بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

ANATOMY

وَلَقَدْ خَلَقْنَا الْإِنسَانَ وَنَعْلَمُ مَا تُوَسْوِسُ بِهِ نَفْسُهُ ۖ وَنَحْنُ أَقْرَبُ إِلَيْهِ مِنْ حَبْلِ الْوَرِيدِ

MID | Lecture 7

Cardiovascular System Pt.2

Written by : Dareen Alhababseh
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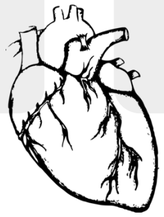
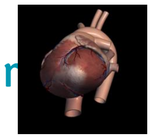
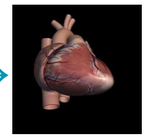
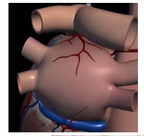
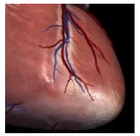


· The heart has a Pyramidal → has apex, base, 4 surfaces
· To claim anatomical position :
direct the apex : anteriorly → to the left → slightly inferior  →  → 

Directly opposite to the apex, we have the base of the heart, which is also called the posterior surface of the heart. 

The surface that is directed toward the right lung is called the right surface,  and we have the anterior surface 

, the left surface  and the final surface is the diaphragmatic surface (inferior surface), which lies on the diaphragm

and can be seen when we turn the heart and look at it from below 

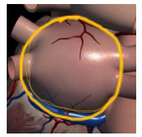
Now let's talk about the chambers of the heart, we have 4 chambers. The first one is the right atrium, which receives deoxygenated blood. From the right atrium, the blood moves to the right ventricle, which pumps the blood to the lungs via the pulmonary arteries.
Then the blood returns to the left atrium via the pulmonary veins, and from there it goes to the left ventricle. Finally, the left ventricle pumps the blood into the aorta, and from the aorta it is distributed to the systemic circulation.
RA → RV → pulmonary arteries → lungs → pulmonary veins → LA → LV → aorta

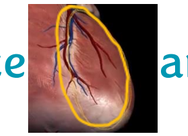
---

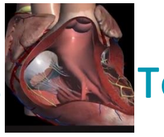
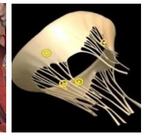
The right atrium forms the right surface of the heart. Each atrium has an extension or pouch called an auricle; in this case

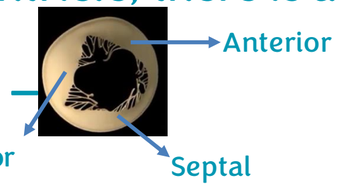
it is called the right auricle.  From the right atrium we go to the right ventricle. The right ventricle forms the anterior

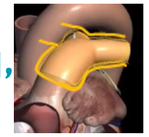
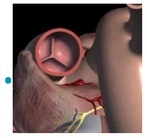
surface and part of the inferior (diaphragmatic) surface of the heart. 

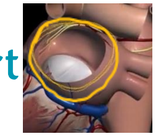
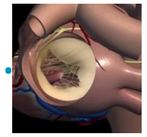
Then we have the left atrium, which forms the posterior surface (the base) of the heart. The left atrium receives 4 pulmonary veins: 2 right pulmonary veins and 2 left pulmonary veins, coming from the right and the left lungs. 

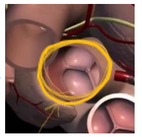
Then we go to the left ventricle. It forms the left surface  and about two-thirds of the inferior (diaphragmatic) surface, and it also forms the apex of the heart. 

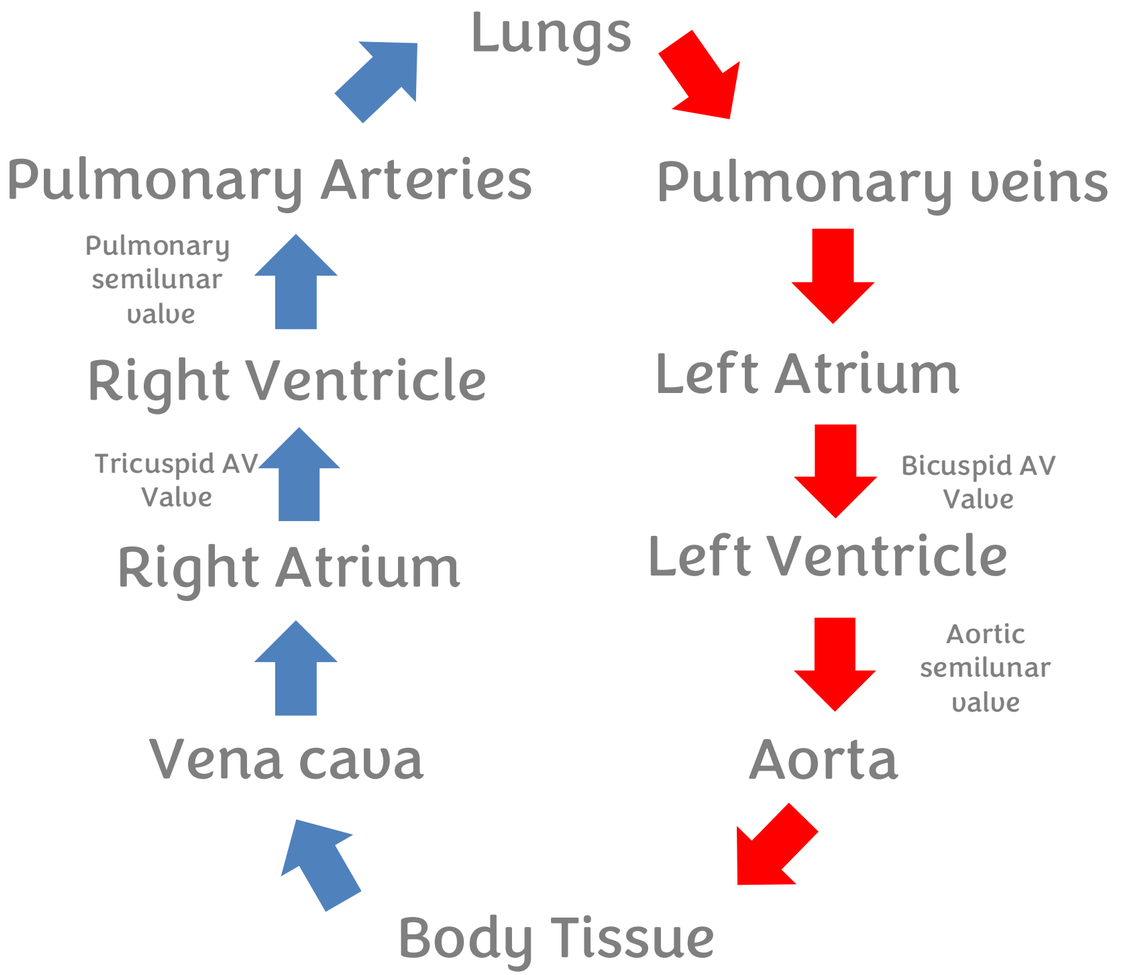
Let's look at the heart from the inside. Here we have the right atrium.  From the right atrium, blood flows down into The right ventricle.  To allow the passage of deoxygenated blood from the right atrium to the right ventricle, there is a valve called the tricuspid valve.   It is composed of three cusps – anterior, posterior, and septal – and is also known as the right atrioventricular (AV) valve.



The right ventricle pumps blood into the pulmonary artery,  which carries it to the two lungs. Between the ventricle And the artery, there is a valve called the pulmonary (semilunar) valve.  It has three cusps, but unlike the tricuspid valve, their shape is semilunar (crescent-shaped).

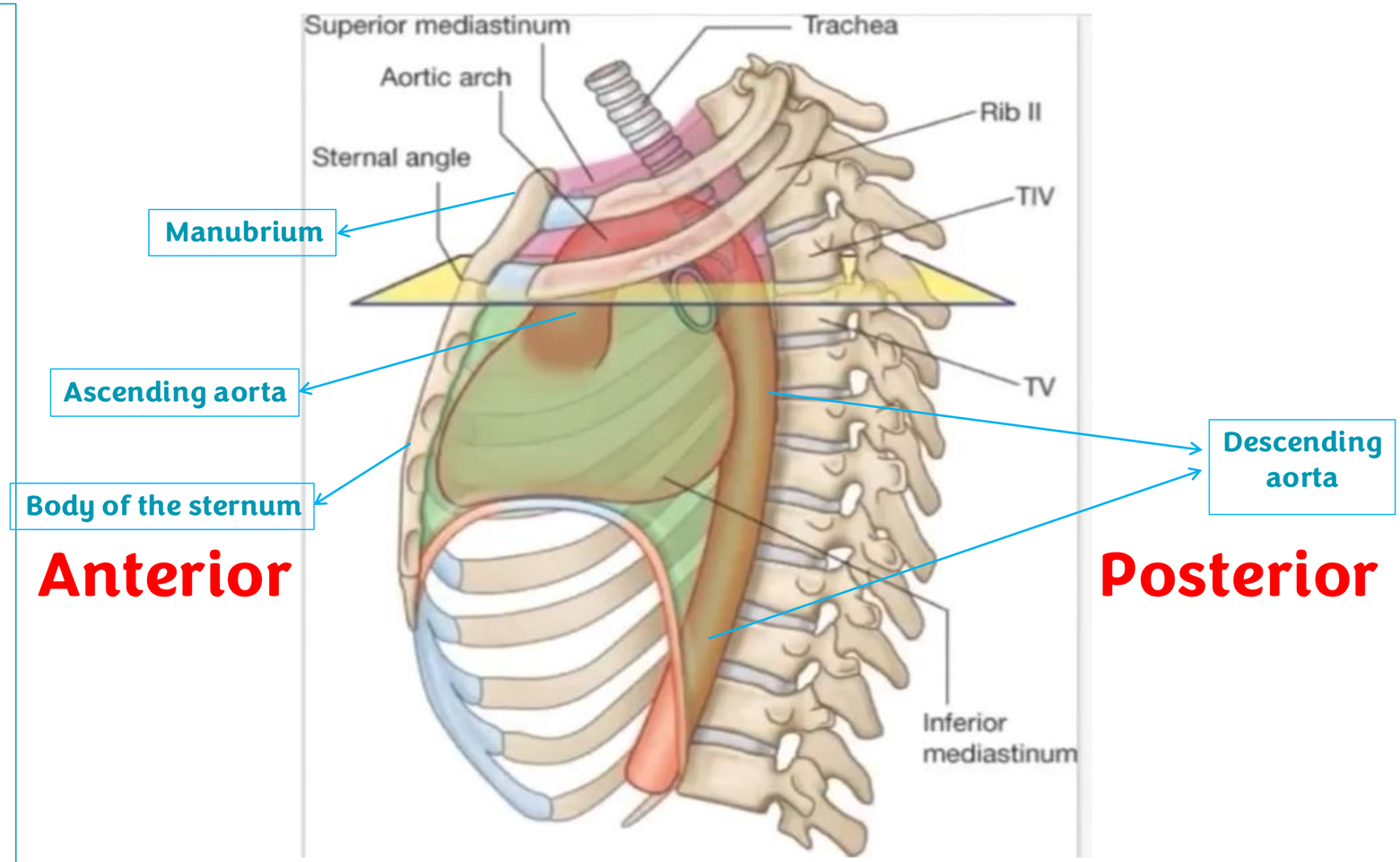
Then the blood returns to the left atrium, which forms the posterior surface (the base) of the heart  From the left atrium,
blood flows down into the left ventricle.  Between the left atrium and left ventricle, there is a valve called the mitral valve
, also known as the bicuspid valve, because it is composed of two cusps.  

Then, from the left ventricle, blood flows into the aorta  Between the left ventricle and the aorta,there is a valve called the aortic valve. This valve is located deep within the heart and, like the pulmonary valve, it is a semilunar valve. Both valves have the same crescent-shaped structure. 



Sternal angle (angle of Luis)

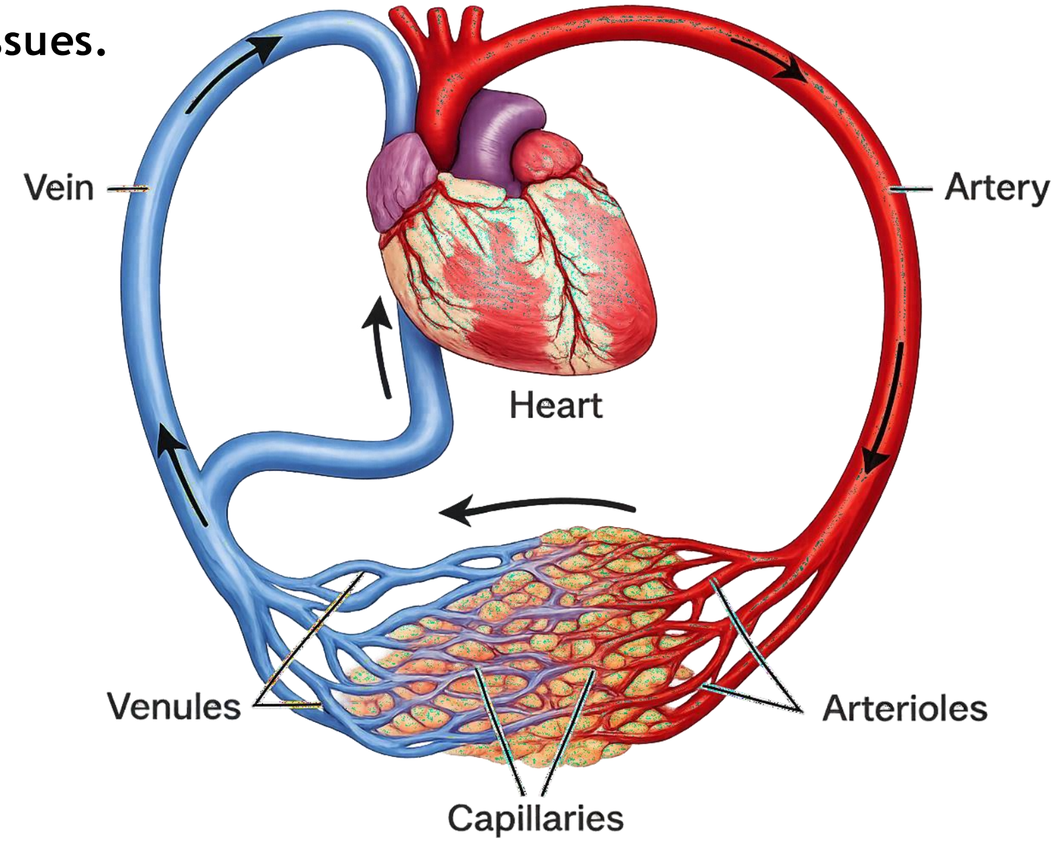
- This angle is located in the sternum between the **manubrium and the body of the sternum** It is clinically useful for counting ribs and intercostal space and it can be used to draw an imaginary plane from it (sternal angle) which extends posteriorly towards the intervertebral disc between the 4th and 5th thoracic vertebrae (T4 and T5) where there are lots of events take place like :
- **Trachea** : (it firstly initiate as one tube, when it reaches this plane it divides into two tubes one goes anteriorly and the other goes posteriorly when you look at it **laterally** (The left and right bronchi)).
- **Aorta** : which arises from the **left ventricle** of the heart, the first part of it is called the **ascending aorta** which begins at the **aortic valve** of the left ventricle and ends at the level of the sternal angle (Angle of Louis), where it continues as the aortic arch. The aortic arch **begins** at the end of the ascending aorta and **ends** at the beginning of the descending thoracic aorta at the level of the sternal angle (T4-T5)which means that the aortic arch starts anteriorly at the level of the sternal angle and ends posteriorly in the same plane until we reach the descending thoracic aorta starts at the end of the aortic arch and descends to the diaphragm.
- Ascending → arch → descending



Lateral view

Capillaries

- They are microscopic, thin-walled blood vessels that connect arterioles to venules.
- Capillaries are the primary sites of exchange between the blood and body cells
  - Their walls consist of a single layer of endothelial cells, which allows the exchange of oxygen, carbon dioxide, nutrients, hormones, and waste products between the blood and the tissues.

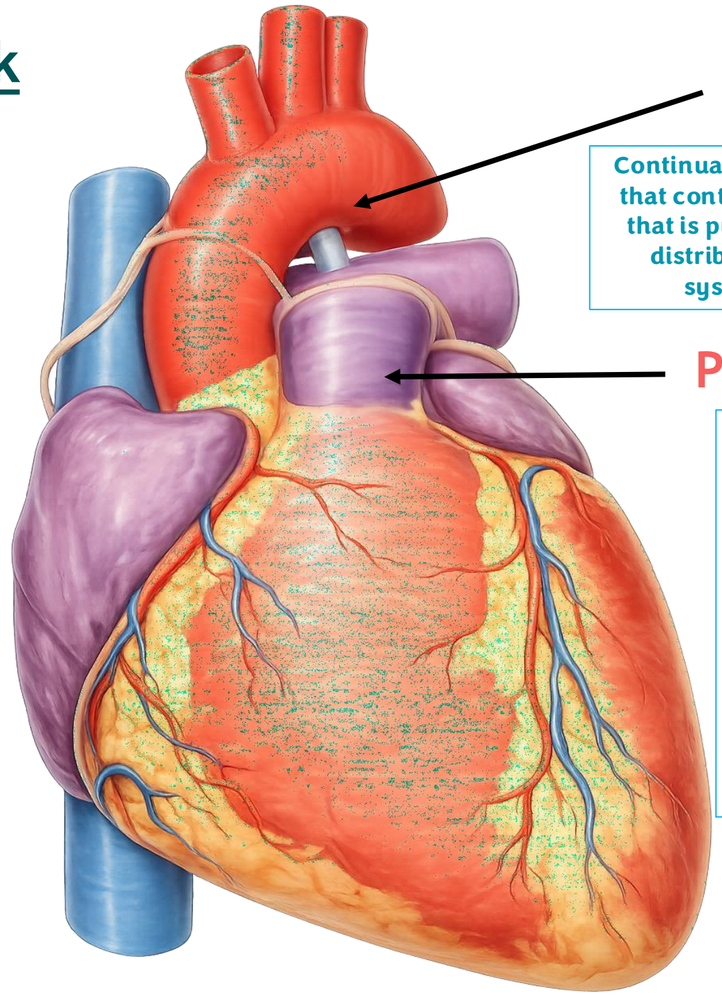


Major Arteries Leaving the Heart

1. Aorta

Right Atrium → Right Ventricle → Pulmonary Artery → Lungs → Left Atrium → Left Ventricle → Aorta → Body

2. Pulmonary Trunk

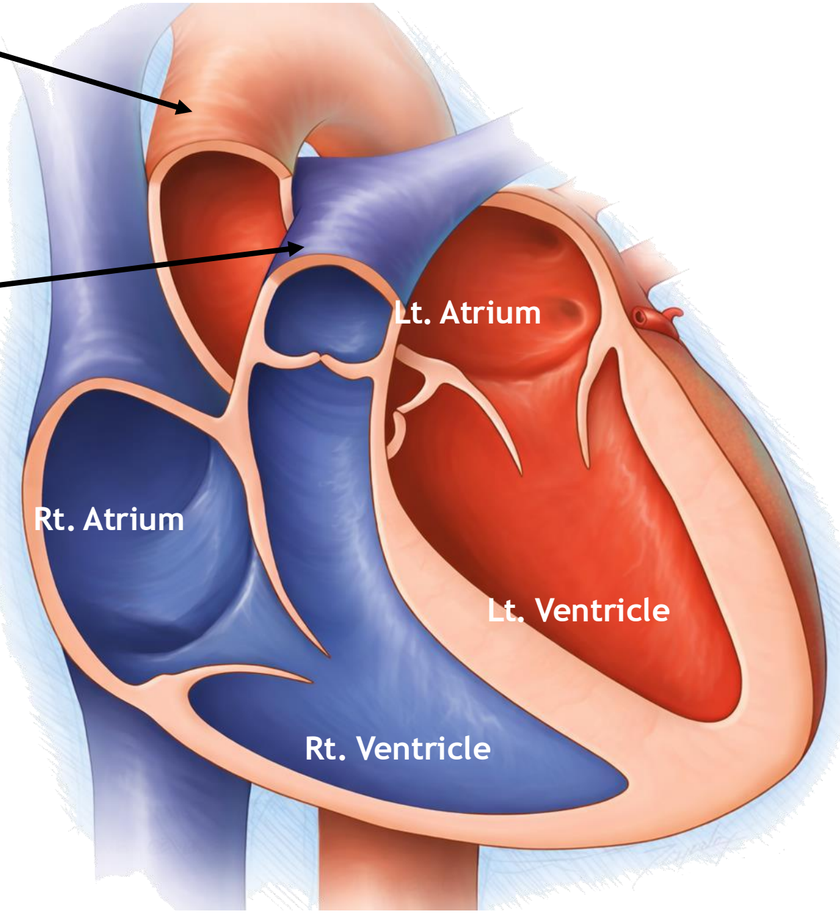


Aorta

Continuation of the left ventricle that contains oxygenated blood that is pumped into it and then distributed throughout the systemic circulation.

Pulmonary

The pulmonary artery is a continuation of the right ventricle, carrying deoxygenated blood, which is pumped into it and sent to the lungs. In the lungs, gas exchange occurs, oxygenating the blood. The oxygenated blood then returns to the left atrium and subsequently passes into the left ventricle.

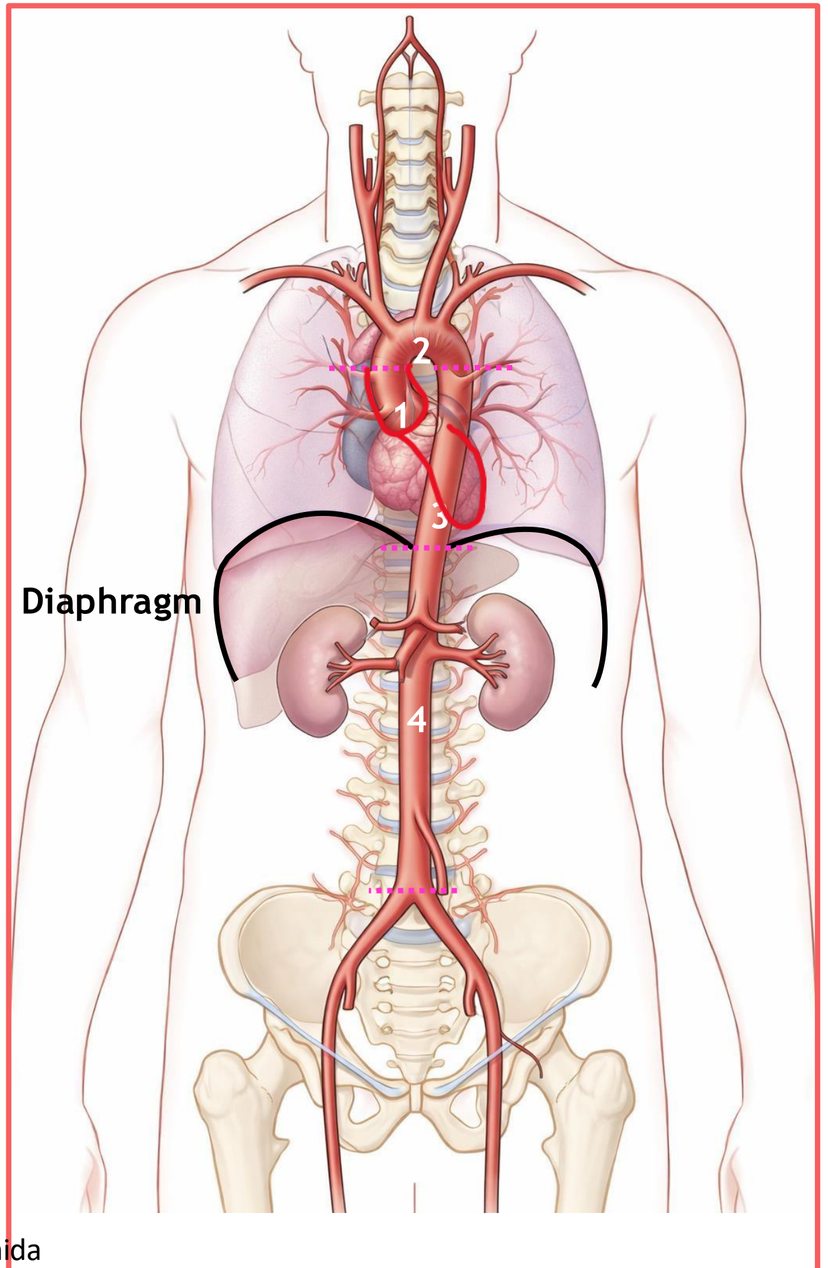


Major Arteries Leaving the Heart

1. Aorta

- The aorta is the largest artery of the body, with a diameter of 2-3 cm (about 1 in.).
- It conveys oxygenated blood from the left ventricle of the heart to all organs throughout the body.
- It consists of four main parts as numbered in the picture :

1. **Ascending aorta :** begins from the aortic valve and ends at the level of the sternal angle (Angle of Louis).
2. **Arch of the aorta :** it curves upward, posteriorly, starting at the end of the ascending aorta and ending posteriorly at the level of the sternal angle (T4-T5), where it continues as the descending thoracic aorta.
3. **Descending thoracic aorta :** in the thoracic cavity then it pierce through the diaphragm to continue at the abdominal cavity
4. **Abdominal aorta :** begins at the diaphragm (T12) as a continuation of the descending thoracic aorta and ends at L4, where it divides into the common iliac arteries.



Major Arteries Leaving the Heart

1. Aorta

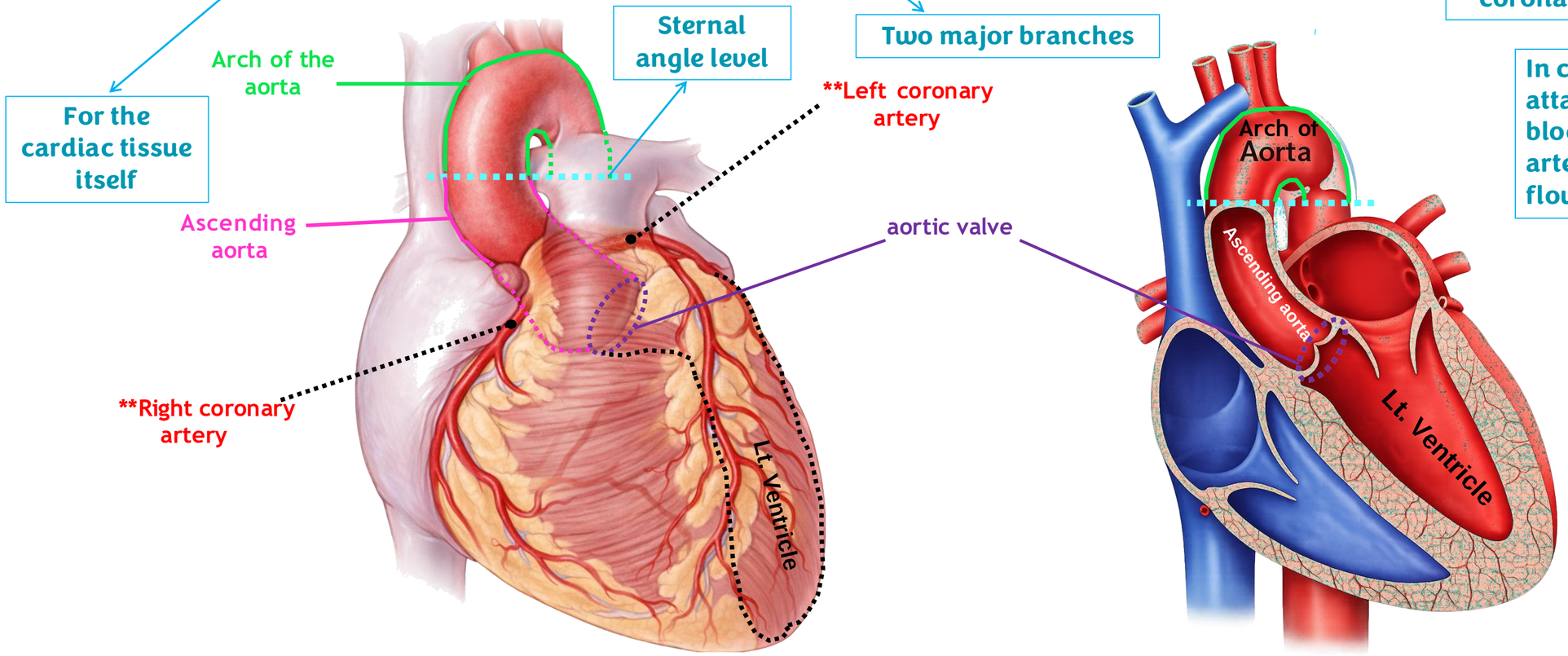
1. Ascending aorta

- The ascending aorta emerges from the left ventricle and runs upward and forward.
- It begins at the aortic valve and ends at the level of the sternal angle, where it becomes the arch of the aorta.
- The ascending aorta gives off two coronary arteries (right and left coronary arteries) that supply the myocardium of the heart.

For the cardiac tissue itself

Two major branches

*coronary arteries = الشرايين التّاجيّة



In certain individuals, a heart attack occurs because of a blockage in the coronary arteries, which reduces blood flow to the heart muscle.

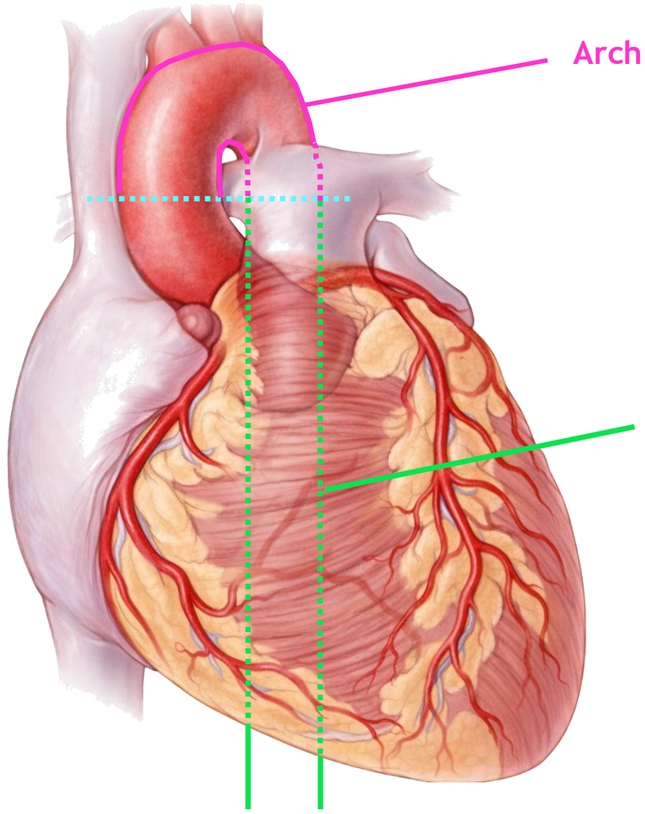
Major Arteries Leaving the Heart

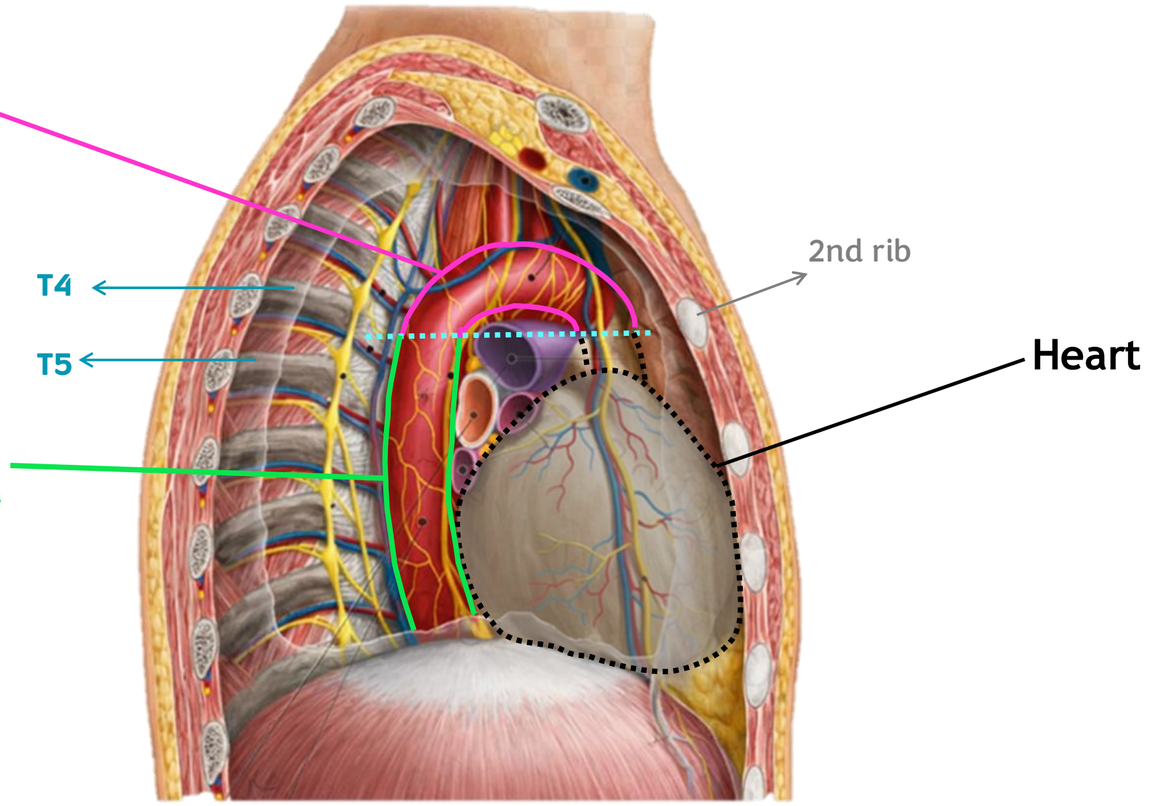
1. Aorta

2. Arch of the aorta

The aortic arch begins anteriorly at the level of the sternal angle and curves posteriorly (behind the heart) and to the left, ending at the same plane (sternal angle) where it continues as the descending thoracic aorta.

- It is the continuation of the ascending aorta.
- It arches upward, backward, and to the left
- It then passes downward and ends at the level of the sternal angle, where it becomes the descending thoracic aorta.





Lateral view

Major Arteries Leaving the Heart

Gross lecture-6

1. Aorta

2. Arch of the aorta

- The arch of the aorta gives rise to three major arteries from its superior (convex) surface:

i. **Brachiocephalic trunk**

- Divides into the right subclavian artery and right common carotid artery.

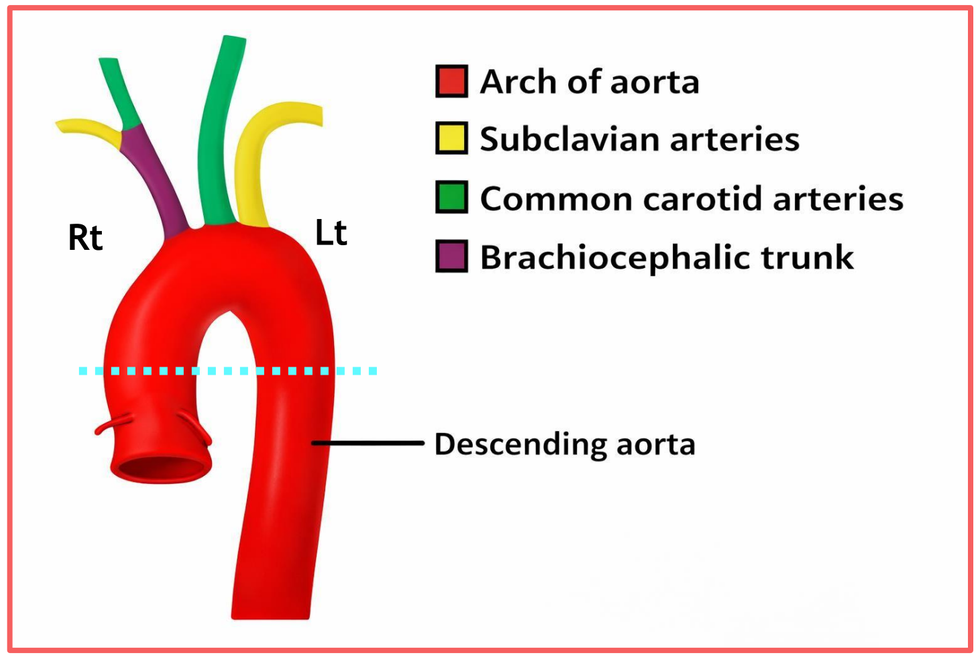
ii. **Left common carotid artery** — It supplies blood to the left side of head and neck

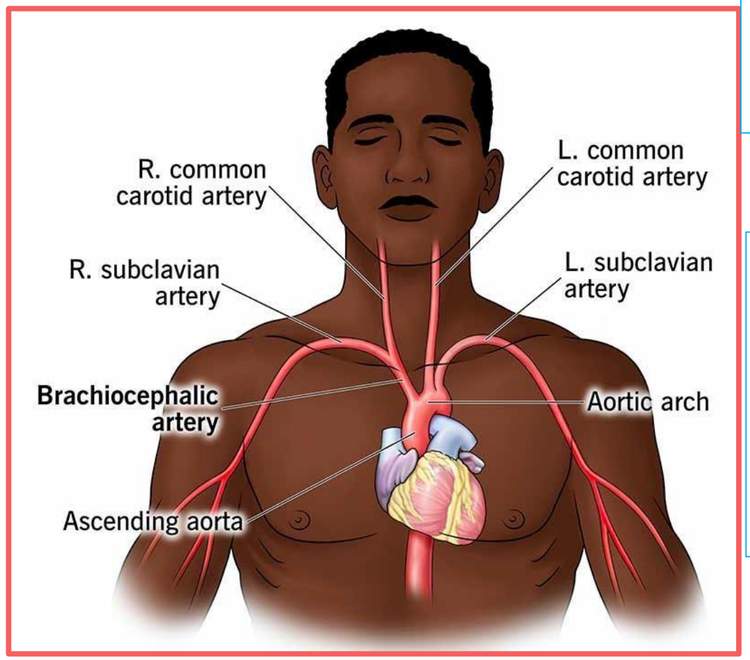
iii. **Left subclavian artery** — It supplies blood to the left upper limb

Brachiocephalic Artery

Name meaning: The term "brachiocephalic" comes from "brachio" (arm) and "cephalic" (head), meaning it supplies blood to the right upper limb and right side of head and nick.

To sum up the brachiocephalic artery, the first branch of the aortic arch, supplies the right side of the head, neck, and upper limb by dividing into the right common carotid artery and the right subclavian artery, while the left common carotid and left subclavian arteries supply the left side of the head, neck, and upper limb, respectively.





Note :"The right subclavian artery and the right common carotid artery arise from the brachiocephalic trunk, which is a branch of the arch of the aorta. In contrast, the left common carotid artery and the left subclavian artery arise directly from the arch of the aorta."

Major Arteries Leaving the Heart

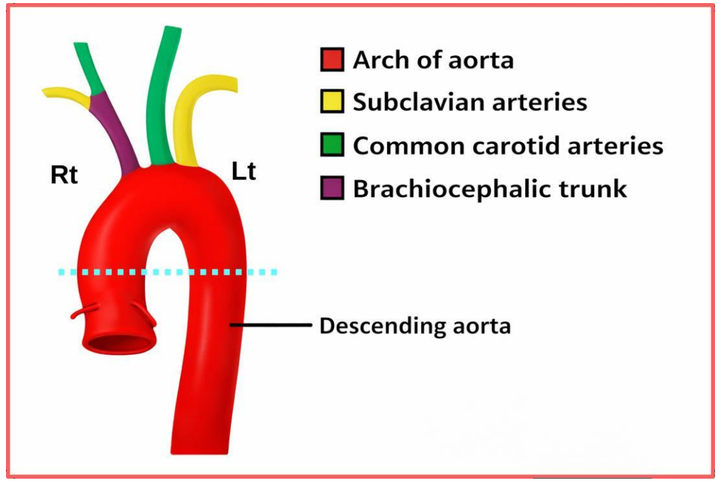
1. Aorta

2. Arch of the aorta

- The arch of the aorta gives rise to three major arteries from its superior (convex) surface:

i. **Brachiocephalic trunk**

- The first and largest branch, passes upward and to the right and divides into the right subclavian artery and right common carotid artery.

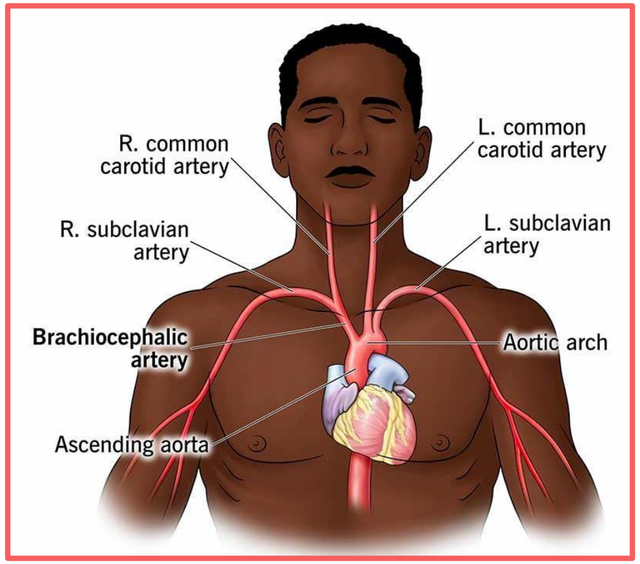


ii. **Left common carotid artery**

- The second branch, arises on the left side of the brachiocephalic artery.
- It runs upward and to the left of the trachea and enters the neck
- It gives off branches that supply the head and neck structures.

iii. **Left subclavian artery**

- The third branch, arises posterior to 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 and continues toward the left upper limb.
- It gives off branches that supply the upper limb structures.



Major Arteries Leaving the Heart

1. Aorta

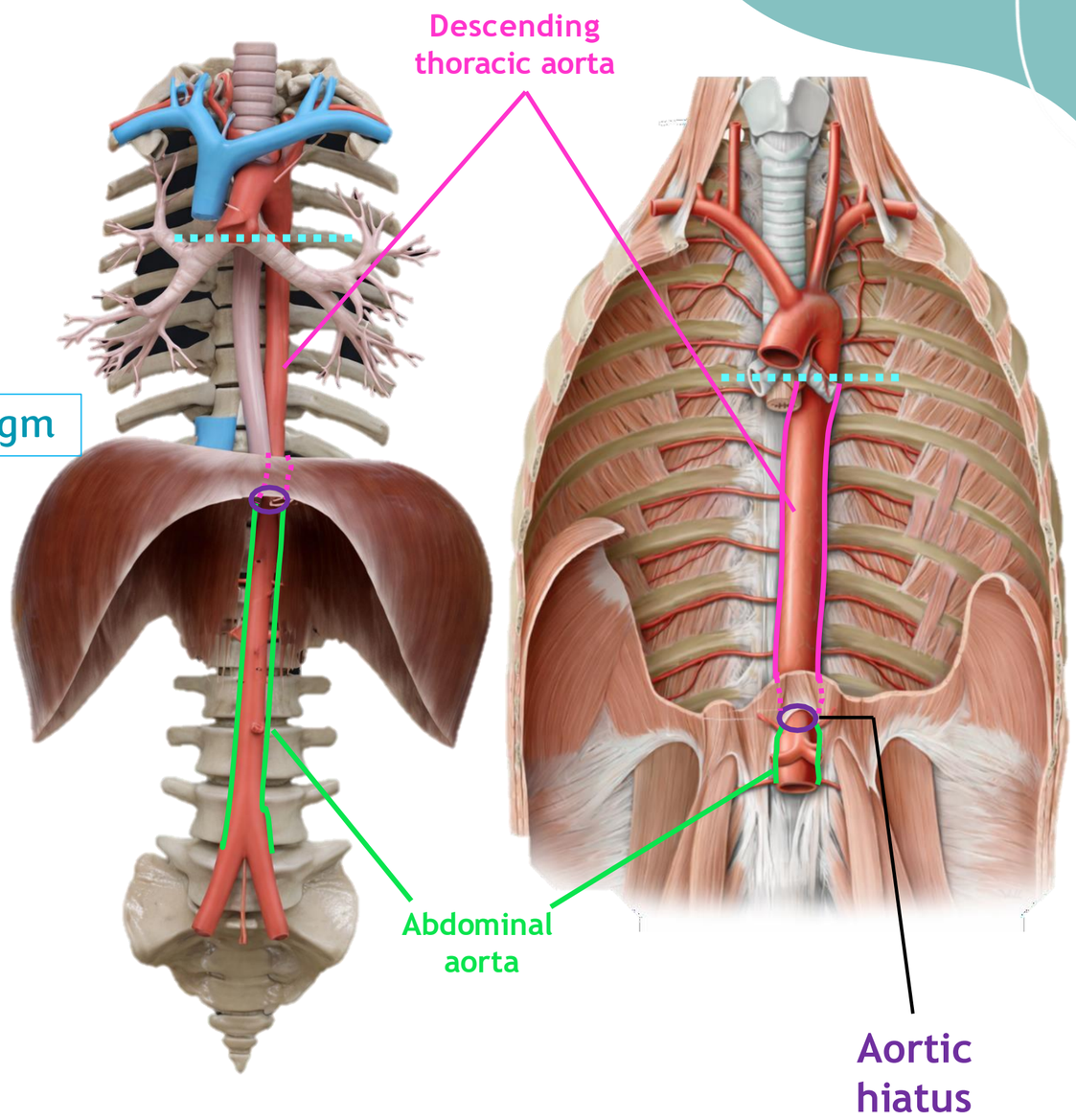
3. Descending thoracic aorta

- It begins as the continuation of the arch of the aorta at the level of the sternal angle.
- It runs downward along the left side of the vertebral column. And runs anterior to the vertebral column
- At the level of the 12th thoracic vertebra (T12), it passes through the aortic hiatus of the diaphragm and becomes continuous with the abdominal aorta.

Opening or piercing in the diaphragm

- It gives off branches that supply most structures of the chest cavity. (thoracic cavity)

The branches is from the lateral side of the descending thoracic aorta



Major Arteries Leaving the Heart

1. Aorta

4. Abdominal aorta

It begins at the aortic hiatus in the diaphragm (which is the end of the descending thoracic aorta) and completing downward toward the pelvic cavity

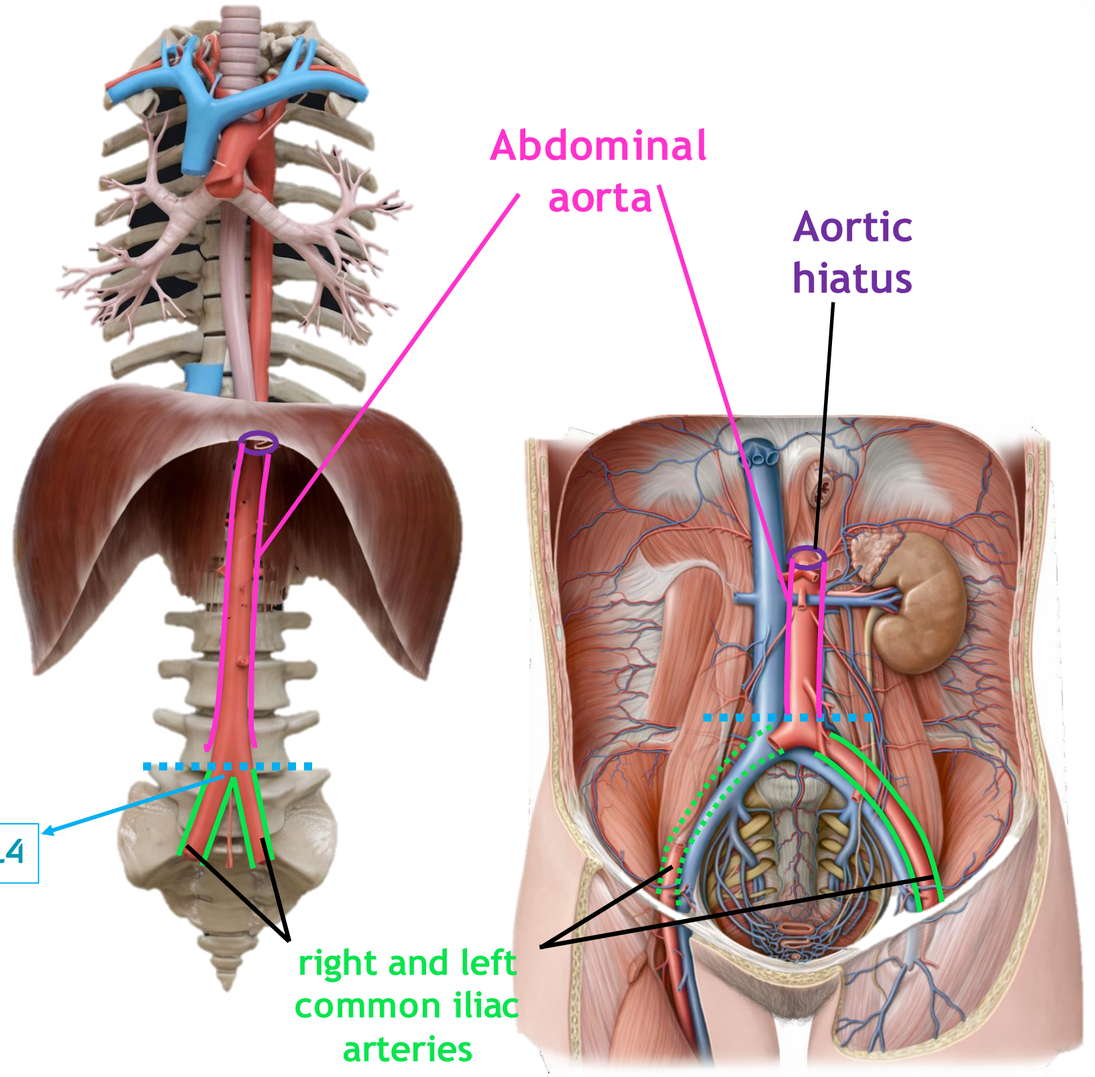
- It is the continuation of the thoracic aorta after it passes through the diaphragm.

- It begins at the aortic hiatus in the diaphragm and ends at about the level of the fourth lumbar vertebra (L4), where it divides into the right and left common iliac arteries.

These right and left common iliac arteries supply the pelvic cavity and a part ot them supply the lower limb

- It gives off visceral and parietal branches that supply most structures in the abdominal cavity.

The major branches is from the lateral side and the anterior surface of the abdominal aorta to supply the internal structure(the most structure in the Abdominal cavity such as :kidney, stomach, large and small intestine .



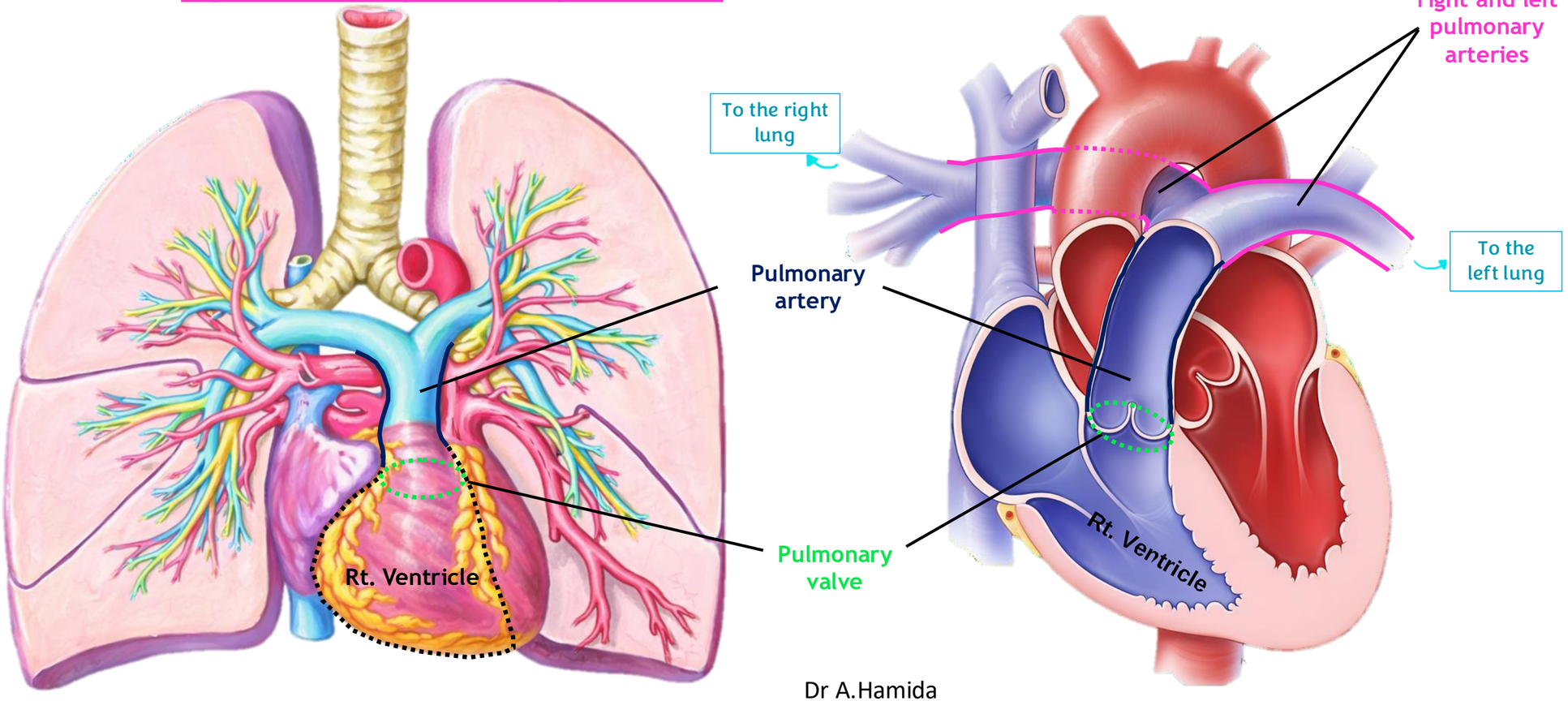
Major Arteries Leaving the Heart

2. Pulmonary Trunk (artery)

It is continuation of the right ventricle

➢ It conveys deoxygenated blood from the right ventricle of the heart to the lungs.

- It leaves the right ventricle and runs upward, backward, and to the left.
- It begins at the pulmonary valve
- It is about 5 cm (2 inches) long and terminates inferior to the arch of the aorta by dividing into the right and left pulmonary arteries.



Major Veines Entering the Heart

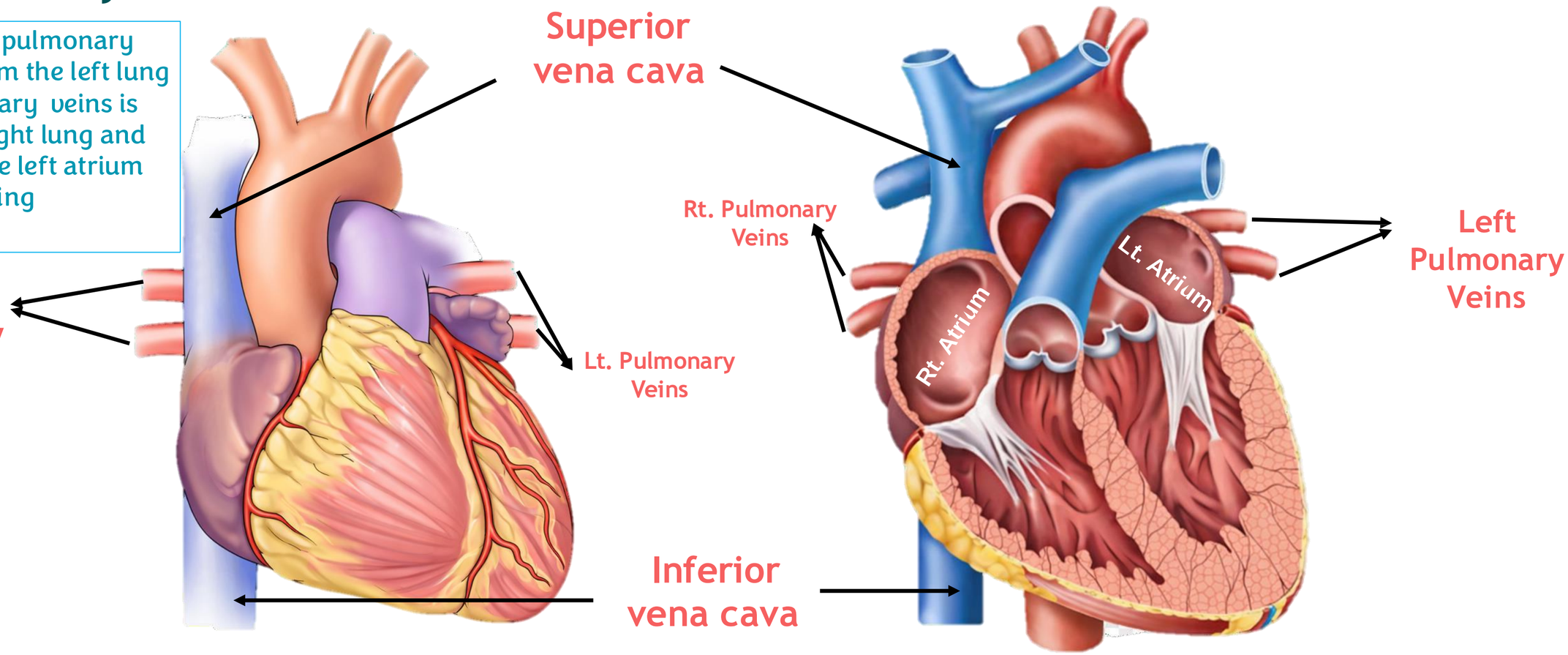
➢ Veins drain blood away from the various parts and return the blood to the heart.

1. Superior vena cava (SVC)
2. Inferior vena cava (IVC)

They are carrying deoxygenated blood and enter the right atrium

3. Pulmonary Veins

Composed of 2 left pulmonary veins is coming from the left lung and 2 right pulmonary veins is coming from the right lung and all of them enter the left atrium and they are carrying oxygenated blood

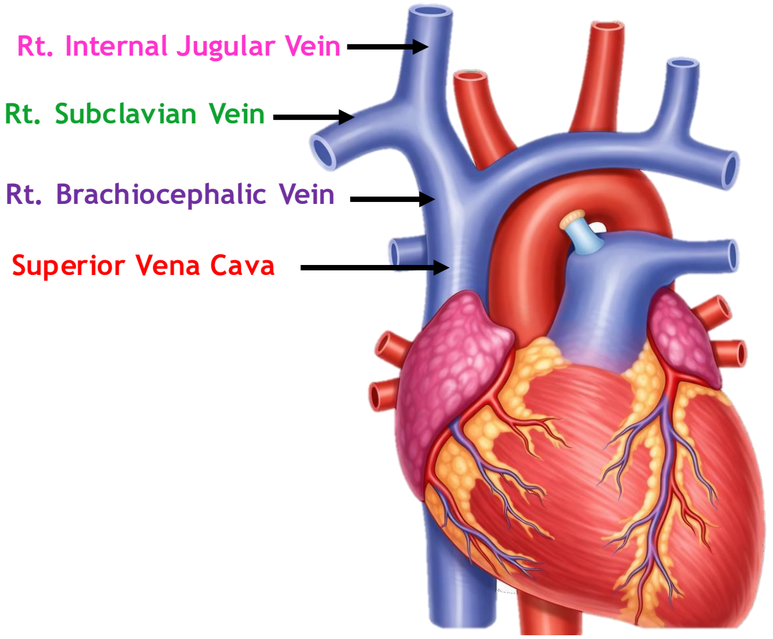


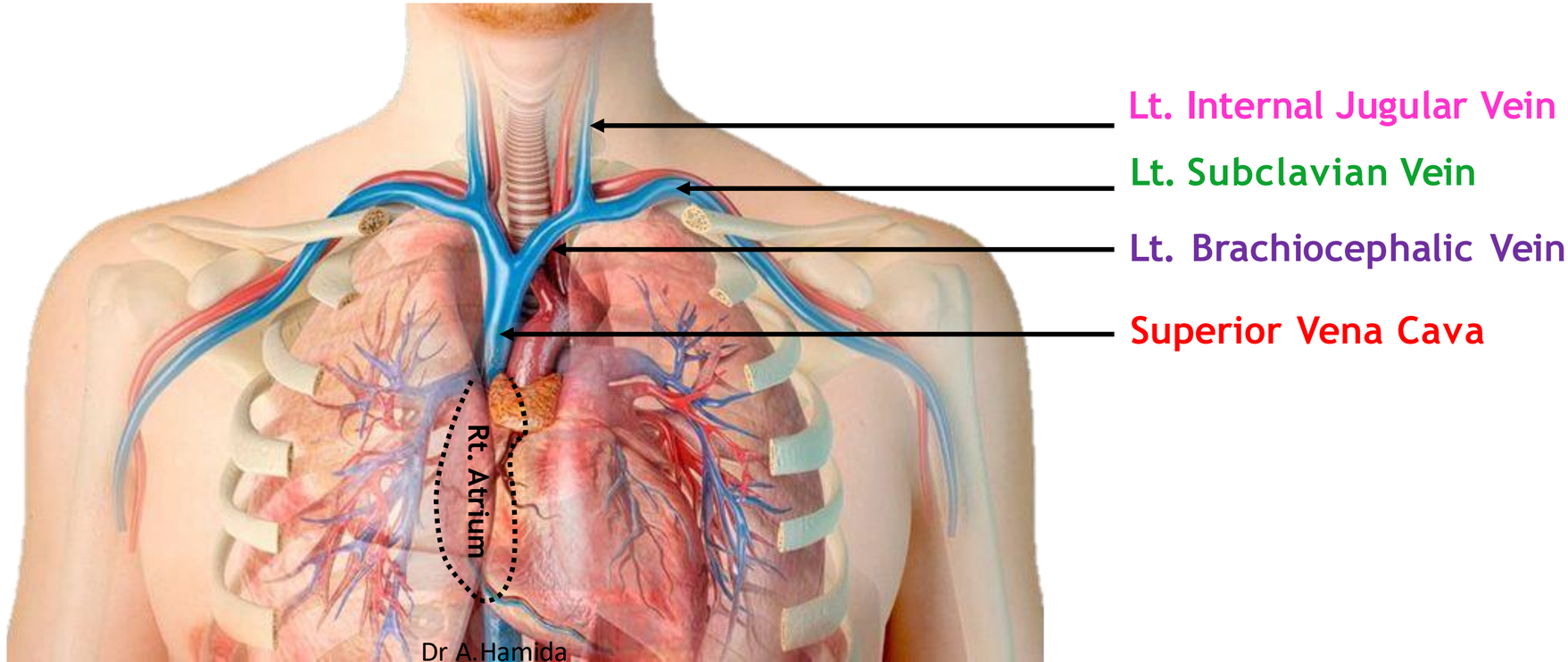
Major Veines Entering the Heart

1. Superior Vena Cava (SVC)

➢ It receives venous blood from the head, neck, thorax (above the diaphragm), and both upper limbs.

- The internal jugular veins convey venous blood from the head and neck.
- The subclavian veins convey venous blood from the upper limbs.
- Each internal jugular vein joins with a subclavian vein to form the right and left brachiocephalic veins.
- The two brachiocephalic veins unite to form the superior vena cava.
- The SVC then passes downward and opens into the upper part of the right atrium.





Major Veines Entering the Heart

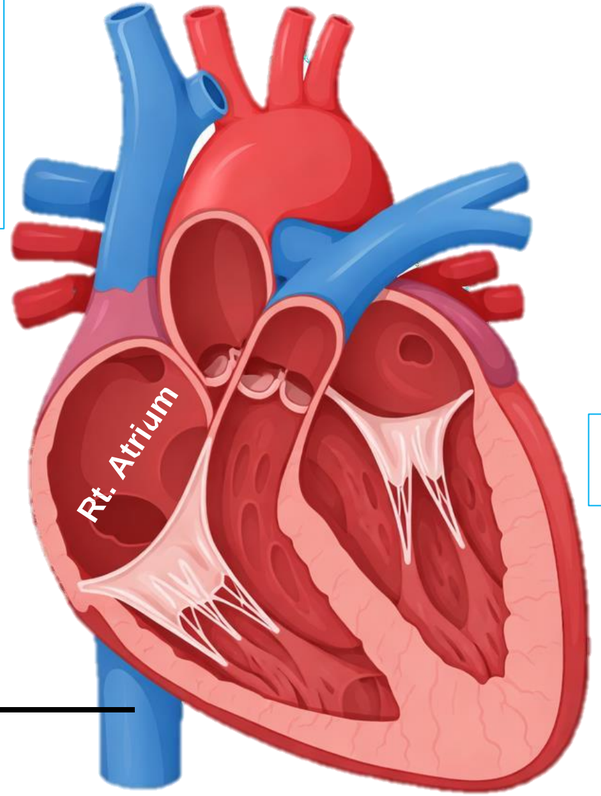
2. Inferior Vena Cava

It runs upward in the abdominal cavity anterior to the vertebral column (lumbar vertebra)

➢ It receives venous blood from the abdomen, pelvis, and both lower limbs.

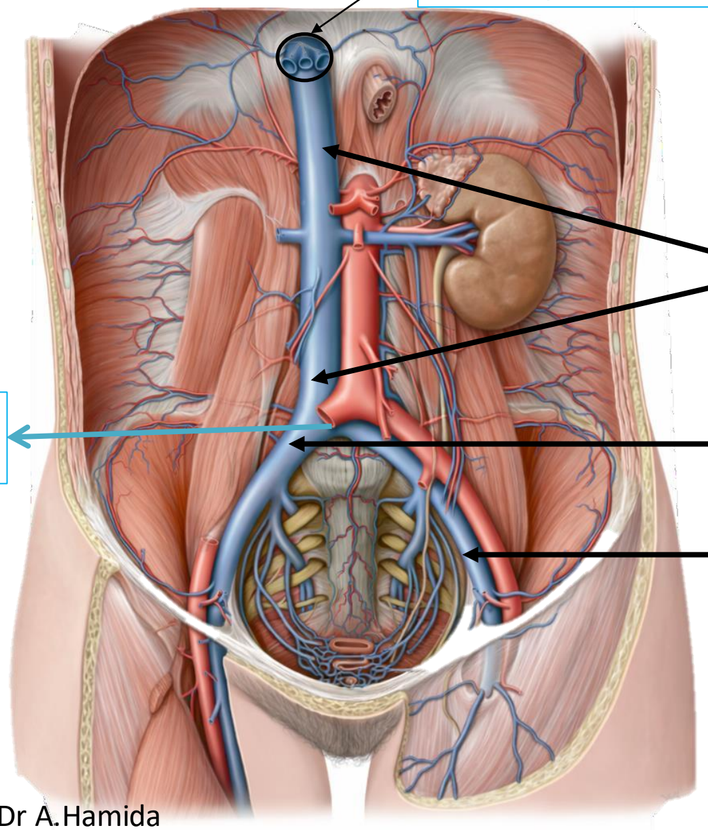
- It begins anterior to the fifth lumbar vertebra (L5) by the union of the right and left common iliac veins.
- It ascends upward, pierces the central tendon of the diaphragm at the level of the eighth thoracic vertebra (T8), and almost immediately enters the lower part of the right atrium.

Since it immediately enters the lower part of the right atrium, so it's thoracic course is minimal (it occupies only a limited space in the thoracic cavity)



Inferior Vena Cava

Caval opening in the diaphragm



Inferior Vena Cava

Level of L5

Rt. common iliac Vein

Lt. common iliac Vein

Major Veines Entering the Heart

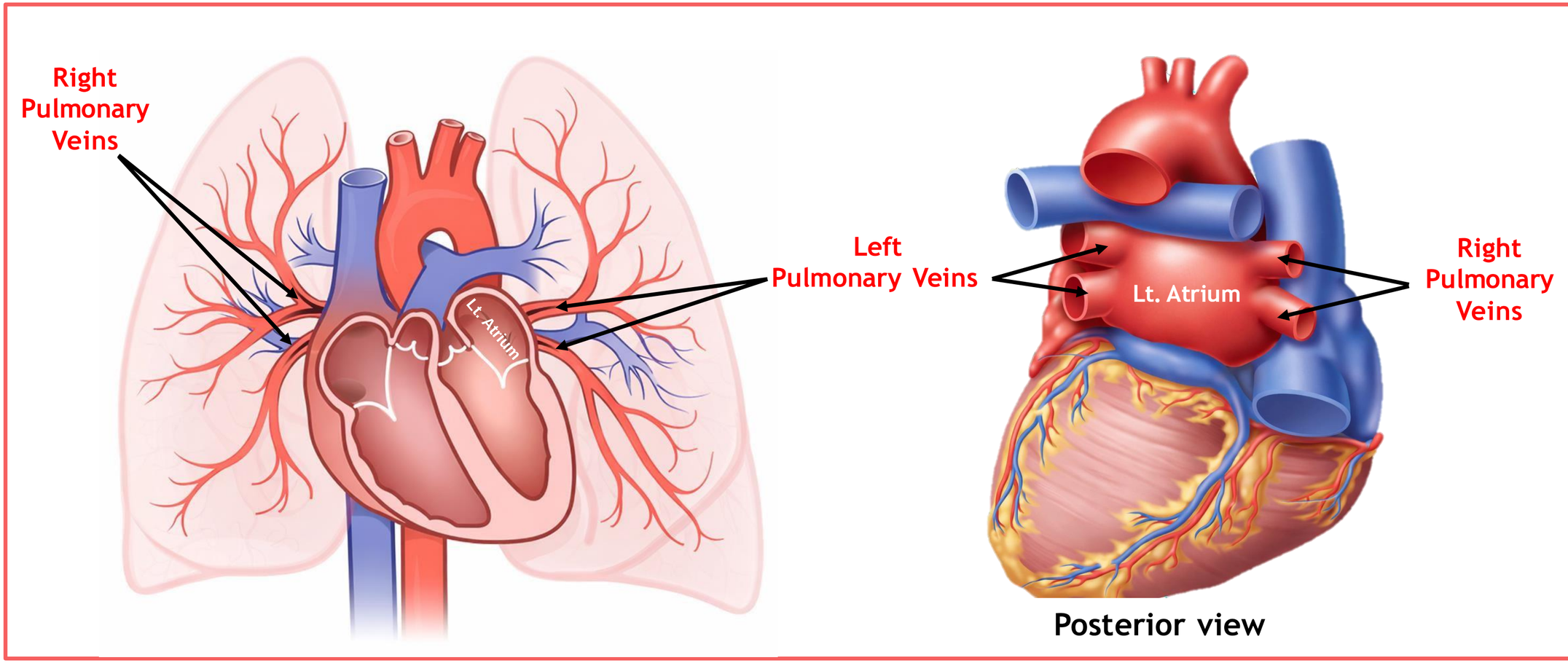
3. Pulmonary Veins

There are 2 left pulmonary veins and 2 right pulmonary veins

➢ They carry oxygenated blood from the lungs to the left atrium.

- Two pulmonary veins leave each lung carrying oxygenated blood and open into the left atrium of the heart.

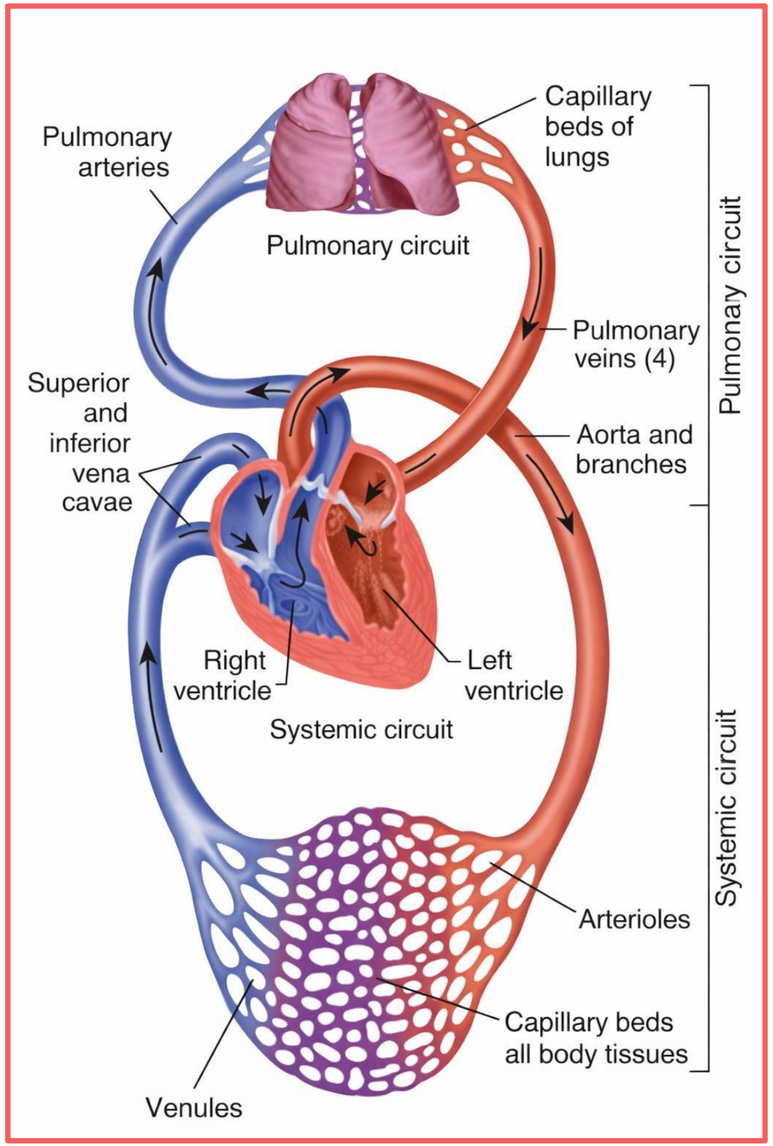
Remember : the left Atrium is located posteriorly (base of the heart)



Blood Circulation

➢ Blood circulation in the body can be categorized into the following two types:

1. Pulmonary circulation
2. Systemic circulation



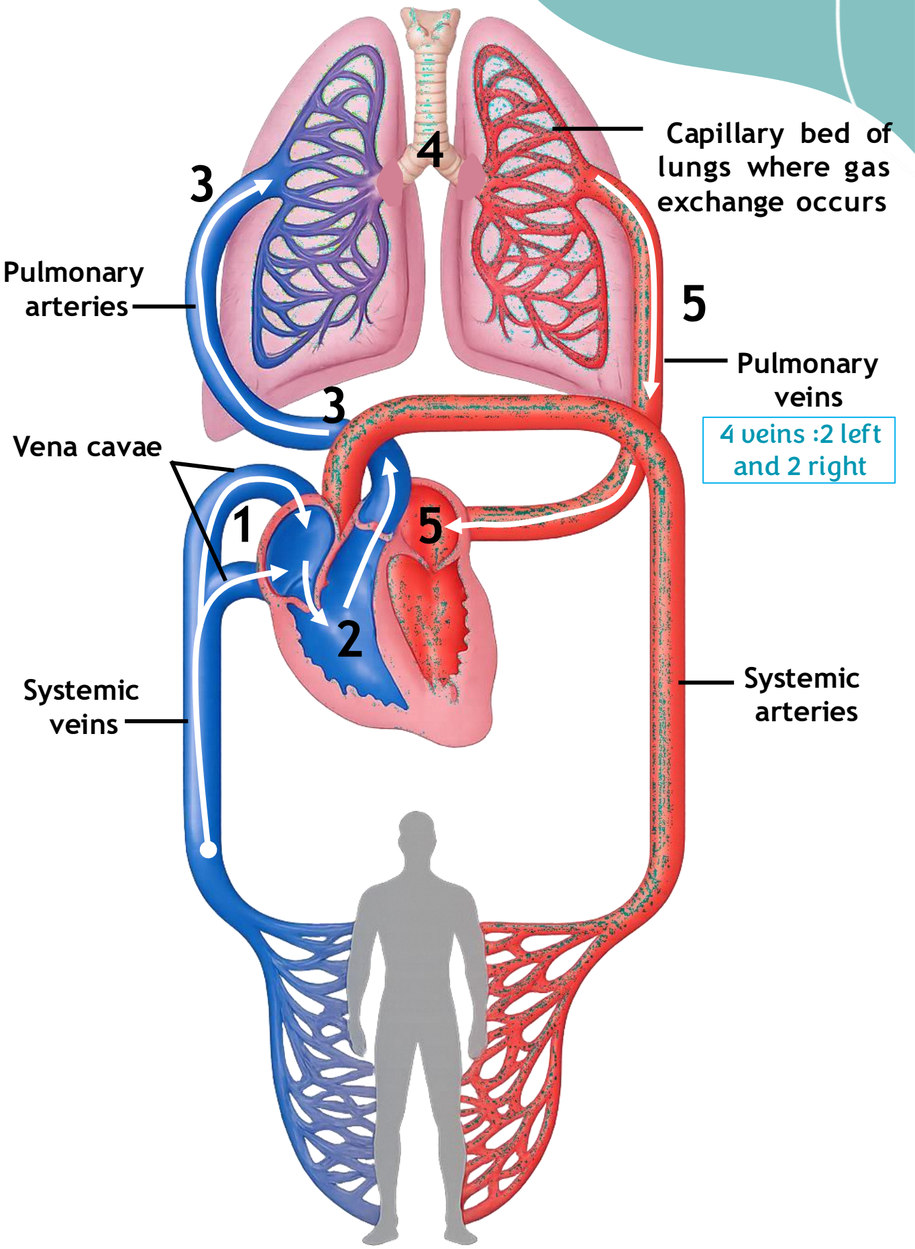
The two circuits are arranged in series, the output of one becomes the input of the other.

Blood Circulation

1. Pulmonary circulation

➢ The right side of the heart is the pump for pulmonary circulation:

1. The right atrium receives all the deoxygenated blood returning from the systemic circulation. By 2 major veins (systemic veins) : superior vena cava –blood from the head , neck and the upper limb– and inferior vena cava –blood from the pelvic,abdominal cavities and lower limb
2. Then passes to the right ventricle. By tricuspid valve
3. Blood then ejected from the right ventricle into the pulmonary trunk, which branches into the right and left pulmonary arteries that carry blood to the lungs.
4. In the lungs, the blood unloads CO_2 (carbon dioxide), which is exhaled, and picks up O_2 (oxygen) from inhaled air. Gas exchange
5. The freshly oxygenated blood then flows into the pulmonary veins and returns to the left atrium.



Blood Circulation

2. Systemic circulation

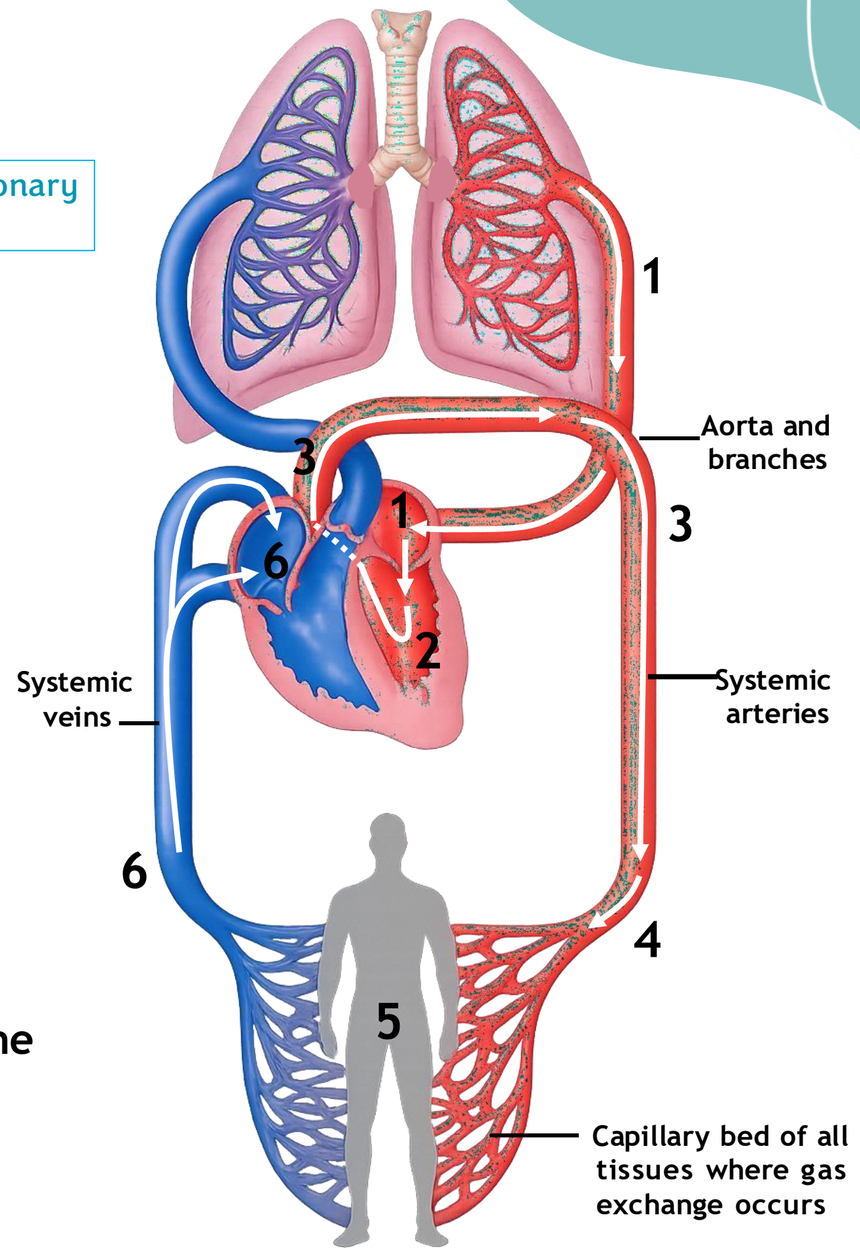
➢ The left side of the heart is the pump for systemic circulation:

1. The left atrium receives oxygenated blood from the lungs. By 4 pulmonary veins
2. Then passes it to the left ventricle. By bicuspid valve

3. The left ventricle ejects blood into the aorta, which branches into progressively smaller systemic arteries that carry blood to all organs throughout the body.
4. In the systemic tissues, arteries give rise to smaller-diameter arterioles, which lead into extensive beds of systemic capillaries.

5. Exchange of nutrients and gases occurs across the thin capillary walls. Blood unloads O_2 and picks up CO_2.

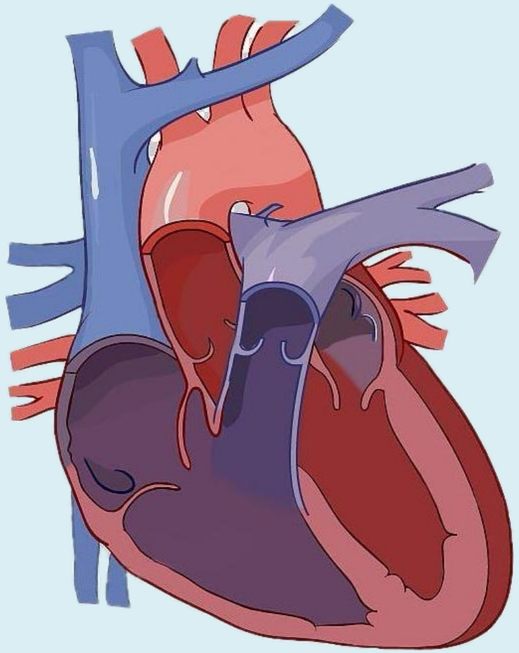
6. The deoxygenated blood then returns through systemic veins to the right atrium.



You can test your understanding by taking the following quiz :

اختبر دراستك عن طريق تقديم هذا الكويز ☺

https://forms.gle/pFwCeST9MYS16Qtr8



Additional Resources:

رسالة من الفريق العلمي:

(كانَ رَسولُ اللهِ صَلَّى اللَّهُ عليه وسلَّمَ، إذَا دَخَلَ العَشْرُ، أَحْيَا اللَّيْلَ، وَأَيْقَظَ أَهْلَهُ، وَجَدَّ وَشَدَّ المِئْزَرَ)

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فجّدوا واجتهدوا والزموا الدعاء الجامع : ((اللهم إنَّك عَفُو كريمٌ، تُحب العَفو، فاعفُ عنَّا)) ،ولا تنسونا والأمة الإسلامية من صالح دُعائكم، ولا تنسوا أهلنا في غزة والمُستضعفين من المُسلمين في كُل بقاع الأرض.

For any feedback, scan the code or click on it.

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			