Thoracic Cage
Intercostal muscles

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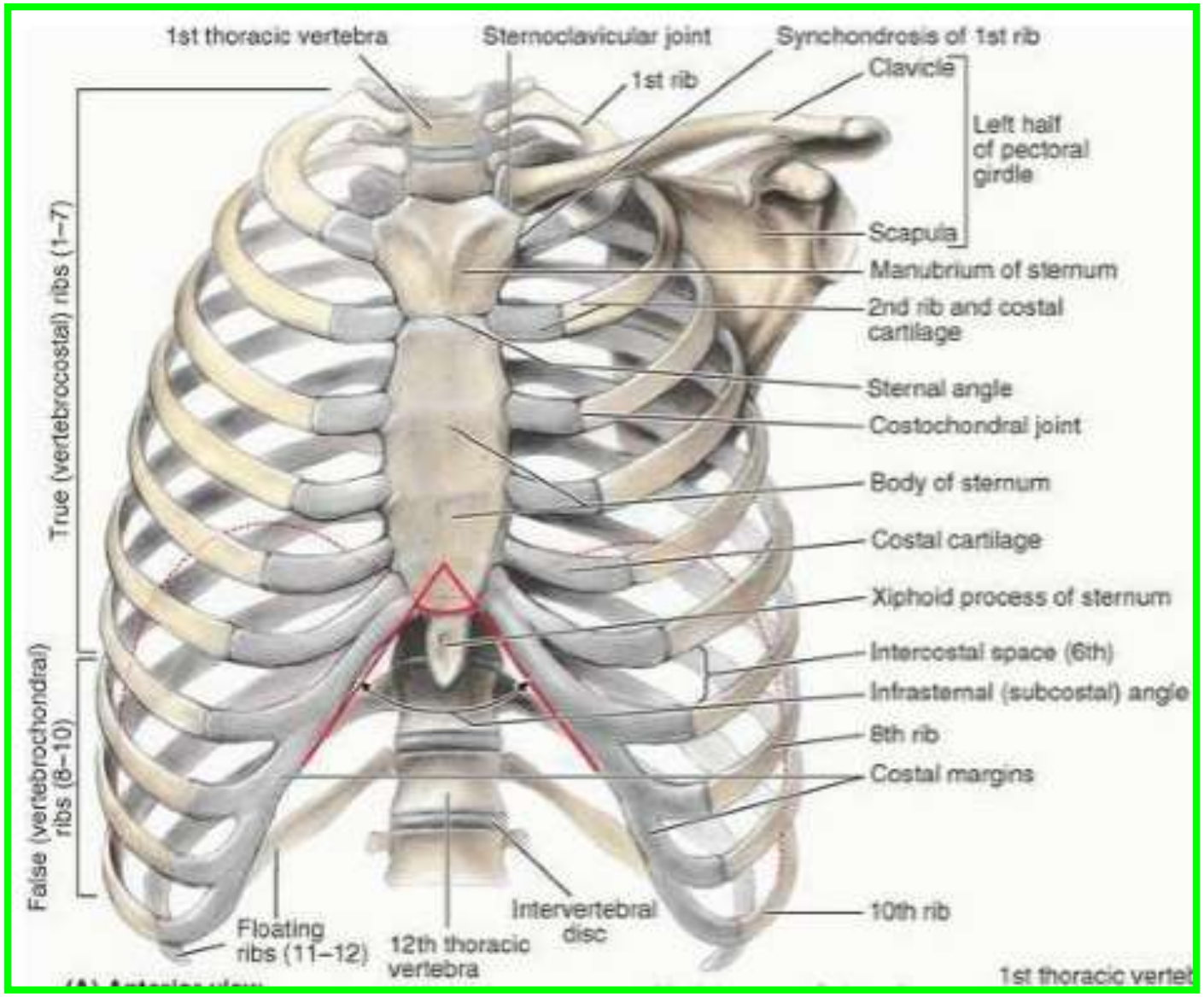
The Thoracic Wall

The thorax (or chest) is the region of the body between the neck and the abdomen.

It is flattened in front and behind but rounded at the sides.

The framework of the walls of the thorax, which is referred to as the ***thoracic cage***



Thoracic Cage

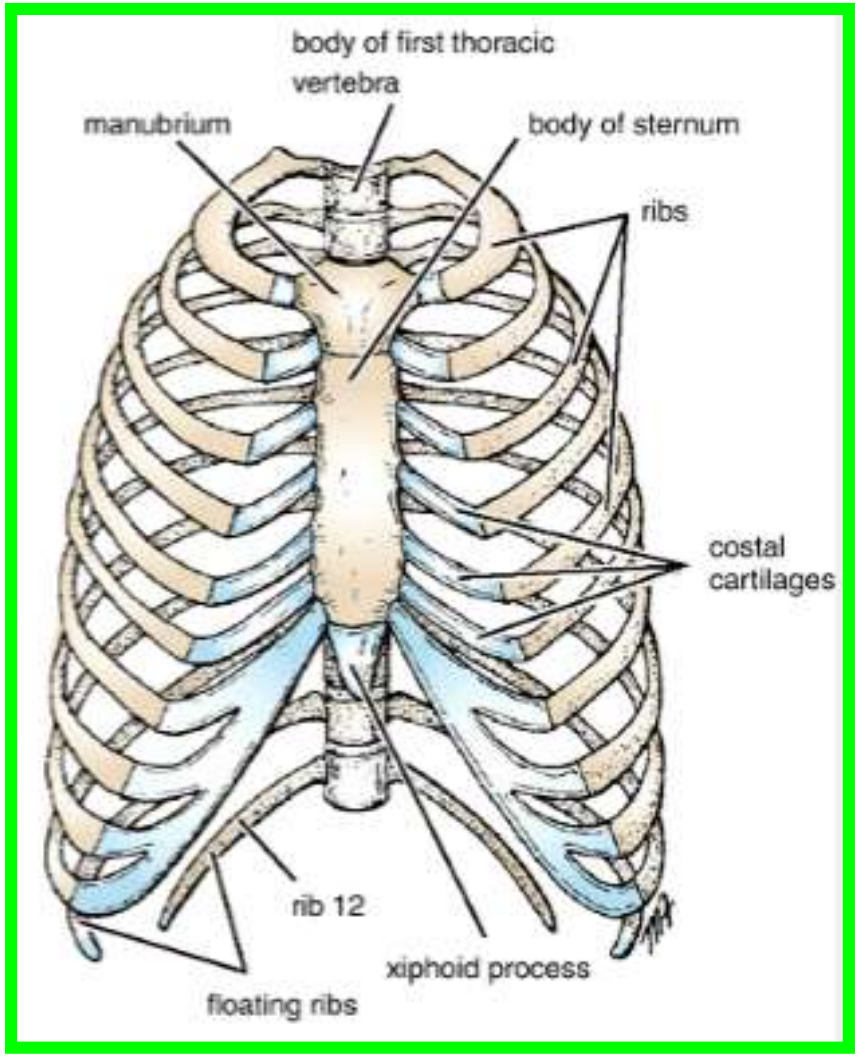
The thoracic wall is formed posteriorly by the thoracic part of the vertebral column;

anteriorly by the sternum and costal cartilages.

laterally by the ribs and intercostal spaces;

superiorly by the suprapleural membrane; and

inferiorly by the diaphragm, which separates the thoracic cavity from the abdominal cavity.

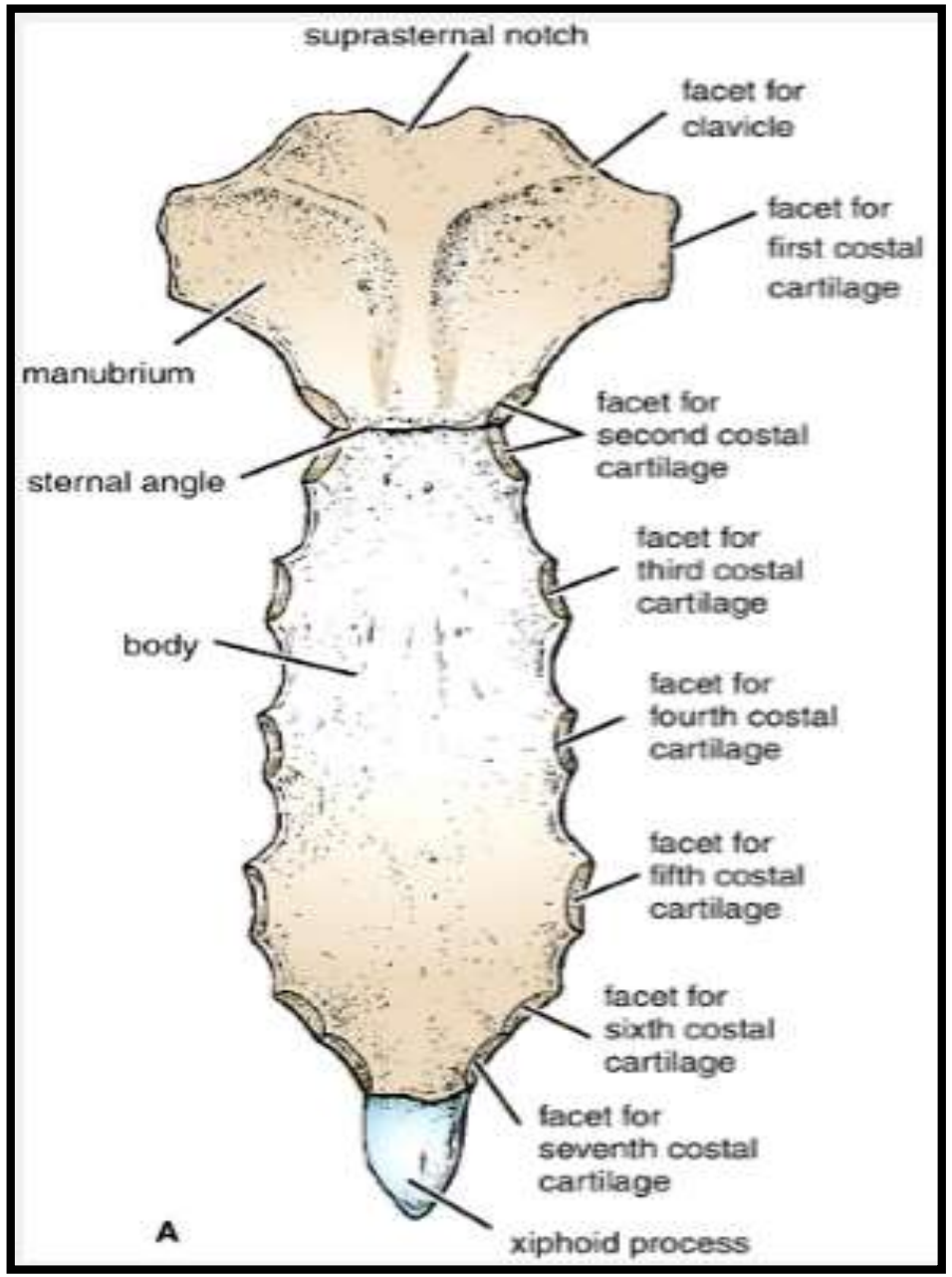


Thoracic Cage

Sternum

lies in the midline of the anterior chest wall.

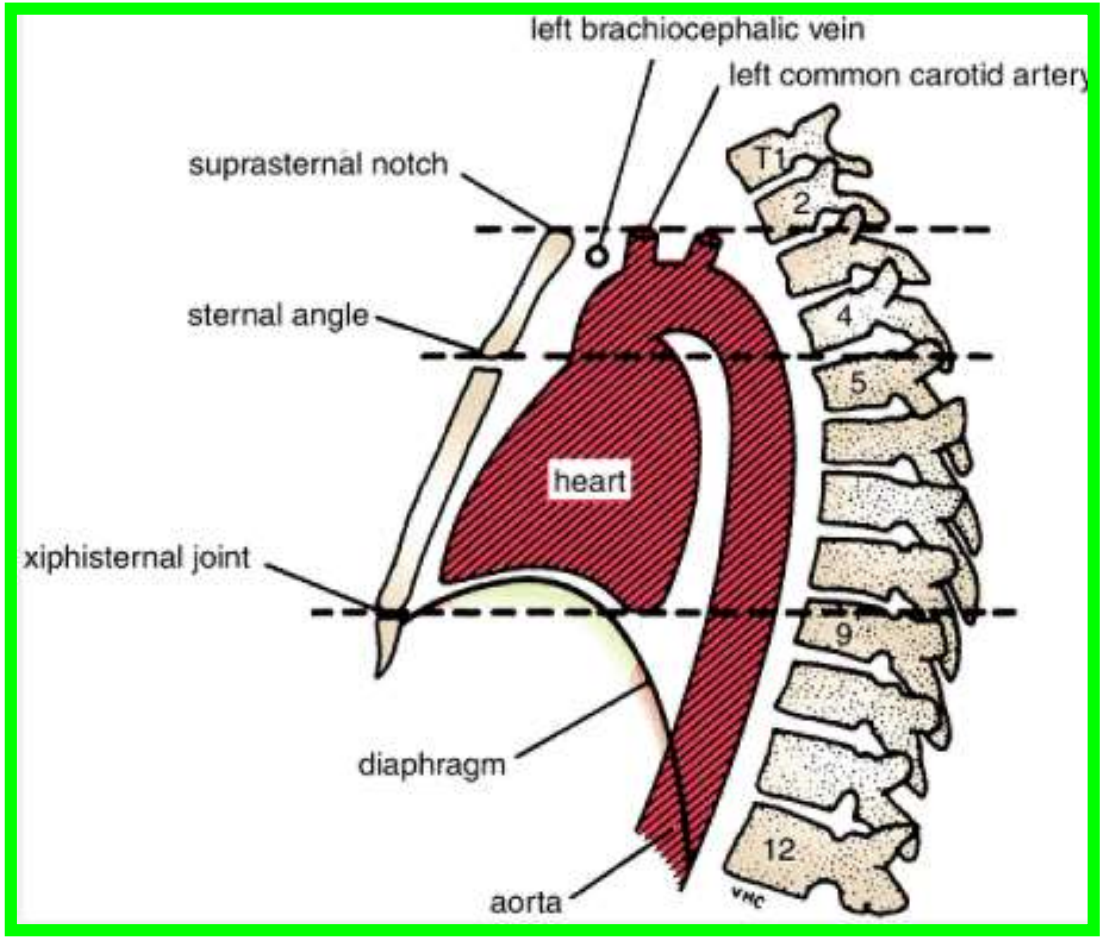
It is a flat bone that can be divided into three parts: manubrium sterni , body of the sternum, and xiphoid process.



Sternum

The manubrium is the upper part of the sternum.

- ✓ It articulates with the body of the sternum at the manubriosternal joint,
- ✓ and articulates with the clavicles and with the first costal cartilage and the upper part of the second costal cartilages on each side



- ✓ It lies opposite the third and fourth thoracic vertebrae

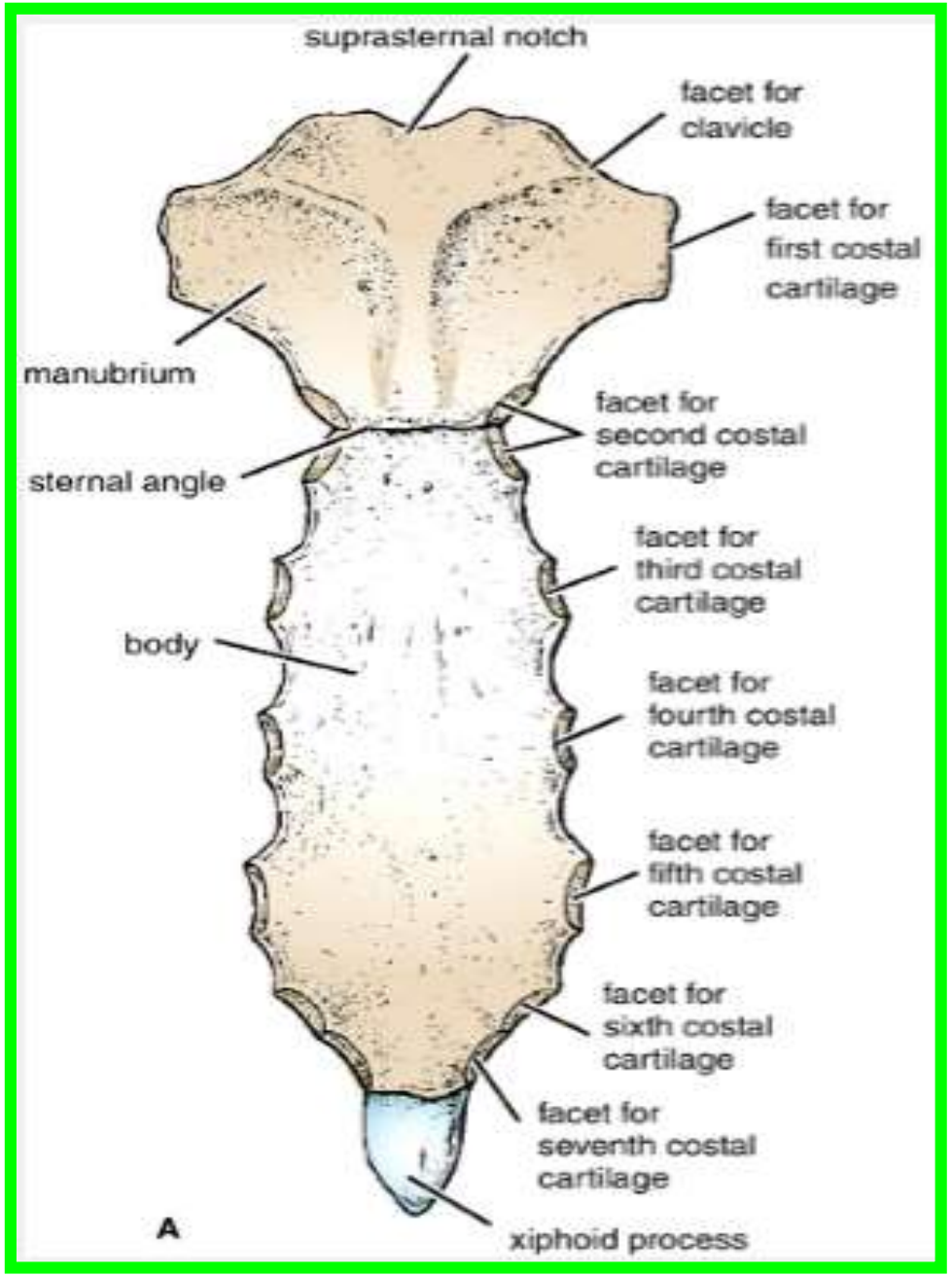
Sternum

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 second to the seventh costal cartilages

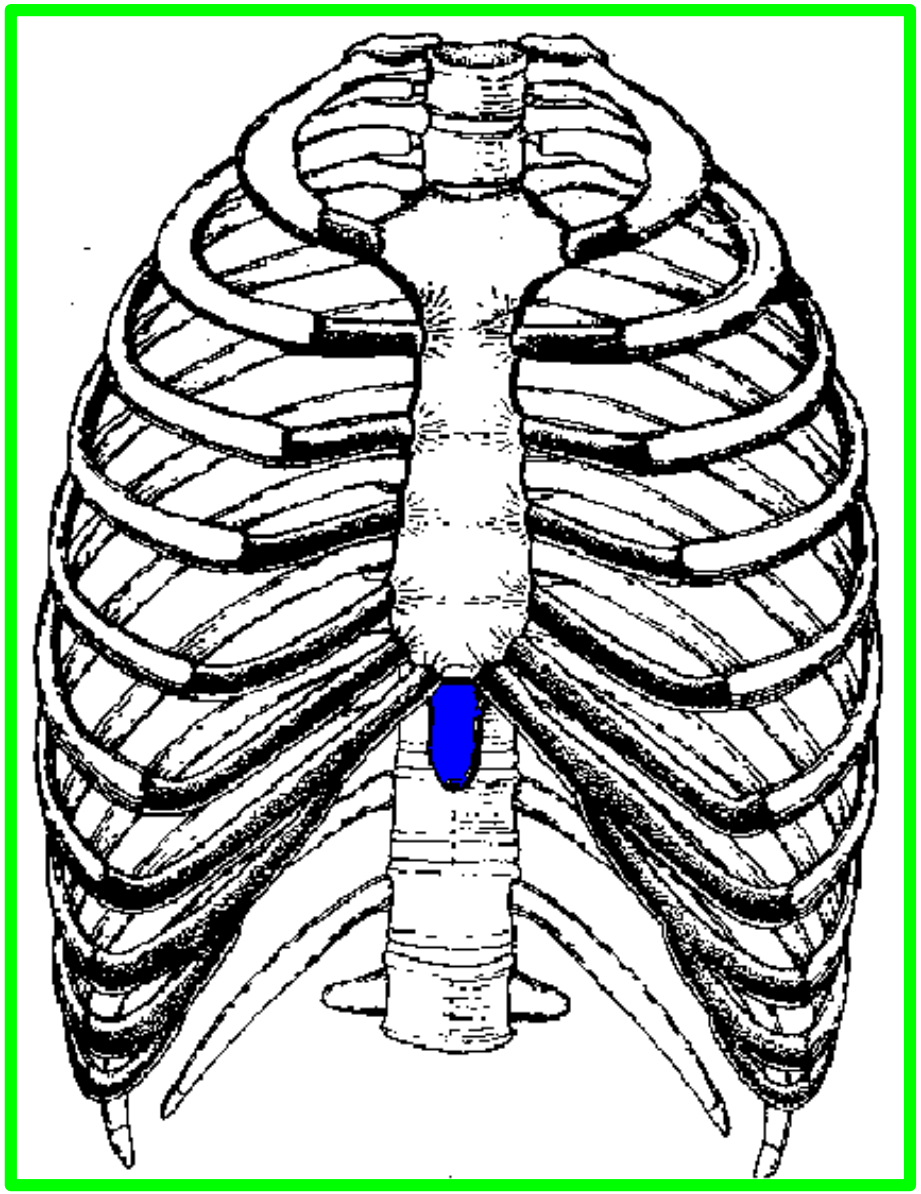


Sternum

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.



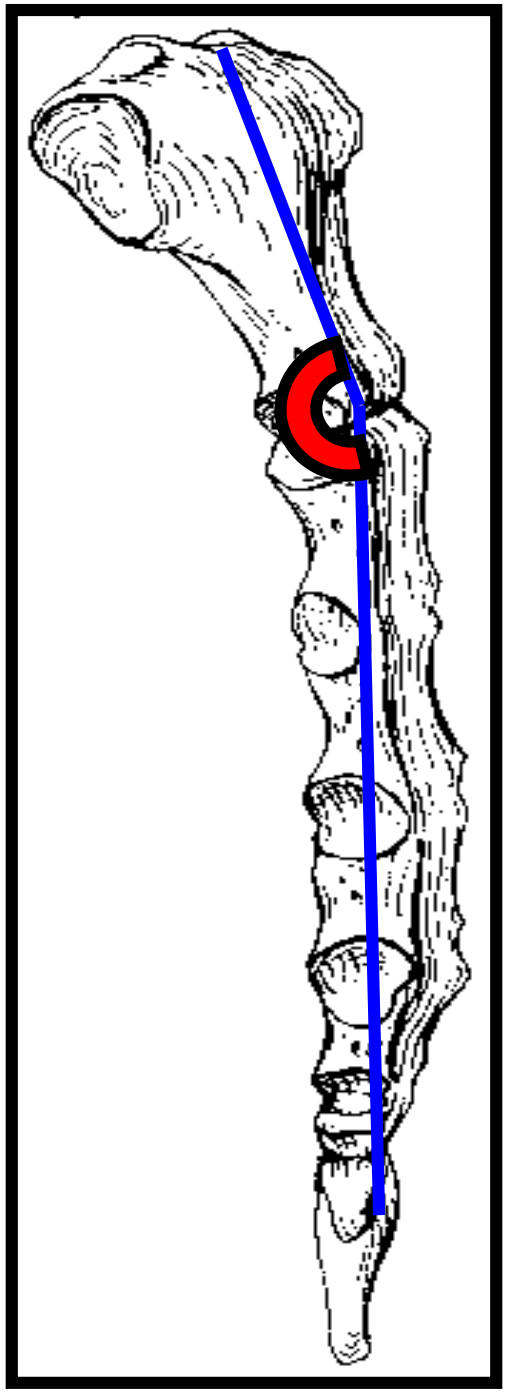
Sternum

The sternal angle (angle of Louis).

formed by the articulation of the manubrium with the body of the sternum,.

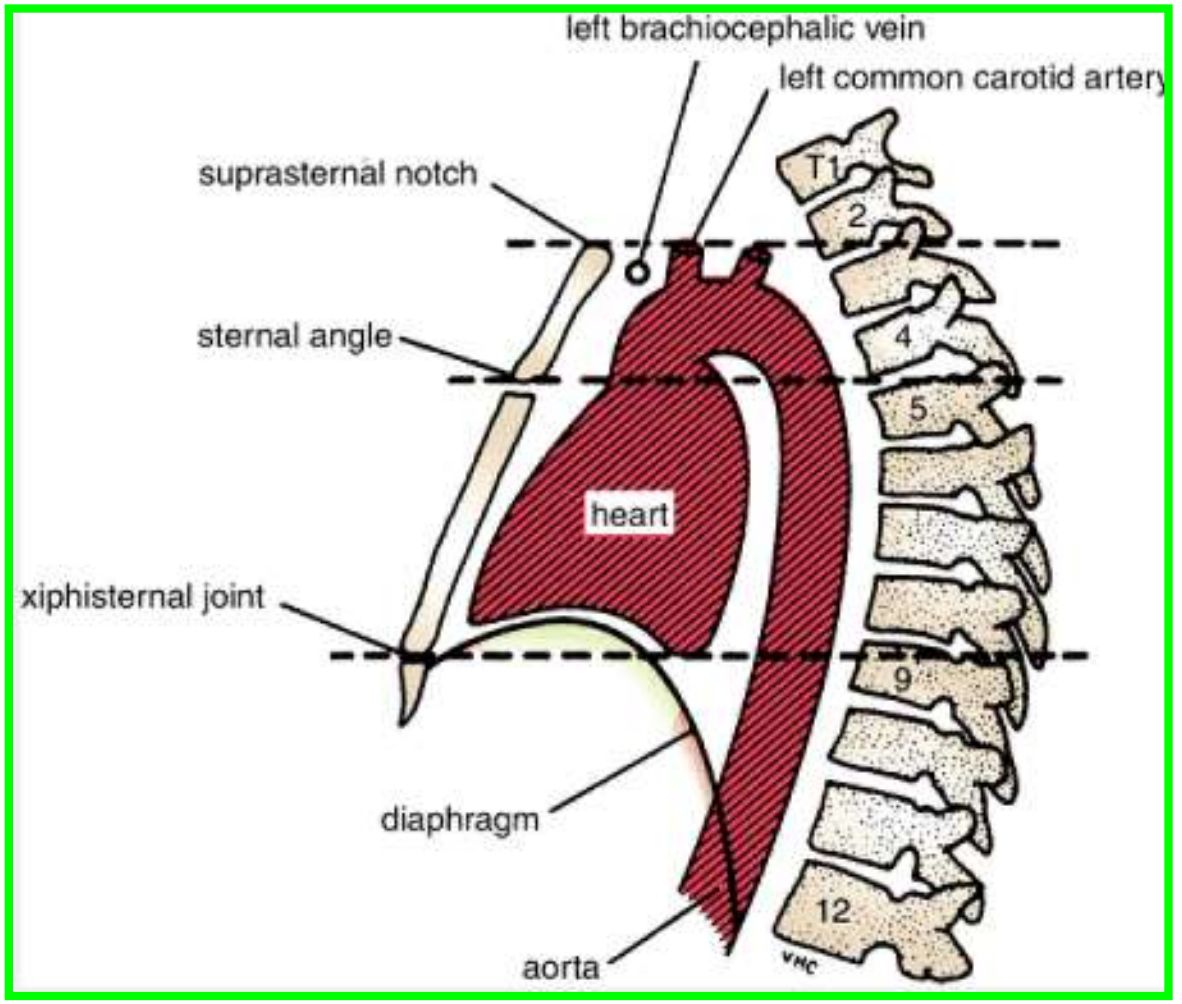
The transverse ridge lies at the level of the second costal cartilage.

- **The point from which all costal cartilages and ribs are counted.**



Sternum

The sternal angle lies opposite the intervertebral disc between the **fourth and fifth thoracic vertebrae.**



- **The xiphisternal joint** lies opposite the body of the **ninth thoracic vertebra**

Sternum

Sternal Biopsy

The sternal body is often used for bone marrow needle biopsy because of its breadth and subcutaneous position .

The needle pierces the thin cortical bone and enters the vascular spongy bone .

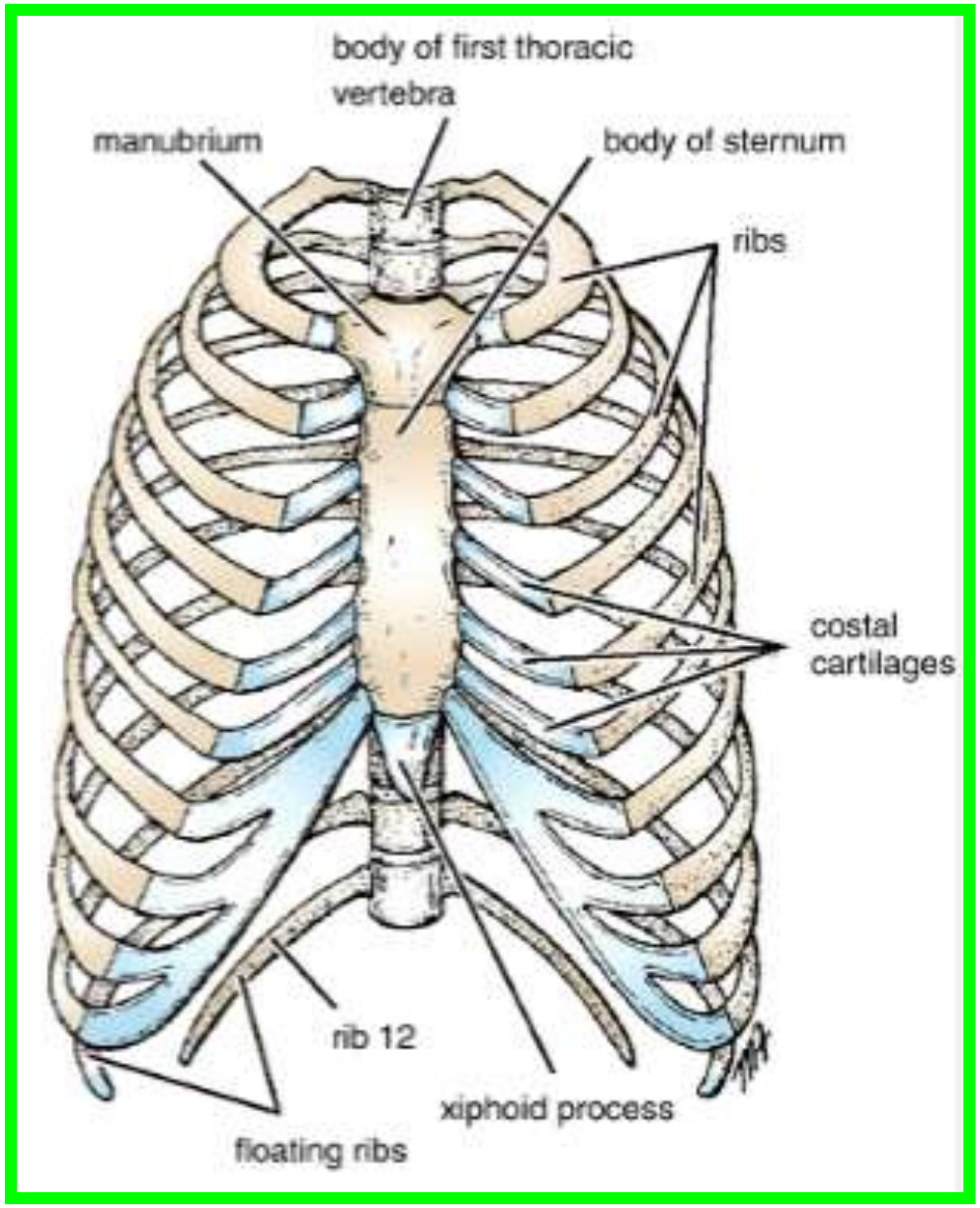
Sternal biopsy is commonly used to obtain specimens of marrow for transplantation and for detection of metastatic cancer and blood dyscrasias (abnormalities)

Thoracic Cage

Ribs

There are 12 pairs of ribs, all of which are attached posteriorly to the thoracic vertebrae

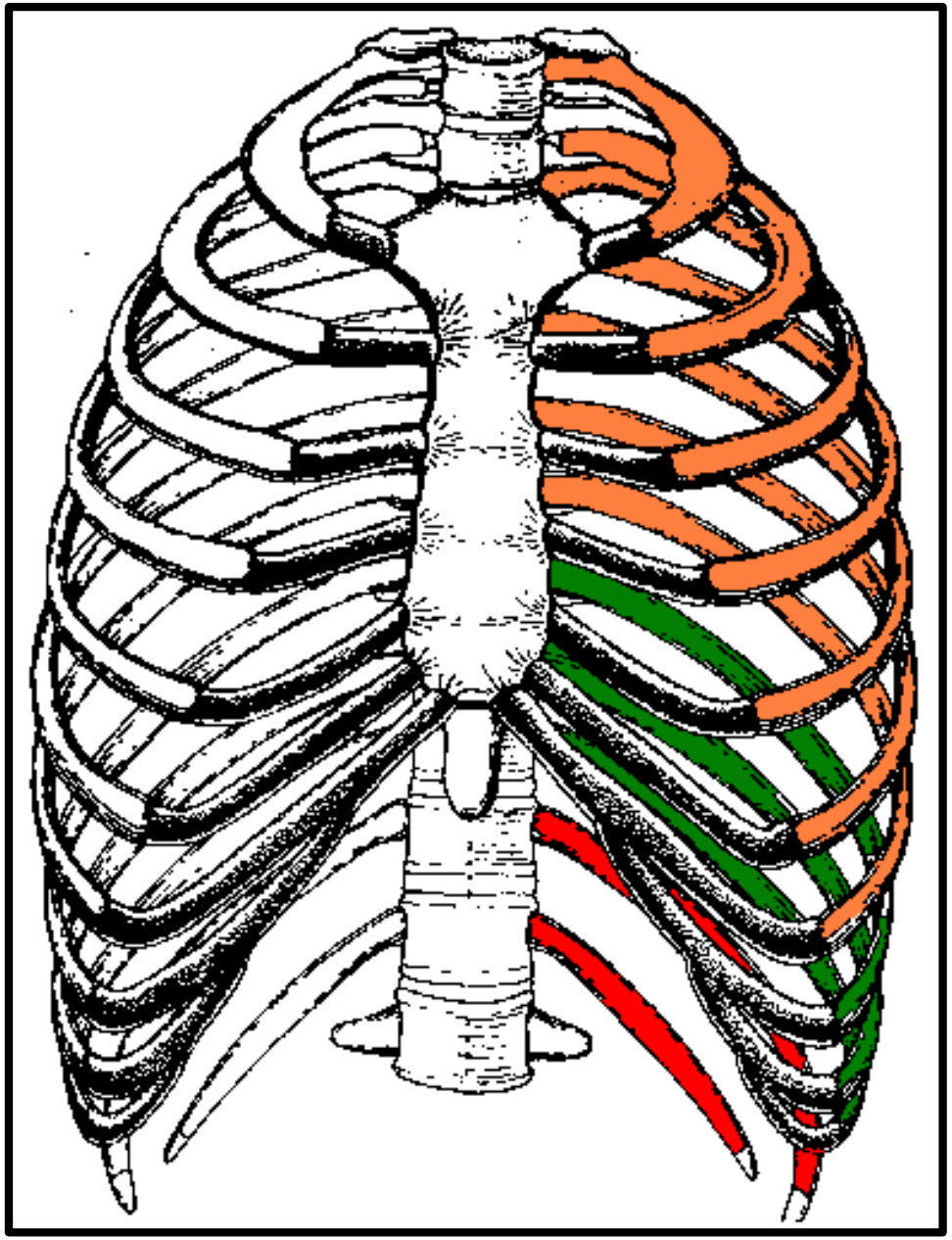
The ribs are divided into three categories:



Thoracic Cage

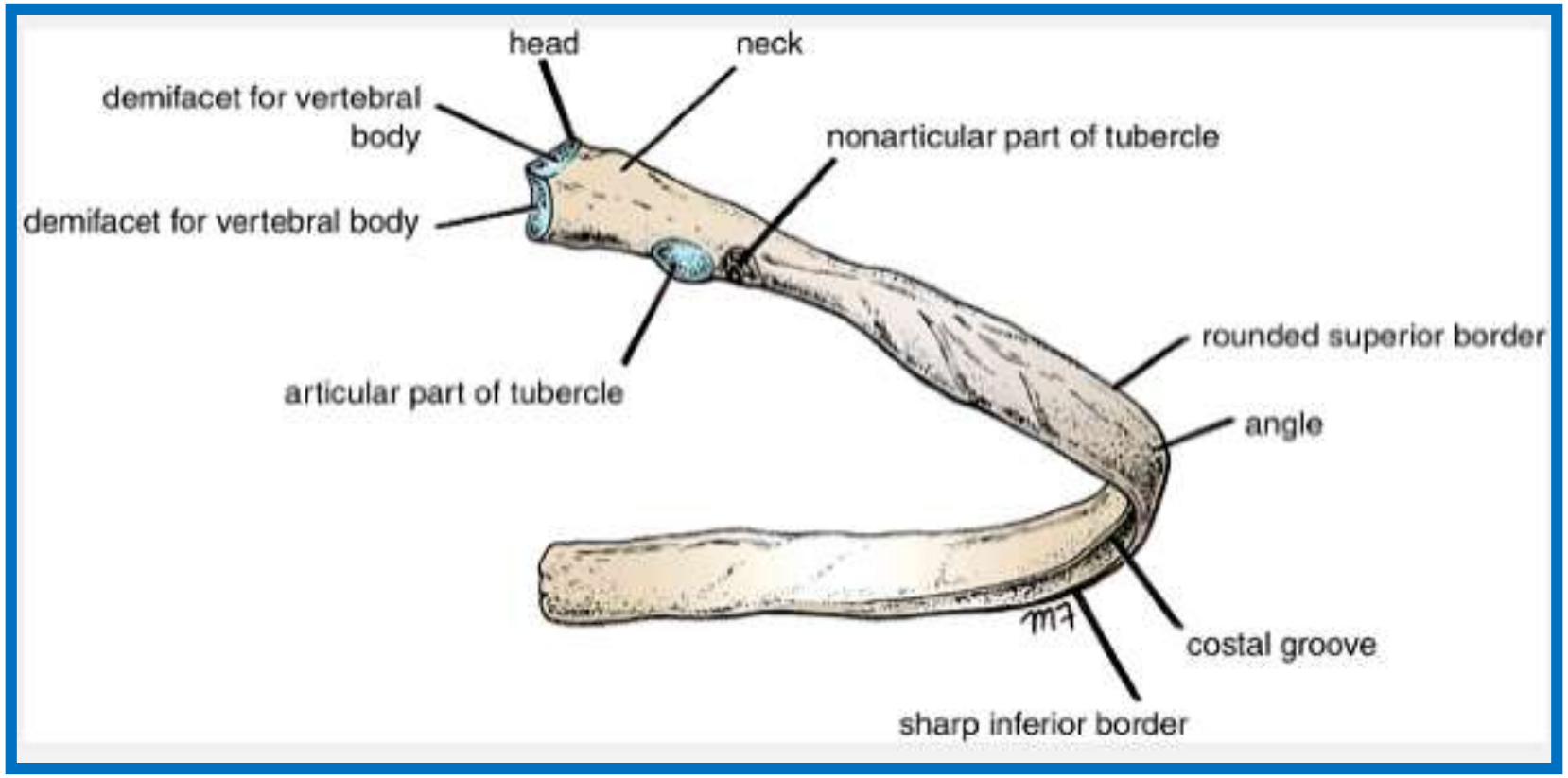
- **True ribs:** The upper seven pairs are attached anteriorly to the sternum by their costal cartilages.

- **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

A typical rib is a long, twisted, flat bone having a rounded, smooth superior border and a sharp, thin inferior border .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.

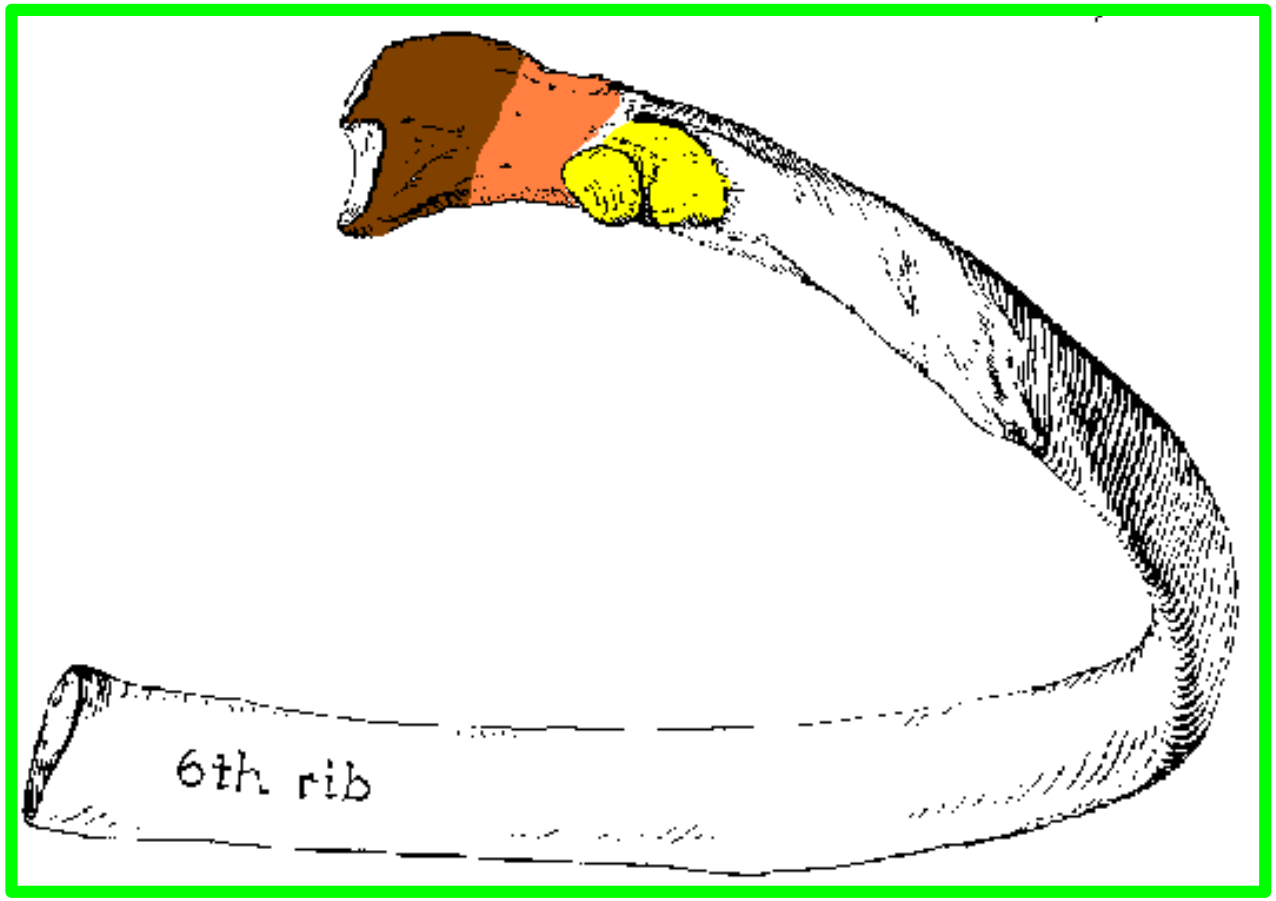


❑ Typical Rib

The typical rib has a head, neck, tubercle, shaft, and angle .

The neck is a constricted portion situated between the head and the tubercle.

- ❖head
- ❖neck
- ❖tubercle
- ❖and a shaft



❖ The head of the typical rib

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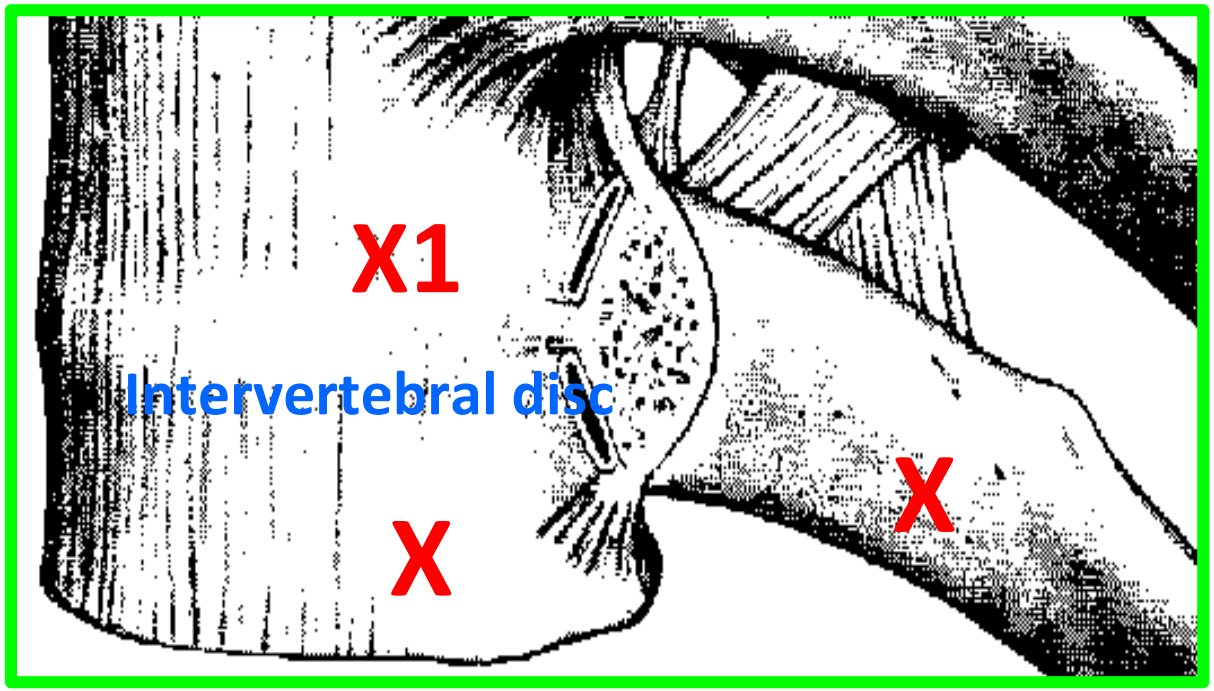
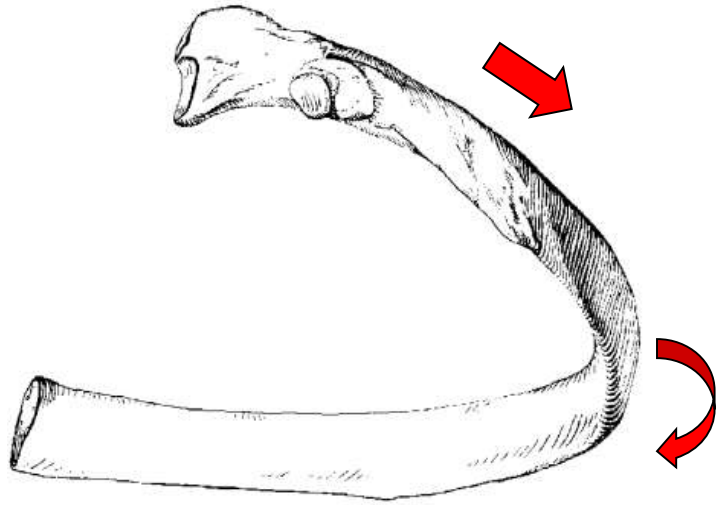
- ❖ is the posterior end of the rib
- ❖ is wedge-shaped
- ❖ carries two articular facets

The head has **two facets** for articulation with the numerically corresponding vertebral body and that of the vertebra immediately above .



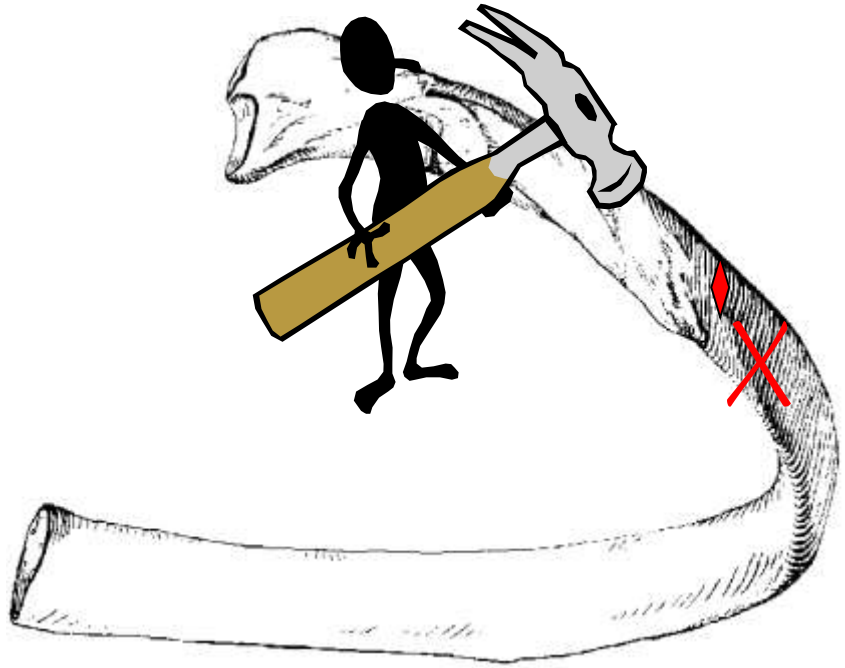
❖ The shaft

- ❖ Is lateral to the tubercle
- ❖ primarily it is directed posteriorly
- ❖ then it bends sharply anteriorly



❖ The angle

- ❖ The point of greatest change in curvature is :
- ❖ The angle of a rib is its weakest part where it tends to fracture.



Typical ribs (3-10) Have

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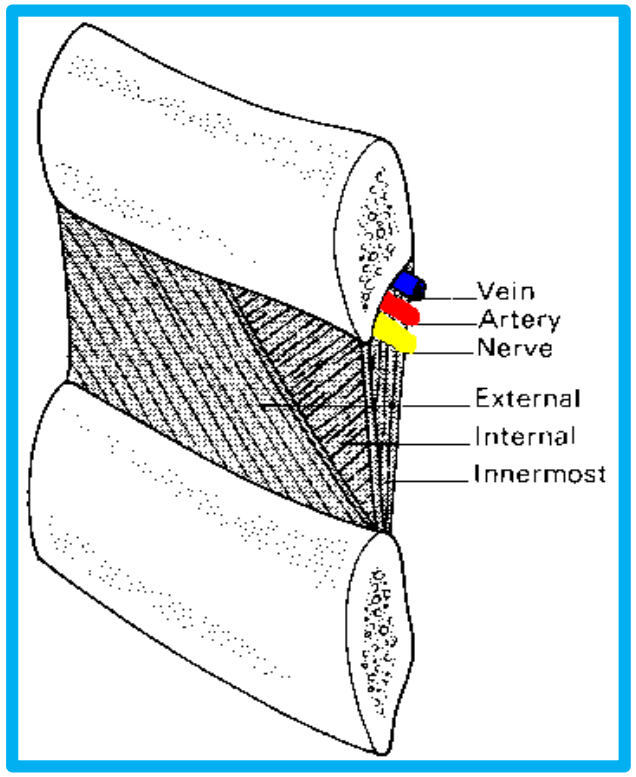
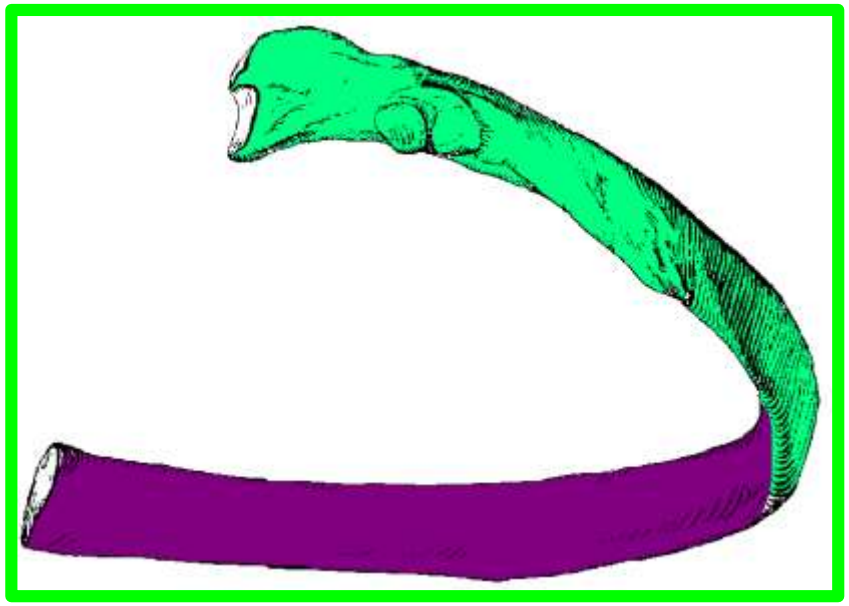
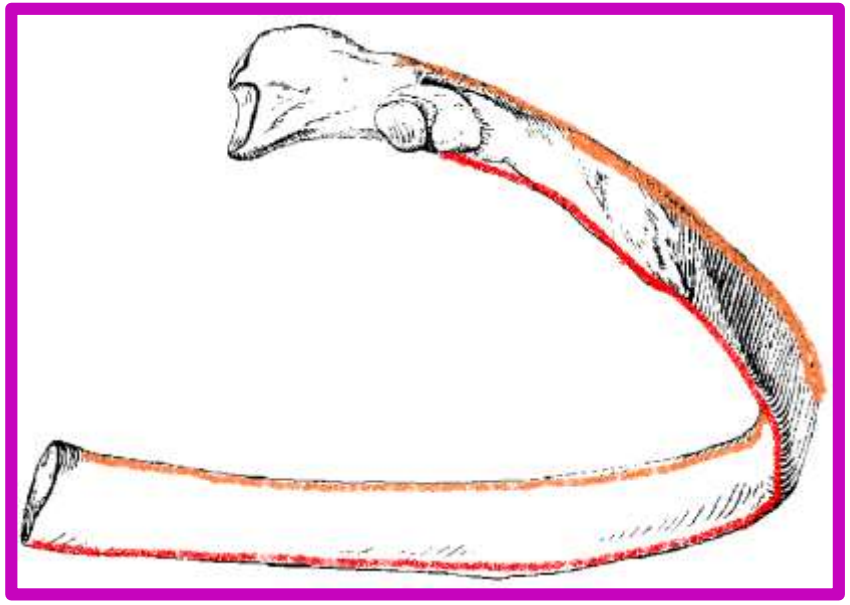
- External and Internal surfaces
- Superior and Inferior borders
- The inferior border is sharp and extends inferior to the costal groove on the internal surface of the shaft so that it protects the:
- intercostal neurovascular bundle located in the costal groove.

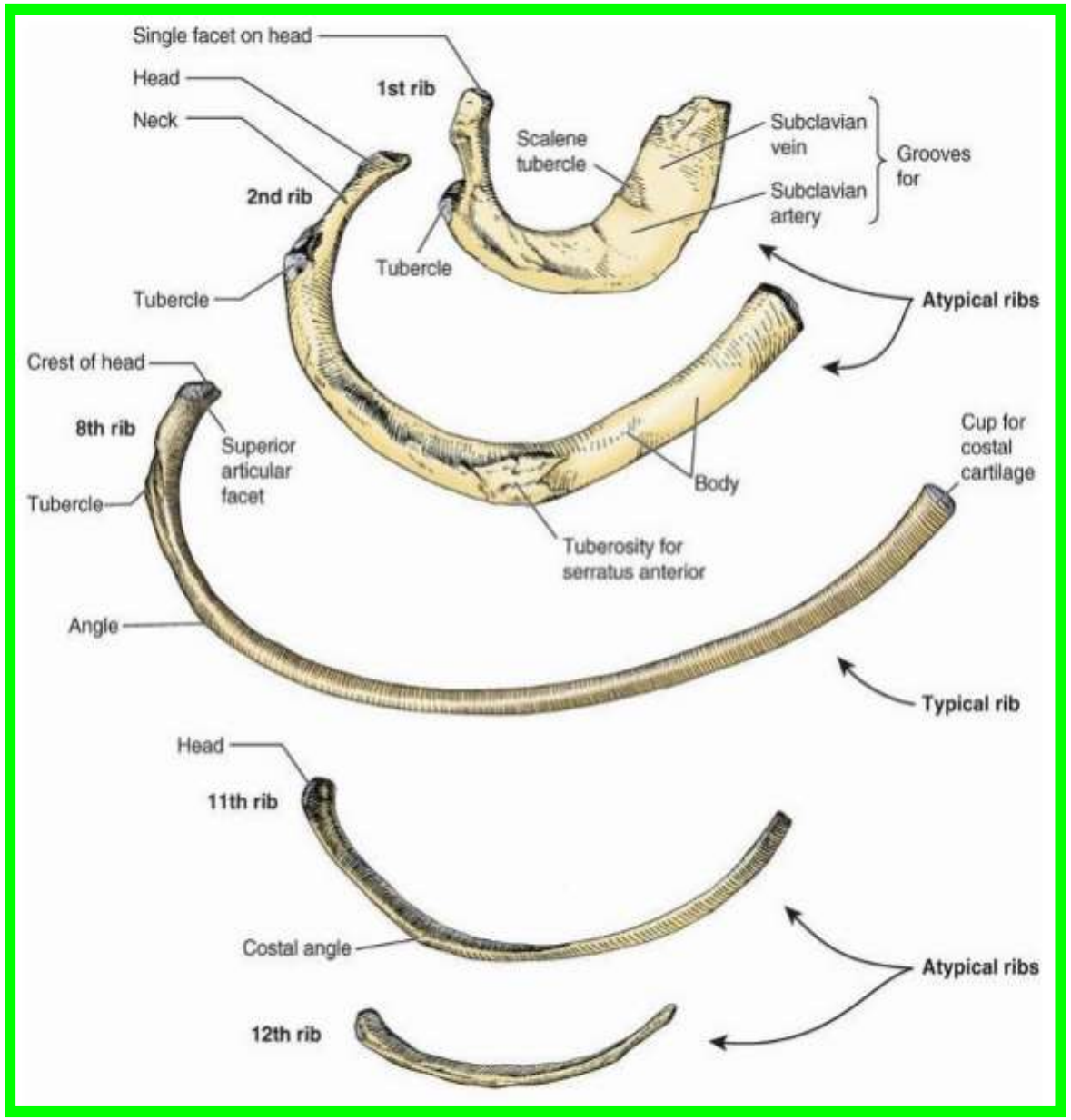






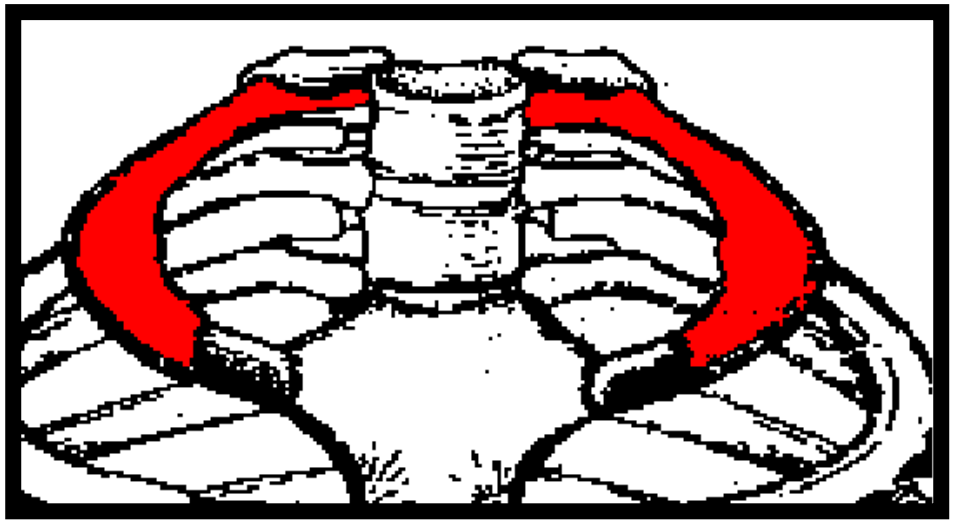
❑ Atypical ribs

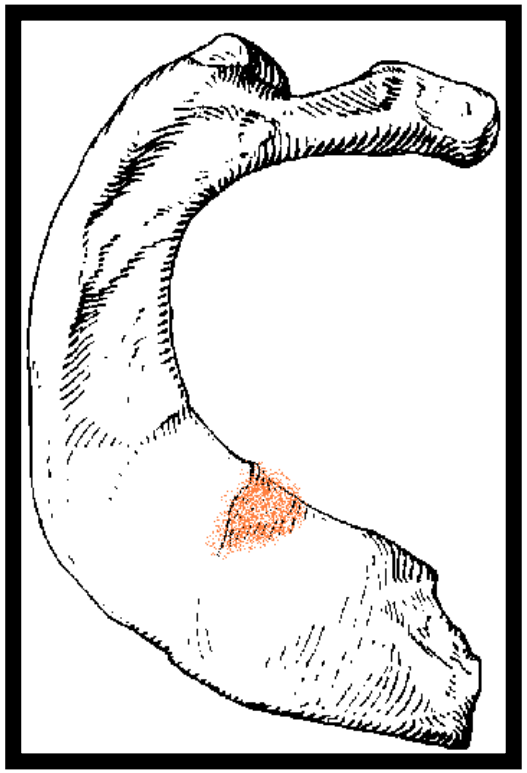
(1st, 2nd, and 11th-12th) are dissimilar :

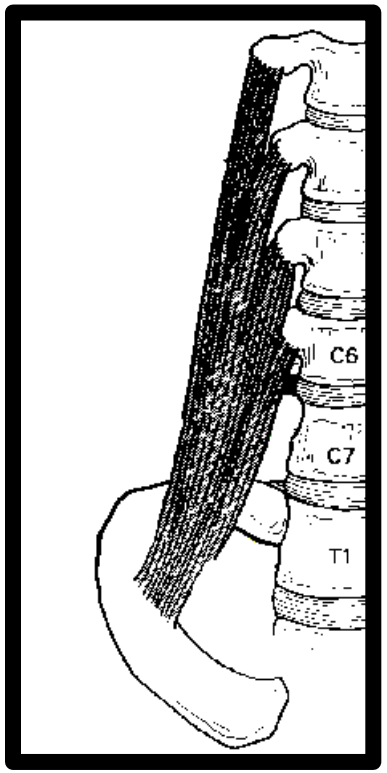


The first rib

- is the broadest and most curved rib
- The shaft has superior and inferior surfaces
- The shaft has inner and outer borders
- The superior surface carries a prominent scalene tubercle on its inner border for the insertion of scalenus anterior muscle

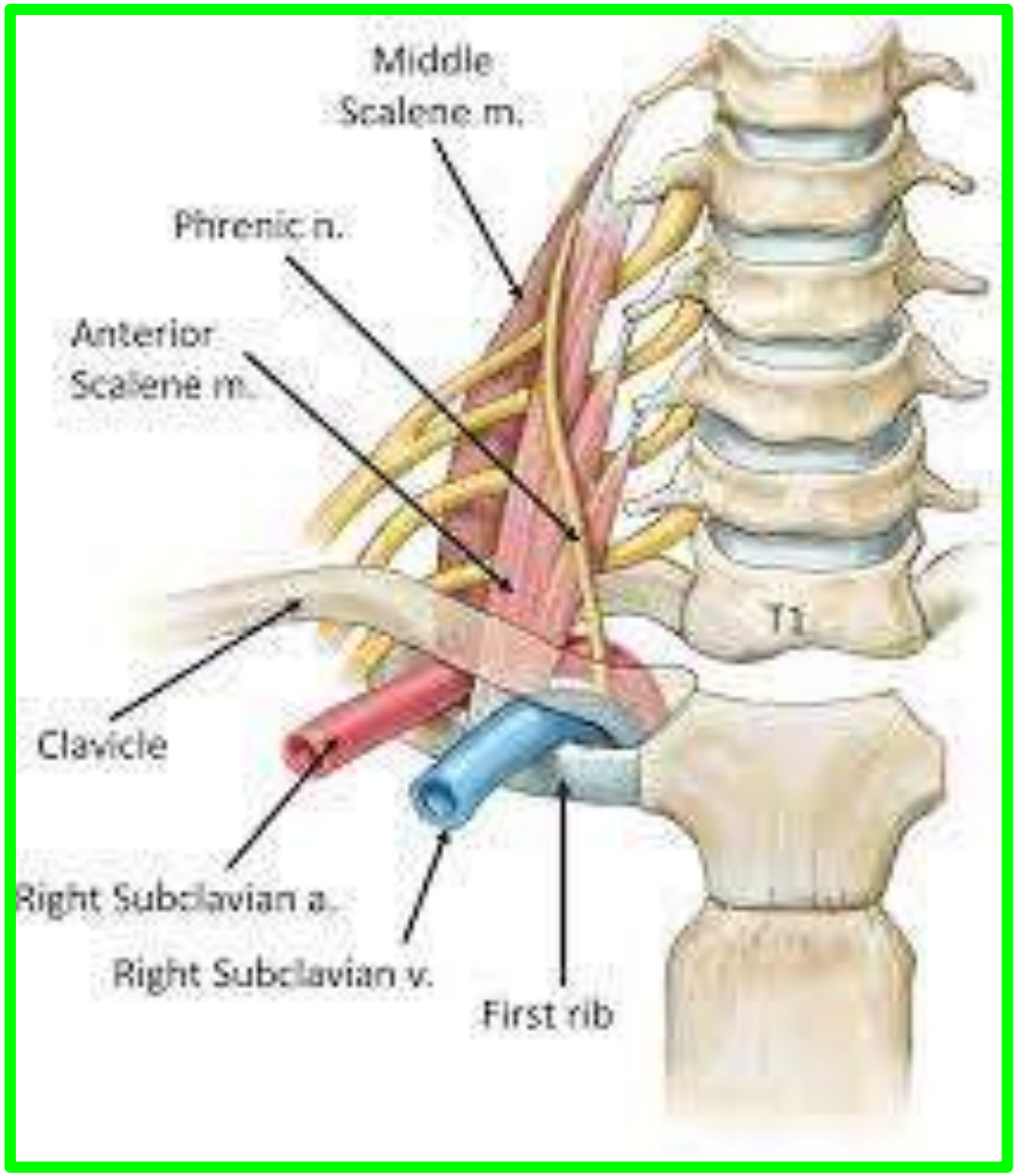






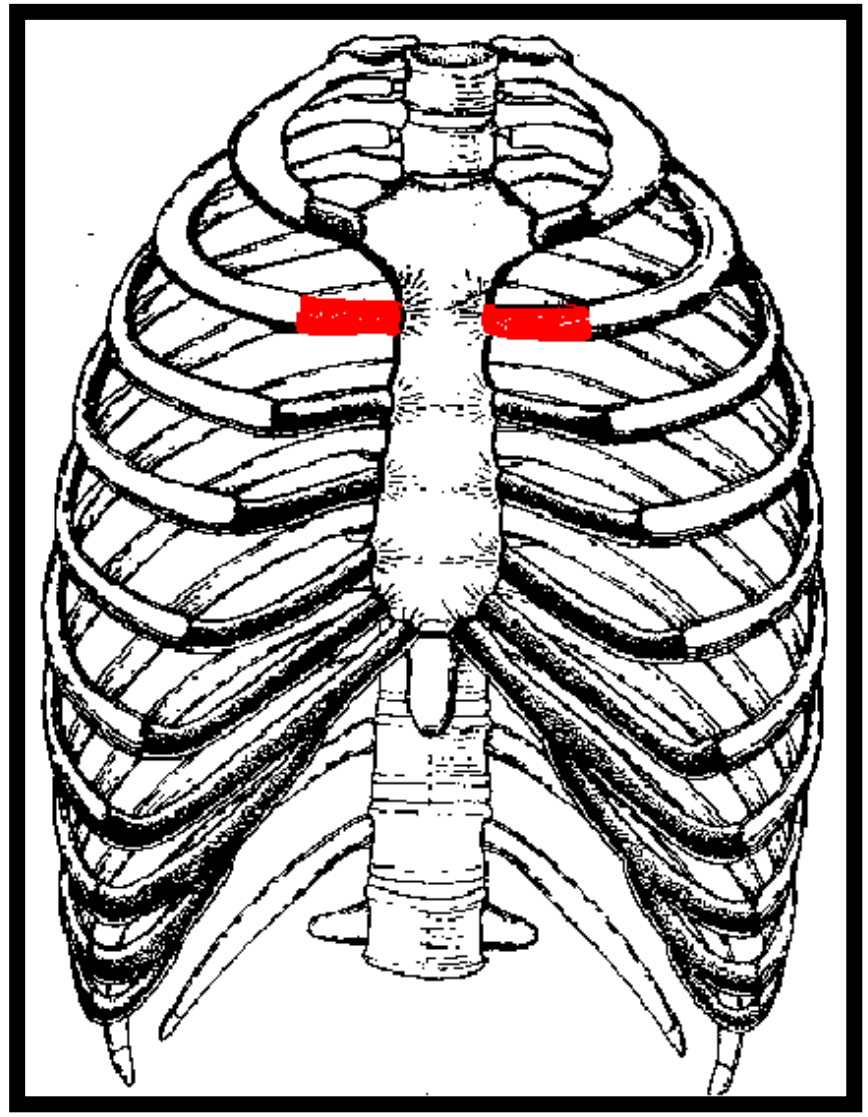
The first rib

- The subclavian vein crosses anterior to scalene tubercle,
- while the subclavian artery and the inferior trunk of the brachial plexus pass posterior to it

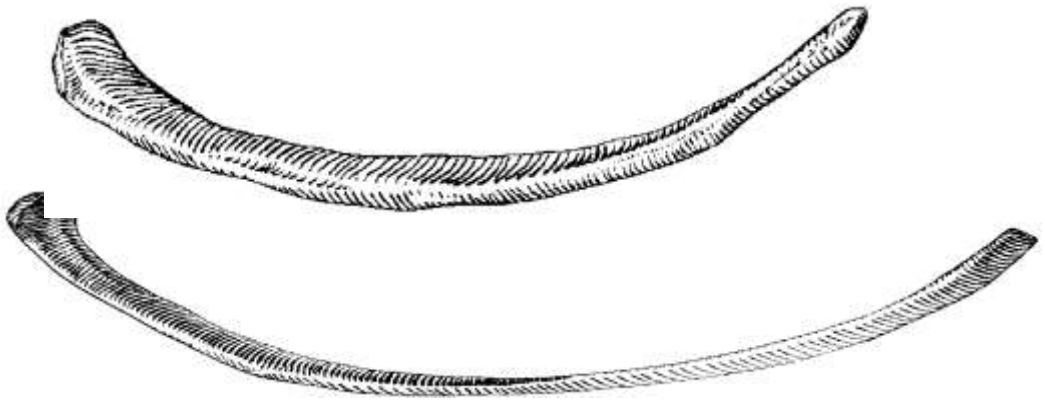


Sternal angle

- It is here that the second costal cartilage joins the sternum
- It is the starting place where the physician counts the ribs to use them as landmarks.



The 11th & 12th ribs

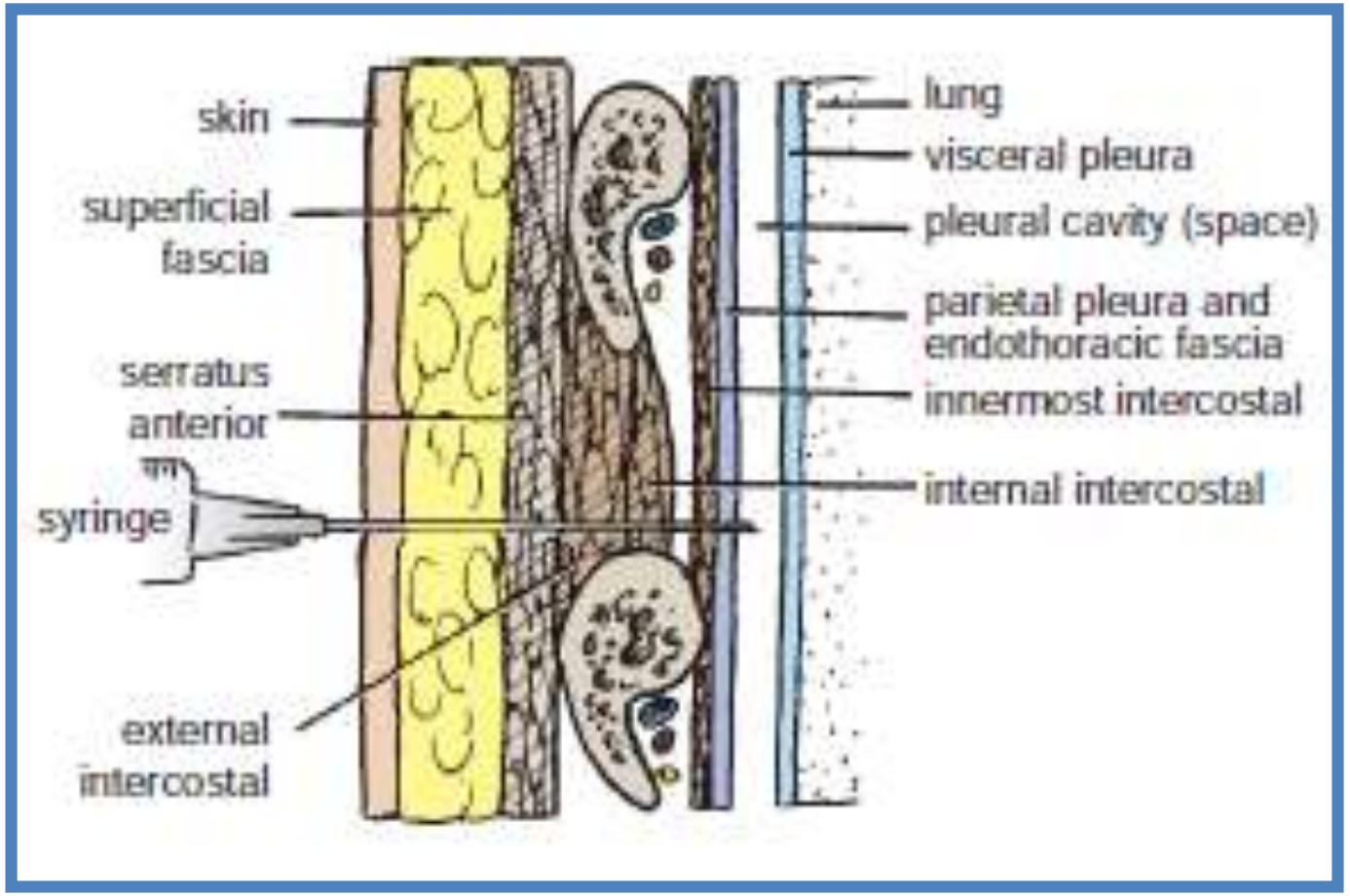


- are short and carry a single facet on the head
- have neither neck nor tubercle

Intercostal Spaces

The spaces between the ribs contain three muscles of respiration: the external intercostal, the internal intercostal, and the innermost intercostal muscle.

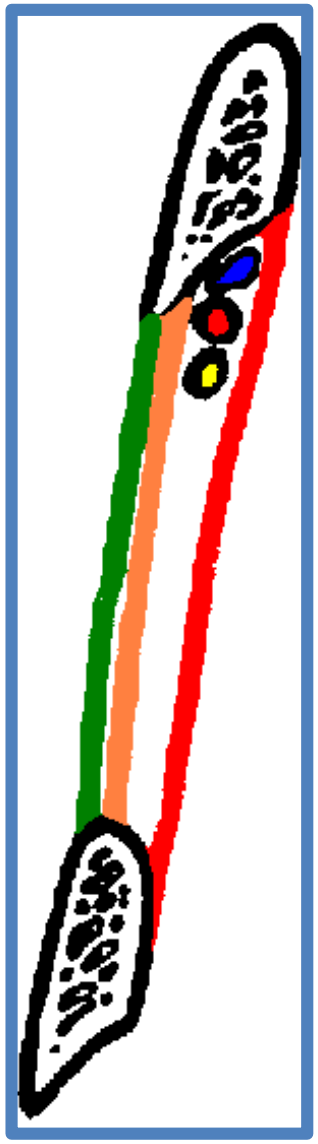
The innermost intercostal muscle is lined internally by the endothoracic fascia, which is lined internally by the parietal pleura.

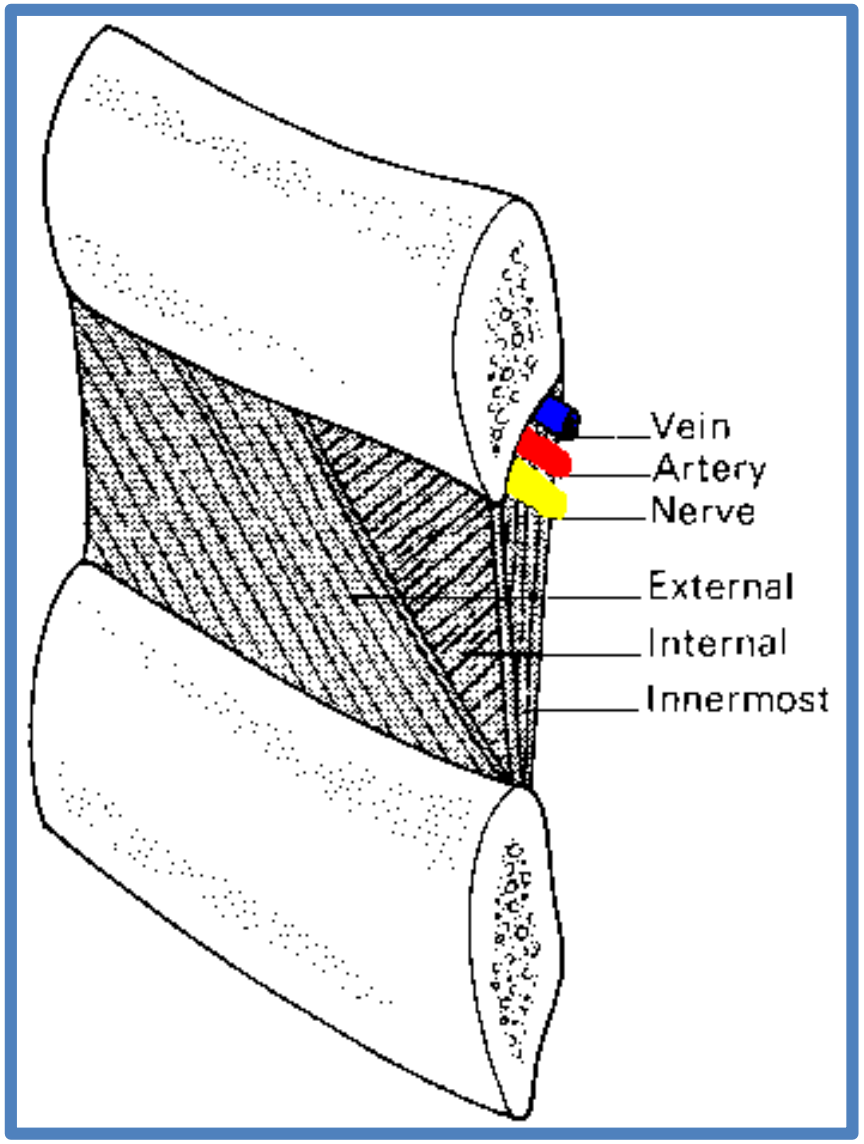


Intercostal Spaces

The intercostal nerves and blood vessels run between the intermediate and deepest layers of muscles

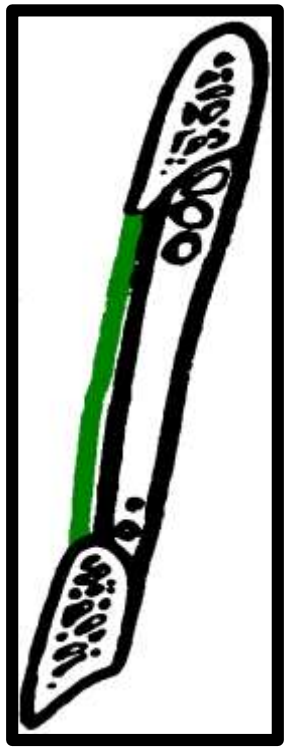
They are arranged in the following order from above downward: intercostal vein, intercostal artery, and intercostal nerve (i.e., VAN).

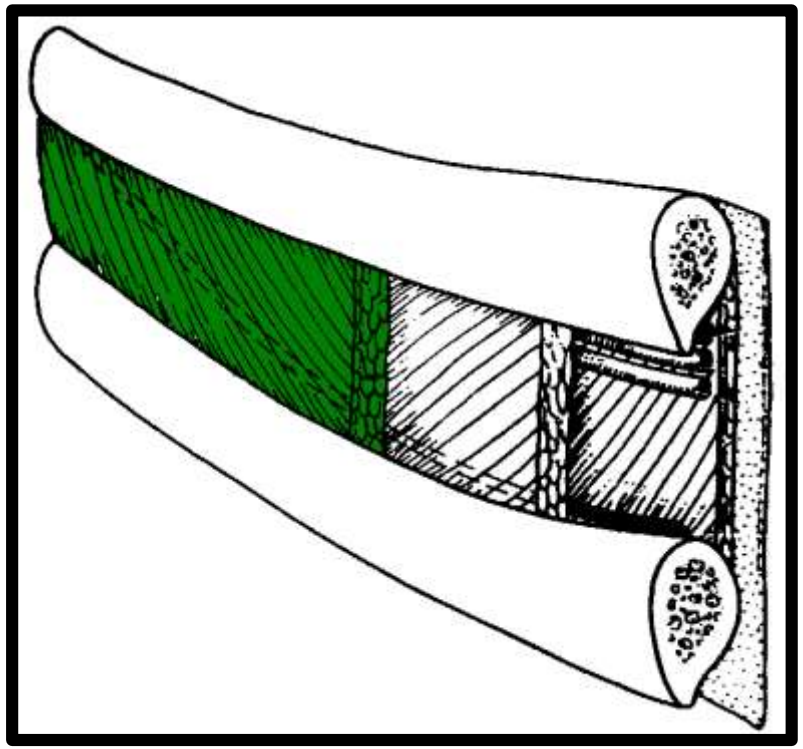




External intercostal

- forms the most superficial layer
- Its fibers are directed downwards and forward (same direction of external oblique muscle of the abdomen)
- from the inferior border of the rib above to the superior border of the rib below





Internal intercostal

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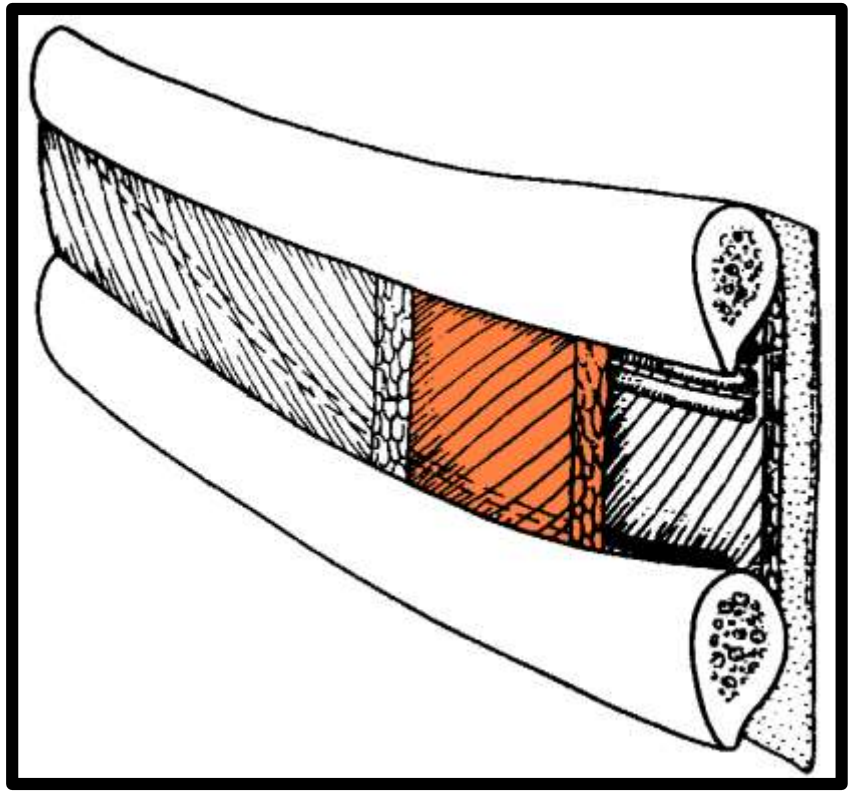
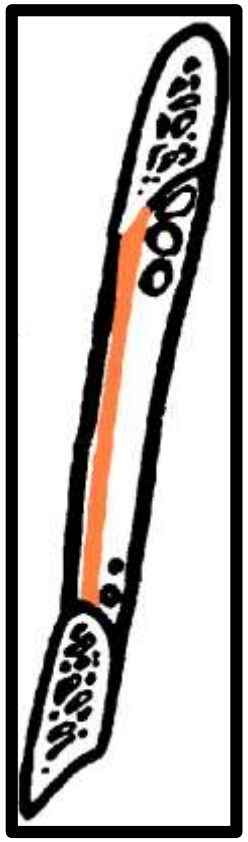
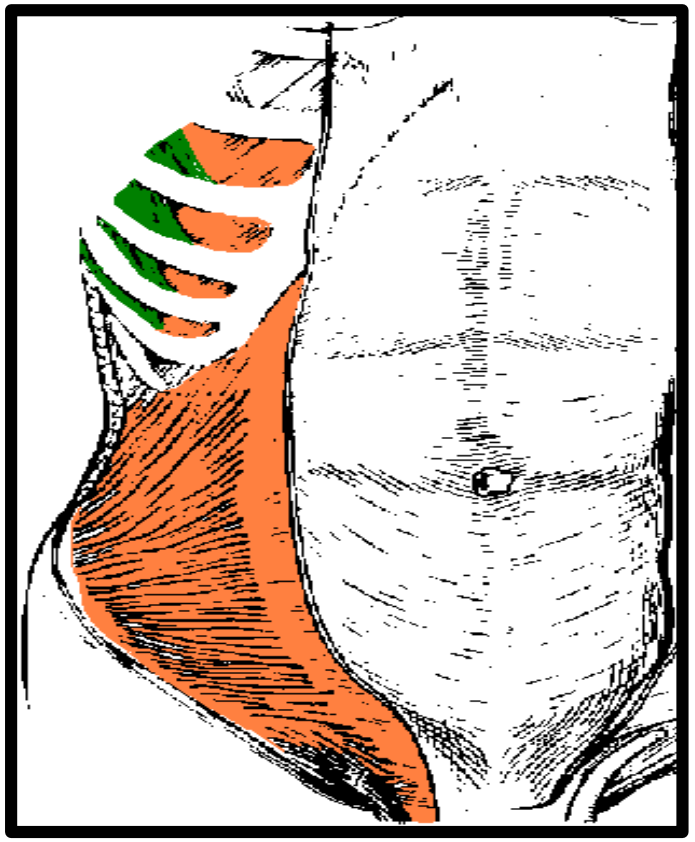
- forms the intermediate layer
- Its fibers are directed dawnwards and backwards (same direction of the internal oblique muscle of the)
- Extends from the costal groove of the rib above to the upper border of the rib below

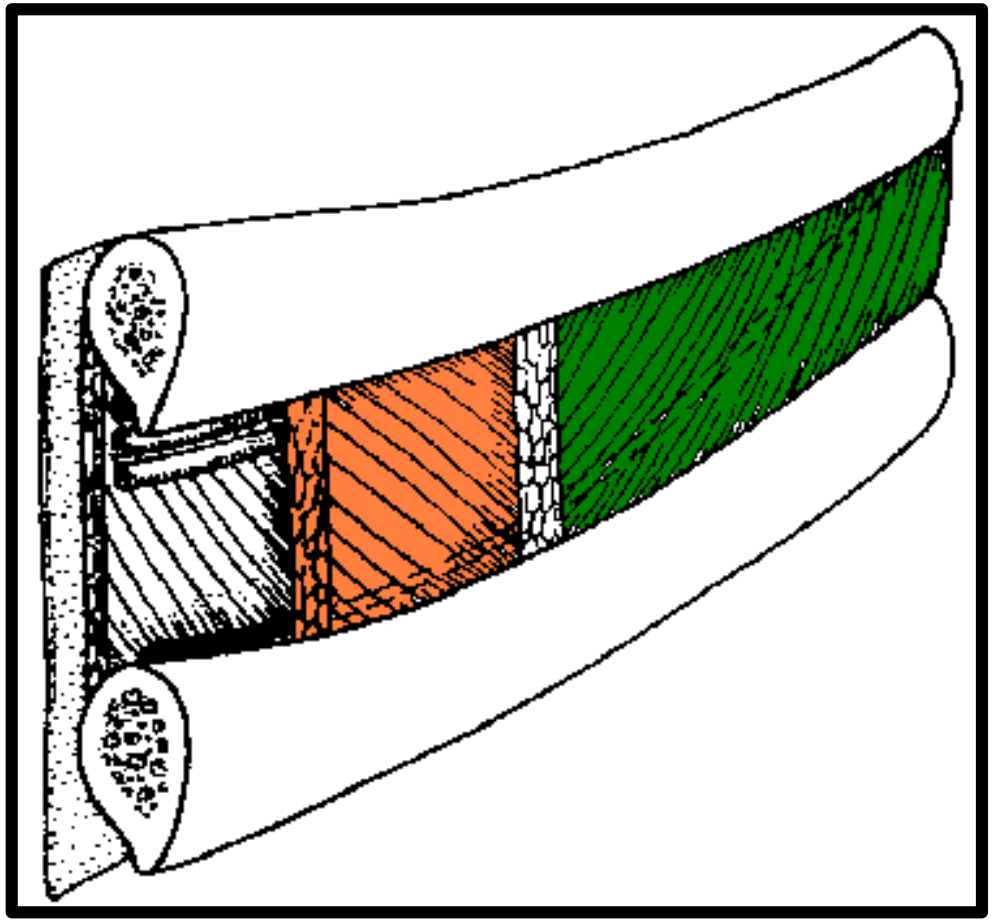






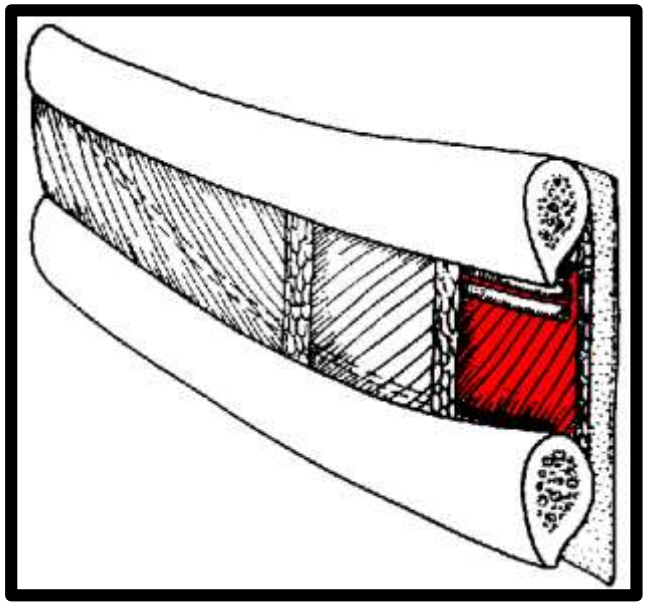
Internal intercostal

- the fibers of the internal intercostal are therefore at right angles to those of the external intercostal

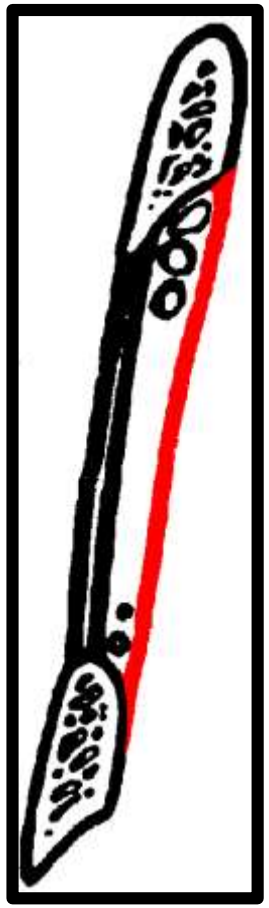


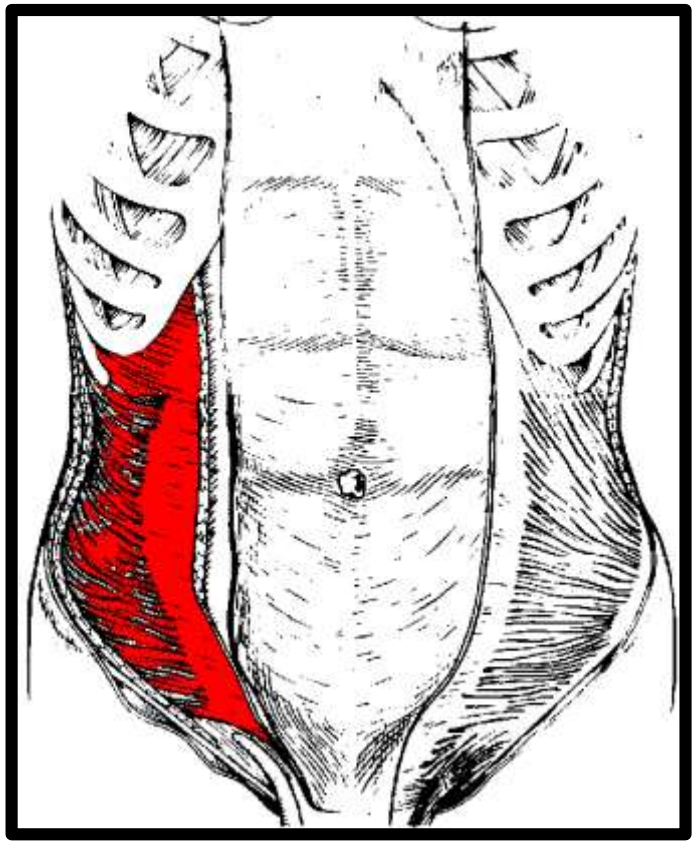
Innermost intercostal

- Extends between internal surfaces of adjacent ribs.



Innermost intercostal



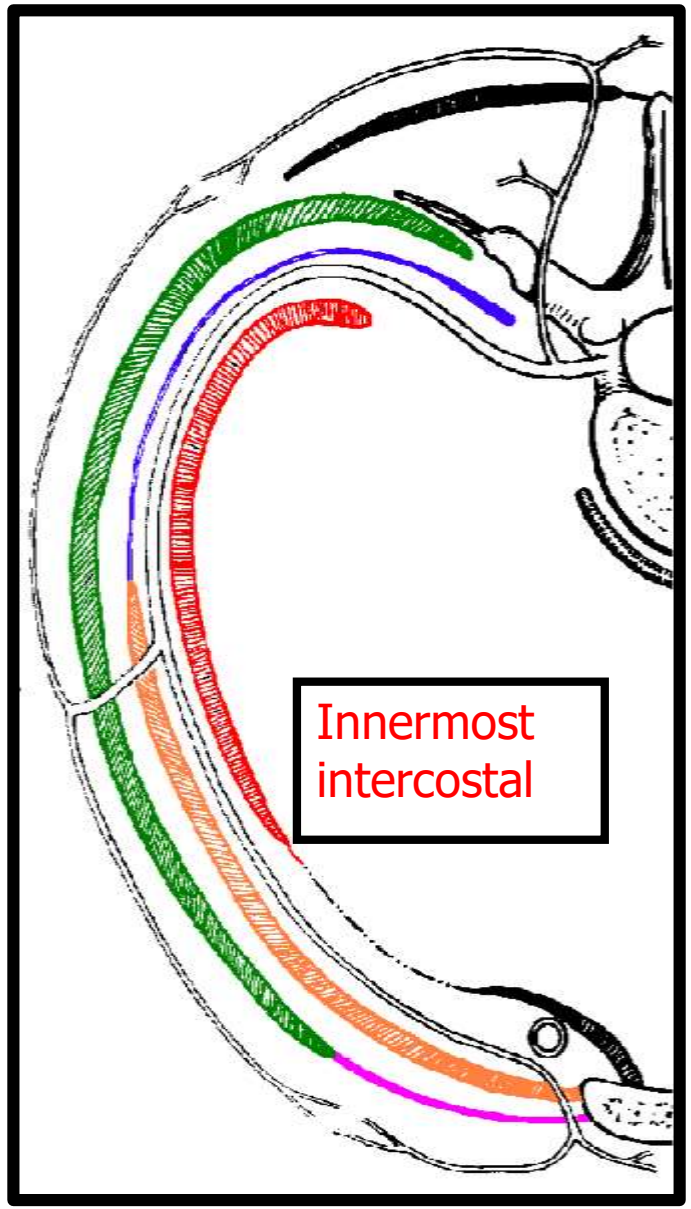


transversus abdominis

- It corresponds to the transversus abdominis muscle of the anterior abdominal wall

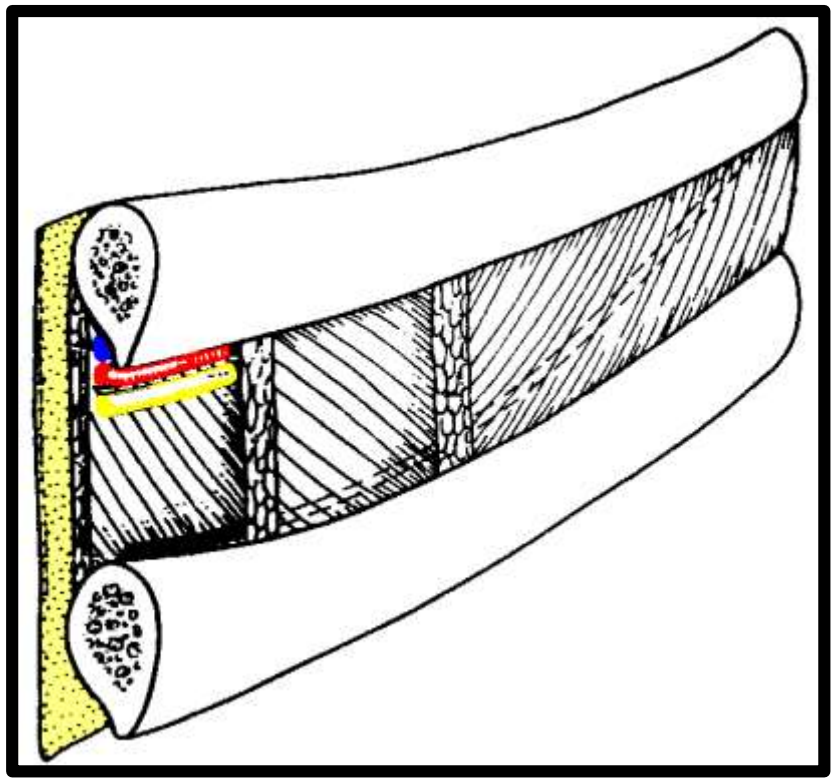
Innermost intercostal

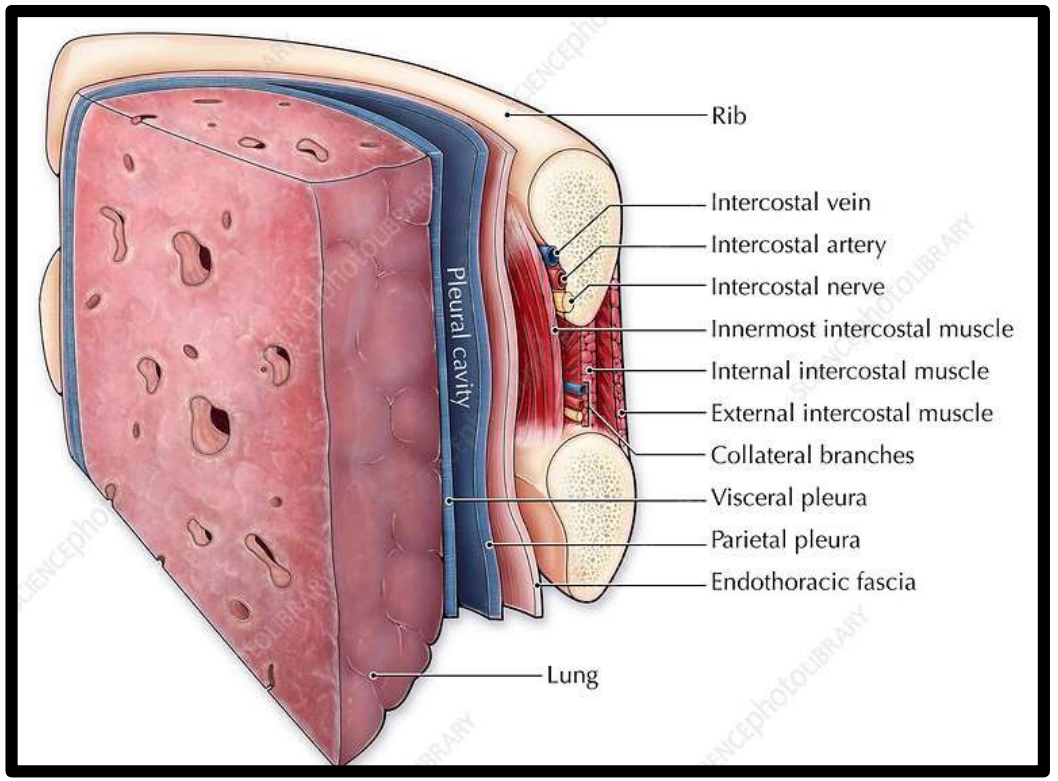
- The external intercostal muscle extends from the rib tubercle behind to the costochondral junction in front as anterior (external) intercostal membrane
- The internal intercostal extends from the side of the sternum in front to the angles of the ribs behind as posterior (internal) intercostal membrane
- The innermost intercostal fibers cover the middle 2/4th of the intercostal spaces



Endothoracic fascia

- The innermost intercostal, Subcostalis, and transversus thoracis separate the intercostal neurovascular bundle from the layer of fascia external to the pleura called the endothoracic fascia





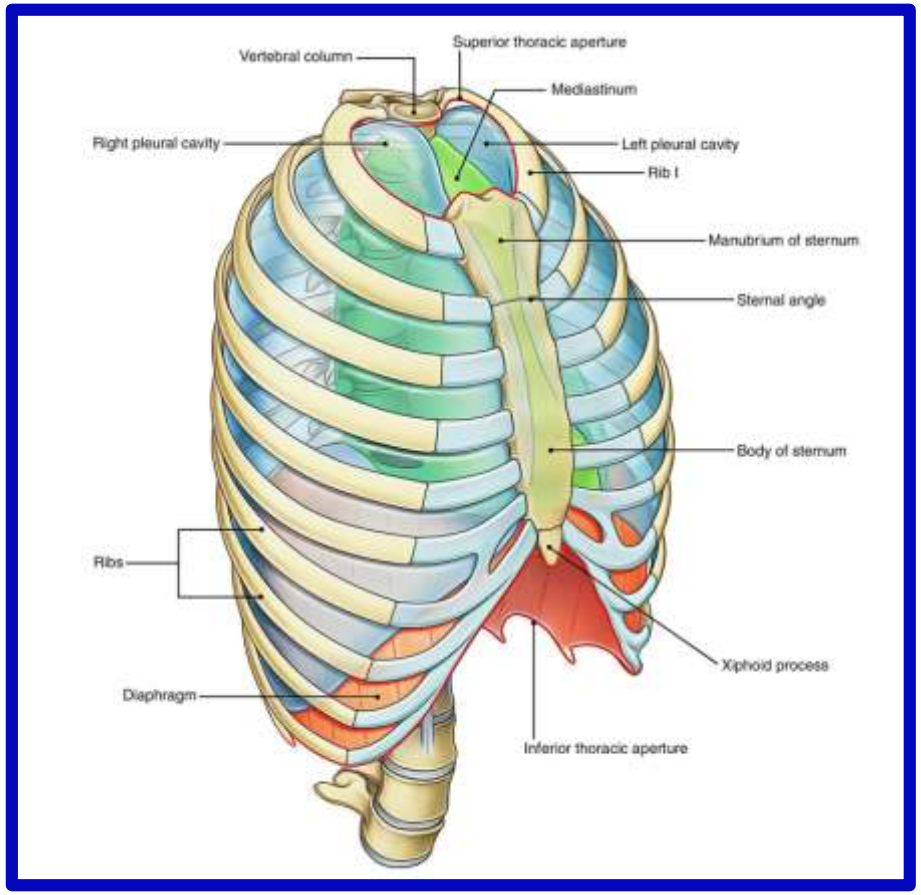
Openings of the Thorax

The chest cavity communicates with the root of the neck through an opening called the thoracic outlet.

The opening is bounded posteriorly by the 1st thoracic vertebra,

laterally by the medial borders of the 1st ribs and their costal cartilages,

and anteriorly by the superior border of the manubrium sterni.



Openings of the Thorax

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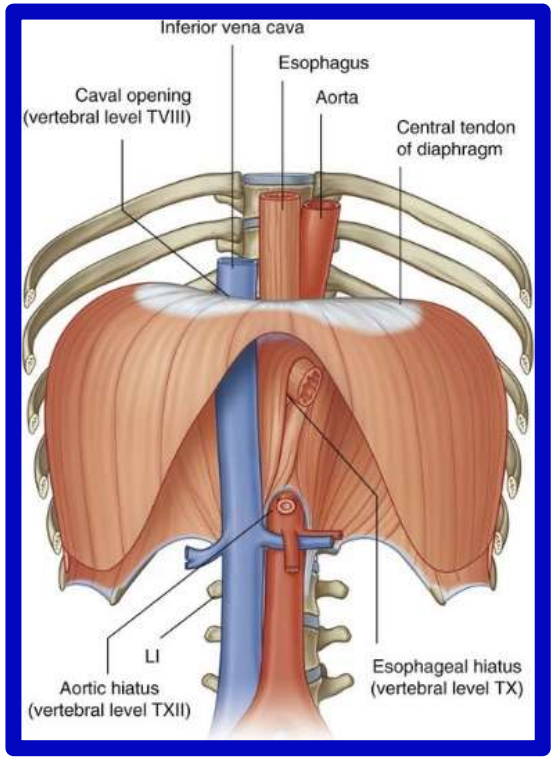
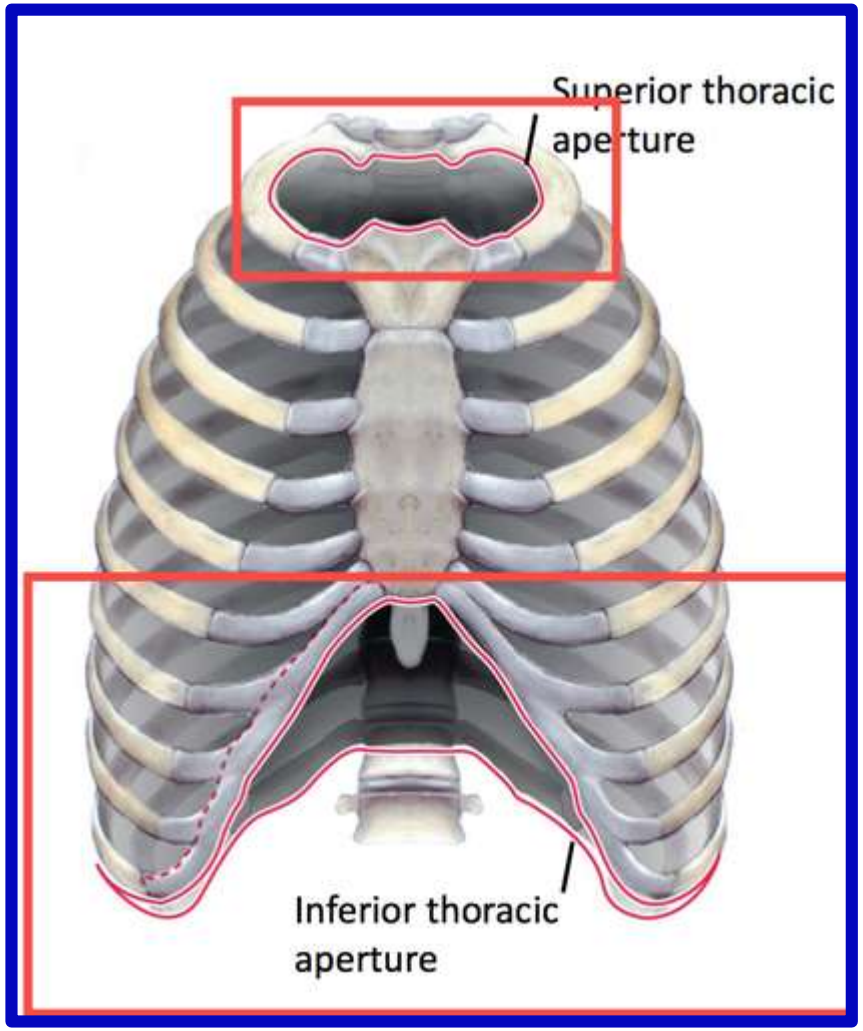
The thoracic cavity communicates with the abdomen through a large opening.

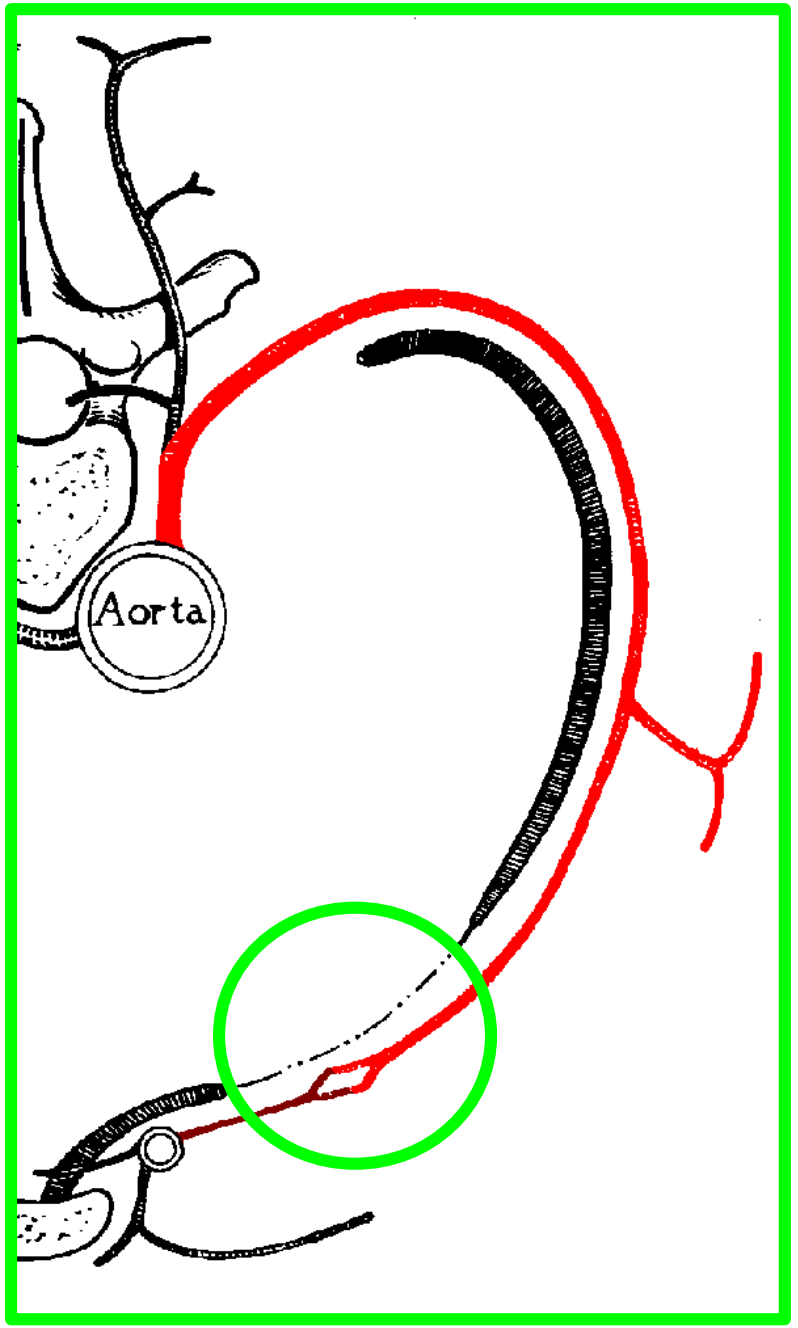
The opening is bounded posteriorly by the 12th thoracic vertebra, laterally by the curving costal margin, and anteriorly by the xiphisternal joint.



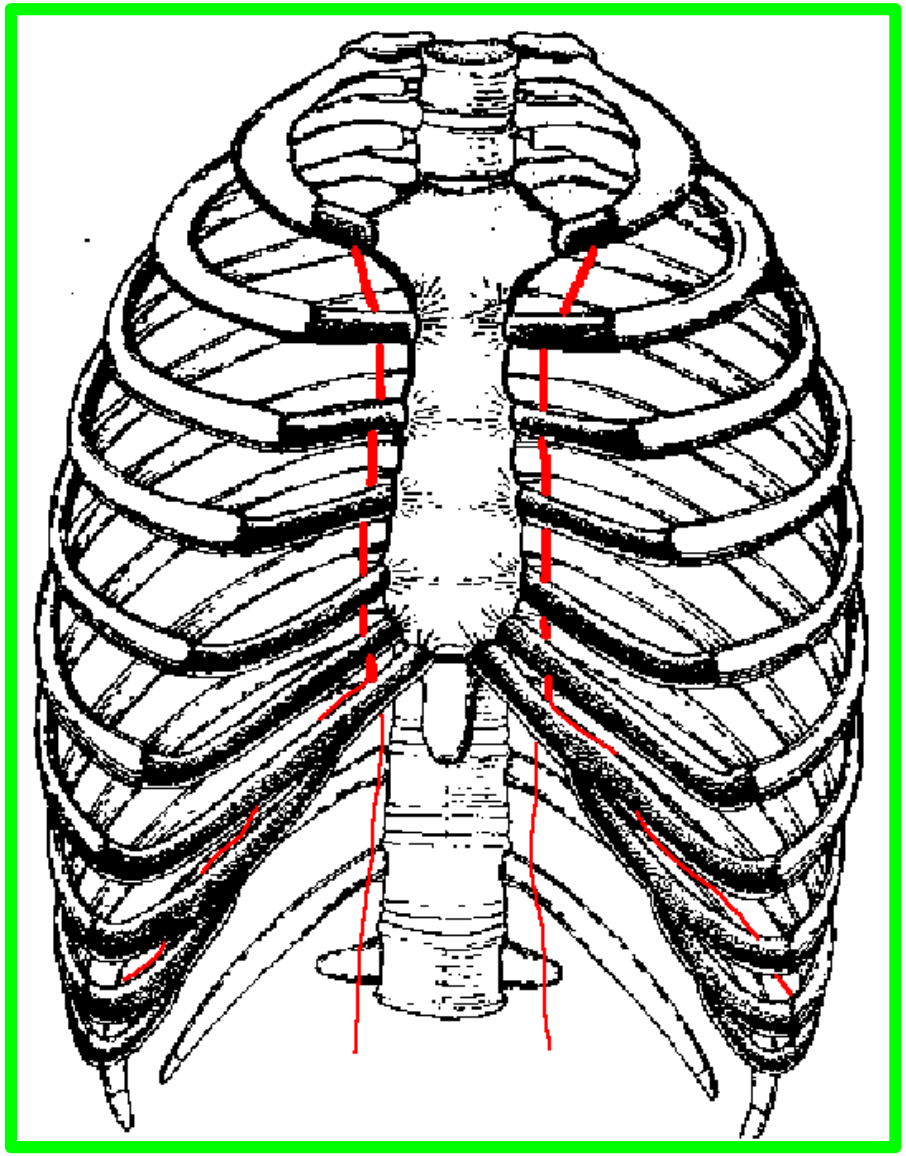


Intercostal arteries

- ❖ Each intercostal space has
- ✓ a large single posterior intercostal artery and
- ✓ two small anterior intercostal arteries.
- ✓ In each space the anterior and posterior intercostal arteries anastomose with each other



Internal thoracic artery



❖Descends vertically about a finger breadth (about 1cm) lateral to the sternum

❖Ends in the 6th intercostal space by dividing into two terminal branches:

✓ superior epigastric

✓ musculophrenic arteries

❖The anterior intercostal arteries of the upper six spaces are branches of the internal thoracic artery.

❖The anterior intercostal arteries of the lower intercostal spaces are branches of the musculophrenic artery

❖The lower two spaces have posterior intercostal arteries only.

Posterior intercostal arteries

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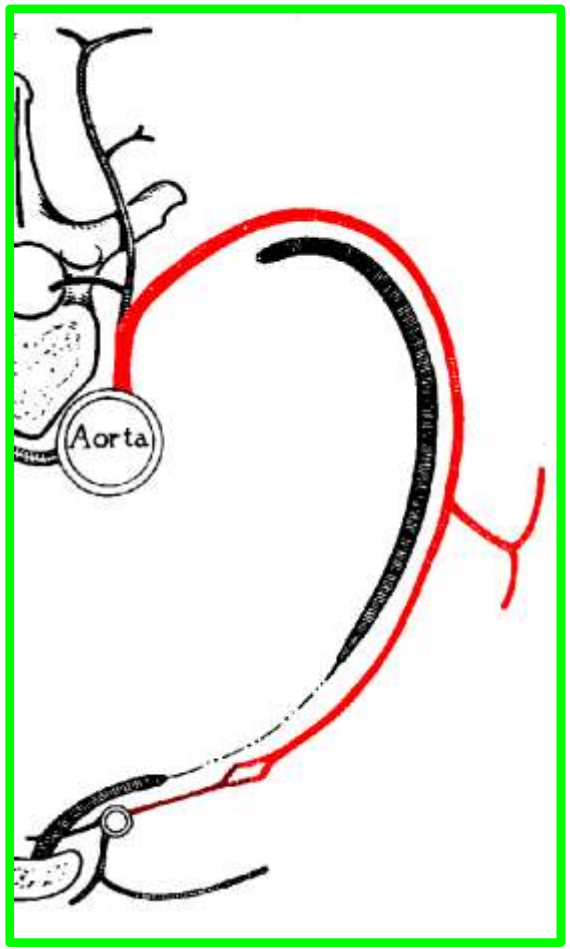
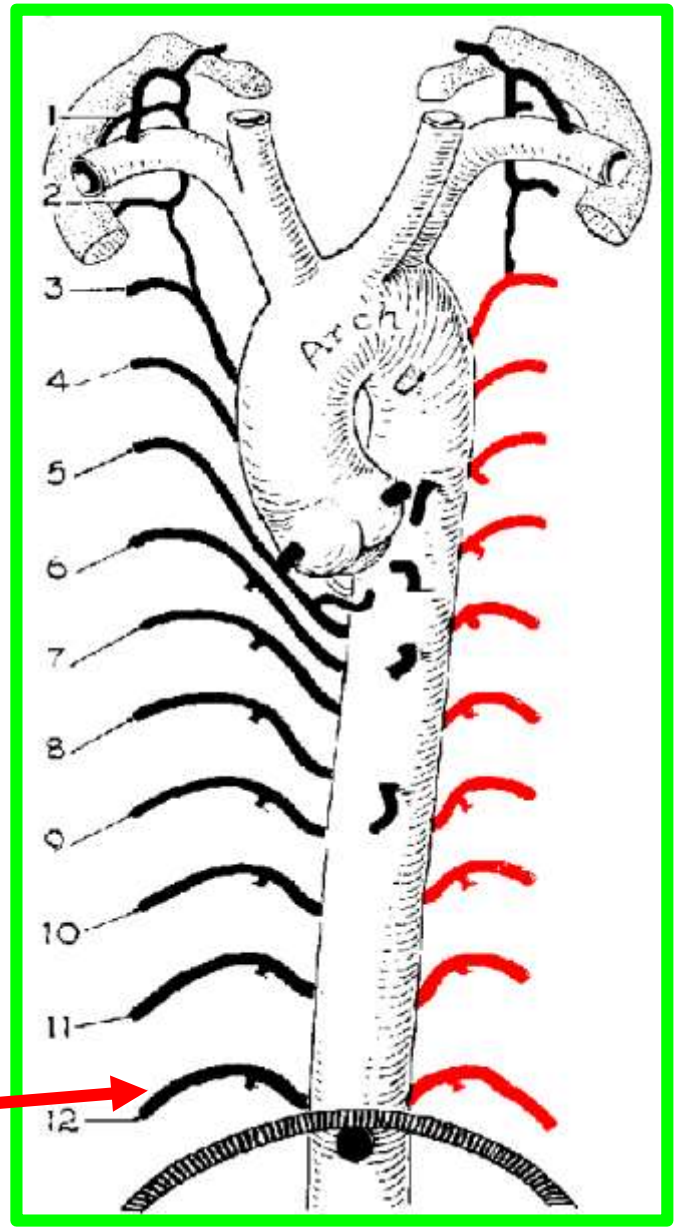
- The posterior intercostal arteries of the lower nine spaces are branches of the descending thoracic aorta, so as the subcostal artery



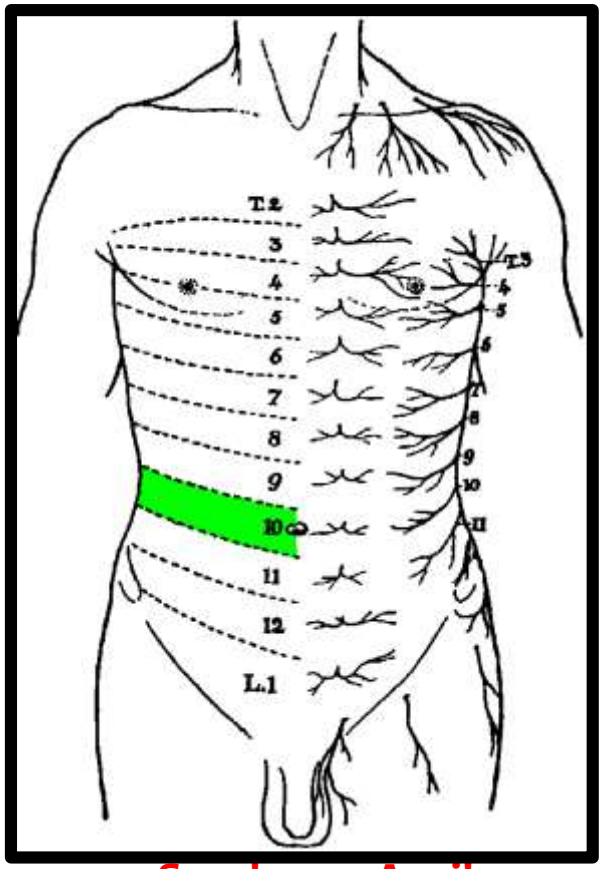


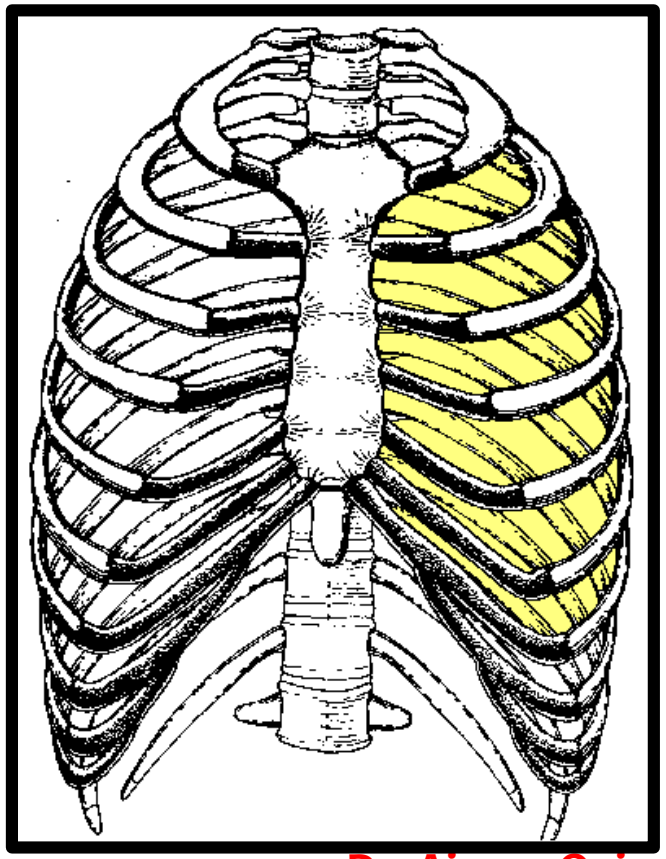
Subcostal artery

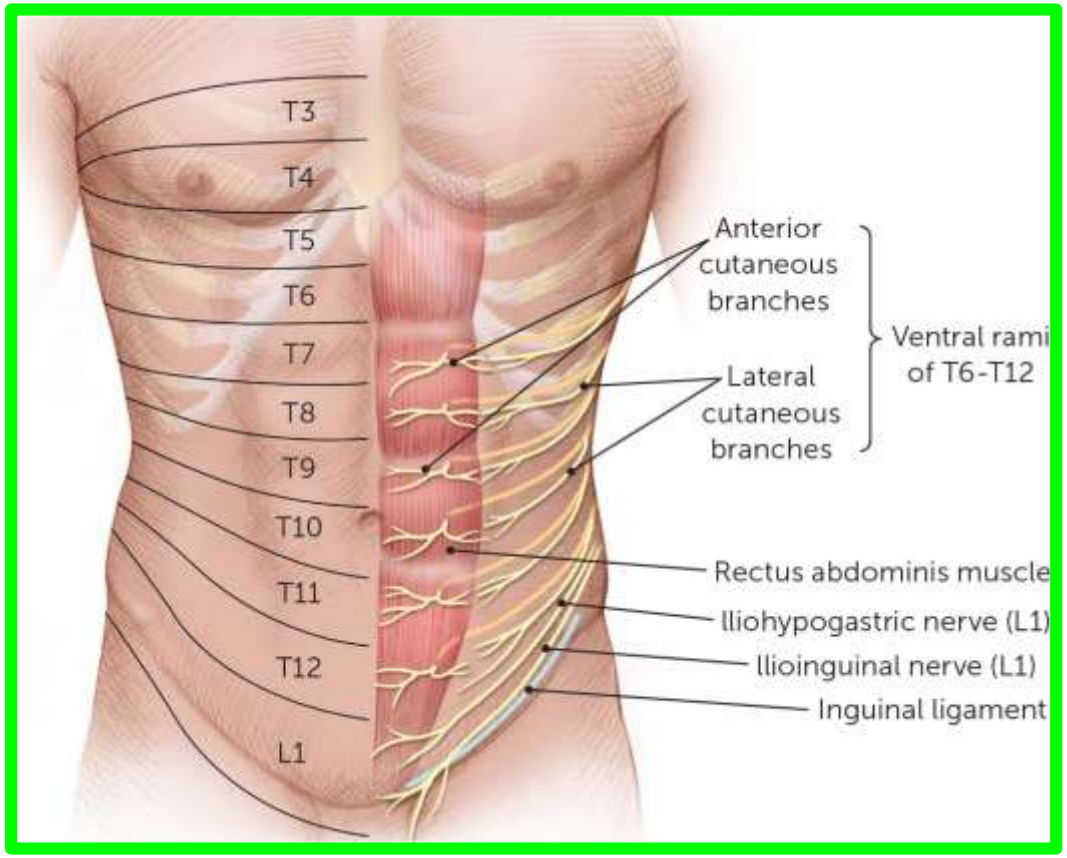
❖ The first six intercostal nerves are distributed within their intercostal spaces

❖ The 7th to 11th intercostal nerves and the subcostal nerve leave the anterior end of the intercostal space to enter the anterior abdominal wall, which they also supply.

❖ e.g., the 10th intercostal nerve reaches the level of the umbilicus








Dr. Aiman Qais Afar
Sunday 27 April 2025