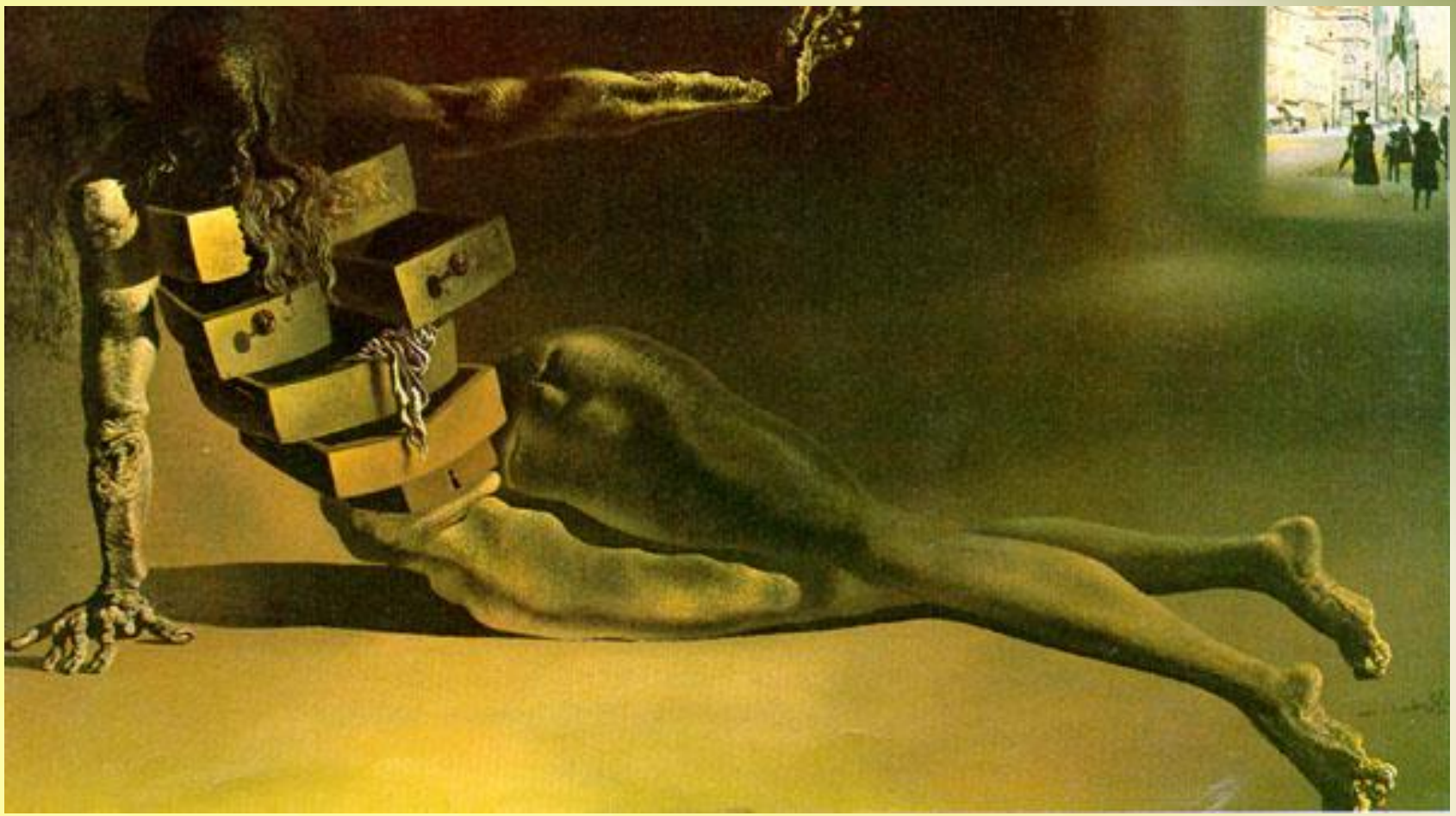
THORACIC WALL



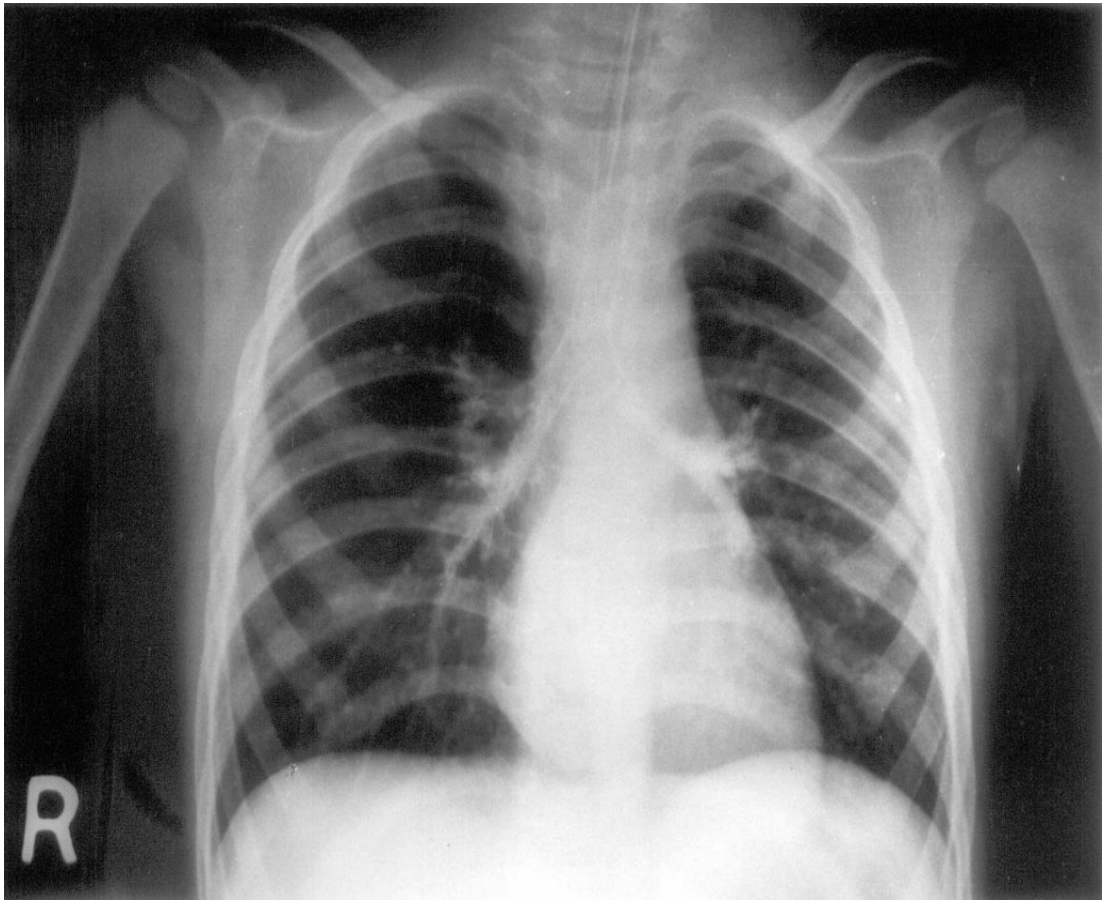
Salvador Dali - Anthropomorphic Chest of Drawers, 1936

Kaan Yücel M.D., Ph.D.

05.March.2014

1. THORAX

the part between the neck and the abdomen



Chest X-ray

1.1. REGIONS/TERMS

Thoracic cavity

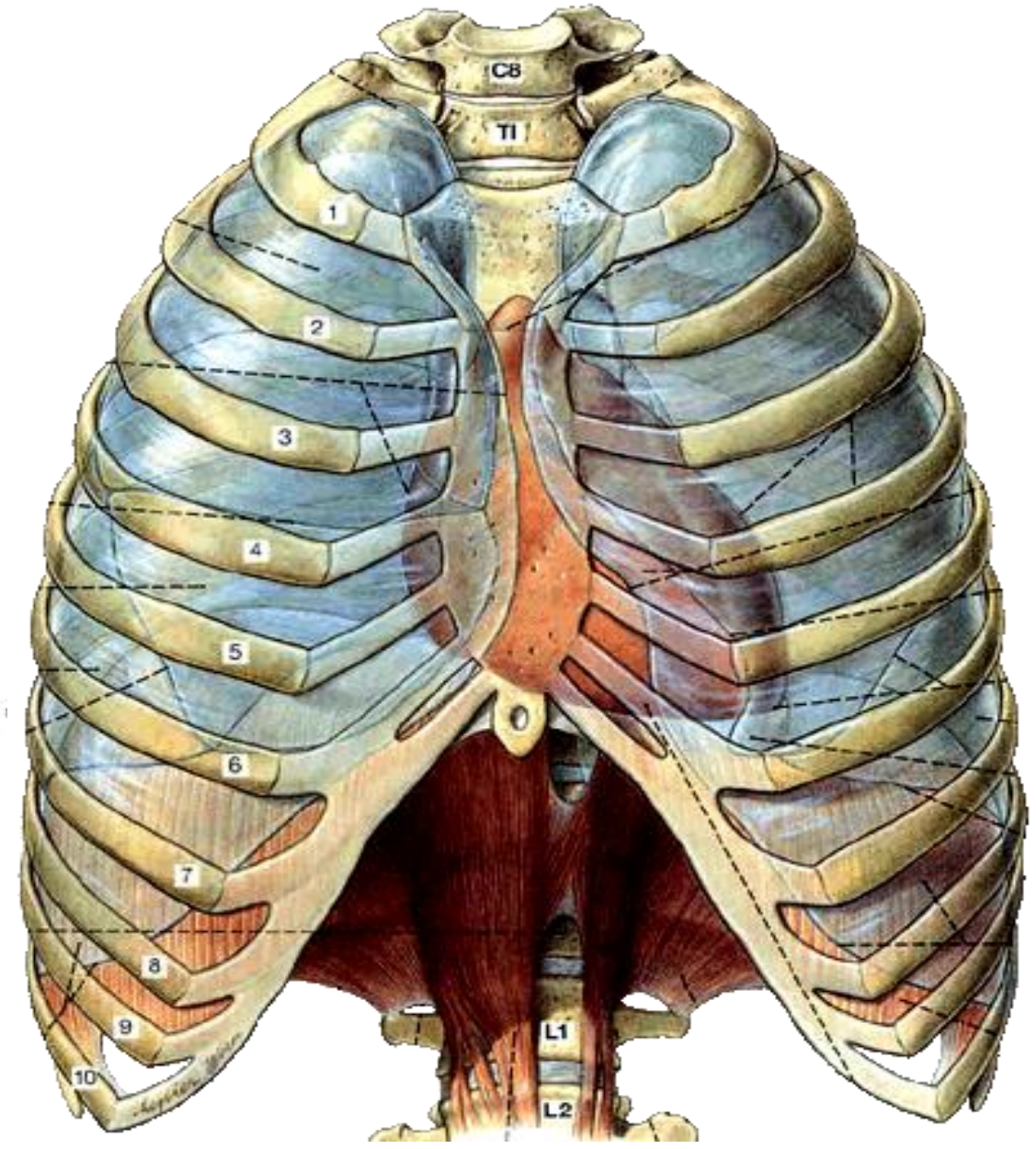
cavity between neck and abdomen
protected by the thoracic wal

Thoracic wall

bounds the thoracic cavity.
formed by the skin, bones, fasciae, and muscles.

Thoracic cage

bony portion of the thoracic wall
thoracic skeleton



1.2. SURFACES OF THE THORAX

STERNUM & COSTAL CARTILAGES anteriorly
12 THORACIC VERTEBRAE & POST. RIBS posteriorly
RIBS & INTERCOSTAL SPACES laterally

Posterior surface

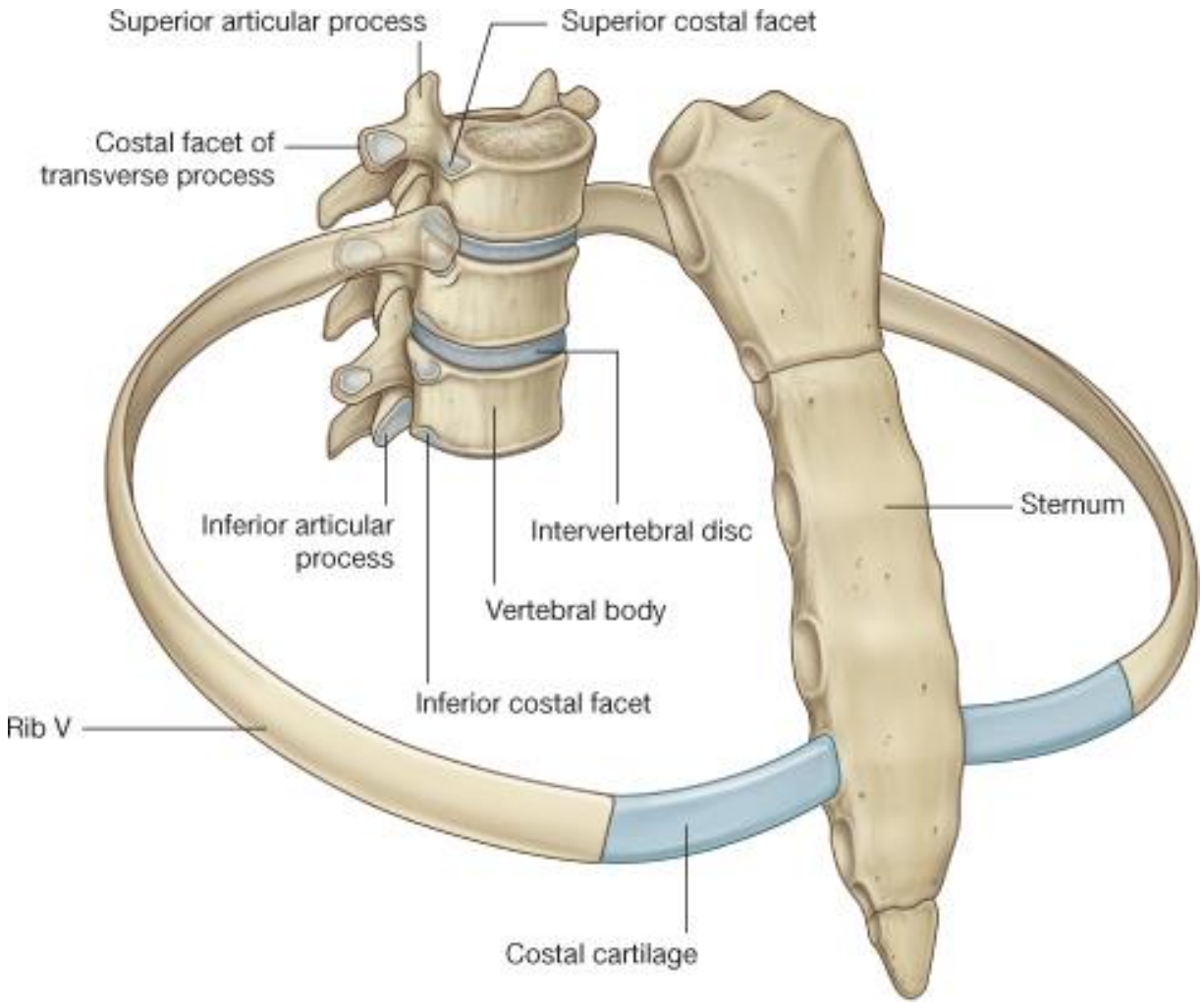
12 thoracic vertebræ & posterior parts of the ribs

Anterior surface

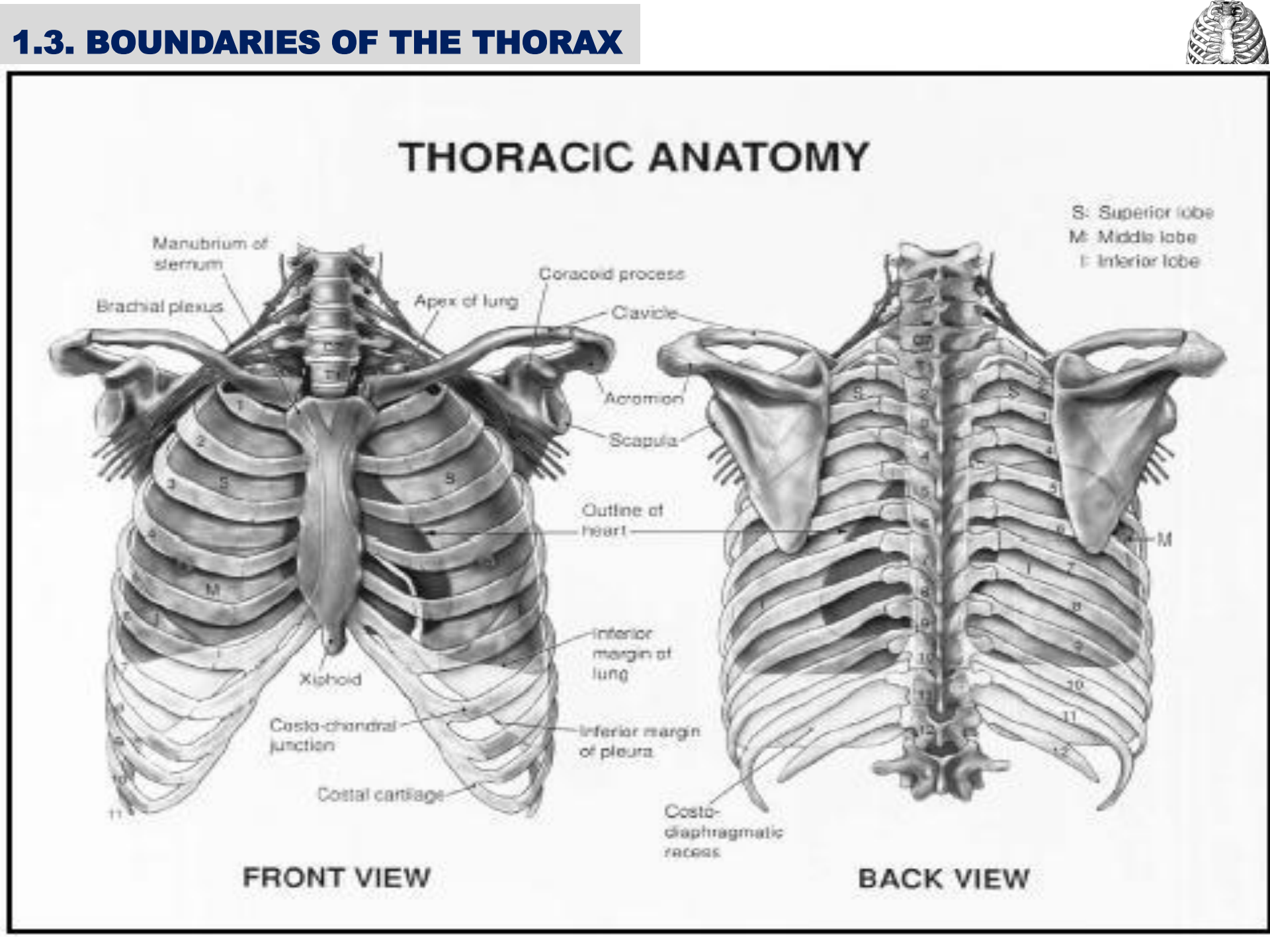
sternum & costal cartilages

Lateral surfaces

ribs, separated by the intercostal spaces

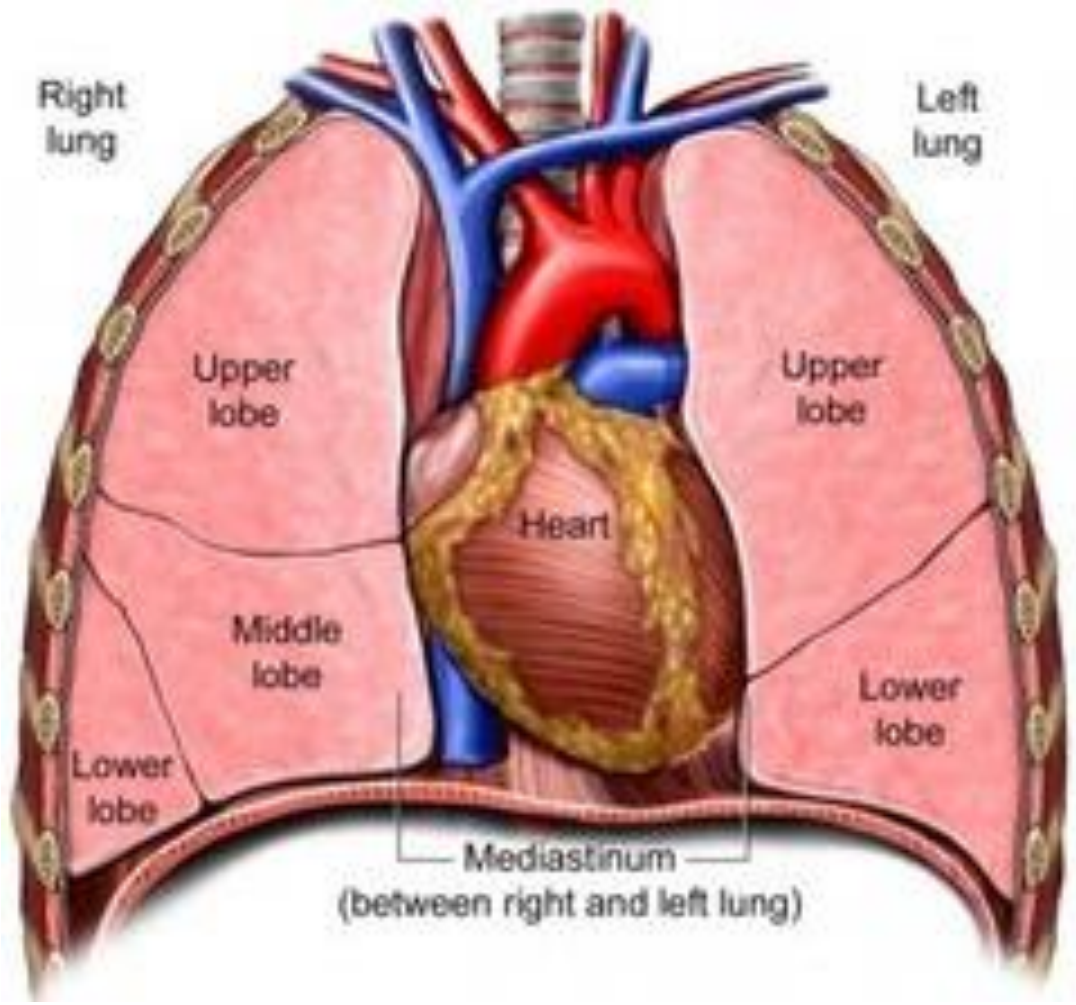


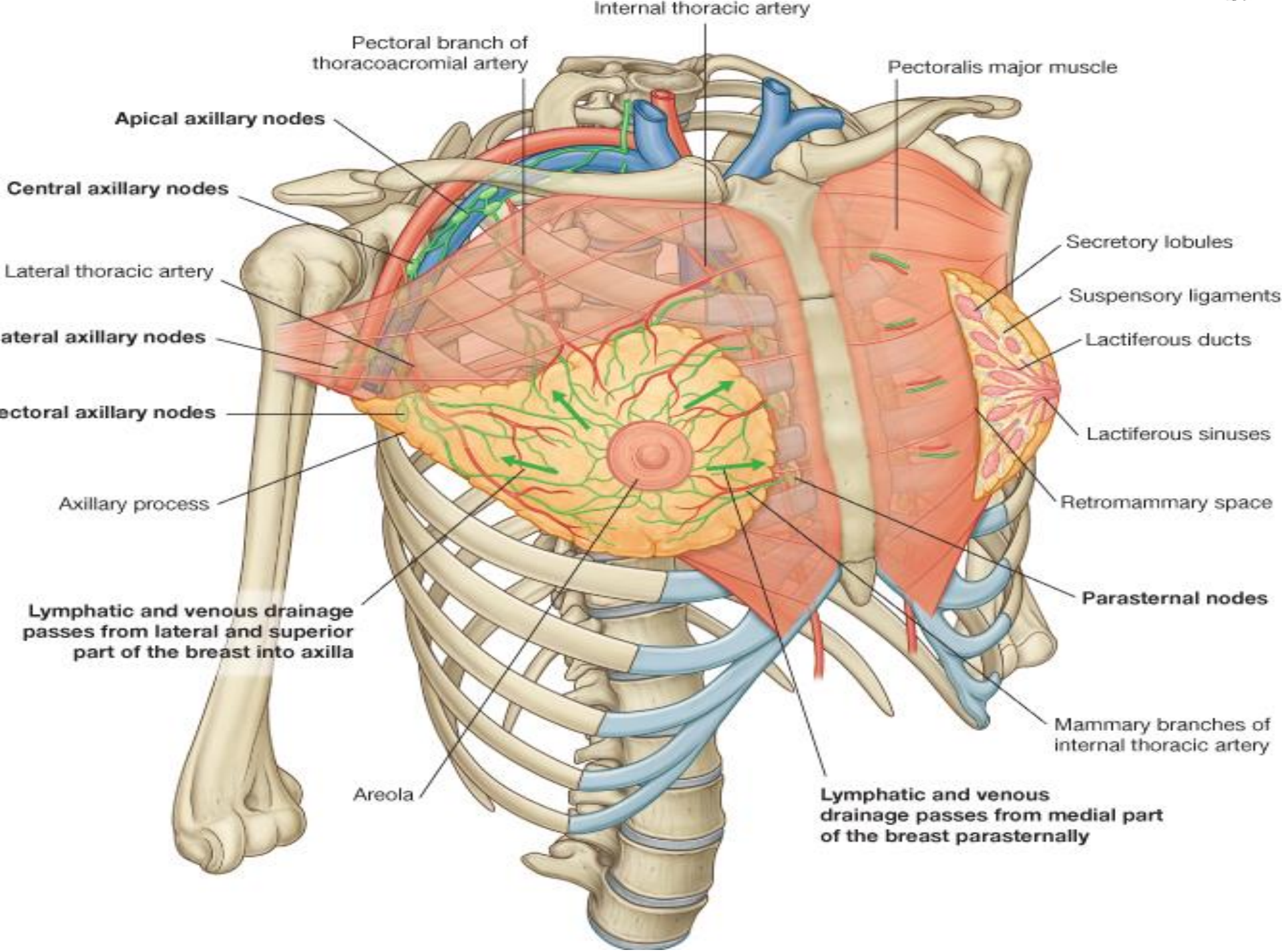
1.3. BOUNDARIES OF THE THORAX



1.4. CONTENTS OF THE THORAX

Organs of the cardiovascular, respiratory, digestive, reproductive, immune, and nervous systems



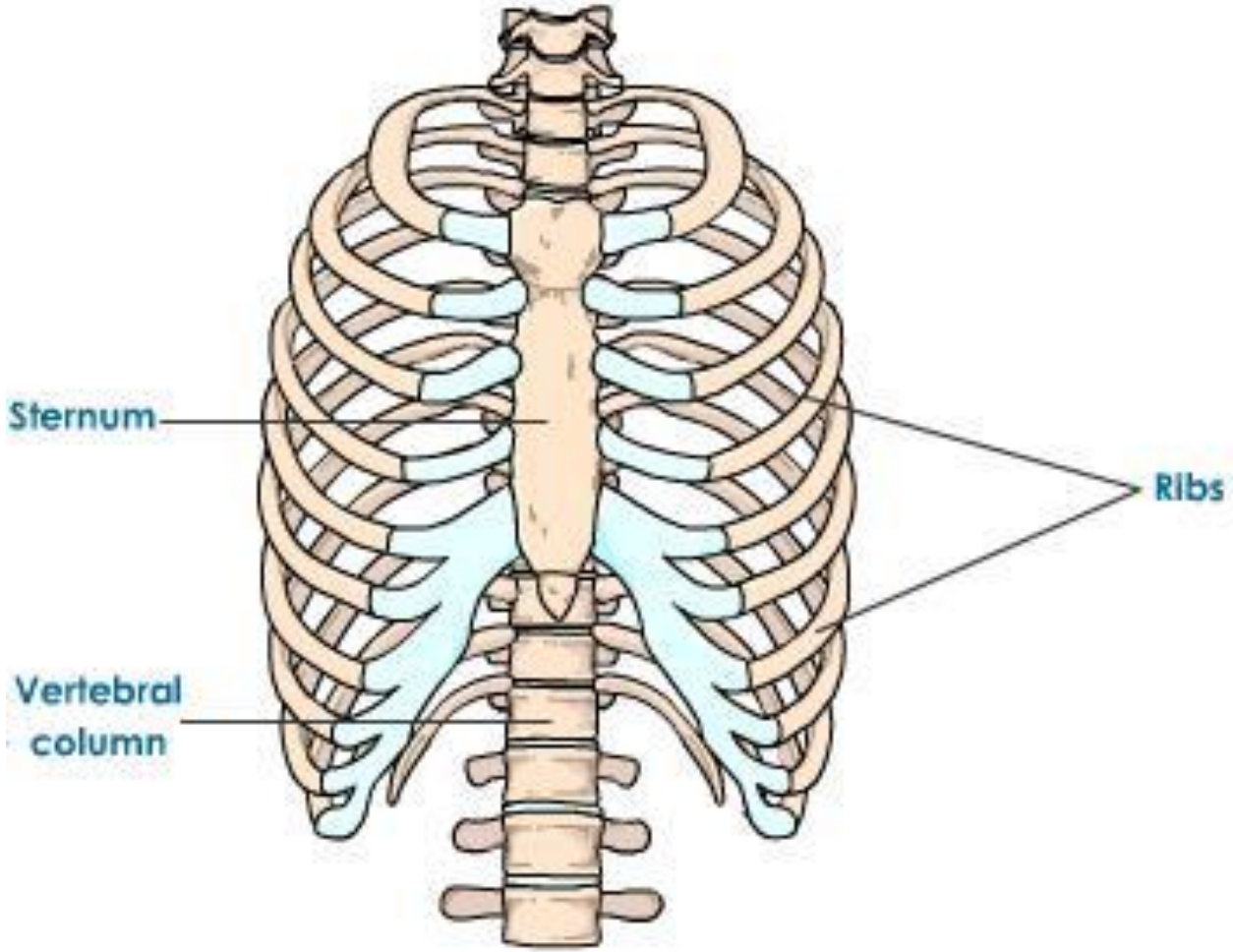

Internal thoracic artery
Pectoral branch of thoracoacromial artery
Pectoralis major muscle
Apical axillary nodes
Central axillary nodes
Lateral thoracic artery
ateral axillary nodes
ectoral axillary nodes
Axillary process
Secretory lobules
Suspensory ligaments
Lactiferous ducts
Lactiferous sinuses
Retromammary space
Parasternal nodes
Lymphatic and venous drainage passes from lateral and superior part of the breast into axilla
Mammary branches of internal thoracic artery
Areola
Lymphatic and venous drainage passes from medial part of the breast parasternally

2.1. FUNCTIONS OF THE THORACIC WALL

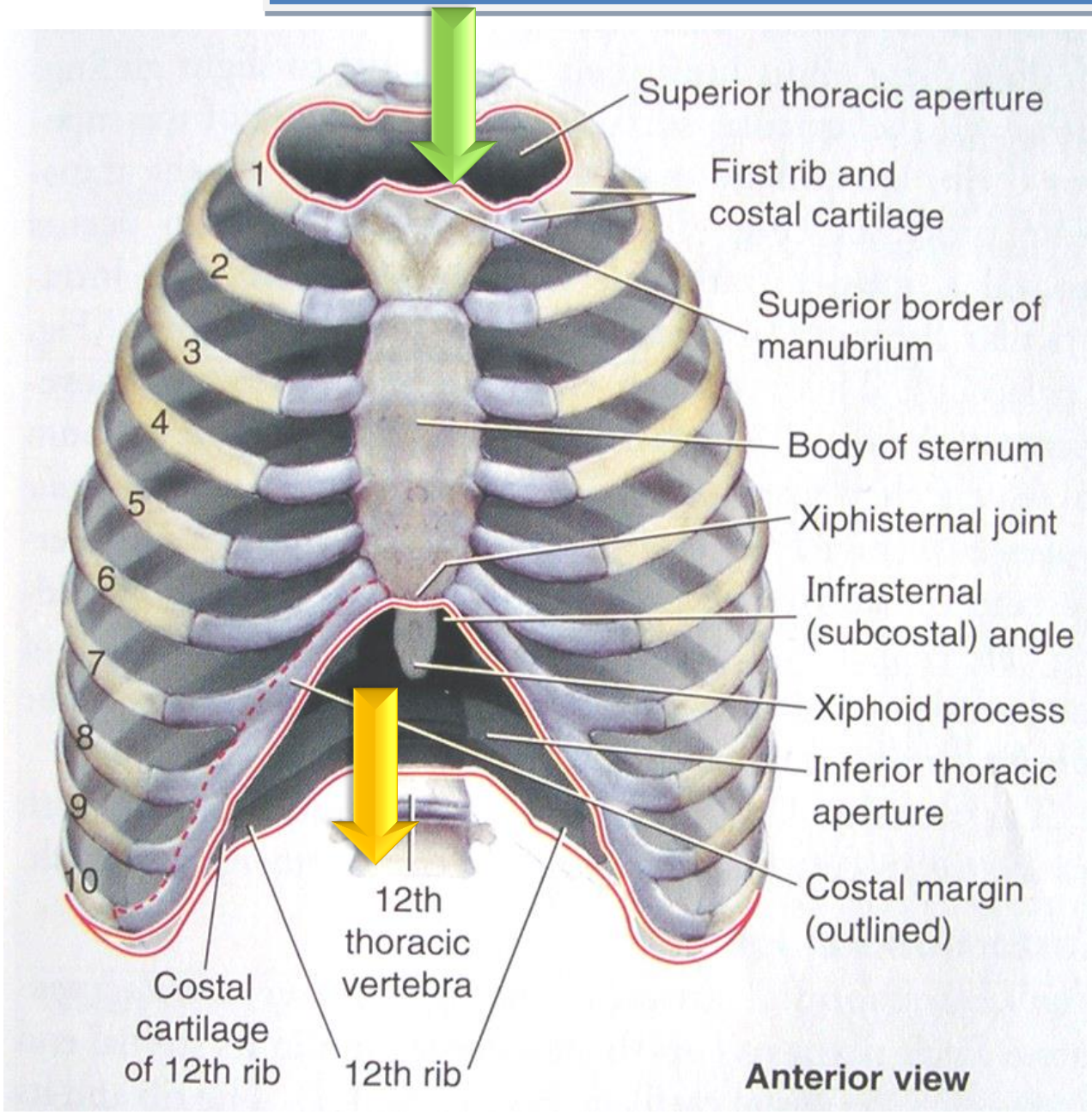
1) **Protects** vital thoracic and abdominal organs
2) **Resists** the negative (sub-atmospheric) internal pressures generated by the elastic recoil of the lungs and inspiratory movements.
3) **Provides attachment** for and support the weight of the upper limbs.
4) **Provides the origins** of many of the muscles that move and maintain the position of the upper limbs relative to the trunk.
5) **Provides attachments** for muscles of the abdomen, neck, back, and respiration.

3. SKELETON OF THE THORACIC WALL

1) 12 pairs of ribs and associated costal cartilages
2) 12 thoracic vertebrae and the intervertebral (IV) discs interposed between them
3) Sternum



4. THORACIC APERTURES



‘Thoracic inlet’

‘Thoracic outlet’

4.1. Superior thoracic aperture

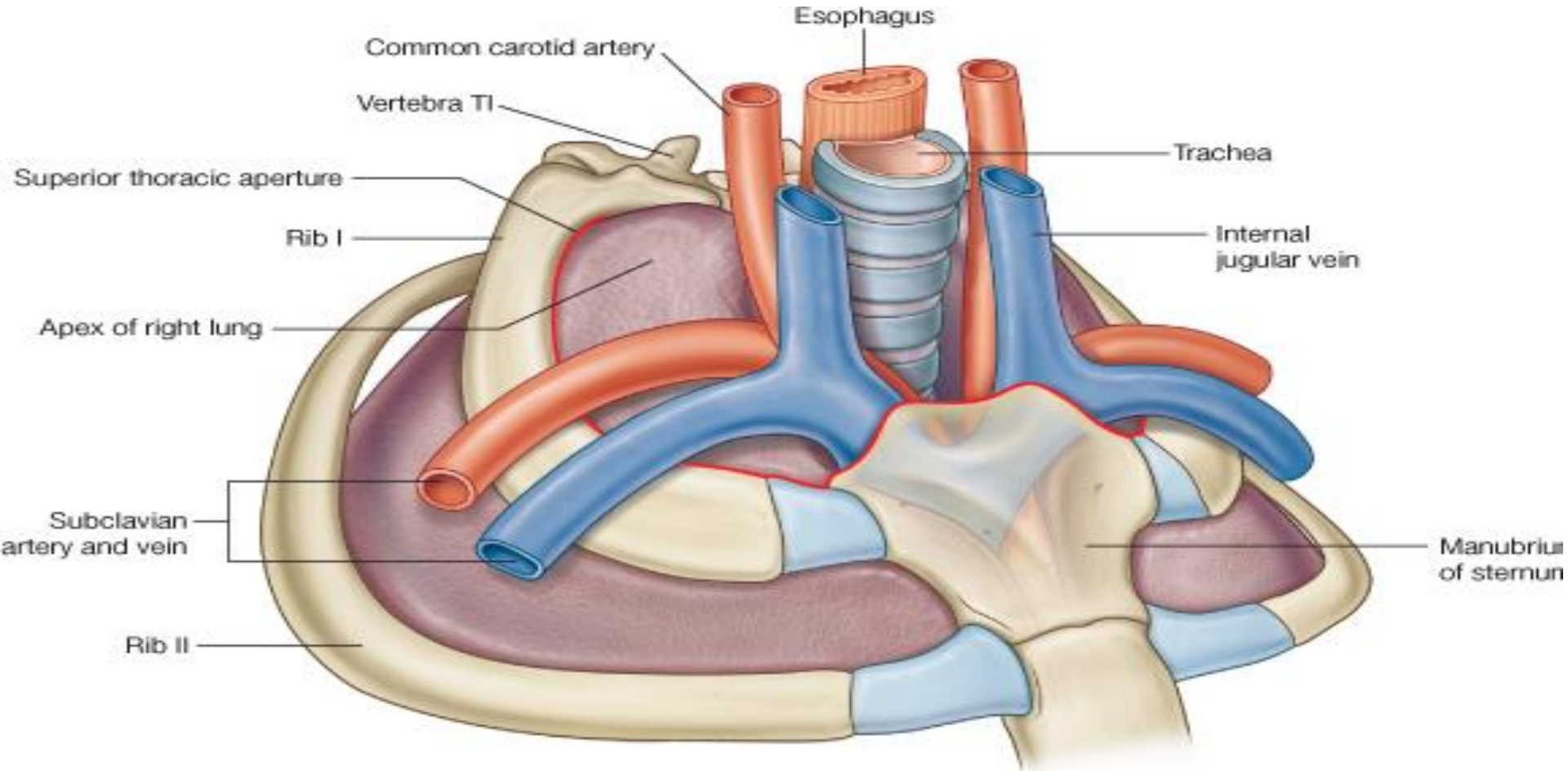
"doorway" between the thoracic cavity and the neck and upper limb

bounded:

Posteriorly vertebra T1

Laterally 1st pair of ribs and their costal cartilages

Anteriorly superior border of the manubrium



4.2. Inferior thoracic aperture

By closing the inferior thoracic aperture, the diaphragm separates the thoracic and abdominal cavities almost completely.

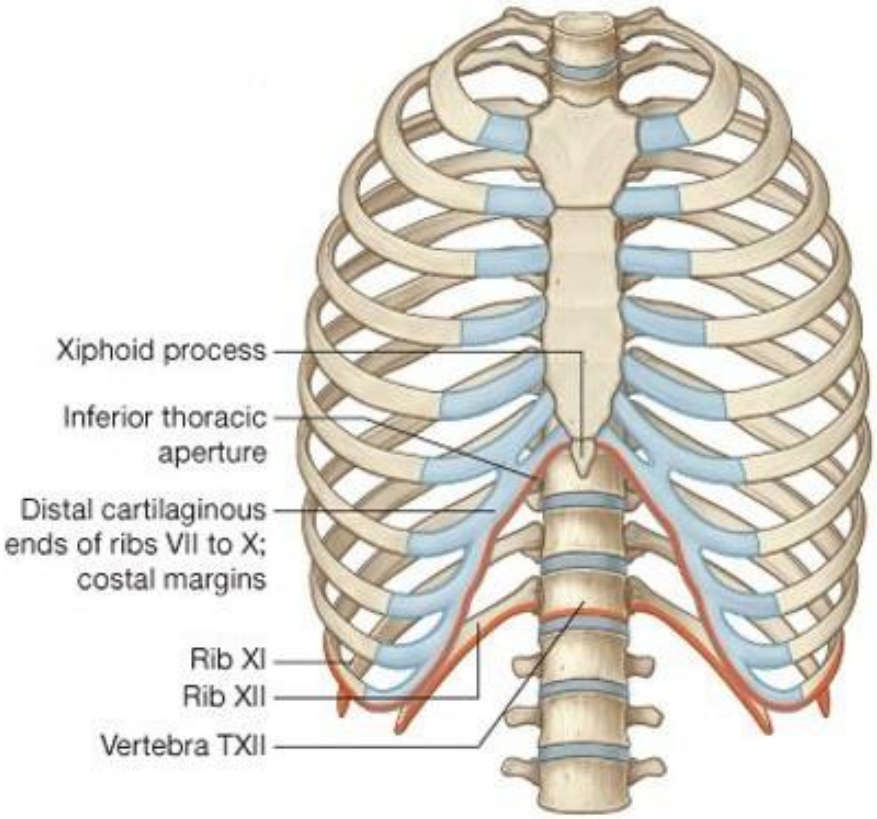
bounded:

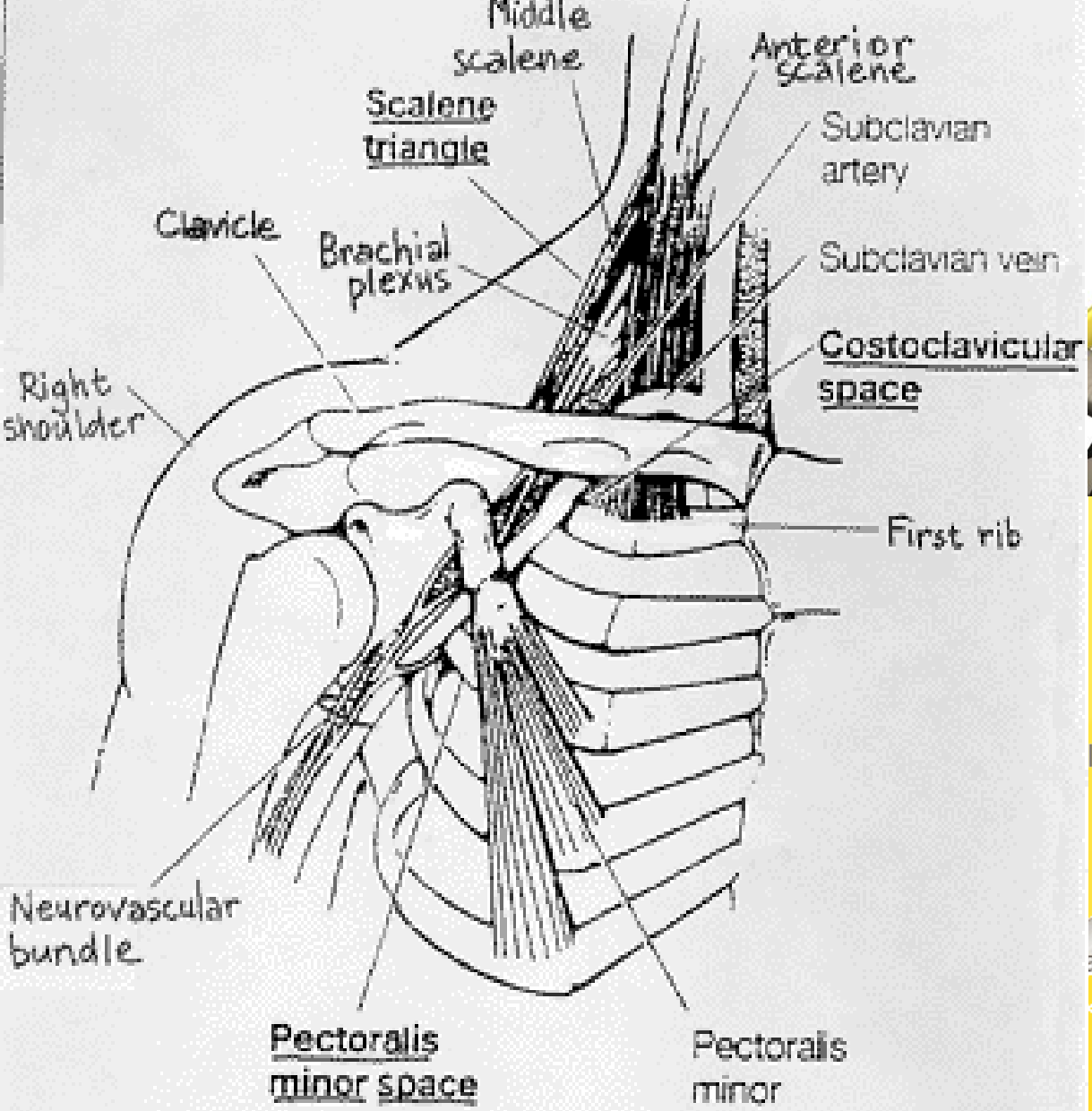
Posteriorly 12th thoracic vertebra

Posterolaterally 11th and 12th pairs of ribs

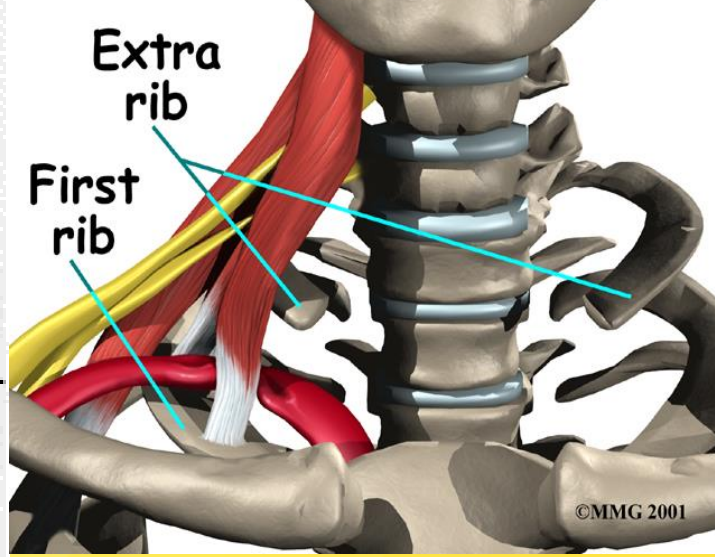
Anterolaterally joined costal cartilages of ribs 7-10 costal margins

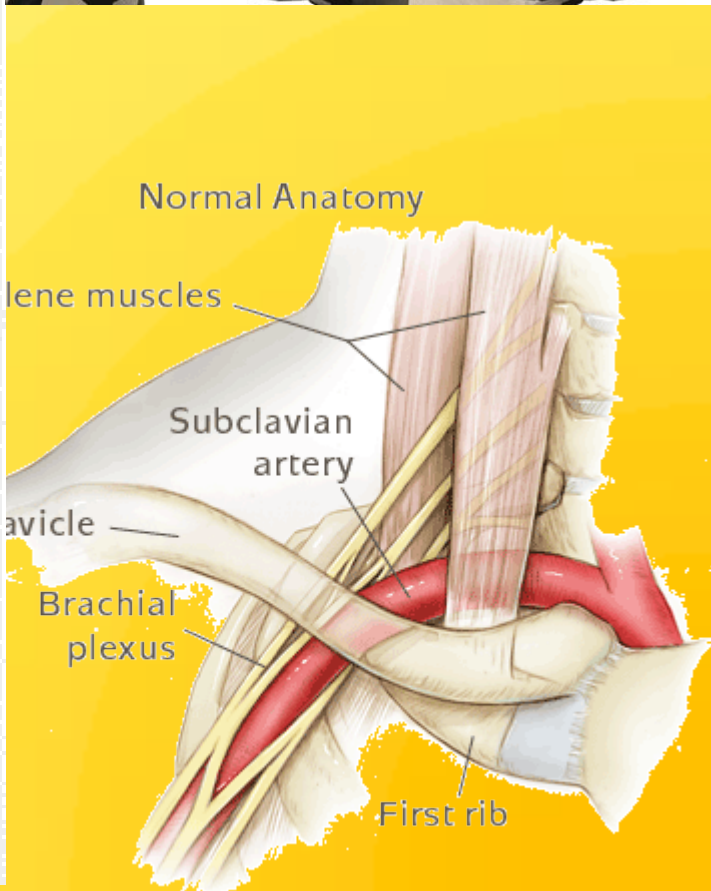
Anteriorly xiphisternal joint





THE CERVICOAXILLARY CANAL
OR
THE THORACIC OUTLET





5. JOINTS OF THE THORACIC WALL

1. Costotransverse joints

between tubercle of a rib & transverse process of its own vertebra

2. Sternocostal joint

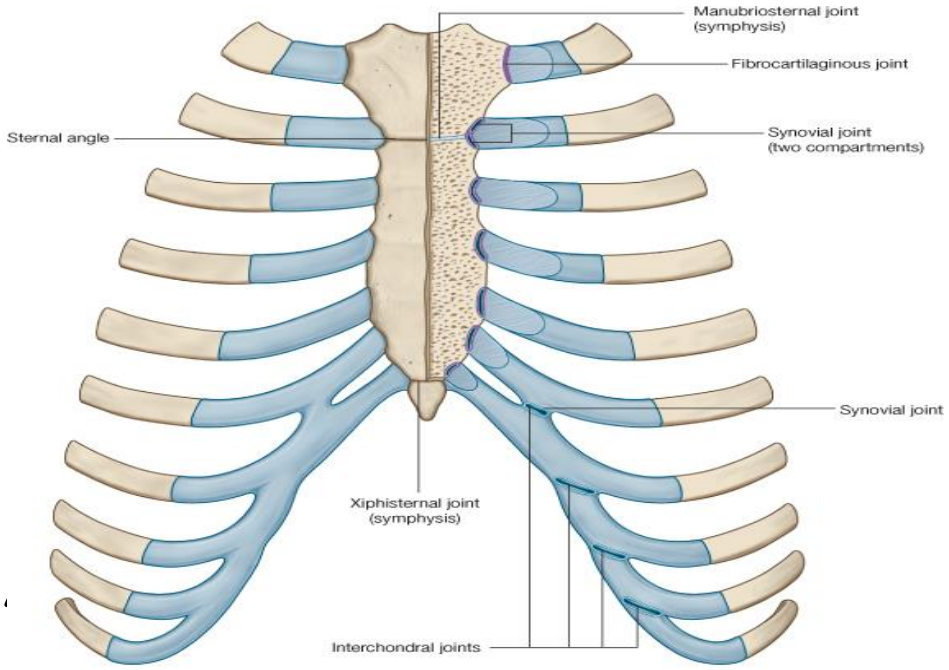
between the sternum and costal cartilages

3. Costachondralis joint

between the rib and costal cartilage

4. Intercondral joints

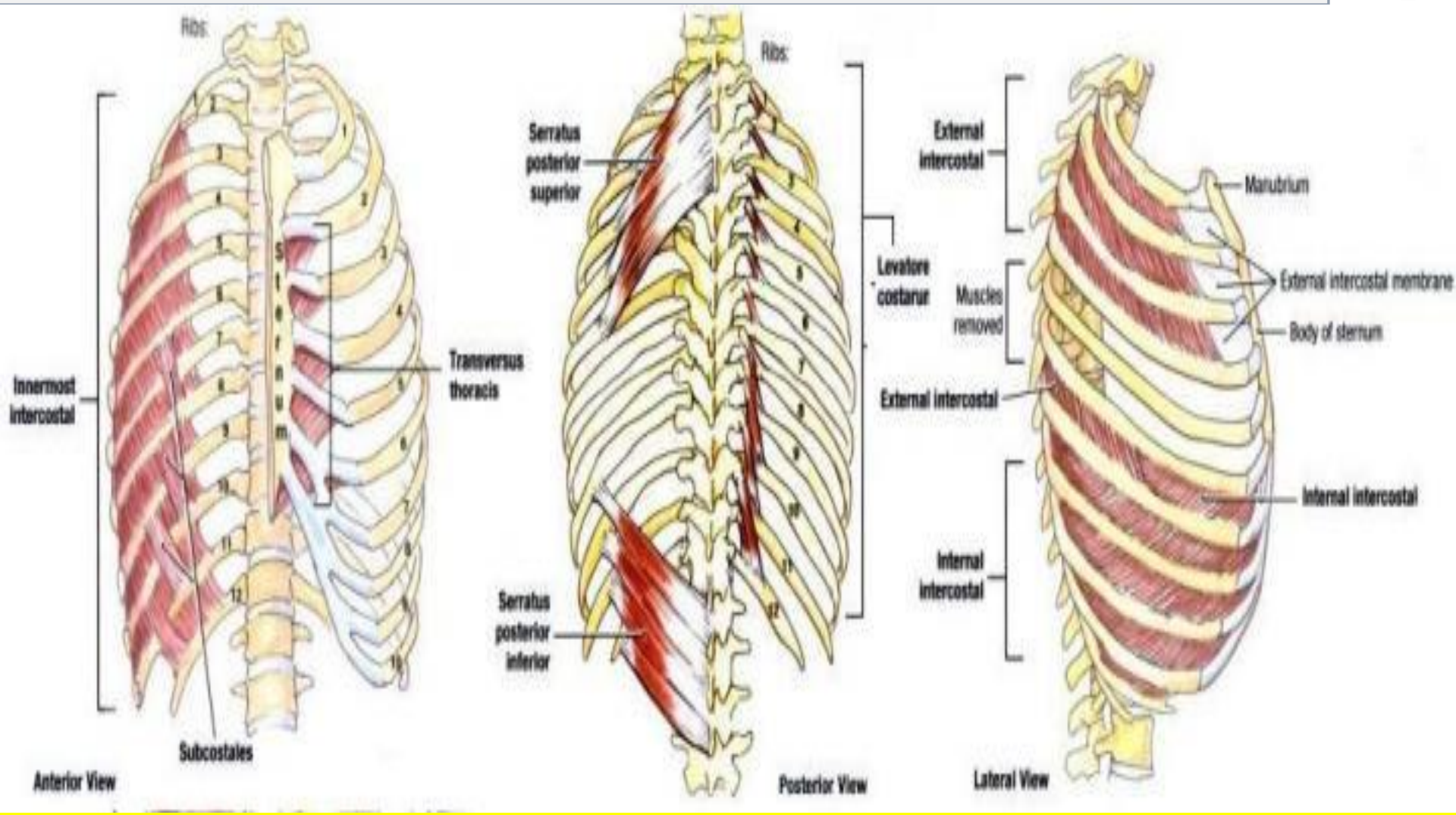
Synovial joints between the costal cartilages of 6th and 7th, 7th and 8th, & 8th and 9th ribs.



5. Sternal Joints

between the manubrium, body, xiphoid process of the sternum.

6. MUSCLES OF THE THORACIC WALL



Serratus posterior **Levator costarum**

Intercostal muscles(External, internal and innermost)

Subcostal **Transverse thoracic**

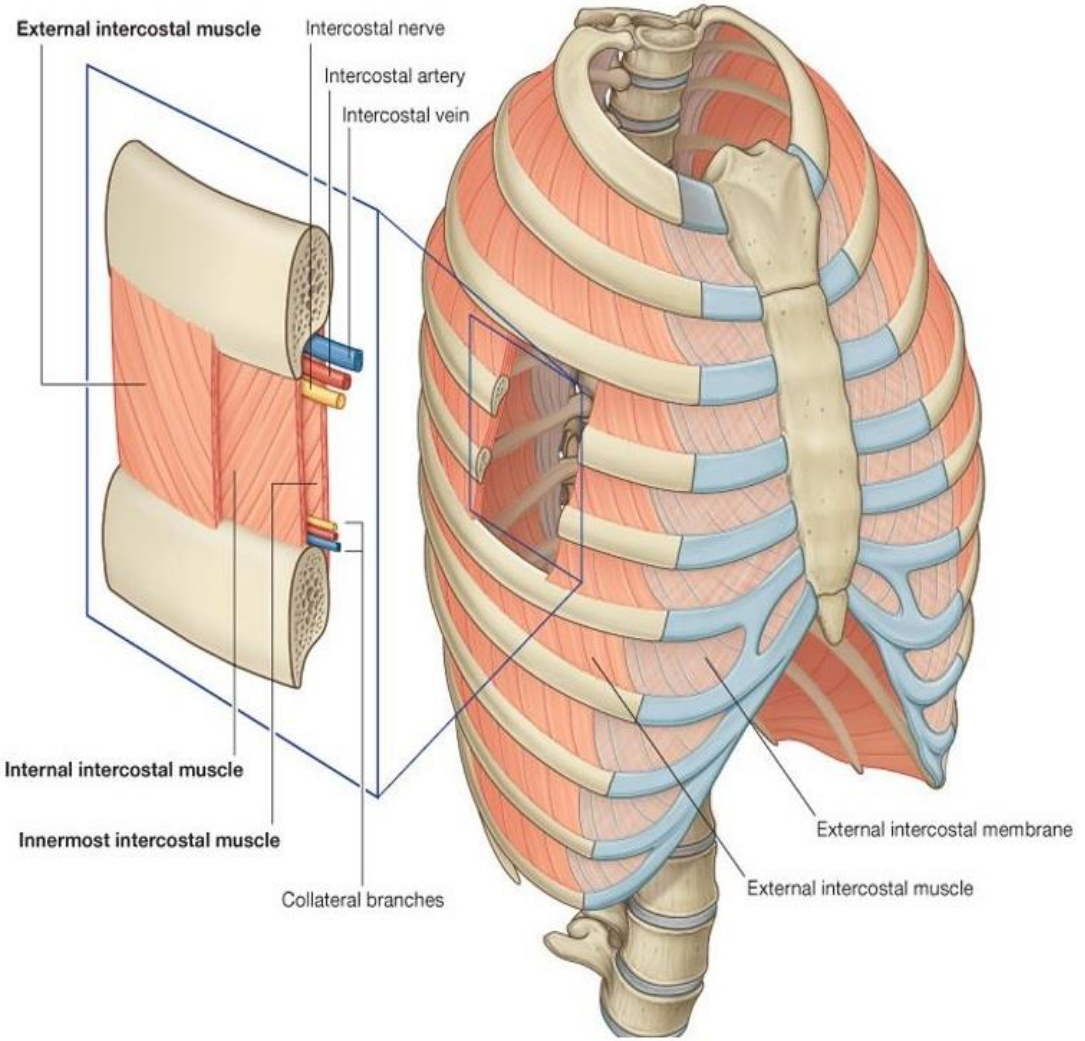
6. MUSCLES OF THE THORACIC WALL

intercostal muscles

three flat muscles found in each intercostal space

external intercostal muscles
most superficial

internal intercostal muscles
between external & innermost muscles

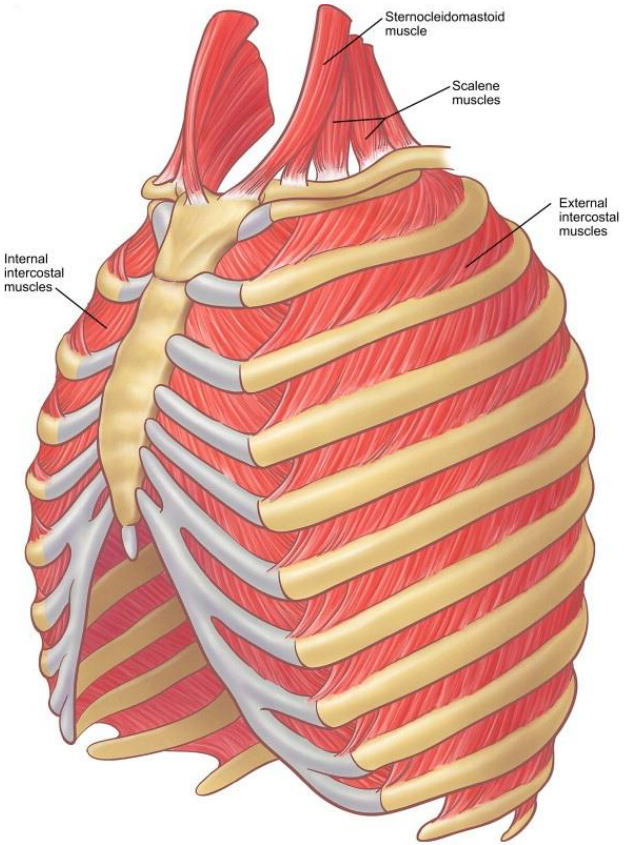


6. MUSCLES OF THE THORACIC WALL

external intercostal muscles

extend from the inferior margins of the ribs above
to the superior margins of the ribs below

pass obliquely anteroinferiorly



6. MUSCLES OF THE THORACIC WALL

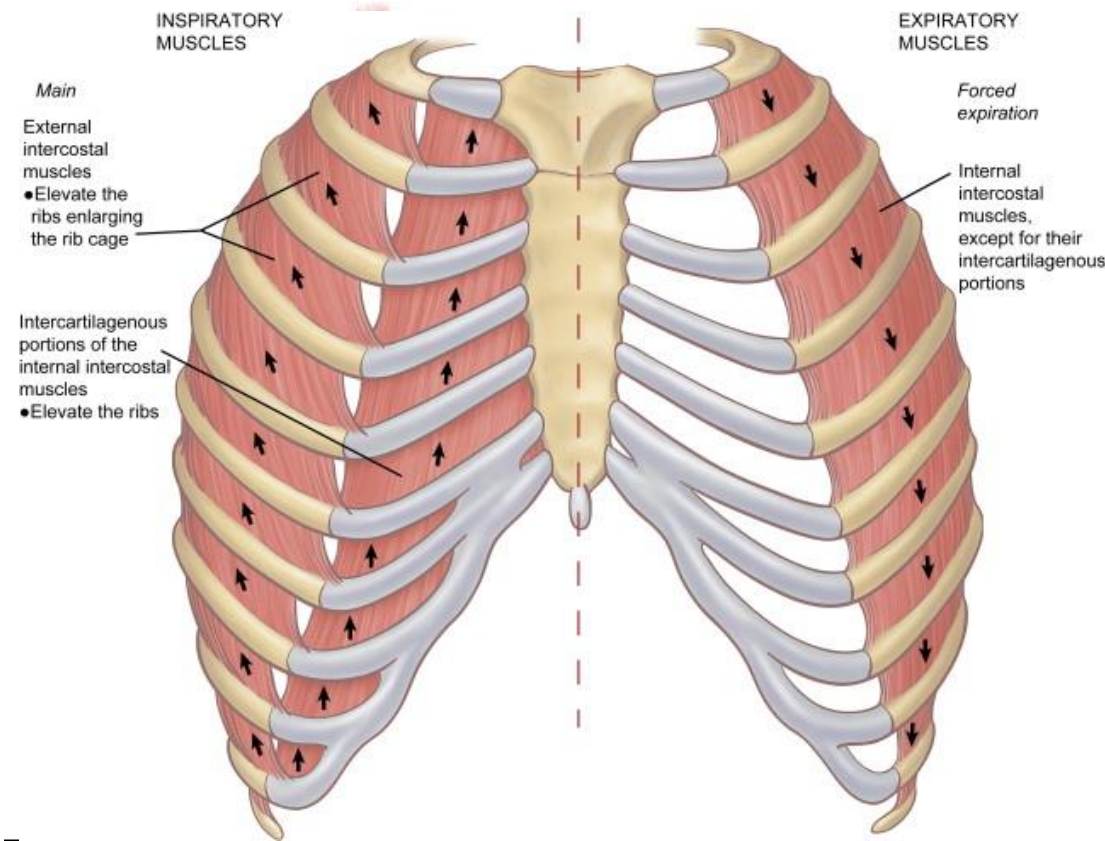
internal intercostal muscles

most active during expiration

between most inferior lateral edge of costal grooves of the ribs above,
to the superior margins of ribs below

in the opposite direction to those of the external intercostal muscles

obliquely posteroinferiorly



Attachment to interosseus parts move down during expiration!

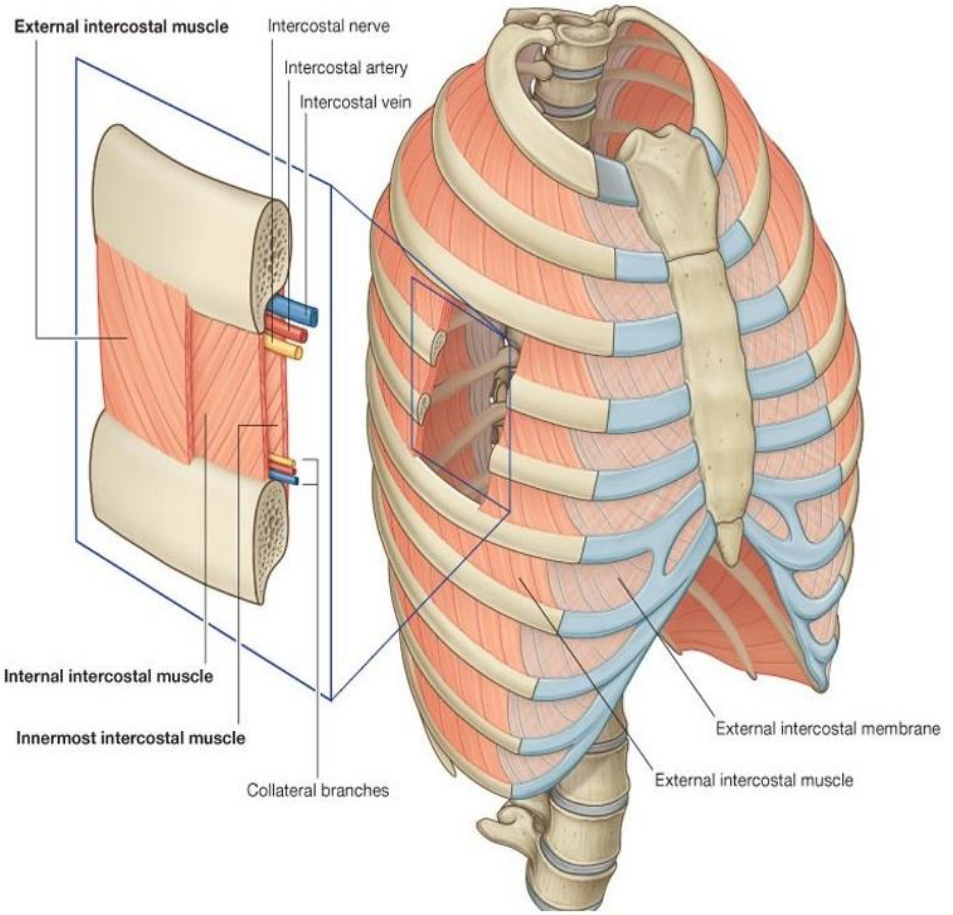
6. MUSCLES OF THE THORACIC WALL

innermost intercostal muscles

least distinct of the intercostal muscles

same orientation as the **internal intercostals**

neurovascular bundles (V.A.N.) in the costal grooves
in a plane between innermost & internal intercostal muscles.

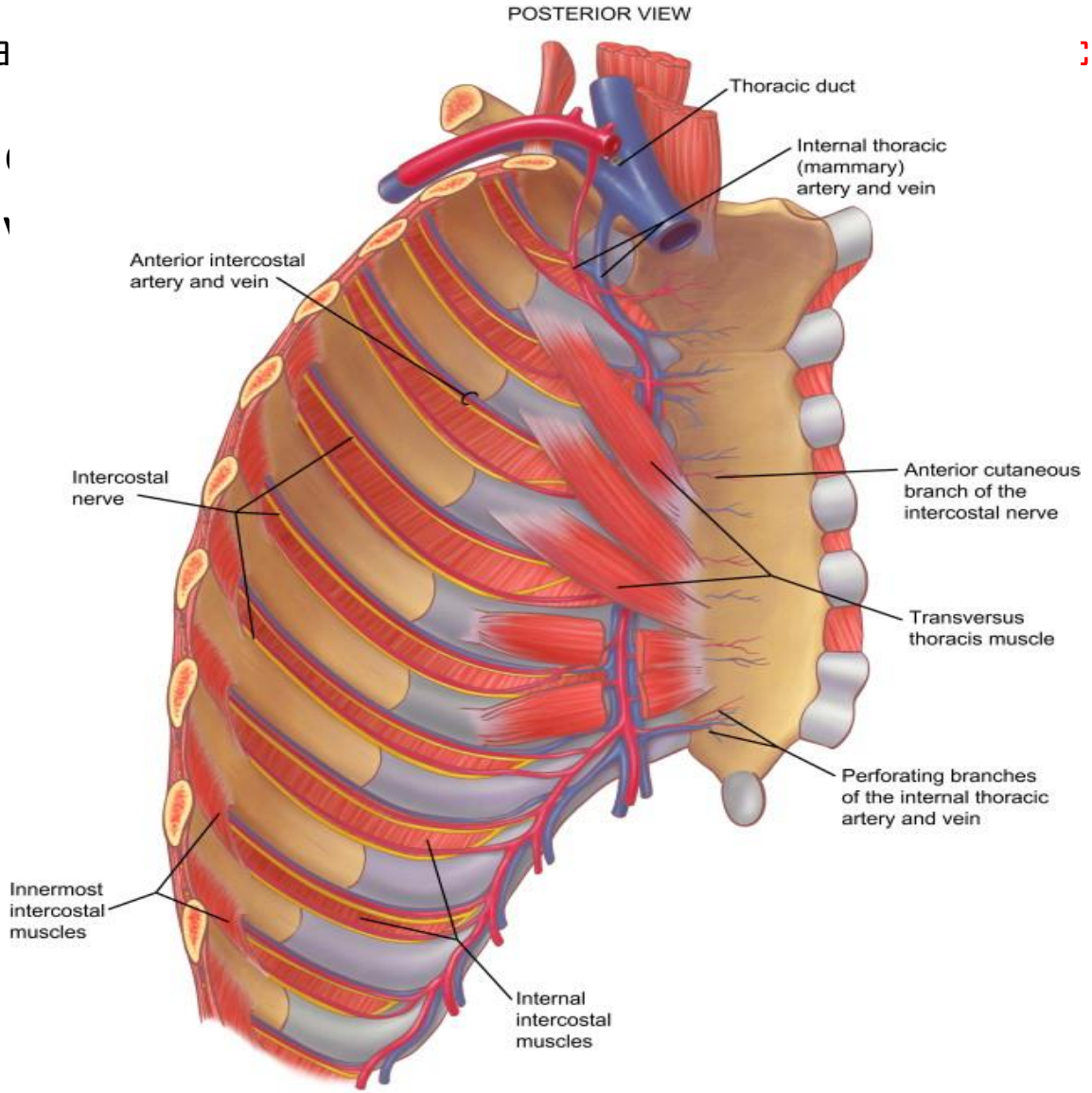


6. MUSCLES OF THE THORACIC WALL

transversus thoracis muscles

on the deep surfa costals

- lie deep to th
- secure these

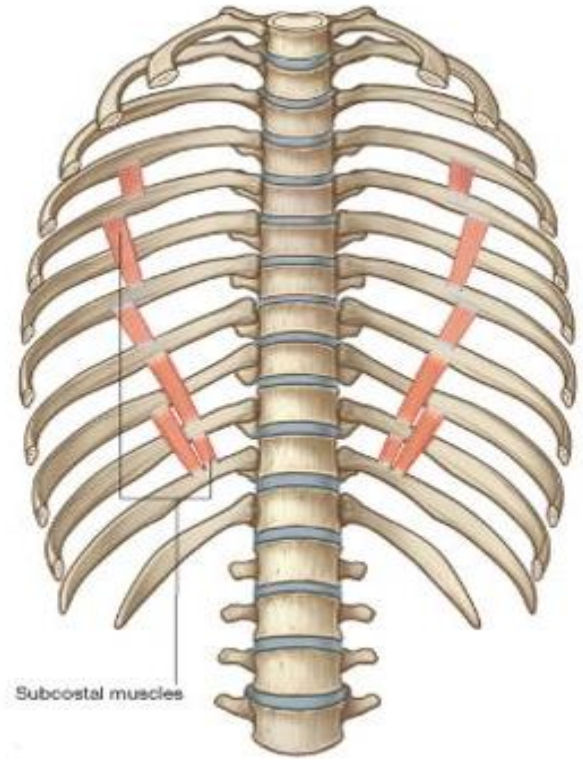


6. MUSCLES OF THE THORACIC WALL

subcostales

@ same plane as innermost intercostals

- Fibers parallel the course of the internal intercostal muscles.
- Extend from the angle of the ribs
  to more medial positions on the ribs below.



6.1. Accessory muscles of respiration

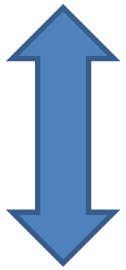
- upper accessory muscles assist with inspiration.
- upper chest, and abdominal muscles assist with expiration.

7. MOVEMENTS OF THE THORACIC WALL

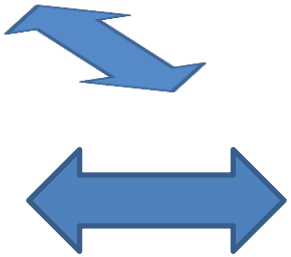
One of the principal functions of the thoracic wall and the diaphragm is to alter the volume of the thorax and thereby move air in and out of the lungs.

During breathing, the dimensions of the thorax change in vertical, lateral, and A-P directions.

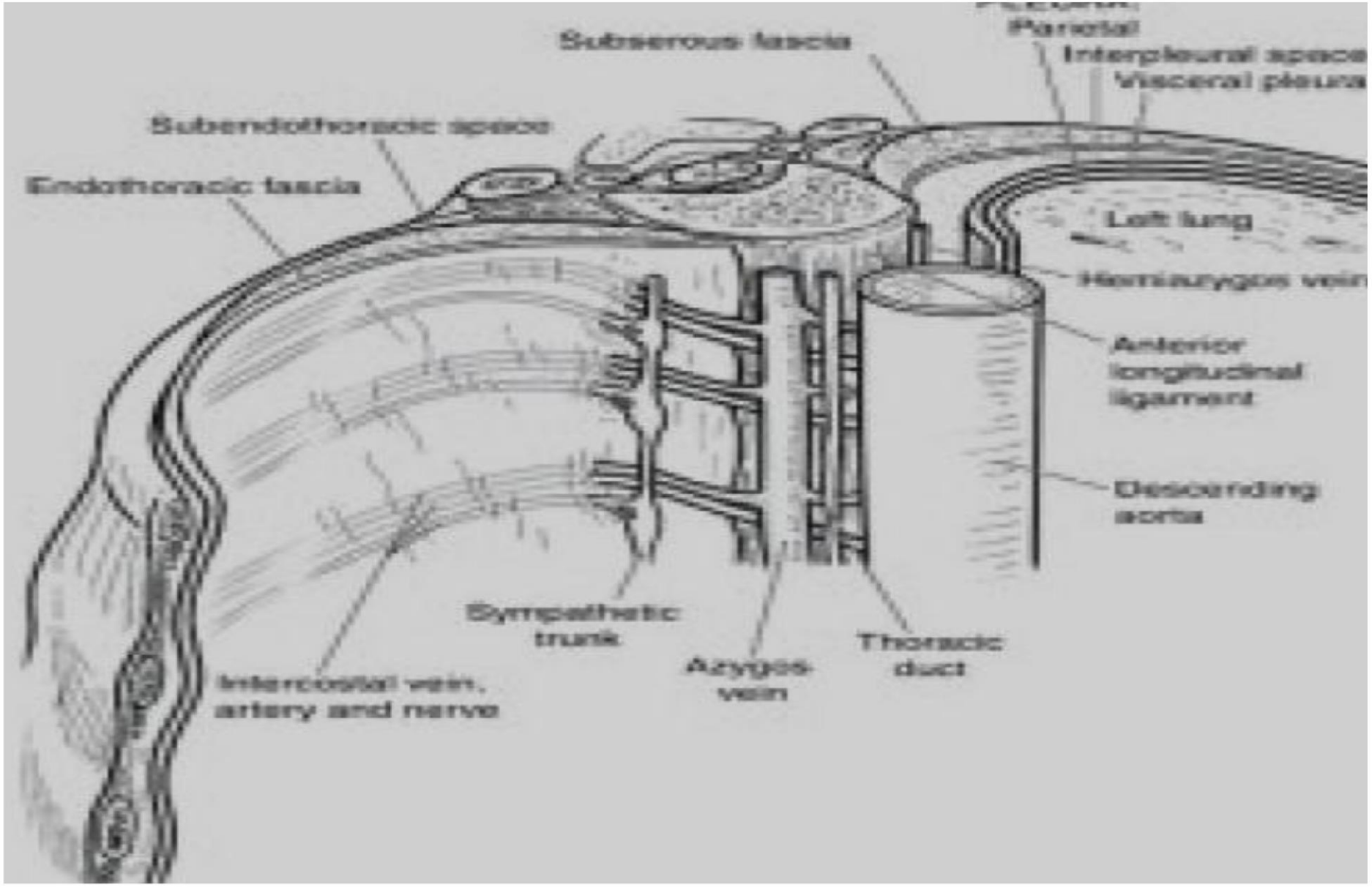
Diaphragm contracts ➔Depression
Diaphragm relaxes ➔ Elevation (during passive expiration)



Elevation &depression of the ribs

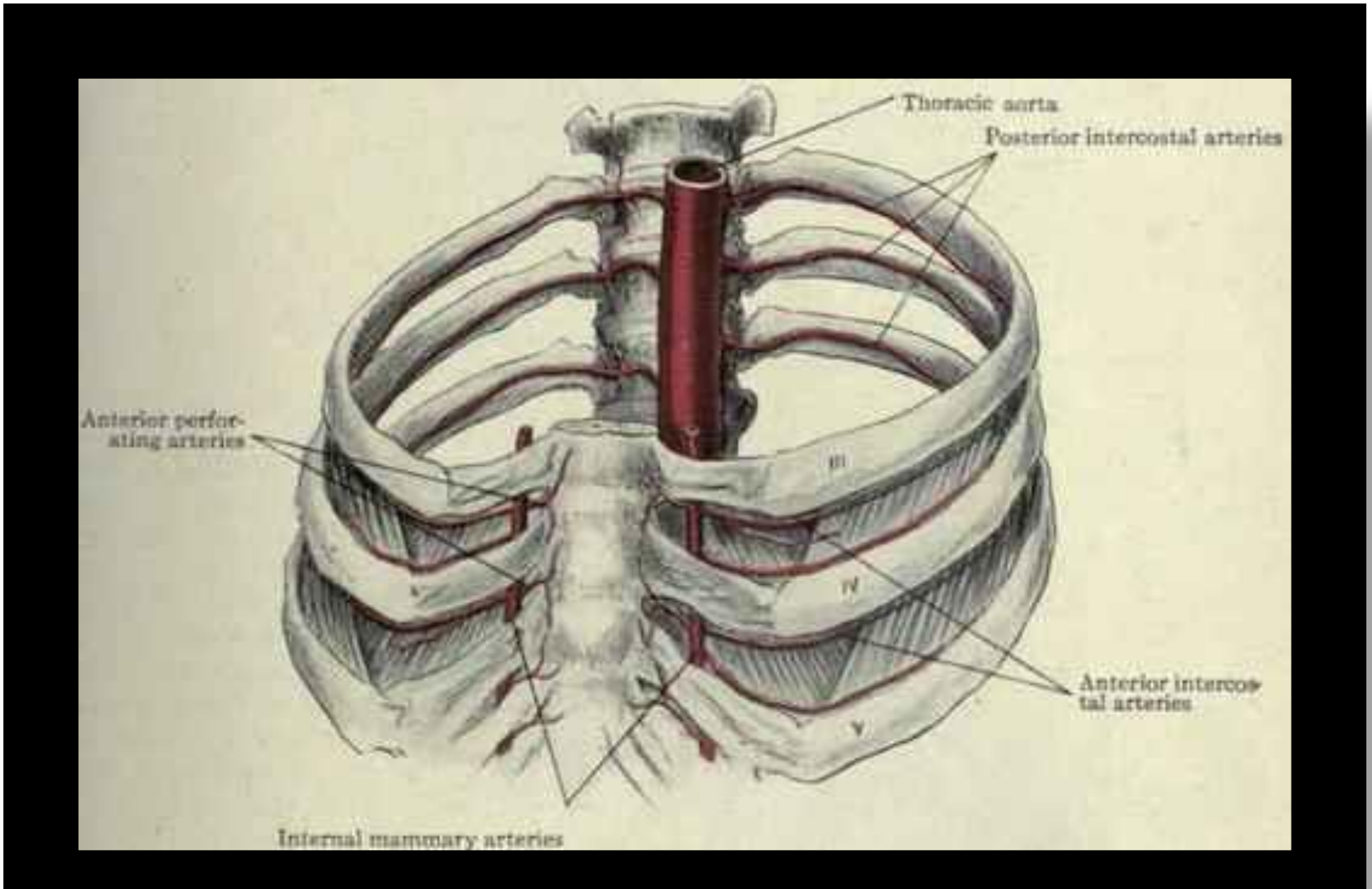


8. FASCIAE OF THE THORACIC WALL



9. VASCULATURE OF THE THORACIC WALL

Mainly **posterior and anterior intercostal arteries**



9.1. ARTERIES OF THE THORACIC WALL

Arterial supply to the thoracic wall derives from

Thoracic aorta

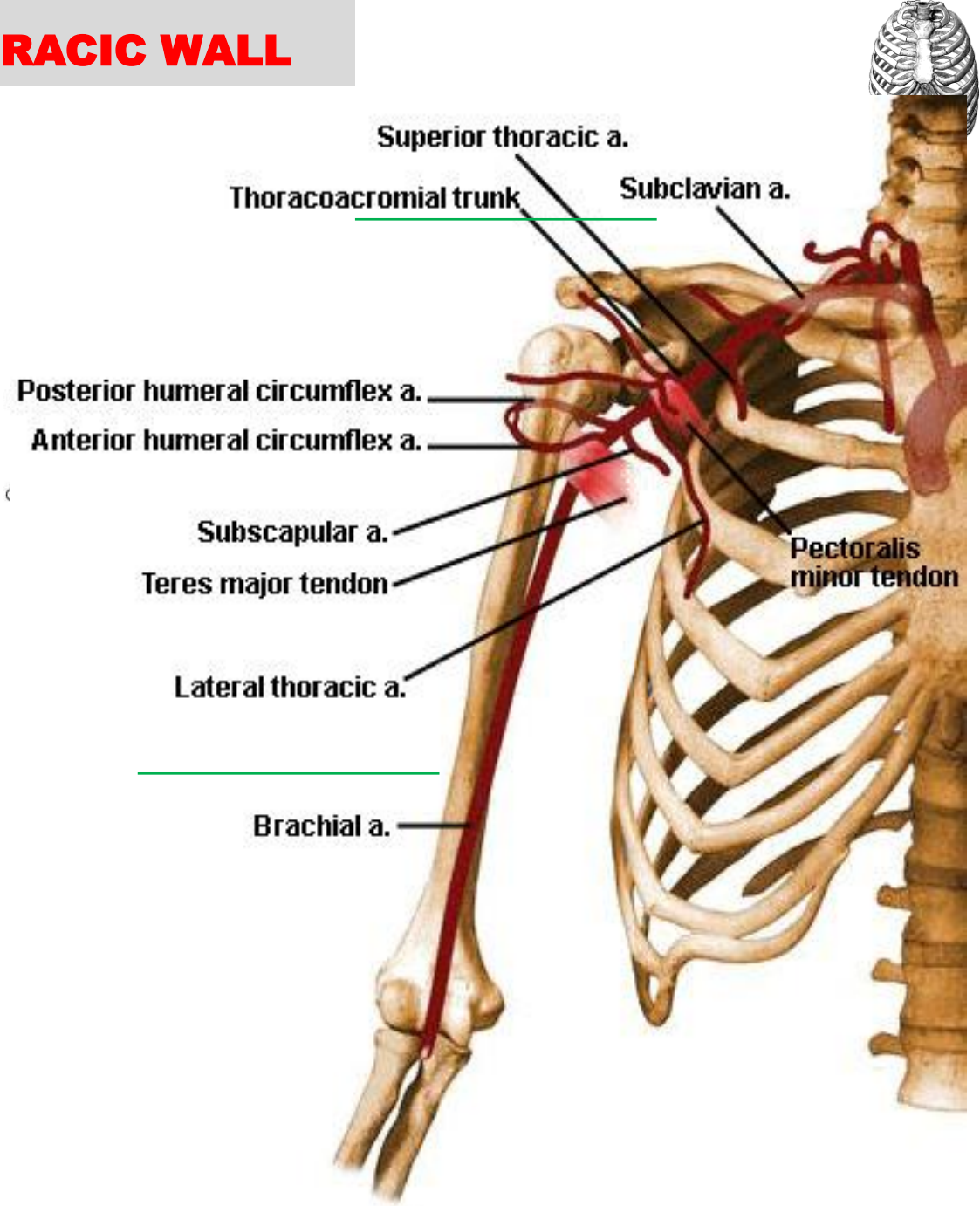
[posterior intercostal & subcostal arteries]

Subclavian artery

[internal thoracic & supreme intercostal arteries]

Axillary artery

[superior & lateral thoracic arteries]



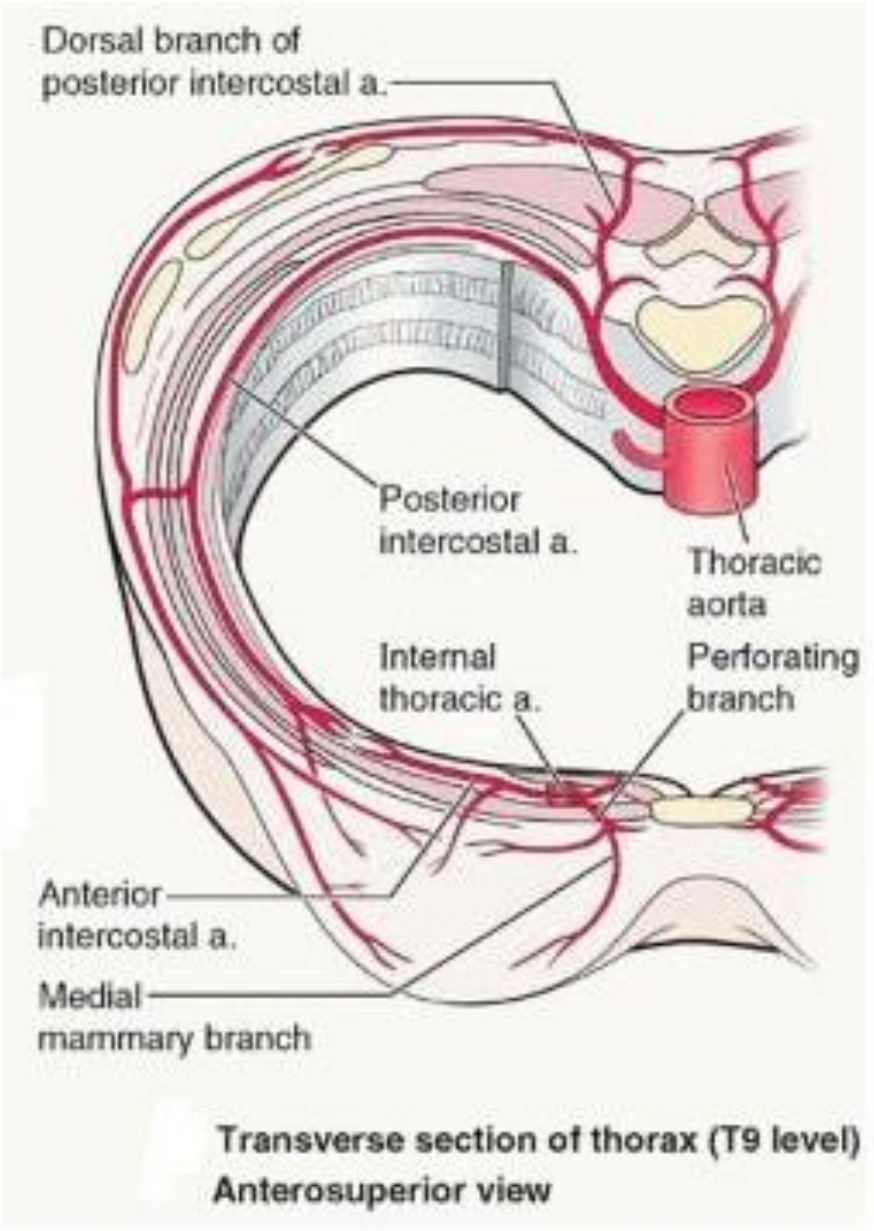
intercostal arteries

course through the thoracic wall between the ribs.

Each intercostal space is supplied by

- a large posterior intercostal artery
- small pair of anterior intercostal arteries

Exception last two intercostal spaces



Transverse section of thorax (T9 level)
Anterosuperior view

Anterior intercostal arteries (paired)

directly or indirectly from internal thoracic artery

1st-6th (from internal thoracic artery)

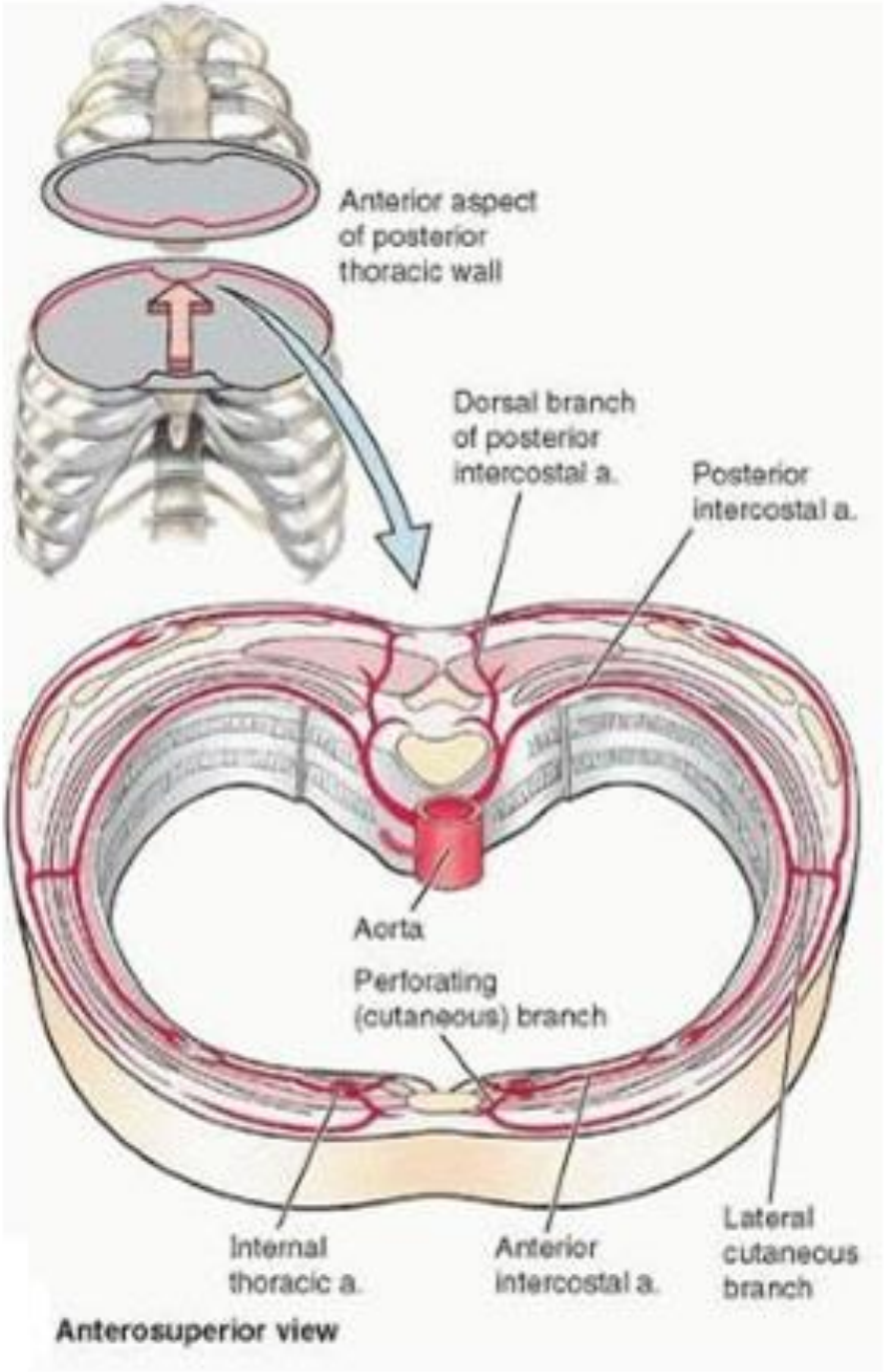
7th-9th (from musculophrenic-branch of internal thoracic)

Posterior intercostal arteries (large, unpaired)

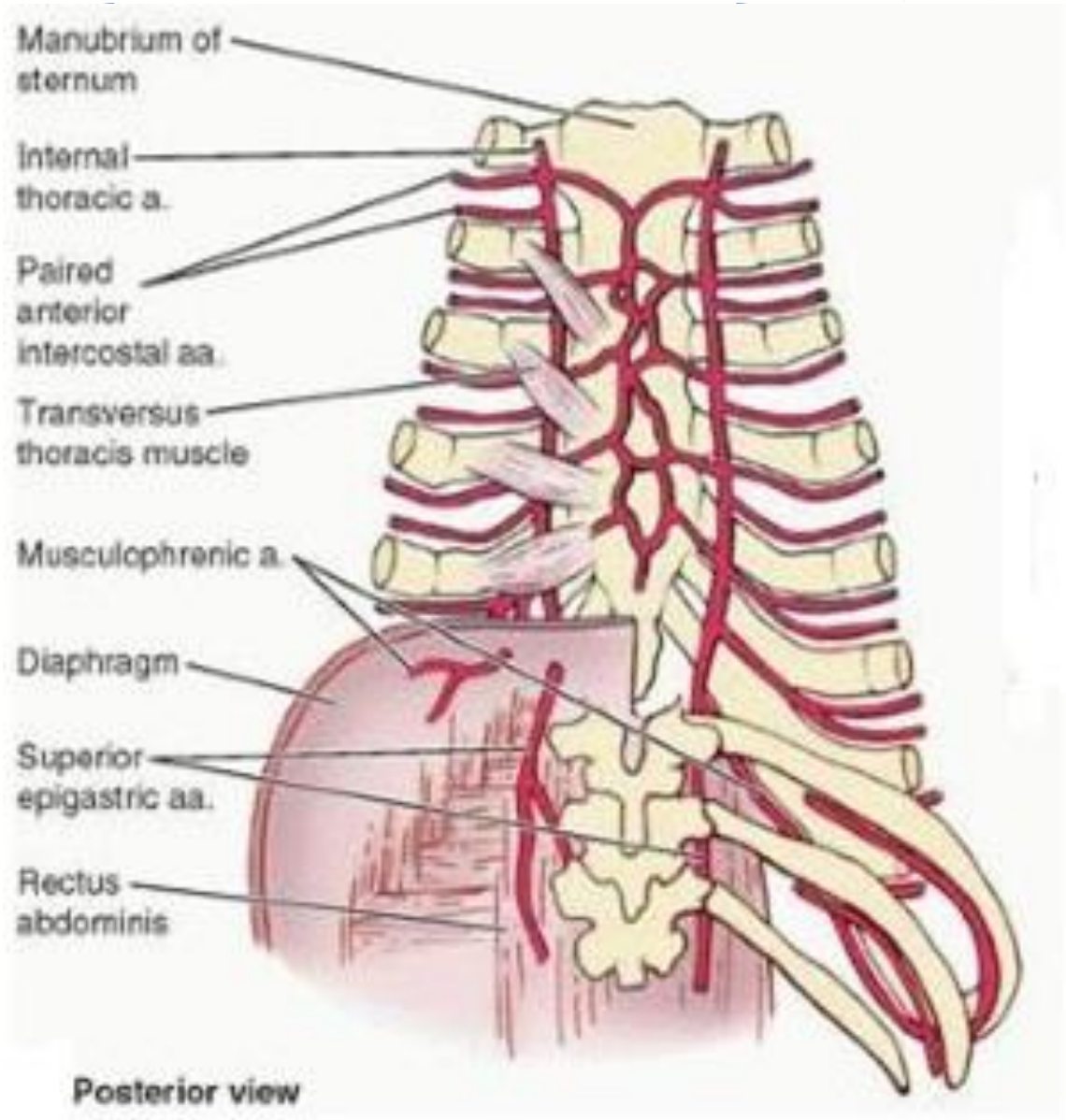
1st-2nd (from supreme intercostal artery- branch of costocervical trunk)

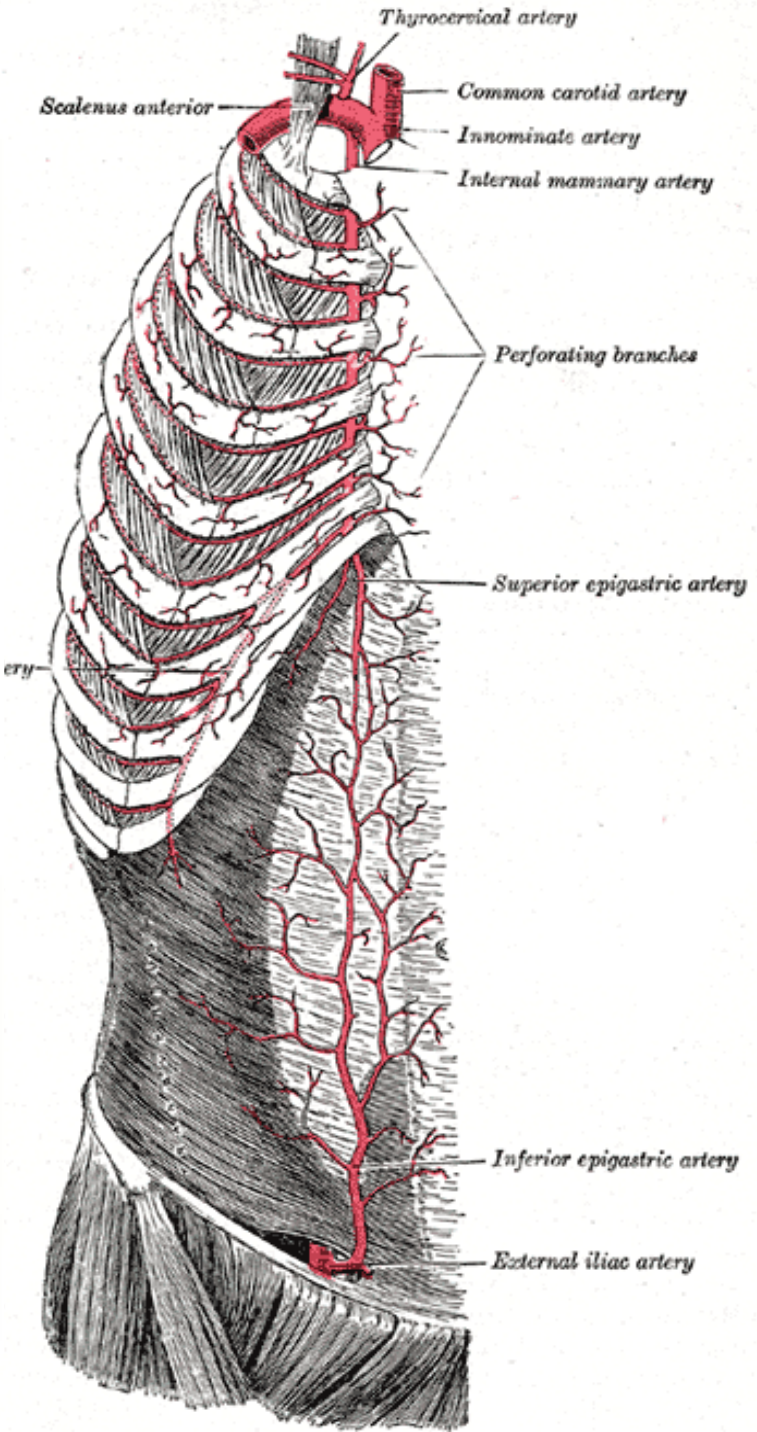
3rd-11th (from thoracic aorta)

Subcostal artery (from thoracic aorta)



internal thoracic artery





9.2. VEINS OF THE THORACIC WALL

Veins
Artery V.A.N.
Nerve

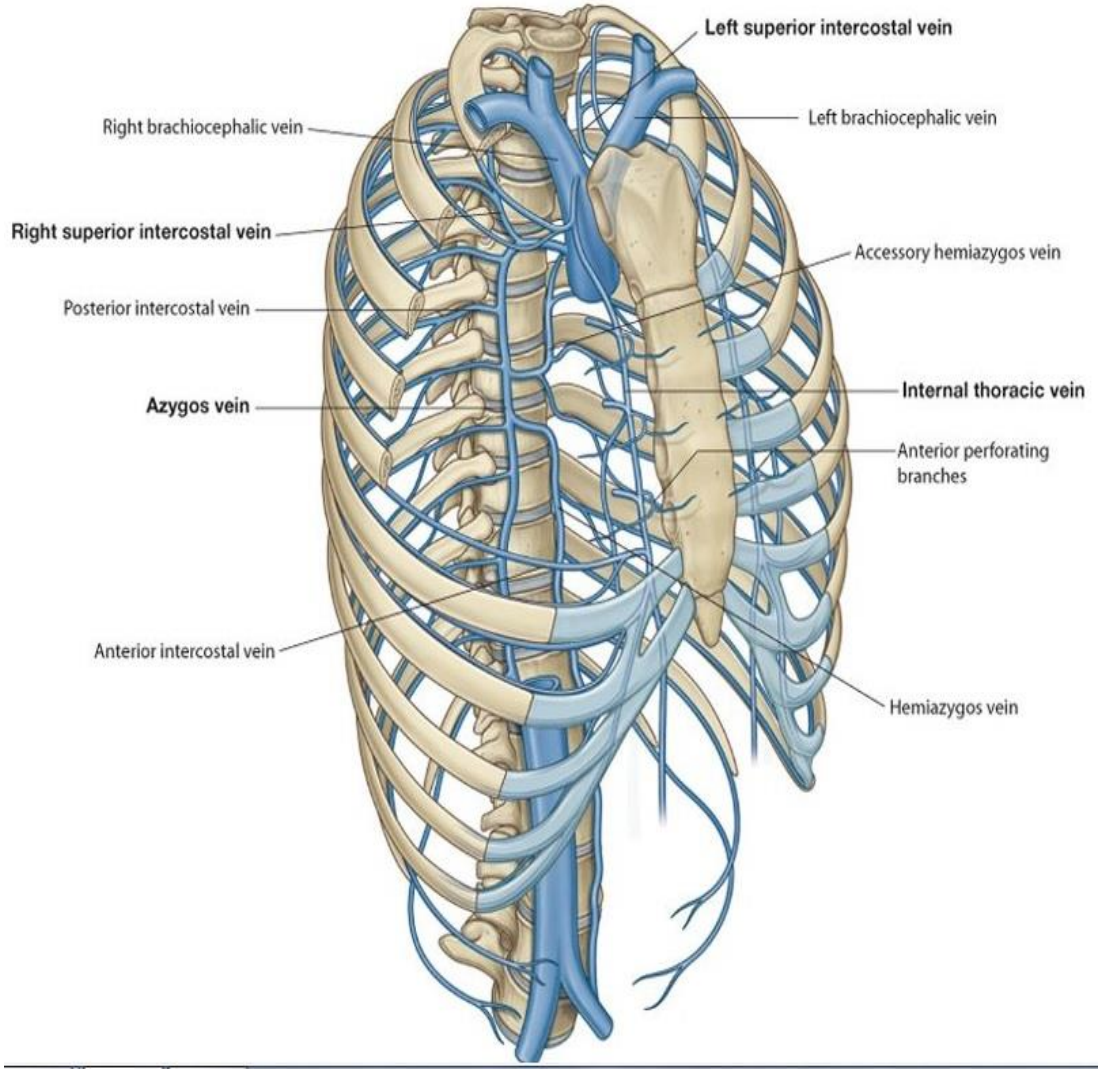
Most posterior intercostal veins (4-11) end @

azygos/hemiazygos venous system

conveys venous blood to SVC.

1st posterior intercostal veins **right & left brachiocephalic veins**

2nd & 3rd (sometimes 4th) form **superior intercostal vein.**



Right superior intercostal vein
final tributary of azygos vein

Left superior intercostal vein
empties into left brachiocephalic vein.

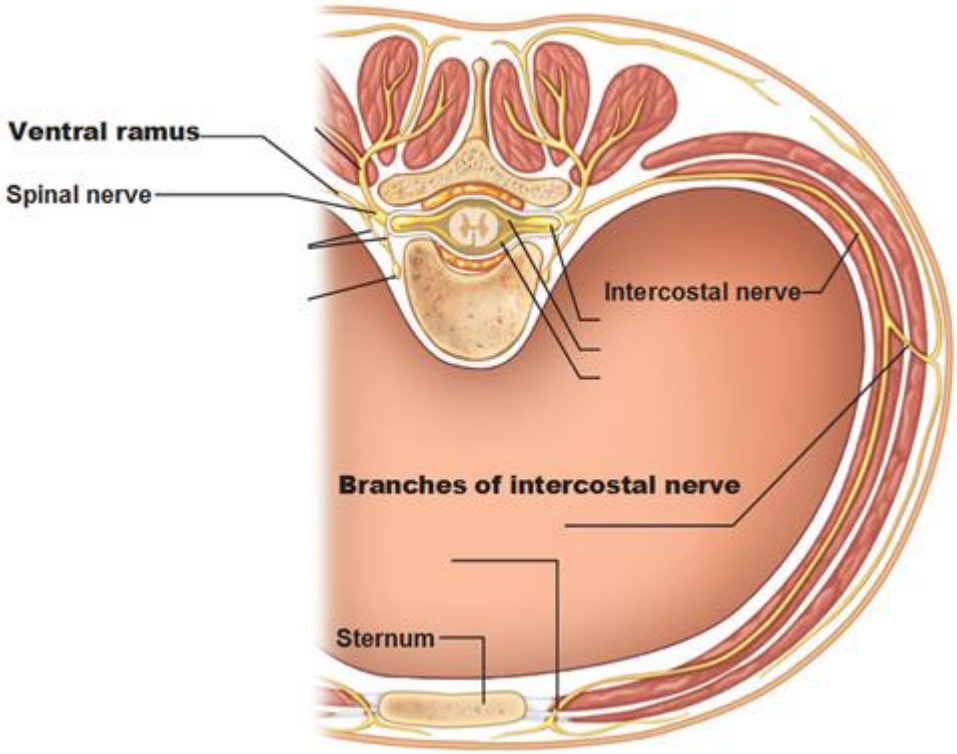
10. NERVES OF THE THORACIC WALL

12 pairs of **intercostal nerves**

anterior rami of spinal nerves TI to TII

lie in the intercostal spaces between adjacent ribs.

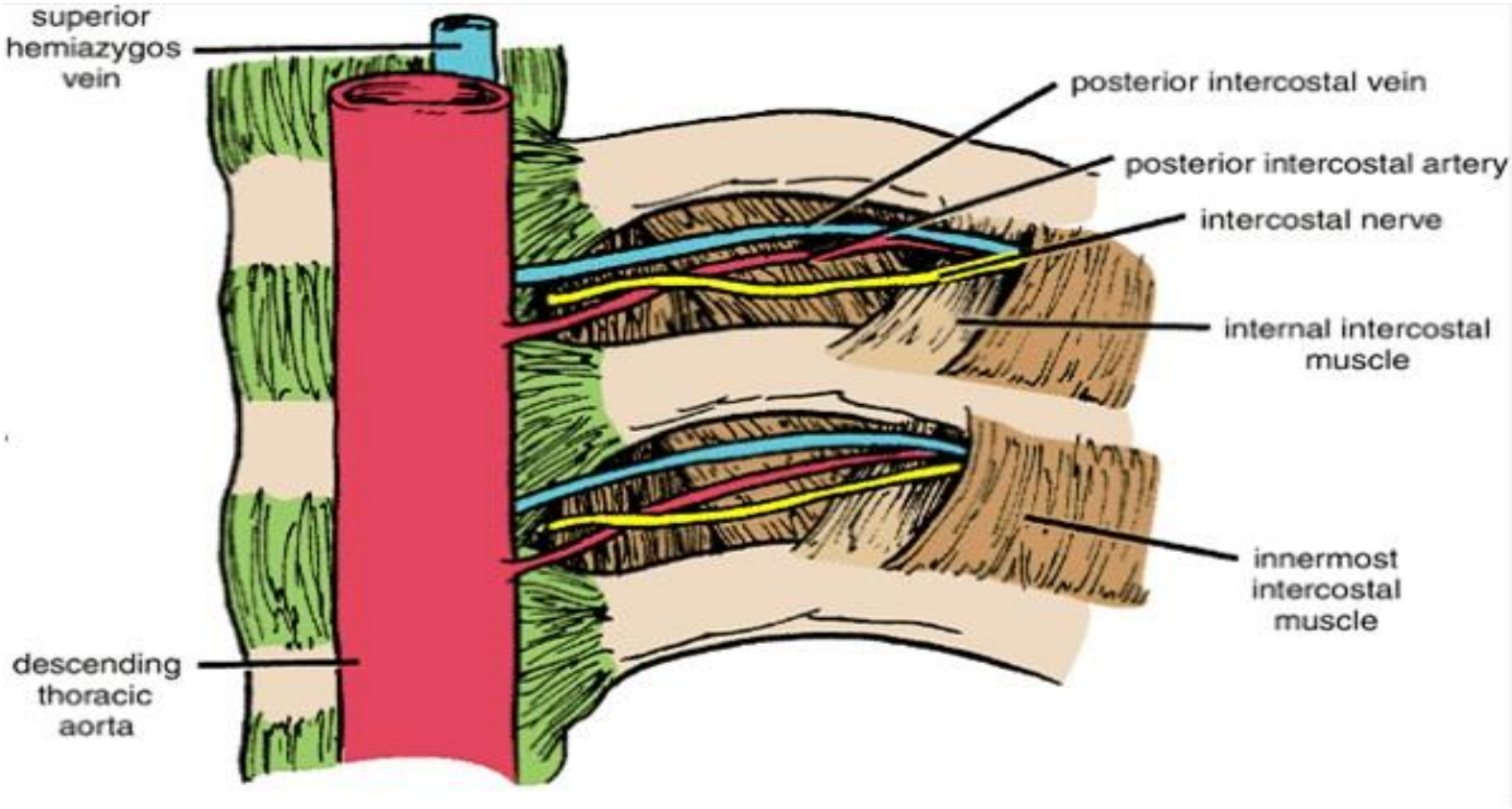
Anterior ramus of spinal nerve T12 (subcostal nerve) inferior to rib XII.



- Near the angles of the ribs, the nerves pass between internal intercostal & innermost intercostal muscles.

V.A.N.

- Neurovascular bundles sheltered by the inferior margins of the overlying rib.

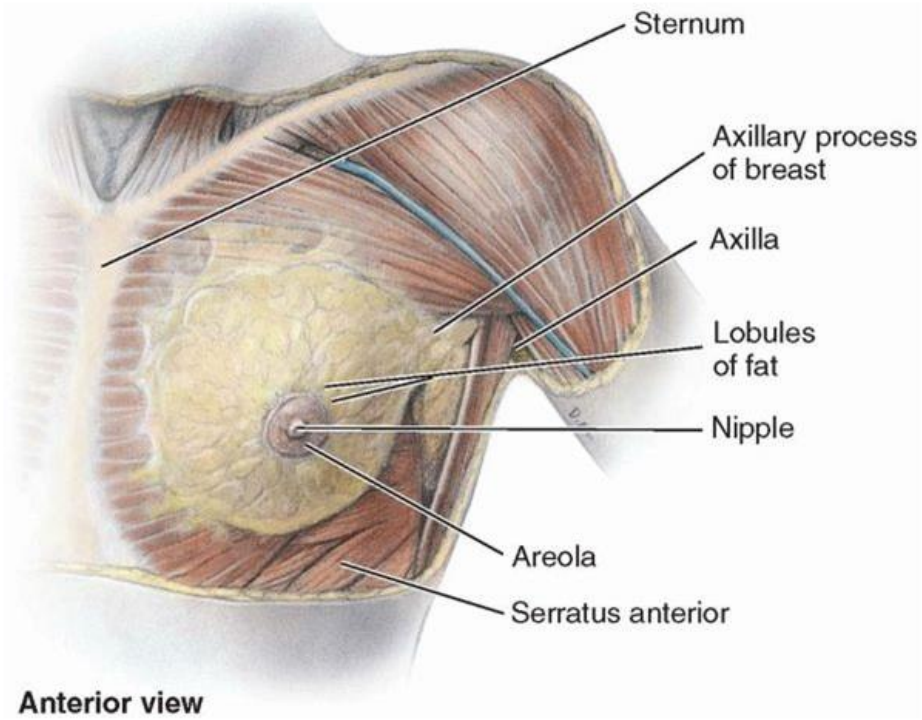


11. BREASTS

Reproduction, back pain
Aesthetics, and breast cancer

Mammary glands & associated skin -connective tissues.

modified sweat glands in the superficial fascia anterior to the pectoral muscles and the anterior thoracic wall.

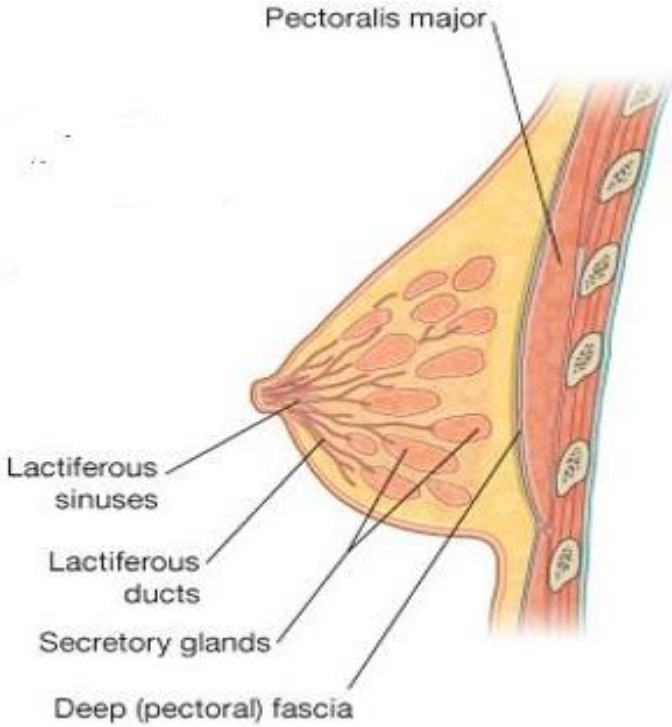


11. BREASTS

Mammary glands:
Series of ducts and associated secretory lobules.

Form 15 to 20 **lactiferous ducts** open ➡ **nipple**.

Nipple is surrounded by a circular pigmented area of skin **areola** (L. small area).

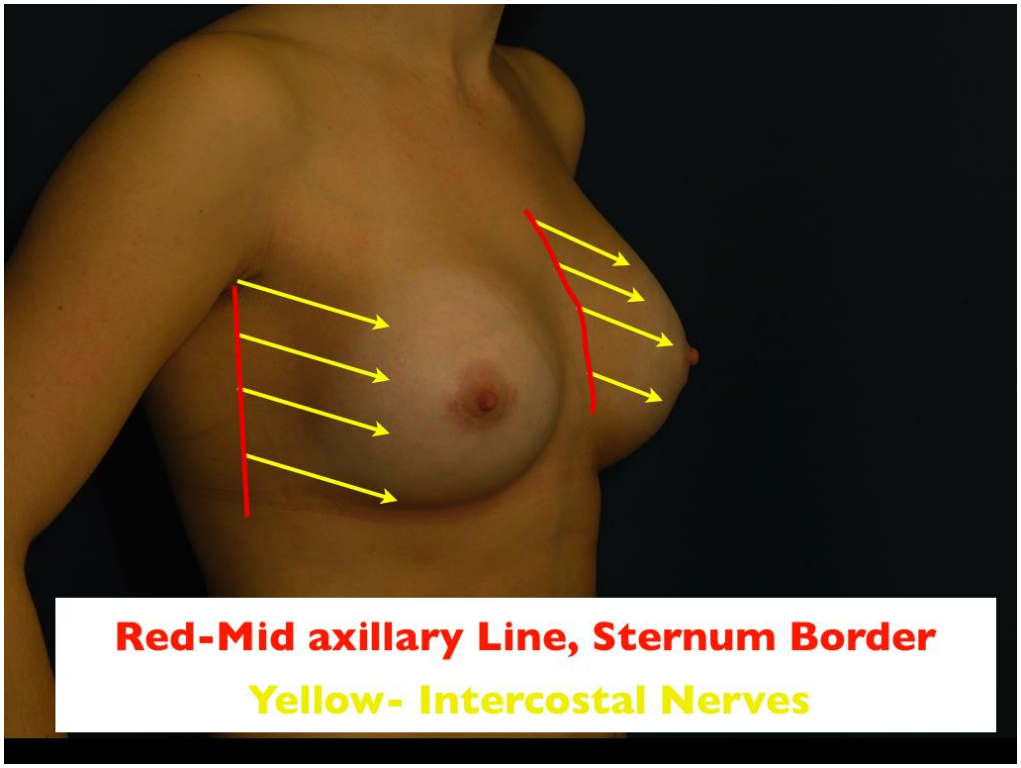


11.1. FEMALE BREASTS

NON-LACTING WOMEN – PREDOMINANT COMPONENT: **FAT**

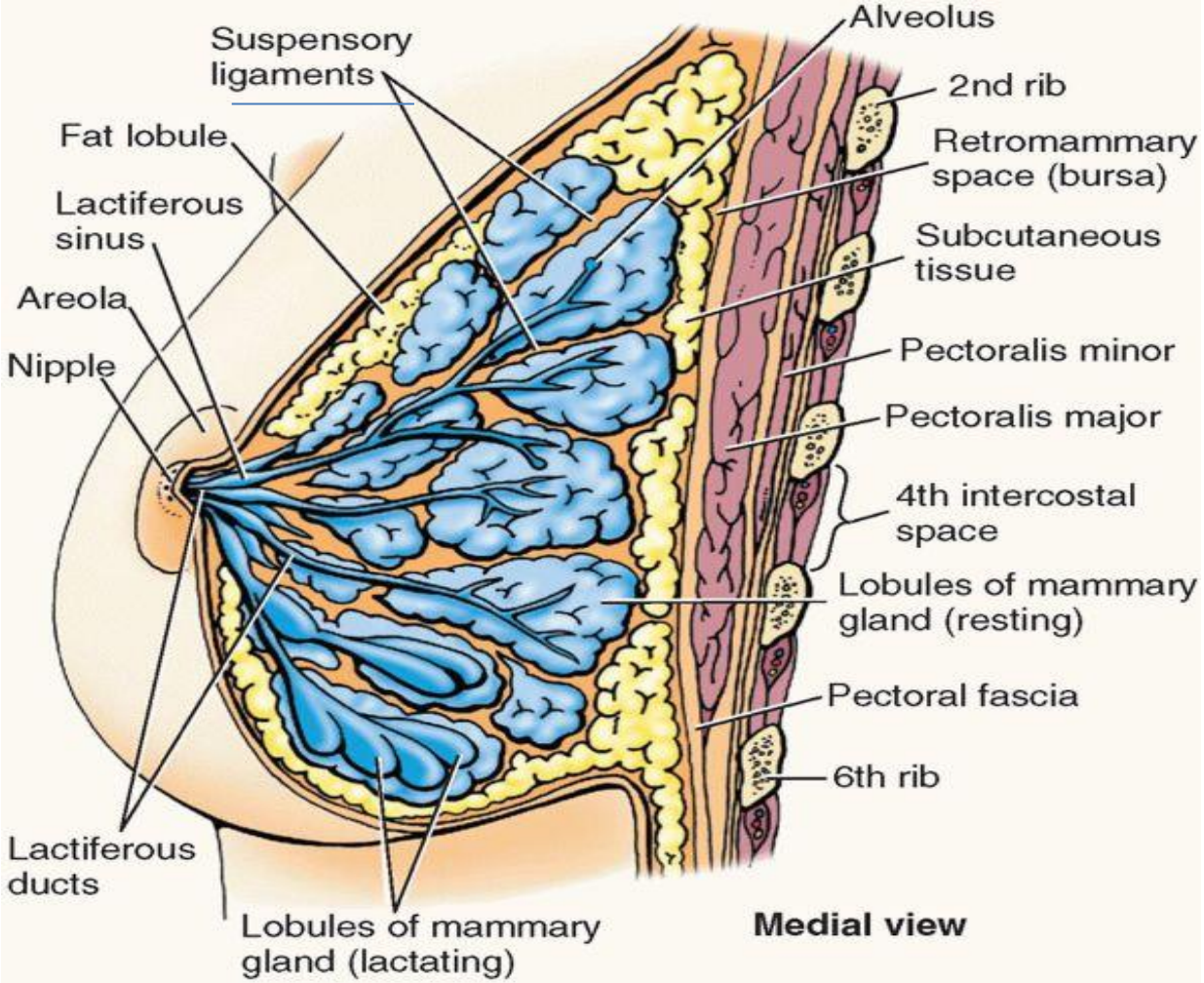
LACTING WOMEN- PREDOMINANT COMPONENT: **GLANDULAR TISSUE**

The breast rests on a bed
extends transversely from
lateral border of the sternum → mid-axillary line
vertically from the 2nd through 6th ribs



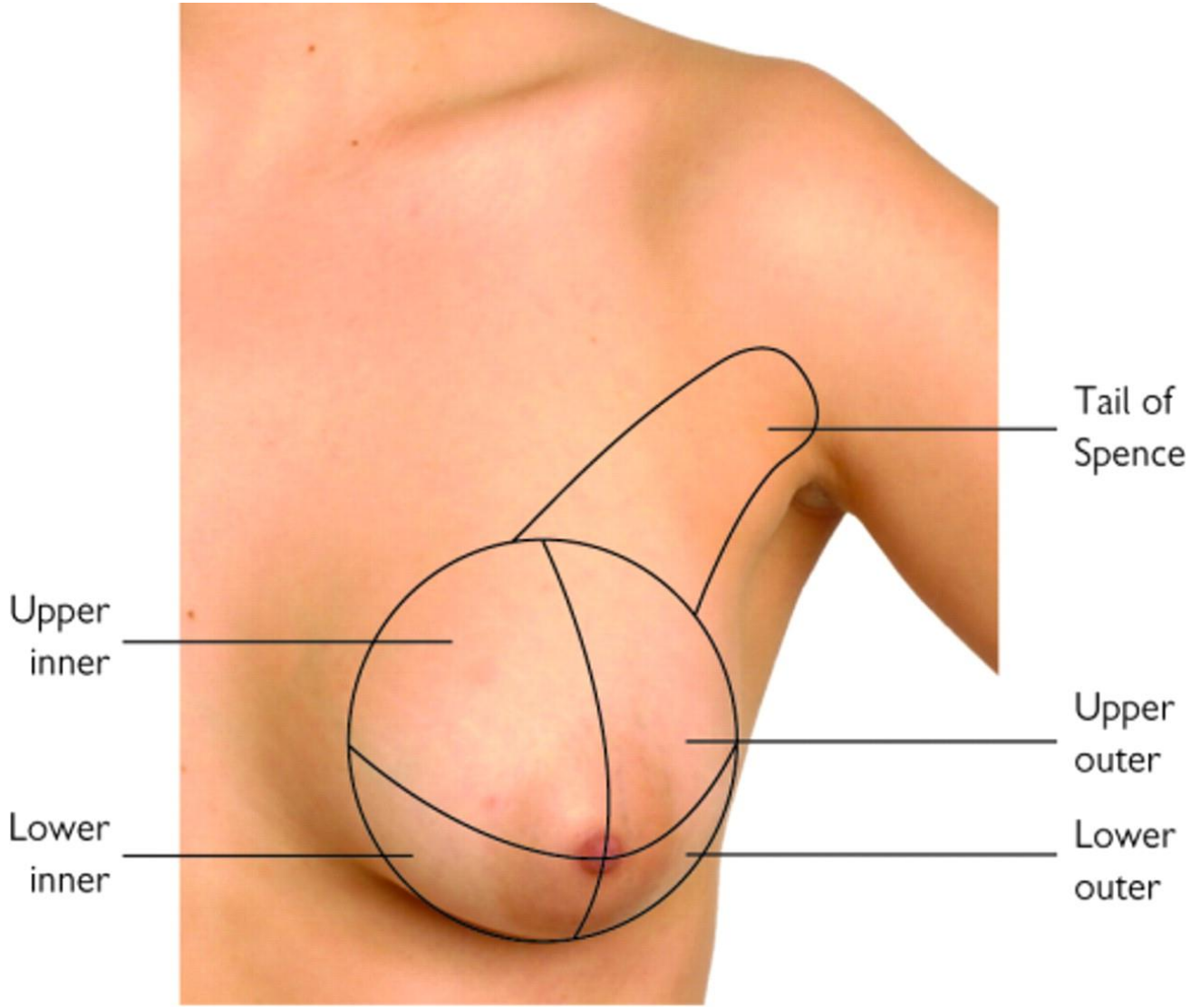
suspensory ligaments (of Cooper)

- substantial skin ligaments attaching mammaryg glands to dermis
- help support the lobes and lobules of the mammary gland.



axillary process or tail (of Spence)

Confused with a lump (tumor) or enlarged lymph nodes.

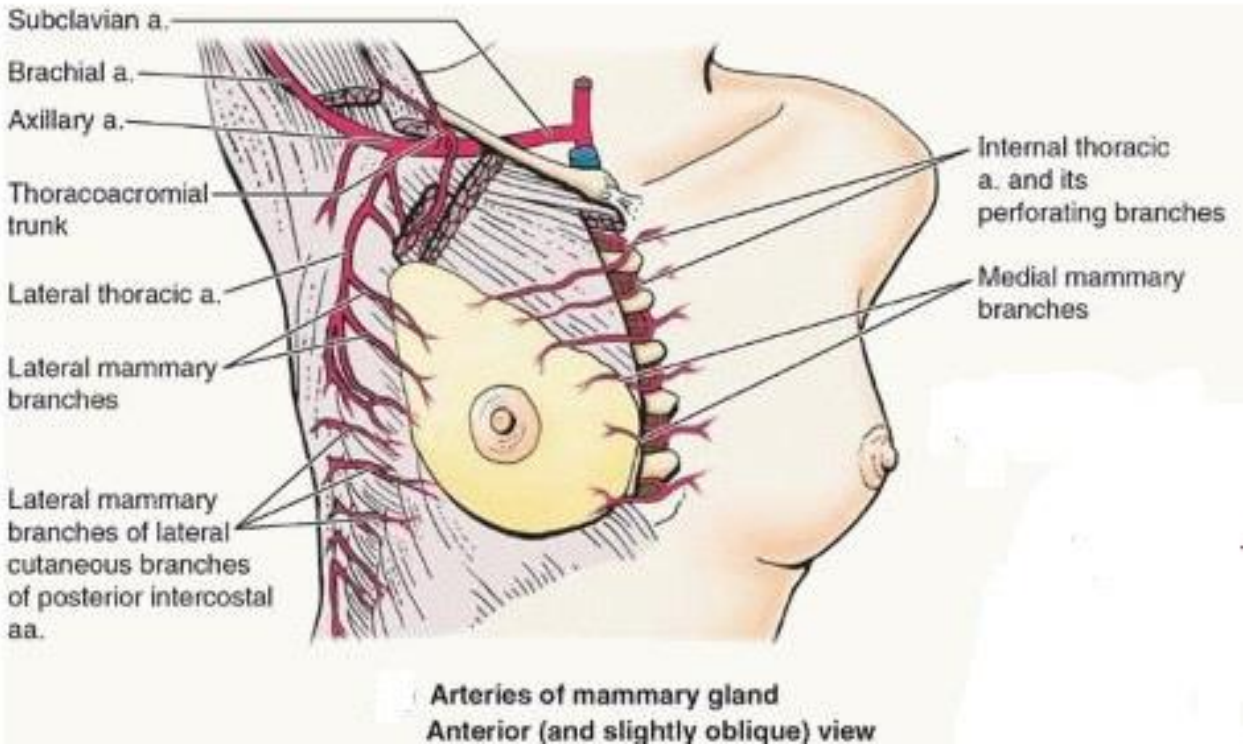


Arterial supply of the breast

1) Medial mammary branches (internal thoracic artery)

2) Lateral mammary branches (axillary artery)

3) Posterior intercostal arteries 2nd-4th (aorta)



Arteries of mammary gland
Anterior (and slightly oblique) view

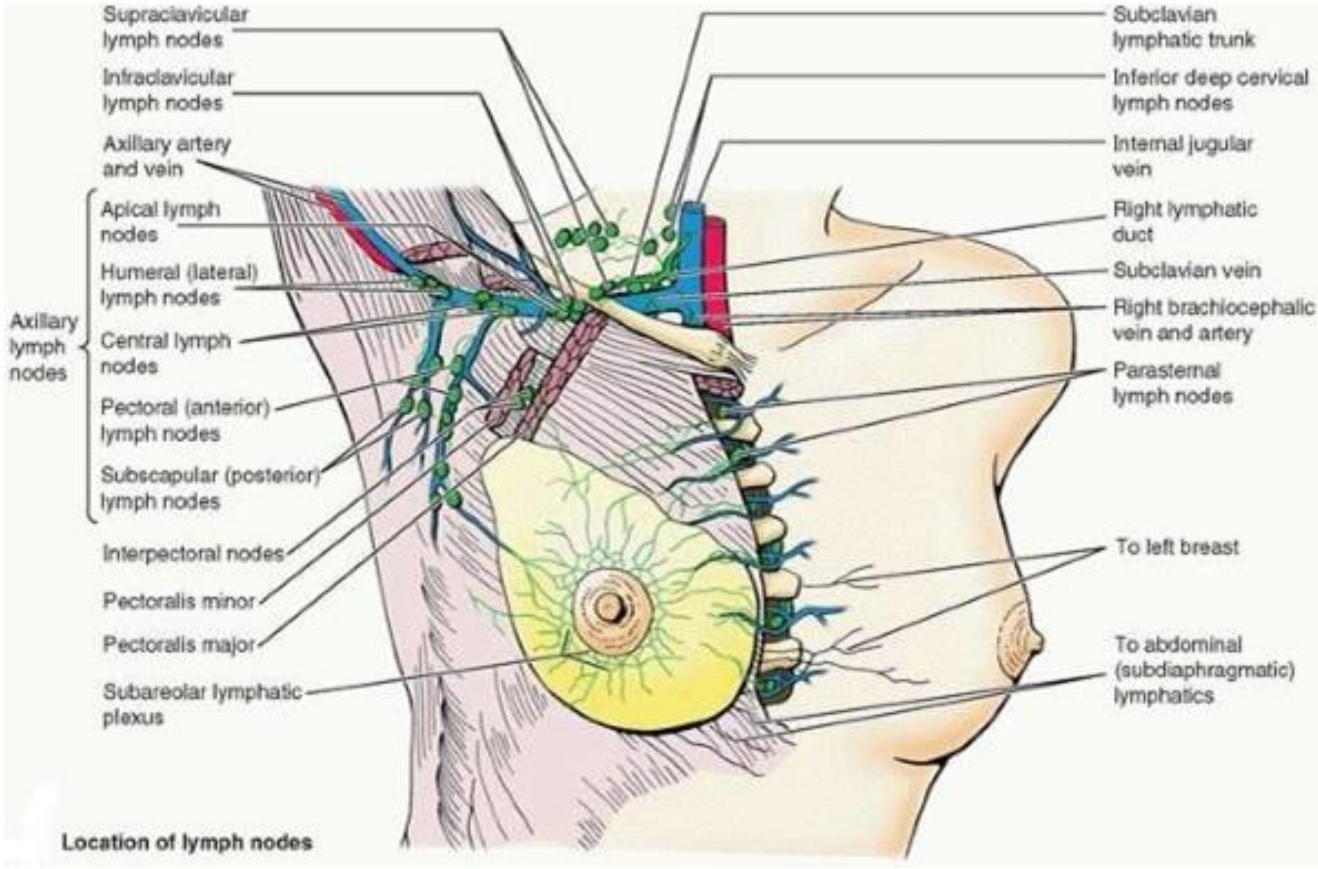
Venous drainage of the breast

Mainly to **axillary vein**

Lymphatic drainage of the breast

75% (lateral breast quadrants) Axillary lymph nodes

Most of the remaining (medial breast quadrants) parasternal lymph nodes or to the opposite breast



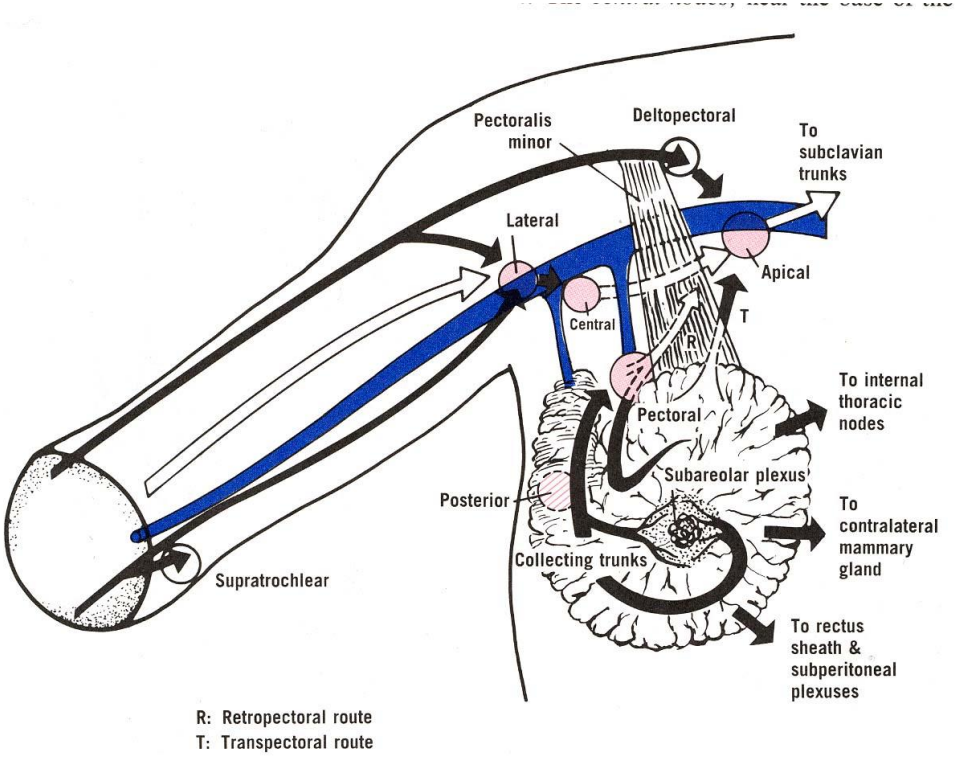
Lymph from inferior quadrants may pass deeply to abdominal lymph nodes.

Lymphatics in the axilla

Drainage from

- Upper limb
- An extensive area on the adjacent trunk

  Regions of the upper back & shoulder, lower neck, chest, upper anterolateral abdominal wall
- Drainage from ~ 75% of the mammary gland.



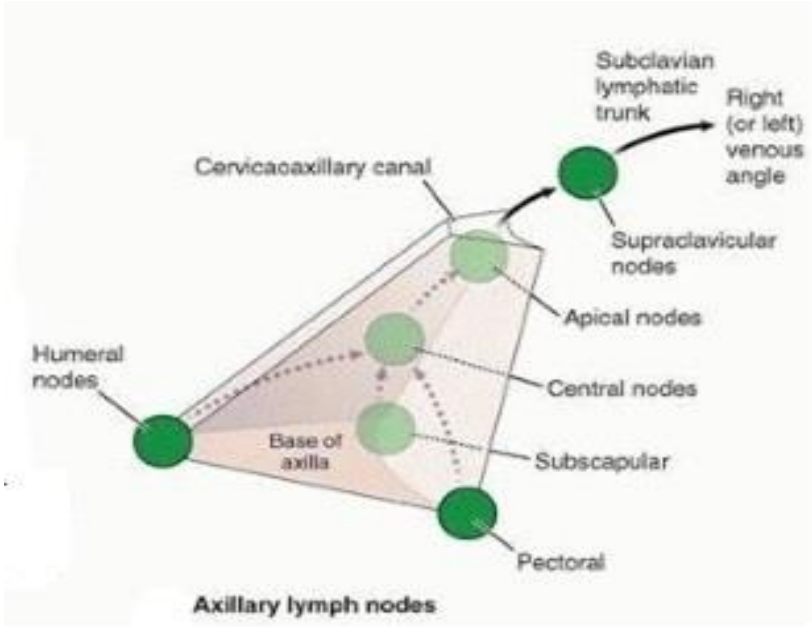
The 20-30 axillary nodes are divided into
5 groups - on the basis of location-

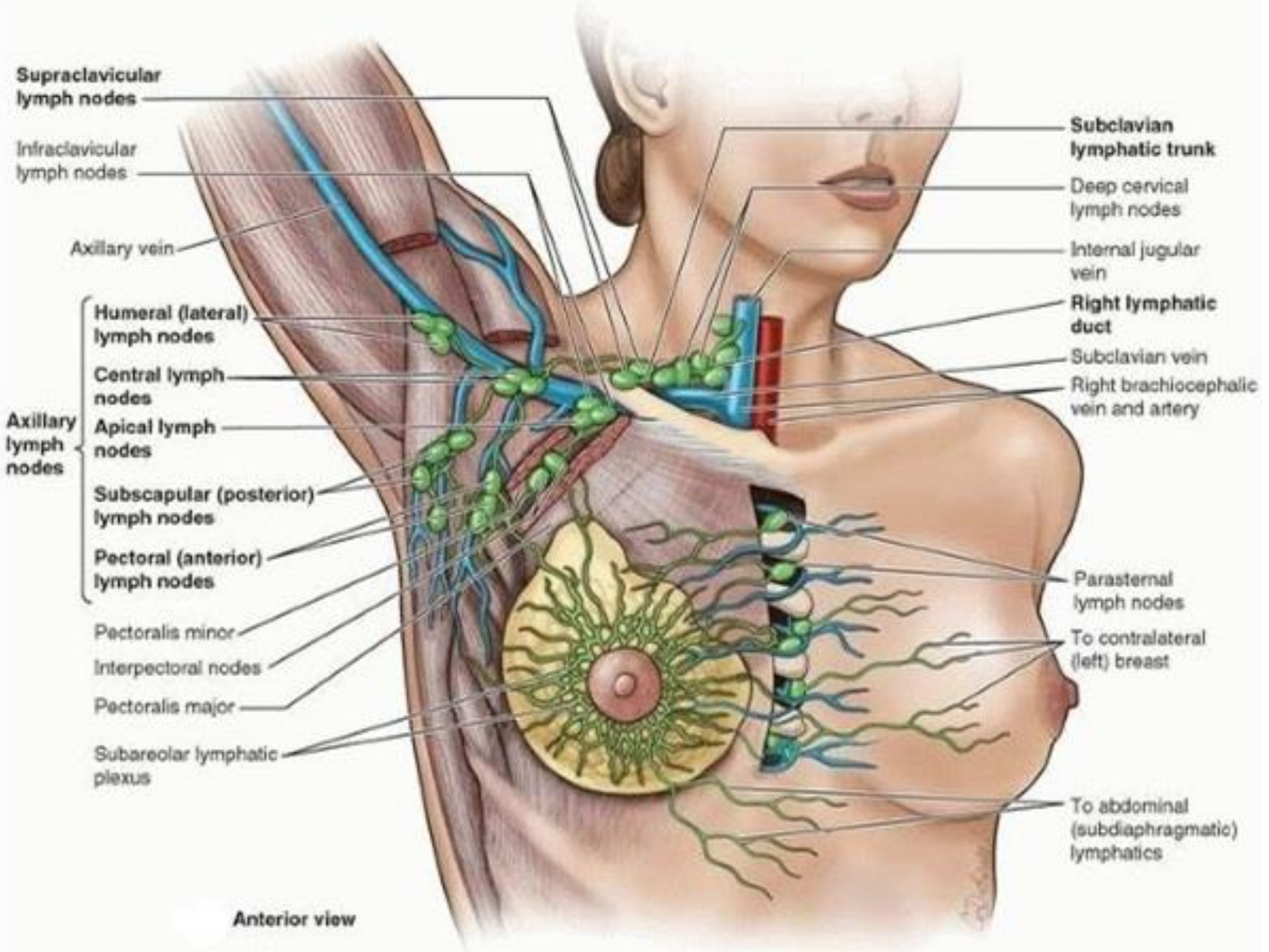
The groups are arranged in a manner that reflects the pyramidal shape of the axilla.

Humeral (lateral) nodes
Pectoral (anterior) nodes
Subscapular (posterior) nodes

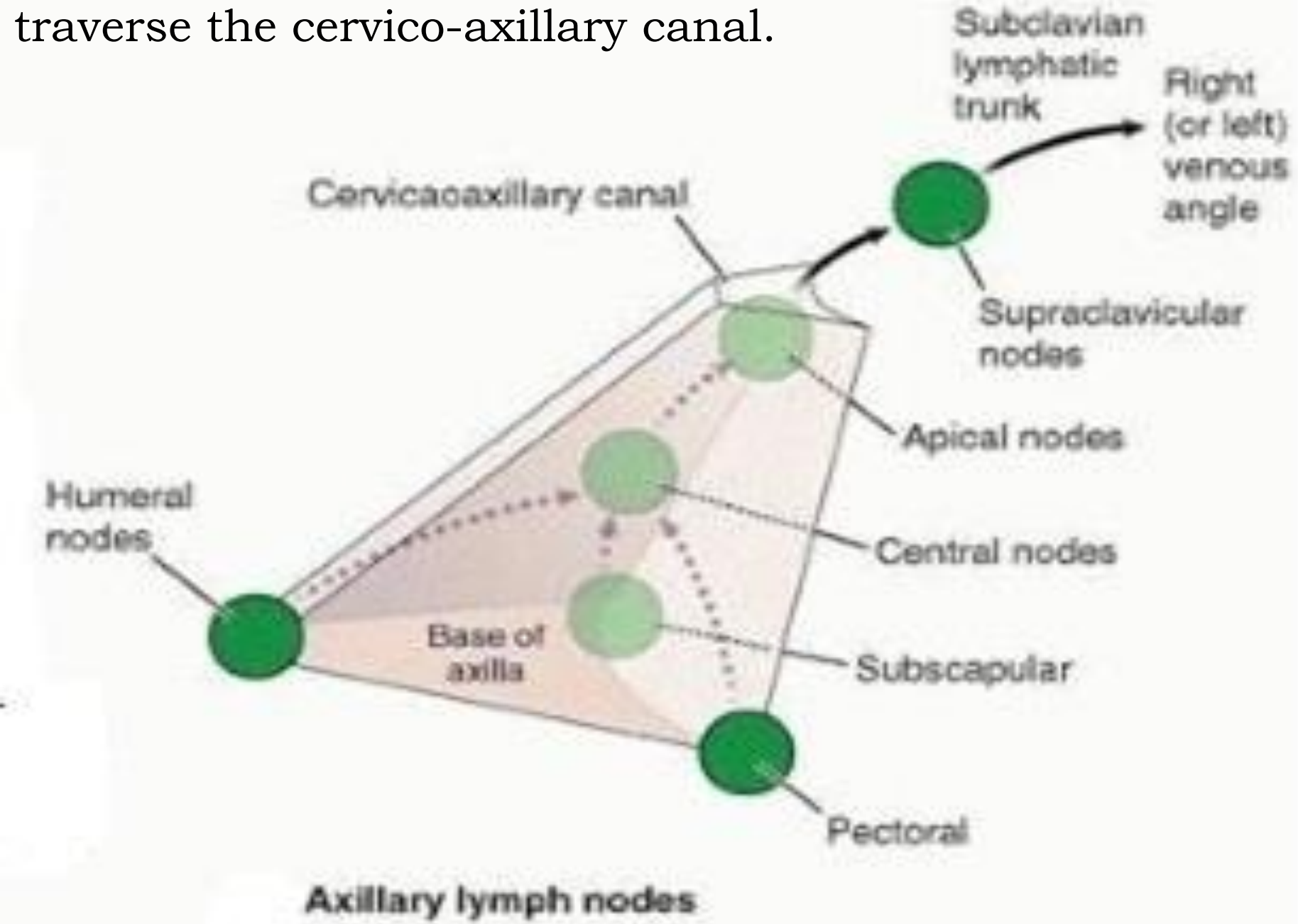
Central nodes

Apical nodes

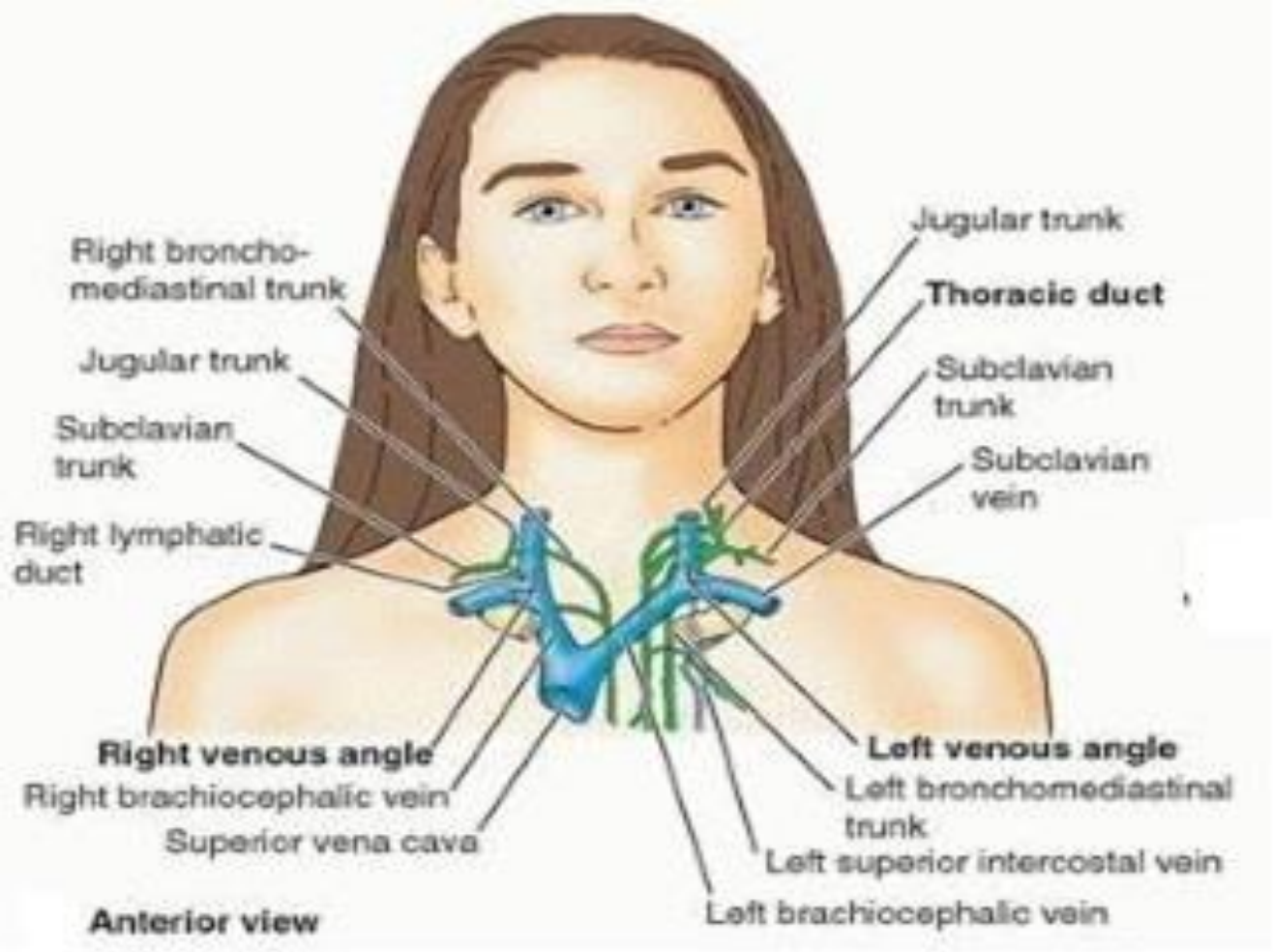



Supraclavicular lymph nodes
Infraclavicular lymph nodes
Axillary vein
Axillary lymph nodes
Humeral (lateral) lymph nodes
Central lymph nodes
Apical lymph nodes
Subscapular (posterior) lymph nodes
Pectoral (anterior) lymph nodes
Pectoralis minor
Interpectoral nodes
Pectoralis major
Subareolar lymphatic plexus
Subclavian lymphatic trunk
Deep cervical lymph nodes
Internal jugular vein
Right lymphatic duct
Subclavian vein
Right brachiocephalic vein and artery
Parasternal lymph nodes
To contralateral (left) breast
To abdominal (subdiaphragmatic) lymphatics
Anterior view

Efferent vessels from the apical group traverse the cervico-axillary canal.



Efferent vessels from the apical group converge to form the **subclavian lymphatic trunk**, which usually joins the venous system at the junction between **right subclavian vein** & **right internal jugular vein** in the neck.



Axillary lymph nodes

↓

Clavicular lymph nodes

↓

Subclavian lypmhatic trunk

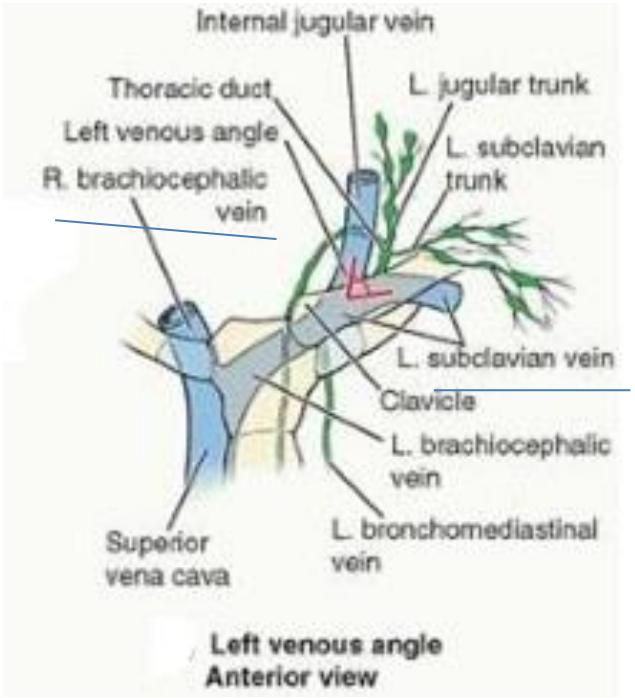
Parasternal lymph nodes

↓

Bronchomediastinal lymph trunks

↓

Right or left venous angle

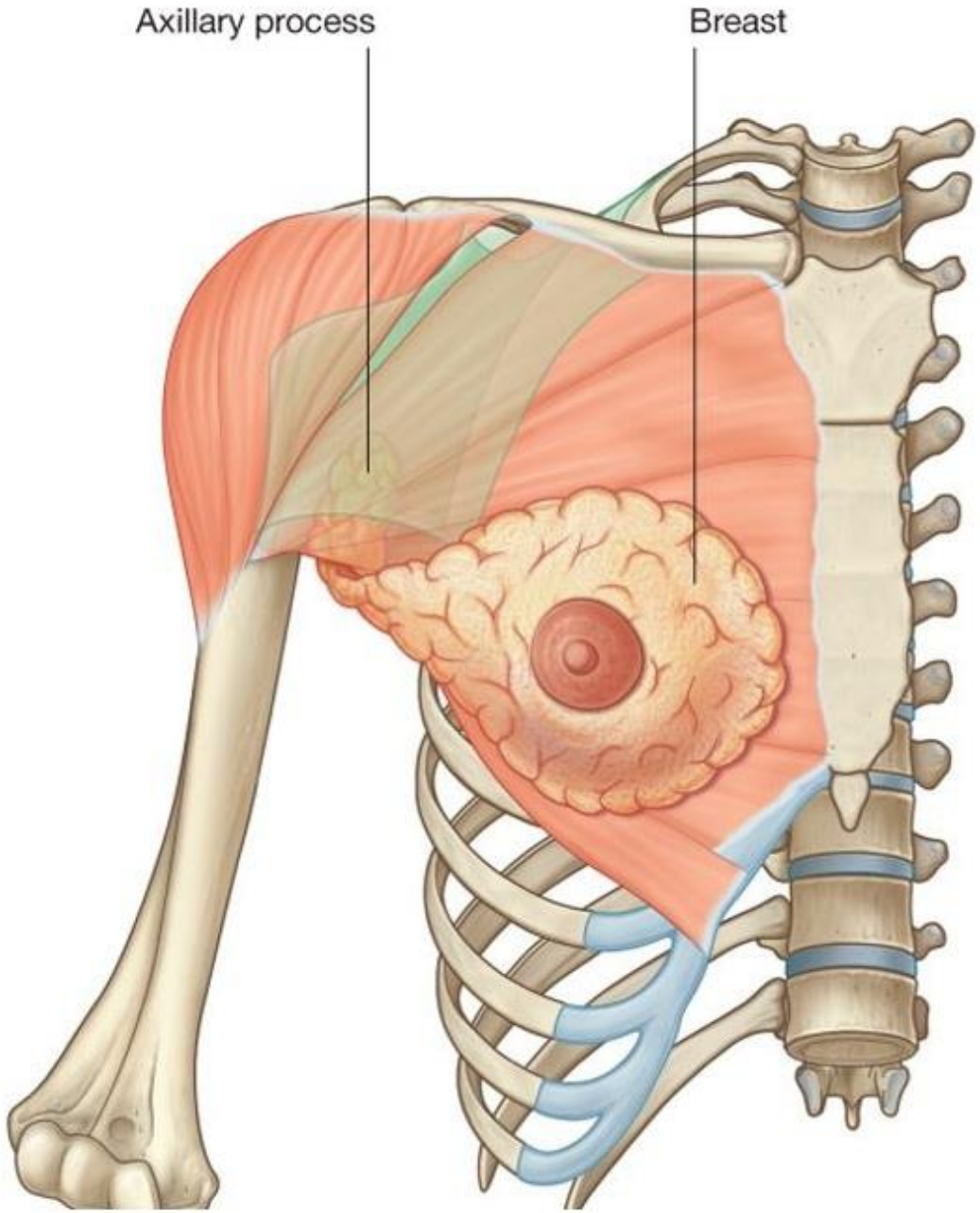


Left venous angle
Anterior view

Axillary process of the mammary gland

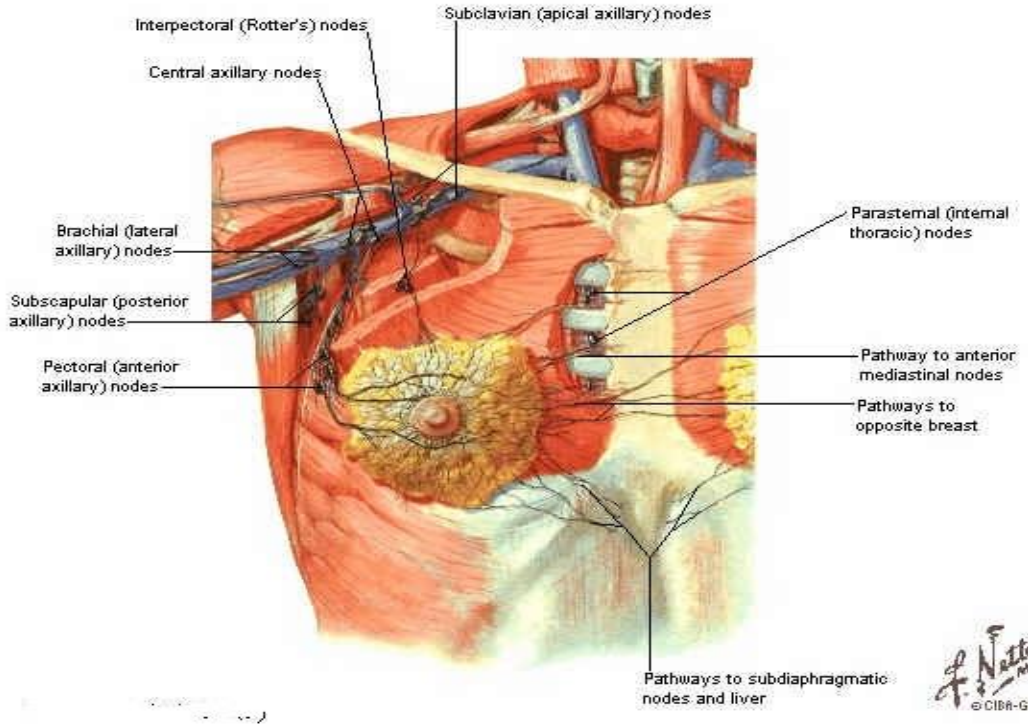
- In some cases, the superolateral region of breast may pass around the margin of pectoral muscle and enters the axilla.

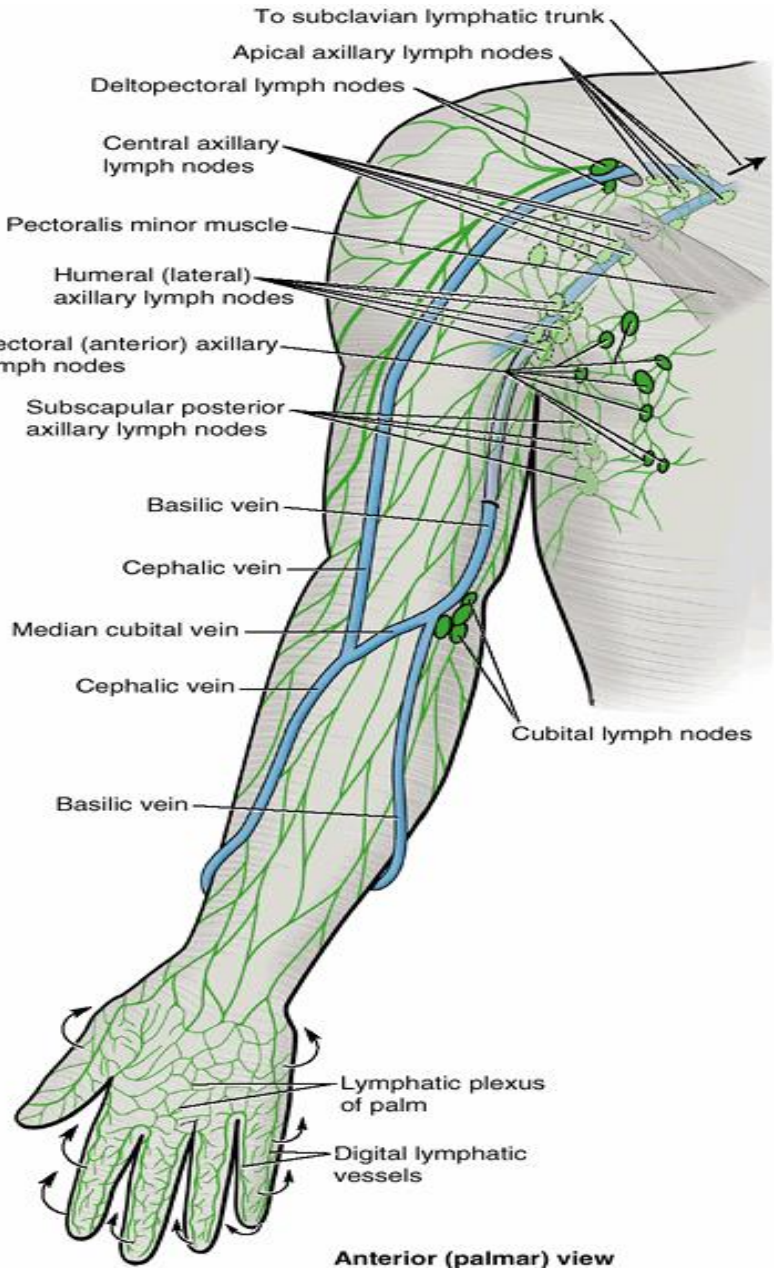
- This axillary process rarely reaches as high as the apex of the axilla.



In metastatic cancer of the apical group, the nodes often adhere to the **axillary vein**, which may necessitate excision of part of this vessel.

Enlargement of the apical nodes may obstruct the cephalic vein superior to the pectoralis minor.





The examination of the axillary lymph nodes always forms part of the clinical examination of the breast.

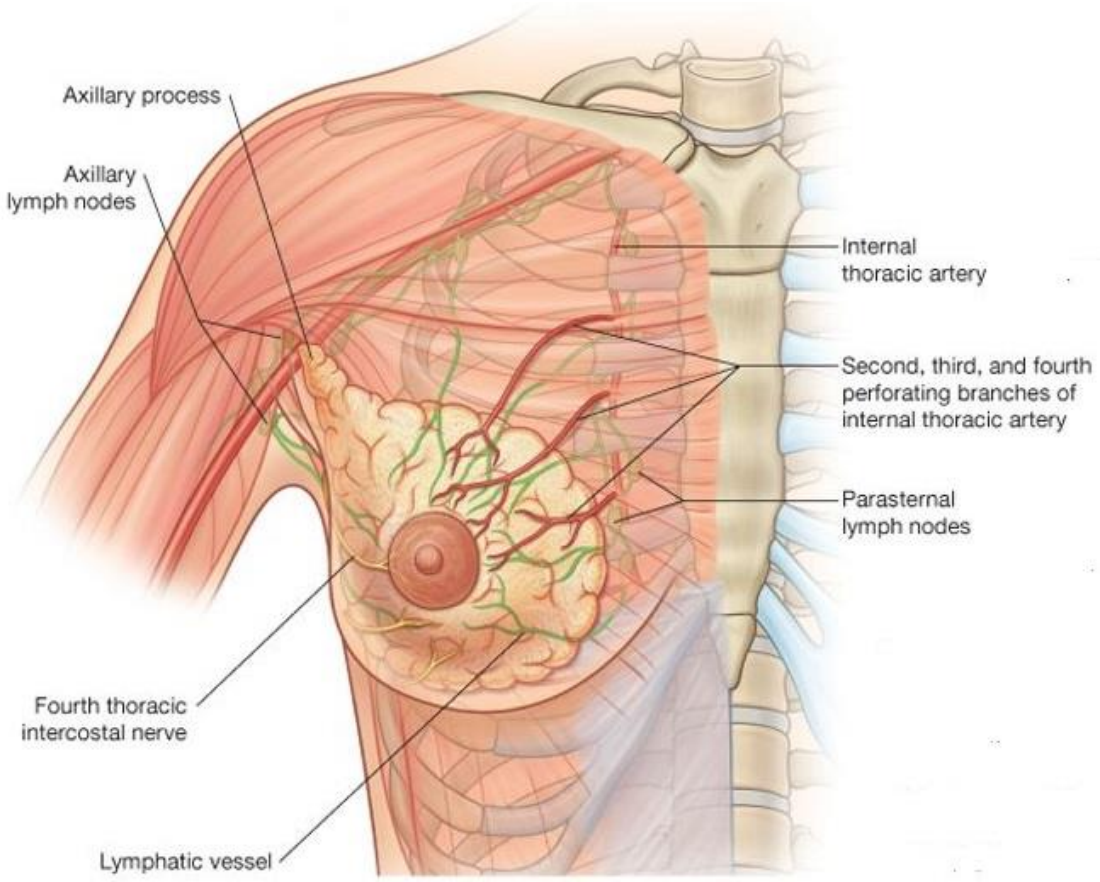
With the patient standing or sitting, he or she is asked to place the hand of the side to be examined on the hip and push hard medially. This action of adduction of the shoulder joint causes the pectoralis major muscle to contract maximally so that it becomes hard like a board. The examiner then palpates the axillary nodes.

EXAMINATION OF THE LYMPH NODES

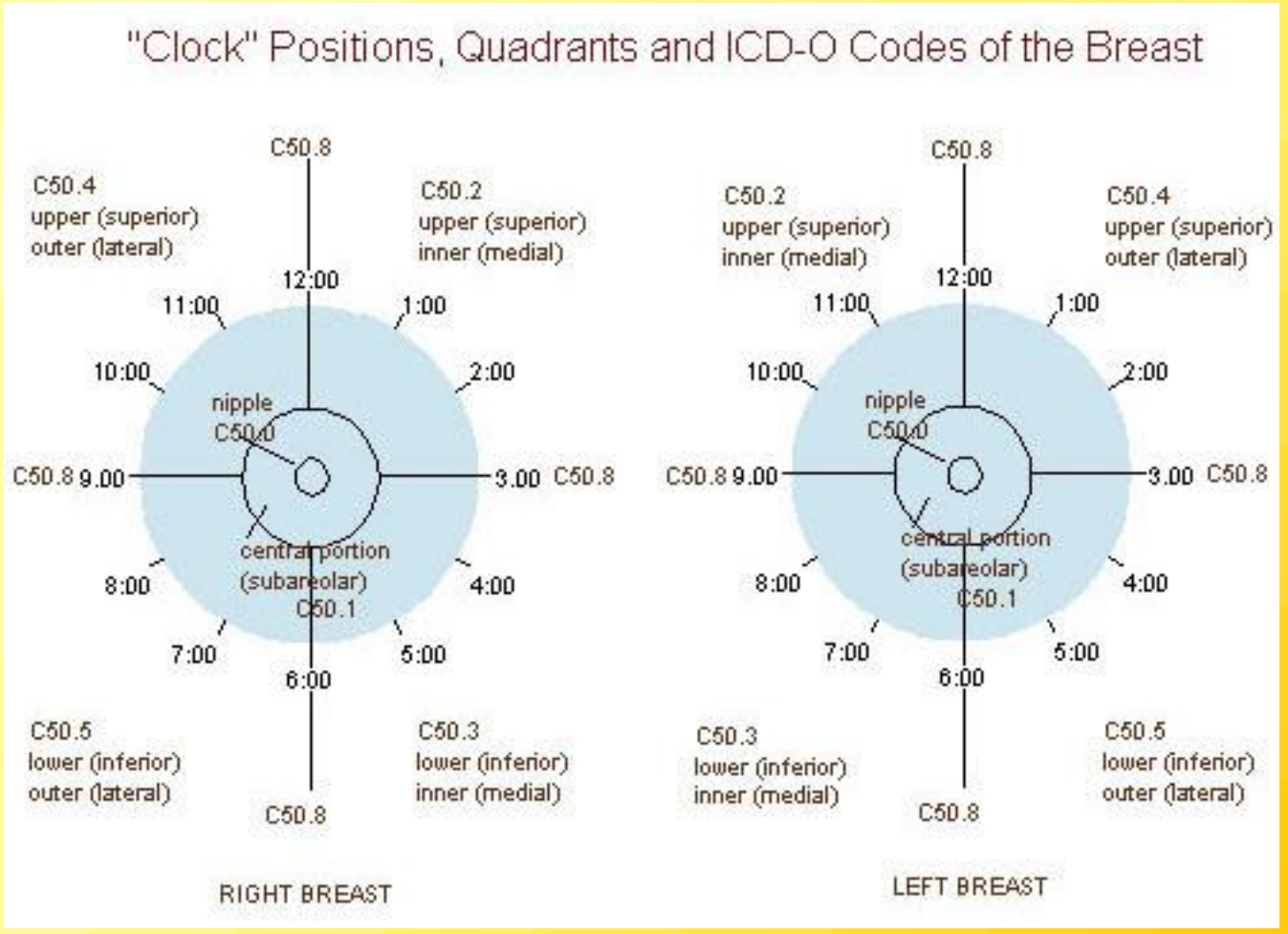
INNERVATION OF THE BREAST

Anterior & lateral cutaneous branches of the 4th-6th intercostal nerves

- sensory fibers from the skin of the breast
- sympathetic fibers to the blood vessels in the breasts
- smooth muscle in the overlying skin and nipple



BREAST QUADRANTS



BREAST CANCER

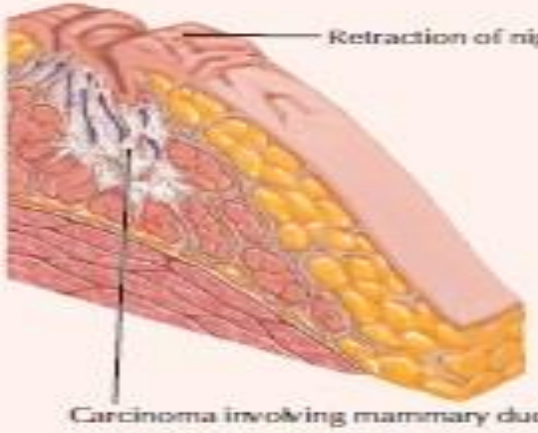
most common cancer among women, other than skin cancer
second leading cause of cancer death in women, after lung cancer

Chance of a woman having an invasive breast cancer some time during her life about 1 in 8

Understanding the lymphatic drainage of the breasts is of practical importance in predicting the metastasis (dispersal) of cancer cells from a carcinoma of the breast (breast cancer).

spreads by means of lymphatic vessels (lymphogenic metastasis), which carry cancer cells from the breast to the lymph nodes, chiefly those in the axilla

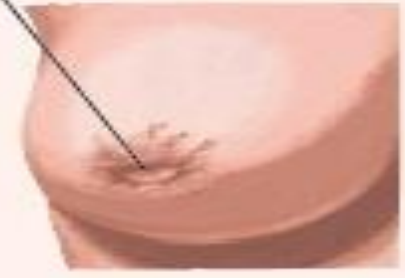
Carcinomatous involvement of mammary ducts may cause duct shortening and retraction or inversion of nipple.



Skin edema

Involvement and obstruction of subcutaneous lymphatic by tumor result in lymphatic dilatation and lymph accumulation in the skin. Resultant edema creates "orange peel" appearance due to prominence of skin gland orifices.

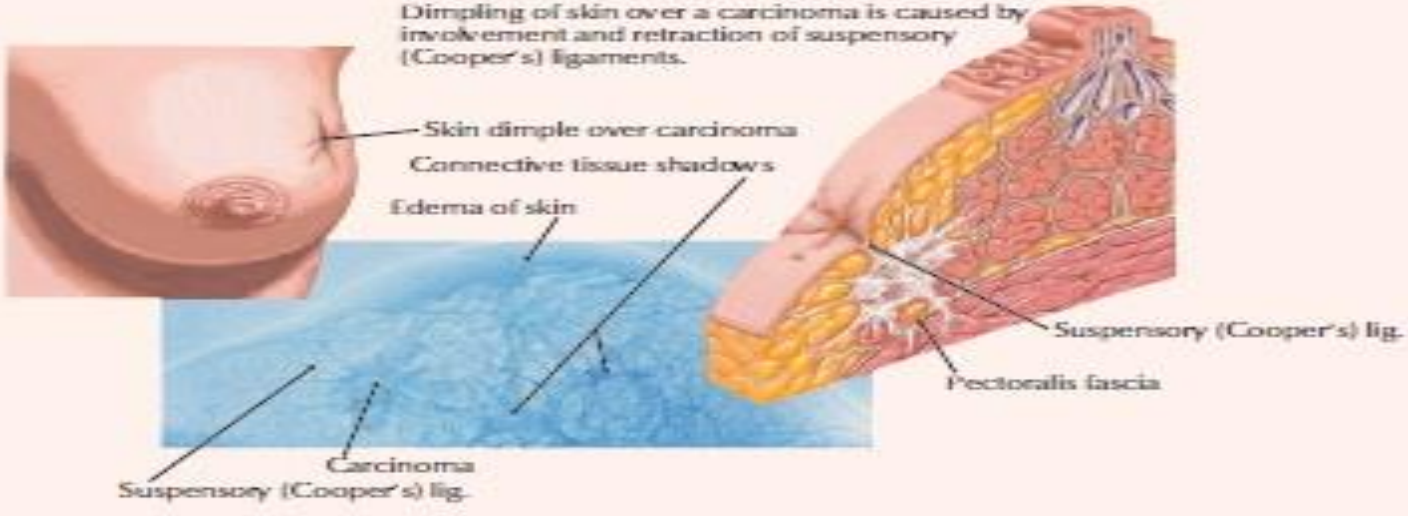
Retraction of nipple



JOHN A. CRAIG, M.D.

Skin dimpling

Dimpling of skin over a carcinoma is caused by involvement and retraction of suspensory (Cooper's) ligaments.



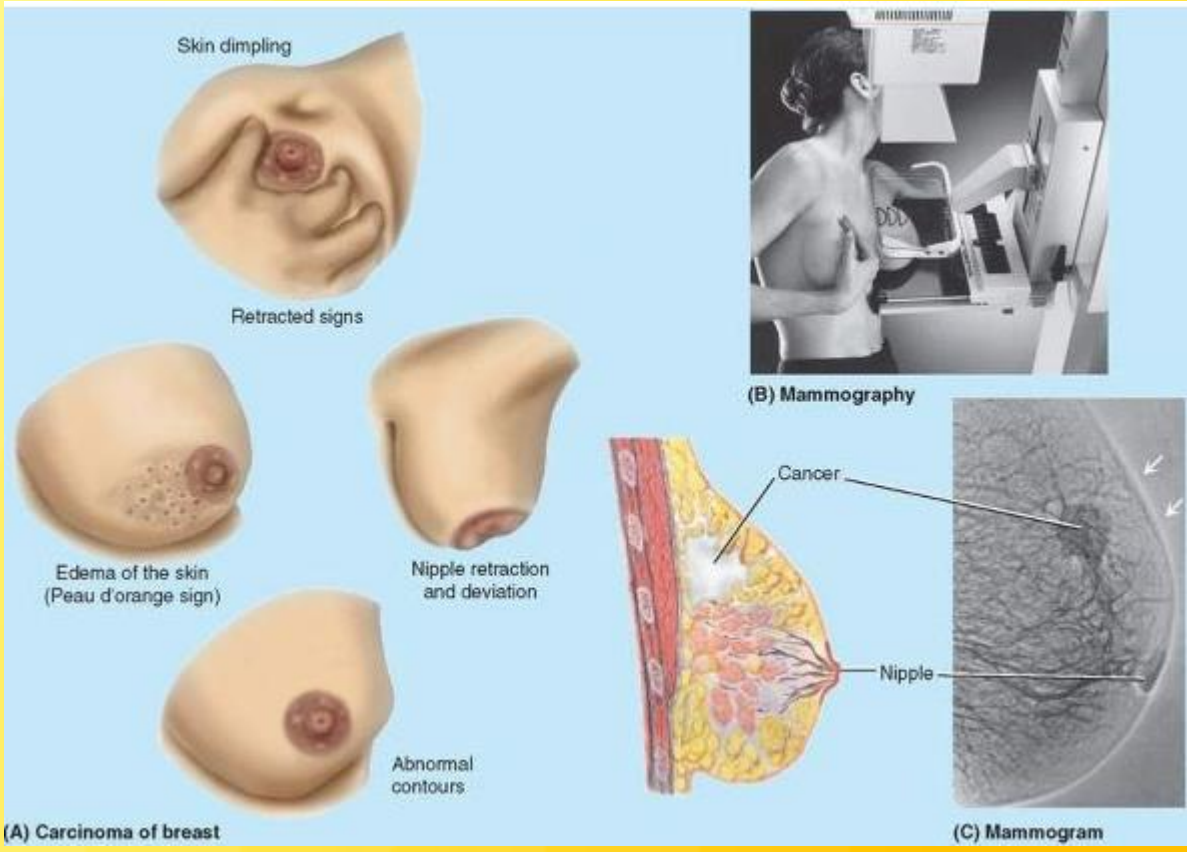
MAMMOGRAPHY

Digital mammograms replacing conventional film mammography

younger women with dense breast tissue benefit most from this type of mammography.

Surgeons use mammography as a guide when removing breast tumors, cysts, and abscesses.

jagged density in the mammogram. The skin is thickened over the tumor and the nipple is depressed



MASTECTOMY

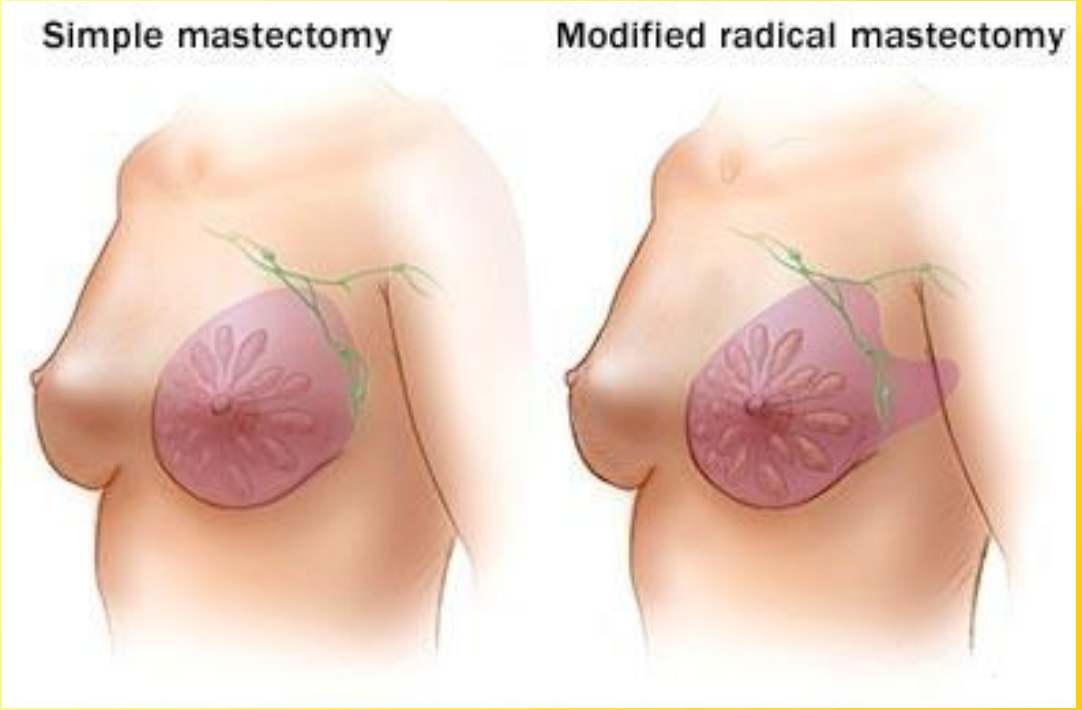
breast excision

simple mastectomy

breast is removed down to the retromammary space.

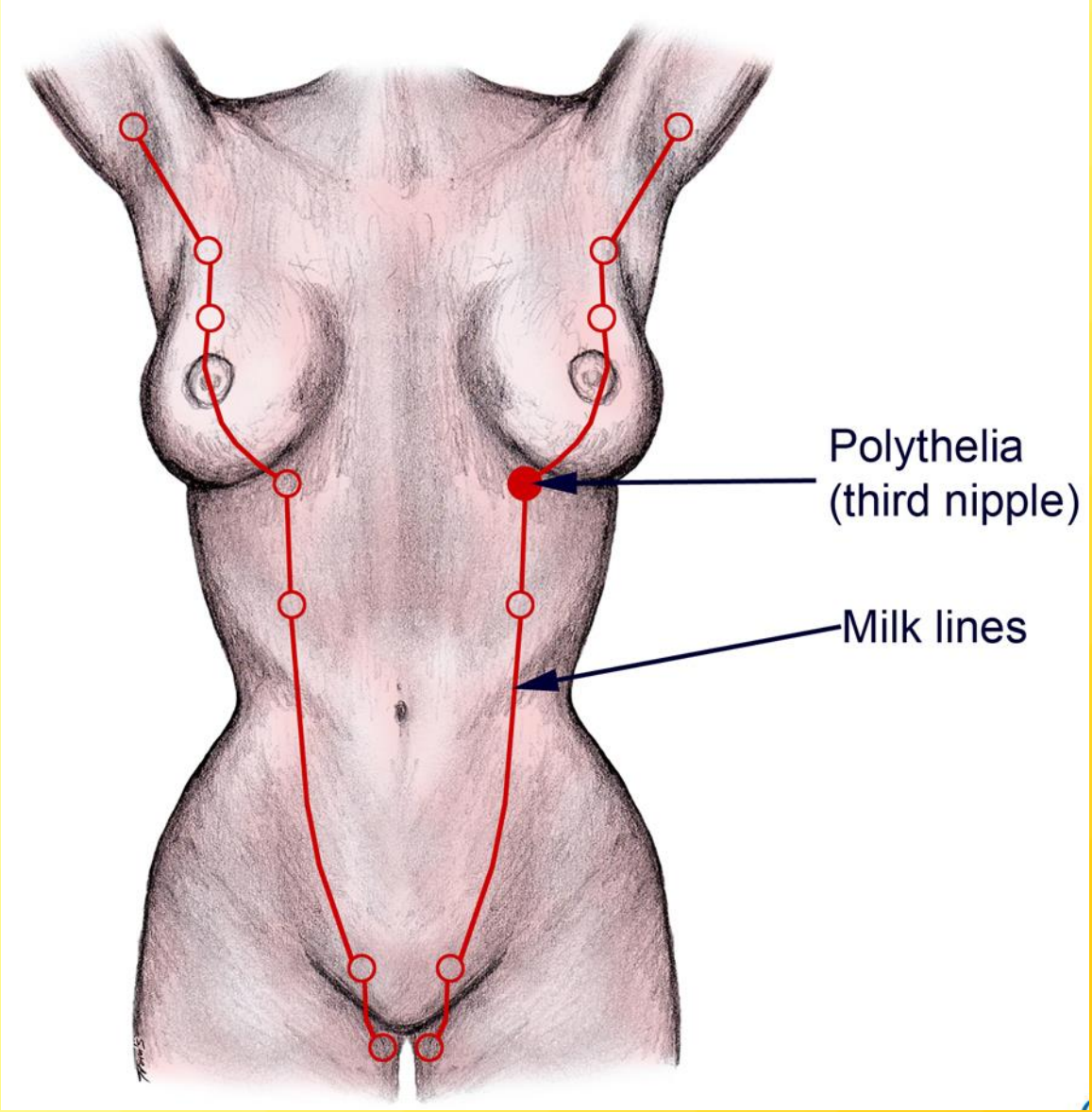
radical mastectomy more extensive surgical procedure

removal of the breast, pectoral muscles, fat, fascia, and as many lymph nodes as possible in the axilla and pectoral region.

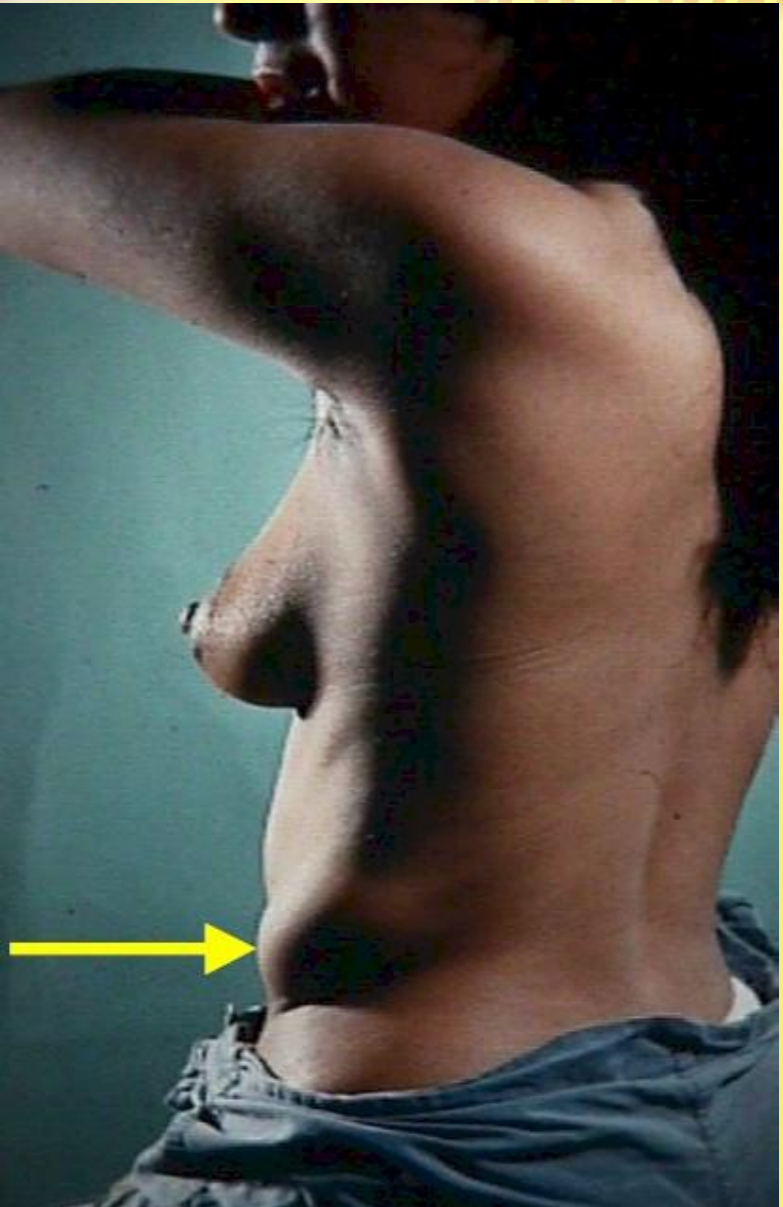


POLYTHELIA

accessory nipples



POLYMASTIA
SUPERNUMERARY BREASTS



- rudimentary nipple & areola
- mistaken for a mole (nevus)

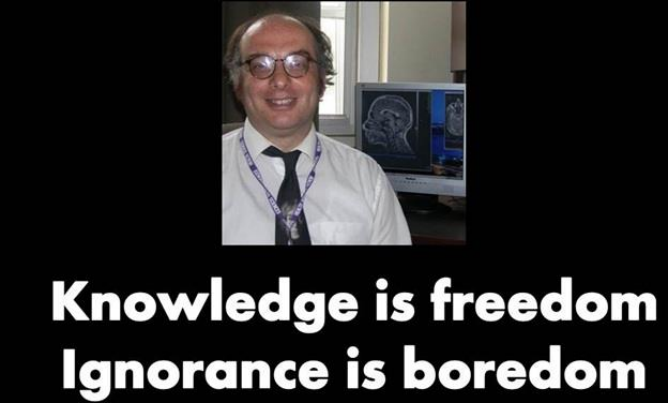
anywhere along a line extending from the axilla to the groin—**embryonic mammary crest (milk line)** from which the breasts develop.

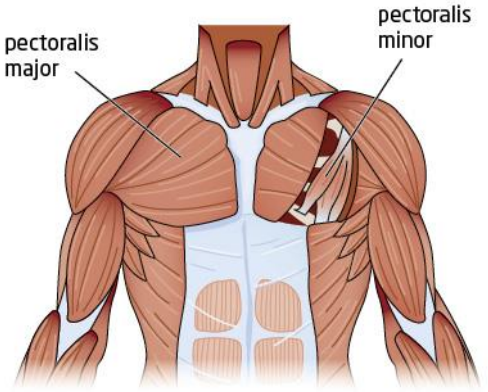
Polymastia

AMASTIA

no breast development

There may be a nipple and/or areola, but no glandular tissue.



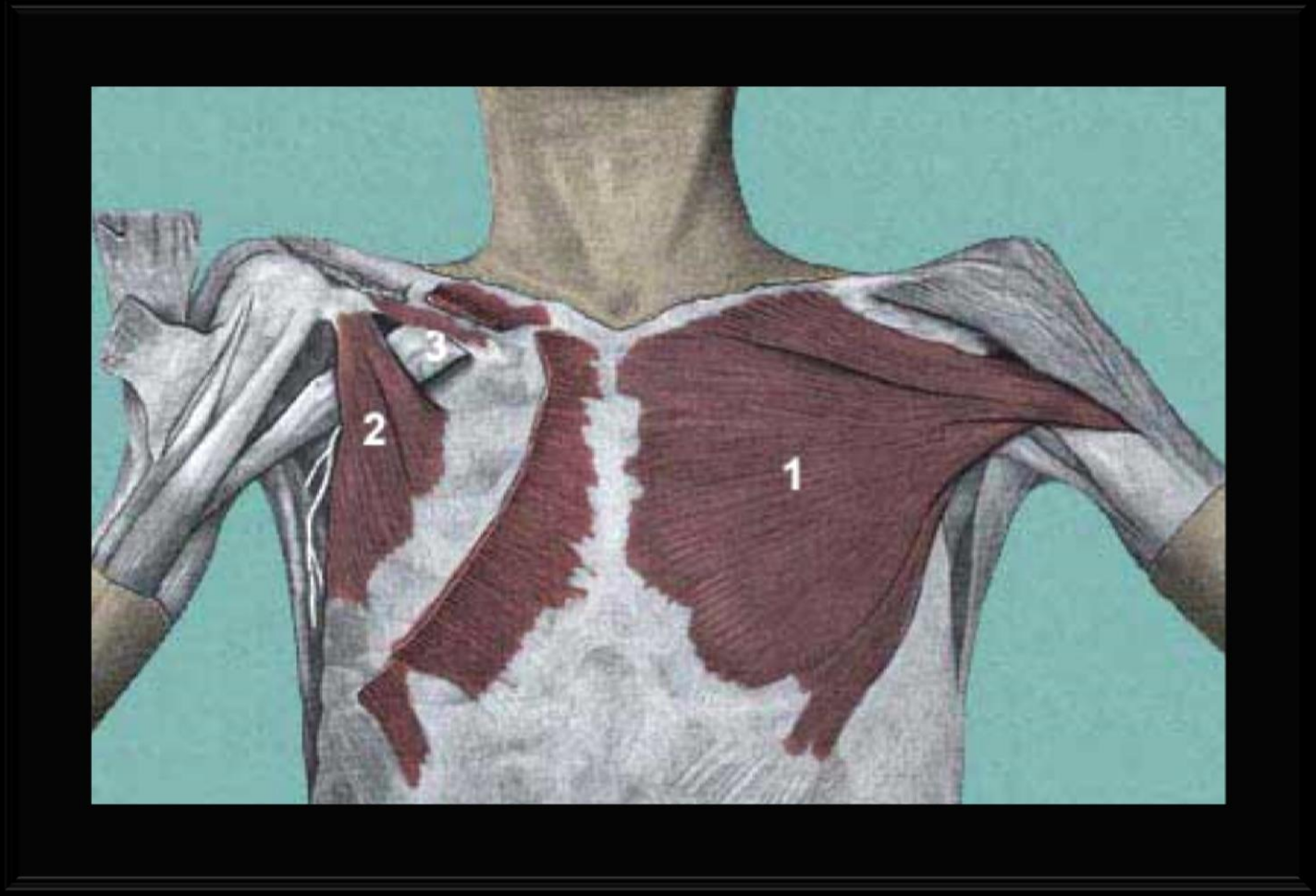


PECTORAL REGION

IN 8 QUESTIONS

1. Where is the pectoral region?

The pectoral region is external to the anterior thoracic wall and anchors the upper limb to the trunk.



2. What does the pectoral region consist of?

Superficial compartment

Contains skin, superficial fascia, breasts

Deep compartment

Contains muscles & associated structures

3. What are the muscles of the pectoral region?

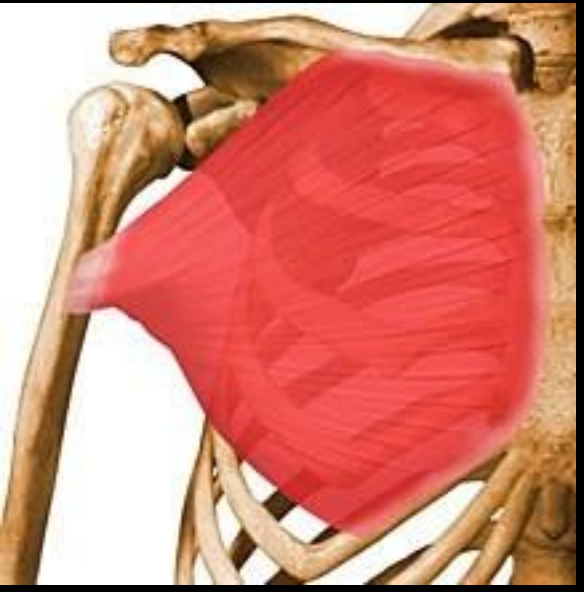
Four pectoral muscles move the pectoral girdle

Pectoralis major

Pectoralis minor

Serratus anterior

Subclavius



Pectoralis major

Serratus anterior

Pectoralis minor

4. What movements does the pectoralis major muscle ?

Pectoralis major
powerful adduction
medial rotation of the arm

clavicular head flexing the humerus

sternocostal head extending it back

5. What movements do pectoralis minor & subclavius ?

Pectoralis minor

stabilizes the scapula

touch an object that is just out of reach.

Assists in elevating the ribs

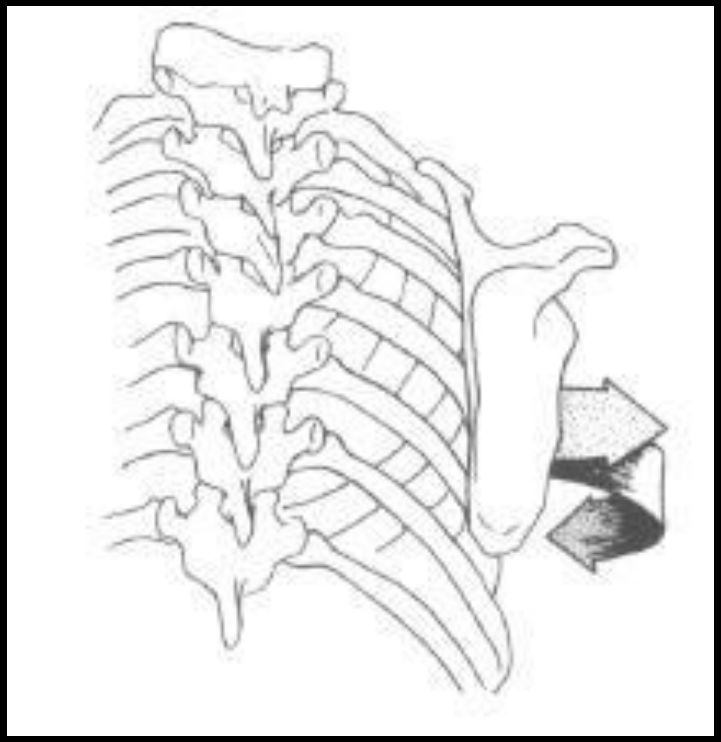
Subclavius

Anchors and depresses the clavicle, stabilizing it during movements of the upper limb.

6. What movements does the serratus anterior ?

one of the most powerful muscles of the pectoral girdle

- Strong protractor of scapula – **Abduction**
- used when punching or reaching anteriorly(boxer's muscle).



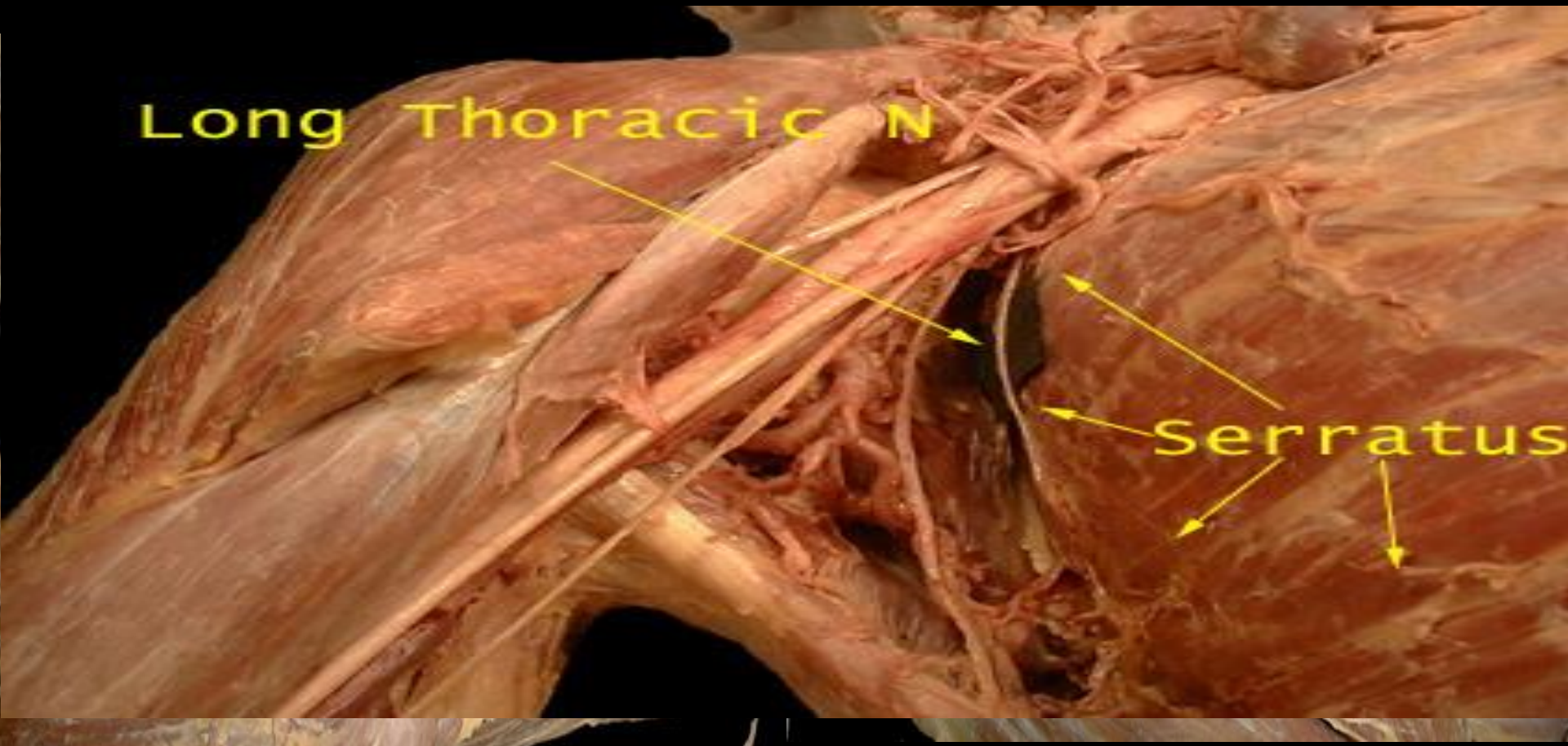
7. How are these muscles innervated?

Pectoralis major Medial & Lateral pectoral nerves

Pectoralis minor Medial pectoral nerve

Subclavius Nerve to subclavius

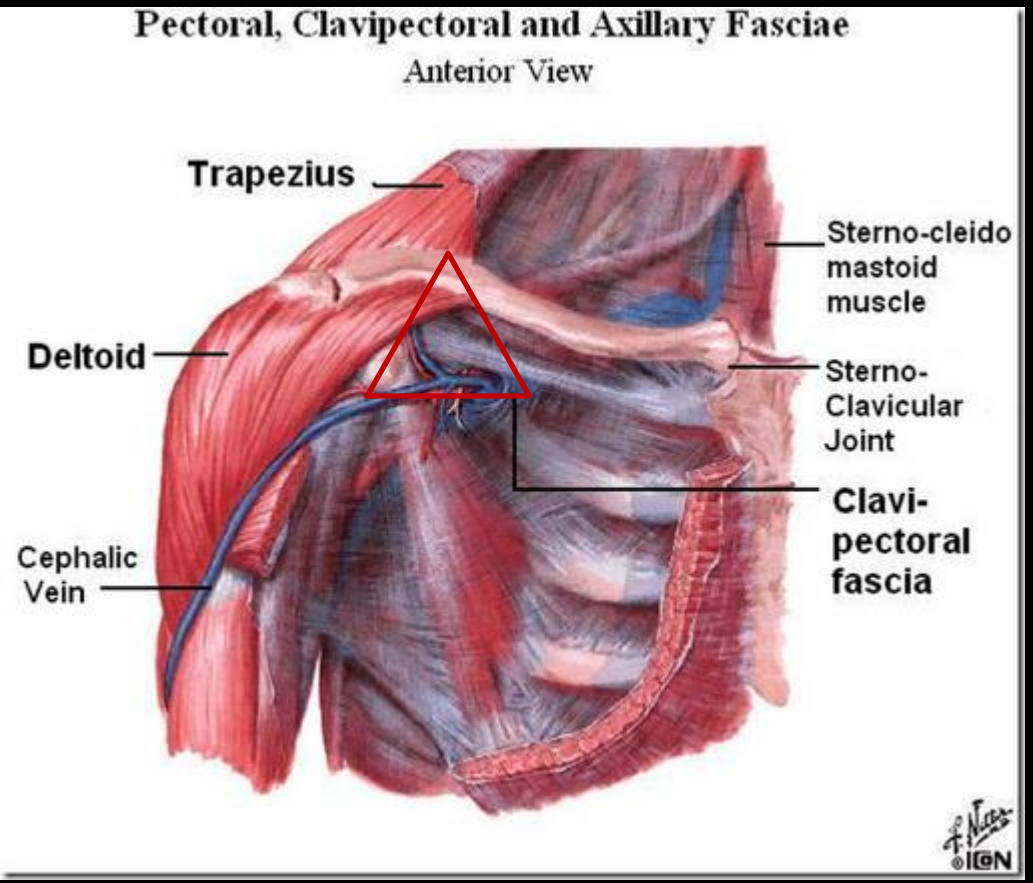
Serratus anterior Long thoracic nerve



8. ..the claviopectoral fascia and triangle?

Deep to the pectoral fascia & pectoralis major

Descends from the clavicle



Clavipectoral triangle

cephalic vein can be found.

formed by pectoralis major, deltoid & clavicle

Deltopectoral groove

Where are the mammary glands?

In the subcutaneous tissue overlying the pectoralis major and minor muscles.

lateral border of the sternum to the midaxillary line vertically from the 2nd through 6th ribs.