THE THORACIC WALL

Boundaries

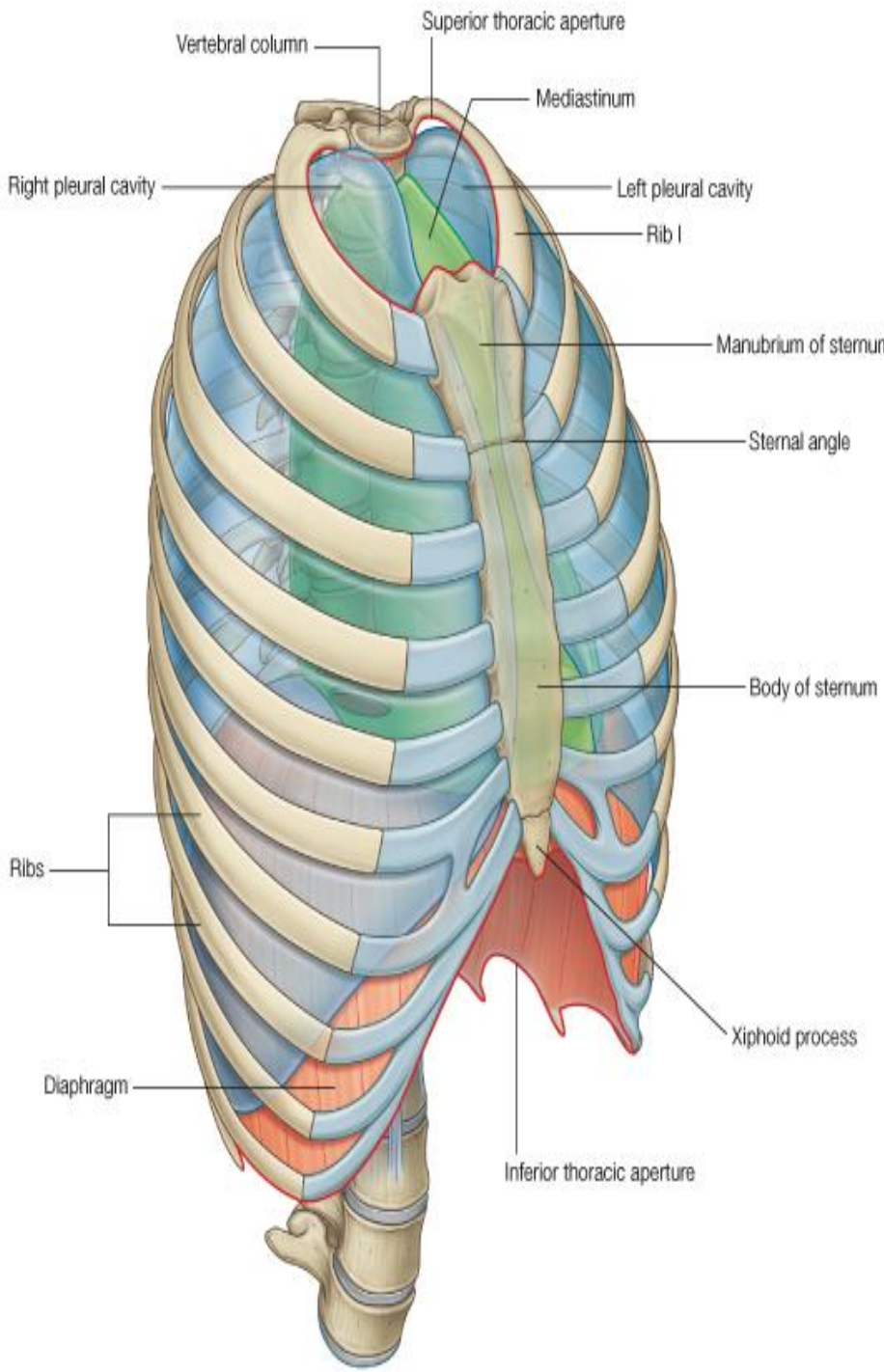
Posteriorly
by the *thoracic part of the vertebral column*

Anteriorly
by *the sternum and costal cartilages*

Laterally
by *the ribs and intercostal spaces*

Superiorly
by *the suprapleural membrane*

Inferiorly
by ***the diaphragm,*** which separates the thoracic cavity from the abdominal cavity



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STERNUM

- Lies in the midline of the anterior chest wall
- It is a flat bone
- Divides into three parts:

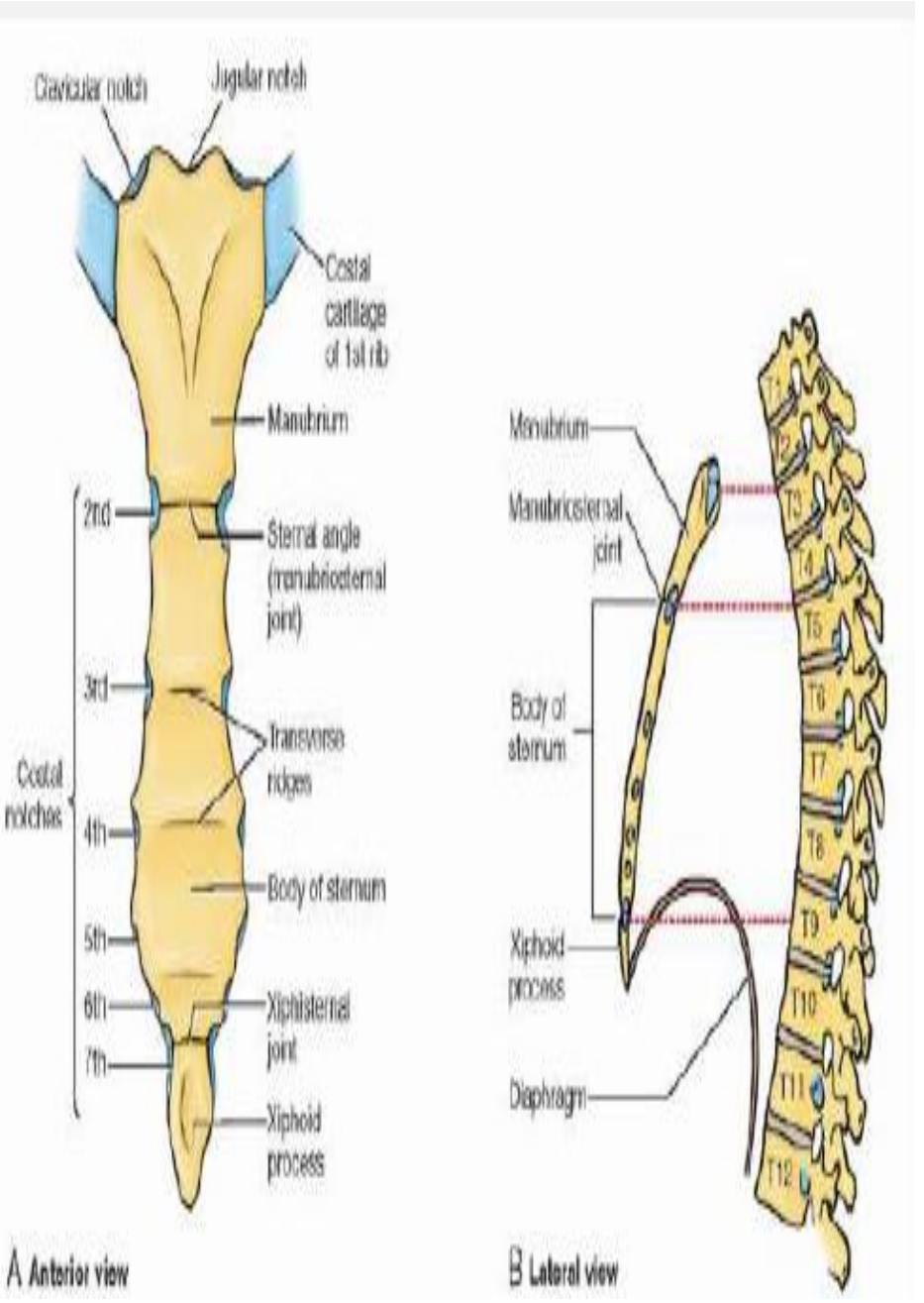
1-Manubrium sterni
2-Body of the sternum
3- Xiphoid process

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*

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



The sternal angle (angle of Louis)

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

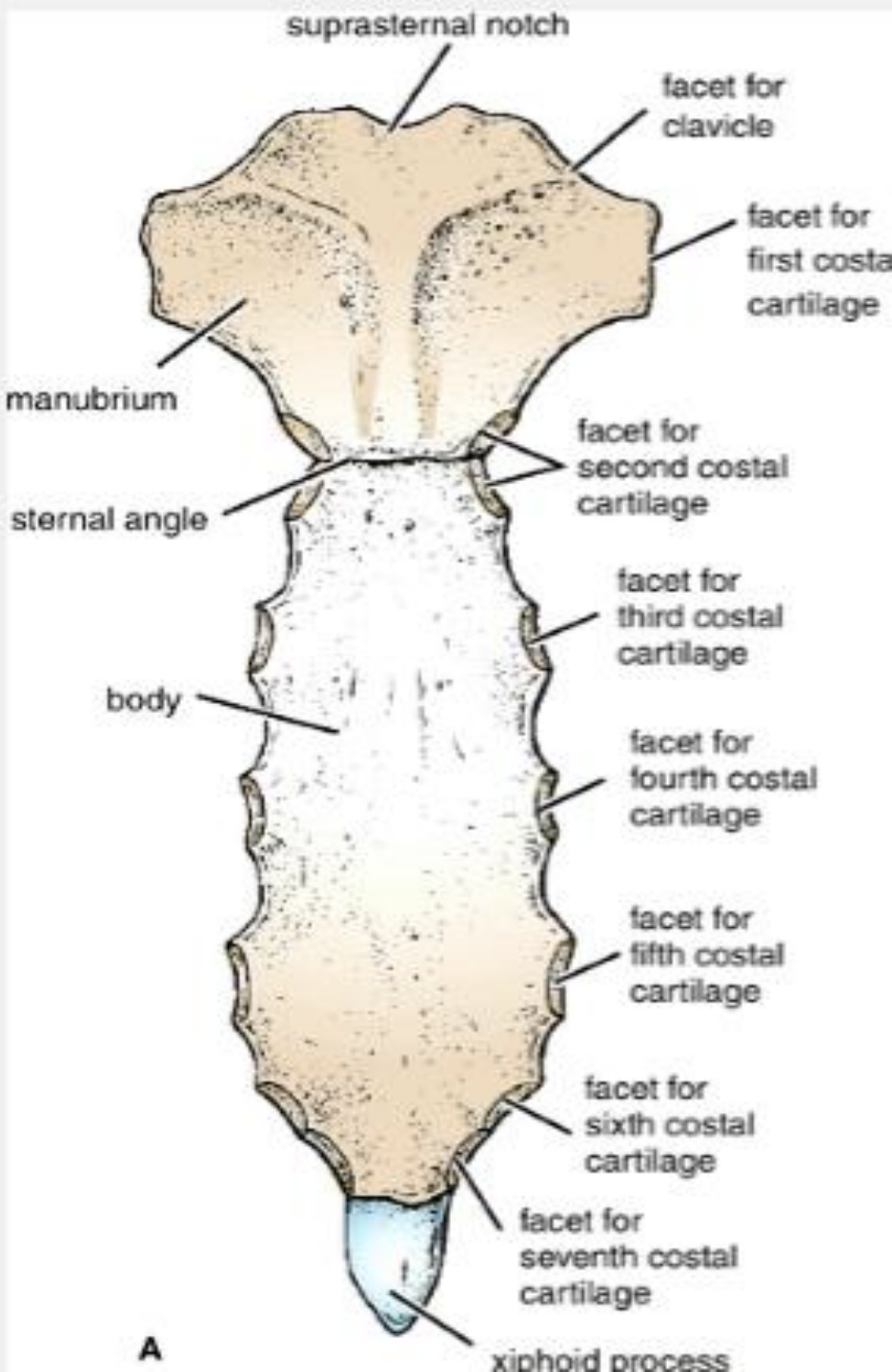
Can be recognized by the presence of a **<u>transverse ridge</u>** on the anterior aspect of the sternum

The transverse ridge lies at the level of the

second costal cartilage

The point from which all costal cartilages and ribs are counted

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



Sternum and Marrow Biopsy

Ribs

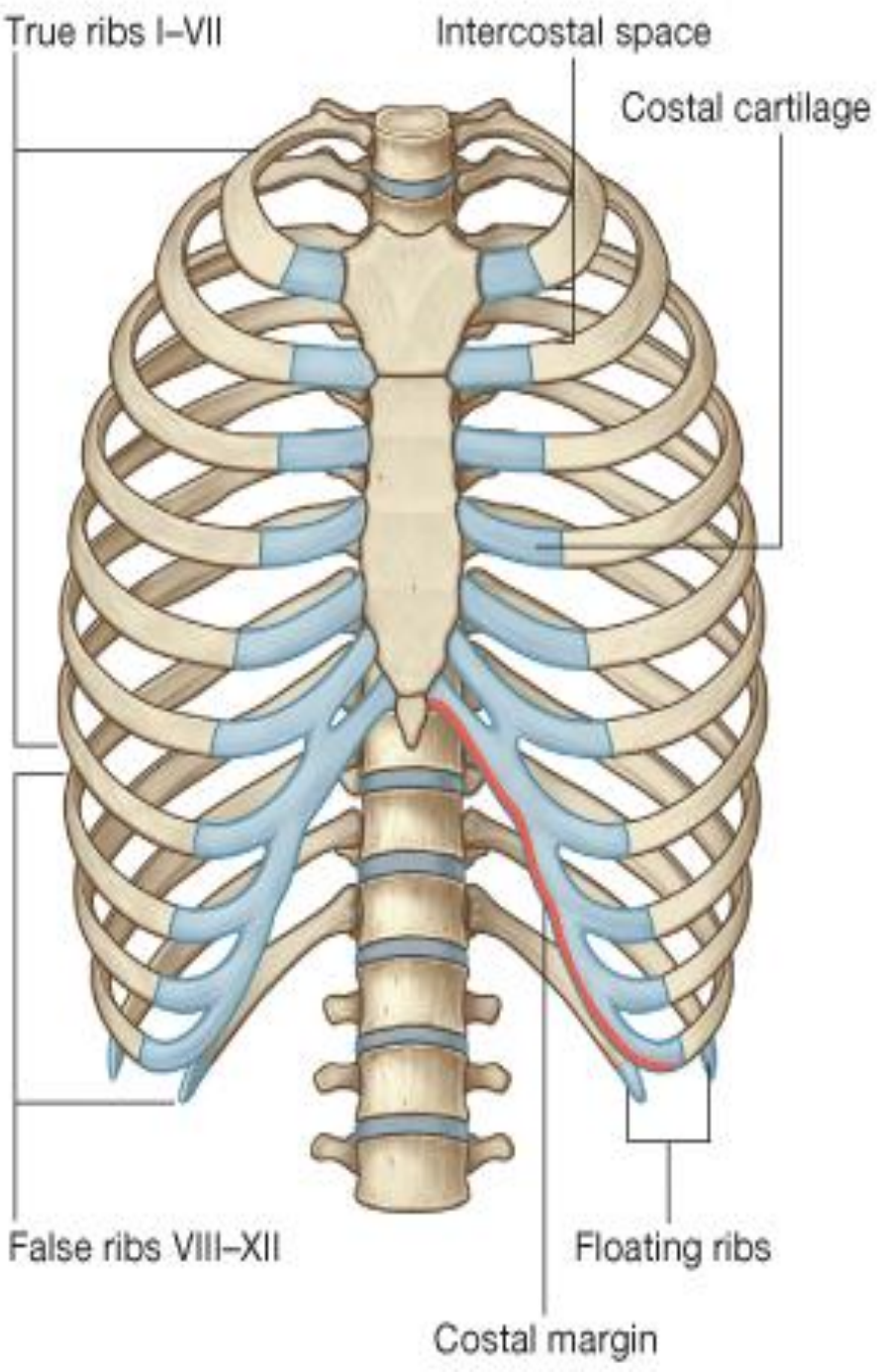
There are 12 pairs of ribs, all of which are attached posteriorly to the thoracic vertebrae.

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



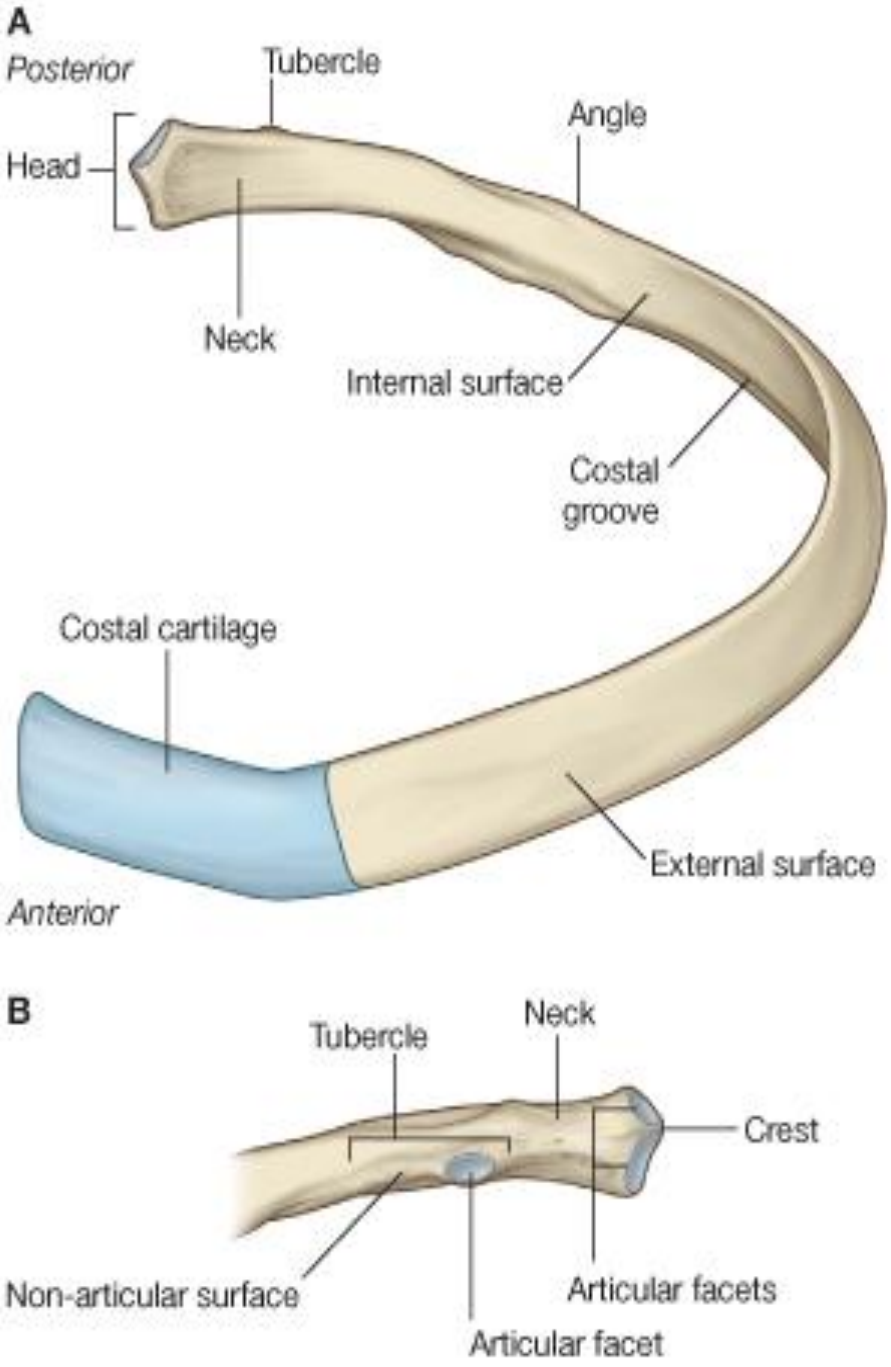
Typical Rib

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

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**



Rib I

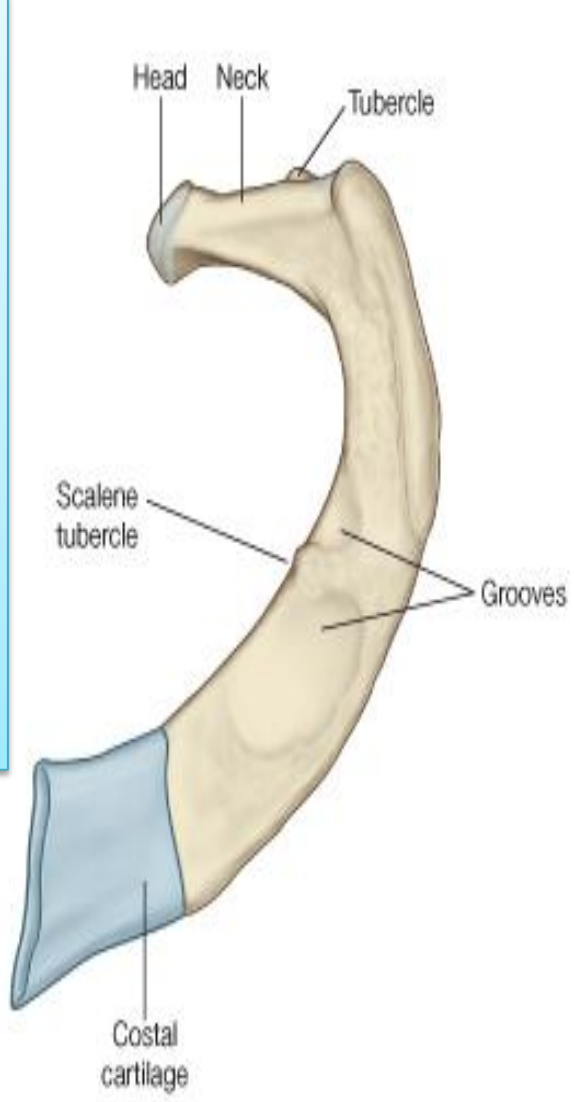
is flat in the horizontal plane

❖Has **broad superior and inferior surfaces**

The head articulates only with the body of vertebra TI and therefore has **only one articular surface**.

Like other ribs, the tubercle has a facet for articulation with the transverse process.

The superior surface of the rib
is characterized by a distinct tubercle,
the scalene tubercle,
which separates two smooth grooves
The anterior groove is caused by the subclavian vein,
and the posterior groove is caused by the subclavian artery



Rib II

Rib II, like rib I, is **flat but twice as long.**

❖It articulates with the vertebral column in a way typical of most ribs.

Rib X

The head of rib X has a single facet for articulation with its own vertebra.

Ribs XI and XII

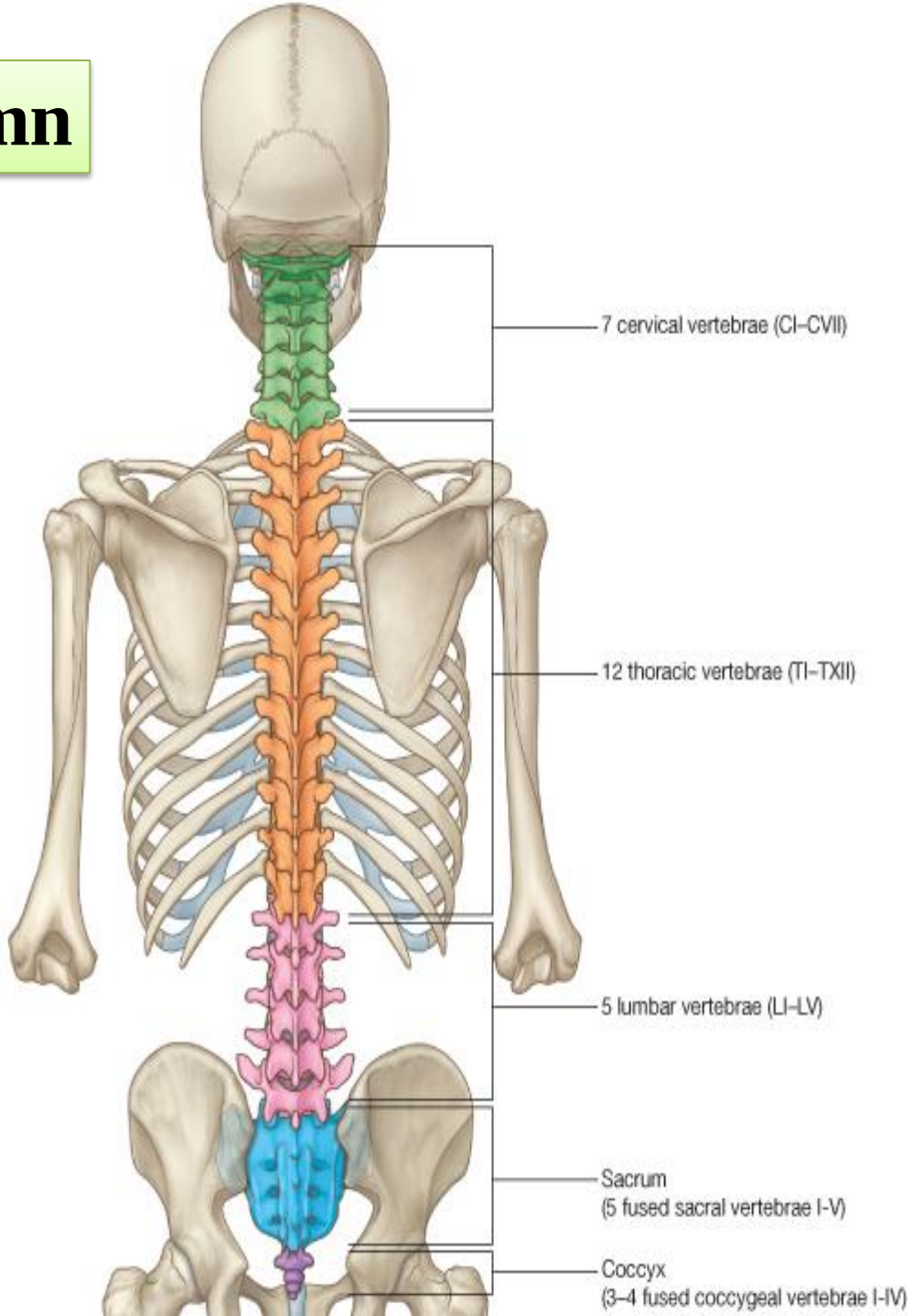
Ribs XI and XII articulate only with the bodies of their own vertebrae and ***have no tubercles or necks***.

Both ribs are short, have little curve,

and are pointed anteriorly

The Vertebral Column

is composed of 33 vertebrae
7 cervical
12 thoracic
5 lumbar
5 sacral
(fused to form the sacrum)
4 coccygeal
(the lower 3 are commonly fused)



A typical vertebra consists of:

1-a rounded body anteriorly

2-a vertebral arch posteriorly.

They enclose a space called

The vertebral foramen

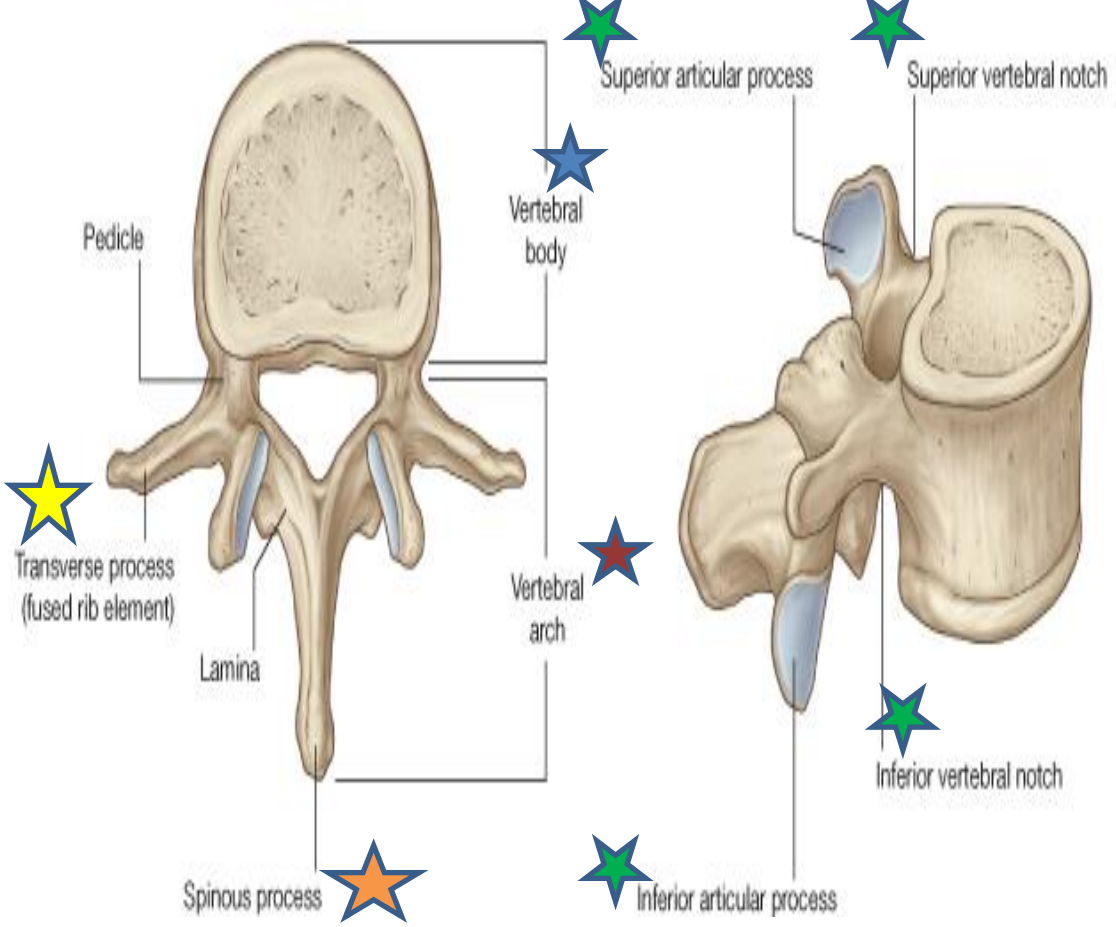
through which run the spinal cord and its coverings

The vertebral arch gives rise ***to seven processes:***

a-One spinous

b-Two transverse

c- Four articular



❖**The spinous process** is directed ***posteriorly***

from the junction of the two laminae.

❖**The transverse processes** are directed **laterally**

from the junction of the laminae and the pedicles

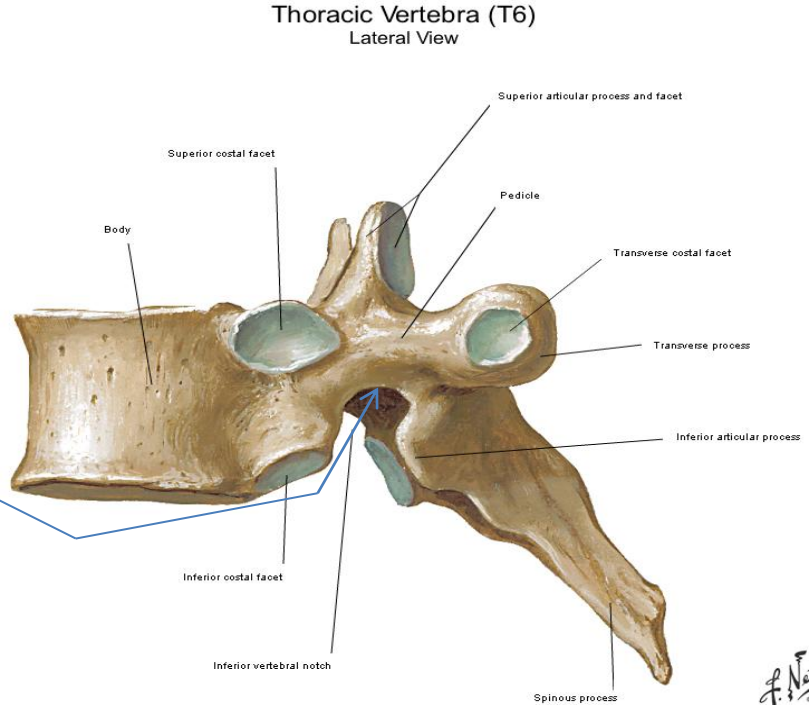
The articular processes are vertically arranged and consist of:

Two superior & **Two inferior processes**

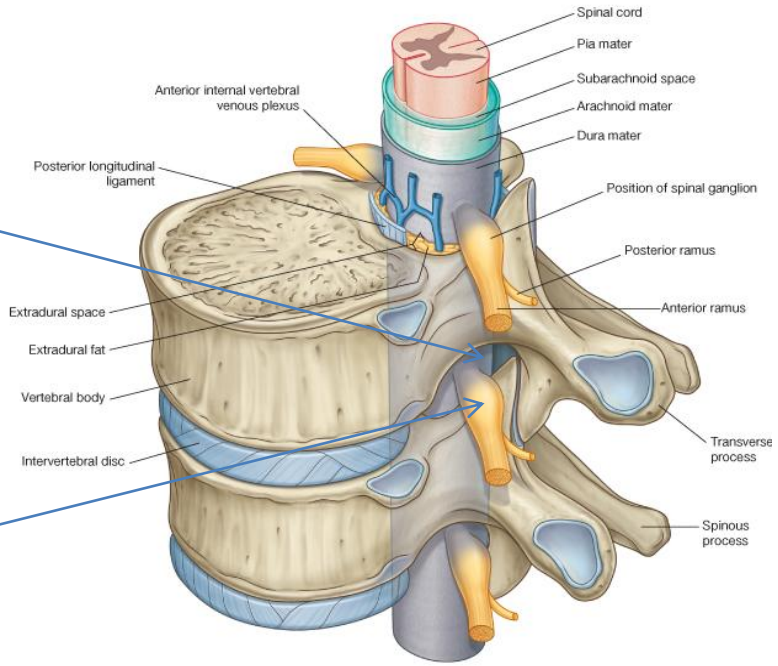
They arise from the junction of the laminae and the pedicles

.

❖**The pedicles are notched on their upper and lower borders Forming the superior and inferior vertebral notches.**



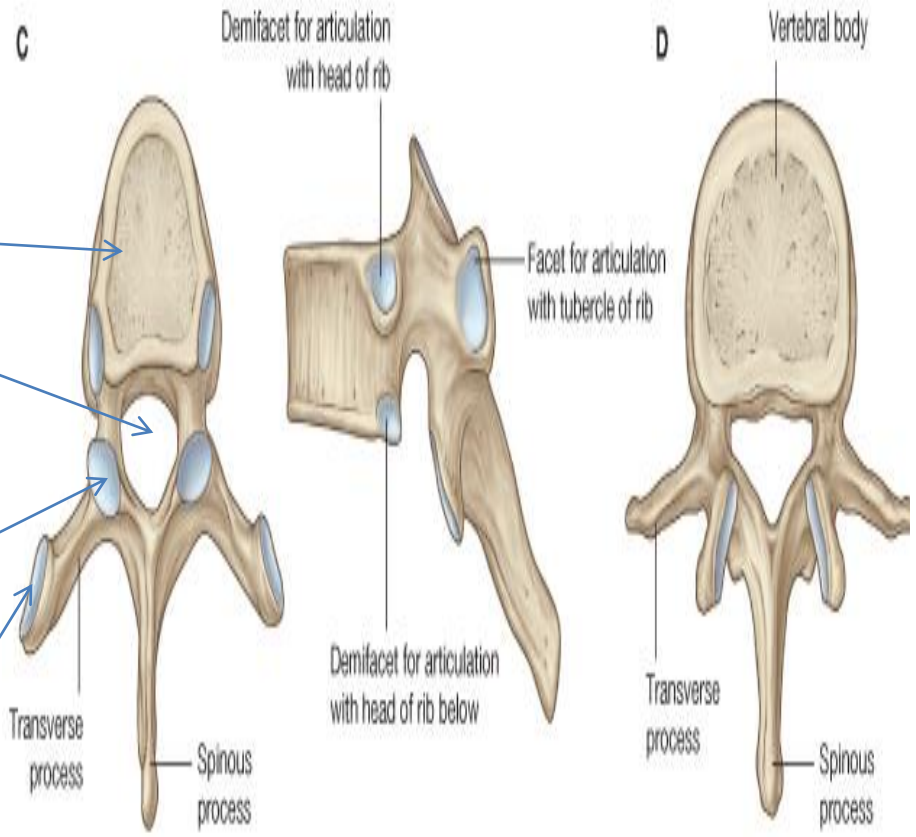
On each side the superior notch of one vertebra and the inferior notch of an adjacent vertebra together form an intervertebral foramen.



These foramina, in an articulated skeleton, serve to transmit the spinal nerves and blood vessels.

Characteristics of a Typical Thoracic Vertebra

- The body is **heart shaped**
- The vertebral foramen is small and **circular**
- The spines are **long and inclined downward**
- **Costal facets are present on the sides of the bodies for articulation with the heads of the ribs**
- **Costal facets are present on the transverse processes for articulation with the tubercles of the ribs**
  (T11 and 12 have no facets on the transverse processes)



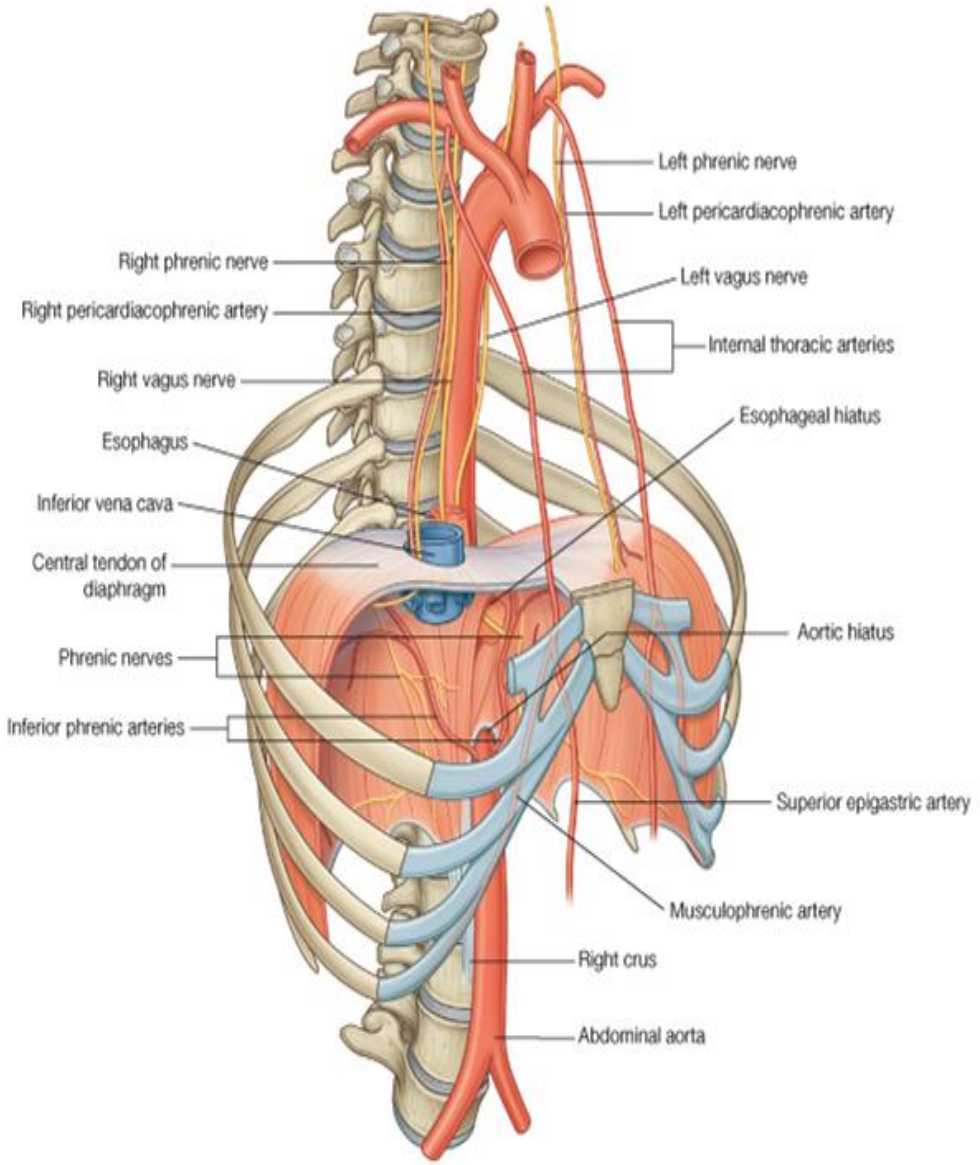
The xiphoid process of the sternum

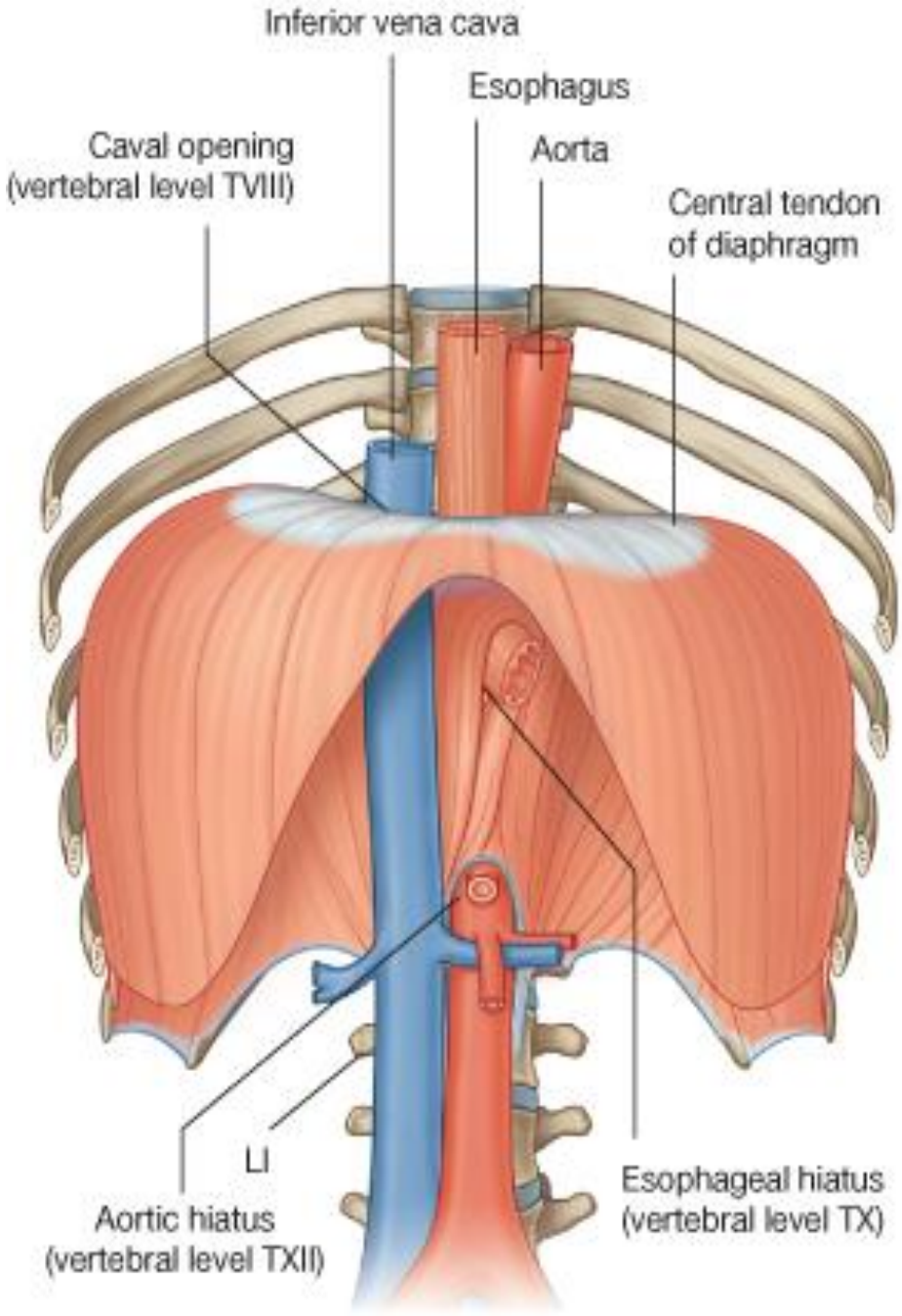
The costal margin of the thoracic wall

The ends of ribs XI and XII

Ligaments that span across structures of The posterior abdominal wall

Vertebrae of the lumbar region.




Inferior vena cava
Esophagus
Caval opening
(vertebral level TVIII)
Aorta
Central tendon
of diaphragm
LI
Aortic hiatus
(vertebral level TXII)
Esophageal hiatus
(vertebral level TX)

The inferior vena cava passes through the central tendon at approximately vertebral level T8

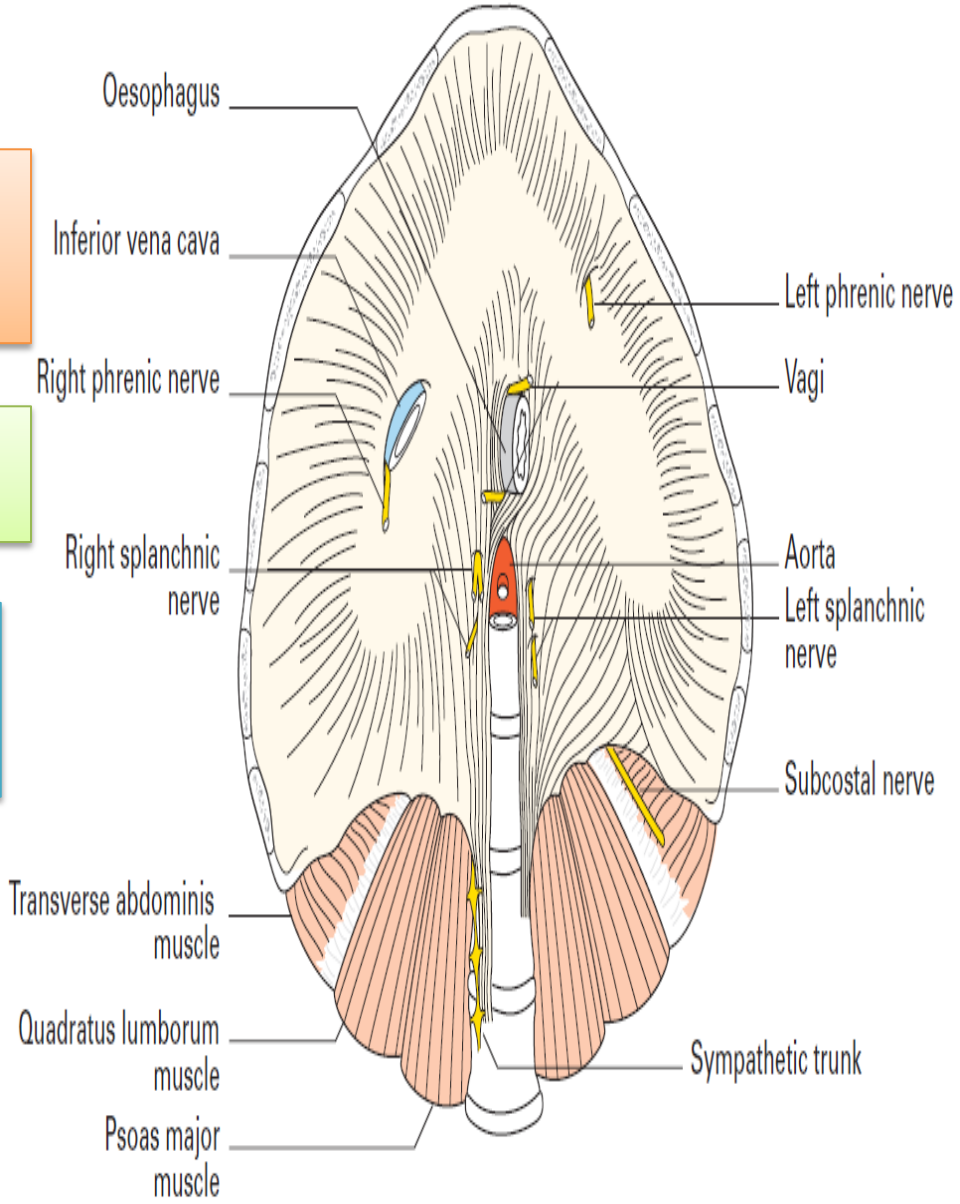
The esophagus passes through the muscular part of the diaphragm, just to the left of midline, approximately at vertebral level T10

The vagus nerves pass through the diaphragm with the esophagus

The aorta passes behind the posterior attachment of the diaphragm at vertebral level T12

The thoracic duct passes behind the diaphragm with the aorta

The azygos and hemiazygos veins may also pass through the aortic hiatus or through the crura of the diaphragm



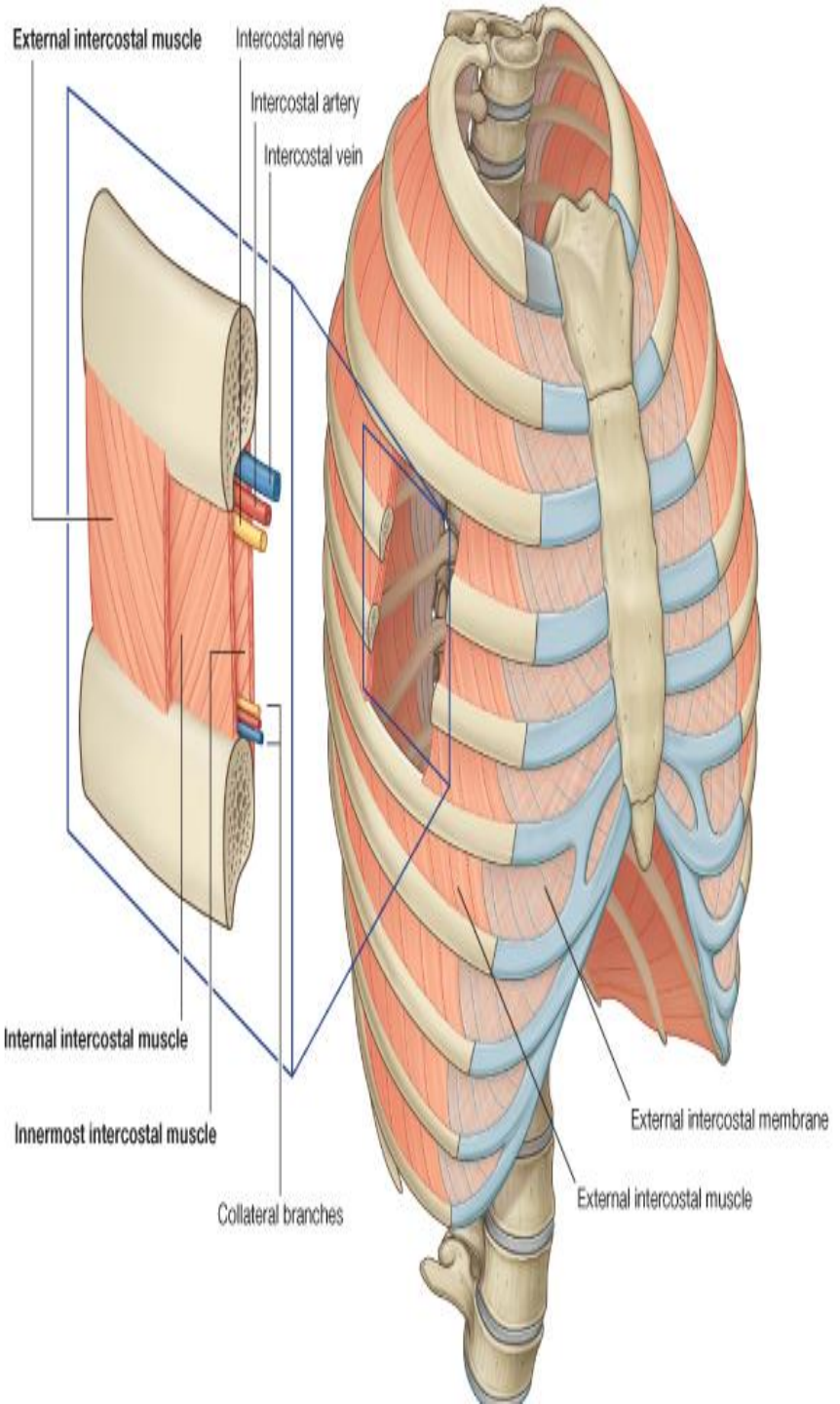
Intercostal Muscles

The external intercostal muscle

- the most superficial layer.
- Its fibers are directed downward and forward

ORIGIN:
FROM THE INFERIOR BORDER OF THE RIB ABOVE
TO
INSERTION:
THE SUPERIOR BORDER OF THE RIB BELOW

The muscle extends forward to the costal cartilage where it is replaced by an aponeurosis,
<u>THE ANTERIOR (EXTERNAL) INTERCOSTAL MEMBRANE</u>



Intercostal Spaces

1-SKIN

2-SUPERFISCIAL FASCIA

3- THREE MUSCLES OF RESPIRATION:

THE EXTERNAL INTERCOSTAL

THE INTERNAL INTERCOSTAL

THE INNERMOST INTERCOSTAL MUSCLE

4-THE ENDOTHORACIC FASCIA

5-THE PARIETAL PLEURA.

The intercostal nerves and blood vessels run between the intermediate **(internal intercostal)** and deepest layers **(innermost intercostal)** of muscles

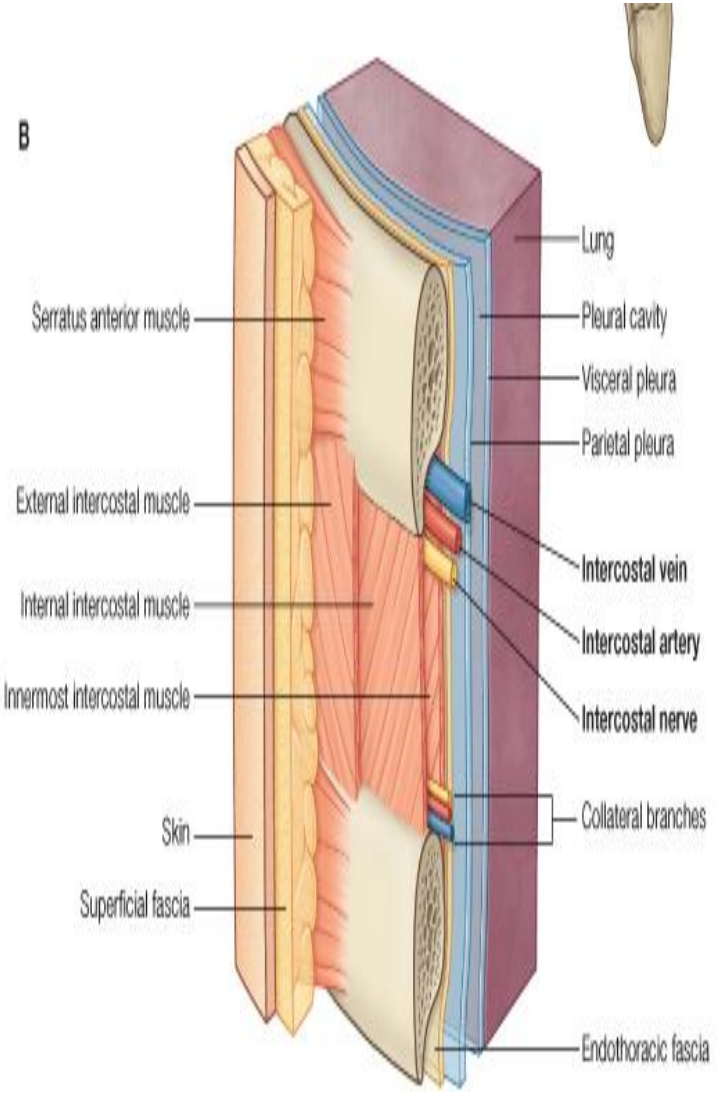
They are arranged in the following order from above downward:

INTERCOSTAL VEIN

INTERCOSTAL ARTERY

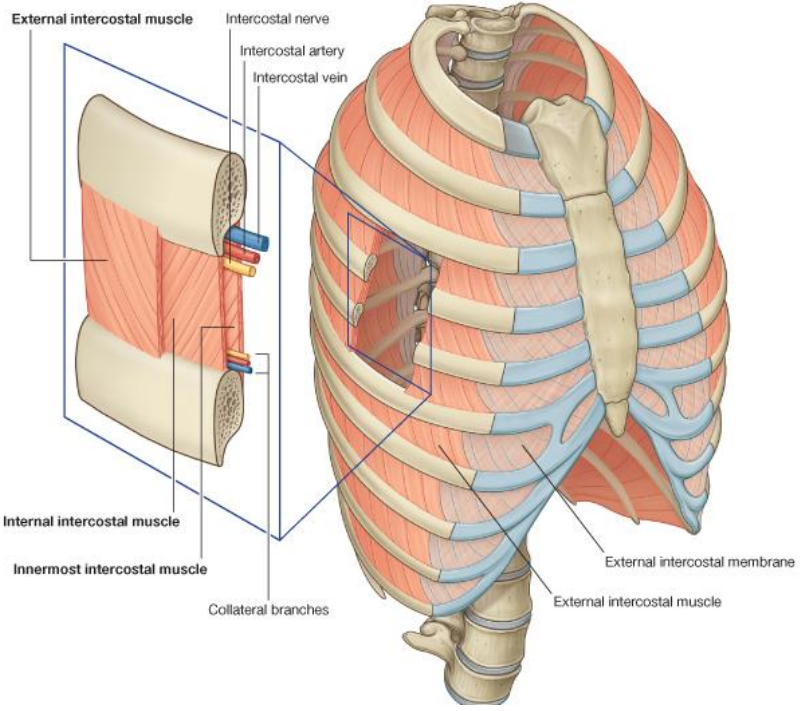
INTERCOSTAL NERVE

(VAN)

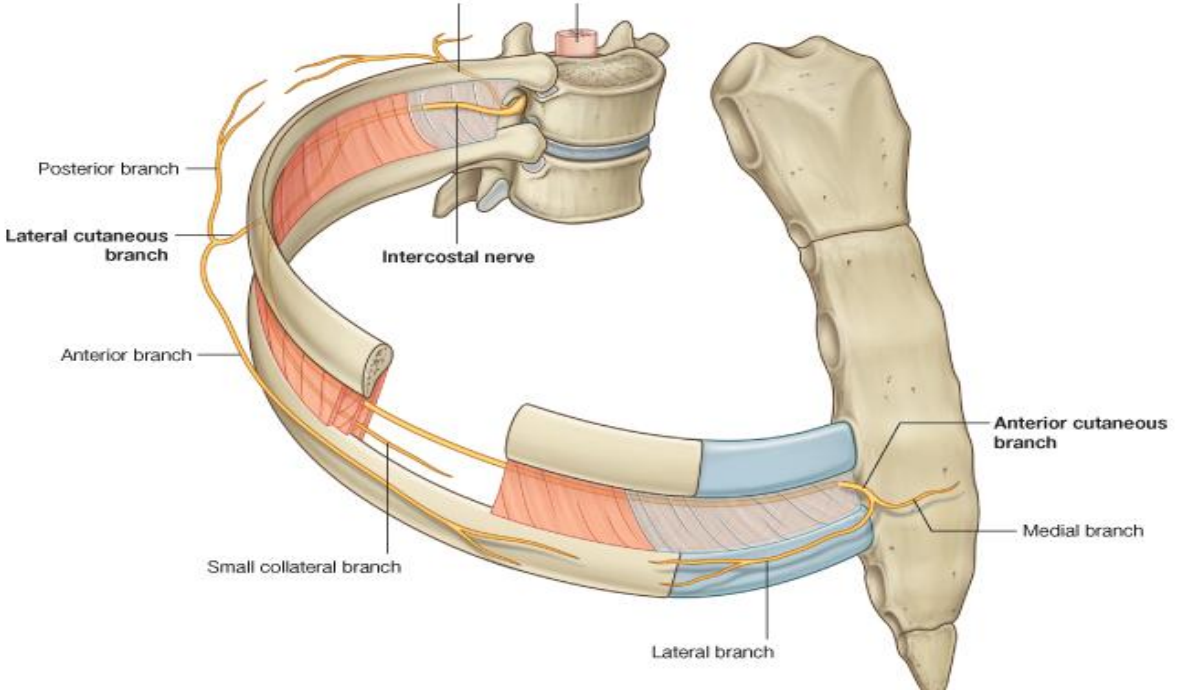


THE INTERNAL INTERCOSTAL MUSCLE

- forms the intermediate layer.
- Its fibers are directed downward and backward from the subcostal groove of the rib above to the 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

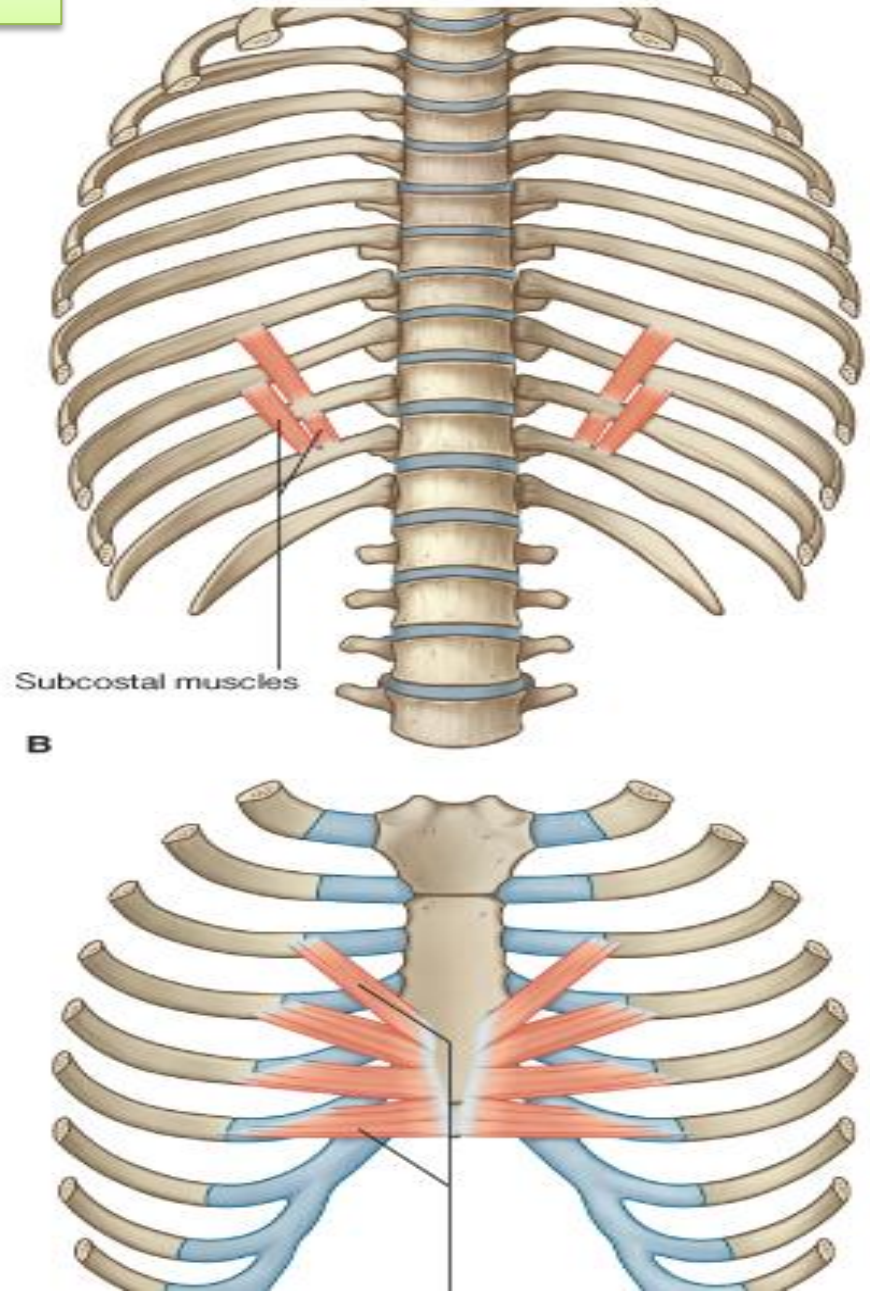


The innermost intercostal muscle

- Forms the deepest layer and corresponds to the transversus abdominis muscle in the anterior abdominal wall

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**

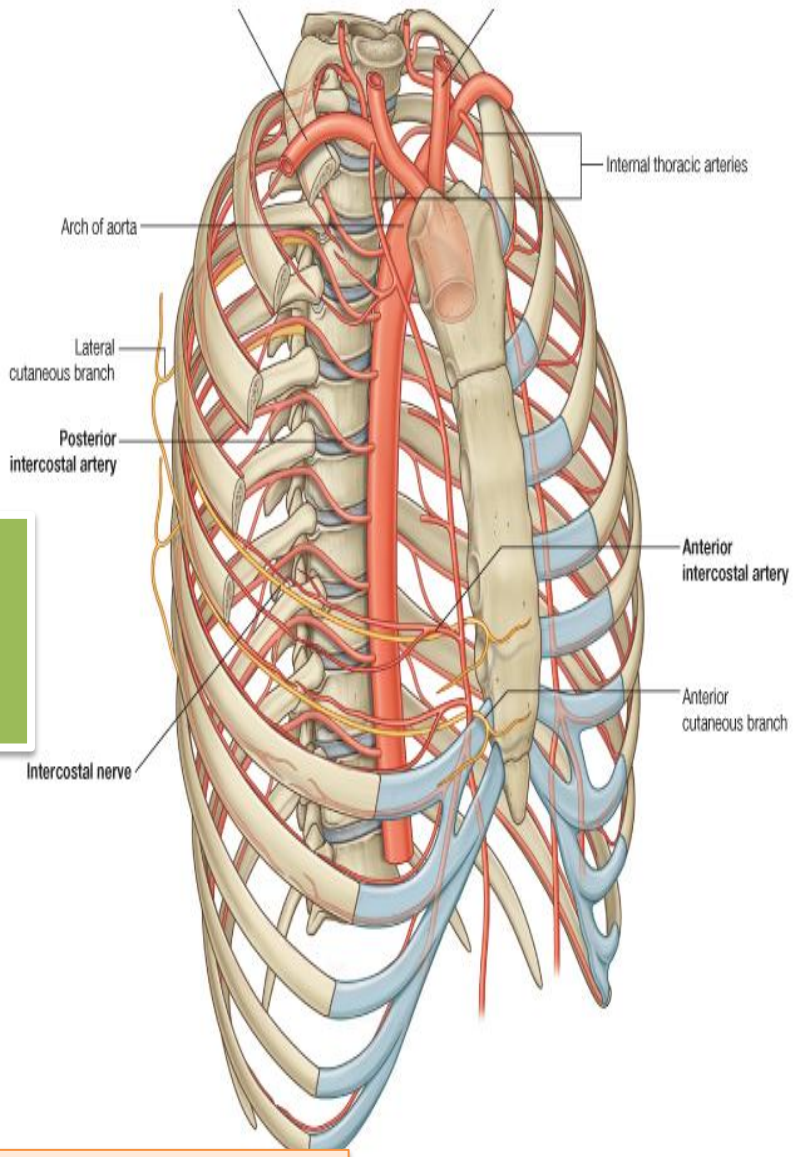


Intercostal Arteries and Veins
Each intercostal space contains a large single posterior intercostal artery and two small anterior intercostal arteries.

The posterior intercostal arteries of the first two spaces are branches from ***the superior intercostal artery,*** a branch of the **costocervical trunk** of the ***subclavian artery***

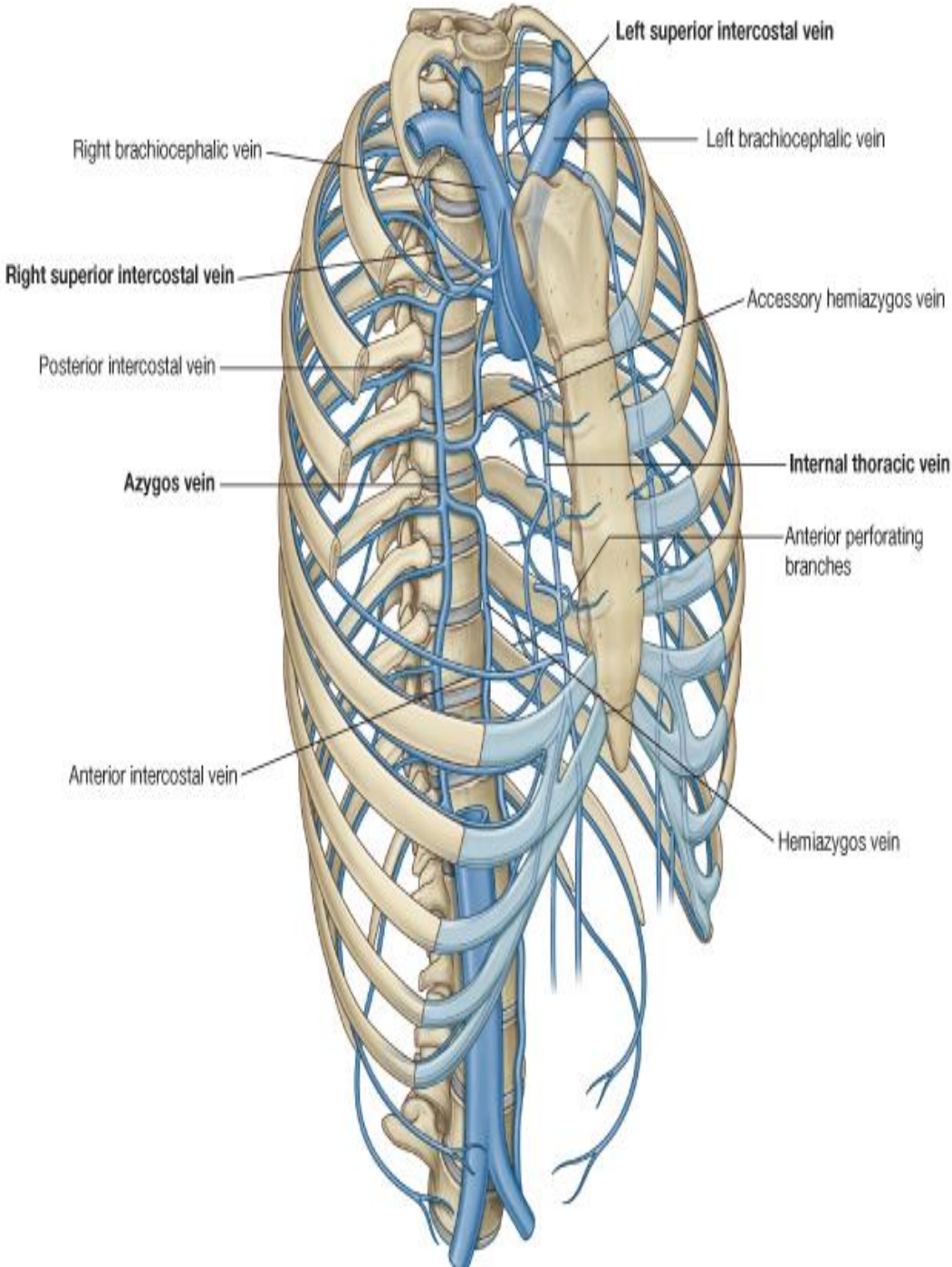
The posterior intercostal arteries of the lower nine spaces are branches of
THE DESCENDING THORACIC AORTA

The anterior intercostal arteries of **the first six** spaces are branches of
THE INTERNAL THORACIC ARTERY
which arises from the first part of the subclavian artery.



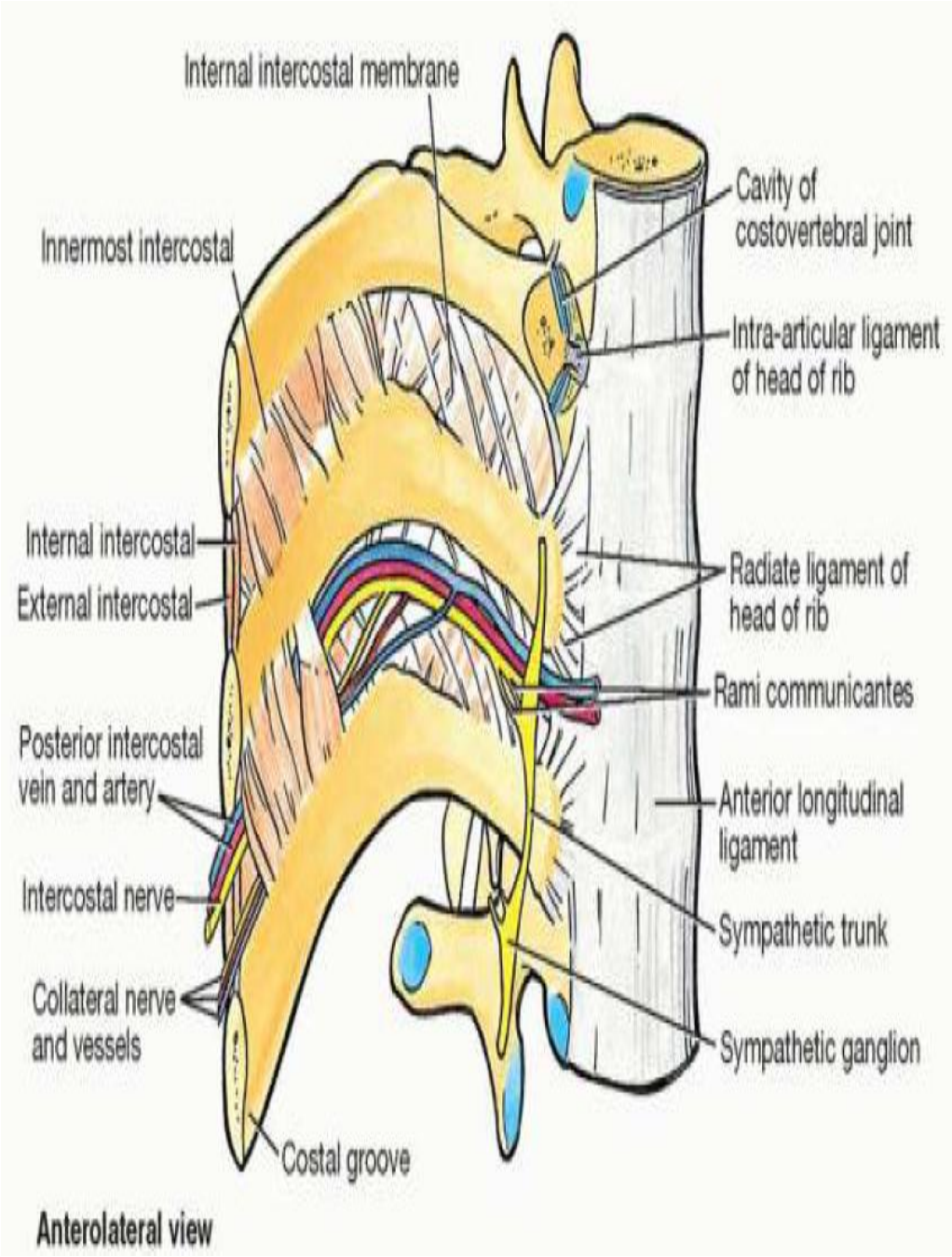
The anterior intercostal arteries of the lower spaces are branches of *THE MUSCULOPHRENIC ARTERY,* one of the terminal branches of the internal thoracic artery.

The corresponding posterior intercostal veins drain backward into the azygos or hemiazygos veins , and the anterior intercostal veins drain forward into the internal thoracic and musculophrenic veins

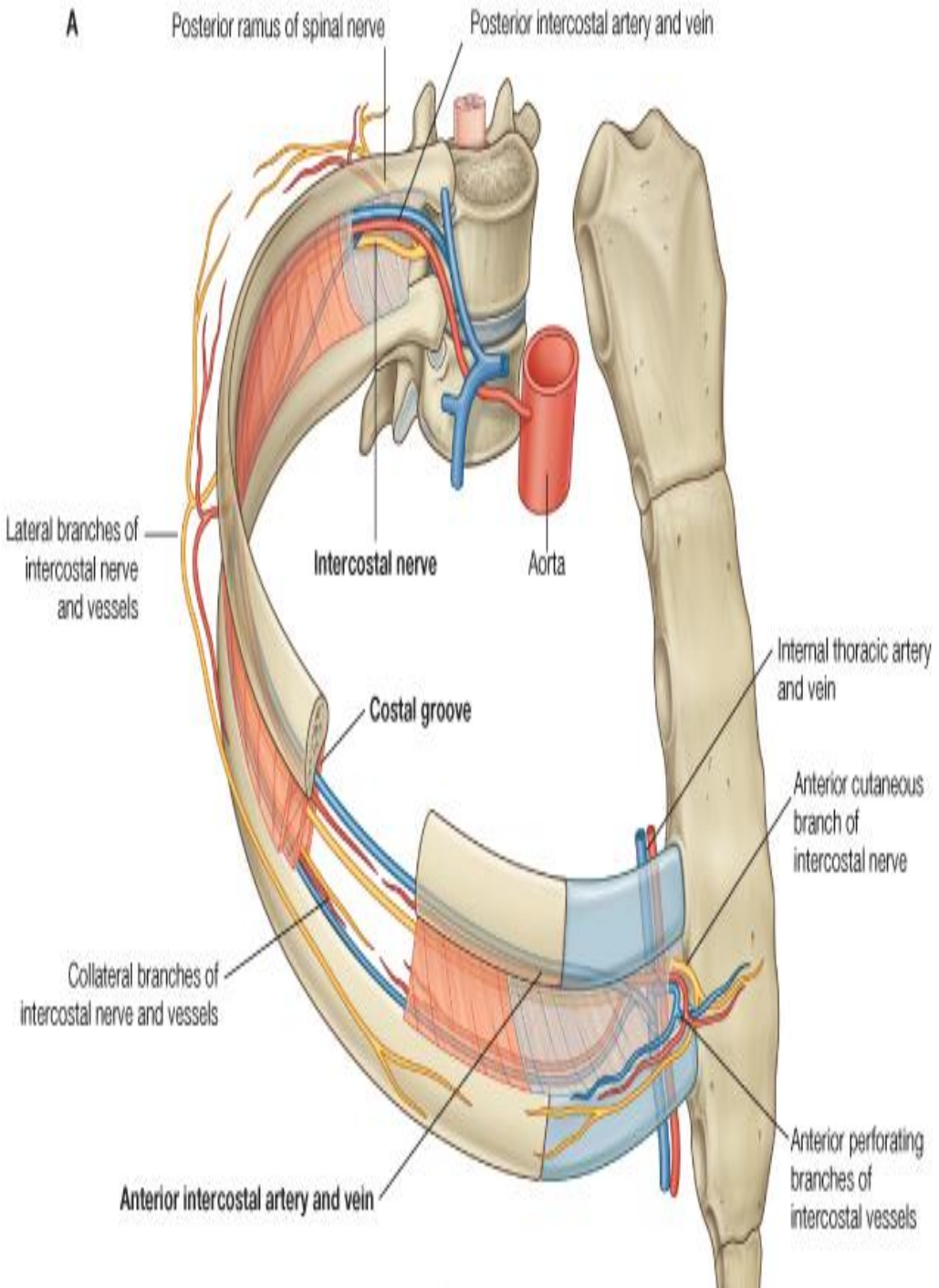


Intercostal Nerves
The intercostal nerves are the anterior rami of the first 11 thoracic spinal nerves

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 between the parietal pleura and the posterior intercostal membrane
It then runs forward inferiorly to the intercostal vessels in the subcostal groove of the corresponding rib, between the innermost intercostal and internal intercostal muscle.



The first six nerves are distributed within their intercostal spaces.

The seventh to ninth intercostal nerves leave the anterior ends of their intercostal spaces by passing deep to the costal cartilages, to enter the anterior abdominal wall.

The 10th and 11th nerves, since the corresponding ribs are floating, pass directly into the abdominal wall