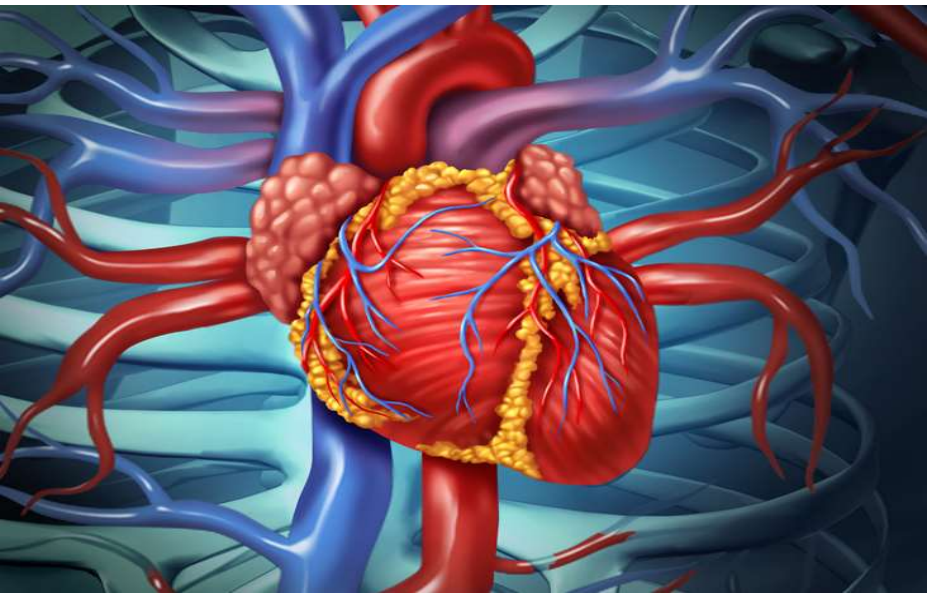
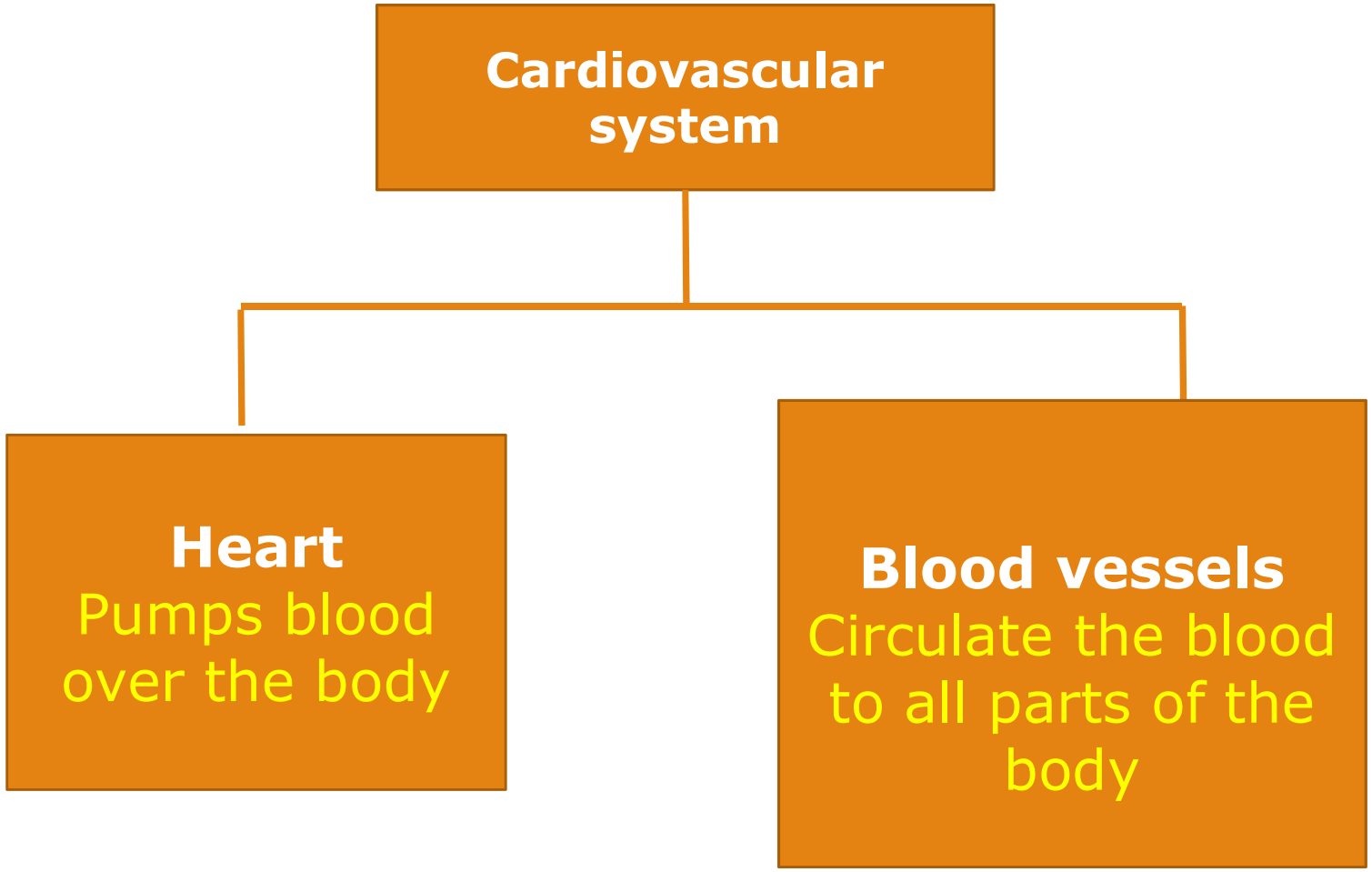
Jordan University
Faculty Of Medicine



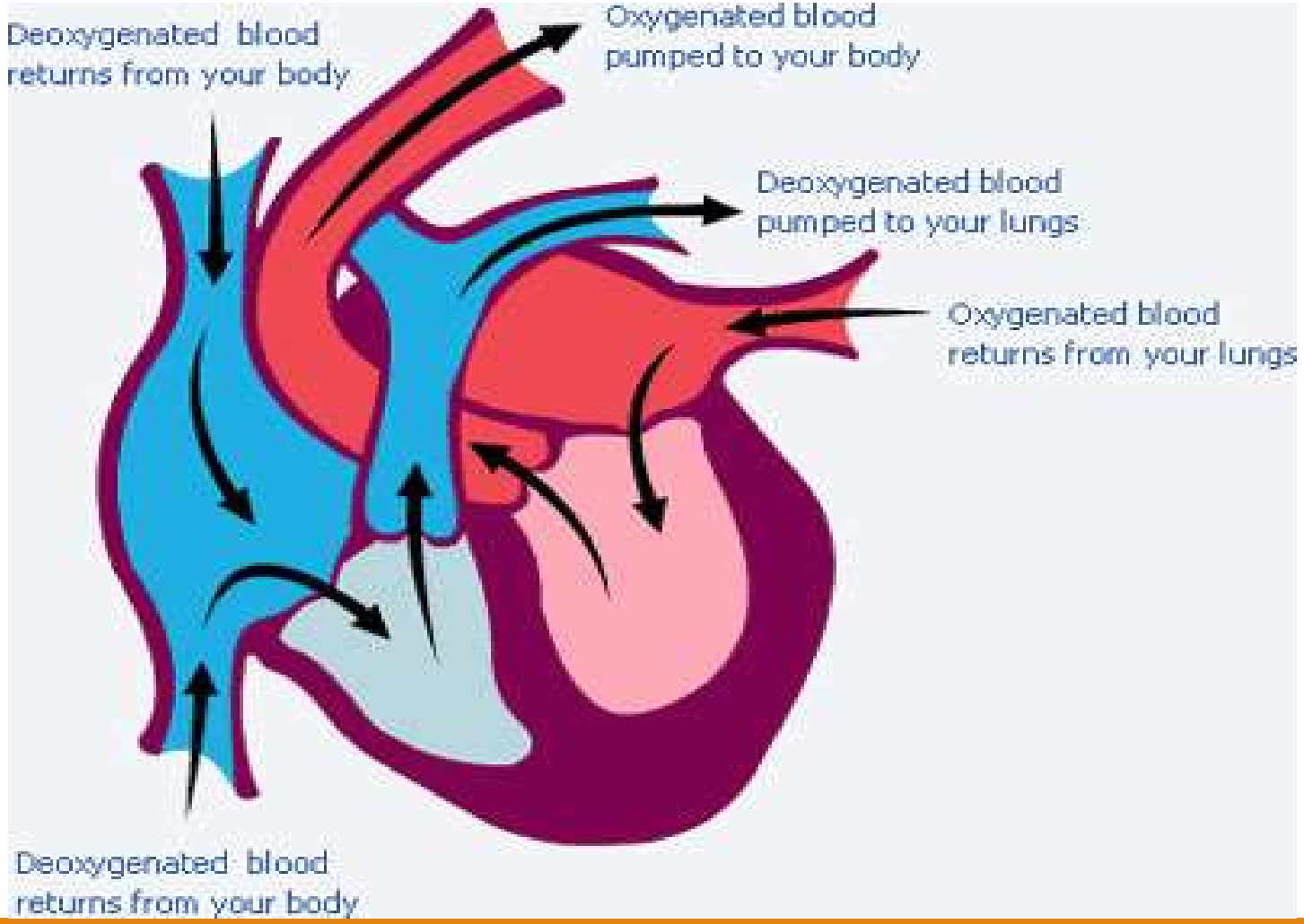
Cardiovascular system

DR. AHMED SALMAN

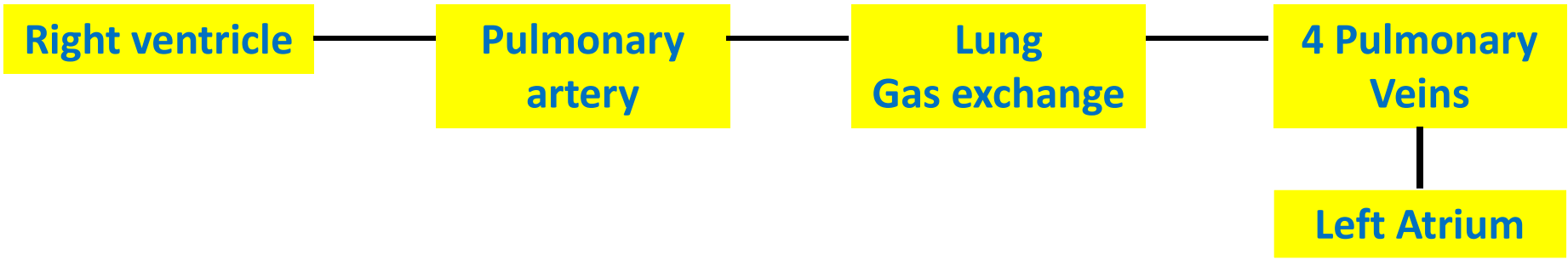
Associate professor of anatomy & embryology


Cardiovascular system
Heart
Pumps blood over the body
Blood vessels
Circulate the blood to all parts of the body

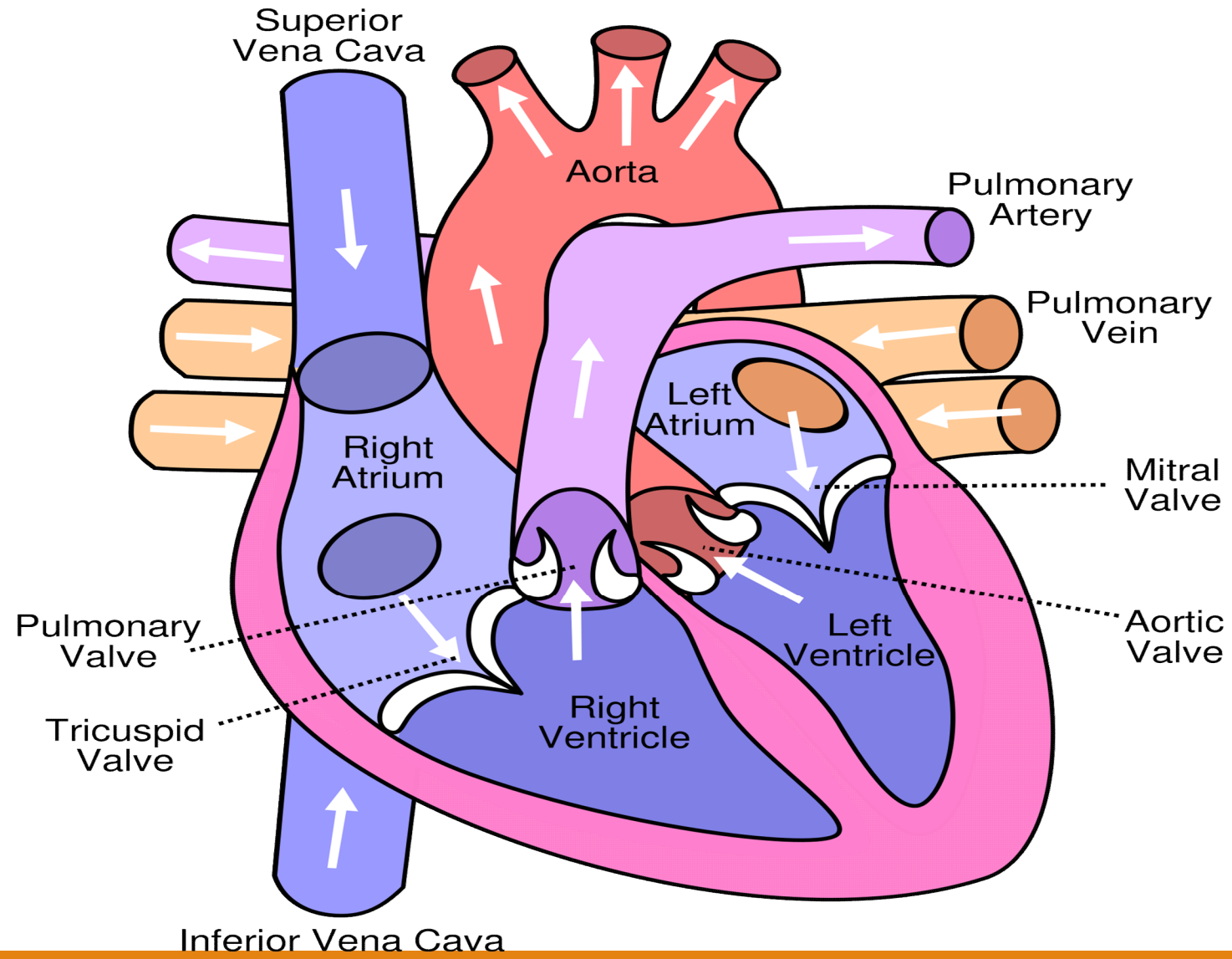
The function cardiovascular system is to carry oxygen and nutrients and to eliminate carbon dioxide and other waste products from the body.

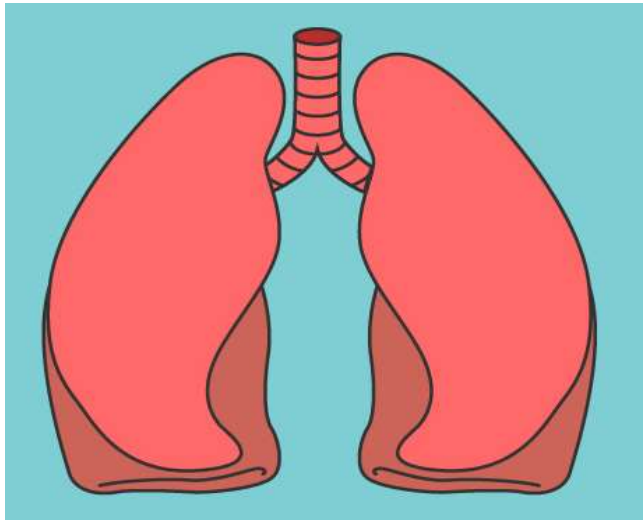


Pulmonary Circulation



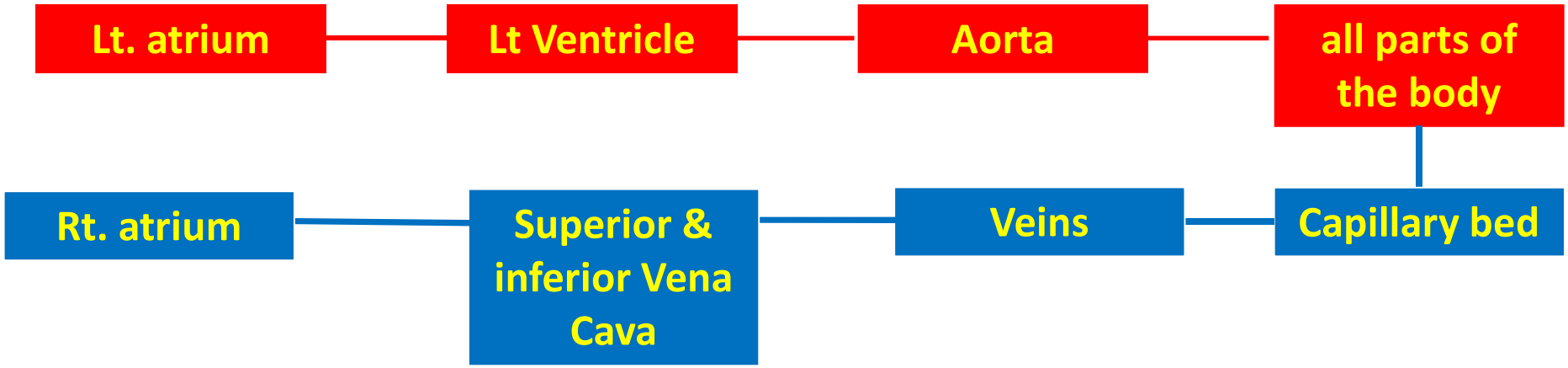
- Pulmonary veins are the only veins that carry oxygenated blood
- Pulmonary arteries are the only arteries that carry deoxygenated blood

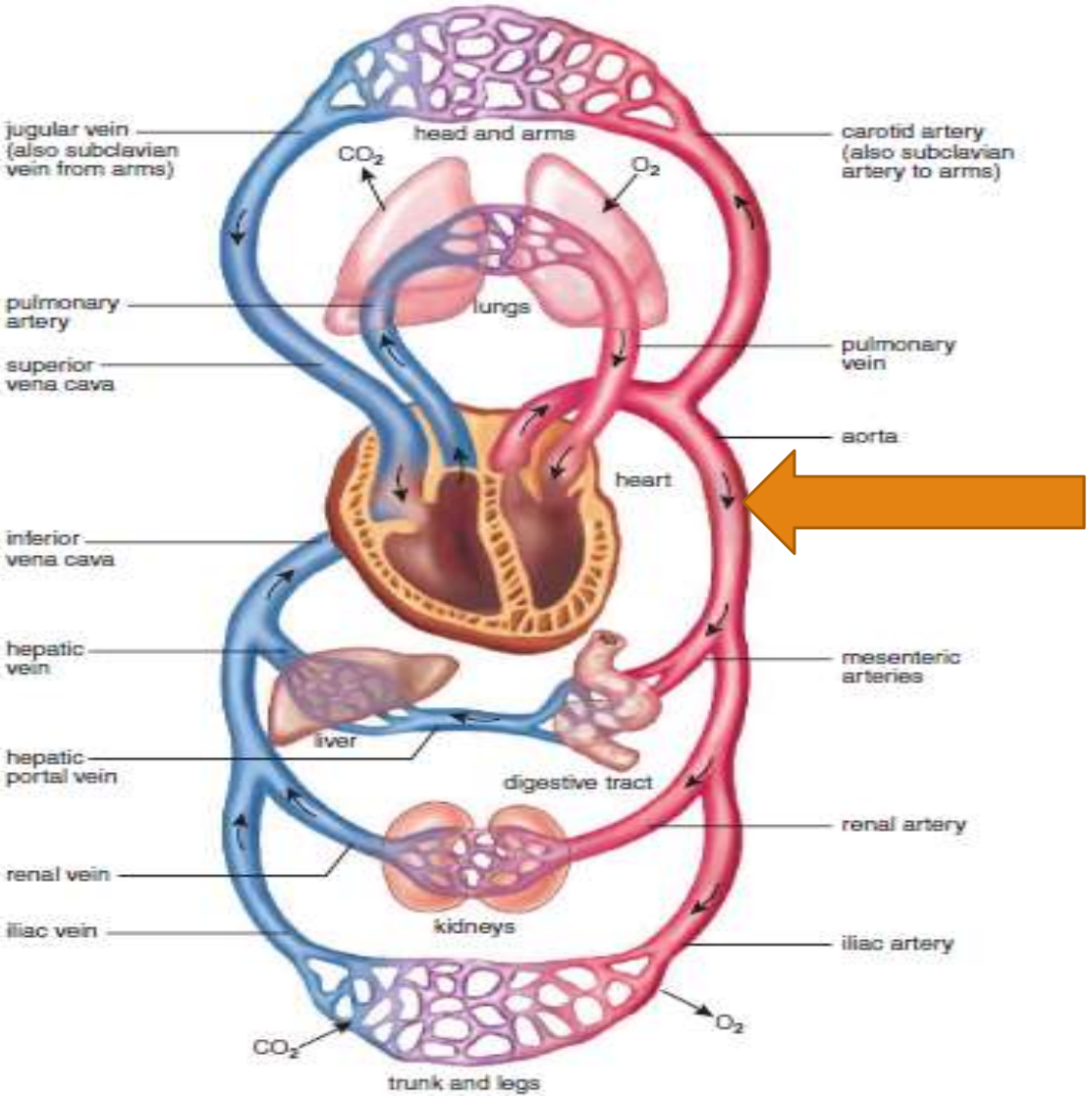

Superior
Vena Cava
Aorta
Pulmonary
Artery
Pulmonary
Vein
Left
Atrium
Right
Atrium
Mitral
Valve
Pulmonary
Valve
Aortic
Valve
Left
Ventricle
Tricuspid
Valve
Right
Ventricle
Inferior Vena Cava



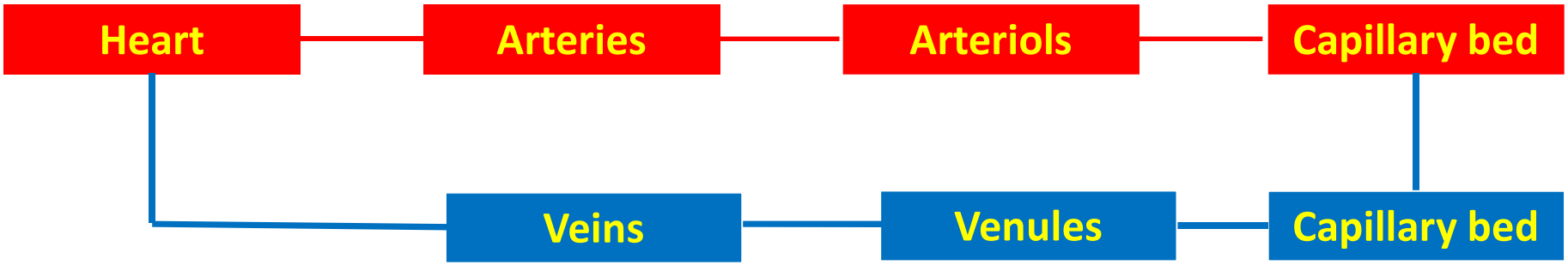
Systemic Circulation

It carries the oxygenated blood from the heart to the body.
And return deoxygenated blood from the body to heart.

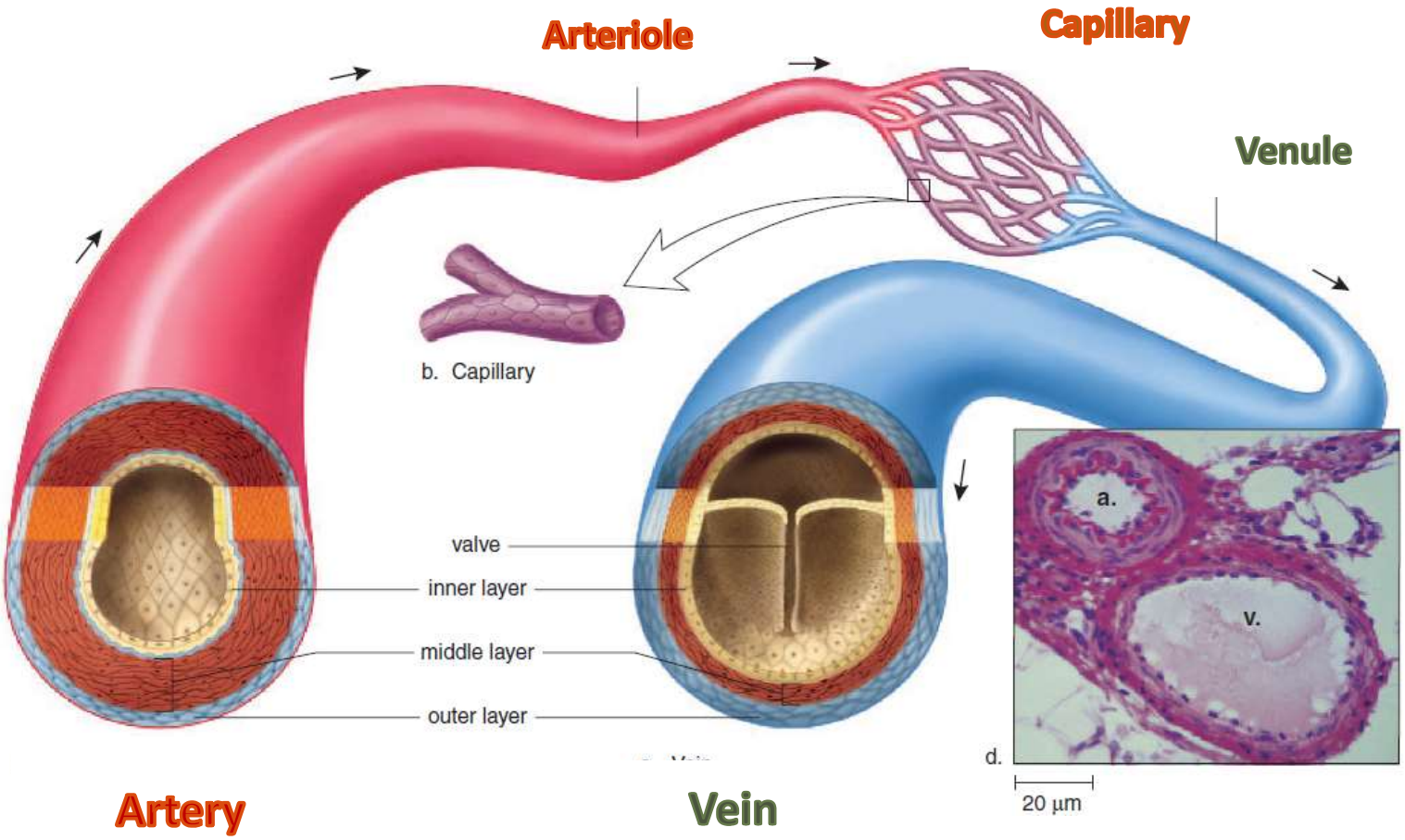



jugular vein
(also subclavian
vein from arms)
head and arms
carotid artery
(also subclavian
artery to arms)
CO_2
O_2
pulmonary
artery
lungs
pulmonary
vein
superior
vena cava
aorta
heart
inferior
vena cava
hepatic
vein
mesenteric
arteries
liver
hepatic
portal vein
digestive tract
renal artery
renal vein
kidneys
iliac vein
iliac artery
O_2
CO_2
trunk and legs

Peripheral Circulation



- ✓ Blood flow in capillaries is regulated by smooth muscle sphincter called precapillary sphincter
- ✓ Vein with large diameter have valves that allow blood flow in one direction only (to the heart)

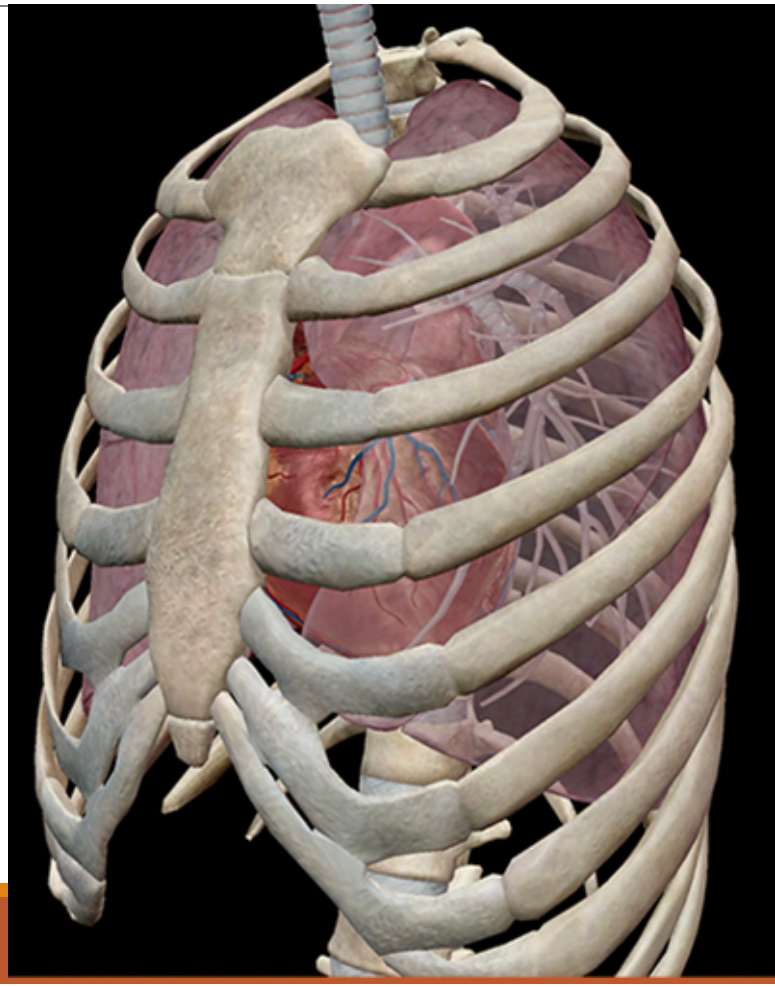

Arteriole
Capillary
Venule
b. Capillary
valve
inner layer
middle layer
outer layer
a.
v.
d.
20 µm
Artery
Vein

Thoracic cavity

- It bounded by thoracic cage (Sternum ,ribs and vertebrae),diaphragm.
- It extends upward into the root of the neck

About one finger breadth above the clavicle on each side

- It contains two pleural cavities containing lungs and mediastinum



Watch this video

https://www.youtube.com/watch?v=FSbQHigjCG4&t=4s

Mediastinum

It is the region between the two pleural cavities.

Boundaries :

Superior: Thoracic Inlet

Inferior: Diaphragm

Anterior: Sternum

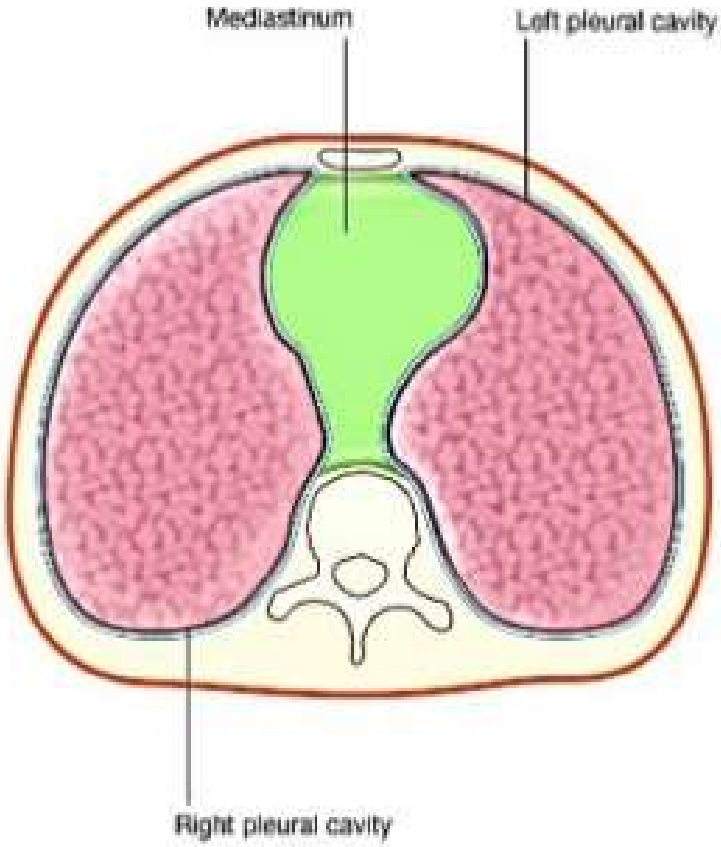
Posterior: Vertebral column

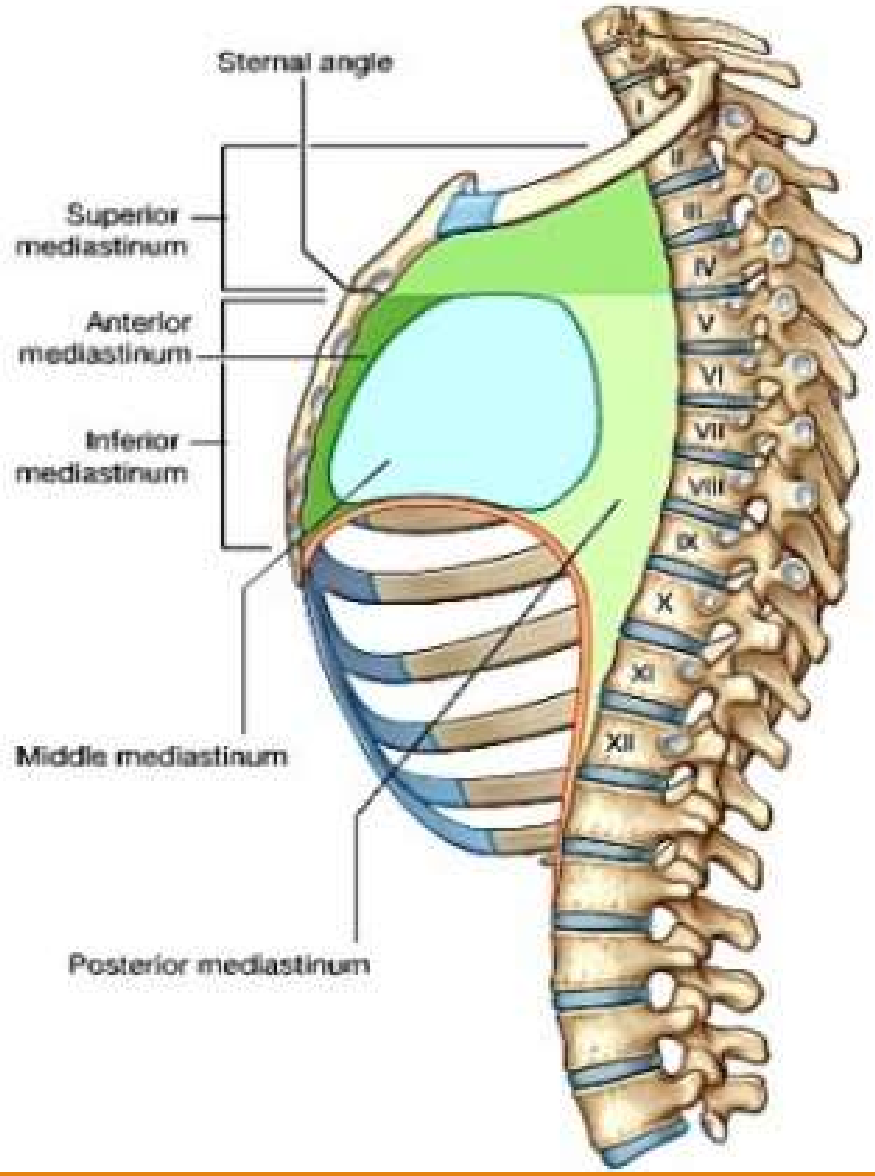
REED ONLY

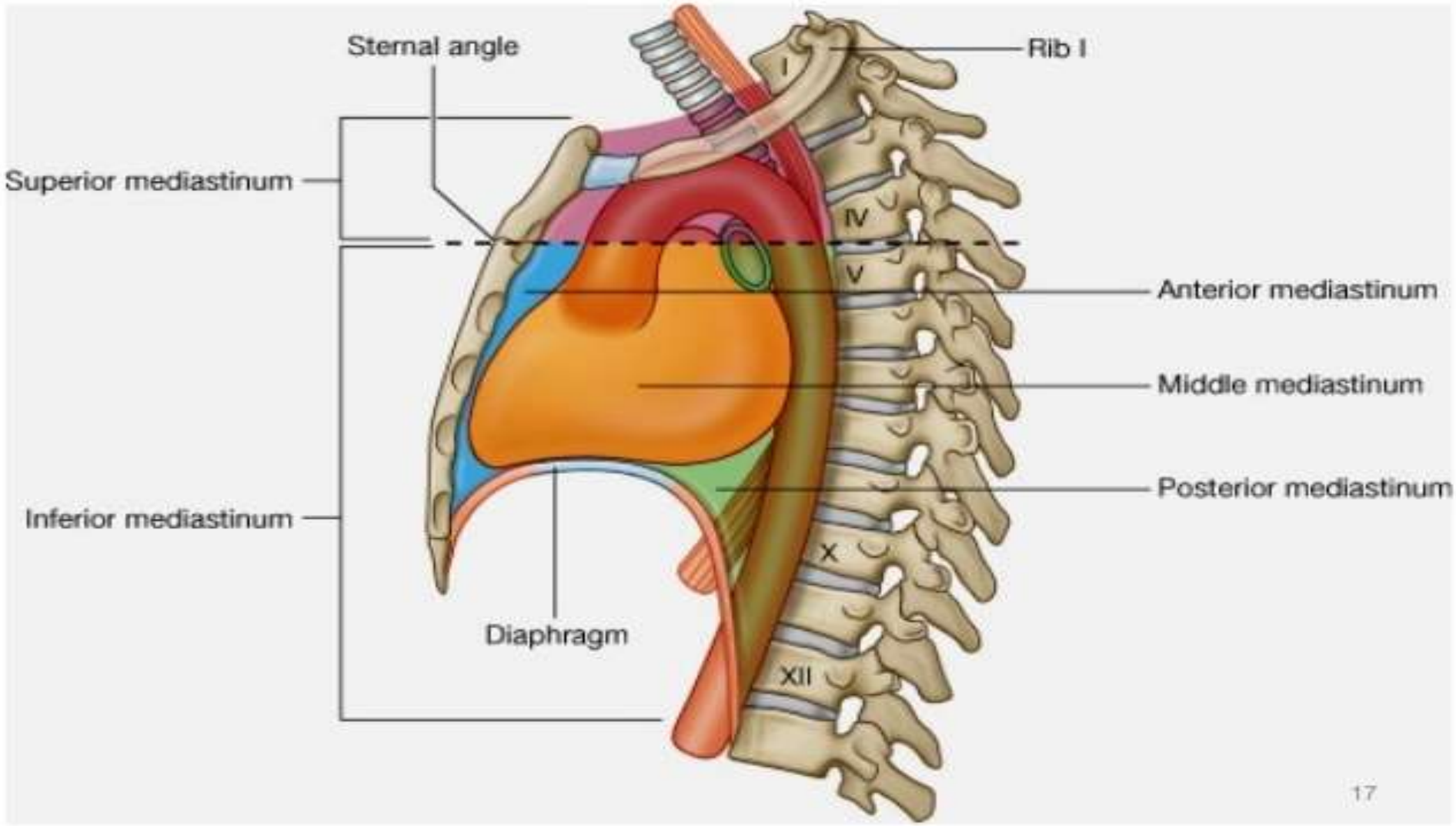
N.B:

Anatomists refer to the superior thoracic aperture as the thoracic inlet because non-circulating substances (air and food) may enter the thorax only through this aperture.

When clinicians refer to the superior thoracic aperture as the thoracic outlet, they are emphasizing the arteries and T1 spinal nerves that emerge from the thorax through this aperture to enter the lower neck and upper limbs


Mediastinum
Left pleural cavity
Right pleural cavity


Sternal angle
Superior mediastinum
Anterior mediastinum
Inferior mediastinum
Middle mediastinum
Posterior mediastinum
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII

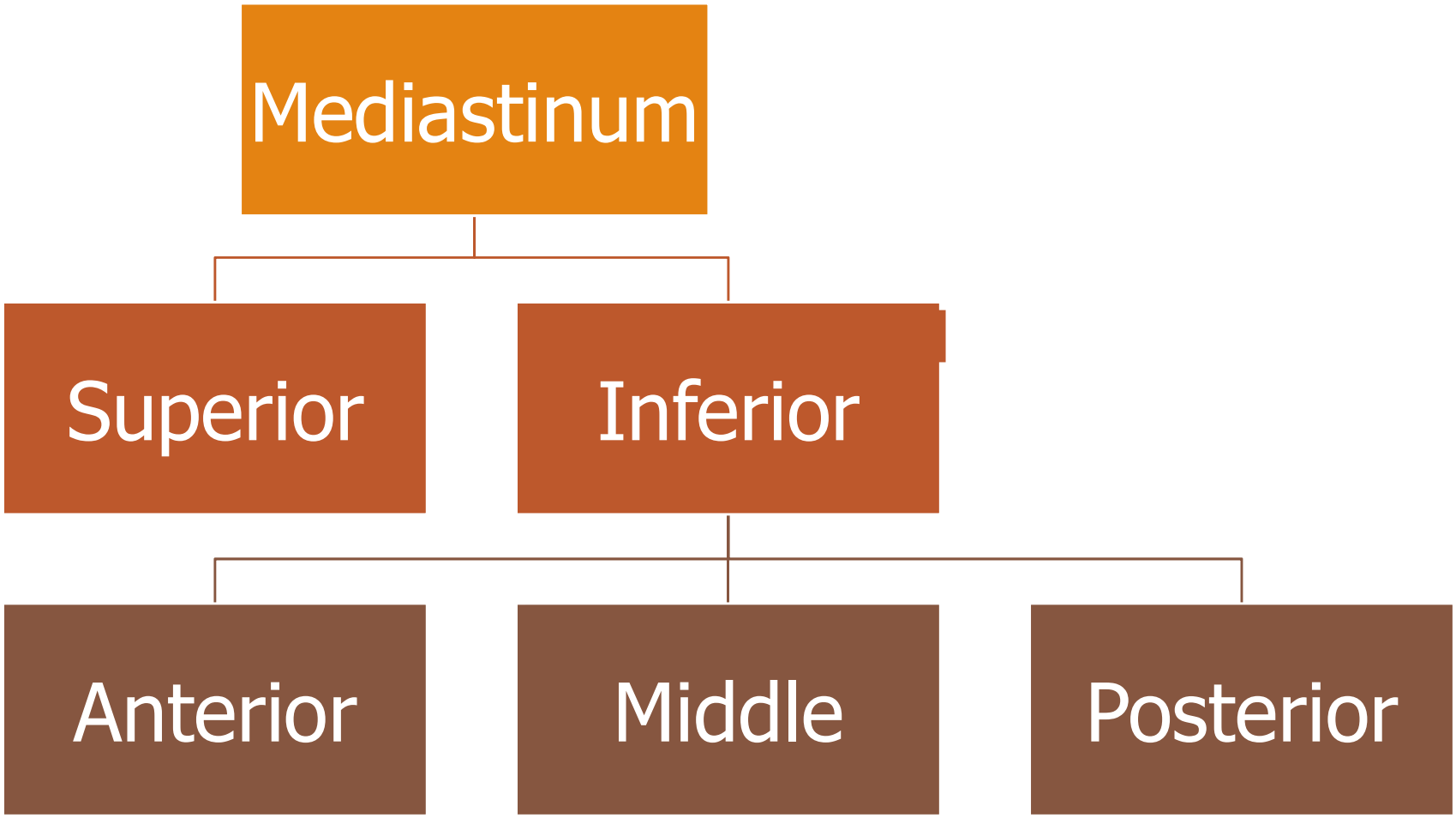

Sternal angle
Rib I
Superior mediastinum
I
IV
V
Anterior mediastinum
Middle mediastinum
Posterior mediastinum
Inferior mediastinum
X
Diaphragm
XII
17

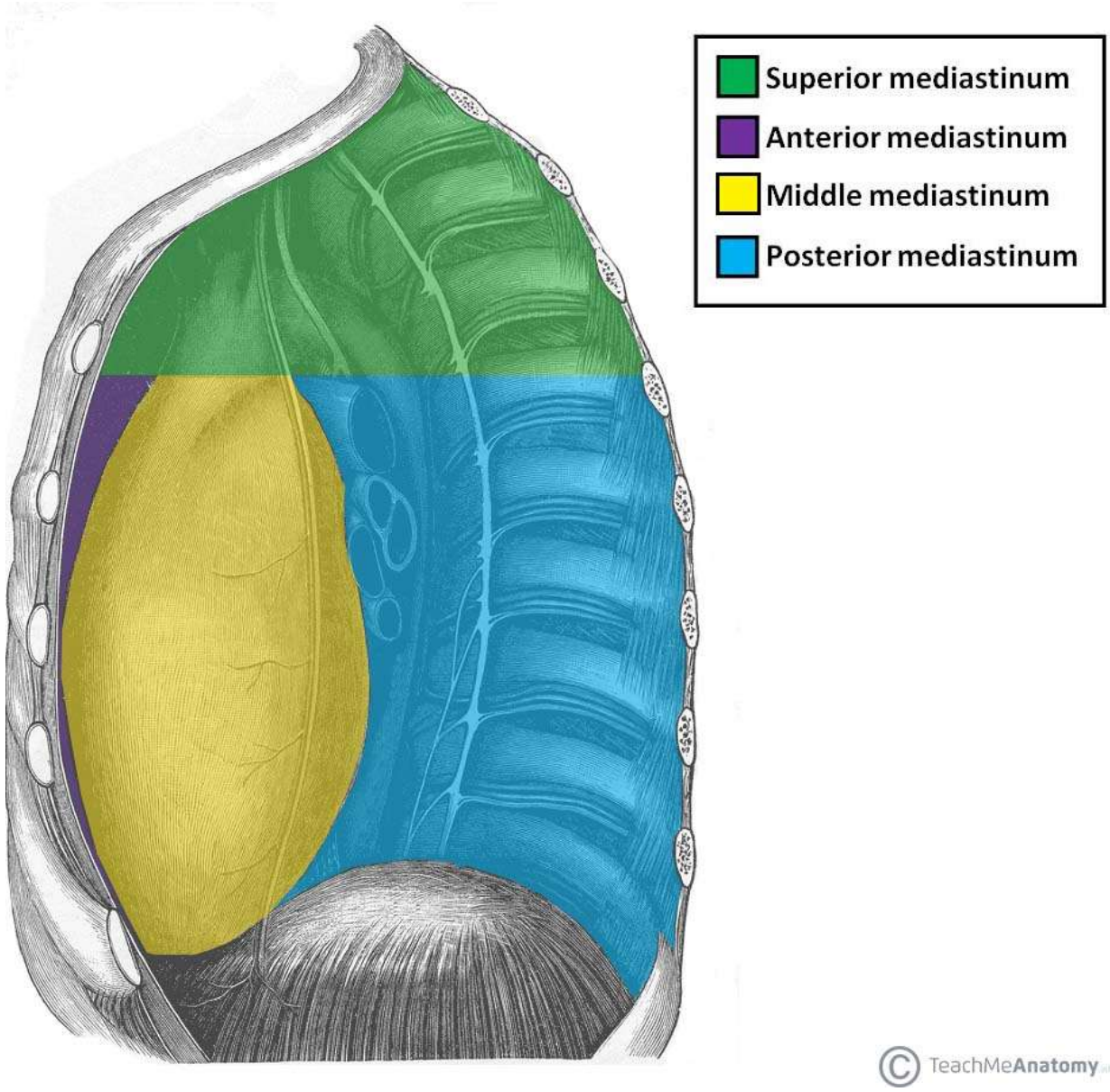
Subdivisions

Division :

An imaginary line from sternal angle to lower border of 4th thoracic vertebra divide mediastinum into :

- ✓ **Superior mediastinum** above the line and inferior mediastinum below the line.
- ✓ **Inferior mediastinum** divided into ;
  - **Middle mediastinum** contains heart and pericardium
  - **Anterior mediastinum** in front middle mediastinum
  - **Posterior mediastinum** behind middle mediastinum


Mediastinum
Superior
Inferior
Anterior
Middle
Posterior


Superior mediastinum
Anterior mediastinum
Middle mediastinum
Posterior mediastinum
TeachMeAnatomy

The Superior mediastinum

Boundaries:

Anteriorly: manubrium sterni.

Posteriorly: upper four thoracic vertebrae.

Superiorly: thoracic inlet.

Inferiorly: imaginary plane.

On each side: mediastinal pleura.

Contents of superior Mediastinum

1- Arch of Aorta and its branches

2- Brachiocephalic veins and superior vena cava

3- Thoracic duct

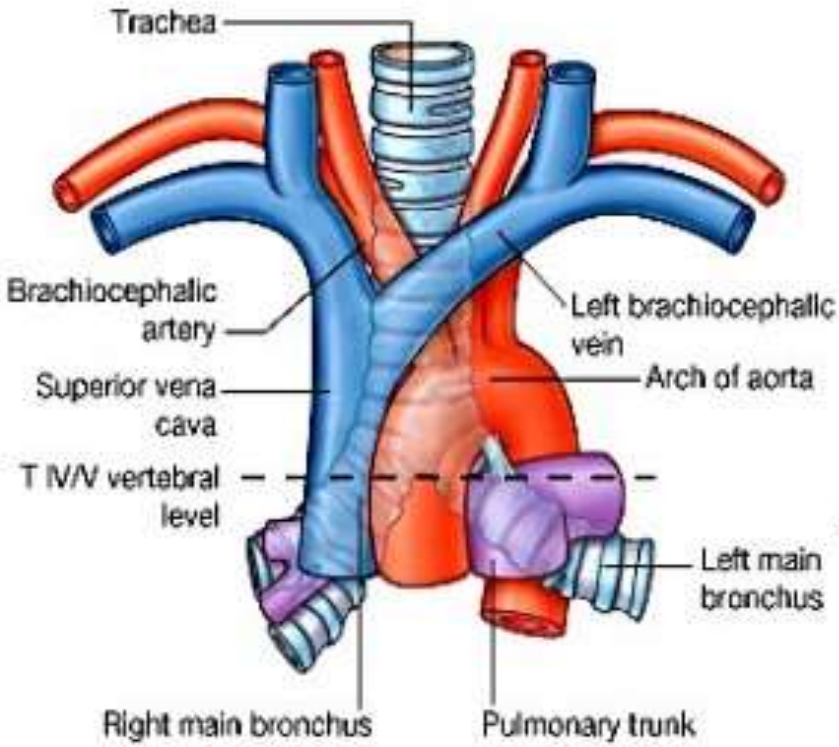
4- Thymus

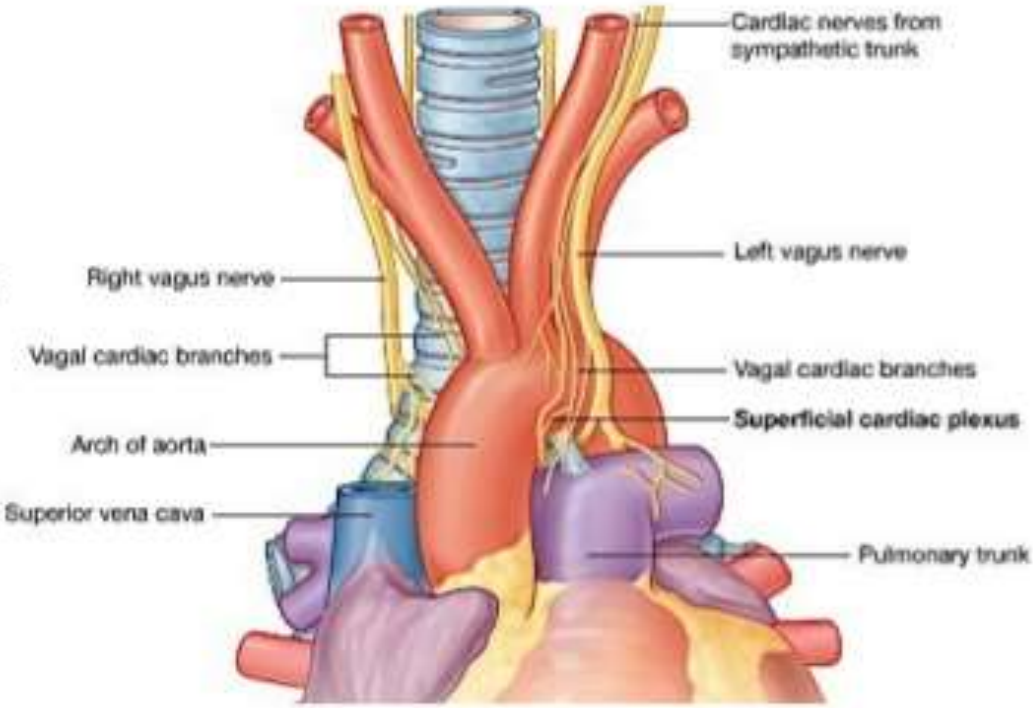
5-Phernic and vagus nerves

6- Trachea

7- Oesophagus

Superior Mediastinum - contents





Brachiocephalic vein (Right and left)

Formation : By union internal jugular and subclavian veins

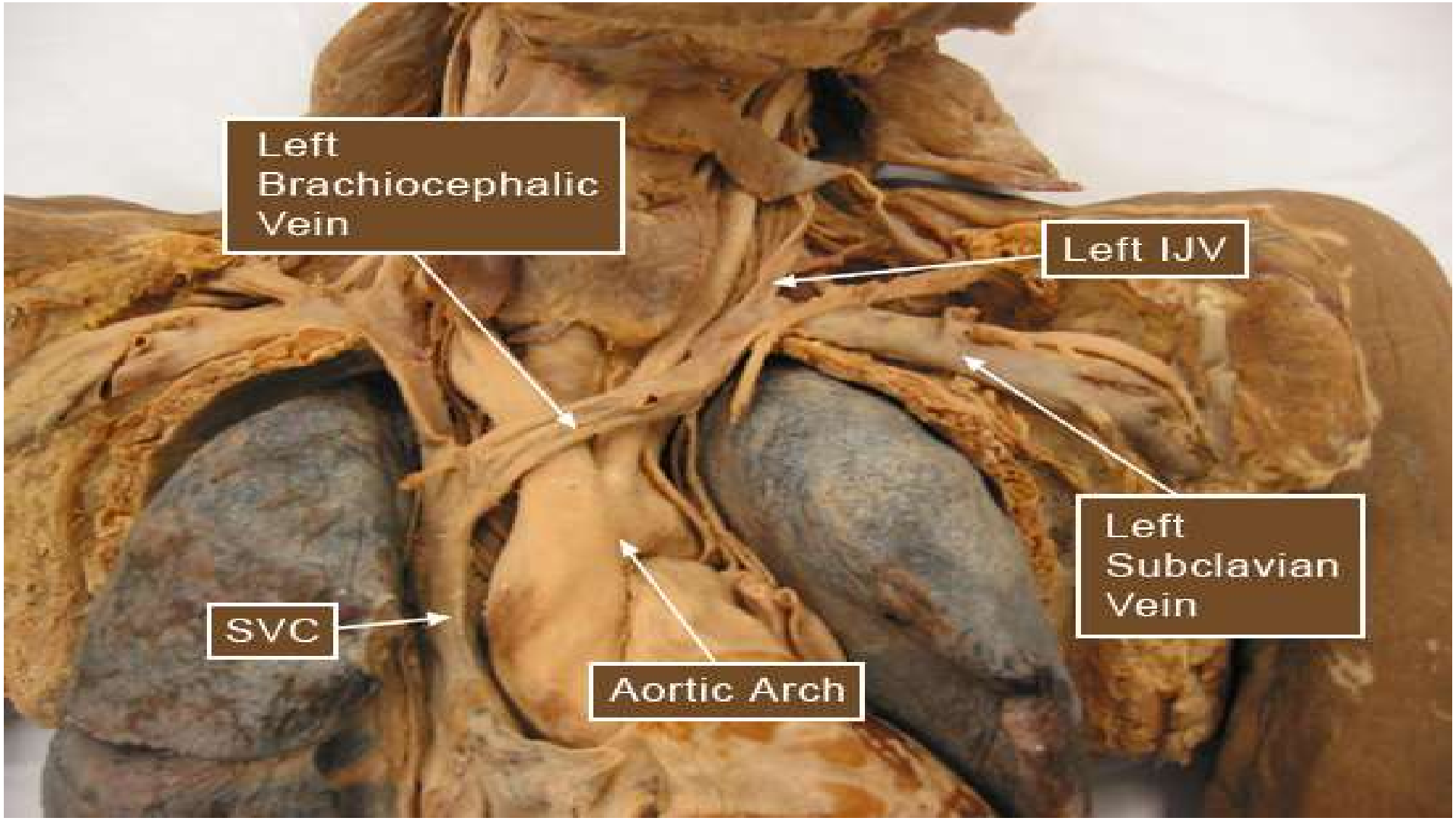
Beginning : Posterior to the sternoclavicular joint

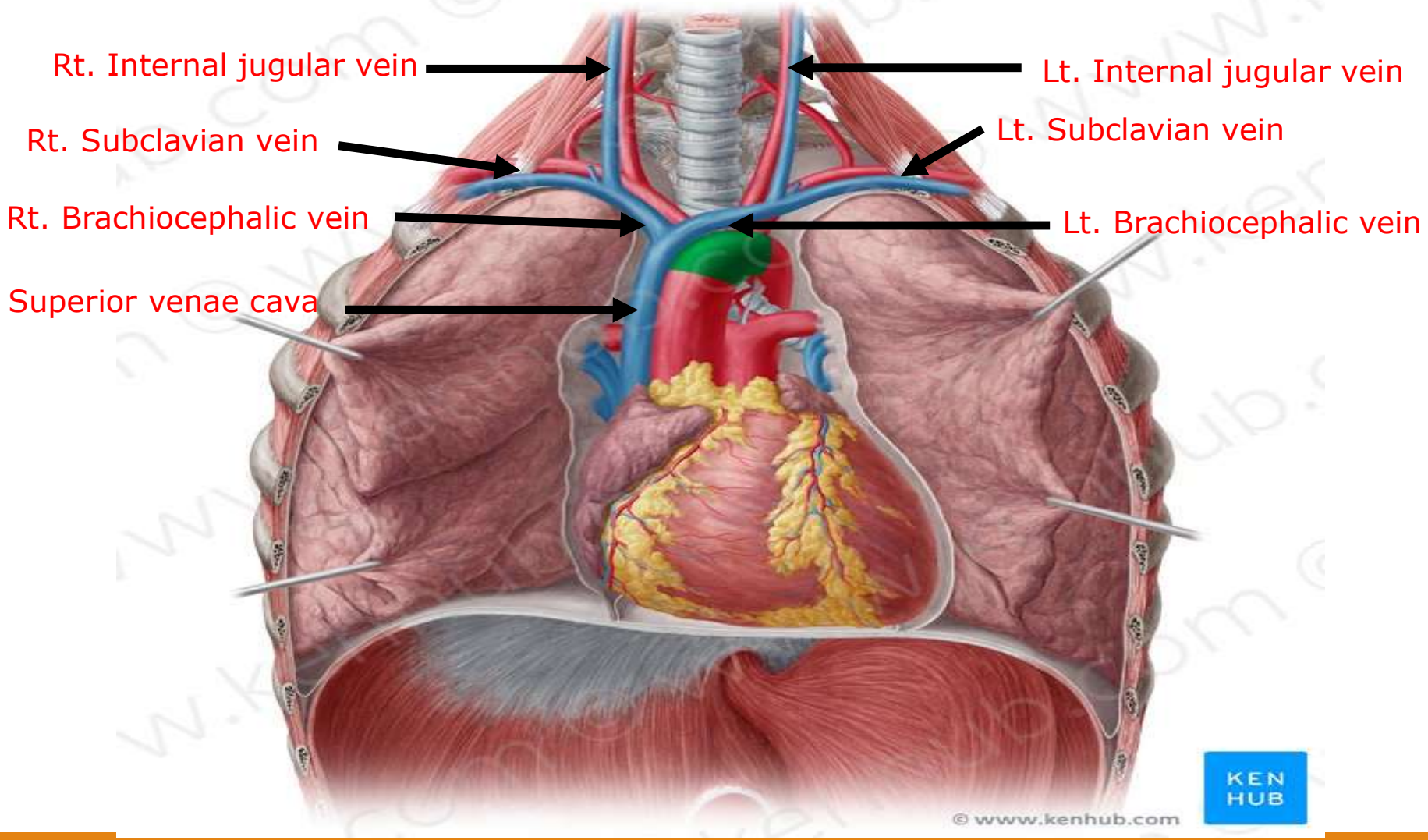
Termination : 1st right costal cartilage

Both right and left Brachiocephalic veins joined together to form superior venae cava

N.B : The left Brachiocephalic vein is longer than the right Brachiocephalic vein **WHY ??**

It passes from the left to the right side, anterior to the roots of the three major branches of the arch of the aorta


Left
Brachiocephalic
Vein
Left IJV
Left
Subclavian
Vein
SVC
Aortic Arch


Rt. Internal jugular vein
Lt. Internal jugular vein
Rt. Subclavian vein
Lt. Subclavian vein
Rt. Brachiocephalic vein
Lt. Brachiocephalic vein
Superior venae cava
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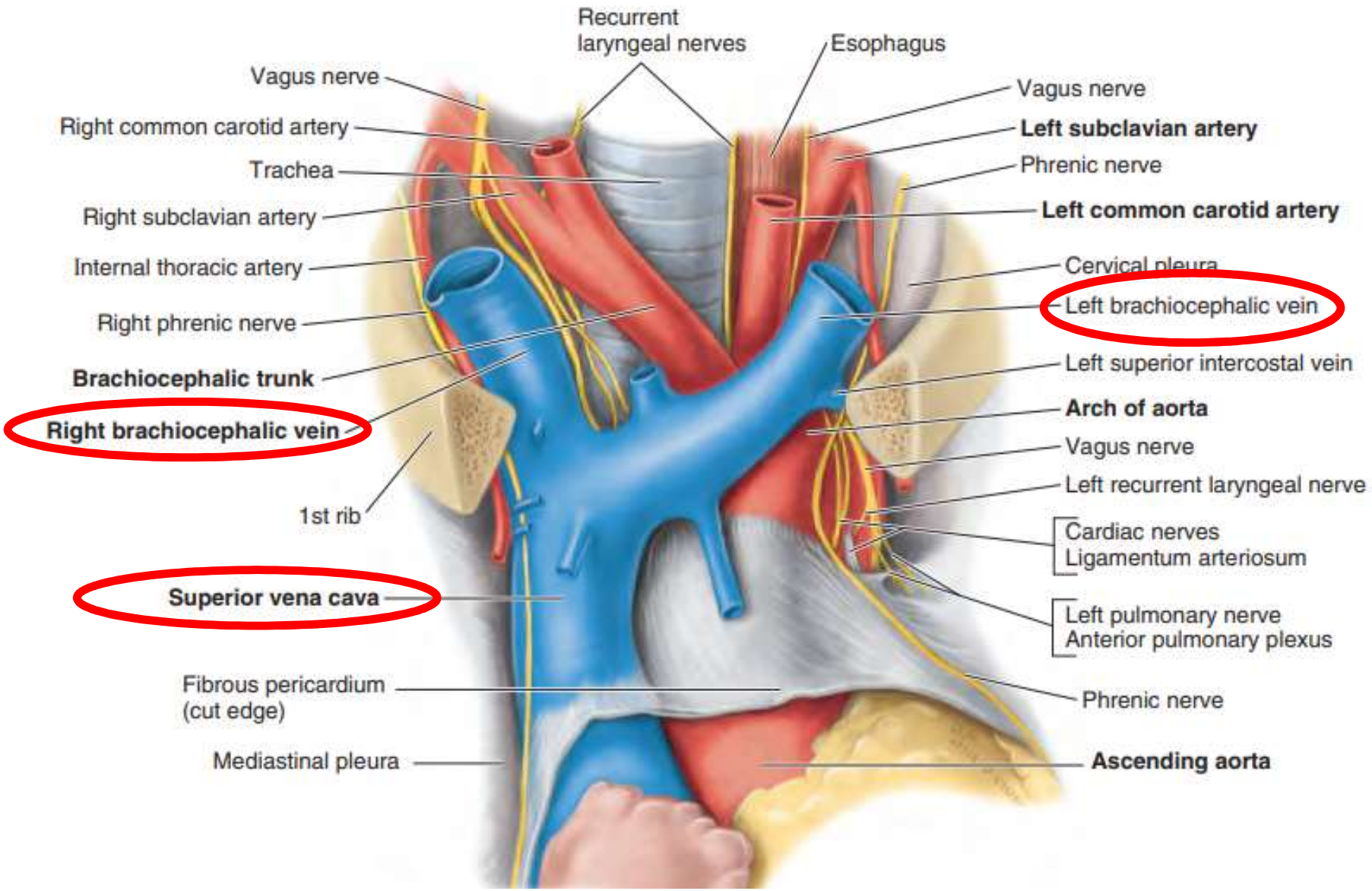
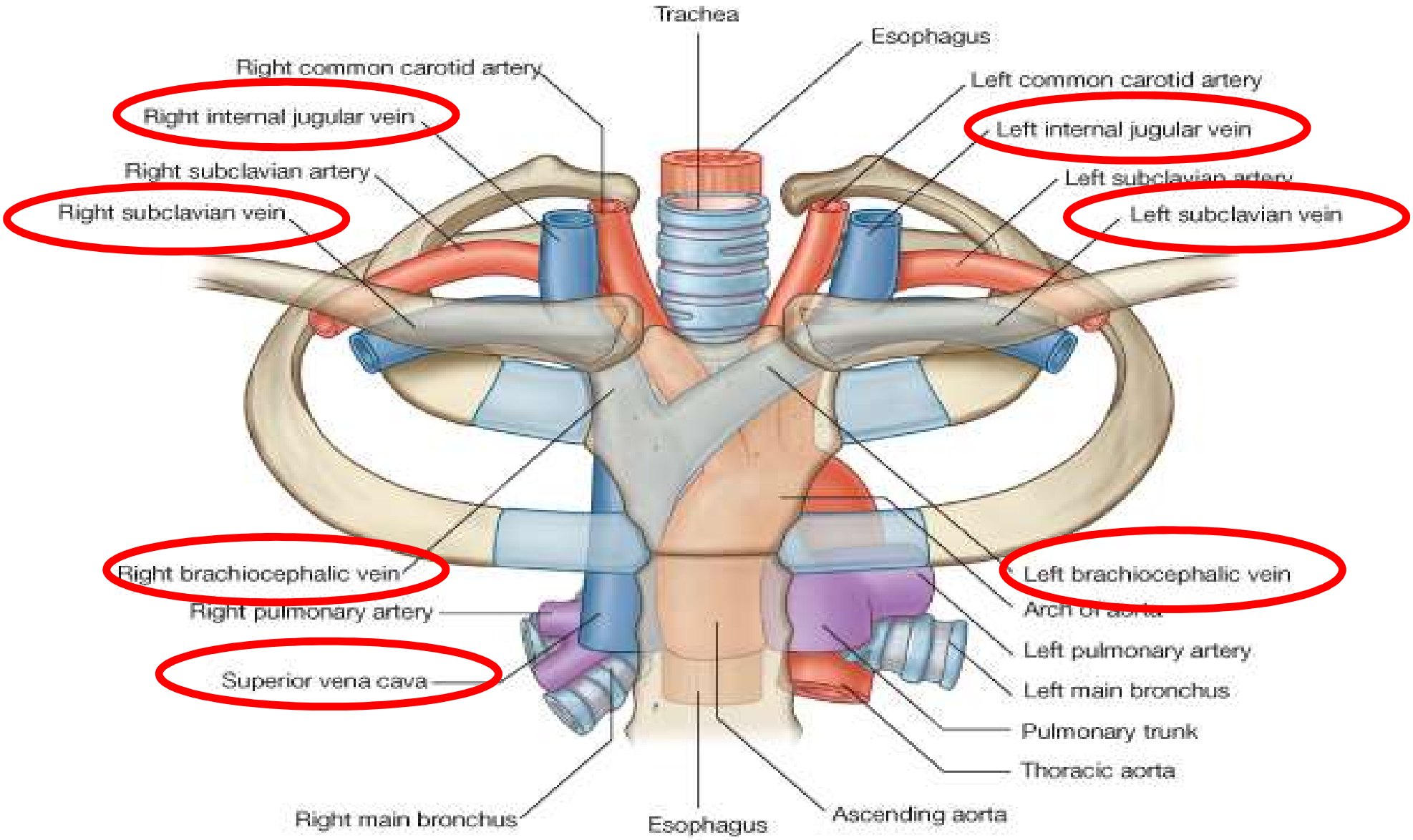

Recurrent laryngeal nerves
Esophagus
Vagus nerve
Right common carotid artery
Trachea
Right subclavian artery
Internal thoracic artery
Right phrenic nerve
Brachiocephalic trunk
Right brachiocephalic vein
1st rib
Superior vena cava
Fibrous pericardium (cut edge)
Mediastinal pleura
Vagus nerve
Left subclavian artery
Phrenic nerve
Left common carotid artery
Cervical pleura
Left brachiocephalic vein
Left superior intercostal vein
Arch of aorta
Vagus nerve
Left recurrent laryngeal nerve
Cardiac nerves
Ligamentum arteriosum
Left pulmonary nerve
Anterior pulmonary plexus
Phrenic nerve
Ascending aorta



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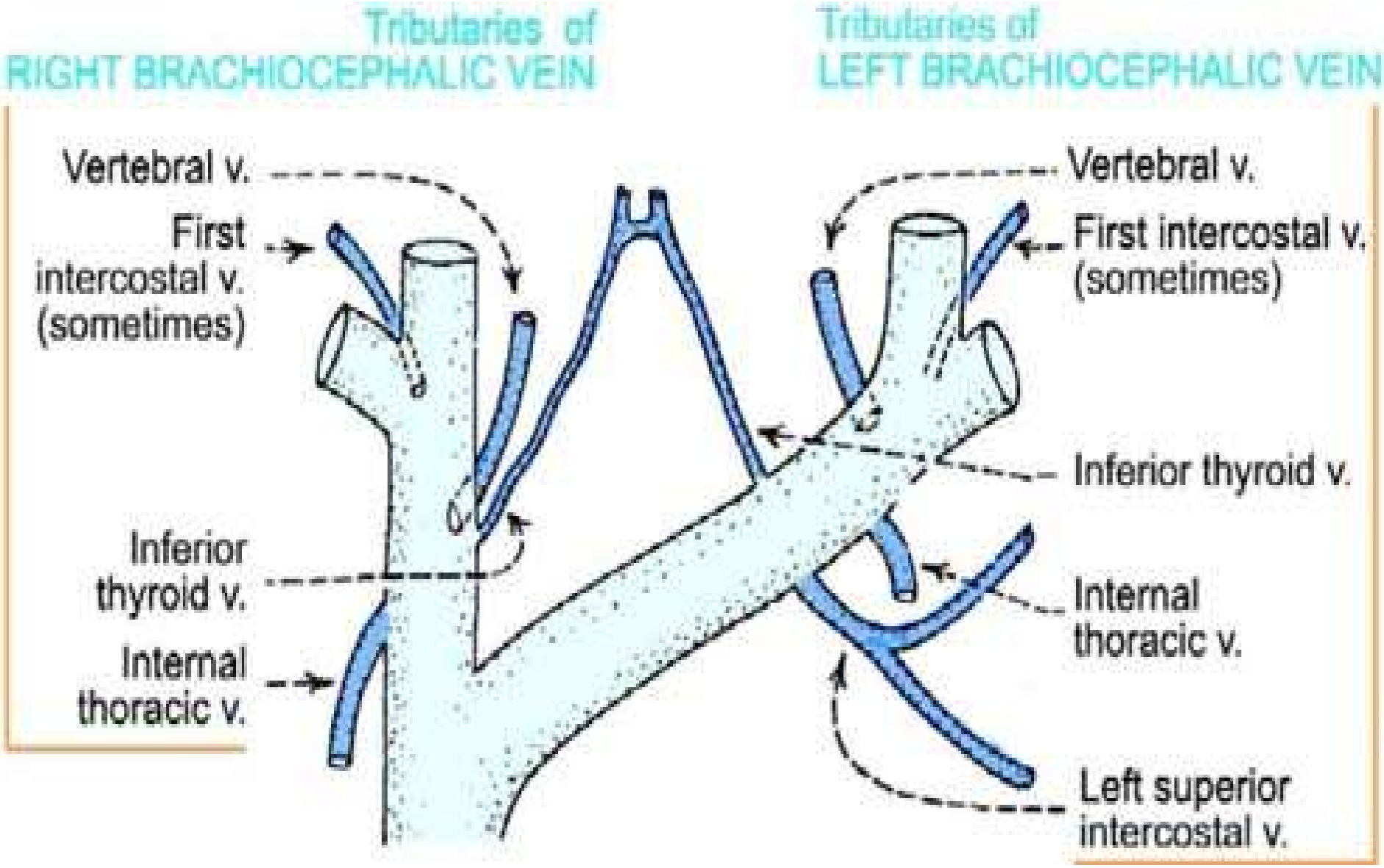
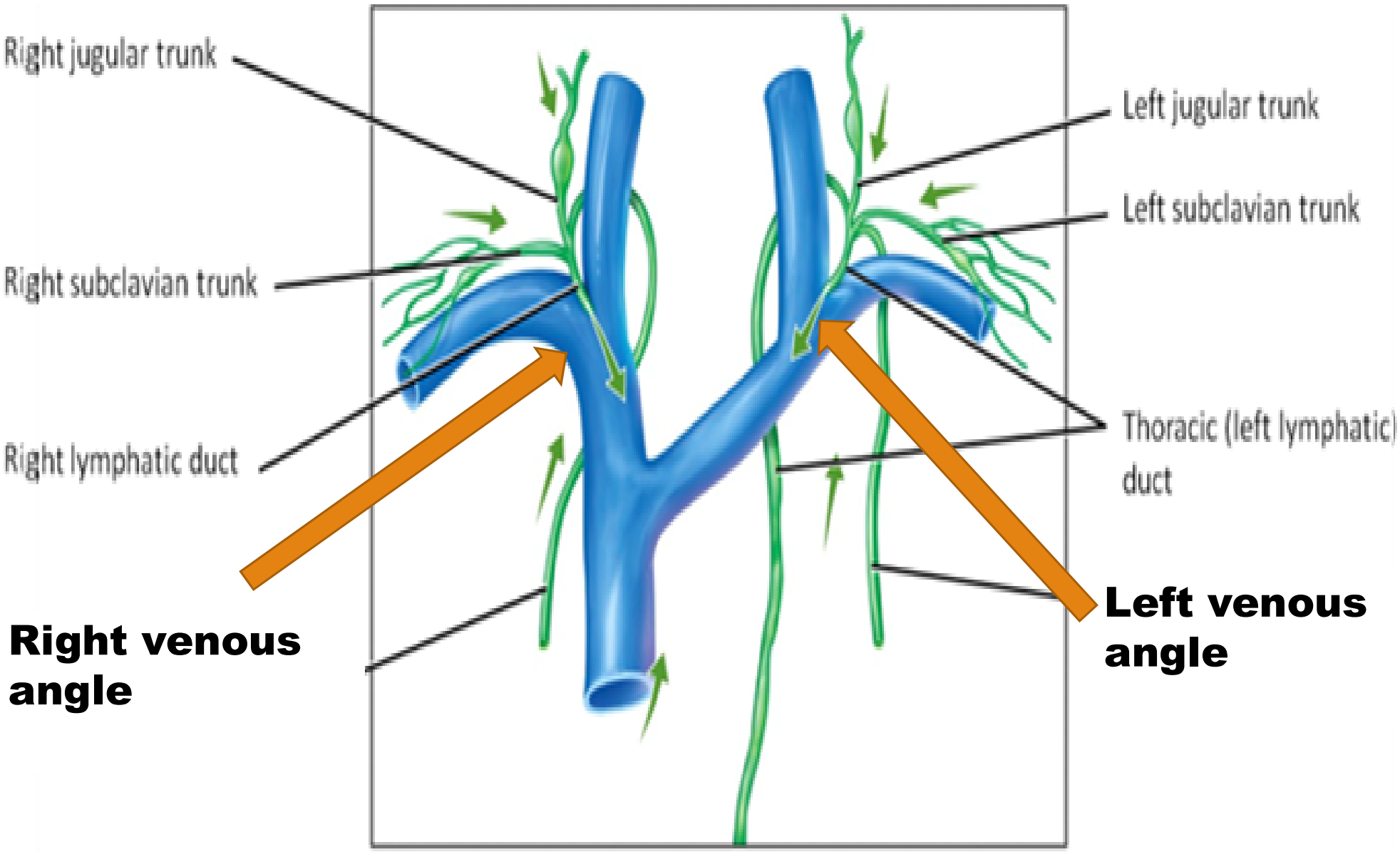
Tributaries of Brachiocephalic vein

Rt. Brachiocephalic vein	Lt. Brachiocephalic vein
Right vertebral vein	Left vertebral vein
Inferior thyroid vein	Inferior thyroid vein
Right Internal thoracic vein	Left Internal thoracic vein
Right first posterior intercostal	Left first posterior intercostal vein
	Left superior intercostal vein


Tributaries of
RIGHT BRACHIOCEPHALIC VEIN
Vertebral v.
First
intercostal v.
(sometimes)
Inferior
thyroid v.
Internal
thoracic v.
Tributaries of
LEFT BRACHIOCEPHALIC VEIN
Vertebral v.
First intercostal v.
(sometimes)
Inferior thyroid v.
Internal
thoracic v.
Left superior
intercostal v.


Right jugular trunk
Left jugular trunk
Left subclavian trunk
Right subclavian trunk
Thoracic (left lymphatic) duct
Right lymphatic duct
Right venous angle
Left venous angle

Superior venae cava

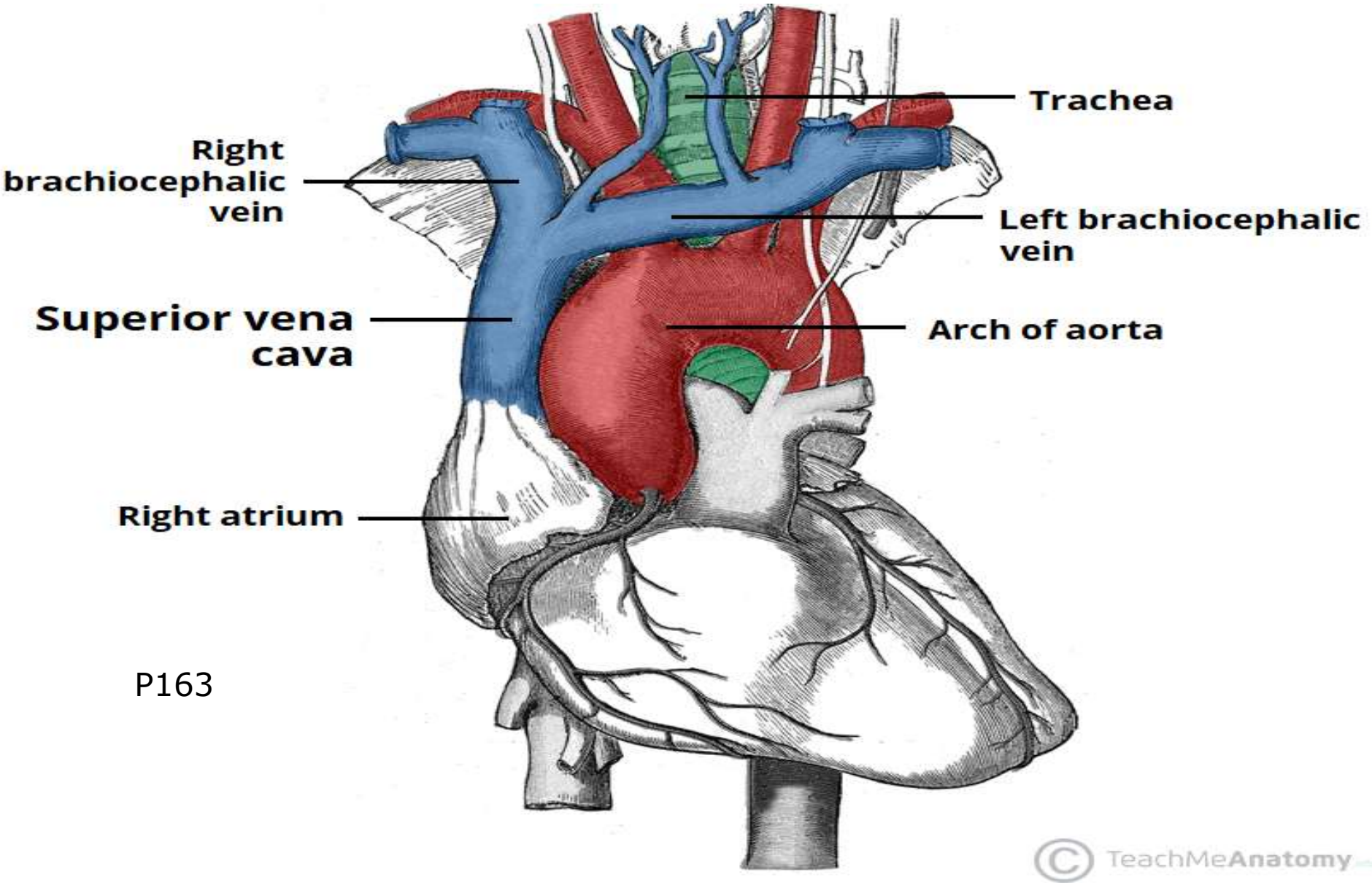
Formation : By union the right and left Brachiocephalic veins

Beginning : 1st right costal cartilage

Termination : 3rd right costal cartilage

as it enters the right atrium of the heart

It receives the venous return from the upper half of the body, above the diaphragm


Trachea
Right brachiocephalic vein
Left brachiocephalic vein
Superior vena cava
Arch of aorta
Right atrium
TeachMeAnatomy

P163

Arteries of the superior mediastinum

I-Arch of the aorta

Beginning : Right border of sternum at 2nd right costal cartilage

Termination: Lower border 4th thoracic vertebra

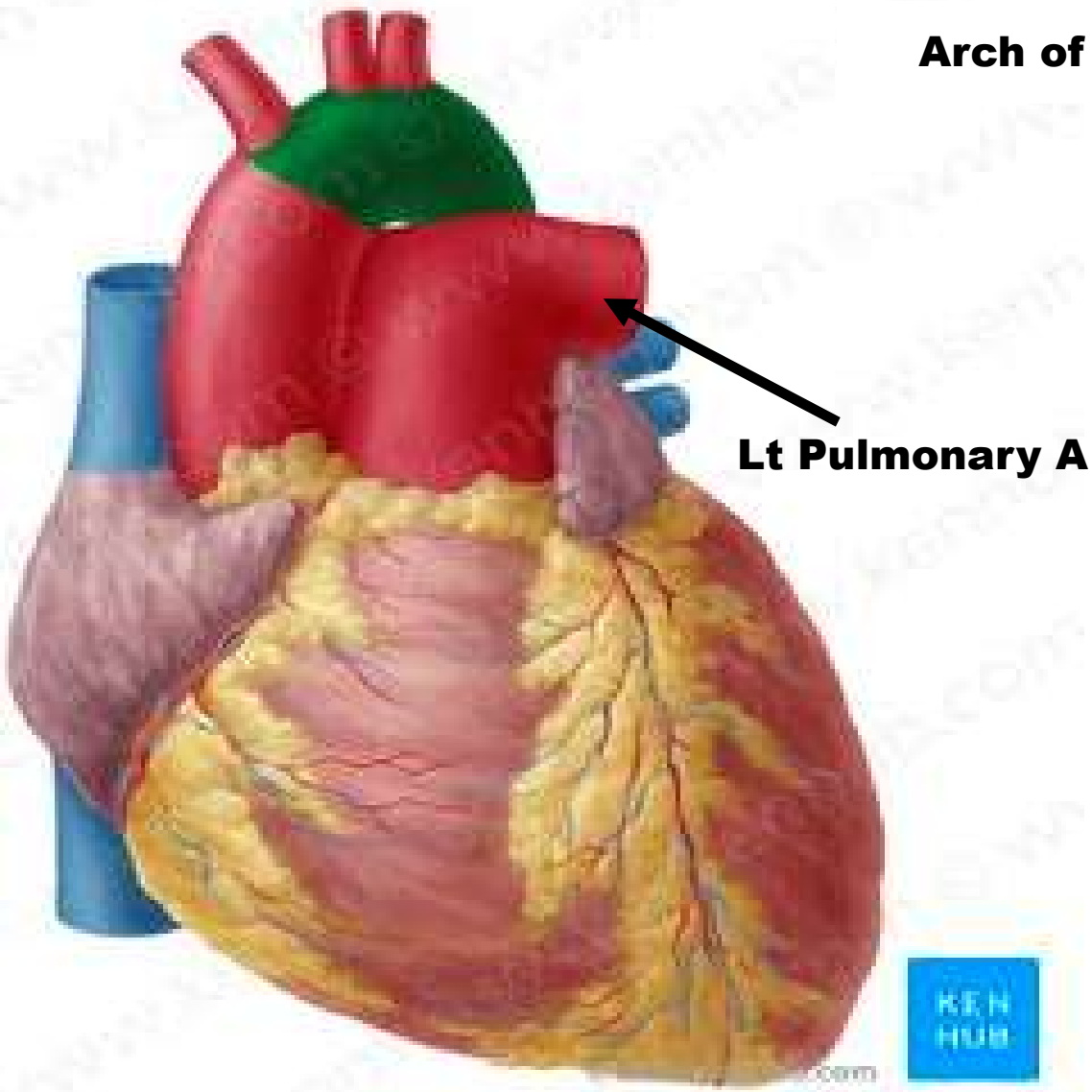
by becoming the thoracic (descending) aorta

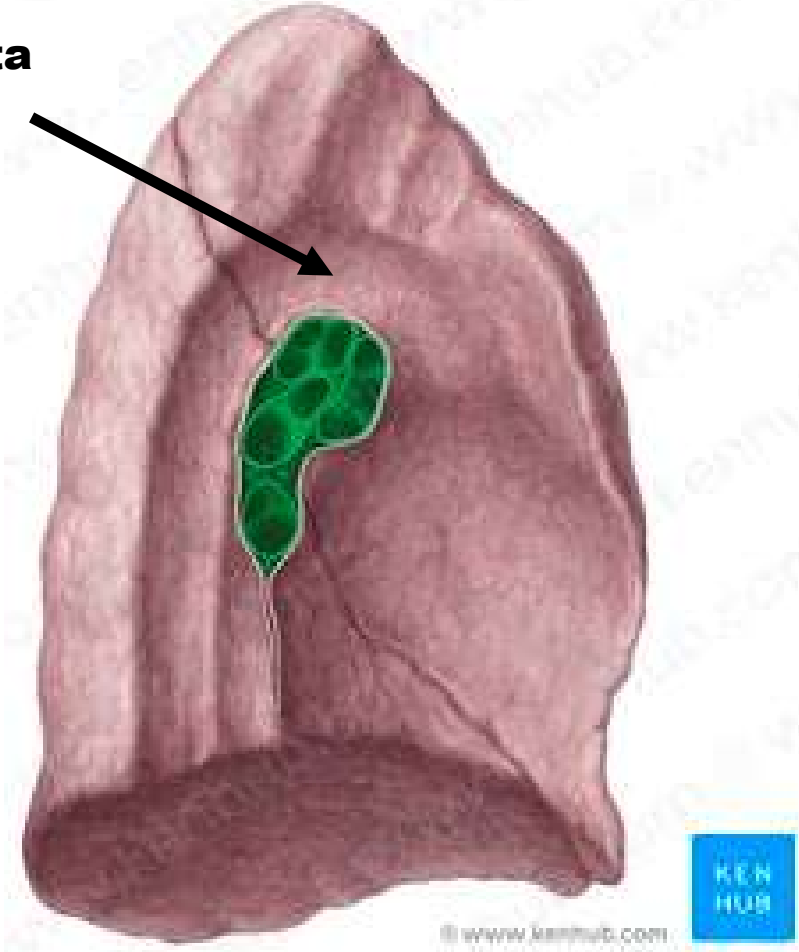
Course:

- It arches superiorly, posteriorly and to the left, and then inferiorly.
- The arch ascends anterior to the right pulmonary artery and the bifurcation of the trachea.
- It passes over the root of the left lung to become at the left side of the trachea and esophagus

N.B The ligamentum arteriosum :

- it is the remnant of the fetal ductus arteriosus.
- It passes from the root of the left pulmonary artery to the inferior surface of the arch of the aorta


Lt Pulmonary A


Arch of Aorta

Relations

Anteriorly and to the left:

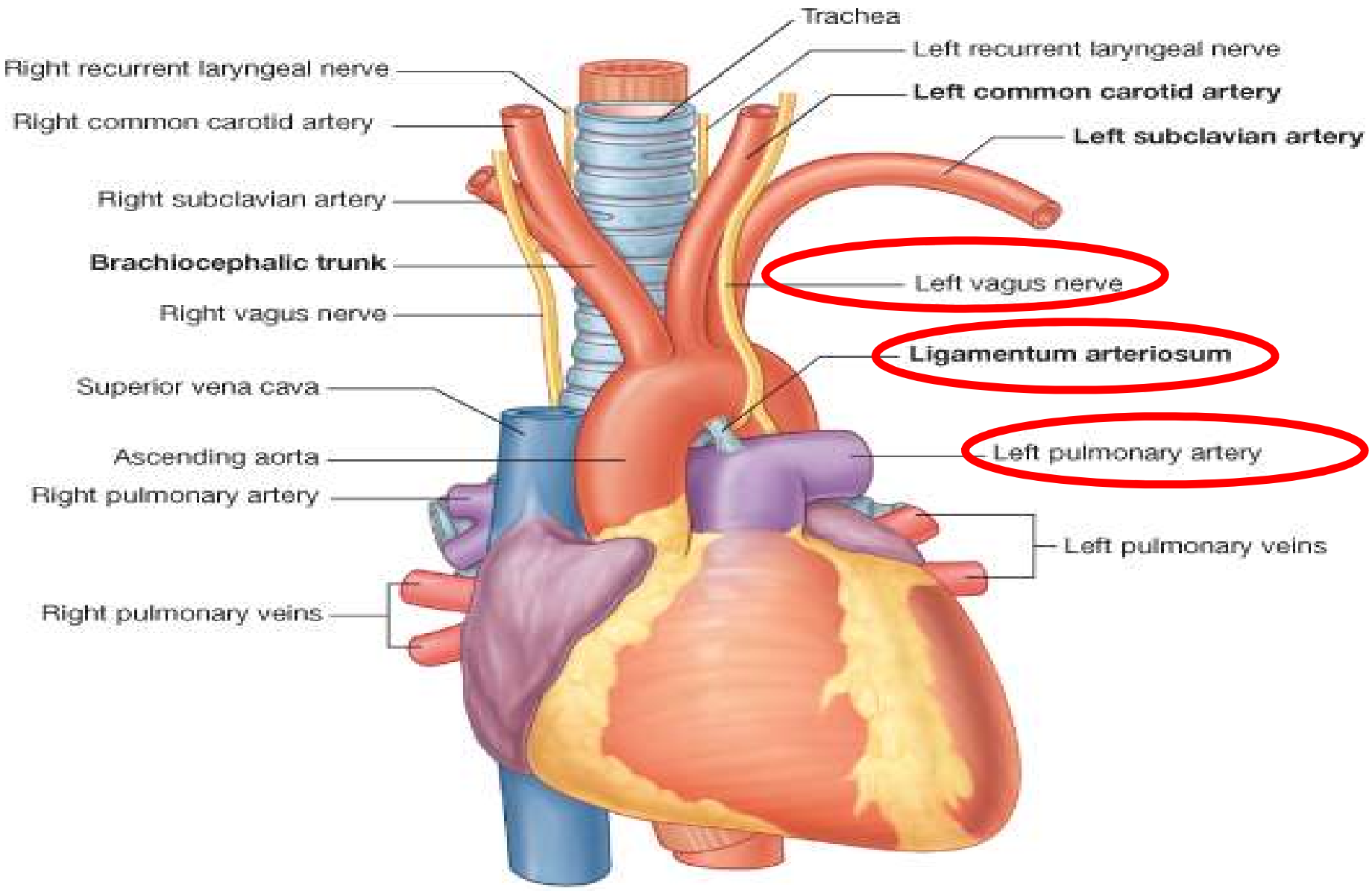
left phrenic, left vagus and left superior intercostal vein

Posteriorly and to the right:

Esophagus, trachea, left recurrent laryngeal nerve and thoracic duct

Inferiorly :

- ✓ Bifurcation of pulmonary trunk
- ✓ Ligamentum arteriosum.
- ✓ Superficial cardiac plexus
- ✓ left recurrent laryngeal nerve.
- ✓ Left main bronchus



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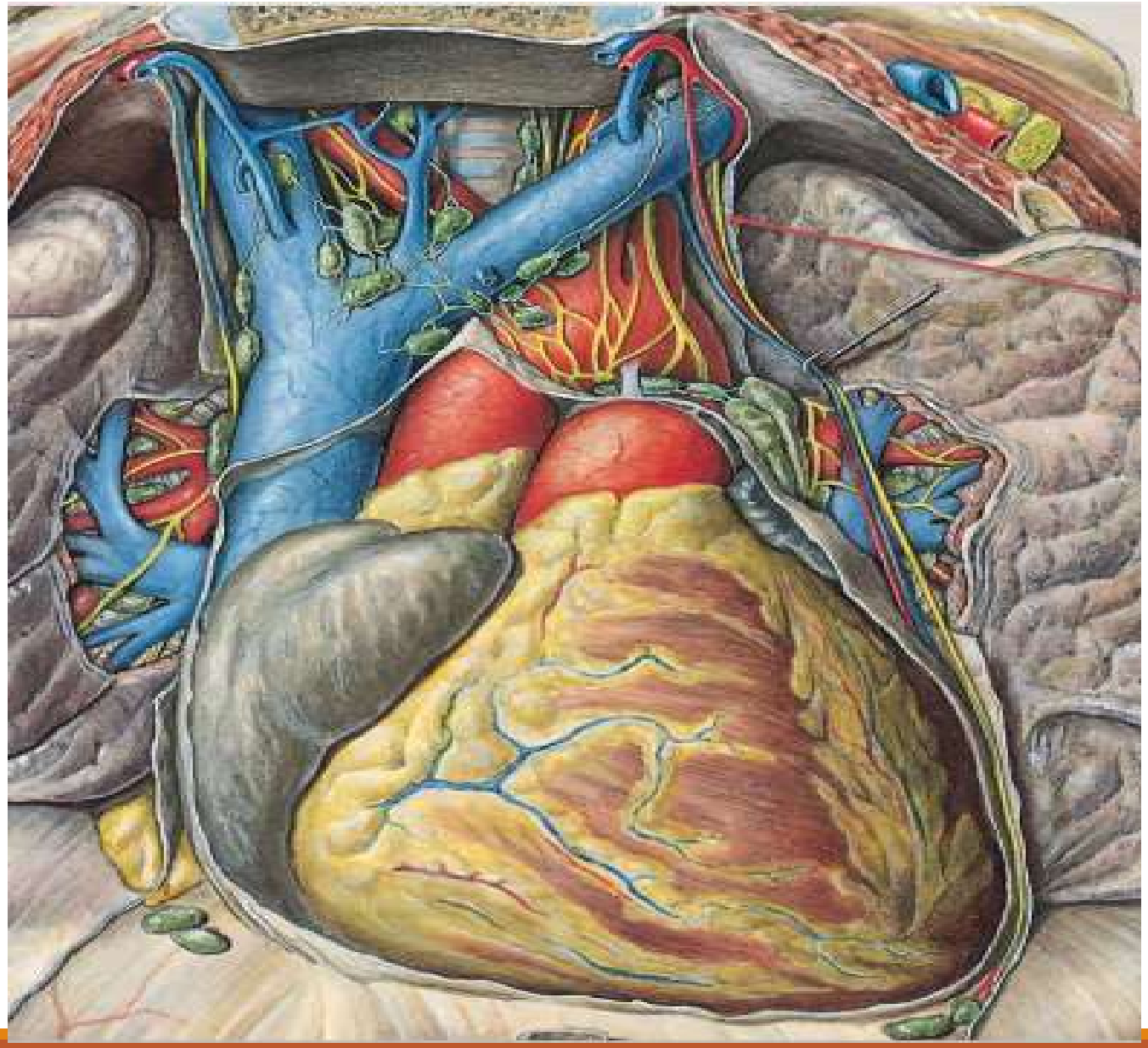
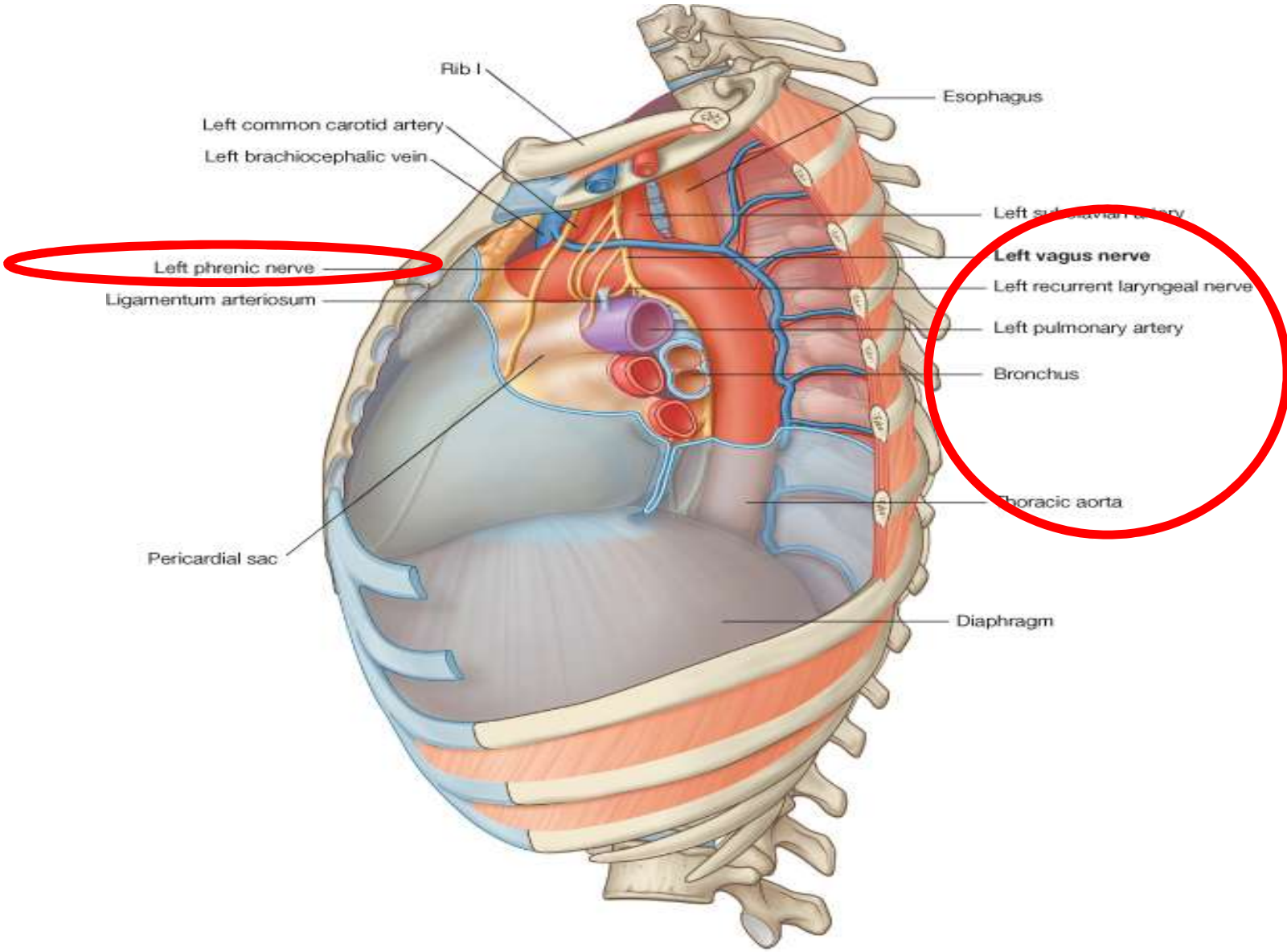


Left phrenic nerve



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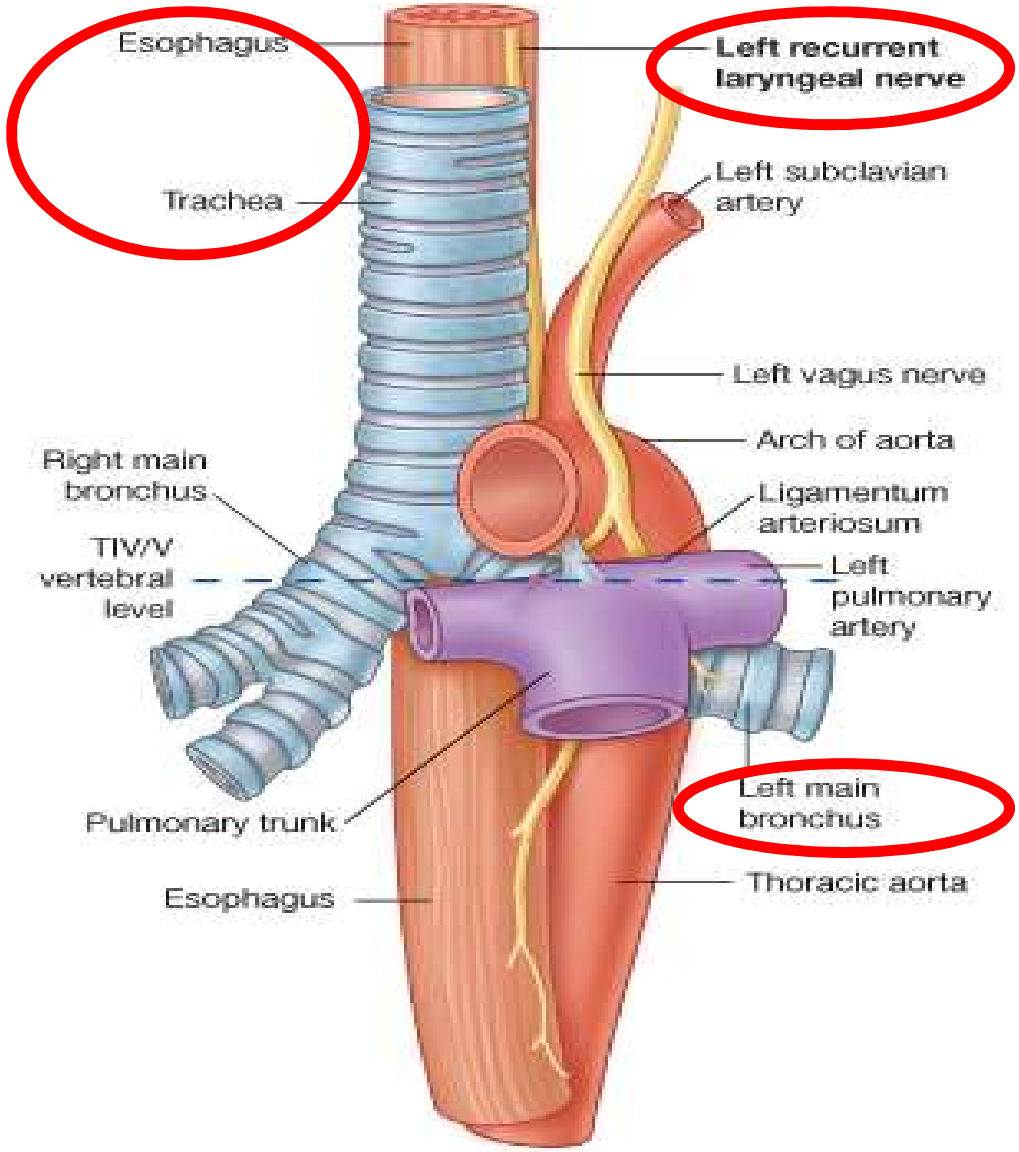

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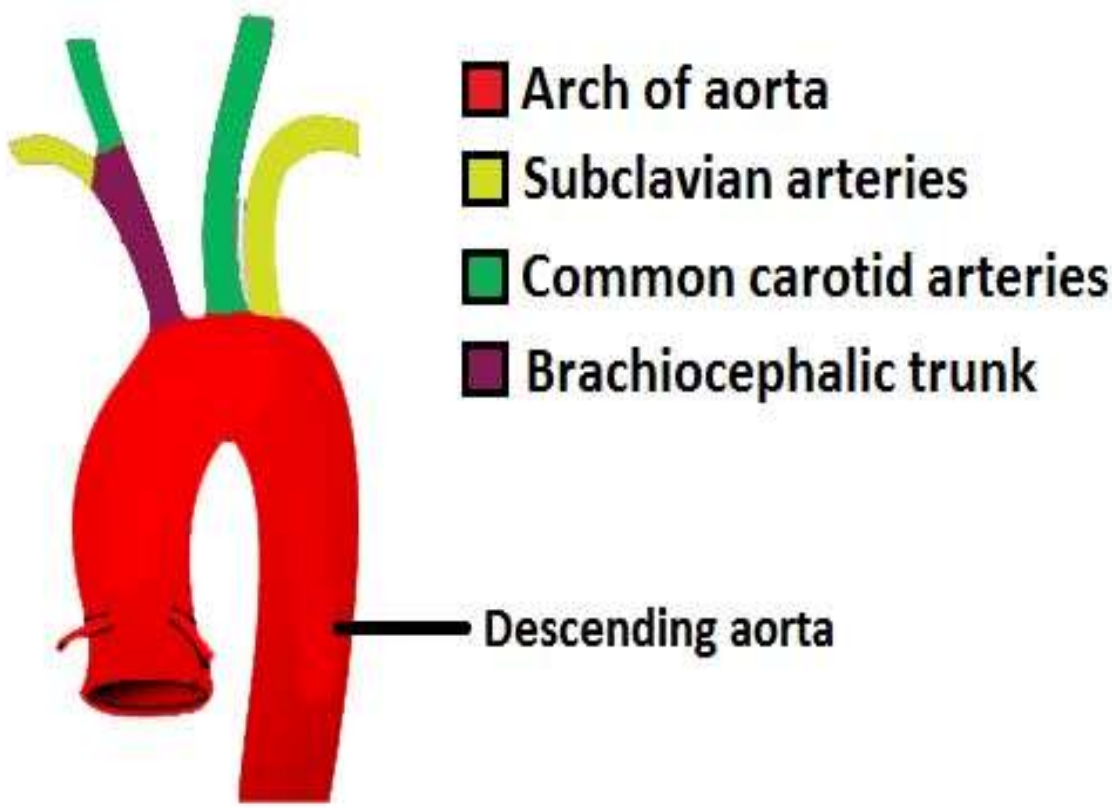
Aortic arch branches

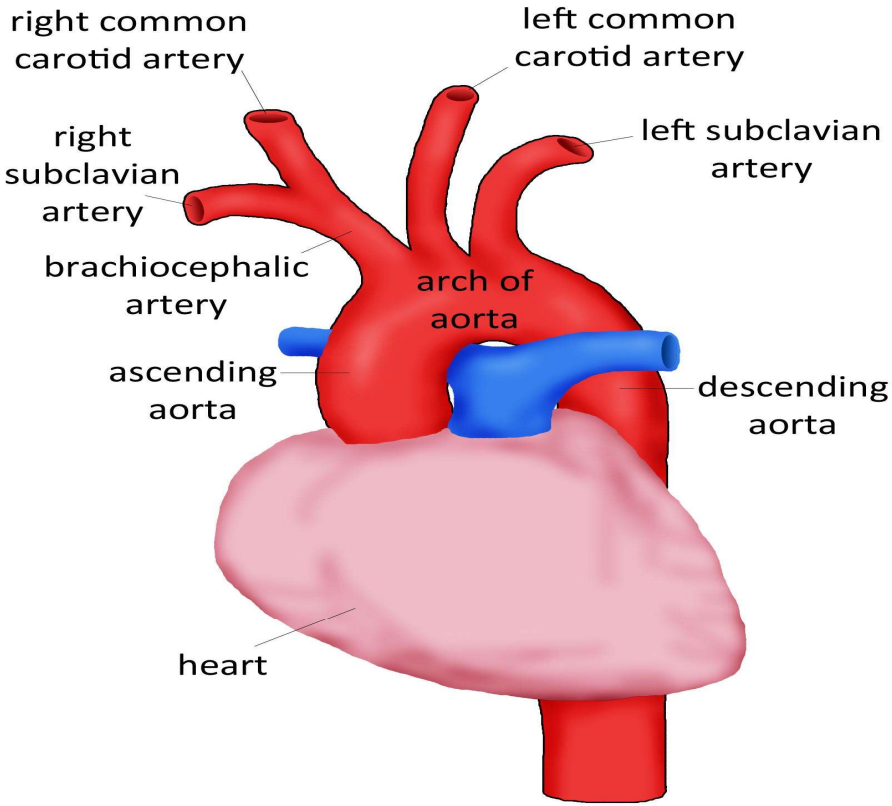
Three branches

1. Brachiocephalic trunk
2. Left common carotid artery
3. Left subclavian artery



The brachiocephalic trunk:

- It arises posterior to the manubrium, where it is anterior to the trachea and posterior to the left brachiocephalic vein
- At the **right sternoclavicular (SC) joint**, it divides into the right common carotid and right subclavian arteries.

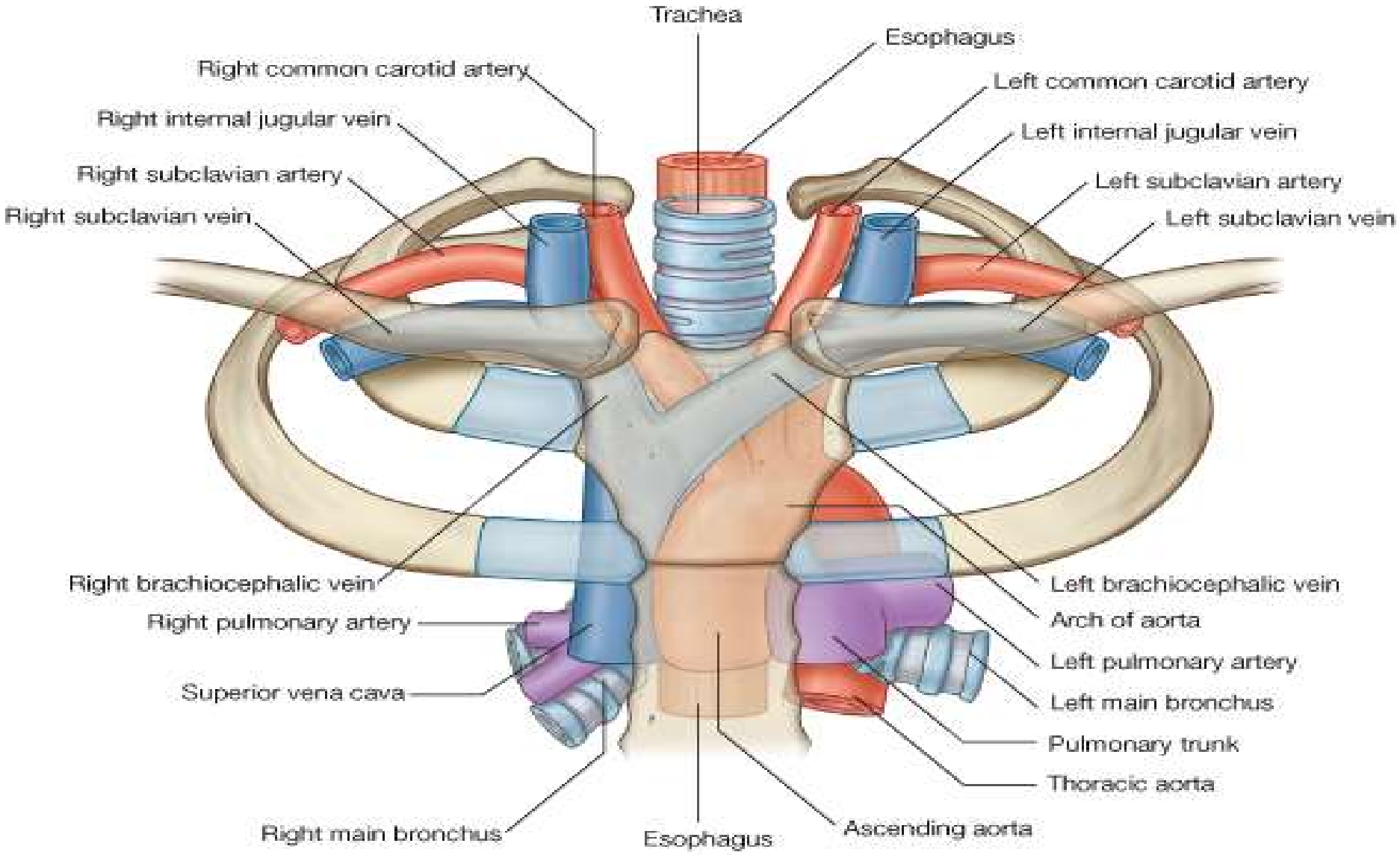


The left common carotid artery:

- It arises posterior to the manubrium
- It enters the neck by passing posterior to the **left SC joint.**

The left subclavian artery :

- It arises from the posterior part of the arch behind left common carotid artery
- It leaves the thorax and enters the root of the neck by passing posterior to the **left SC joint.**



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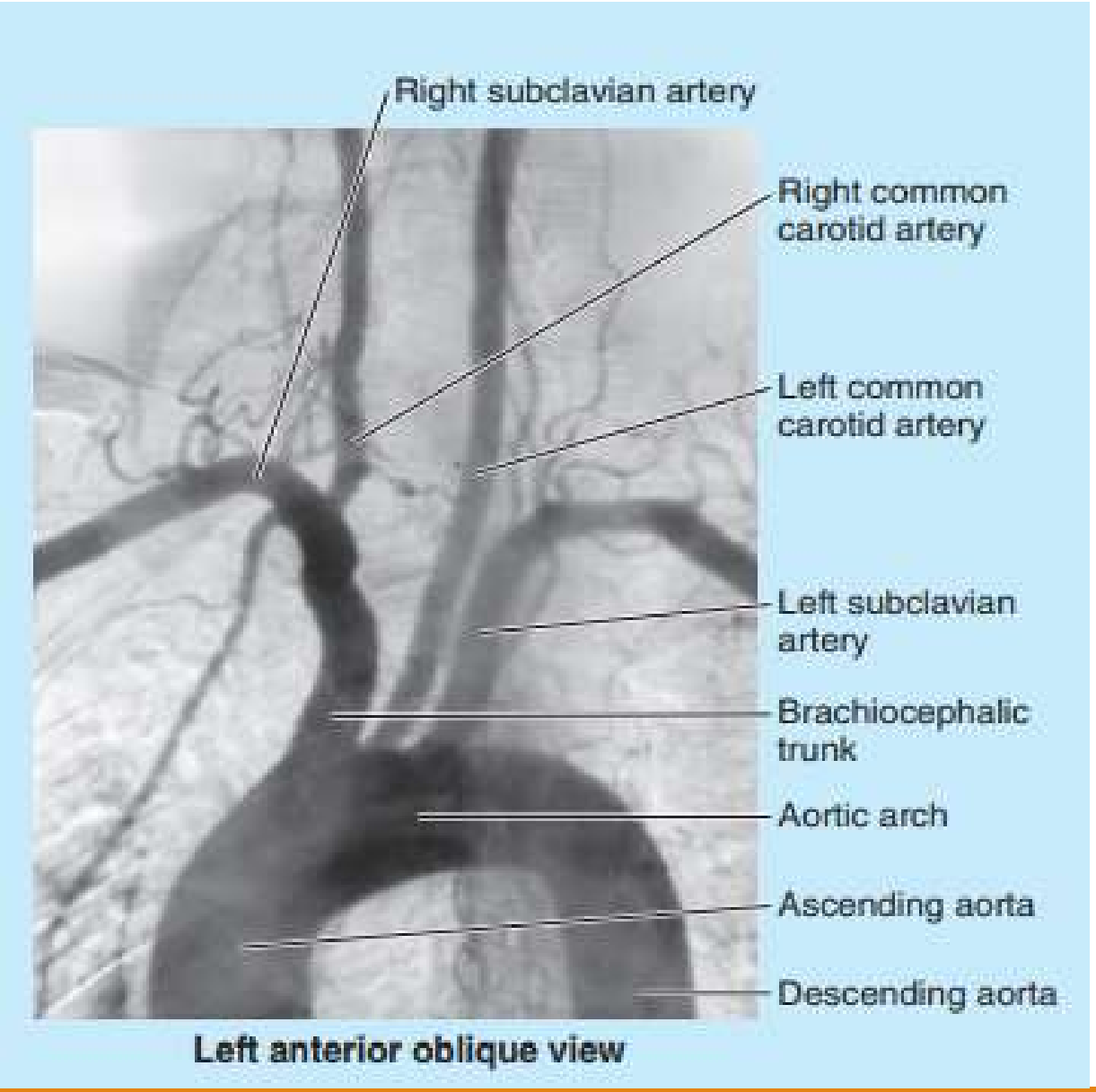


Aortic angiogram (aortogram)

Clinically Oriented Anatomy. keith moore.

Nerves of the superior mediastinum

I-Vagus Nerve

Right vagus nerve

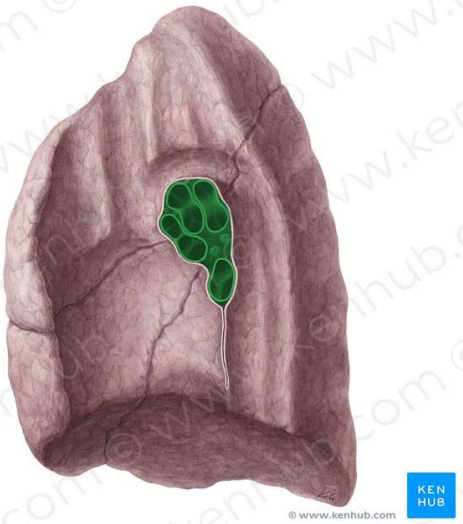
- Passes on the right side of the trachea ,then posterior to the right brachiocephalic vein, SVC
- It contribute to Rt. pulmonary, esophageal and cardiac plexuses
- It gives right recurrent laryngeal nerve ,which hooks around the right subclavian artery and ascends between the trachea and esophagus to supply the larynx

The left vagus nerve

- It enters the mediastinum between the left common carotid artery and left subclavian artery.
- It gives left recurrent laryngeal nerve which hooks around the arch of the aorta, lateral to the ligamentum arteriosum, and ascends in the groove between the trachea and the esophagus to supply the larynx

Both vagi are passing behind the root of the lung

Left Lung



Right Lung

The phrenic nerves : is motor and sensory nerve supply for the diaphragm and sensory to the pericardium and mediastinal pleura.

The right phrenic nerve : passes along the right side of the right brachiocephalic vein, SVC, and the pericardium over the right atrium and descends on the right side of the IVC to passes through caval opening of the diaphragm.

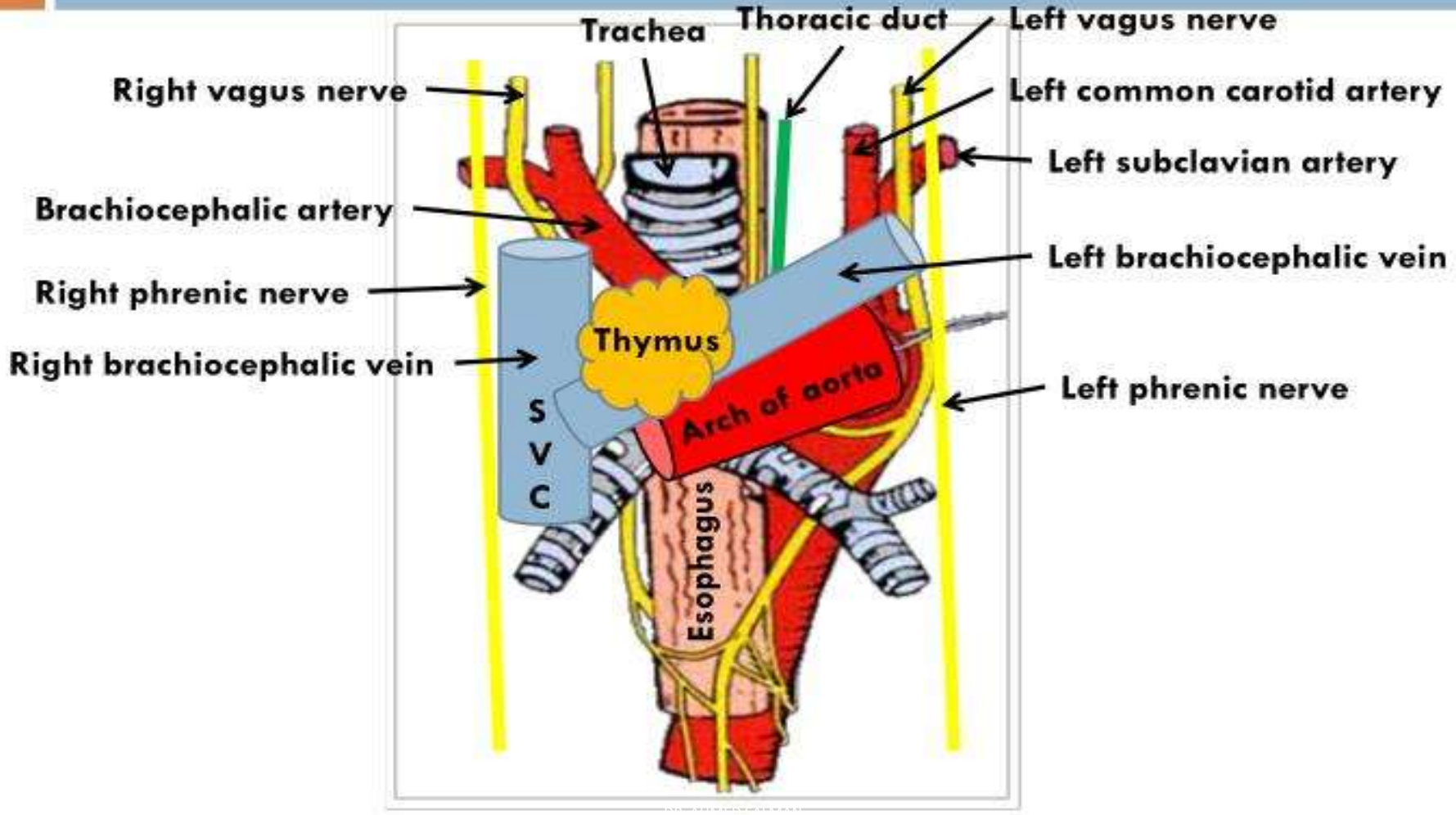
The left phrenic nerve :

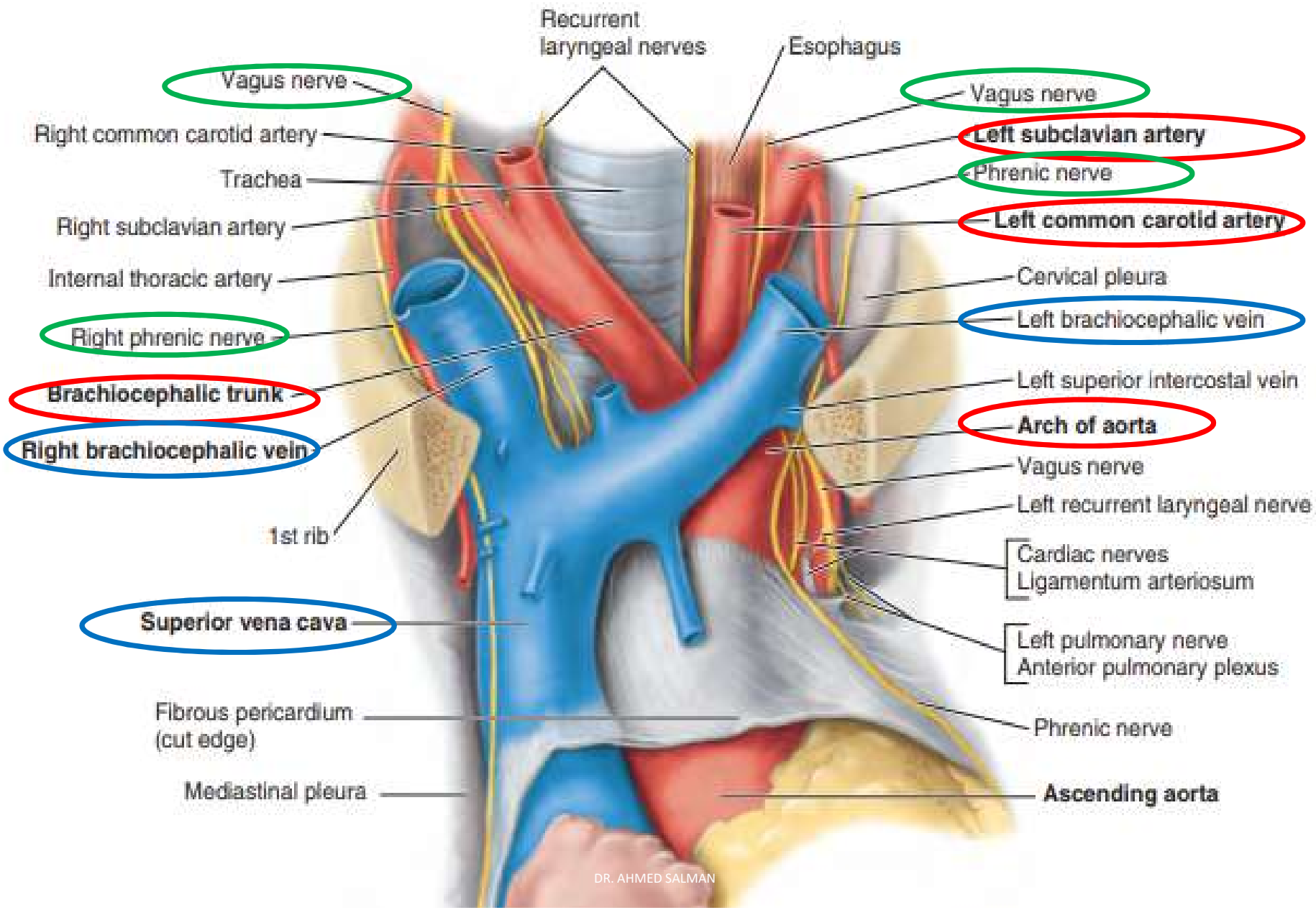
It crosses the left vagus ,then ,it runs along the fibrous pericardium , the left atrium and ventricle of the heart.

It pierces the diaphragm to the left of the pericardium

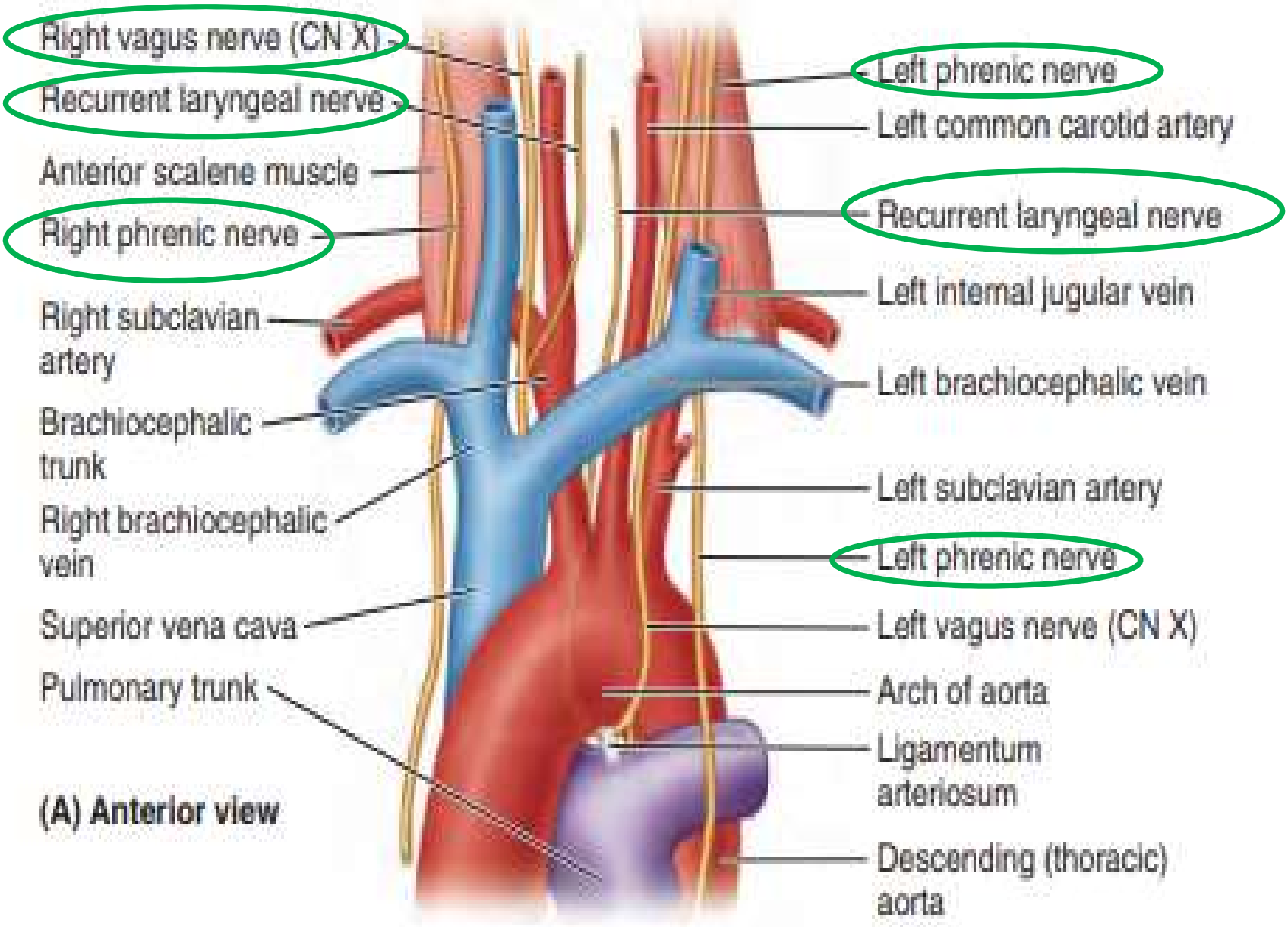
Both phrenic nerves are passing anterior to the root of the lungs

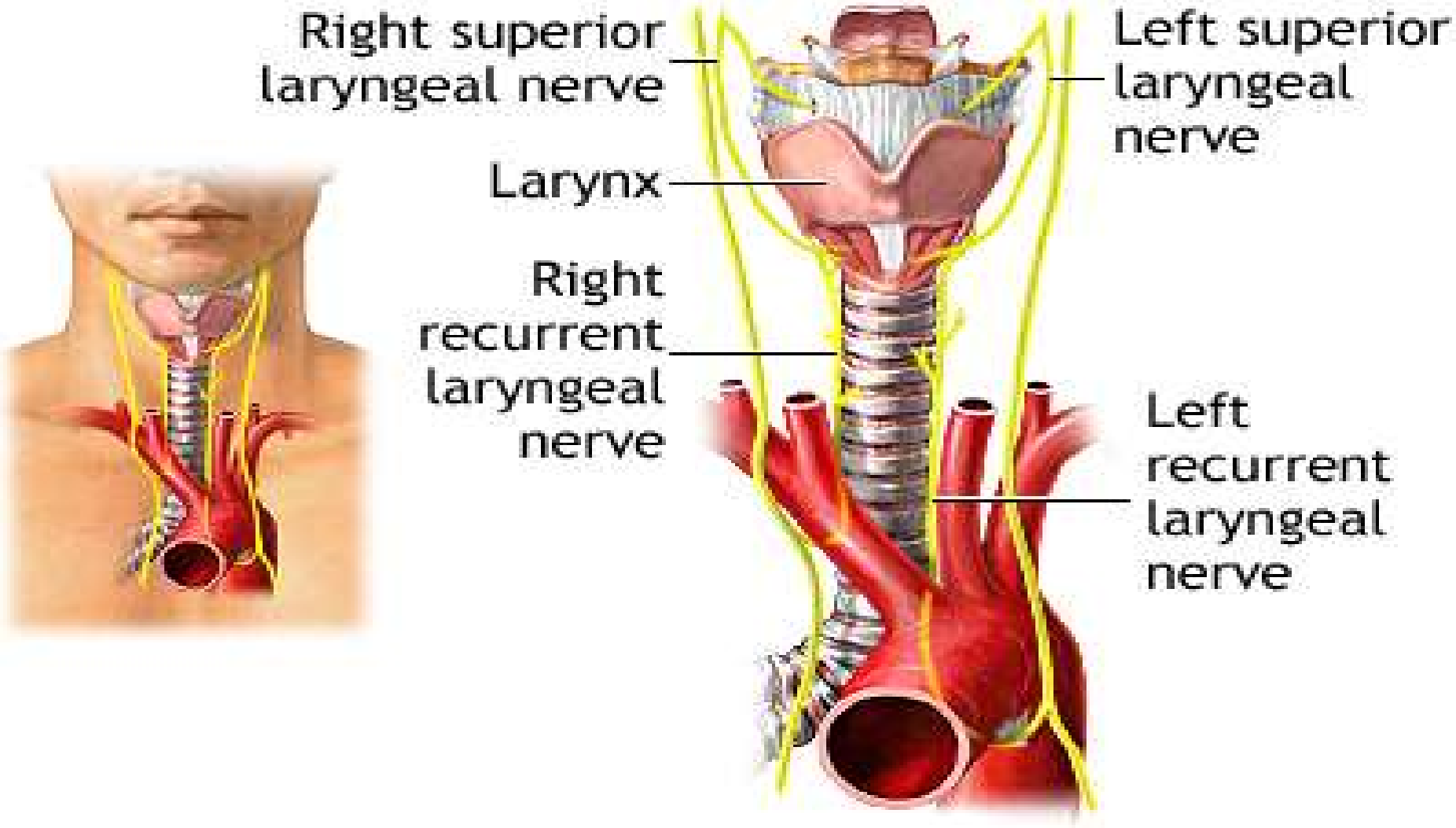
CONTENTS OF SUPERIOR MEDIASTINUM

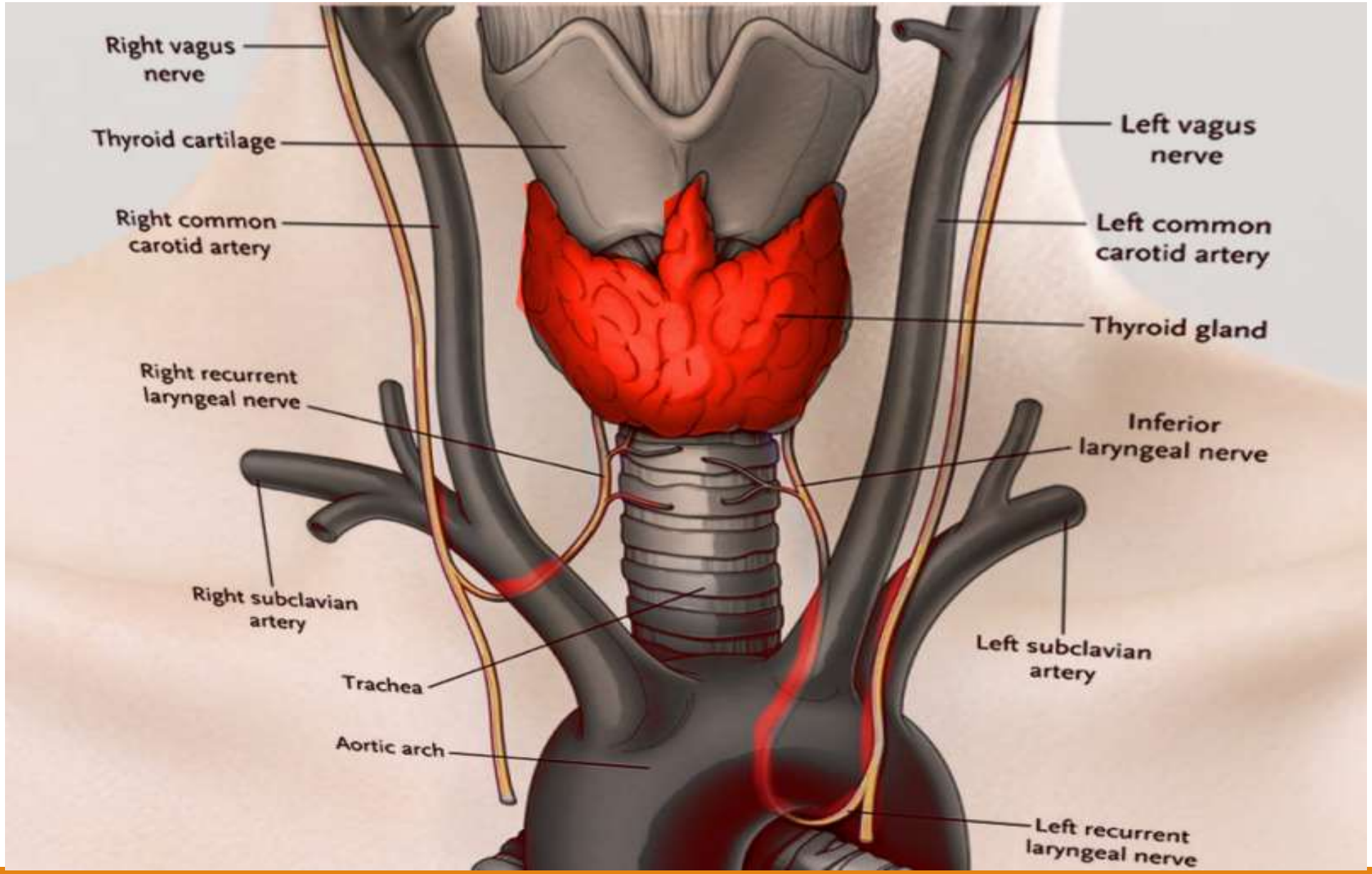


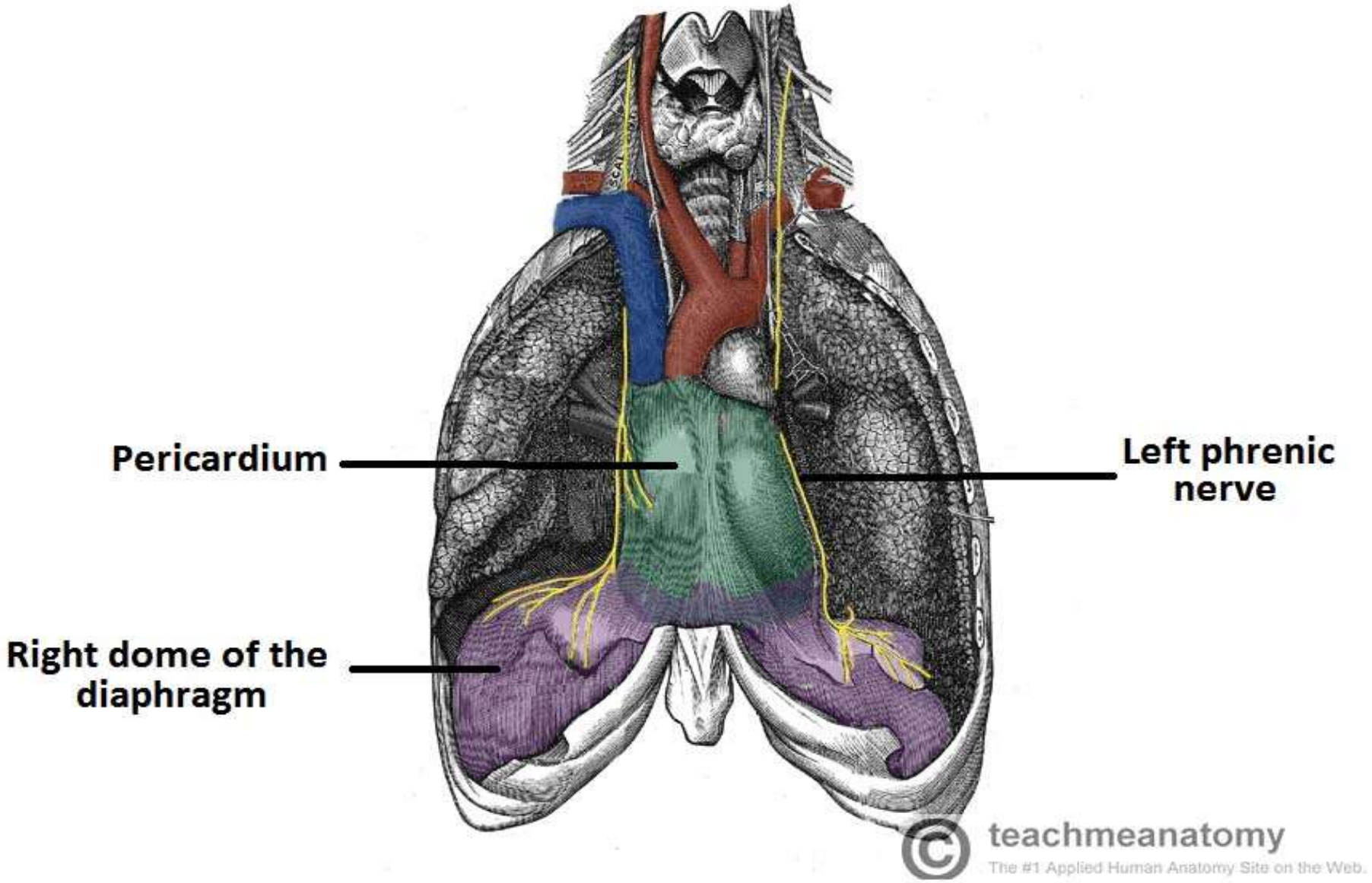


DR. AHMED SALMAN


Right vagus nerve (CN X)
Recurrent laryngeal nerve
Anterior scalene muscle
Right phrenic nerve
Right subclavian artery
Brachiocephalic trunk
Right brachiocephalic vein
Superior vena cava
Pulmonary trunk
(A) Anterior view
Left phrenic nerve
Left common carotid artery
Recurrent laryngeal nerve
Left internal jugular vein
Left brachiocephalic vein
Left subclavian artery
Left phrenic nerve
Left vagus nerve (CN X)
Arch of aorta
Ligamentum arteriosum
Descending (thoracic) aorta


Right superior laryngeal nerve
Larynx
Right recurrent laryngeal nerve
Left superior laryngeal nerve
Left recurrent laryngeal nerve
A.D.A.M.


Right vagus nerve
Thyroid cartilage
Right common carotid artery
Left vagus nerve
Left common carotid artery
Thyroid gland
Right recurrent laryngeal nerve
Inferior laryngeal nerve
Right subclavian artery
Trachea
Aortic arch
Left subclavian artery
Left recurrent laryngeal nerve


Pericardium
Left phrenic nerve
Right dome of the diaphragm
teachmeanatomy
The #1 Applied Human Anatomy Site on the Web.

Anterior Mediastinum

It lies between pericardium and sternum

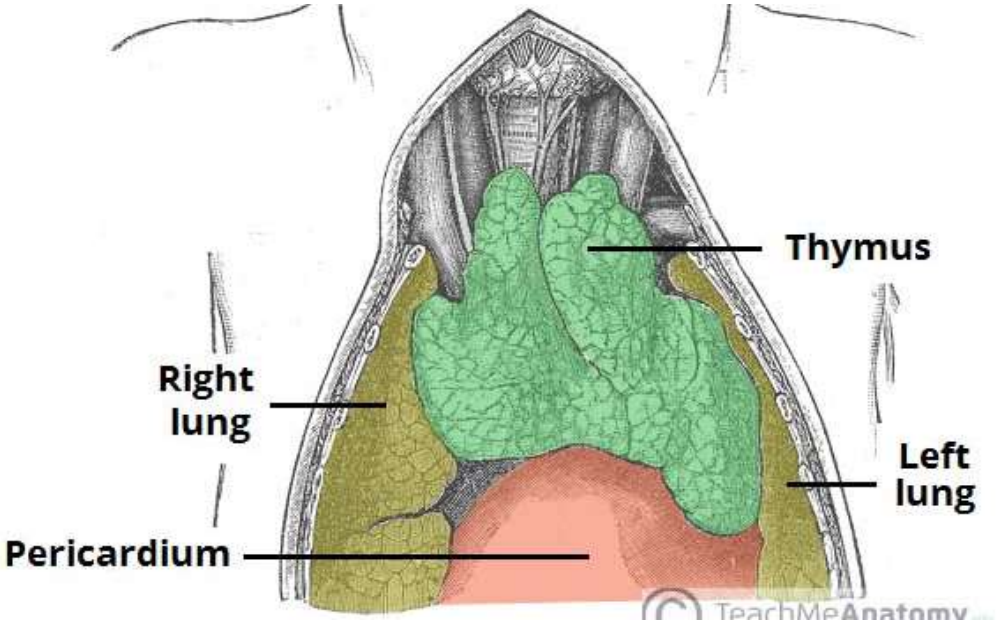
Contents :

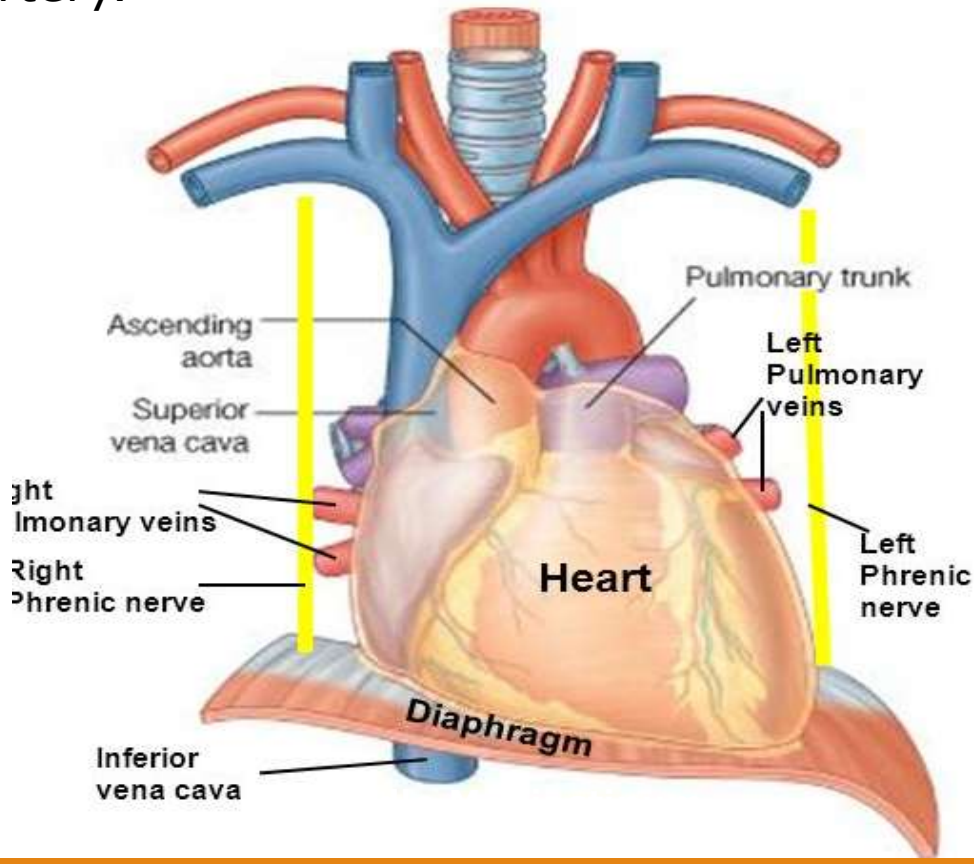
1- Remains of thymus gland.

2-Superior and inferior sterno-pericardial ligaments

4-Mediastinal branches of internal thoracic artery.

5-lymph nodes.





Anterior Mediastinum

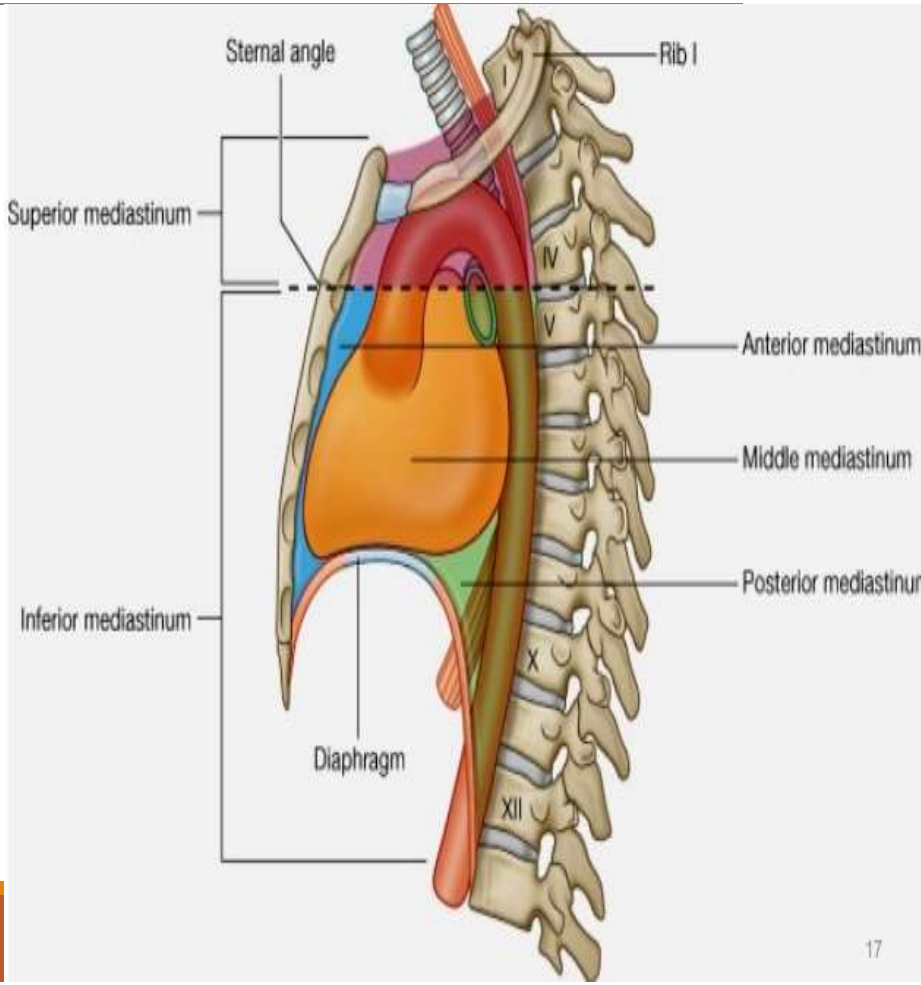
Posterior mediastinum

Boundaries:

Anteriorly : Pericardium & heart.

Posteriorly: Lower 8 thoracic vertebrae. (T5-T12)

Laterally : Mediastinal pleura on each side.



Contents of posterior mediastinum:

1. Descending thoracic aorta **(Artery)**
2. Azygos vein **(Vein)**
3. Superior and inferior hemiazygos veins **(Vein)**
4. Thoracic duct **(Lymph)**
5. Posterior mediastinal lymph nodes **(Lymph)**
6. Right and left vagi **(Nerve)**
7. Esophagus **(Tube)**

Descending thoracic aorta

Beginning : as a continuation of the arch of the aorta on the left side of the inferior border of the body of the **T4** vertebra

Course : It descends on the posterior mediastinum on the left sides of the **T5–T12** vertebrae

- It lies posterior to the root of the left lung and pericardium.
- The esophagus descends on the right side of aorta then crosses in front of it at level of **T7**.

Termination : It becomes abdominal aorta as it enters abdomen at **T12** vertebra through the aortic hiatus in the diaphragm

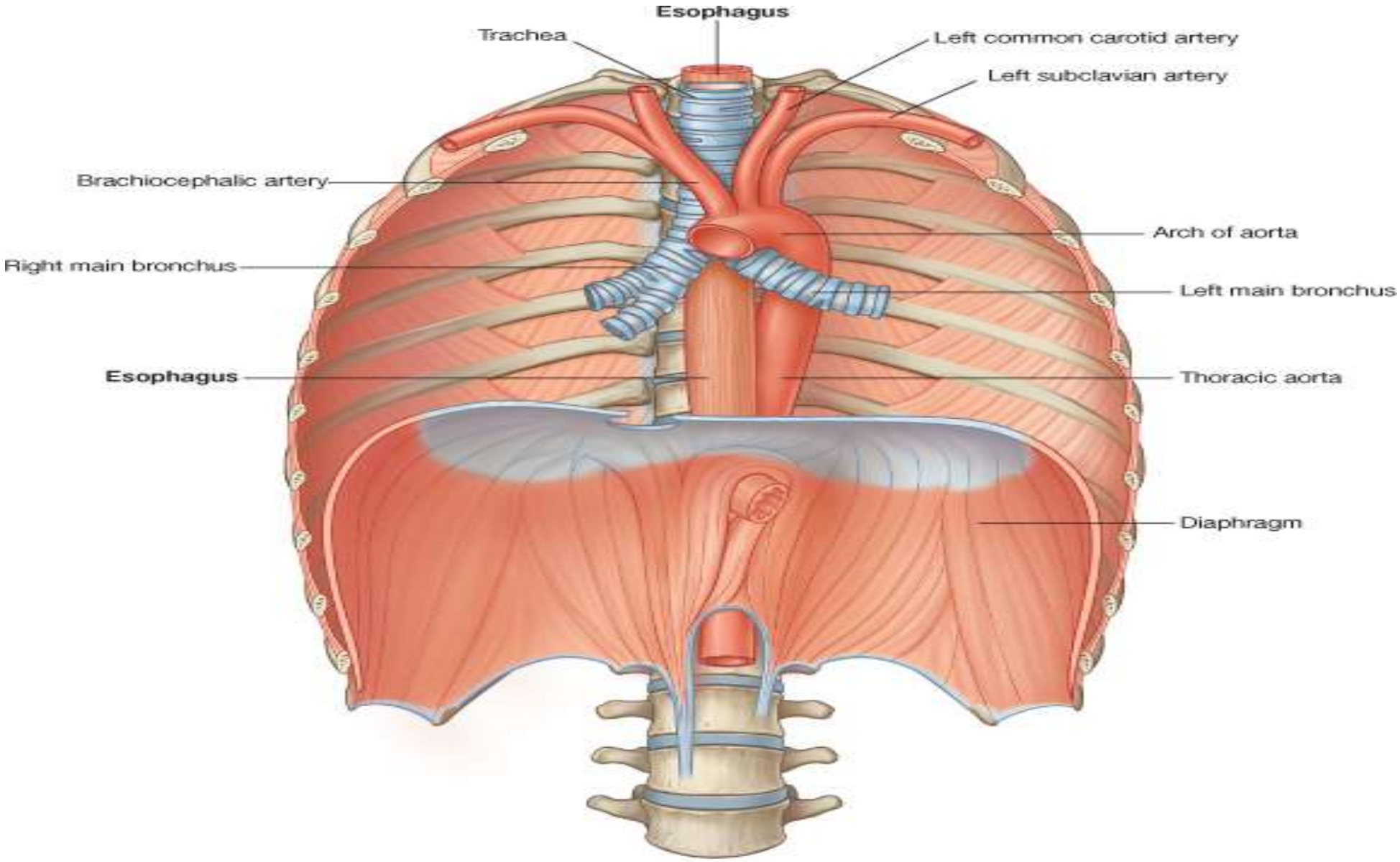
Branches:

➢ Parietal branches:

1. Posterior intercostal arteries from 3-11.
2. Subcostal artery.
3. Superior phrenic artery.

➢ Visceral branches:

1. Two left bronchial arteries.
2. Esophageal branches.
3. Pericardial branches.
4. Mediastinal branches.



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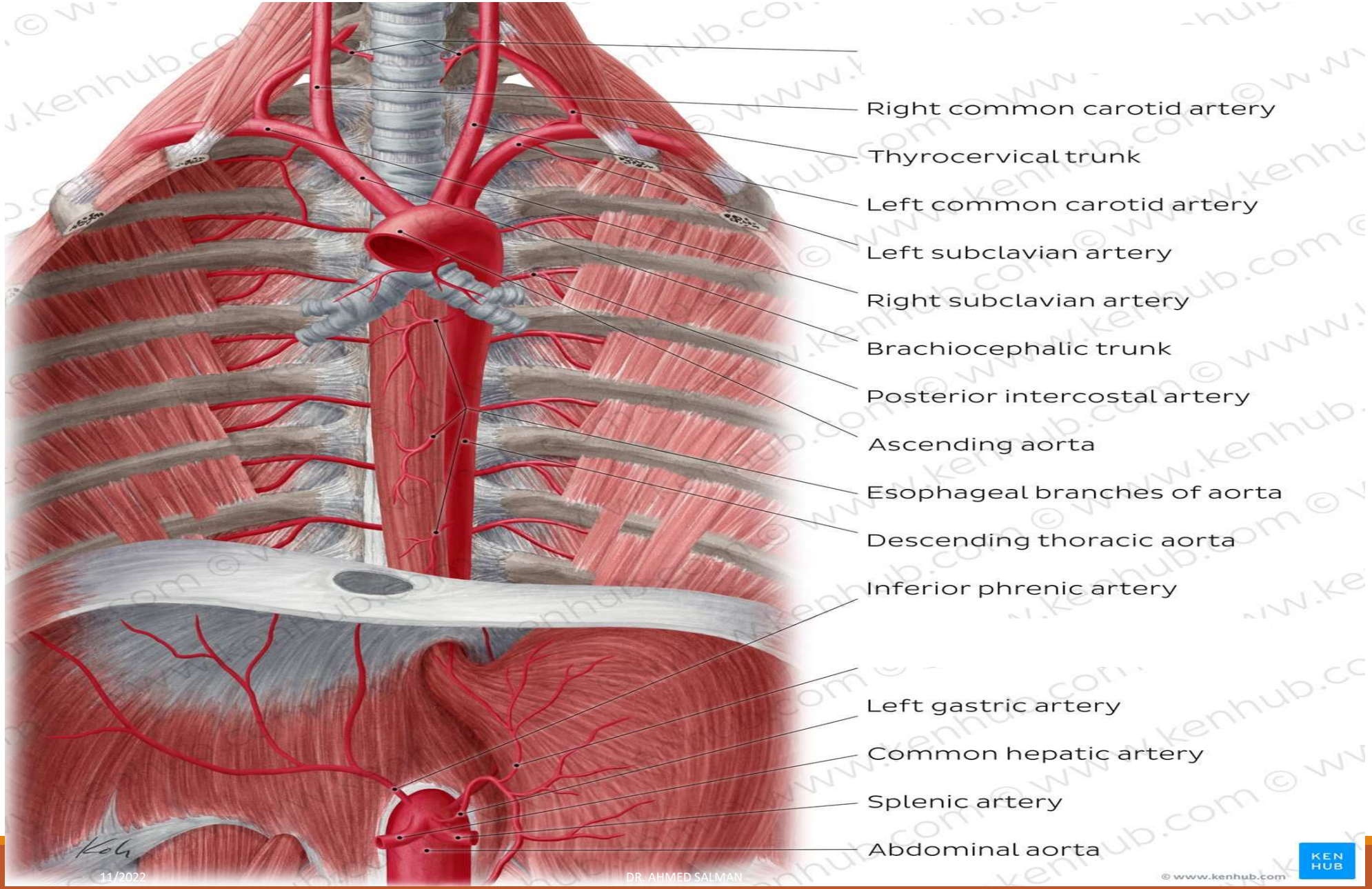
Right common carotid artery
Thyrocervical trunk
Left common carotid artery
Left subclavian artery
Right subclavian artery
Brachiocephalic trunk
Posterior intercostal artery
Ascending aorta
Esophageal branches of aorta
Descending thoracic aorta
Inferior phrenic artery
Left gastric artery
Common hepatic artery
Splenic artery
Abdominal aorta
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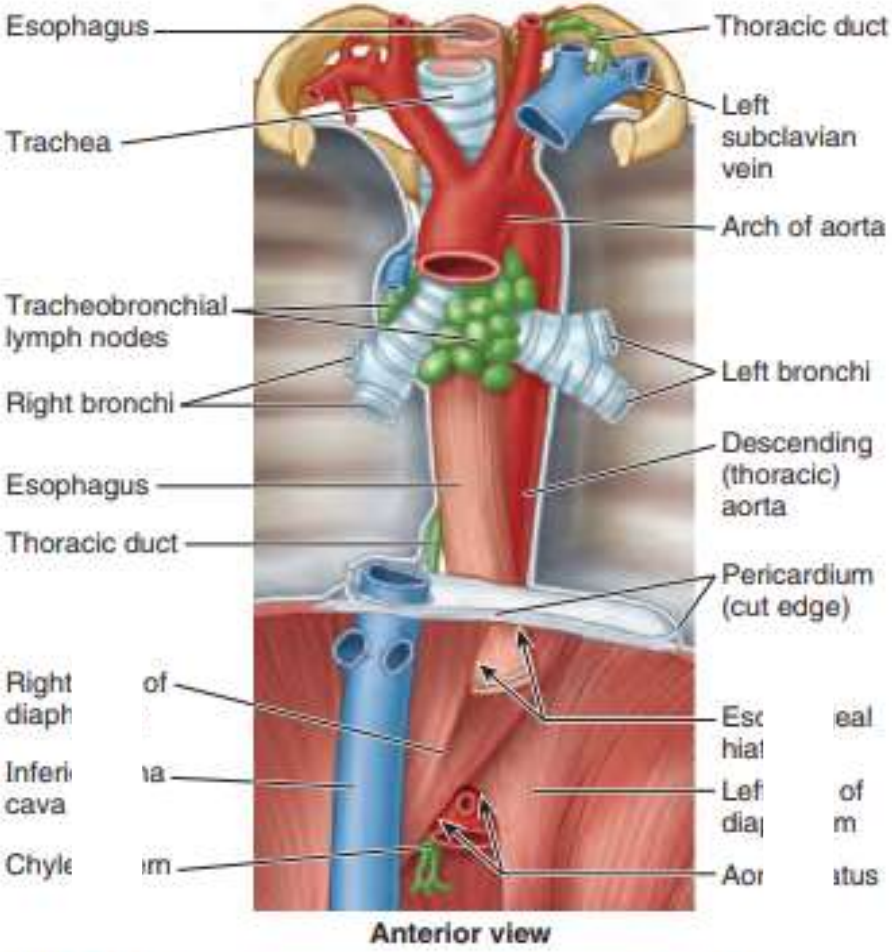
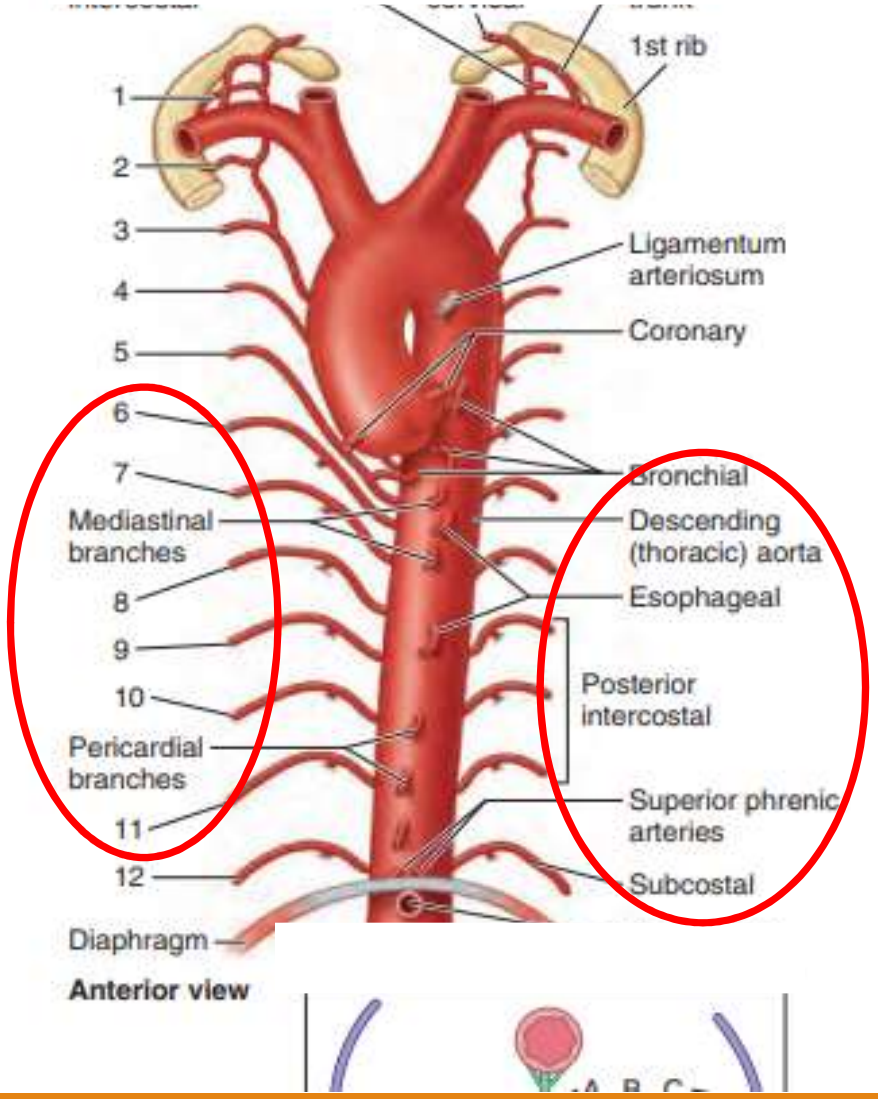


and esophagus. Enlargement of the inferior tracheobronchial (carinal) nodes may widen the angle between the main bronchi. In this specimen, the thoracic duct enters the left subclavian vein.



Azygos Vein

Beginning :

- From the back of IVC opposite **L2** (level of renal vein)
- Or by union of right subcostal and right ascending lumbar veins.

Course:

- It ascends through **aortic** opening of diaphragm.
- Then it ascends in posterior mediastinum till T4 where it arches forwards above right bronchus

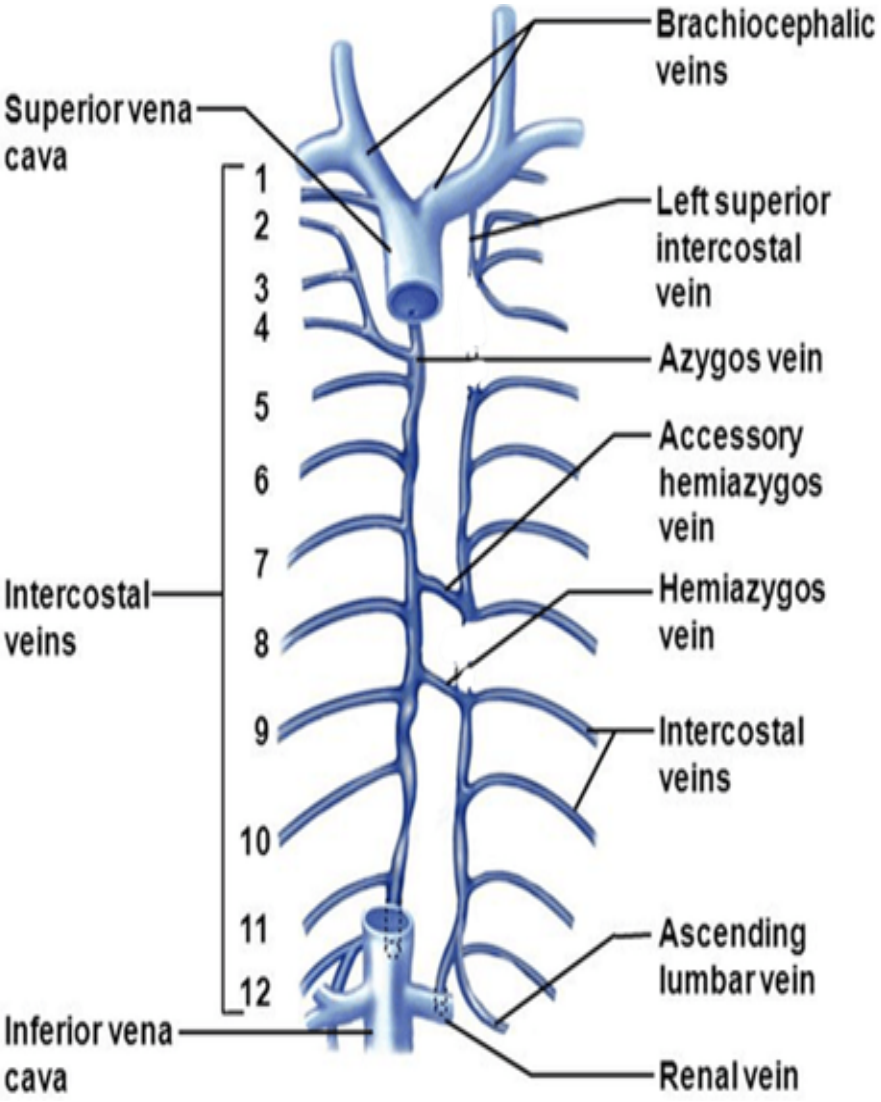
Termination: the back of SVC opposite **right 2nd costal cartilage.**

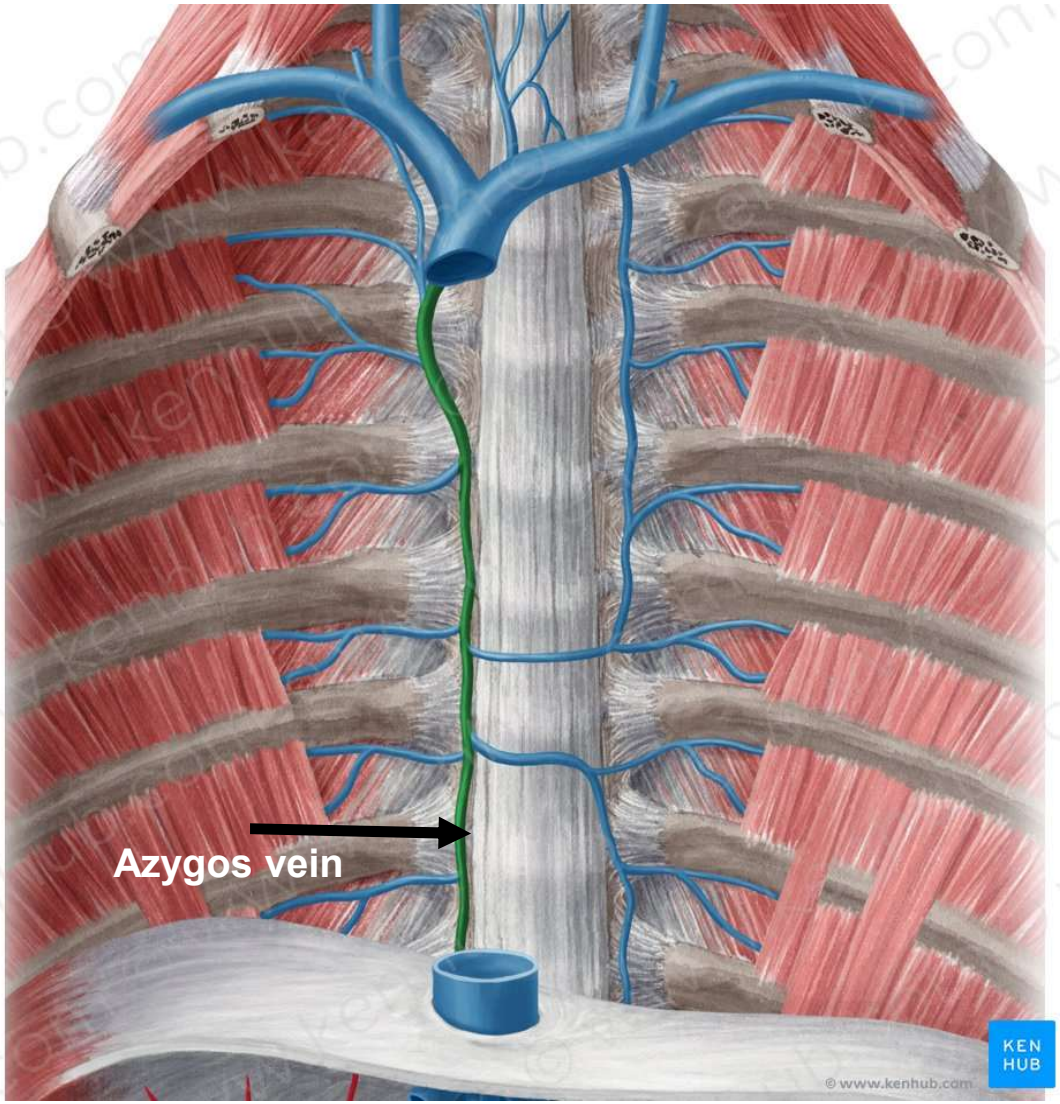
Tributaries:

1. Right subcostal vein.
2. Right ascending lumbar vein.
3. Right posterior intercostal veins from 2-11.
4. Superior and inferior hemiazygos veins.
5. Right bronchial veins.
6. Esophageal veins.
7. Pericardial veins.
8. Mediastinal veins.

Clinical note:

- Azygos vein is a direct link between SVC and IVC .So, it can help in cases of thrombosis of SVC or IVC
- The azygos vein communicates with the vertebral venous plexuses that drain the back, vertebrae, and structures in the vertebral canal.


Brachiocephalic veins
Superior vena cava
1
2
3
4
Left superior intercostal vein
Azygos vein
5
6
7
8
9
10
11
12
Accessory hemiazygos vein
Hemiazygos vein
Intercostal veins
Intercostal veins
Ascending lumbar vein
Inferior vena cava
Renal vein


Azygos vein
KEN HUB
© www.kenhub.com

Superior hemiazygos

It is a longitudinal venous channel that descends on the left side of vertebral body

Termination:

At the level of T7, it curves to right to end in azygos vein.

Tributaries:

1. Left posterior intercostal veins from 4-8.
2. Left bronchial veins.

Inferior hemiazygos vein

Beginning : From the back of the left renal vein opposite L2.

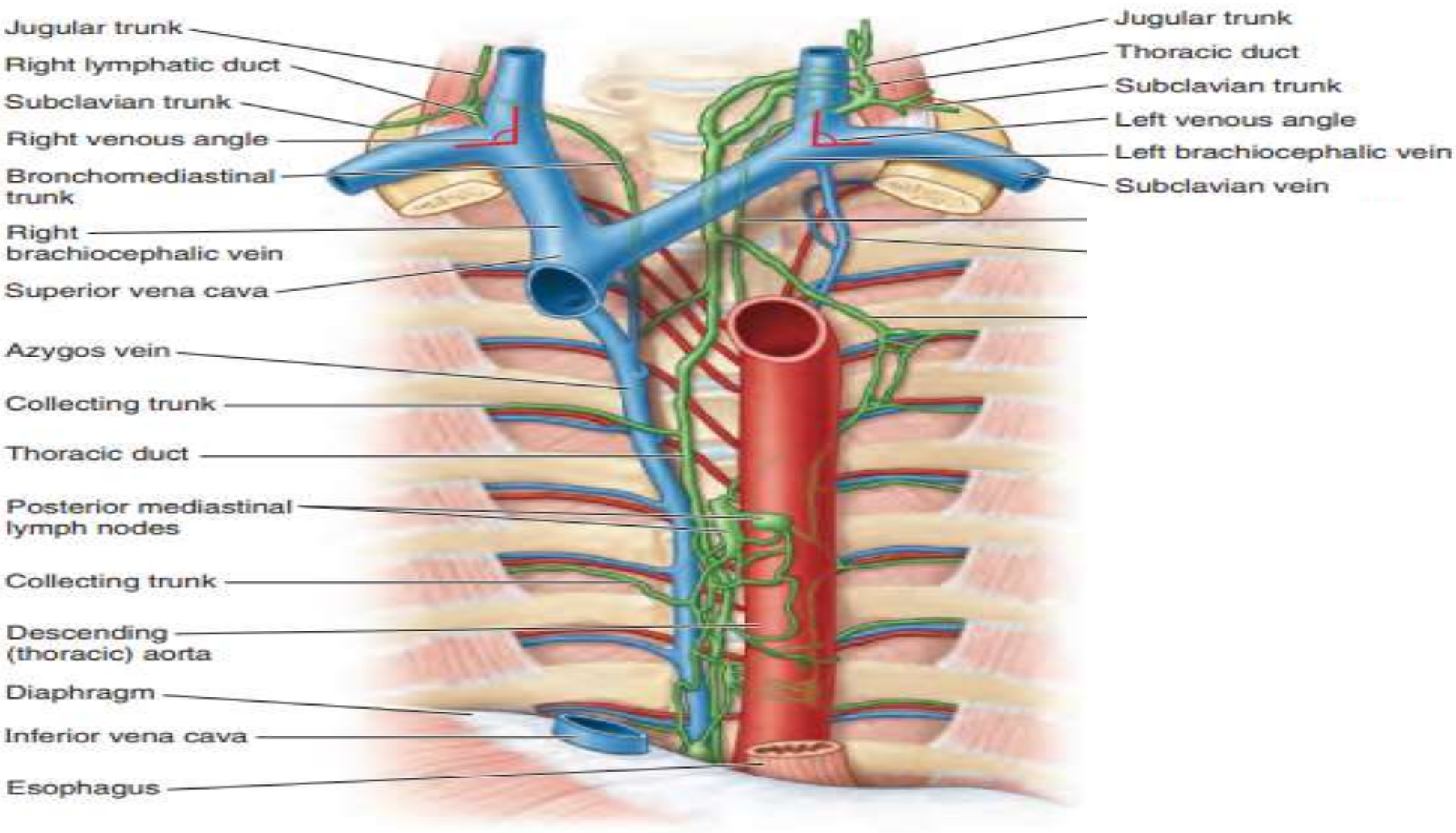
- Or by union of left subcostal and left ascending lumbar veins.

Termination :

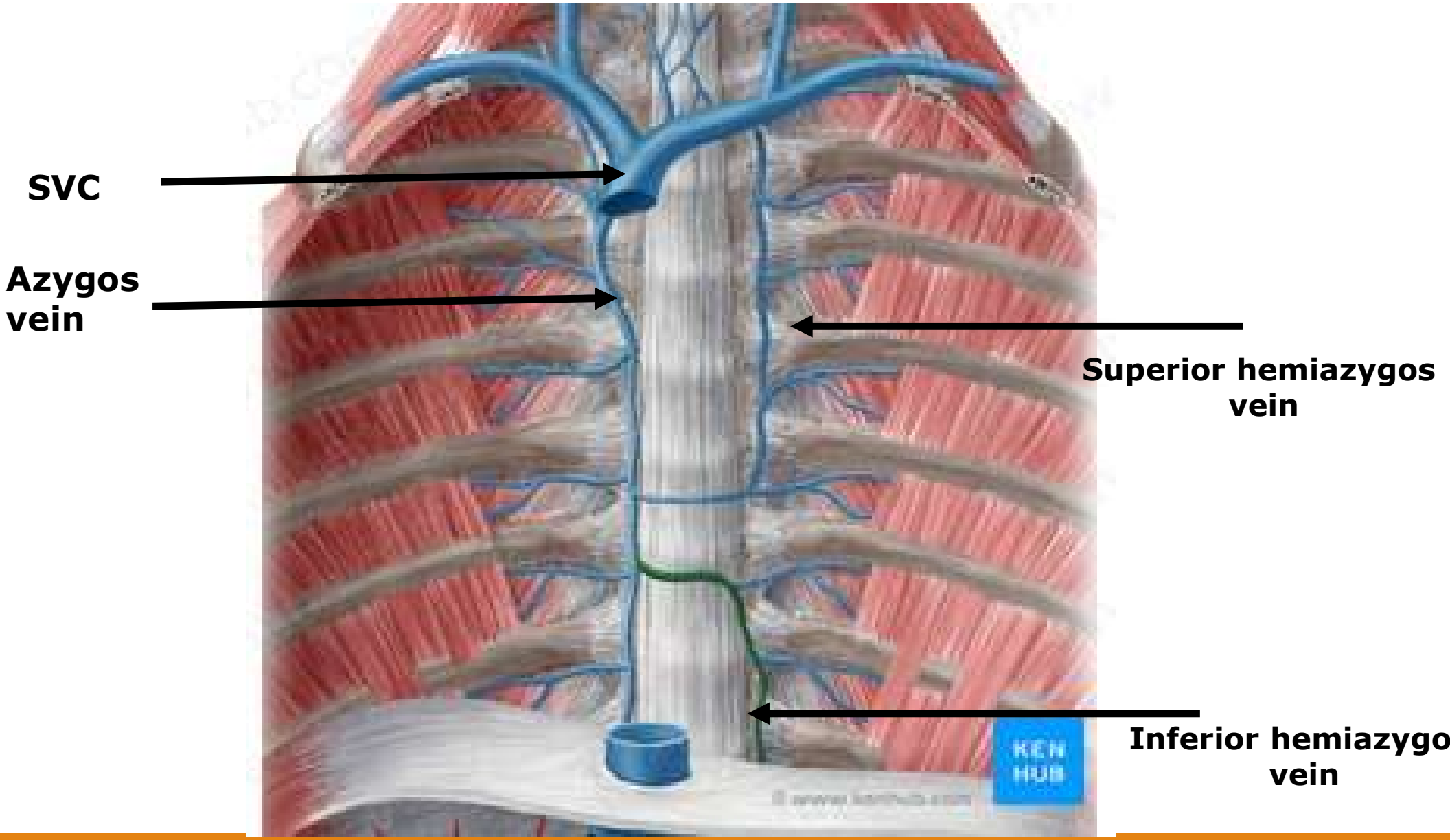
- At the level of T8, it curves to the right to end into azygos vein.

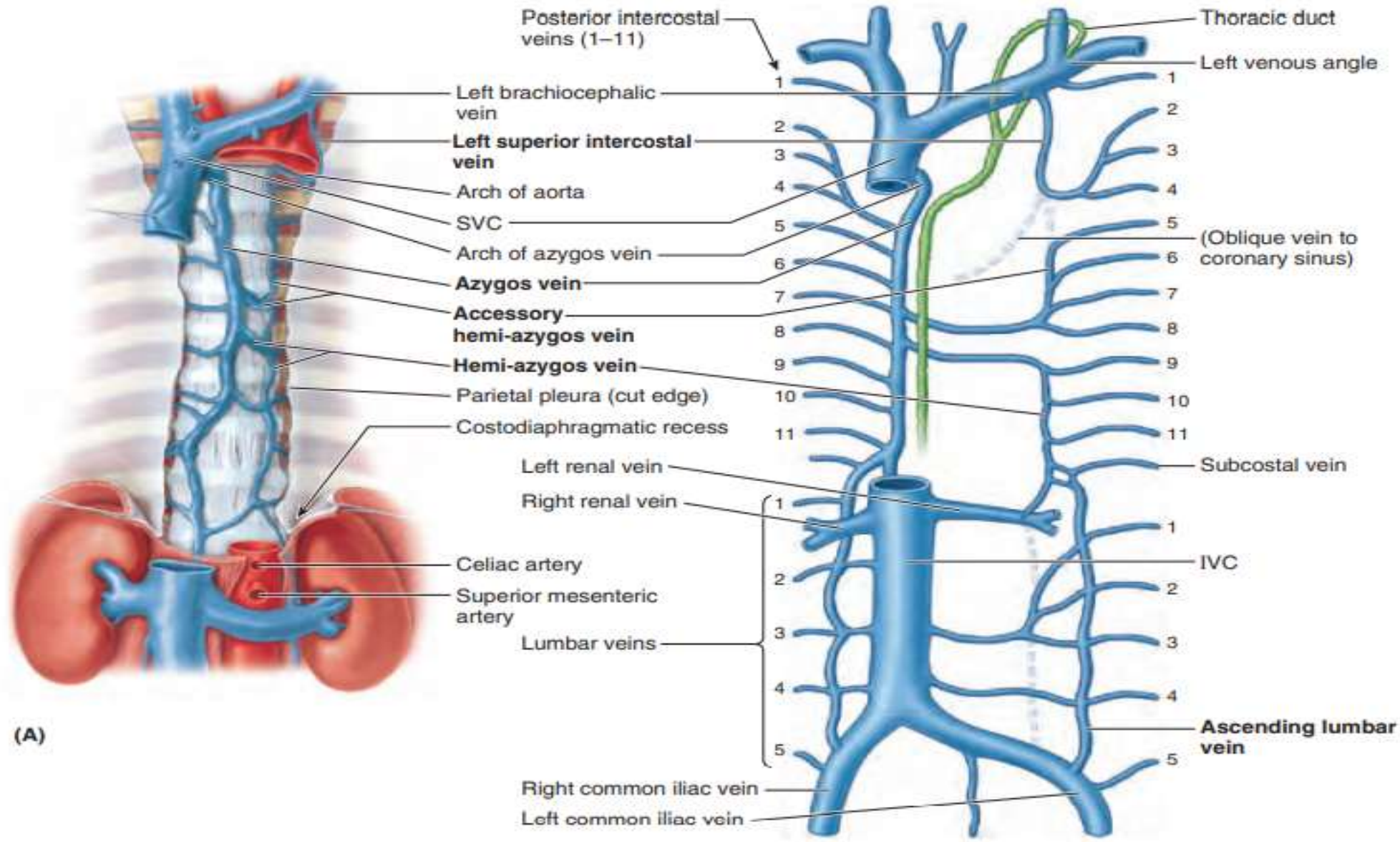
Tributaries:

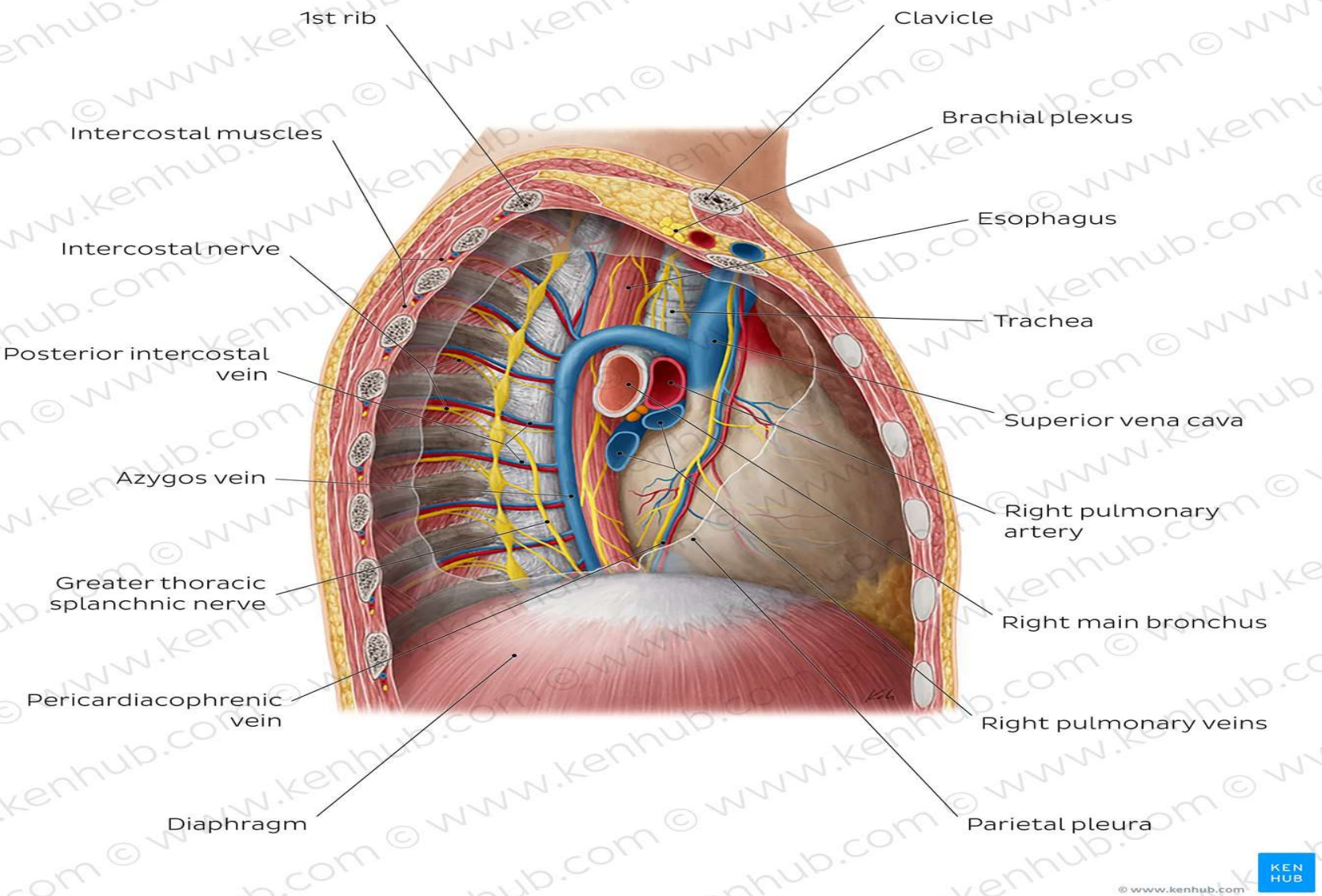
1. Left posterior intercostal veins from 9-11.
2. Left subcostal and left ascending lumbar veins.



(A) Anterior view


SVC
Azygos vein
Superior hemiazygos vein
Inferior hemiazygo vein
KEN HUB


Posterior intercostal veins (1–11)
Left brachiocephalic vein
Left superior intercostal vein
Arch of aorta
SVC
Arch of azygos vein
Azygos vein
Accessory hemi-azygos vein
Hemi-azygos vein
Parietal pleura (cut edge)
Costodiaphragmatic recess
Left renal vein
Right renal vein
Celiac artery
Superior mesenteric artery
Lumbar veins
Right common iliac vein
Left common iliac vein
Thoracic duct
Left venous angle
(Oblique vein to coronary sinus)
Subcostal vein
IVC
Ascending lumbar vein
1
2
3
4
5
6
7
8
9
10
11
(A)


1st rib
Clavicle
Intercostal muscles
Brachial plexus
Esophagus
Intercostal nerve
Trachea
Posterior intercostal vein
Superior vena cava
Azygos vein
Right pulmonary artery
Greater thoracic splanchnic nerve
Right main bronchus
Pericardiacophrenic vein
Right pulmonary veins
Diaphragm
Parietal pleura
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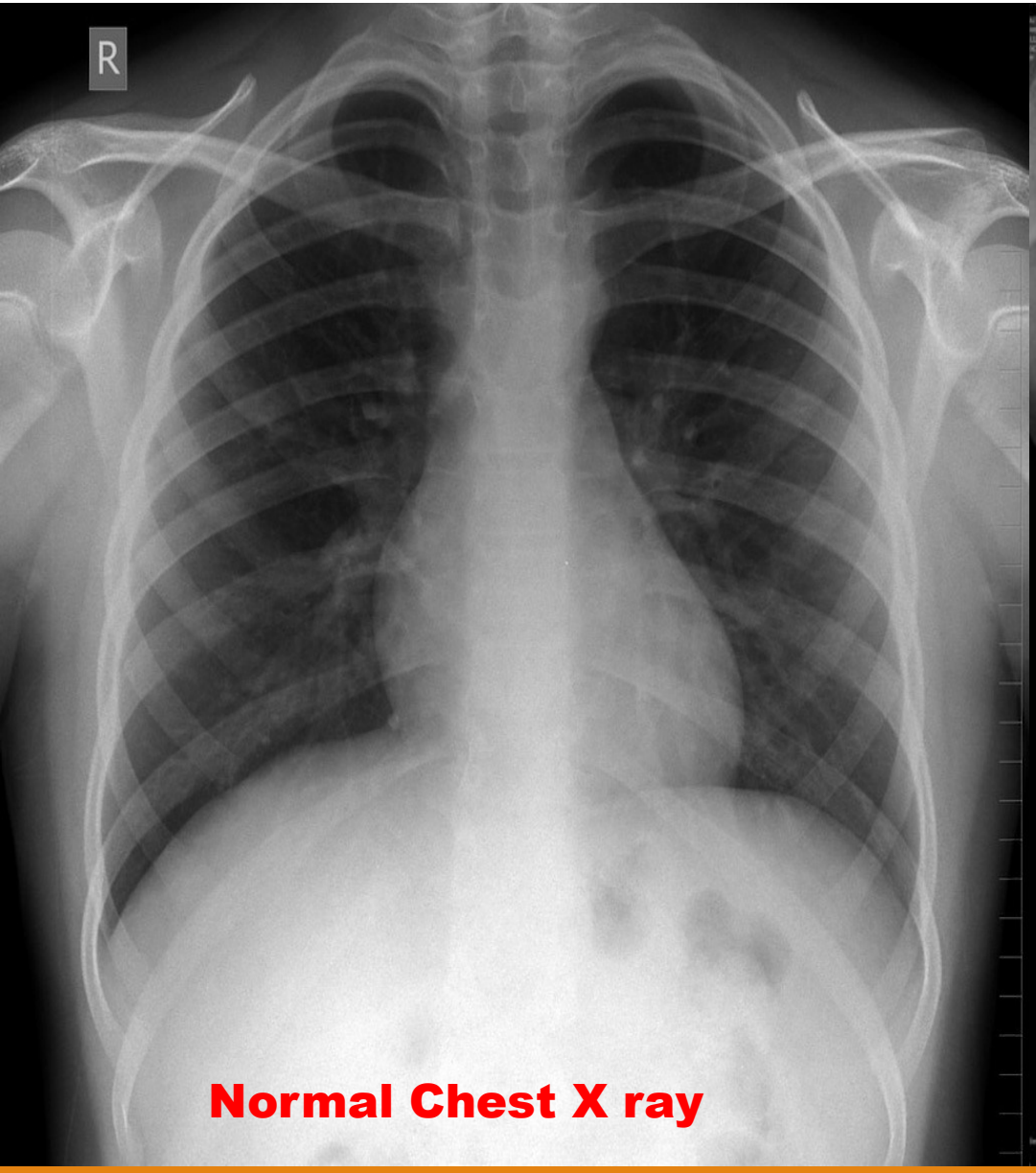
Mediastinal syndrome

Definition: group of symptoms due to compression of the mediastinal contents by a space-occupying lesion.e.g. malignant tumour as lung cancer or non-Hodgkin's lymphoma

Symptoms:

- **Dyspnea**: due to compression of **trachea.**
- **Dysphagia**: due to compression of **esophagus**.
- **Congestion of veins**: due to compression of **SVC.**
- **Ischemia**: due to compression of **branches of arch of aorta.**
- **Hoarseness of voice**: due to compression on **left recurrent laryngeal nerve.**
- **Paralysis of hemi-diaphragm**: due to compression on **phrenic nerve.**



Normal Chest X ray

Mediastinal syndrom

Superior vena cava syndrome

Due to obstruction of Superior vena cava

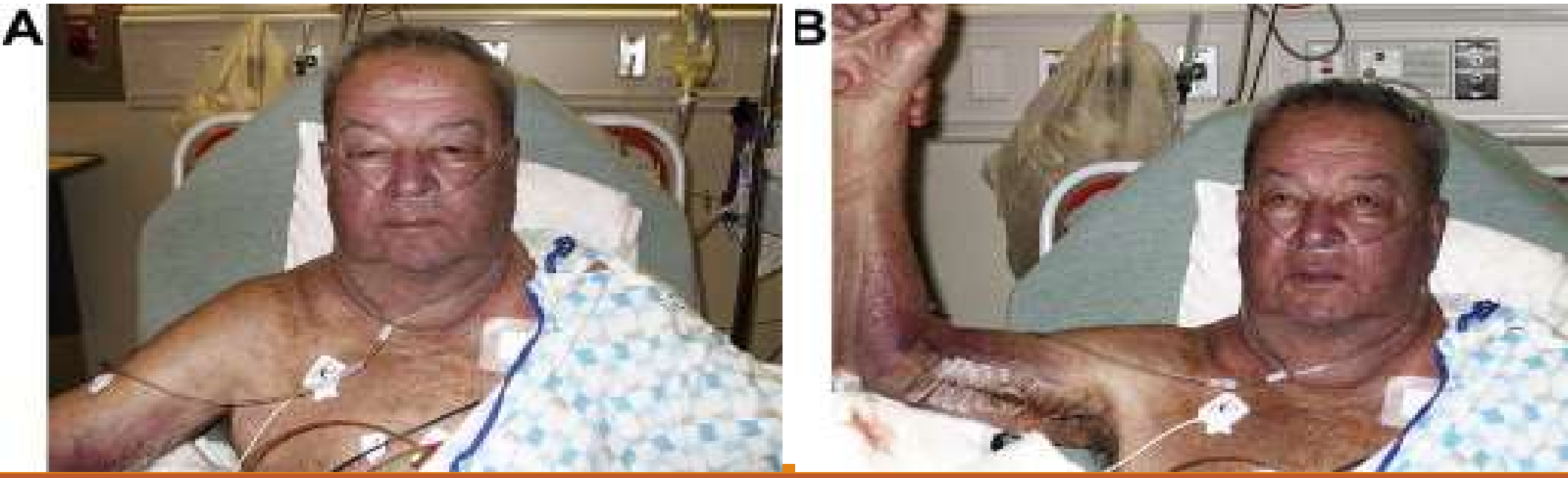
Manifestation

Dyspnea and edema in the face and arms

Pemberton sign:

Ask the patient to raise both arms above head , facial edema or cyanosis indicates SVCS

https://www.youtube.com/watch?v=dz4CEkntWPM



Jugular venous pressure (JVP)

- ✓ It provides an indirect measure of central venous pressure.
- ✓ The internal jugular vein connects to the right atrium without any intervening valves ,thus acting as a column for the blood in the right atrium.

Difference between carotid and jugular pulse

The jugular venous pulse is:

Not palpable.

Obliterated by pressure.

Variable with respiration - it decreases with inspiration.

Causes of increased Jugular venous pressure

Heart failure.

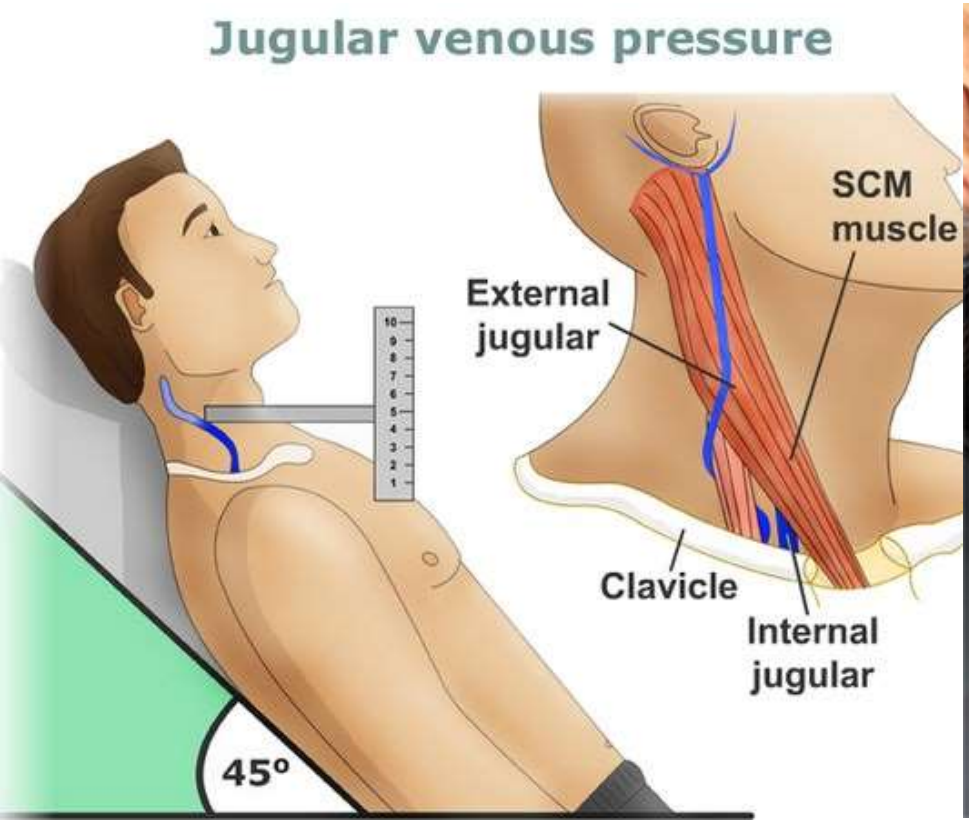
Pulmonary hypertension.

Superior vena cava obstruction .

Constrictive pericarditis

Fluid overload – eg. renal disease.

https://www.youtube.com/watch?v=4YBXaWWG3Ns


Jugular venous pressure
SCM muscle
External jugular
Clavicle
Internal jugular
45°


THANK YOU!