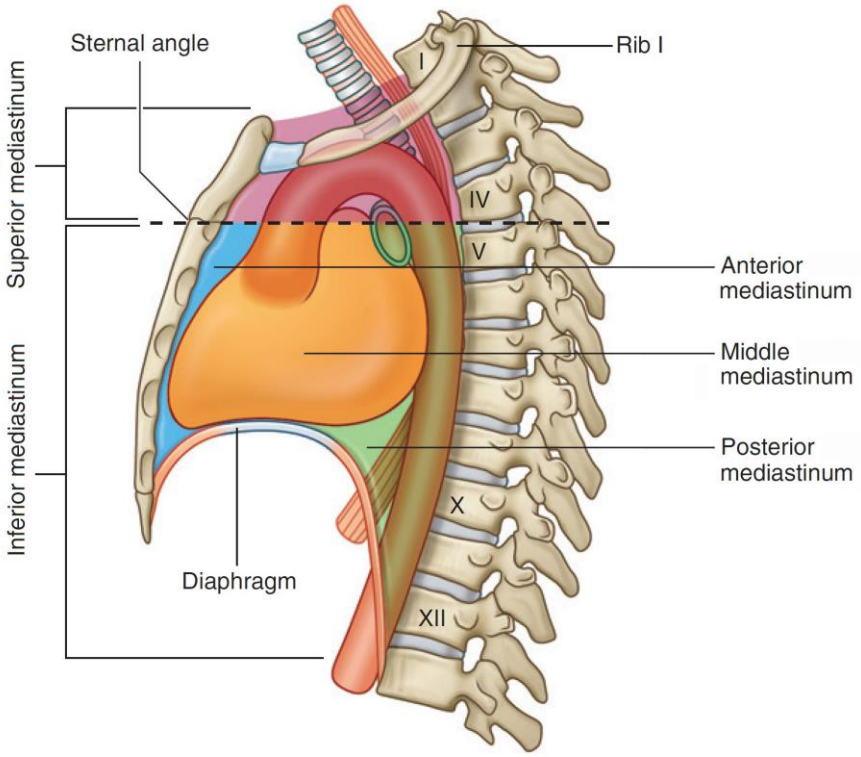
Mediastinum

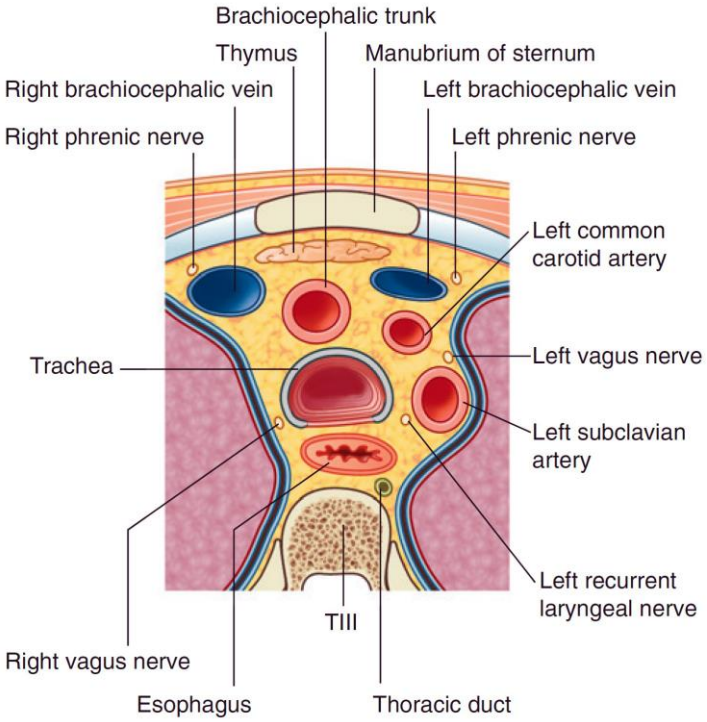
Region between the pulmonary cavities.
It is covered by the mediastinal pleura. It does not contain the lungs.
It extends from the thoracic inlet superiorly to the diaphragm inferiorly.

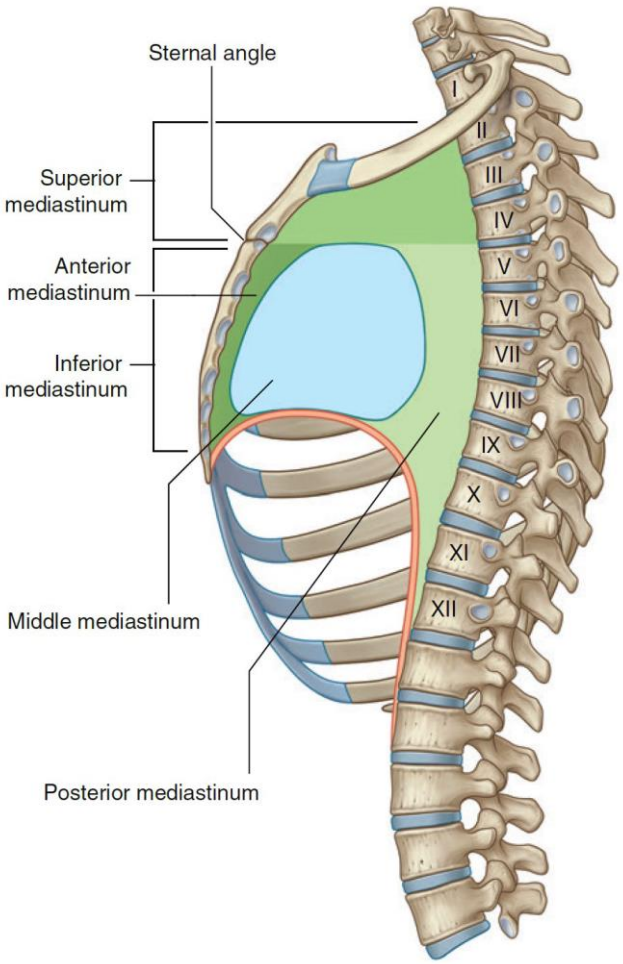
Mediastinal regions

- Superior mediastinum (between manubriosternal angle and T4/5)
- Middle mediastinum
- Posterior mediastinum
- Anterior mediastinum

Region	Contents
Superior mediastinum	• Superior vena cava • Brachiocephalic veins • Arch of aorta • Thoracic duct • Trachea • Oesophagus • Thymus • Vagus nerve • Left RLN • Phrenic nerve
Anterior	• Thymic remnants • Lymph nodes • Fat
Middle mediastinum	• Pericardium • Heart • Aortic root • Arch of azygos vein • Main bronchi
Posterior Mediastinum	• Oesophagus • Thoracic aorta • Azygos vein • Thoracic duct • Vagus nerve • Sympathetic nerve trunks • Splanchnic nerves



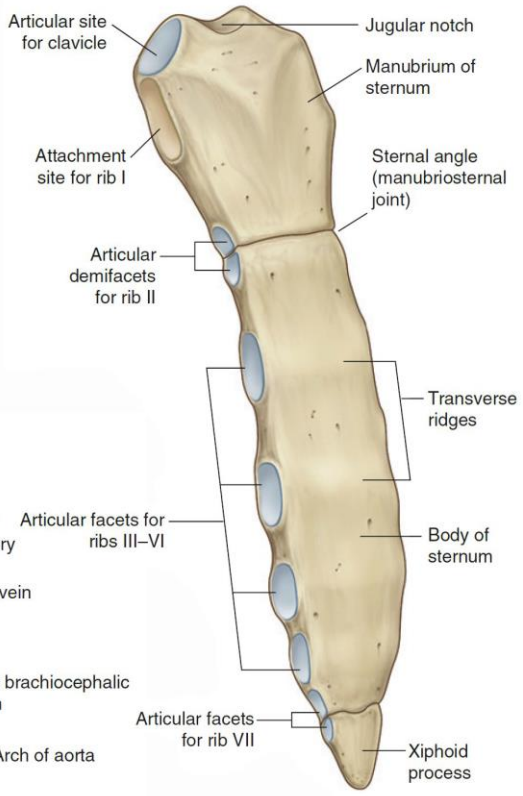


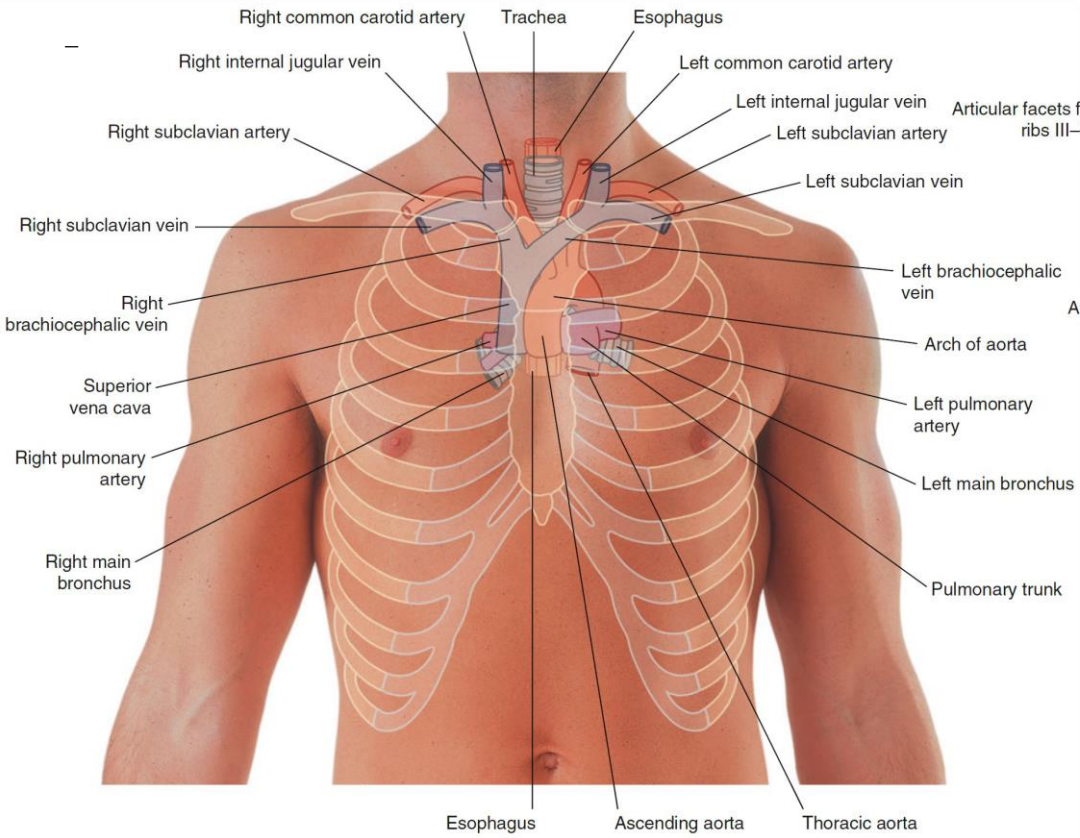


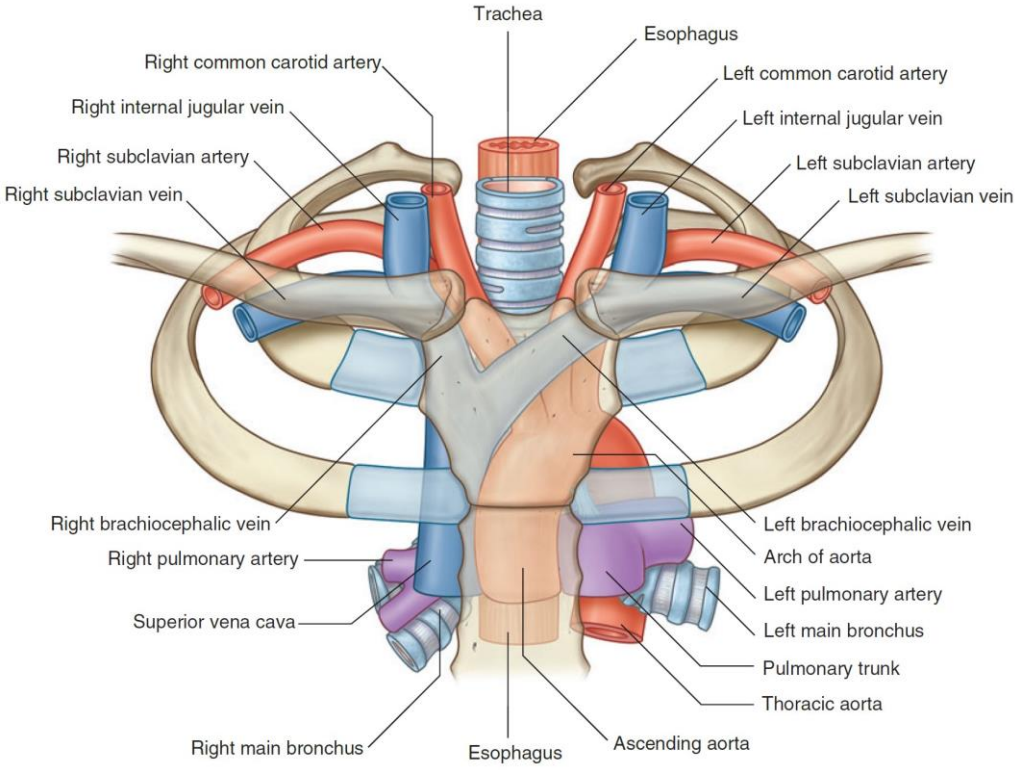
Sternal Angle

Anatomical structures at the level of the manubrium and upper sternum

Upper part of the manubrium	• Left brachiocephalic vein • Brachiocephalic artery • Left common carotid • Left subclavian artery
Lower part of the manubrium / manubrio-sternal angle	• Costal cartilages of the 2nd ribs • Transition point between sup. and inf. mediastinum • Arch of the aorta • Tracheal bifurcation • Union of the azygos vein and superior vena cava • The thoracic duct crosses to the midline







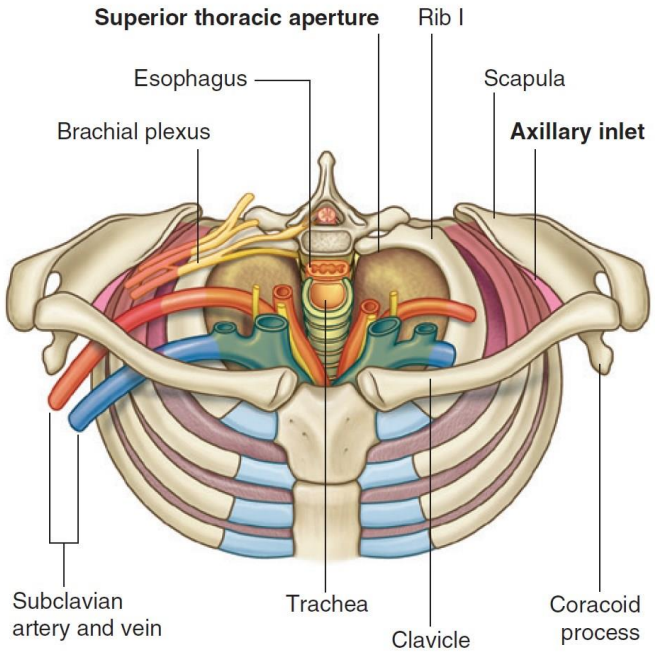
Trachea

Trachea

Location	**C6** vertebra to the upper border of **T5** vertebra (bifurcation)
Arterial and venous supply	Inferior thyroid arteries and the thyroid venous plexus.
Nerve	Branches of vagus, sympathetic and the recurrent nerves

Relations in the neck

Anterior *(Superior to inferior)*	• Isthmus of the thyroid gland • Inferior thyroid veins • Arteria thyroidea ima *(if exists)* • Sternothyroid • Sternohyoid • Cervical fascia • Anastomosing branches between the anterior jugular veins
Posterior	Oesophagus.
Laterally	• Common carotid arteries • Right and left lobes of the thyroid gland • Inferior thyroid arteries • Recurrent laryngeal nerves



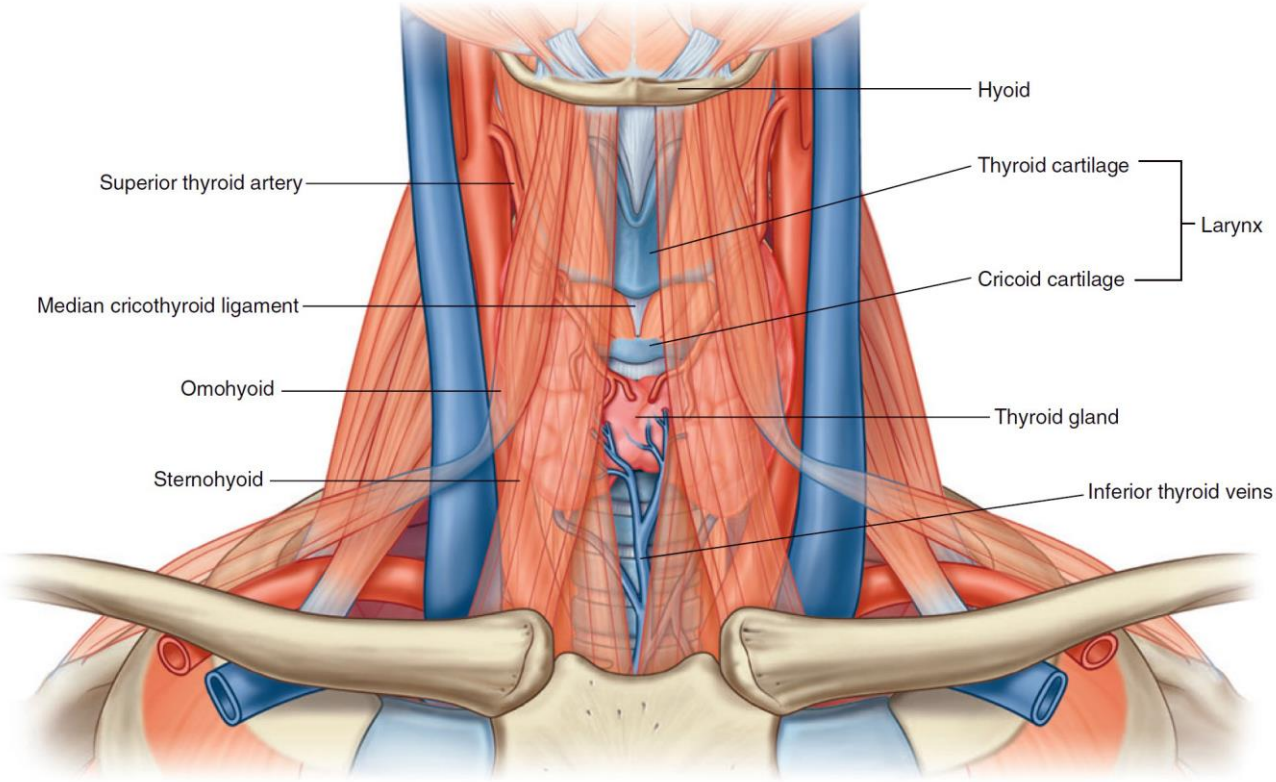
Relations in the thorax

Anterior

- Manubrium, the remains of the thymus, the aortic arch, left common carotid arteries, and the deep cardiac plexus

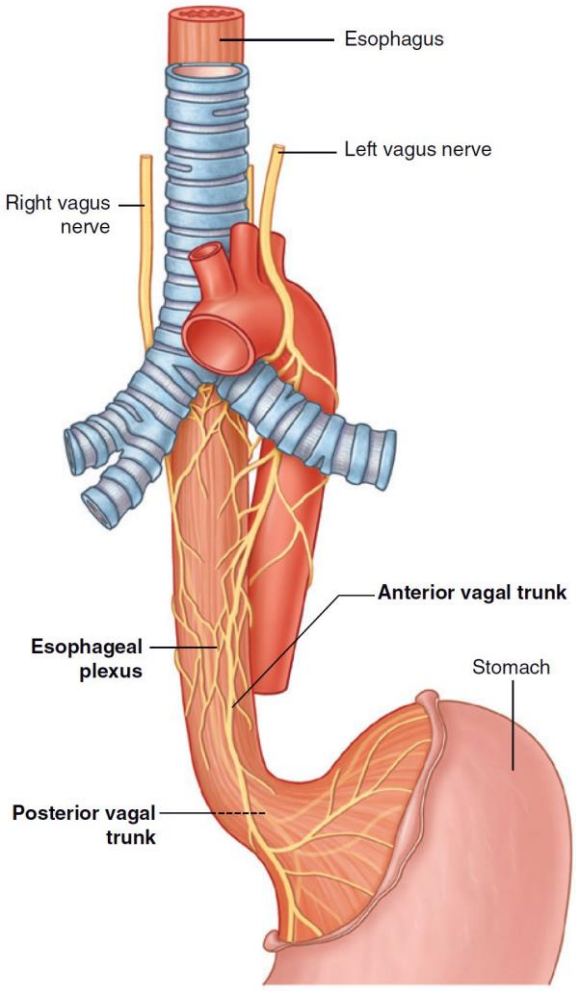
Lateral

- In the superior mediastinum, on the right side is the pleura and right vagus; on its left side are the left recurrent nerve, the aortic arch, and the left common carotid and subclavian arteries.



Oesophagus

- 25cm long. Starts at C6 vertebra, pierces diaphragm at T10 and ends at T11
- Squamous epithelium. The oesophagus **has no serosal covering** and hence holds sutures poorly. The Auerbach's and Meissner's nerve plexuses lie in between the longitudinal and circular muscle layers and submucosally. The sub mucosal location of the Meissner's nerve plexus facilitates its sensory role.



Constrictions of the oesophagus

Structure	Distance from incisors
Cricoid cartilage	15cm
Arch of the Aorta	22.5cm
Left principal bronchus	27cm
Diaphragmatic hiatus	40cm

Relations

Anteriorly	• Trachea to T4 • Recurrent laryngeal nerve • Left bronchus, Left atrium • Diaphragm
Posteriorly	• Thoracic duct to left at T5 • Hemiazygos to the left T8 • Descending aorta • First 2 intercostal branches of aorta
Left	• Thoracic duct • Left subclavian artery
Right	• Azygos vein

Arterial, venous and lymphatic drainage of the oesophagus

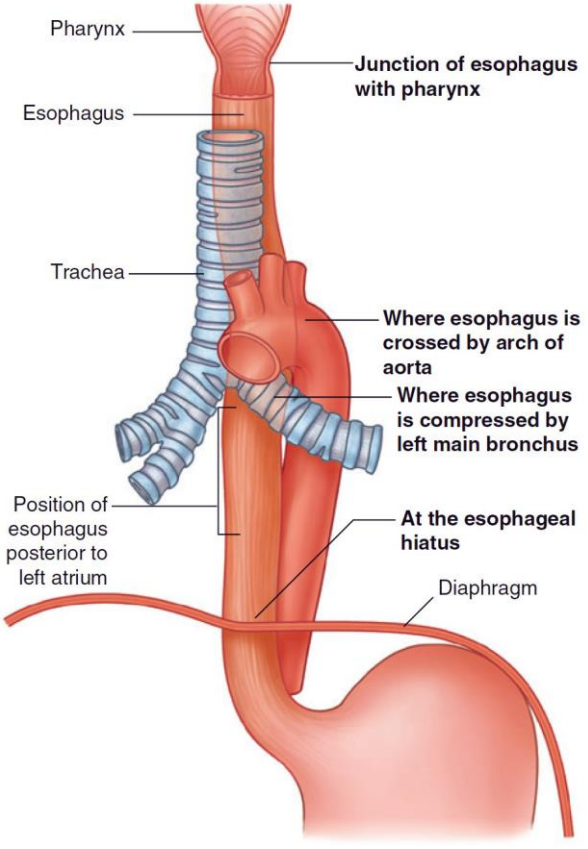
	Artery	Vein	Lymphatics	Muscularis externa
Upper third	Inferior thyroid	Inferior thyroid	Deep cervical	Striated muscle
Mid third	Aortic branches	Azygos branches	Mediastinal	Smooth & striated muscle
Lower third	Left gastric	Left gastric	Gastric	Smooth muscle

Nerve supply

- Upper half is supplied by recurrent laryngeal nerve
- Lower half by oesophageal plexus (vagus)

Histology

- Mucosa :Non-keratinized stratified squamous epithelium
- Submucosa: glandular tissue
- Muscularis externa (muscularis): composition varies. See table
- Adventitia



Lung Anatomy

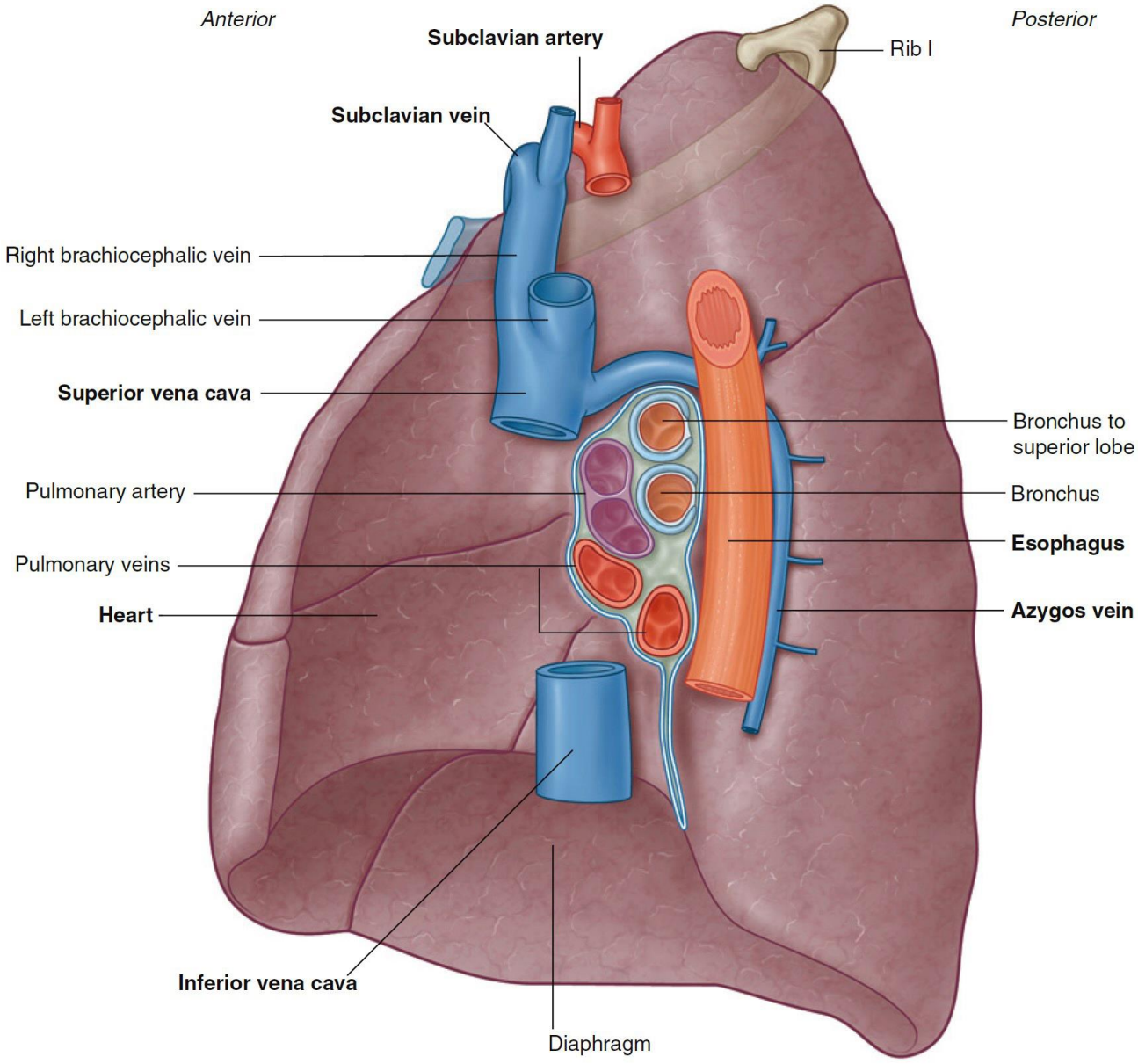
The right lung is composed of 3 lobes divided by the oblique and transverse fissures. The left lung has two lobes divided by the oblique fissure. The apex of both lungs is approximately 4cm superior to the sternocostal joint of the first rib. Immediately below this is a sulcus created by the subclavian artery.

Peripheral contact points of the lung

- Base: diaphragm
- Costal surface: corresponds to the cavity of the chest
- Mediastinal surface: Contacts the mediastinal pleura. Has the cardiac impression. Above and behind this concavity is a triangular depression named the hilum, where the structures which form the root of the lung enter and leave the viscus. These structures are invested by pleura, which, below the hilum and behind the pericardial impression, forms the pulmonary ligament

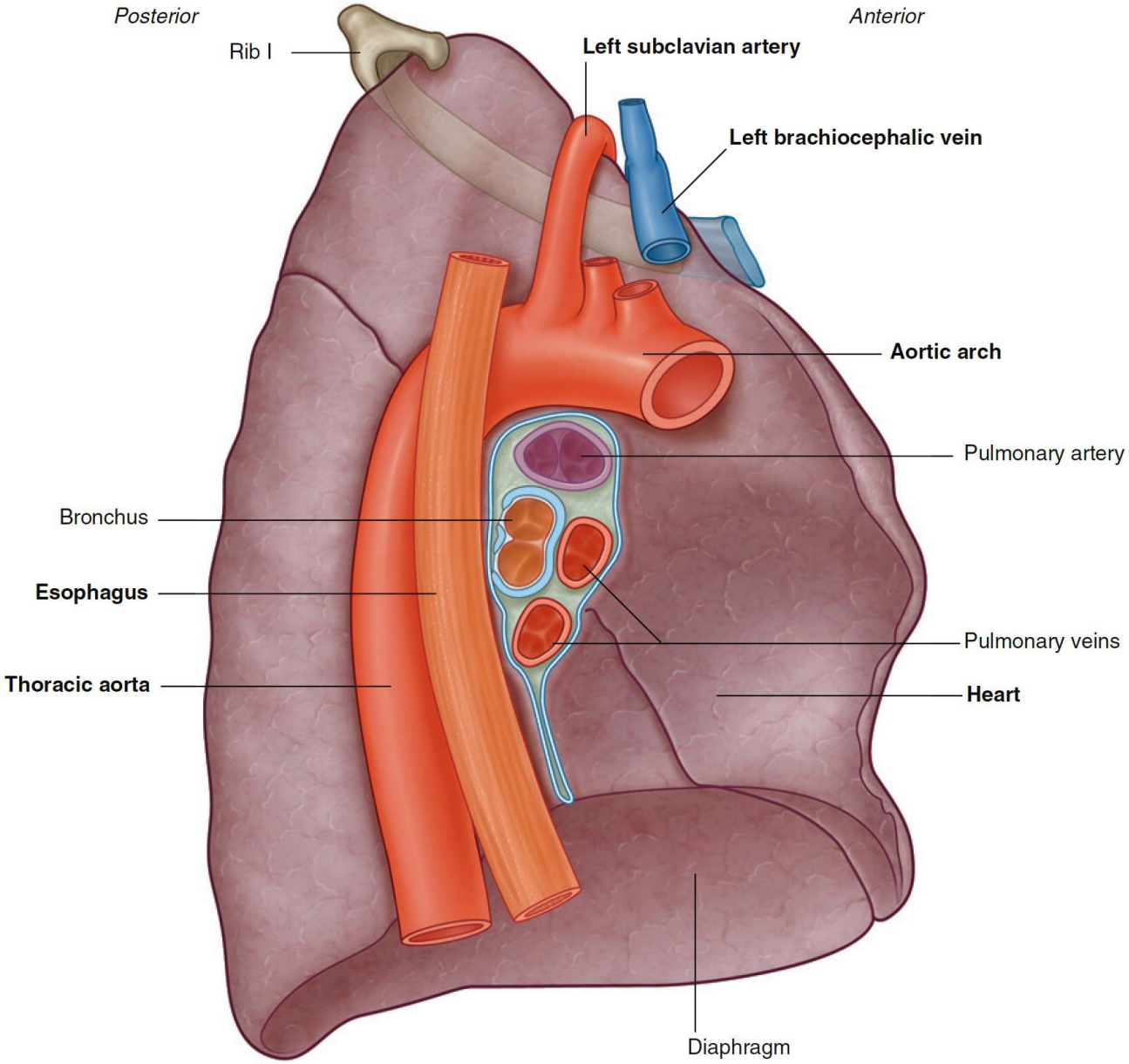
Right lung

- Above the hilum is the azygos vein; Superior to this is the groove for the superior vena cava and right innominate vein; behind this, and nearer the apex, is a furrow for the innominate artery. Behind the hilum and the attachment of the pulmonary ligament is a vertical groove for the oesophagus; In front and to the right of the lower part of the oesophageal groove is a deep concavity for the extrapericardial portion of the inferior vena cava.
- The root of the right lung lies behind the superior vena cava and the right atrium, and below the azygos vein.
- The right main bronchus is shorter, wider and more vertical than the left main bronchus and therefore the route taken by most foreign bodies.



Left lung

- Above the hilum is the furrow produced by the aortic arch, and then superiorly the groove accommodating the left subclavian artery; Behind the hilum and pulmonary ligament is a vertical groove produced by the descending aorta, and in front of this, near the base of the lung, is the lower part of the oesophagus.
- The **phrenic nerve lies anteriorly** at this point (hilum of left lung). The vagus passes anteriorly and then arches backwards immediately superior to the root of the left bronchus, giving off the recurrent laryngeal nerve as it does so.
- The root of the left lung passes under the aortic arch and in front of the descending aorta.



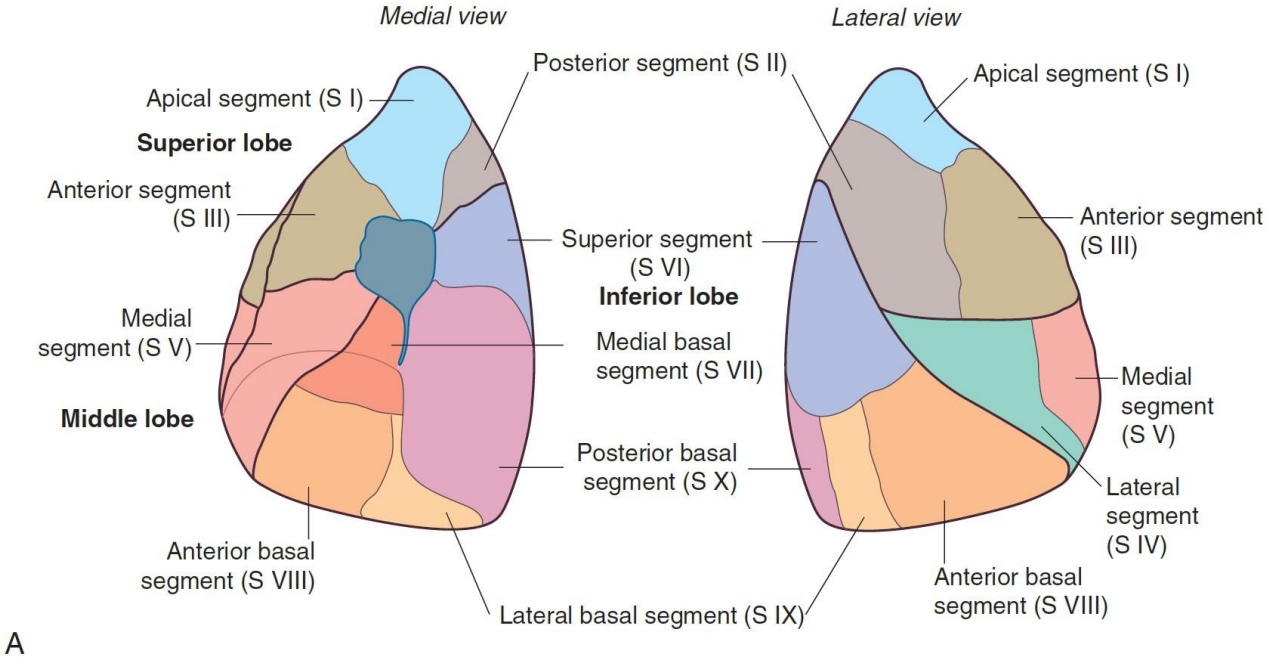
Inferior borders of both lungs

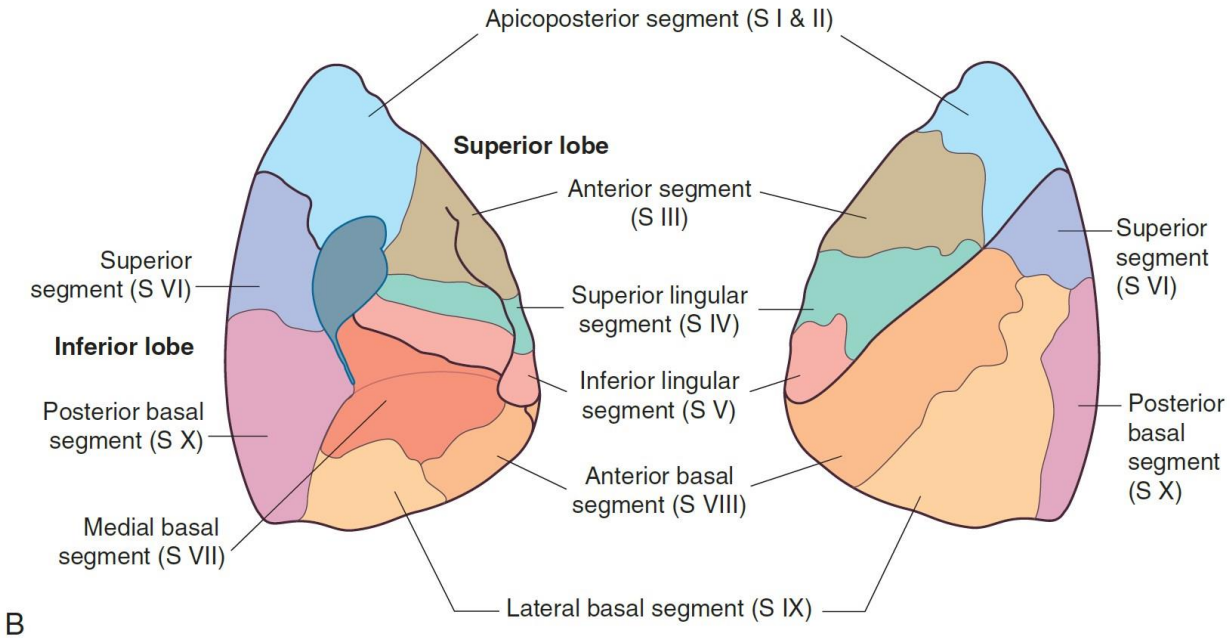
- 6th rib in mid clavicular line
- 8th rib in mid axillary line
- 10th rib posteriorly

The pleura runs two ribs lower than the corresponding lung level.

Bronchopulmonary segments

Segment number	Right lung	Left lung
1	Apical	Apical
2	Posterior	Posterior
3	Anterior	Anterior
4	Lateral	Superior lingular
5	Medial	Inferior lingular
6	Superior (apical)	Superior (apical)
7	Medial basal	Medial basal
8	Anterior basal	Anterior basal
9	Lateral basal	Lateral basal
10	Posterior basal	Posterior basal

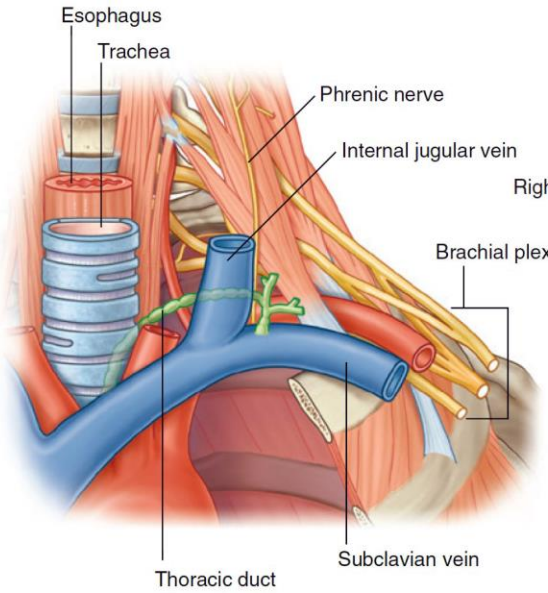


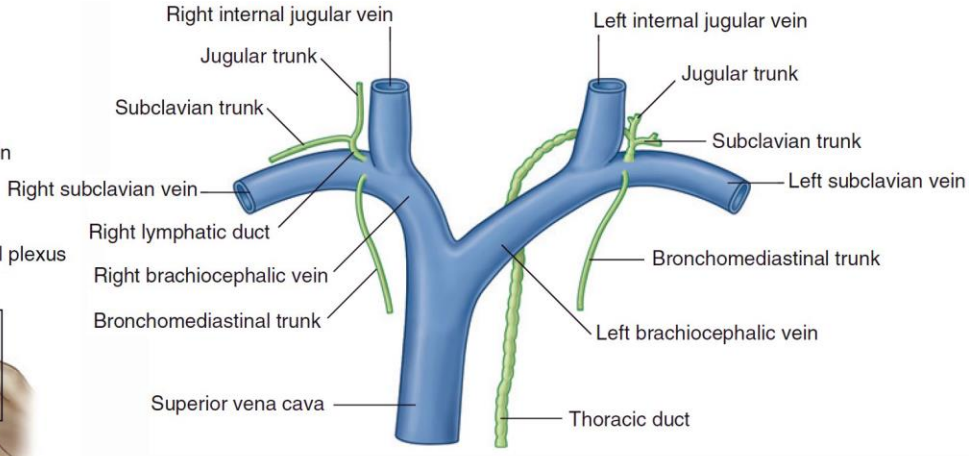


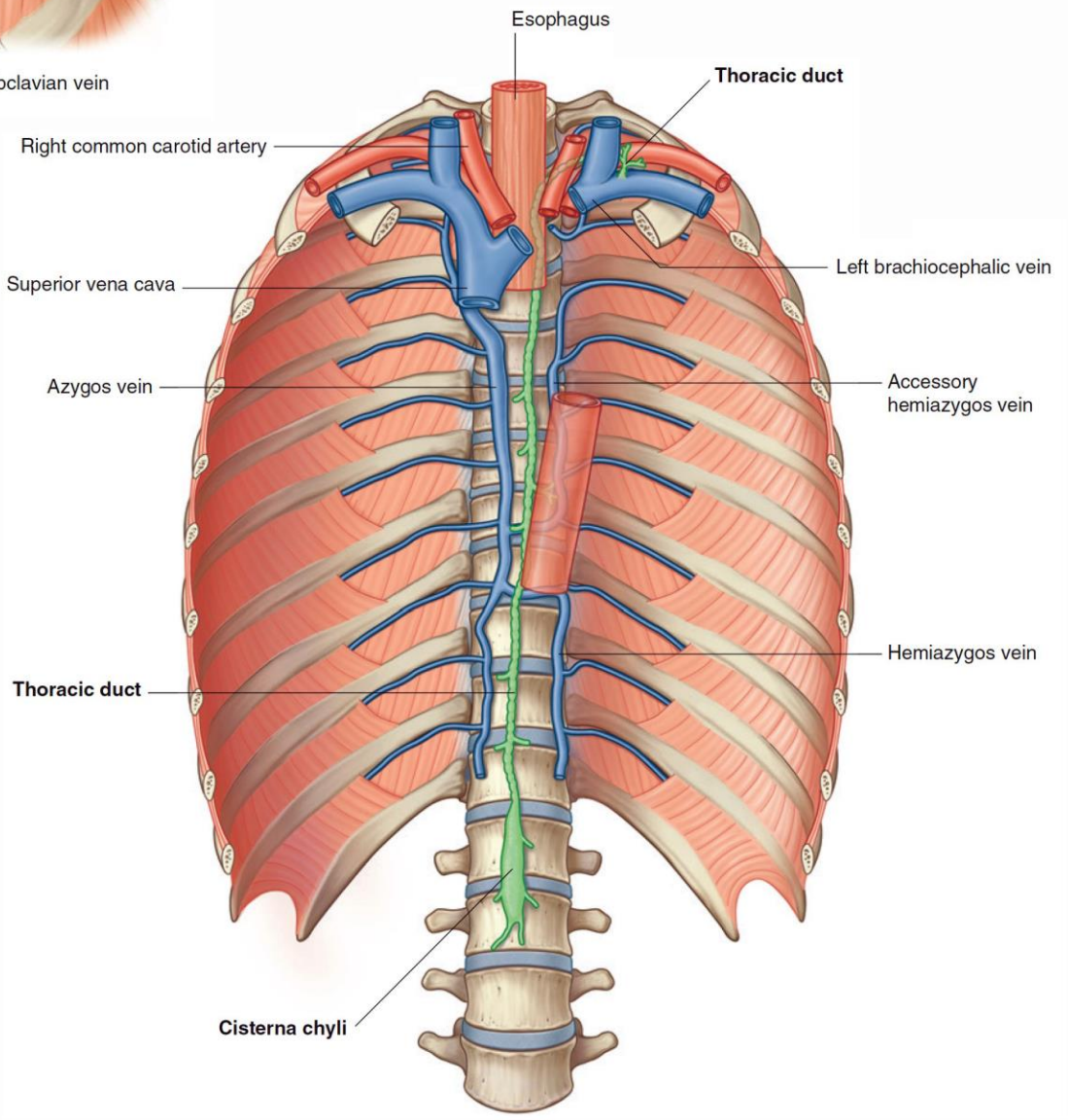
Bronchopulmonary segments. A. Right lung. B. Left lung.

Thoracic Duct

- Continuation of the cisterna chyli in the abdomen.
- Enters the thorax at **T12**. Lies within the **posterior and superior mediastinum**.
- Lies posterior to the oesophagus for most of its intrathoracic course. Passes to the left at T5.
- Lymphatics draining the left side of the head and neck join the thoracic duct prior to its insertion into the left brachiocephalic vein.
- Lymphatics draining the right side of the head and neck drain via the subclavian and jugular trunks into the right lymphatic duct and thence into the mediastinal trunk and eventually the right brachiocephalic vein.
- Its location in the thorax makes it prone to injury during oesophageal surgery. Some surgeons **administer cream** to patients prior to oesophagectomy so that it is easier to identify the cut ends of the duct.







Phrenic Nerve

Origin

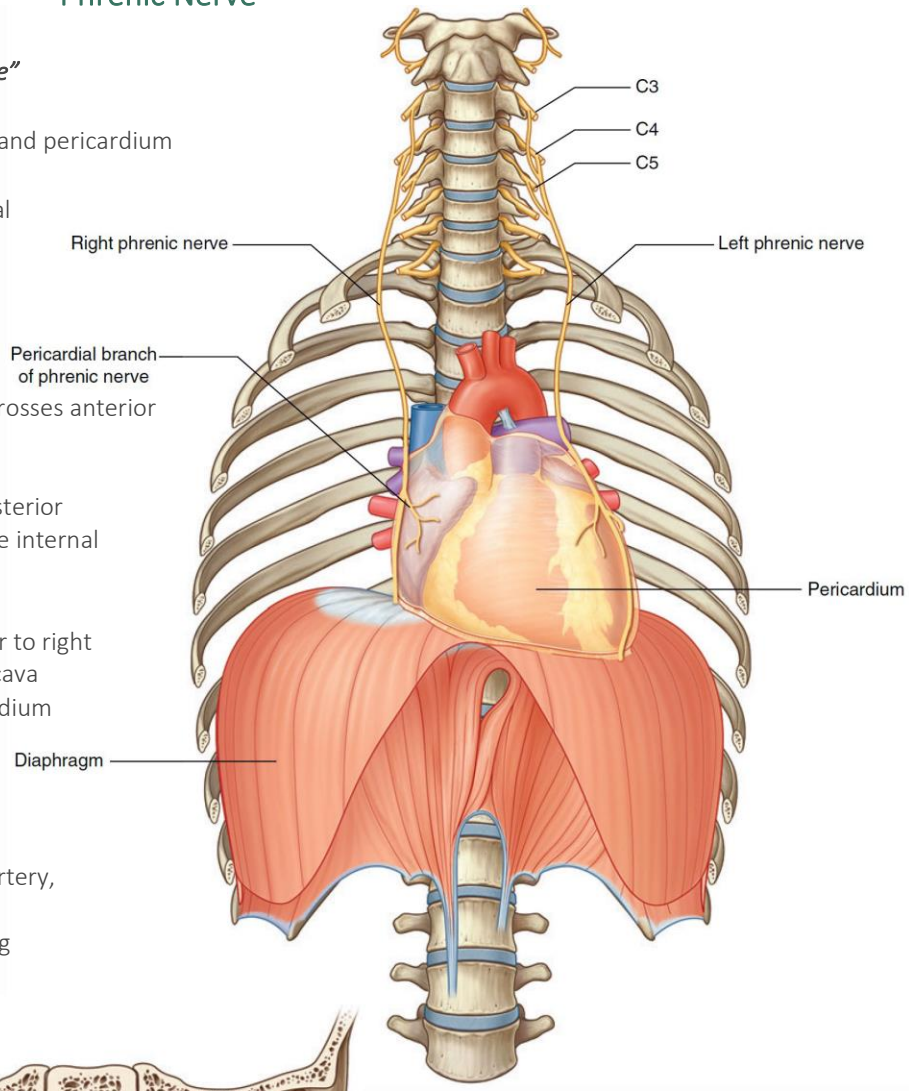
- C3,4,5 ***"C3, 4, 5 Keeps the diaphragm alive"***

Supplies

- Diaphragm, sensation central diaphragm and pericardium

Path

- The phrenic nerve passes with the internal jugular vein across scalenus anterior. It passes deep to prevertebral fascia of deep cervical fascia.
- ***Left:*** crosses **anterior** to the **1st** part of the subclavian artery.
- ***Right***: **Anterior** to scalenus anterior and crosses anterior to the **2nd** part of the subclavian artery.
- On both sides, the phrenic nerve runs posterior to the subclavian vein and posterior to the internal thoracic artery as it enters the thorax.

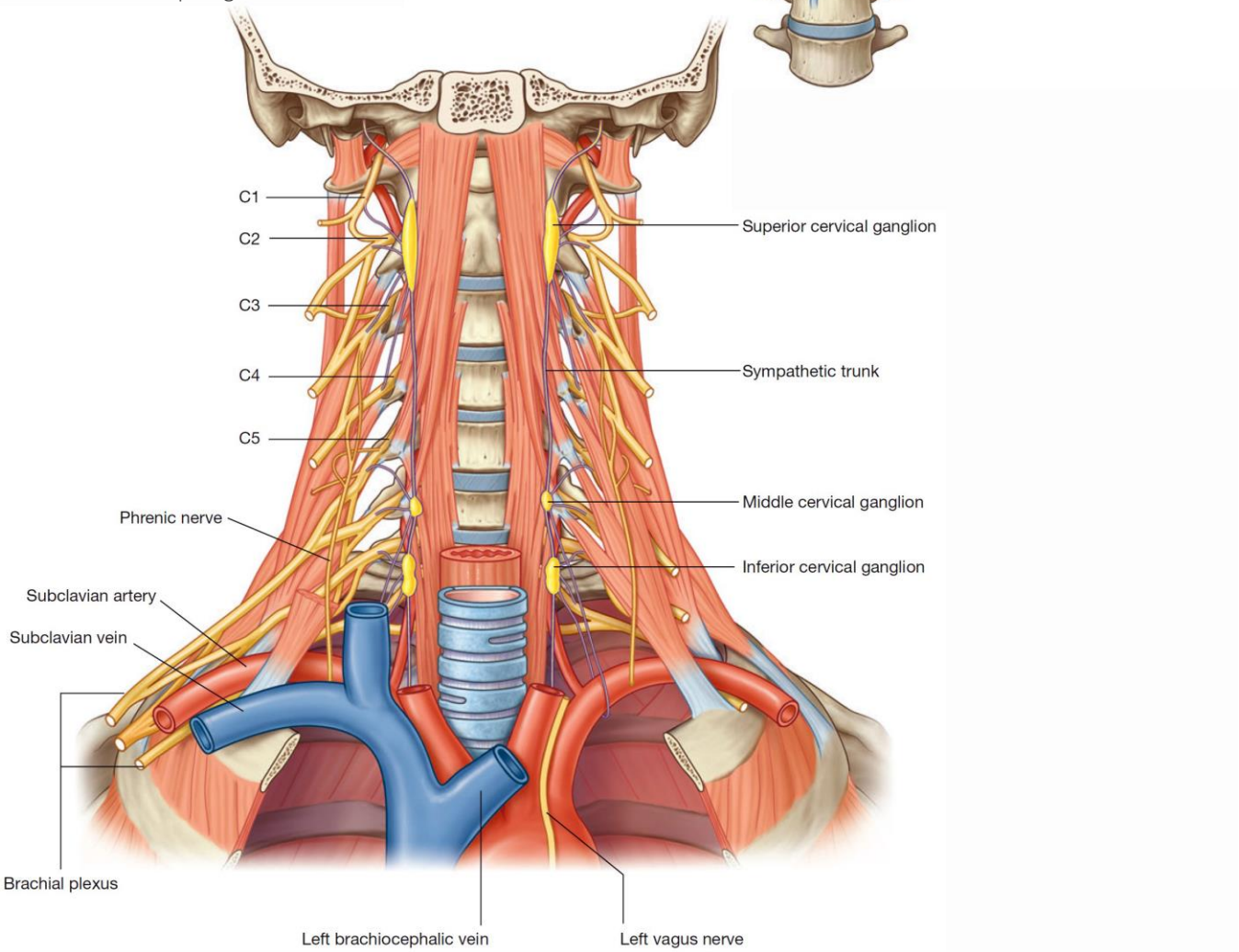


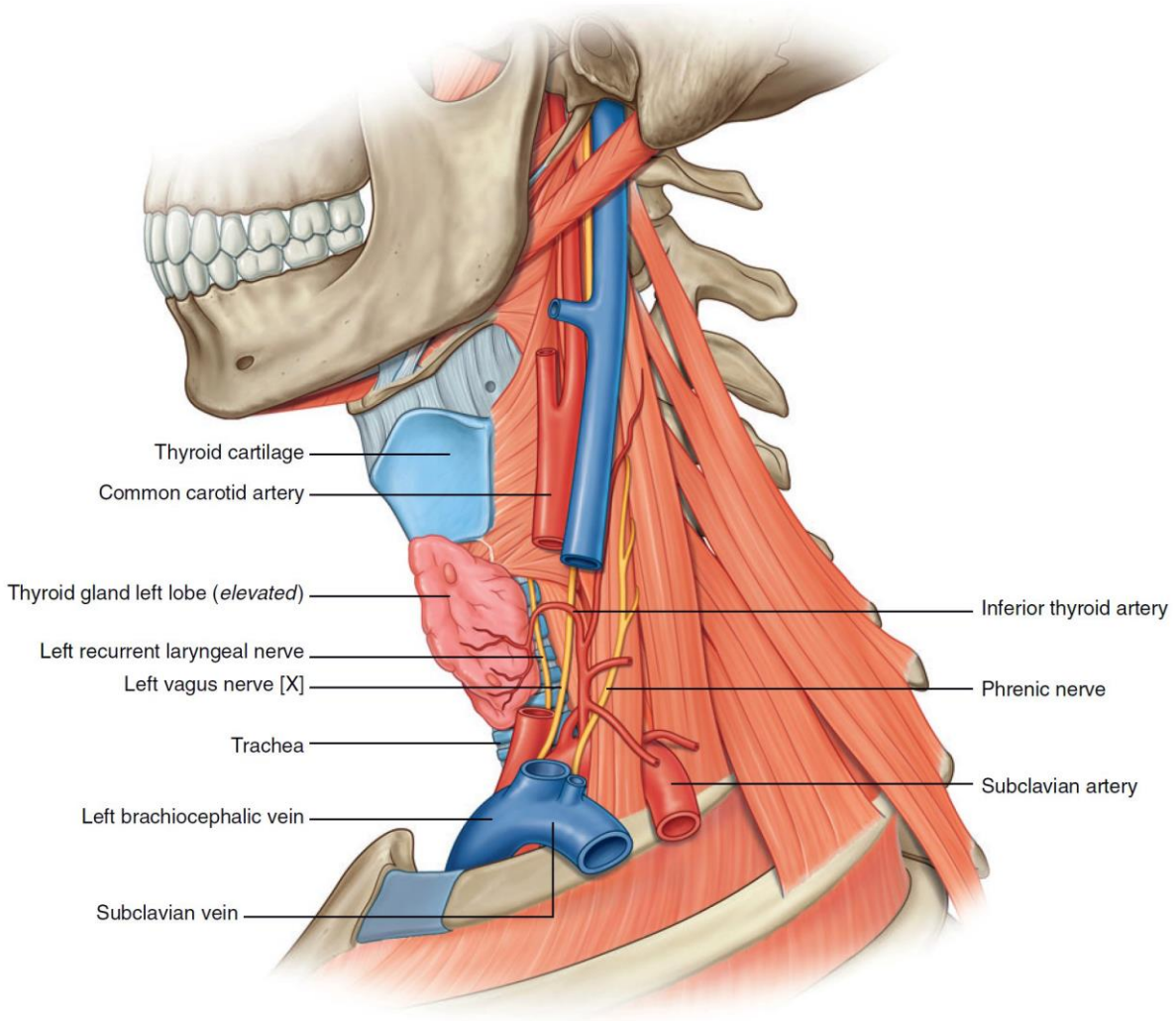
Right phrenic nerve

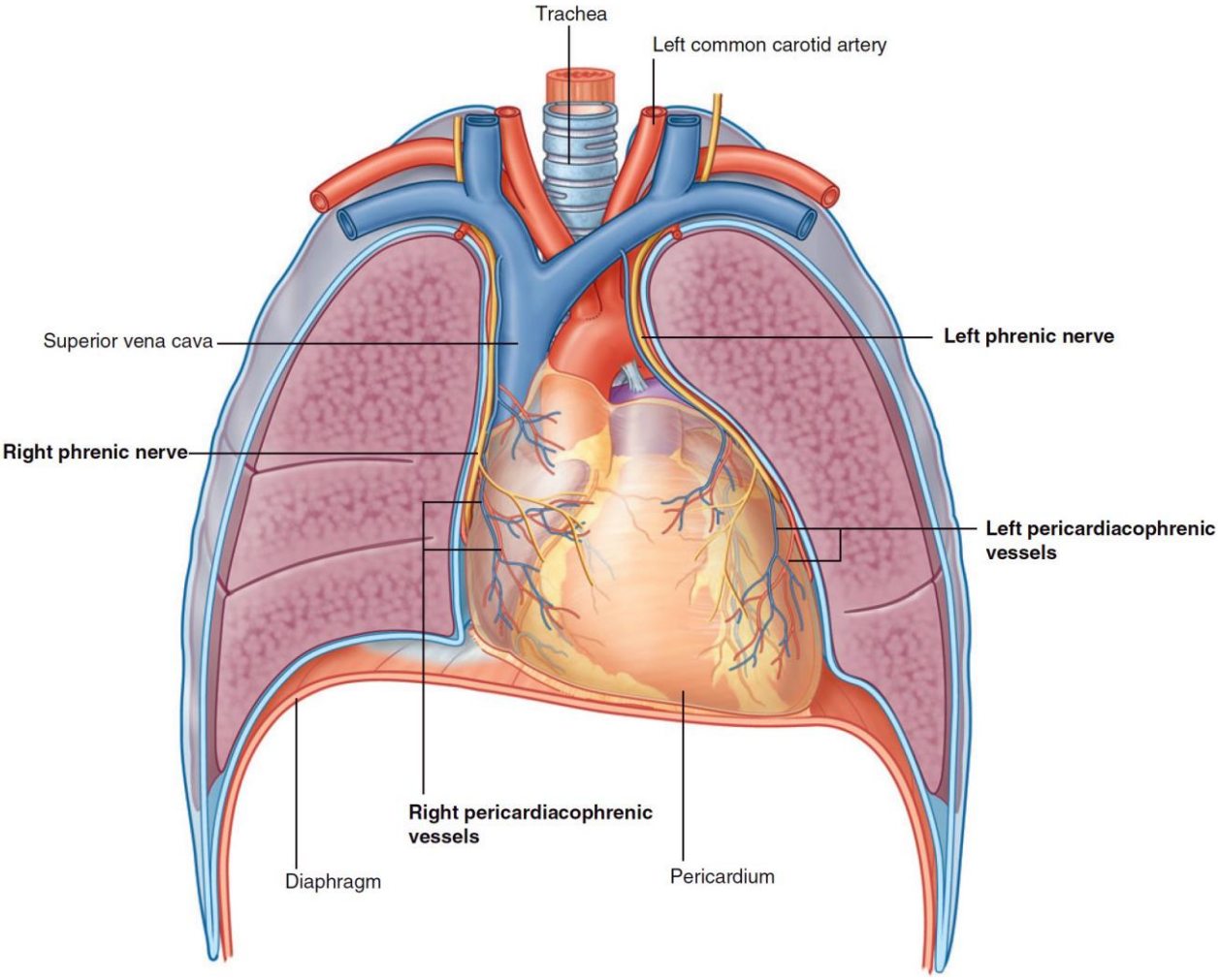
- In the superior mediastinum: anterior to right vagus and laterally to superior vena cava
- Middle mediastinum: right of pericardium
- It passes over the right atrium to exit the diaphragm at **T8** via vena cava hiatus.

Left phrenic nerve

- Passes lateral to the left subclavian artery, aortic arch and left ventricle
- Passes anterior to the root of the lung
- Pierces the diaphragm alone




Thyroid cartilage
Common carotid artery
Thyroid gland left lobe (*elevated*)
Left recurrent laryngeal nerve
Left vagus nerve [X]
Trachea
Left brachiocephalic vein
Subclavian vein
Inferior thyroid artery
Phrenic nerve
Subclavian artery


Trachea
Left common carotid artery
Superior vena cava
Right phrenic nerve
Left phrenic nerve
Left pericardiacophrenic vessels
Right pericardiacophrenic vessels
Diaphragm
Pericardium

Heart Anatomy

The walls of each cardiac chamber comprise:

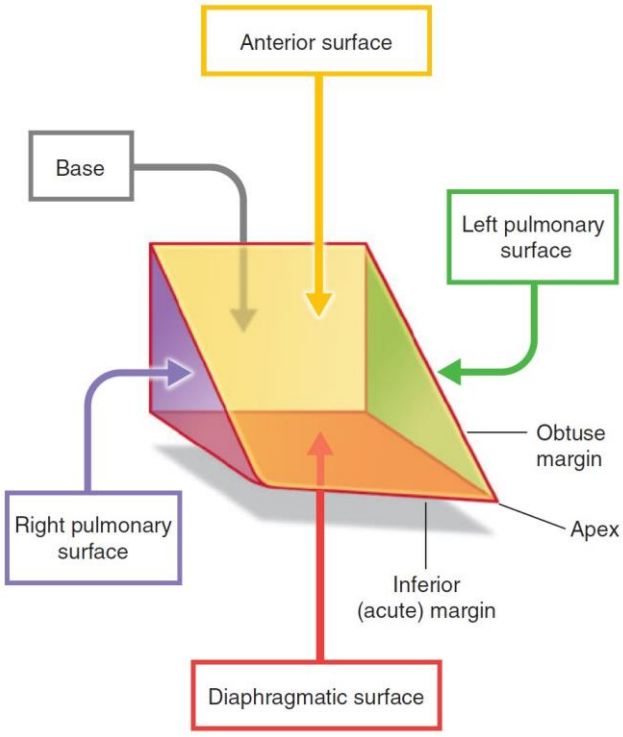
- Epicardium
- Myocardium
- Endocardium

Cardiac muscle is attached to the cardiac fibrous skeleton.

Relations

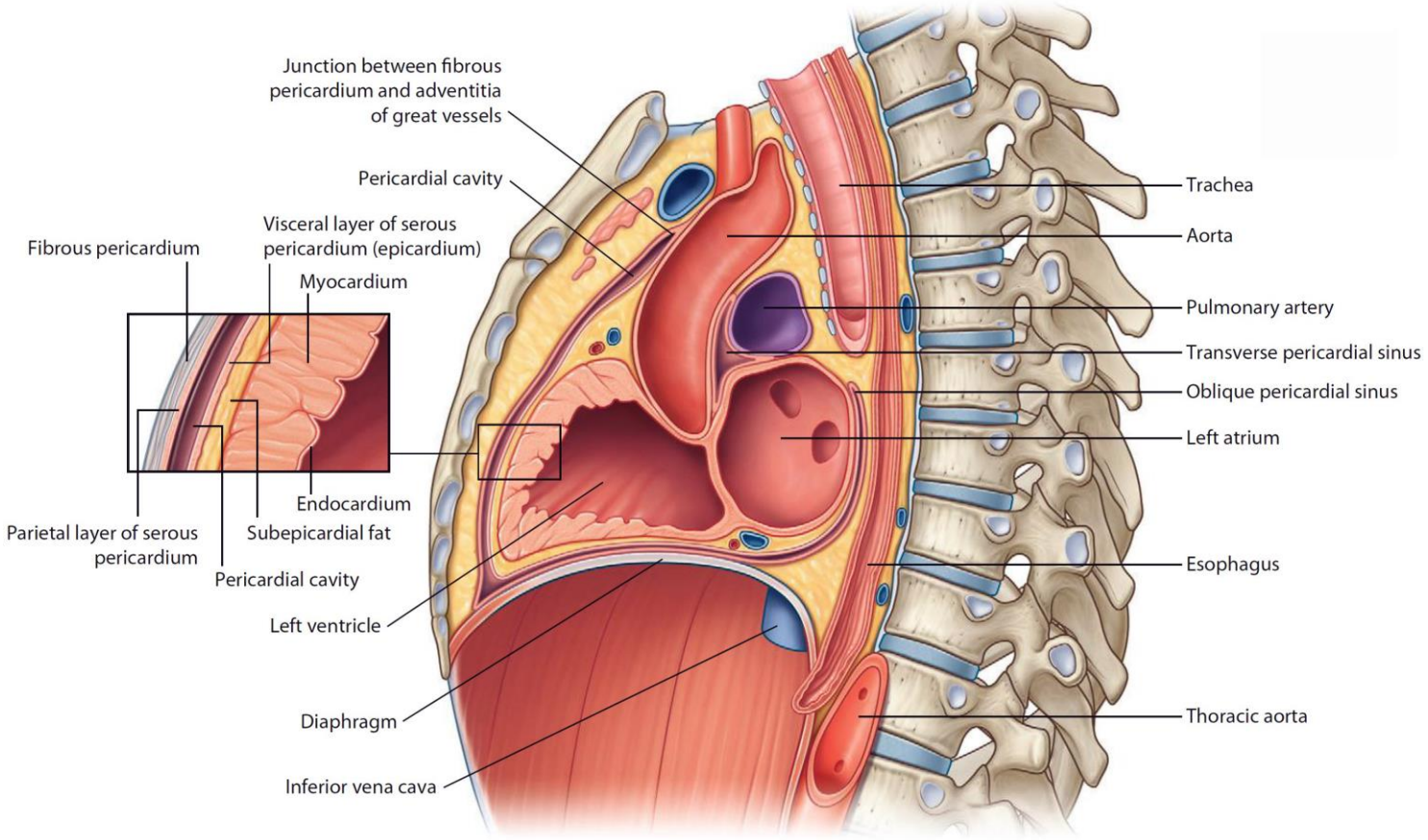
The heart and roots of the great vessels within the pericardial sac are related to the posterior aspect of the sternum, medial ends of the 3rd to 5th ribs on the left and their associated costal cartilages. The heart and pericardial sac are situated obliquely two thirds to the left and one third to the right of the median plane.

The pulmonary valve lies at the level of the left third costal cartilage.
The mitral valve lies at the level of the fourth costal cartilage.

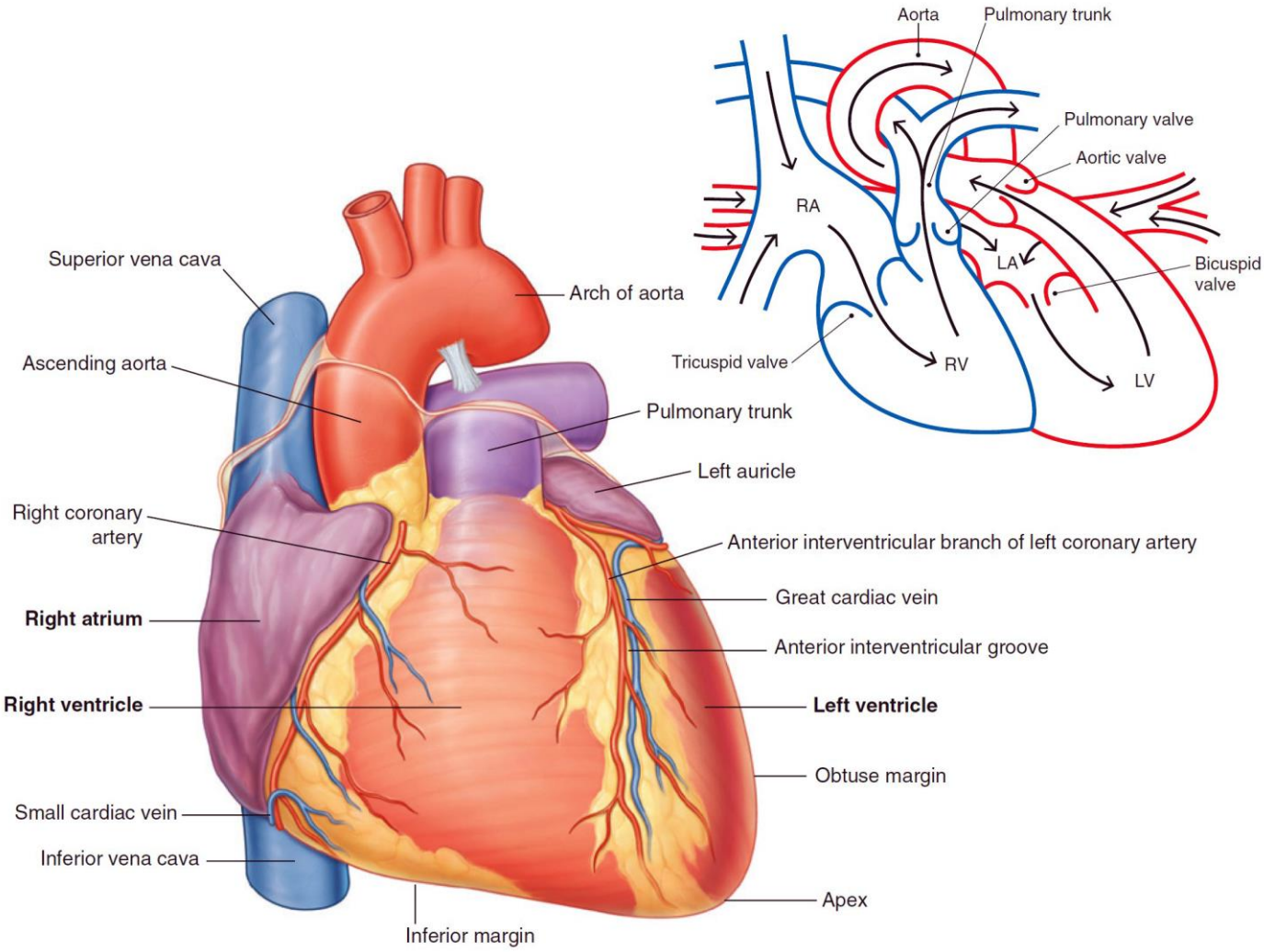


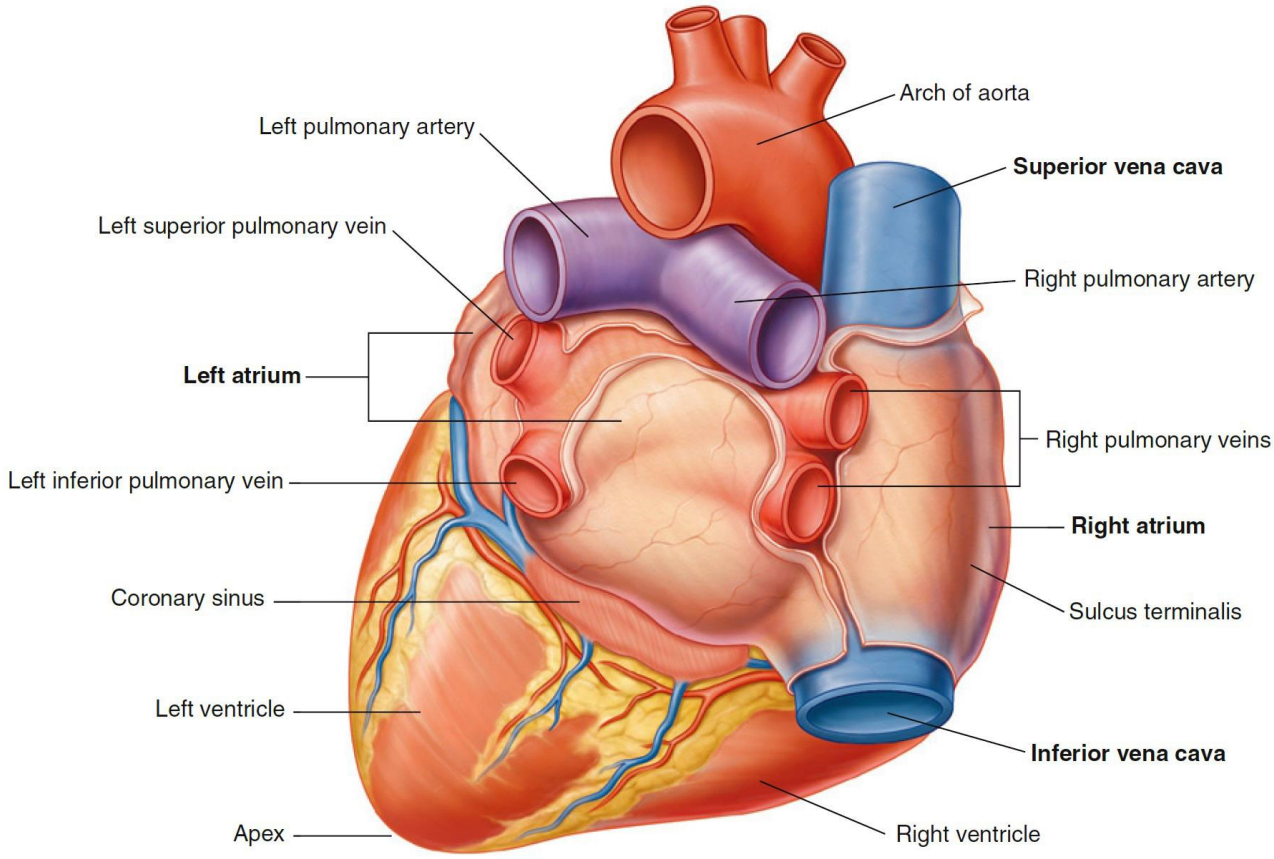
Features of the left ventricle as opposed to the right

Structure	Left Ventricle
A-V Valve	Mitral (double leaflet)
Walls	Twice as thick as right
Trabeculae carnae	Much thicker and more numerous
Conus arteriosus	Absent



Sagittal section of the pericardium and heart


Aorta
Pulmonary trunk
Pulmonary valve
Aortic valve
RA
LA
Bicuspid valve
Tricuspid valve
RV
LV
Superior vena cava
Arch of aorta
Ascending aorta
Pulmonary trunk
Left auricle
Right coronary artery
Anterior interventricular branch of left coronary artery
Great cardiac vein
Right atrium
Anterior interventricular groove
Right ventricle
Left ventricle
Obtuse margin
Small cardiac vein
Inferior vena cava
Apex
Inferior margin

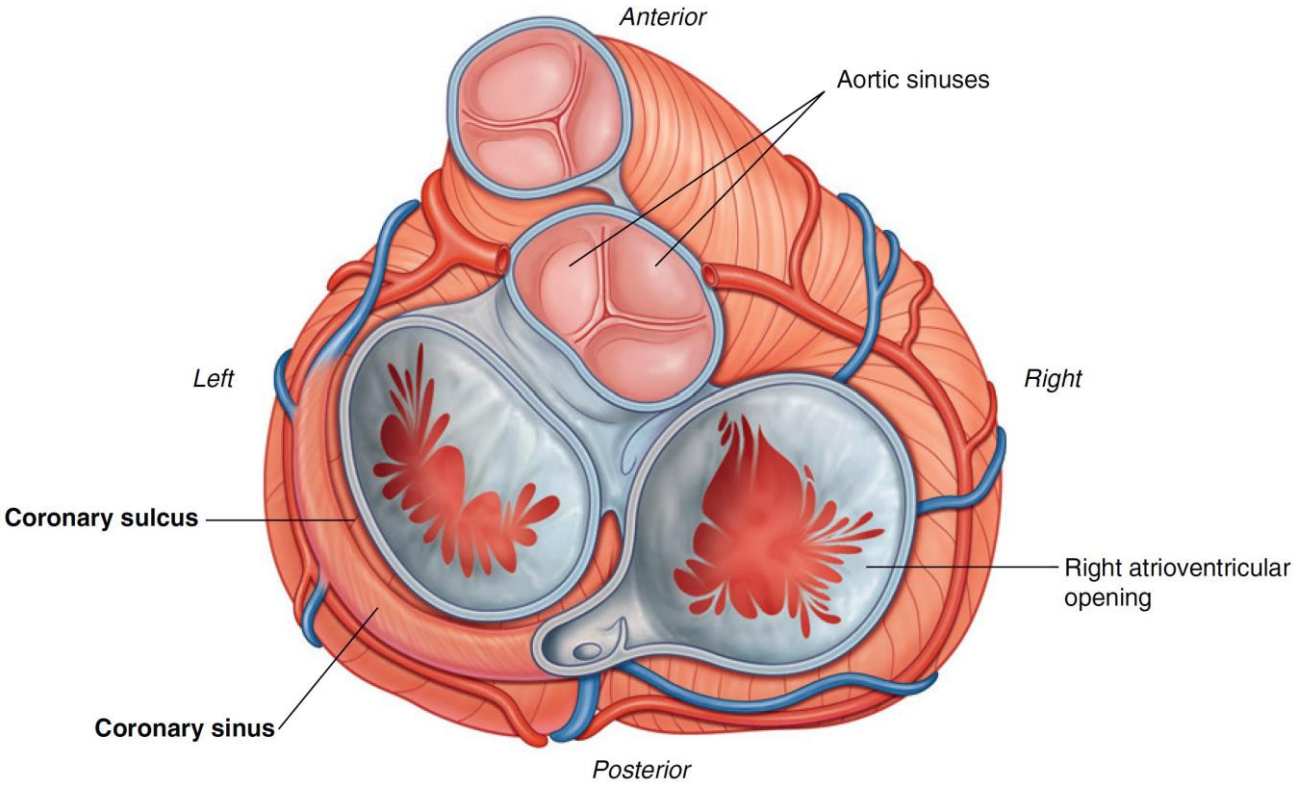

Arch of aorta
Left pulmonary artery
Superior vena cava
Left superior pulmonary vein
Right pulmonary artery
Left atrium
Right pulmonary veins
Left inferior pulmonary vein
Right atrium
Coronary sinus
Sulcus terminalis
Left ventricle
Inferior vena cava
Apex
Right ventricle

Coronary sinus

This lies in the posterior part of the coronary groove and receives blood from the cardiac veins. The great cardiac vein lies at its left and the middle and small cardiac veins lie on its right. The smallest cardiac vein (anterior cardiac vein) drains into the right atrium directly.

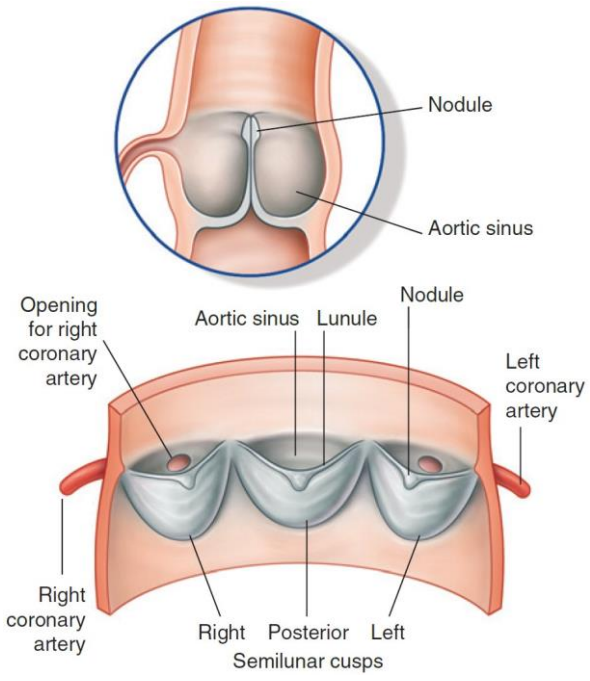
Aortic sinus

Right coronary artery arises from the right aortic sinus, the left is derived from the left aortic sinus, which lies posteriorly.

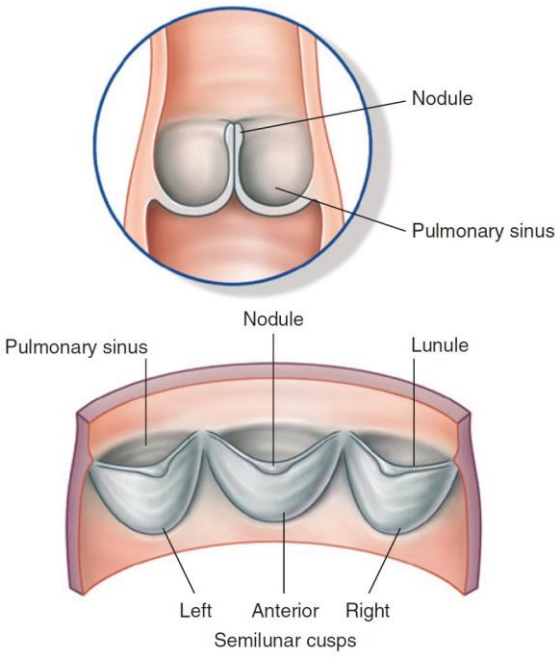


Valves of the heart

Mitral valve	*Aortic valve*	*Pulmonary valve*	*Tricuspid valve*
2 cusps	3 cusps	3 cusps	3 cusps
1st heart sound	2nd heart sound	2nd heart sound	1st heart sound
1 anterior cusp	2 anterior cusps	2 anterior cusps	2 anterior cusps
Attached to chordae tendinae	No chordae	No chordae	Attached to chordae tendinae



Anterior view of the aortic valve.



Posterior view of the pulmonary valve.

Right coronary artery

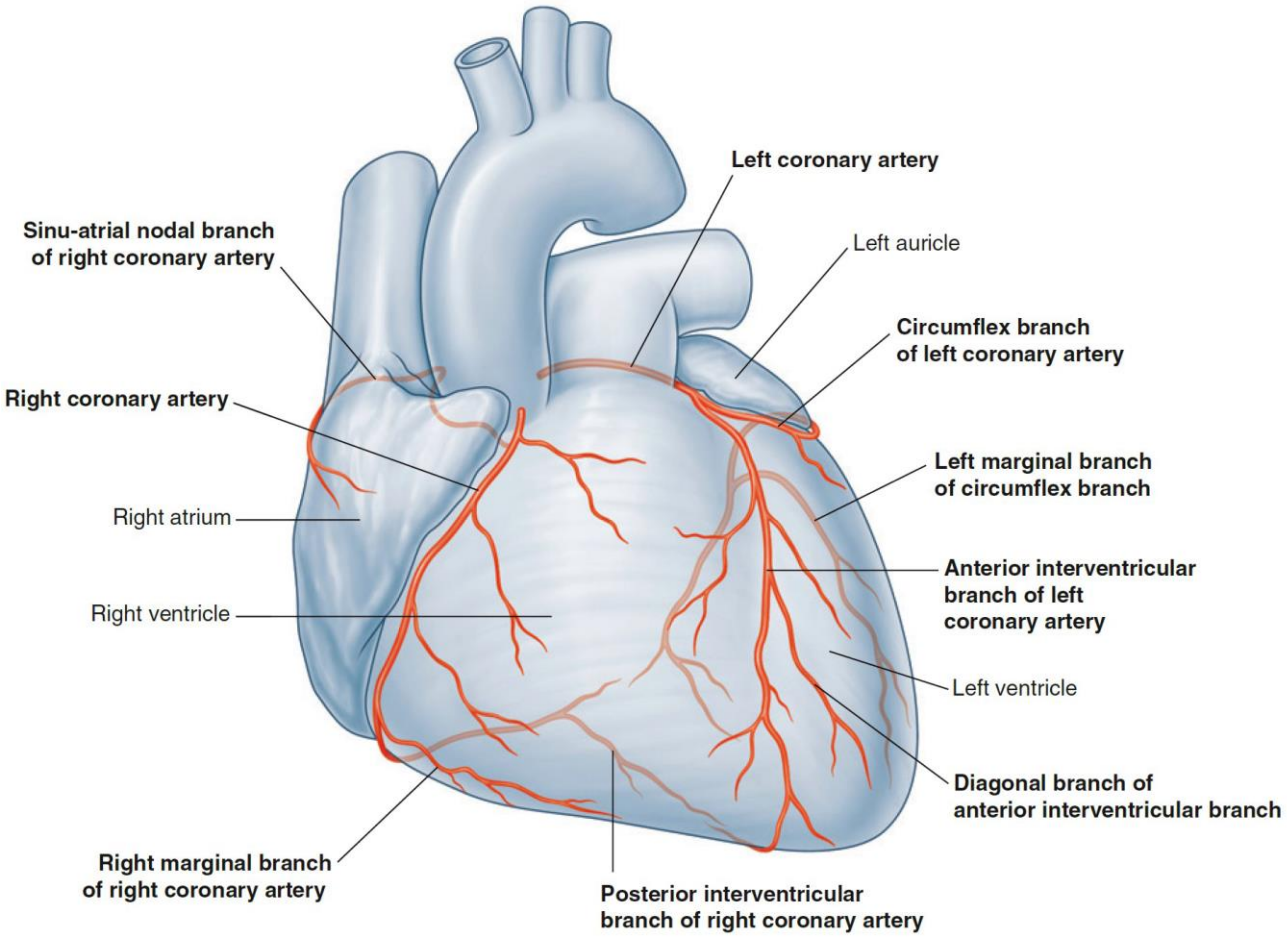
The RCA supplies:

- Right atrium
- Diaphragmatic part of the right ventricle
- Usually the posterior third of the interventricular septum
- The sino atrial node (60% cases)
- The atrio ventricular node (80% cases)

Left coronary artery

The LCA supplies:

- Left atrium
- Most of left ventricle
- Part of the right ventricle
- Anterior two thirds of the inter ventricular septum
- The sino atrial node (remaining 40% cases)



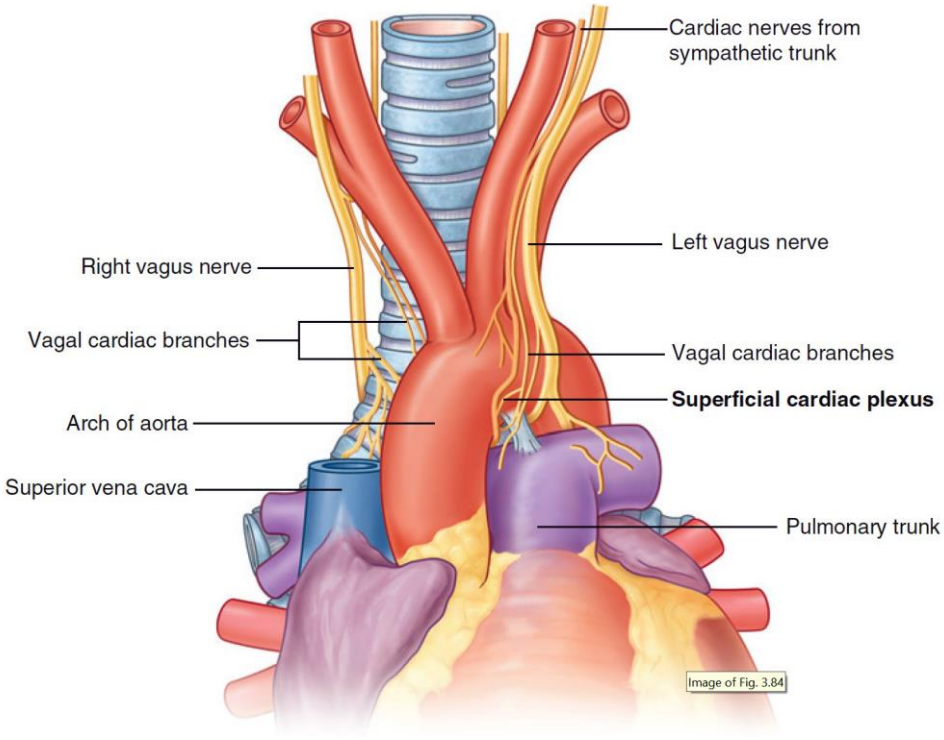
Innervation of the heart

(See Vagus n. in Head & Neck)

Autonomic nerve fibres from the superficial and deep cardiac plexus.

These lie anterior to the bifurcation of the trachea, posterior to the ascending aorta and superior to the bifurcation of the pulmonary trunk.

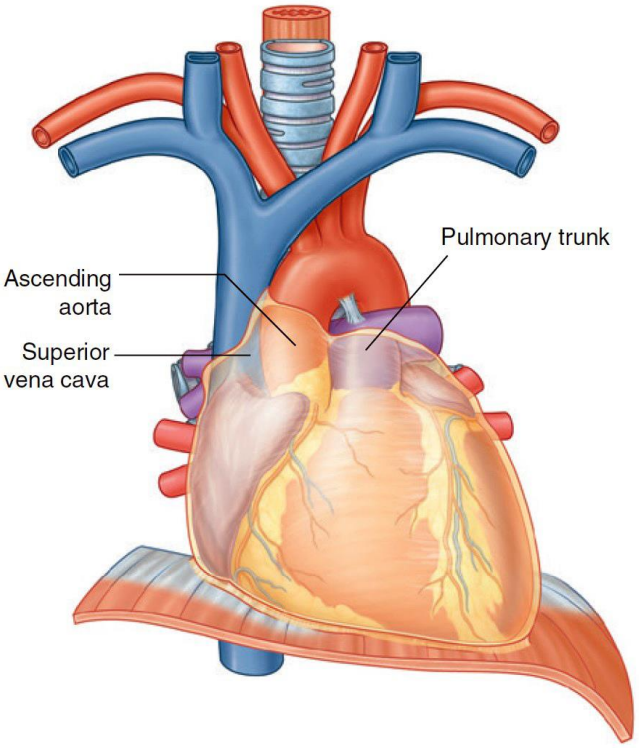
The parasympathetic supply to the heart is from presynaptic fibres of the vagus nerves.



Superior Vena Cava

Drainage

- Head and neck
- Upper limbs
- Thorax
- Part of abdominal walls



Formation

- Subclavian and internal jugular veins unite to form the right and left brachiocephalic veins
- These unite to form the SVC
- Azygos vein joins the SVC before it enters the right atrium

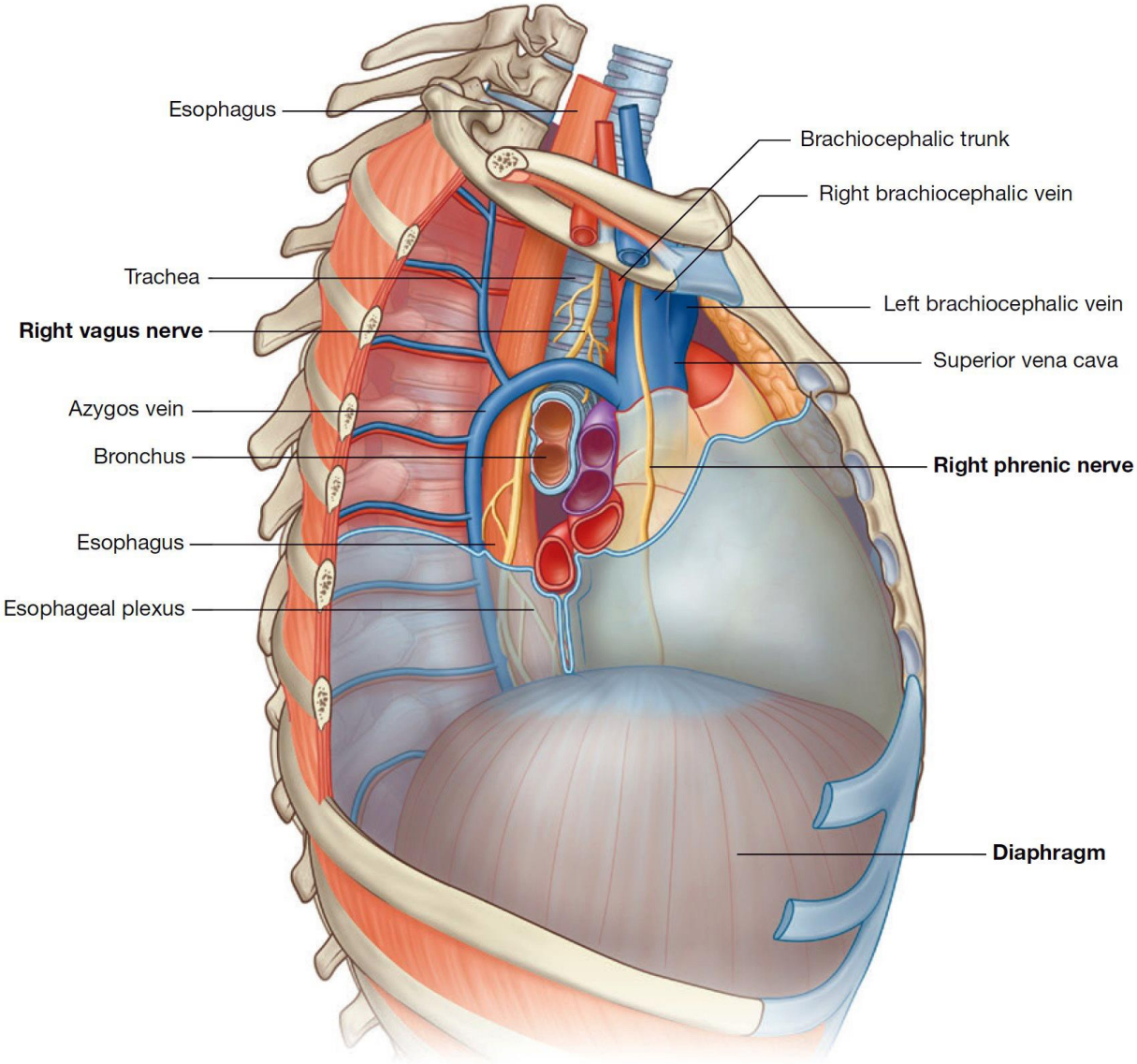
Relations

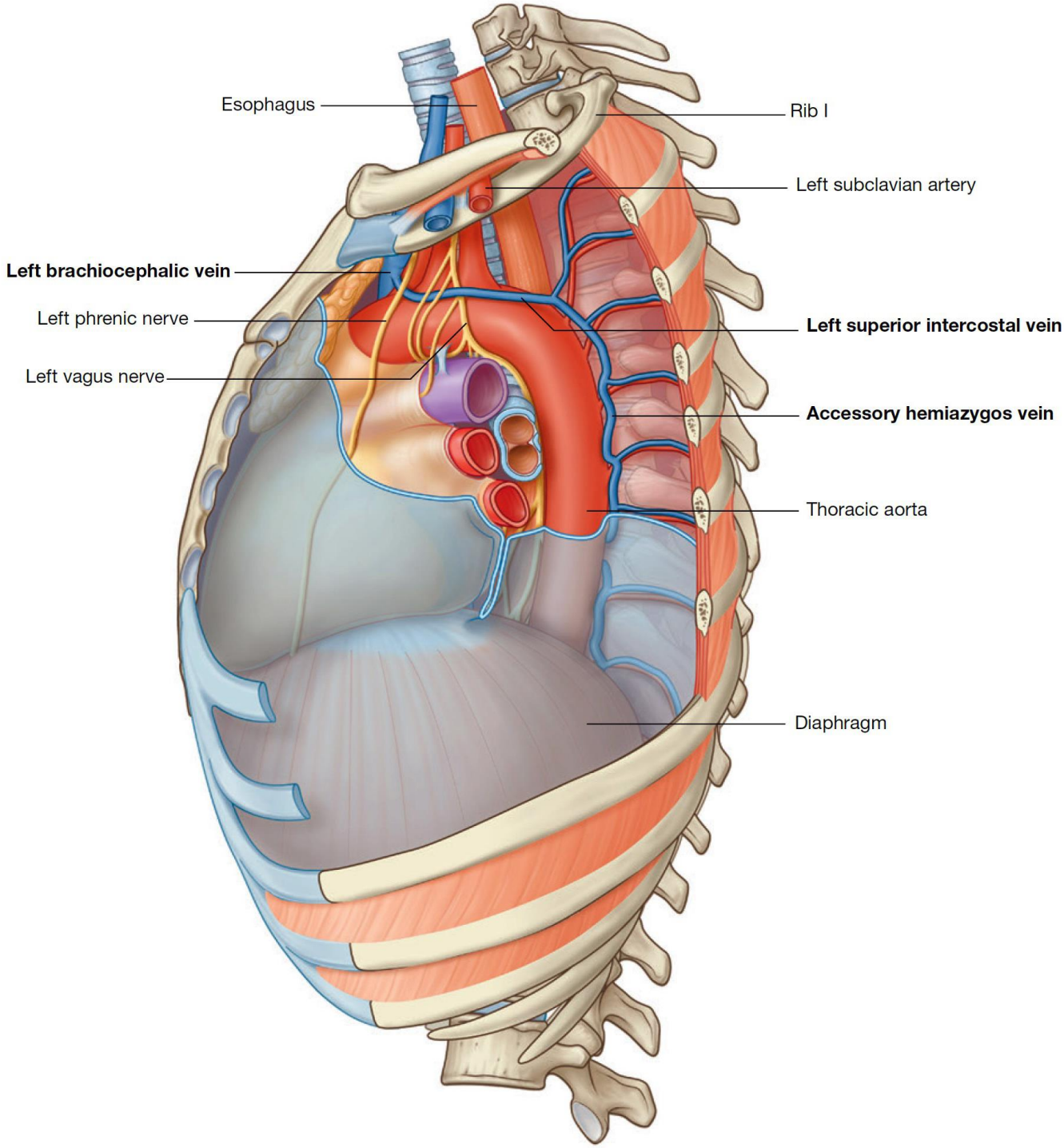
Anterior	Anterior margins of the right lung and pleura
Posteromedial	Trachea and right vagus nerve
Posterolateral	Posterior aspects of right lung and pleura Pulmonary hilum is posterior
Right lateral	Right phrenic nerve and pleura
Left lateral	Brachiocephalic artery and ascending aorta

There are 4 collateral venous systems:

- Azygos venous system
- Internal mammary venous pathway
- Long thoracic venous system with connections to the femoral and vertebral veins (2 pathways)

Despite this, venous hypertension still occurs in SVC obstruction.



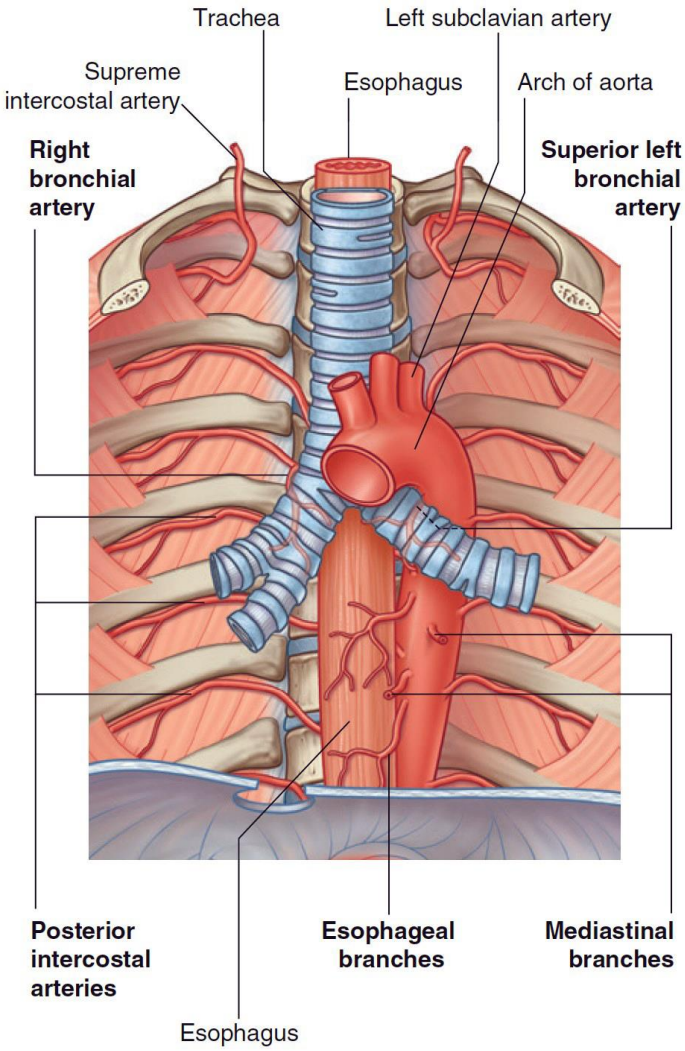


Developmental variations

Anomalies of the connection of the SVC are recognised. In some individuals a persistent left sided SVC drains into the right atrium via an enlarged orifice of the **coronary sinus**. More rarely the left sided vena cava may connect directly with the superior aspect of the left atrium, usually associated with an un-roofing of the coronary sinus. The commonest lesion of the IVC is for its abdominal course to be interrupted, with drainage achieved via the azygos venous system. This may occur in patients with left sided atrial isomerism.

Thoracic Aorta

Origin	T4
Terminates	T12
Relations	• ***Anteriorly:*** (from top to bottom) Root of the left lung, the pericardium, the oesophagus, and the diaphragm • ***Posteriorly***: Vertebral column, Azygos vein • ***Right***: Hemiazygos veins, Thoracic duct • ***Left***: Left pleura and lung
Branches	• Lateral segmental branches: Posterior intercostal arteries • Lateral visceral: Bronchial arteries supply bronchial walls and lung excluding the alveoli • Midline branches: Oesophageal arteries



Prosthetic Heart Valves On Chest X-Rays

The aortic and mitral valves are most commonly replaced and when a metallic valve is used, can be most readily identified on plain x-rays.
The presence of cardiac disease (such as cardiomegaly) may affect the figures quoted here.

Aortic

Usually located medial to the 3rd interspace on the right.

Mitral

Usually located medial to the **4th interspace on the left**.

Tricuspid

Usually located medial to the 5th interspace on the right.

Please note that these are the sites at which an artificial valve may be located and are NOT the sites of auscultation.