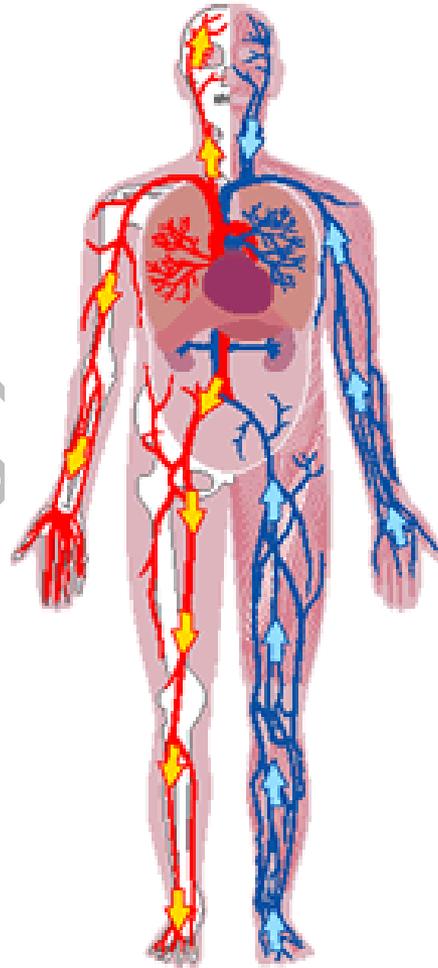


# TRANSPORT SYSTEM IN HUMANS



MARS Learning Centre

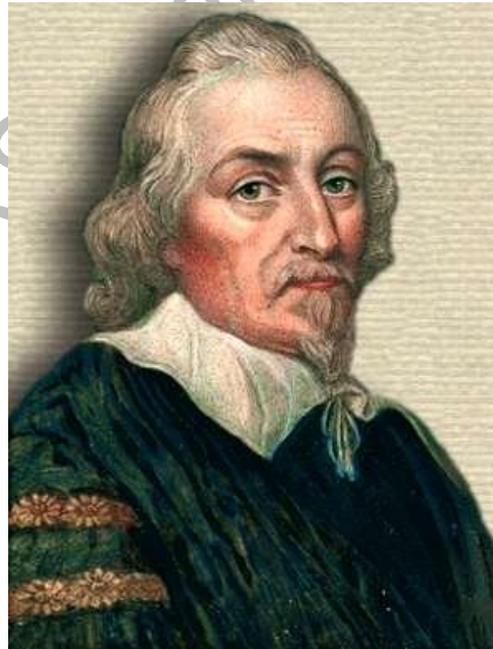


# CIRCULATORY SYSTEM IN HUMAN

Vertebrates possess a closed circulatory system

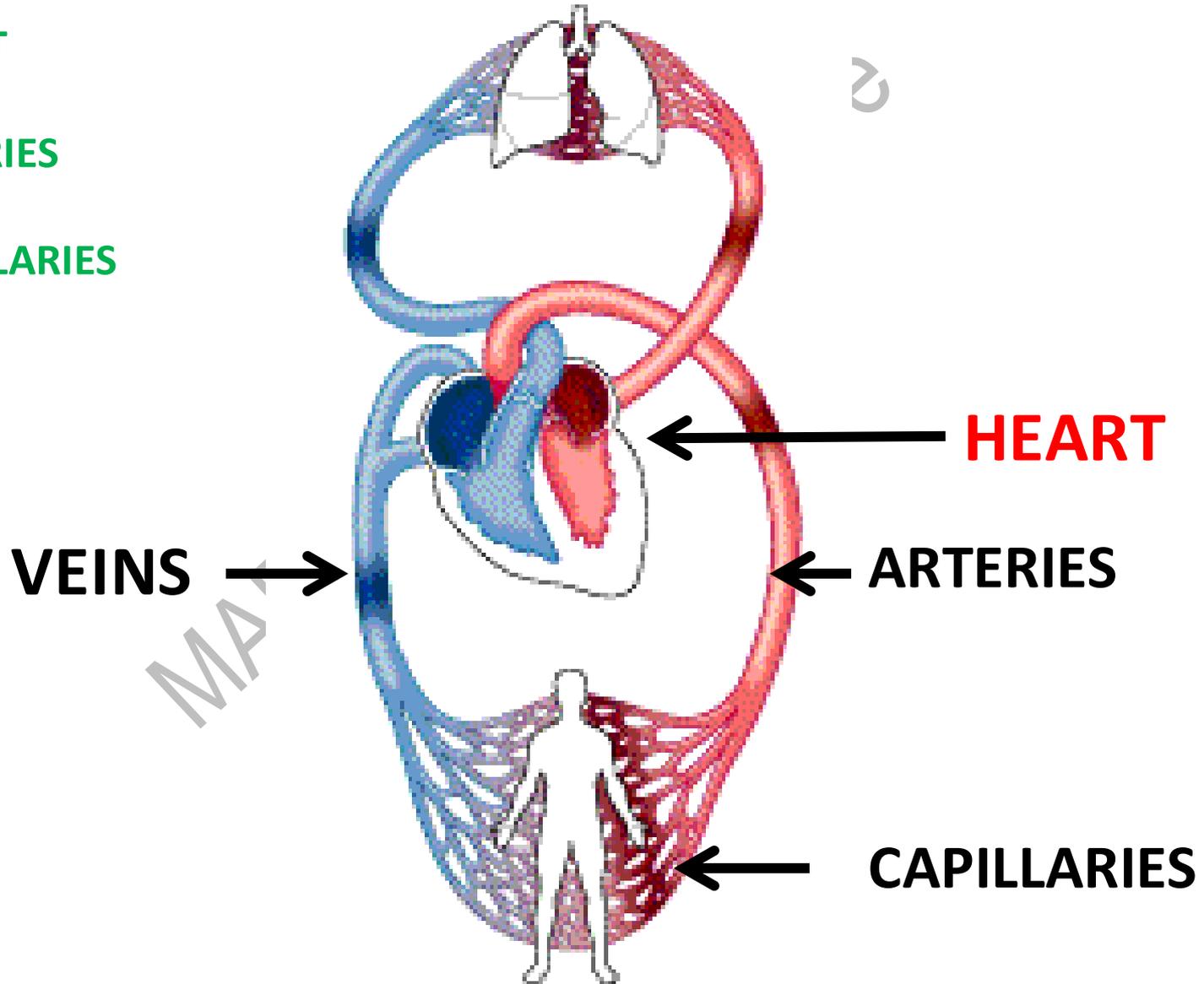
Circulatory system consists of heart, blood vessels and blood.

William Harvey ( 1628 ) discovered that the blood circulates in the body.



# PARTS OF CARDIOVASCULAR SYSTEM

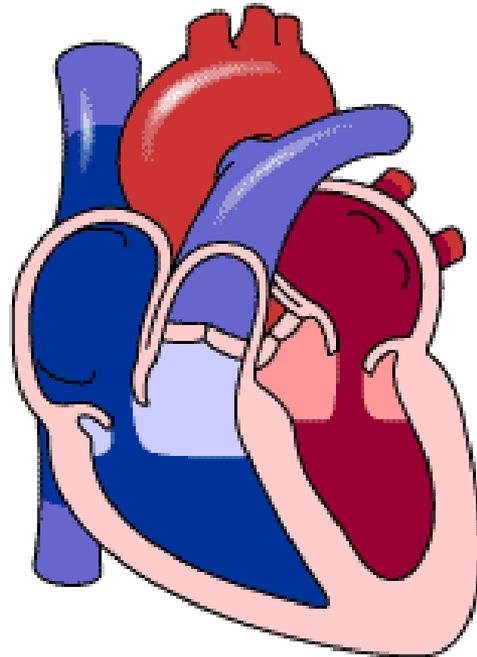
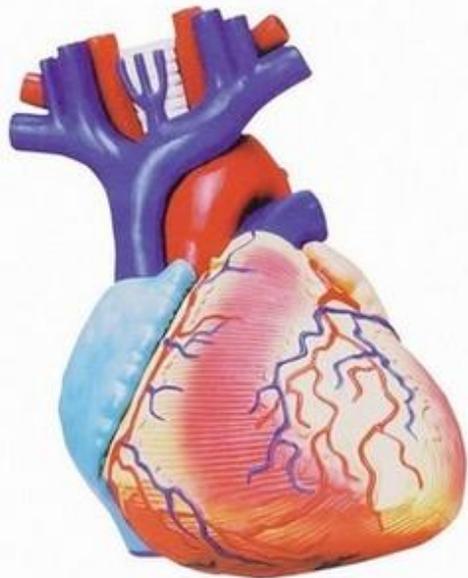
1. HEART
2. ARTERIES
3. CAPILLARIES
4. VEINS



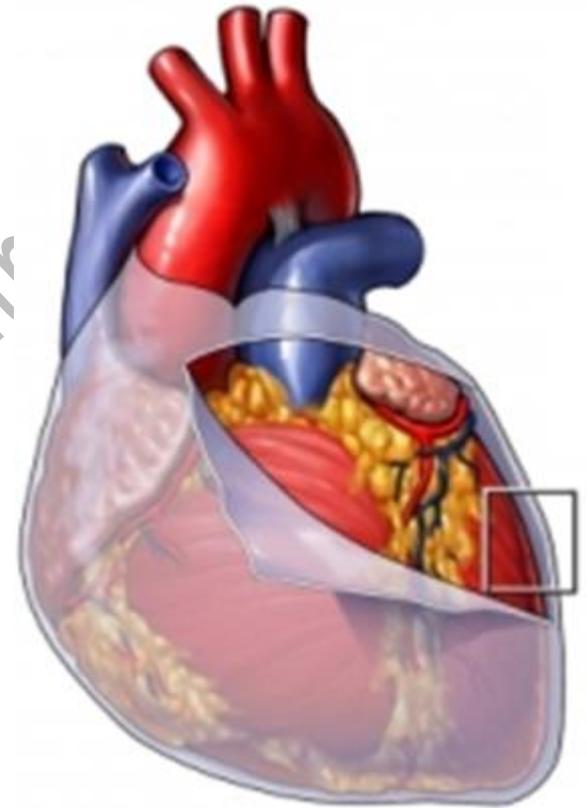
# HEART

Conical hollow muscular organ

Lies within the pericardium



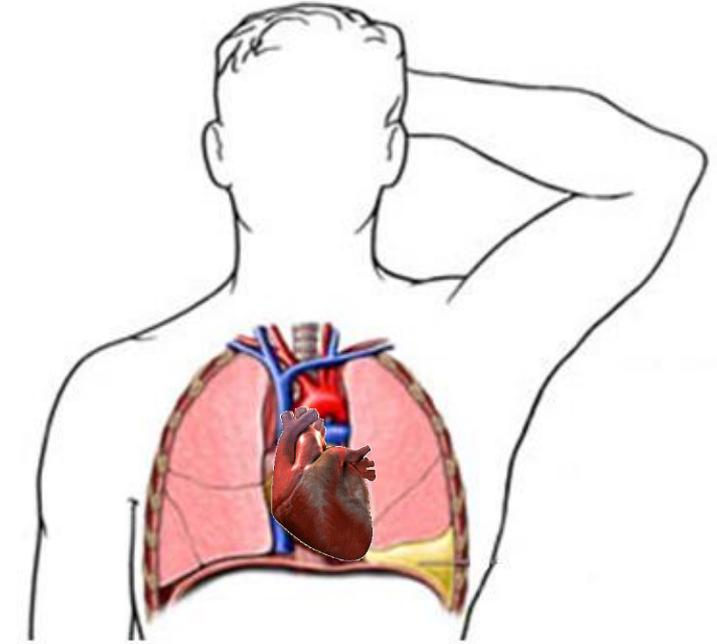
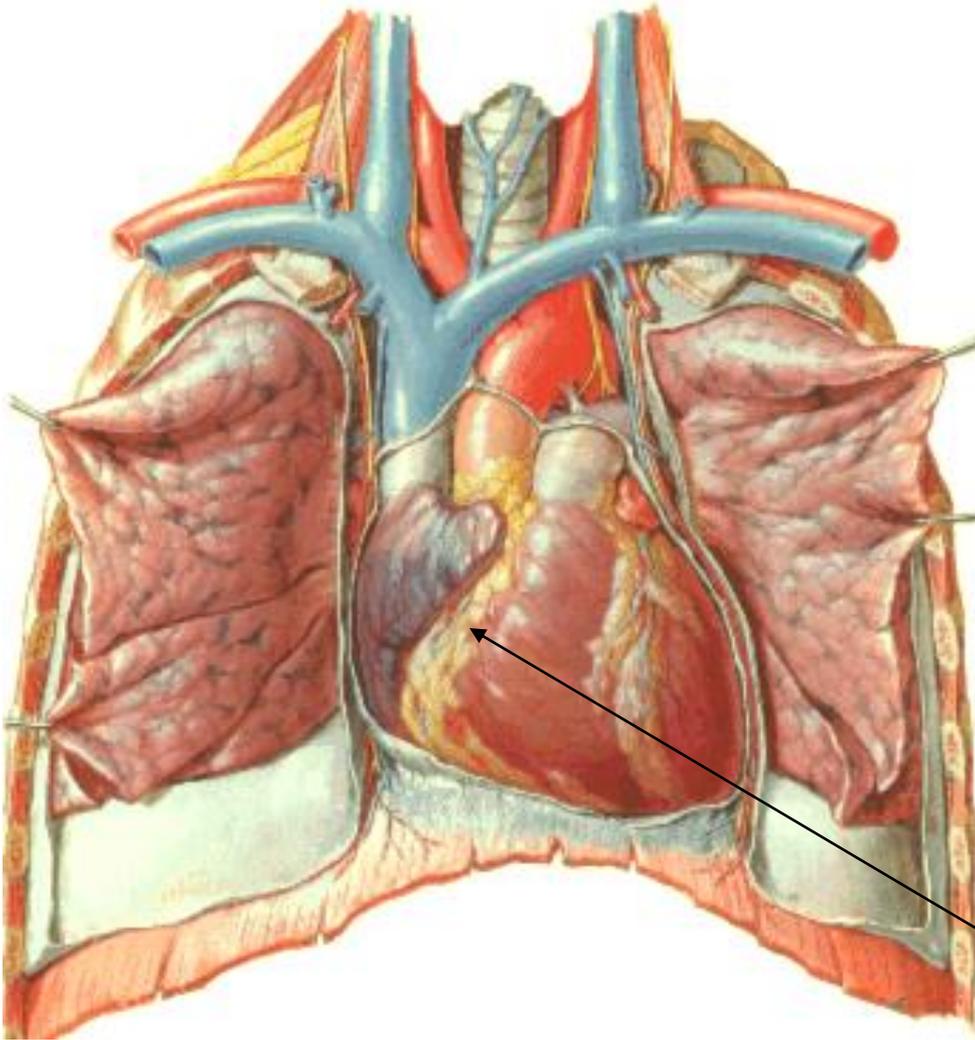
Centr



Pericardium

# HEART

**SITUATED IN MEDIASTINUM**



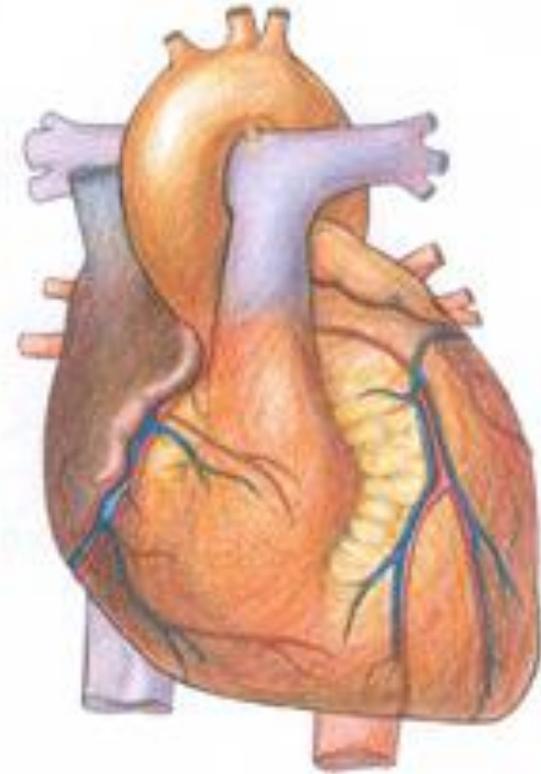
**Mediastinum is the space between the 2 lungs.**

# HEART

**Measurements- 12X6 cm.**

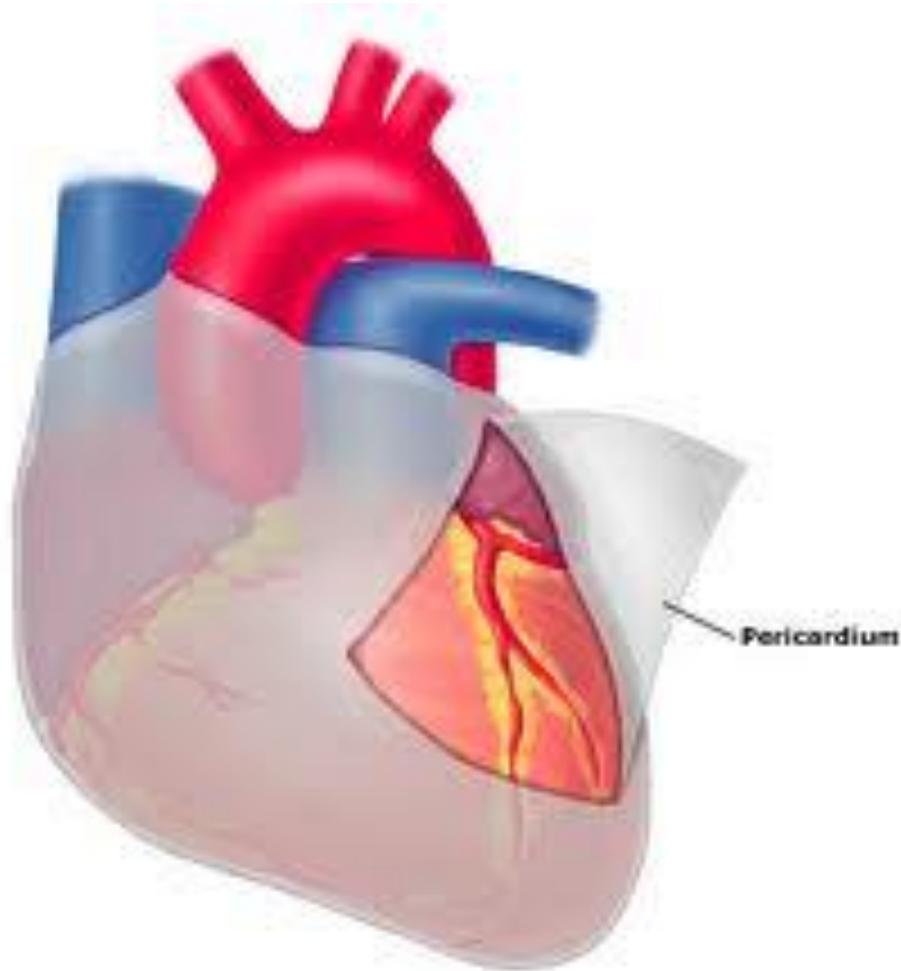
**Transverse diameter-8 to 9 cm**

**Weight- 300g in males, 250g in females.**



# PERICARDIUM

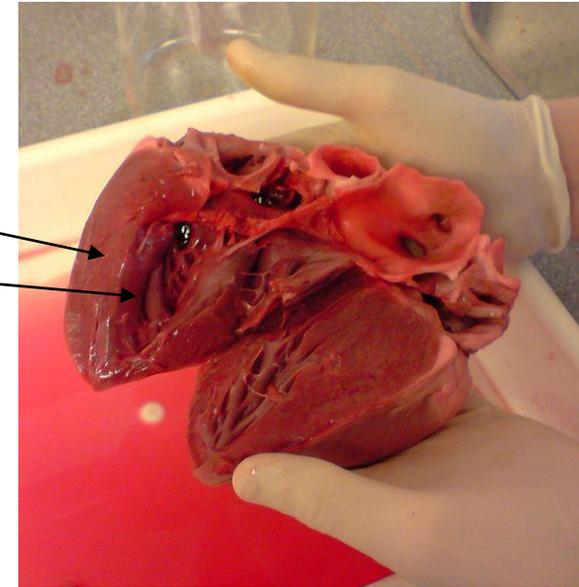
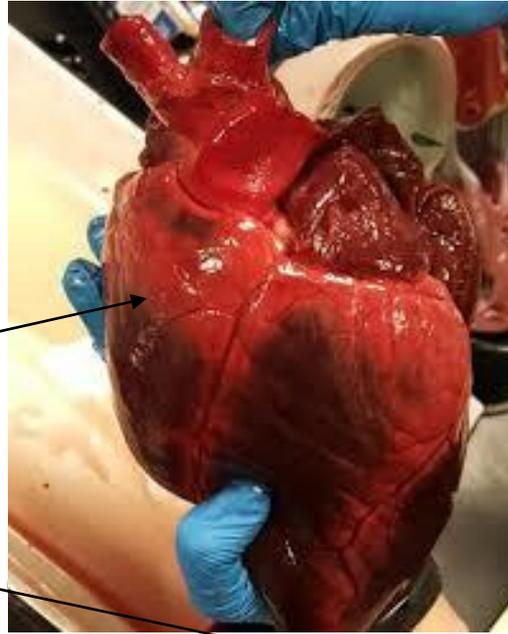
Heart is covered by a loose fitting double membrane pericardial sac or pericardium.



# WALL OF THE HEART

Consists of 3 layers

1. EPICARDIUM
2. MYOCARDIUM
3. ENDOCARDIUM



**Epicardium** is thin and transparent.

**Myocardium** is composed of cardiac muscle.

**Endocardium** is a thin layer of endothelium which lines the inside of myocardium.

It contains specialised muscle fibres called **purkinje fibres** in the ventricles.

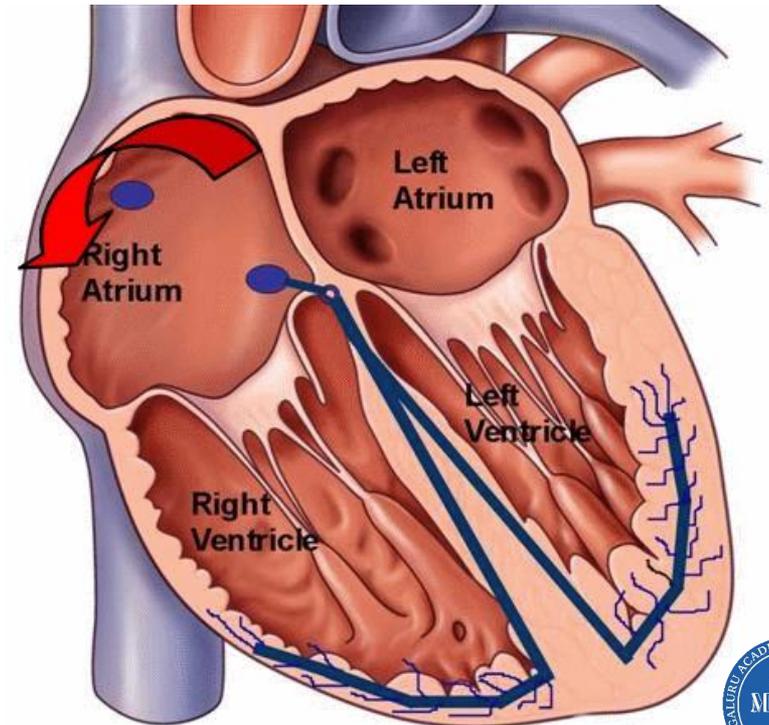
**The heart pumps about 1 million barrels of blood during an average lifetime  
– that's enough to fill more than 3 super tankers.**

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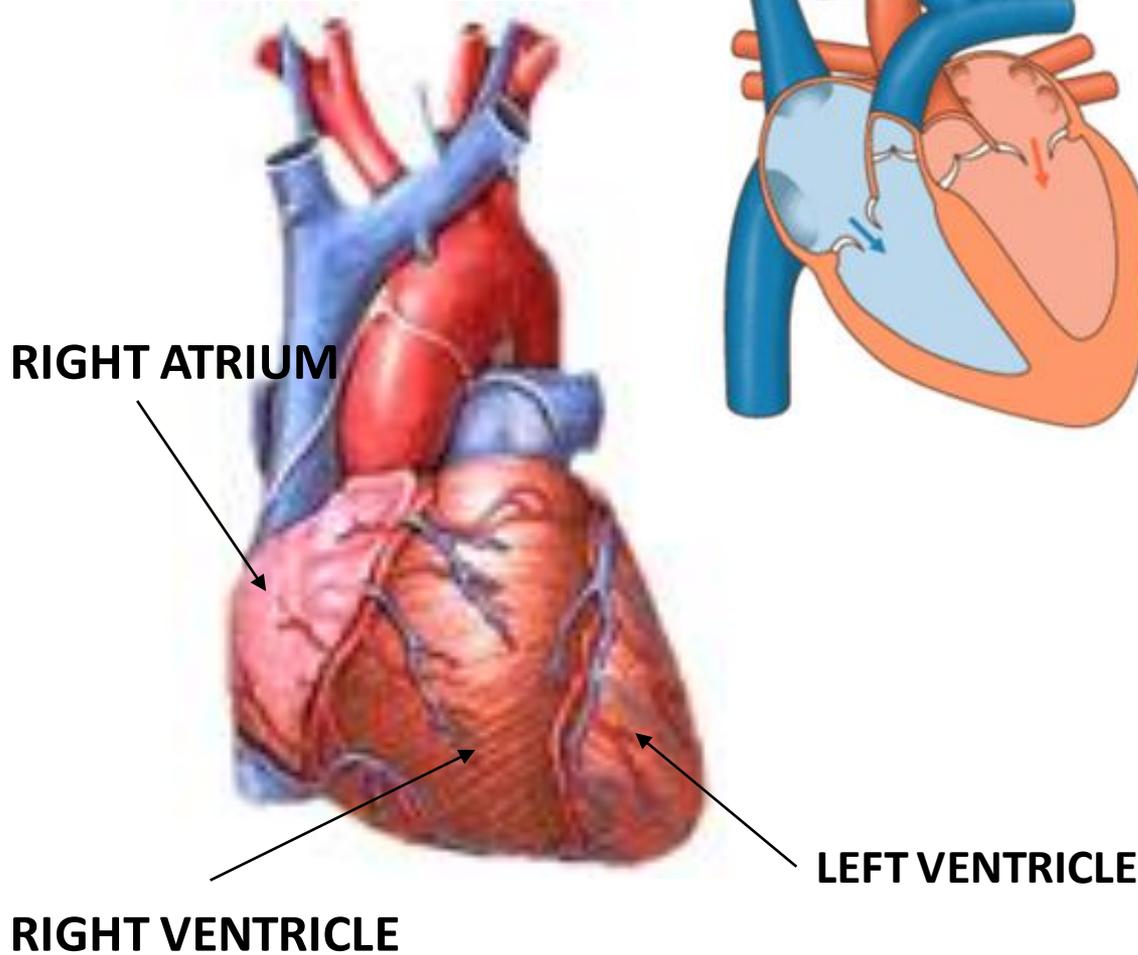
# CHAMBERS OF THE HEART

Internally the heart is divided into 4 chambers

1. Right atrium
2. Left atrium
3. Right ventricle
4. Left ventricle



# CHAMBERS OF THE HEART



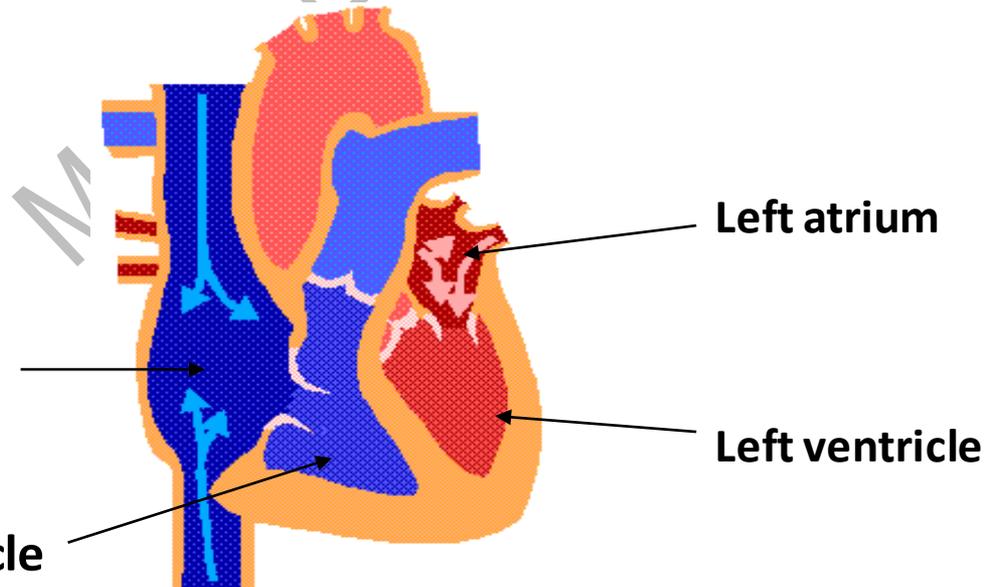
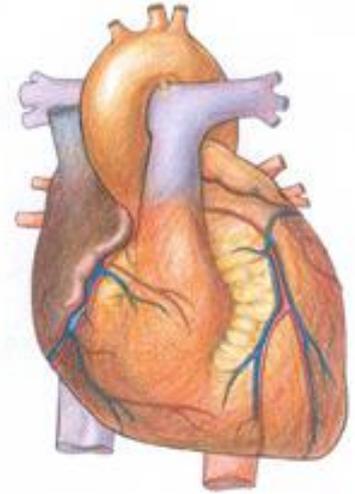
LEFT ATRIUM

# ATRIUM

**Atria ( receiving chambers ) are situated in front of the ventricles.**

**They are thin walled chambers.**

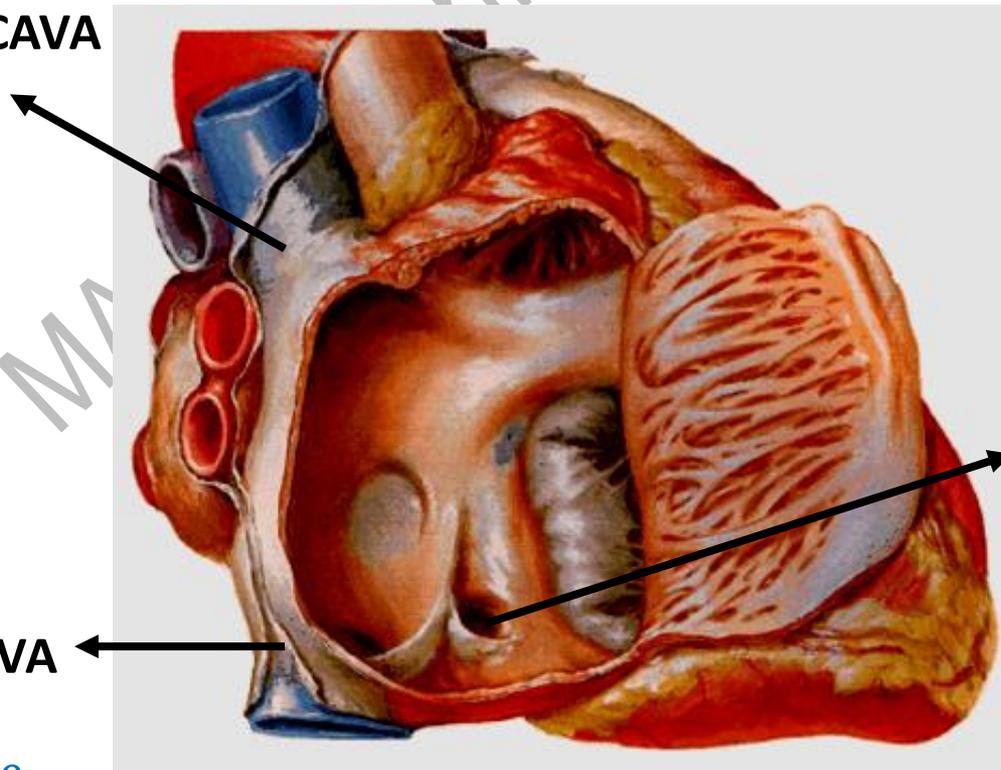
**Separated from one another by a muscular interatrial septum.**



# INTERIOR OF RIGHT ATRIUM

Right atrium **receives deoxygenated blood** through **superior venacava**, **inferior venacava** and the **coronary sinus**.

SUPERIOR VENACAVA

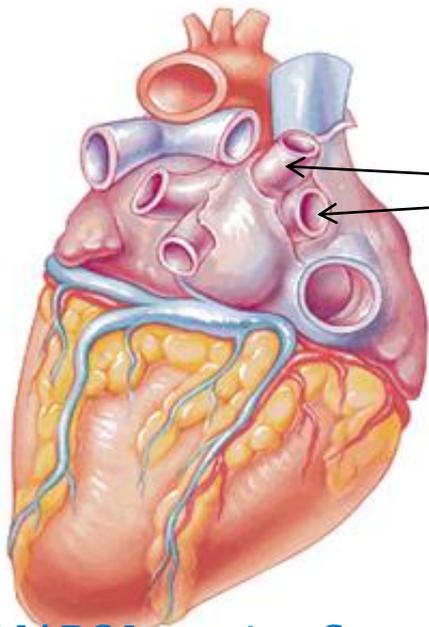


CORONARY SINUS

INFERIOR VENACAVA

# INTERIOR OF LEFT ATRIUM

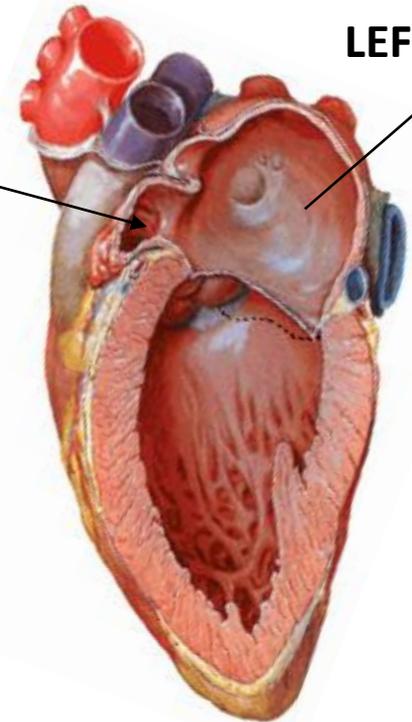
The left atrium **receives oxygenated blood** from the lungs through 2 pairs of pulmonary veins.



PULMONARY VEINS

LEFT AURICLE

LEFT ATRIUM

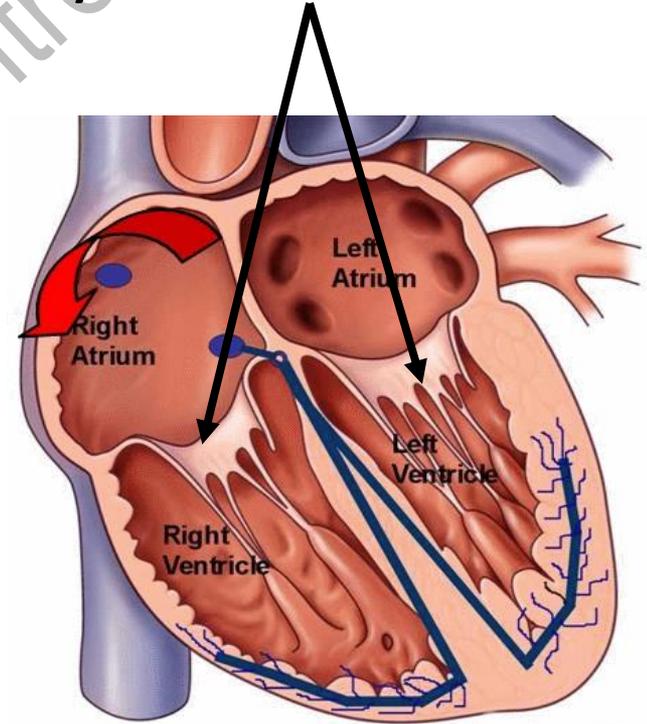


# ATRIOVENTRICULAR VALVES

The right and left atria open into right and left ventricles through the respective atrioventricular apertures. They are guarded by **atrioventricular valves**.

The **right atrioventricular aperture** is guarded by the **tricuspid valve** which has 3 flaps or cusps.

The **Left atrioventricular aperture** is guarded by the **bicuspid valve or the mitral valve** which has two flaps.

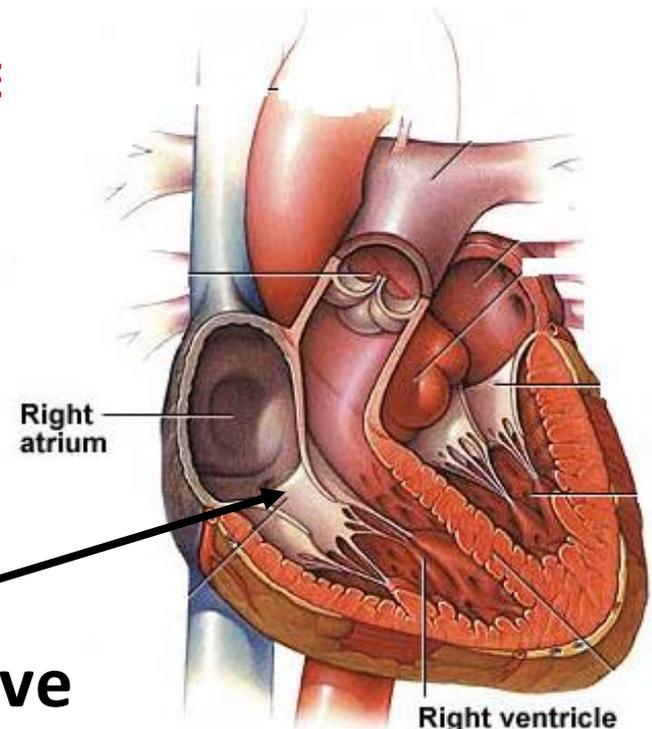


# ATRIOVENTRICULAR VALVE

TRICUSPID VALVE has following 4 components

1. TRICUSPID ANNULUS
2. LEAFLETS OR CUSPS
3. CHORDAE TENDINEAE
4. PAPILLARY MUSCLES

Tricuspid valve



# RIGHT VENTRICLE

## TRICUSPID VALVE

INCLUDES

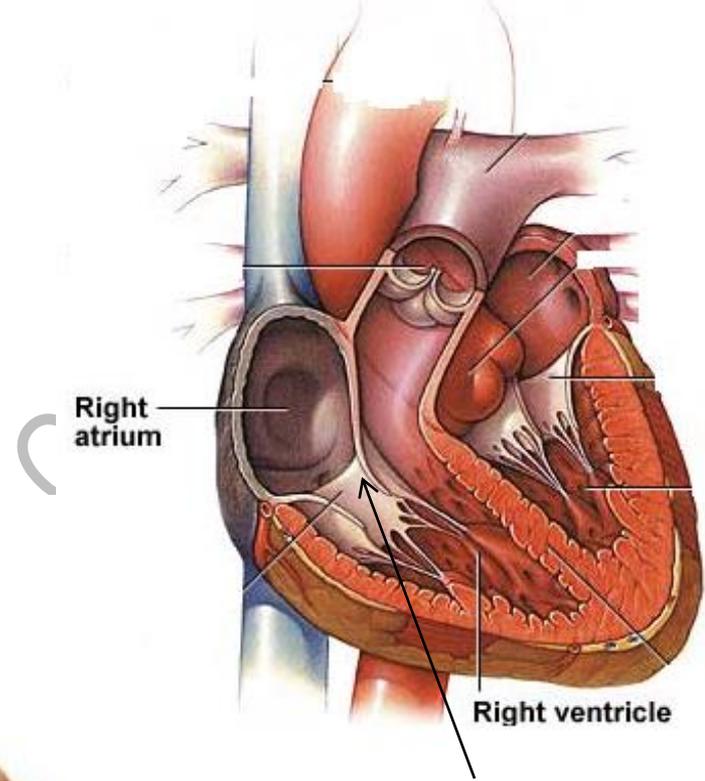
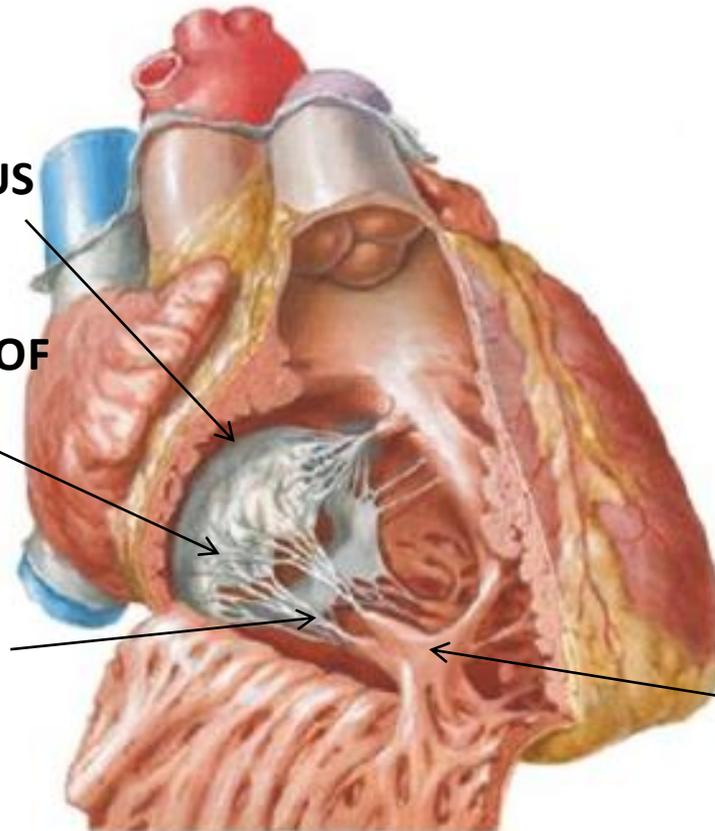
TRICUSPID ANNULUS

LEAFLETS OR CUSPS OF TRICUSPID VALVE

CHORDAE TENDINAE

ATRIOVENTRICULAR ORIFICE

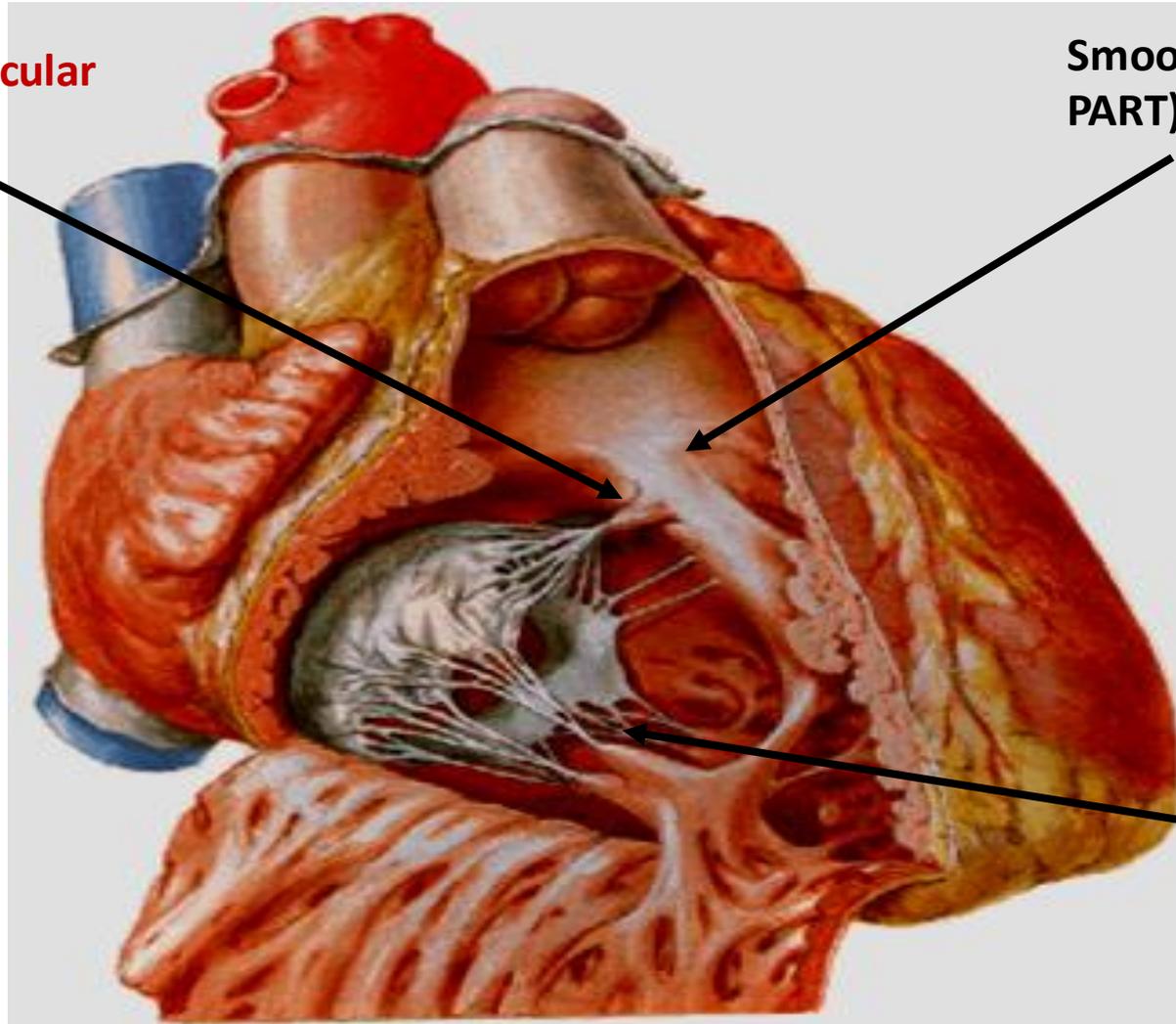
PAPILLARY MUSCLES



# Right ventricle

Supraventricular  
crest

Smooth part(OUTFLOWING  
PART)



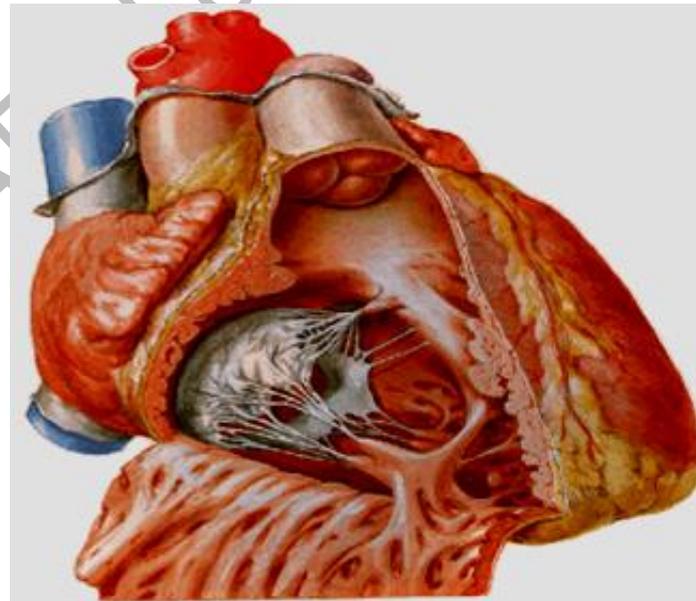
Rough  
part(INFLOWING  
PART)

**TRICUSPID ANNULUS:** is a collagenous ring succeeding the orifice, where the bases of cusp are attached.

**LEAFLETS OR CUSP:** are 3 in number

**CHORDAE TENDINEAE:** these are endothelial covered collagenous threads

**PAPILLARY MUSCLES:** Are conical muscular projection, two in number



The cusps of the valves are prevented from swinging back into the atria by the papillary muscles and the chordae tendinae.

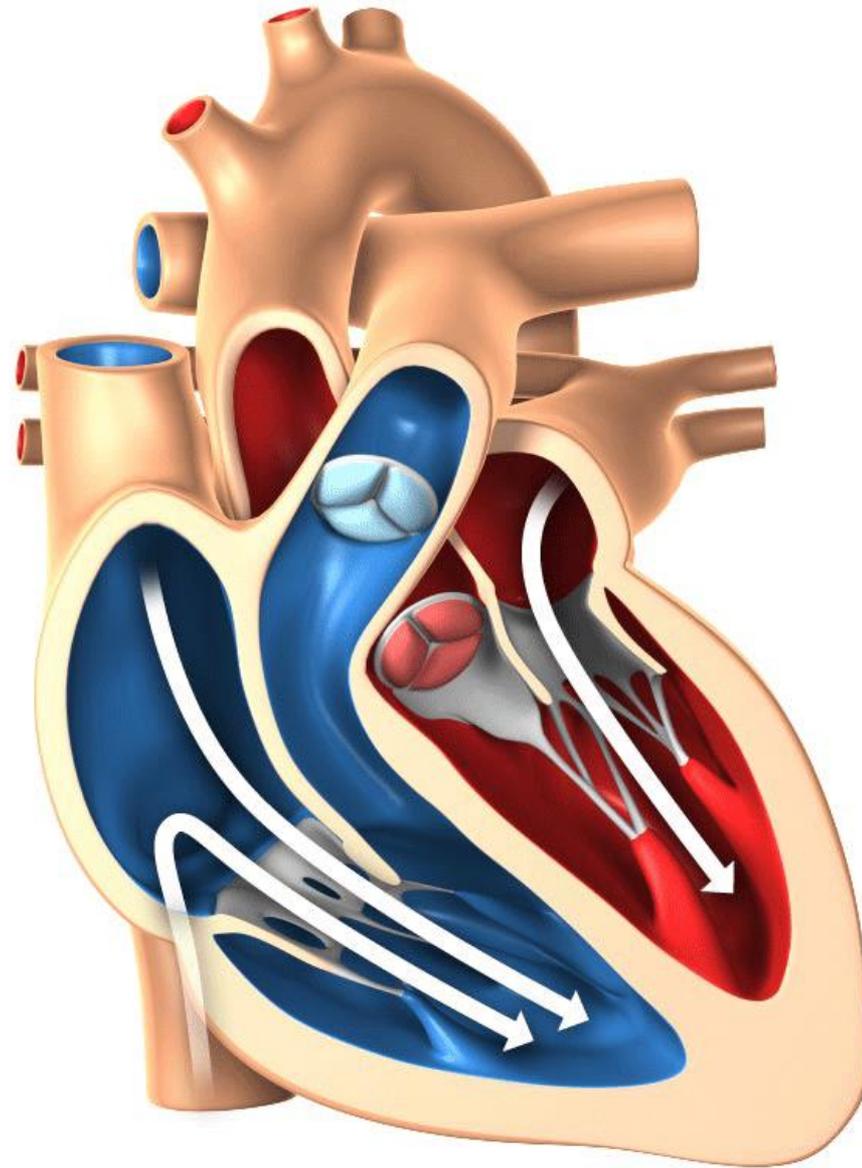
The atrioventricular valves prevent the blood from flowing back into the atria and maintain a unidirectional blood flow.

Hence, blood always flows from the atria into the corresponding ventricles but not vice Versa.

Chordae tendinae regulate the opening and closing of atrioventricular valves.

The first heart sound , **LUBB** is produced by the closing of these valves.





# VENTRICLES

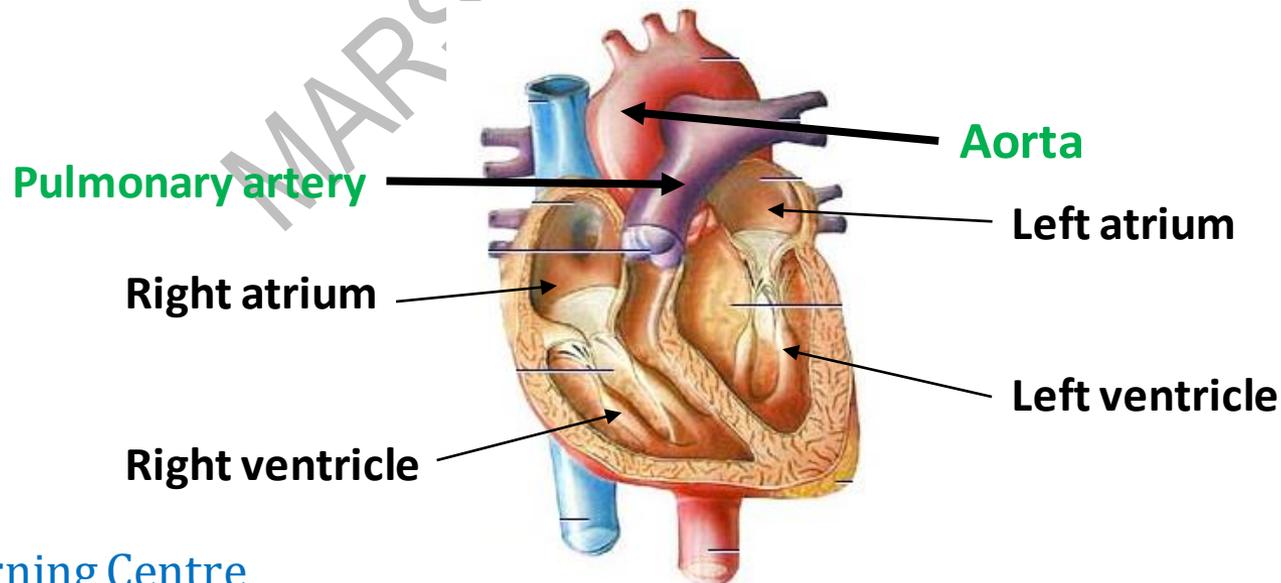
These are the pumping chambers which are thick walled

They are separated from one another by an **interventricular septum**.

The wall of the left ventricle is much thicker than that of the right ventricle.

From the right ventricle arises the **pulmonary artery** which carries deoxygenated blood from the right ventricle to the lungs for oxygenation.

**Aorta** the largest blood vessel of the body arises from the left ventricle. It carries oxygenated blood from the left ventricle for distribution to various parts of the body.



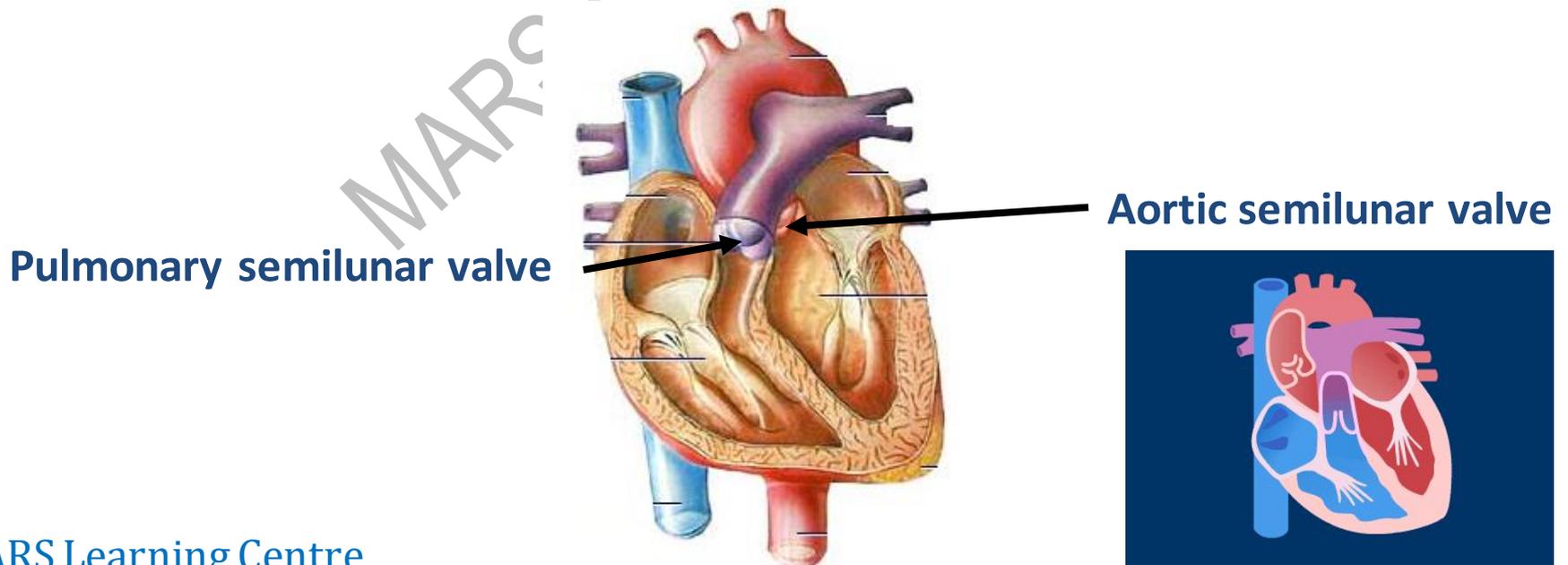
Opening of the pulmonary artery in the right ventricle is guarded by **pulmonary semilunar valve**.

Opening of the aorta in the left ventricle is guarded by **aortic semilunar valve**.

Both the valves consist of 3 semilunar cusps.

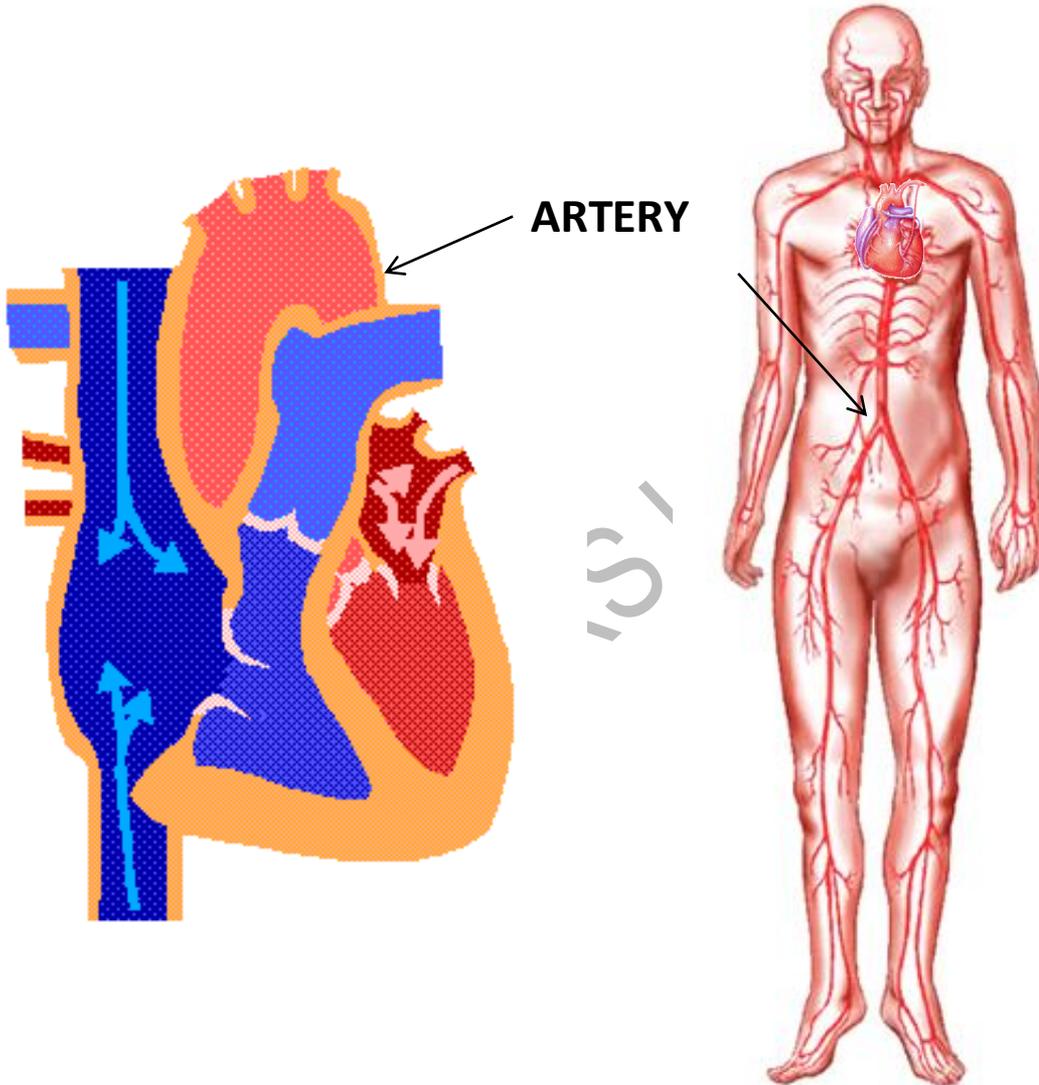
They prevent blood from flowing back into the ventricles and maintain an unidirectional blood flow.

The second heart sound , **DUBB** is produced by the closing of these valves.

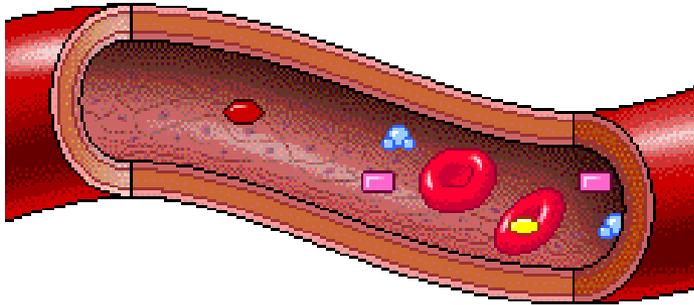


# ARTERY

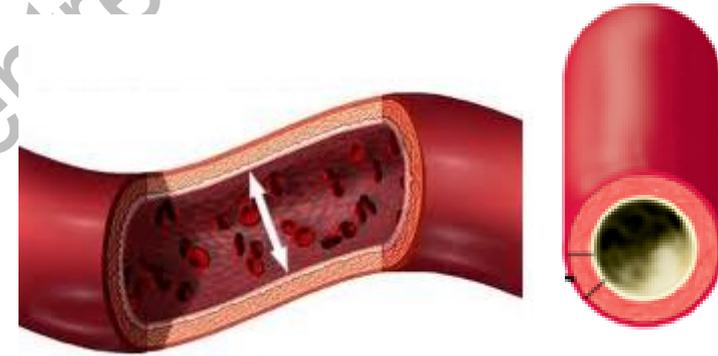
DISTRIBUTING CHANNELS, CARRY BLOOD AWAY FROM HEART



# CHARACTERISTIC FEATURES OF ARTERY



**THICK WALLED**

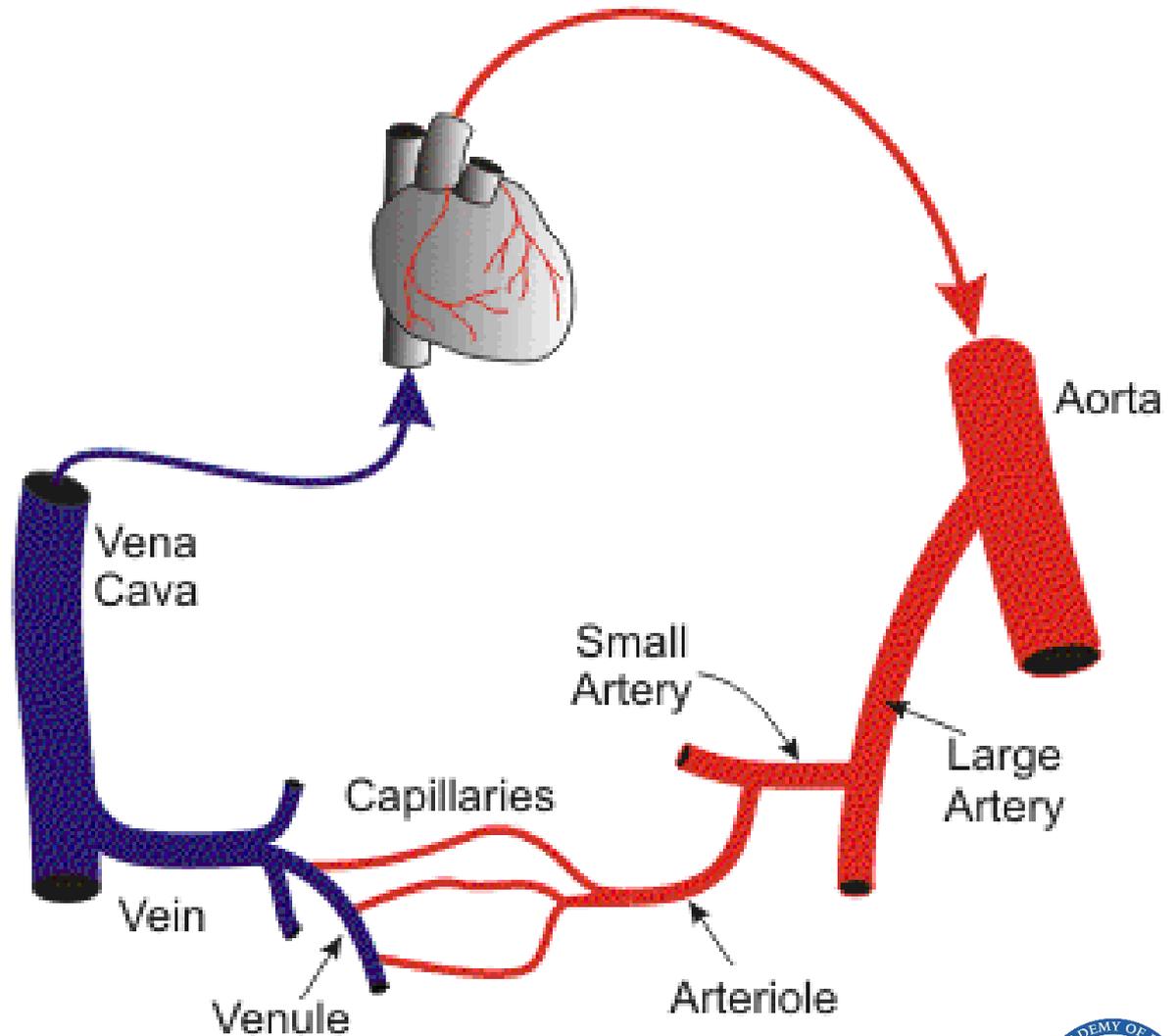
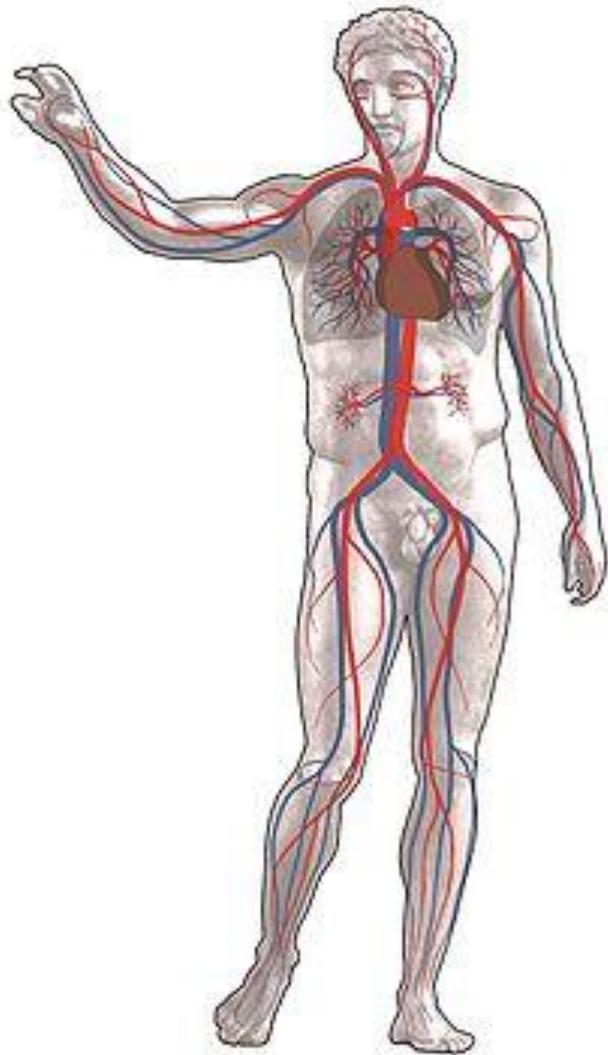


**LUMEN IS SMALL**

Flow in arteries at rest

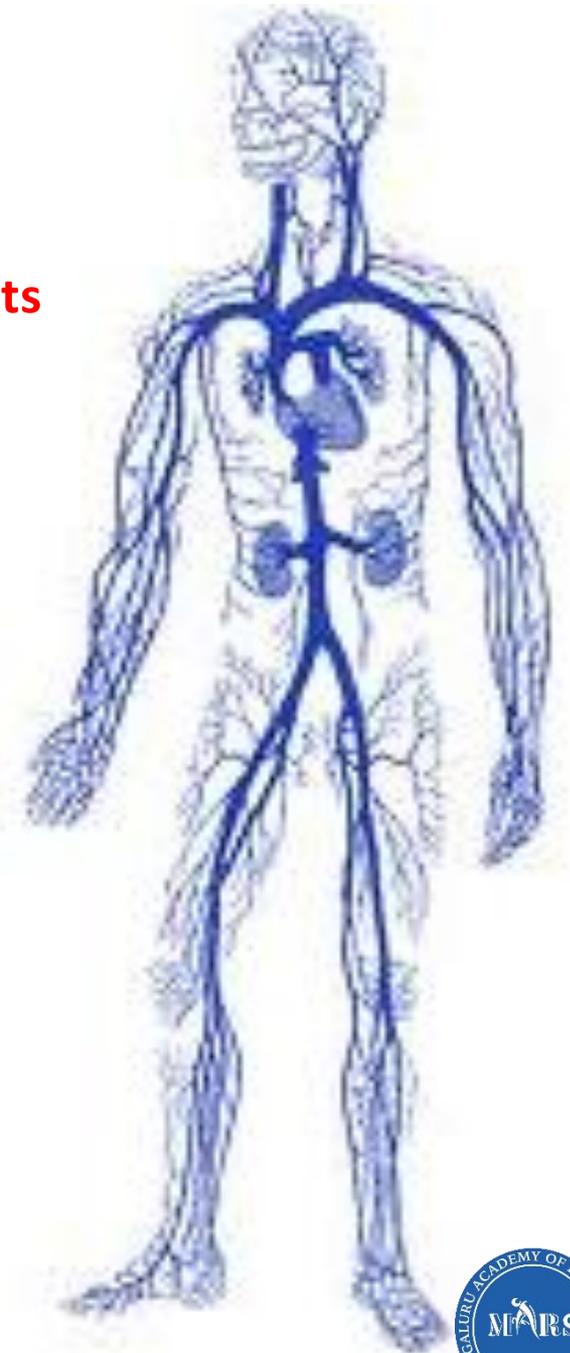
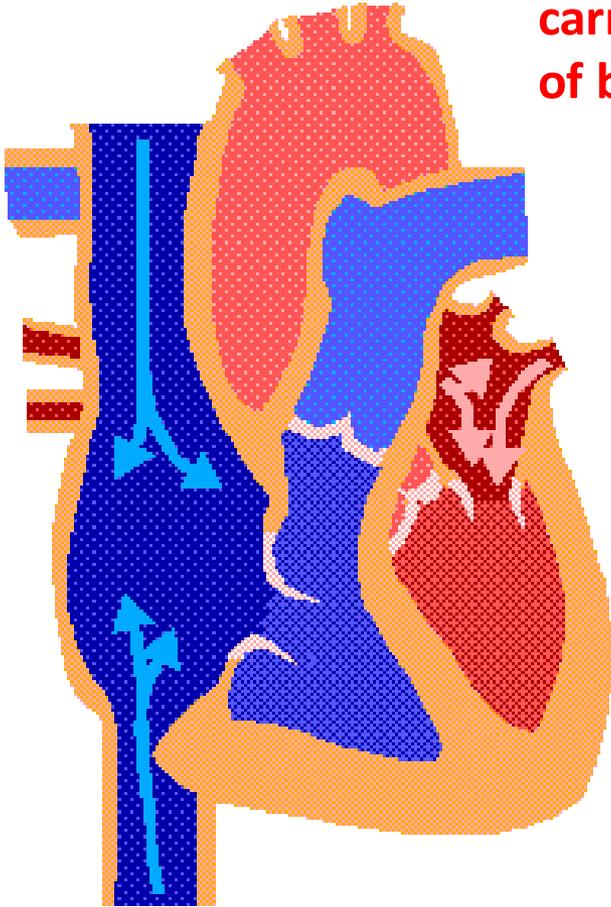
**NO VALVES**

# TYPES OF ARTERIES

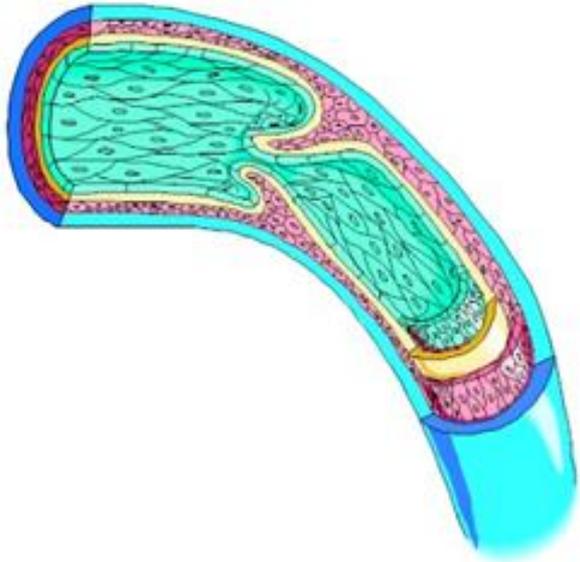


# VEINS

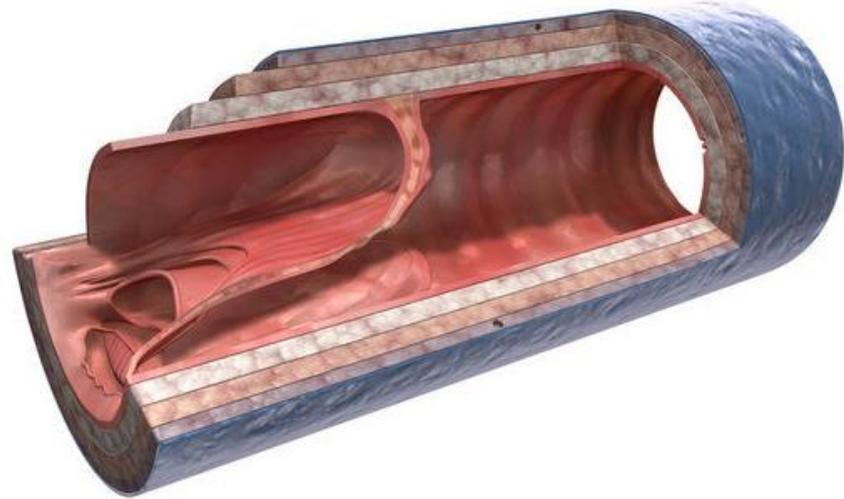
Draining channels which carry blood from different parts of body back to heart.



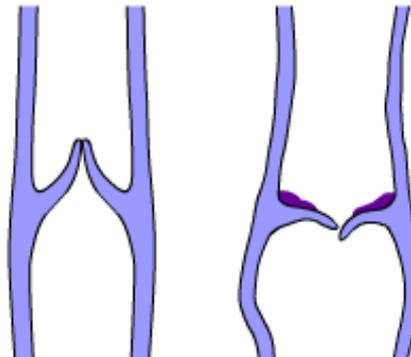
# CHARACTERISTIC OF VEINS



**THIN -WALLED**



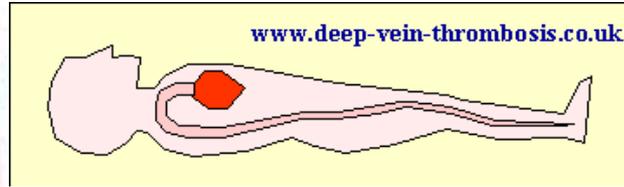
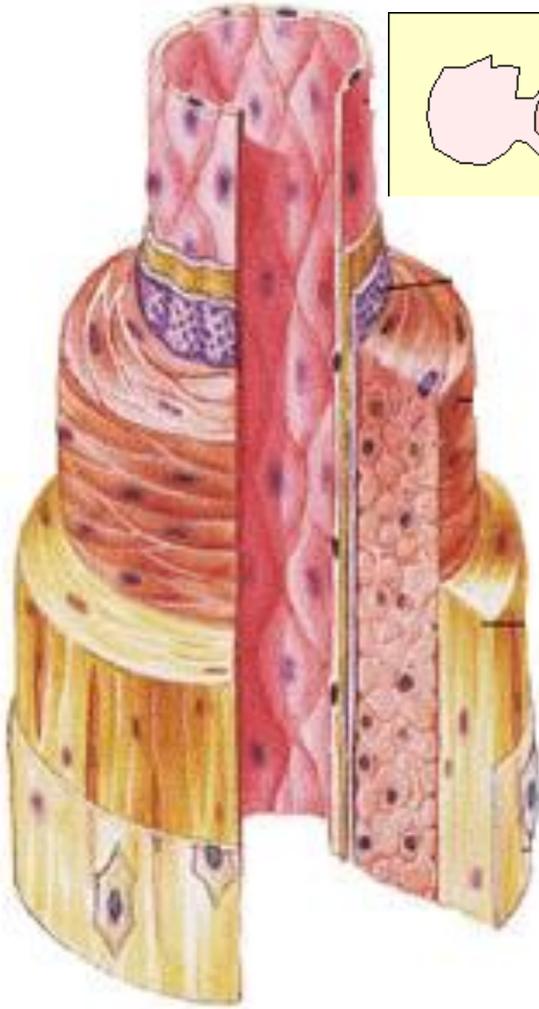
**LUMEN IS LARGER**



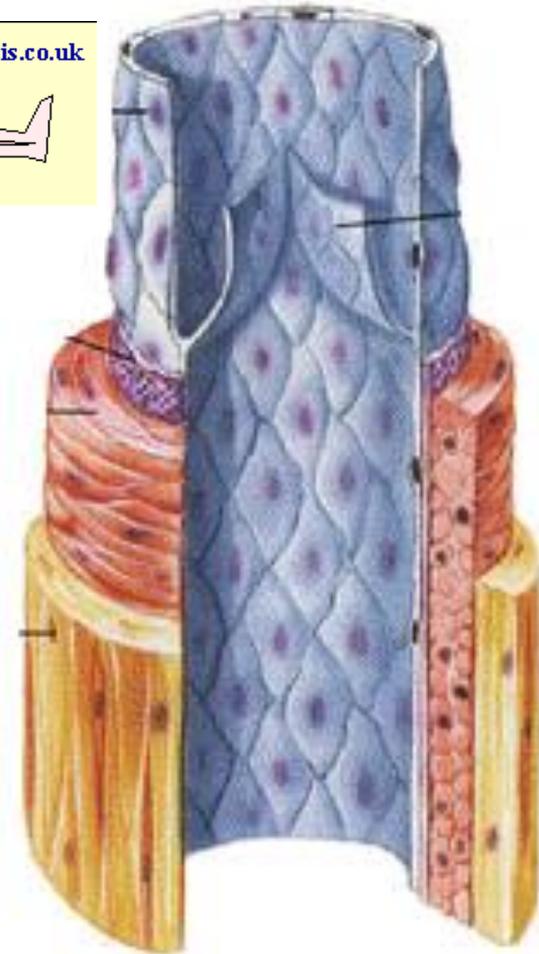
**PRESENCE OF VALVES**

# COMPARISON

ARTERY

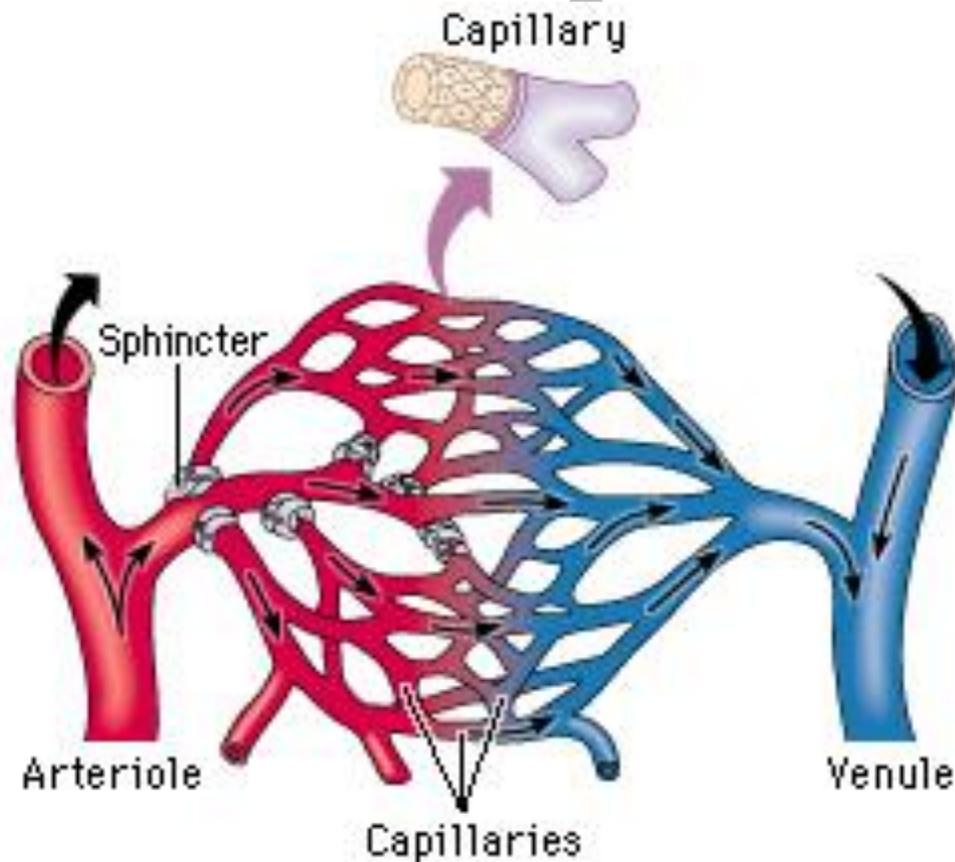


VEIN



# CAPILLARIES

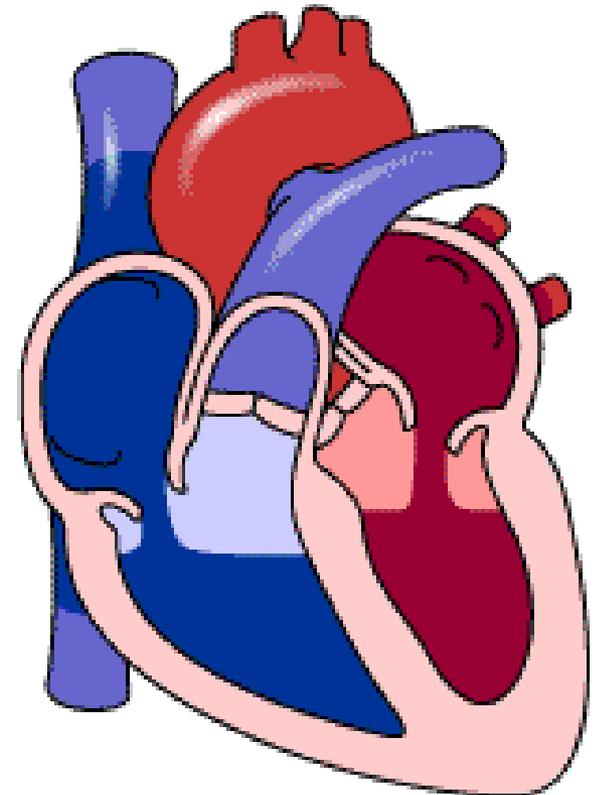
Capillaries are very narrow, thin walled microscopic tubes. Through the thin walls of the capillaries exchange of gases, nutrients and wastes occur between the blood and body cells.



# FUNCTION OR WORKING OF THE HEART

**FUNCTION OF THE HEART** is to maintain the blood circulation in the body by pumping the blood.

Pumping of the blood is accomplished by the contraction and relaxation of the chambers of the heart.

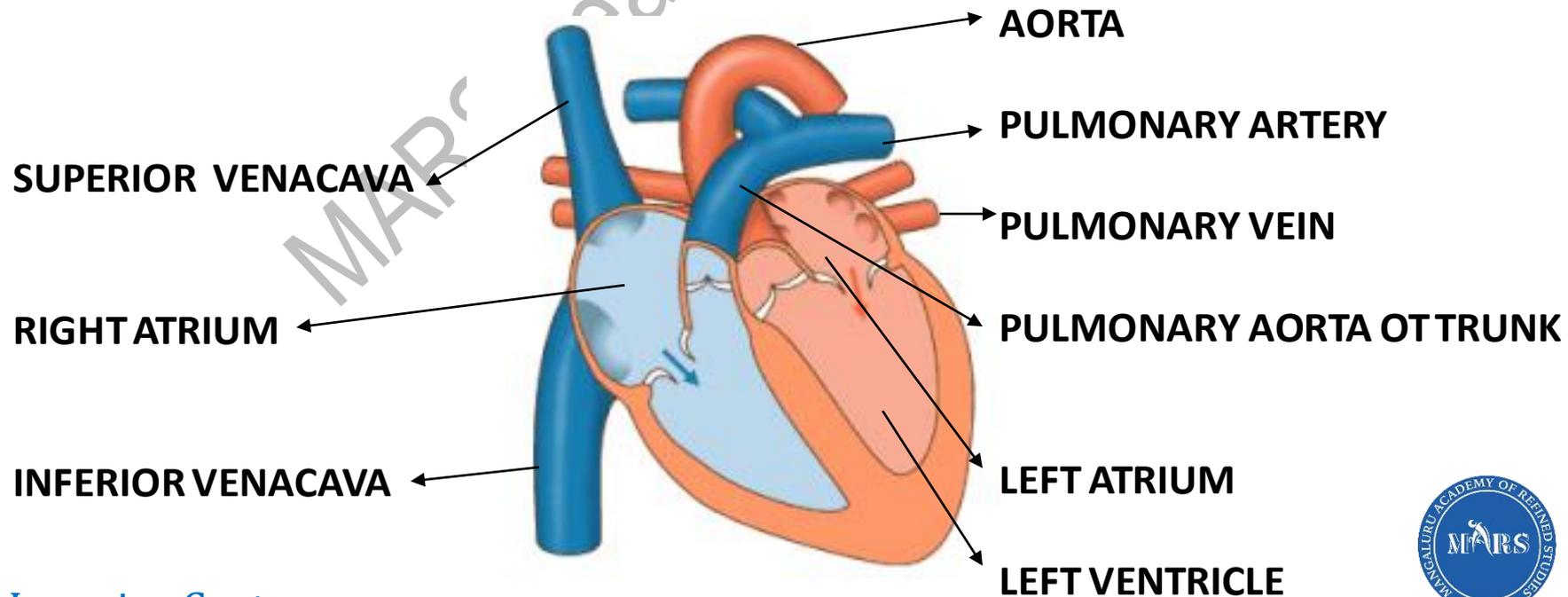


**SYSTOLE:** The contracted state of the chambers is called systole.

**DIASTOLE:** The relaxed state of the chambers is called diastole.

**HEART BEAT OR CARDIAC CYCLE:** A systole and a diastole together constitute a heart beat or cardiac cycle.

The duration of a cardiac cycle or one heart beat in a normal human adult is about 0.8 seconds.



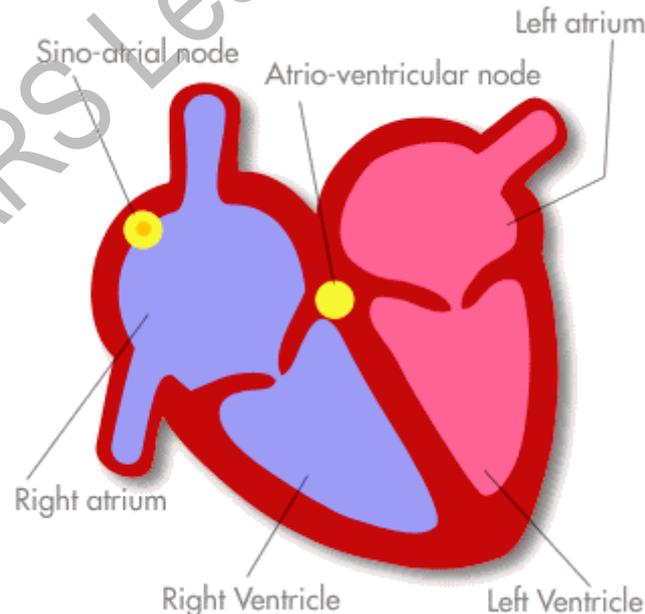
**Heart beat is controlled by a special masses of muscles** that are **capable of generating electric current for contraction of different parts of heart.**

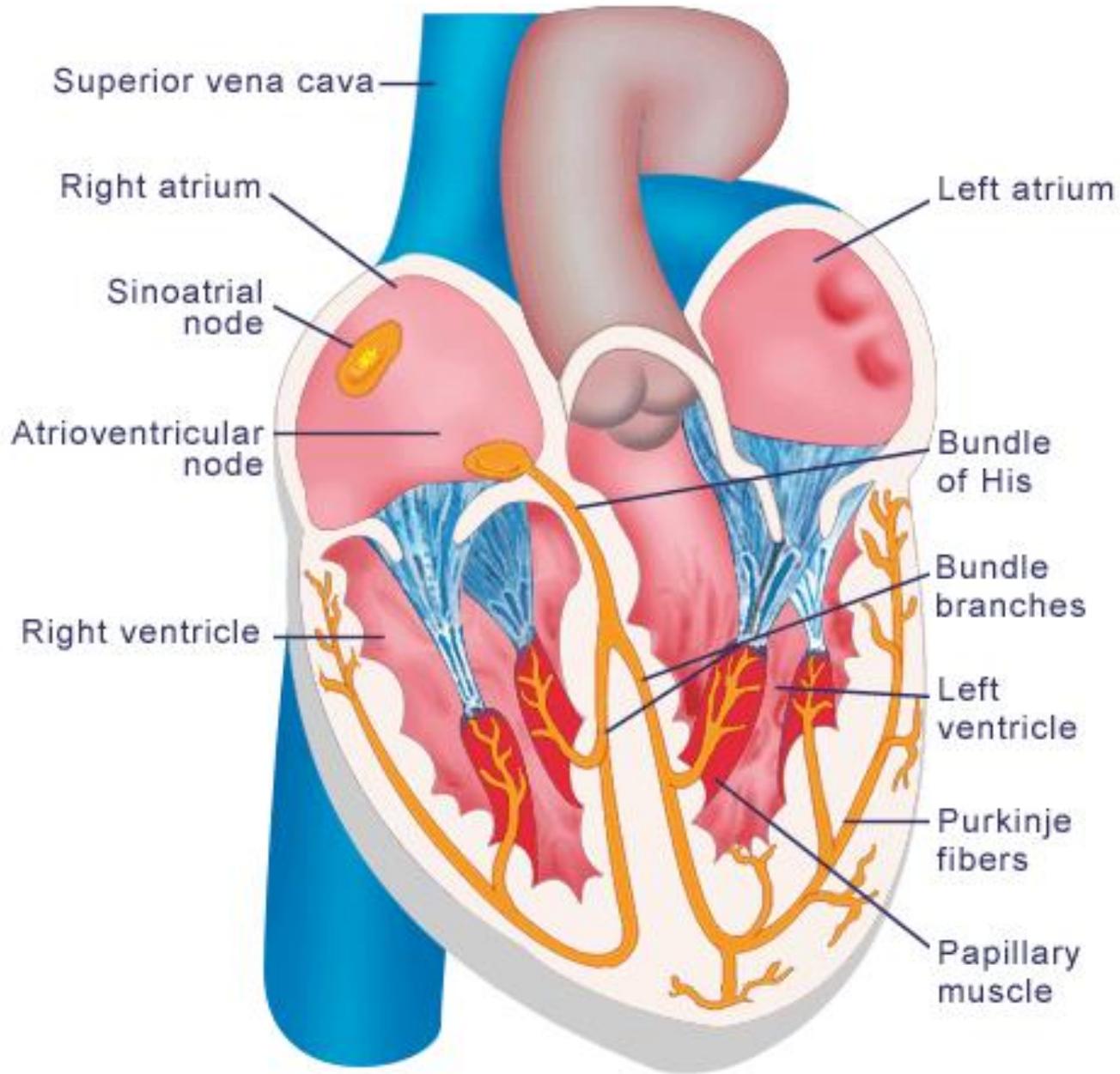
They consists of **SA NODE** ( SINOATRIAL NODE IN RIGHT ATRIUM )

**AV NODE** ( ATRIOVENTRICULAR NODE IN RIGHT ATRIUM )

**BUNDLE OF HIS** and its branches ( WALL OF VENTRICLES )

**SINOATRIAL NODE** is also called **PACEMAKER** as impulse for heart beat originates from it.





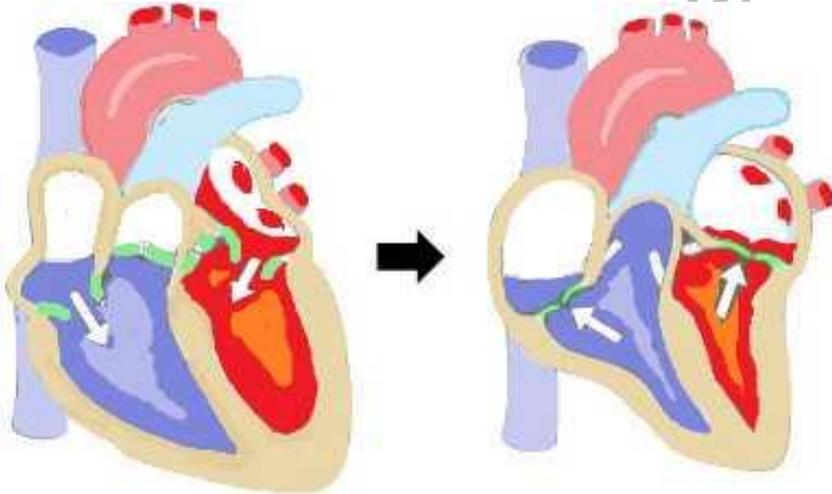
# PHASES OF CARDIAC CYCLE

## PHASE I ( ATRIAL SYSTOLE ):

In this phase, the atria contract to pump the blood into the ventricles.

## PHASE II ( VENTRICULAR SYSTOLE ):

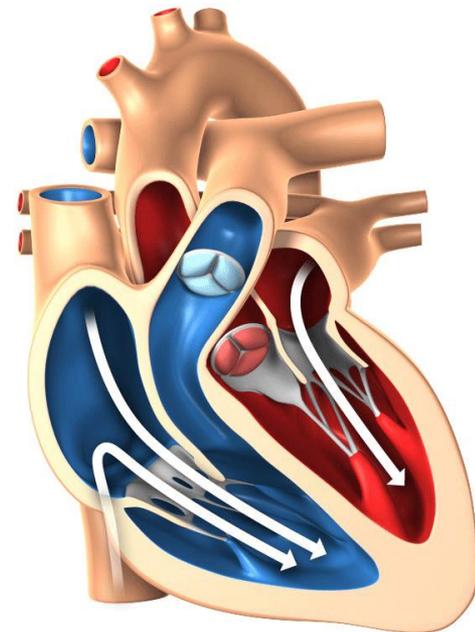
In this phase , the ventricles contract to pump the blood onto the aorta and pulmonary artery.

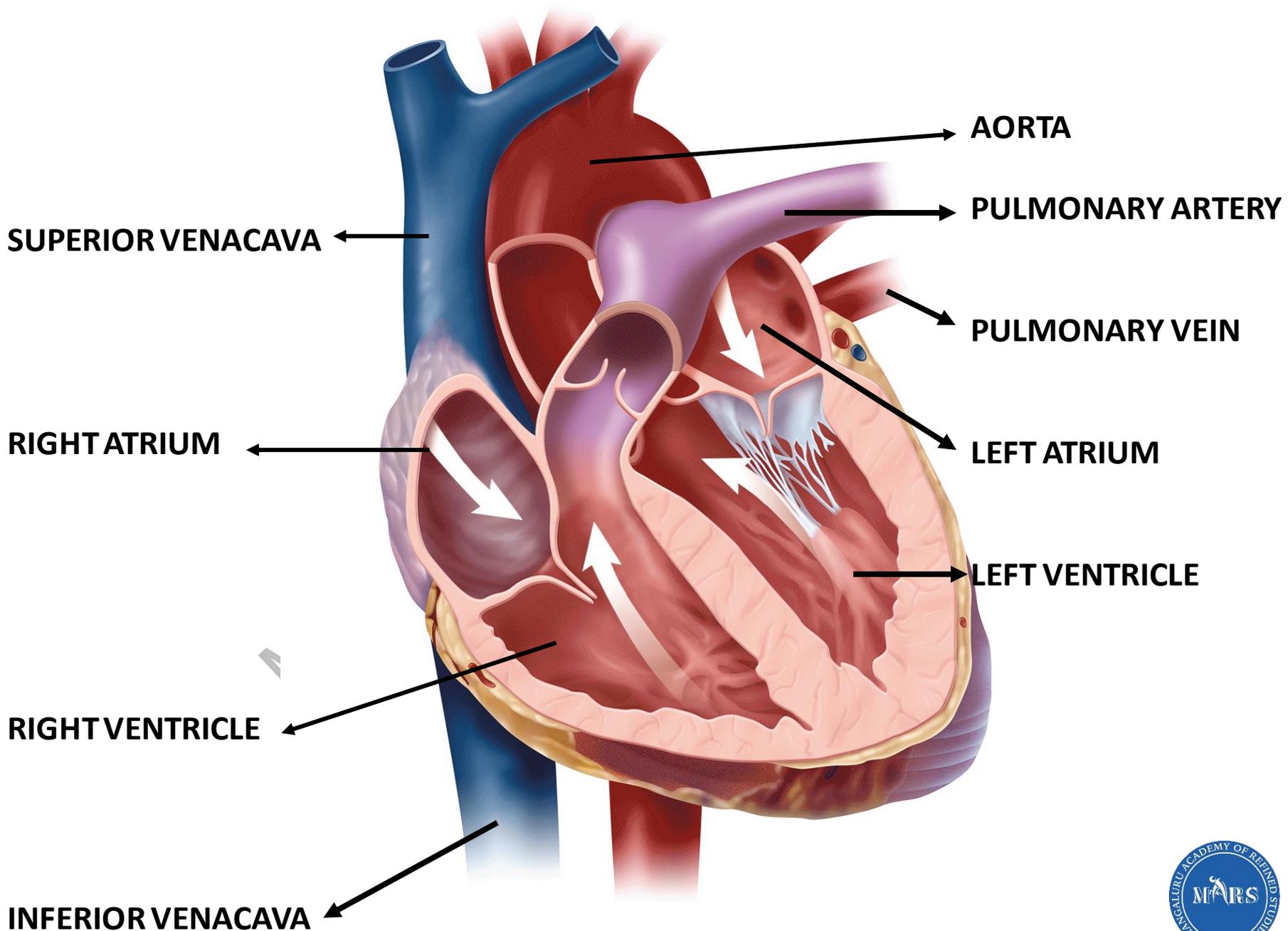


Atrial Systole

Ventricular Systole

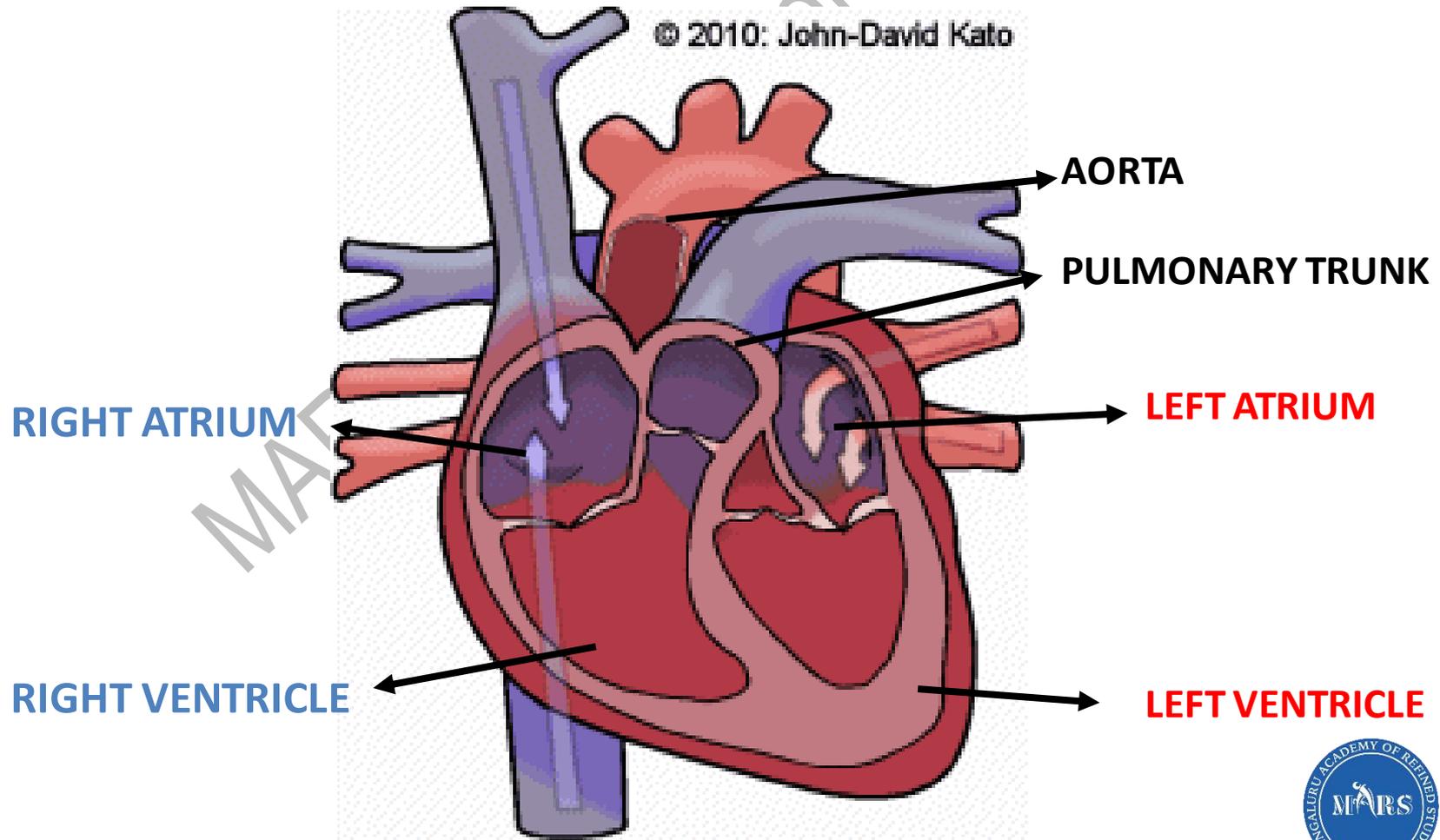
FIRST HEART SOUND ('LUBB')  
CLOSURE OF THE *Atrioventricular* valves





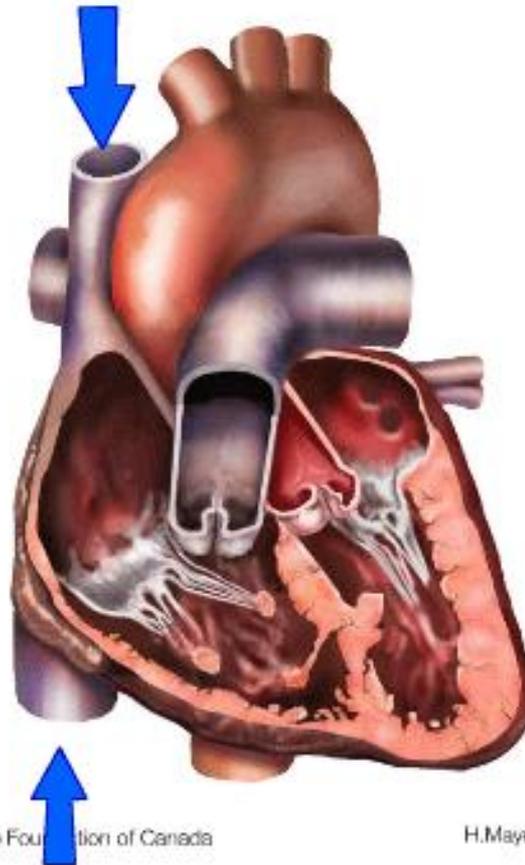
### PHASE III ( COMPLETE CARDIAC DIASTOLE ):

This is a pause phase. During this phase, the deoxygenated blood flows into the right atrium and oxygenated blood into the left atrium ( it lasts for about 0.4 seconds ).



During the **atrial diastole** , the **right atrium is filled with deoxygenated blood** received through the inferior and superior vena cava and the coronary sinus.

The **left atrium** is filled with **oxygenated blood** received through the pulmonary veins.

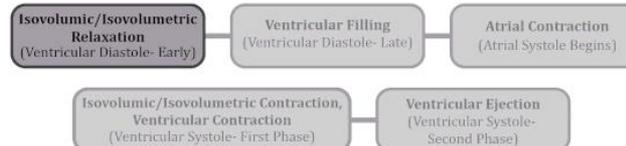
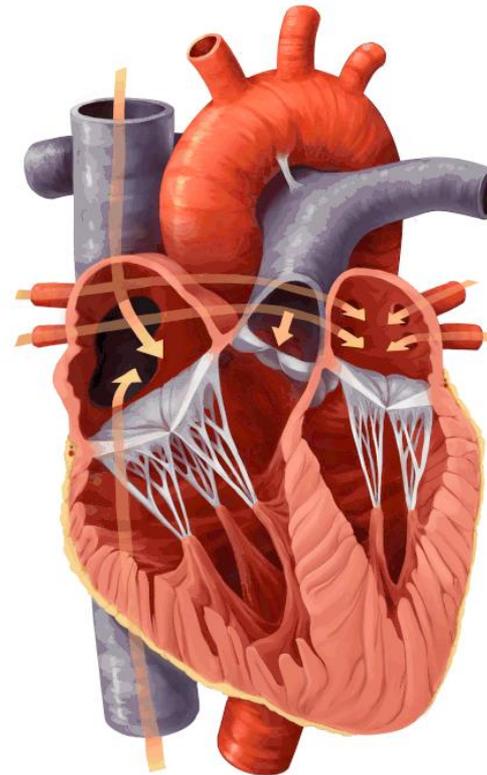


©Heart and Stroke Foundation of Canada

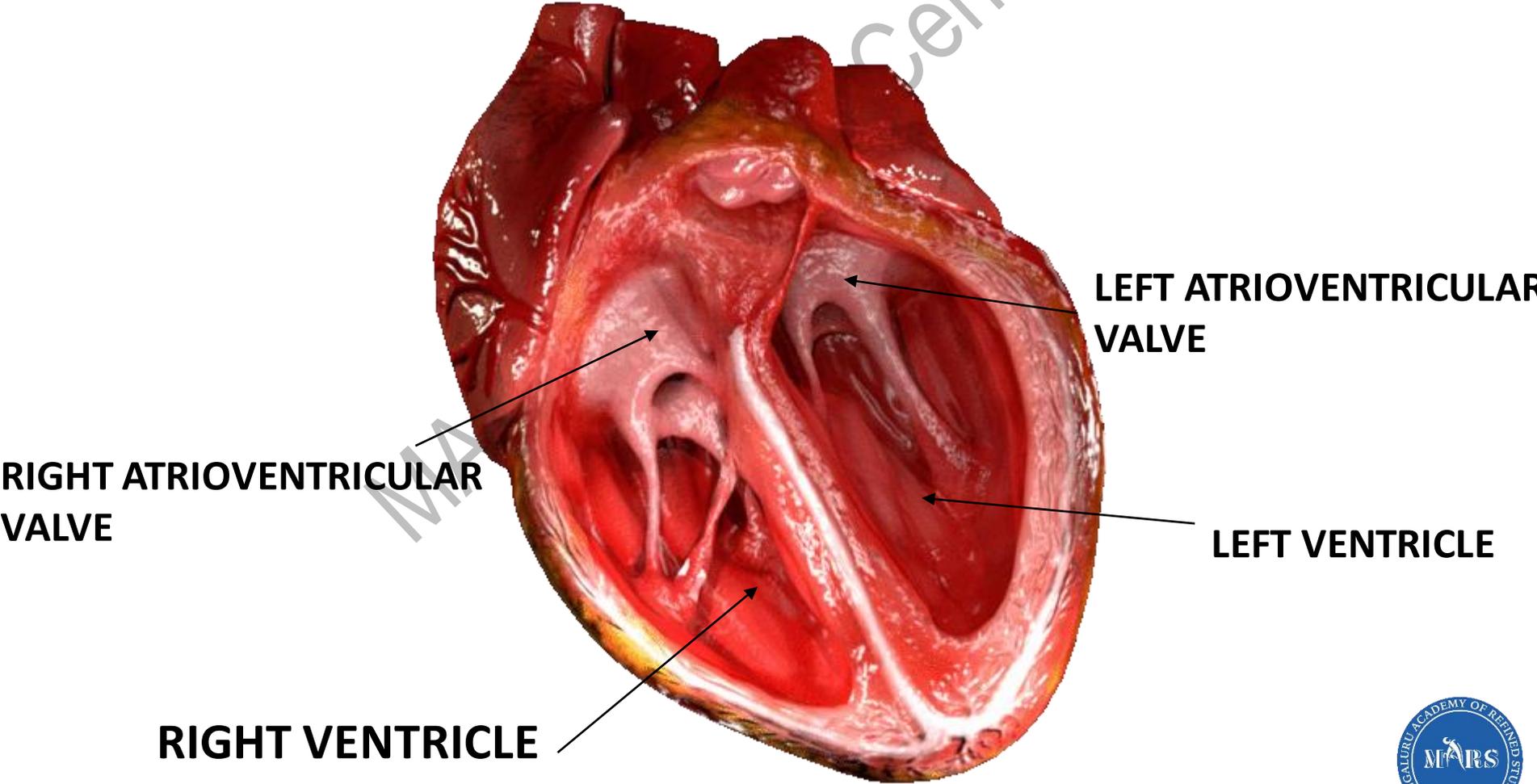
H.Mayer

During the **atrial systole**, that is, when the atria contract, the **atrioventricular valves are forced open** to allow the flow of blood onto the respective ventricles.

Thus the right ventricle receives deoxygenated blood and the left ventricle, oxygenated blood.



When the ventricles contract, that is, during ventricular systole, the atrioventricular apertures are closed by their valves and the semilunar valves open to allow the flow of blood into the pulmonary aorta and systemic aorta respectively.



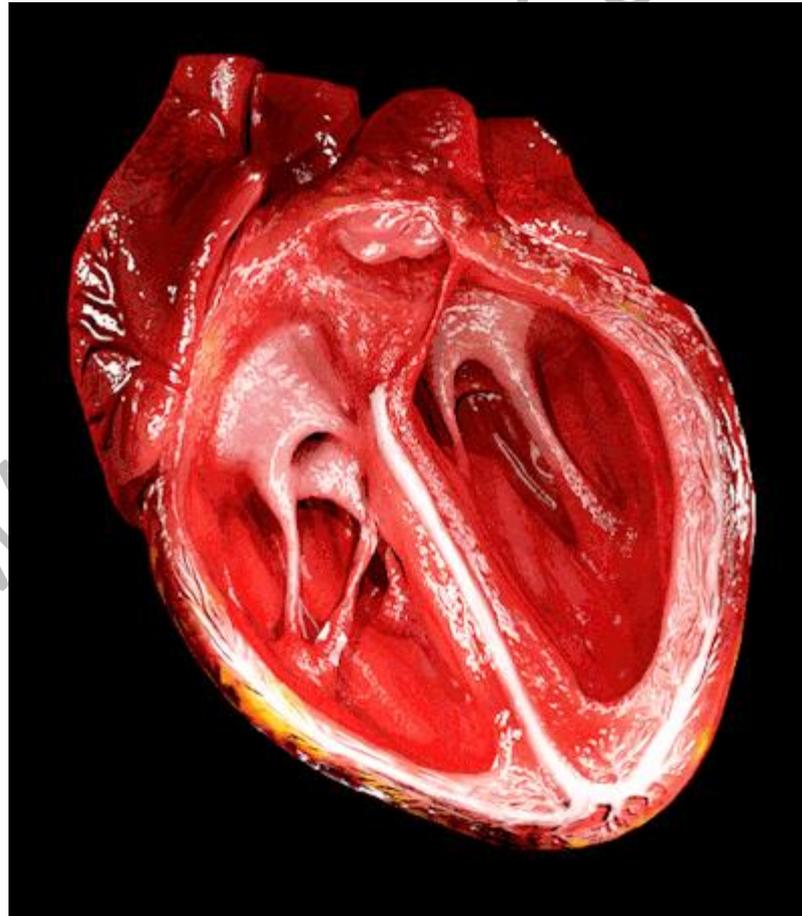
**RIGHT ATRIOVENTRICULAR VALVE**

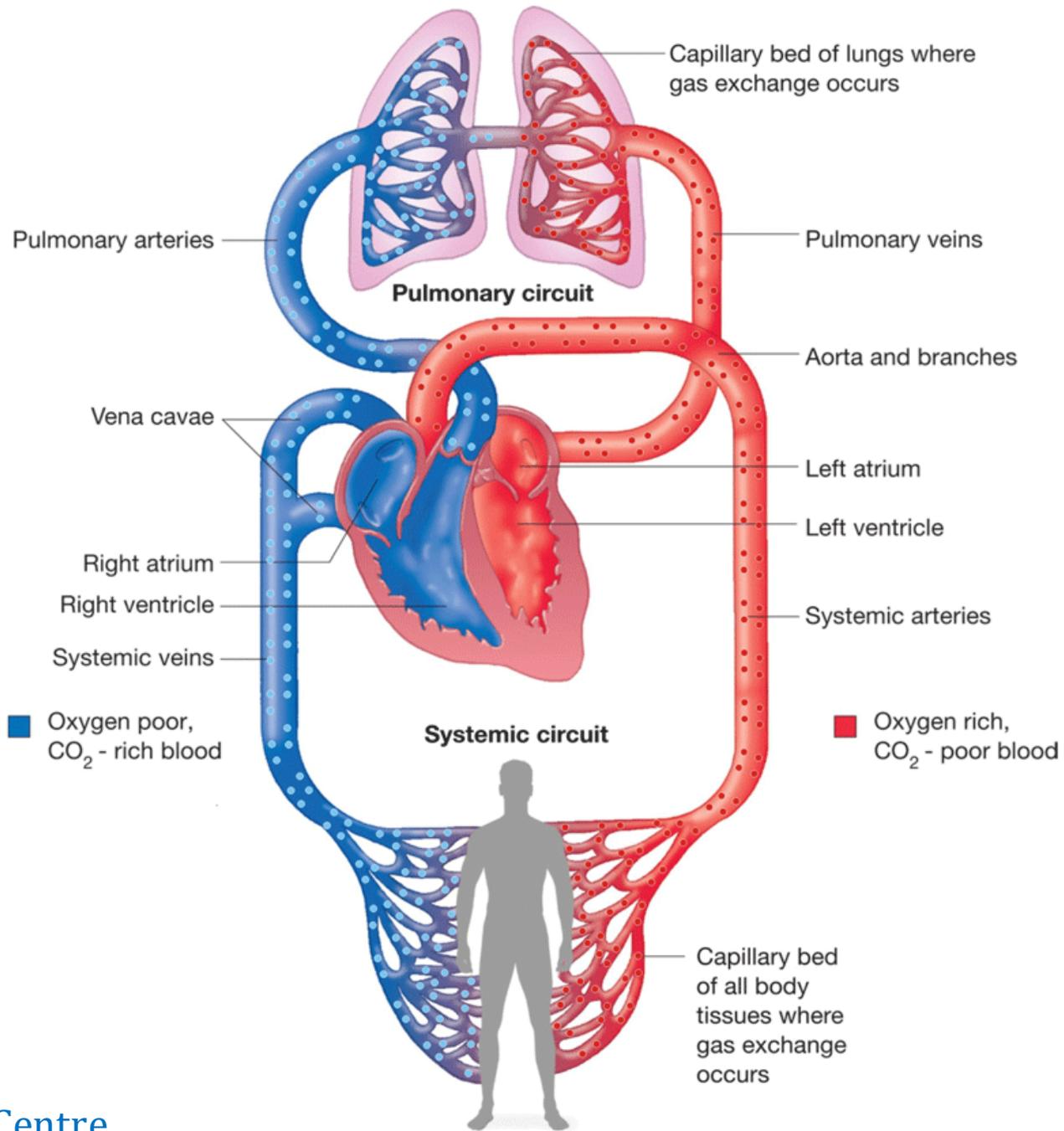
**LEFT ATRIOVENTRICULAR VALVE**

**RIGHT VENTRICLE**

**LEFT VENTRICLE**

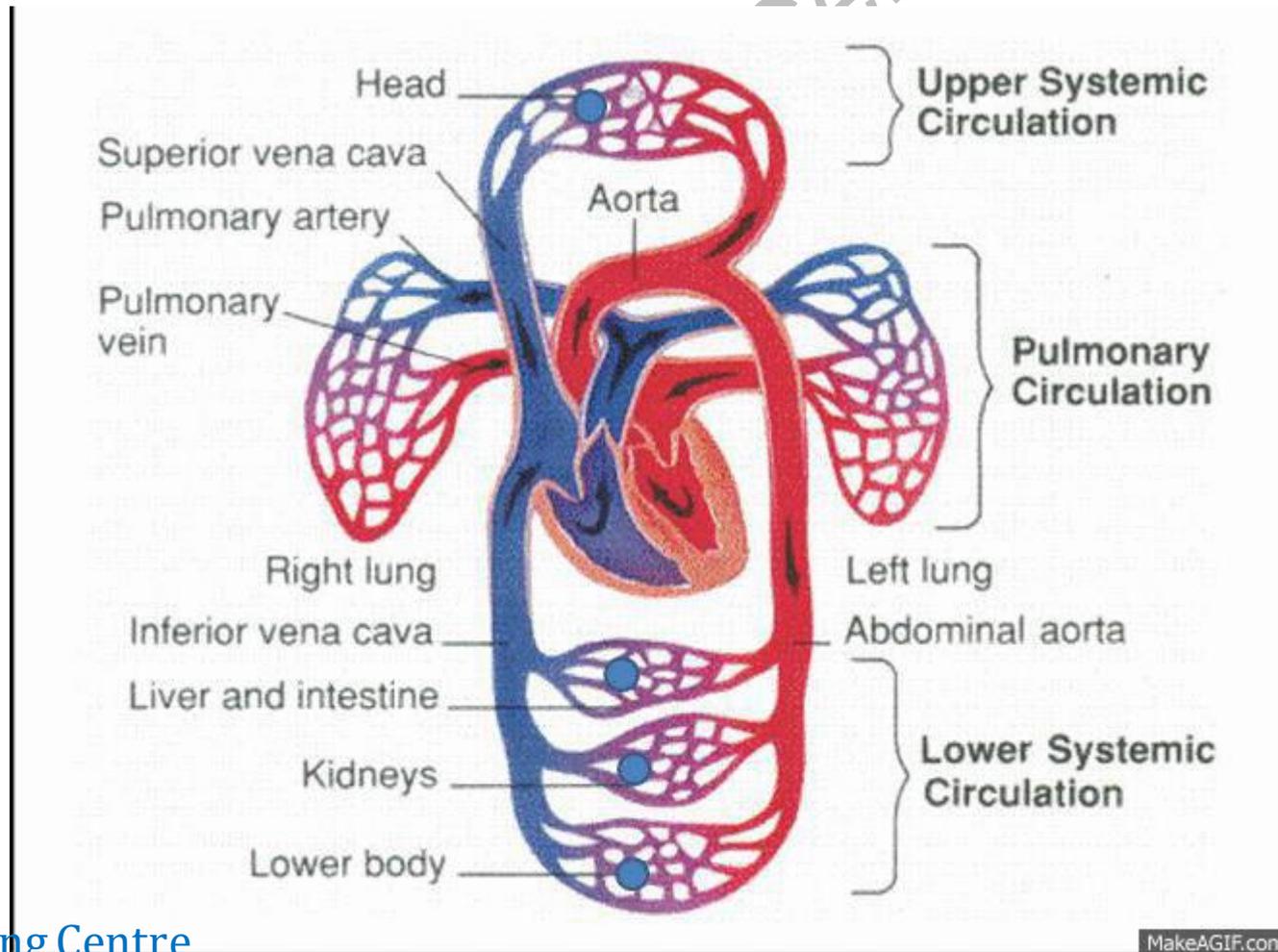
Thus, the **deoxygenated blood from the right ventricle is carried to the lungs for oxygenation, by the pulmonary arteries** . **Oxygenated blood from the left ventricle is distributed to various parts of the body through the systemic aorta**.





# BLOOD CIRCULATION

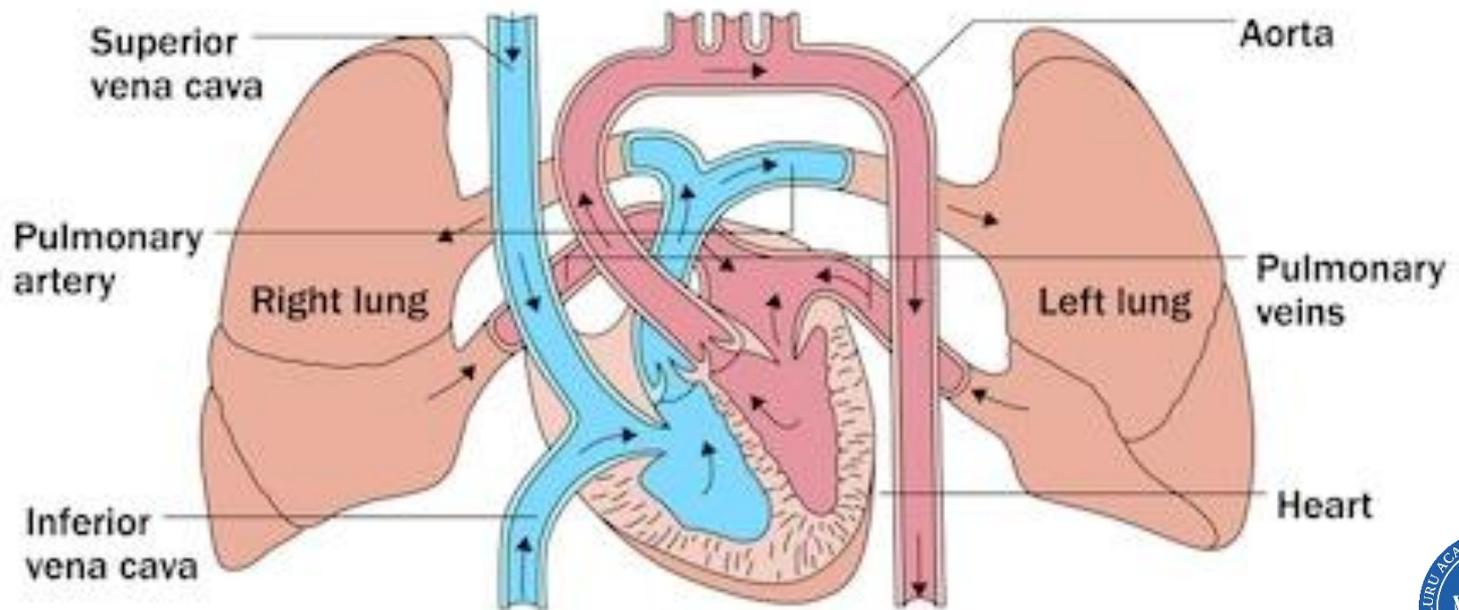
A circulatory system in which blood flows through two separate circuits is called **DOUBLE CIRCULATION**. They are **(i) pulmonary circulation** and **(ii) systemic circulation**.



# PULMONARY CIRCULATION

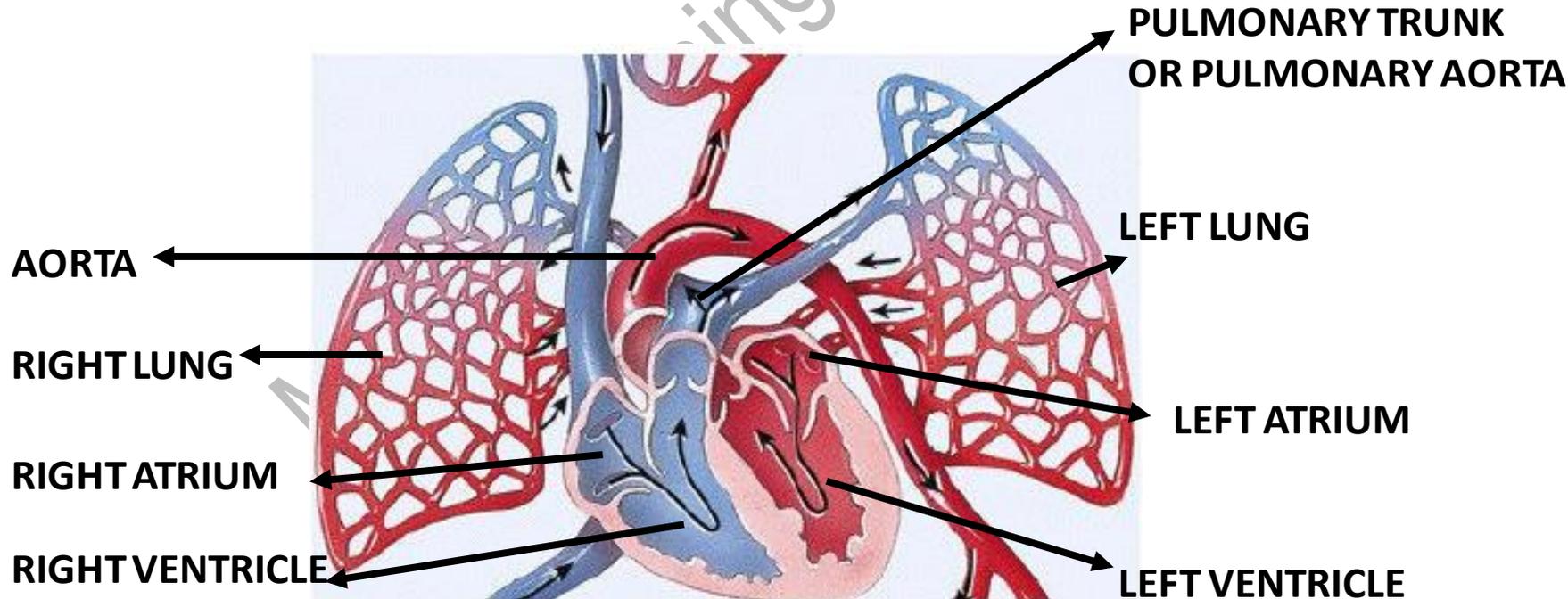
It pertains to the lungs. It starts in the pulmonary aorta arising from the right ventricle which soon divides into two branches, **the right and left pulmonary arteries that enter the respective lungs**. **Pulmonary veins, two from each lung collect the oxygenated blood from the lungs and carry it to the left atrium.**

## Pulmonary circulation



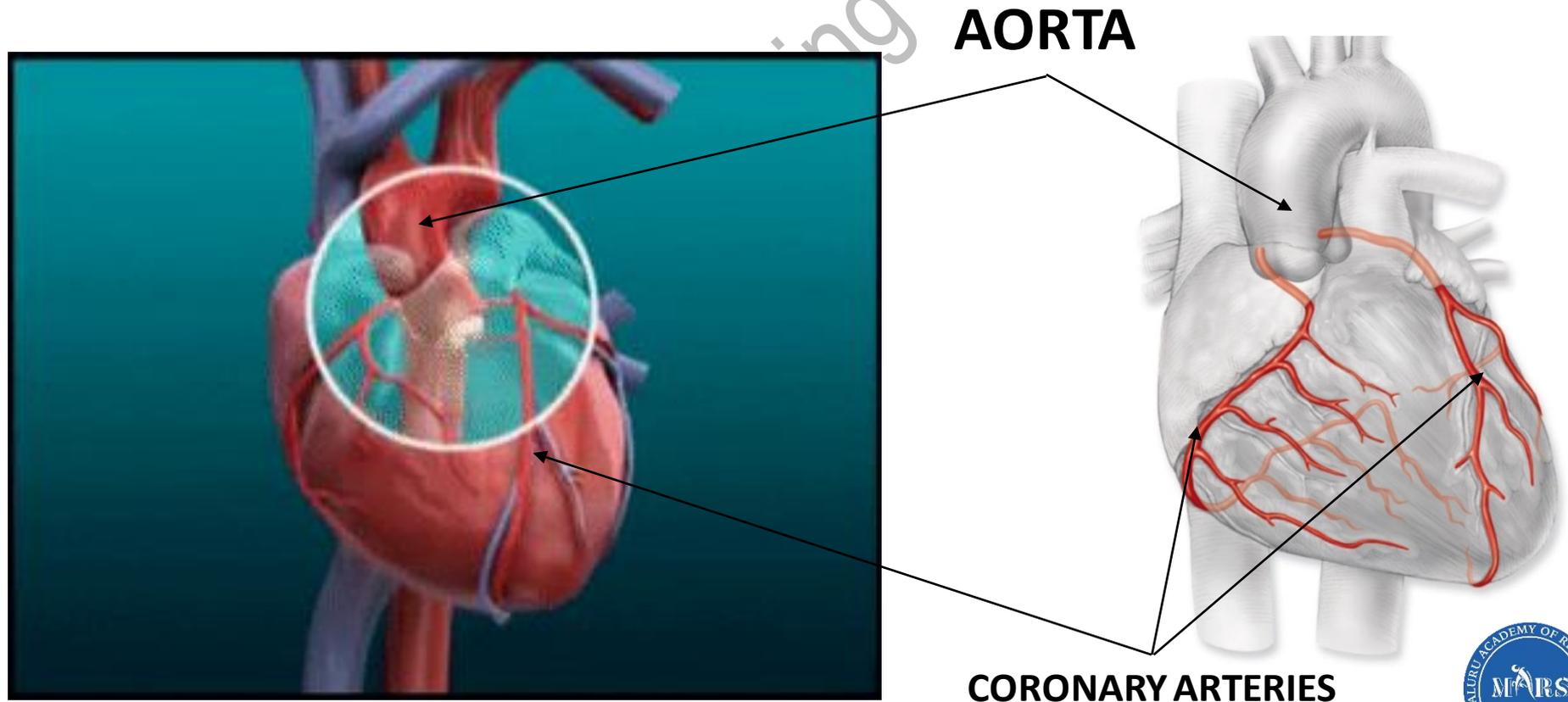
## SYSTEMIC CIRCULATION:

**The systemic circulation is the major circulation of the body.** It starts with the aorta that arises from the left ventricle. The aorta arches to the left and sends arteries to various body parts and their tissues. From there, the blood is collected by veins and poured back into the heart.



# CORONARY CIRCULATION

As soon as the aorta leaves the left ventricle, the left and right coronary arteries arise from the ascending aorta and supply oxygenated blood to the left and right sides of the heart respectively. The heart, although a blood pumping organ, also requires blood for its proper functioning.



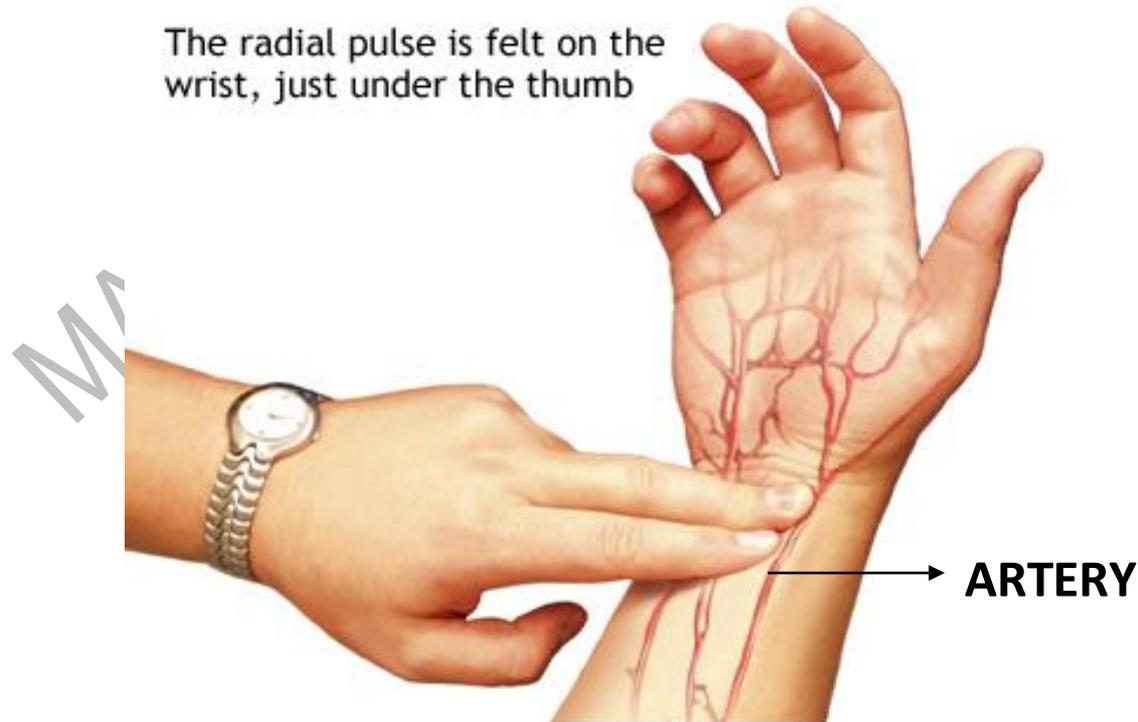
In a normal person at rest, the **cardiac output**, i.e., the amount of blood pumped per minute by the left ventricle is approximately **5 liters**.



**PULSE** are the repeated throbs felt in a superficial artery over the wrist below the base of the thumb. The throb is due to forceful pumping of blood into arteries during ventricular systole. Number of throbs per minute is called **PULSE RATE**.

**Pulse rate is equal to the rate of heart beat.** In a kid, resting pulse might range from 90 to 120 beats per minute. In an adult, pulse rate slows to an average of 72 beats per minute.

The radial pulse is felt on the wrist, just under the thumb

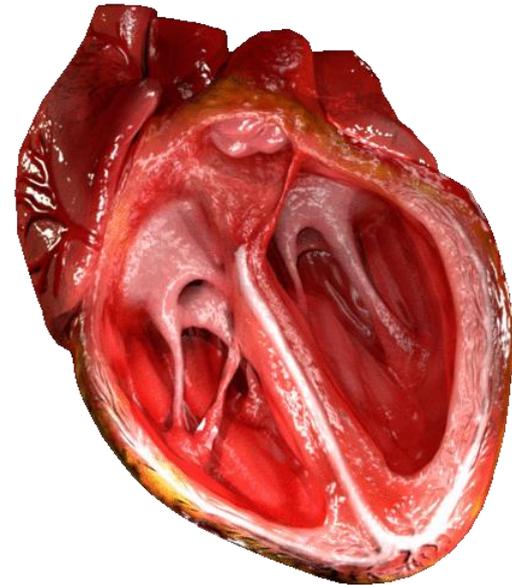


**All blood is red. In your textbook, arteries are colored red while veins are colored blue to distinguish between the oxygenated and deoxygenated blood for demonstrative purposes. Oxygenated blood is bright red whereas deoxygenated blood is dark red.**

**Our blood vessels appear blue through our skin because the lower frequency light is absorbed by our skin, whereas higher frequency light is reflected back to our eye- blue is perceived from a higher frequency light wave.**



**Give a tennis ball a good, hard squeeze. You are using the same amount of force your heart uses to pump blood out to the body. Even at rest, the muscles of the heart work hard- twice as hard as the leg muscles of a person sprinting.**



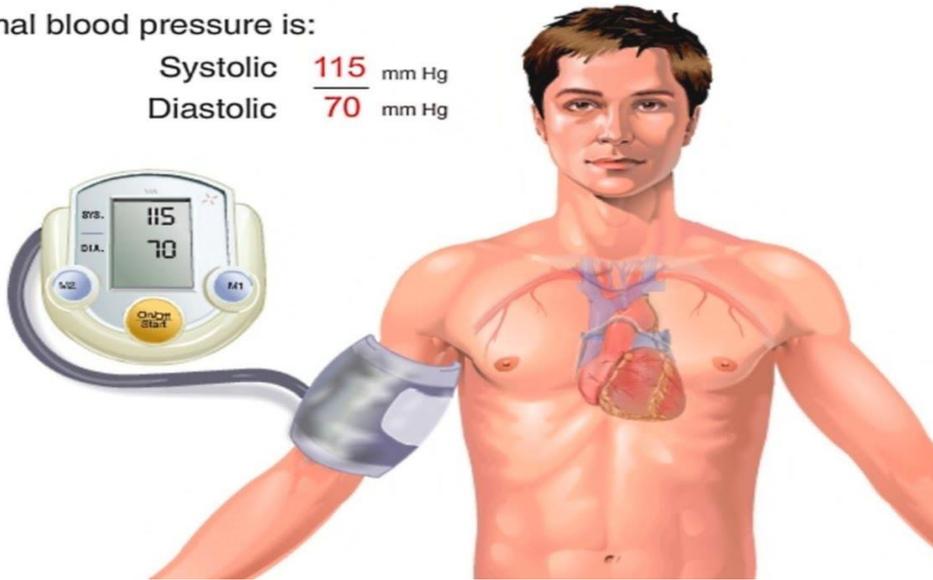
The normal blood pressure for the adult is 120/70 where 100-120mm of Hg is the ventricular systolic pressure and 60-80mm of Hg is the ventricular diastolic pressure.

A rise in blood pressure above 140/90 is known as hypertension.

The instrument used to measure blood pressure is sphygmomanometer.

Normal blood pressure is:

Systolic	115	mm Hg
Diastolic	70	mm Hg



# BLOOD PRESSURE

Pressure exerted by blood on the walls of arteries due to the pumping action of the ventricles is called blood pressure.

Blood leaves the ventricles under a terrific pressure. It is greatest in the arteries near the heart and gradually decreases in more distant arteries.

The pressure is lesser in the veins. Hence, when an artery is cut, blood rushes out in spurts due to great pressure. When a vein is cut, blood flows smoothly due to less pressure.

ARTERIES



VEINS



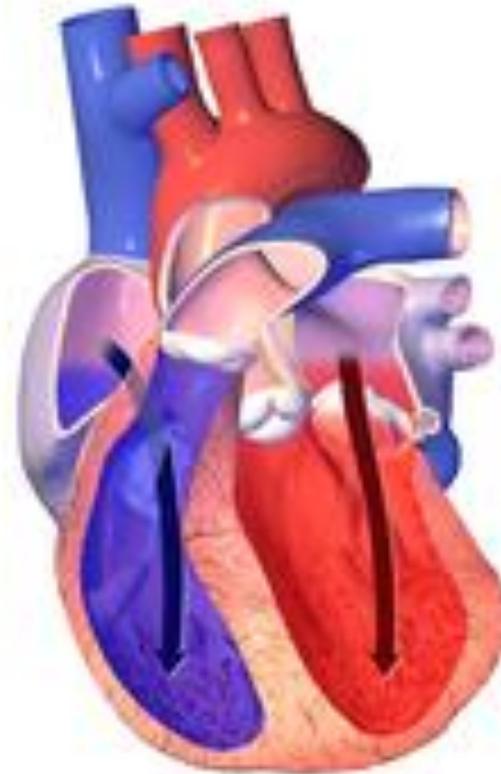
CAPILLARIES



There are two phases of blood pressure namely, **Systolic blood pressure** (SBP) and **diastolic blood pressure** (DBP). The pressure is maximum during systole and minimum during diastole.



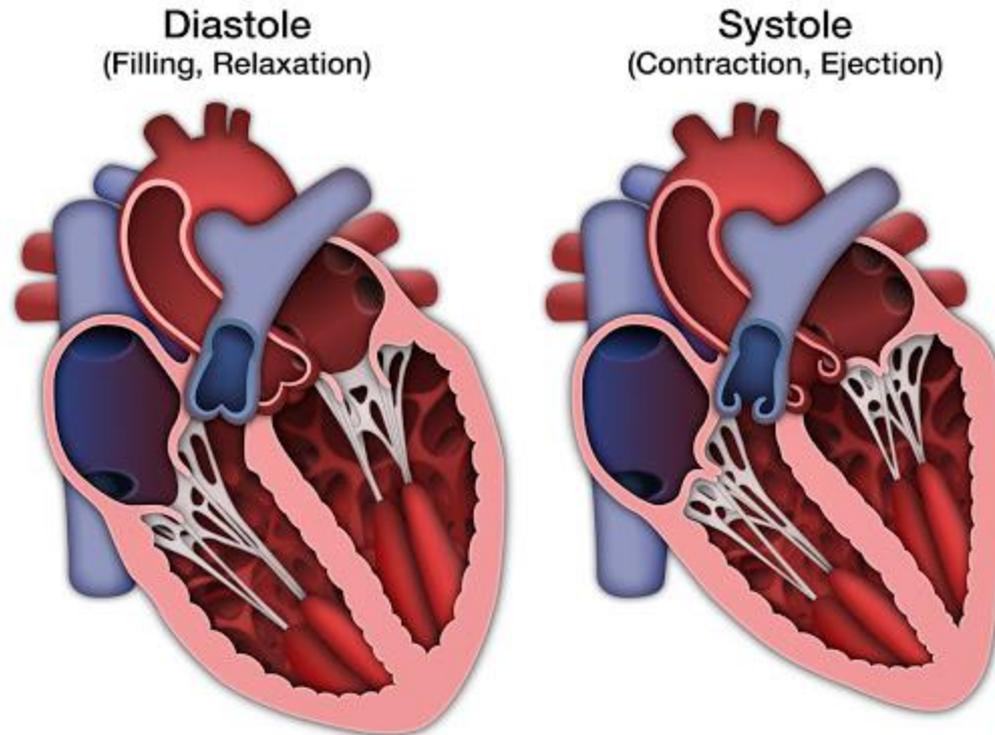
**Systole**  
(pumping)



**Diastole**  
(filling)

The maximum arterial blood pressure caused due to ventricular systole is called **SYSTOLIC PRESSURE**.

The minimum or lowest arterial pressure caused due to ventricular diastole is called **DIASTOLIC PRESSURE**.



THANK YOU

MARS Learning Centre