CARDIOVASCULAR SYSYTEM

- **HEART**
- **ACTIONS OF HEART**
- **BLOOD VESSELS**

- **DIVISIONS IN CIRCULATION**

- CVS includes heart and blood vessels
- Heart pumps blood into blood vessels

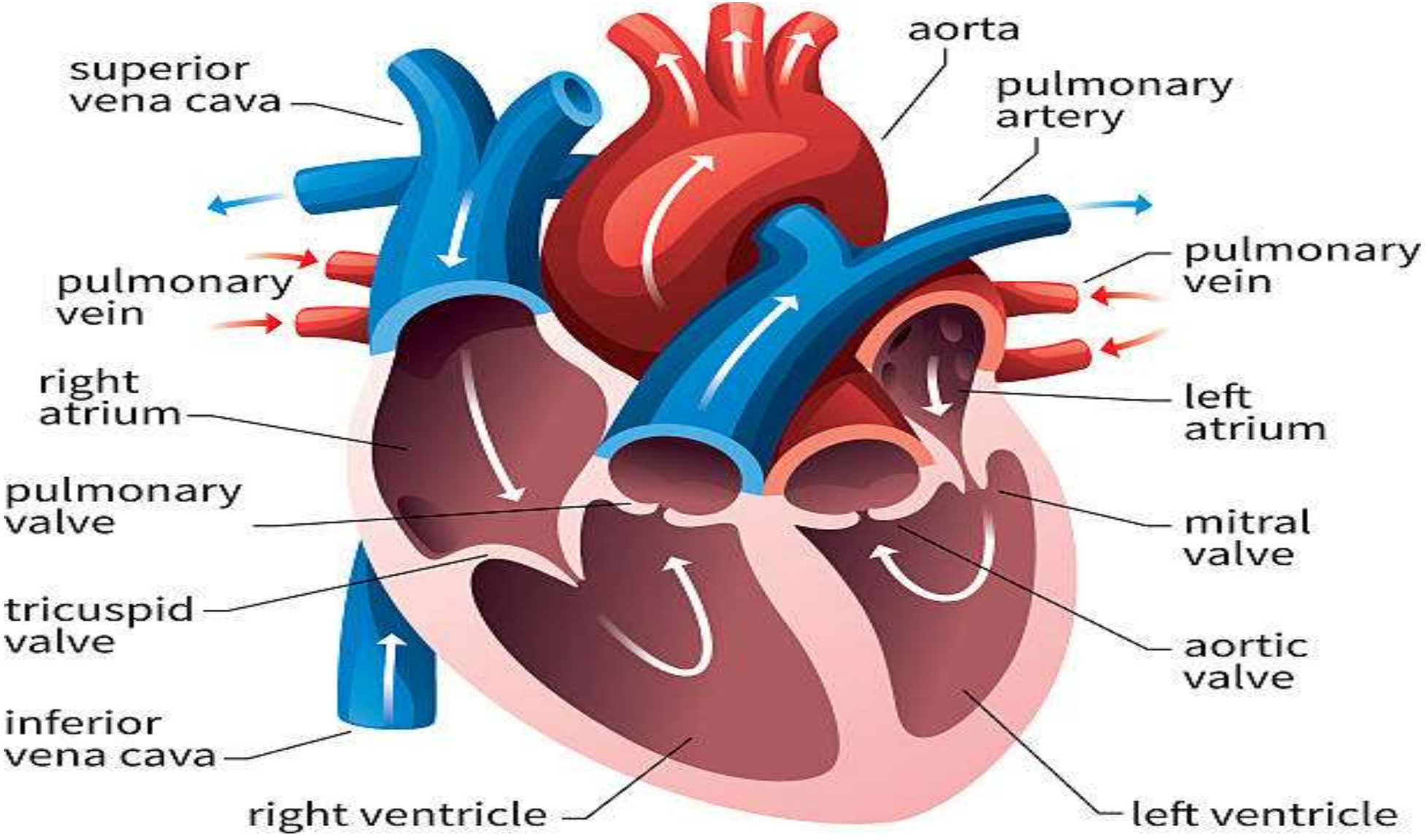
- Circulates blood throughout the body
- Blood transports nutrients and oxygen to tissues and removes CO2 and waste products from the tissues

- **Heart is a muscular Organ that pumps blood throughout the circulatory System**
- **Situated in b/w two lungs in the mediastinum**
- **Has four chambers**

❑ **2 Atria**

❑ **2 Ventricles**

- **Musculature is thicker in ventricles.**


aorta
superior vena cava
pulmonary artery
pulmonary vein
pulmonary vein
right atrium
left atrium
pulmonary valve
mitral valve
tricuspid valve
aortic valve
inferior vena cava
right ventricle
left ventricle

RIGHT SIDE OF HEART

: Chambers- Right atrium and Right ventricle

- Pacemaker known as SINOATRIAL NODE
- Produces cardiac impulses
- Atrioventricular node conducts impulses to the ventricles.
- Receives venous (Deoxygenated Blood) via
- SUPERIOR VENA CAVA –Head,neck,upper

Limbs

- INFERIOR VENA CAVA –Lower parts of the body

- RA communicates with RV through TRICUSPID VALVE
- Pulmnory Artery Arises

LEFT SIDE OF THE HEART

- CHAMBERS – Left Atrium and Left Ventricles
- Left atrium is thin walled and low pressure chamber
- Receives oxygenated blood from lungs through pulmnory veins
- AN ARTERY carries DEOXYGENATED blood and A VEIN carries OXYGENATED blood
- Blood enters from LA to LV through Mitral Or BICUSPID valve
- Pumps arterial blood to different parts of the body through SYSTEMIC AORTA

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SEPTA OF HEART

- RA and LA separated by fibrous septum called INTERATRIAL SEPTUM
- RV and LV separated by INTERVENTRICULAR SEPTUM
- Upper-Membranous
- Lower-Muscular

LAYERS OF THE HEART

- 1.Outer parietal pericardium
- 2.Middle Myocarduium
- 3.Inner Endocardium

PERICARDIUM

i. Outer parietal pericardium

ii. Inner visceral Pericardium

1. OUTER PARIETAL PERICARDIUM

- Strong protective sac for the heart
- Helps to anchor heart within the mediastinum

Outer Fibrous layer

Formed by fibrous connective tissue

- Attached to Diaphragm and continuous with tunica adventitia
- Protects the heart from overstretched

Inner serous layer formed by mesothelium

- Secretes small amount of fluid
- Prevents friction and allows free movement
- Fluid volume -25 to 35 ml

2. **INNER VISCERAL PERICARDIUM lines surface of myocardium Layer also known as EPICARDIUM**

MYOCARDIUM

Middle layer of the heart and formed by cardiac muscles or cardiac myocytes

Forms the bulk and responsible for pumping action of the heart

Involuntary muscles.

3 types of muscle fibers

Forming contractile unit of heart

Form pacemaker

Form conducting system

1. Muscles forming contractile unit

- Muscle fibres are striated
- Bound by sarcolemma
- Centrally placed nuclues
- Myofibrils embedded in sarcoplasm
- Sarcomere has contractile protein actin,myosin,troponin,tropomyosin

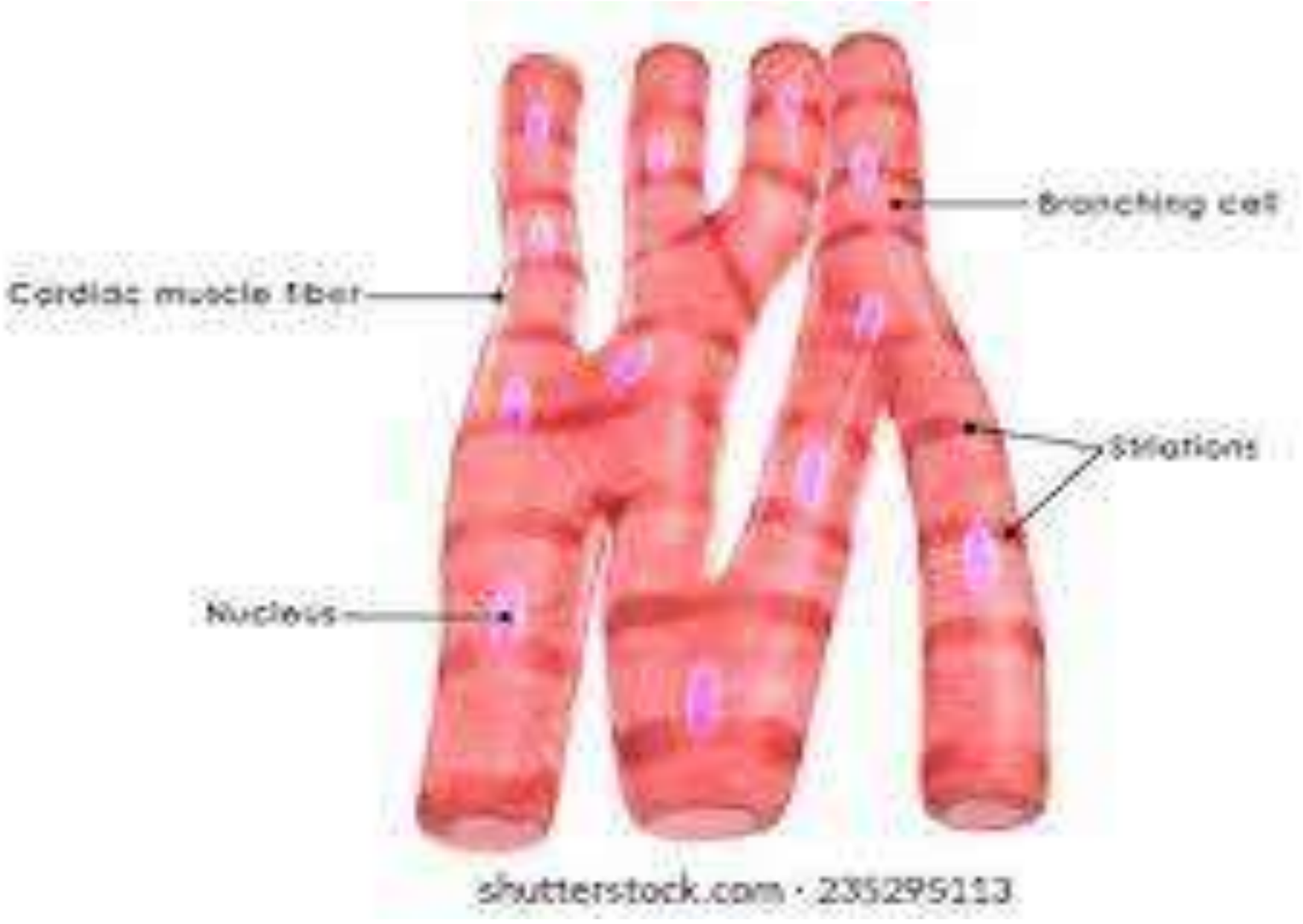
- Sacrotubular structure is similar to skeletal muscle
- Important difference is cardiac muscles are branched

INTERCALATED DISK

- Tough double membranous Structure
- Situated between branches of neighbouring cardiac muscle
- Forms ADHERENS JUNCTION - Role in contraction of cardiac muscle as a single unit

SYNCYTIUM

- Means tissue with cytoplasmic continuity between adjacent cells
- Cardiac muscle is like PHYSIOLOGICAL SYNCTIUM
- Muscle fibres are separated by cell membrane
- These membranes of adjacent muscle fibres fuse to form GAP JUNCTIONS
- Permeable to ions and facilitates rapid conduction of action potential from one fiber to another.
- Syncytium of heart has two portions each for atria and ventricles connected by non-conducting fibrous ring called ATRIOVENTRICULAR RING.


Branching cell
Cardiac muscle fiber
Striations
Nucleus
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2.Muscle Fibres forming Pacemaker

- Pacemaker of heart is a structure that generates impulses to heart beat.
- Formed by pacemaker cells called P CELLS
- SA node forms pacemaker

3. Muscle fibres forming conducting system

- Formed by modified cardiac muscles
- Impulses from SA node transmitted to atria directly.
- Impulses transmitted to ventricles through conducting system.

ENDOCARDIUM

- Inner most layer of heart wall
- Thin,smooth and glistening membrane
- Formed by single layer of endothelial cells
- Continues with endothelium of blood vessels

VALVES OF THE HEART

- Four valves in human heart
- Two valves are present between atria and ventricles called

ATRIOVENTRICULAR VALVES

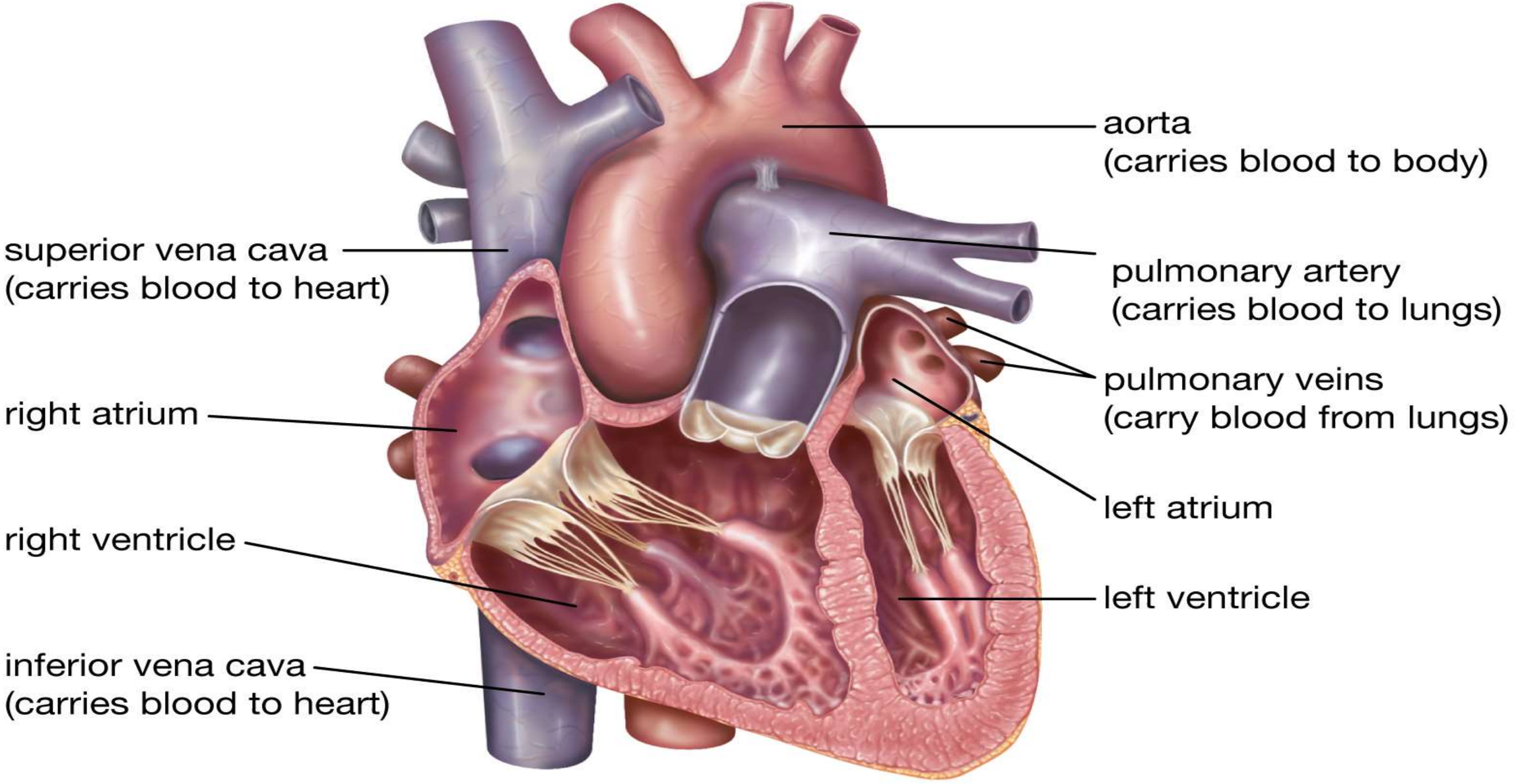
- Two other valves **SEMILUNAR VALVES** placed at opening of blood vessels arising from ventricles namely PULMNORY ARTERY AND SYSTEMIC AORTA

AV VALVES

- Left AV valve- MITRAL VALVE or BICUSPID VALVE
- Formed by two valvular cusps
- Right AV valve –TRICUSPID VALVE and formed by three cusps
- Both are attached to AV ring
- Cusps are attached to papillary muscle by CHORDAE TENDINAE
- Papillary muscle arise from inner surface of ventricles
- Role in closure of cusps and in preventing back flow of blood from atria to ventricle during ventricular contraction
- AV valves opens towards ventricles and prevents back flow of blood into atria

SEMILUNAR VALVES

- Aortic valve and Pulmonary valve
- Shape- Half moon shape
- Made up of three flaps
- Valves will open towards aorta and pulmnory valve and prevent backflow of blood into ventricles.



ACTIONS OF HEART

1. CHRONOTROPIC ACTION

Frequency of heart rate

- TACHYCARDIA – Increase in heart rate
- BRADYCARDIA – Decrease in heart rate

2. INOTROPIC ACTION

Force of contraction

- Positive- Increase in force contraction
- Negative – Decrease in force contraction

3.DROMOTROPIC ACTION

Conduction of impulses through heart

- Positive –Increase in velocity of conduction
- Negative –Decrease in velocity of conduction

4. BATHMOTROPHIC ACTION

Excitability of cardiac muscle

- Positive –Increase in Excitability of cardiac muscle

- Negative –Decrease in Excitability of cardiac muscle

BLOOD SUPPLY

Aorta → Arteries → Arterioles →

CAPILLARIES -Gaseous exchange takes place.

Venules → Veins → Vena cava

ARTERIAL SYSTEM

❖Walls of aorta & arteries formed by 3 layers

1. Outer tunica adventitia- > Connective tissue layer. Continuation of fibrous layer of parietal pericardium.

2. Middle tunica media -> Smooth muscles

3. Inner tunica intima -> Made up of endothelium

Contd----

- External elastic lamina – Between first and second layer
- Internal elastic lamina – Between second and third layer
- Aorta and arterioles – More elastic tissues
- Arterioles – Smooth muscles
- Branches get narrowed till it reaches periphery
- Aorta – 25mm diameter
- 4 mm in arterioles 30 μ
- 10μ in terminal arterioles
- Arteries- Resistance vessels as it provides resistance
- Veins – Diameter 20μ Large amount of blood is held up in venules so called capacitance vessels.

COMPLICATIONS

- ARTERIOSCLEROSIS ; Disease of arteries associated with hardening,thickening and loss of elasticityin the wall of the vessels.
- ATHEROSCLEROSIS : Narrowing of lumen of arterial vessel due to deposition of cholestrol
- ARTERIOLES- Tone of smooth muscle in arterioles increases , BP increases
- VEINS – Inflammation of wallof veins ⇒ INTRAVASCULAR CLOT
- Called THROMBOSIS. Clot dislodged ⇒ EMBOLISM

CIRCULATION

- **SYSTEMIC – Greater circulation Oxygenated blood is supplied from heart to tissues and venous blood returns to heart from tissues.**

- **PULMONARY – Lesser circulation between right ventricle to lungs and gases exchange between blood and alveoli of lungs**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