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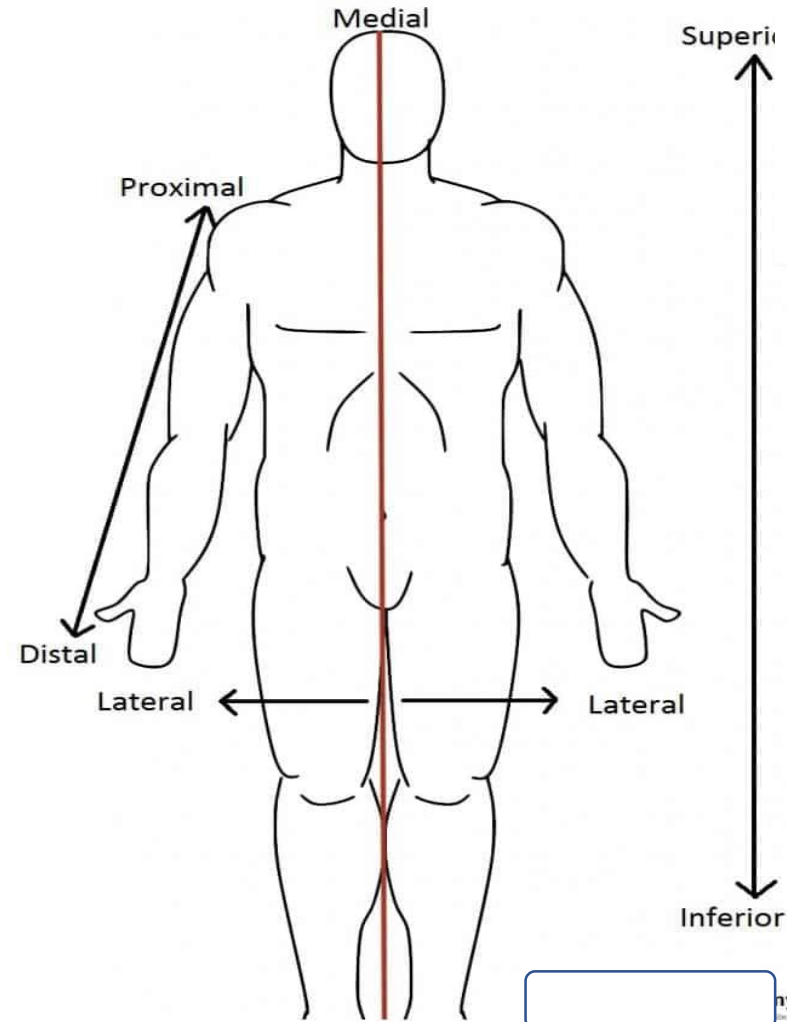
College of Pharmacy / First Stage



ANATOMY

(L5) Cardiovascular System

Dr. Abdulhusein Mizhir Almaamuri



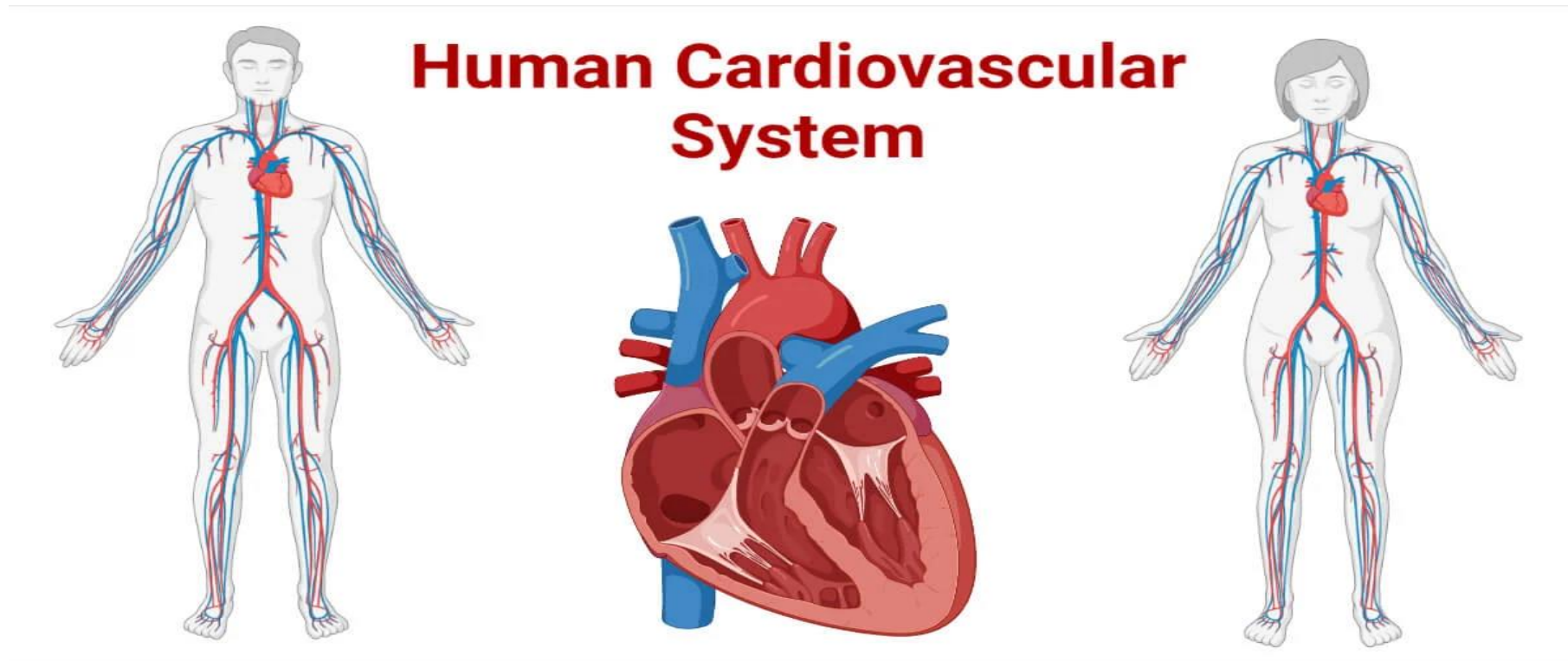
The primary function of the **cardiovascular system** is to provide an adequate supply of oxygen and nutrients to all cells of the body and carry away the waste products of their metabolism. The principal components of the cardiovascular system are:

1- blood

2-blood vessels

3-the heart.

Blood carries materials to and from the tissues, blood vessels are conduits that bring blood close to cells, and the heart is used to create the pressure that is needed to propel blood around the system.



Circulatory system has been divided into two functionally opposite parts:

1. *Systemic circulation*
2. *Pulmonary circulation*

Systemic Circulation

From the left ventricle arises the aorta, carrying oxygenated blood to the tissues.

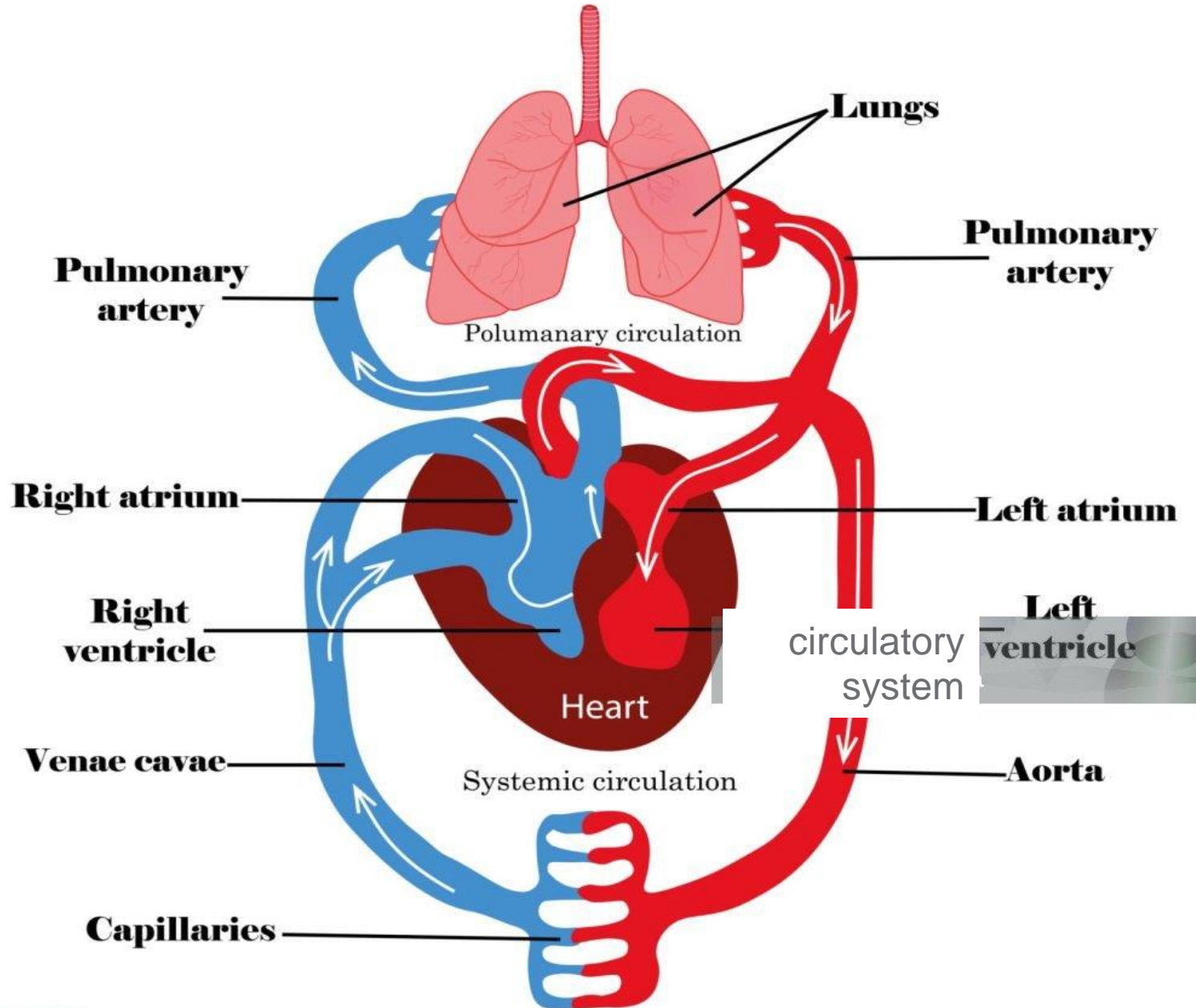
The right atrium receives all the venous blood from the body through three veins; the inferior and the superior venae cavae, and the coronary sinus.

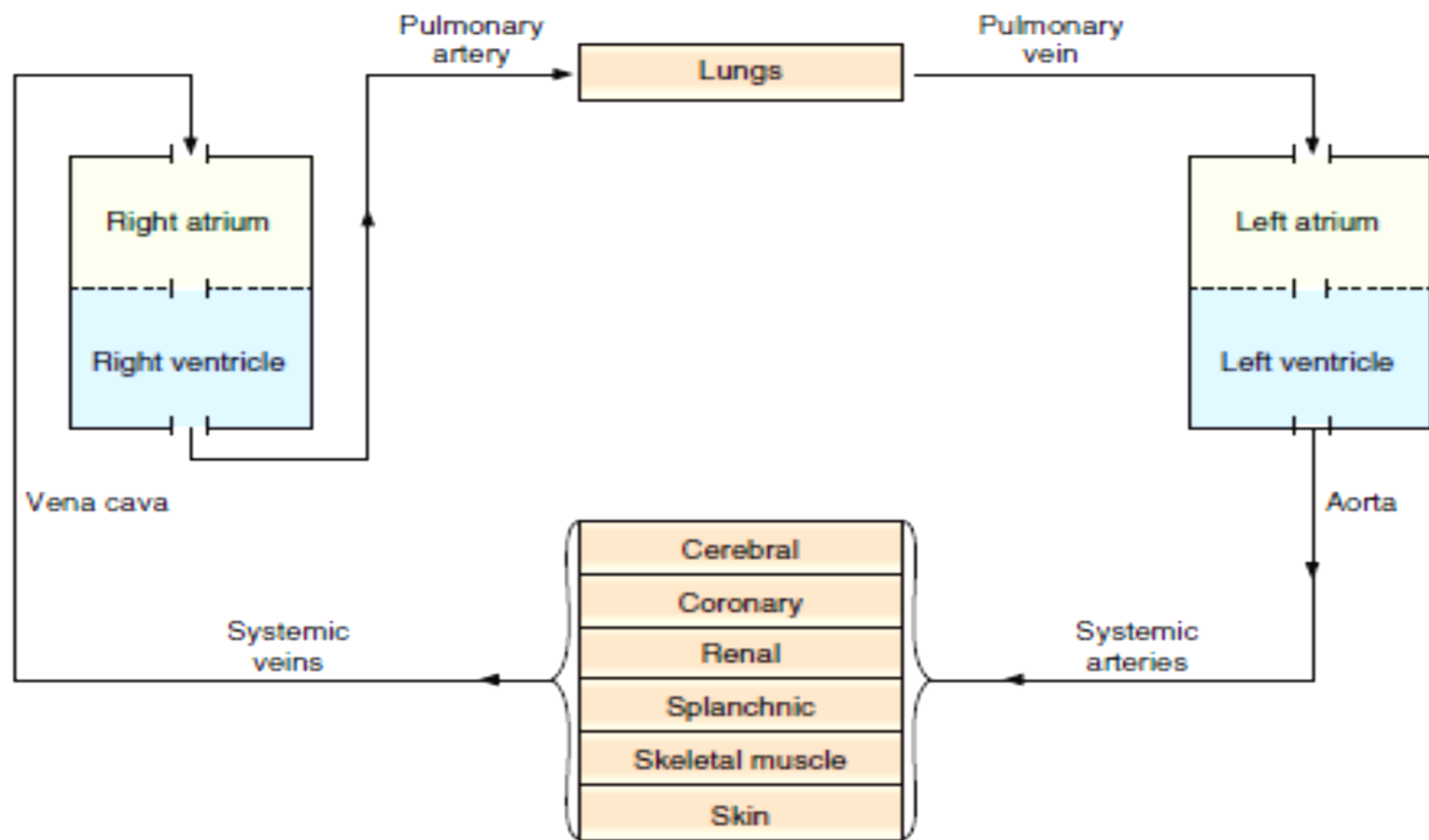
Pulmonary Circulation

From the right ventricle, which is less muscular than the left, arises the pulmonary trunk, carrying reduced blood to the lungs.

The left atrium receives all the oxygenated blood from the lungs through pulmonary veins.

BLOOD CIRCULATION

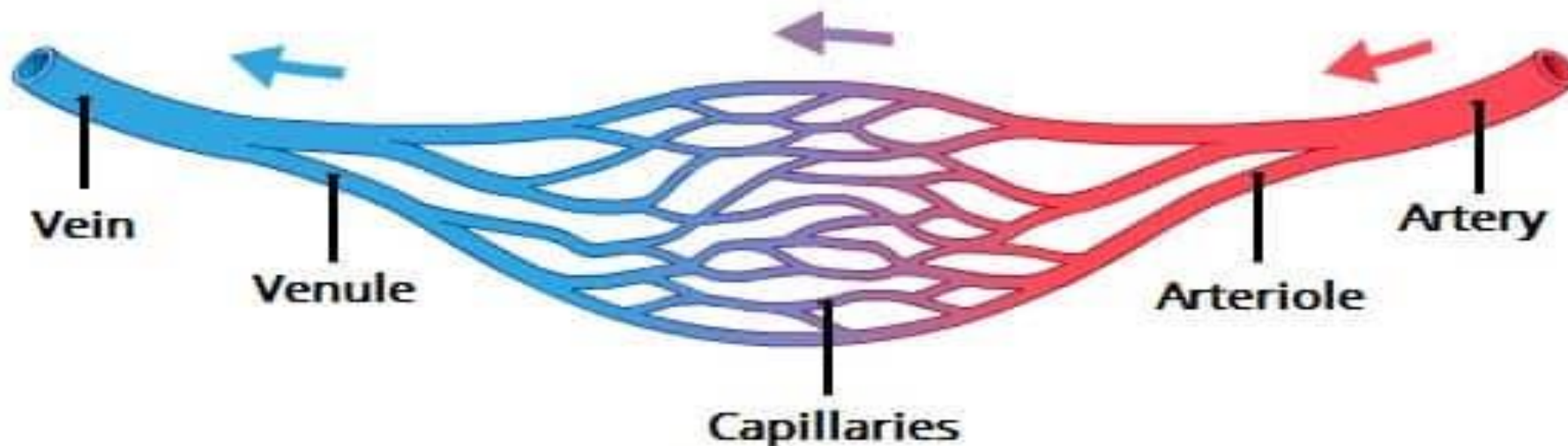




Vascular System

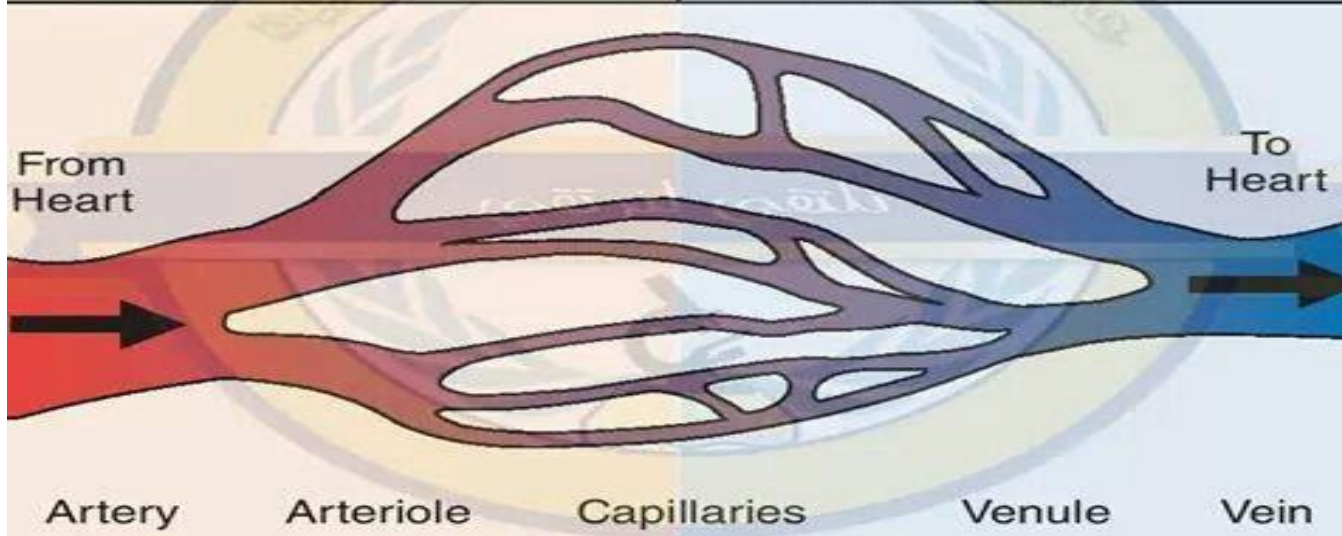
The average man has approximately six litres of blood in his body. This blood is carried by several different types of blood vessels, each of which are specialised to play their role in circulating blood around the body.

There are three major types of vessels; arteries, veins and capillaries. Arteries (with the exception of the pulmonary artery) deliver **oxygenated** blood to the tissues. At the tissues, the oxygen and nutrient exchange is carried out by the capillaries. The capillaries also return **deoxygenated** blood to the veins, which bring it back to the heart (with the exception of the pulmonary veins).



ARTERIES VERSUS VEINS

Arteries	Veins
1. Carry blood from the heart, carry oxygenated blood (except pulmonary artery)	1. Carry blood to the heart, carry deoxygenated blood (except pulmonary vein)
2. Normally bright red in color	2. Normally dark red in color
3. Elastic walls that expand with surge of blood	3. Thin walls/less elastic
4. No valves	4. Valves
5. Can feel a pulse	5. No pulse



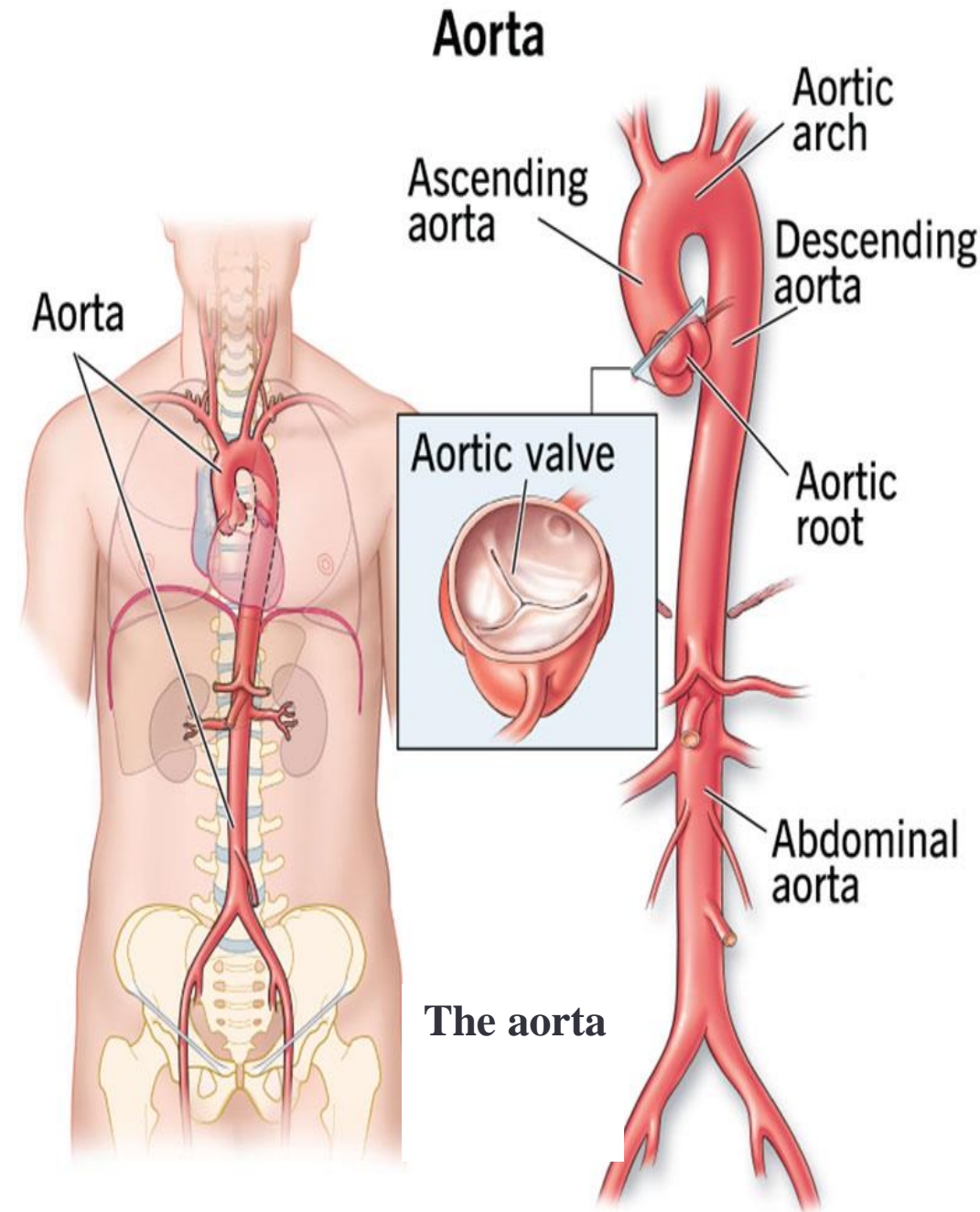
Veins contain **valves** that primarily prevent the back-flow of blood. They also act together with muscle contraction, squeezing the veins to propel blood towards the heart.

Great Vessels of the Heart:

The great vessels of the heart function to carry blood to and from the heart as it pumps, located largely within the middle mediastinum.

The aorta is the largest artery in the body, initially being an inch wide in diameter. It receives the cardiac output from the left ventricle and supplies the body with oxygenated blood via the systemic circulation.

The aorta can be divided into four sections: the **ascending aorta**, the **aortic arch**, the **thoracic (descending) aorta** and the **abdominal aorta**. It terminates at the level of L4 by bifurcating into the left and right common iliac arteries. The aorta classified as a large elastic artery.



Ascending Aorta:

They give rise to the left and right coronary arteries that supply the myocardium

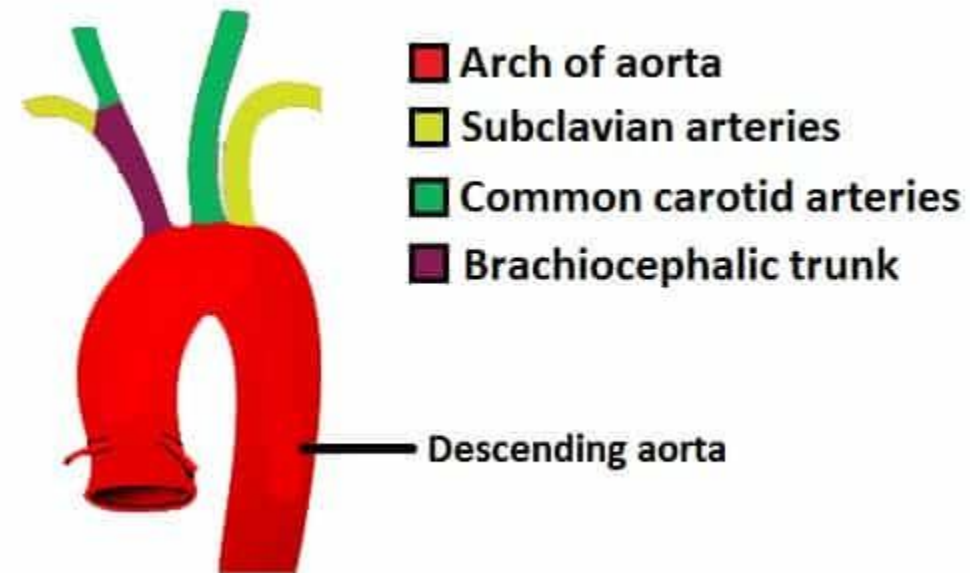
Aortic Arch

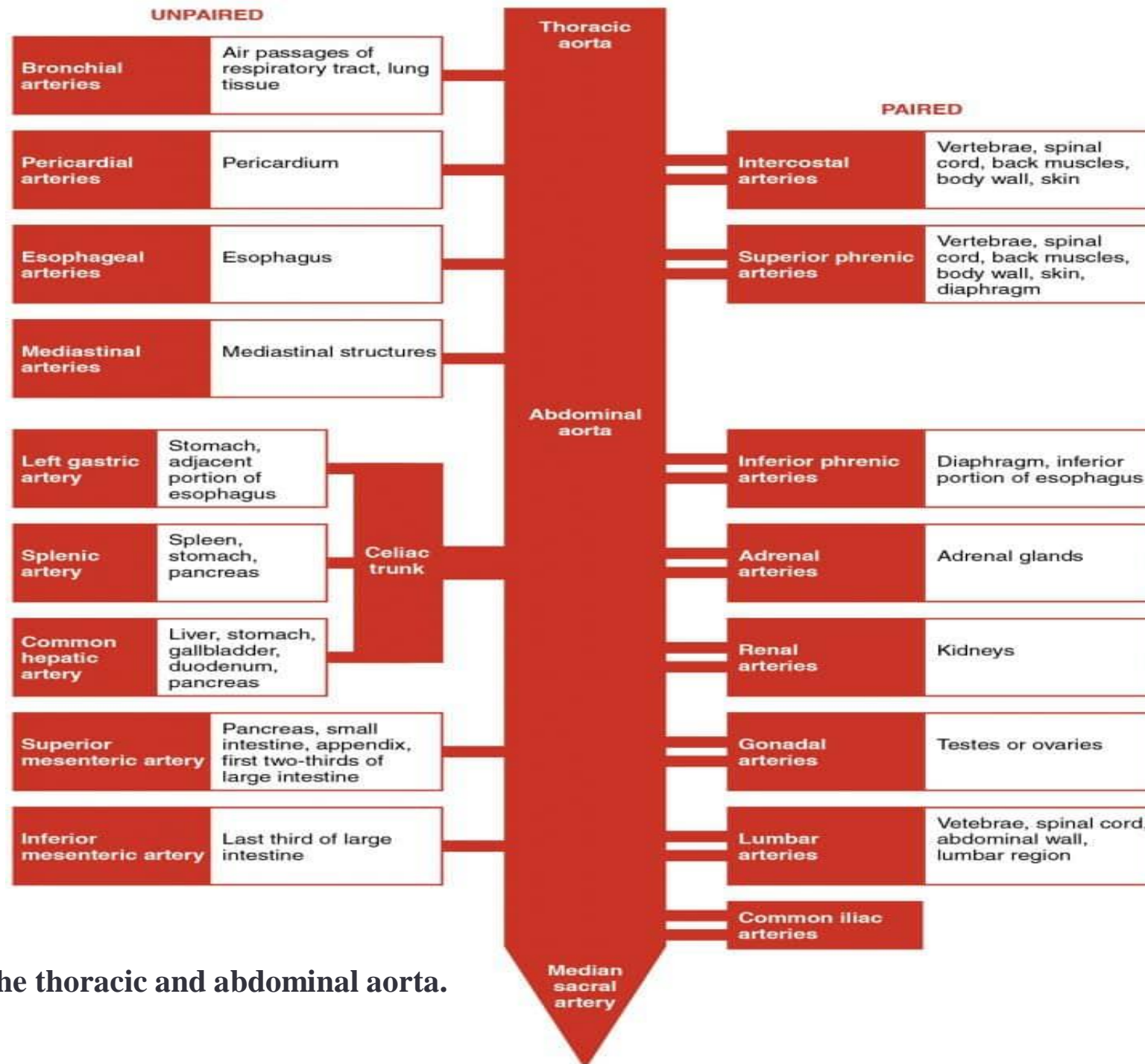
Branches: (Proximal to distal)

Brachiocephalic trunk: The first and largest branch split into the right common carotid and right subclavian arteries. These arteries supply the right side of the head and neck, and the right upper limb.

Left common carotid artery: Supplies the left side of the head and neck.

Left subclavian artery: Supplies the left upper limb.





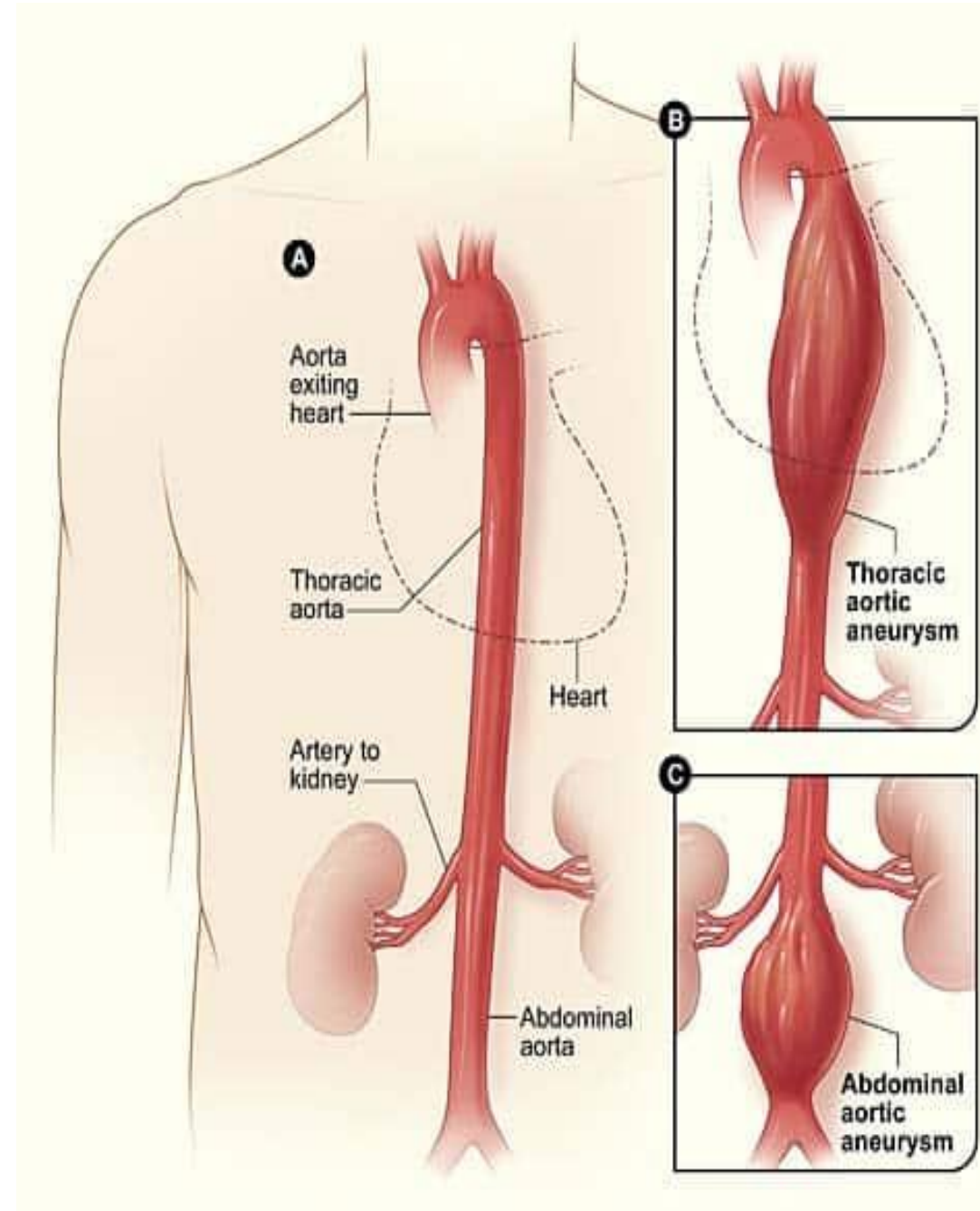
Schematic of the branches of the thoracic and abdominal aorta.

Aortic aneurysm describes a dilation of the artery to more than **1.5** times its original size. The **abdominal** component of the aorta is the most common site for aneurysmal changes.

Patients suffering with an abdominal aortic aneurysm may experience abdominal pulsations, abdominal pain and back pain.

A patient with an aortic arch aneurysm may have a hoarse voice due to the dilation stretching the **left recurrent laryngeal nerve** (supplying the **left vocal cord**).

Patients may also not have any symptoms at all.



Pulmonary Arteries

The pulmonary arteries receive **deoxygenated** blood from the right ventricle and deliver it to the lungs for gas exchange to take place. The arteries begin as the **pulmonary trunk**, a thick and short vessel, and then splits into the **right and left pulmonary arteries**.

Pulmonary Veins

The pulmonary veins receive oxygenated blood from the lungs, delivering it to the left side of the heart to be pumped back around the body. There are **four pulmonary veins**, with one superior and one inferior for each of the lungs.

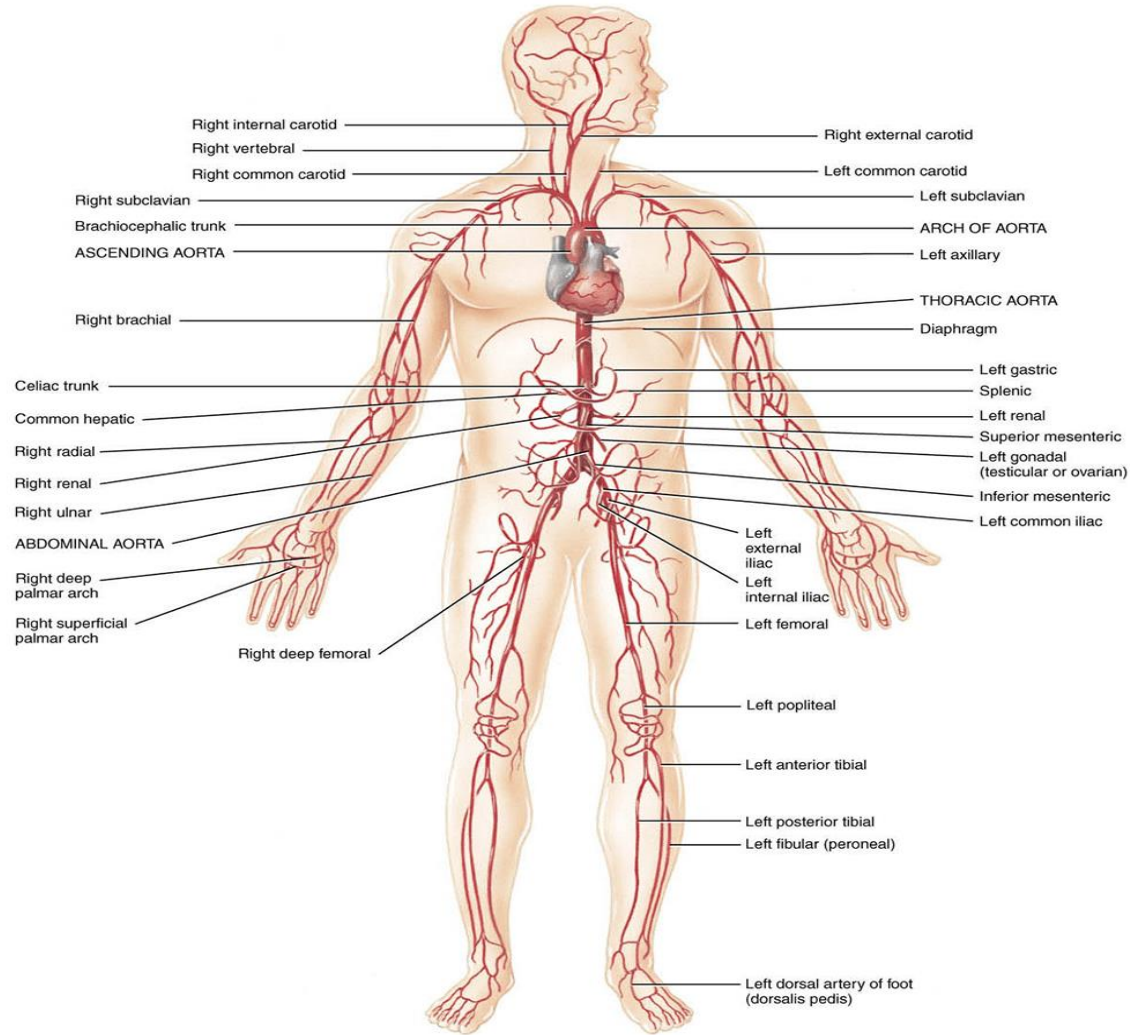
Superior Vena Cava

The superior vena cava receives deoxygenated blood from the upper body (superior to the diaphragm, excluding the lungs and heart), delivering it to the right atrium.

Inferior Vena Cava

The inferior vena cava receives deoxygenated blood from the lower body (all structures inferior to the diaphragm), delivering it back to right atrium.

Major Arteries of the Body



Overall anterior view of the principal branches of the aorta

image via: anatomylibrary99.com

Major Veins of the Body

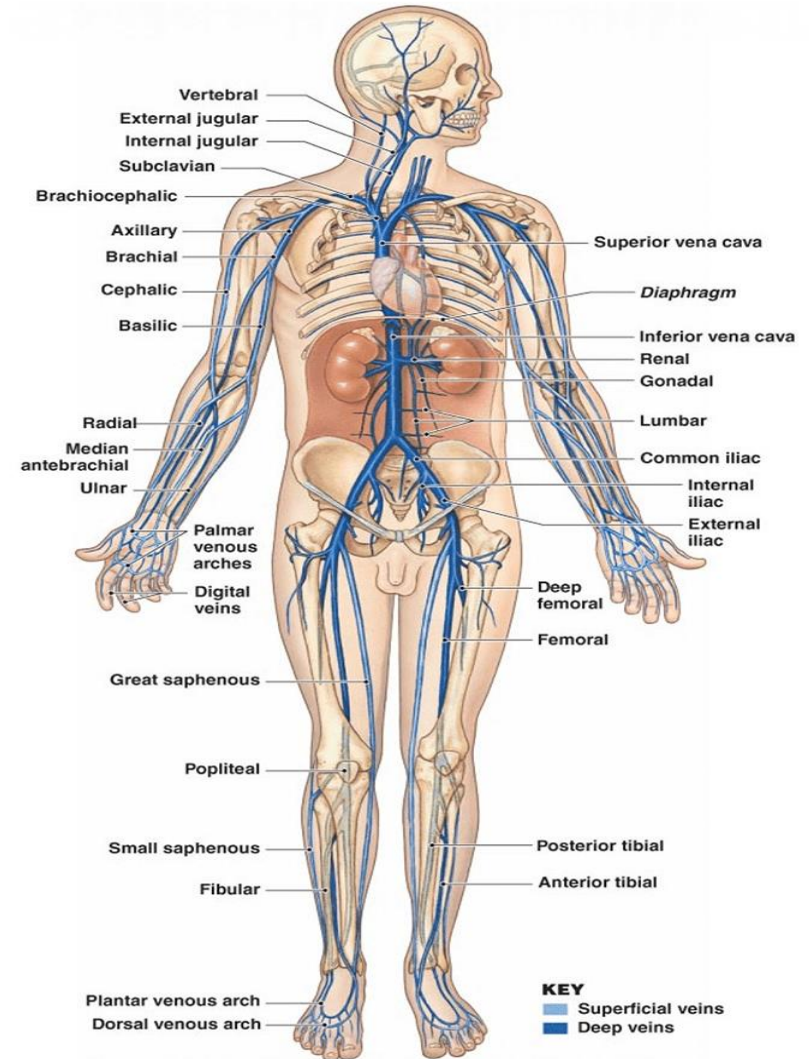


image via: anatomylibrary99.com

Cardiac System

Atria: Right Atrium

The right atrium receives deoxygenated blood from the superior and inferior **vena cavae**, and from the coronary veins. It pumps this blood through the right **atrioventricular orifice** (guarded by the tricuspid valve) into the right ventricle.

The coronary sinus receives blood from the coronary veins. It opens into the right atrium.

The interatrial septum is a solid muscular wall that separates the right and left atria.

Left Atrium

The left atrium receives oxygenated blood from the four pulmonary veins, and pumps it through the left atrioventricular orifice (guarded by the mitral valve) into the left ventricle.

Ventricles: Right Ventricle

The right ventricle receives deoxygenated blood from the right atrium, and pumps it through the pulmonary orifice (guarded by the pulmonary valve), into the pulmonary artery.

Left Ventricle

The left ventricle receives oxygenated blood from the left atrium, and pumps it through the aortic orifice (guarded by the aortic valve) into the aorta.

The interventricular septum separates the two ventricles.

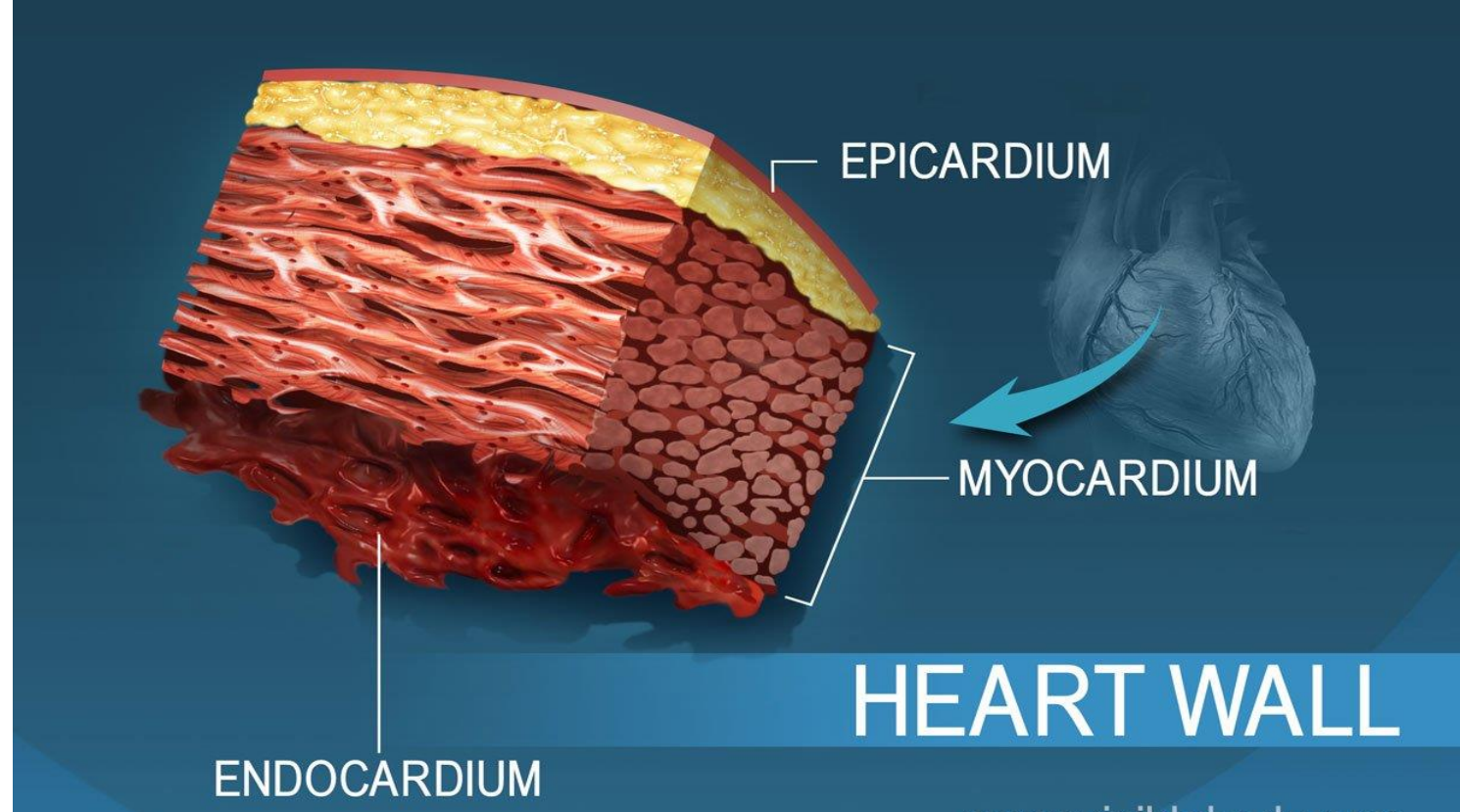
The heart wall : can be divided into three distinct layers :

1. The **endocardium:** is The innermost layer of the cardiac wall. It lines the cavities and valves of the heart.

2. The **myocardium:** is composed of cardiac muscle and is an involuntary striated muscle. It is responsible for contractions of the heart. .

3. **Epicardium:** is the outermost layer of the heart, formed by the visceral layer of the [pericardium](#).

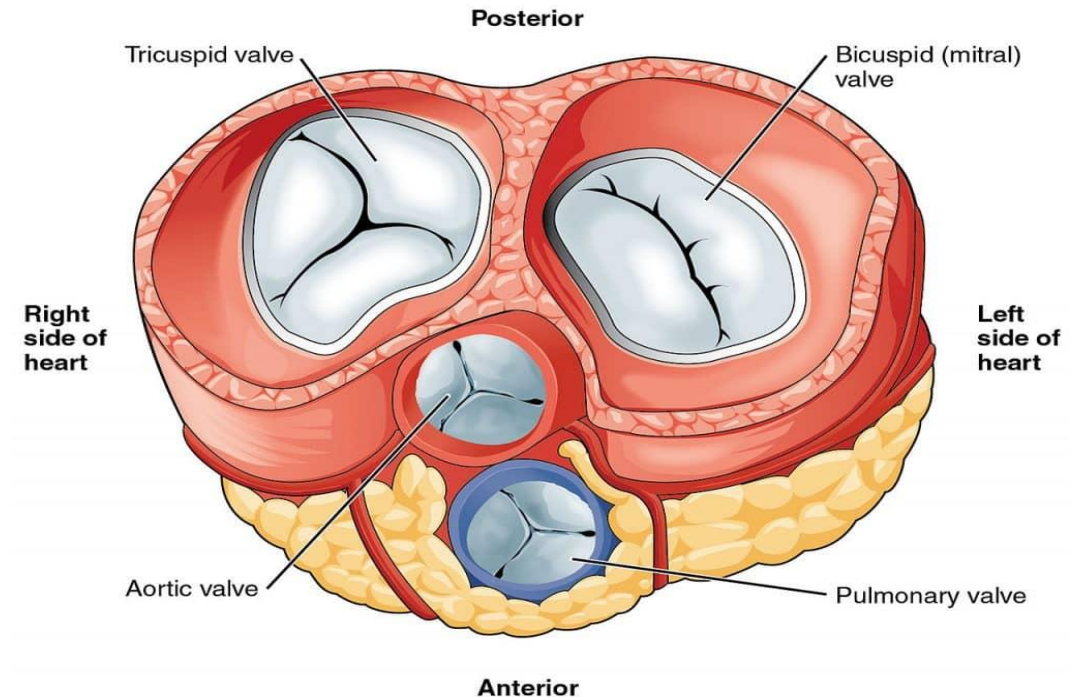
The pericardium is made up of two main layers: a tough external layer known as the **fibrous pericardium**, and a thin, internal layer known as the **serous pericardium**, which is divided into two layers: the outer **parietal layer** that lines the internal surface of the fibrous pericardium and the internal **visceral layer** that forms the outer layer of the heart (also known as the **epicardium**).



The valves of the heart are structures which ensure blood flows in only one direction. There are four valves of the heart, which are divided into two categories:

Atrioventricular valves: The tricuspid valve and mitral (bicuspid) valve. They are located between the atria and corresponding ventricle.

Semilunar valves: The pulmonary valve and aortic valve (each valve consists of three cusps). They are located between the ventricles and their corresponding artery, and regulate the flow of blood leaving the heart.



Vasculature of the Heart

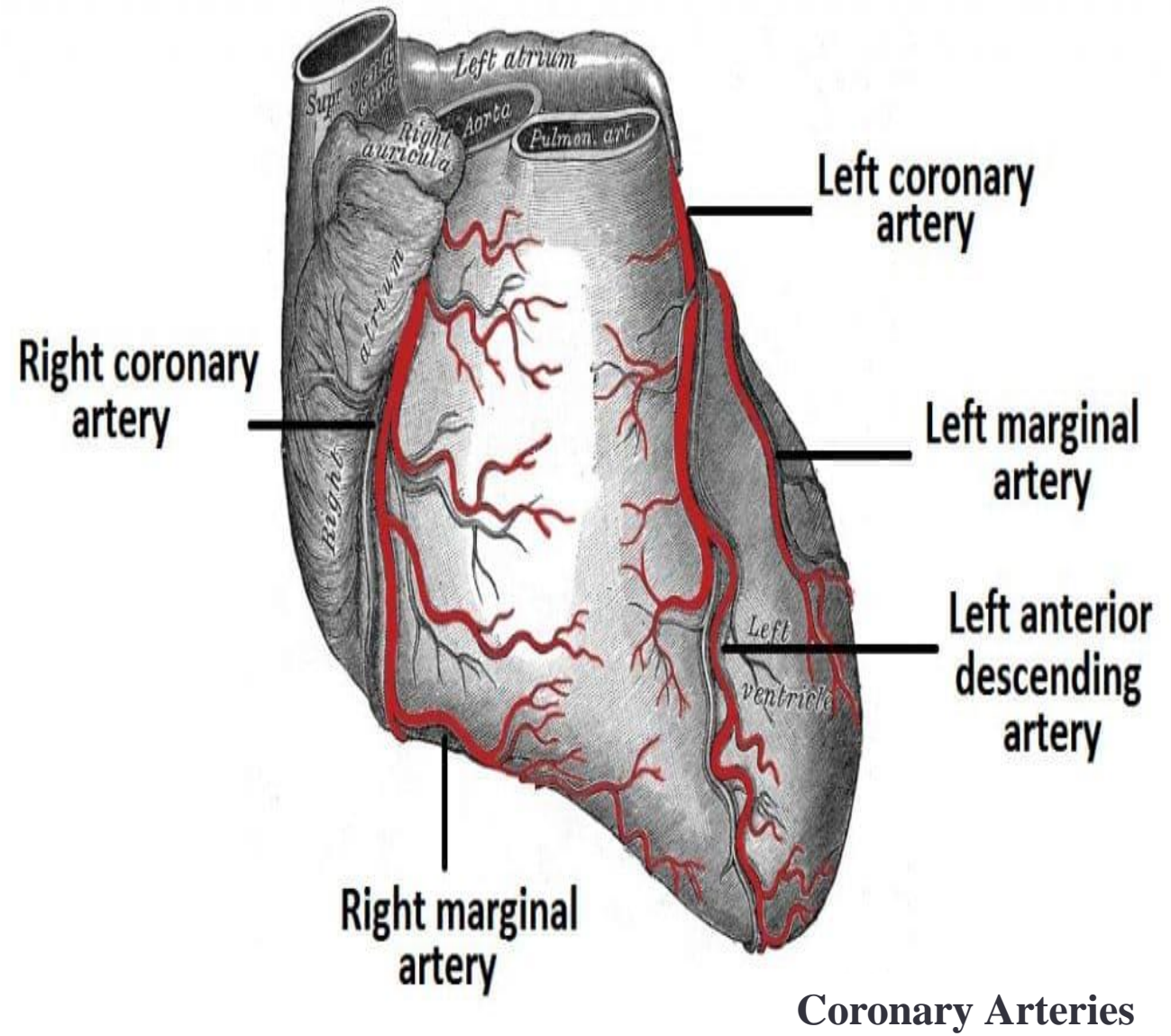
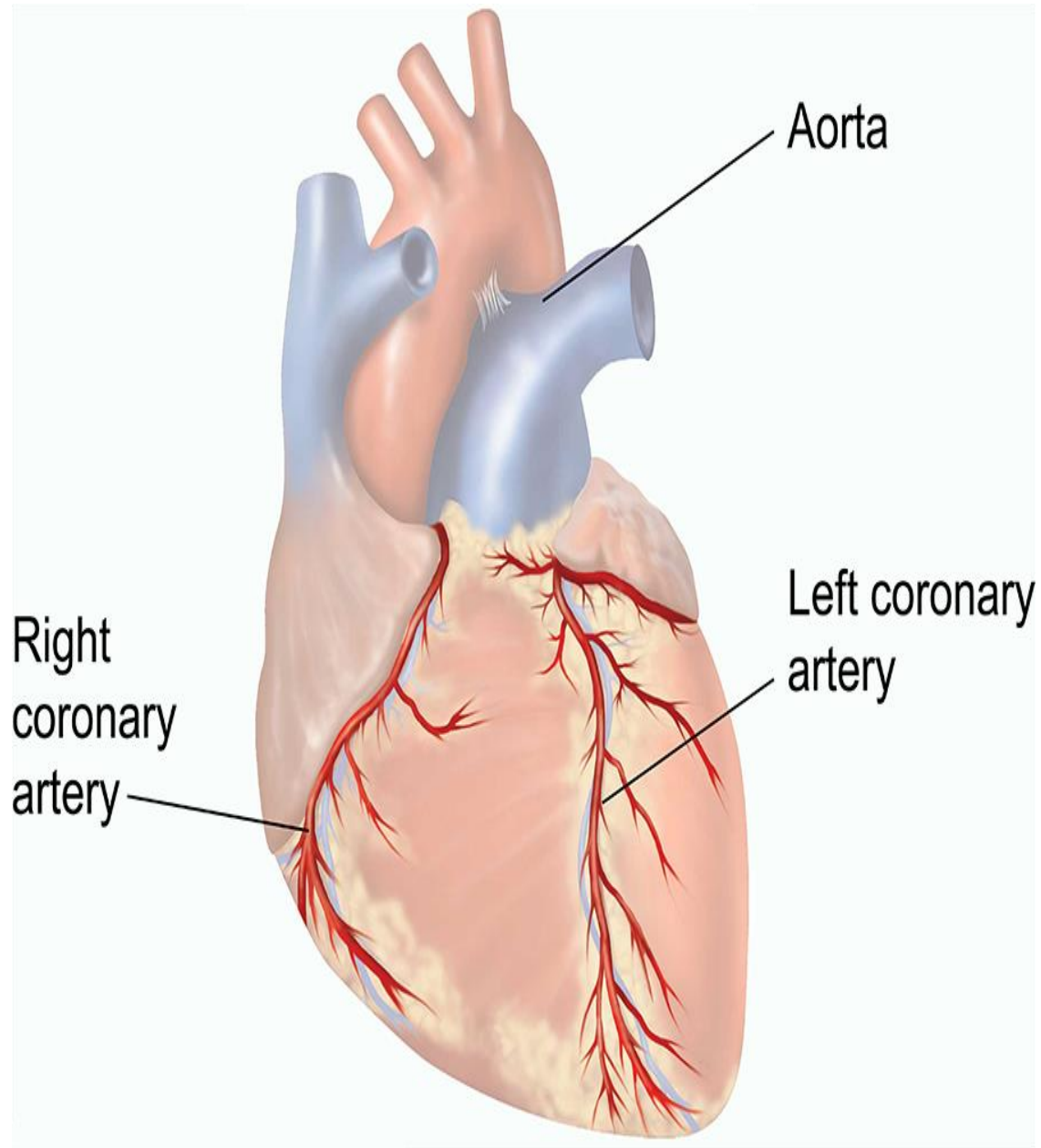
The entire body must be supplied with nutrients and oxygen via the **circulatory system** and the heart is no exception. The coronary circulation refers to the vessels that supply and drain the heart. Coronary arteries are named as such due to the way they encircle the heart, much like a crown.

Coronary Arteries

There are two main coronary arteries which branch to supply the entire heart. They are named the left and right coronary arteries, and arise from the left and right **aortic sinuses** within the aorta. The aortic sinuses are small openings found within the aorta behind the left and right flaps of the **aortic valve**.

Cardiac Veins

The venous drainage of the heart is mostly through the **coronary sinus** – a large venous structure located on the posterior aspect of the heart. The cardiac veins drain into the coronary sinus, which in turn, empties into the right atrium. There are also smaller cardiac veins which pass directly into the right atrium.



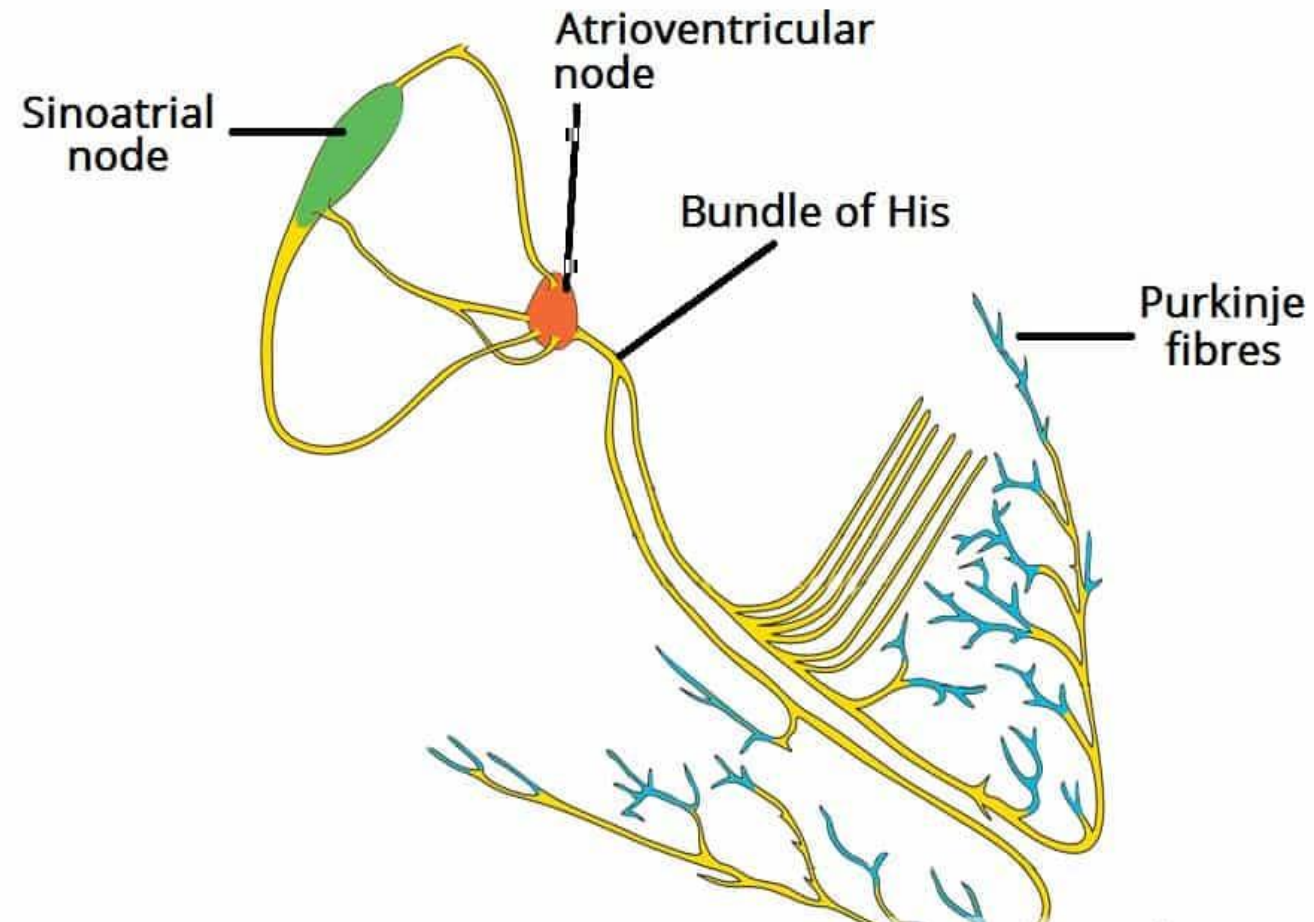
The **cardiac conduction system** is a collection of nodes and specialized conduction cells that initiate and co-ordinate contraction of the heart muscle. It consists of:

Sinoatrial node

Atrioventricular node

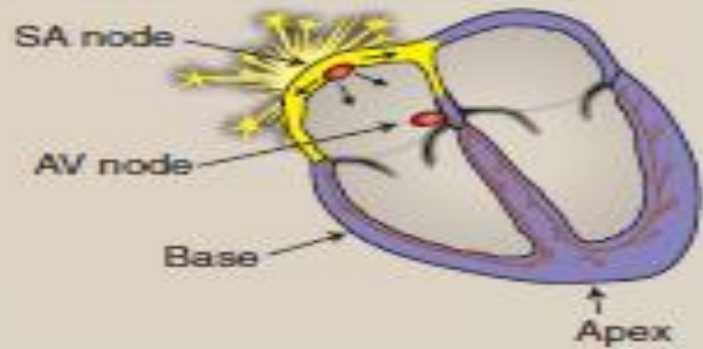
Atrioventricular bundle (bundle of His)

Purkinje fibres



cardiac conduction system

1 SA node fires. Wave of depolarization spreads over atria.



2 Atria are depolarized. AV node relays wave of excitation.



3 Purkinjes relay wave to septum. Septum depolarizes.



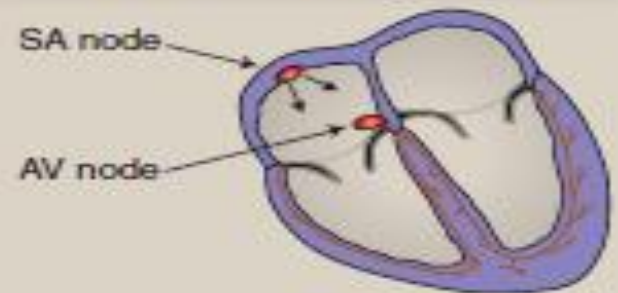
4 Apical region and ventricular free walls depolarize.



5 Base of ventricle depolarizes.

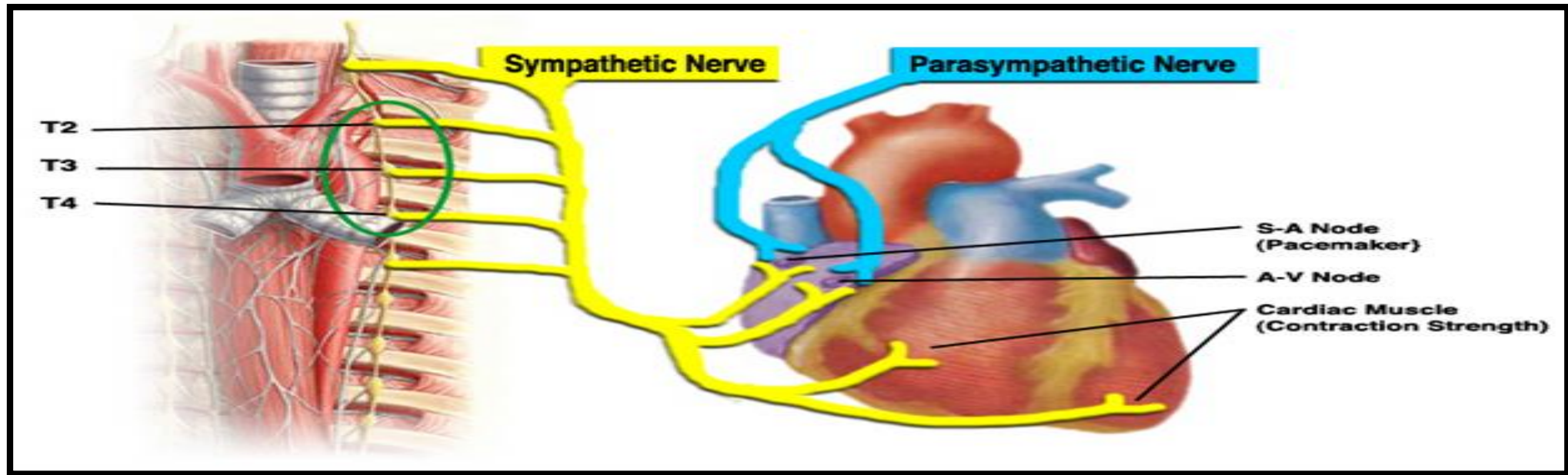


6 Atria and ventricles recover in the period between beats.



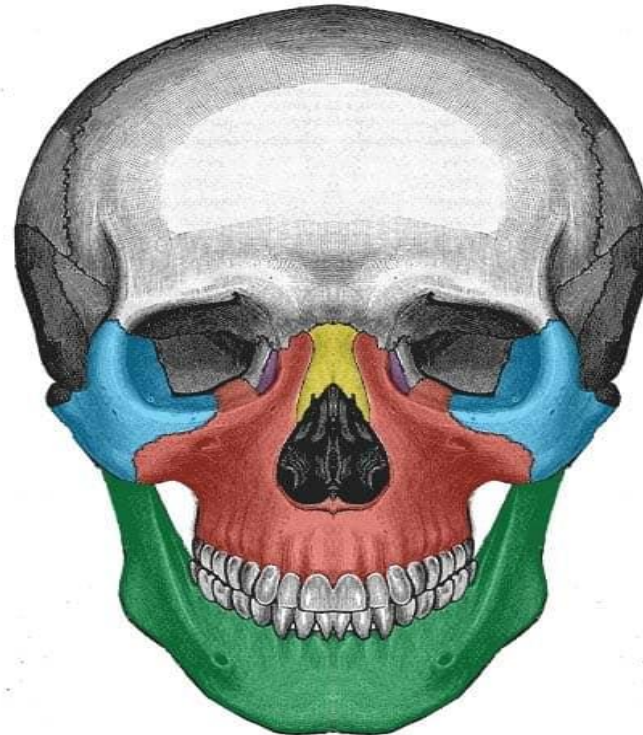
Neural regulation of the heart rate

- **Sympathetic nerves:** supply all parts of the heart (atria, ventricles, and conduction system). When activated they increase Heart rate (+ve chronotropic effect).
- **Parasympathetic nerves:** supply atria, SA & AV nodes **but not the ventricles**. When activated, they decrease Heart rate (-ve chronotropic effect).





THANK YOU!



-  Zygomatic
-  Maxilla
-  Nasal
-  Lacrimal
-  Mandible