

# Thoracic Anatomy

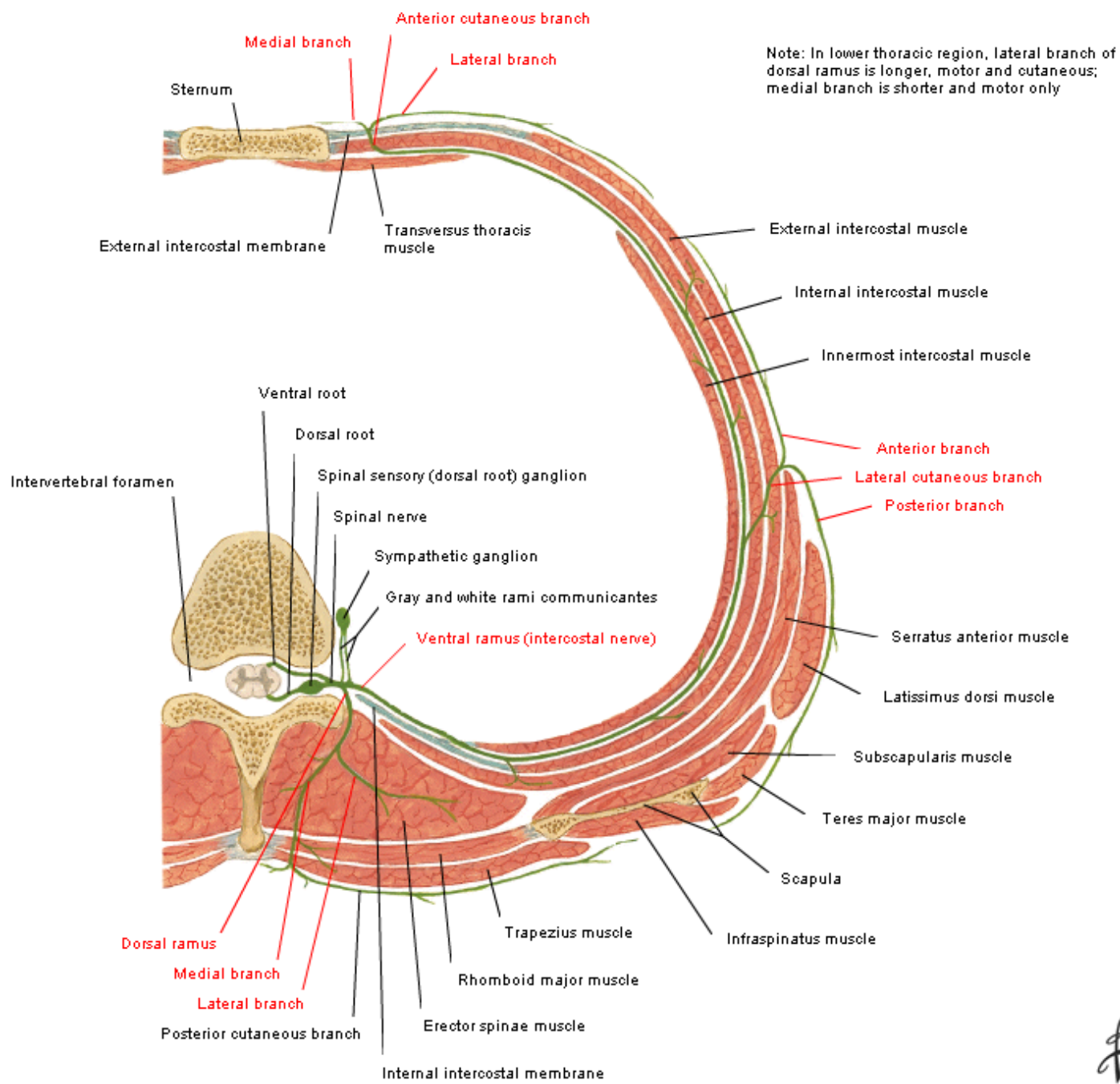
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# BODY WALL – innervated by spinal nerves

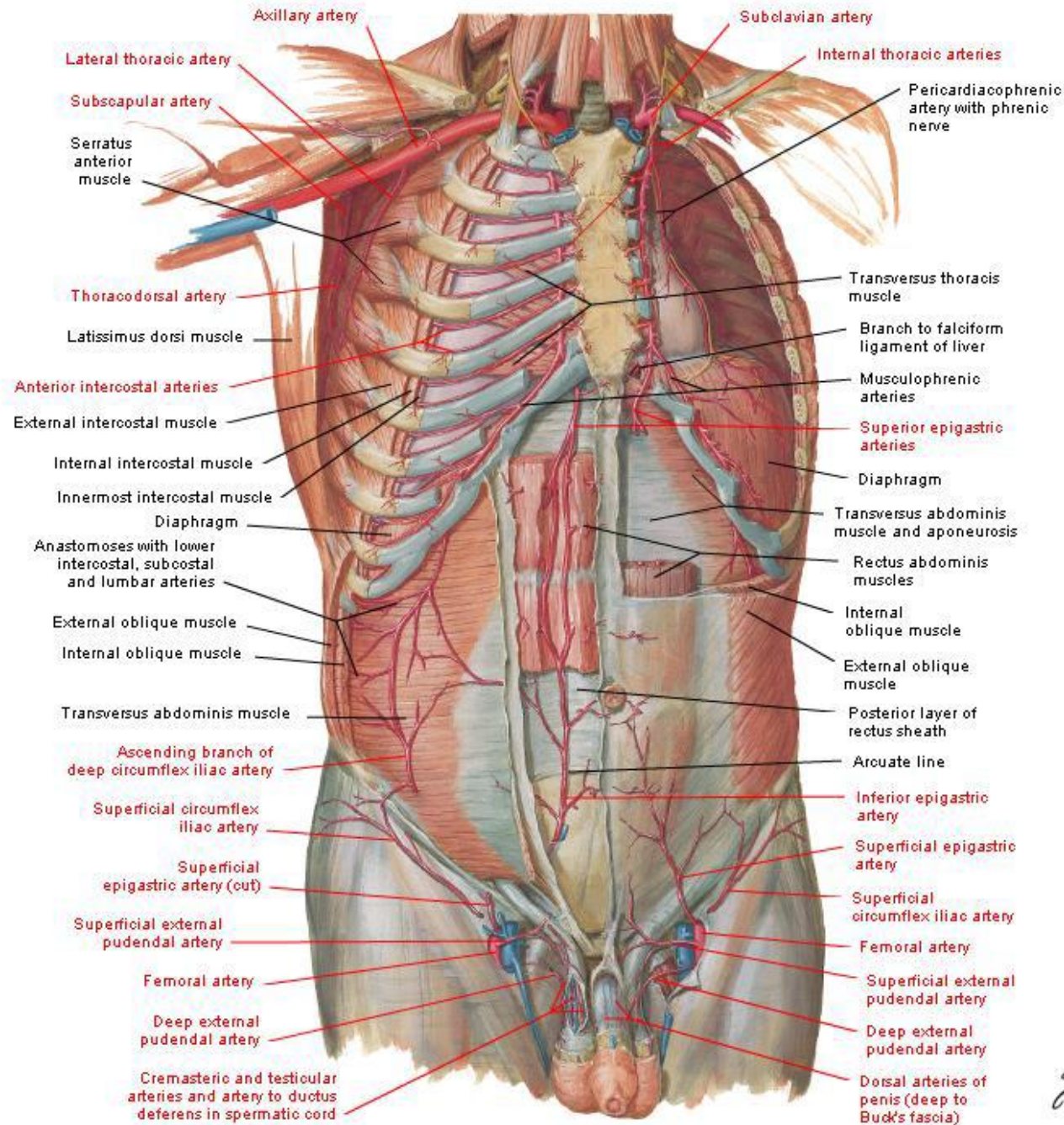
- **Anterior Rami:** supply all other muscles of **trunk and limbs** and the **skin at the sides and front of neck and body**
  - o C1: No cutaneous branch
  - o C2,3,4: supply skin in neck by cervical plexus
  - o C5,6,7,8,T1: supply skin of upper limb by brachial plexus
  - o T2-L1: supply skin of trunk segmentally
  - o Muscles supplied below L1 are in lower limb
- Supply the prevertebral flexor muscles segmentally by separate branches from each nerve
- The anterior rami of the lower 4 cervical and first thoracic supply muscles via brachial plexus
- T1-12 and L1 supply muscle of body wall segmentally
- Each intercostal nerve supplies its intercostal space
- Lower 6 thoracic nerves pass beyond costal margin obliquely to supply muscles of anterior abdo wall
- The lowermost spinal nerve to supply the ant abdo wall iliohypogastric and ilioinguinal nerve (L1)
- Intercostal nerve have a **lateral branch** to supply the side and an **anterior terminal branch** to supply the front of the body wall

- **Posterior Rami:** pass backwards and supply the **extensor muscles of vertebral column** and **skull** and **varying degree of skin**
  - Erector spinae
  - Transversospinalis groups that lie deep to thoracolumbar fascia
  - The Levator costae muscles
  - In the neck → Splenius and all muscles deep to it
  - Has medial and lateral branches – both supply muscle only one supplies cutaneous branches
  - Upper body – medial branch to skin
  - Lower body – lateral branch to skin
- **C1 NO cutaneous branch**
- The posterior branch of the lower 2 nerves in the cervical and lumbar regions of the cord fail to reach skin
- **ALL 12 thoracic and 5 sacral nerves reach the skin**
- No posterior ramus ever supplies skin or muscle of a limb

# Typical Thoracic Spinal Nerve



# Arteries of Anterior Abdominal Wall



# THORACIC CAGE

- The skeleton of the thoracic wall consists of 12 thoracic vertebrae, 12 pairs of ribs and costal cartilages and the sternum.
- **Thoracic cavity** – **roofed in** above lung apices by **suprapleural membrane** and **floored by diaphragm**
- Ribs articulate with vertebral column in 2 places → **Costovertebral Joint**
- At the front the ribs join costal cartilages → **Costochondrial joint**
- Upper 7 ribs articulate with sternum → **Sternocostal joint**
- Next 3 Ribs articulate with each other → **Interchondral joint**
- **The 7th and 8th** costal cartilage complete the **costal margin**
- Ribs 11,12 = Free

## Costovertebral joint

- Each facet makes a small synovial joint with a demifacet of a vertebral body
  - **Inferior facet** → fuses with **super costal facet** of its **own** vertebre
  - **Superior facet** → fuses with inferior costal facet of vertebre above
- **Intra-articular ligament**: attaches rib to intervertebral disc. Reinforced by **radiate ligament** → upper, central and lower band

## Costotransverse (CT) joint

- Articular facet of rib articulates with near tip of TP of its own vertebrae. 3 ligaments:
  - **Lateral CT ligment** → Runs from non-articular facet to the tip of TP
  - **CT ligament** → Runs between back of neck of rib and front of TP
  - **Superior CT ligament** → between crest of neck to undersurface of TP above

## Costochondral Joint

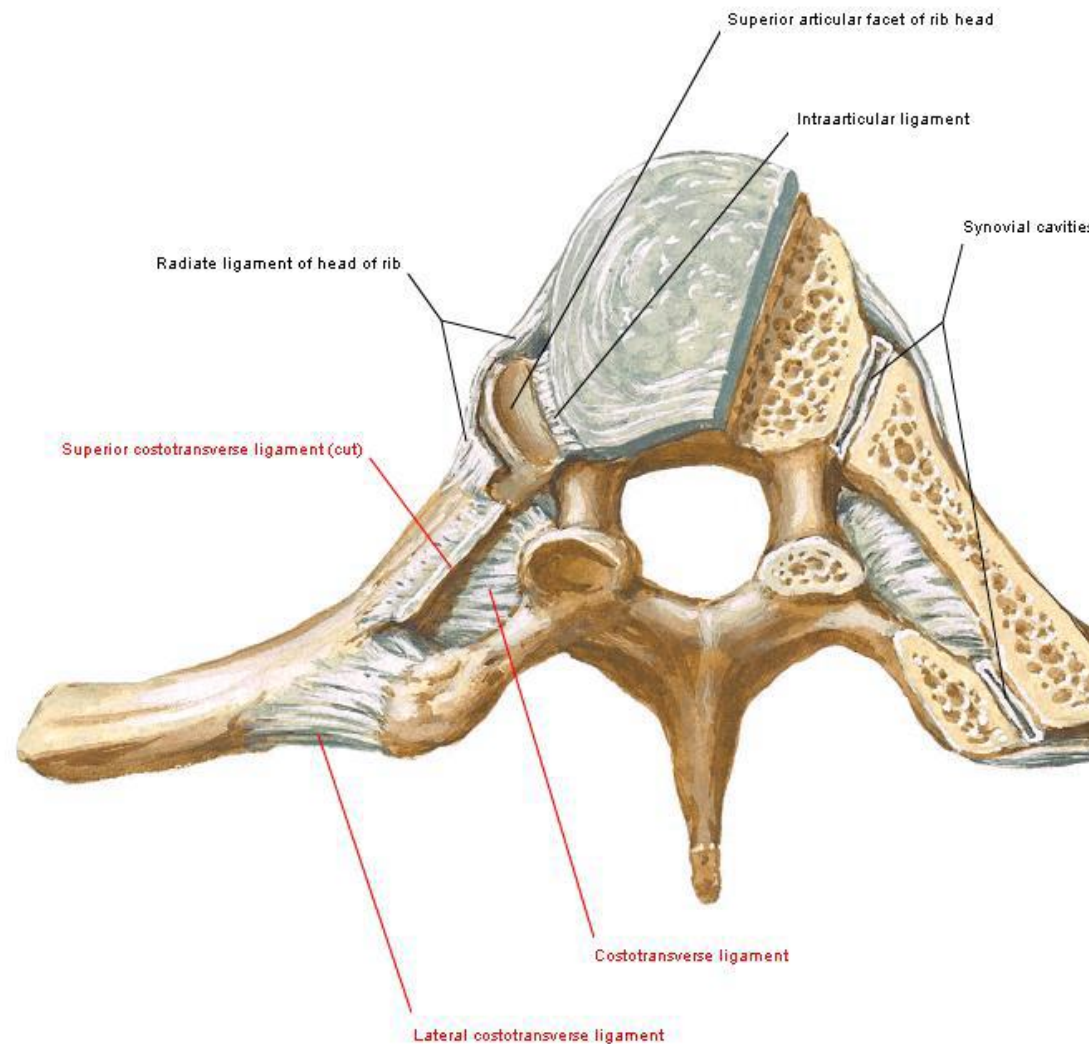
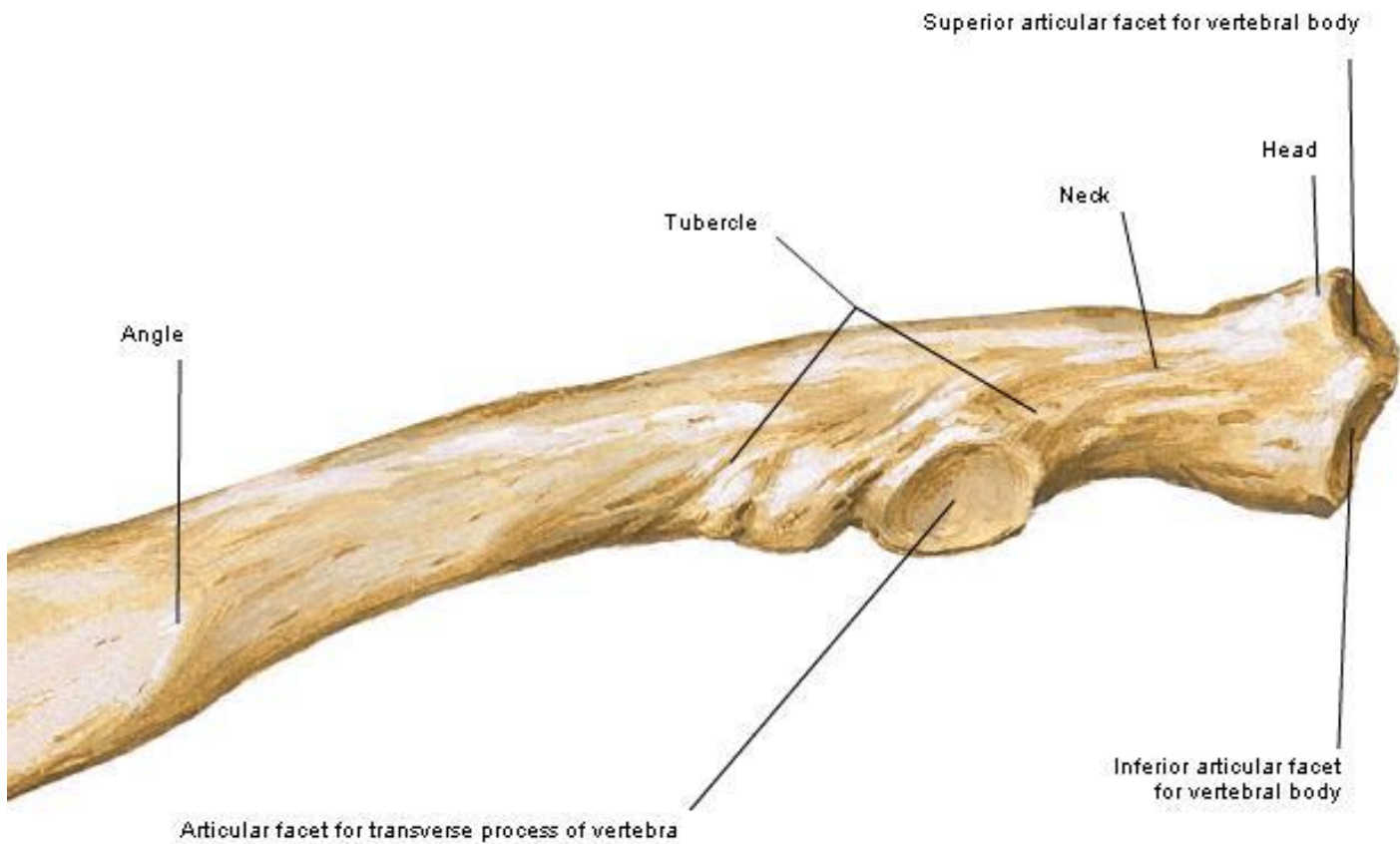
- Every rib makes with its costal cartilage a primary cartilaginous joint. The costal cartilage is no more than the unossified anterior part of the rib

## Interchondral joint

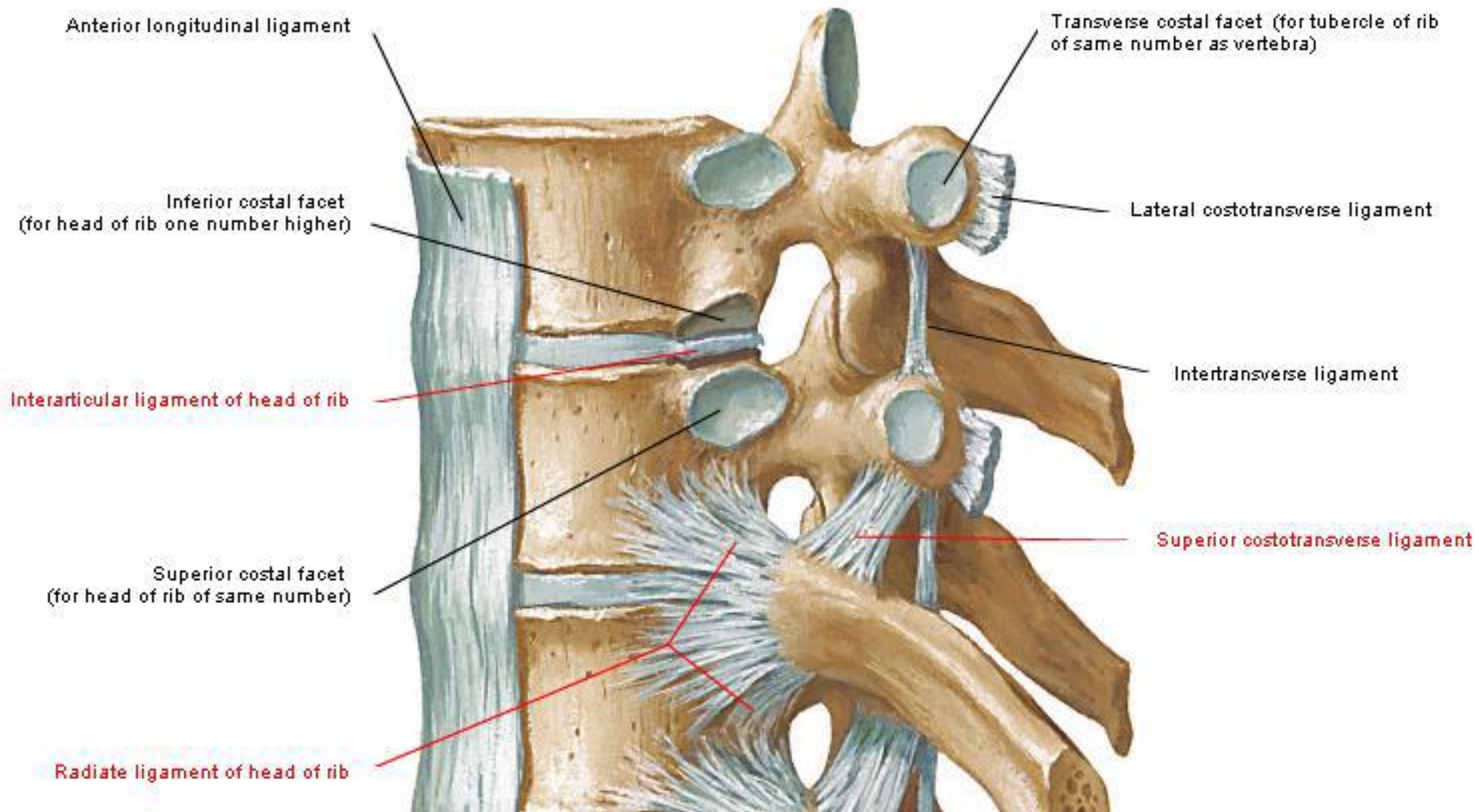
- Costal cartilages 6&7, 7&8, 8&9 are joined by small synovial joint. 9&10 joined by ligamentous fibres

## Sternocostal joint

- The 1st CC articulates with the manubrium by a primary cartilaginous joint. Thus the 1st ribs are fixed and move together with sternum as one
- The next six CC each articulate with the sternum by a synovial joint



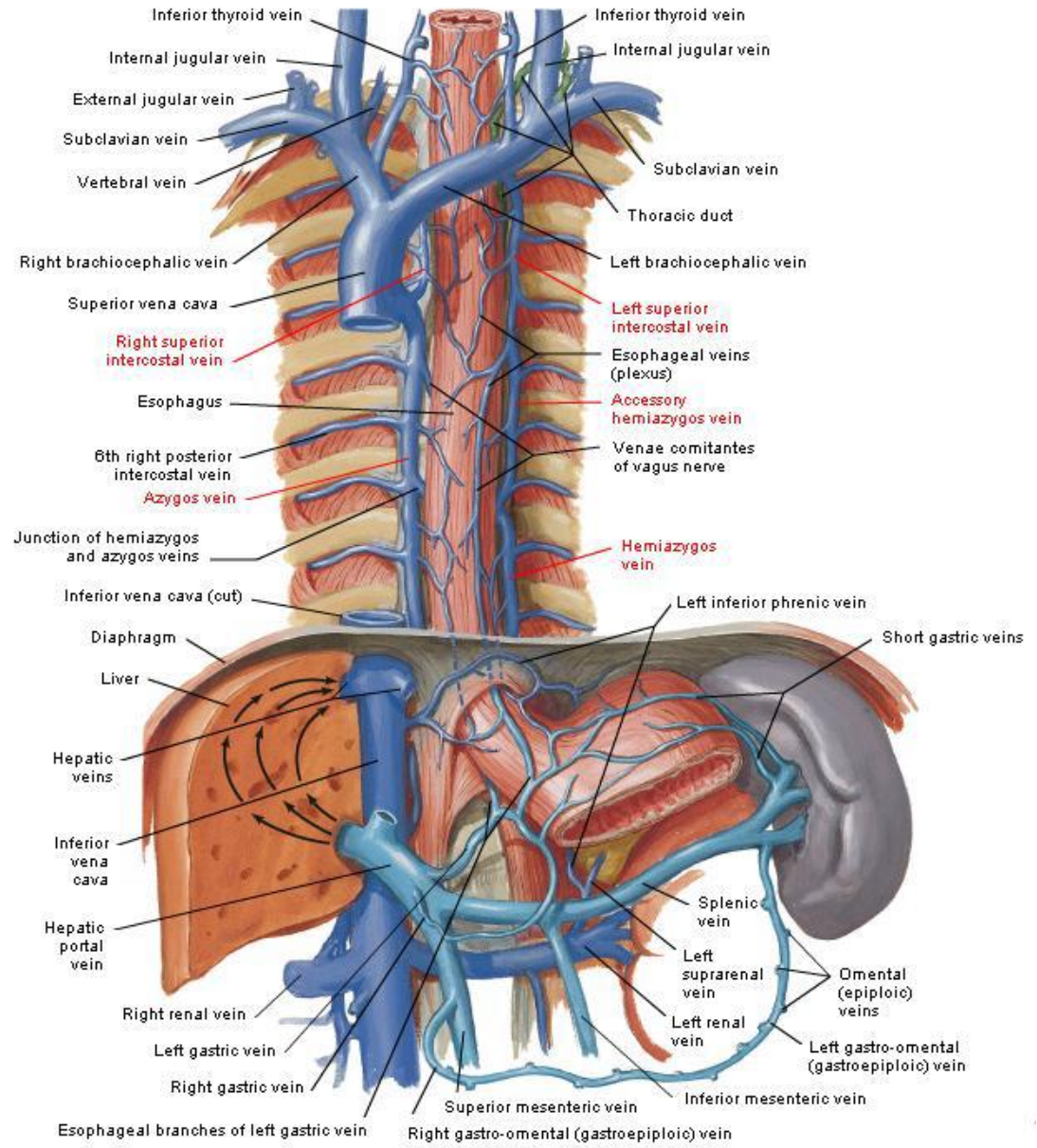
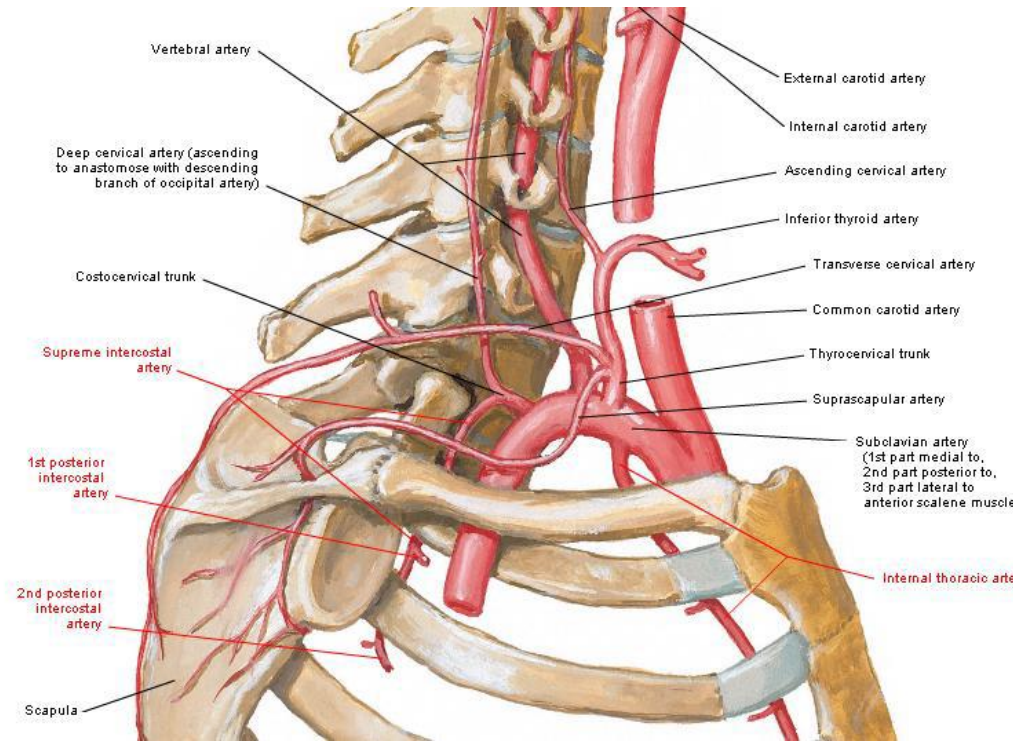




# THORACIC MUSCLES

- Lie in 3 morphological layers (as those of abdominal wall). But in thoracic region have
- become divided by presence of ribs. Innervated segmentally by anterior rami.
- **1. External intercostal** muscles (*outer layer*)
- **2. Internal intercostals** (*middle layer*)
- **3. Inner layer** → (broken into 3 muscles) (*inner layer*)
  - Subcostals (posterior)
  - Innermost intercostals (lateral)
  - Transversus thoracis (anterior)
- *Note: middle and inner layer = neurovascular plane*

- **Superior (supreme) intercostals artery**
  - Descends from costocervical trunk
  - Enters thorax by passing across the front of the neck of the 1st rib
  - Supplies upper two spaces
- **Posterior intercostal arteries**
  - Supplies remaining 9 intercostal spaces
- **Anterior intercostals arteries**
  - Br of the *internal thoracic* (upper 6 spaces) and the *musculophrenic artery* in the (7,8,9th spaces)
  - NO anterior intercostal artery in last 2 spaces
  - They pass back to anastomose with posterior intercostal arteries
- **1 posterior** and **2 anterior** intercostals veins in each space, accompany arteries
- The **Anterior intercostals** vein drain into **musculophrenic** and **internal thoracic veins**
- Posterior intercostal veins
  - Lower 8 spaces drain into the azygos system
- The 2, 3 and sometimes the 4th posterior intercostals veins forms a single **Superior intercostals veins**
  - Right → Azygos
  - Left → left brachiocephalic vein

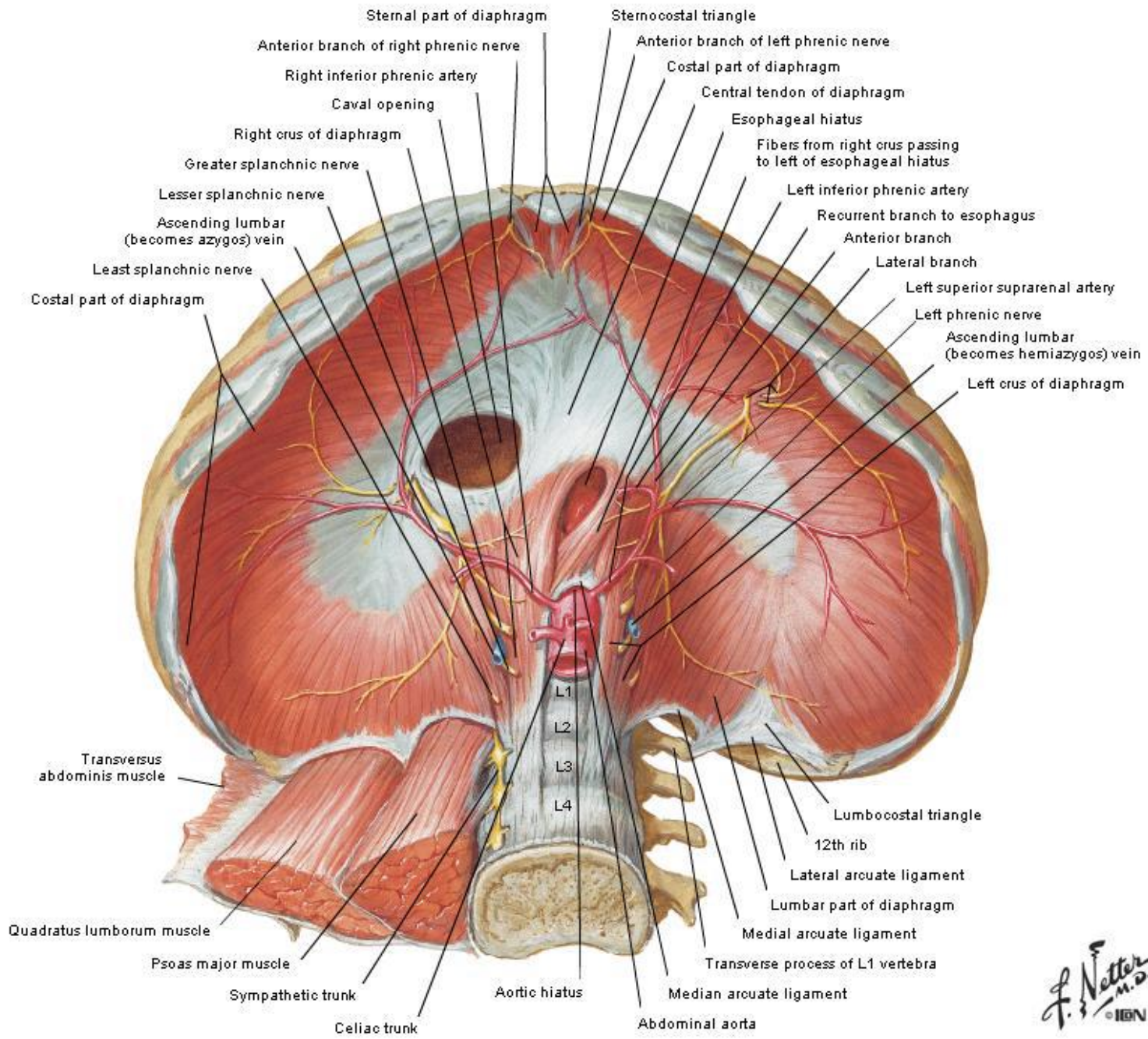


# DIAPHRAGM

- Domed fibromuscular sheet, separates thoracic and abdominal cavity
- Morphologically a derivative of the inner layer of body wall muscle
- Arise from continuity of TA and completed behind by the costal fibres that arise from the arcuate ligaments and crura
- Descends to a central tendon at level of xiphisternal joint
- **Crura** → strong tendons attached to ant-lateral surfaces of upper lumbar vertebrae
  - **Right crus:** Fixed to upper 3 lumbar vertebrae and intervening discs
  - **Left crus:** Fixed to upper two lumbar
- *Median arcuate ligament:* where each crus unite in front of each other at T12
- *Medial arcuate ligament:* thickening of psoas fascia
- *Lateral arcuate ligament:* thickening of the anterior layer of the lumbar fascia on the front of quadratus lumborum
- **Central tendon:** trefoil shape, inseparable from the fibrous pericardium

# Diaphragm

## Abdominal Surface



*F. Netter M.D.*  
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Vertebrae	Opening	Contents
<b>T8</b> 8= vena cava	Vena Cava Opening	<ul style="list-style-type: none"> <li>• Vena Cava</li> <li>• Right Phrenic</li> </ul>
<b>T10</b> 10 = Oesophagus	Oesophageal opening (2.5cm to the left of midline, in the fibres of the left crus)	<ul style="list-style-type: none"> <li>• Vagal trunks</li> <li>• Oesophageal branches of left gastric</li> <li>• Veins</li> <li>• Lymphatics</li> </ul>
<b>T12</b> At bottom Aorta	Aortic Opening (Behind median arcuate liagment)	<ul style="list-style-type: none"> <li>• Aorta</li> <li>• Azygos vein to right</li> <li>• Thoracic duct b/w</li> </ul>

- **Blood Supply:**
- Costal Margin → lower 5 intercostal and subcostal arteries
- Abdominal surface → R and L inferior phrenic arteries
- Small supply by → pericardiophrenic and musculophrenic branches
- **Nerve Supply:**
- C3,4,5 (mostly C4)
- Each phrenic supplies each half of diaphragm
- Fibres of the R crus that loop to left are supplied by left phrenic

# MEDIASTINUM

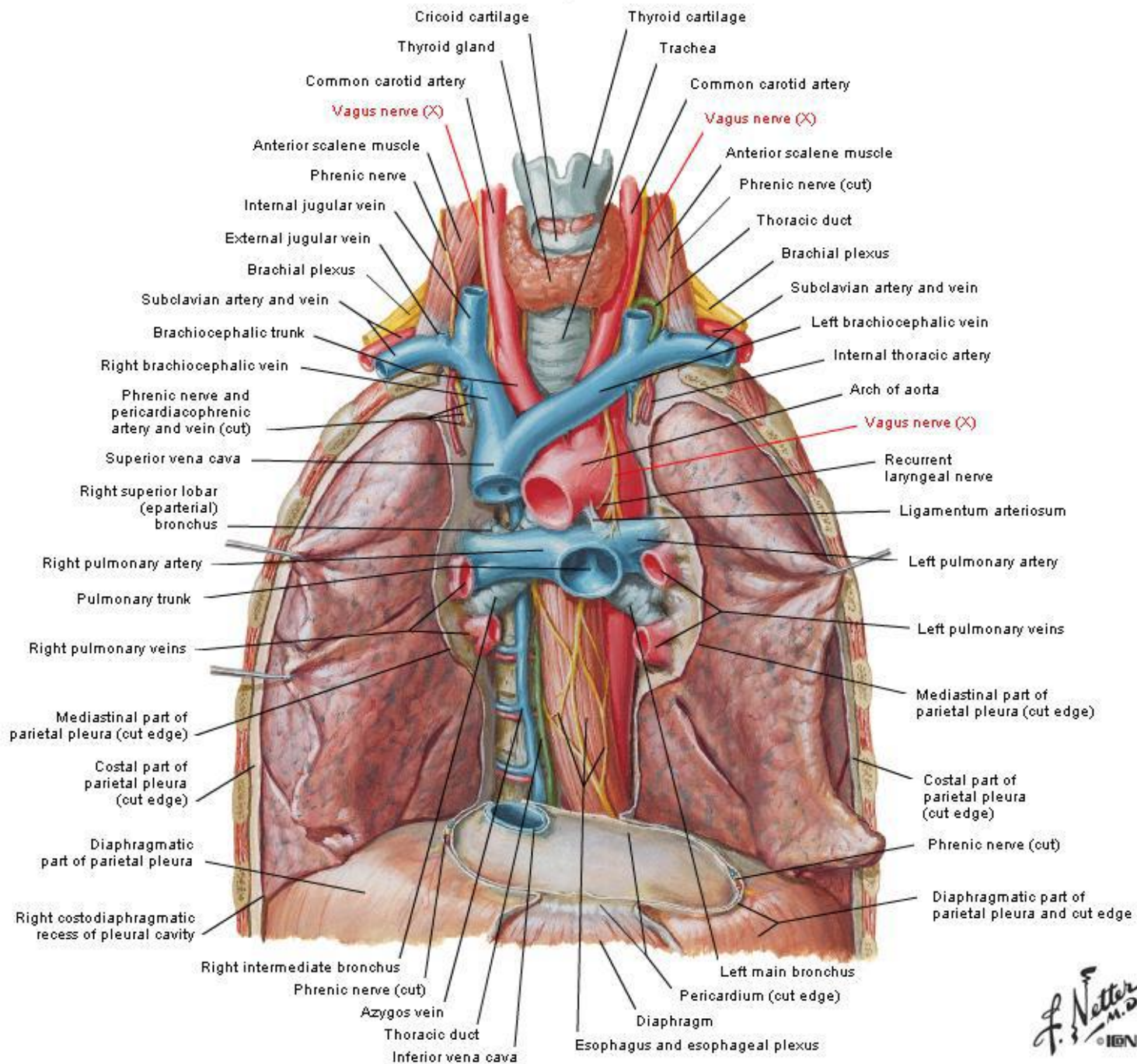
- **Plane of division** = Through Sternal Angle (T4)
- **Superior mediastinum**
- **Inferior mediastinum**
  - Anterior mediastinum (continuous with superior with the pre-tracheal space)
  - Middle mediastinum (contains heart, great vessels and lung roots)
  - Posterior mediastinum (continuous with the superior through the retropharyngeal and paratracheal space of the neck up to the base of the skull)



# SUPERIOR MEDIASTINUM

- ***Anterior Boundary*** = Manubrium
- ***Posterior Boundary*** = First 4 thoracic vertebrae
  
- **Thoracic Inlet (Outlet): CONTENTS**
  - Oesophagus lies against T1
  - Trachea lies on oesophagus and may touch jugular notch
  - Arch of Aorta
  - Ligamentum Arteriosum
  - Brachiocephalic Veins
  - SVC
  - Cardiac Plexus
  - Phrenic and vagus nerves

# Great Vessels of Superior Mediastinum



- **ARCH OF AORTA**

- Becomes arch at manubriosternal joint
- Passes over left main bronchus
- **Reaches T4** just left of mid line
- Gives off **3 great arteries** – Brachiocephalic trunk, Left Common Carotid, Left Subclavian
- Arch is crossed on its **left side by phrenic and vagus nerve as they pass down in front and behind of lung roots respectively**
- Left recurrent laryngeal nerve hooks under ligamentum arteriosum to pass upwards in trachea-oesophageal groove

- **Brachiocephalic trunk (Innominate a)**

- Divides into right CC and right subclavian
- Has no branches except from a rare thyroidea ima artery

- **Left common carotid**

- Has no branches in the mediastinum

- **Left Subclavian**

- Arches over the pleura and apex of lung

- **Ligamentum arteriosum**

- Remnant of the ductus arteriosus
- Passes from the **left pulmonary artery** to the concavity of the **aortic arch, beyond the point where the left subclavian branches off**
- Left recurrent laryngeal nerve hooks round

- **Brachiocephalic Veins**

- Formed by confluence of internal jugular and subclavian veins
- IJ = lateral to the CC artery in front of anterior scalene
- Subclavian vein lies lateral to then in front of lower anterior scalene
- Medial to anterior scalene = Brachiocephalic vein
- The left brachiocephalic vein receives the thoracic duct

- **SVC**

- Commences at lower border of 1st right cc
- Confluence of two brachiocephalic veins
- Pierces pericardium at the level of the 2nd cc
- It receives the azygos vein which has arched forwards over the root of the right lung

# TRACHEA

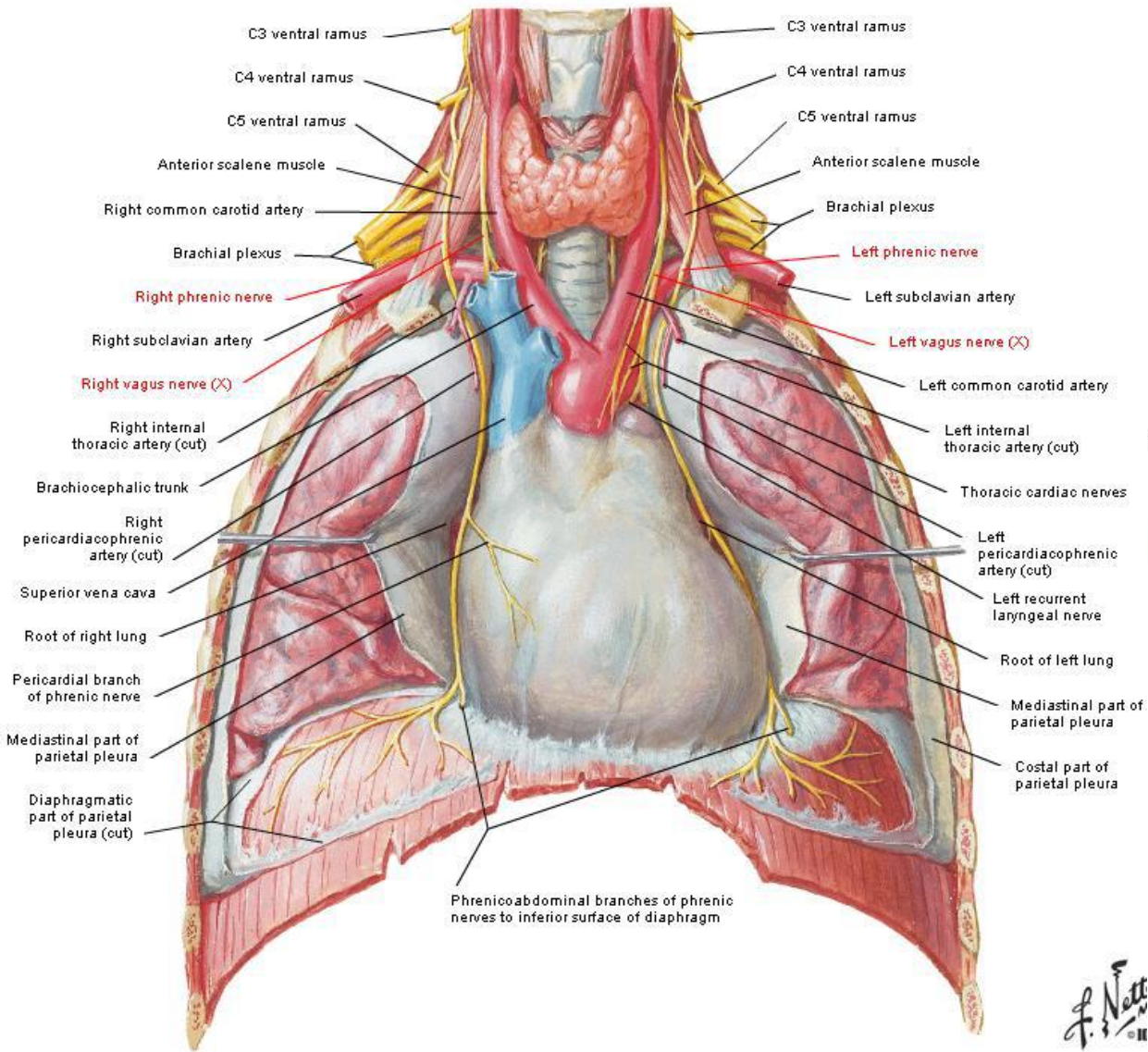
- Continuation of larynx
- Commences below cricoid cartilage at level C6, 5cm above the jugular notch
- 10cm long, 2cm diameter, Enters thoracic inlet midline
- **Bifurcates** into main bronchi at **T5**
- **Right vagus** is in **contact** with the right side of trachea which is separated from the right lung by pleura and the arch of the azygos
- On the left, the **left CC and subclavian prevent** the pleura and the **left vagus** nerve from coming into contact with the trachea

# PHRENIC NERVES

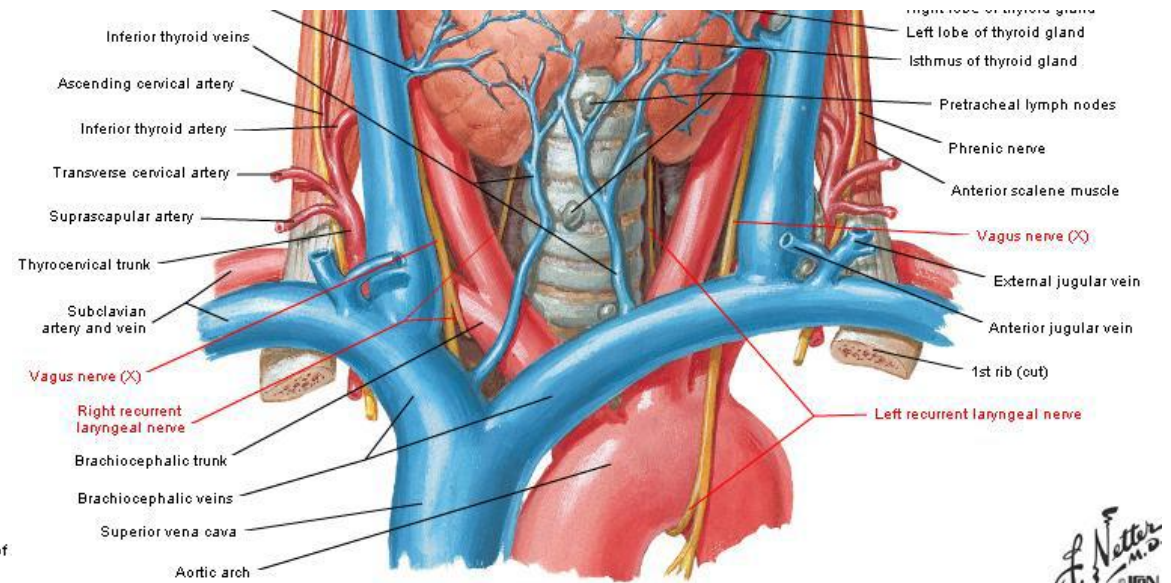
- **Right Phrenic Nerve:**
  - **Related medially with venous structures**
  - R brachiocephalic vein, SVC, pericardium over R atrium lie to its medial side
  - **Passes through diaphragm with IVC**
- **Left Phrenic Nerve:**
  - **Related medially with arterial structures**
  - left common carotid, left subclavian arteries to its medial side, crosses the arch
  - laterally, down the pericardium over the left ventricle, **pierces the diaphragm just**
  - **left of the pericardium**
- \* 2/3 of phrenic is motor to diaphragm
- \* 1/3 sensory to diaphragm, mediastinal pleura, fibrous pericardium, parietal layer of serrous
- pericardium, central part of diaphragmatic pleura and peritoneum

# VAGUS NERVE

- **Right Vagus:**
- In **contact with trachea**, medial to the arch of the azygos vein
- Gives off recurrent laryngeal branch that **hooks around right subclavian artery**
  
- **Left Vagus:**
- **Held away from trachea** by left CC and subclavian
- Crosses arch medial to the left superior intercostal vein
- Over the arch flattens out and gives off its *recurrent laryngeal branch*
- **Hooks over ligamentum arteriosum and passes superiorly between oesophagus and trachea**



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# ANTERIOR MEDIASTINUM

- Potential space between sternum and pericardium
- *Contains*
  - **Thymus**
  - Sternopericardial ligaments
  - Few lymph nodes
  - Branches of the internal thoracic vessels

# MIDDLE MEDIASTINUM

- ***Contains:***
- pericardium and heart
- adjoining parts of great vessels
- lung roots
- Phrenic nerves and deep cardiac plexus

- **HEART**

- Lies obliquely in the thorax

- ***Right border:*** consists entirely of RA

- ***Inferior border:*** mostly of RV with a small amount of LV

- ***Apex:*** LV

- ***Left border:*** LV with auricle of LA forming uppermost surface

- ***Sternocostal surface:*** Consists mainly of RV, bit of RA and LV

- ***Diaphragmatic surface:*** 1/3 RV and 2/3 LV

- ***Posterior surface:*** Entirely of LA

# CORONARY ARTERIES

- **RCA** – Arises from the Anterior Aortic Sinus. **LCA** – Arises from the Left Posterior Aortic Sinus
- **Right Coronary Artery**
  - Runs down the AV groove and turns backwards at the inferior border of the heart and runs posteriorly
- BRANCHES:
  - **Conus Artery:** Highest branch, passes in front of RA
  - **SA nodal artery:** Supplies SA node in about 60% of hearts (remaining 40% from the circumflex)
  - **Right Marginal Artery:** Passes to left along right ventricle
  - **Posterior interventricular branch:** From diaphragmatic surface, supplies apex
- The RCA has a characteristic loop where the posterior interventricular artery is given off the AV nodal artery arises. Eventually anastomoses with the termination of the circumflex branch of the LCA.
- **Left Coronary Artery**
- BRANCHES:
  - **Circumflex:** continues around the left margin of heart to the back in the AV groove
  - **LAD (anterior interventricular artery):** Runs down the interventricular groove to anastomose under the apex with the posterior interventricular branch of the RCA.
  - **Left Marginal:** runs down the rounded left border of heart
- In about 10% of hearts the RCA is shorter thus the circumflex supplies the posterior interventricular area and also the AV node = LEFT DOMINANCE

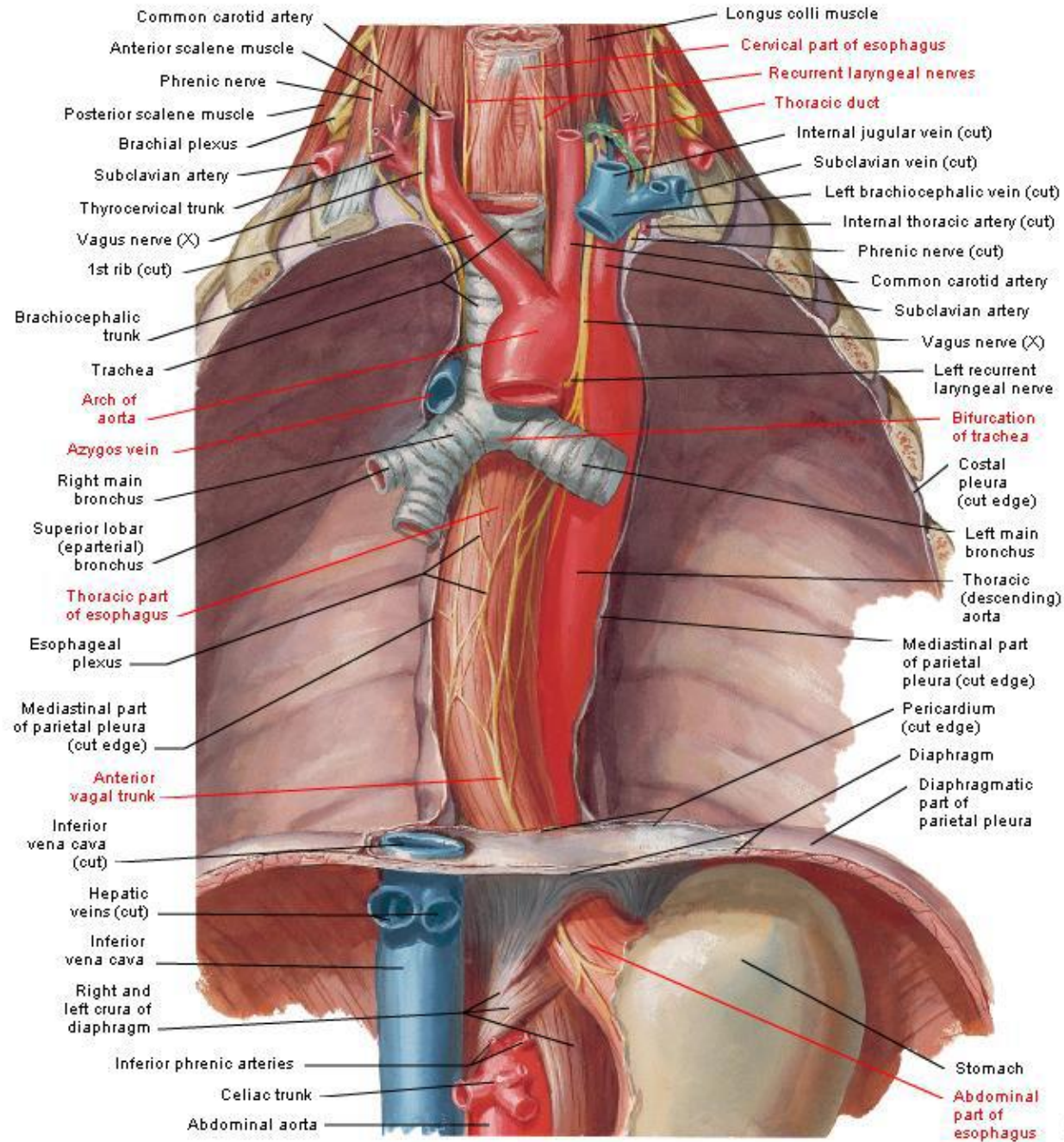
# POSTERIOR MEDIASTINUM

- ***Posterior boundary:*** T5 –T12
- ***Anterior boundary:*** pericardium and sloping border of diaphragm
  
- **Contains**
  - Oesophagus
  - Thoracic aorta
  - Azygos vein
  - Hemiazygos vein
  - Accessory hemiazygos veins
  - Thoracic duct
  - Lymph nodes

# OESOPHAGUS

- **25cm long muscular tube begins** at the lower border of the cricoid cartilage (**C6**)
- Passes through diaphragm at **T10** (7th CC), 2.5cm to the left of midline
  - Here fibres of the right crus sweep around oesophageal opening
- Abdominal oesophagus is about 1-2cm in length
- Ends in the abdomen at the cardiac orificae at T11
- Constrictions
  - circopharyngeal sphincter, 15cm from incisor (C/6)
  - Crossed by arch at 22cm (T4)
  - Left main bronchus 27cm (T5)
  - Opening in the diaphragm at 38cm (T10)

# Esophagus In Situ

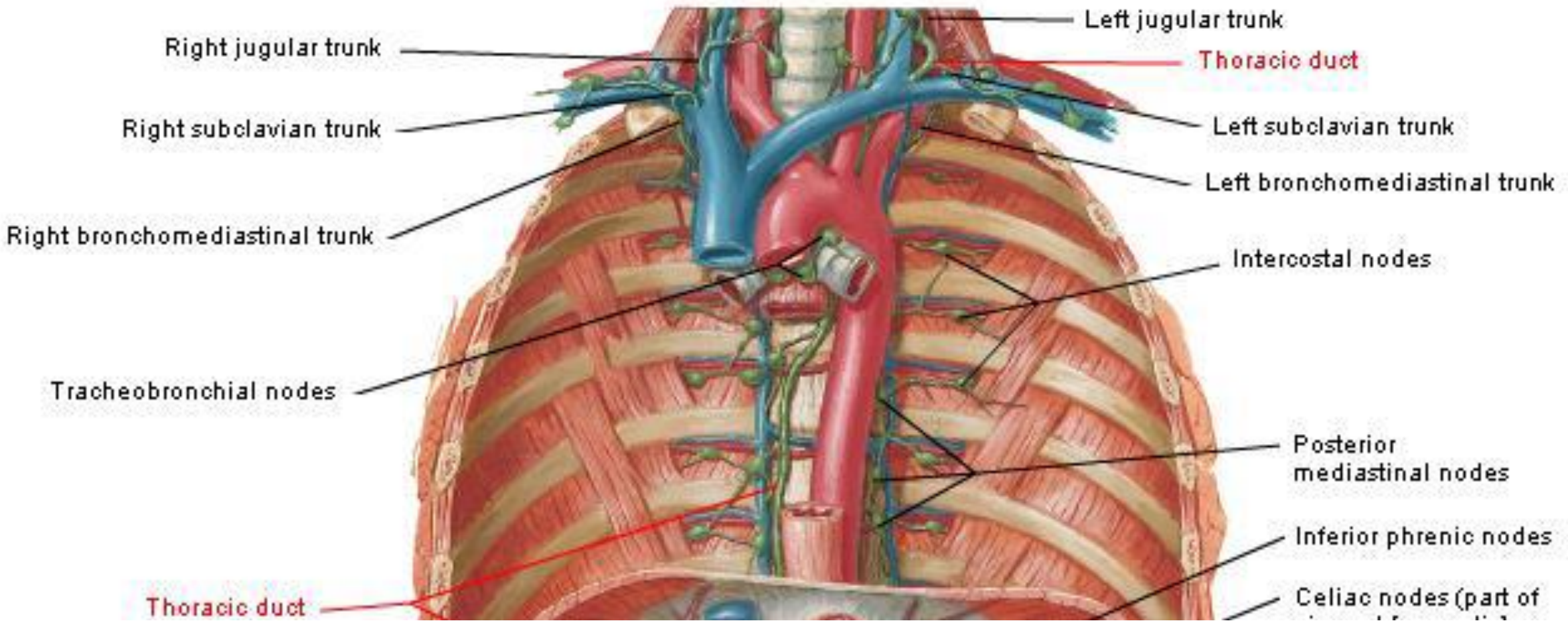


<b>Part of Oesophagus</b>	<b>Blood Supply</b>	<b>Lymph</b>	<b>Nerve</b>
Upper	<b>Inferior thyroid</b>  <i>Veins: brachiocephalic</i>	Deep cervical	Recurrent laryngeal
Middle	<b>Oesophageal branches from aorta + bronchial arteries</b>  <i>Veins: Azygos system</i>	Tracheobronchial and posterior mediastinal node	Thoracic sympathetic trunks and greater splanchnic nerves + Vagus
Lower	<b>Left gastric</b>  <i>Veins: Oesophageal tributaries of the left gastric which empties into the portal vein thus porto-systemic shunt</i>	L.gastric and celiac nodes	Thoracic sympathetic trunks and greater splanchnic nerves + vagus * anterior trunk = left vagus *posterior trunk = mainly right vagus



# THORACIC DUCT

- Commences at upper end of cistern chyli at T12
- Passes upwards with these structures and comes to lie against the R side of the oesophagus **between aorta and azygos vein**
- At T5 it moves to left and passes behind the oesophagus
- At the root of the neck it arches forwards and to the left, behind the carotid sheath, crossing over the dome of the pleura and the left subclavian artery to **enter** the point of confluence of the **left internal jugular** and **subclavian veins**
- Drains all the lymph of the body *except* R upper limb and the R halves of the thorax, head and neck
- The *right lymphatic duct* drains the remaining into the right brachiocephalic vein



# AZYGOUSSYSTEM

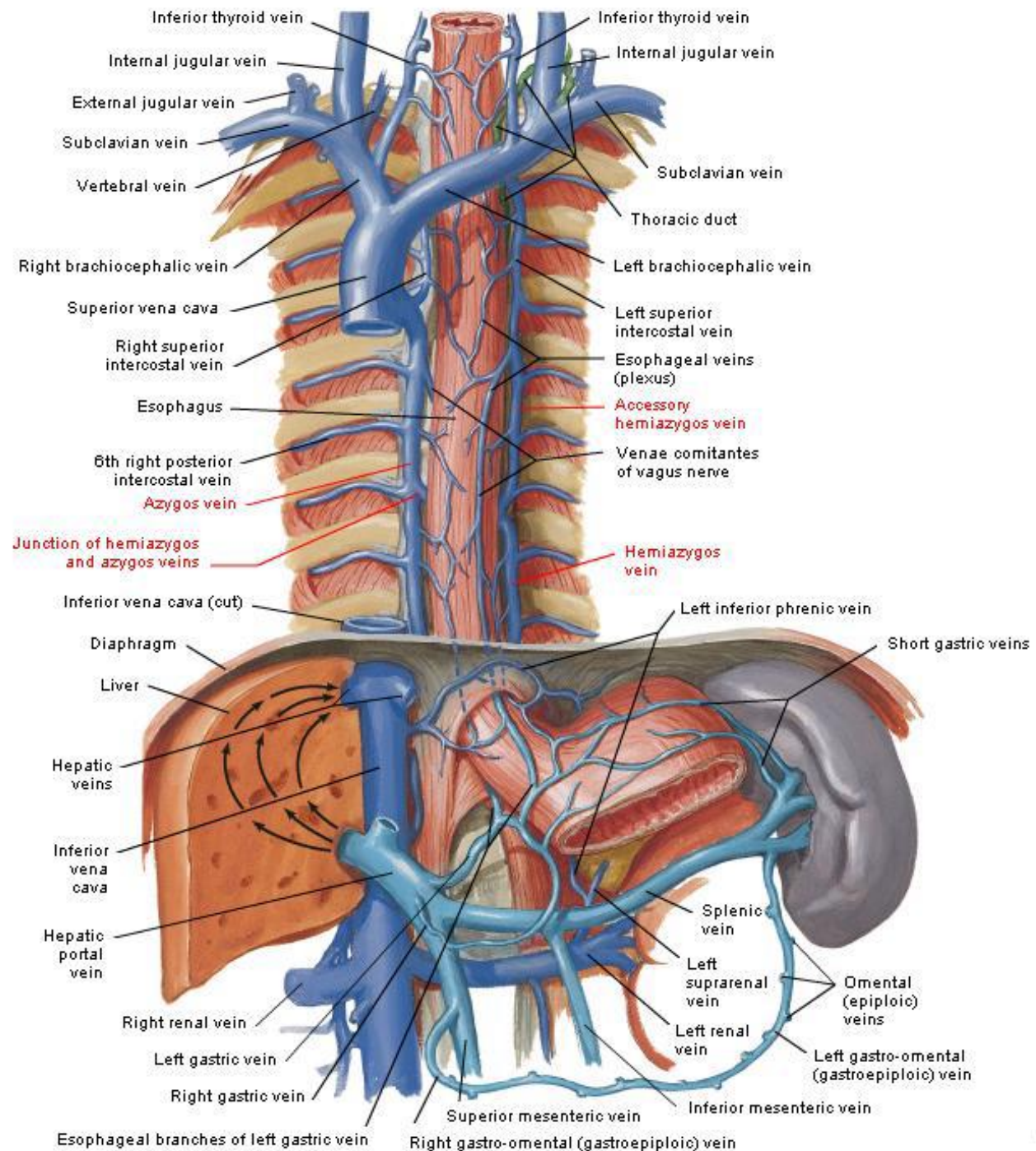
- **Azygos vein**

- Formed by ascending lumbar vein and subcostal vein on the R side
- Heads superiorly over the R side of vertebral bodies and ends in the **SVC** at **T4**

- It receives the lower 8 posterior intercostals veins and at its convexity the superior
- intercostals vein of the right side
- o Two Hemiazygous veins (on the R) usually join the azygos at T7 or 8

- **Hemiazygos veins**

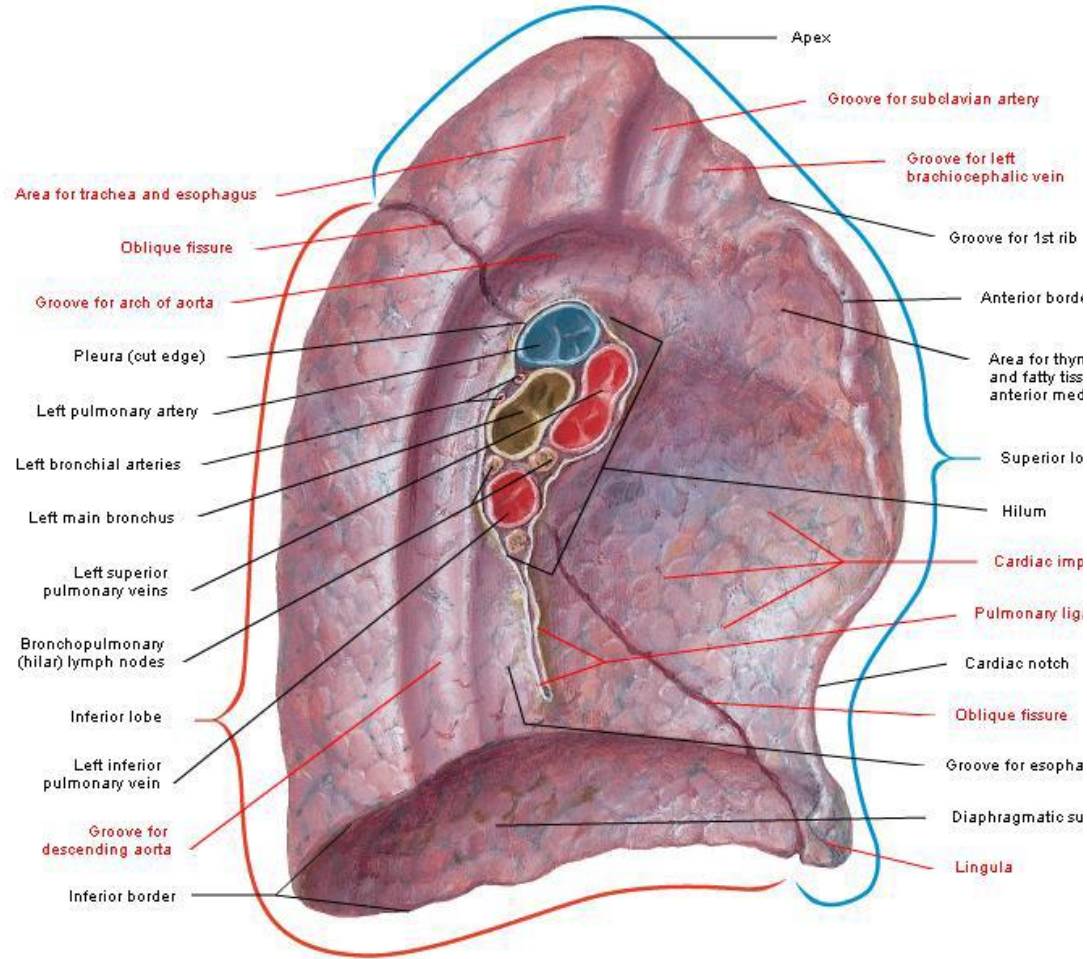
- These two veins lie on the **left side** of the bodies of the thoracic vertebrae
- Characteristically drain separately into the azygos behind the oesophagus
- They receive the left lower 8 posterior intercostals veins – four each



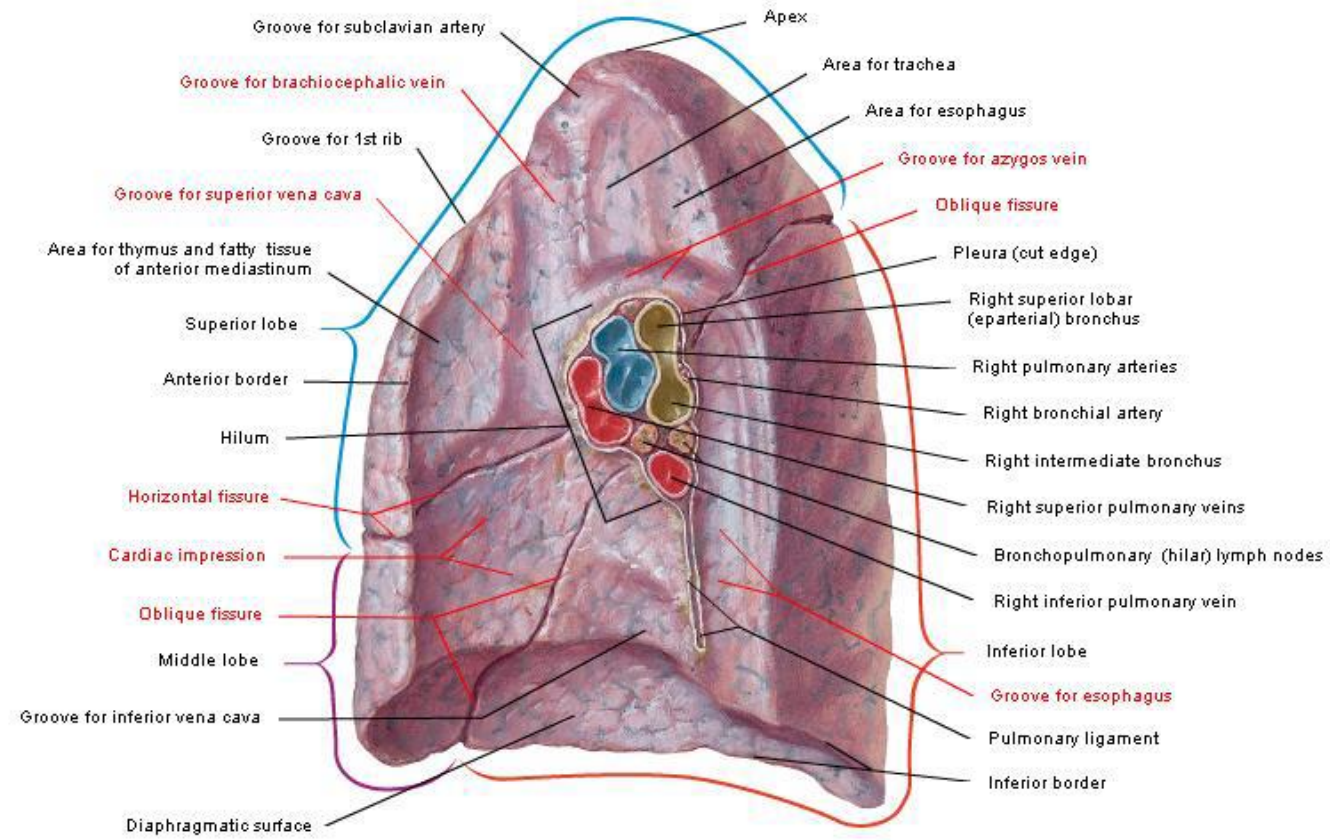
# LUNG

- **2 lobes LEFT, 3 lobes RIGHT**
- Main bronchus, 1 pulmonary artery, 2 pulmonary veins
- **Left lung root**
  - **Upper** part occupied by **left pulmonary artery**
  - Below is the left bronchus
  - Two pulmonary veins one in front of bronchus, one behind
  - All these structures enclosed within a sleeve of pleura continuous with pulmonary ligament
- **Right lung root:**
- Similar to left however the **bronchus to the upper lobe** and the **pulmonary artery to the upper lobe** originate outside the lung, thus are found above the level of the main bronchus.

Left Lung  
Medial View



Right Lung  
Medial View



- Right main bronchus is 2.5cm long, shorter and more vertical than the left which is 5cm long
- **Blood Supply**
- **Arterial**
- The bronchial tree receives its own arterial supply by the **bronchial arteries**
  - Two on the left which are direct branches from the aorta
  - One on the right coming from the 3rd right posterior intercostal artery
- **Venous**
  - **Superficial system** draining from the hilar region and visceral pleura
  - Right main bronchus veins = Azygos Vein
  - Left main bronchus veins = Accessory hemiazygos Vein
  - Deep System draining into pulmonary veins or directly into LA

Questions



# In the superior mediastinum:

- A. the left superior intercostal vein passes forward across the arch of the aorta deep to the vagus nerve
- B. the left superior intercostal vein passes forward across the arch of the aorta superficial to the phrenic nerve
- C. the aortic bodies subserve respiratory reflexes via vagal fibres
- D. the left subclavian artery gives its internal thoracic branch
- E. the ligamentum arteriosum passes from the right pulmonary artery to the aortic arch

- **Answer: C**

- A: False, the left superior intercostal vein passes forwards across the aortic arch, SUPERFICIAL to VAGUS and DEEP to PHRENIC nerves.
- B: False, the left superior intercostal vein passes forwards across the aortic arch, SUPERFICIAL to VAGUS and DEEP to PHRENIC nerves.
- C: True, the aortic bodies lie under the arch in the region of ligamentum arteriosum and subserve respiratory reflexes and hypoxia detection via vagus nerve fibres (chemoreceptors)
- D: False, the left subclavian artery (and left common carotid artery) give NO branches in the mediastinum.
- E: False, the ligamentum arteriosum passes from the commencement of the left pulmonary artery to the aortic arch concavity.

# The superior mediastinum contains the

- A. left phrenic nerve passing medial to the left vagus nerve, just above the arch of the aorta
- B. left superior intercostal vein
- C. whole of the superior vena cava
- D. oesophagus held to the left of the midline by the aorta
- E. origin of the right recurrent laryngeal nerve

**Answer: B**

A: False, the left phrenic nerve passes lateral to the left vagus nerve

B: True, the left superior intercostal vein passes forwards (IN THE SUPERIOR MEDIASTINUM) across the arch superficial to the vagus, deep to the phrenic, to empty into the left brachiocephalic vein.

C: False, the azygos vein enters to SVC at the lower border of the superior mediastinum, the SVC continues and terminates in the MIDDLE mediastinum where it empties into the right atrium.

D: False, the oesophagus enters the superior mediastinum in the midline against the vertebral body of T1 with the trachea anterior to it.

E: False, the right recurrent laryngeal nerve originates in the ROOT of the neck and hooks around the right subclavian artery.

# The fibrous pericardium

- A. has visceral and parietal layers
- B. has no attachments to the sternum
- C. encloses a part only of the superior vena cava
- D. is inferiorly related to the diaphragmatic pleura
- E. has none of the above properties

## Answers: C

- A: False, the SEROUS pericardium has visceral and parietal layers, the fibrous pericardium is a single layer
- B: False, it is connected to the upper and lower sternum ends by sternopericardial ligaments.
- C: True, it fuses with the ROOT of the SVC and doesn't extend into the superior mediastinum with the SVC
- D: False, the fibrous pericardium overlies the central tendon of the diaphragm to which is it inseparably blended.
- E: False, as C is true

# The fibrous pericardium

- 1: is attached to the sternum (T/F)
- 2: is separated from the central tendon of diaphragm (T/F)
- 3: is derived from the septum transversum (T/F)
- 4: fuses with the root of the IVC (T/F)

- **Answers: TFTF**

- 1: True, the fibrous pericardium is attached to the upper and lower ends of the sternum via weak sternopericardial ligaments.
- 2: False, the fibrous pericardium blends with the central tendon of the diaphragm and can be regarded as one structure.
- 3: True, the fibrous pericardium and central tendon of the diaphragm are both derived from the septum transversum.
- 4: False, it is fused with the roots of the great vessels EXCEPT the IVC which is already fused with the tendon of the diaphragm.

# The right atrium

- A. has the atrioventricular node in the upper part of the crista terminalis
- B. continues above as the auricular appendage
- C. has the coronary sinus opening in the fossa ovalis
- D. has the interatrial septum forming the left wall of the atrium
- E. recovers blood from all the vena cordis minimae

## Answer: B

A: False, the SINUATRIAL node is in the upper part of the crista terminalis, NOT the atrioventricular node.

B: True, the upper end of the right atrium is prolonged to the left of the SVC as the right auricle.

C: False, the coronary sinus opens to the left of the fossa ovalis and above the septal cusp of the tricuspid valve and to the left of the IVC orifice.

D: False, the interatrial septum forms the POSTERIOR wall of the right atrium. The right VENTRICLE projects to the left of the right atrium

E: False, the venae cordis minimae are small veins in the walls of all four chambers of the heart that open directly into the respective chambers. They appear to be most frequent in the right atrium; their numbers have been exaggerated in the past, and their contribution to venous return is negligible

# The AV node receives blood from the

- A. conus arteriosus
- B. interventricular branch of the left coronary artery
- C. right marginal artery
- D. left marginal artery
- E. by a terminal branch of the right coronary artery

• Answer: E

# The right coronary artery

1: arises from the right aortic sinus (T/F)

2: usually supplies the sino-atrial node (T/F)

3: gives off a posterior interventricular branch (T/F)

4: provides the main blood supply of the conus arteriosus(infundibulum) (T/F)

- **Answers: TTTT**

1: True, the RCA arises from the right aortic sinus

2: True, the RCA supplies the SA nodal artery in 60% of adults

3: True, the RCA gives off the posterior interventricular branch onto the hearts diaphragmatic surface, this branch is larger than the remaining RCA that continues to anastomose with the left circumflex artery

4: True, the conus artery is one of the highest branches from the proximal RCA

# The left coronary artery

- A. arises from the posterior aortic sinus
- B. supplies the sinuatrial node in only 10% of cases
- C. gives off the anterior interventricular artery
- D. usually gives off the posterior interventricular artery
- E. supplies no part of the right ventricle

- **Answer: C**

A: False, the LCA arises from the left aortic sinus

B: False, the LCA supplies the SA node via the SA nodal artery in 40% of cases

C: True, the LCA supplies the anterior interventricular artery (LAD), which runs down the interventricular groove to the apex

D: False, the RCA usually gives off the posterior interventricular artery (90% of cases), the LCA only supplies the posterior interventricular artery in 10% of cases where the large anterior interventricular gives off the posterior interventricular artery

E: False, the LCA gives off the the anterior interventricular artery which supplies some right ventricular and the anterior 2/3 of the interventricular septum.



# The left pulmonary artery

- 1: is connected to the arch of the aorta by a fibrous ligament (T/F)
- 2: is shorter than the right pulmonary artery (T/F)
- 3: passes in front of the left main bronchus (T/F)
- 4: lies above the left recurrent laryngeal nerve (T/F)

- **Answers: TTTF**

- 1: True, the left pulmonary artery is attached to the under surface of the aortic arch by the ligamentum arteriosum.
- 2: True, the left pulmonary artery is shorter than the right pulmonary artery (remember: pulmonary trunk bifurcation occurs anterior to the LEFT main bronchus, so the right pulmonary artery has further to travel to reach the lung hilum).
- 3: True, the pulmonary trunk divides in front of the left main bronchus, forming the left (and right) pulmonary arteries
- 4: False, the left recurrent laryngeal nerve hooks under aortic arch to the left and then posterior to the ligamentum arteriosum and is above the left pulmonary artery.

# The arch of the aorta

1: is crossed anteriorly and to the left by the left supreme intercostal vein (T/F)

2: has the left brachiocephalic vein above it (T/F)

3: usually causes an impression on the left side of the oesophagus (T/F)

4: is crossed anteriorly and to the left by the left phrenic nerve (T/F)

- **Answers: FTTT**

1: False, the arch of the aorta is crossed anterior by the left SUPERIOR intercostal vein. The supreme or highest intercostal veins drain directly into the left and right brachiocephalic veins or vertebral veins at a level above the arch of aorta (as the SVC forms at the lower border of the right first costal cartilage - Last's 9th Page 259 IVC)

2: True, the left brachiocephalic vein runs behind the UPPER half of the manubrium to join with the right brachiocephalic vein at the lower border of the first costal cartilage. This is ABOVE the arch of the aorta that only reaches the midpoint of the manubrium at its upper convexity.

3: True, on the right side of the arch lie the trachea and oesophagus and the aortic arch causes an impression here (no reference found)

4: True, the left phrenic nerve passes anteriorly and to the left of the aortic arch, in contact with mediastinal pleura.

# The internal thoracic artery

- 1: supplies the anterior body wall from clavicle to umbilicus (T/F)
- 2: at its origin is closely related to the phrenic nerve (T/F)
- 3: supplies the pleura and fibrous pericardium (T/F)
- 4: passes into the rectus sheath between rectus abdominis and the anterior sheath (T/F)

- **Answers: TTTF**

1: True, perforating branches of the internal thoracic artery emerge through each intercostal space to supply the anterior body wall from clavicle to umbilicus.

2: True, it arises from the lower surface of the subclavian artery and passes down, crossed by or crossing the phrenic nerve (which is posterior to the artery in Netter's picture)

3: True, it gives off the pericardiophrenic artery that runs with phrenic nerve and supplies the phrenic nerve, pleural, fibrous and parietal serous pericardium.

4: False, the internal thoracic artery divides at the costal margin into superior epigastric and musculophrenic arteries. The superior epigastric artery passes lateral to the xiphisternal fibres of the diaphragm and enters the rectus sheath **POSTERIOR** to the muscle (i.e. between the posterior layer of rectus sheath and rectus abdominis muscle).

# The thoracic trachea

- 1: is directly related to the right lung and pleura (T/F)
- 2: lies immediately posterior to the brachiocephalic artery (T/F)
- 3: does not contact the left lung and pleura directly (T/F)
- 4: has the bifurcation of the pulmonary trunk directly anterior (T/F)

- **Answers: TTTF**

- 1: True, on the right side the trachea is separated from the lung by the pleura only.
- 2: True, the brachiocephalic and left common carotid arteries diverge on either side of the trachea - from directly in front.
- 3: True, on the left side, the trachea is separated from the lung by the common carotid and subclavian arteries.
- 4: False, the bifurcation of the pulmonary trunk occurs in front of the left main bronchus.

# The diaphragm

- A. has motor innervation from the phrenic nerve, to all its parts except the crura
- B. has sensory innervation from the vagus nerves
- C. has a blood supply mostly from the pericardiophrenic arteries
- D. has lymph nodes that drain into the tracheobronchial group
- E. moves in respiration under central control of cell groups in the region of the nucleus of the tractus solitarius

- **Answer: E**

A: False, the phrenic nerves are the ONLY motor supply to the diaphragm.

B: False, sensory innervation to the diaphragm comes from the phrenic nerve, except the periphery which is supplied by the lower intercostal nerves.

C: False, the tiny pericardiophrenic artery only supplies the phrenic nerve, pleura and fibrous pericardium.

D: False, no part of the diaphragm drains to tracheobronchial nodes.

E: True, bilaterally groups of cells in the medullary region of the nucleus of tractus solitarius appear to function as an inspiratory centre.

# In the diaphragm

1: the sympathetic trunk passes behind the medial arcuate ligament (T/F)

2: the subcostal nerve and vessels pass behind the lateral arcuate ligament (T/F)

3: the greater and lesser splanchnic nerves pierce each crus (T/F)

4: the neurovascular bundles of the seventh to eleventh intercostal spaces pass between the digitations of the diaphragm and transversus abdominis into the neurovascular plane of abdominal wall (T/F)

- **Answers: TTTT**

1: True, the sympathetic trunk passes behind the medial arcuate ligament which runs from the body of L1 (or L2) to the transverse process of L1 at the lateral margin of psoas.

2: True, the subcostal nerve and vessels pass behind the lateral arcuate ligament which runs from the transverse process of L1 to the 12th rib at the lateral border of quadratus lumborum.

3: True, the thoracic splanchnic nerves pierce each crus on its corresponding side.

4: True, the neurovascular bundles of the seventh to the eleventh intercostal spaces pass between the digitations of the diaphragm and transversus abdominis into the neurovascular plane of the abdominal wall.

# The intercostal spaces have the

- A. collateral branches located superior to the main nerve in the neurovascular plane
- B. neurovascular bundles between the external and internal intercostal muscles
- C. internal intercostal muscle as the main muscle of respiration
- D. levator costae muscles innervated by the anterior primary rami of the spinal nerves
- E. intercostal nerves related inferior to the vein and arteries

- **Answers: E**

A: False, the collateral branches run just above the rib that forms the LOWER boundary of that space - hence inferior to the main neurovascular bundle from which it arose.

B: False, the neurovascular plane exists between the transversus thoracis and internal intercostal muscles.

C: False, no text to suggest the internal intercostal muscles play a larger role in respiration than the external intercostals.

D: False, levator costae muscles are the only thoracic muscles innervated by POSTERIOR RAMI of spinal nerves.

E: True, the intercostal nerves lie below the arteries and veins as they run around the body wall.

# The body of the sternum

- A. gives attachment to the external intercostal muscles laterally
- B. has the internal thoracic artery on its posterior surface
- C. gives attachment to the pectoralis major and minor anteriorly
- D. has a manubrium and body connected by a secondary cartilaginous joint
- E. is related directly to the trachea

- **Answer: D**

A: False, the external intercostal muscle is membranous from the costochondral joint and hence the sternum gives attachment to the anterior intercostal membrane (and internal intercostal muscle).

B: False, internal thoracic artery passes down lateral to the body of the sternum.

C: False, pectoralis minor arises from the 3-5th ribs, only pectoralis major as a sternal origin.

D: True, the manubriosternal joint is a symphysis (i.e. secondary cartilaginous joint) with an intervening disc of fibrocartilage.

E: False, the trachea bifurcates into the left and right main bronchi at the sternal angle (i.e. above the body)



# The lines of pleural reflection

1: lie posterior to the kidneys (T/F)

2: are adjacent from the angle of Louis to the level of the 4th costal cartilage (T/F)

3: cross the mid-clavicular line at the tenth costal cartilage (T/F)

4: project above the neck of the first rib (T/F)

- **Answers: TTFF**

1: True, there is thus a triangle of pleura in the costovertebral angle below the twelfth rib, behind the upper pole of the kidney.

2: True, pleural reflections meet at the sternal angle and pass down vertically to the 4th costal cartilage where the left (not right) pleura diverges.

3: False, pleural reflections cross the midclavicular line at the 8th rib and midAXILLARY line at the 10th rib.

4: False, the pleural superior projection is above the medial 3rd of the clavicle for 3cm due to the obliquity of the thoracic inlet, the pleural surface marking is just a projection of the first rib border, NOT above the first rib.

# The thoracic duct

- A. enters the thorax anterior to the aorta between the crura of the diaphragm
- B. crosses anterior to the oesophagus from right to left as it ascends
- C. at its termination arches laterally and lies posterior to the vagus nerve
- D. crosses the dome of pleura inferior to the subclavian artery
- E. contains a valve at its termination

- **Answer: C**

- A: False, it enters the thorax posterior and to the right of the aorta (between aorta and azygos vein), under the median arcuate ligament (between the crura of the diaphragm)
- B: False, it inclines posterior to the oesophagus from right to left (crossing the midline at T5) to lie on the left of the oesophagus in the superior mediastinum.
- C: True, the thoracic duct terminates at the confluence of the left IJV and subclavian veins and this is lateral and posterior to the vagus nerve.
- D: False, it arches superiorly over the dome of the left pleura and the subclavian artery to empty into the junction of the IJV and subclavian vein.
- E: False, the thoracic duct has no valve at its termination allowing blood to flow to and fro during respiration.

# The oesophagus

1: is encircled by fibres of the left crus as it passes through the diaphragm (T/F)

2: has a coat containing non-striated muscle fibres in its lower two-thirds (T/F)

3: is in contact with the right mediastinal pleura in the posterior mediastinum (T/F)

4: pierces the diaphragm at the level of the tenth thoracic vertebra (T/F)

- **Answers: FTTT**

1: False, the oesophagus is surrounded by a sling-like loop of fibres from the RIGHT crus of diaphragm.

2: True, the lower 2/3 of the oesophagus contains visceral non-striated muscle fibres.

3: True, the mediastinal pleura touches the oesophagus in places, particularly on the right side, where low down there is a pocket of pleura between the oesophagus and the aorta, but nowhere is the pleura attached to the oesophagus.

4: True, the oesophagus pierces the diaphragm at T10, 2.5cm left of the midline.