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Thoracic wall - structure, blood supply and innervation

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MediTec training for students

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Thoracic borders

external -

Upper:

jugular notch,
clavicle, acromion
scapulae, spine of C7 (vertebra
prominens)

Lower:

xiphoid process,
costal arches (right and left),
Th12

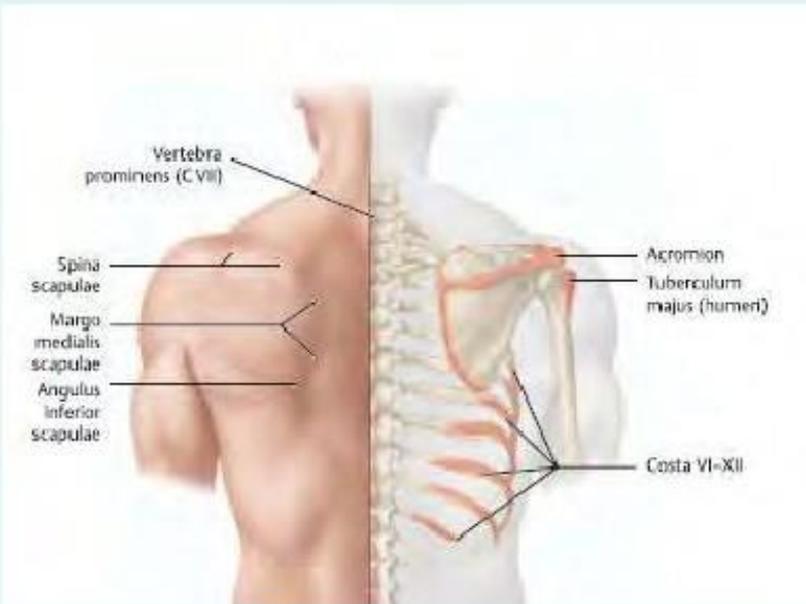
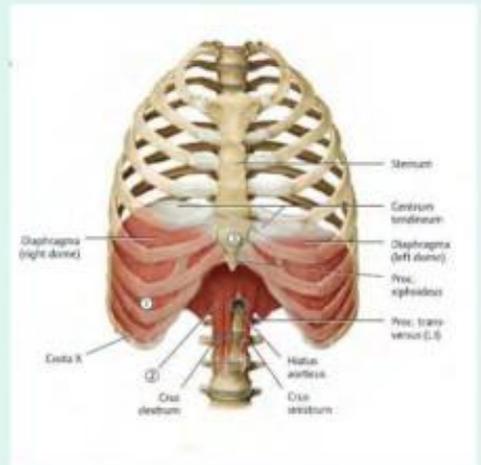
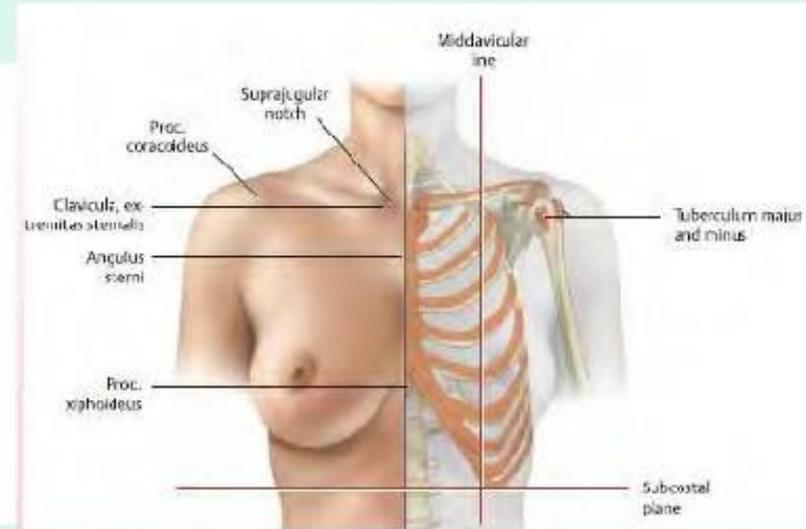
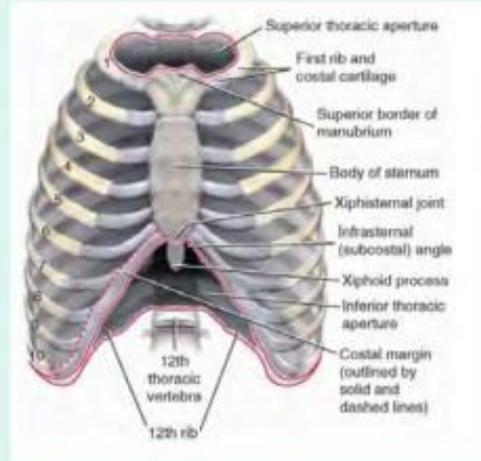
internal -

Upper:

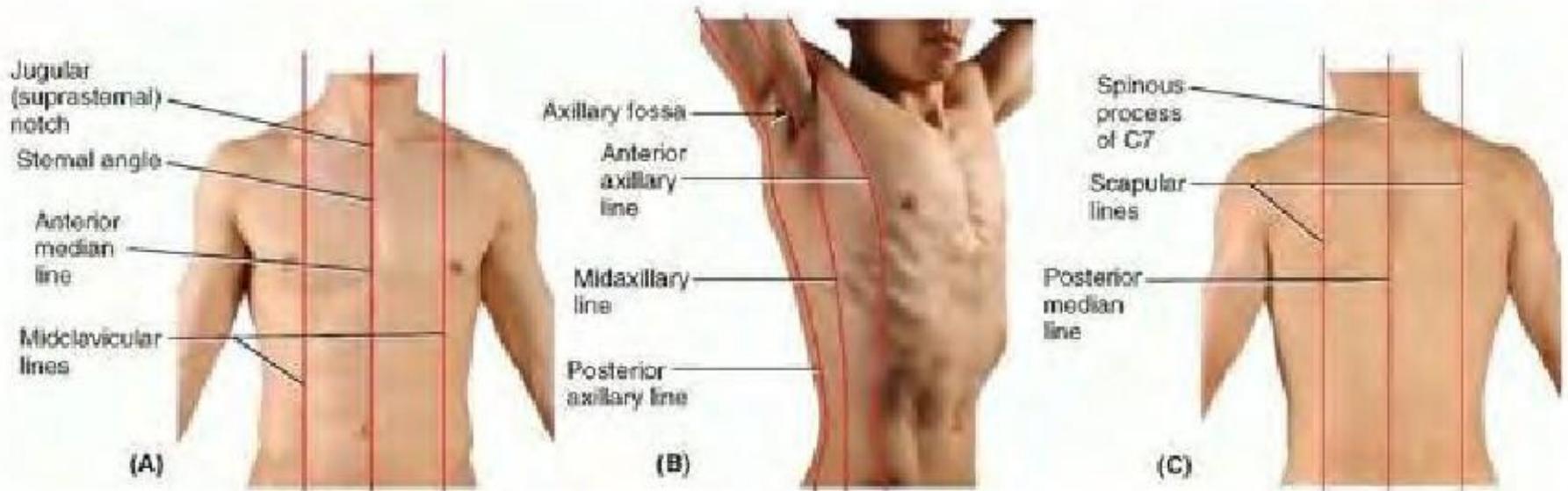
superior thoracic aperture:
jugular notch, 1. pair of ribs, Th1

Lower:

inferior thoracic aperture:
diaphragm (right side - to 4. ICS
left side - to 5. ICS)



Lines of orientation



Anterior median line (midsternal)
Sternal line
Parasternal I.
Midclavicular I.

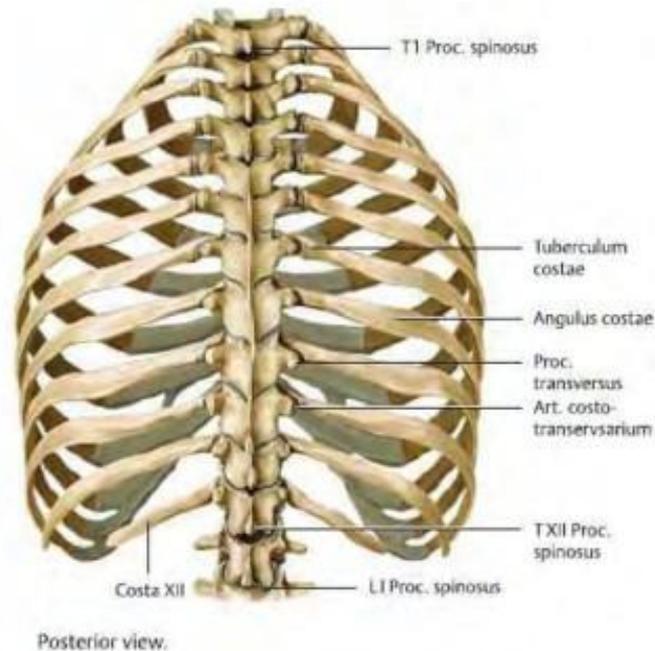
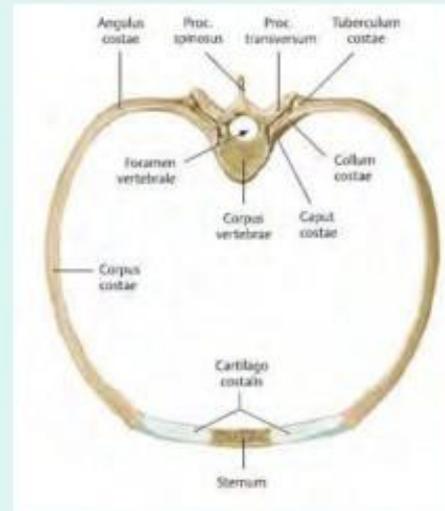
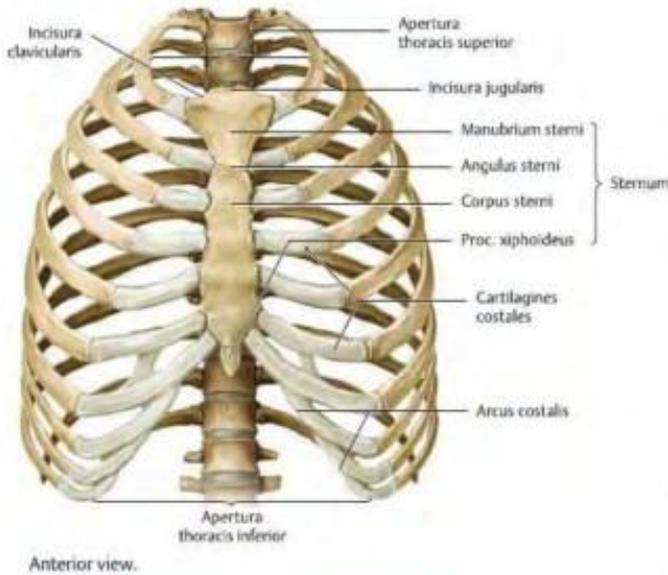
Anterior axillary I.
Middle axillary I.
Posterior axillary I.

Scapular I.
Paravertebral I.
Posterior median line

► Deep layer

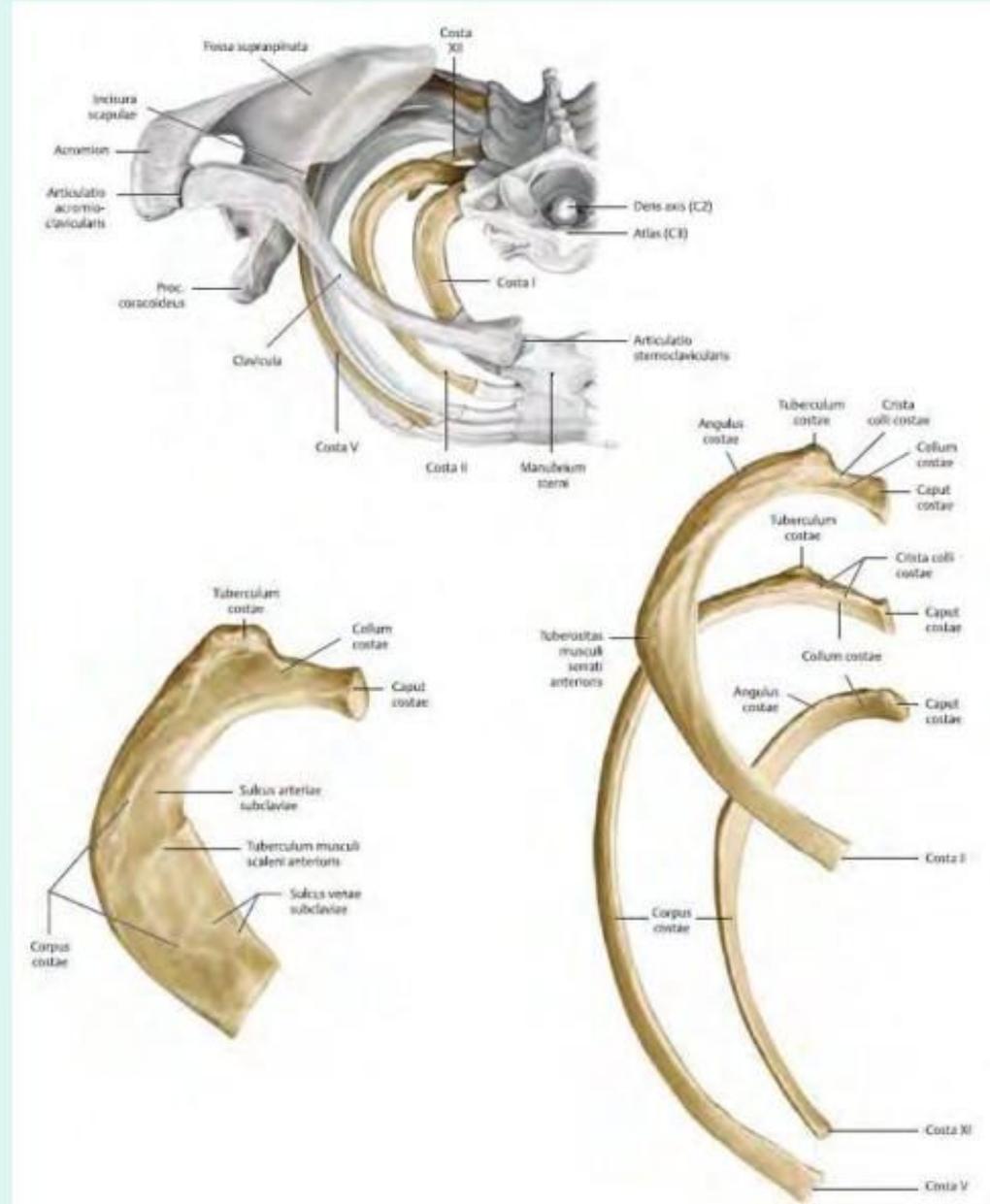
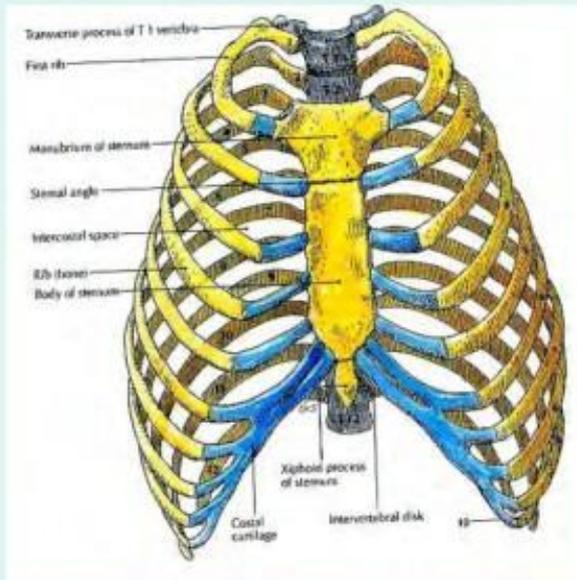
Osteothorax

- ribs
- sternum
- thoracic vertebrae

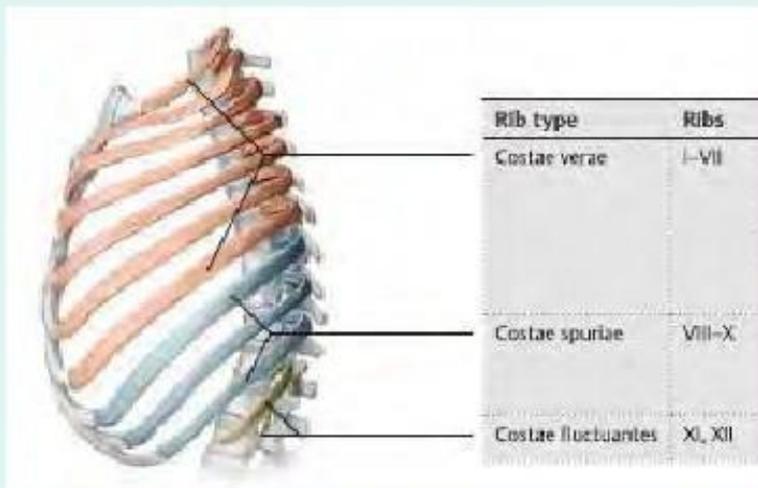


Osteothorax

Ribs



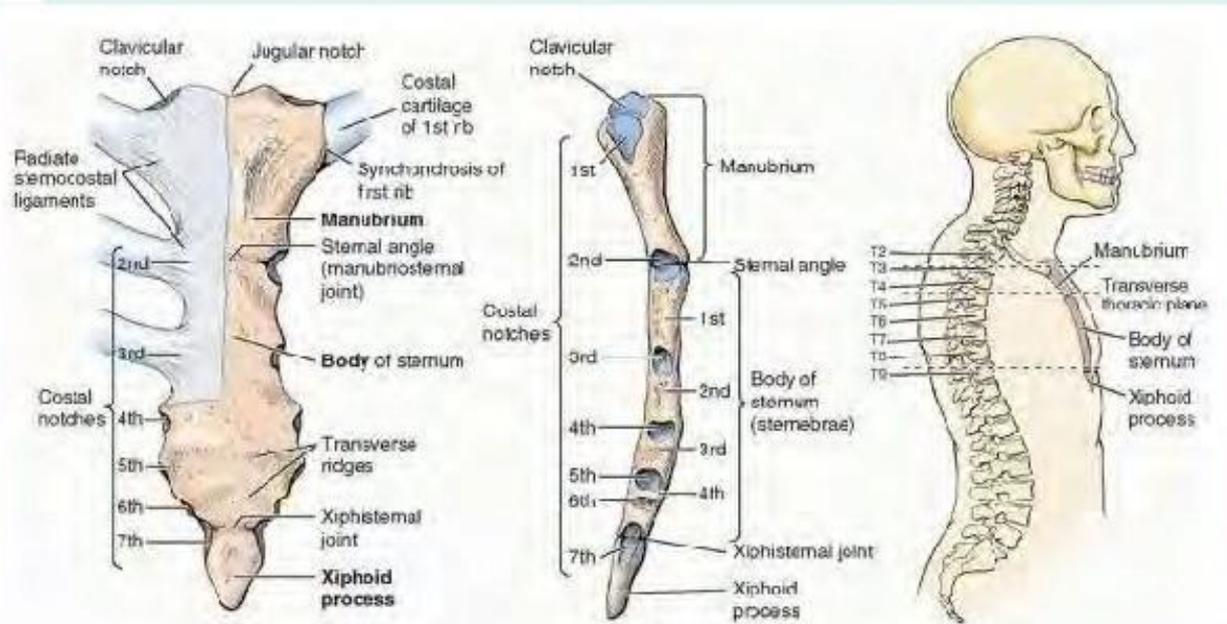
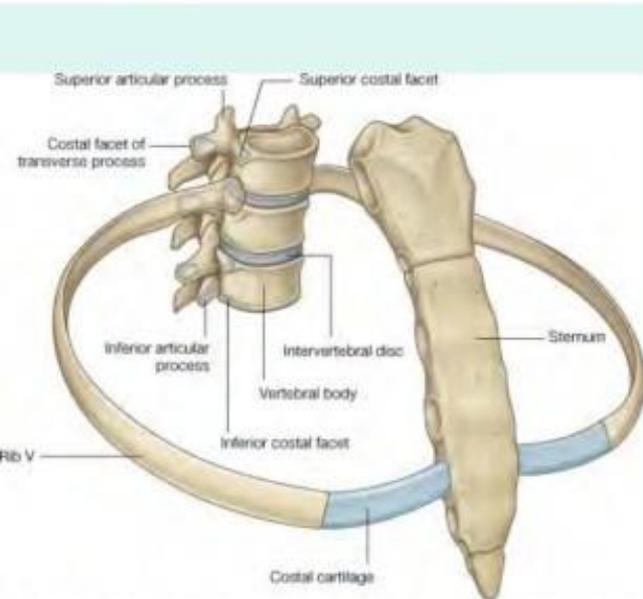
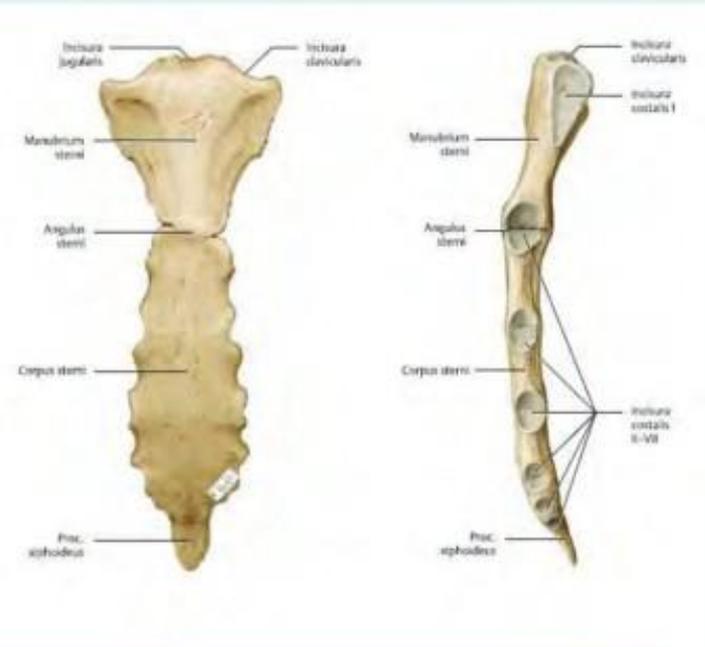
Types of ribs:



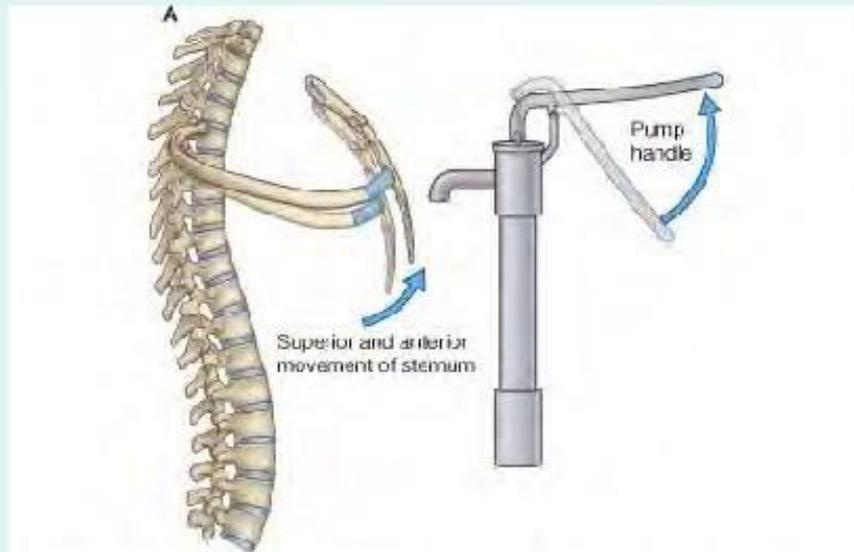
Sternum

- manunbrium of sternum
- body of sternum
- xiphoid process

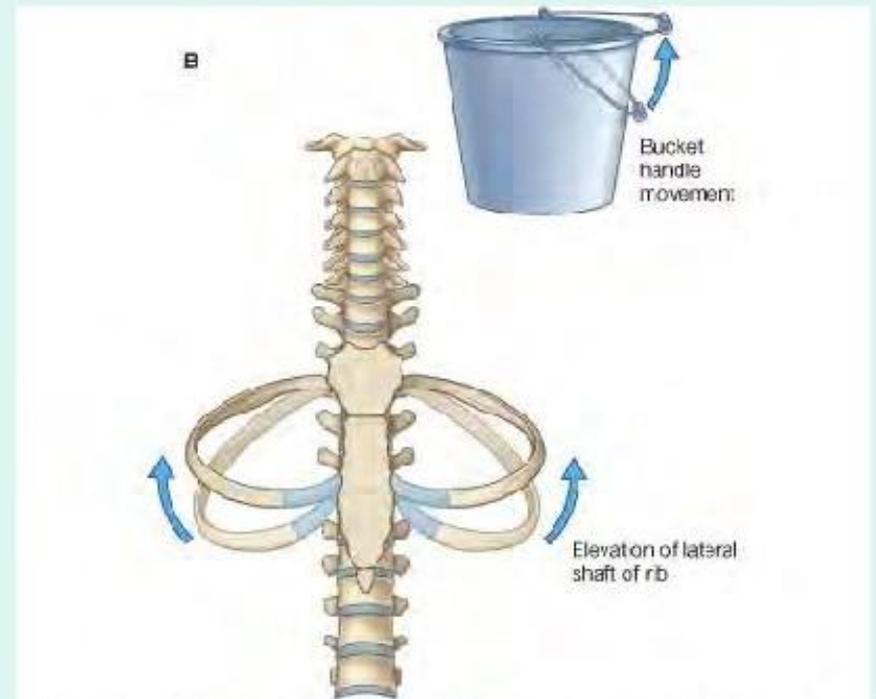
- manunbriosternal and xiphisternal synchondrosis(synostosis)



Movement of the ribs and sternum during breathing



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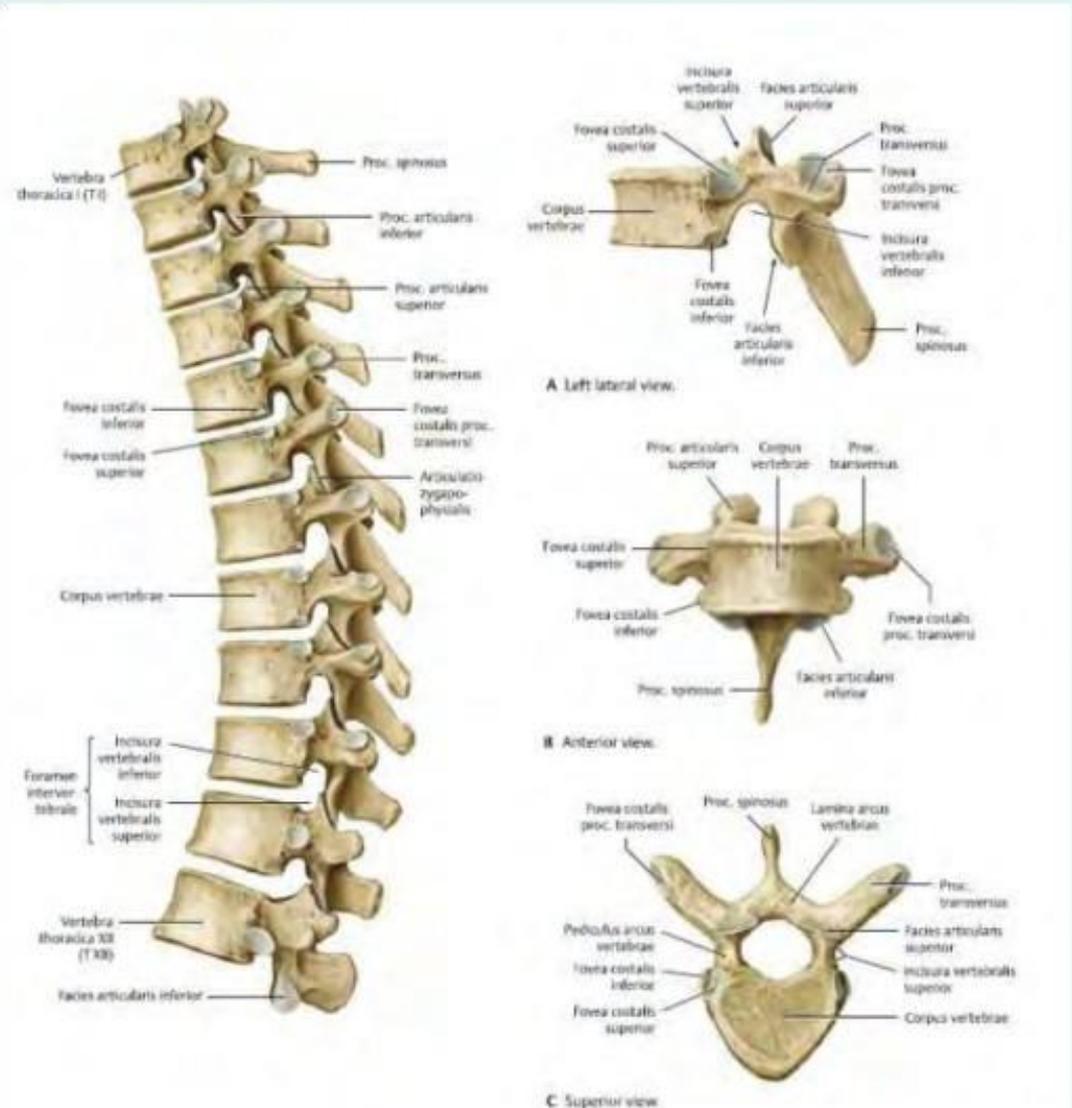


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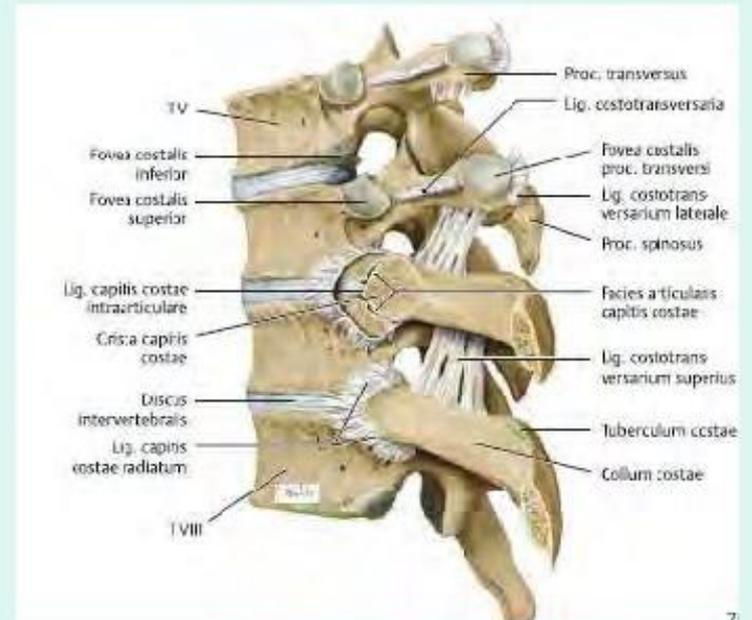
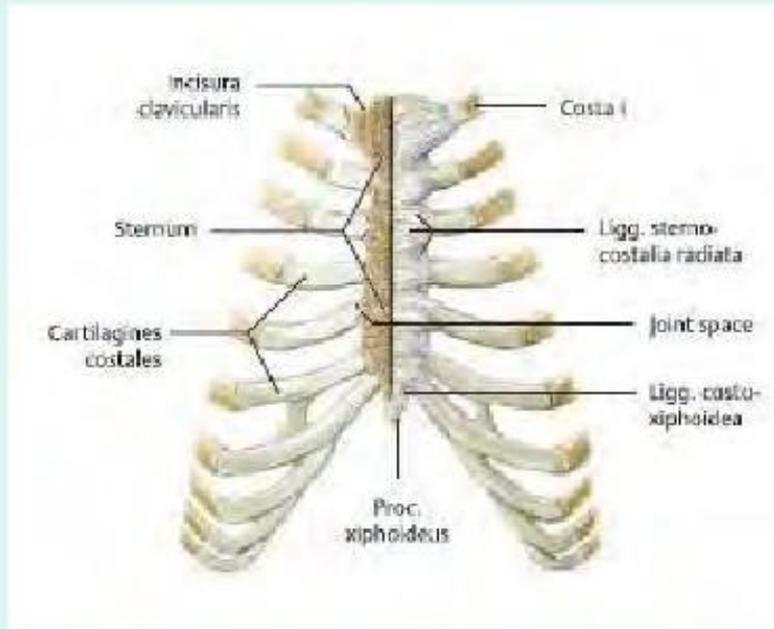
Thoracic vertebrae



- body
- arch
(lamina+pedicles)
- spinous process
- transverse processes
- superior and inferior articular processes



Joints of the ribs



anteriorly

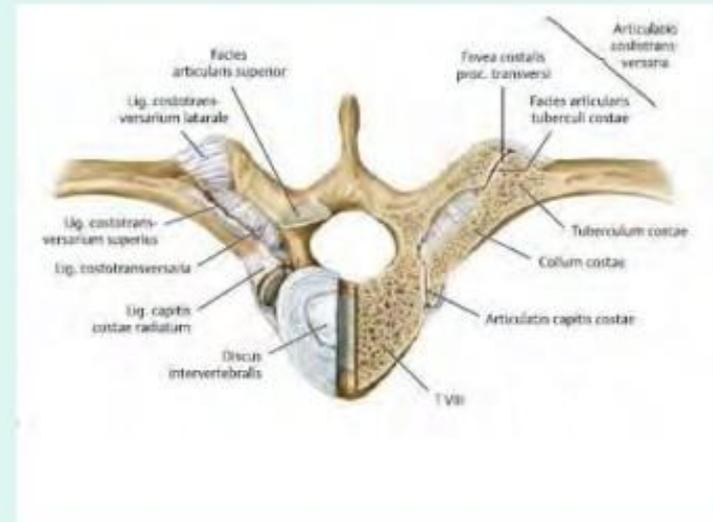
► sternocostal joints (2nd-5th ribs)

posteriorly

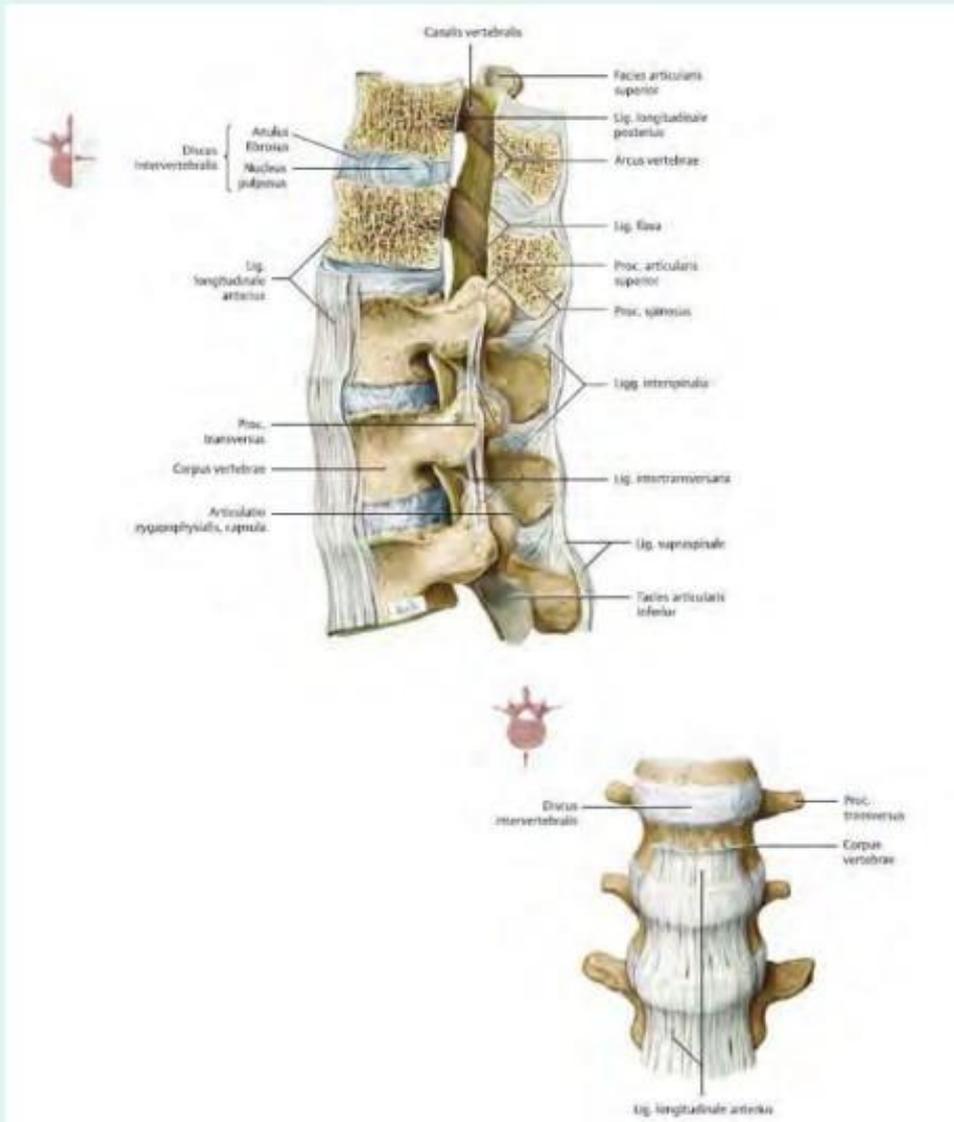
► costovertebral joints

- joints of the heads of the ribs

- costotransverse joints



Ligaments of vertebral column



(Syndesmosis)

► *long ligaments:*

anterior et posterior longitudinal ligaments

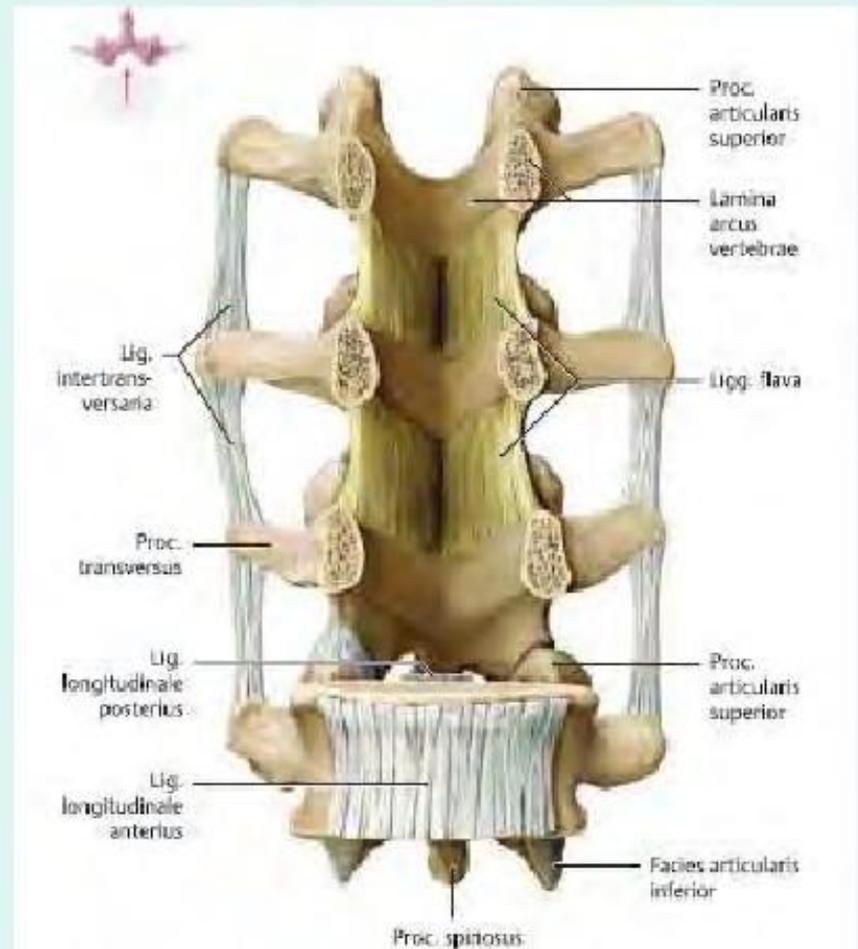
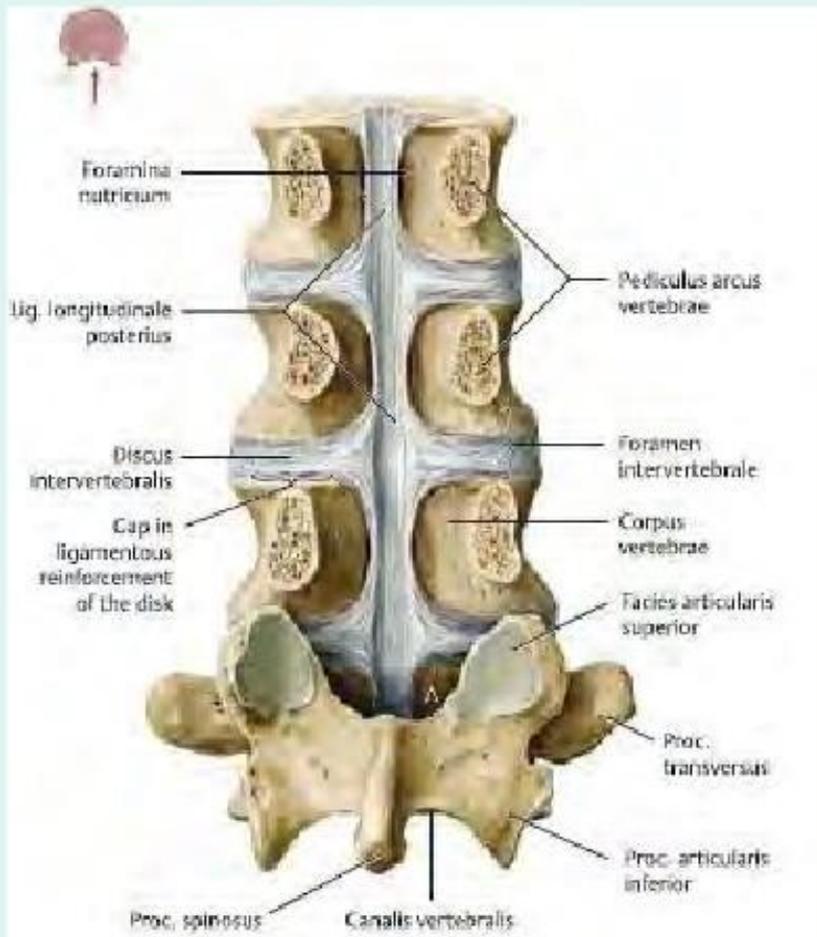
► *short ligaments:*

flava ligaments

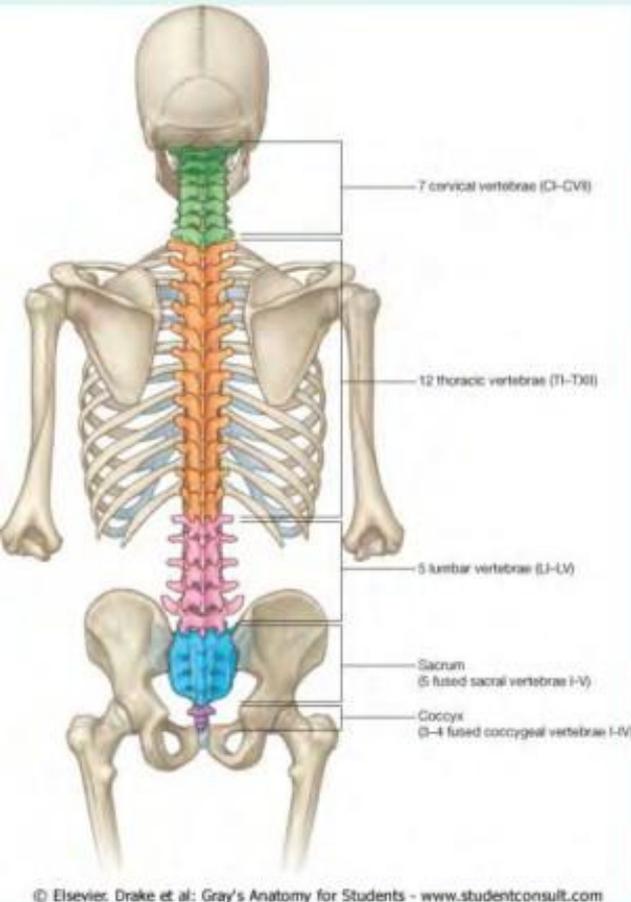
interspinous ligaments

intertransverse ligaments

Ligaments of vertebral column



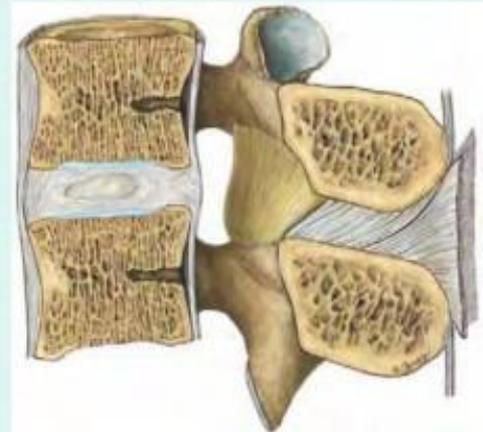
Intervertebral disk (*synchondrosis*)



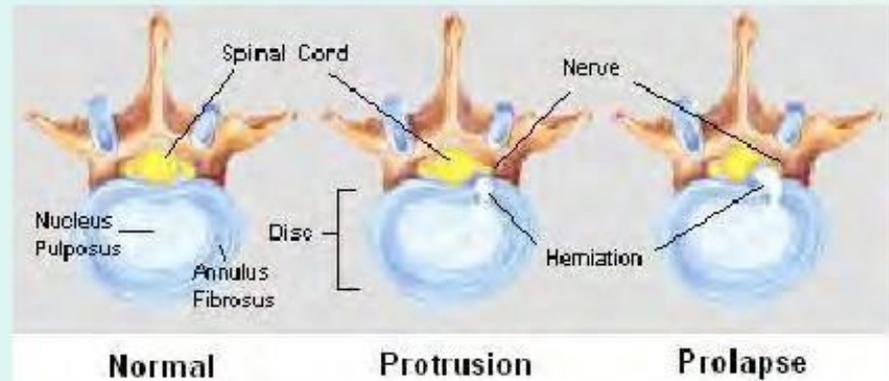
- number: 23
- 1st i.d.: C2-C3
- last i.d.: L5-S1
- nucleus pulposus
et annulus fibrosus



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Os sacrum (*synostosis*)



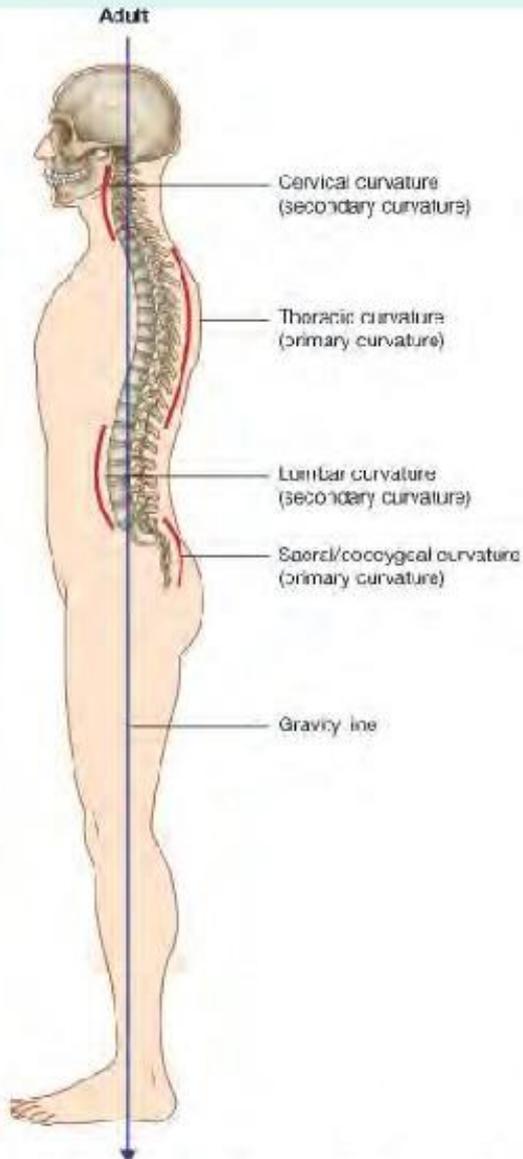


Joints of vertebral column

- superior and inferior articular processes



Curvatures of vertebral column



-sagittal plane

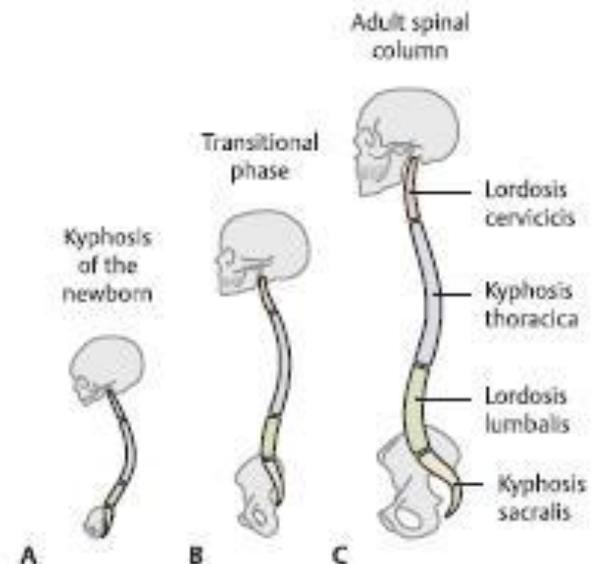
- **Lordoses** - cervical and lumbar
- **Kyfooses** - thoracic and sakral

-frontal plane

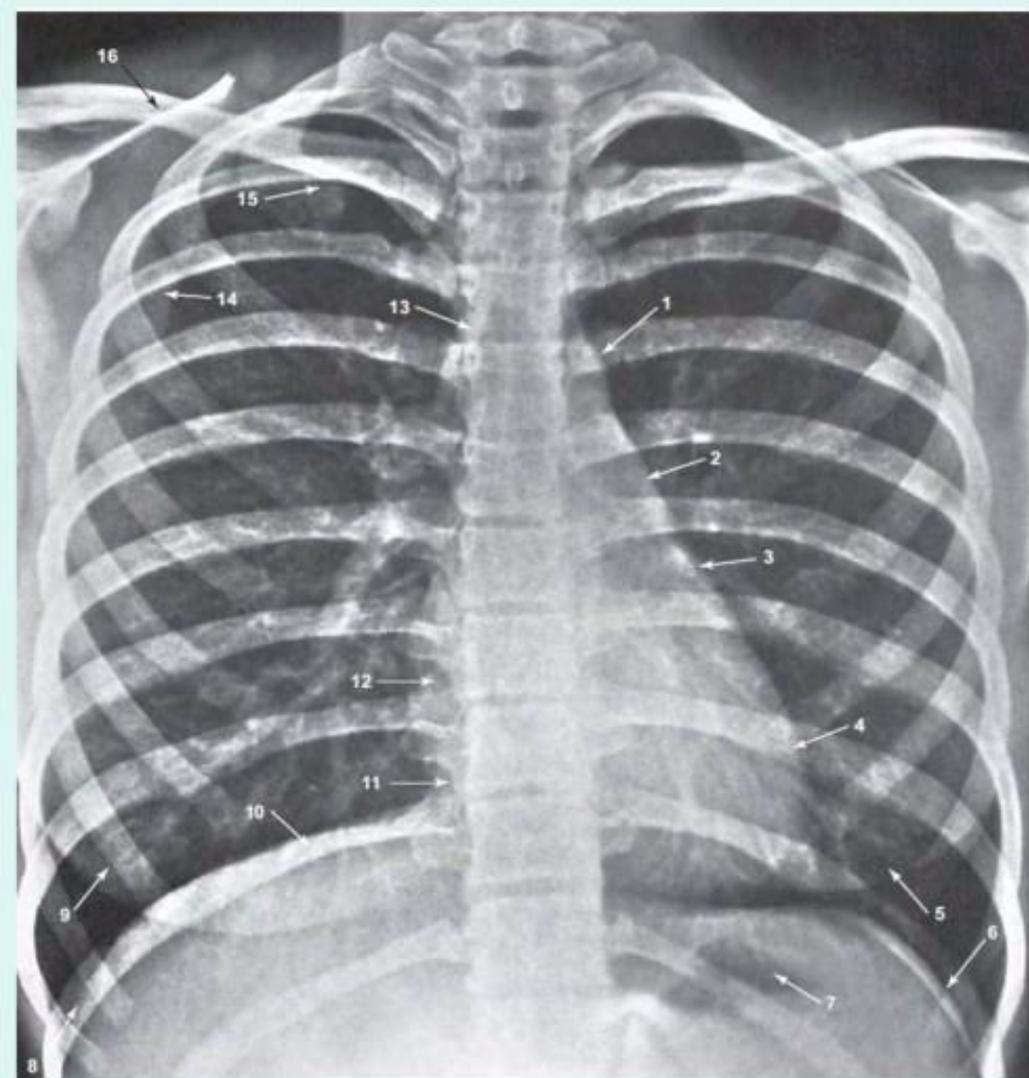
- **Skoliosis**

Spinal development

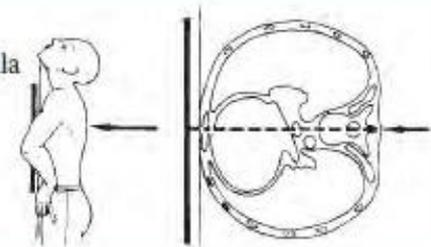
The characteristic curvatures of the adult spine appear over the course of postnatal development, being only partially present in a newborn. The newborn has a "kyphotic" spinal curvature (A); lumbar lordosis develops later and becomes stable at puberty (C).



Radiograph of thorax (postero-anterior projection)

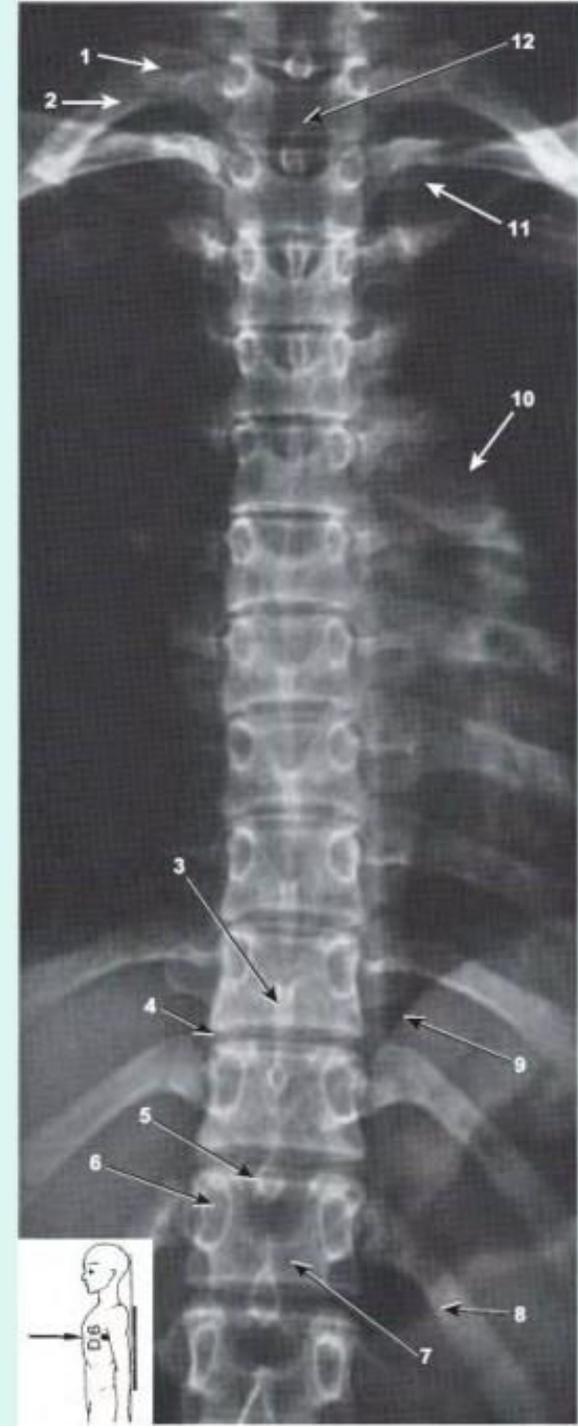


- | | | | |
|--------------------|------------------------------|----------------------------|------------------------------|
| 1. Arch of aorta | 5. Contour of left breast | 9. Contour of right breast | 13. Superior vena cava |
| 2. Pulmonary trunk | 6. Diaphragm | 10. Diaphragm | 14. Medial border of scapula |
| 3. Left auricle | 7. Air in fundus of stomach | 11. Inferior vena cava | 15. First rib |
| 4. Left ventricle | 8. Costodiaphragmatic recess | 12. Right atrium | 16. Right clavicle |



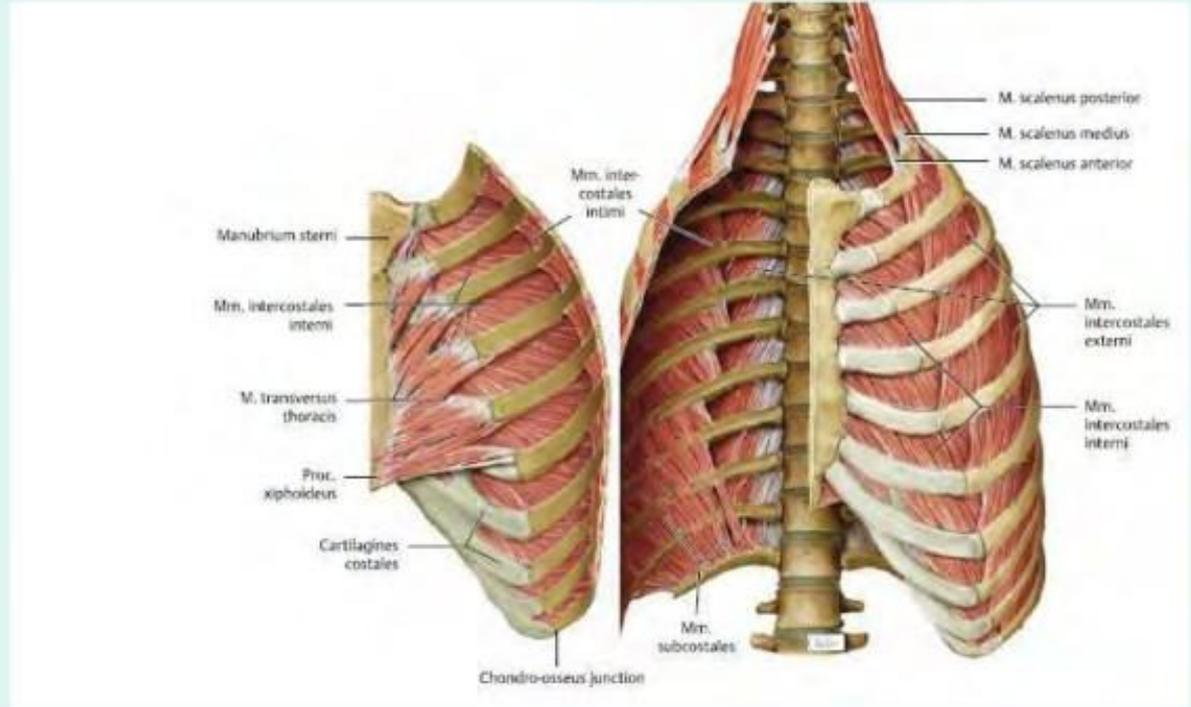
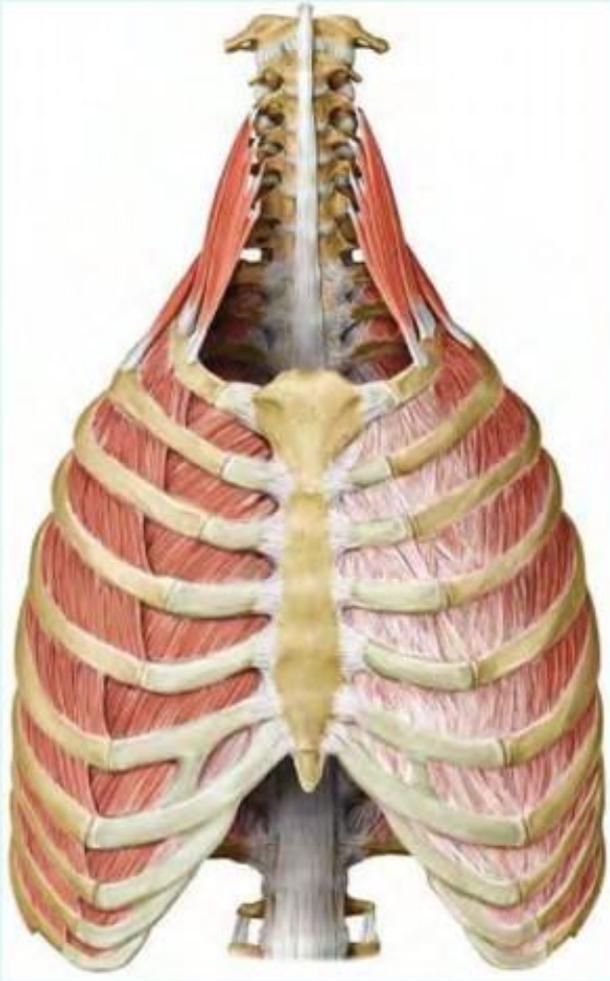
Radiograph of vertebral column, thoracic part (antero-posterior projection)

1. Neck of first rib
2. First rib
3. Spinous process
4. Inferior articular process
5. Superior articular process
6. Pedicle of vertebral arch
7. Twelfth thoracic vertebra
8. Twelfth rib
9. Diaphragm
10. Left contour of the heart
11. Clavicle
12. T1 vertebra



► Deep layer

Mm. of the proper thoracic wall



1. intercostals external - inspiration
2. intercostals internal - expiration
3. intercostals intimi (innermost) - exp.
4. subcostals - exp.
5. transversus thoracis - exp.

Blood supply: post. intercostal aa. vv.,
internal thoracic a.+v.,
supreme intercostal a.+v.

Nerve supply: intercostal nn.

► Deep layer

Intrinsic mm. of the back

Erector spinae - in the osteofibrous canal lateral to spinous processes

- in cervical region by lig. nuchae
- in lumbar region - is covered by thoracolumbar fascia
- in sacral region - starts by tendon

Origin: median sacral crest, spinous procc. of lumbar, 11. and 12. Th, supraspinal lig.

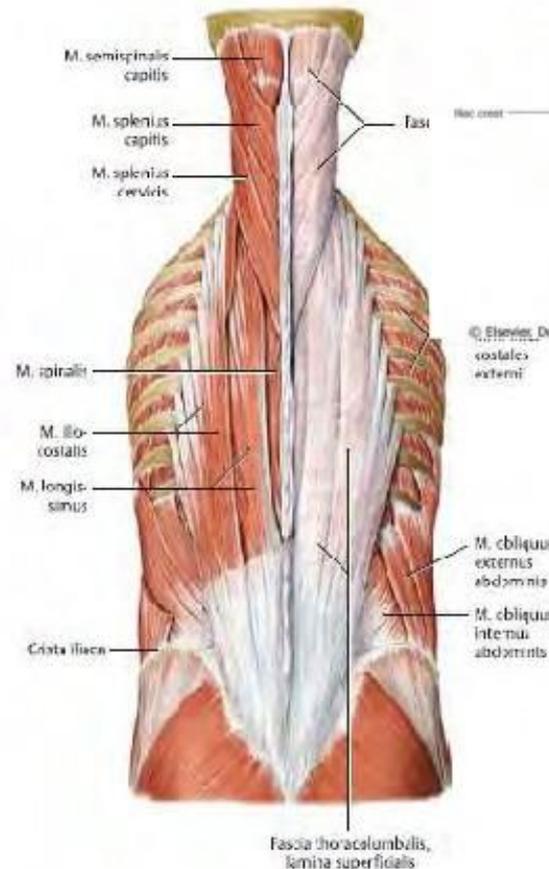
- divided into 2 tracts:

Lateral tract - iliocostalis, longissimus

Medial tract - spinalis

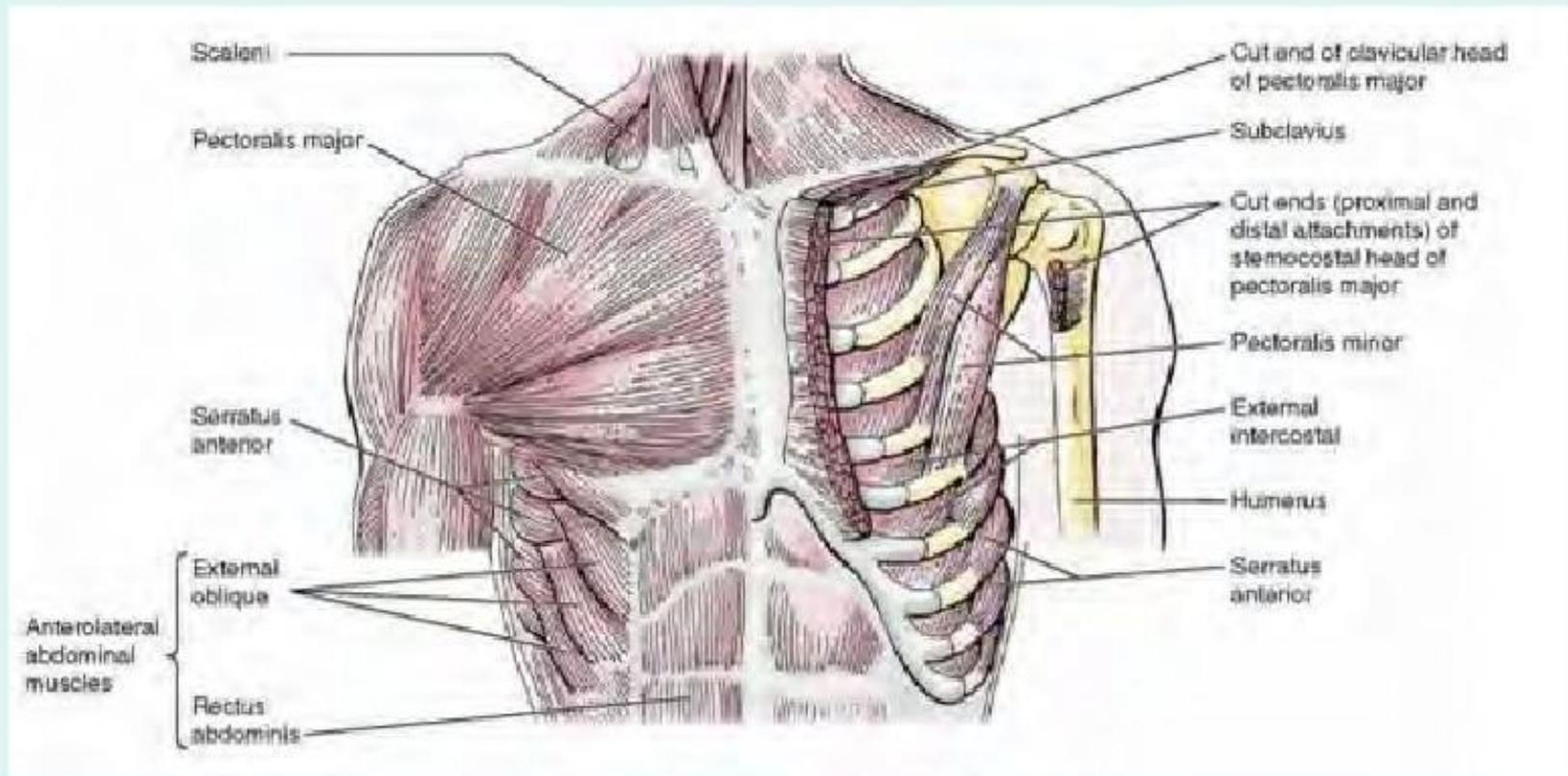
Innervation:

- dorsal rr. of spinal nerves



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► Middle layer (thoracohumeral muscles + mm. of the back)



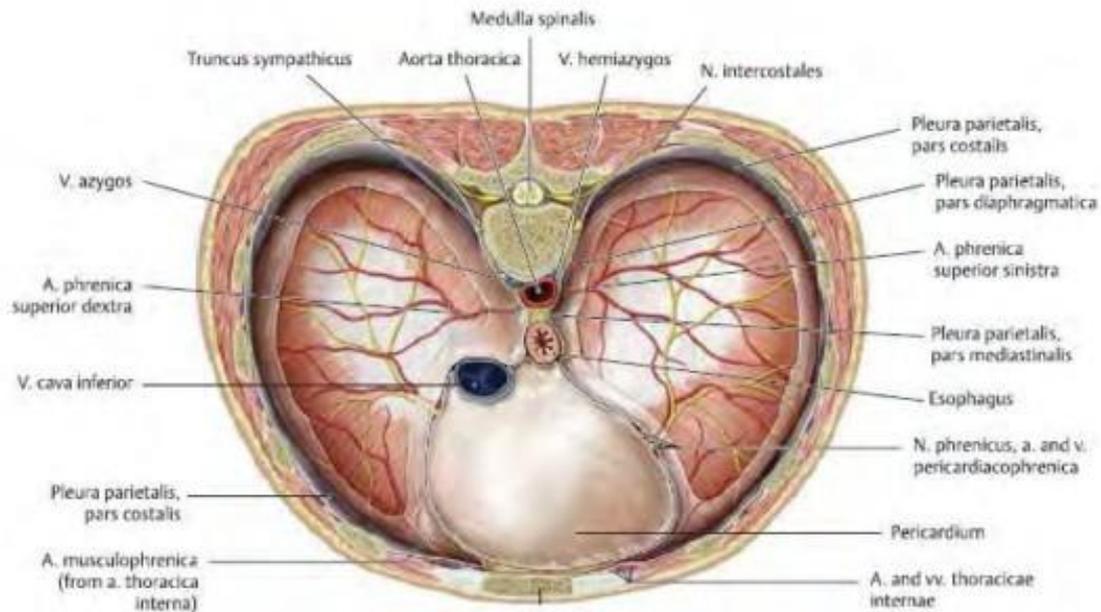
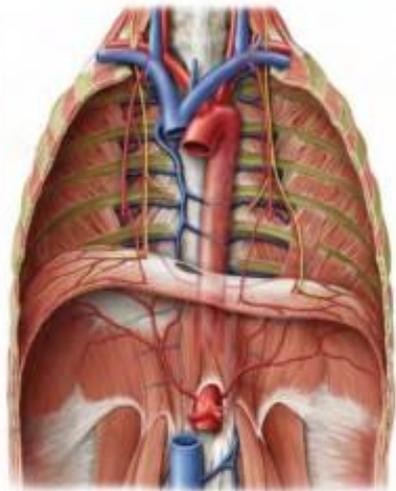
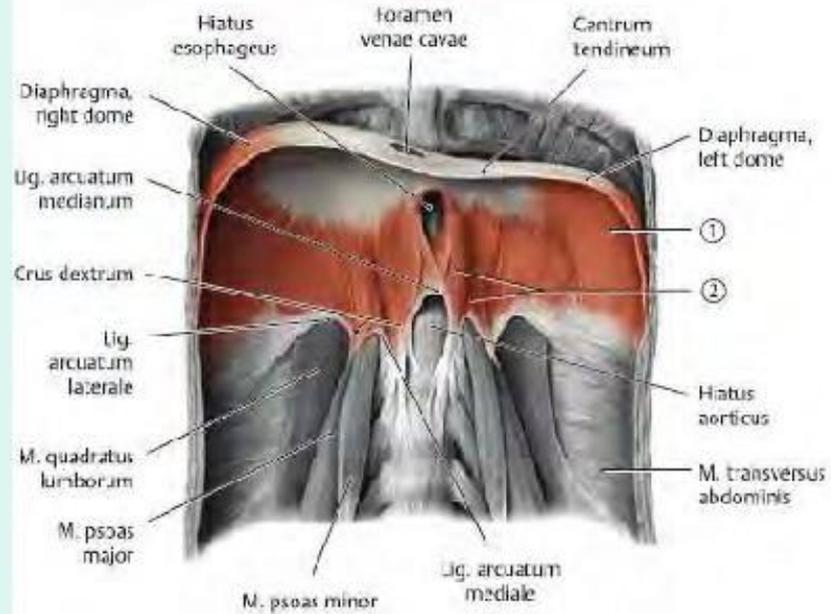
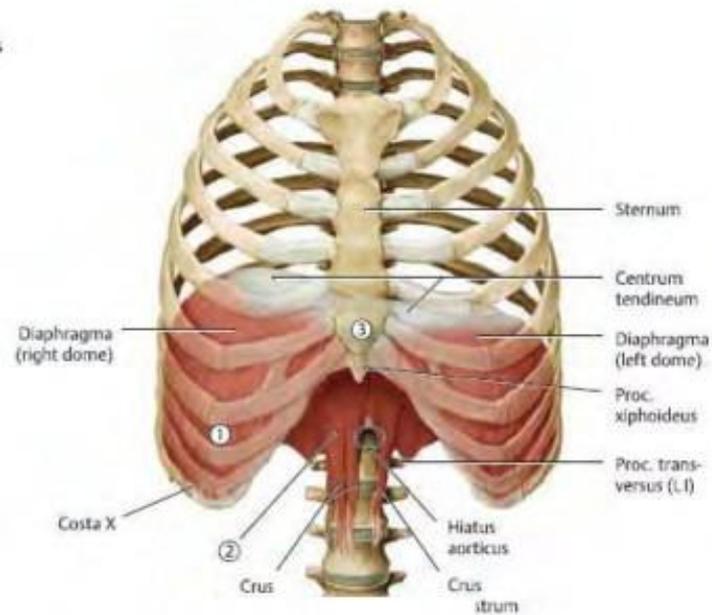
Thoracohumeral muscles

1. pectoralis major - pectoral br. (from thoracoacromial a.), med.+later.pectoral nn. (brachial pl.)
 2. pectoralis minor - #
 3. serratus anterior - lateral thoracic a. (axillary a.), long thoracic n. (from brachial pl.)
 4. subclavius - clavicular br. (a. thoracoacromialis), suclavius n. (brachial pl.)
- help during inspiration

Pectoral fascia

Clavipectoral fascia - attaches to clavicle

Diaphragm



Mm. of the back

- 1st layer - spinohumeral muscles

1. Trapezius

Origin: spinous process of Th12-1, C7-1, nuchal lig., external occipital protuberance

Insertion: spine of scapula, acromion, clavicle

Function: turns, lifts up, adducts scapula to spine,

turns the head

Innervation: accessory n.

2. Latissimus dorsi

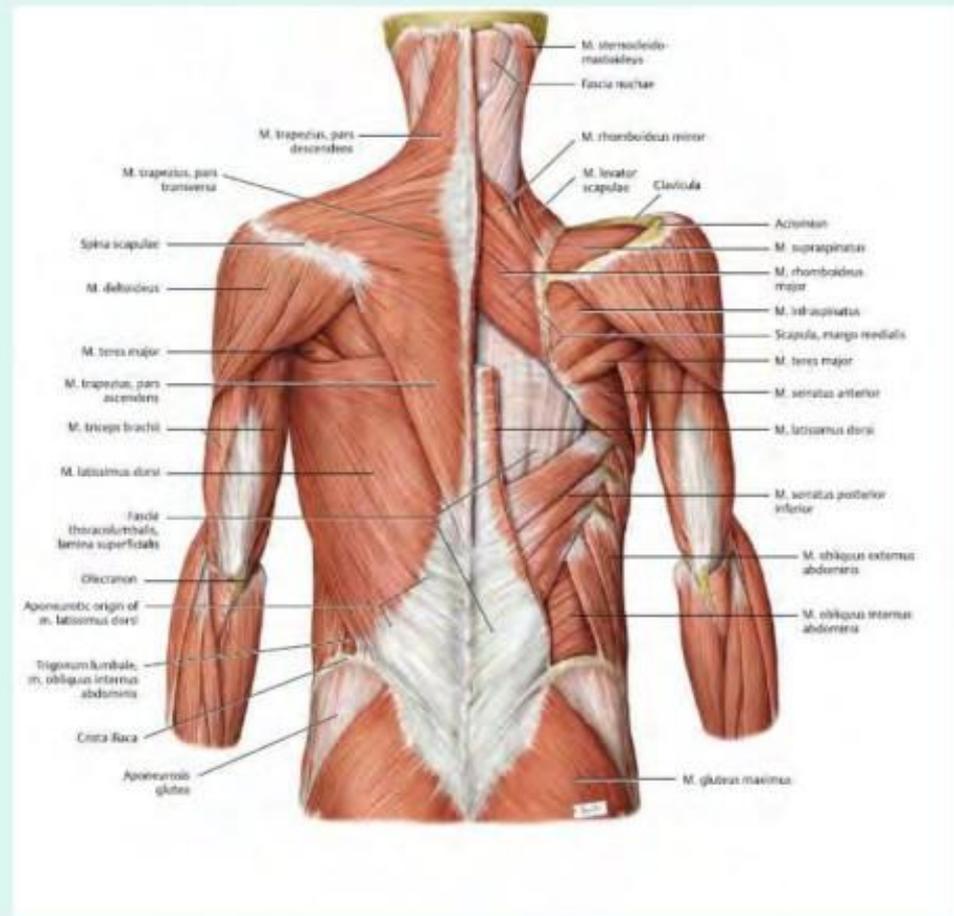
Origin: thoracolumbar fascia, spinous process of Th7-12, L1-5,

sacrum, lower ribs

Insertion: crest of lesser tubercle

Function: extension, internal rotation of humerus

Innervation: thoracodorsal n.



Mm. of the back

- 2nd layer - spinohumeral muscles

1. Levator scapulae

Origin: transverse proc. C1-4

Insertion: sup. angle of scapula

2. Rhomboid minor

Origin: spinous proc. C6-7

Insertion: med. margin of scapula

3. Rhomboid major

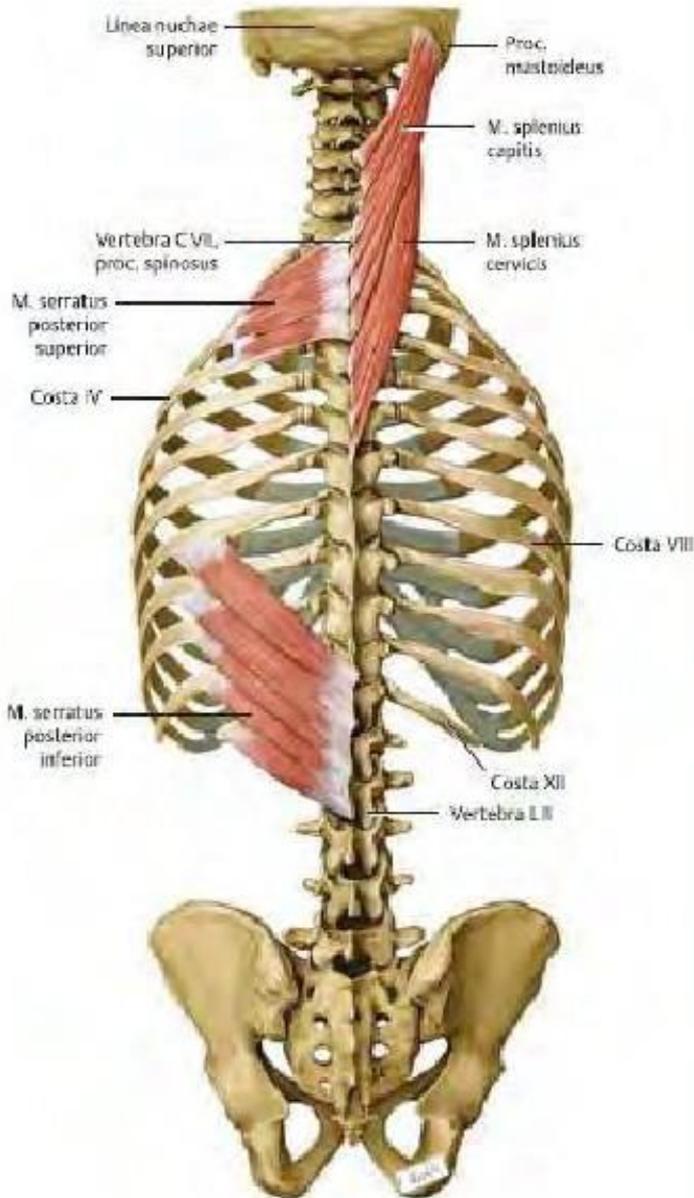
Origin: spinous proc. Th1-4

Insertion: medial margin of scapula

Function: lift up scapula

Innervation: dorsal scapular n.





Mm. of the back

●3rd layer - spinocostal mm.

1. Serratus posterior superior

Function:

- pulls the ribs upward
- inspiration

2. Serratus posterior inferior

Function:

- pulls the ribs down
- expiration

Innervation: - Intercostal nn.

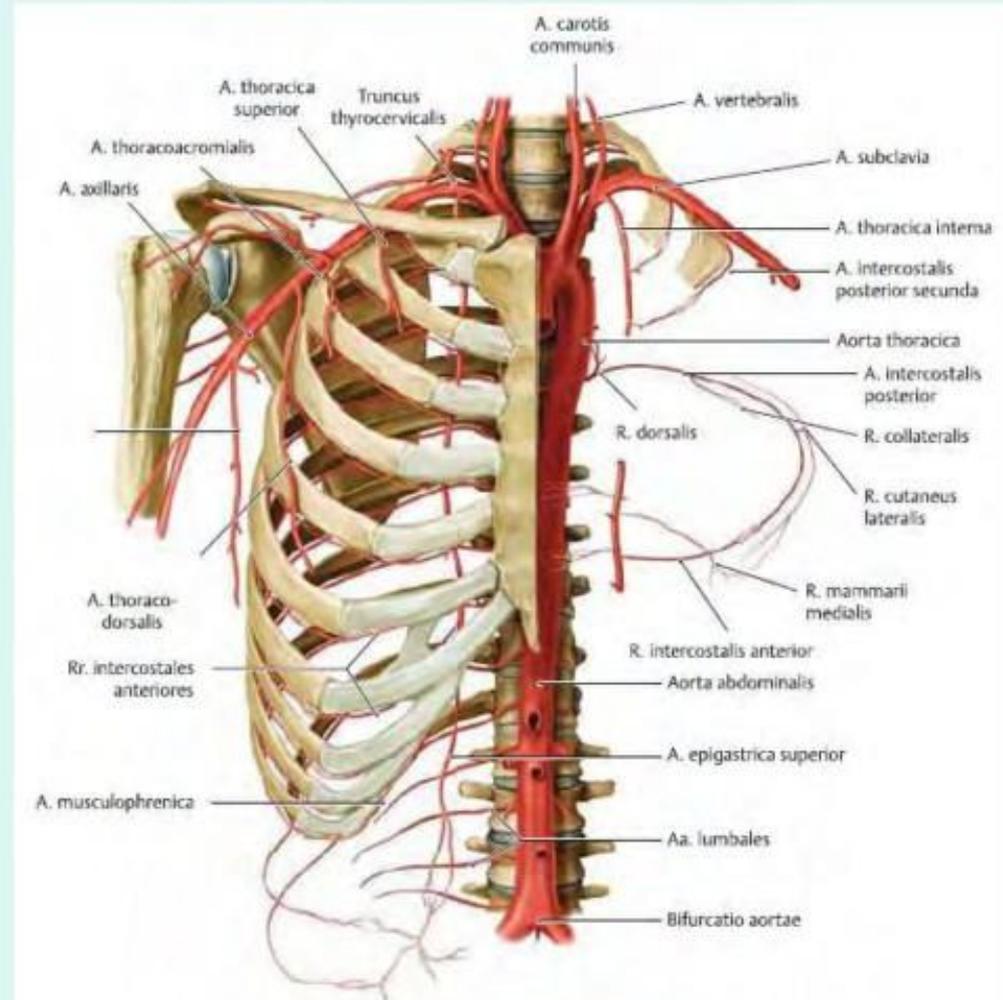
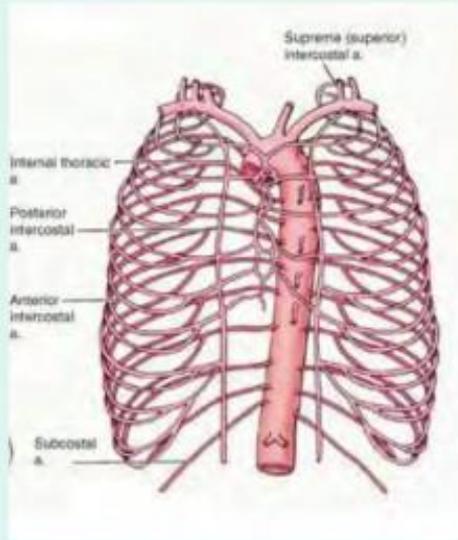
Arteries of the thoracic wall

Three sources:

axillary artery

subclavian artery

thoracic aorta



A. subclavia
and a.
axillaris

A. thoracica superior
A. thoracica lateralis
A. thoracoacromialis
Aa. intercostales
posteriores (1st and 2nd;
see p. 34)

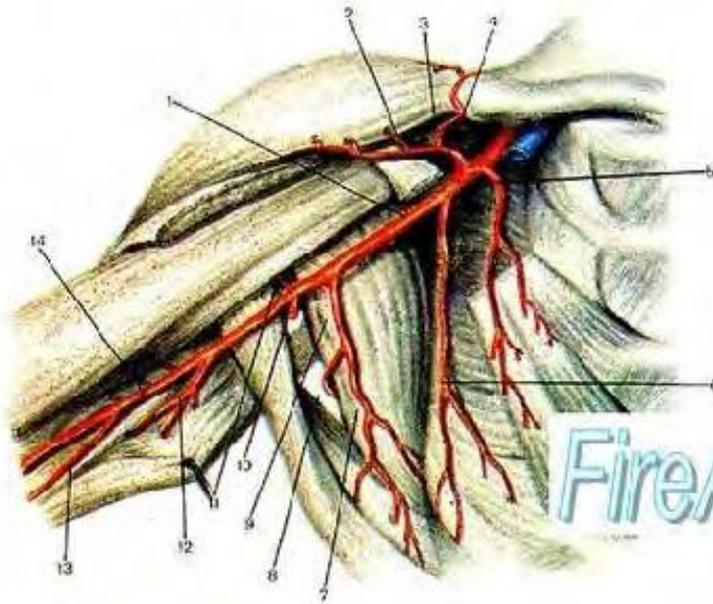
Aorta
thoracica

Aa. intercostales
posteriores (3rd through
12th)

A. thoracica
interna

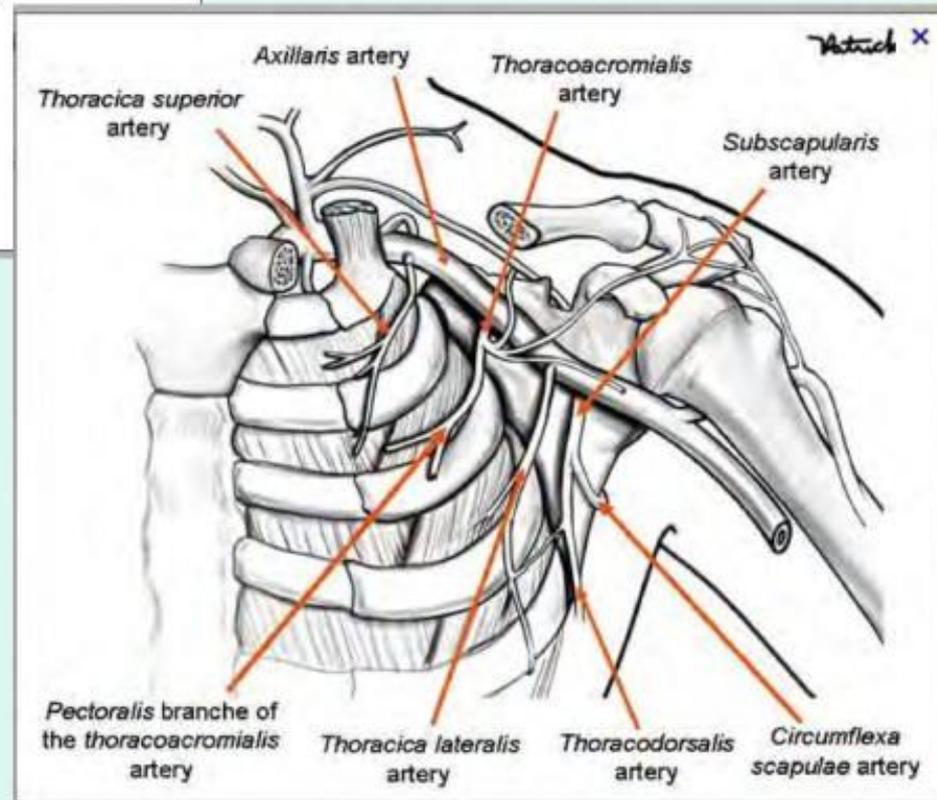
Aa. intercostales
anteriores
A. musculophrenica
A. epigastrica superior

Arteries of the thoracic wall - continuation



- 1 - a. axillaris;
- 2 - r. deltoideus;
- 3 - r. acromialis;
- 4 - a. thoracoacromialis;
- 5 - r. pectoralis;
- 6 - a. thoracica lateralis;
- 7 - a. thoracodorsalis;
- 8 - a. circumflexa scapulae;
- 9 - a. subscapularis;
- 10 - a. circumflexa posterior humeri;
- 11 - a. circumflexa anterior humeri;
- 12 - a. profunda brachii;
- 13 - a. collateralis ulnaris superior;
- 14 - a. brachialis.

FireAiD



Axillary artery

Superior thoracic artery

Thoracoacromial artery

Lateral thoracic artery

Subscapular artery

thoracodorsal artery

circumflex scapular artery

Arteries of the thoracic wall -

(Arterial blood supply of ICS)

Thoracic aorta

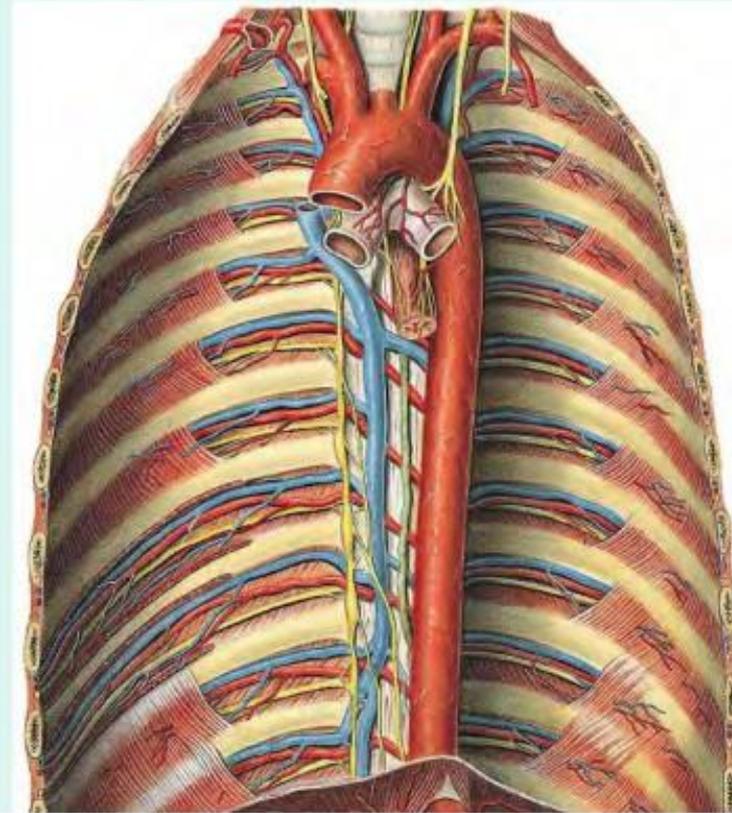
3.-12. posterior intercostal aa (aa.ICP), a.subcostal a.

Subclavian artery

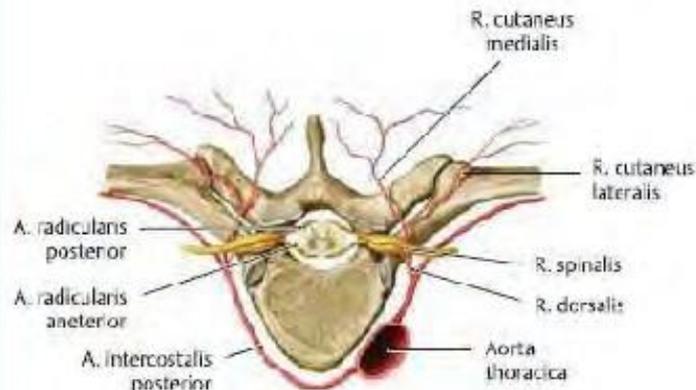
costocervical trunk

supreme IC a.

1.-2. aa.ICP



▮► branches of posterior intercostal a.



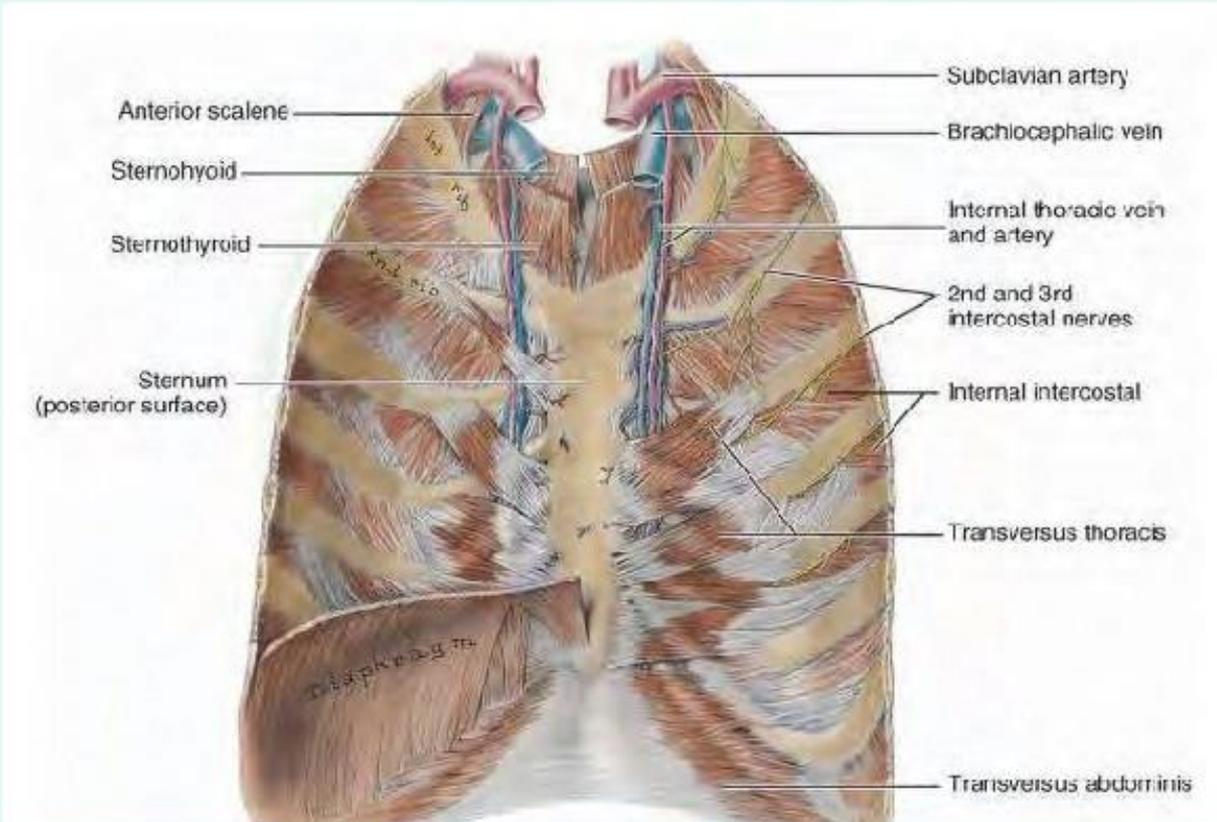
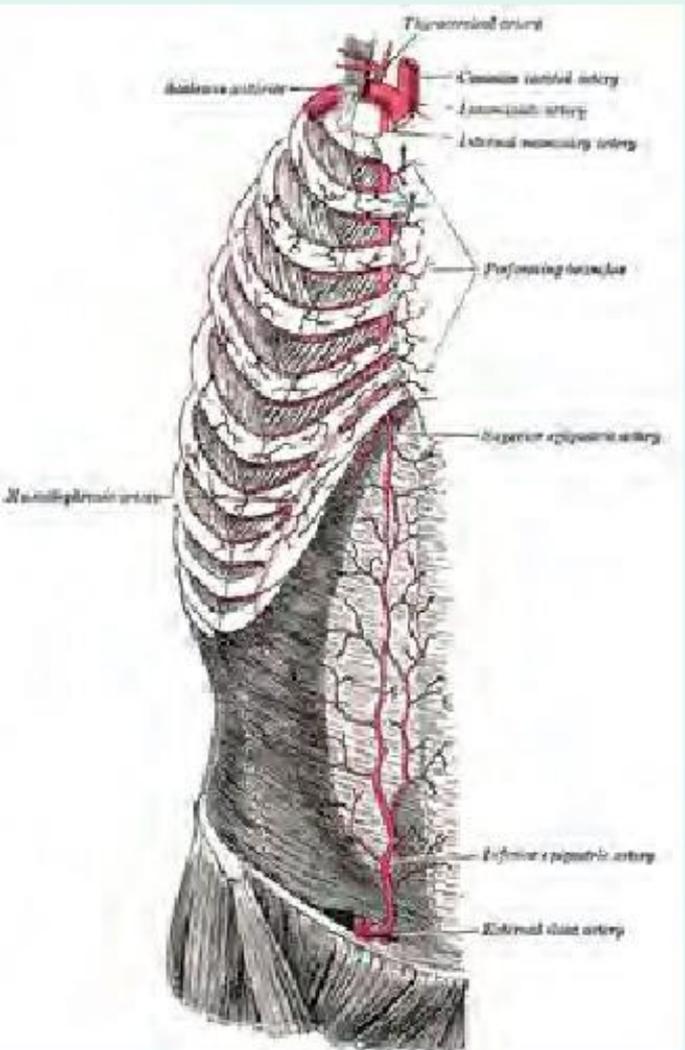
Aa. intercostales posteriores	Ramus dorsalis	Rami spinales	Spinal cord
		Ramus cutaneus medialis	Posterior thoracic wall
		Ramus cutaneus lateralis	Lateral thoracic wall
	Ramus collateralis		Anterior thoracic wall
	Ramus cutaneus lateralis*		

Arteries of the thoracic wall

Subclavian artery

internal thoracic a.

internal thoracic v.



Veins of the thoracic wall

Posterior wall:

azygos v.

hemiazygos v.

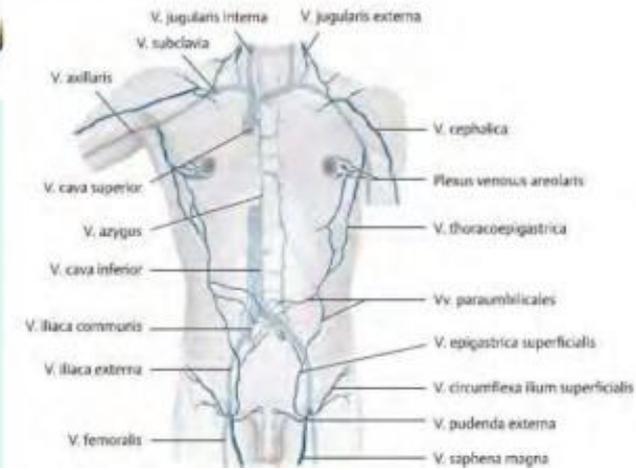
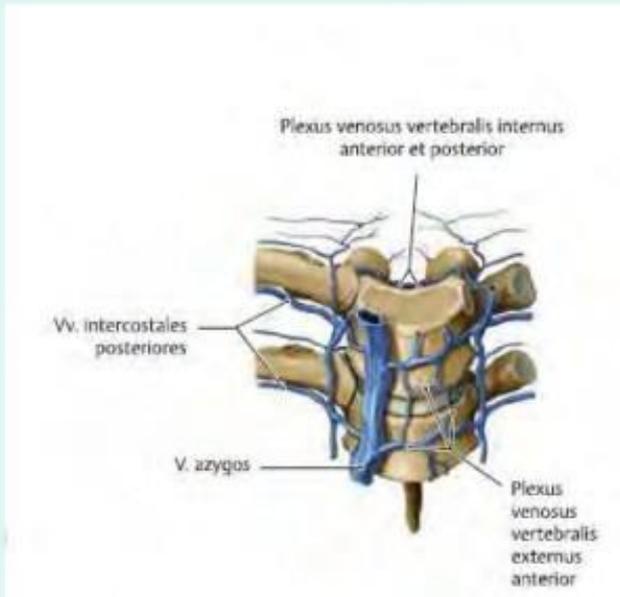
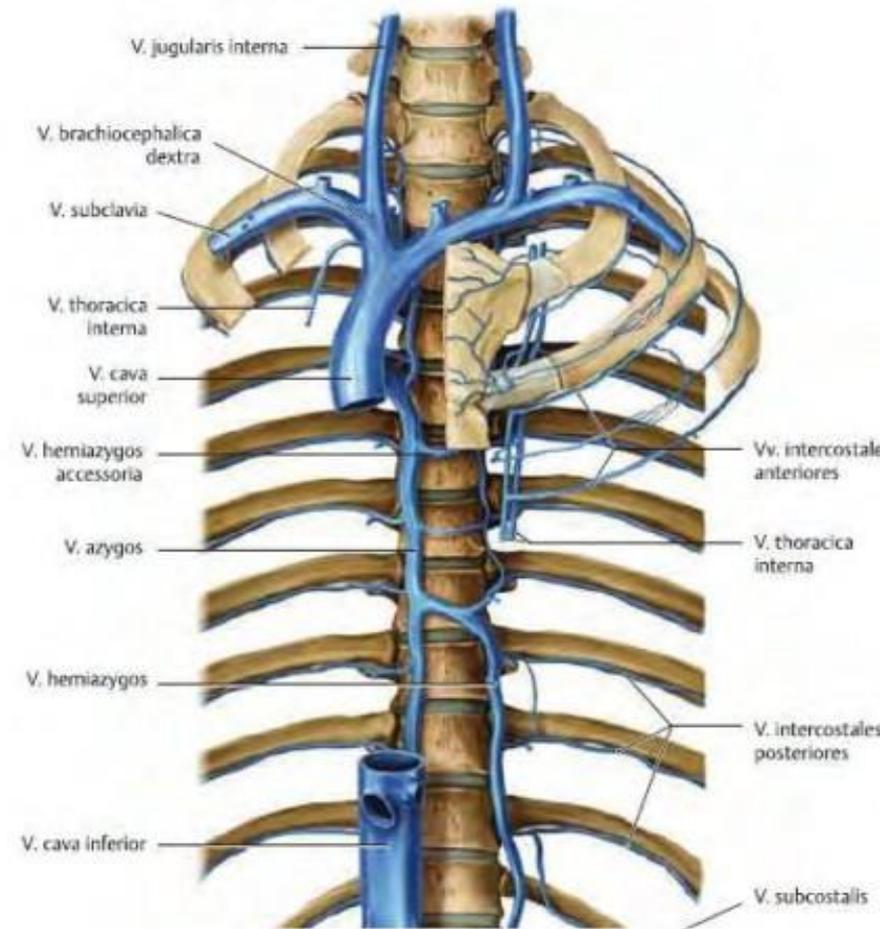
accessory hemiazygos v.

Lateral wall:

thoracoacromial v.

lateral thoracic v. ← thoracoepigastric v.

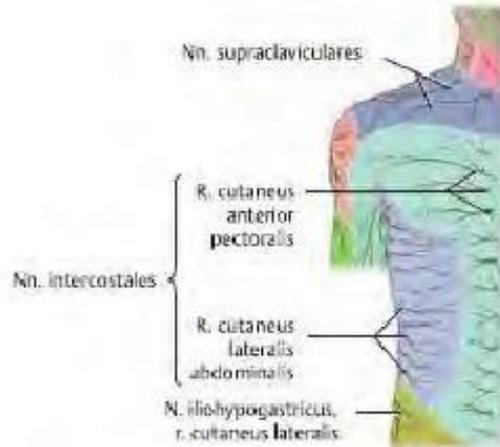
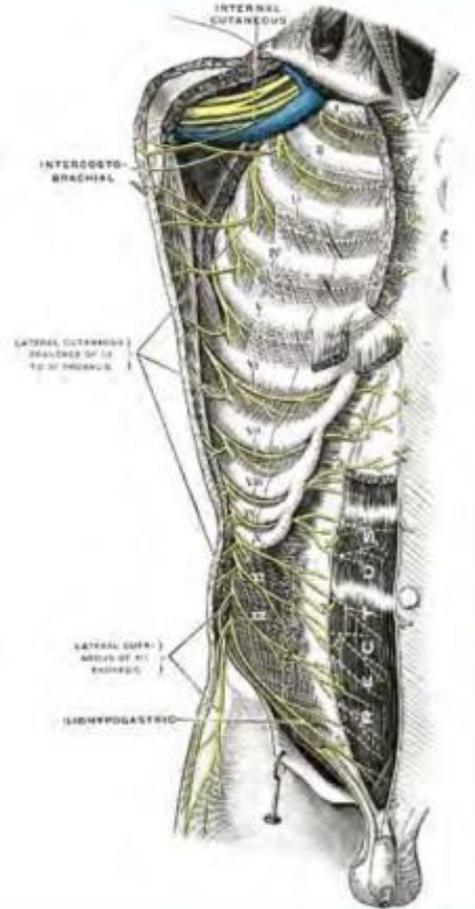
thoracodorsal v.



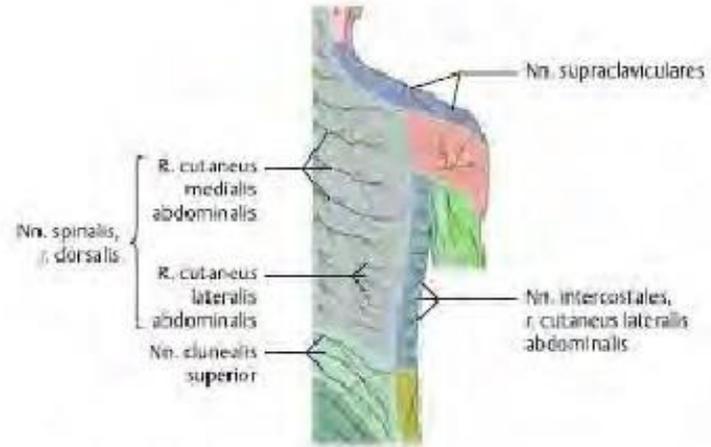
Anterior wall:

internal thoracic vein

Innervation of the thoracic wall - continuation

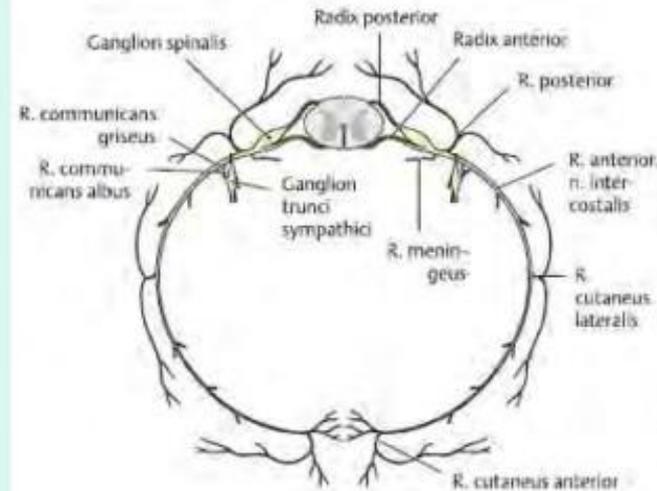


A. Anterior view.



B. Posterior view.

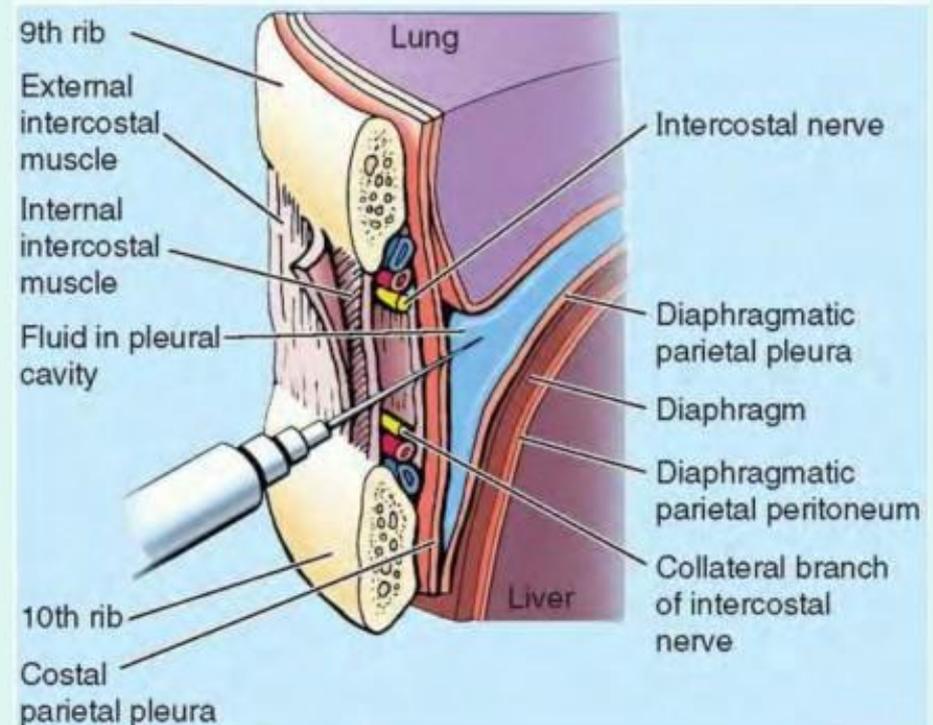
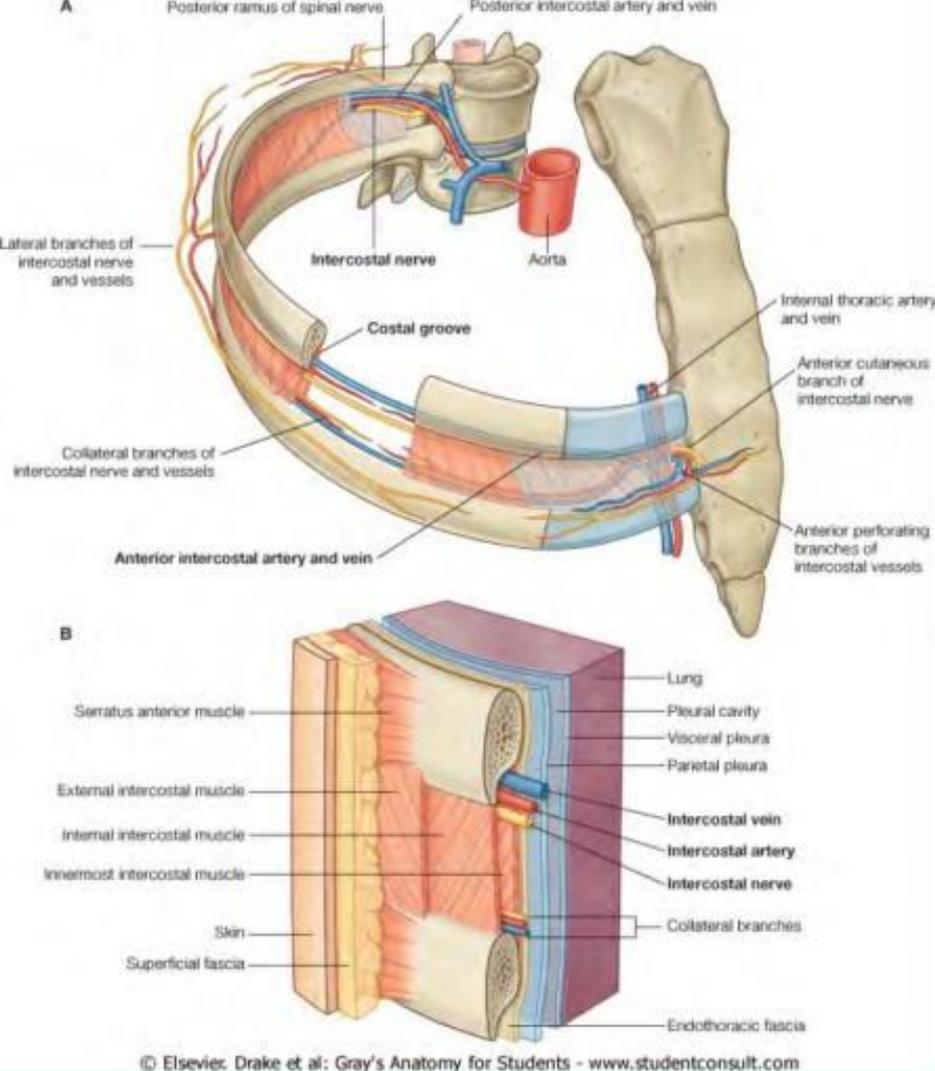
Sensory innervation:
intercostals nerves
supraclavicular nerves
intercostobrachial nerves



▮ branches of intercostal nerve

Neurovascular bundle

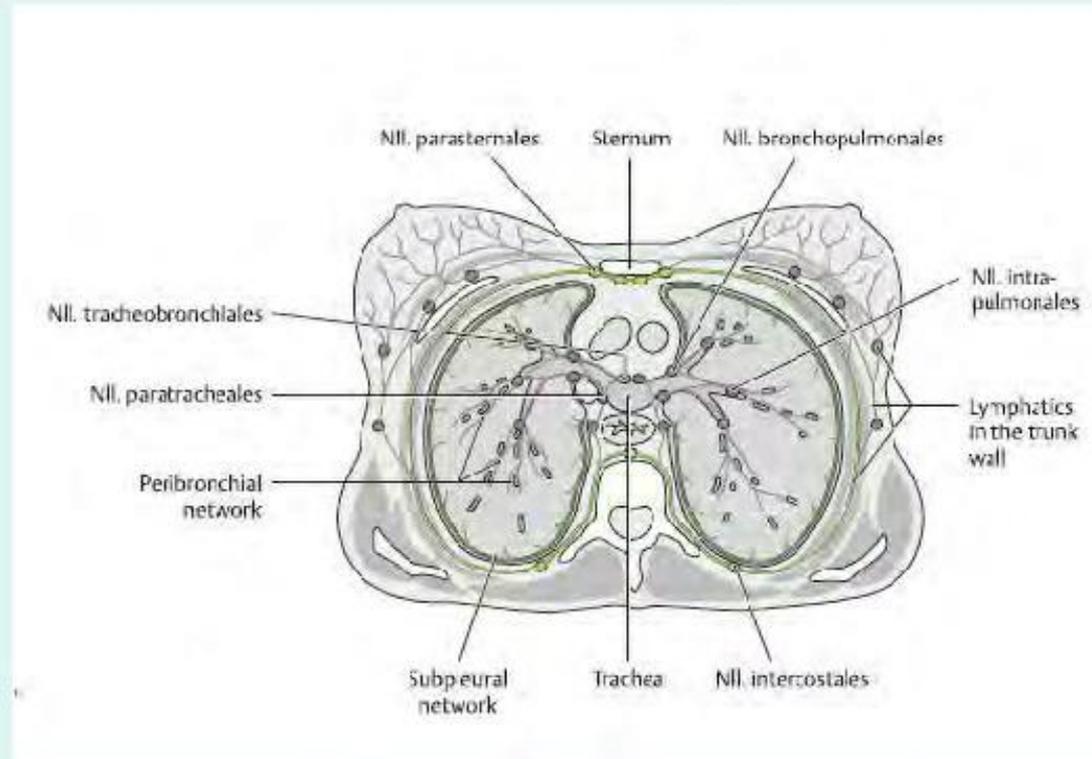
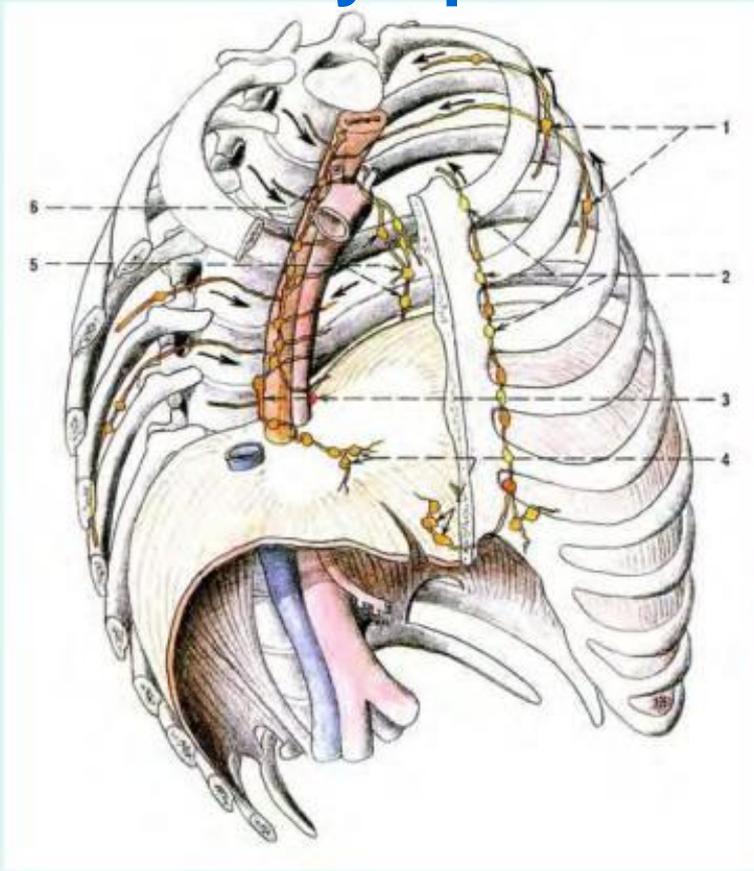
- VAN



3 parts in intercostal space: posterior intercostal vein, artery and intercostal nerve = VAN

1. Between endothoracic fascia and internal intercostal
2. Between internal intercostals mm. > separate innermost (intimi) intercostals
3. Between endothoracic fascia and internal intercostals

Lymphatic drainage of thoracic wall

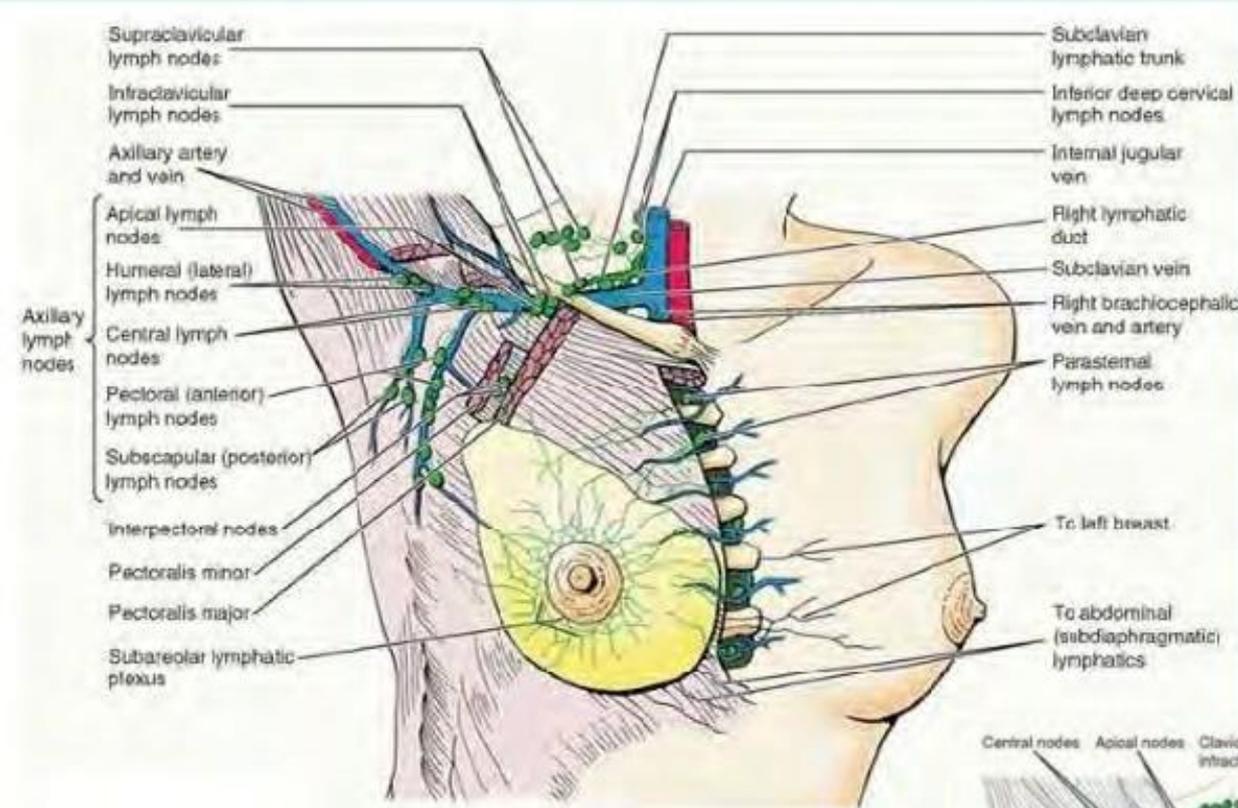


Lymph nodes: visceral and parietal

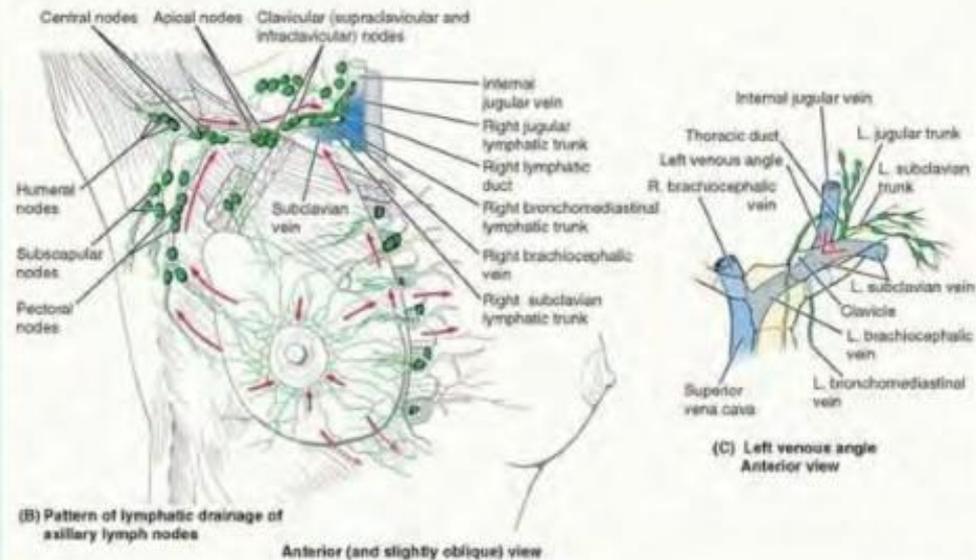
Parietal:

- **Parasternal I.n.** (from mammary gland, liver, diaphragm, pericardium, intercostal spaces)
- **Intercostal** (from intercostal spaces, deep muscles of the back, vertebral canal)
- **Prevertebral I. n.**
- **Phrenic** (from diaphragm, liver)
- **Axillary** (from mammary gland, thoracic wall, upper limb)

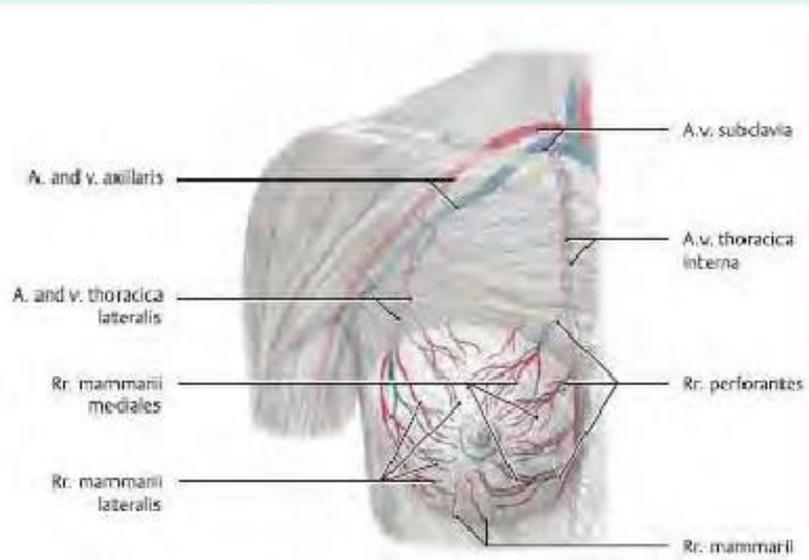
Mammary gland - lymphatic drainage



1. Axillary lymph nodes (interpectoral l.n. - Sorgius l.n.)
2. Parasternal l.n.
3. Supraclavicular l.n.
4. Superficial inguinal l.n.

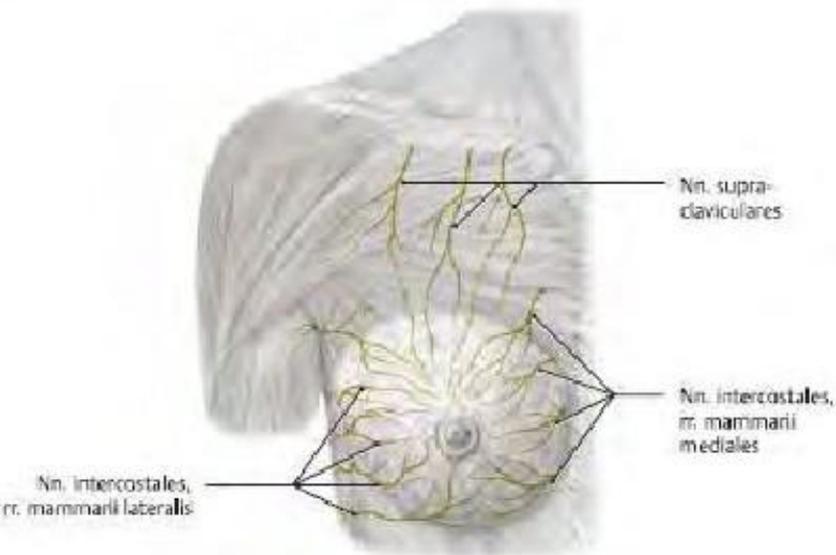


Mammary gland - blood supply, innervation



Blood supply:

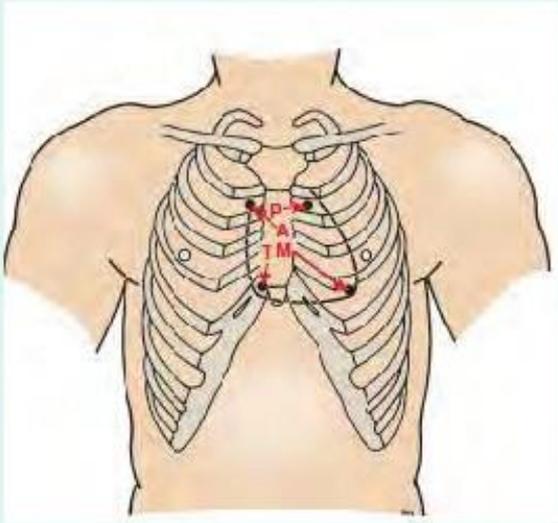
1. Thoracoacromial a. - pectoral br.
2. Lateral thoracic a. - lateral mammary br.
3. Internal thoracic a. - medial mammary br. (perforating br.)



Nerve supply:

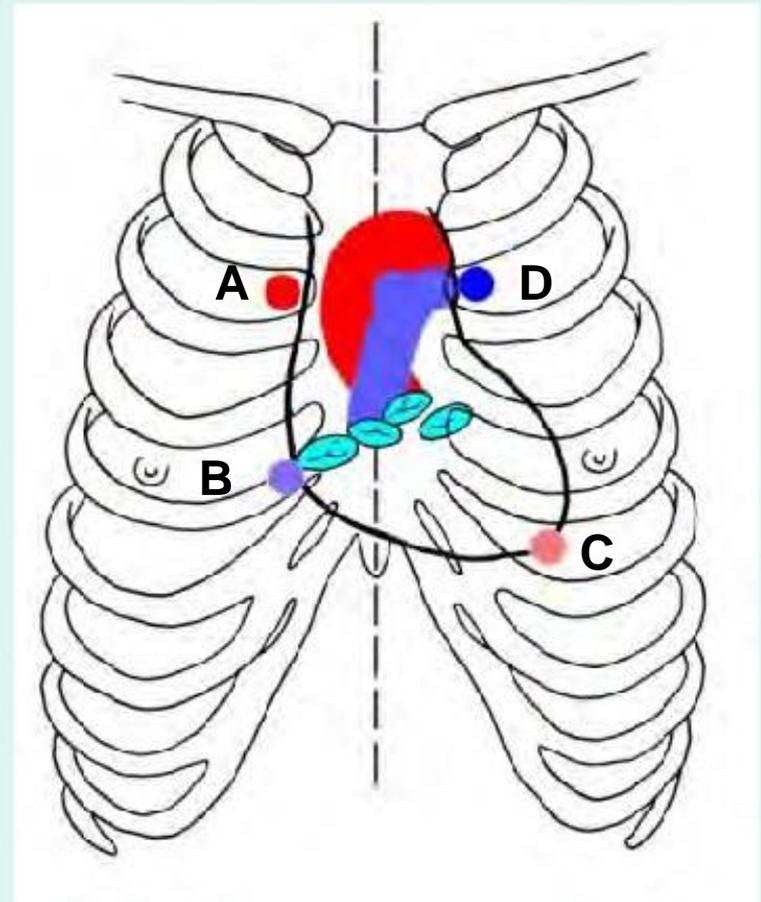
1. Lateral mammary br. (intercostal nn.)
2. Medial mammary br. (intercostal nn.)
3. Medial supraclavicular nn. (cervical pl.)

Projection and auscultation of heart



Testute's points

- A. Right 2.ICS - 1cm from sternum - aortic valve
- B. Right 5. ICS next to sternum - tricuspid valve
- C. Left 5. ICS - 5cm from sternum - bicuspid valve
- D. Left 2. ICS - 2cm from sternum - valve of pulmonary trunk



Projection of lungs, pleura

Lungs, pleura

Anterior border:

- major supraclavic. fossa, caudally to 2. pair of ribs, 2.-4. ribs - together,

Right side- to 6. rib

Left- to 6. rib, curves laterally

Lower border:

Parastern. l. - cartilage of 6. rib

Midclavicular l. - 6. rib

Axillary l. - 8. rib

Scapular l. - 10. rib

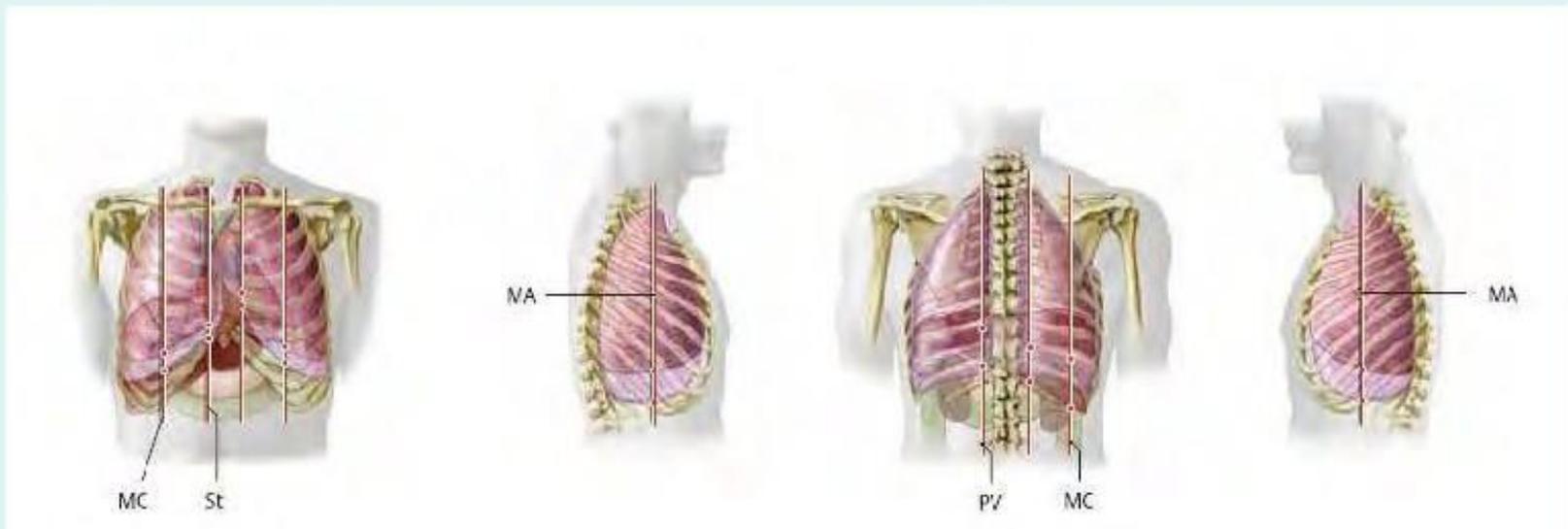
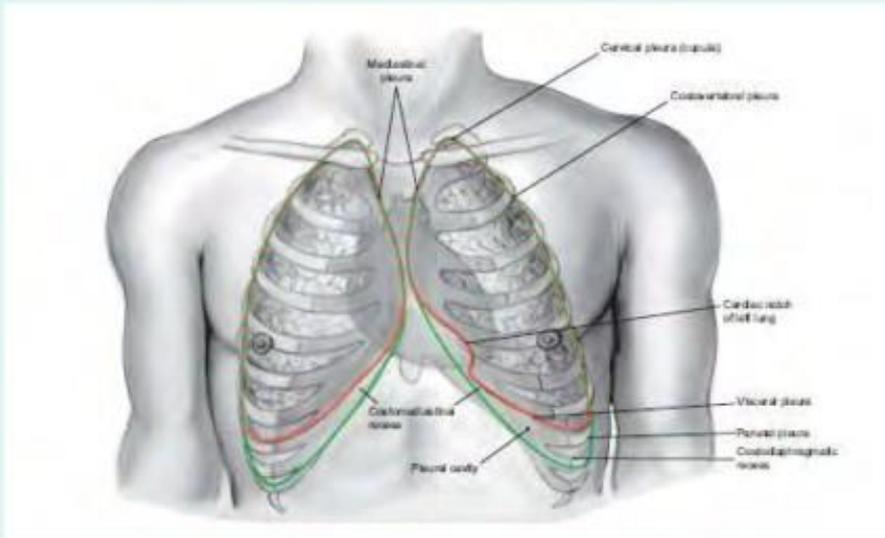
Posterior border:

In paravertebr. l. to apex of lung

Pleura: inferior - 1 rib lower than lungs

Sup. interpl. area - thymic

Inf. interpl. area - pericardiac



TRINSIC
ANIMATION

Take home message

Study!

- Bones (costae, sternum, vertebrae)
- Joints of ribs (sternocostal et vertebrocostal art.)
- Continuous and discontinuous joints of vertebral column (ligaments, intervertebral disk, intervertebral art.)
- Mm. of the thorax (mm. of proper thoracic wall+ thoracohumeral mm.)
- Mm. of the back (spinothoracic mm. + spinocostal mm. + deep mm. of the back)
- Arteries of thoracic wall (thoracic aorta, internal thoracic a., repeat branches of axillary a.)
- Veins of thoracic wall (internal thoracic v., lat. thoracic v., thoracoepigastric v., thoracoacromial v., azygos v., hemiazygos v., accessory hemiazygos v.)
- Lymph nodes of thoracic wall - parietal
- Innervation of thoracic wall (intercostal nn., repeat nerves of brachial plexus - supraclavicular part, supraclavicular nn.)
- Mammary gland

Thank you for your attention

