

## Bones and skeletal tissues

### Cartilages:

Cartilaginous structures are found throughout the adult human body. These cartilages, shown in, include (1) cartilage in the **external ear**; (2) cartilages in the **nose**; (3) **articular cartilages**, which cover the ends of most bones at movable joints; (4) **costal cartilages**, which connect the ribs to the sternum (breastbone); (5) cartilages in the **larynx** (voice box), including the *epiglottis*, a flap that keeps food from entering the larynx and the lungs; (6) cartilages that hold open the **air tubes of the respiratory system**; (7) cartilage in the discs between the vertebrae; (8) cartilage in the **pubic symphysis**; and (9) cartilages that form the **articular discs** within certain movable joints, the *meniscus* in the knee for example.

**Three** types of cartilage tissue occur in the body: *hyaline cartilage*, *elastic cartilage*, and *fibrocartilage*.

### Bones:

The bones of the skeleton are *organs* because they contain several different tissues. Although bone tissue predominates, bones also contain nervous tissue in nerves, blood tissue in blood vessels, cartilage in articular cartilages, and epithelial tissue lining the blood vessels.

### Functions of Bones:

Bone carries out the following functions:

**1. Support.** Bones provide a hard framework that supports the weight of the body.

**2. Movement.** Skeletal muscles attach to the bones by tendons and use the bones as levers to move the body and its parts. The arrangement of the bones and the structure of the joints determine the types of movement that are possible.

**3. Protection.** The bones of the skull form a protective case for the brain. The vertebrae surround the spinal cord, and the rib cage helps protect the organs of the thorax.

**4. Mineral storage.** Bone serves as a reservoir for minerals, the most important of which are calcium and phosphate.

**5. Blood cell formation and energy storage.** Bones contain red and yellow *bone marrow*. Red marrow makes the blood cells, and yellow marrow is a site of fat storage.

**6. Energy metabolism.** The role of bone cells in regulating energy metabolism has just recently been identified.

**Bones are classified by their shape as long, short, flat, or irregular:**

**1. Long bones.** As their name suggests, long bones are considerably longer than they are wide. Most bones in the limbs are long bones.

**2. Short bones.** Short bones are roughly cube-shaped. They occur in the wrist and the ankle.

**3. Flat bones.** Flat bones are thin, flattened, and usually somewhat curved. Most cranial bones of the skull are flat, as are the ribs, sternum (breastbone), and scapula (shoulder blade).

**4. Irregular bones.** Irregular bones have various shapes that do not fit into the previous categories. Examples are the vertebrae and hip bones.

## **Skeleton**

The skeleton consists of **bones, cartilages, joints, and ligaments**. Joints, also called **articulations**, are the junctions between skeletal elements. Ligaments connect bones and reinforce most joints. The 206 named bones of the human skeleton are grouped into the axial and appendicular skeletons.

**Appendicular skeleton** consists of the bones of the upper and lower limbs, including the pectoral (shoulder) and pelvic girdles that attach the limbs to the axial skeleton. The **axial skeleton**, which forms the long axis of the body. It has 80 named bones arranged into three major regions: the *skull, vertebral column, and thoracic cage*. This axial division of the skeleton supports the head, neck, and trunk, and protects the brain, spinal cord, and the organs in the thorax.

### **The skull:**

The **skull** is the body's most complex bony structure. It is formed by cranial and facial bones. The *cranial bones*, or **cranium**, enclose and protect the brain and provide attachment sites for some head and neck muscles. The *facial bones*: (1) form the framework of the face; (2) form cavities for the sense organs of sight, taste, and smell; (3) provide openings for the passage of air and food; (4) hold the teeth; and (5) anchor the muscles of the face.

Most skull bones are flat bones and are firmly united by interlocking, immovable joints called sutures.

### **Cranial Bones:**

The eight large bones of the cranium are the paired parietal and temporal bones and the unpaired frontal, occipital, sphenoid, and ethmoid bones.

Together these bones form the brain's protective "shell."

The skeleton of the face consists of 14 bones. These are the unpaired mandible and the vomer, plus the paired maxillae, zygomatics, nasals, lacrimals, palatines, and inferior nasal conchae.

## The vertebral column

The **vertebral column**, also called the *spinal column* or *spine*, consists of **26** bones connected into a flexible, curved structure. The vertebral column extends from the **skull** to the **pelvis**. It surrounds and protects the delicate **spinal cord** and provides attachment points for the **ribs** and for **muscles** of the neck and back. In the fetus and infant, the vertebral column consists of **33** separate bones, or **vertebrae**. Inferiorly, nine of these eventually fuse to form two composite bones, the **sacrum** and the tiny **coccyx** (tailbone). The remaining **24** bones persist as individual vertebrae separated by *inter vertebral discs*.

### Regions and Normal Curvatures:

The vertebral column, which is about 70 cm (28 inches) long in an average adult, has **five** major regions. The **7** vertebrae of the neck are the **cervical vertebrae**, the next **12** are the **thoracic vertebrae**, and the **5** that support the lower back are the **lumbar vertebrae**. The vertebrae become progressively larger from the cervical to the lumbar region. Inferior to the lumbar vertebrae is the **sacrum**, which articulates with the hip bones of the pelvis. The most inferior part of the vertebral column is the tiny **coccyx**. From a lateral view, four curvatures that give the vertebral column an **S** shape are visible. The **cervical** and **lumbar curvatures** are concave posteriorly, whereas the

**thoracic** and **sacral curvatures** are convex posteriorly. Only the thoracic and sacral curvatures are well developed at birth.

## The thoracic cage

The bony framework of the chest (thorax), called the **thoracic cage**, is roughly barrel-shaped and includes the **thoracic vertebrae** posteriorly, the **ribs** laterally, and the **sternum** and **costal cartilages** anteriorly. The **thoracic cage** forms a protective cage around the heart, lungs, and other organs. It also supports the shoulder girdles and upper limbs and provides attachment points for many muscles of the back, neck, chest, and shoulders. In addition, the *intercostal spaces* are occupied by the **intercostal muscles**, which lift and depress the thorax during breathing.

### Sternum

The **sternum** (breastbone) lies in the anterior midline of the thorax.

Resembling a dagger, it is a flat bone about 15 cm long consisting of three sections: the **manubrium**, **body**, and **xiphoid process**.

The sternum has three important anatomical landmarks that can be palpated: the jugular notch, the sternal angle, and the xiphisternal joint .

### Ribs

**Twelve** pairs of **ribs** form the flaring sides of the thoracic cage. All ribs attach to the thoracic vertebrae posteriorly and run anteroinferiorly to reach the front of the chest. The **superior seven** pairs, which attach directly to the sternum by their *costal cartilages*, are the **true ribs**, or *vertebrosternal ribs*.

The **inferior five** pairs, ribs **8–12**, are called **false ribs** because they attach to the sternum either indirectly or not at all.

## Joint

The rigid elements of the skeleton meet at sites called **joints**, or **articulations**. The Greek root *arthro* means “joint,” and the scientific study of joints is called *arthrology*. It is the articulation of bones at joints and the contraction of skeletal muscles that attach to the bones, cause movement.

### Classification of joints:

The joints are classified by structure and by function. The ***functional classification*** focuses on the amount of movement allowed. Accordingly, **synarthroses** are immovable joints, **amphiarthroses** are slightly movable joints, and **diarthroses** are freely movable joints. Diarthroses predominate in the limbs, whereas synarthroses and amphiarthroses are largely restricted to the axial skeleton.

The ***structural classification*** is based on the material that binds the bones together and on the presence or absence of a joint cavity. Structurally, joints are classified as **fibrous**, **cartilaginous**, or **synovial joints**. In **fibrous** joints; The bones are connected by fibrous tissue, no joint cavity is present. Most fibrous joints are immovable or only slightly movable (Eg. sutures of the skull). In **cartilaginous** joints, the articulating bones are united by cartilage. Cartilaginous joints lack a joint cavity and are not highly movable, like pubic symphysis of the hip. **Synovial** joints are the most movable joints of the body, and all are diarthroses (freely movable). Each synovial joint contains a fluid-filled *joint cavity*. Most joints of the body are in this class, especially those in the limbs.

## Skeletal muscles tissue

*Muscle* is from a Latin word meaning “little mouse,” a name given because flexing muscles look like mice running beneath the skin.

### Functions:

Muscle tissue has the following functions:

1. Movement.
2. Maintenance of posture.
3. Joint stabilization.
4. Heat generation.

### **Classification:**

There are three types of muscle tissue: *skeletal*, *cardiac*, and *smooth*. Each type can be characterized by two main features: (1) the presence or absence of light and dark stripes, called *striations*, in the muscle cells and (2) whether control is voluntary or involuntary.

**Skeletal muscle tissue** is located in the **skeletal muscles**; Discrete organs that attach to and move the skeleton. This tissue makes up a full 40% of body weight. The muscle cells of skeletal muscle tissue are striated, and its contraction is subject to voluntary control.

**Cardiac muscle tissue** occurs only in the wall of the heart. The muscle cells of cardiac muscle tissue are striated, but its contraction is involuntary, which means that as a rule, we have no direct conscious control over how fast our heart beats.

Most **smooth muscle tissue** in the body is found in the walls of hollow internal organs other than the heart, such as the stomach, urinary bladder, blood vessels, and respiratory passages. The muscle cells of smooth muscle tissue lack striations, and like cardiac muscle tissue, smooth muscle tissue is under involuntary control.

**Skeletal muscles:** Each muscle is an organ made of several kinds of tissue; In addition to skeletal muscle tissue, a muscle also contains connective tissue, blood vessels, and nerves.

**Naming of skeletal muscles:** Naming of skeletal muscle is according to

1. Location.
2. Shape.
3. Relative size.
4. Direction of fascicles and fibers.
5. Location of attachments.
6. Number of origins.
7. Action.

**Anatomy:** is the science of the structure and function of the body.

**Clinical anatomy** is the study of the macroscopic structure and function of the body as it relates to the practice of medicine and other health sciences.

**Basic anatomy** is the study of the minimal amount of anatomy consistent with the understanding of the overall structure and function of the body.

### **Anatomical Terms**

When discussing anatomy, the following terms are used to describe the relative positions of the parts of the body. When using these terms, it is assumed that the body is in the anatomical position.

**Lateral** - More distant to the body midline. In the anatomical position, the radius is lateral to the ulna. A simpler example is the "thumb" is lateral to the "pinky."

**Medial** - Closer to the midline; on the inner side. The sternum (breast plate) is medial to the clavicle (shoulder bone).

**Superior** - Above, towards the cephalic (head) end. The cranial cavity (head cavity) is superior to the scapula (shoulder blade).

**Inferior** - Below, towards the plantar (foot) end. The patella (knee cap) is inferior to the femur (thigh bone).



**Anterior** - Towards the front of the body. The sternum is anterior to the spine. Also known as ventral, but this term is not as common in human anatomy.

**Posterior** - Towards the rear/backside of the body. The fibula is posterior to the tibia. Also known as dorsal, but this term is not as common.

**Superficial** - Closer to the skin, nearer the body surface. Skin is superficial to the organs.

**Deep** - Further from the body surface.

**internal** and **external** are used to describe the relative distance of a structure from the center of an organ or cavity

**Distal** - Further from the limb's attachment to the trunk (where 'trunk' refers to the 'torso' of the body: the body minus the head, neck, and limbs).

**proximal** - Nearer to the limb's attachment to the trunk. The humerus is proximal to the radius.

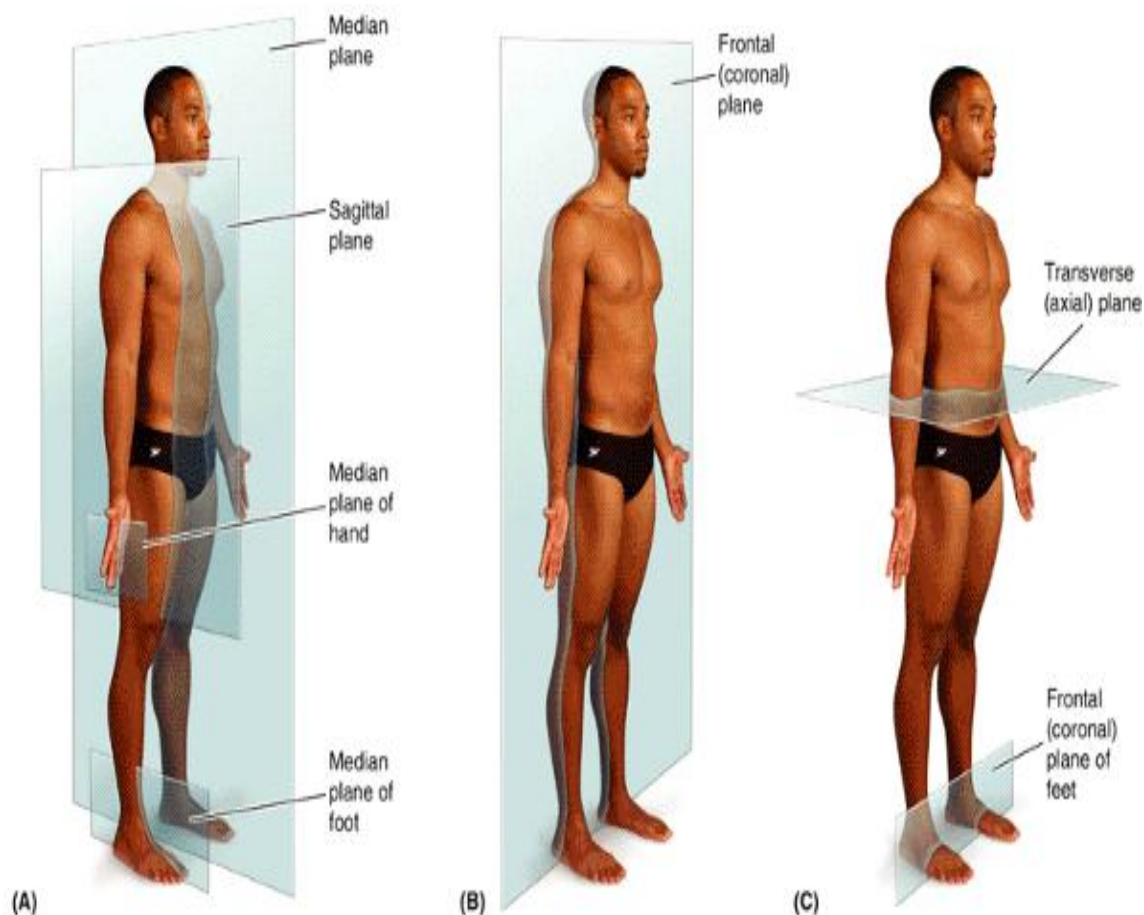
**Anatomical plane:****Median Sagittal Plane**

This is a vertical plane passing through the center of the body, dividing it into equal right and left halves (Fig. 1-1).

**Coronal Planes**

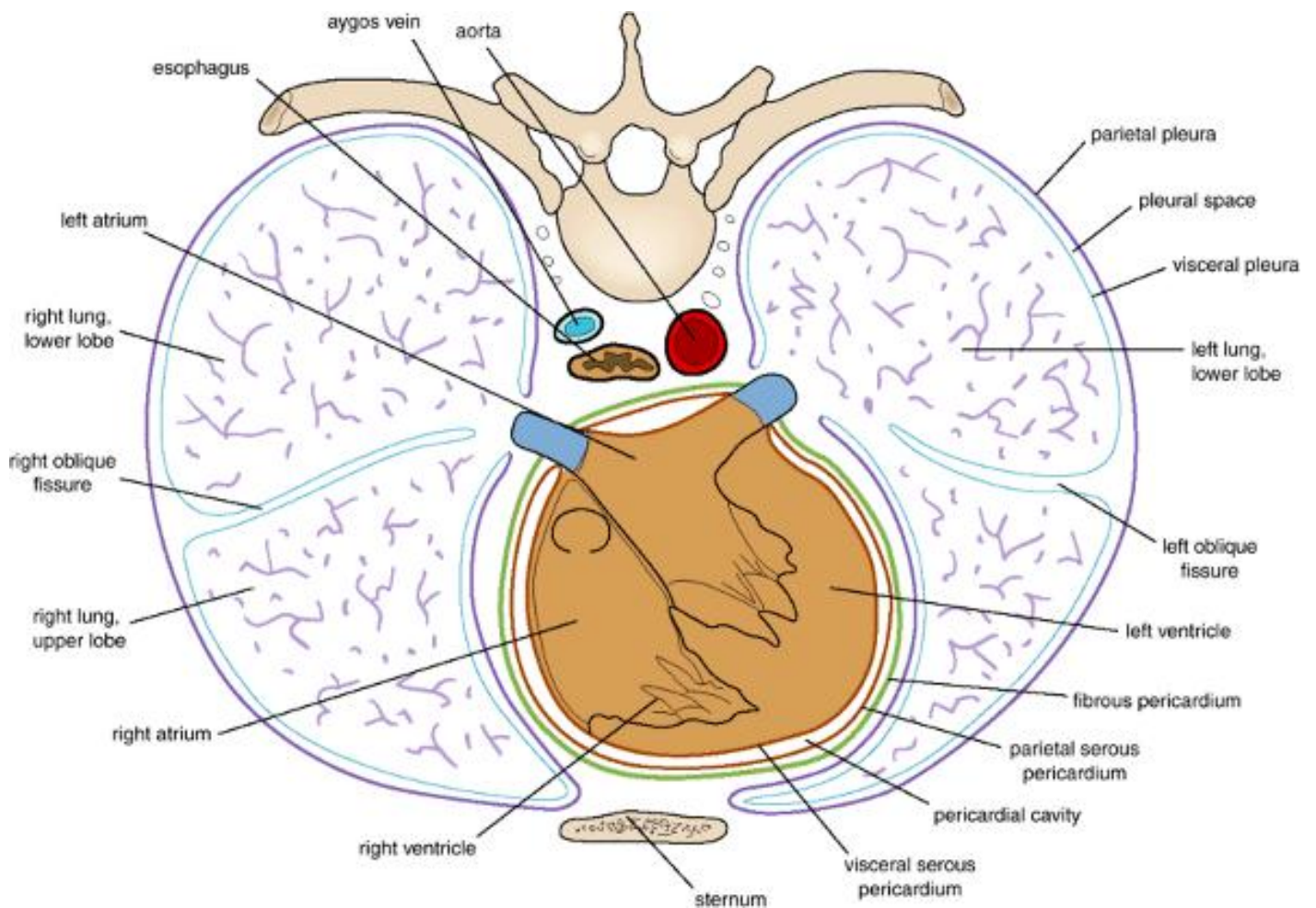
These planes are imaginary vertical planes at right angles to the median plane (Fig. 1-1).

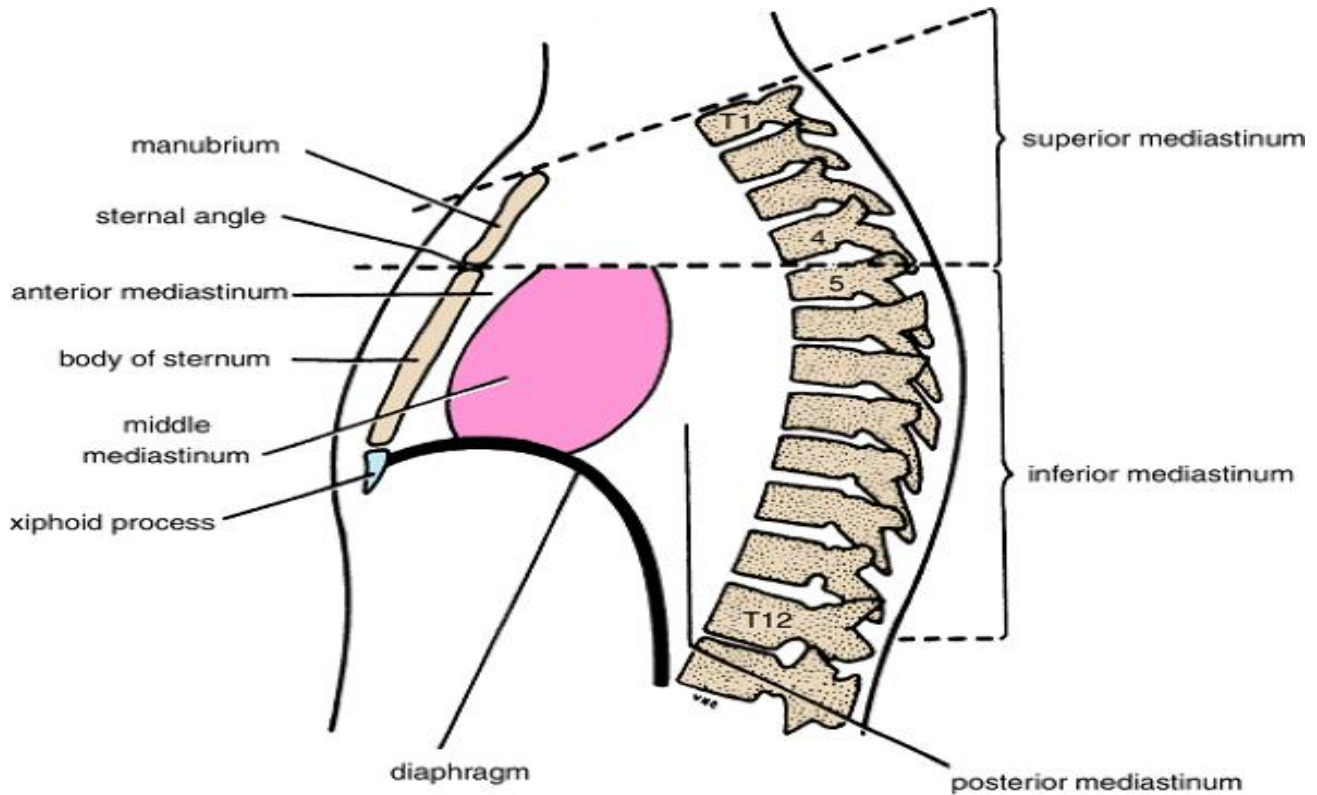
**Horizontal, or Transverse Planes** These planes are at right angles to both the median and the coronal planes



## Chest Cavity

The chest cavity is bounded by the chest wall and below by the diaphragm. It extends upward into the root of the neck about one fingerbreadth above the clavicle on each side. The diaphragm, which is a very thin muscle, is the only structure (apart from the pleura and peritoneum) that separates the chest from the abdominal viscera. The chest cavity can be divided into a median partition, called the mediastinum, and the laterally placed pleurae and lungs





## Mediastinum

The mediastinum, though thick, is a movable partition that extends superiorly to the thoracic outlet and the root of the neck and inferiorly to the diaphragm. It extends anteriorly to the sternum and posteriorly to the vertebral column. It contains the remains of the thymus, the heart and large blood vessels, the trachea and esophagus, the thoracic duct and lymph nodes, the vagus and phrenic nerves, and the sympathetic trunks. The mediastinum is divided into **superior and inferior mediastina**.

The **inferior mediastinum** is further subdivided into the **middle mediastinum**, which consists of the pericardium and heart; **the anterior mediastinum**, which is a space between the pericardium and the sternum; and the **posterior mediastinum**, which lies between the pericardium and the vertebral column.

## Superior Mediastinum

(a) Thymus, (b) large veins, (c) large arteries, (d) trachea, (e) esophagus and thoracic duct, and (f) sympathetic trunks

The superior mediastinum is bounded in front by the manubrium sterni and behind by the first four thoracic vertebrae (Fig. 3).

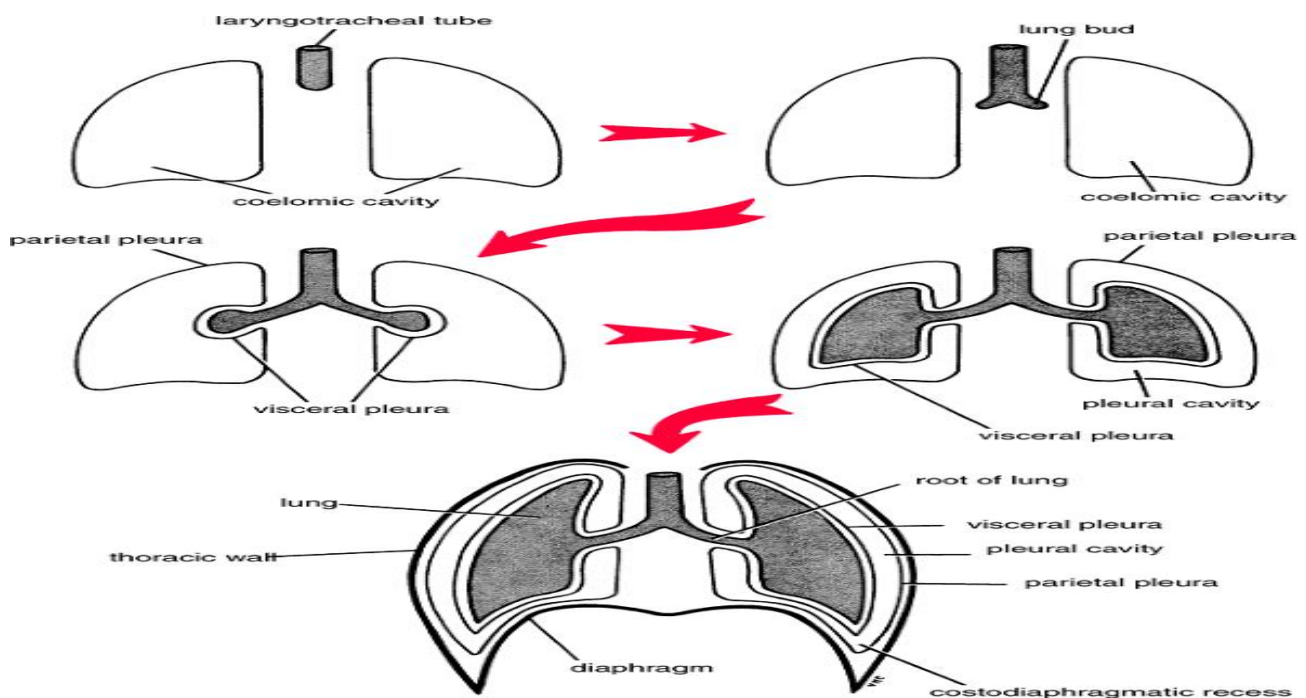
## Inferior Mediastinum

(a) Thymus, (b) heart within the pericardium with the phrenic nerves on each side, (c) esophagus and thoracic duct, (d) descending aorta, and (e) sympathetic trunks

## Pleurae

The pleurae and lungs lie on either side of the mediastinum within the chest cavity (Fig. 3).

Each pleura has two parts: a **parietal layer**, which lines the thoracic wall; and a **visceral layer**, which completely covers the outer surfaces of the lungs.



## **Pericardium**

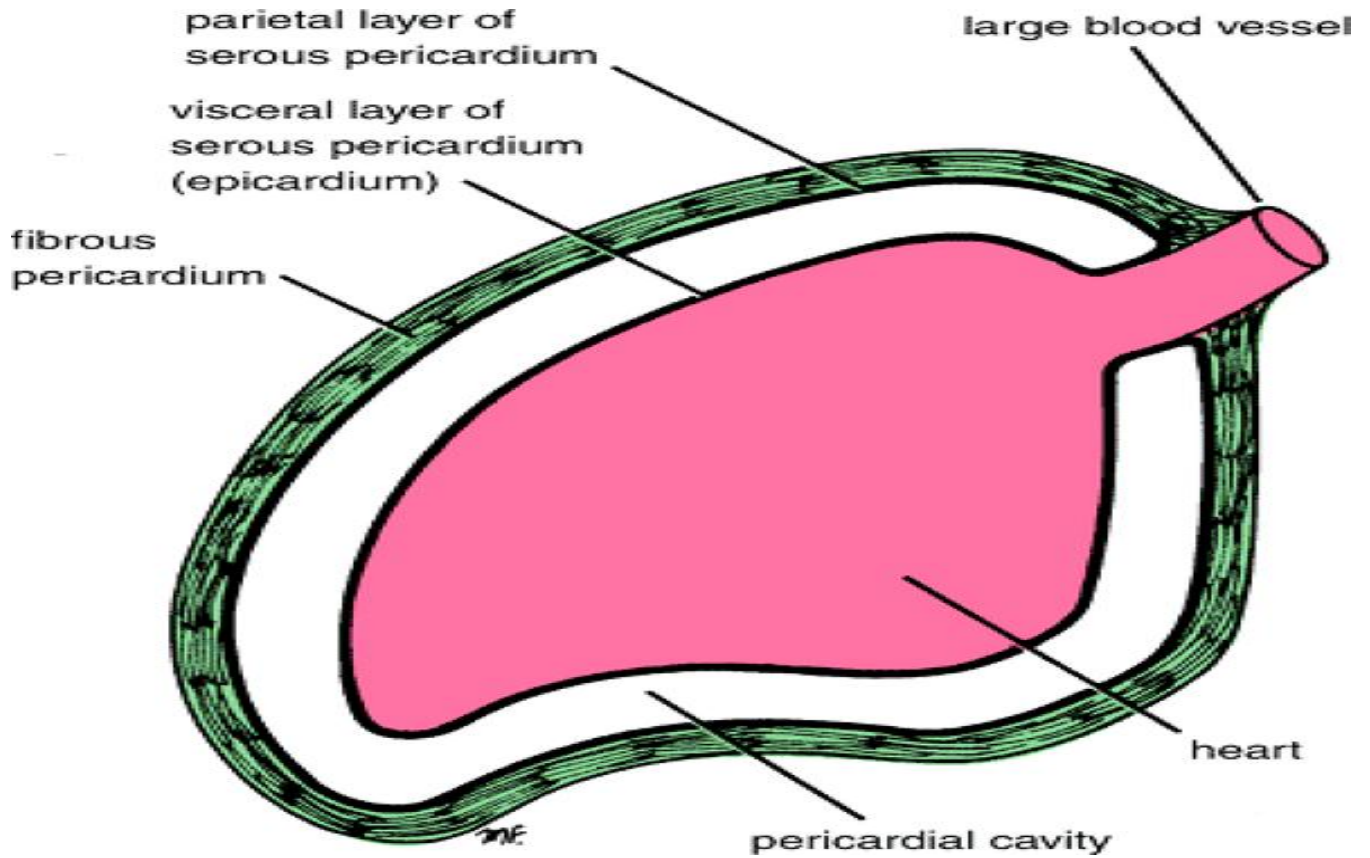
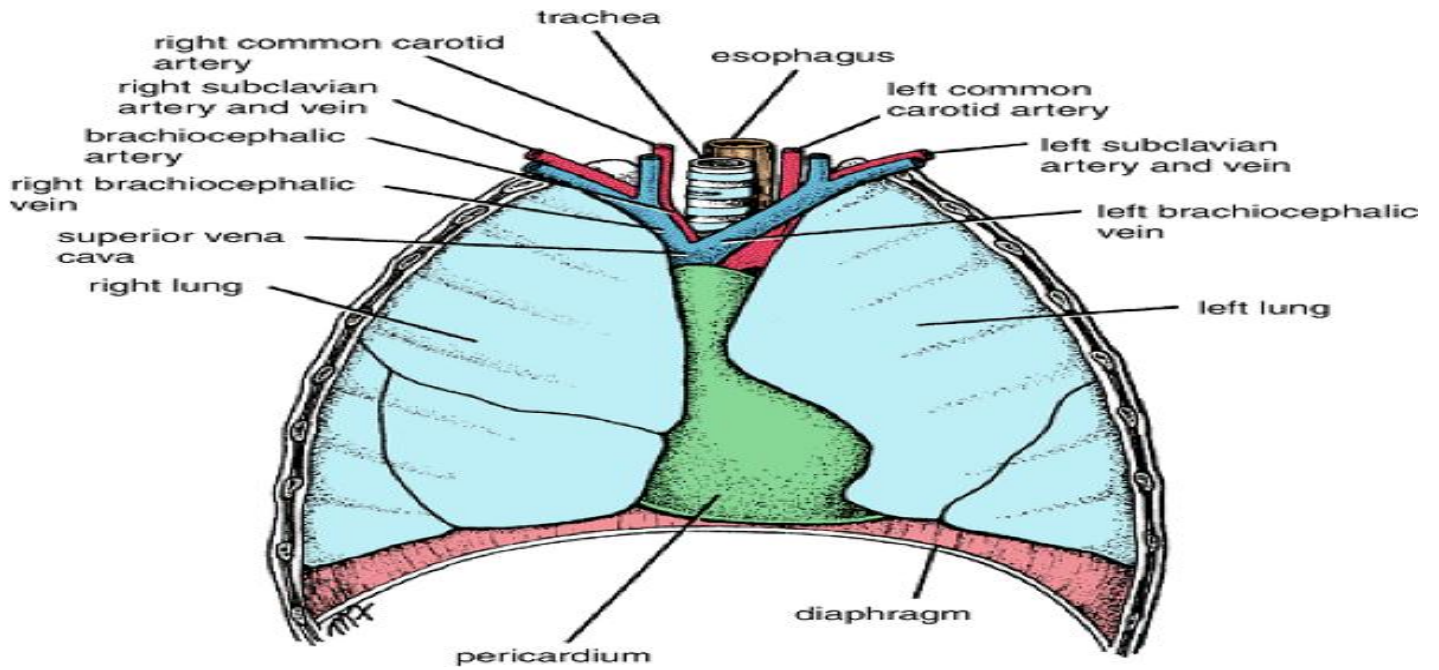
The pericardium is a fibroserous sac that encloses the heart and the roots of the great vessels. Its function is to restrict excessive movements of the heart as a whole and to serve as a lubricated container in which the different parts of the heart can contract. The pericardium lies within the middle mediastinum

### **Fibrous Pericardium**

The fibrous pericardium is the strong fibrous part of the sac. It is firmly attached below to the central tendon of the diaphragm.

### **Serous Pericardium**

The serous pericardium lines the fibrous pericardium and coats the heart. It is divided into **parietal** and **visceral layers**.



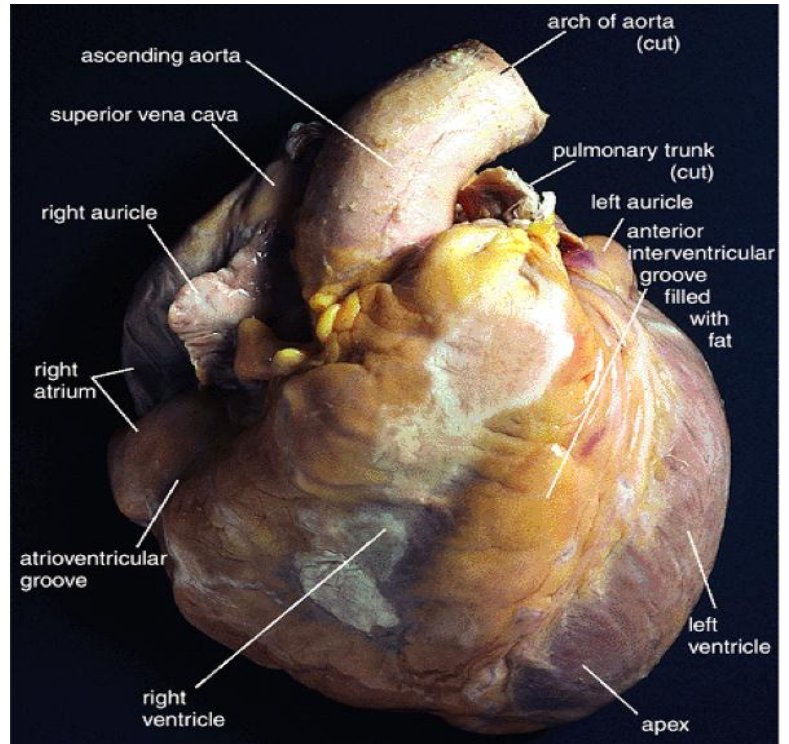
## Heart

The heart is a hollow muscular organ that is somewhat pyramid shaped and lies within the pericardium in the mediastinum.

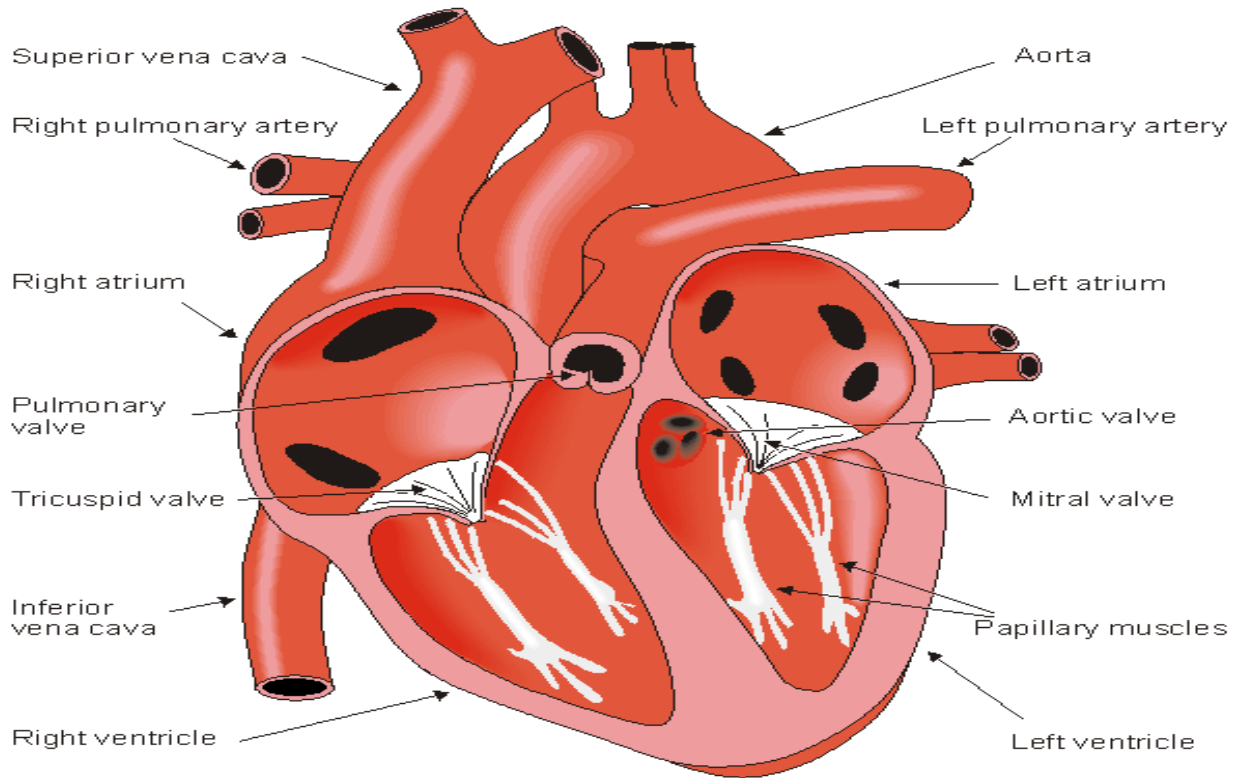
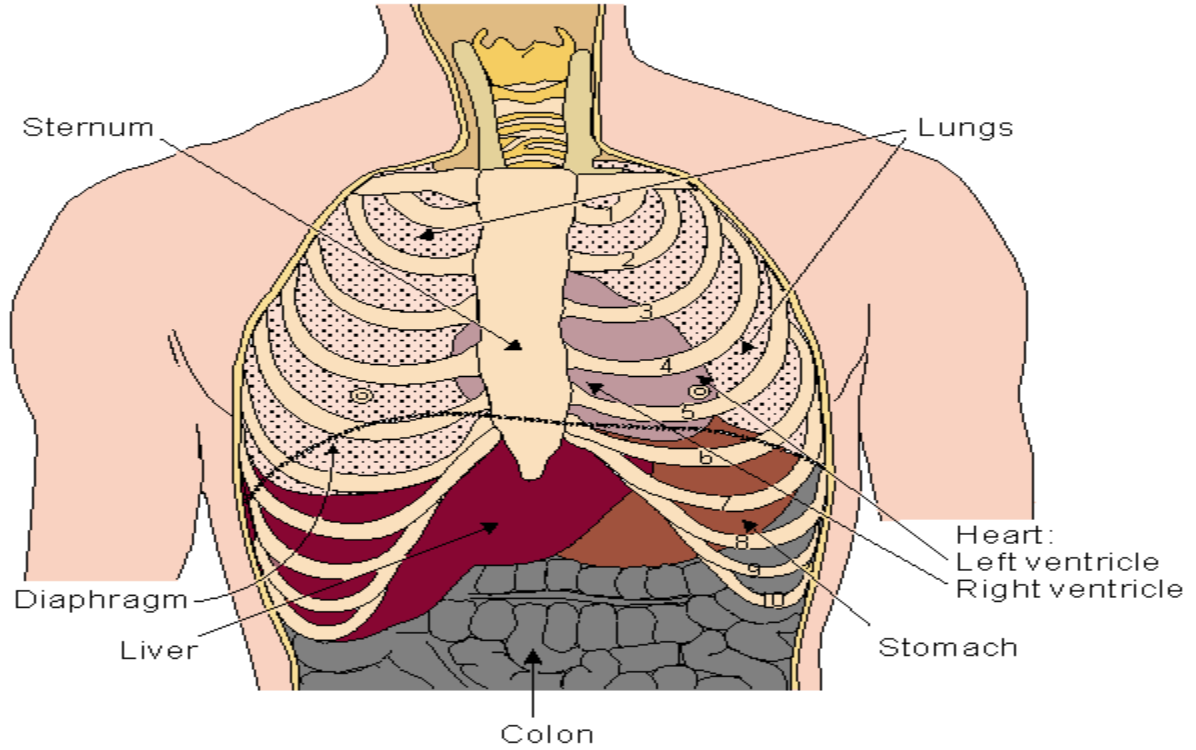
### Location of the Heart

The heart is located in the chest between the lungs behind the sternum and above the diaphragm. It is

surrounded by the pericardium. Its size is about that of a fist, and its weight is about 250-300 g. Its center is located about 1.5 cm to the left of the midsagittal plane. Located above the heart are the great vessels: the superior and inferior vena cava, the pulmonary artery and vein, as well as the aorta. The aortic arch lies behind the heart.







## **Chambers of the Heart**

The heart is divided by vertical septa into four chambers: the right and left atria and the right and left ventricles. The right atrium lies anterior to the left atrium, and the right ventricle lies anterior to the left ventricle.

The walls of the heart are composed of cardiac muscle, the myocardium; covered externally with serous pericardium, the epicardium; and lined internally with a layer of endothelium, the endocardium.

## **Openings into the Right Atrium**

**The superior vena cava** opens into the upper part of the right atrium; it has no valve. It returns the blood to the heart from the upper half of the body. **The inferior vena cava** (larger than the superior vena cava) opens into the lower part of the right atrium; It returns the blood to the heart from the lower half of the body.

**The coronary sinus**, which drains most of the blood from the heart wall ,opens into the right atrium between the inferior vena cava and the atrioventricular orifice. It is guarded by a rudimentary, nonfunctioning valve.

**The right atrioventricular orifice** lies anterior to the inferior vena cava opening and is guarded by the tricuspid valve.

**Many small orifices of small veins** also drain the wall of the heart and open directly into the right atrium.

## **Right Ventricle**

The right ventricle communicates with the right atrium through the atrioventricular orifice and with the pulmonary trunk through the pulmonary orifice. The walls of the right ventricle are much thicker than those of the right atrium and show several internal projecting ridges formed of muscle bundles. The projecting ridges give the ventricular wall a spongelike appearance and are known as trabeculae carneae.

The tricuspid valve guards the atrioventricular orifice and consists of three cusps formed by a fold of endocardium with some connective tissue enclosed: anterior, septal, and inferior (posterior) cusps.

The pulmonary valve guards the pulmonary orifice and consists of three semilunar cusps formed by folds of endocardium with some connective tissue enclosed.

## **Left Atrium**

Similar to the right atrium, the left atrium consists of a main cavity and a left auricle. The left atrium is situated behind the right atrium and forms the greater part of the base or the posterior surface of the heart

### **Openings into the Left Atrium**

The four pulmonary veins, two from each lung, open through the posterior wall and have no valves. The left atrioventricular orifice is guarded by the mitral valve.

## **Left Ventricle**

The left ventricle communicates with the left atrium through the atrioventricular orifice (It consists of two cusps valve) and with the aorta through the aortic orifice (aortic valve guards). The walls of the left ventricle are three times thicker than those of the right ventricle. (The left intraventricular blood pressure is six times higher than that inside the right ventricle).

## **Structure of the Heart**

The walls of the heart are composed of a thick layer of cardiac muscle, the myocardium, covered externally by the epicardium and lined internally by the endocardium. The atrial portion of the heart has relatively thin walls and is divided by the atrial (interatrial) septum into the right and left atria. The septum runs from the anterior wall of the heart backward and to the right. The ventricular portion of the heart has thick walls and is divided by the ventricular (interventricular) septum into the right and left ventricles.

## **Conducting System of the Heart**

The normal heart contracts rhythmically at about 70 to 90 beats per minute in the resting adult. The rhythmic contractile process originates spontaneously in the conducting system and the impulse travels to different regions of the heart, so the atria contract first and together, to be followed later by the contractions of both ventricles together. The slight delay in the passage of the impulse from the atria to the ventricles allows time for the atria to empty their blood into the ventricles before the ventricles contract.

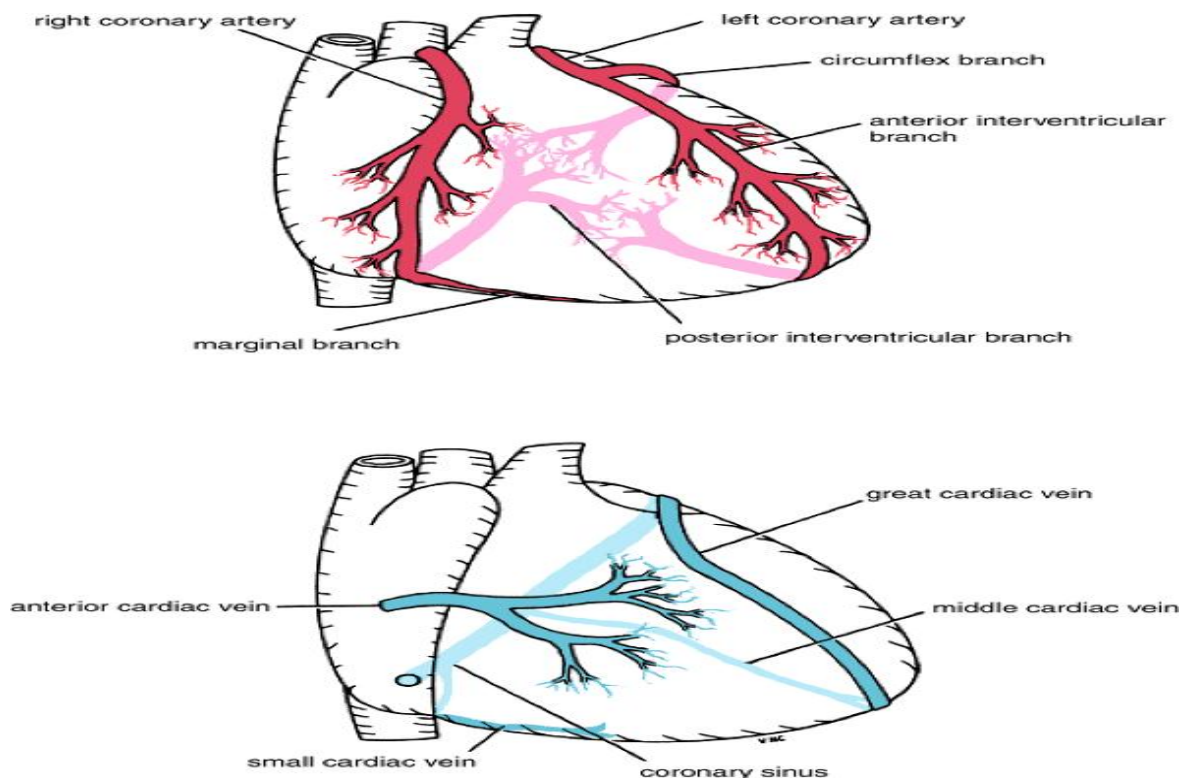
The conducting system of the heart consists of **specialized cardiac muscle present in the sinuatrial node, the atrioventricular node, the atrioventricular bundle and its right and left terminal branches, and the subendocardial plexus of Purkinje fibers (specialized cardiac muscle fibers that form the conducting system of the heart).**

### Arterial Supply of the Heart

The arterial supply of the heart is provided by the right and left coronary arteries, which arise from the ascending aorta immediately above the aortic valve.

### Venous Drainage of the Heart

Most blood from the heart wall drains into the right atrium through the coronary sinus.



## **Large Veins of the Thorax**

### **Brachiocephalic Veins**

The right brachiocephalic vein and the left brachiocephalic vein. It passes obliquely downward and to the right behind the manubrium sterni and in front of the large branches of the aortic arch. The left branch joins the right brachiocephalic vein to form the **superior vena cava**.

### **Superior Vena Cava**

The superior vena cava contains all the venous blood from the head and neck and both upper limbs and is formed by the union of the two brachiocephalic veins. It passes downward to end in the right atrium of the heart.

### **Azygos Veins**

The azygos veins consist of the main azygos vein, the inferior hemiazygos vein, and the superior hemiazygos vein. They drain blood from the posterior parts of the intercostal spaces, the posterior abdominal wall, the pericardium, the diaphragm, the bronchi, and the esophagus.

### **Azygos Vein**

The origin of the azygos vein is variable. It ascends through the aortic opening in the diaphragm on the right side of the aorta to the level of the fifth thoracic vertebra. Here it arches forward above the root of the right lung to empty into the posterior surface of the superior vena cava.

### **Inferior Hemiazygos Vein**

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

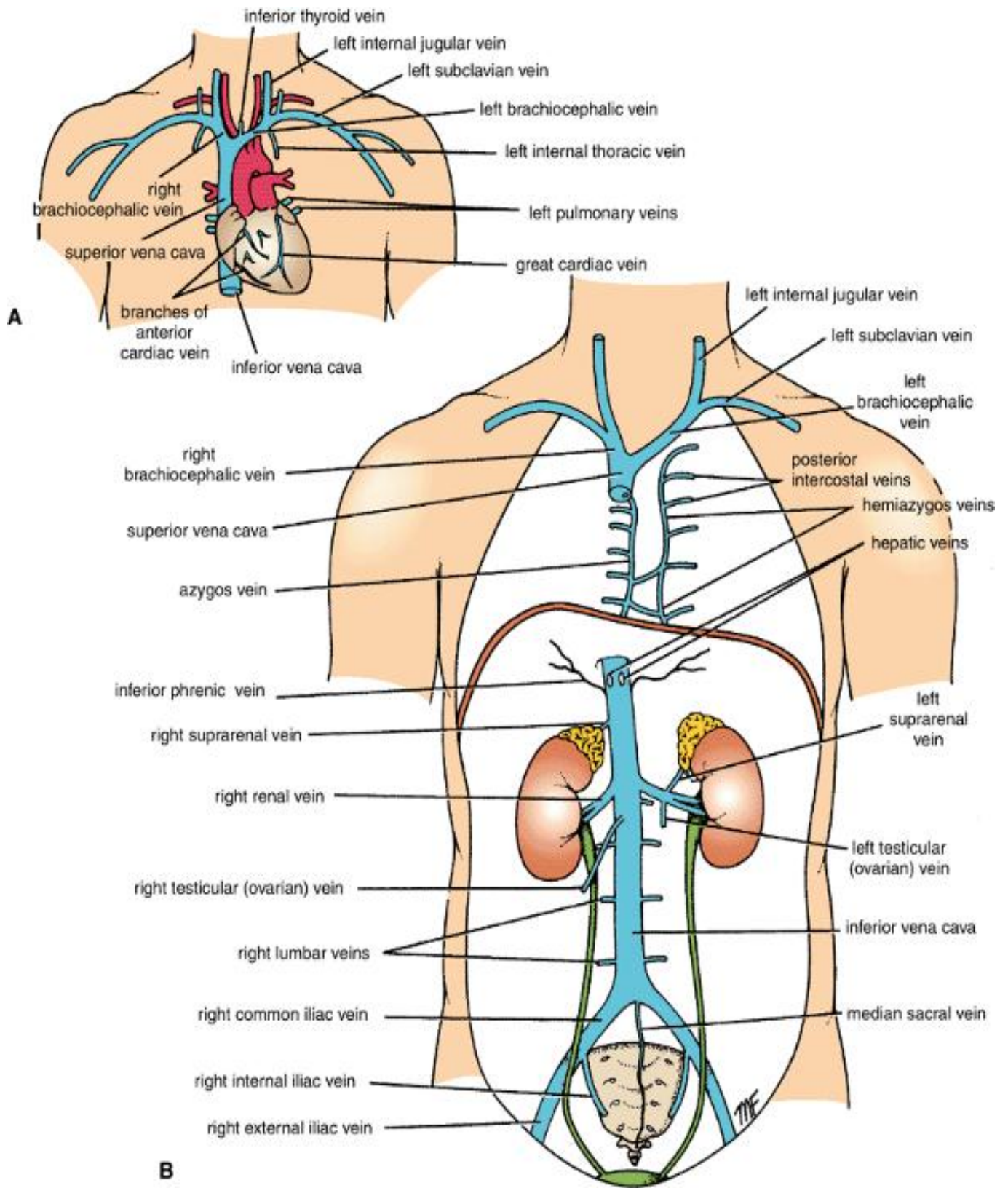
### **Superior Hemiazygos Vein**

The superior hemiazygos vein is formed by the union of the fourth to the eighth intercostal veins. It joins the azygos vein at the level of the seventh thoracic vertebra.

### **Inferior Vena Cava**

The inferior vena cava pierces the central tendon of the diaphragm opposite the eighth thoracic vertebra and almost immediately enters the lowest part of the right atrium.

**Pulmonary Veins** Two pulmonary veins leave each lung carrying oxygenated blood to the left atrium of the heart .





## **Large Arteries of the Thorax**

### **Aorta**

The aorta is the main arterial trunk that delivers oxygenated blood from the left ventricle of the heart to the tissues of the body. It is divided for purposes of description into the following parts: ascending aorta, arch of the aorta, descending thoracic aorta, and abdominal aorta.

### **Ascending Aorta**

The ascending aorta begins at the base of the left ventricle and runs upward and forward to come to lie behind the right half of the sternum at the level of the sternal angle, where it becomes continuous with the arch of the aorta.

### **Branches**

The right coronary artery arises from the anterior aortic sinus, and the left coronary artery arises from the left posterior aortic sinus.

### **Arch of the Aorta**

The arch of the aorta is a continuation of the ascending aorta. It lies behind the manubrium sterni and arches upward, backward, and to the left in front of the trachea (its main direction is backward). It then passes downward to the left of the trachea and, at the level of the sternal angle, becomes continuous with the descending aorta.

### **Branches**

The **brachiocephalic artery** arises from the convex surface of the aortic arch. It passes upward and to the right of the trachea.

The **left common carotid** artery arises from the convex surface of the aortic arch on the left side of the brachiocephalic artery. It runs upward and to the left of the trachea and enters the neck behind the left sternoclavicular joint.

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.

### **Descending Thoracic Aorta**

The descending thoracic aorta lies in the posterior mediastinum and begins as a continuation of the arch of the aorta on the left side of the lower border of the body of the fourth thoracic vertebra (i.e., opposite the sternal angle). It runs downward in the posterior mediastinum, inclining forward and medially to reach the anterior surface of the vertebral column. At the level of the 12th thoracic vertebra, it passes behind the diaphragm (through the aortic opening) in the midline and becomes continuous with the abdominal aorta.

### **Branches**

Posterior intercostal arteries are given off to the lower nine intercostal spaces on each side. Subcostal arteries are given off on each side and run along the lower border of the 12th rib to enter the abdominal wall.

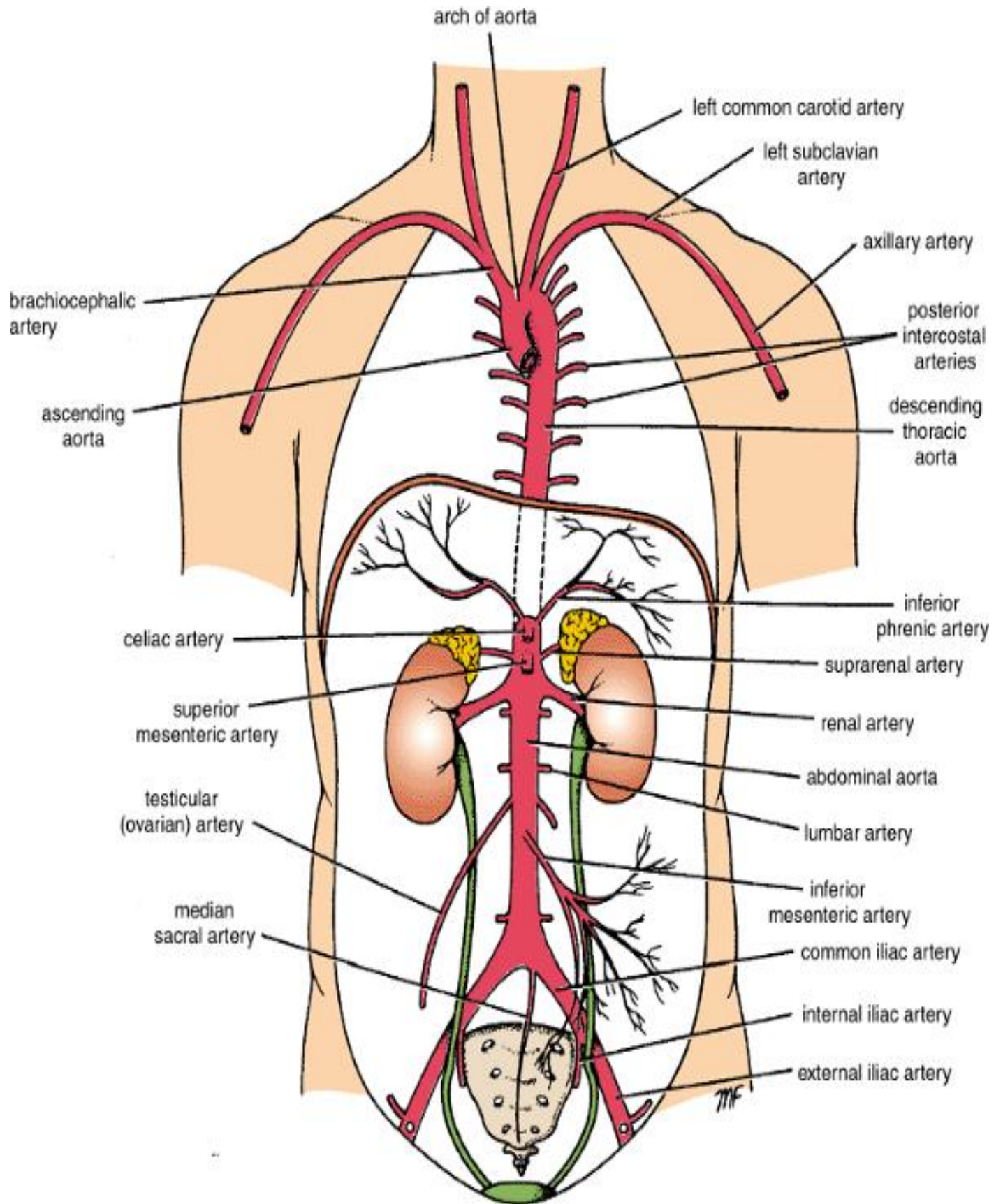
Pericardial, esophageal, and bronchial arteries are small branches that are distributed to these organs.

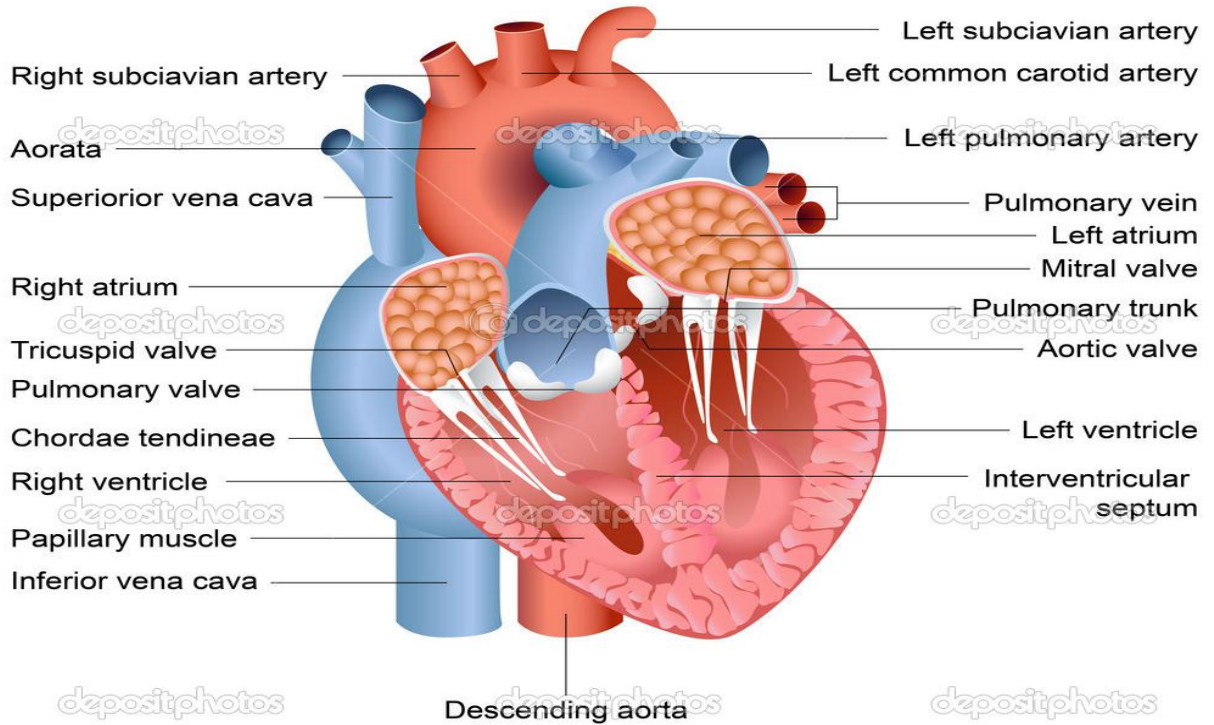
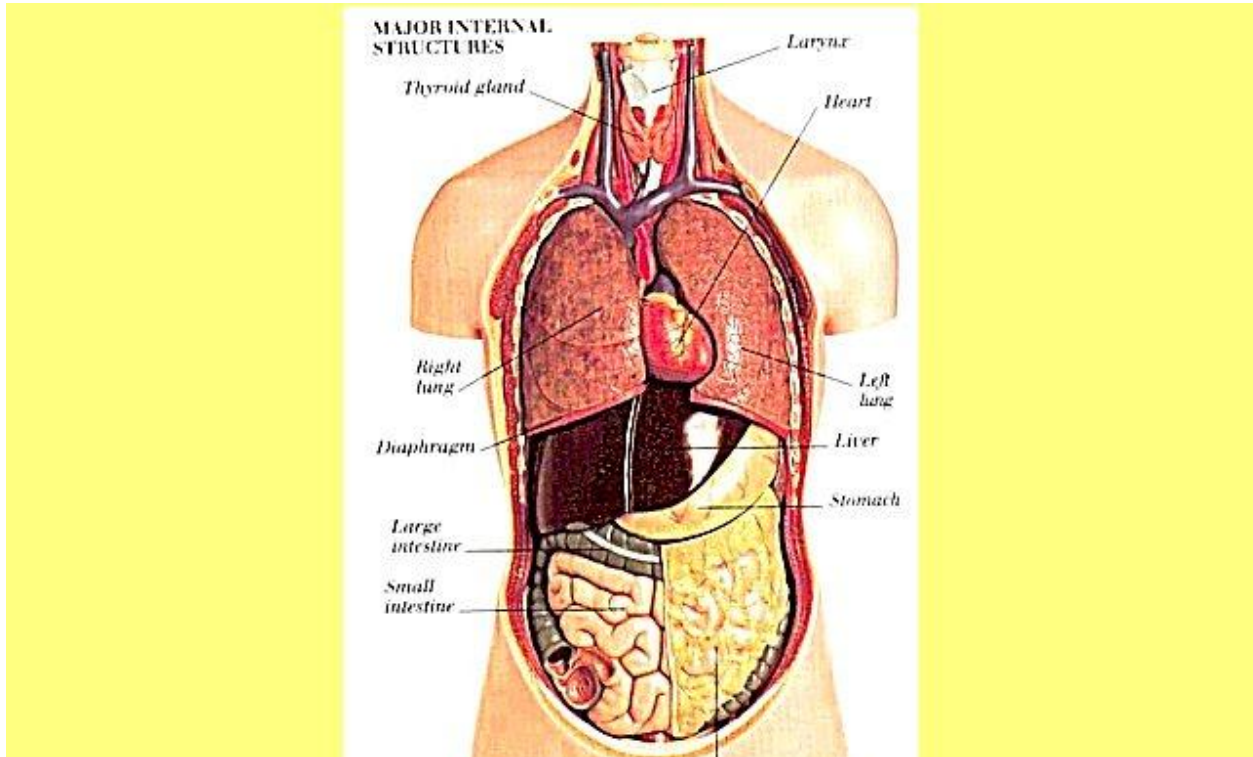
## **Pulmonary Trunk**

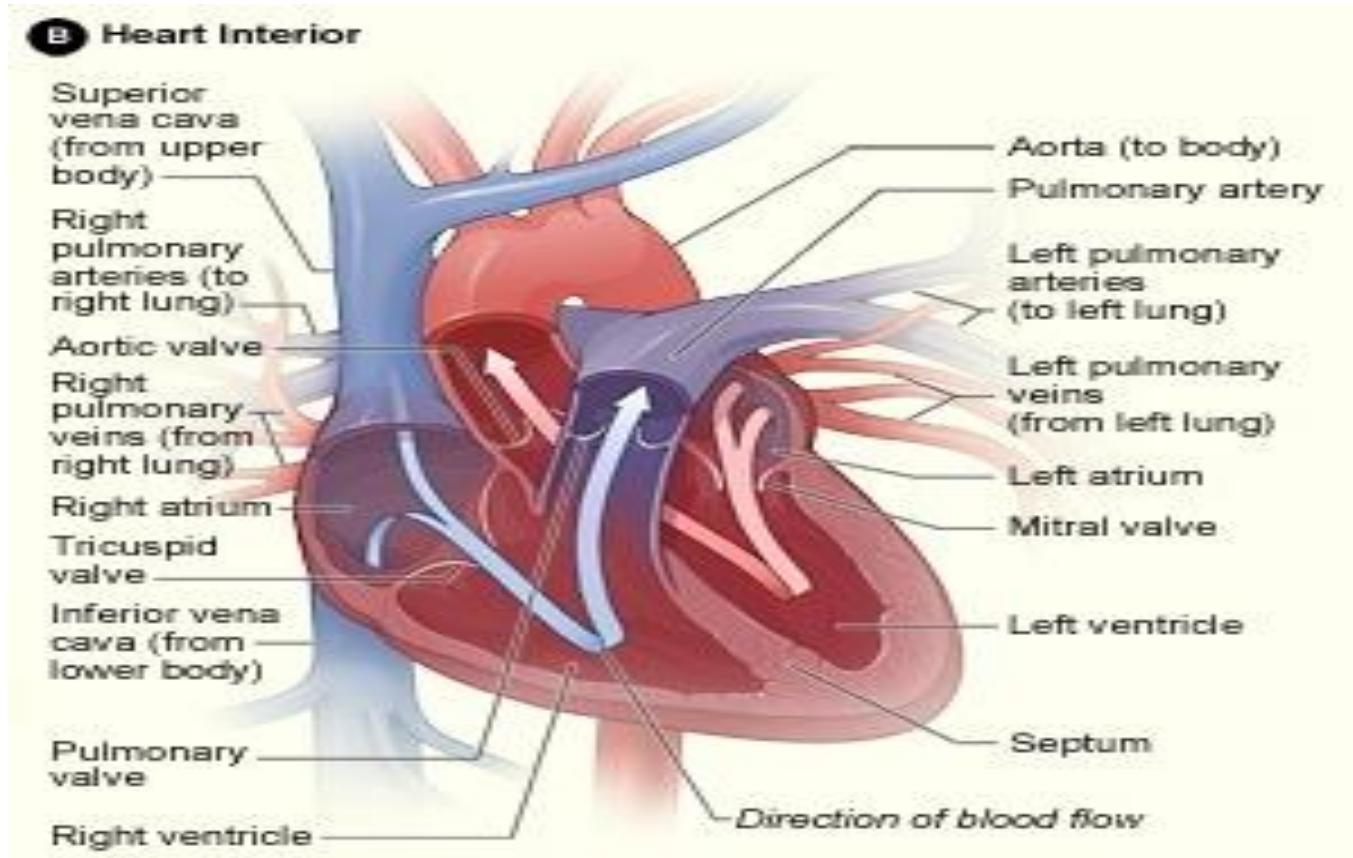
The pulmonary trunk conveys deoxygenated blood from the right ventricle of the heart to the lungs. It leaves the upper part of the right ventricle and runs upward, backward, and to the left. It is about 2 in. (5 cm) long and terminates in the concavity of the aortic arch by dividing into right and left pulmonary arteries. Together with the ascending aorta, it is enclosed in the fibrous pericardium and a sheath of serous pericardium.

## **Branches**

The right pulmonary artery runs to the right 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 Digestive System

The human digestive system is an extended tube with specialized parts between two openings, the mouth and the anus. Digestion takes place within a tube called the digestive tract, which begins with the mouth and ends with the anus. The functions of the digestive system are to ingest food, digest it to nutrients that can cross plasma membranes, absorb nutrients, and eliminate indigestible remains.

*((The digestive or alimentary system (gastroenterology) consists of the organs and glands associated with ingestion, mastication (chewing), deglutition (swallowing), digestion, and absorption of food and the elimination of feces (solid waste) remaining after the nutrients have been absorbed)).*

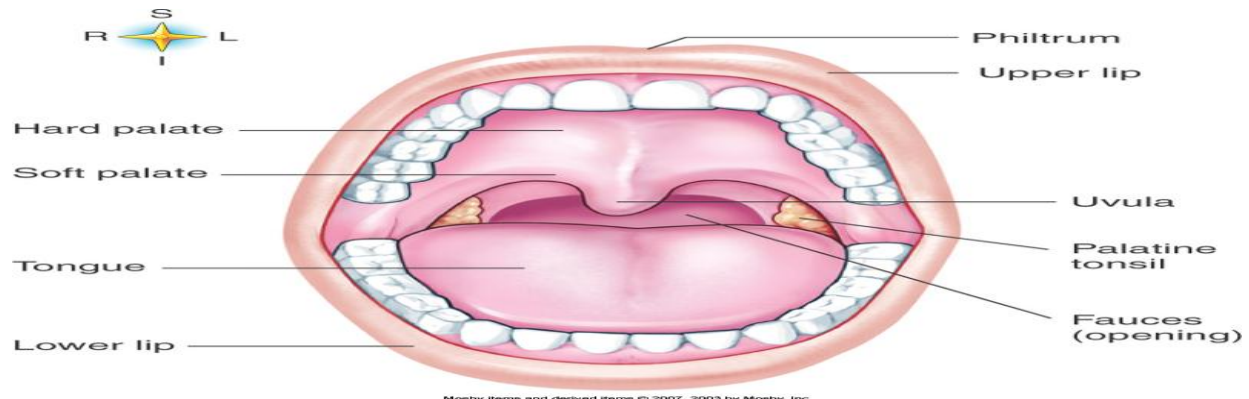
- Structure of the Oral Cavity

1. Lips

- Externally covered by skin, internally by a mucous membrane
- Keep food in the mouth
- Sense temperature and texture of food

2. Cheeks

- Lateral boundaries of the oral cavity
- Formed largely by the buccinator muscle lined with mucous membrane



## Mouth

### 3. Tongue

- Skeletal muscle covered by mucous membrane
- Covered with papillae which contain taste buds
- Lingual frenulum helps anchor the tongue to the floor of the mouth
- Rich supply of blood vessels allows for quick absorption (sublingual medications)

**4. hard palate** and a posterior (toward the back) **soft palate**. The hard palate contains several bones, but the soft palate is composed entirely of muscle.

### 5. Salivary Glands

#### **Parotid glands**

Anterior and inferior to the ear Produce watery saliva containing enzymes;

#### **Submandibular glands**

At the mandibular angle Produce saliva containing enzymes

#### **Sublingual glands**

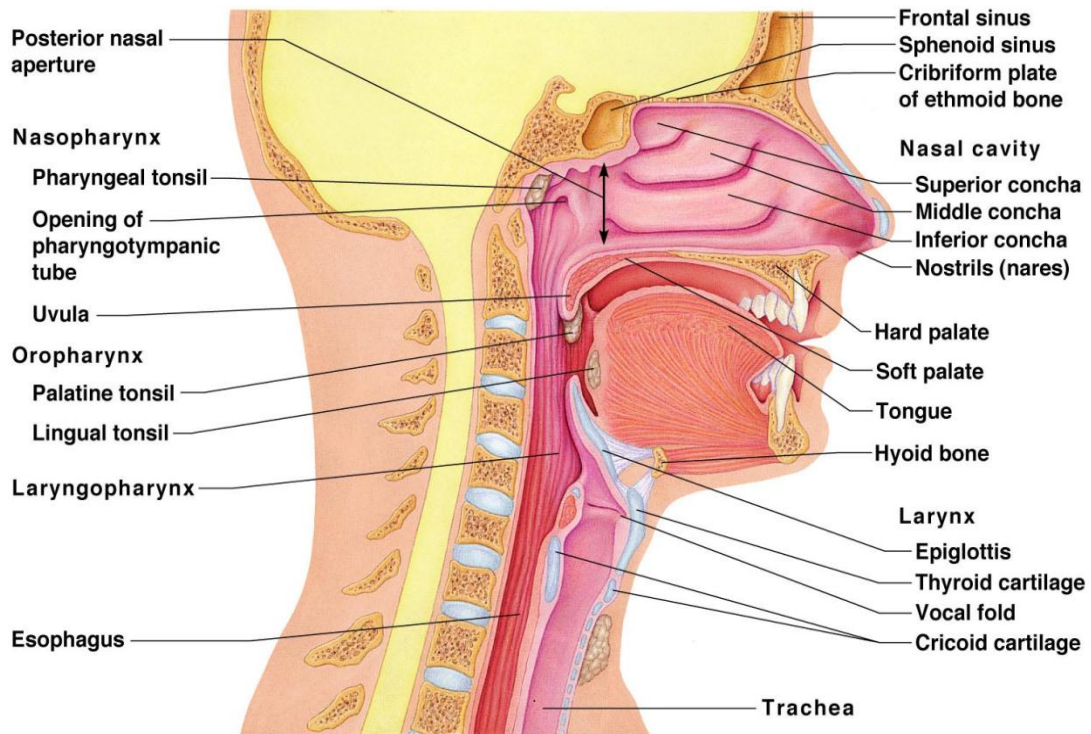
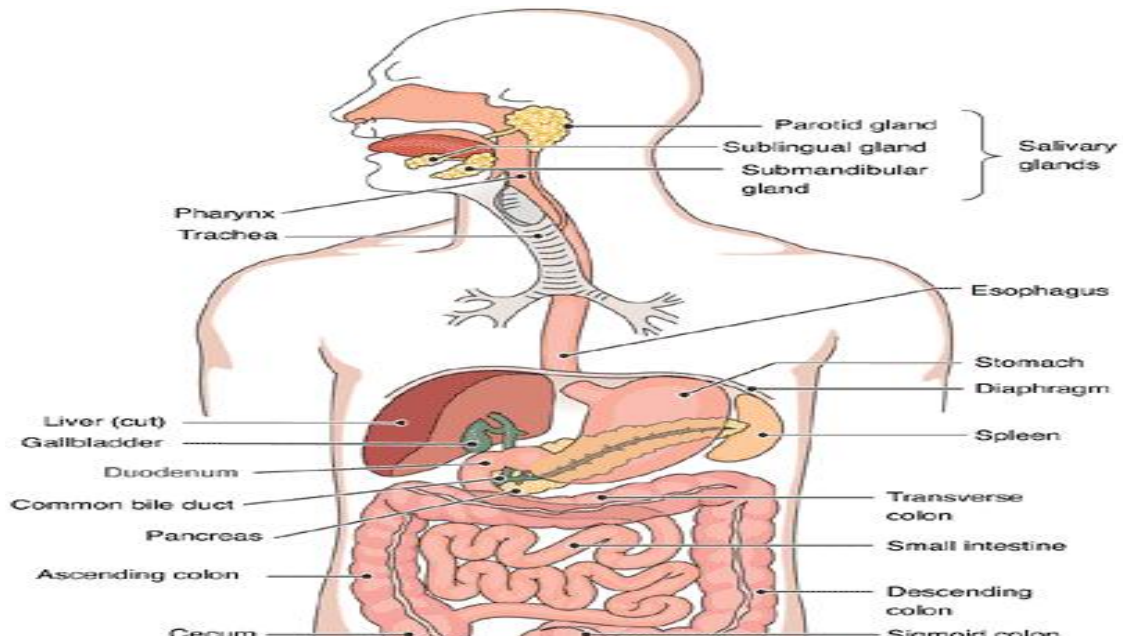
In front of the submandibular glands Produce mucus saliva

- **Pharynx**
- The pharynx is the part of the digestive system situated posterior to the nasal and oral cavities and posterior to the larynx. It is therefore divisible into nasal, oral, and laryngeal parts:



- **Esophagus**

- The esophagus is a muscular tube that passes from the pharynx through the thoracic cavity and diaphragm into the abdominal cavity where it joins the stomach.

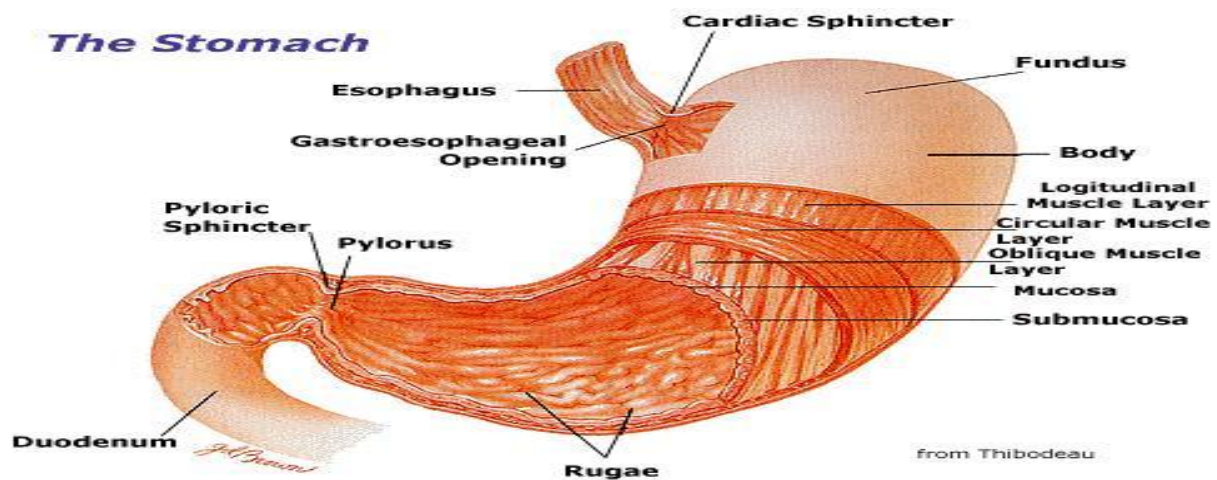


## Stomach

The stomach (Cardiac, Fundus, body and pylorus)(greater and lesser curvatures; and gastro-esophageal and pyloric openings) Cardiac is a thick-walled, J-shaped organ that lies on the left side of the body beneath the diaphragm. The stomach is continuous with the esophagus above and the duodenum of the small intestine below. The stomach stores food and aids in digestion. The wall of the stomach has deep folds, which disappear as the stomach fills to an approximate capacity of one liter.

## The Small Intestine

The **small intestine** (duodenum, jejunum, ileum) is named for its small diameter (compared to that of the large intestine), The small intestine averages about 6 meters (18 feet) in length, compared to the large intestine, which is about 1.5



meters.

**duodenum** It is C-shaped, the concavity enclosing the head of the pancreas. It extends from the pylorus to the duodeno-jejunal flexure. Ducts from the liver and pancreas join to form one duct that enters the duodenum. The small intestine receives bile from the liver and pancreatic juice from the pancreas via this duct.

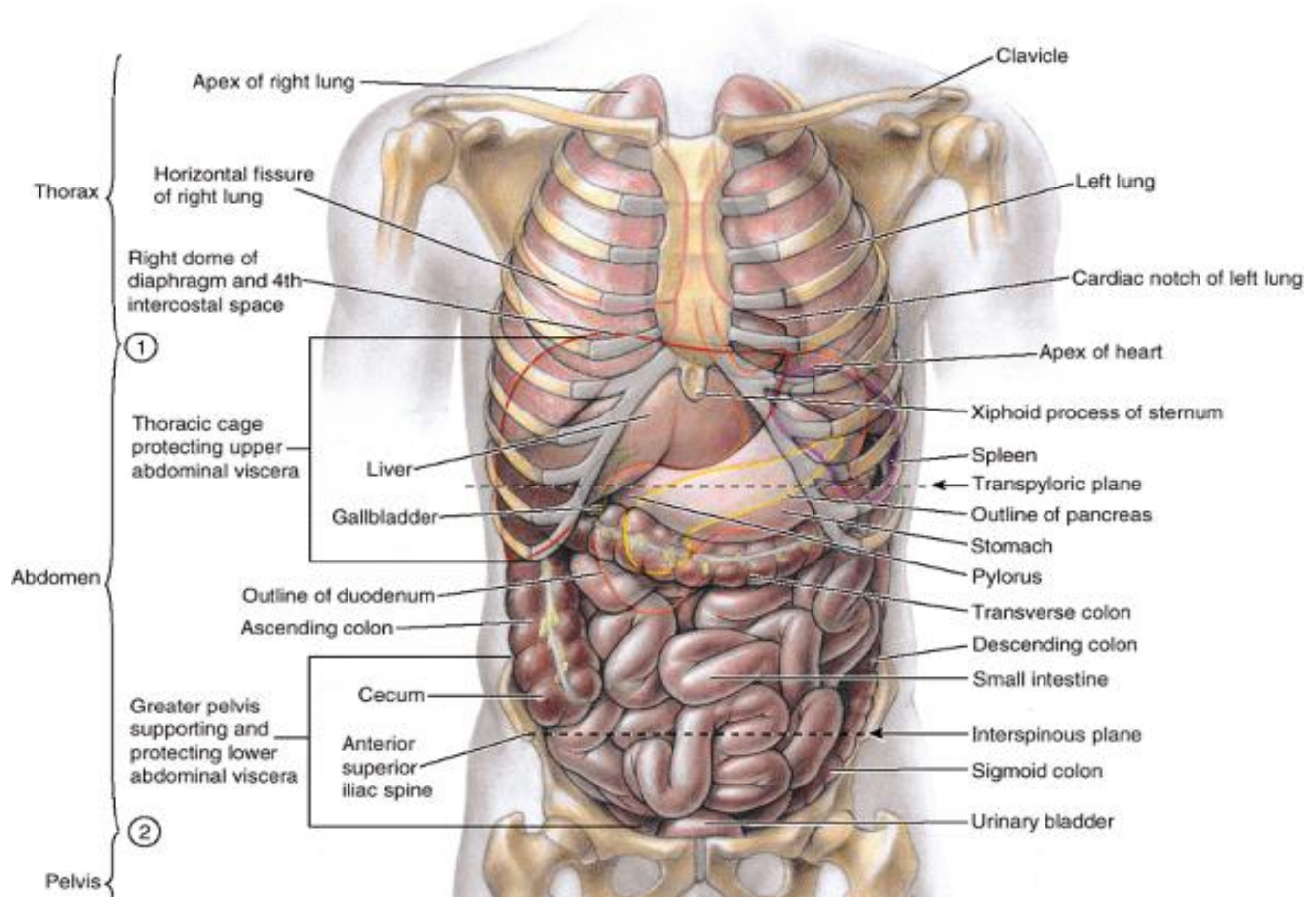
The jejunum and ileum are the continuous coiled part of the small intestine. In contrast to the ileum, the jejunum is shorter

## The Large Intestine

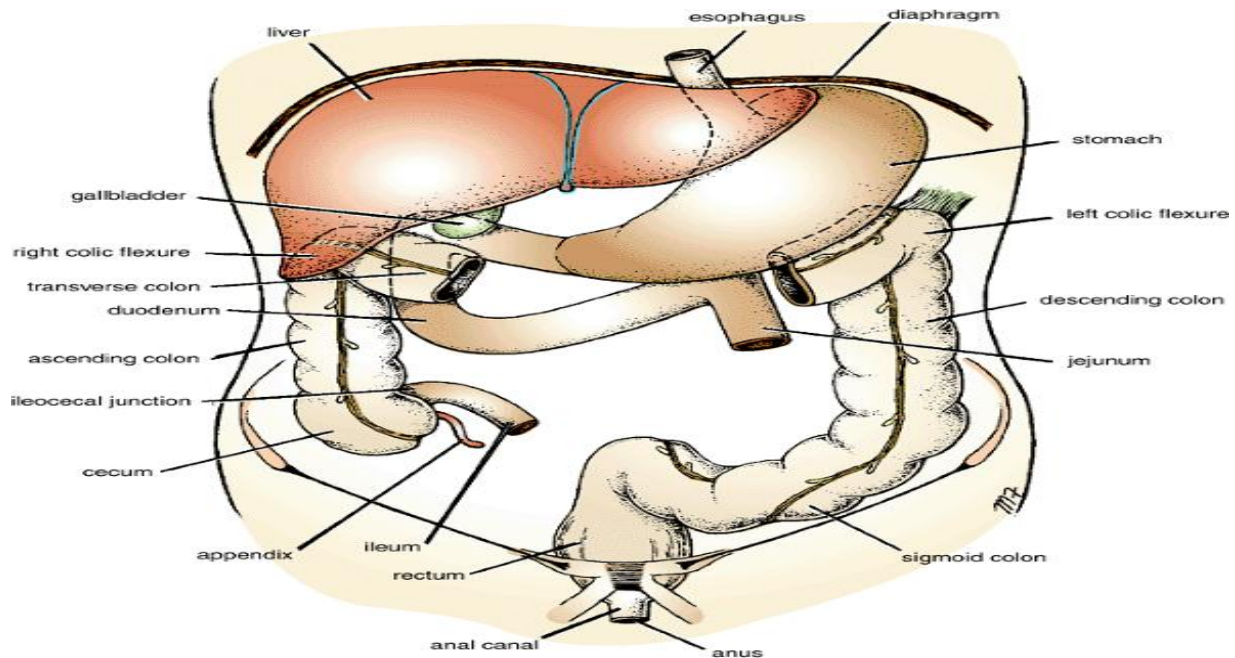
The large intestine absorbs water, salts, and some vitamins. The large intestine is divided into the cecum, appendix, ascending colon, transverse colon, descending colon, sigmoid colon, rectum, and anal canal.

The cecum is a blind-ended sac

The appendix is a worm-shaped tube that arises from its medial side .



The rectum occupies the posterior part of the pelvic cavity. It is continuous above with the sigmoid colon and descends in front of the sacrum to leave the pelvis by piercing the pelvic floor. Here, it becomes continuous with the anal canal.

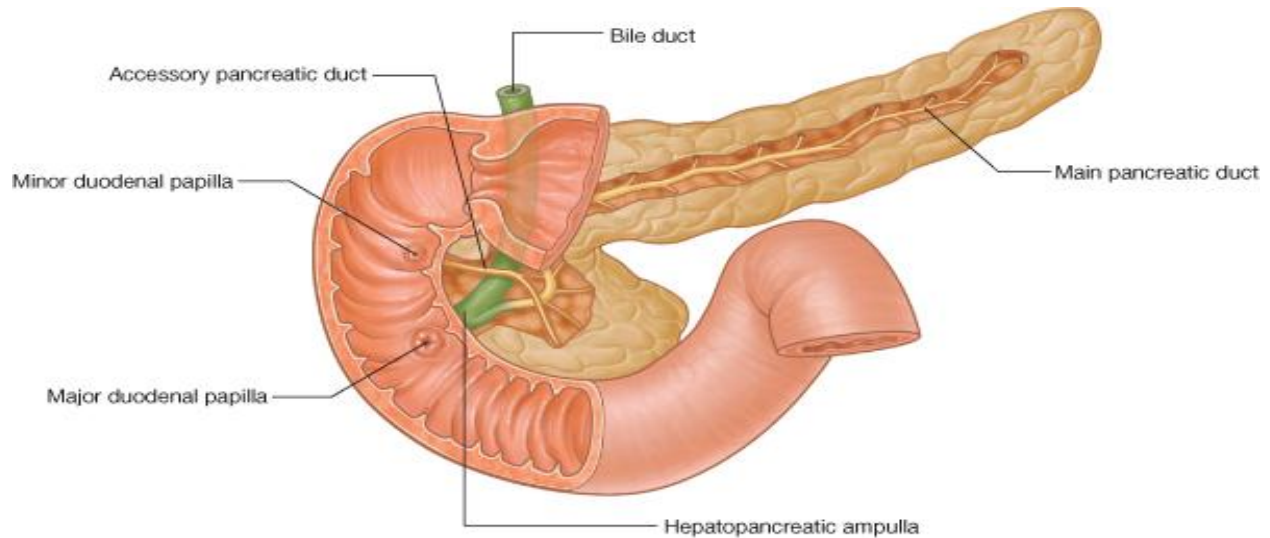


### Three Accessory Organs

The pancreas, liver, and gallbladder are accessory digestive

## Pancreas

The pancreas is a soft, lobulated organ extends from the duodenum to the spleen. that has both an endocrine and an exocrine function. the **head of pancreas** lies within the C-shaped concavity of the duodenum;



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## Liver

The **liver**, which is the largest gland in the body, lies mainly in the upper right section of the abdominal cavity, under the diaphragm. The liver is divided into right and left lobes by fossae for the gallbladder

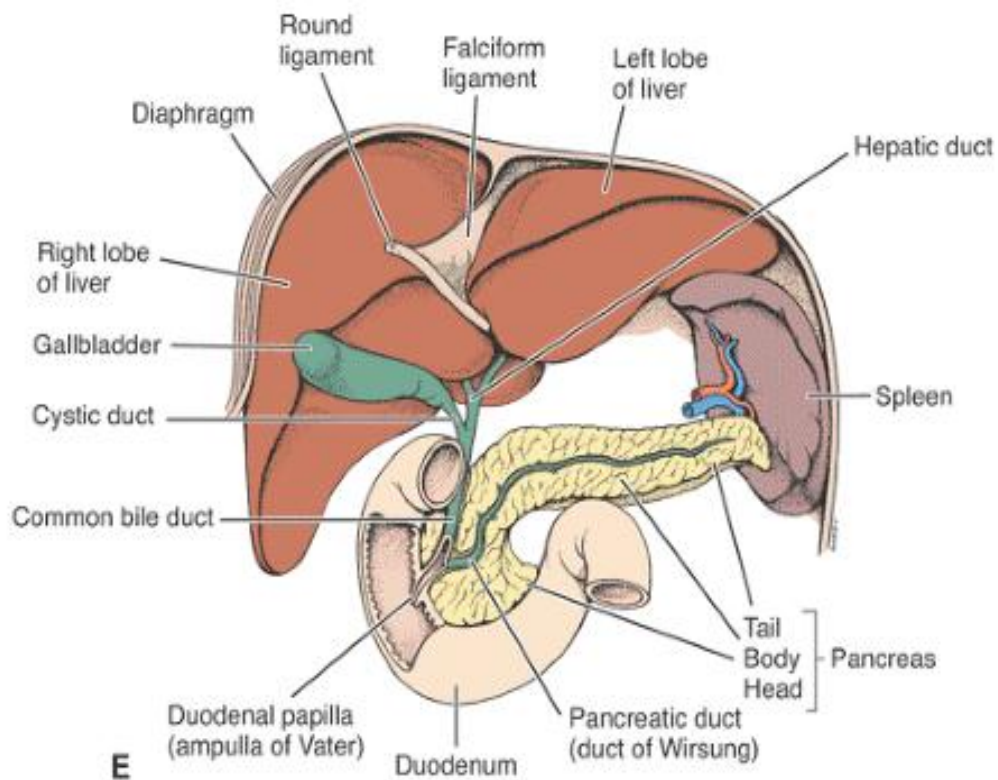
The **right lobe of liver** is the largest lobe, whereas the **left lobe of liver** is smaller. Surfaces of the liver include: the surfaces of liver are

a **diaphragmatic surface** a **visceral surface**

- **Gallbladder**

The **gallbladder** muscular sac attached to the surface of the liver .About 1,000 ml of bile are produced by the liver each day, and any excess is stored in the gallbladder. bile leaves the gallbladder and proceeds to the duodenum via the common bile duct.

- gallbladder. This completes the formation of the **bile duct**. The bile duct continues to descend, passing posteriorly to the superior part of the duodenum before joining with the pancreatic duct to enter the descending part of the duodenum at the major duodenal papilla.



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**Anatomy:** is the science of the structure and function of the body.

**Clinical anatomy** is the study of the macroscopic structure and function of the body as it relates to the practice of medicine and other health sciences.

**Basic anatomy** is the study of the minimal amount of anatomy consistent with the understanding of the overall structure and function of the body.

### **Anatomical Terms**

When discussing anatomy, the following terms are used to describe the relative positions of the parts of the body. When using these terms, it is assumed that the body is in the anatomical position.

**Lateral** - More distant to the body midline. In the anatomical position, the radius is lateral to the ulna. A simpler example is the "thumb" is lateral to the "pinky."

**Medial** - Closer to the midline; on the inner side. The sternum (breast plate) is medial to the clavicle (shoulder bone).

**Superior** - Above, towards the cephalic (head) end. The cranial cavity (head cavity) is superior to the scapula (shoulder blade).

**Inferior** - Below, towards the plantar (foot) end. The patella (knee cap) is inferior to the femur (thigh bone).

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**Anterior** - Towards the front of the body. The sternum is anterior to the spine. Also known as ventral, but this term is not as common in human anatomy.

**Posterior** - Towards the rear/backside of the body. The fibula is posterior to the tibia. Also known as dorsal, but this term is not as common.

**Superficial** - Closer to the skin, nearer the body surface. Skin is superficial to the organs.

**Deep** - Further from the body surface.

**internal** and **external** are used to describe the relative distance of a structure from the center of an organ or cavity

**Distal** - Further from the limb's attachment to the trunk (where 'trunk' refers to the 'torso' of the body: the body minus the head, neck, and limbs).

**proximal** - Nearer to the limb's attachment to the trunk. The humerus is proximal to the radius.



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## Anatomical plane:

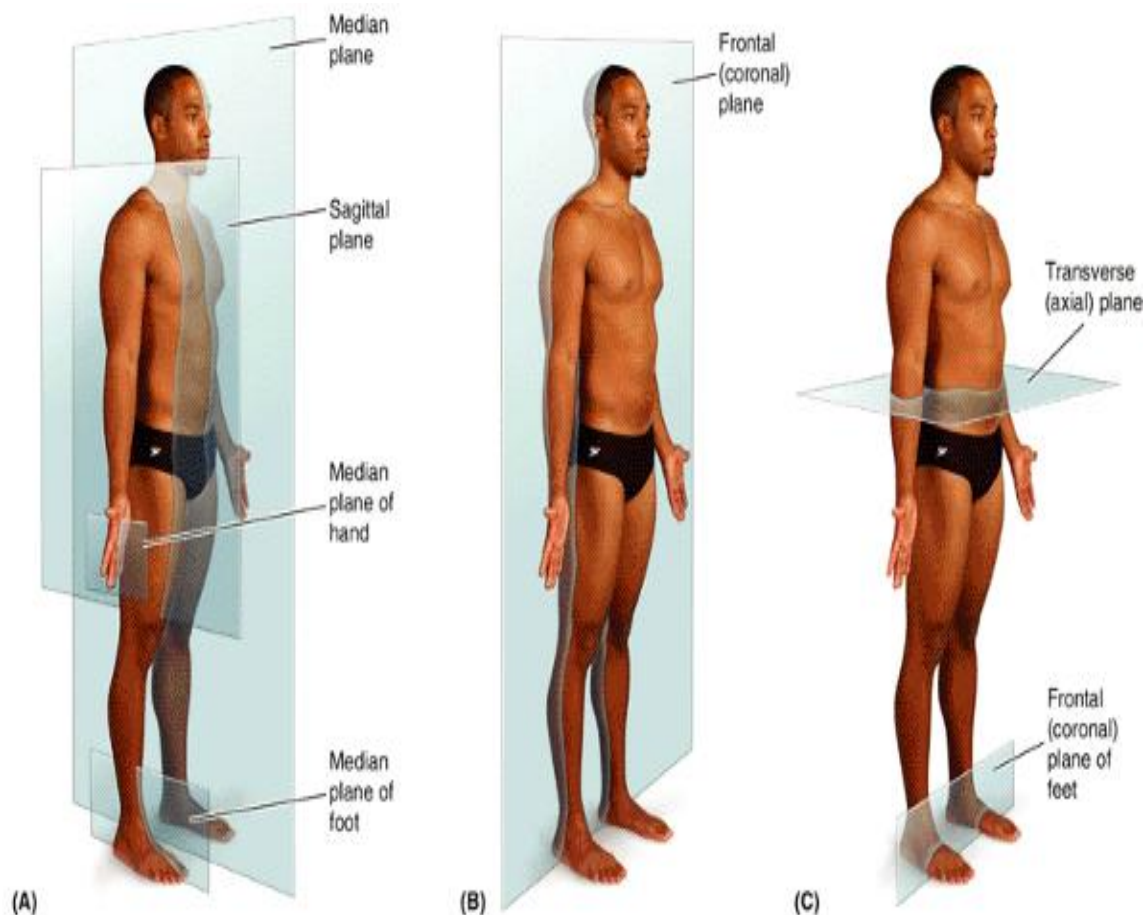
### Median Sagittal Plane

This is a vertical plane passing through the center of the body, dividing it into equal right and left halves (Fig. 1-1).

### Coronal Planes

These planes are imaginary vertical planes at right angles to the median plane (Fig. 1-1).

**Horizontal, or Transverse Planes** These planes are at right angles to both the median and the coronal planes

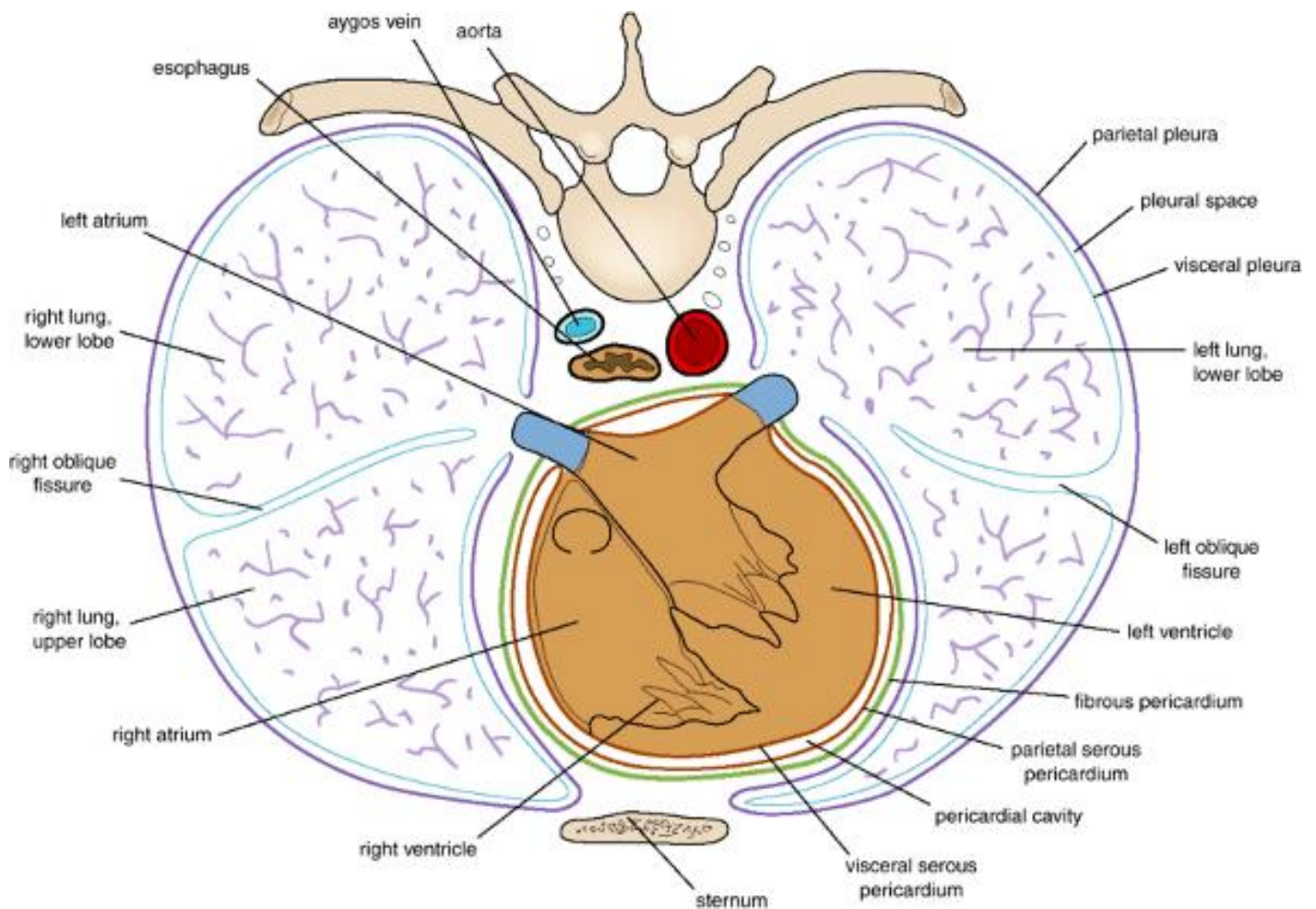


# Anatomy 1<sup>st</sup> stage Lec. 1

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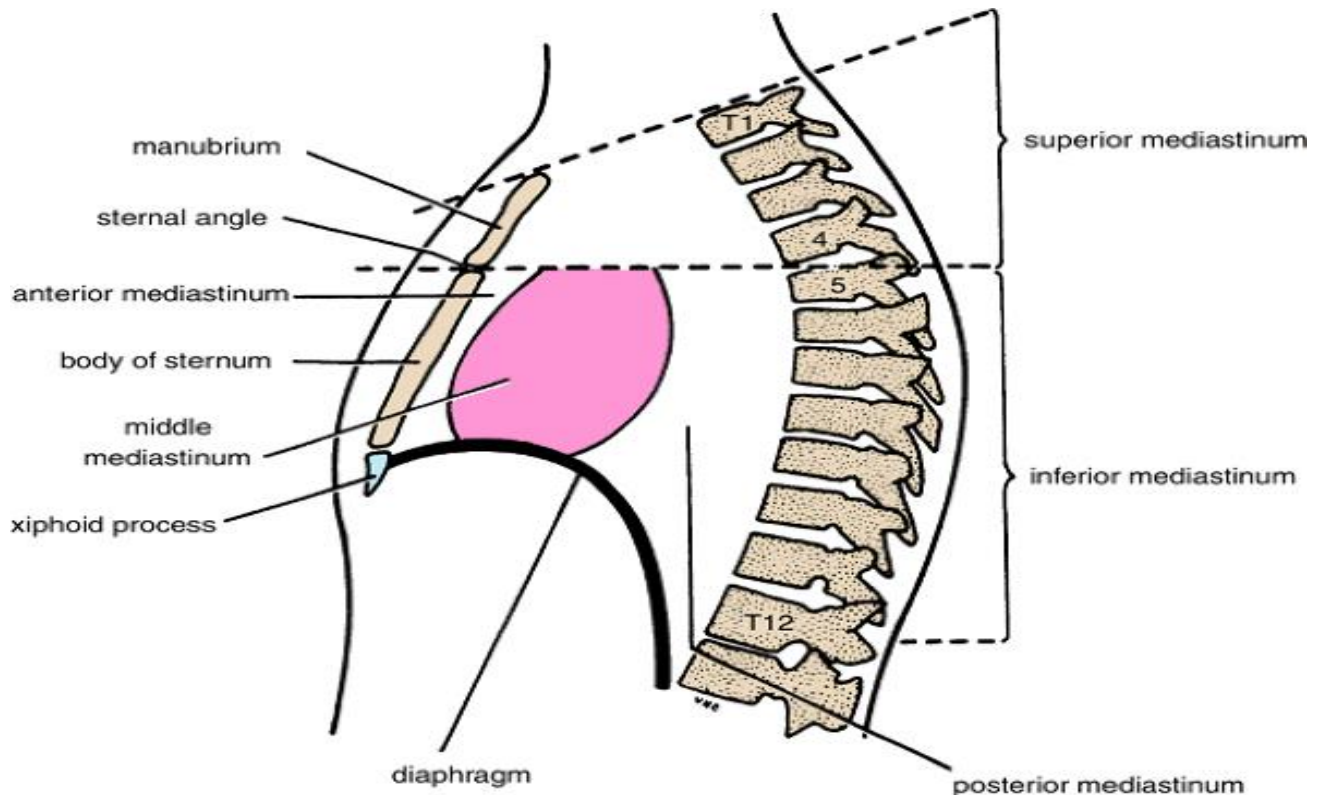
## Chest Cavity

The chest cavity is bounded by the chest wall and below by the diaphragm. It extends upward into the root of the neck about one fingerbreadth above the clavicle on each side. The diaphragm, which is a very thin muscle, is the only structure (apart from the pleura and peritoneum) that separates the chest from the abdominal viscera. The chest cavity can be divided into a median partition, called the mediastinum, and the laterally placed pleurae and lungs



## Anatomy 1<sup>st</sup> stage Lec. 1

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## Mediastinum

The mediastinum, though thick, is a movable partition that extends superiorly to the thoracic outlet and the root of the neck and inferiorly to the diaphragm. It extends anteriorly to the sternum and posteriorly to the vertebral column. It contains the remains of the thymus, the heart and large blood vessels, the trachea and esophagus, the thoracic duct and lymph nodes, the vagus and phrenic nerves, and the sympathetic trunks.

The mediastinum is divided into **superior and inferior mediastina**.

The **inferior mediastinum** is further subdivided into the **middle mediastinum**, which consists of the pericardium and heart; **the anterior mediastinum**, which is a space between the pericardium and the sternum; and the **posterior mediastinum**, which lies between the pericardium and the vertebral column.

## **Anatomy 1<sup>st</sup> stage Lec. 1**

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### **Superior Mediastinum**

(a) Thymus, (b) large veins, (c) large arteries, (d) trachea, (e) esophagus and thoracic duct, and (f) sympathetic trunks

The superior mediastinum is bounded in front by the manubrium sterni and behind by the first four thoracic vertebrae (Fig. 3).

### **Inferior Mediastinum**

(a) Thymus, (b) heart within the pericardium with the phrenic nerves on each side, (c) esophagus and thoracic duct, (d) descending aorta, and (e) sympathetic trunks

### **Pleurae**

The pleurae and lungs lie on either side of the mediastinum within the chest cavity.

Each pleura has two parts: **a parietal layer**, which lines the thoracic wall; and **a visceral layer**, which completely covers the outer surfaces of the lungs.

### **Pericardium**

The pericardium is a fibroserous sac that encloses the heart and the roots of the great vessels. Its function is to restrict excessive movements of the heart as a whole and to serve as a lubricated container in which the different parts of the heart can contract. The pericardium lies within the middle mediastinum

### **Fibrous Pericardium**

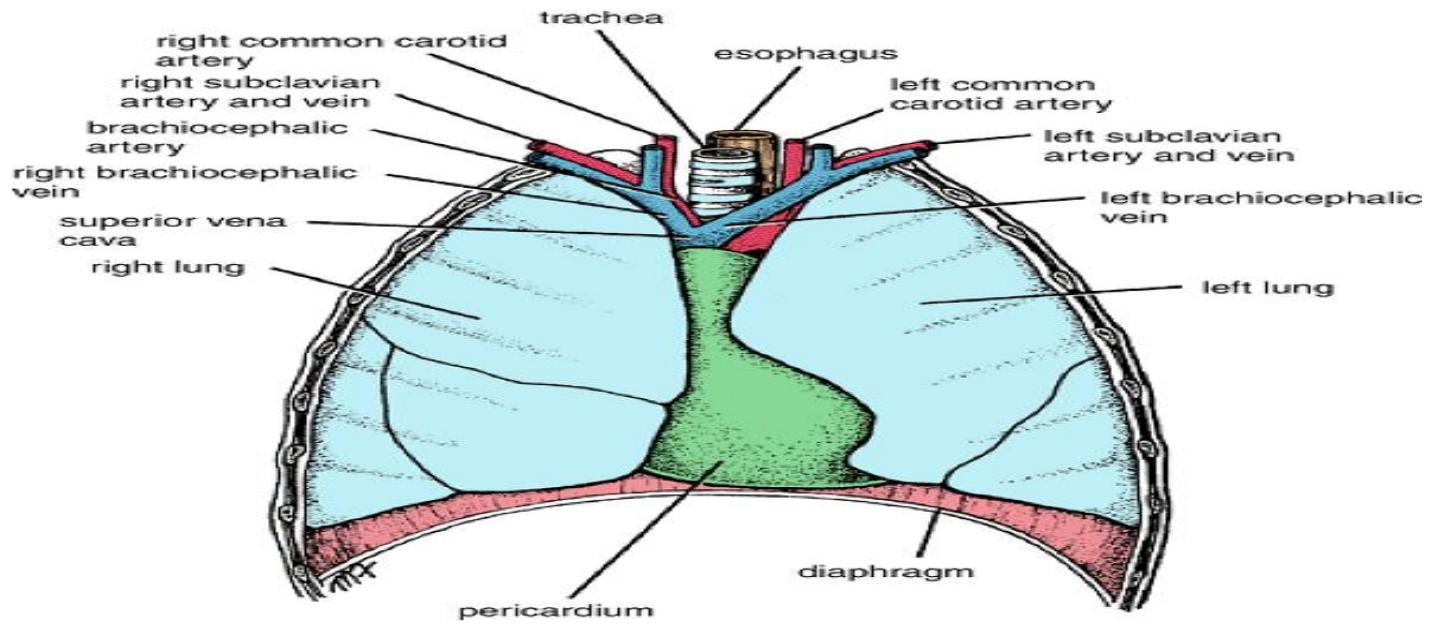
The fibrous pericardium is the strong fibrous part of the sac. It is firmly attached below to the central tendon of the diaphragm.

## Anatomy 1<sup>st</sup> stage Lec. 1

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### Serous Pericardium

The serous pericardium lines the fibrous pericardium and coats the heart. It is divided into **parietal** and **visceral layers**.



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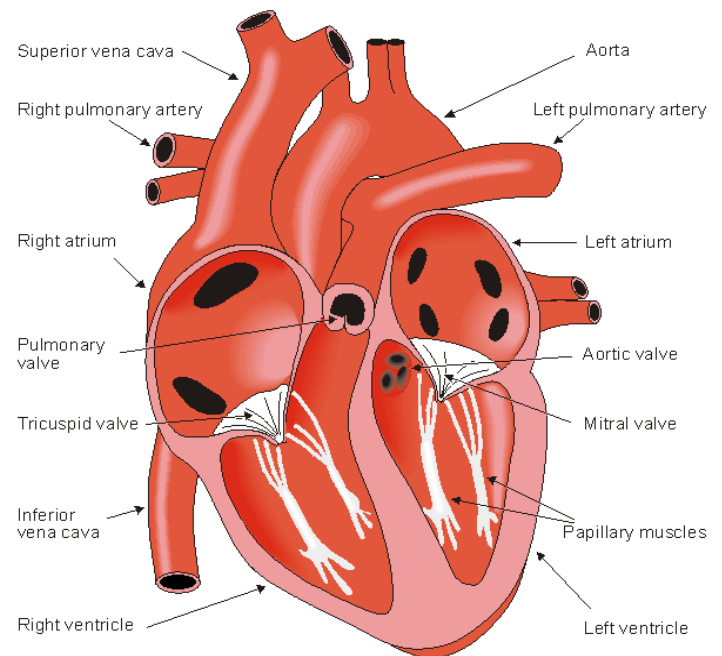
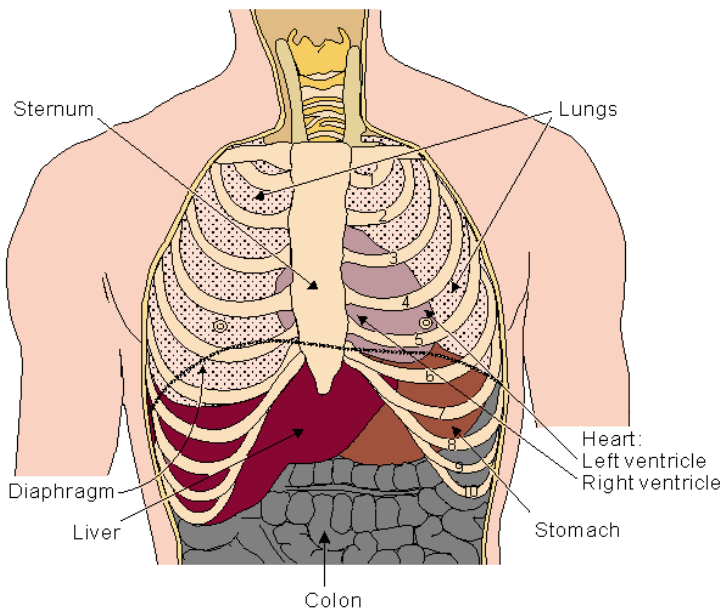
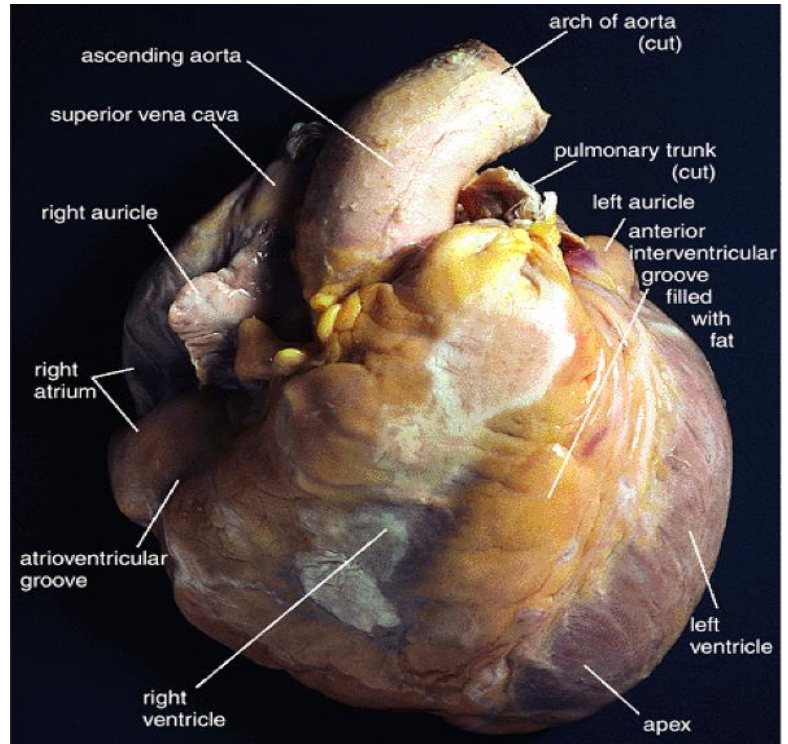
## Heart

The heart is a hollow muscular organ that is somewhat pyramid shaped and lies within the pericardium in the mediastinum.

### Location of the Heart

The heart is located in the chest between the lungs behind the sternum and above the diaphragm. It is surrounded by the pericardium. Its size is

about that of a fist, and its weight is about 250-300 g. Its center is located about 1.5 cm to the left of the midsagittal plane. Located above the heart are the great vessels: the superior and inferior vena cava, the pulmonary artery and vein, as well as the aorta. The aortic arch lies behind the heart.



## **Anatomy 1<sup>st</sup> stage Lec. 1**

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### **Chambers of the Heart**

The heart is divided by vertical septa into four chambers: the right and left atria and the right and left ventricles. The right atrium lies anterior to the left atrium, and the right ventricle lies anterior to the left ventricle.

The walls of the heart are composed of cardiac muscle, the myocardium; covered externally with serous pericardium, the epicardium; and lined internally with a layer of endothelium, the endocardium.

### **Openings into the Right Atrium**

**The superior vena cava** opens into the upper part of the right atrium; it has no valve. It returns the blood to the heart from the upper half of the body. **The inferior vena cava** (larger than the superior vena cava) opens into the lower part of the right atrium; It returns the blood to the heart from the lower half of the body.

**The coronary sinus**, which drains most of the blood from the heart wall ,opens into the right atrium between the inferior vena cava and the atrioventricular orifice. It is guarded by a rudimentary, nonfunctioning valve.

**The right atrioventricular orifice** lies anterior to the inferior vena cava opening and is guarded by the tricuspid valve.

**Many small orifices of small veins** also drain the wall of the heart and open directly into the right atrium.

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### **Right Ventricle**

The right ventricle communicates with the right atrium through the atrioventricular orifice and with the pulmonary trunk through the pulmonary orifice. The walls of the right ventricle are much thicker than those of the right atrium and show several internal projecting ridges formed of muscle bundles. The projecting ridges give the ventricular wall a spongelike appearance and are known as trabeculae carneae.

The tricuspid valve guards the atrioventricular orifice and consists of three cusps formed by a fold of endocardium with some connective tissue enclosed: anterior, septal, and inferior (posterior) cusps.

The pulmonary valve guards the pulmonary orifice and consists of three semilunar cusps formed by folds of endocardium with some connective tissue enclosed.

### **Left Atrium**

Similar to the right atrium, the left atrium consists of a main cavity and a left auricle. The left atrium is situated behind the right atrium and forms the greater part of the base or the posterior surface of the heart

### **Openings into the Left Atrium**

The four pulmonary veins, two from each lung, open through the posterior wall and have no valves. The left atrioventricular orifice is guarded by the mitral valve.



## **Anatomy 1<sup>st</sup> stage Lec. 1**

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### **Left Ventricle**

The left ventricle communicates with the left atrium through the atrioventricular orifice (It consists of two cusps valve) and with the aorta through the aortic orifice (aortic valve guards). The walls of the left ventricle are three times thicker than those of the right ventricle. (The left intraventricular blood pressure is six times higher than that inside the right ventricle).

### **Structure of the Heart**

The walls of the heart are composed of a thick layer of cardiac muscle, the myocardium, covered externally by the epicardium and lined internally by the endocardium. The atrial portion of the heart has relatively thin walls and is divided by the atrial (interatrial) septum into the right and left atria. The septum runs from the anterior wall of the heart backward and to the right. The ventricular portion of the heart has thick walls and is divided by the ventricular (interventricular) septum into the right and left ventricles.

### **Conducting System of the Heart**

The normal heart contracts rhythmically at about 70 to 90 beats per minute in the resting adult. The rhythmic contractile process originates spontaneously in the conducting system and the impulse travels to different regions of the heart, so the atria contract first and together, to be followed later by the contractions of both ventricles together. The slight delay in the passage of the impulse from the atria to the ventricles allows time for the atria to empty their blood into the ventricles before the ventricles contract.

## Anatomy 1<sup>st</sup> stage Lec. 1

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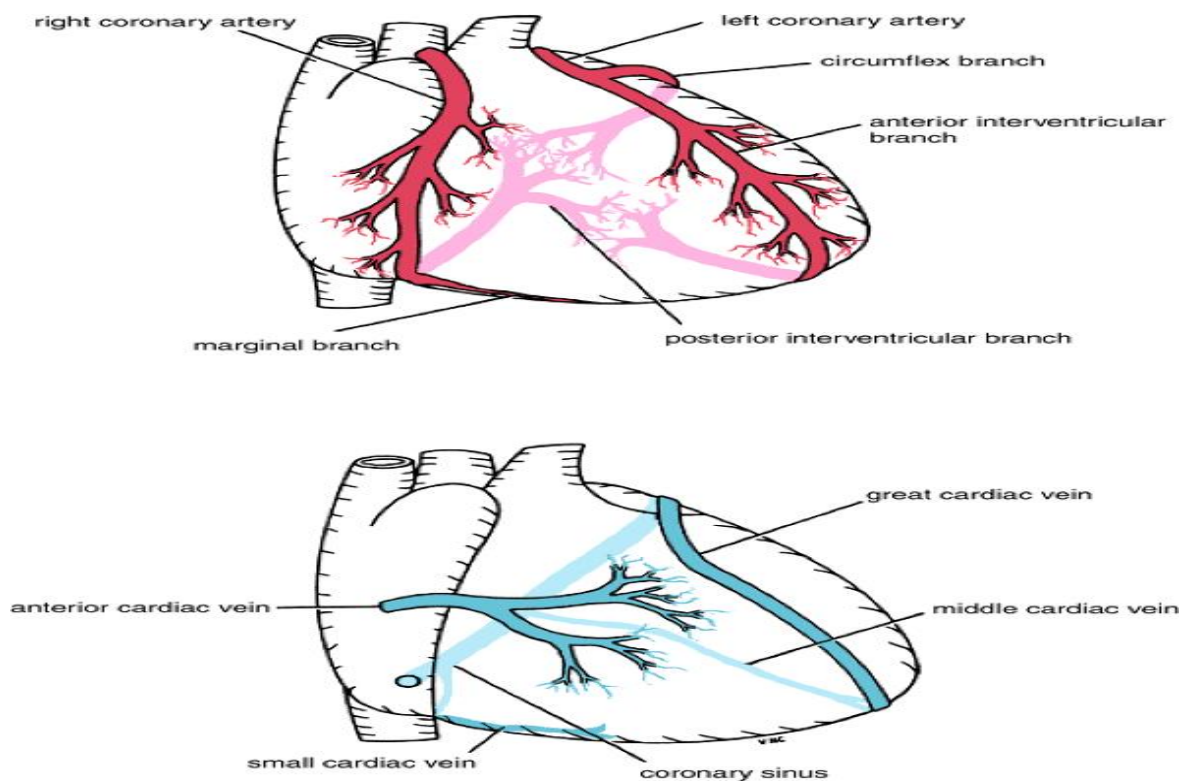
The conducting system of the heart consists of **specialized cardiac muscle present in the sinuatrial node, the atrioventricular node, the atrioventricular bundle and its right and left terminal branches, and the subendocardial plexus of Purkinje fibers (specialized cardiac muscle fibers that form the conducting system of the heart).**

### Arterial Supply of the Heart

The arterial supply of the heart is provided by the right and left coronary arteries, which arise from the ascending aorta immediately above the aortic valve.

### Venous Drainage of the Heart

Most blood from the heart wall drains into the right atrium through the coronary sinus.



## Anatomy 1<sup>st</sup> stage Lec. 1

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- **Large Veins**
- **The superior Vena Cava (IVC)**
- **The Inferior Vena Cava (IVC) and Confluence**
- The Inferior Vena Cava (IVC) is formed from the Common Iliac veins. It brings blood into the right atrium of the heart.
- **Tributaries of the IVC**
- Common Iliac Vein
- Lumbar Vein
- Gonadal Vein
- Renal Vein
- Suprarenal Vein
- Inferior Phrenic vein
- Hepatic Vein

## **Large Veins of the Thorax**

### **Brachiocephalic Veins**

The right brachiocephalic vein and the left brachiocephalic vein. It passes obliquely downward and to the right behind the manubrium sterni and in front of the large branches of the aortic arch. The left branch joins the right brachiocephalic vein to form the **superior vena cava**.

### **Superior Vena Cava**

The superior vena cava contains all the venous blood from the head and neck and both upper limbs and is formed by the union of the two

## **Anatomy 1<sup>st</sup> stage Lec. 1**

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brachiocephalic veins . It passes downward to end in the right atrium of the heart .

## **Azygos Veins**

### **Azygos Vein**

### **Inferior Hemiazygos Vein**

### **Superior Hemiazygos Vein**

**Inferior Vena Cava** The inferior vena cava pierces the central tendon of the diaphragm opposite the eighth thoracic vertebra and almost immediately enters the lowest part of the right atrium.

**Pulmonary Veins** Two pulmonary veins leave each lung carrying oxygenated blood to the left atrium of the heart .

- **The Aorta is usually divided into 4 sections.**
- Ascending Aorta (between the heart and the aortic arch)
- Aortic Arch
- Descending Aorta (this is divided into 2 separate sections)
  - Thoracic Aorta (above the diaphragm)

-Abdominal Aorta (below the diaphragm to the iliacs)

- **Branches of the Abdominal Aorta**
- Celiac Artery (separates into the Hepatic artery, Splenic artery and the left gastric artery)
- Superior Mesenteric Artery (SMA)
- Middle Suprarenal Artery (supplies the adrenal glands)

## **Anatomy 1<sup>st</sup> stage Lec. 1**

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- Renal Artery
- Gonadal Artery (ovaries and testicles)
- Lumbar Artery (abdominal wall and spinal cord)
- Inferior Mesenteric Artery
- Common Iliac (Branches to supply lower extremities and pelvis)

## **Large Arteries of the Thorax**

### **Aorta**

The aorta is the main arterial trunk that delivers oxygenated blood from the left ventricle of the heart to the tissues of the body. It is divided for purposes of description into the following parts: ascending aorta, arch of the aorta, descending thoracic aorta, and abdominal aorta.

### **Ascending Aorta**

The ascending aorta begins at the base of the left ventricle and runs upward and forward to come to lie behind the right half of the sternum at the level of the sternal angle, where it becomes continuous with the arch of the aorta.

### **Branches**

The right coronary artery and the left coronary artery.

### **Arch of the Aorta**

The arch of the aorta is a continuation of the ascending aorta. It lies behind the manubrium sterni and arches upward, backward, and to the left in front of the trachea (its main direction is backward). It then passes

## **Anatomy 1<sup>st</sup> stage Lec. 1**

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downward to the left of the trachea and, at the level of the sternal angle, becomes continuous with the descending aorta.

### **Branches**

The **brachiocephalic artery**.

The **left common carotid** artery.

The **left subclavian artery**.

### **Descending Thoracic Aorta**

The descending thoracic aorta lies in the posterior mediastinum and begins as a continuation of the arch of the aorta on the left side of the lower border of the body of the fourth thoracic vertebra. At the level of the 12th thoracic vertebra, it passes behind the diaphragm.

### **Branches**

Posterior intercostal arteries.

Subcostal arteries.

Pericardial, esophageal, and bronchial arteries are small branches that are distributed to these organs.

### **Pulmonary Trunk**

The pulmonary trunk conveys deoxygenated blood from the right ventricle of the heart to the lungs. It leaves the upper part of the right ventricle and runs upward, backward, and to the left. It is about (5 cm) long and terminates in the concavity of the aortic arch by dividing into right and left pulmonary arteries. Together with the ascending aorta, it is enclosed in the fibrous pericardium and a sheath of serous pericardium.

## Anatomy of Urinary System

### Organs:

**kidneys** – clean and filter blood

**ureters** – tubes that take urine to bladder

**bladder** – stores urine until eliminated

**urethra** – removes urine from body

The urinary system is primarily concerned with the removal of nitrogenous wastes from the body. In addition to this excretory function, the kidneys maintain the electrolyte, acid-base, and fluid balances of the blood and are the major homeostatic organs of the body. Malfunction of the urinary system leads to a failure in homeostasis, which is fatal if left uncorrected.

### Location and External Anatomy

The bean-shaped kidneys lie in a retroperitoneal position (between the dorsal body wall and the parietal peritoneum) in the *superior* lumbar region. Extending approximately from T12 to L3, the kidneys receive some protection from the lower part of the rib cage. The right kidney is crowded by the liver and lies slightly lower than the left. An adult's kidney has a mass of about 150 g and its average dimensions are 12 cm long, 6 cm wide, and 3 cm thick— about the size of a large bar of soap. The lateral surface is convex. The medial surface is concave and has a vertical cleft called the **renal hilum** that leads into an internal space within the kidney called the *renal sinus*. The ureter, renal blood vessels, lymphatics, and nerves all join each kidney at the hilum and occupy the sinus. Atop each kidney is an *adrenal* (or *suprarenal*) *gland*, an endocrine gland.

Three layers of supportive tissue surround each kidney:

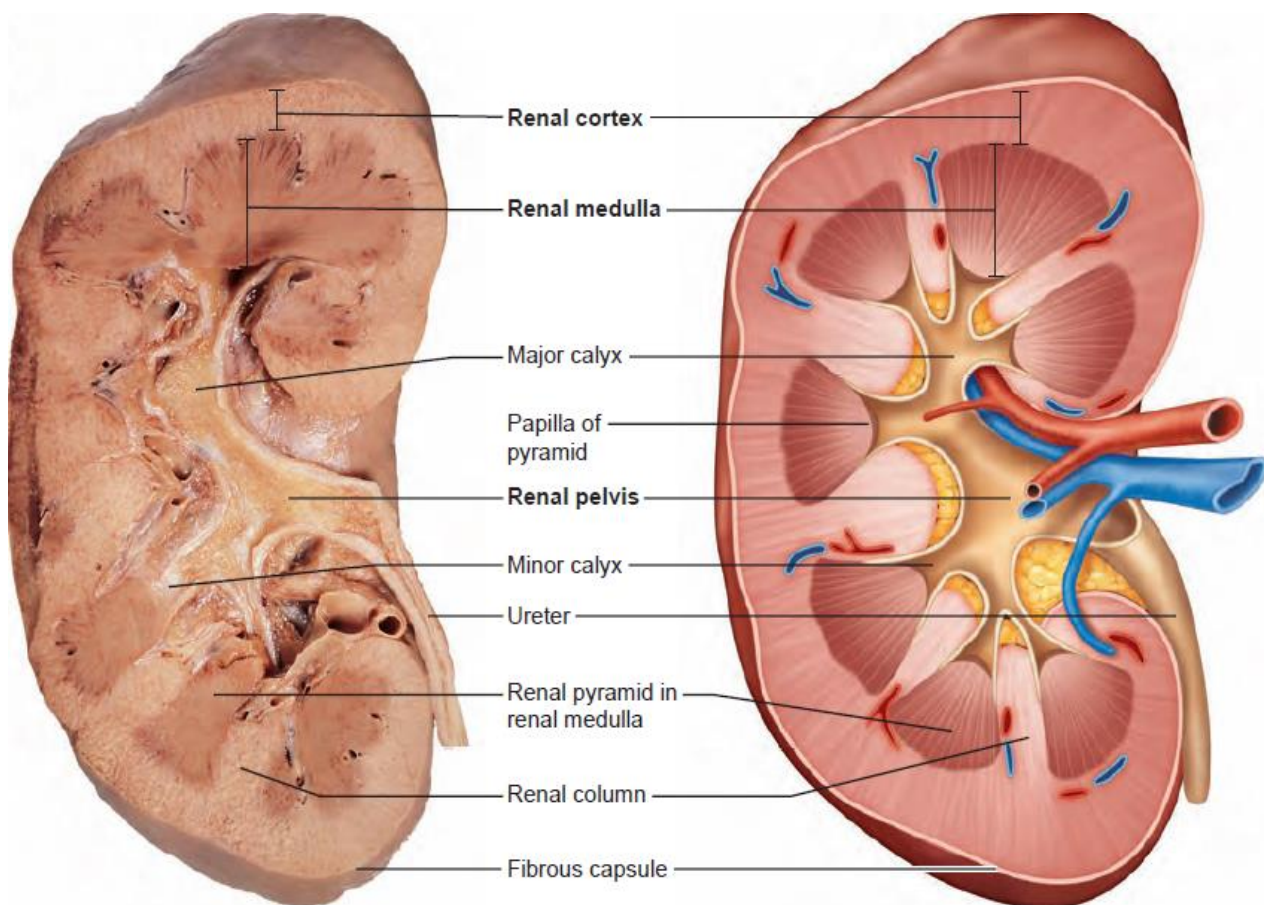
1. The **renal fascia**, an outer layer of dense fibrous connective tissue that anchors the kidney and the adrenal gland to surrounding structures
2. The **perirenal fat capsule**, a fatty mass that surrounds the kidney and cushions it against blows
3. The **fibrous capsule**, a transparent capsule that prevents infections in surrounding regions from spreading to the kidney.

### Internal Anatomy

A frontal section through a kidney reveals three distinct regions: *cortex*, *medulla*, and *pelvis*. The most superficial region, the **renal cortex**, is light in color and has a granular appearance. Deep to the cortex is the darker, reddish-brown **renal medulla**, which exhibits cone-shaped tissue masses called **medullary** or **renal pyramids**. The broad *base* of each pyramid faces toward the cortex, and its apex, or *papilla* (“nipple”), points internally. The pyramids appear striped because they are formed almost entirely of parallel bundles of microscopic urine-collecting tubules and capillaries. The **renal columns**, inward extensions of cortical tissue, separate the pyramids. Each pyramid and its surrounding cortical tissue constitutes one of approximately eight **lobes** of a kidney. The **renal pelvis**, a funnel-shaped tube, is continuous with the ureter



leaving the hilum. Branching extensions of the pelvis form two or three **major calyces**. Each one subdivides to form several **minor calyces**, cup-shaped areas that enclose the papillae. The calyces collect urine, which drains continuously from the papillae, and empty it into the renal pelvis. The urine then flows through the renal pelvis and into the ureter, which moves it to the bladder to be stored. The walls of the calyces, pelvis, and ureter contain smooth muscle that contracts rhythmically to propel urine along its course by peristalsis.

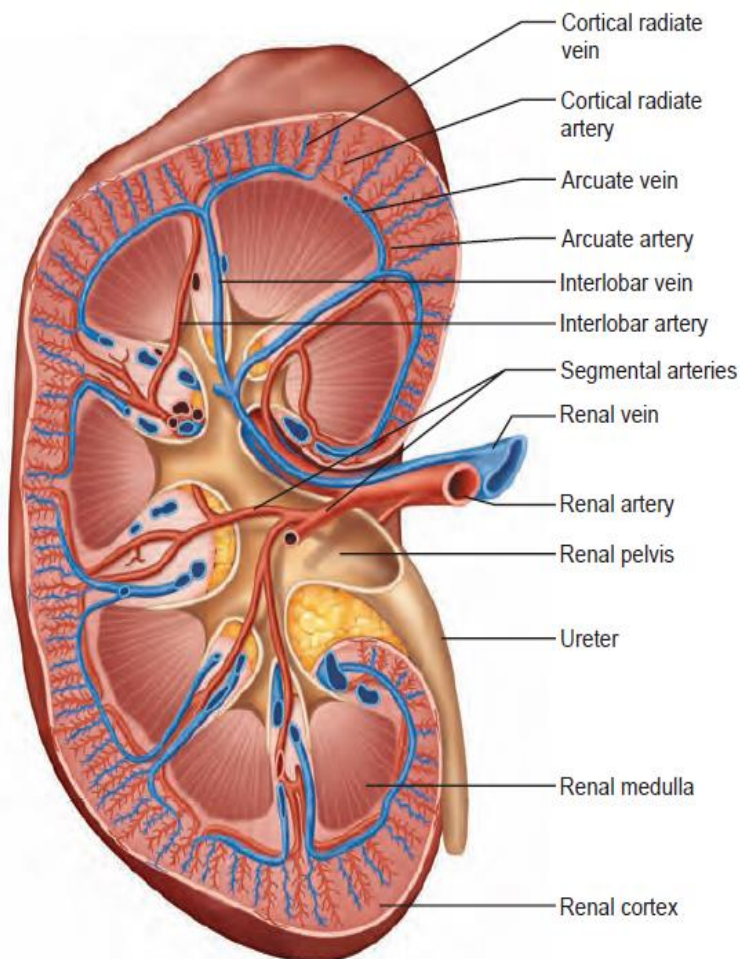


(a) Photograph of right kidney, frontal section

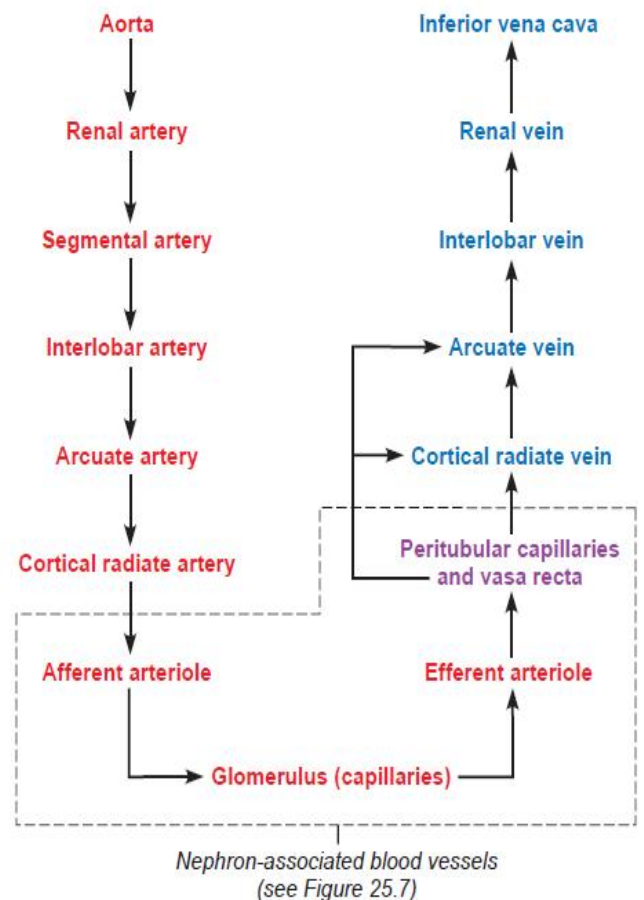
(b) Diagrammatic view

## Blood Supply

The renal arteries issue at right angles from the abdominal aorta, and the right renal artery is longer than the left because the aorta lies to the left of the midline. As each renal artery approaches a kidney, it divides into five **segmental arteries**. Within the renal sinus, each segmental artery branches further to form several **interlobar arteries**. At the medulla-cortex junction, the interlobar arteries branch into the **arcuate arteries**, that arch over the bases of the medullary pyramids. Small **cortical radiate arteries** radiate outward from the arcuate arteries to supply the cortical tissue. More than 90% of the blood entering the kidney perfuses the renal cortex.



(a) Frontal section illustrating major blood vessels



(b) Path of blood flow through renal blood vessels

Figure 25.4 Blood vessels of the kidney.

- The **ureters** drain urine from the kidneys and conduct it by peristalsis to the bladder.

The **ureters** are slender tubes that convey urine from the kidneys to the bladder. Each ureter begins at the level of L2 as a continuation of the renal pelvis. From there, it descends behind the peritoneum and runs obliquely through the posterior bladder wall. This arrangement prevents backflow of urine during bladder filling because any increase in bladder pressure compresses and closes the distal ends of the ureters.

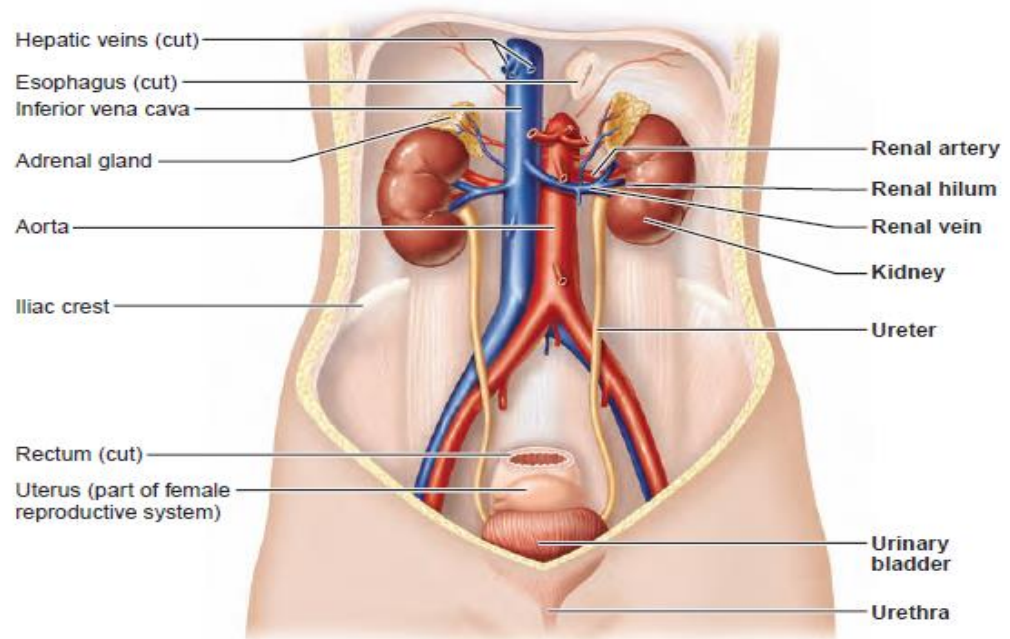
- The **urinary bladder** provides temporary storage for urine.

The **urinary bladder** is a smooth, collapsible, muscular sac that stores urine temporarily. It is located retroperitoneally on the pelvic floor just posterior to the pubic symphysis. The prostate (part of the male reproductive system) lies inferior to the bladder neck, which empties into the urethra. In females, the bladder is anterior to the vagina and uterus. The interior of the bladder has openings for both ureters and the urethra. The smooth, triangular region of the bladder base outlined by these three openings is the **trigone** which is delineated by three openings (two ureteral and one urethral orifice).

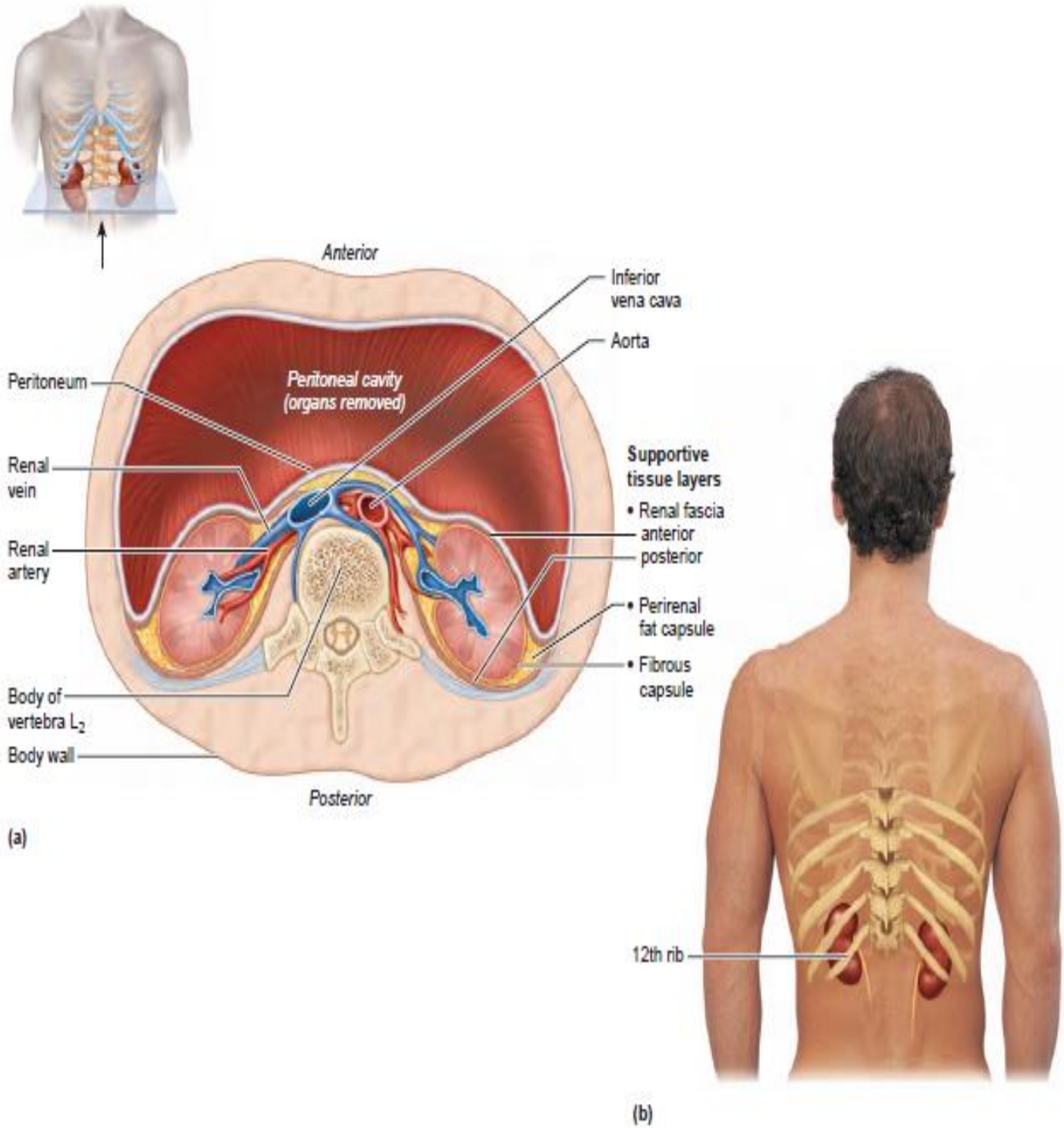
- The single **urethra** drains the bladder.

The **urethra** is a thin-walled muscular tube that drains urine from the bladder and conveys it out of the body.

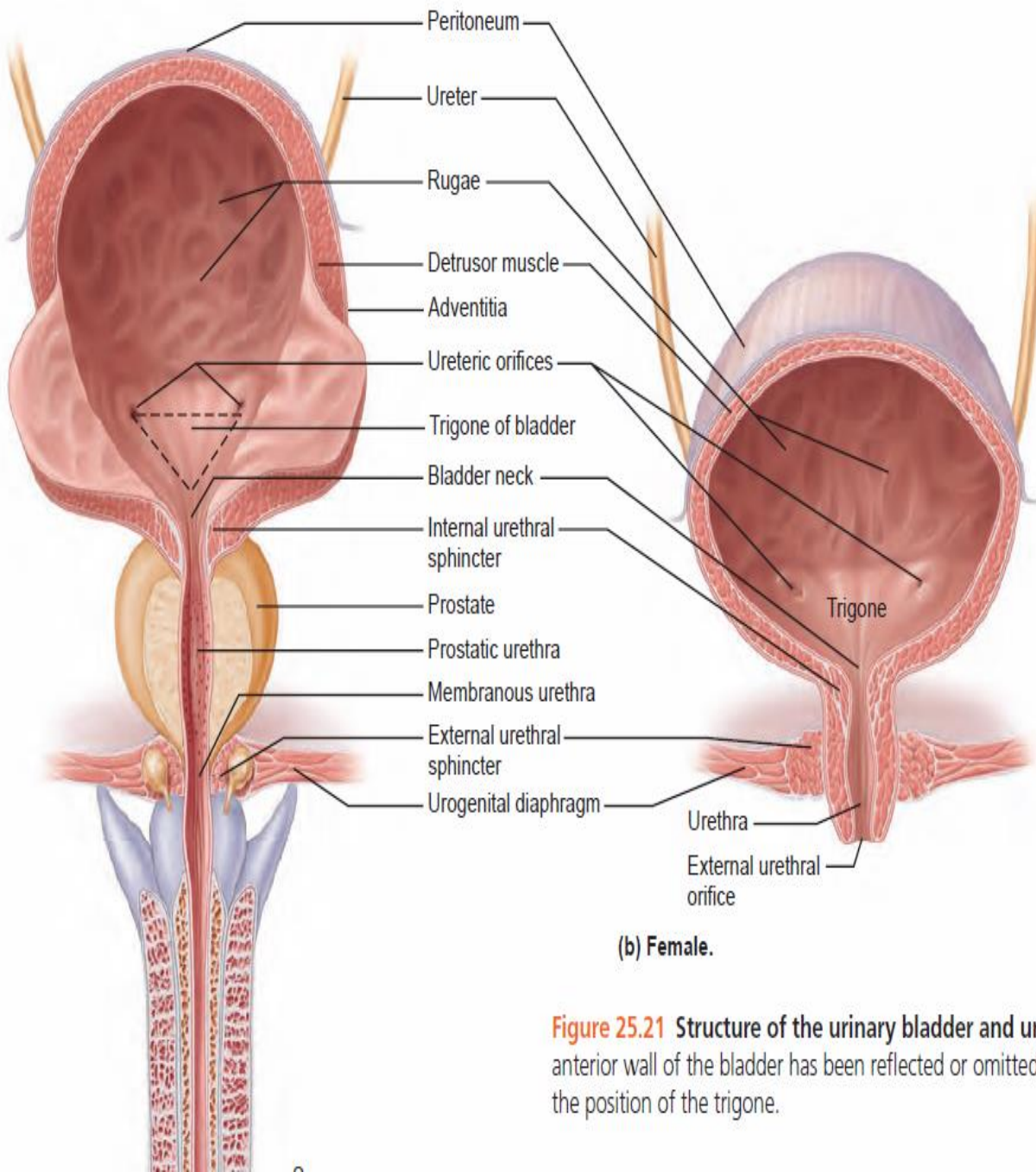
- In males, the urethra is approximately 20 cm long. It has three regions: the **prostatic**, **membranous**, and **spongy (penile) urethrae**. It, also, has a dual function in males: it serves as a urine conduit to the body exterior, and it provides a passageway for semen ejaculation. So, in males, the urethra is part of both the urinary and reproductive systems.
- In females, the urethra is only about 4 cm long. The female urethra serves only to transport urine to the body exterior. The **external urethral orifice**, its external opening, lies anterior to the vaginal opening.



**Figure 25.1 The urinary system.** Anterior view of the female urinary organs. (Most unrelated abdominal organs have been omitted.)



**Figure 25.2** Position of the kidneys against the posterior body wall. **(a)** Cross-section viewed from inferior direction. Note the retroperitoneal position and the supportive tissue layers of the kidney. **(b)** Posterior in situ view showing relationship of the kidneys to the 12th rib pair.



(b) Female.

**Figure 25.21** Structure of the urinary bladder and urethra. The anterior wall of the bladder has been reflected or omitted to reveal the position of the trigone.

## Lymphatic tissues

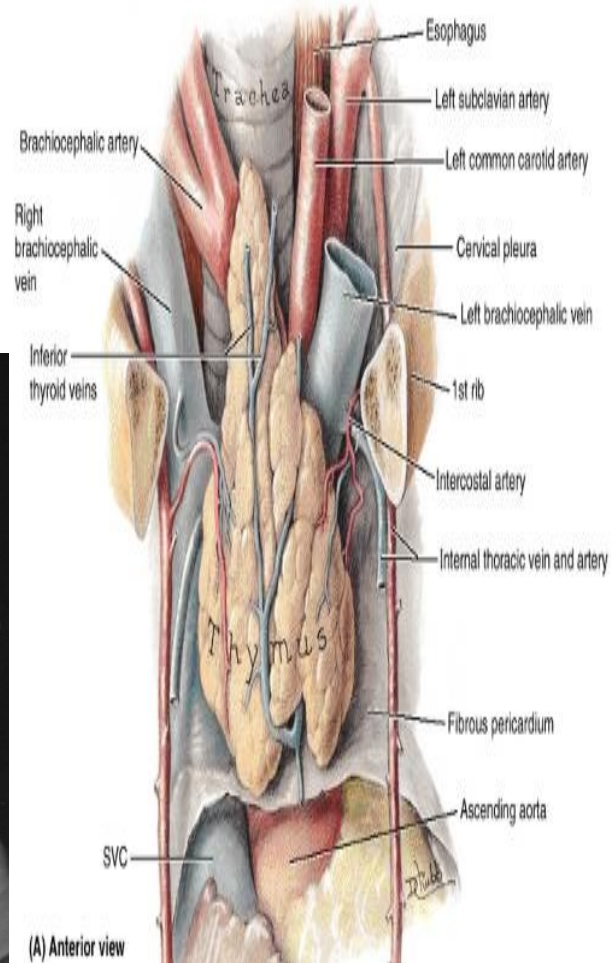
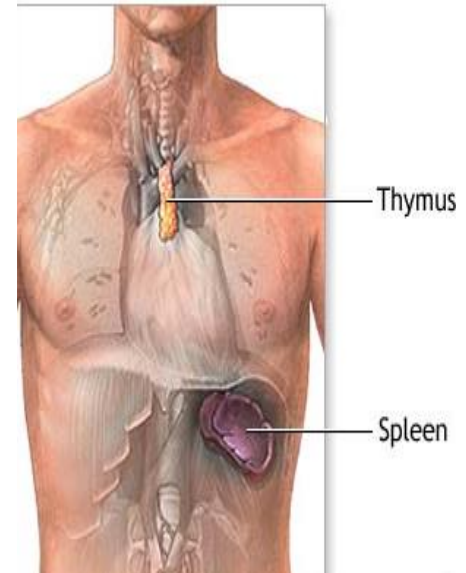
Lymphatic tissues are a type of connective tissue that contains large numbers of lymphocytes. Lymphatic tissue is organized into the following organs or structures: the thymus, the lymph nodes, the spleen, and the lymphatic nodules. Lymphatic tissue is essential for the immunologic defenses of the body against bacteria and viruses.

The lymphoid tissues are divided functionally into primary and secondary organs.

- a. The central (primary) lymphoid organs are the thymus and the bone marrow.
- b. The peripheral (secondary) lymphoid tissues are the lymph nodes, spleen, diffuse lymphoid tissues, and lymphoid follicles.

## Thymus gland

The thymus gland is a primary lymphoid organ, and it is a flattened, bilobed structure lying between the sternum and the pericardium (**located in the inferior part of the neck and the anterior part of the superior mediastinum. It lies posterior to the manubrium and extends into the anterior mediastinum, anterior to the fibrous pericardium**). In the newborn infant, it reaches its largest size relative to the size of the body. The thymus continues to grow until puberty but thereafter undergoes involution. It has a pink, lobulated appearance and is the site for development of T (thymic) lymphocytes. Thymus produces hormones: thymosin & thymopoietin both promote development and maturation of lymphocytes (T-lymphocytes).





## Spleen

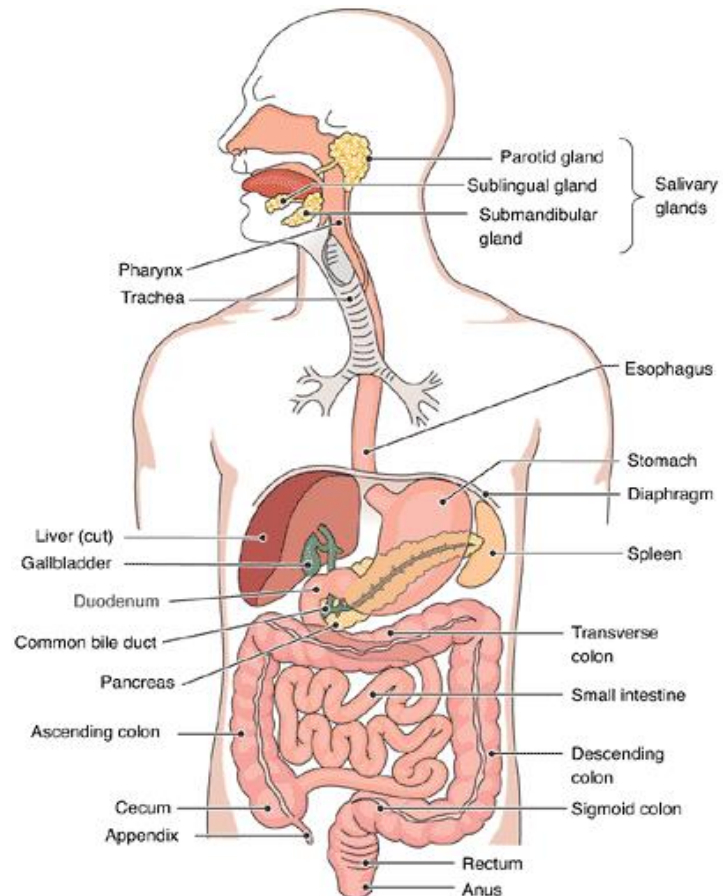
The spleen is reddish largest single soft mass of lymphatic tissue in the body that occupies the left upper part of the abdomen between the stomach and the diaphragm. It is oval, flat bean shaped and has a notched anterior border, with its long axis, 12 cm long, it's located lateral to stomach (below diaphragm in left hypochondriac region), lying along the line of the tenth rib resembles a large lymph node that is encapsulated & subdivided into lobules by connective tissues

### Relations

- Anteriorly: The stomach, tail of the pancreas, and left colic flexure. The left kidney lies along its medial border.
- Posteriorly: The diaphragm; left pleura (left costodiaphragmatic recess); left lung; and 9th, 10th, and 11th ribs.

### Functions:

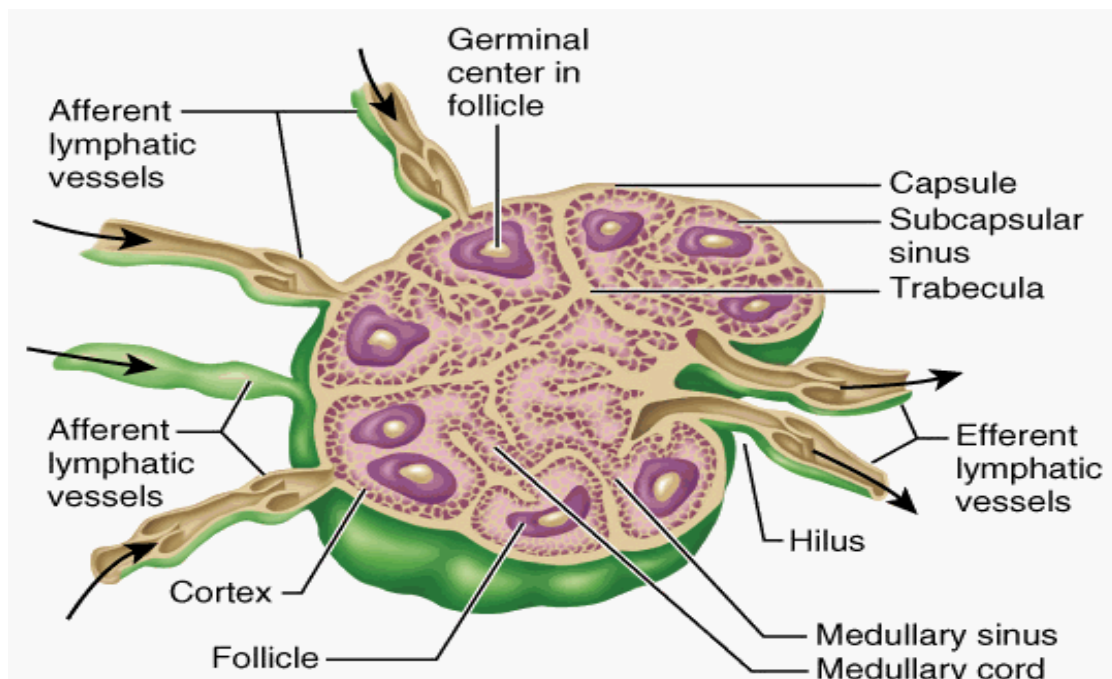
- remove abnormal blood cells
- store iron from recycled RBCs for reuse
- initiate immune response by B & T cells in response to antigens in blood
- store platelets
- site of fetal erythrocyte production



## Lymph nodes

Lymph nodes are small, oval bean-shaped bodies 1-25mm scattered throughout body **covered by a capsule of dense connective tissue**, may be deep or superficial that occur along lymphatic vessels. They are abundant where lymphatic vessels merge to form trunks, especially in the respiratory tree and GI tract, in the mammary glands, axillae, and groin, filter lymph fluid to trap foreign organisms, cell debris, and tumor cells.

Lymph flows into a node through afferent lymphatic vessels that enter the convex side of a node. It exits the node at the hilus, the indented region on the opposite, concave side of the node(hilum), through efferent lymphatic vessels. Efferent vessels contain valves that restrict lymph to movement in one direction out of the lymph node. The number of efferent vessels leaving the lymph node is fewer than the number of afferent vessels entering, slowing the flow of lymph through the node.



\*hilum – indented region of bean- shaped node, blood vessels & nerves connect at the hilum of the lymph node.

\*afferent vessels enter at various points on the convex surface of the node & this is how lymph enters the node.

\*efferent vessels (lymphatic vessels) exit at the hilum of the node & lymph leaves the node through these vessels.

### 1. cleanse lymph

-as lymph flows through sinuses of node it slows down and microorganisms and foreign matter are removed

### 2. alert immune system to pathogens

### 3. important in hemopoiesis

- lymphocytes and monocytes are made here.

## **lymph nodes**

### **1. submental & submaxillary lymph nodes**

floor of mouth;

drain nose, lips teeth

### **2. cervical lymph nodes**

neck

drain neck and head

### **3. superficial cubital (supratrochlear)**

above bend in elbow

drain forearm

#### **4. axillary lymph nodes**

armpit (axilla) and upper chest

drains arm and upper thorax including breasts breasts contains 2 sets of lymphatics: (NOT mammary glands) those that drain the skin over breast excluding the areola and nipple those that originate in and drain deeper portions of breast and skin of areola and nipple numerous connections join the lymphatic systems of the breast with: the other breast axillary nodes (85% of lymph from breast enters them) abdominal nodes

#### **5. thoracic lymph nodes**

in thoracic cavity

receive lymph from lungs, airways, and mediastinum

#### **6. abdominal lymph nodes**

receive lymph from urinary and reproductive systems

#### **7. intestinal and mesenteric lymph**

**nodes**

receive lymph from the digestive tract

#### **8. inguinal lymph nodes**

in groin area

drain legs and genitals

#### **9. popliteal lymph nodes**

in back of knee

receive lymph from leg as lymphatic vessels converge they become larger and larger.

## **Tonsils**

masses of lymphoidal tissue embedded in mucous membranes of covered by epithelium, with deep pits(=crypts) crypts often contain food debris, bacteria, dead wbc's etc

### **three main sets of tonsils:**

#### **pharyngeal tonsils** (=adenoids)

on wall of pharynx behind nasal cavity

#### **palatine tonsils**

at post margin of oral cavity largest and most often infected = tonsilitis

usually *Streptococcus* today usually treated with antibiotics

#### **lingual tonsils**

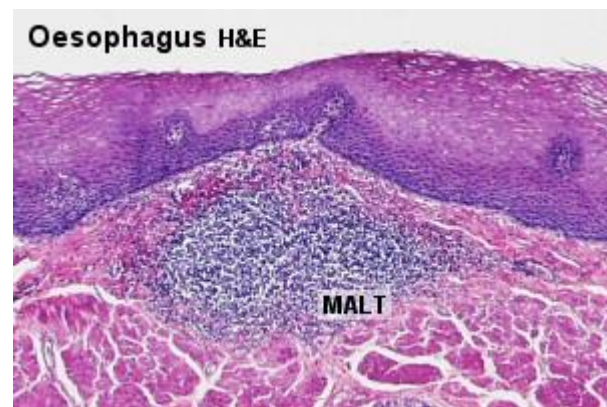
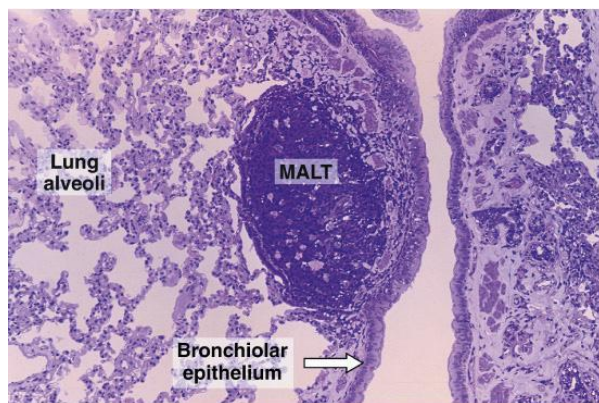
on each side of root of tongue

## Lymphatic Nodules

Lymphatic Nodules differ from Lymph Nodes in that lymphatic nodules are not surrounded by capsules (of dense connective tissue). They are also known as **mucosa-associated lymphatic tissue (MALT)**.

found in the lamina propria of mucous membranes in various sites of the body, such as the gastrointestinal tract, thyroid, breast, lung, salivary glands, eye, and skin. MALT is populated by lymphocytes such as T cells and B cells, as well as plasma cells and macrophages, each of which is well situated to encounter antigens passing through the mucosal epithelium. In the case of intestinal MALT, M cells are also present, which sample antigen from the lumen and deliver it to the lymphoid tissue.

MALT can be functionally divided into effector sites and inductive sites.



## Nervous System

The nervous system is divided into two main parts: the **central nervous system (CNS)**, which consists of the **brain** and **spinal cord**, and the **peripheral nervous system (PNS)**, which consists of **12 pairs of cranial nerves** and **31 pairs of spinal nerves** and their associated ganglia.

**Functionally**, the nervous system can be further divided into the:

- \*Somatic nervous system, which controls voluntary activities, and the
- \*Autonomic nervous system, which controls involuntary activities.

The nervous system, together with the endocrine system, controls and integrates the activities of the different parts of the body.

### Central Nervous System

The **central nervous system** is composed of large numbers of nerve cells and their processes, supported by specialized tissue called neuroglia. Neuron is the term given to the nerve cell and all its processes. The nerve cell has two types of processes, called dendrites and an axon. Dendrites are the short processes of the cell body; the axon is the longest process of the cell body.

The interior of the central nervous system is organized into **gray** and **white matter**.

**Gray matter** consists of **nerve cells embedded in neuroglia**.

**White matter** consists of **nerve fibers (axons) embedded in neuroglia**.

### Peripheral Nervous System

The peripheral nervous system consists of the cranial and spinal nerves and their associated ganglia. On dissection, the cranial and spinal nerves are seen as grayish white cords. They are made up of bundles of nerve fibers (axons) supported by delicate areolar tissue.

## Cranial Nerves

There are 12 pairs of cranial nerves that leave the brain and pass through foramina in the skull. All the nerves are distributed in the head and neck except the Xth (vagus), which also supplies structures in the thorax and abdomen. The cranial nerves are described in Chapter 11 (Richard S. Snell).

- I. Olfactory (sensory)
- II. Optic (sensory)
- III. Oculomotor (motor)
- IV. Trochlear (motor)
- V. Trigeminal (mixed)
- VI. Abducent (motor)
- VII. Facial (mixed)
- VIII. Vestibulocochlear (sensory)
- IX. Glossopharyngeal (mixed)
- X. Vagus (mixed)
- XI. Accessory (motor)
- XII. Hypoglossal (motor)

## Spinal Nerves

A total of 31 pairs of spinal nerves leave the spinal cord and pass through intervertebral foramina in the vertebral column (Figs. 1-20 and 1-21). The spinal nerves are named according to the region of the vertebral column with which they are associated: 8 cervical, 12 thoracic, 5 lumbar, 5 sacral, and 1 coccygeal.

Each spinal nerve is connected to the spinal cord by two roots: the anterior root and the posterior root (Figs. 1-19 and 1-21). The anterior root consists of bundles of nerve fibers carrying nerve impulses away from the central nervous system (Fig. 1-21). Such nerve fibers are called efferent fibers. Those efferent fibers that go to skeletal muscle and cause them to contract are called motor fibers.



The posterior root consists of bundles of nerve fibers that carry impulses to the central nervous system and are called afferent fibers (Fig. 1-19). Because these fibers are concerned with conveying information about sensations of touch, pain, temperature, and vibrations, they are called sensory fibers.

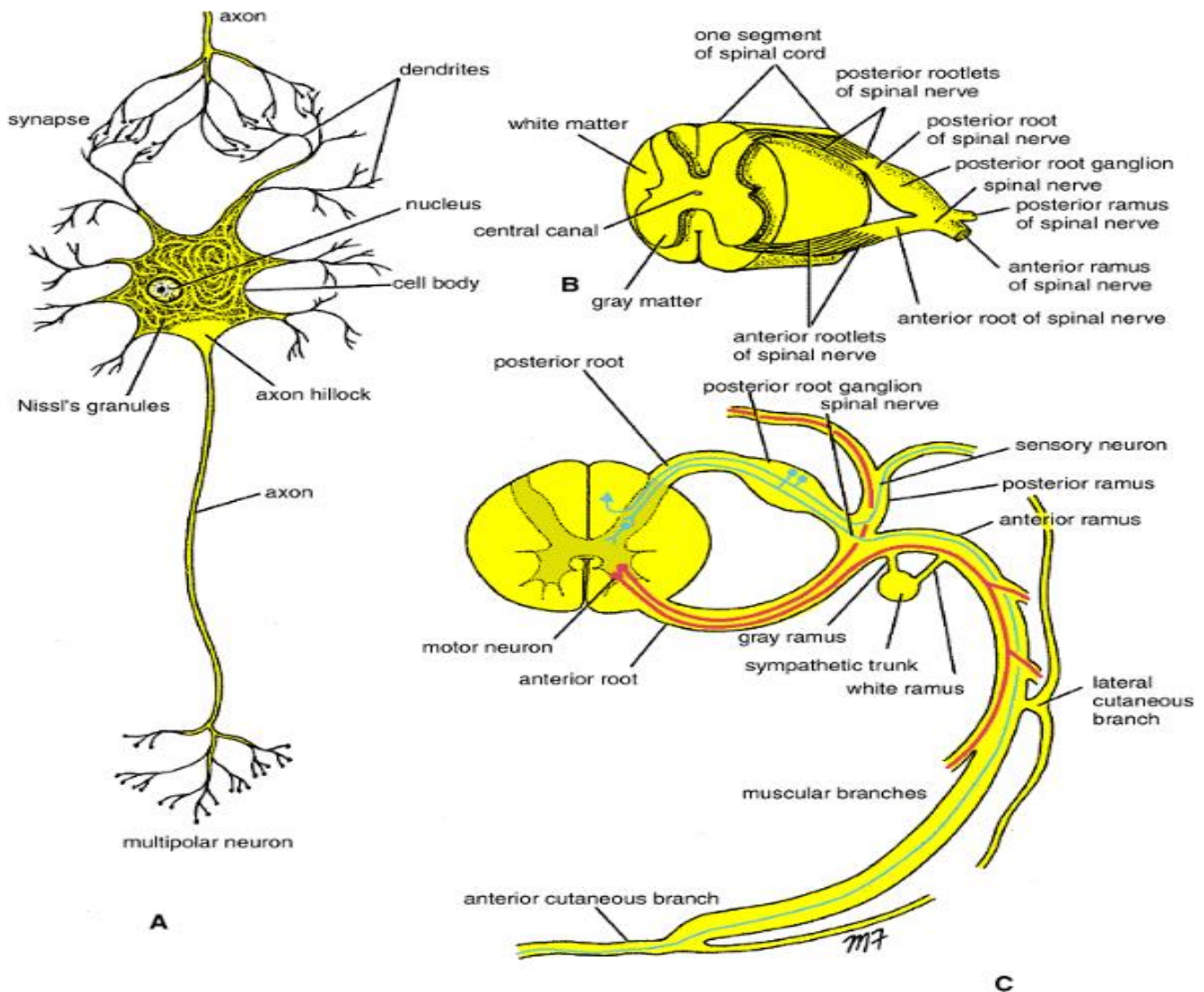


Figure 1-19 A. Multipolar motor neuron with connector neuron synapsing with it. B. Section through thoracic segment of spinal cord with spinal roots and posterior root ganglion. C. Cross section of thoracic segment of spinal cord showing roots, spinal nerve, and anterior and posterior rami and their branches.

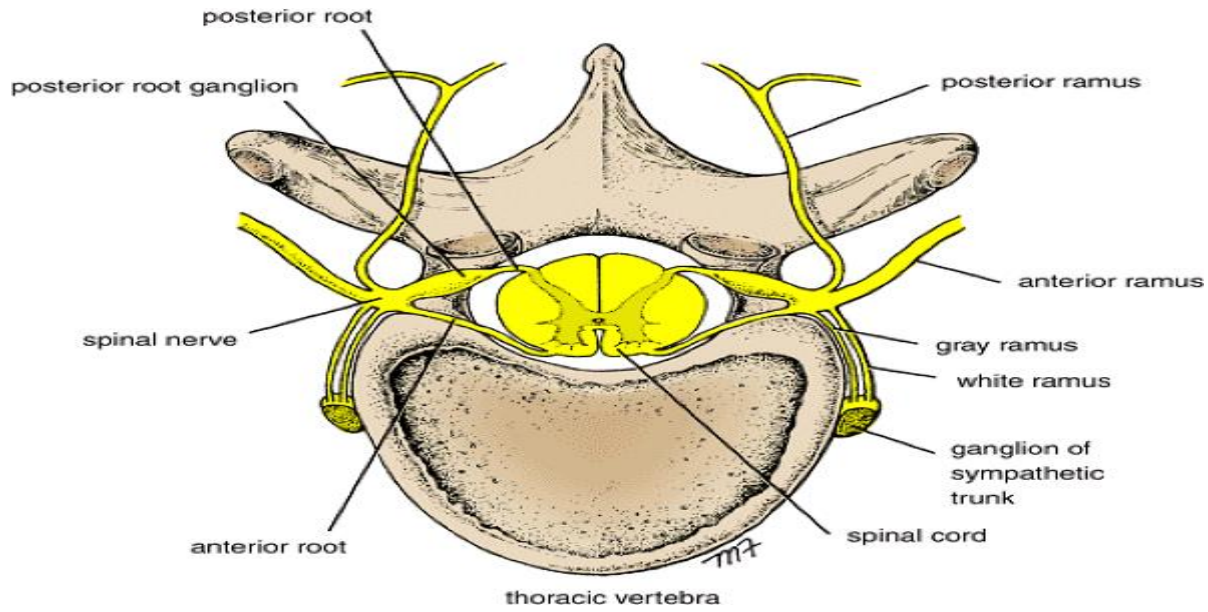
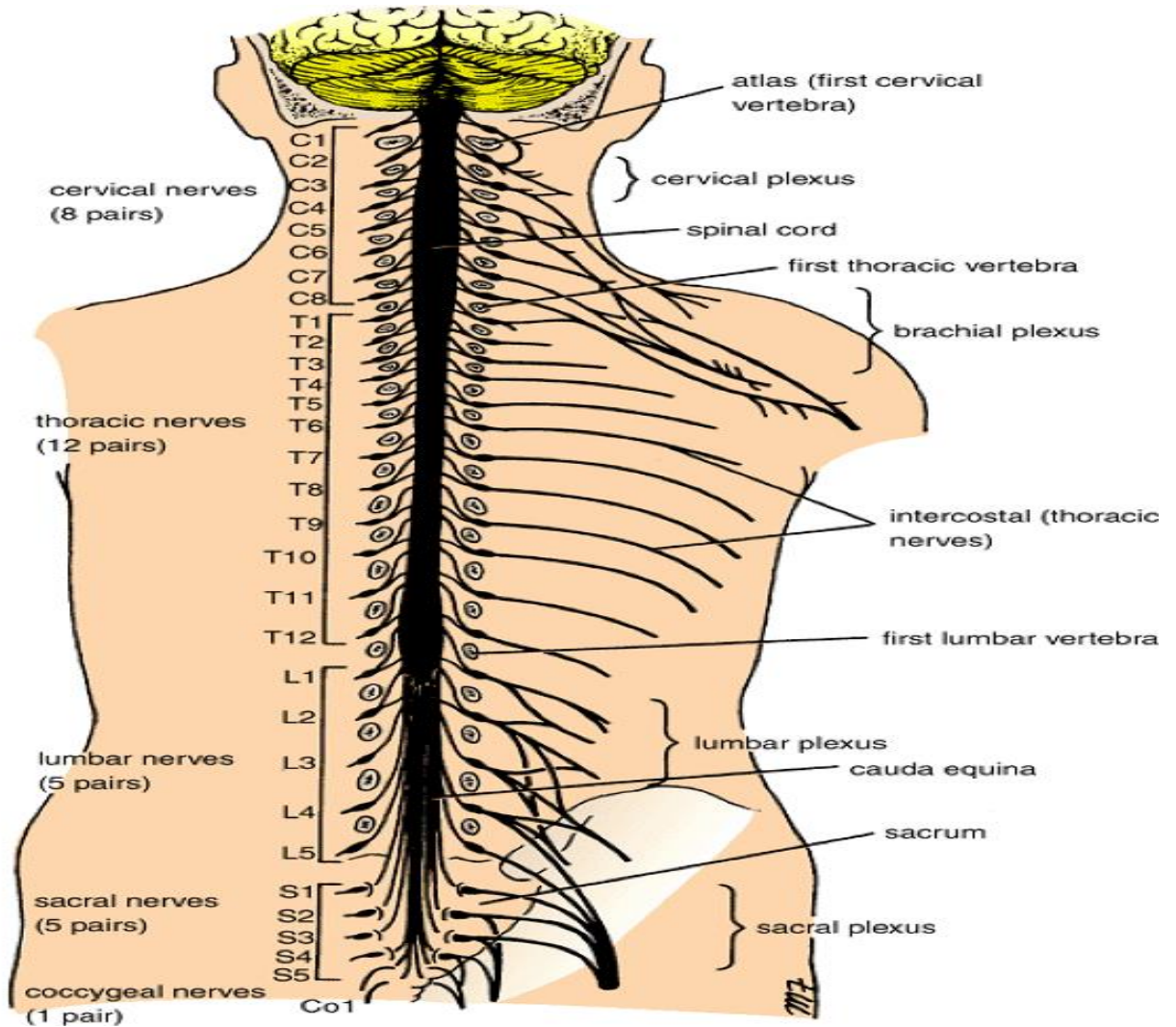


Figure 1-21 The association between spinal cord, spinal nerves, and sympathetic trunks.



At each intervertebral foramen, the anterior and posterior roots unite to form a spinal nerve (Fig. 1-21). Here, the motor and sensory fibers become mixed together, so that a spinal nerve is made up of a mixture of motor and sensory fibers (Fig. 1-19). On emerging from the foramen, the spinal nerve divides into a large anterior ramus and a smaller posterior ramus.

### **Autonomic Nervous System**

The autonomic nervous system is the part of the nervous system concerned with the innervation of involuntary structures such as the heart, smooth muscle, and glands throughout the body and is distributed throughout the central and peripheral nervous system. The autonomic system may be divided into two parts the sympathetic and the parasympathetic and both parts have afferent and efferent nerve fibers.

The activities of the sympathetic part of the autonomic system prepare the body for an **emergency**. It accelerates the heart rate, causes constriction of the peripheral blood vessels, and raises the blood pressure. The sympathetic part of the autonomic system brings about a redistribution of the blood so that it leaves the areas of the skin and intestine and becomes available to the brain, heart, and skeletal muscle. At the same time, it inhibits peristalsis of the intestinal tract and closes the sphincters.

The activities of the parasympathetic part of the autonomic system aim at conserving and restoring energy. They slow the heart rate, increase peristalsis of the intestine and glandular activity, and open the sphincters.

The **hypothalamus** of the brain controls the autonomic nervous system and integrates the activities of the autonomic and neuroendocrine systems, thus preserving homeostasis in the body.

### The Meninges

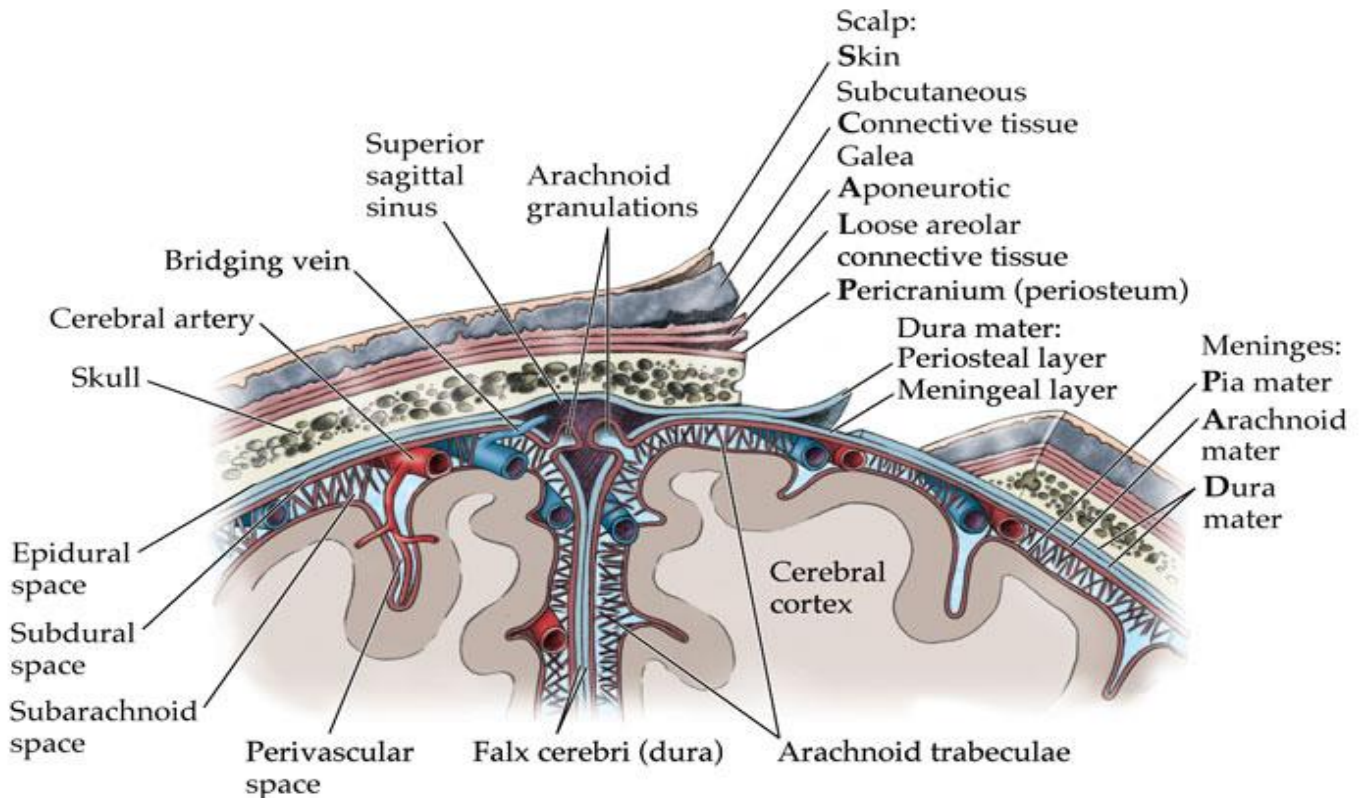
The brain in the skull is surrounded by three protective membranes, or meninges: the dura mater, the arachnoid mater, and the pia mater. (The spinal cord in the vertebral column is also surrounded by three meninges.

#### \*Dura Mater of the Brain

The dura mater is conventionally described as two layers: the endosteal layer and the meningeal layer (Fig. 11-2). These are closely united except along certain lines, where they separate to form venous sinuses.

\*\*The **falx cerebri** is a sickle-shaped fold of dura mater that lies in the midline between the two cerebral hemispheres.

\*\*The **tentorium cerebelli** is a crescent-shaped fold of dura mater that roofs over the posterior cranial fossa. It covers the upper surface of the cerebellum and supports the occipital lobes of the cerebral hemispheres.



## Arachnoid Mater of the Brain

The arachnoid mater is a delicate, impermeable membrane covering the brain and lying between the pia mater internally and the dura mater externally. It is separated from the dura by a potential space, the subdural space, and from the pia by the subarachnoid space, which is filled with cerebrospinal fluid.

The cerebrospinal fluid is produced by the choroid plexuses within the lateral, third, and fourth ventricles of the brain. It escapes from the ventricular system of the brain through the three foramina in the roof of the fourth ventricle and so enters the subarachnoid space. It now circulates both upward over the surfaces of the cerebral hemispheres and downward around the spinal cord. Eventually, the fluid enters the

bloodstream by passing into the arachnoid villi and diffusing through their walls.

Cerebrospinal fluid has three main functions:

- CSF protects brain and spinal cord from trauma.
- CSF supplies nutrients to nervous system tissue.
- CSF removes waste products from cerebral metabolism.

### Pia Mater of the Brain

The pia mater is a vascular membrane that closely invests the brain, covering the gyri and descending into the deepest sulci. It extends over the cranial nerves and fuses with their epineurium (epi., peri., endo) . The cerebral arteries entering the substance of the brain carry a sheath of pia with them.

### Parts of the Brain

Major Parts of the Brain		Cavities of the Brain
Forebrain	Cerebrum	Right and left lateral ventricles
	Diencephalon	
Midbrain		Third ventricle
Hindbrain	Pons	Cerebral aqueduct
	Medulla oblongata	
	Cerebellum	
		Fourth ventricle and central canal

The brain is that part of the central nervous system that lies inside the cranial cavity. It is continuous with the spinal cord through the foramen magnum.

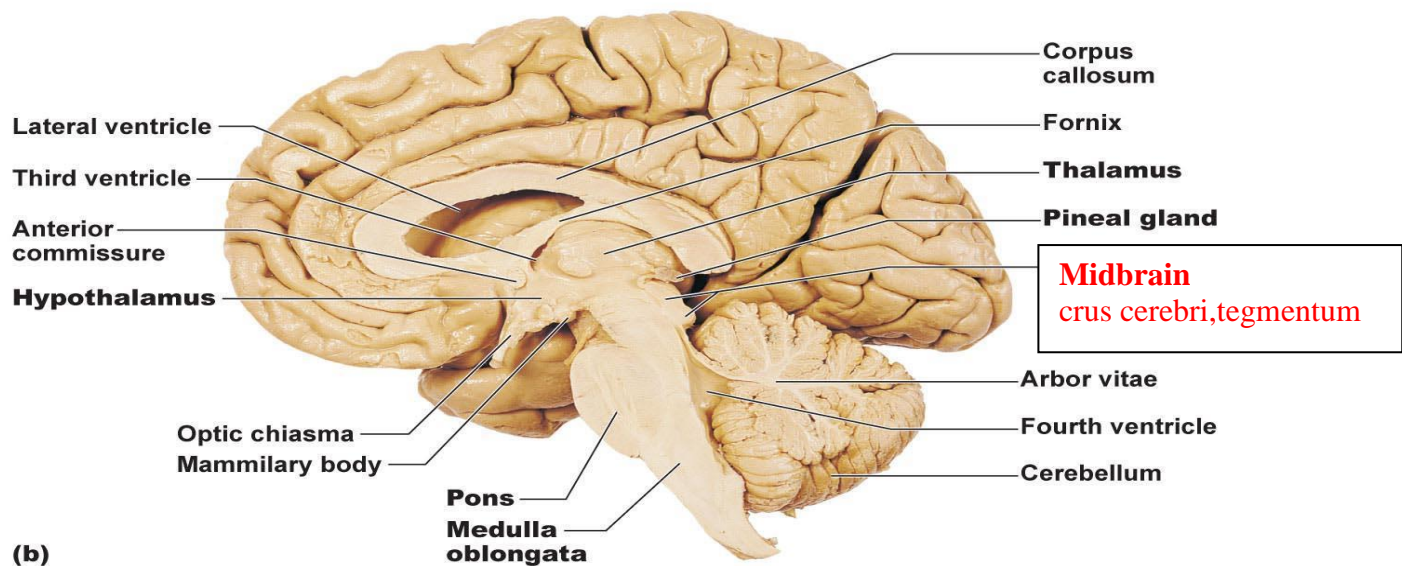
## Cerebrum

The cerebrum is the largest part of the brain and consists of two cerebral hemispheres connected by a mass of white matter called the corpus callosum. The hemispheres are separated by a deep cleft, the longitudinal fissure. The surface layer of each hemisphere is called the cortex and is composed of gray matter.

## Diencephalon

The diencephalon is almost completely hidden from the surface of the brain. It consists of a **dorsal thalamus** and a **ventral hypothalamus**. The **thalamus** is a large mass of gray matter that lies on either side of the third ventricle. It is the great relay station on the afferent sensory pathway to the cerebral cortex.

The **hypothalamus** forms the lower part of the lateral wall and floor of the third ventricle. The following structures are found in the floor of the third ventricle from before backward: the optic chiasma, the tuber cinereum and the infundibulum, the mammillary bodies, and the posterior perforated substance.

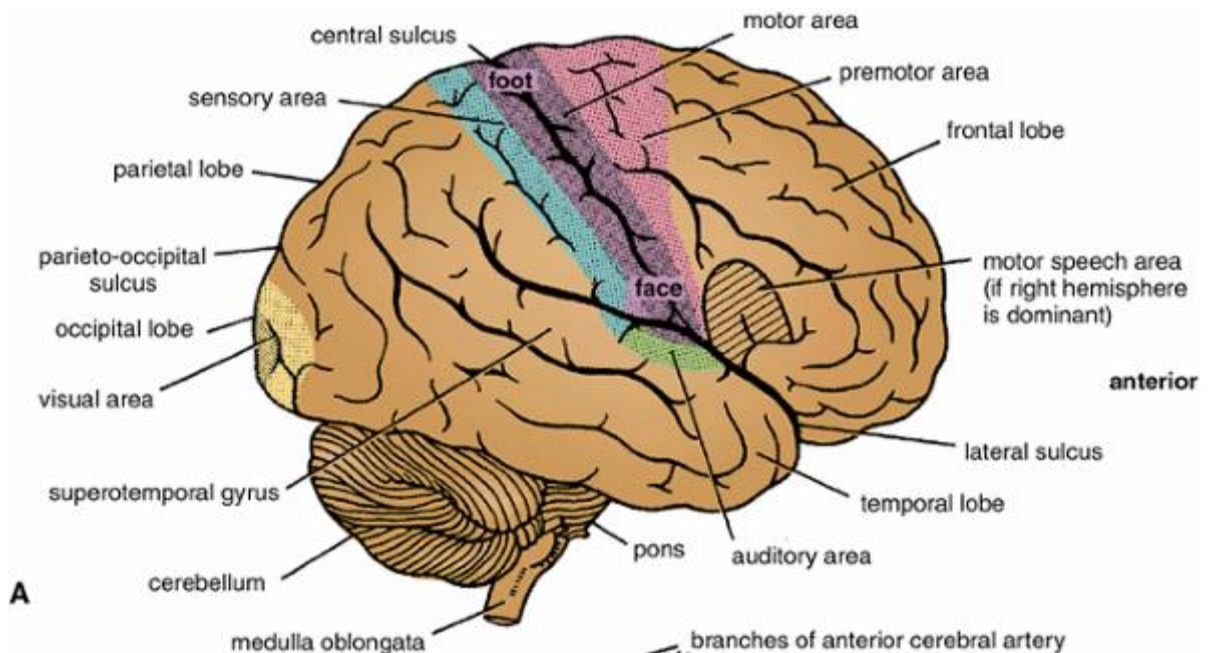


**midbrain** The comprises two lateral halves called the cerebral peduncles; each of these is divided into an anterior part, the crus cerebri, and a posterior part, the tegmentum, by a pigmented band of gray matter, the substantia nigra.

## Hindbrain

The **pons** is situated on the anterior surface of the cerebellum below the midbrain and above the medulla oblongata. It is composed mainly of nerve fibers, which connect the two halves of the cerebellum. It also contains ascending and descending fibers connecting the forebrain, the midbrain, and the spinal cord.

The **medulla oblongata** is conical in shape and connects the pons above to the spinal cord below. A median fissure is present on the anterior surface of the medulla, and on each side of this is a swelling called the pyramid.





The **cerebellum** lies within the posterior cranial fossa beneath the tentorium cerebelli. It is situated posterior to the pons and the medulla oblongata. It consists of two hemispheres connected by a median portion, the vermis. The cerebellum is connected to the midbrain by the superior cerebellar peduncles, to the pons by the middle cerebellar peduncles, and to the medulla by the inferior cerebellar peduncles.

## Terminology

**Medical terminology:** Medical terms are words that are used by medical staffs ( physician, nurses...etc.) for active communication, that they include Greek and Latin terms. Medical terms are constant over the world.

**Basic elements of medical term:** The medical term is formed from:

1. **Root:** It is the main and effective part of the medical term that express an anatomical or physiological part of the body. The root is a word that can be coupled with other parts (suffix and prefix) to form meaningful term.
2. **Prefix:** That part where put in the beginning of the word. It is short, has special meaning, when added to the root it will change the meaning completely.
3. **Suffix:** The part where put in the end of the word, usually short, comes after root and has special meaning.
4. **Combining vowels:** Letters that connect the suffix with the root, or root with other root. These letters are: o, a, e, i, u. Usually (o) is used.

How to analyze medical term: We do this analysis to know meanings of its parts (root, prefix, suffix) to make us know meaning of whole term.

Ex.: 1. **Neurology.** Either analyzed as **neuro/logy** (neuro is combining form, logy is suffix), or analyzed as **neur/o/gy** (Neur is root, o is combining vowel, logy is suffix).

2. **Gastroenteritis.** Analyzed as **Gastro/enter/itis** (Gastro is combining form, enter is root, itis is suffix), or analyzed as **Gastr/o/enter/itis** (Gaster is root, o is combining vowel, enter is root, itis is suffix).

Some roles in pronouncing medical terms:

1. Letters (c), (g)
  - a. Before letters (e, i, y) they are given soft sound (like: cerebral, gel, gingivitis).
  - b. They are given hard sound before other letters (like: cardiac, gastric).

2. a. Some words have the following coupled letters and are uttered as follow:

Letters combination	sound	Examples
<b>Pt</b>	<b>T</b>	<b>Pterygoid</b>
<b>Ps</b>	<b>S</b>	<b>Psoriasis</b>
<b>Pn</b>	<b>N</b>	<b>Pneumonia</b>
<b>Gn</b>	<b>N</b>	<b>Gnathitis</b>
<b>Mn</b>	<b>N</b>	<b>Mnemonic</b>

- b. Some words have couple of 2 vowel letters (oe, ae), these will be uttered as (ee) as follow: **haema**, **rugae**, **coelom**, **septicaemia**, **caecum**.
- c. Some words have coupled consonant letters, uttered as follow:

Letters combination	Sound	Examples
<b>Ph</b>	<b>f</b>	<b>Phrenoplegia</b>
<b>Rh</b>	<b>r</b>	<b>Rhythm</b>
<b>Ch</b>	<b>k</b>	<b>Cochlea</b>
<b>X</b>	<b>z</b>	<b>Xanthic</b>
<b>dys</b>	<b>dis</b>	<b>dysphagia</b>

3. How to make plural form from singular form in medical terms? Here are some roles:

Singular	Plural
<b>us →</b>	<b>i</b>
Nucleus	Nuclei
Bronchus	bronchi
<b>is →</b>	<b>es</b>
Analysis	analyses
Basis	bases
<b>ix, ex, ax →</b>	<b>ices</b>
Appendix	appendices
Cortex	cortices
Thorax	thoraces
<b>um →</b>	<b>a</b>
Bacterium	bacteria
Ovum	ova
<b>ma →</b>	<b>mata</b>

Diastema	diastemata
Sarcoma	sarcomata
<b>nx/anx/ynx →</b>	<b>nges</b>
Larynx	larnges
Phalanx	phalanges

4. How to put the meaning of the medical term? First we divide the term, first we take the suffix meaning, followed by the first part meaning and then the meaning of the middle part. Ex.: **Gastroenteritis** (**Gastr/o** means stomach, **enter** means intestine, **itis** means inflammation) التهاب المعدة و الامعاء
- .....

## Terminology

### Prefixes السوابق

Prefix	Meaning	Example	بالعربي
a-, an, ana-	Not, without	Agranulocytosis, anhydrous, anaplasia	بدون
ab	Away from	abduction	بعيدا عن
ad	toward	adduction	نحو
Ante-	before	anteversion	قبل، امام
Anti-	against	antibacterial	مضاد
Apo-	Away from	Apocrine glands	انفصال
Auto-	self	autoagglutination	ذات، نفس
Bi-	Both, two	bilateral	كلا، اثنان
Brady-	slow	bradycardia	بطيء
Circum-	around	Circum oral	حول
Contra-	against	contralateral	مضاد
Cyan-	blue	cyanosis	ازرق
De-	Lack of	dehydration	نقص، بعيد
di-	two	diplegia	اثنان
Dia-	through	dialysis	خلال
Dys-	Bad, difficult	dysplastic	صعب، سيء

Echo-	sound	echocardiography	صوت
Ec-	outward	ectoderm	خارج
End-, endo-	within	endothelium	داخل، باطن
Epi-	above	epigastric	فوق
Ex-, exo-	out	exostosis	خارج
Extra-	outside	extracardia	خارج
Gyne-	woman	gynecology	انثى، امرأة
Hemi-	half	hemiplegia	نصف
Homo-	same	homogenous	مثلي
Hyde-	water	hydrophilic	ماء
hyper	excessive	hypertension	مرتفع، زائد
Hypo-	Below, under, deficient	hypotension	منخفض ناقص
In-	not	insomnia	لا، غير
Infra-	Beneath, below	infrared	تحت، دون، اسفل
Inter-	between	intercostal	بين
Intra-	within	intracerebral	داخل
Leuko-	white	leukocytes	ابيض
Lipo-	fat	lipocytes	شحم
Macro-	large	macroglossia	ضخم
Micro-	small	microscope	صغير
Mega-	great	megacolon	ضخم
Mono-	one	monocyte	وحيد
Multi-	many	multipara	متعدد
Neo-	new	neonatal	جديد
Non-	not	nonbacterial	غير
Pan-	all	panphobia	شامل
Para-	Beside, near	paraplegia	مجاور
Peri-	around	perivascular	احاطة
Poly-	many	polycystic	متعدد
Post-	behind	Postsurgical	خلف، تالي
Pre-	before	preauricular	قبل
Pro-	In front of	proptosis	امام
quadri-	four	quadriplegia	اربعة
Re-	again	rehydration	اعادة
Retro-	behind	retroflexion	خلف

<b>Sub-</b>	<b>below</b>	<b>subcutaneous</b>	<b>تحت</b>
<b>Super-</b>	<b>above</b>	<b>superficial</b>	<b>فوق، فرط</b>
<b>Supra-</b>	<b>above</b>	<b>suprapubic</b>	<b>فوق</b>
<b>Tachy-</b>	<b>rapid</b>	<b>tachycardia</b>	<b>سريع</b>
<b>Tetra-</b>	<b>four</b>	<b>tetralogy</b>	<b>اربعة</b>
<b>Tri-</b>	<b>three</b>	<b>Tricuspid</b>	<b>ثلاثة</b>
<b>Uni-</b>	<b>one</b>	<b>unilateral</b>	<b>واحد</b>

## Terminology

### Suffixes اللواحق

Suffix	Meaning	Example	بالعربي
-al	Pertaining to	abdominal	متعلق ب
-algia	pain	arthralgia	ألم
-ar	Pertaining to	vascular	متعلق ب
-ary	Pertaining to	biliary	متعلق ب
-ase	enzyme	oxidase	أنزيم
-blast	Immature cell	normoblast	خلية غير ناضجة
-crine	Secrete within	endocrine	يفرز ضمن
-cyte	cell	leukocyte	خلية
-cytosis	Abnormal increase of cells	leukocytosis	زيادة غير طبيعية للخلايا
-ectasia, -ectasis	dilation	bronchiectasis	توسع
-ectomy	Surgical removal	hysterectomy	ازالة جراحية
-edema	Accumulation of fluid, swelling	lymphedema	تراكم سوائل، تورم
-emesis	vomiting	hematemesis	قيء
-emia	Blood condition	anemia	حالة الدم
-gen	producing	carcinogen	ينتج
-gram	Record or picture	echocardiogram	تخطيط او صورة

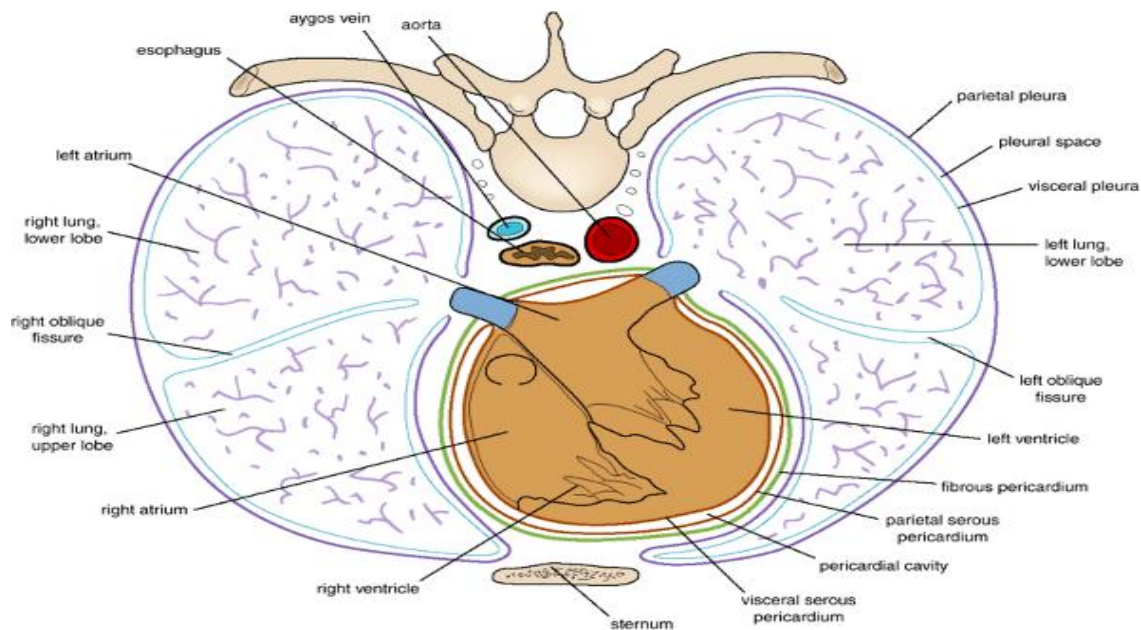
<b>-graph</b>	<b>Instrument used to record</b>	<b>echocardiograph</b>	أداة تستعمل للتصوير
<b>-graphy</b>	<b>Process of recording</b>	<b>echcardiography</b>	طريقة تصوير
<b>-ic</b>	<b>Pertaining to</b>	<b>lymphatic</b>	متعلق ب
<b>-ist</b>	<b>practitioner</b>	<b>radiologist</b>	اخصائي في حقل
<b>-itis</b>	<b>inflammation</b>	<b>dermatitis</b>	التهاب
<b>-logy</b>	<b>Study of</b>	<b>biology</b>	دراسة
<b>-lysis</b>	<b>Loosening, dissolving</b>	<b>hemolysis</b>	انحلال
<b>-megaly</b>	<b>enlargement</b>	<b>cardiomegaly</b>	تضخم
<b>-meter</b>	<b>Instrument to measure</b>	<b>sphygmomanometer</b>	أداة قياس
<b>-metry</b>	<b>Process of measuring</b>	<b>spirometry</b>	عملية قياس
<b>-oid</b>	<b>Resembling</b>	<b>ovoid</b>	شبيهه
<b>-oma</b>	<b>Tumor, mass</b>	<b>fibroma</b>	ورم
<b>-opia</b>	<b>Vision condition</b>	<b>myopia</b>	رؤية
<b>-osis</b>	<b>Disease, condition</b>	<b>keratosis</b>	حالة
<b>-ous</b>	<b>Pertaining to</b>	<b>mucous</b>	متعلق ب
<b>-pathy</b>	<b>disease</b>	<b>neuropathy</b>	مرض
<b>-penia</b>	<b>deficiency</b>	<b>thrombocytopenia</b>	نقص
<b>-phobia</b>	<b>fear</b>	<b>photophobia</b>	خوف
<b>-plasm</b>	<b>Condition of formation</b>	<b>neoplasm</b>	نمو
<b>-plasty</b>	<b>Surgical repair</b>	<b>bronchoplasty</b>	تقويم
<b>-plegia</b>	<b>paralysis</b>	<b>paraplegia</b>	شلل
<b>-pnea</b>	<b>breathing</b>	<b>apnea</b>	تنفس
<b>-rhage, -rhagia</b>	<b>hemorrhage</b>	<b>hemorrhage</b>	نزف
<b>-rhea</b>	<b>flow</b>	<b>oligomenorrhea</b>	انسياب
<b>-sarcoma</b>	<b>cancer</b>	<b>osteosarcoma</b>	سرطان
<b>-scope</b>	<b>Instrument to view</b>	<b>otoscope</b>	منظار
<b>-scopy</b>	<b>Process of viewing</b>	<b>bronchoscopy</b>	عملية منظار
<b>-spasm</b>	<b>contraction</b>	<b>bronchosapsm</b>	تشنج
<b>-stasis</b>	<b>stoppage</b>	<b>hemostasis</b>	توقف

<b>-tome</b>	<b>Instrument to cut</b>	<b>microtome</b>	آلة قطع
<b>-tomy</b>	<b>incision</b>	<b>laparotomy</b>	شق
<b>-uria</b>	<b>urine</b>	<b>hematuria</b>	بول



## Chest Cavity

The chest cavity is bounded by the chest wall and below by the diaphragm. It extends upward into the root of the neck about one fingerbreadth above the clavicle on each side. The diaphragm, which is a very thin muscle, is the only structure (apart from the pleura and peritoneum) that separates the chest from the abdominal viscera. The chest cavity can be divided into a median partition, called the mediastinum, and the laterally placed pleurae and lungs



## Mediastinum

The mediastinum, though thick, is a movable partition that extends superiorly to the thoracic outlet and the root of the neck and inferiorly to the diaphragm. It extends anteriorly to the sternum and posteriorly to the vertebral column. It contains the remains of the thymus, the heart and large blood vessels, the trachea and esophagus, the thoracic duct and lymph nodes, the vagus and phrenic nerves, and the sympathetic trunks.

The mediastinum is divided into superior and inferior mediastina.

The inferior mediastinum is further subdivided into the middle mediastinum, which consists of the pericardium and heart; the anterior mediastinum, which is a space between the pericardium and the sternum; and the posterior mediastinum, which lies between the pericardium and the vertebral column.

## Superior Mediastinum

(a) Thymus, (b) large veins, (c) large arteries, (d) trachea, (e) esophagus and thoracic duct, and (f) sympathetic trunks

The superior mediastinum is bounded in front by the manubrium sterni and behind by the first four thoracic vertebrae

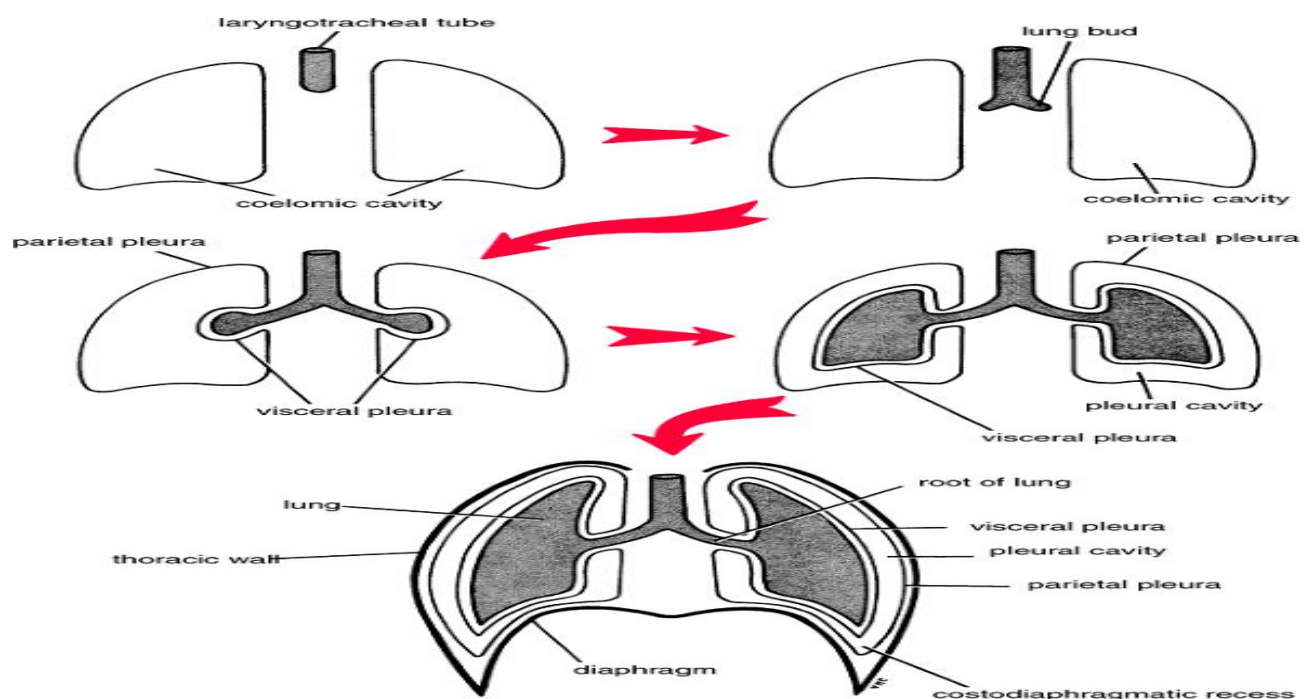
## Inferior Mediastinum

(a) Thymus, (b) heart within the pericardium with the phrenic nerves on each side, (c) esophagus and thoracic duct, (d) descending aorta, and (e) sympathetic trunks

## Pleurae

The pleurae and lungs lie on either side of the mediastinum within the chest cavity

Each pleura has two parts: a parietal layer, which lines the thoracic wall; and a visceral layer, which completely covers the outer surfaces of the lungs.



## Pericardium

The pericardium is a fibroserous sac that encloses the heart and the roots of the great vessels. Its function is to restrict excessive movements of the heart as a whole and to serve as a lubricated container in which the different parts of the heart can contract. The pericardium lies within the middle mediastinum

## Fibrous Pericardium

The fibrous pericardium is the strong fibrous part of the sac. It is firmly attached below to the central tendon of the diaphragm.

## Serous Pericardium

The serous pericardium lines the fibrous pericardium and coats the heart. It is divided into parietal and visceral layers.

