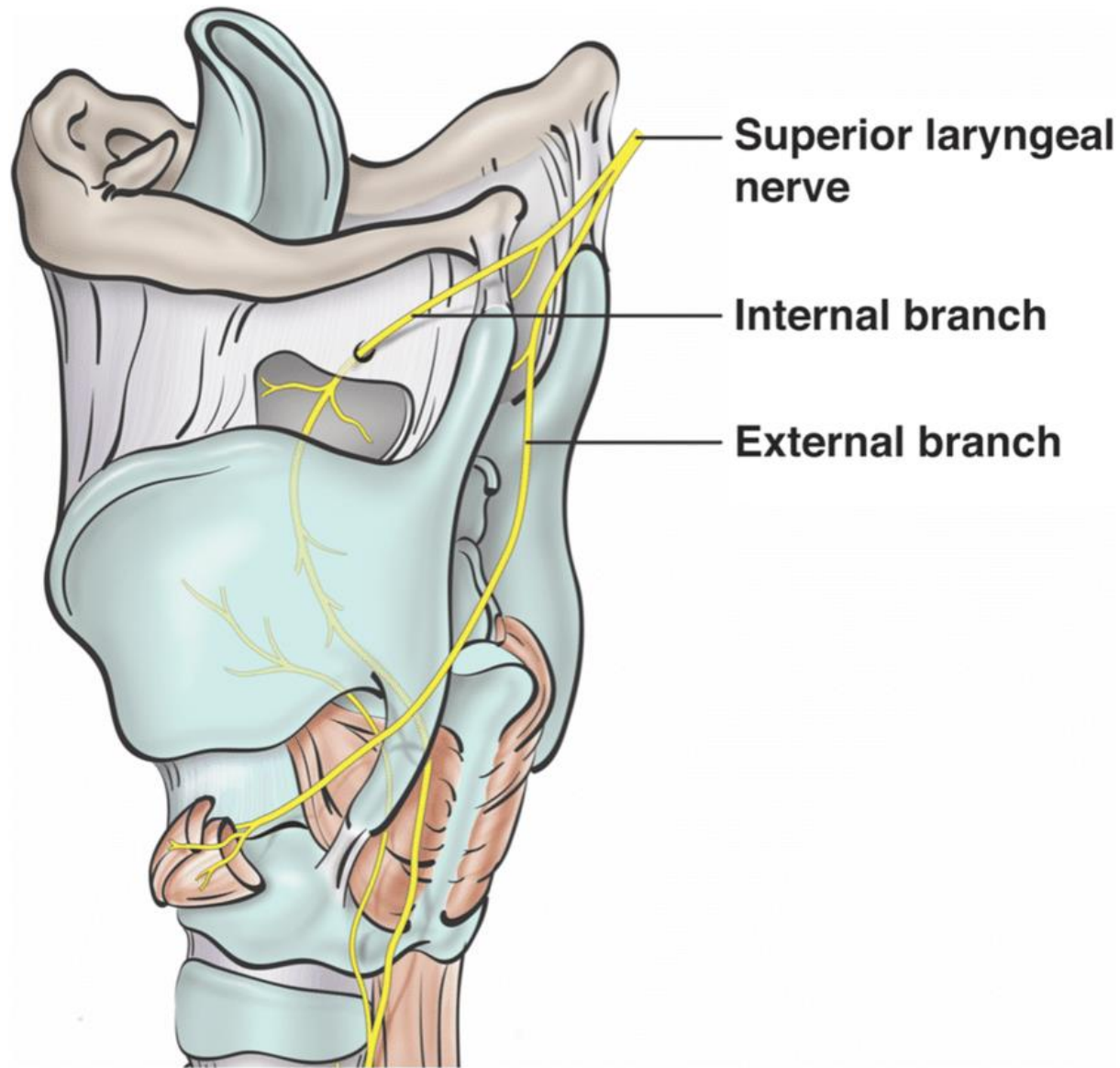
Recurrent laryngeal nerve



Superior laryngeal nerve

- It divides into the internal and the external laryngeal nerves.
- **Internal laryngeal nerve** is sensory to the mucous membrane of the piriform fossa and the larynx down as far as the vocal cords.
- **External laryngeal nerve** is motor and is located close to the superior thyroid artery; it supplies the cricothyroid muscle.

Superior laryngeal nerve



Cervical part of Sympathetic Chain

➤ Site:

- ✓ Anterior to the longus colli and longus capitis muscles
- ✓ Posterior to the common carotid artery and ICA

➤ It is connected to each cervical spinal nerve by a gray ramus communicants

➤ Has **Three ganglia**

❖ **The superior cervical ganglion** : at level of C1 & C2 , branches:

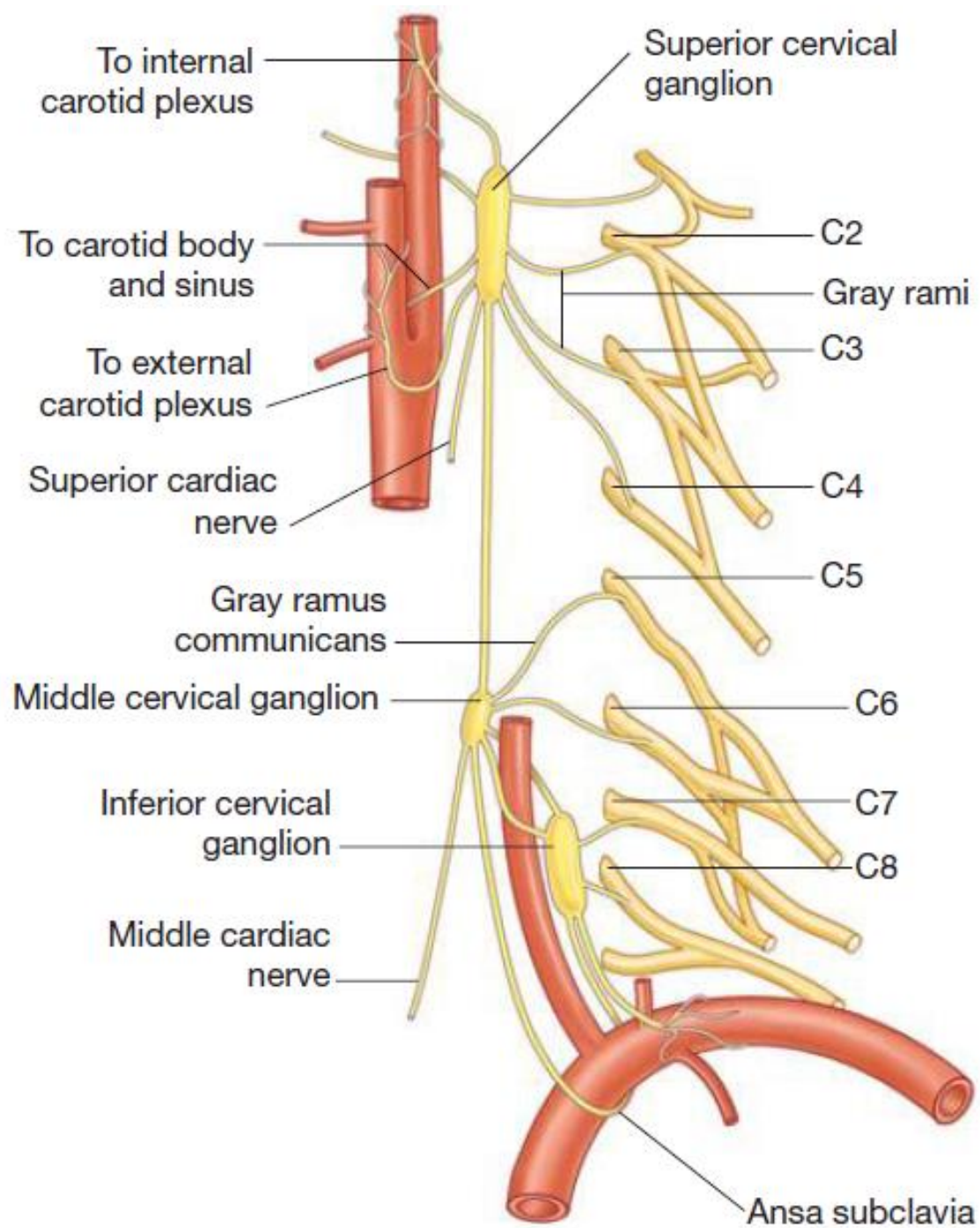
- ✓ the heart as **superior cardiac nerves** .
- ✓ Forming plexuses around ICA & ECA.
- ✓ the pharynx
- ✓ cervical spinal nerves C1 to C4

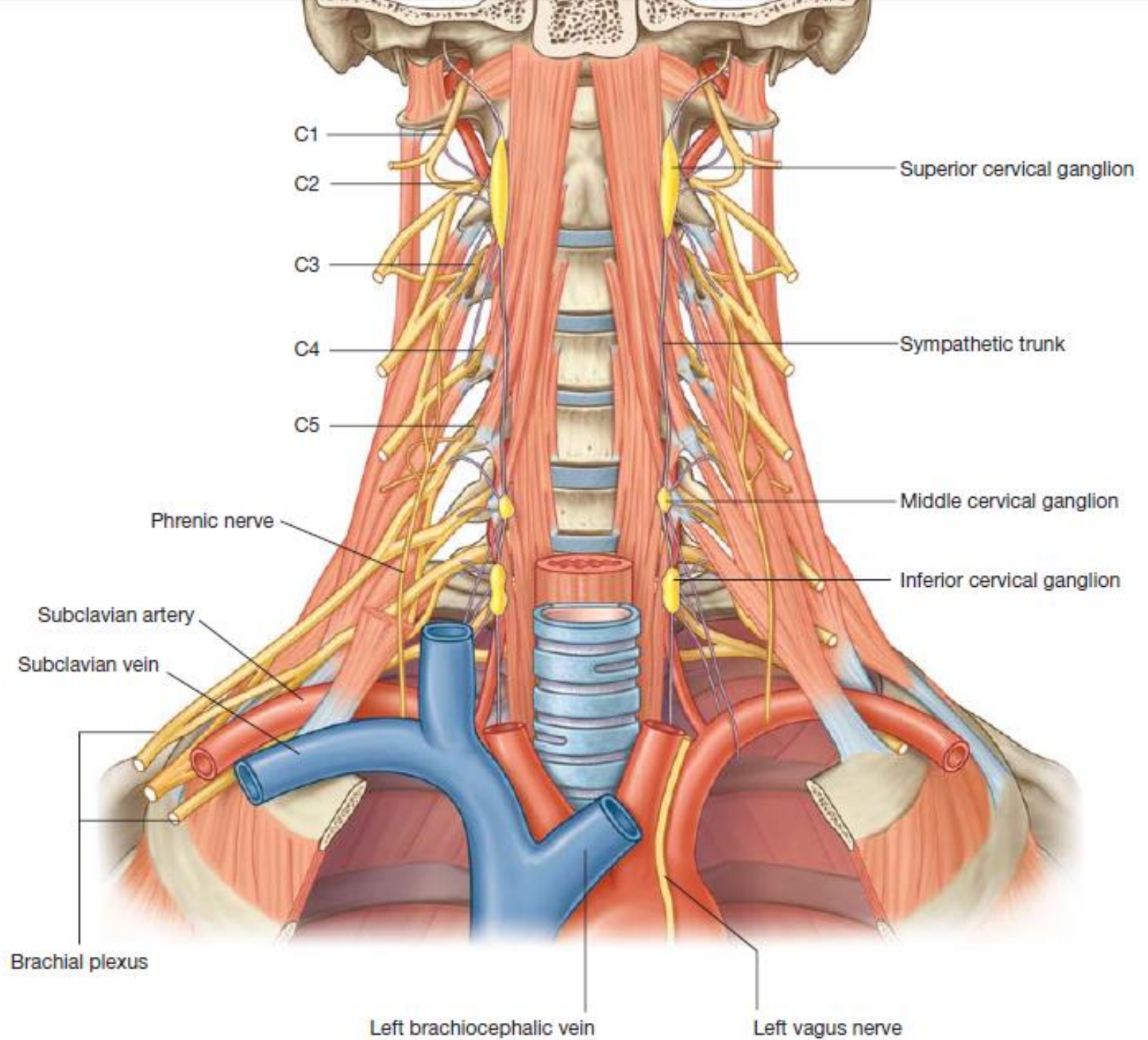
❖ **The middle cervical ganglion** : at level of C6 , branches :

- ✓ the heart as **middle cardiac nerves** .
- ✓ cervical spinal nerves C5 and C6

❖ **The inferior cervical ganglion**: anterior to the neck of 1st rib and the transverse process of C7 , branches :

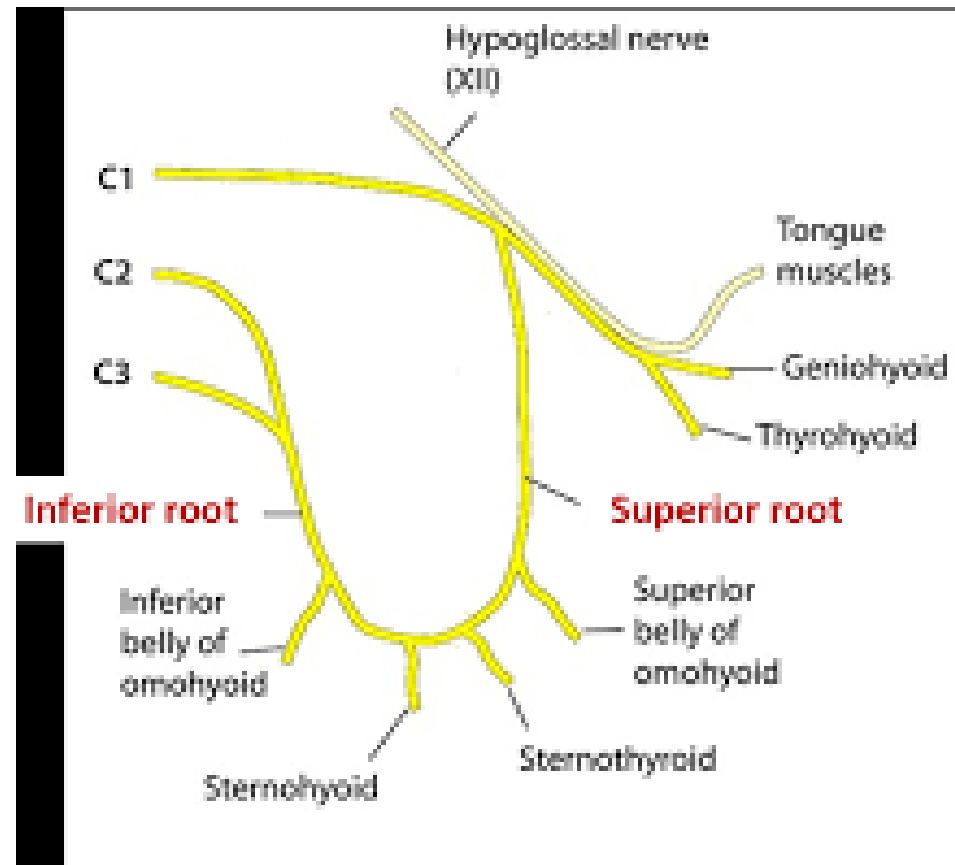
- ✓ the heart as **inferior cardiac nerves** .
- ✓ spinal nerves C7 to T1
- ✓ Forming a plexus around the vertebral artery





Ansa Cervicalis

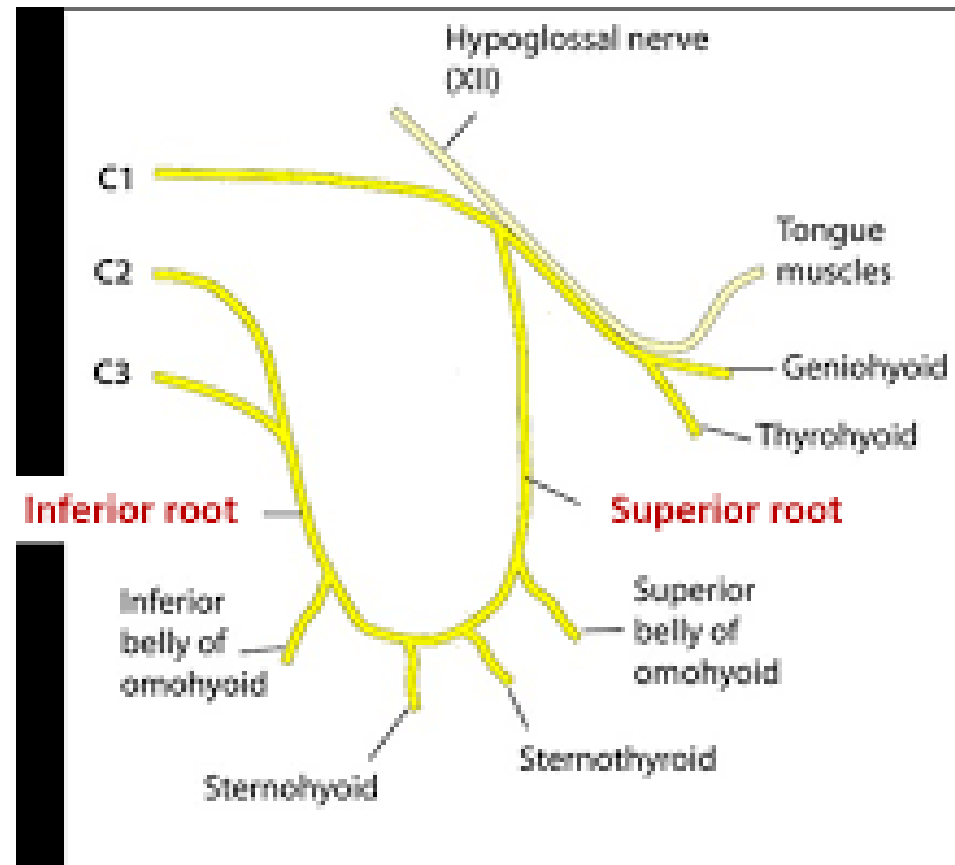
- **ansa = loop**
- It is a **loop of nerve fibers** from cervical nerves **C1 to C3** that innervate the “strap muscles” in the anterior triangle of the neck
- It joins the hypoglossal nerve [XII] soon after it leaves the skull.
- It crosses the carotid sheath and its contents



Ansa Cervicalis

It has 2 roots :

- ✓ **Superior root:** innervate the superior belly of the omohyoid , upper parts of the sternohyoid and sternothyroid muscles.
- ✓ **Inferior root:** innervate the inferior belly of the omohyoid, lower parts of the sternohyoid and sternothyroid muscles.



Hypoglossal nerve

C1

C2

C3

Thyrohyoid muscle

Omohyoid muscle
(superior belly)

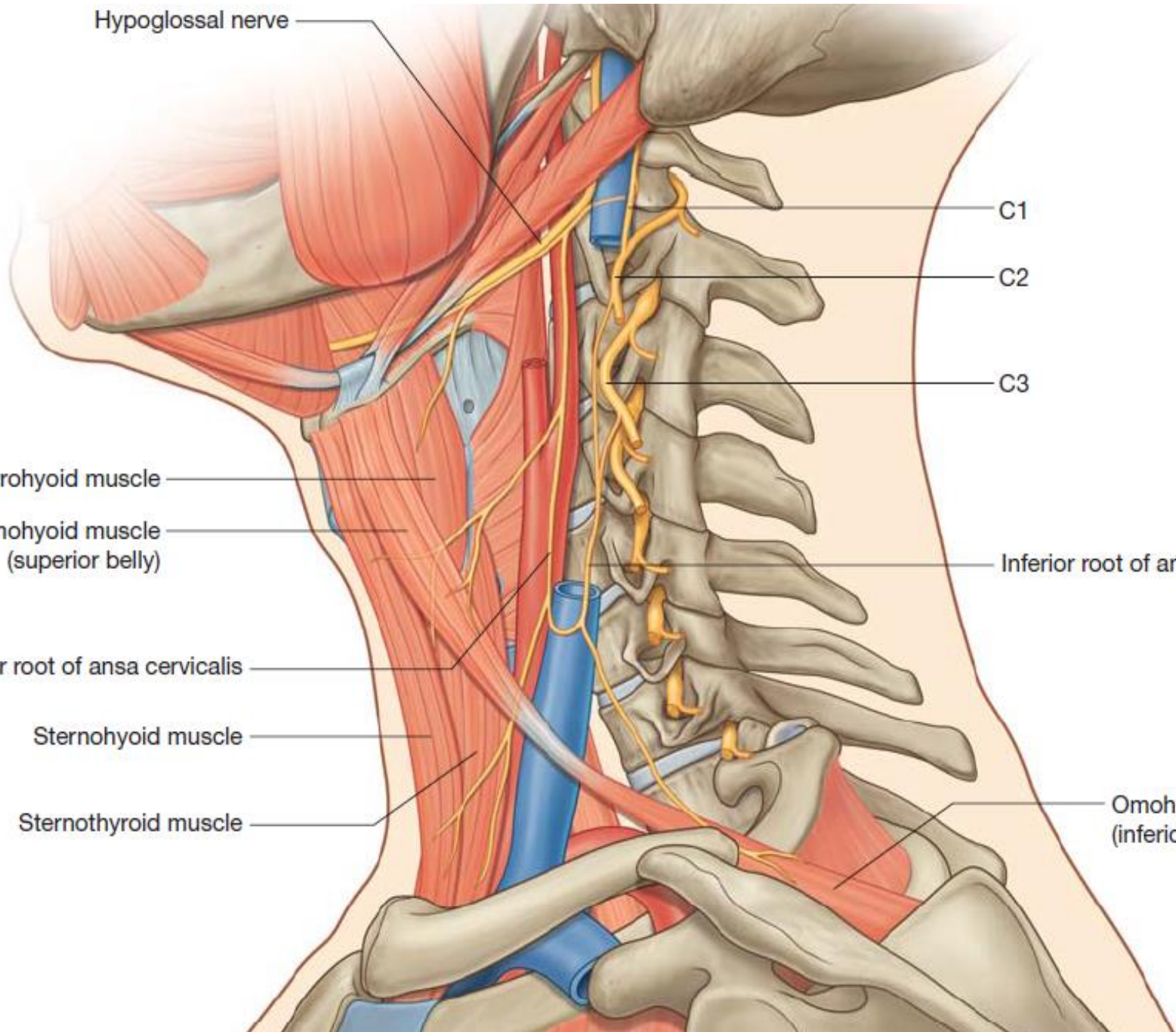
Inferior root of ansa cervicalis

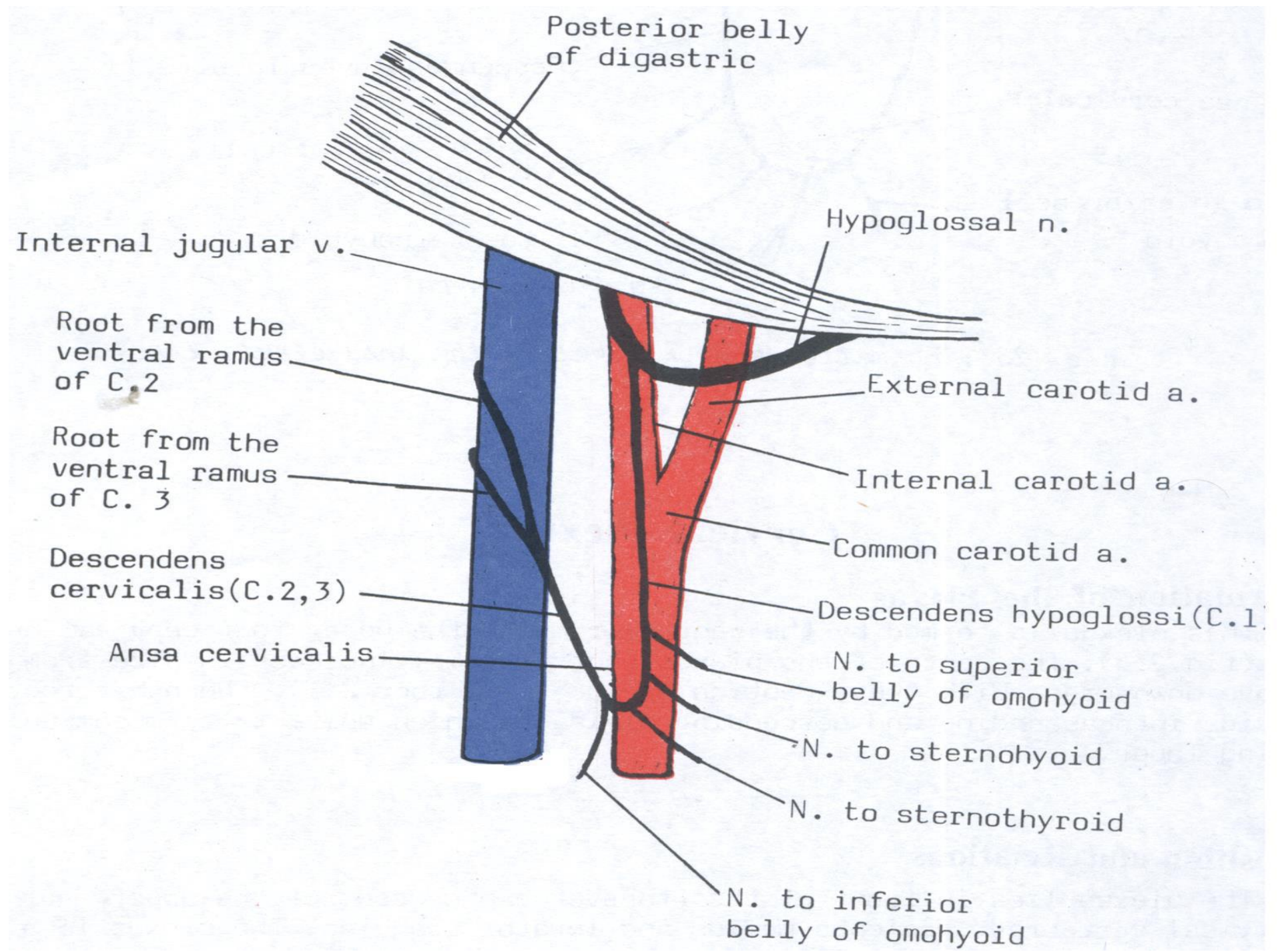
Superior root of ansa cervicalis

Sternohyoid muscle

Sternothyroid muscle

Omohyoid muscle
(inferior belly)





Carotid Sheath

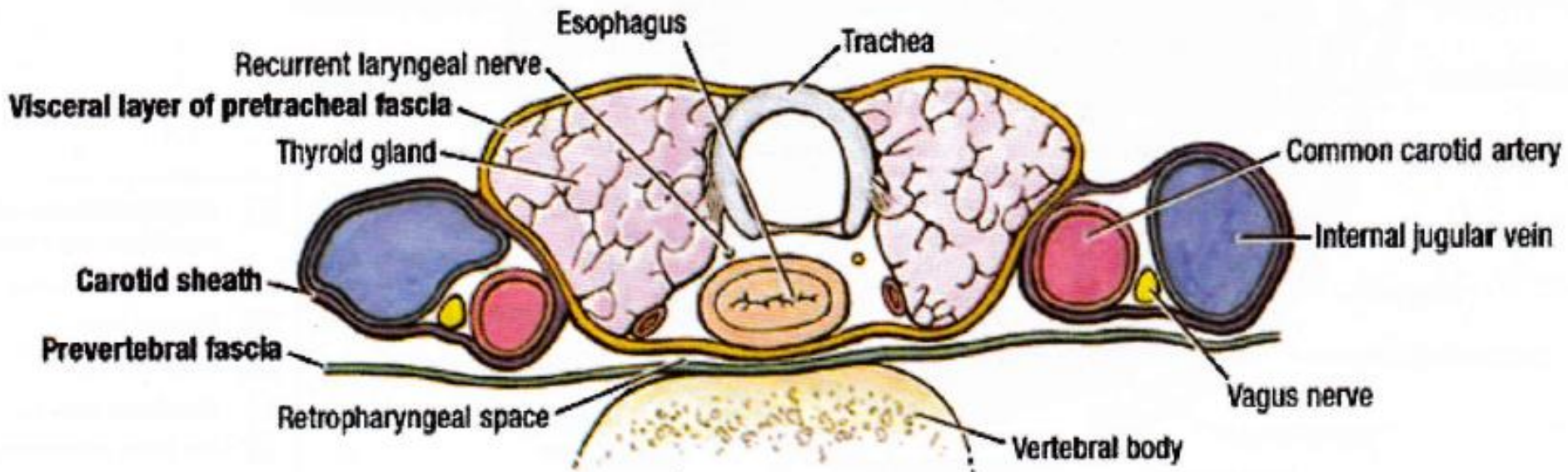
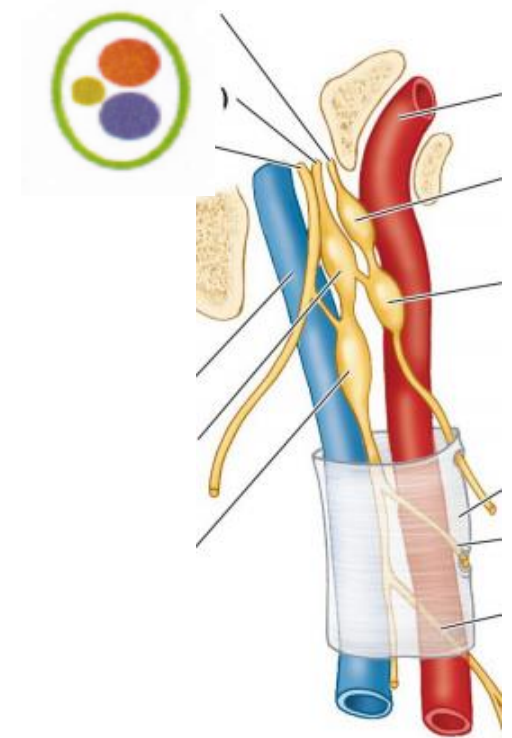


- It is a tube of deep fascia extending from base of the skull down to root of the neck
- **It surrounds the :**
 1. **internal Jugular vein:** laterally.
 2. **Common carotid & internal carotid artery:** medially.
 - N.B: external carotid is not surrounded by sheath.
 3. **Vagus nerve:** behind the interval between the internal jugular vein & common carotid artery.

Carotid Sheath

Structures embedded in its walls:

- 1) **Sympathetic trunk:** embedded in posterior wall.
- 2) **Ansa cervicalis & its roots :** embedded in the anterior wall.



Carotid Sheath



Superficial Relations:

- **Below the upper border of thyroid cartilage:**
 - Thyroid gland.
 - Infra-hyoid muscles (sternohyoid, sternothyroid, omohyoid).
 - Sternocleidomastoid muscle.

- **Above the upper border of thyroid cartilage:**
 - Styloid process and attached structures.
 - Posterior belly of digastric muscle.
 - Parotid gland

Deep Relations:

- Transverse processes of all cervical vertebrae and the covering pre-vertebral muscles & fascia.
- inferior thyroid artery: crosses deep to it at C6 (on both sides).
- Thoracic duct: crosses deep to it at C7 (on left side).