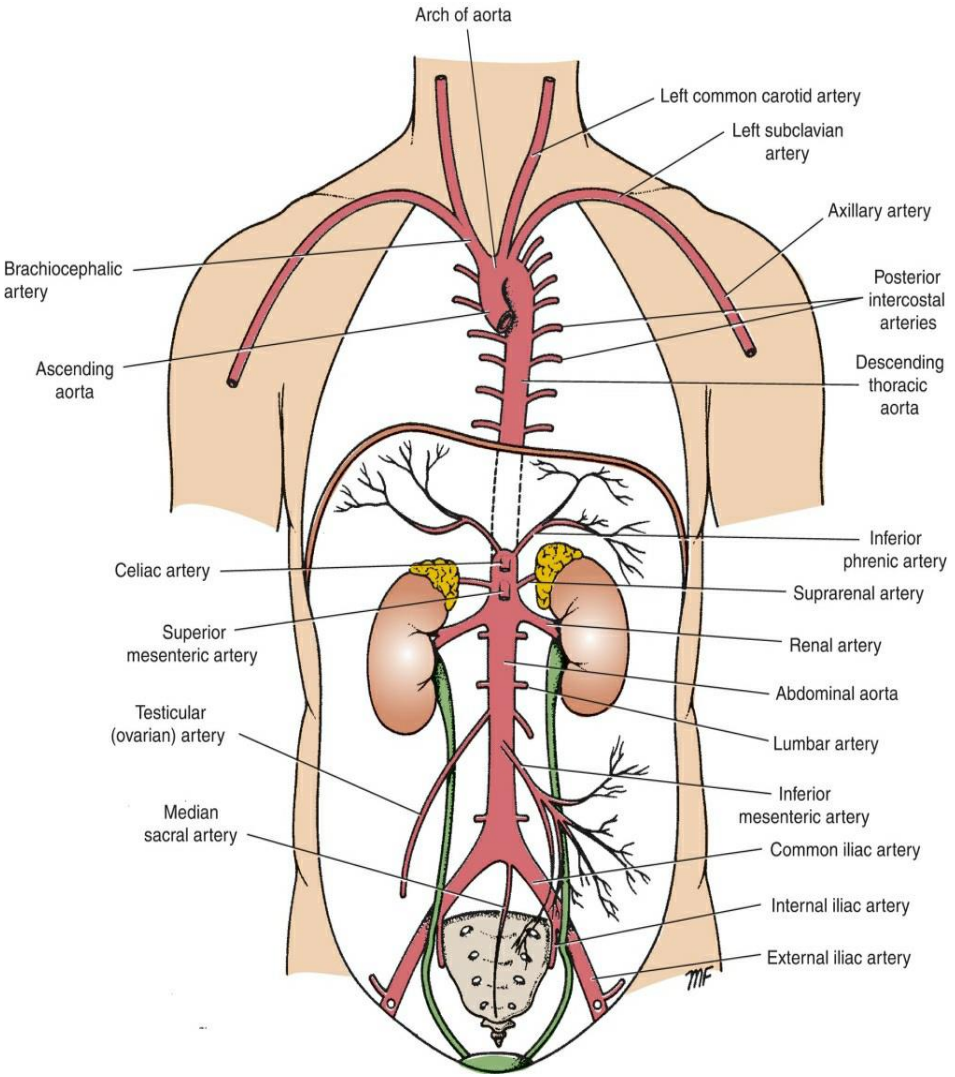
THORAX part 111 a

LARGE THORACIC ARTERIES

The aorta and pulmonary trunk are the large arteries in the thorax.

Aorta

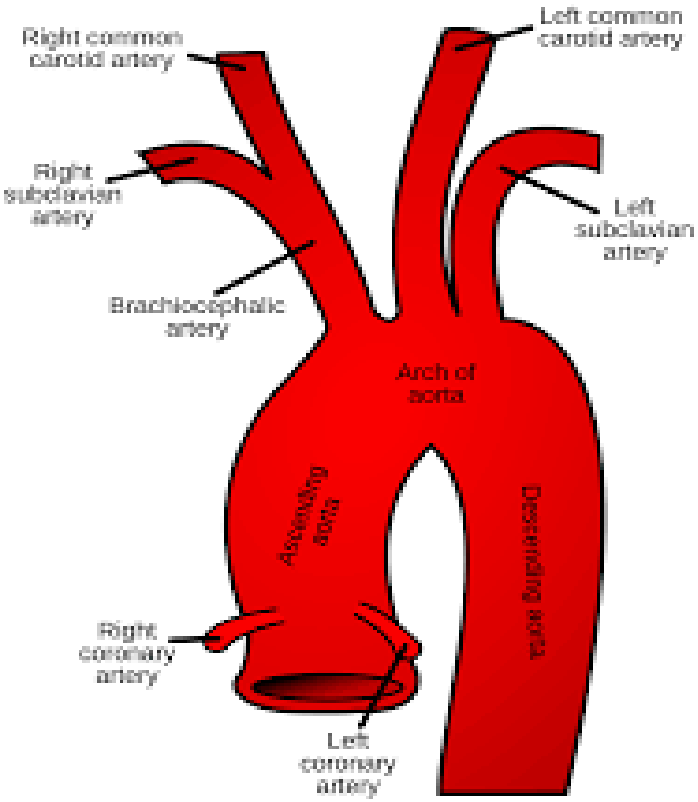
The aorta oxygenated blood from the left ventricle of the heart to the tissues of the body. It consists of four main parts: 1.**ascending aorta, 2. arch of the aorta, descending 3. thoracic aorta, and 4. abdominal aorta.**



Ascending Aorta

Begins at **the base of the left ventricle, then** comes to lie behind the sternum **at the level of the sternal angle**, where it becomes **continuous with the arch of the aorta.** The ascending aorta lies in the middle mediastinum.

Branches. **1)The right coronary artery arises from the right aortic sinus, 2) the left coronary artery arises from the left aortic sinus.**



Aortic Arch

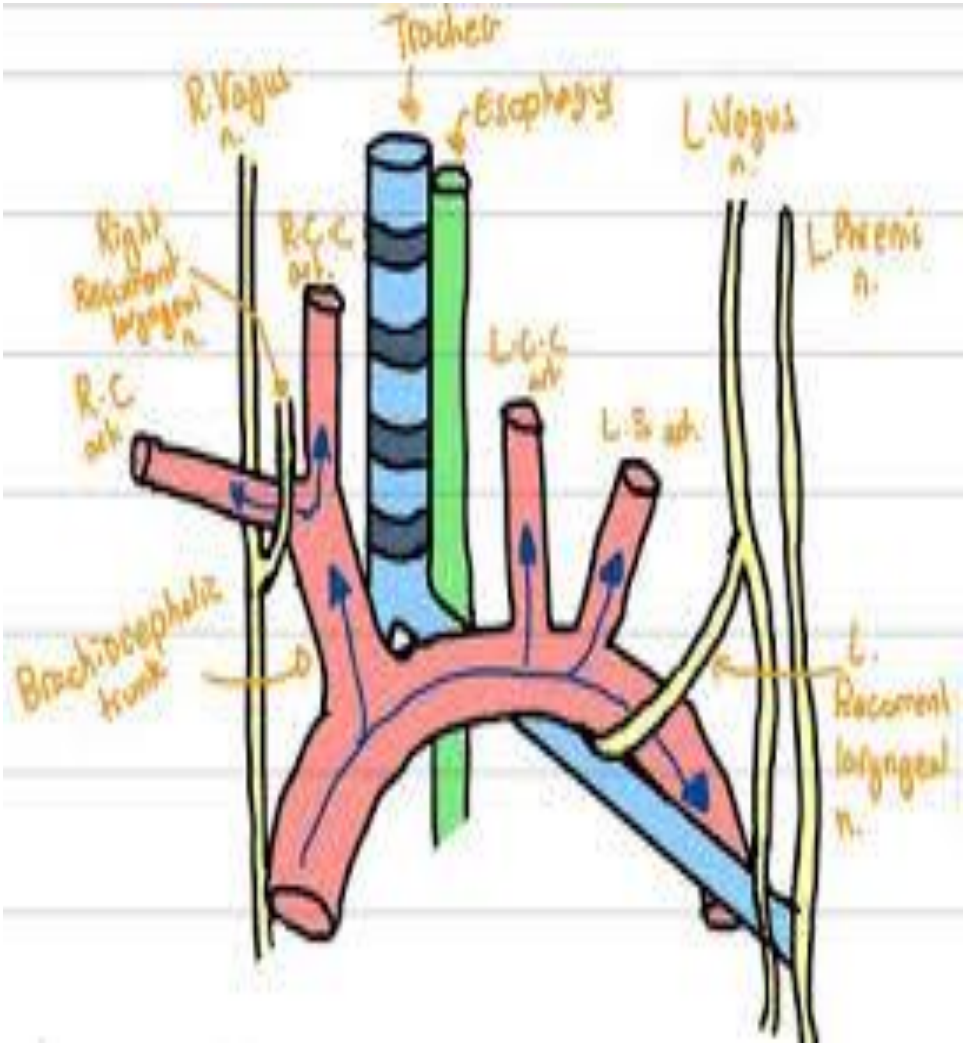
The arch of the aorta **lies in the superior mediastinum, behind the manubrium sterni,** in **front of the trachea**.

It then passes downward to become to the left of the trachea and, **at the level of the sternal angle, becomes continuous with the descending aorta**.

Branches

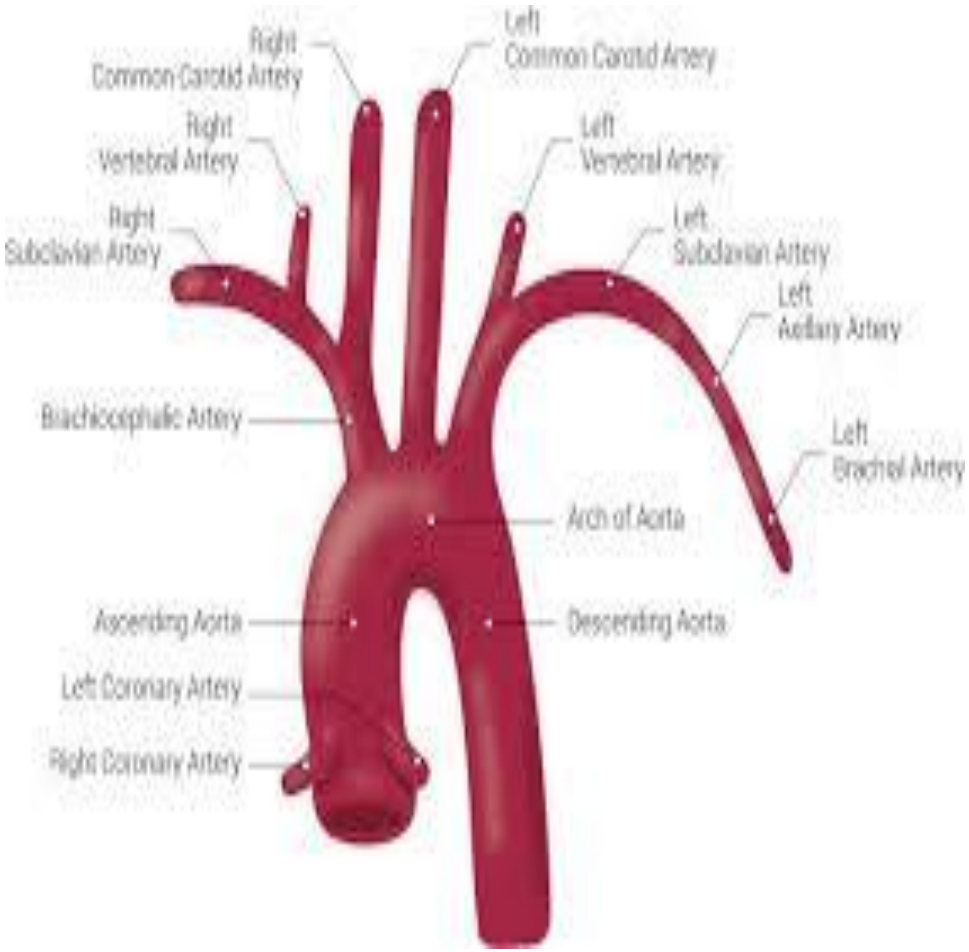
1) brachiocephalic artery, 2) left common carotid artery, and 3) left subclavian artery.

The brachiocephalic artery, arises from the convexity of the arch, passes **upward and to the right of the trachea** and divides into the right subclavian and right common carotid arteries behind the **right sternoclavicular joint.**



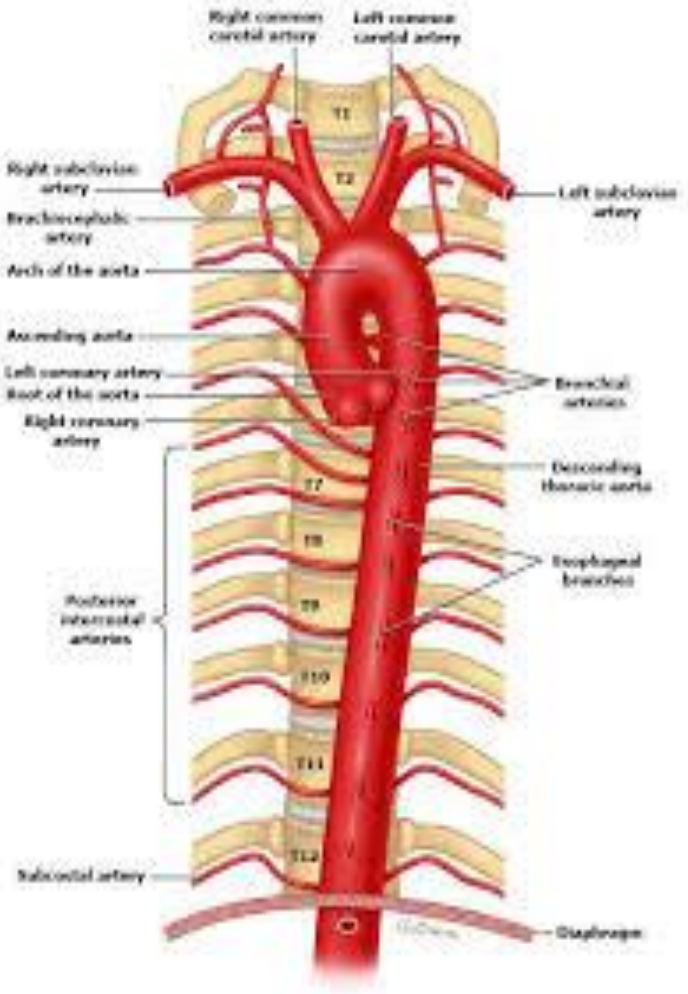
2)The left common carotid artery, arises on the left side of the brachiocephalic artery. It runs upward and enters the neck behind the left sternoclavicular joint.

3) The left subclavian artery, arises from the aortic arch behind the left common carotid artery. It runs upward along the left side of the trachea and the esophagus to enter the root of the neck. It arches over the apex of the left lung and continues toward the left upper limb.



Descending Thoracic Aorta

The descending thoracic aorta lies in the posterior mediastinum. It begins as the continuation of the arch of the aorta on the left side of the lower border of the body of the fourth thoracic vertebra and reach the anterior surface of the vertebral column at the level of the 12th thoracic vertebra, where it passes through the aortic opening and becomes continuous with the abdominal aorta.

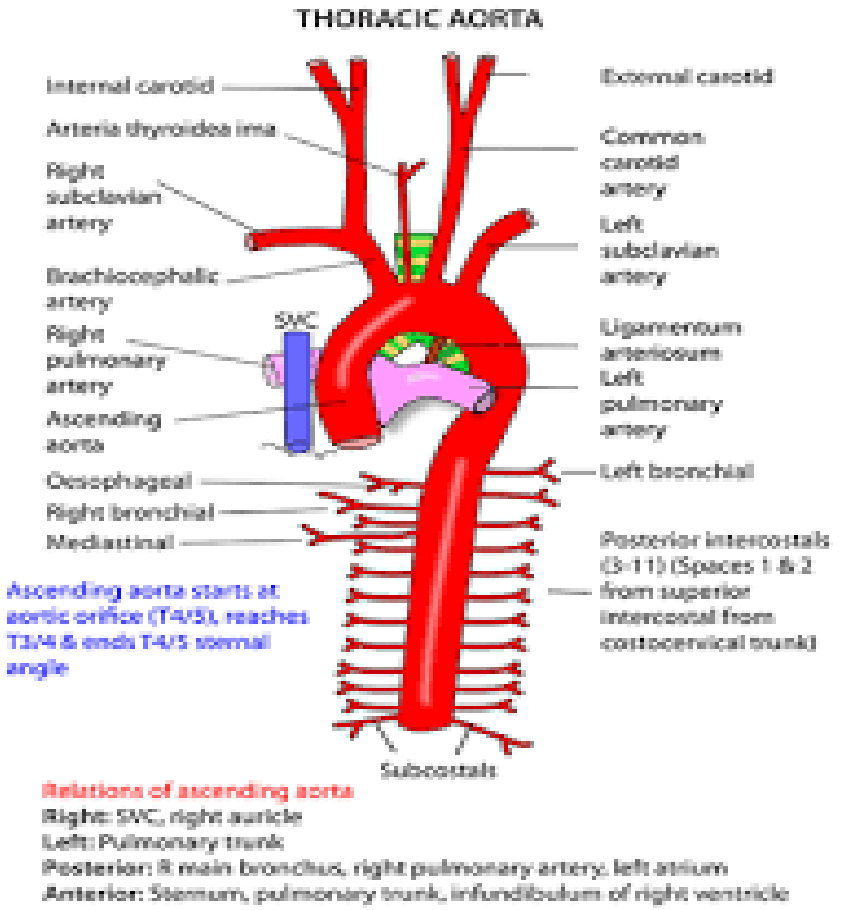


Branches

1)Posterior intercostal arteries branch to the **lower nine intercostal spaces on each side (3rd -12th).**

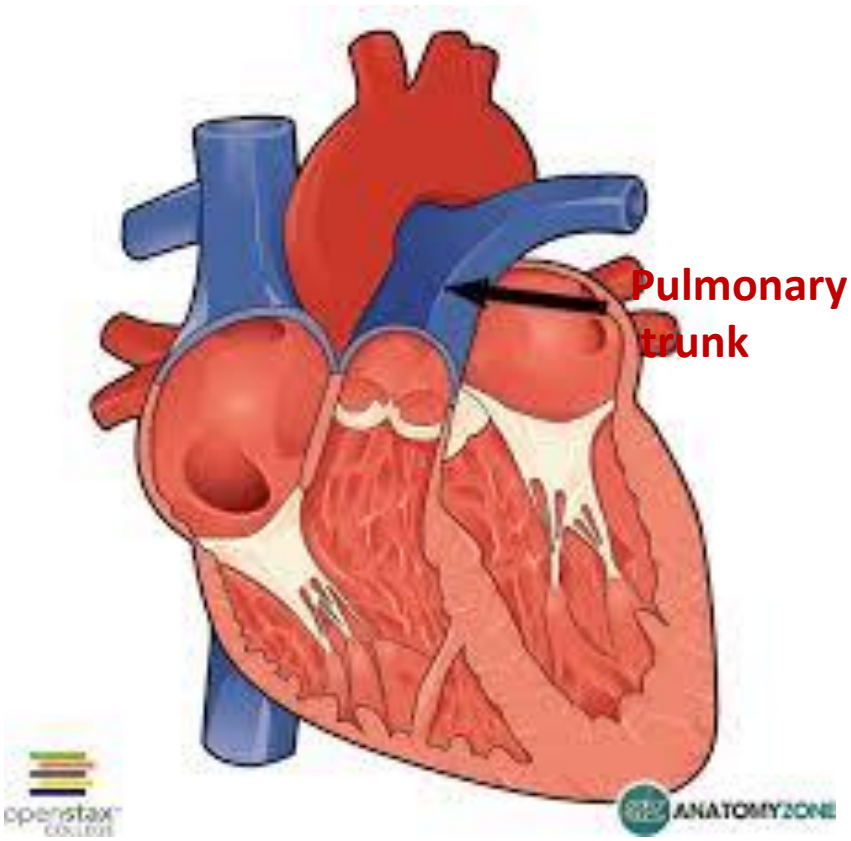
2) Subcostal arteries arise on each side and run along the lower border of the 12th rib to enter the abdominal wall.

3) Pericardial, **esophageal**, and **bronchial arteries** are small branches that supply these organs.



Pulmonary Trunk

Conveys deoxygenated blood from the right ventricle of the heart to the lungs. **It leaves the infundibulum (upper part) of the right ventricle**. It is about 5-cm long and terminates in the concavity of the aortic arch by dividing into **right** and **left pulmonary arteries.** It lies in the middle mediastinum, together with the ascending aorta enclosed by peircardium.

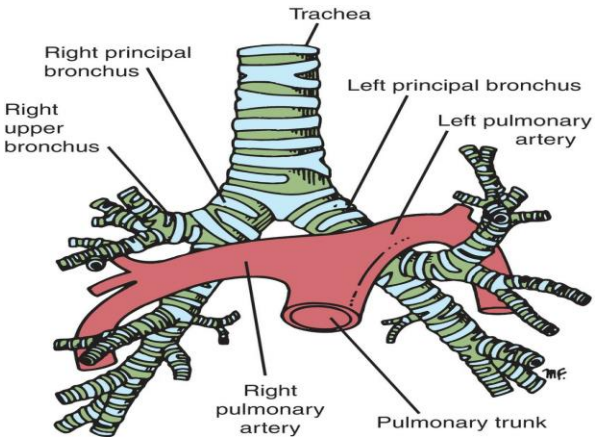


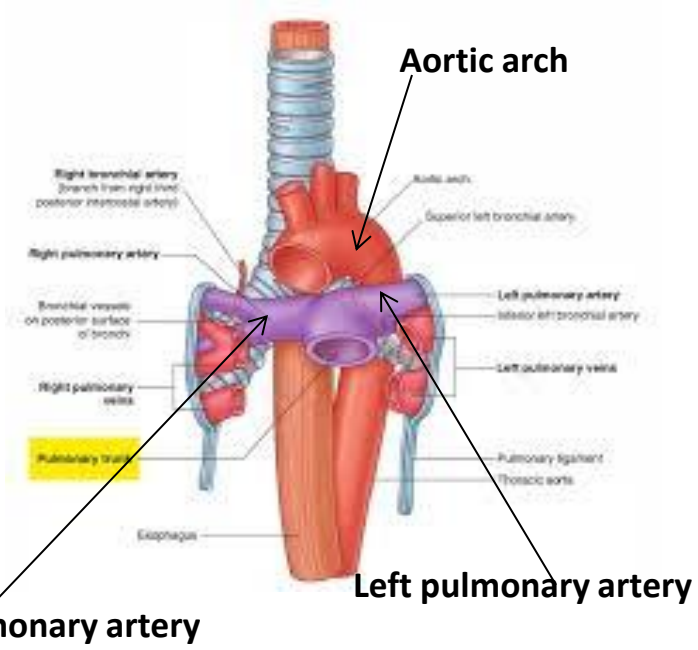
Branches

The right pulmonary artery runs behind the ascending aorta and superior vena cava to enter the root of the right lung.

The left pulmonary artery runs to the left in front of the descending aorta to enter the root of the left lung .

The ligamentum arteriosum is a fibrous band that connects the bifurcation of the pulmonary trunk to the lower concave surface of the aortic Arch. The ligamentum arteriosum is the remnant of the **ductus arteriosus.** **The left recurrent laryngeal nerve** hooks around the lower border of the ductus which closes after birth.

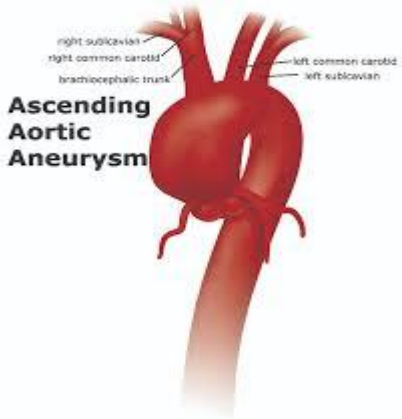




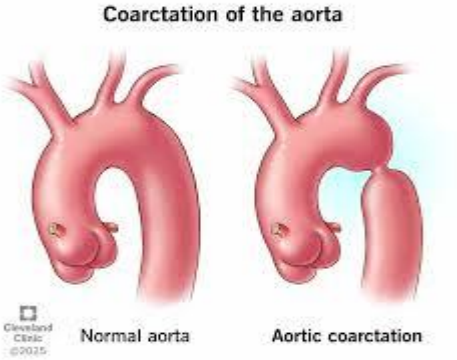
Clinical Notes

Aneurysm and Coarctation of the Aorta

The arch of the aorta lies behind the manubrium sterni. **A gross dilatation of the aorta (aneurysm)** may show itself as a pulsatile swelling in the suprasternal notch.

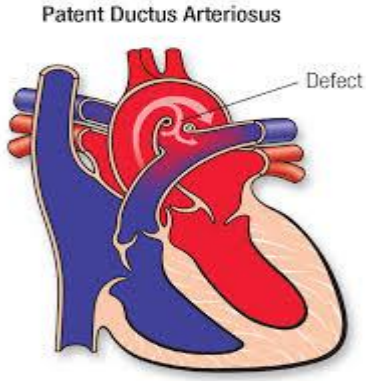


Coarctation of the aorta is a congenital narrowing of the aorta just proximal, opposite, or distal to the site of attachment of the ligamentum arteriosum. This condition is believed to result from an unusual quantity of ductus arteriosus muscle tissue in the wall of the aorta. Clinically, the cardinal sign of aortic coarctation is absent or diminished pulses in the femoral arteries of both lower limbs.



Patent Ductus Arteriosus

The ductus arteriosus connects the left pulmonary artery (near its origin from the pulmonary trunk) to the beginning of the descending aorta . During fetal life, blood passes through it from the pulmonary artery to the aorta. After birth, it normally constricts , later closes, and becomes the ligamentum arteriosum. A persistent patent ductus arteriosus results in high-pressure aortic blood passing into the pulmonary artery, producing pulmonary hypertension and hypertrophy of the right ventricle. A patent ductus **arteriosus is life threatening and should be ligated and divided surgically.**

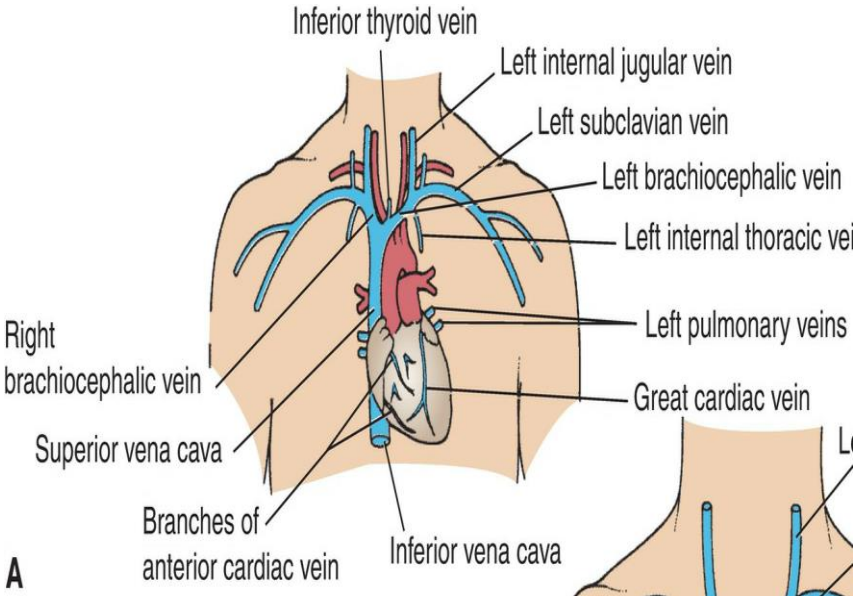


LARGE THORACIC VEINS

The brachiocephalic and azygos veins and the superior vena cava are the large veins in the thorax. They receive blood drainage from the head, neck, upper limbs, and thorax. **The inferior vena cava receives blood mainly from the body below the diaphragm and has only a brief appearance in the thorax.**

Brachiocephalic Veins

The **right and left brachiocephalic veins** form at **the root of the neck on each side** by the union of the respective subclavian and internal jugular veins. The left brachiocephalic vein passes obliquely downward behind the manubrium sterni. The right brachiocephalic vein is relatively short and descends almost vertically. **The two brachiocephalic veins join to form the superior vena cava .**



Superior Vena Cava

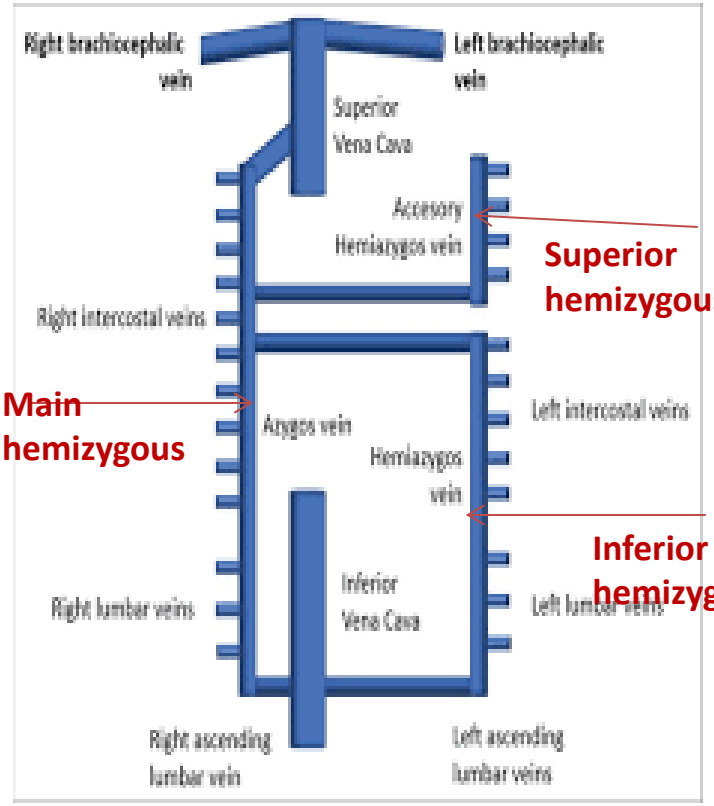
The two brachiocephalic veins join to form the superior vena cava. It passes downward to end in the right atrium of the heart. The azygos vein joins the posterior aspect of the superior vena cava just before it enters the pericardium.

Azygos Veins

1)**main azygos vein, 2)the inferior hemizygous vein, and 3) the superior hemizygous vein**. Collectively, they drain blood **from the posterior parts of the intercostal spaces, the posterior abdominal wall, the pericardium, the diaphragm, the bronchi, and the esophagus.**

Main Azygos Vein

The main azygos vein form the union of the **right ascending lumbar vein and the right subcostal vein in the abdomen.** It ascends through the **aortic opening on the right side of the aorta** up to the level 5th **thoracic vertebra**. Above the root of the right lung it empty **into the posterior surface of the superior vena cava.**

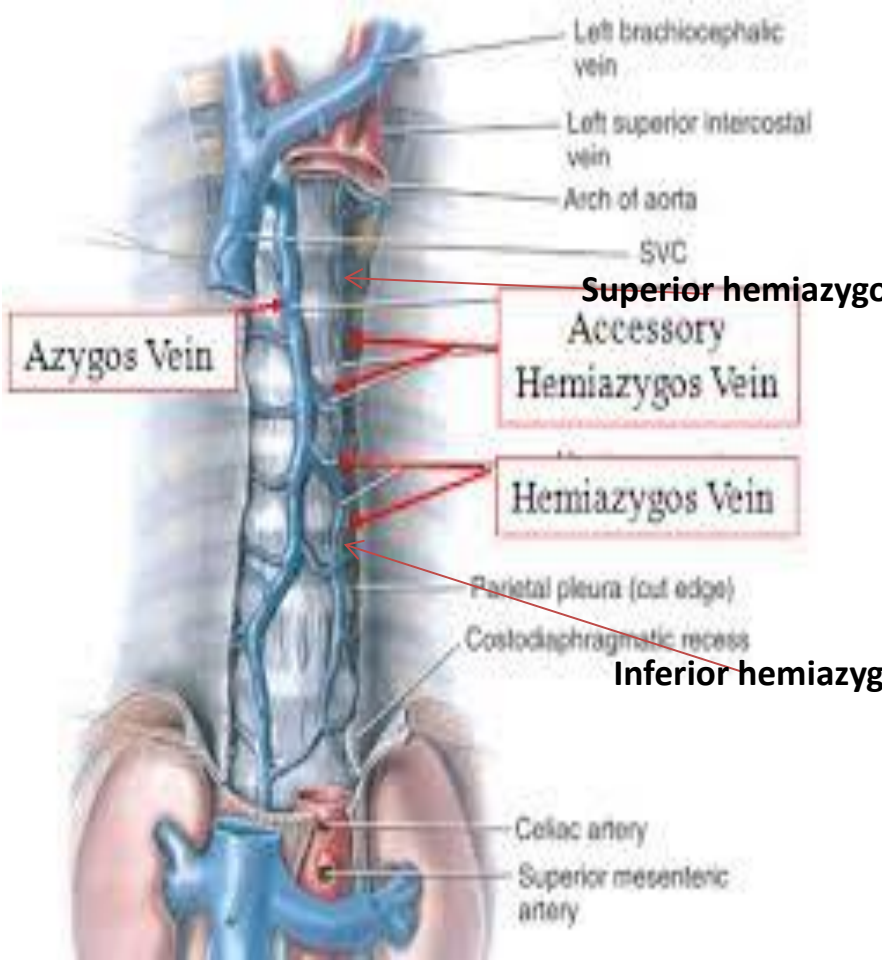


Inferior Hemizygous Vein

It is formed by the union of the **left ascending lumbar vein** and the **left subcostal vein.** It ascends through the left crus of diaphragm and, at about the level of the **eighth thoracic vertebra**, turns to the right and joins the azygos vein.

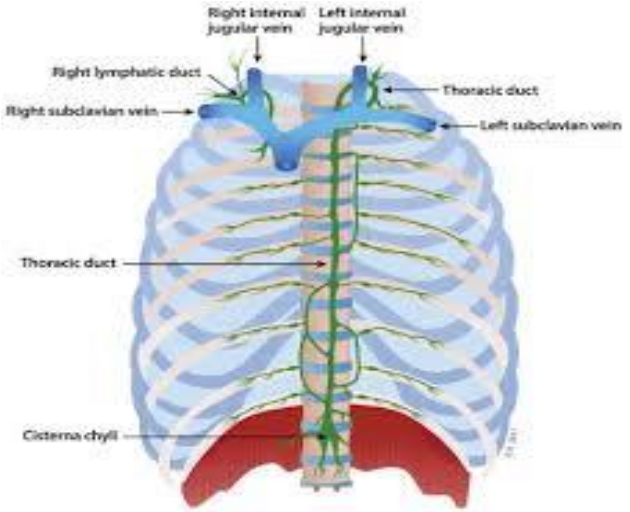
Superior Hemizygous Vein

The union of the **left superior intercostal vein** and the **fourth to the eighth intercostal veins** forms the superior hemizygous vein. **It joins the main azygos vein at the level of the seventh thoracic vertebra.**



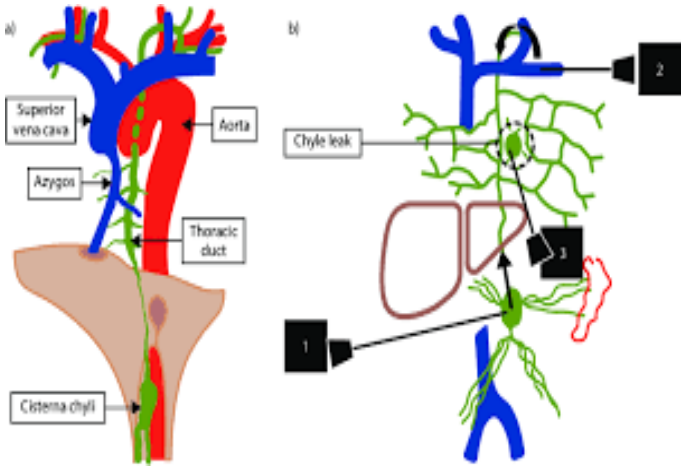
THORACIC LYMPHATICS

The lymph vessels in the thorax collect lymph from virtually **all parts of the body below the neck and upper limbs.**



Thoracic Duct

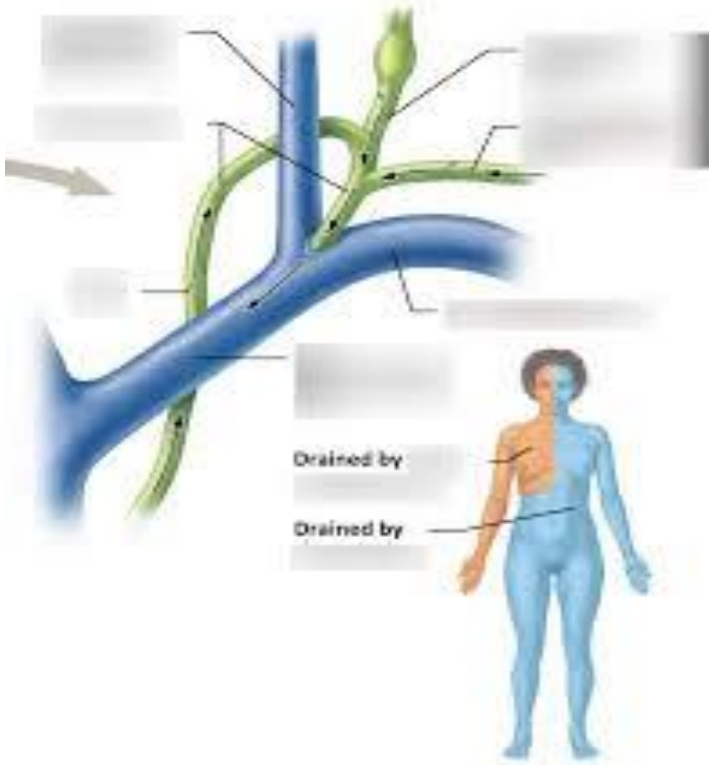
The thoracic duct begins in the abdomen as **the cisterna chyli.** passes through the aortic opening of the diaphragm on the right side of the descending aorta then it inclines to the left to reaches the left edge of the esophagus at the level of the sternal angle. It then runs upward along the left edge of the esophagus to enter the root of the neck. Here, it bends laterally and turns downward in front of the left phrenic nerve and crosses the subclavian artery to enter **the beginning of the left brachiocephalic vein**.



At the root of the neck, the thoracic duct receives the **left jugular**, **subclavian**, and **bronchomediastinal lymph trunks**. **Thus, the thoracic duct conveys all lymph from the lower limbs, pelvic cavity, abdominal cavity, left side of the thorax, and left side of the head, neck, and arm.**

Right Lymphatic Duct

it drains the **right jugular**, **subclavian**, and **bronchomediastinal trunks**, which drain the right side of the head and neck, the right upper limb, and the right side of the thorax, respectively. This common duct, if present, is about 0.5-in. (1.3-cm) long and **opens into the beginning of the right brachiocephalic vein**.



(b) Drainage point of the thoracic duct

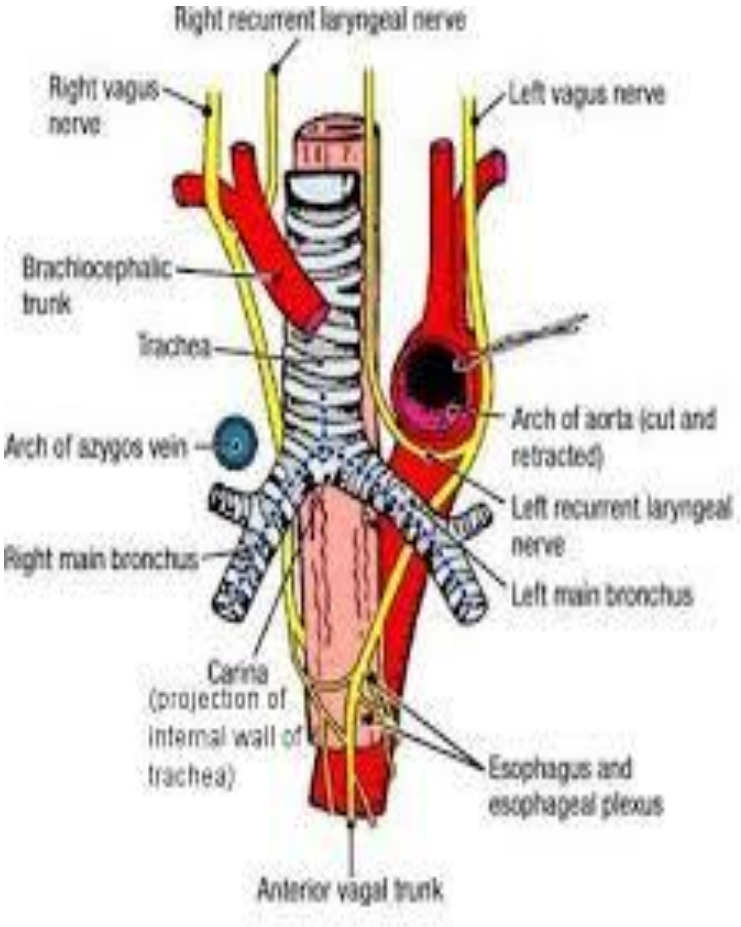
THORACIC NERVES

The vagus and phrenic nerves are the major nerves that run through the thoracic cavity.

Vagus Nerves

The vagus nerves carry **preganglionic parasympathetic fibers and** contribute to the pulmonary, esophageal, and cardiac plexuses and supply the lungs, esophagus, and heart, respectively.

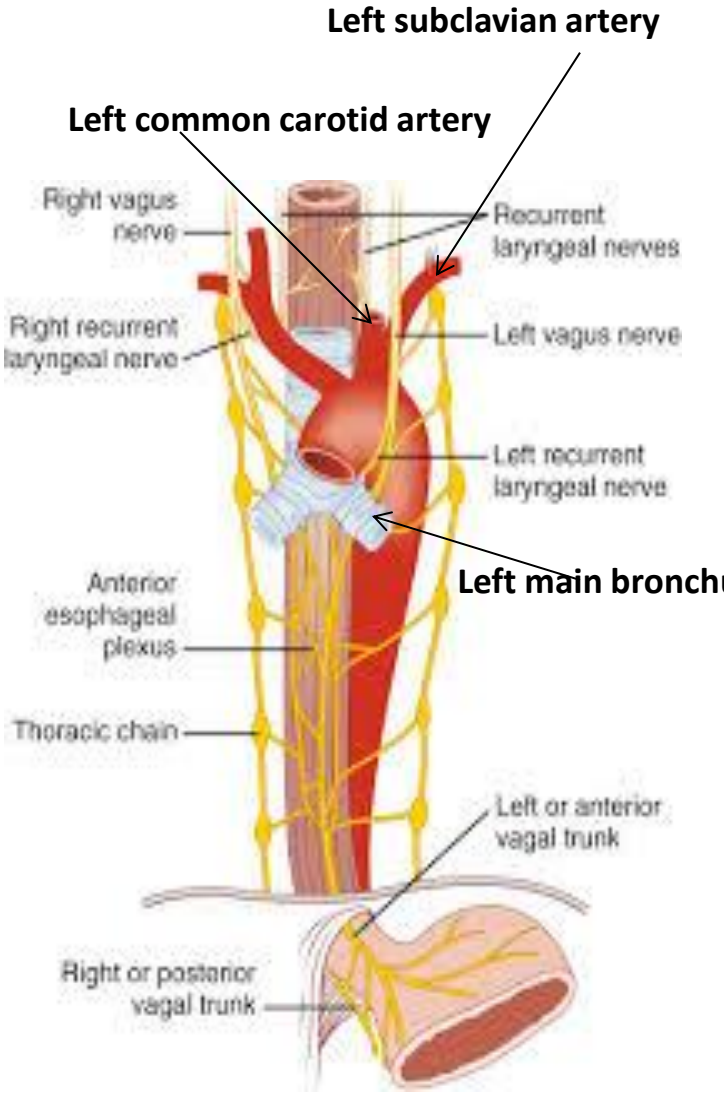
The right vagus nerve descends in the thorax, first lying posterolateral to the brachiocephalic artery, then lateral to the trachea. It passes behind the root of the right lung to share in formation of the pulmonary plexus, then the vagus passes onto the posterior surface of the esophagus and takes part in the formation of the **esophageal plexus**. It **then passes through the esophageal opening behind the esophagus to reach the posterior surface of the stomach.**



The left vagus nerve in the thorax it lies **between the left common carotid and the left subclavian arteries,** then crosses the left side of the aortic arch where it passes under the left phrenic nerve. **The vagus then turns backward behind the root of the left lung** and assists in the formation of the **pulmonary plexus**. Then it passes onto the anterior surface of the esophagus and takes part in the formation of the **esophageal plexus**. It then passes through the esophageal opening in front of the esophagus to reach the anterior surface of the stomach

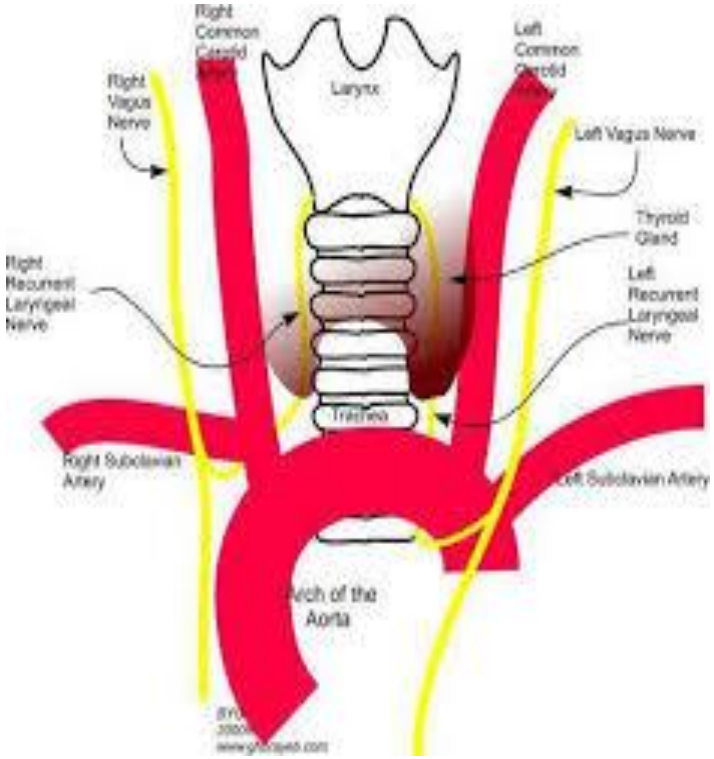
Branches of vagus nerves

Each vagus gives origin to a **recurrent laryngeal nerve**. The right and left recurrent laryngeal nerves have significantly different relations in the thorax.



The right recurrent laryngeal nerve arises from the right vagus in the neck, hooks around the right subclavian artery, and ascends between the trachea and esophagus.

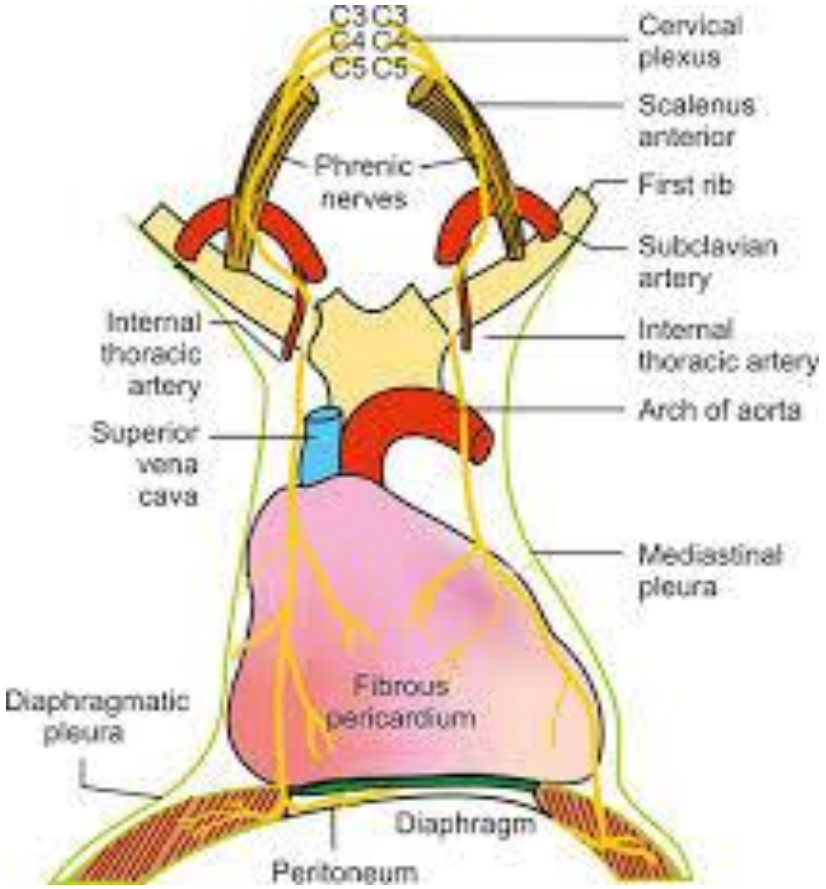
The left recurrent laryngeal nerve arises from the left vagus trunk as the nerve crosses the arch of the aorta. It hooks around the aortic arch and ascends in the groove between the trachea and the esophagus on the left side. **Thus, the left recurrent laryngeal has a much lower origin in the chest and close relations to the arch of the aorta and the ligamentum arteriosum.** **The recurrent laryngeal nerves supply the trachea and esophagus as they ascend in the neck and ultimately provide the major motor and sensory supply to the larynx.**



Phrenic Nerves

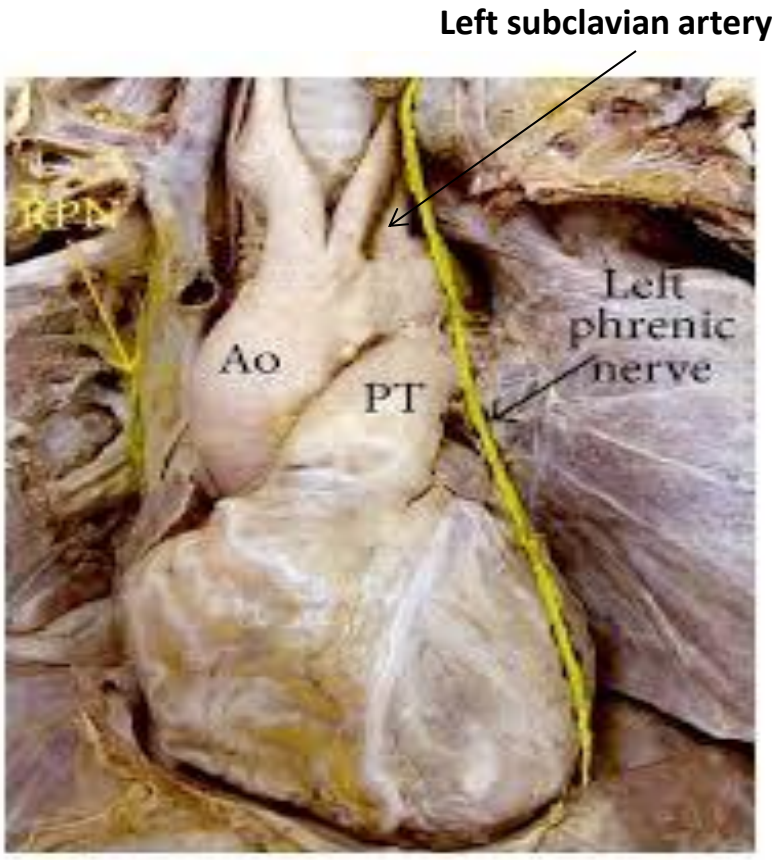
The phrenic nerves arise in the neck from the **anterior rami of the third, fourth, and fifth cervical nerves.**

The right phrenic nerve descends in the thorax along the right side of the right brachiocephalic vein and the superior vena cava**. It passes in front of the root of the right lung** and runs along the right side of the pericardium, which separates the nerve from the right atrium. It then descends on the right side of the inferior vena cava to the diaphragm. **its terminal branches pass through the caval opening in the diaphragm to supply the central part of the peritoneum on its abdominal aspect .**



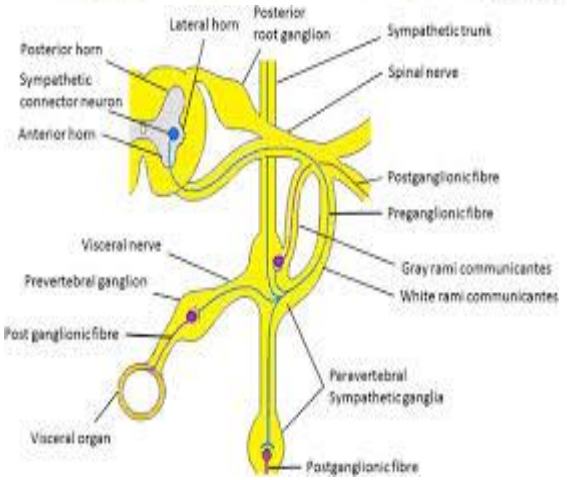
The left phrenic nerve descends in the thorax along the left side of the left subclavian artery. It crosses the left side of the aortic arch. **It passes in front of the root of the left lung** and then descends over the left surface of the pericardium. On reaching the diaphragm, the terminal branches pierce the muscle and supply the central part of the peritoneum on its abdominal aspect. The phrenic nerves possess both efferent and afferent fibers.

The efferent fibers are the sole motor supply to the muscle of the diaphragm. The **afferent fibers** carry sensation from the **peritoneum covering the central region of the undersurface of the diaphragm, the pleura covering the central region of the upper surface of the diaphragm, and the pericardium and mediastinal parietal pleura.**



Thoracic Sympathetic Trunks

The thoracic part of the sympathetic trunk is the most laterally placed structure in the mediastinum and runs downward on the heads of the ribs. It leaves the thorax on the side of the body of the 12th thoracic vertebra by passing behind the medial arcuate ligament of the diaphragm. The thoracic sympathetic trunk has 12 (often only 11) segmentally arranged ganglia, each with a **white** and **gray ramus communicans** passing to the corresponding spinal nerve. The first ganglion is often fused with the inferior cervical ganglion to form the **stellate anglion**.

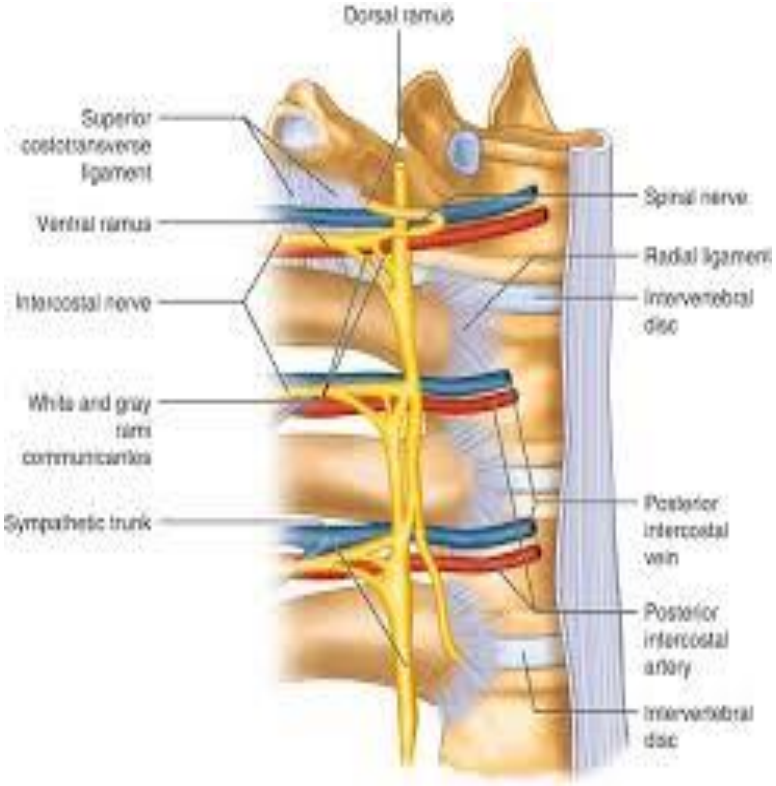


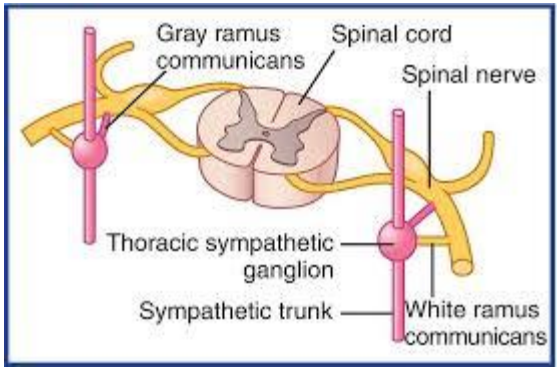
Branches

1. **White rami communicantes** connect individual thoracic spinal nerves with the sympathetic chain. These rami convey preganglionic fibers from the spinal nerves into the sympathetic chain.

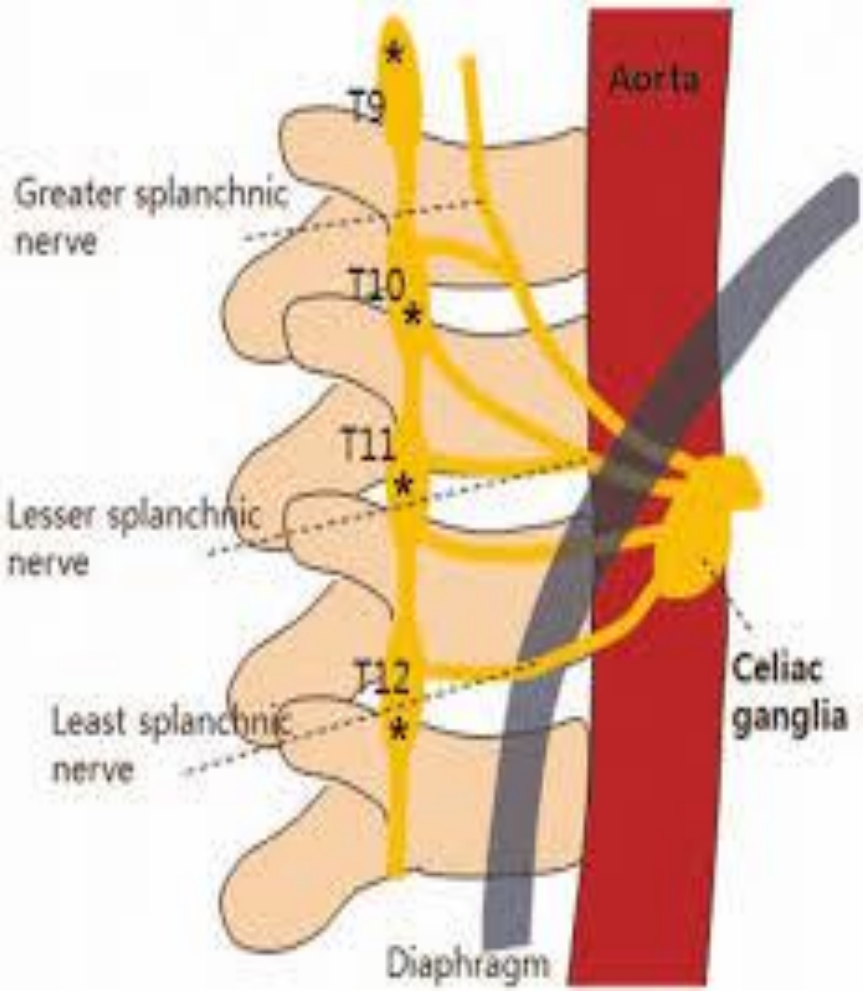
2. **Gray rami communicantes** connect sympathetic chain ganglia to their matching thoracic spinal nerves. These rami carry postganglionic fibers that are distributed through the branches of the spinal nerves to the blood vessels, sweat glands, and erector pili muscles of the skin of the body wall and limbs.

3. **Thoracic splanchnic** (**visceral**) **branches** arise from the **first four or five thoracic chain ganglia.** These carry postganglionic fibers to the pulmonary, cardiac, and esophageal plexuses and to the lungs, heart, aorta, and esophagus.





4. **Abdominal splanchnic** (**visceral**) **nerves)** arise from the lower eight thoracic chain ganglia. These carry mainly preganglionic fibers to the abdominal viscera. There are three abdominal splanchnic nerves arise from the thoracic part of the sympathetic chain: These are the **greater splanchnic nerve** arises from ganglia 5 to 9, the **lesser splanchnic nerve** arises from ganglia 10 and 11, and the **lowest** (**least**) **splanchnic nerve** arises from ganglion 12. They all enter the abdomen by piercing the crura of the diaphragm.



Chest Pain

Chest pain is a common presenting symptom in clinical practice. Unfortunately, chest pain is a symptom to many conditions and **may be caused by disease in the thoracic and abdominal walls or in many different thoracic and abdominal viscera**. The severity of the pain is often unrelated to the seriousness of the cause. **Myocardial pain may mimic esophagitis, musculoskeletal chest wall pain, and other non–life threatening causes.** If the physician is not aware, a patient may be discharged with a more serious condition than the symptoms indicate. An understanding of chest pain helps the physician in the systematic consideration of the differential diagnosis.

Somatic Chest Pain

Pain arising from the chest or abdominal walls is intense and well localized. Somatic pain arises in general somatic sensory nerve endings in the chest and abdomen is conducted to the central nervous system by segmental spinal nerves.

Visceral Chest Pain

Visceral pain is diffuse and poorly localized. It is conducted to the central nervous system along general visceral sensory nerves that accompany autonomic nerves. Most visceral pain fibers ascend to the spinal cord along sympathetic nerves and enter the cord through the posterior nerve roots of segmental spinal nerves. Some pain fibers from the pharynx and upper part of the esophagus and the trachea enter the central nervous system through parasympathetic nerves via the glossopharyngeal and vagus nerves.

Referred Chest Pain

Referred chest pain is the feeling of pain at a location other than the site of origin of the stimulus but in an area supplied by the same or adjacent segments of the spinal cord. Referred pain can be related to both somatic and visceral structures, for example, myocardial pain referred to the upper limb**.** A working knowledge of the thoracic dermatomes is essential to understanding chest pain earlier.

Thank you