

THE THORAX

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SURFACE MARKINGS

- Superior angle of scapula T₂
- Spine of scapula T₃
- Sternal notch T₂-T₃
- Manubrium T₃-T₄ [where is the **aortic arch**]
- Sternal angle of Lewis T₃-T₄ [where the 2nd costal cartilage joins the sternum]
- Sternum T₄-T₈ [beneath it lies the heart and the origins of the great vessels]
- Inferior angle of scapula T₈
- Xiphisternal joint T₉
- Lowest part of costal margin L₃ [10th rib]
- The first spinous process that can be palpated is the C₇ [vertebra prominens]
- Nipple: 4th intercostal space, 10cm from the midline
- Apex heart beat: 5th intercostal space, 9cm from the midline

TRACHEA

Starts at the level of the **cricoid cartilage** [C₆] and terminates at the **sternal angle** [T₄ - 5], to the right of the midline.

Its **bifurcation is on the T₆ level** [erect, full inspiration]

PLEURA

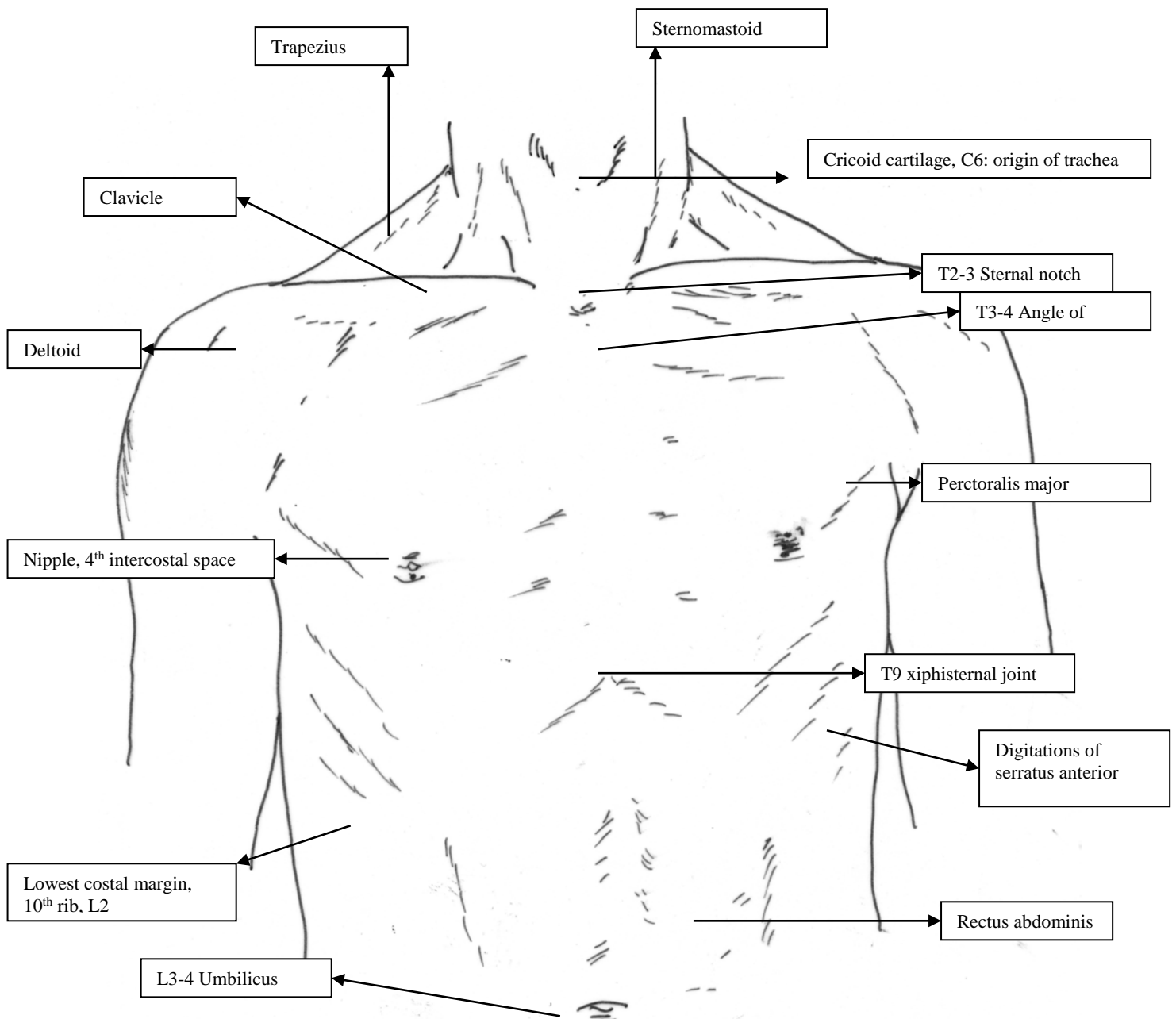
The **apex** of the pleura is 2.5cm above the clavicle and is easily wounded there [central lines].

The 2 **pleural reflexions** [serosal membrane] meet at the midline, at the angle of Lewis [T₄₋₅], course vertically downwards to the 6th costal cartilage and then cross:

- **midclavicular line** 8th rib
- **midaxillary line** 10th rib
- **lateral border of erector spinae muscle** 12th rib

LUNGS

- **Anterior border** corresponds to the mediastinal pleura
- **Cardiac notch** 5th-6th costal cartilage
- **Lower border** [5-8cm excursion on inspiration]
 - midclavicular line** 6th rib
 - midaxillary line** 8th rib
 - vertebral column** 10th rib
- **Oblique fissure** [lower/upper lobes]:
 - a line from the 5th thoracic vertebra to the 6th costal cartilage [or parallel to the medial border of the scapula when the shoulder is abducted]
- **Transverse fissure** [right upper/middle lobes]:



- *Surface markings of thorax*

a horizontal line along the 4th costal cartilage

HEART

Forms an **irregular quadrangle**, bounded by the following points:

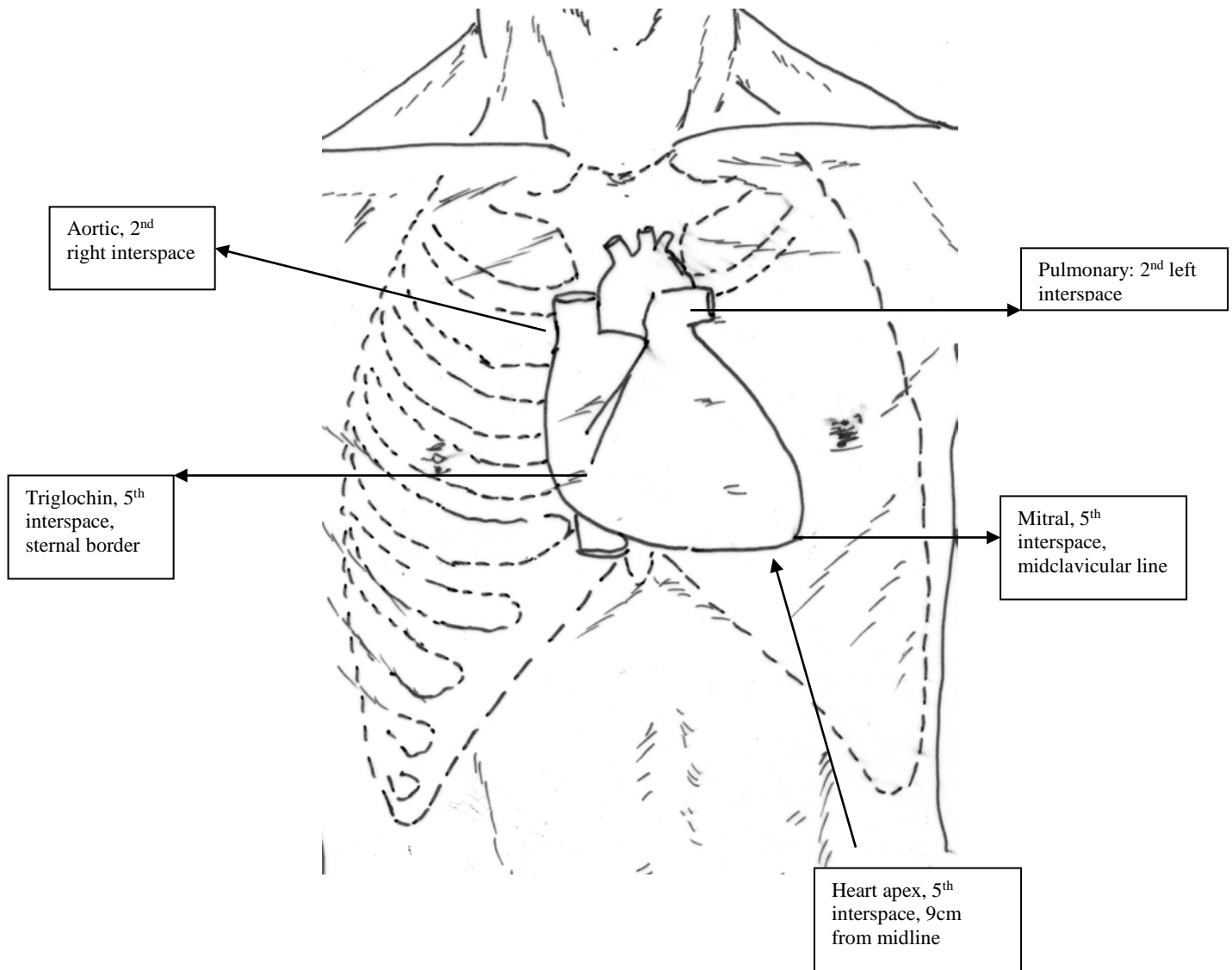
- **2nd costal cartilage on the left, 12mm from the sternum**
- **3rd right costal cartilage, 12mm from the sternum**
- **6th right costal cartilage, 12mm from the sternum**
- **5th left intercostal space, 9cm from the midline** [apex beat]

The **left border** of the quadrangle is formed by the **left ventricle**

The **right border** by the **right atrium**

The **lower border** is formed by the **right ventricle and the apical part of the left ventricle**

The **internal mammary vessels** run vertically downwards behind the costal cartilages, at a distance 12mm from the lateral sternal border.



- *The surface markings of heart and sites of auscultation*

THE THORACIC CAGE

Is formed by: **vertebral column**
ribs and intercostal spaces
costal cartilages
sternum

Superiorly, the **thoracic inlet** [or outlet] connects it to the root of the neck. Inferiorly the **diaphragm** separates it from the abdominal cavity.

THE RIBS

12 pairs of ribs: 1-7 attached to the sternum by individual cartilage
 8,9,10, articulate with the cartilage above
 11,12 are free [**floating ribs**]

Each rib has:

head with 2 facets which articulate with the vertebral body and the rib above

neck and

a **tubercle** which has a facet to articulate with the transverse vertebral process.

DIFFERENCES BETWEEN RIBS

- **1ST RIB.** The shortest and most curvaceous, flattened from above downwards

Has a prominent inner tubercle on which **scalenus anterior** is inserted

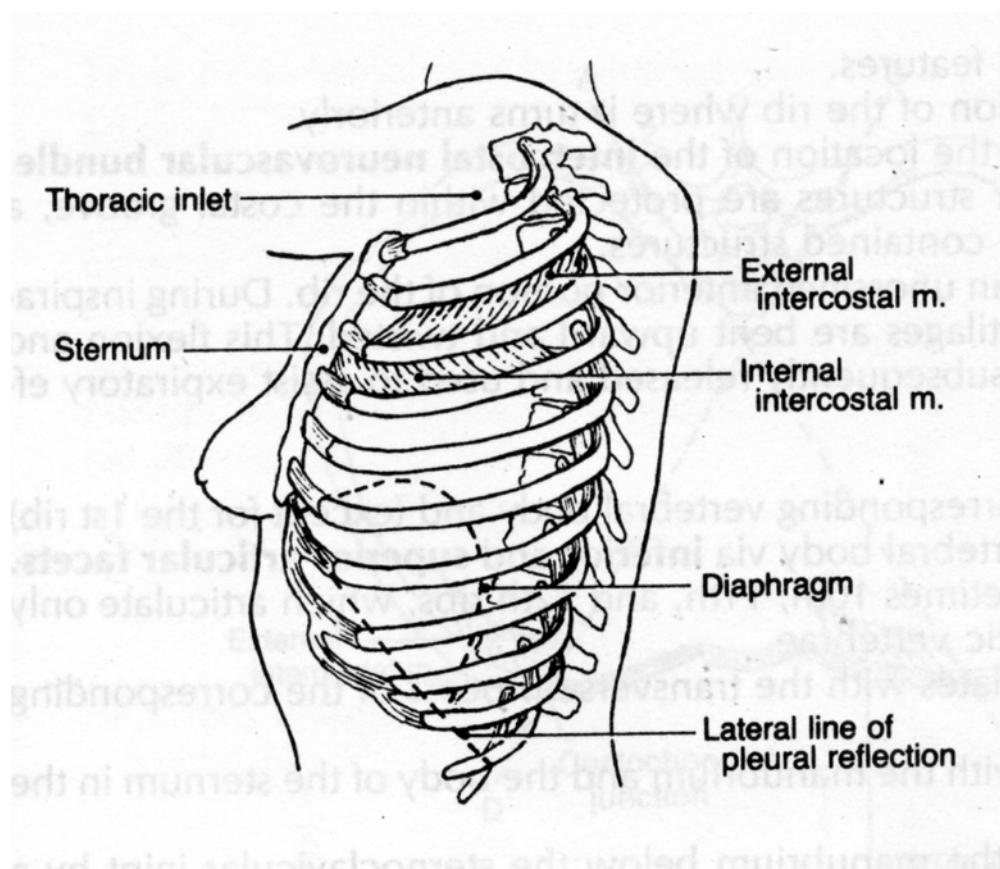
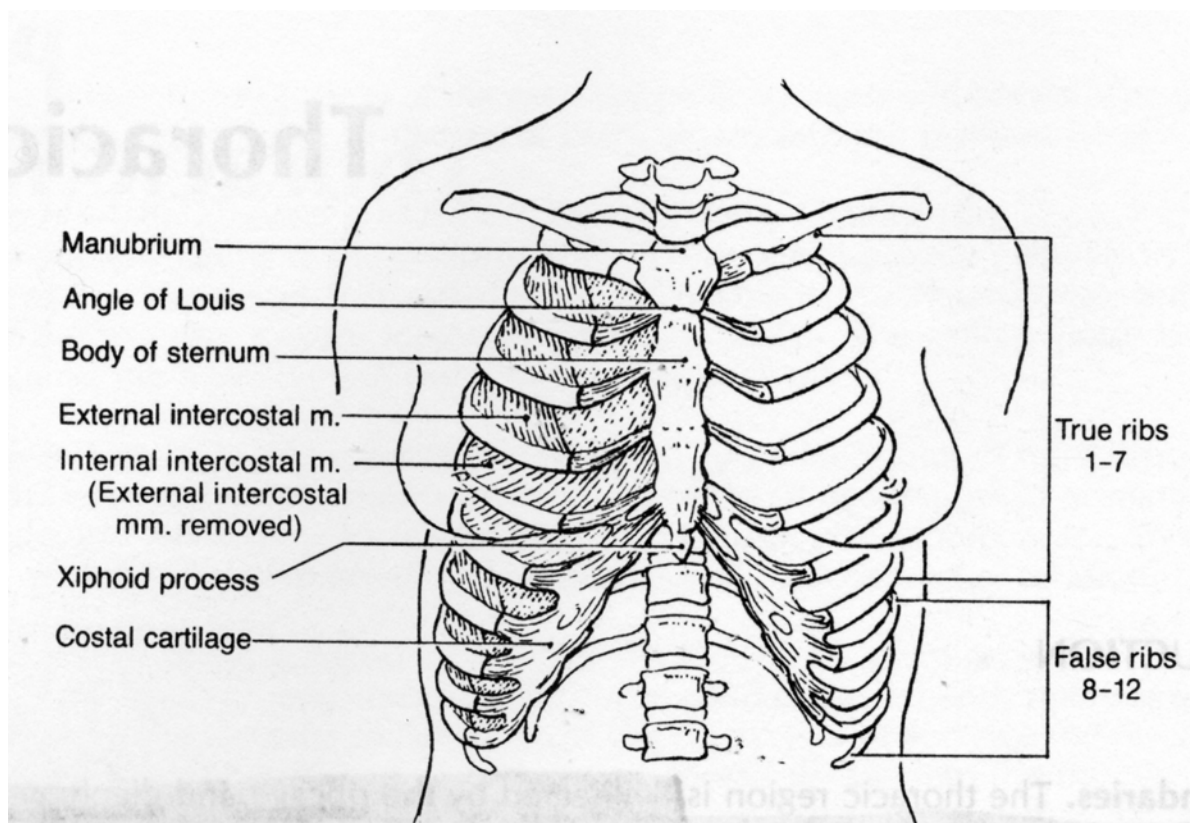
Its ridge is the insertion point **scalenus medius**

Bears **two grooves** on its upper surface on one of which lie the brachial plexus and subclavian artery and the subclavian vein on the other

- The 10th rib has only one articular surface on its head
- The 11th and 12th have no tubercle and have only one head facet

CLINICAL COMMENTS

- **Flail chest:** multiple rib fractures causing paradox respiration [depression on inspiration] which may lead to swinging movements of the mediastinum and severe shock. Chest drainage and positive pressure respiration are usually necessary.
- **Cervical rib** [7th]: Incidence 0.5%, in 50% of these bilateral. May exert pressure on the lower brachial trunk resulting in paraesthesia on the ulnar border of the forearm and wasting of the small muscles in the hand which are innervated by the T₁ root. Vascular changes are not so common, but a poststenotic dilatation may be evident which may lead to small distal emboli.
- **Aortic coarctation:** The **superior intercostals** [branches of the costocervical trunk of the subclavian artery], the **internal mammary** [and the superior epigastric] and the **scapular artery** are the vessels supplying the **inferior intercostals** [branches of the aorta]. The dilatation and tortuosity of the intercostals erode the ribs forming **notches**.



INTERCOSTAL SPACES

MUSCLES

1. **External intercostal:** fibers directed downwards and forwards, forming the **anterior intercostal membrane**.
2. **Internal intercostal:** downwards and backwards, forming the **posterior intercostal membrane**
3. **Innermost intercostal muscle:** transverse fibers

INTERCOSTAL VESSELS

They lie between the middle and innermost muscle layers, in the groove at the lower rib border

Subclavian artery → **costocervical trunk** → superior intercostal branch → 1st & 2nd **posterior intercostal arteries**

Aorta → 3rd-11th posterior intercostal

Internal mammary artery → 1st-6th **anterior intercostals** [& perforating branches to the breast]

Phrenic artery → musculophrenic branch → 7th-9th anterior intercostals [there are no 10th-12th anterior intercostals]

The **intercostal veins** follow the arteries and drain to the azygos and hemiazygos system

INTERCOSTAL NERVES

They represent the **anterior primary rami of the thoracic nerves**. Near to their origin they give off a collateral **muscular branch** and they bifurcate to the **anterior and lateral cutaneous** branches. They follow the same route as the posterior intercostal arteries.



- *The location of the vessels at the posteromedial surface of the rib. Intercostal space should be entered on the top of the inferior rib*

THE DIAPHRAGM

A dome shaped septum with a peripheral **muscular** and a **central tendinous** [aponeurosis] part, separating the thoracic and abdominal cavities, attached:

- **Posteriorly:** First, second and third lumbar vertebrae[crura] [quadratus lumborum and psoas], forming the **median arcuate ligament** in front of the aorta
- **Anteriorly:** Lower sternum
- **Laterally:** Costal arches.

MUSCLE FIBERS

- **Costal part**
- **Sternal part**
- **Vertebral part** → 1. **Left crus** of the diaphragm [from L₁₋₂] → **median arcuate ligament**
2. **Right crus** [L₁₋₃]
3. **Psoas muscle** → **medial arcuate ligament**
4. **Quadratus lumborum muscle** → **lateral arcuate ligament**

INNERVATION

- **Phrenic nerve** [C₃₋₅]: motor & sensory innervation of its central part [referred shoulder pain]
- **Lower intercostal nerves:** sensory innervation of its peripheral part and the crura [periumbilical pain]

OPENINGS

1. **Aortic** [T₁₂], below the median arcuate ligament. Through this pass the aorta and the thoracic duct
2. **Oesophageal** [hiatus, T₁₀]: Oesophagus and the 2 vagi nerves.
3. **Inferior vena cava foramen** [T₈]: Vena cava and right phrenic nerve
 - **Left phrenic nerve:** perforates the front part of the central tendon at T₈
 - **Splanchnic nerves**, greater and lesser: they carry sympathetic fibers and pierce the crura at T₁₀₋₁₁
 - **Sympathetic chain:** passes behind the diaphragm, lateral to the crura and medially to the medial arcuate ligament [T₁₁₋₁₂]

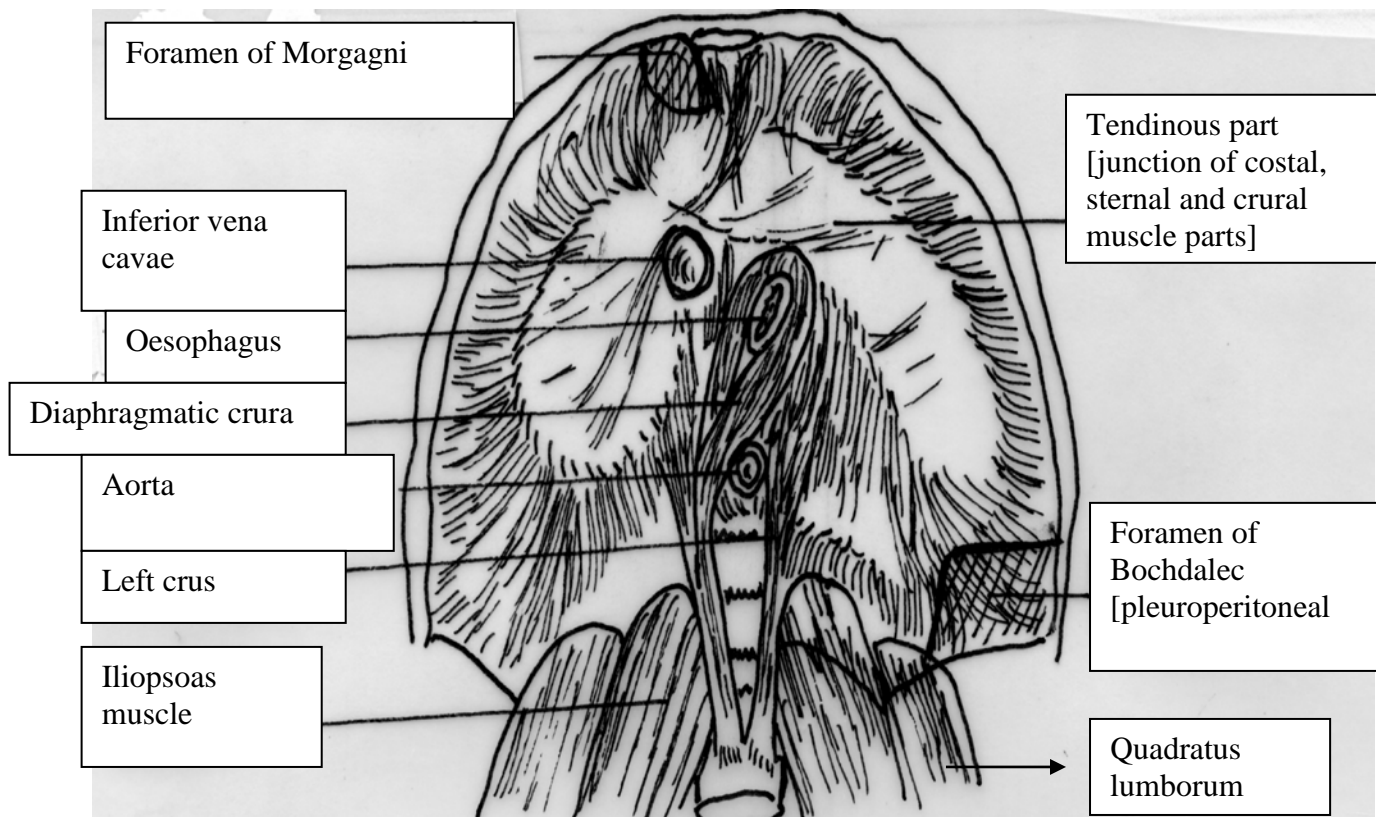
HERNIAS

1. **Foramen of Morgagni** [xiphoid-costal or costo-sternal], congenital defect
2. **Foramen of Bochdalec** [pleuroperitoneal, at the side of the vertebrae], congenital
3. **Hiatus** [oesophageal foramen]
4. **Traumatic** [may take a lot of time to develop after injury]
5. **Eventration** [prolapse of the diaphragm, the whole central portion may be deficient]

EMBRYOLOGY

The diaphragm is formed by fusion of:

- **septum transversum** which forms the frontal part of central tendon
- contribution of the **body wall** which forms its periphery
- **dorsal oesophageal mesentery** [aorta, oesophagus, vena cava]
- **right and left pleuroperitoneal membranes**, which form the dorsal tendinous part



- *The diaphragm and its openings*

THE RESPIRATORY SYSTEM

THE TRACHEA

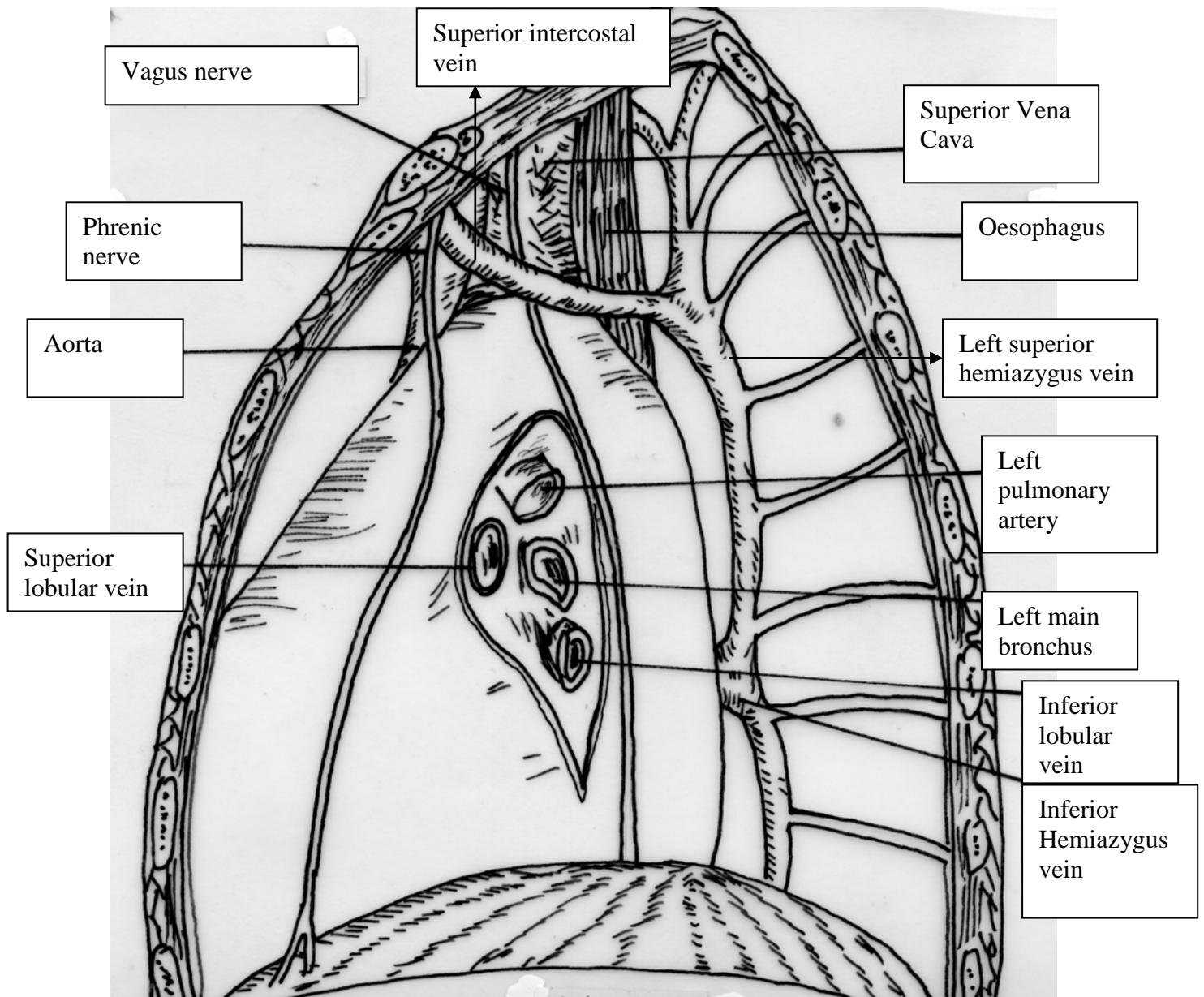
Commences at the lower body of the cricoid cartilage [C₆] and terminates at the level of the sternal angle [T₄₋₅]

RELATIONS

- **Anteriorly:**
 - isthmus of the thyroid
 - inferior thyroid veins and thyroid ima artery
 - sternothyroid - sternohyoid muscles
 - innominate artery [brachiocephalic trunk]
 - left carotid artery
 - left innominate vein
 - upper border of aortic arch and thymus gland
- **Posteriorly:**
 - oesophagus
 - recurrent laryngeal nerves [both]
 - thoracic duct
 - C₆ - T_{4,5} vertebrae
- **Left lateral:**
 - thyroid lobe
 - common carotid artery
 - left subclavian artery
 - left innominate, subclavian and jugular vein
 - aortic arch
 - left phrenic, vagus and left recurrent laryngeal nerves
 - pleura
- **Right lateral:**
 - thyroid lobe
 - carotid sheath and its contents
 - superior vena cava
 - right phrenic and vagus nerves
 - azygos vein
 - innominate artery
 - pleura

STRUCTURE

15-20 **U-shaped cartilages** which are deficient posteriorly; the wall is completed by fibrous tissue and a sheath of smooth muscle [trachealis]. It is lined by ciliated columnar epithelium which contains many goblet [mucous secreting] cells.



- *Hilum of left lung [removed] and left posterior hemithorax*

THE BRONCHI

- RIGHT:** Wider, shorter and more vertical than the left
 2.5cm long, joins the root of lung at T₅
 Gives off an upper lobar branch, then passes behind the pulmonary artery and joins the lung hilum.
 The azygos vein arches over it from behind to join the superior vena cava
 There is a greater tendency for foreign bodies to lodge into the right bronchus
- LEFT:** 5cm long, passes downwards and outwards, below the aortic arch and in front of the oesophagus and the descending aorta.
 Joins the lung hilum at T₆ level, lying at first behind and then below the left pulmonary artery

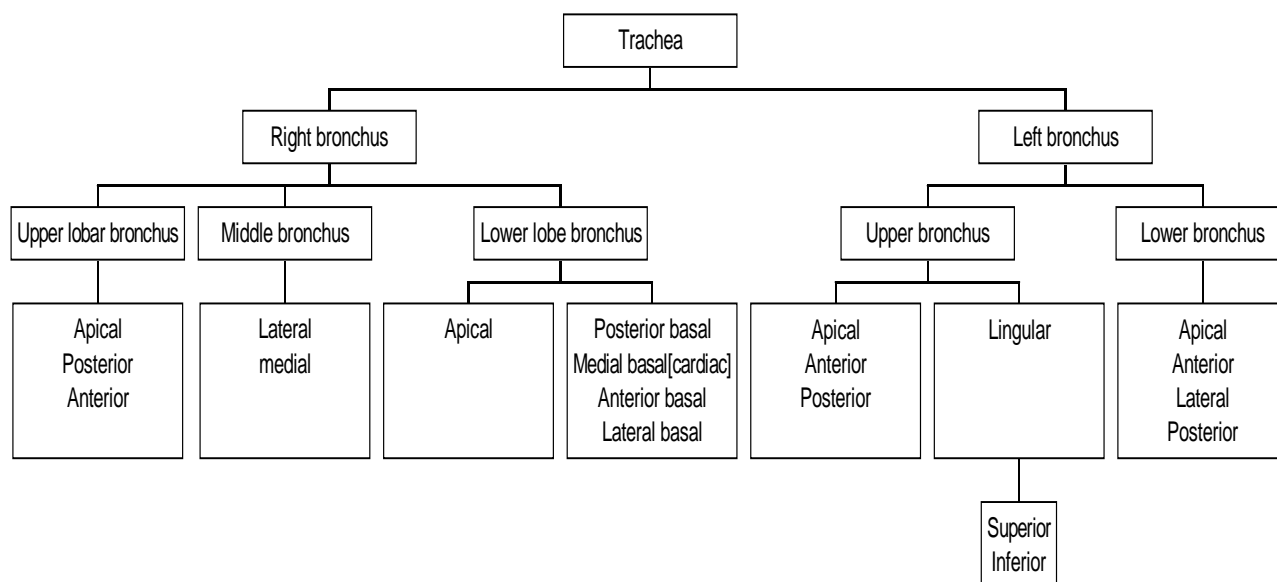
THE LUNGS

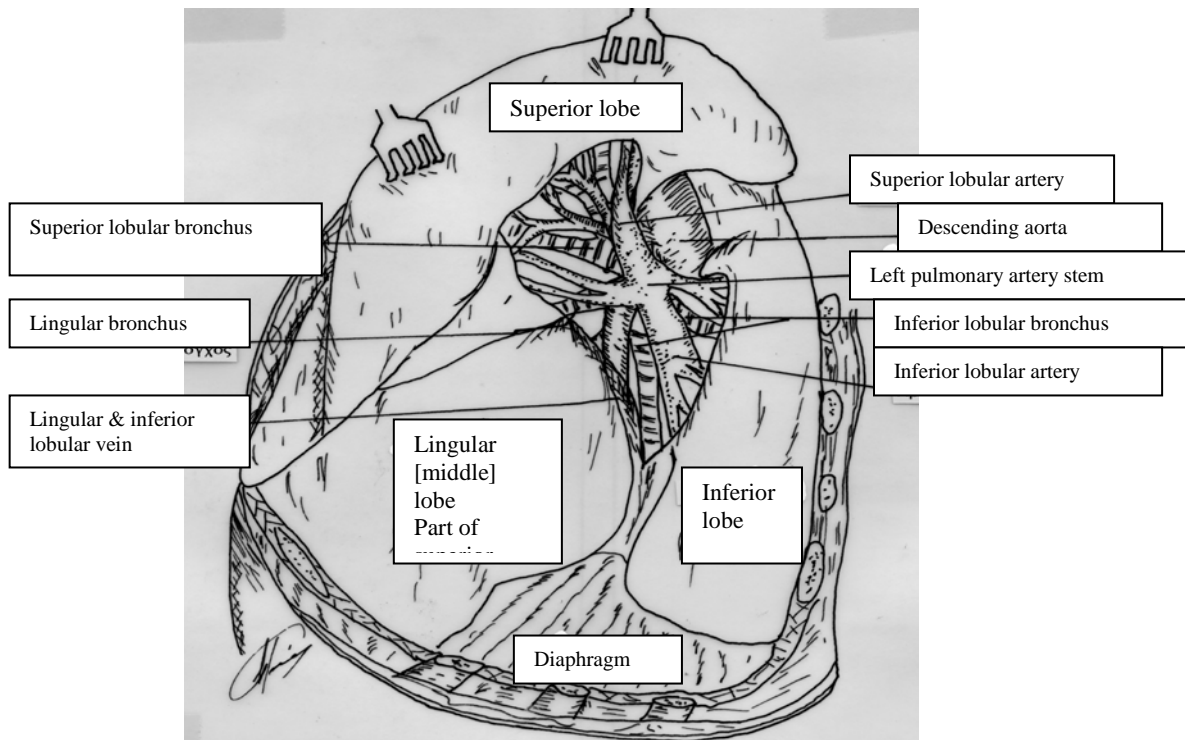
They have a conical shape with a blunt apex reaching above the first rib, a concave base [diaphragm] a concave mediastinal surface [pericardium] and an extensive, convex, costovertebral surface.

The **right lung** is slightly larger and has **3 lobes: upper, middle and lower**, the former two separated by the **oblique fissure** while the **transverse [horizontal] fissure** separates the upper from the lower.

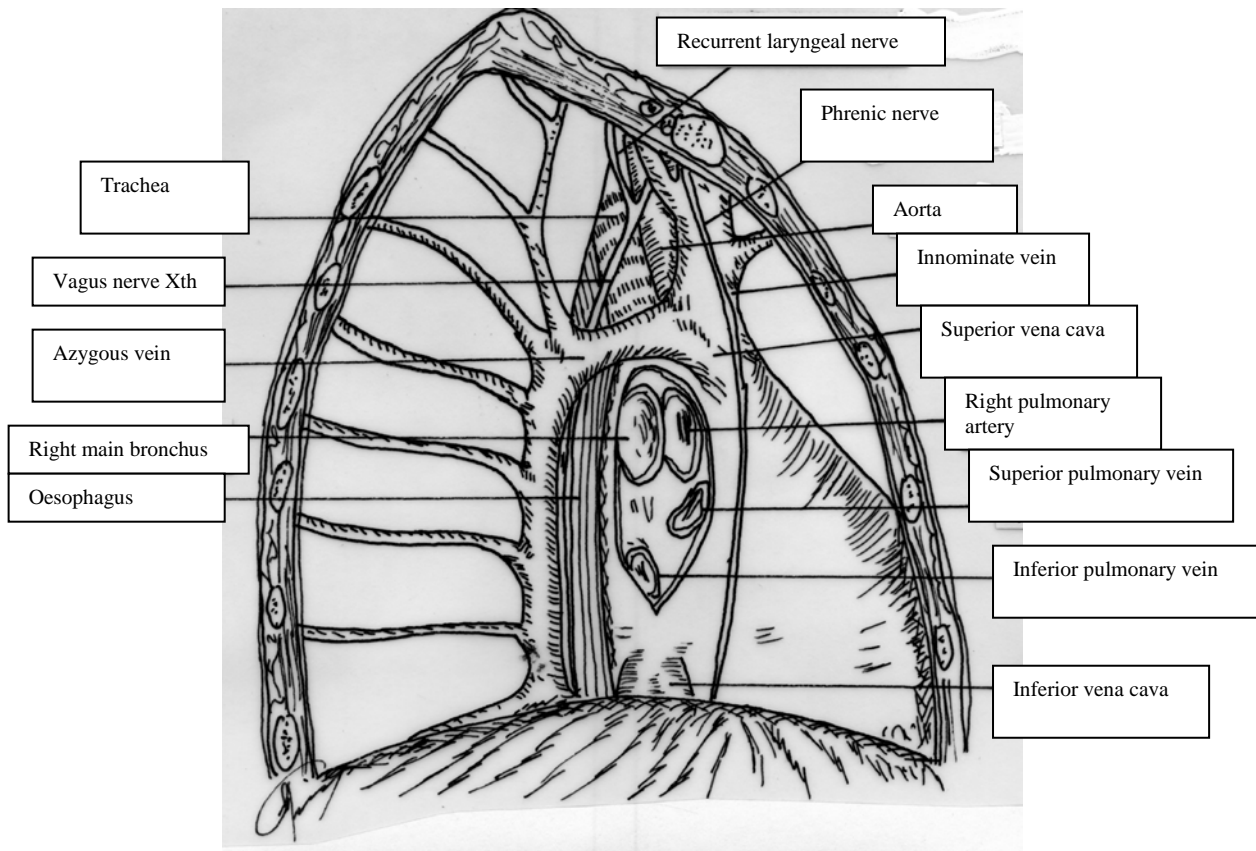
The **left lung** has only **two lobes [upper/lower]** separated by the **oblique fissure**. Part of the upper is called the **lingular** [or middle]

THE BRONCHOPULMONARY SEGMENTS





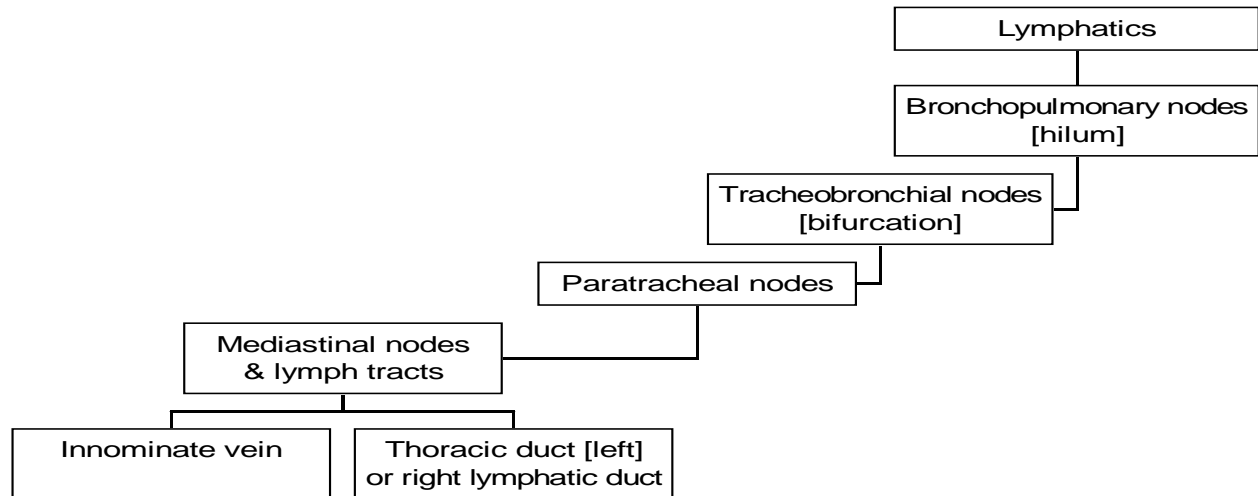
• *Anatomy of left lung*

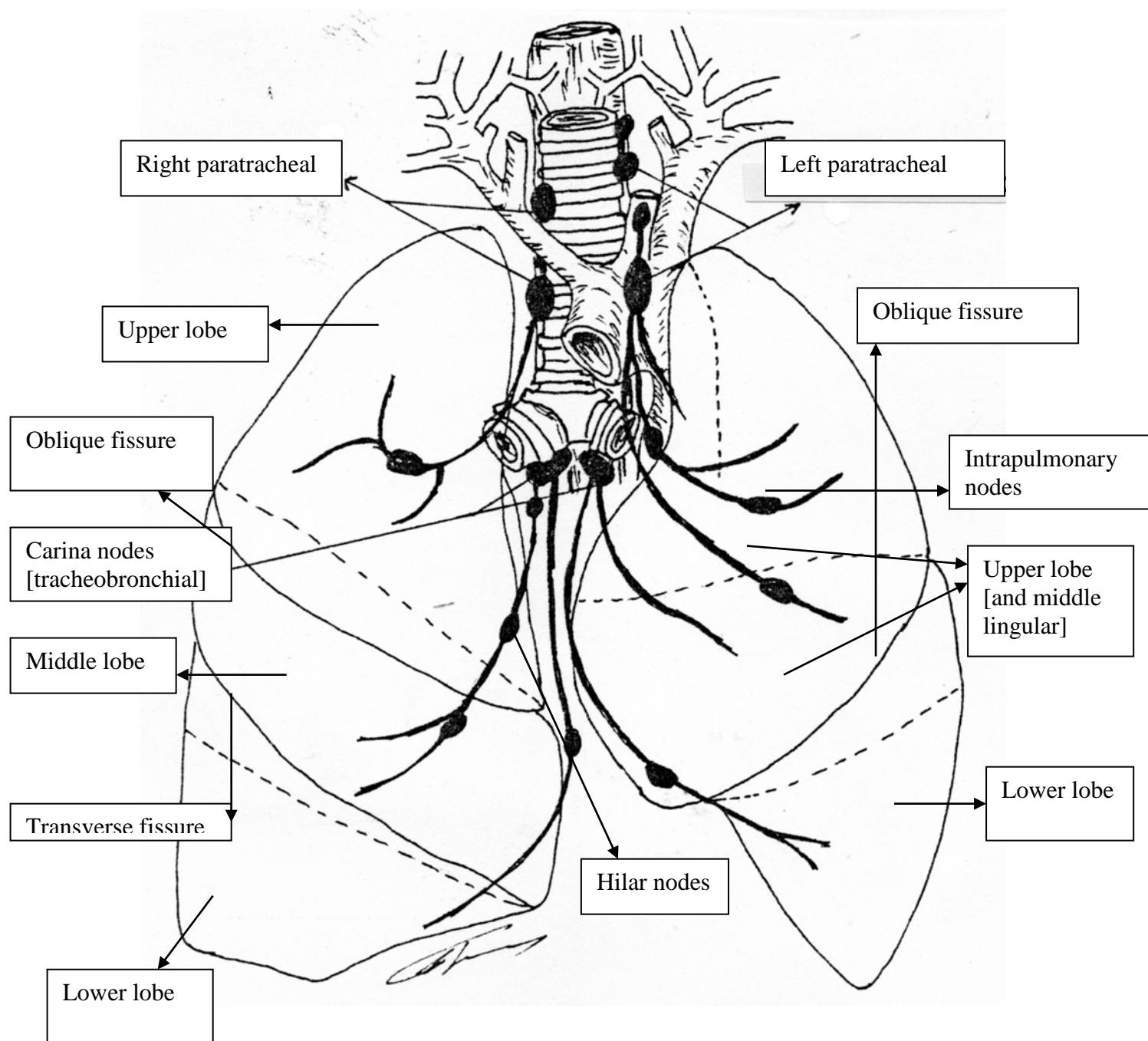


• *The right lung [removed] hilum*

BLOOD SUPPLY / DRAINAGE

- Bronchial arteries [branches of the descending aorta]
- Bronchial veins [drain to the pulmonary arteries]
- Centripetal lymphatics [from pleura to hilum]:





• *The pulmonary lymph nodes*

THE MEDIASTINUM

It is a space formed by the sternum and the costal cartilages anteriorly, the vertebrae and the heads of the ribs posteriorly, the mediastinal pleural on its lateral sides, the diaphragm inferiorly and the root of the neck superiorly.

SUPERIOR MEDIASTINUM

Space between a line from the sternal notch to T₁₋₂ superiorly and a line from the angle of Lewis to T₄₋₅ inferiorly. Contains the origins of the great vessels, the aortic arch and the thymus gland.

- **Boundaries:**
 - anteriorly, manubrium sterni
 - posteriorly, 4 first thoracic vertebrae
 - laterally, 3 first ribs and costal cartilages
 - above, root of the neck
 - inferiorly, inferior mediastinum [heart]
- **Content:**
 - great vessels [aortic arch, brachiocephalic trunk, superior vena cava, left carotid and subclavian artery, innominate veins, arch of azygos vein]
 - thymus
 - oesophagus
 - thoracic duct
 - phrenic nerves
 - left recurrent laryngeal nerve
 - vagi
 - trachea

The oesophagus lies posteriorly behind the trachea which is covered by the aortic arch. The right innominate artery and the left carotid artery form a V in front of the trachea. The innominate veins form a V in front of the arteries as they form the superior vena cava

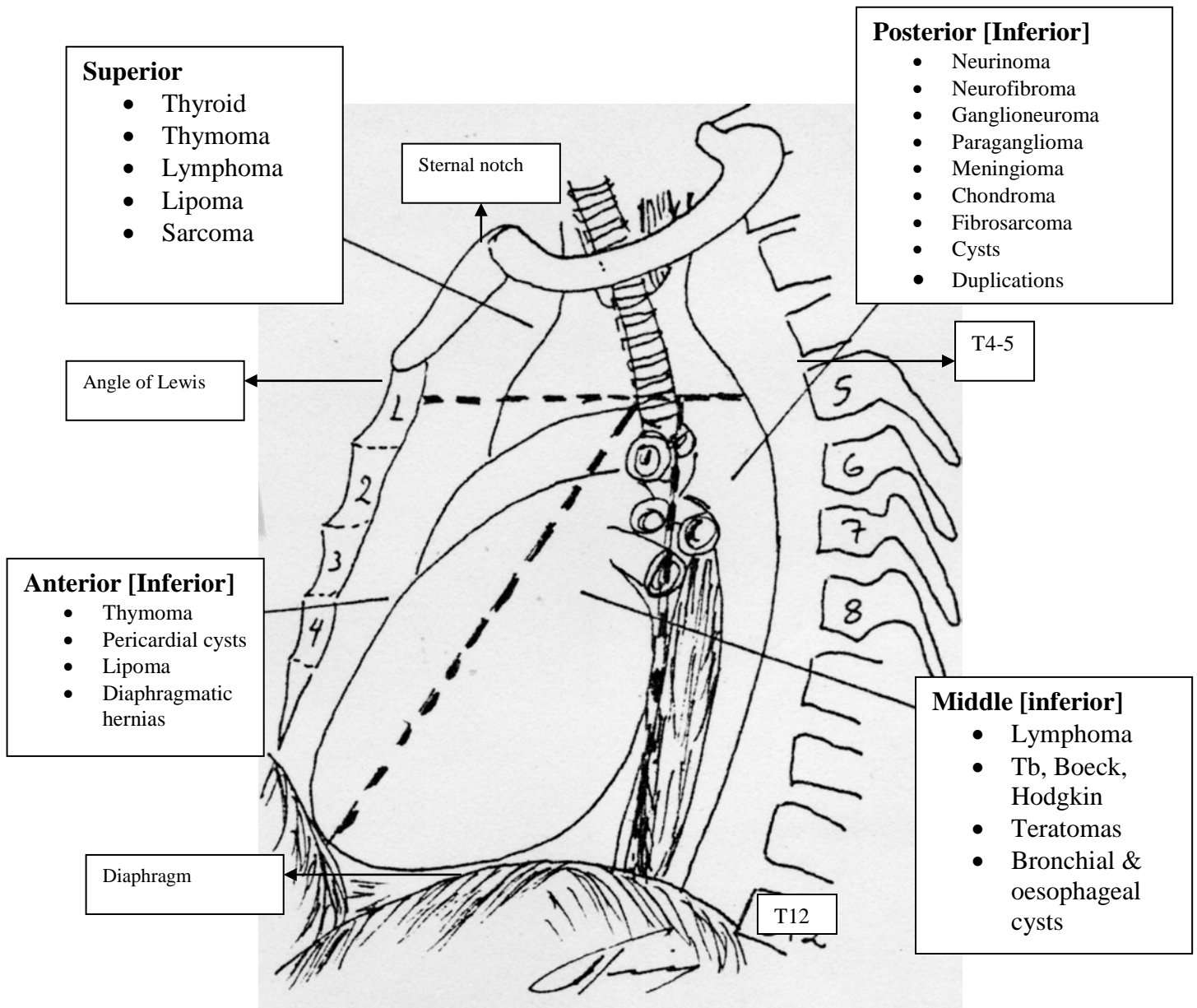
INFERIOR MEDIASTINUM

It is confined, superiorly by the line joining the angle of Lewis to the spine and by the diaphragm inferiorly. Contains the heart by which it is subdivided to:

- anterior mediastinum**, in front of the heart
- posterior**, behind the heart and
- middle**, containing the heart, pericardium and precordial fat

THE PERICARDIUM

It is a double membrane covering the heart and the origins of the great vessels.



- *The mediastinum [and location sites of specific space occupying lesions]*

The apex of the **fibrous pericardium** is fused with the adventitia of the great vessels and its base fuses with the diaphragm. The inner layer of the fibrous pericardium is lined by a serous [parietal layer] which, around the root of the great vessels, reflects to become continuous with the visceral layer or epicardium, giving rise to the transverse and oblique sinus.

THE HEART

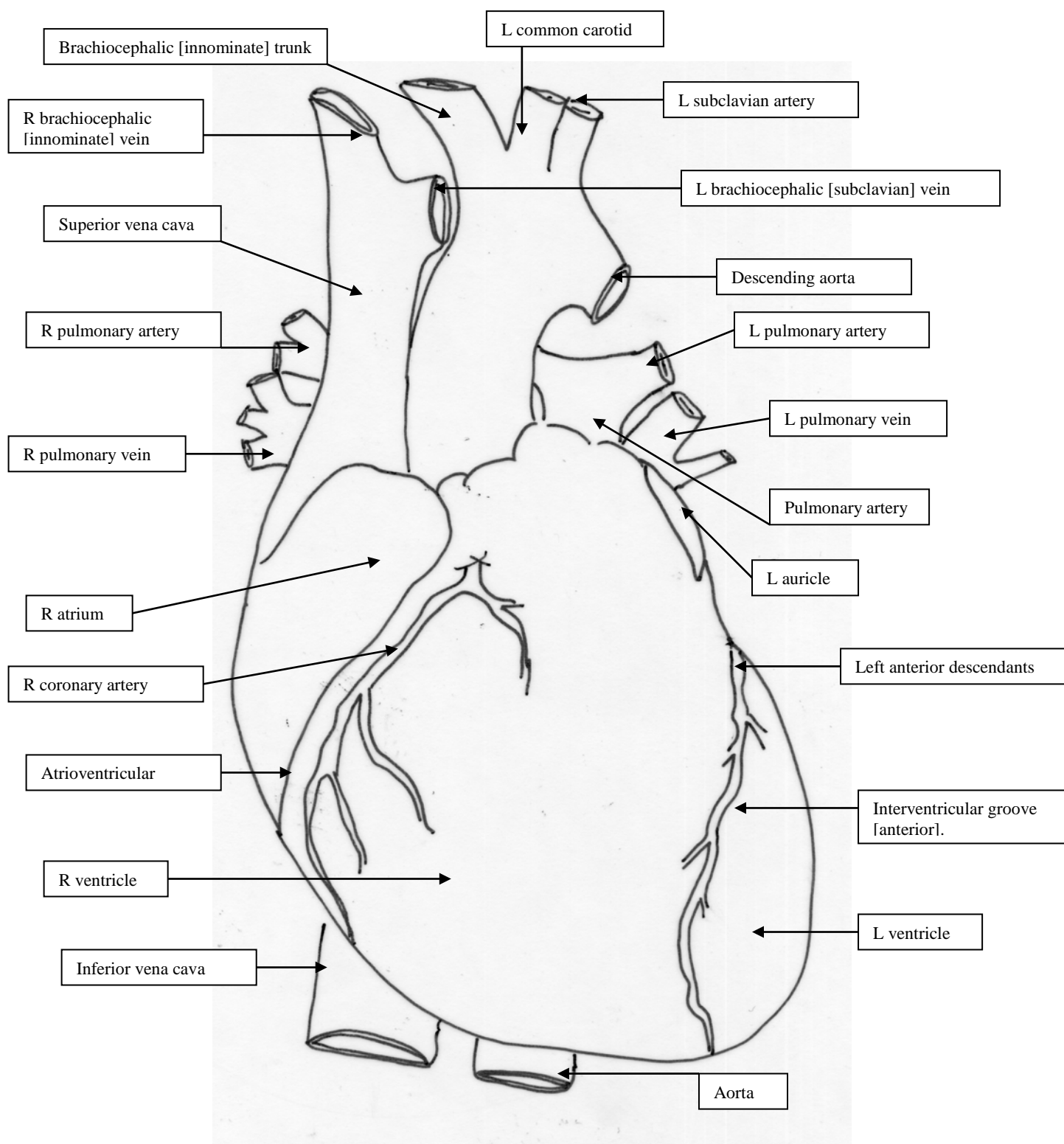
The shape and size of the heart resembles a closed fist.

ANTERIOR VIEW

- **Right border:** **Superior vena cava**
Right atrium
Inferior vena cava
Posterolaterally, at the level of the junction of the SVC to the atrium are the origins [from above downwards] of the upper lobar branch of the right pulmonary artery, the right pulmonary artery and the two pulmonary veins
- **Left border:** **Auricle of the left atrium**
Left ventricle
Posterolaterally, at the level of the atrium, arise the left pulmonary artery and the two pulmonary veins.
- **Superior border:** The **pulmonary trunk** which bifurcates behind the aortic arch
The **ascending aorta** which comes from behind and right to forward and to the left, crossing the pulmonary bifurcation [site of the **ligamentum arteriosum**]
The **superior vena cava** lies to the right, while the left innominate vein courses parallel to and above the arch crossing its branches
- **Inferior border:** **Right atrium** receiving the vena cava [small part]
Right ventricle
Apex of the left ventricle
- **Anterior surface:** The **right ventricle**
Right atrium with its auricle [**coronary sulcus** or **atrioventricular groove** between atrium and ventricle]
Ascending aorta
Pulmonary trunk
Slight portion of the **left auricle**
Small part of the **left ventricle** separated from the right by the anterior **interventricular sulcus** [or **anterior longitudinal groove**]

INFERIOR [DIAPHRAGMATIC] VIEW

Is formed by the **right and left ventricle** [with the interventricular groove], plus a small part of the **right atrium** which receives the inferior vena cava.



• *Anterior view of the heart*

POSTERIOR SURFACE

It is **quadrilateral**, formed by:

Left atrium [central part] which receives the two pulmonary veins on each side

Left ventricle [left border] separated from the atrium by the coronary sulcus

Right atrium [right border], receiving the superior and inferior vena cavae

Pulmonary arteries [above the veins]. Above them arches the aortic arch moving posteriorly and to the left.

CHAMBERS OF THE HEART

• RIGHT ATRIUM

Has 4 openings with valves, which receive:

1. **Superior vena cava** [at its supero-posterior part]

2. **Inferior vena cava** [at its infero-posterior part]

3. **Coronary sinus** [at its infero-posterior part]

4. **Anterior cardiac vein** [anteroposterior part] and **venae minimae** [thebesian]

The **sulcus terminalis** on its anterior surface [between the main atrium and its auricle] corresponds to a muscular ridge, the **crista terminalis** on its inner surface, which separates the appendage from the posterior atrium.

The **interatrial septum** bears the **fossa ovalis** [where the **foramen ovale** was] and a ridge above it, the **annulus ovalis**.

The right atrioventricular or tricuspid orifice is situated at the anterior aspect of the atrium.

• RIGHT VENTRICLE

The **tricuspid** orifice is situated posterolaterally and vertically.

The **inflow tract** is formed by some irregular muscle elevations called **trabeculae carneae** from which arise the **papillary muscles**; from these, the **chordae tendinae** are attached to the free border of the **cusps** of the **tricuspid valve**. One of the trabeculae [the septo-marginal muscle bundle from the interventricular septum to the anterior wall] conveys the right branch of the atrioventricular bundle and is called the **moderator band**.

The **outflow tract** is formed by smooth funnel-shaped wall, the **conus arteriosus** or **infundibulum**, which leads upwards to the 3 **semilunar cusps** of the **pulmonary valve**.

• LEFT ATRIUM

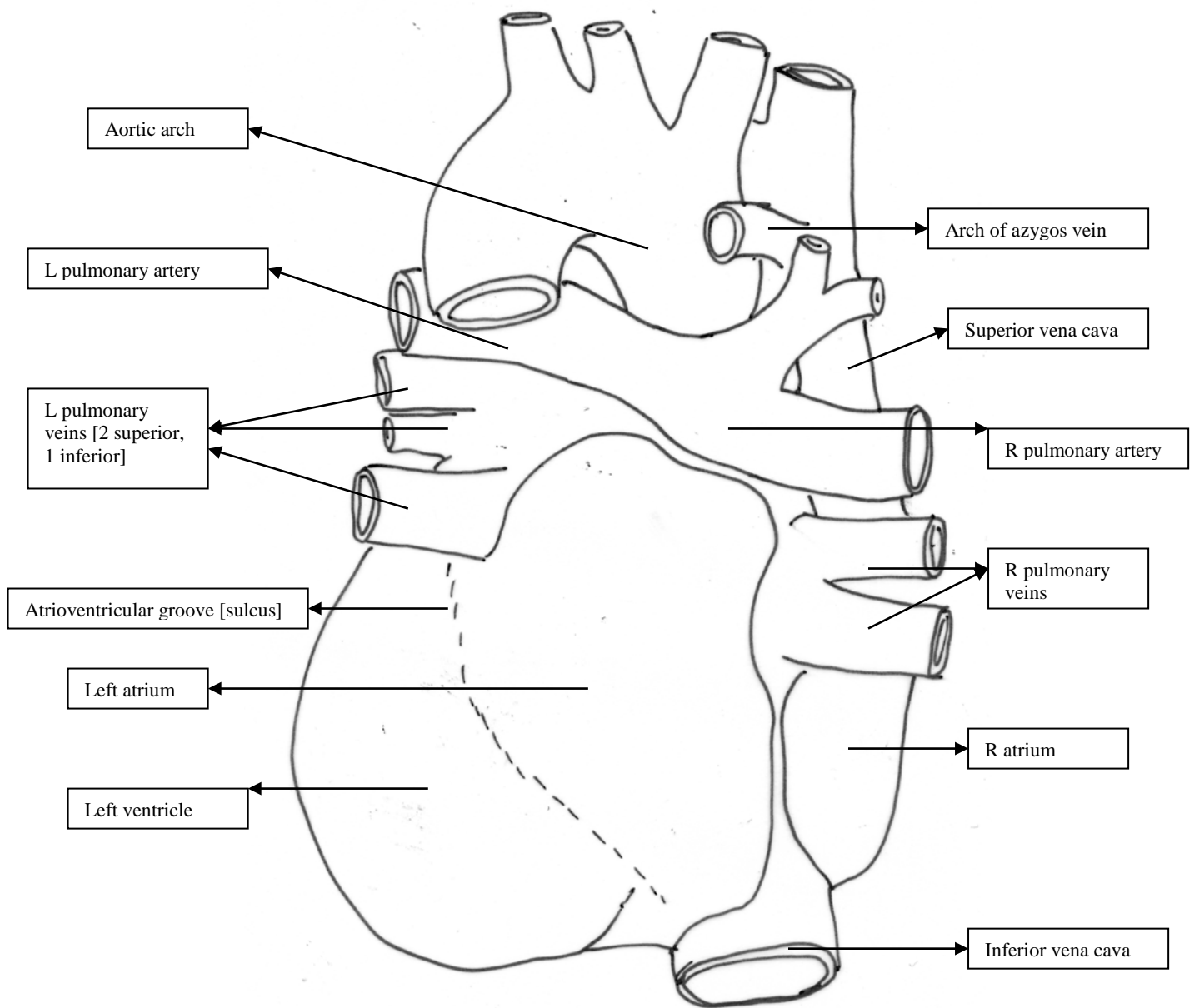
Smaller than the right but with thicker wall.

Posteriorly, it has 4 openings through which it receives the **pulmonary veins**.

The wall is smooth, apart from the auricle, which has ridges, due to the underlying **pectinate muscle**.

• LEFT VENTRICLE

Has a conical shape. The **atrioventricular** [bicuspid] **orifice** is situated posteriorly, while the **aortic orifice** superiorly.



• *Posterior view of the heart*

The wall is thinner at the apex and has trabeculae carneae, except at the vestibule just below the aortic orifice.

The **mitral valve [bicuspid]** has two cusps, a large anterior and a small posterior, supported by chordae tendinae and papillary muscles.

The aortic valve has 3 semilunar cusps, the **anterior, left** and **posterior or non-coronary cusp**, forming the 3 aortic sinuses superiorly. Just above the anterior sinus is the origin of the right coronary artery and above the left the orifice of the left coronary artery.

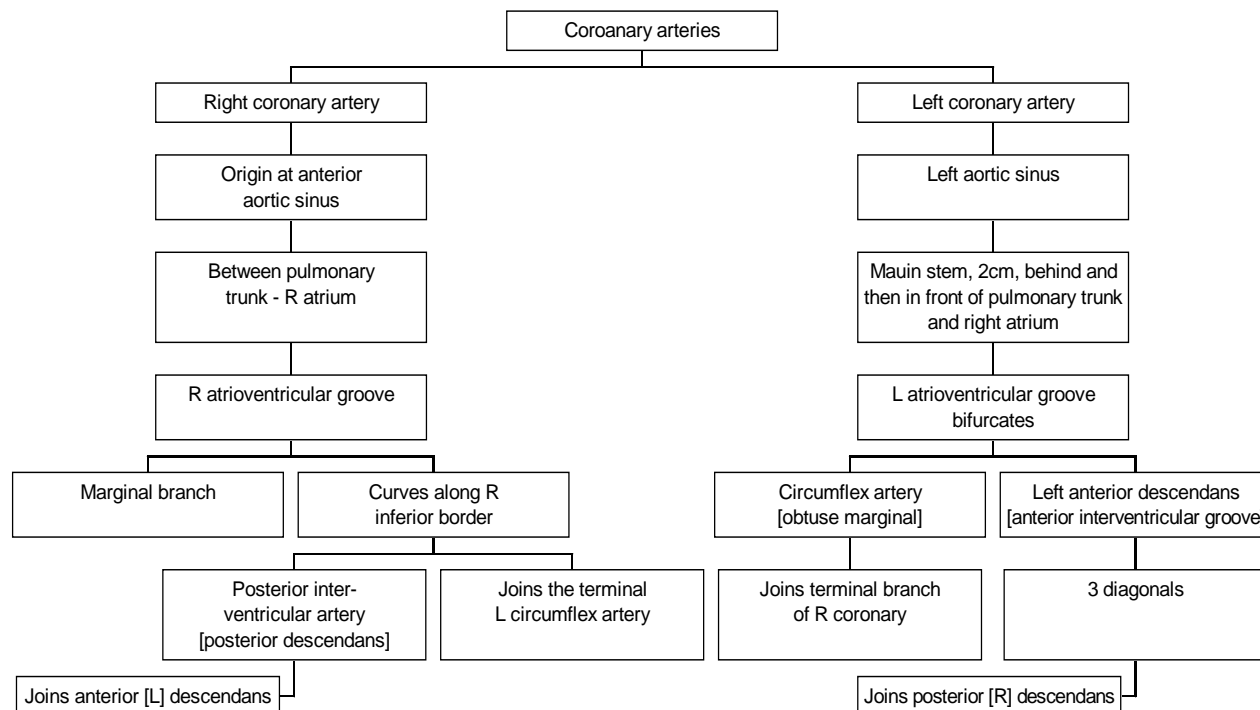
CONDUCTING SYSTEM

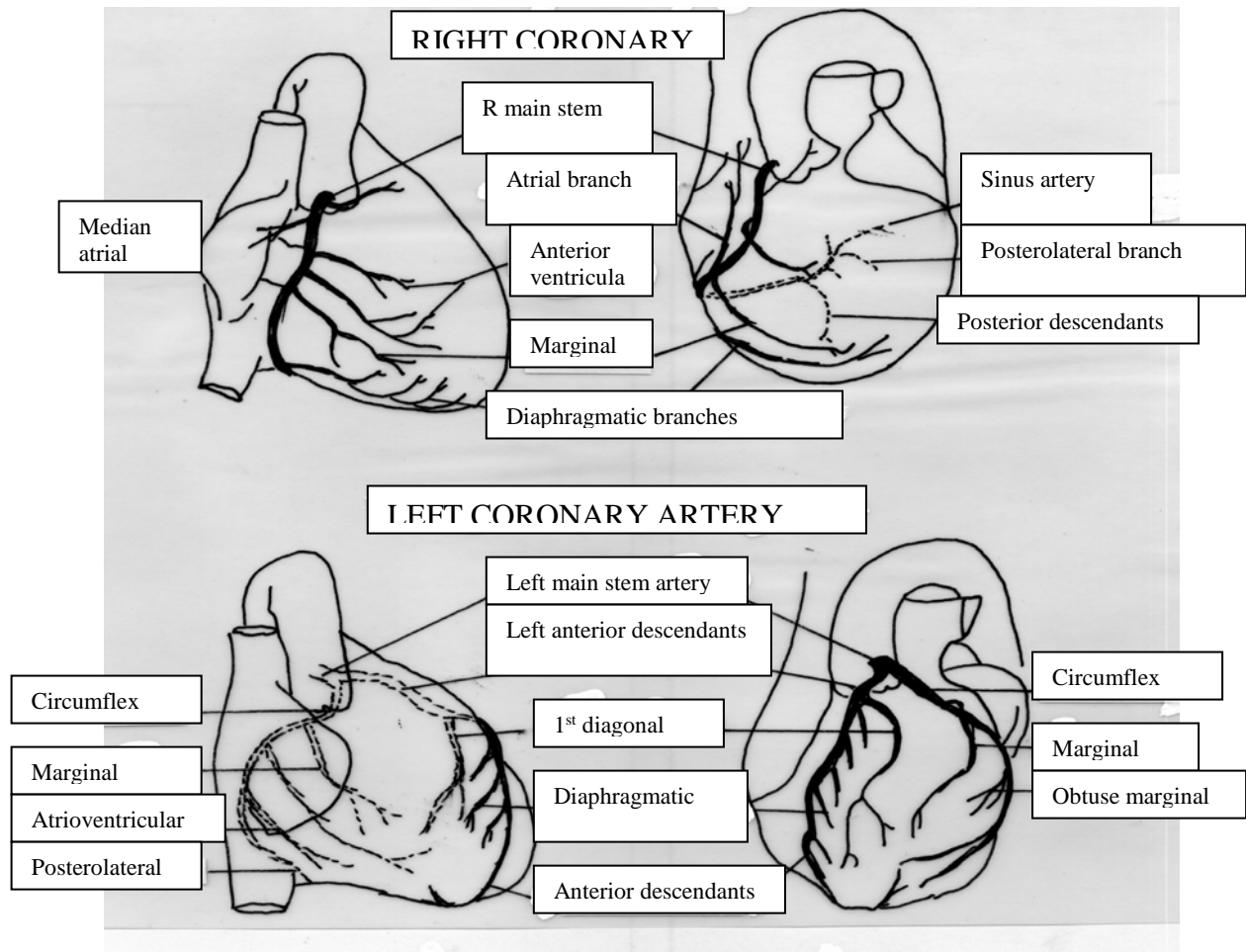
Specialized muscle, capable of initiating action potentials.

In the right atrium, on the upper part of the crista terminalis and near the superior vena cava opening is the **sinoatrial node** which stimulates the atrial musculature. The stimulus passes to the **atrioventricular node**, which lies on the lowermost interatrial septum, immediately above the opening of the coronary sinus; from there it passes through the **atrioventricular bundle of Hiss** which bifurcates [at the point where the membranous and muscular part of the interventricular septum join] to the **left and right bundle** which stimulate the ventricular muscle through the **Purkinje fibers**.

CORONARY ARTERIES

The two arteries arise from the aorta above the aortic sinuses.





- *The Coronary circulation*

VENOUS DRAINAGE

- **Veins that accompany the arteries:**

1. **Great cardiac vein** [follows the LAD in the anterior interventricular groove and then the circumflex in atrioventricular groove, where, posteriorly, it receives the **oblique vein** from the left atrium].

2. **Middle cardiac vein** [in the posterior interventricular groove with the RPD, joins the great cardiac vein forming the coronary sinus in the R part of the atrioventricular groove]

3. **Small cardiac vein** [follows the marginal branch of the right to join the coronary sinus]
The **coronary sinus** drains into the right atrium just to the left of the inferior vena cava opening.

- **Anterior cardiac veins:** two vessels originating from the upper part of the anterior cardiac surface which drain directly into the right atrium at the right atrioventricular groove
- **Thebesian veins [venae cordis minimae]:** drain the septum and open directly into the right atrium.

NERVE SUPPLY

Is through the superficial and deep cardiac nerve plexuses, formed by:

- **Vagus** [cardioinhibitor]
- **Cervical and upper thoracic sympathetic ganglia** [cardioaccelerator]

EMBRYOLOGY OF THE HEART

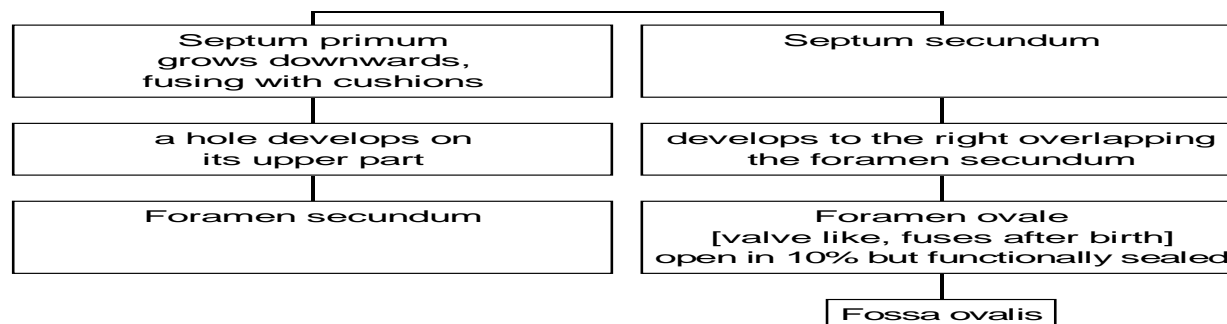
Starts from the **primitive single tube** from which develop:

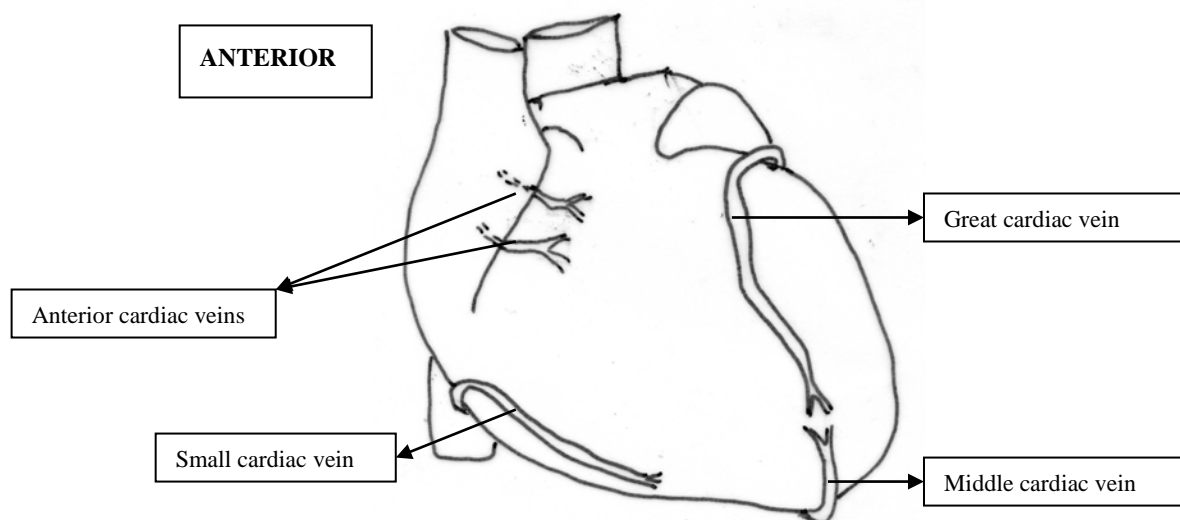
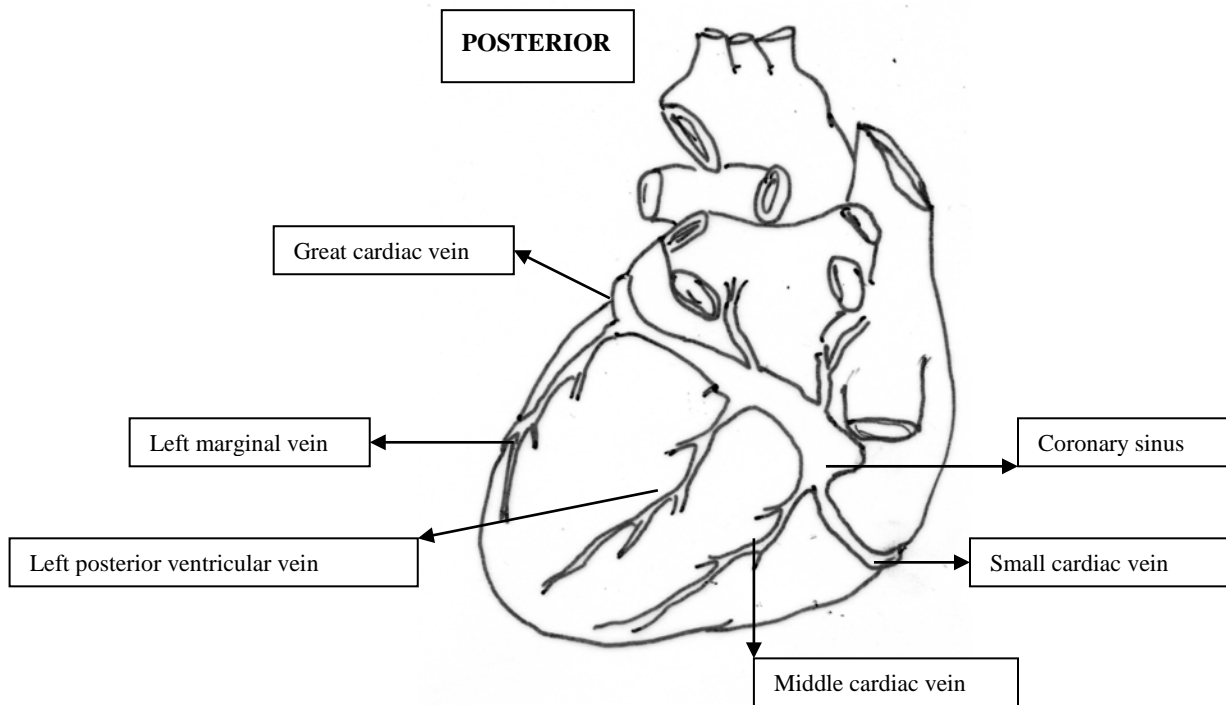
1. **Truncus arteriosus**
2. **Bulbus cordis**
3. **Ventricle.** Joins the bulbus and the structure enlarges and kinks, so that its caudal end comes to lie behind its cephalad [arterial] end
4. **Atrium**
5. **Sinus venosum**, joining the atrium

Inside the bulbus the dorsal and ventral endocardial cushions develop which meet at the midline, dividing the common atrioventricular chamber in left [mitral orifice] and right [tricuspid orifice]

DIVISION IN CHAMBERS

- **Common atrium division**





- *The veins of the heart*

- **Division of ventricle**

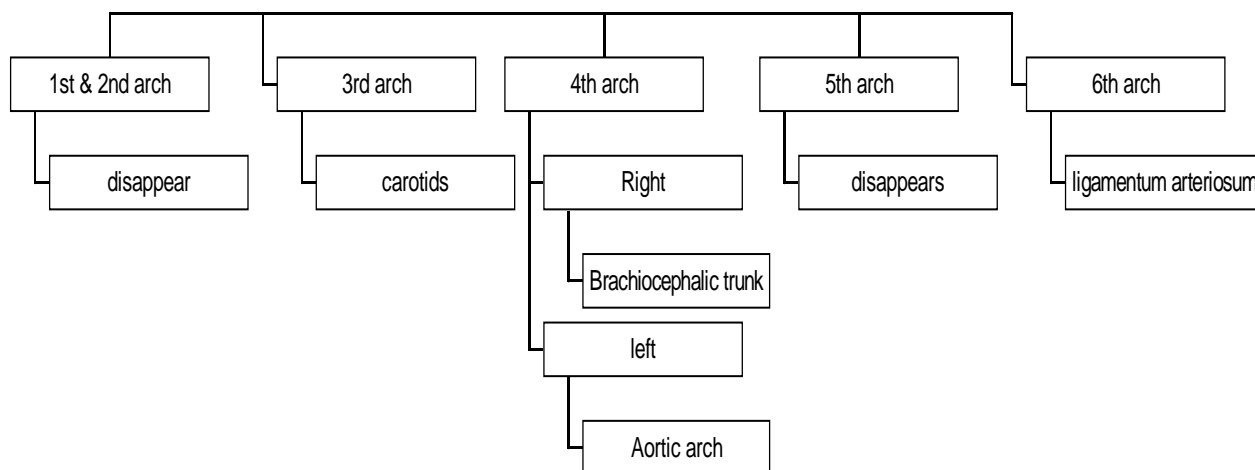
The **interventricular septum** grows from the apex upwards, meeting the **pars membranous** which grows downwards.

- **Division of truncus arteriosus.**

The **spiral septum** divides it to the aorta and pulmonary trunk.

AORTIC ARCHES AND DERIVATIVES

The truncus arteriosus gives off 6 pairs of arteries [aortic arches] which curve around the primitive pharynx to join posteriorly, forming 2 dorsal aortae, which later fuse distally to form the descending aorta.



Recurrent laryngeal nerve

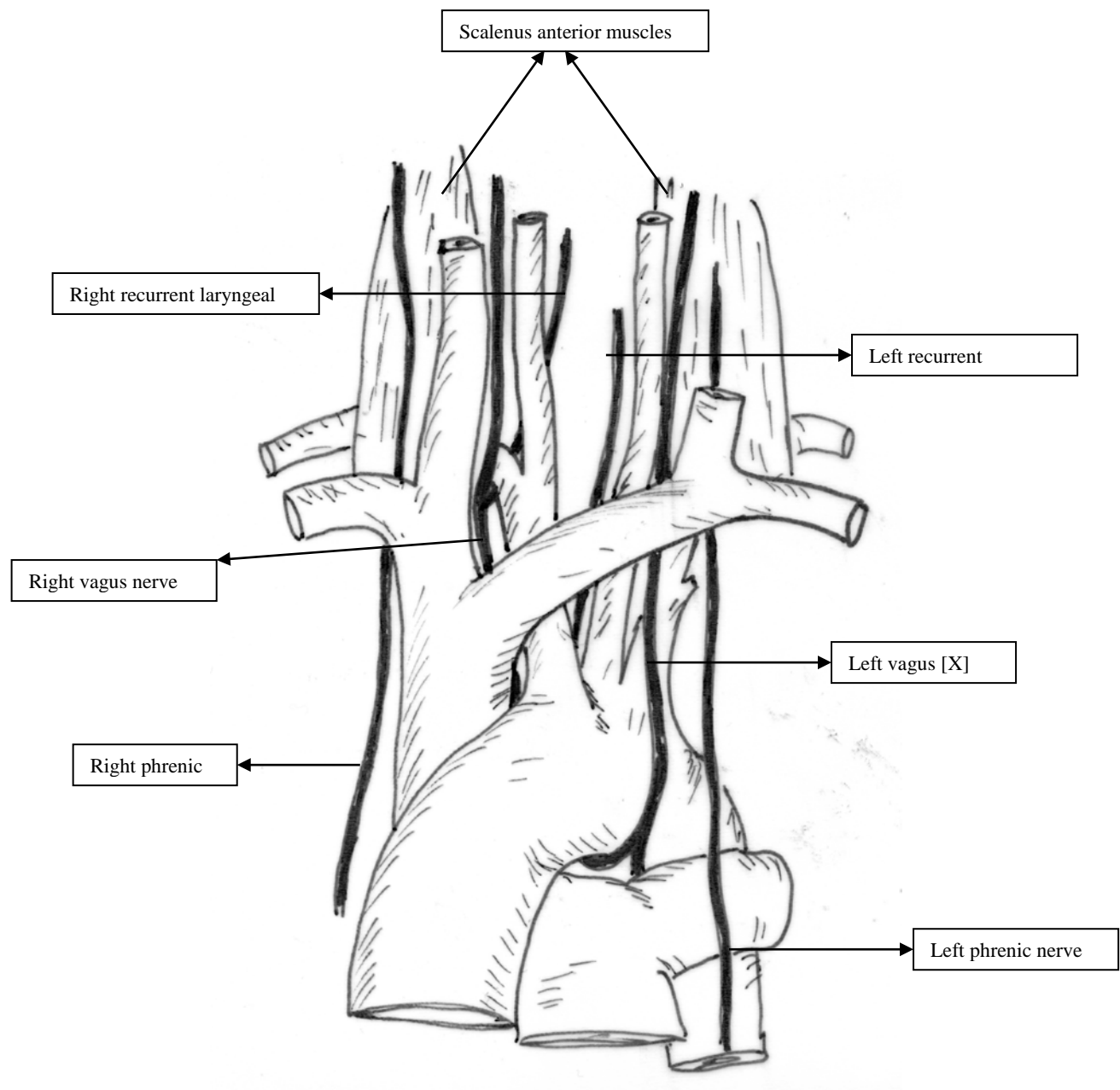
In the fetus the **vagus** lies lateral to the **primitive pharynx**, separated from it by the **aortic arches**. The recurrent laryngeal nerve pass medially, caudal to the arches to innervate the larynx. With elongation of the neck and caudal migration of the heart, the nerves are caught up and dragged down by the arches. On the right, as the distal part of the **6th and 5th arch disappear**, the nerve hooks around the **right subclavian artery**, while on the left the nerve hooks around the **6th arch** which retains the contention between the aorta and the pulmonary trunk, forming the ductus or **ligamentum arteriosum** and the gross developed aortic arch [4th arch].

FETAL CIRCULATION

From the **placenta**, carrying oxygenated blood, the **umbilical vein** joins the **inferior vena cava**, bypassing the liver through the **ductus venosus** and is brought into the **right atrium**. Most of the flow is directed through the **foramen ovale** into the **left atrium**. The oxygenated left atrium blood is directed into the **ascending aorta** to supply the brain and the heart. Through the **ductus arteriosus** some enters the pulmonary circulation while the rest enters the descending aorta to supply the viscera and limbs. From there, is brought back to the placenta by the **umbilical veins**. The deoxygenated stream from the superior vena cava is directed towards the right ventricle.

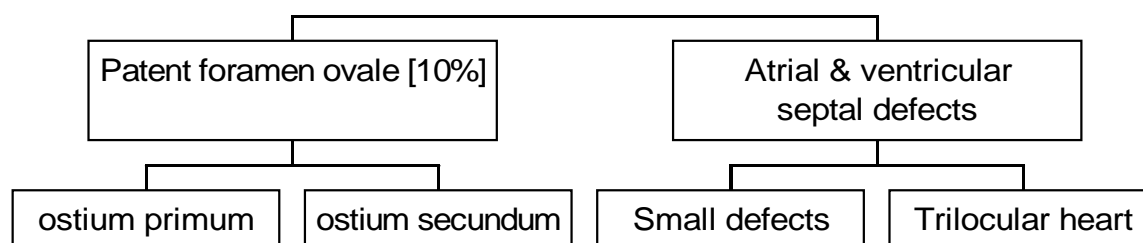
CONGENITAL ANOMALIES

- **Dextrocardia:** A complete mirror image. It is commonly associated with complete visceral malrotation [reversal]



- *The nerves and the great vessels*

- **Septal defects:**



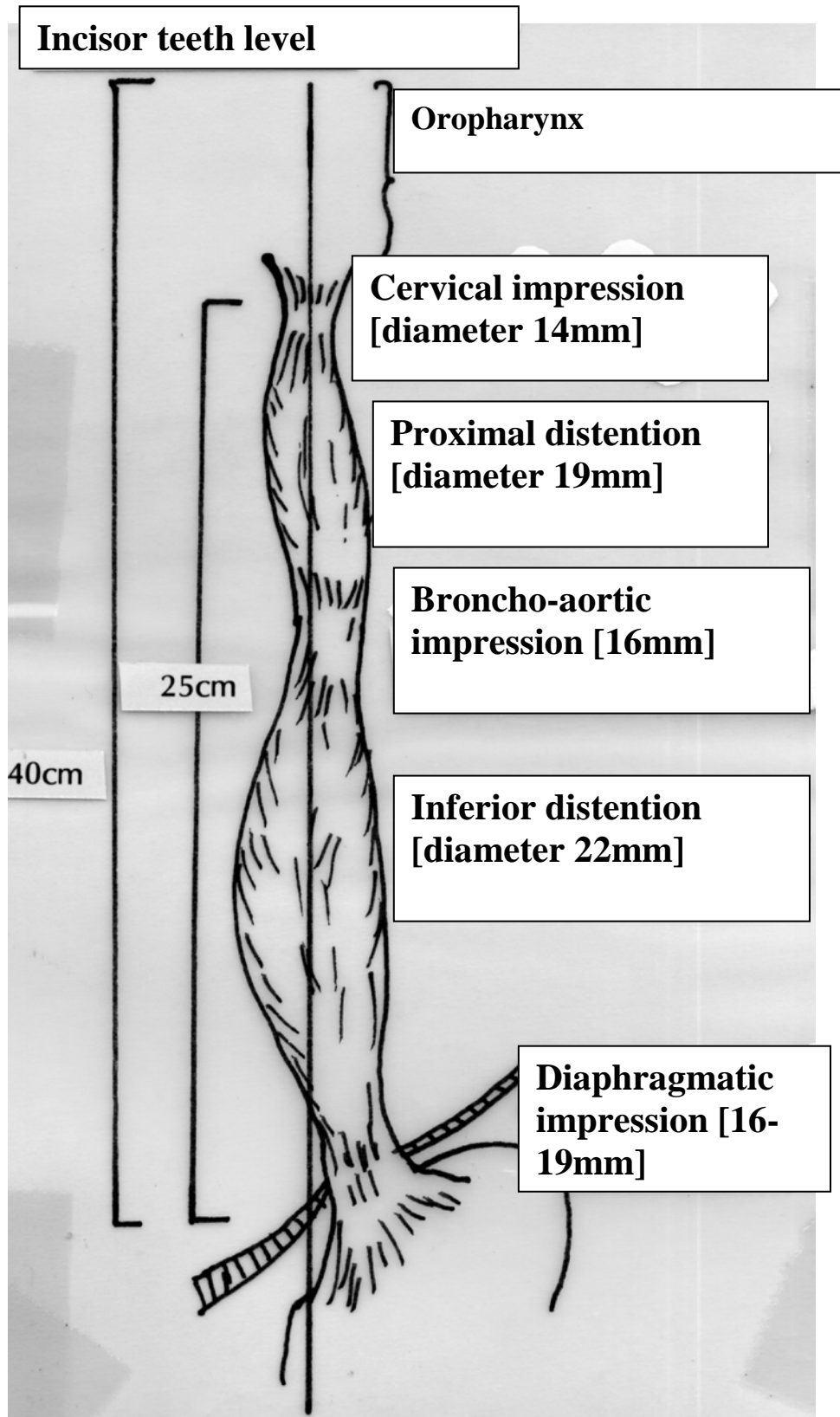
- **Pulmonary stenosis:** can affect the trunk, the valve or the infundibulum. It is usually associated with septal defects and compensatory right ventricular hypertrophy
- **Fallot's tetralogy:**
 1. Pulmonary stenosis
 2. Ventricular septal defect
 3. Compensatory R hypertrophy
 4. Overriding of the aorta over the right ventricle
 5. Cyanosis
- **Patent ductus arteriosus**
- **Aortic coarctation:**
 - collateral arteries around the scapula
 - upper intercostals and internal mammary feed the inferior intercostals and the distal aorta rib notches
- **Right aortic arch**
- **Double aortic arch**
- **Dorsal aorta** behind the oesophagus, causing what is called **dysphagia lusoria**
- **Aortopulmonary window**

THE OESOPHAGUS

Muscular tube, serving as conduit for the passage of food and fluids from the pharynx to the stomach [40-45cm from incisor teeth, 30-35cm from cricopharyngeus muscle]

COURSE & RELATIONS

- **NECK:** Commences at the medial plane [6th cervical vertebra, cricoid cartilage] and deviates slightly to the left as it approaches the thoracic inlet.
 - Front relations:** trachea, thyroid
 - Posterior:** prevertebral fascia, lower cervical vertebrae
 - Lateral:** carotids, recurrent laryngeal nerves. [the subclavian and thoracic duct on the left]
- **THORAX:** Initially left, behind aortic arch and left main stem bronchus, returns to midline at T₅. Moves to the right and then [below the bifurcation of the bronchi and tracheobronchial lymph nodes] left to enter the abdomen through the hiatus at T₁₀.
 - Anterior relations:** trachea, left bronchus, tracheobronchial nodes, pericardium, left atrium, diaphragm.
 - Posterior:** thoracic duct, thoracic vertebrae, azygos and hemiazygos vein with their tributaries, descending aorta.
 - Left lateral:** left recurrent laryngeal nerve, terminal part of the aortic arch, left subclavian artery, vagus, left pleura, hemiazygos system of veins, thoracic duct



- *Gross oesophageal anatomy [narrowing's & distentions]*

Right lateral: pleura, azygos vein

- **ABDOMEN:** intraabdominal portion 2-5 cm

Relations: right crus of the diaphragm [separates it from the aorta], peritoneum with its reflexion to stomach & phreno-oesophageal membrane, left triangular hepatic ligament, liver, left crus, dome of the spleen

ANATOMIC NARROWINGS

1. cricoid cartilage [14-20cm, pharyngoesophageal sphincter]
2. midthorax [28 cm compression from arch and bronchus]
3. hiatus [40cm gastroesophageal sphincter]

STRUCTURE

1. outer sheath of areolar connective tissue
2. lacks serosa [anastomoses do not heal so well]
3. inner circular, outer longitudinal muscle fibers [upper 1/3 skeletal striated fibers, lower 2/3 smooth]
4. submucosa
5. mucosa with stratified squamous epithelium [columnar in the last 3-5cm in 10% of subjects]

ARTERIAL SUPPLY

1. branches from inferior thyroid arteries
2. bronchial arteries
3. direct oesophageal branches from the aorta
4. left inferior phrenic artery
5. oesophageal branches of left gastric artery

VENOUS DRAINAGE

1. inferior thyroid vein
2. oesophageal venous plexus
3. azygos hemiazygos vein / superior vena cava
4. coronary vein / portal vein

LYMPHATIC DRAINAGE

The peri-oesophageal lymphatic plexus drains to the posterior mediastinal nodes and from them to the supraclavicular, while the lower third drains into the left gastric nodes.

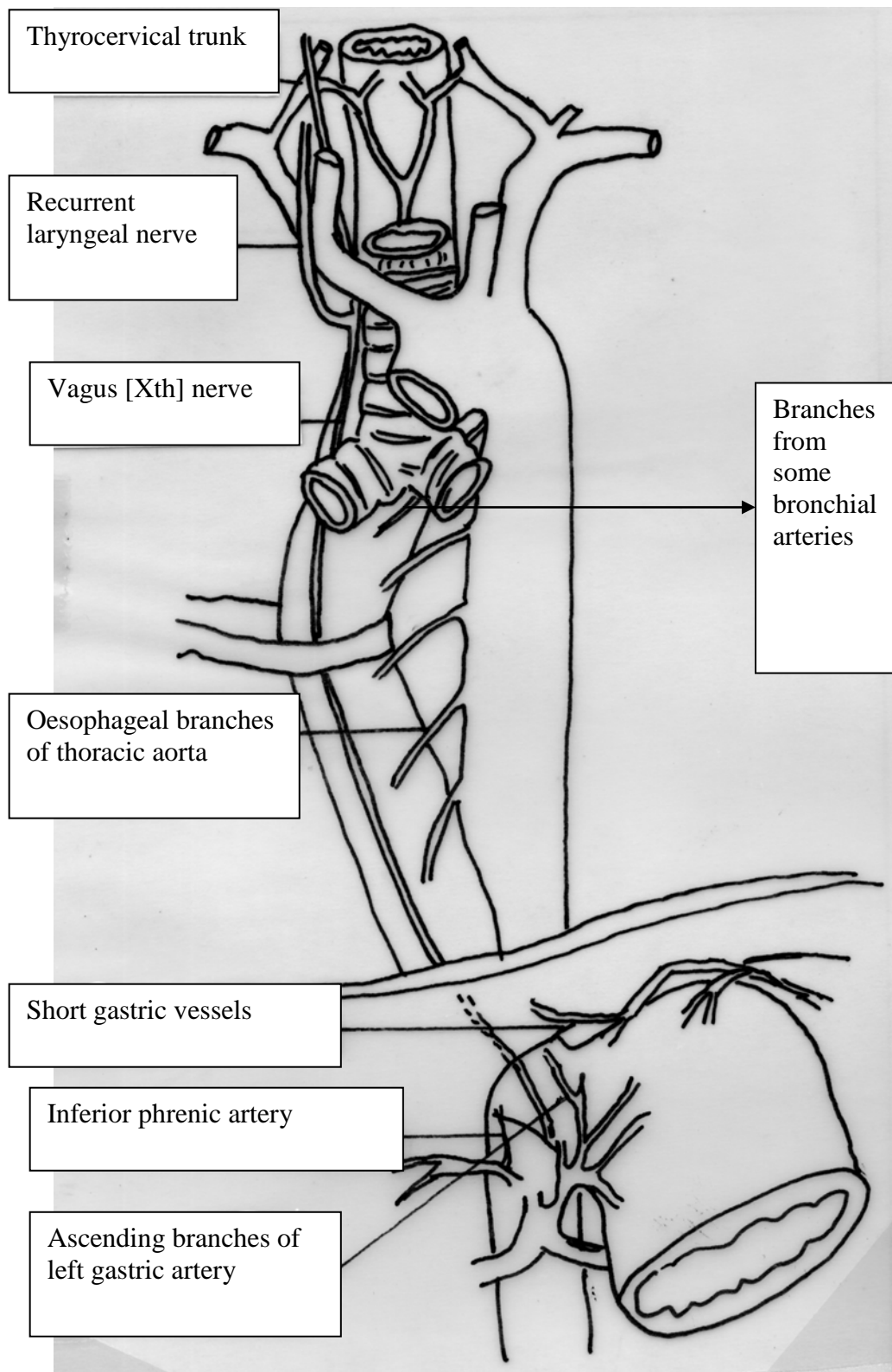
NERVE SUPPLY

autonomic

vagus oesophageal plexus [left anterior, right posterior vagus nerve]

DEVELOPMENT

From the distal part of the **primitive foregut**. On its floor develops a groove, the **laryngotracheal groove**, converting into a tube with a bud on each side, which differentiate into lungs. for this reason, oesophageal atresia is associated with tracheoesophageal fistula.



- *Oesophageal blood supply*

THE THORACIC DUCT

CHISTERNA CHYLI

Located between the **abdominal aorta** and the **right crus** of the diaphragm [median arcuate ligament]. Receives lymphatics from the abdomen and lower limbs [collecting trunks].

THORACIC DUCT.

Crosses the aortic opening and ascends behind the oesophagus and in front and laterally to the descending aorta. At T₅ it inclines to the left and runs on the **left side of the oesophagus** reaching the neck. Passes laterally behind the carotid sheath, and then descends over the left subclavian artery to drain into the origin of the **left innominate vein**.

It receives the **jugular, subclavian** and **left mediastinal lymphatic trunks**.

RIGHT LYMPHATIC DUCT

Is formed by the merge of the of the **right jugular, mediastinal** and **subclavian** collecting trunks. Drains into the **right innominate vein**.

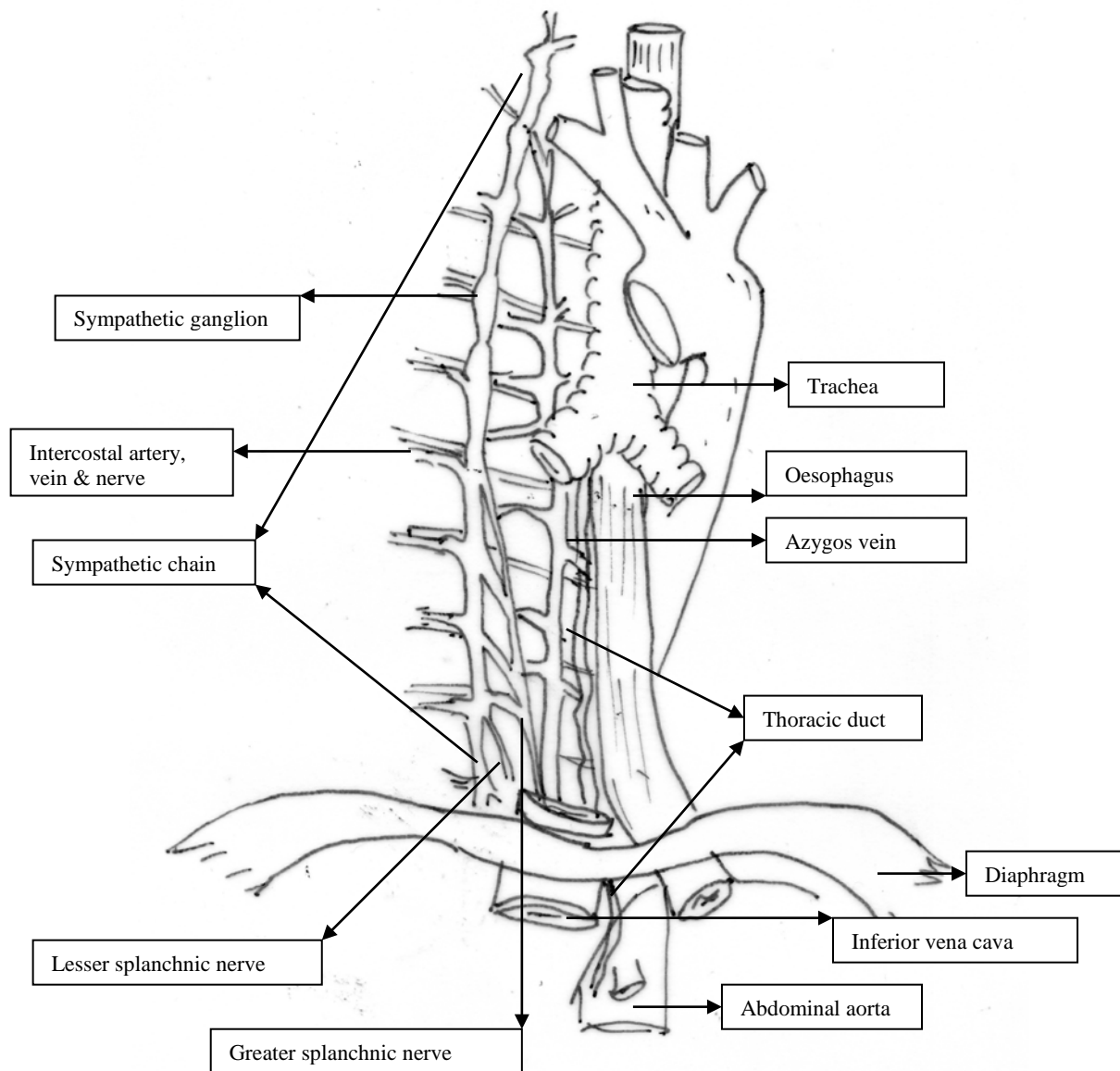
THE THORACIC SYMPATHETIC TRUNK

It is the most laterally placed structure in the **posterior mediastinum**. As it descends from the **cervical chain**, it crosses the **neck of the 1st rib**, the **heads of the 2nd-10th ribs** and the bodies of the 11th & 12th thoracic vertebrae.

It enters the abdomen behind the **medial arcuate ligament** with the splanchnic nerves lying medially.

- The **sympathetic nerve cell bodies** are located in the gray matter of the **lateral horns of T₁ - L₂ (3)** spinal segments. The fibers enter the **ventral roots**, then the **spinal nerves**, the **rami communicantes** and finally the **spinal ganglia**, one on each side. From there, fibers are distributed to:
 - a. **cervical sympathetic trunk**
 - b. **lumbar sympathetic trunk**
 - c. **thoracic viscera** [via plexuses]
 - d. **intercostal nerves** [via the rami communicantes]
 - a. **abdominal ganglia** [coeliac, superior mesenteric] via the splanchnic nerves
- The first thoracic ganglion frequently fuses with the inferior cervical, forming the stellate [cervicothoracic] ganglion.
- Postganglionic fibers from **T₁₋₅** are distributed to the **thoracic viscera**.
- The **splanchnic nerves** are formed by preganglionic fibers:
 1. T₅₋₁₀ **greater splanchnic nerve**
 2. T₁₀₋₁₁ **lesser splanchnic nerve**
 3. T₁₂ **least splanchnic nerve**

They pierce the crura [medially to the trunk] and pass to the coeliac, mesenteric and renal ganglia, from where postganglionic fibers are distributed to the abdominal viscera



- *The thoracic sympathetic chain and the thoracic duct*

