

بِسْمِ اللَّهِ الرَّحْمَنِ
الرَّحِيمِ





THORAX

➤ The framework of the walls of the thorax, which is referred to as the thoracic cage, is **formed** by the vertebral column behind, the ribs and intercostal spaces on either side, and the sternum and costal cartilages in front.

➤ **Superiorly**, the thorax communicates with the neck, and **inferiorly** it is separated from the abdomen by the diaphragm. The thoracic cage **protects** the lungs and heart and affords attachment for the muscles of the thorax, upper extremity, abdomen, and back.

➤ The cavity of the thorax can be **divided** into a median partition, called the mediastinum, and the laterally placed pleurae and lungs.

Jugular notch

Clavicle

Medicallook.com

True ribs

False ribs

Floating ribs

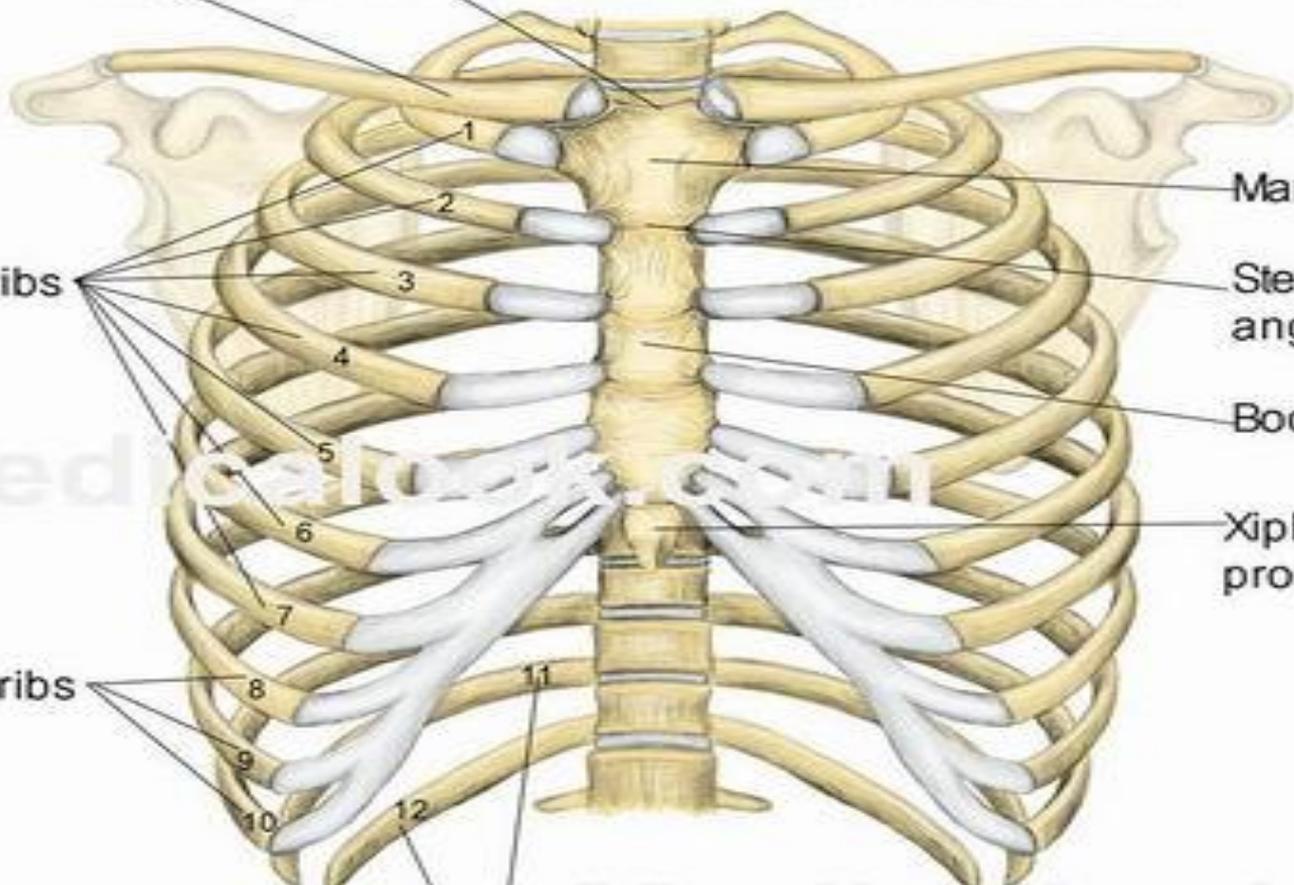
Manubrium

Sternal angle

Body

Xiphoid process

Sternum



➤ Structure of the Thoracic Wall

➤ The thoracic wall is covered on the outside by skin and by muscles attaching the shoulder girdle to the trunk. It is lined with parietal pleura.

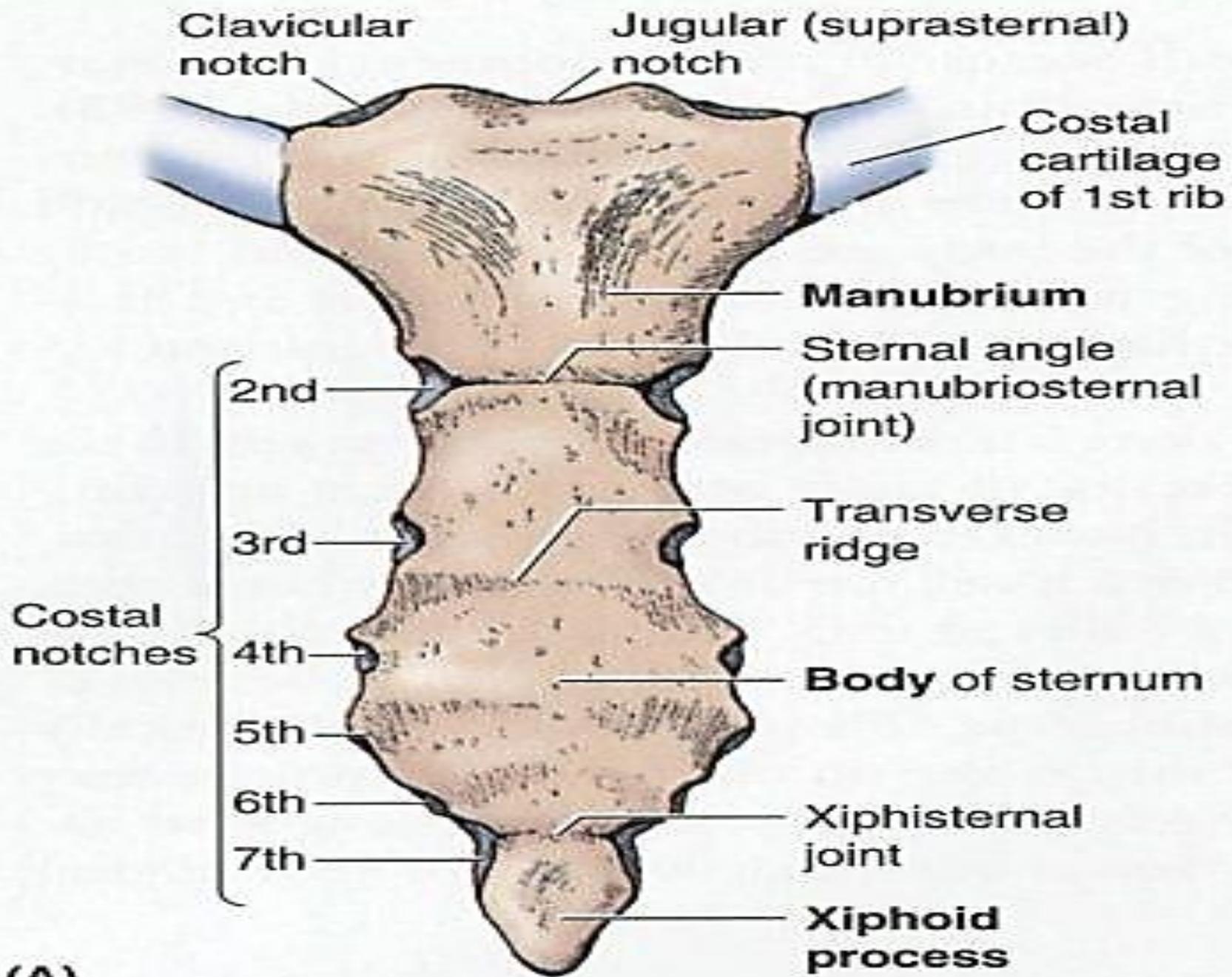
➤ □ Sternum

➤ The sternum lies in the midline of the anterior chest wall. It is a flat bone that can be divided into three parts: manubrium sterni, body of the sternum, and xiphoid process.

➤ □ The **manubrium** is the upper part of the sternum. It articulates with the body of the sternum at the manubriosternal joint, and it also articulates with the clavicles and with the 1st costal cartilage and the upper part of the 2nd costal cartilages on each side.

➤ The **body of the sternum** articulates above with the manubrium at the **manubriosternal joint** and below with the xiphoid process at the **xiphisternal joint**. On each side, it articulates with the 2nd to the 7th costal cartilages.

➤ The **xiphoid process** is a thin plate of cartilage that becomes ossified at its proximal end during adult life. **No ribs or costal cartilages are attached to it.**

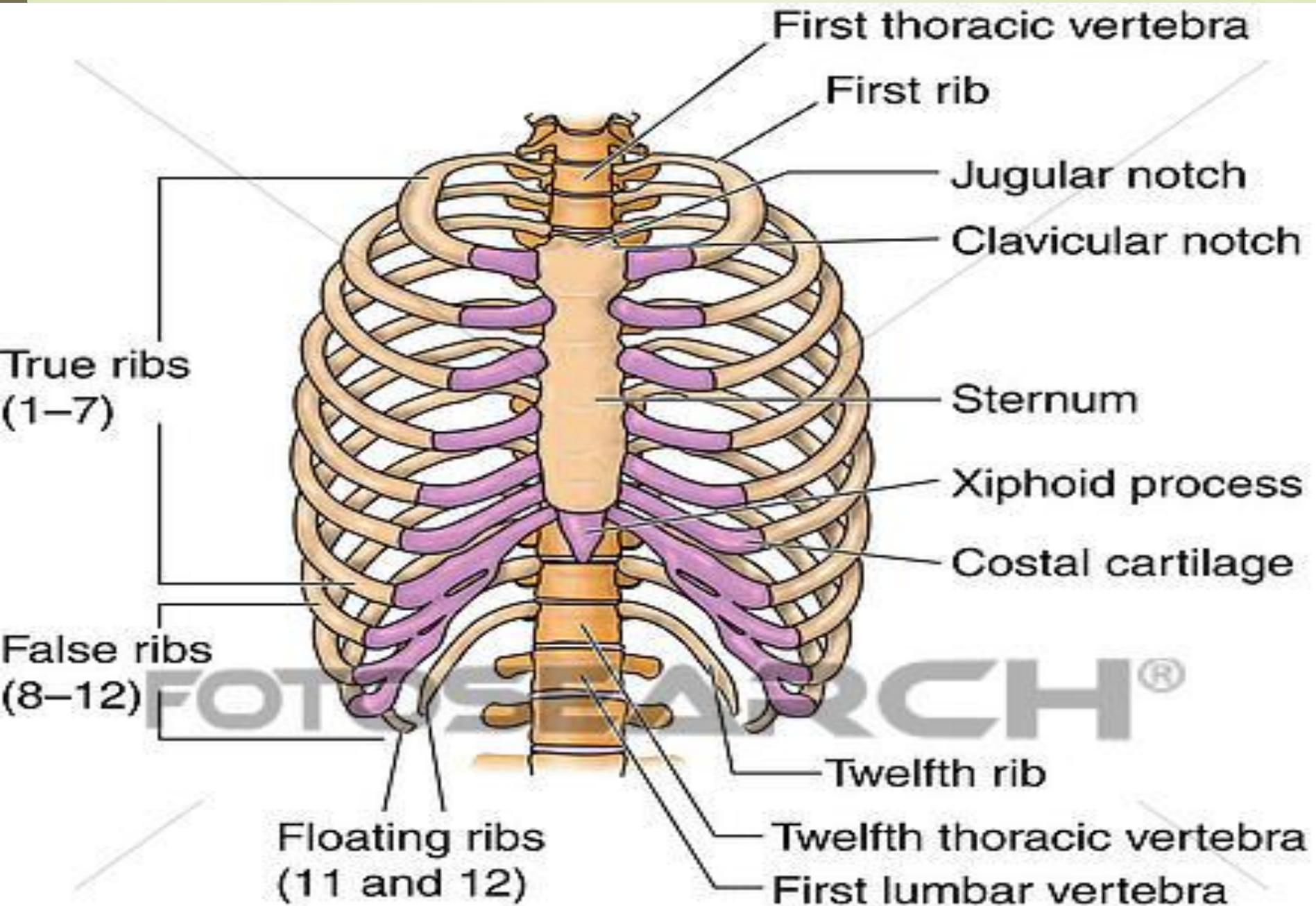


(A)

☐ Ribs

There are 12 pairs of ribs, all of which are attached posteriorly to the thoracic vertebrae. The ribs are divided into three categories:

- **True ribs:** The upper seven pairs 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 and small synovial joints.
- **Floating ribs:** The 11th and 12th pairs have no anterior attachment
- **Typical Rib**
- 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 cartilage.
- A rib has a **head, neck, tubercle, shaft, and angle**.
- The **head** has two facets for articulation with the numerically corresponding vertebral body and that of the vertebra immediately above.



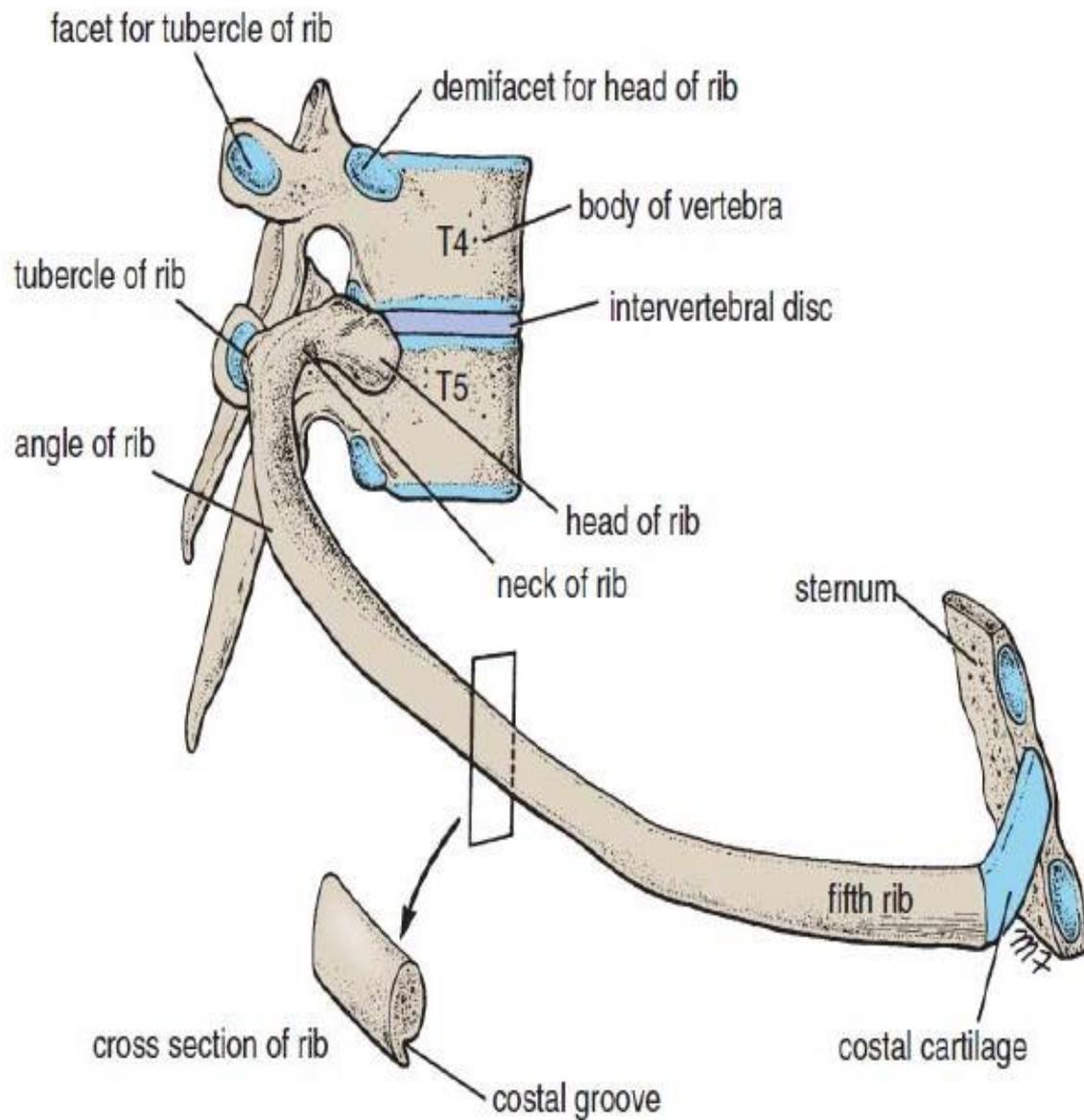
➤ The **neck** is a constricted portion situated between the head and the tubercle. The **tubercle** is a prominence on the outer surface of the rib at the junction of the neck with the shaft. It has a facet for articulation with the transverse process of the numerically corresponding vertebra.

➤ The **shaft** is thin and flattened and twisted on its long axis. Its inferior border has the costal groove. The **angle** is where the shaft of the rib bends sharply forward.

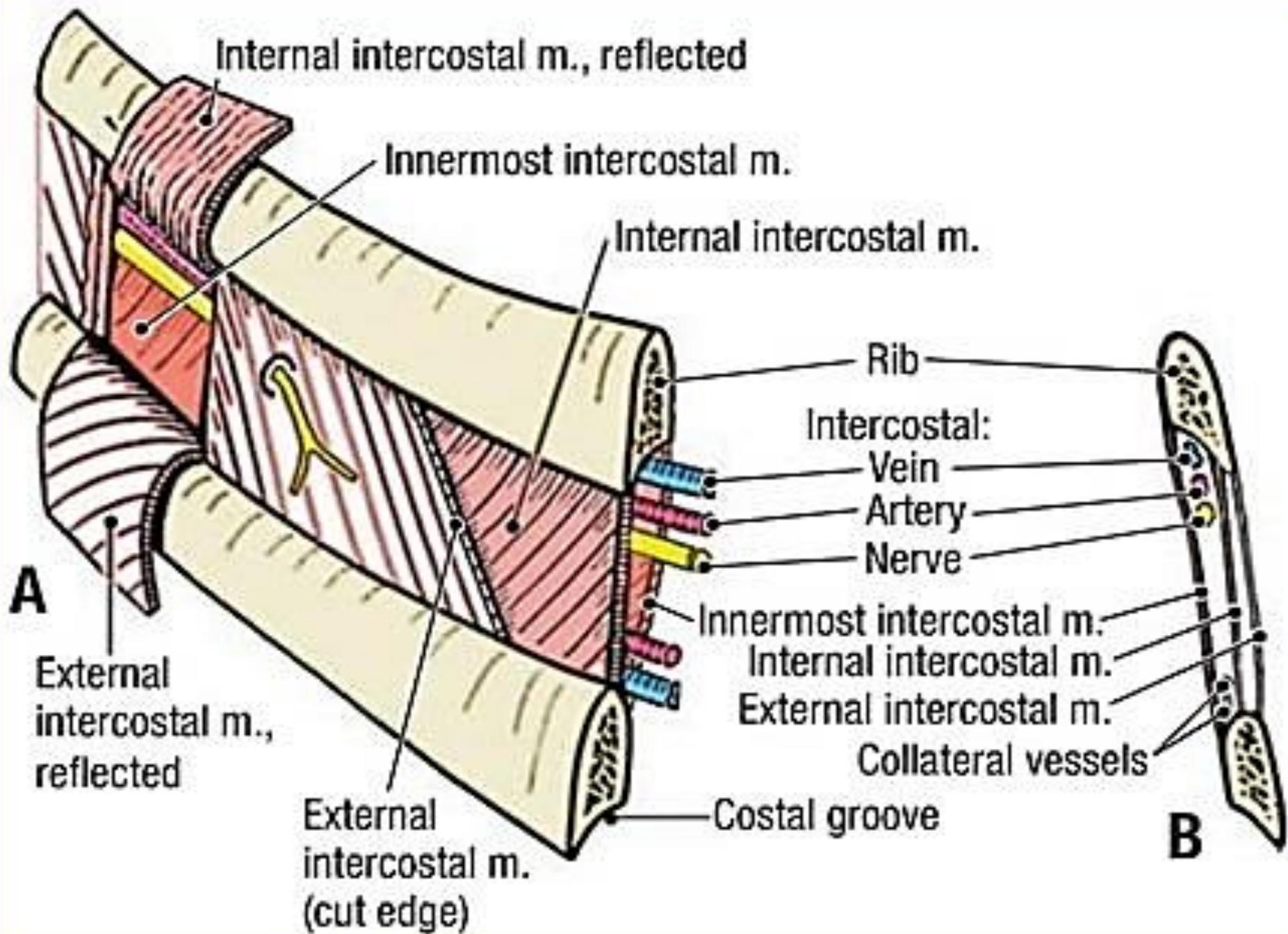
➤ □ Costal Cartilages

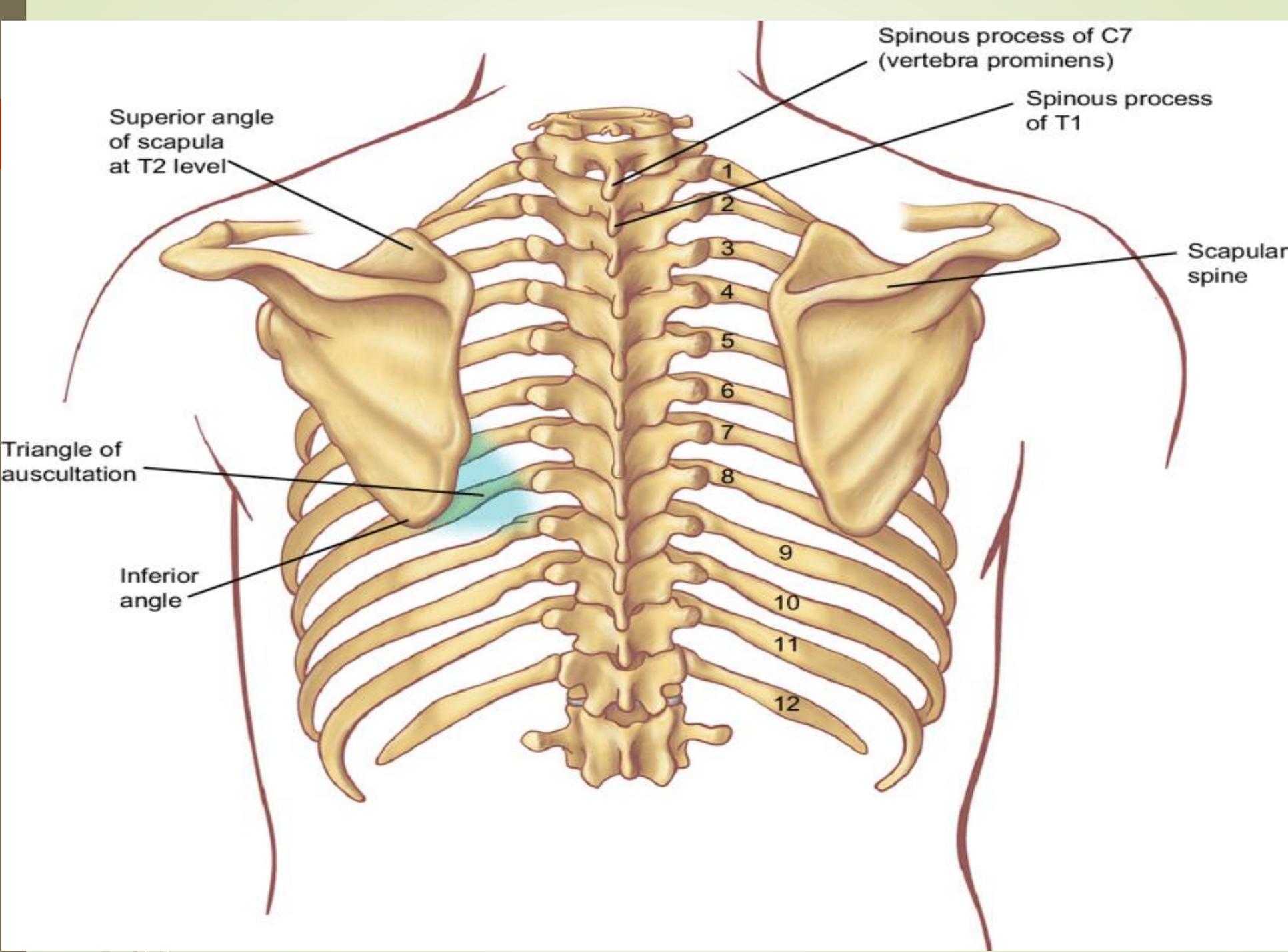
➤ Costal cartilages are bars of cartilage connecting the **upper seven ribs** to the lateral edge of the sternum and the **8th, 9th, and 10th ribs** to the cartilage immediately above. The cartilages of the **11th and 12th ribs** end in the abdominal musculature.

➤ The costal cartilages contribute significantly to the elasticity and mobility of the thoracic walls. In old age, the costal cartilages tend to lose some of their flexibility as the result of superficial calcification.



Fifth right rib as it articulates with the vertebral column posteriorly and the sternum anteriorly. Note that the rib head articulates with the vertebral body of its own number and that of the vertebra immediately above. Note also the presence of the costal groove along the inferior border of the rib.





➤ Joints of the Chest Wall

☐ Joints of the Sternum

The **manubriosternal joint** is a cartilaginous joint between the manubrium and the body of the sternum. A small amount of angular movement is possible during respiration.

➤ The **xiphisternal joint** is a cartilaginous joint between the xiphoid process (cartilage) and the body of the sternum. The xiphoid process usually fuses with the body of the sternum during middle age.

☐ Joints of the Heads of the Ribs

➤ The 1st rib and the three lowest ribs (10,11,12 ribs) have a single synovial joint with their corresponding vertebral body.

➤ For the 2nd to 9th ribs, the head articulates by means of a synovial joint with the corresponding vertebral body and that of the vertebra above it. There is a strong **intraarticular ligament** that connects the head to the intervertebral disc.

➤ □ Joints of the Tubercles of the Ribs

- The tubercle of a rib articulates by means of a synovial joint with the transverse process of the corresponding vertebra. (This joint is absent on the 11th and 12th ribs.)

➤ □ Joints of the Ribs and Costal Cartilages

- These joints are cartilaginous joints. **No movement is possible.**

➤ □ Joints of the Costal Cartilages with the Sternum

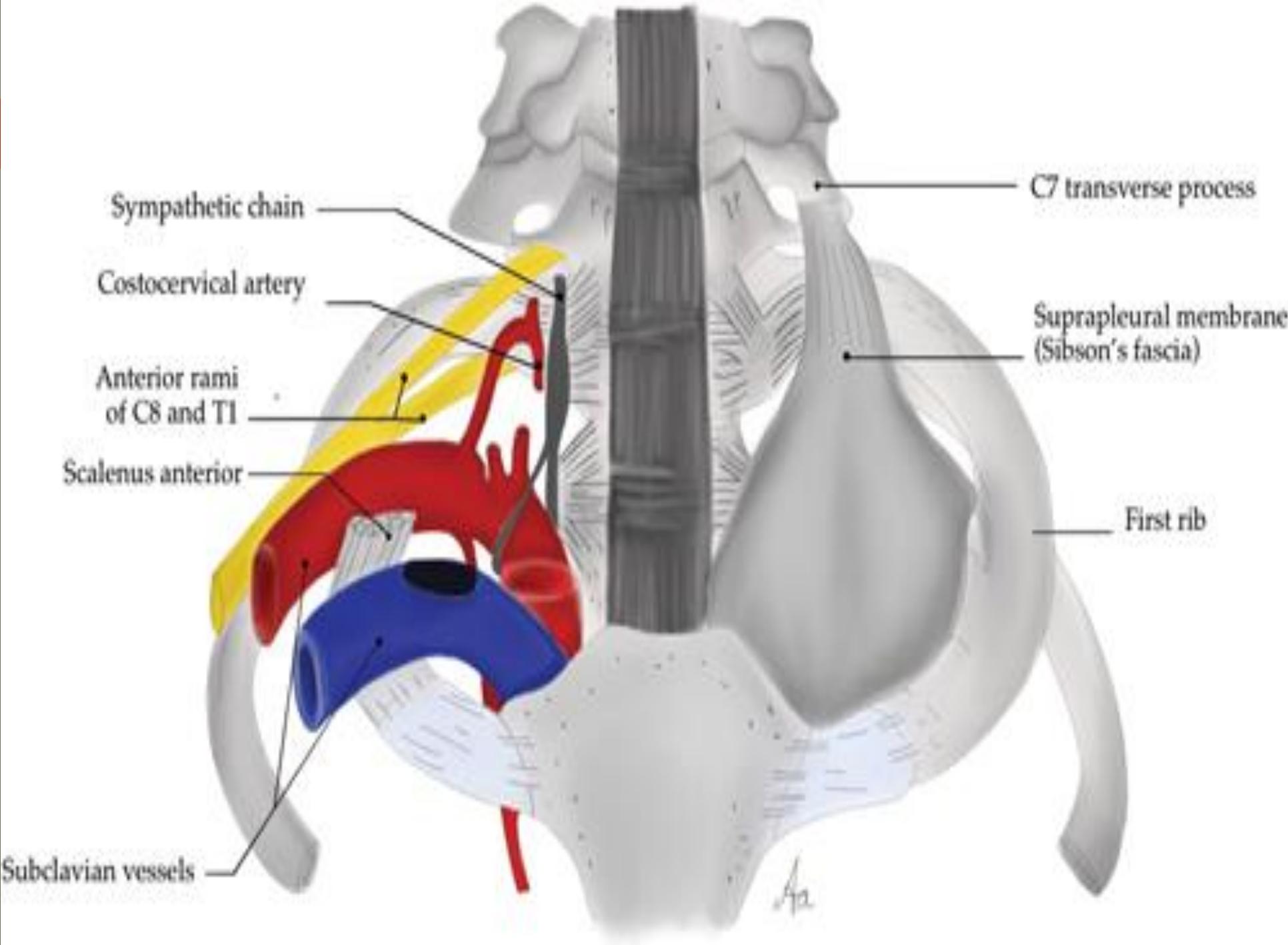
- The 1st costal cartilages articulate with the manubrium, by cartilaginous joints that permit **no movement**.
- The 2nd to 7th costal cartilages articulate with the lateral border of the sternum by **synovial joints**.
- In addition, the 6th, 7th, 8th, 9th, and 10th costal cartilages articulate with one another along their borders by small synovial joints.
- The cartilages of the 11th and 12th ribs are embedded in the abdominal musculature.

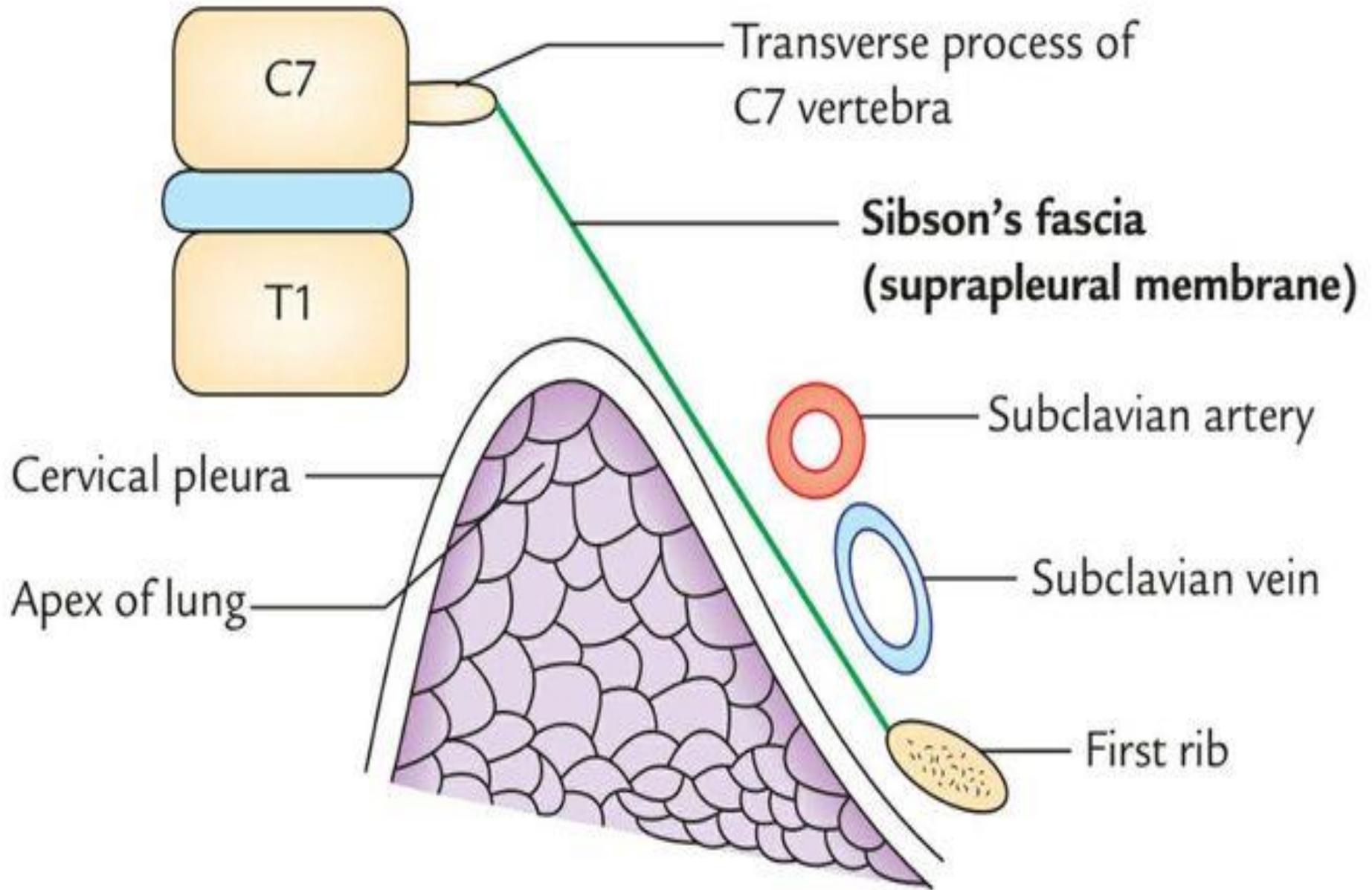
➤ Suprapleural Membrane

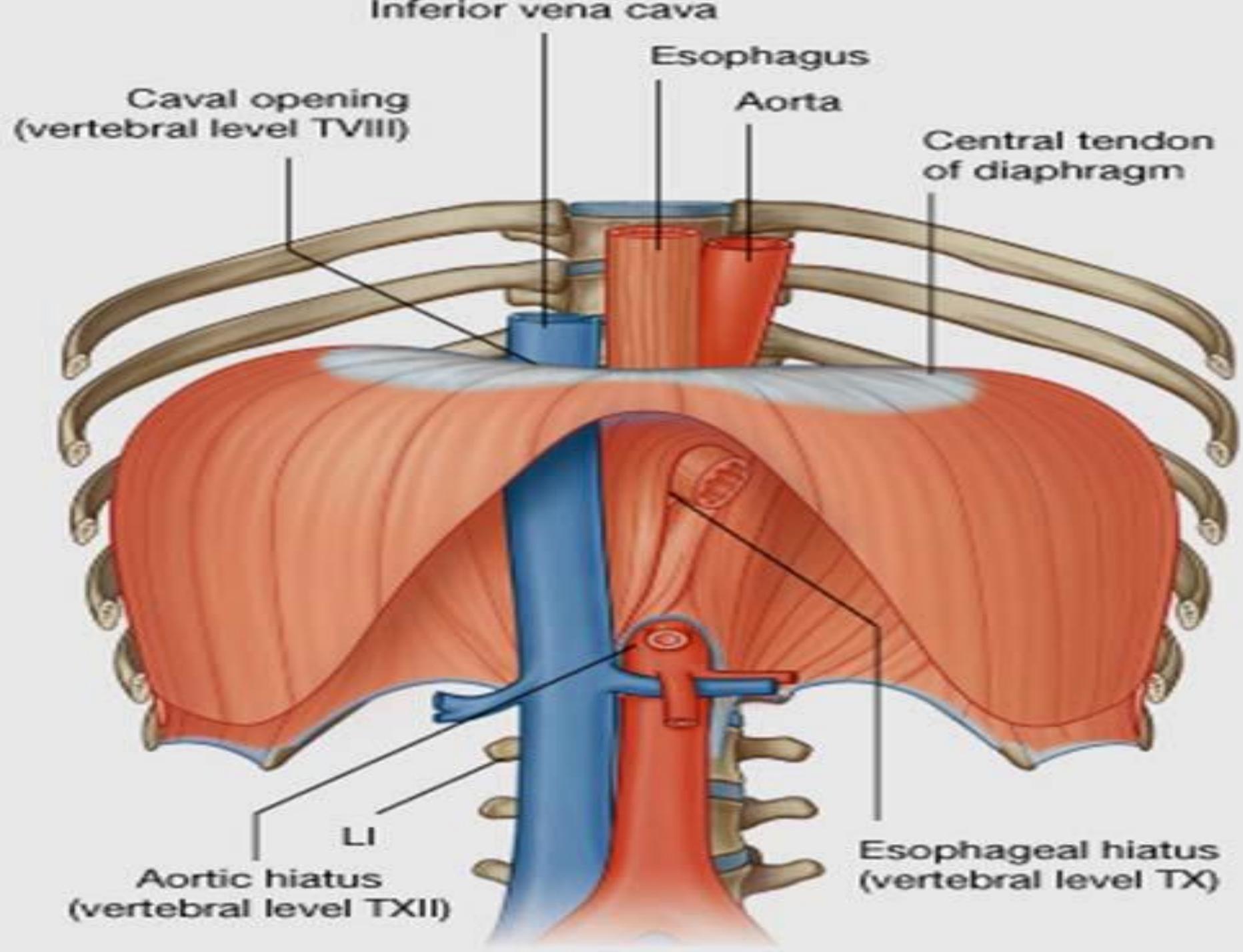
- Superiorly, the thorax opens into the root of the neck by a narrow aperture, the **thoracic outlet**. The outlet transmits structures that pass between the thorax and the neck (esophagus, trachea, blood vessels, etc.) and for the most part lie close to the midline. On either side of these structures, the outlet is closed by a dense fascial layer called the **suprapleural membrane**.

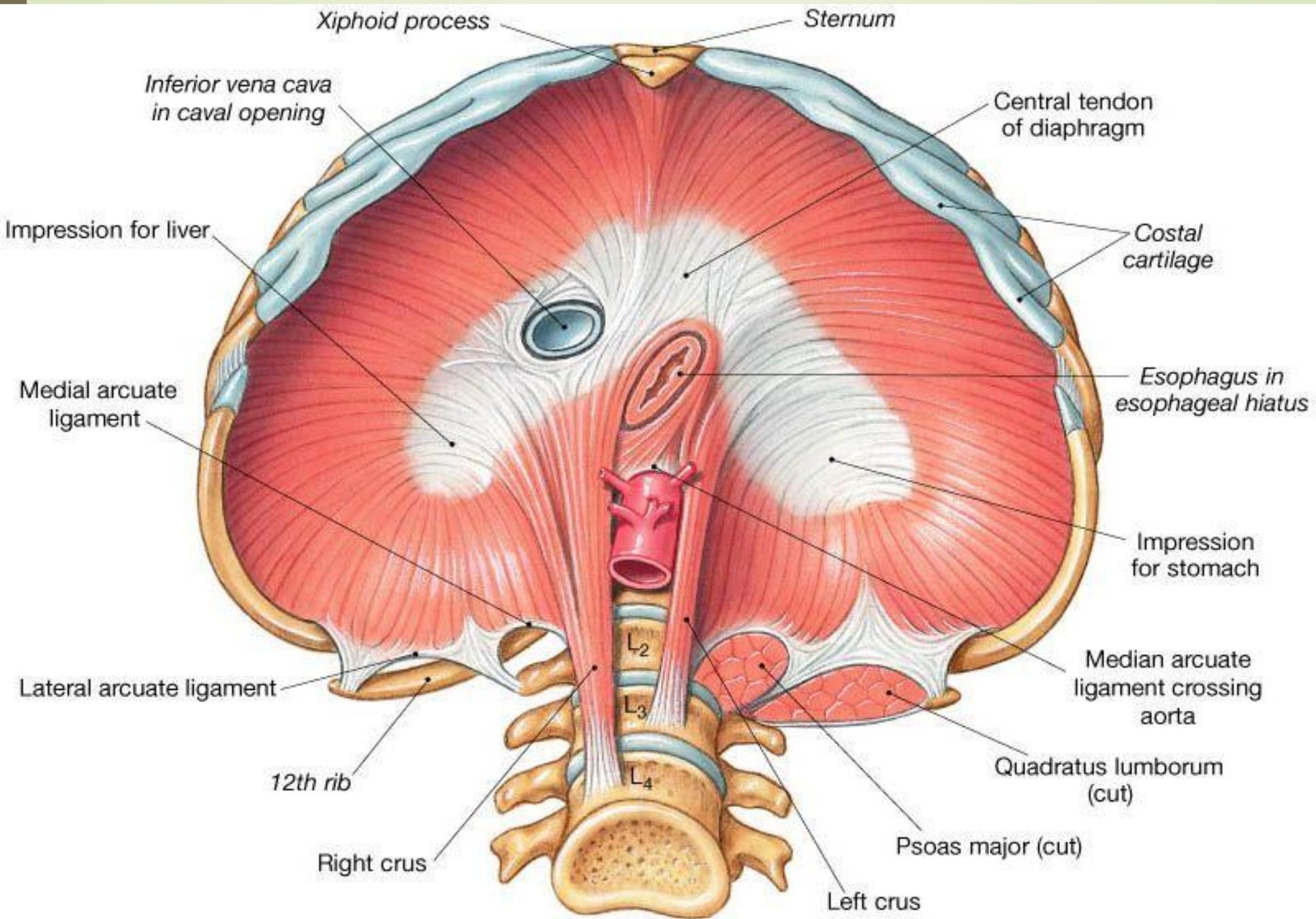
➤ Diaphragm

- The diaphragm is a **thin muscular and tendinous septum** that separates the chest cavity above from the abdominal cavity below. It is pierced by the structures that pass between the chest and the abdomen. The diaphragm is the most important muscle of respiration. It is dome shaped and consists of a **peripheral** muscular part, which arises from the margins of the thoracic opening, and a **centrally** placed tendon.
- The origin of the diaphragm can be divided into three parts:
 - A **sternal part** arising from the posterior surface of the xiphoid process.
 - A **costal part** arising from the deep surfaces of the lower six ribs and their costal cartilages.
 - A **vertebral part** arising by vertical columns









(a) Inferior view

➤ □ **Shape of the Diaphragm**

➤ As seen from in front, the diaphragm curves up into *right and left domes*. The **right dome** reaches as high as the upper border of the 5th rib, and the **left dome** may reach the lower border of the 5th rib. (The right dome lies at a higher level, because of the large size of the right lobe of the liver.) The central tendon lies at the level of the xiphisternal joint. The domes support the right and left lungs, whereas the central tendon supports the heart.

➤ **Action of the Diaphragm**

➤ On contraction, the diaphragm pulls down its central tendon and increases the vertical diameter of the thorax.

➤ **Openings in the Diaphragm**

➤ The diaphragm has three main openings:

- 1) **The aortic opening** lies anterior to the body of the 12th thoracic vertebra. It transmits the aorta, the thoracic duct, and the azygos vein.
- 2) **The esophageal opening** lies at the level of the 10th thoracic vertebra. It transmits the esophagus, the right and left vagus nerves.
- 3) **The caval opening** lies at the level of the 8th thoracic vertebra in the central tendon. It transmits the inferior vena cava and terminal branches of the right phrenic nerve.



THANK YOU

