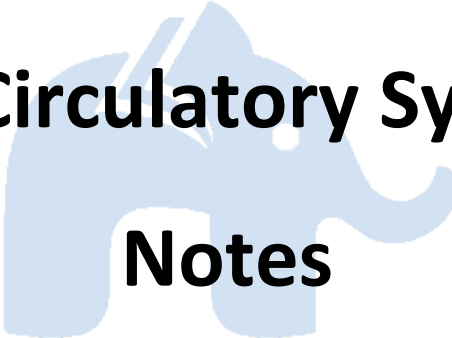


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Class 8 - ICSE

BIOLOGY

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The Circulatory System

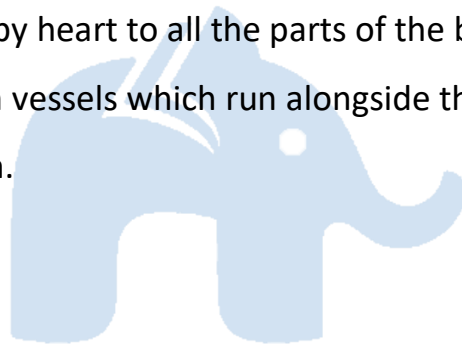
Notes

Human Circulatory System

- Transports useful and harmful substances
- Also called as Cardiovascular or circulatory system
- Circulatory system comprises of the heart, blood and blood vessels which circulate blood throughout the body, helping in the transport of nutrients, oxygen and carbon dioxide.

The transport of nutrients and oxygen and removal of wastes is carried out through blood by a transport system called circulatory system.

- Carried out by blood and lymph.
- Blood is pumped by heart to all the parts of the body through blood vessels and lymph vessels which run alongside the blood vessels of circulatory system.



Fluids in our Body

The Blood

- Red-coloured fluid
- Contained in heart and blood vessels (arteries, veins, capillaries) of circulatory system

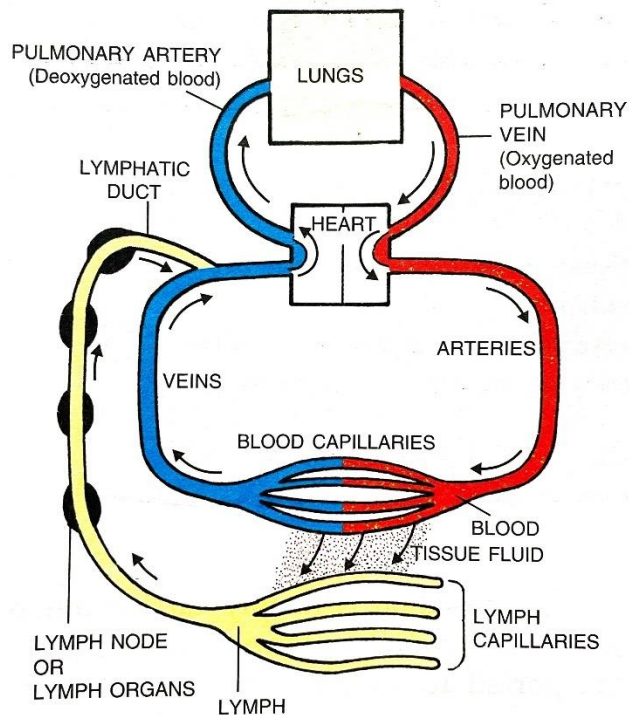
Tissue Fluid (Interstitial fluid)

- Occupies spaces between individual cells of body

Lymph

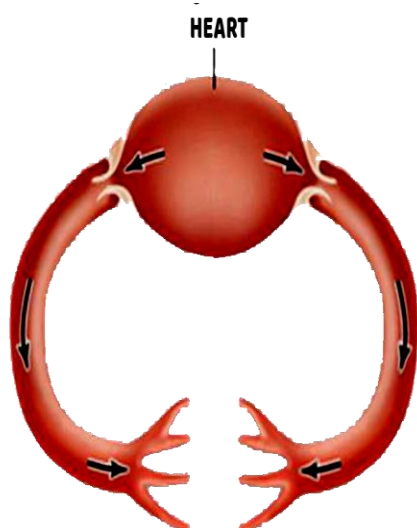
- Contained within the lymph vessels & lymphatic organs

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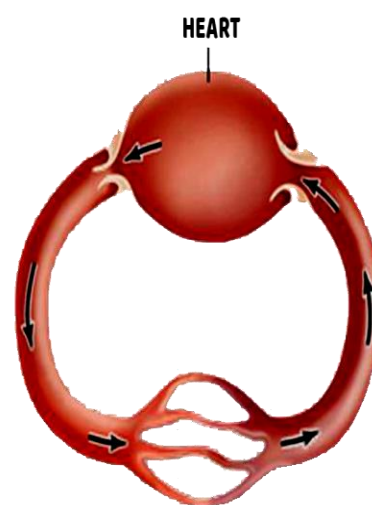


Blood flows in a closed manner through blood vessels and flow is regulated by heart. Heart acts as a pump which push and receives blood from whole body. This type of blood circulatory system is called ***closed vascular system***.

In most animals like insects, blood mostly flows through open spaces. This type of circulatory system is called ***open vascular system***.



Open Vascular System



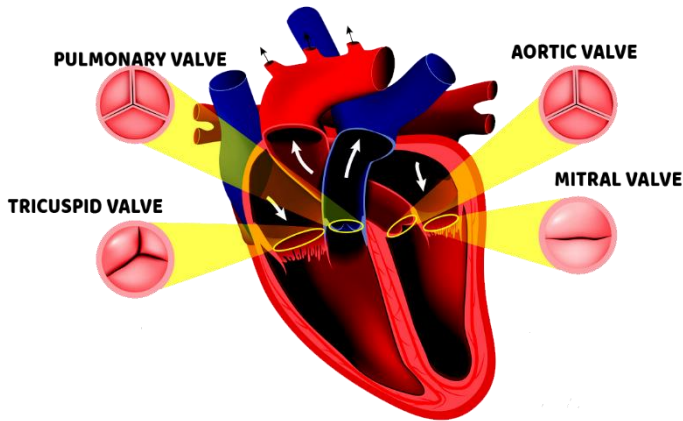
Closed Vascular System

Functions of Circulatory System

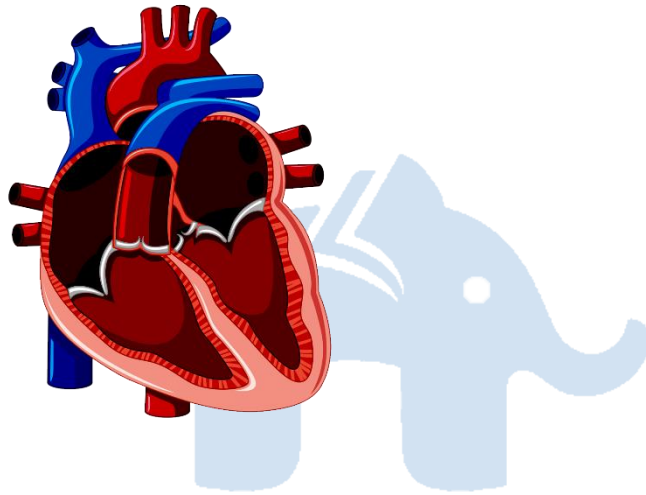
- Transports nutrients from small intestine to liver
- Carries oxygen and carbon dioxide
- Carries waste products to kidneys
- Maintain water balance in tissues
- Regulates body temperature
- Provides immunity by destroying disease-causing germs
- Prevent excessive bleeding by formation of clots

Heart – The Pumping Organ

- Size of one's folded fist, weighing 225-340 gms
- Cone shaped, muscular organ with size of a clenched fist
- Located in chest cavity between two lungs, slightly tilted towards left.
- Protected by rib cage.
- Enclosed within protective double membrane layer – PERICARDIUM
- Space between the two membranes is filled with fluid called PERICARDIAL FLUID
- Muscles: specialised muscles called cardiac muscles
- Show contraction and relaxation without any rest throughout the lifetime of a person
- Main Function – To receive and pump blood and keep circulating throughout the body.
- Heart Chambers: Four chambers upper two chambers (atria/auricles) and lower two chambers (ventricles)
- Heart Valves: Auricles separated by AV-valve or atrio-ventricular valve. Valves regulate blood flow.



- Heart membrane: Divided into right and left side by membrane or septum



Auricles and Ventricles

Auricle – “Receiving chambers”

- Smaller and have thin walls
- Receive blood brought by veins

Ventricles – “Distributing chambers”

- Pump blood into lungs and blood vessels, taking blood to different body parts

Right side of heart receives deoxygenated blood whereas left side distributes oxygenated blood. Blood do not mix.

Heart Valves

1. Tricuspid Valve – having 3-cusps/flaps

- Opening of right auricle into right ventricle

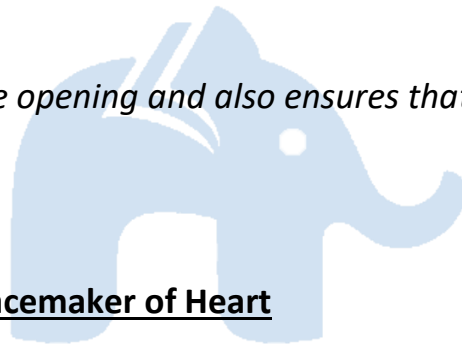
2. Bicuspid Valve – having 2 cusps/flaps

- Opening of left auricle into left ventricle

3. Semi-lunar Valves

- Blood flows from right ventricle into pulmonary artery and from left ventricle in aorta (largest artery) regulated by SL-valve
- Resembles half moon

Valves are present at the opening and also ensures that blood does not flow back into ventricles.



Pacemaker – Natural Pacemaker of Heart

- Heart is a muscular organ made of specialised muscles (cardiac muscles)
 - Muscles contract and relax without any rest throughout lifetime.
 - This contraction & relaxation is a result of electrical impulse which originates in a node called SA NODE or Sinoatrial node.
 - Located in right upper corner of right auricle.
 - Responsible for setting rhythm for contraction and relaxation of heart
- [HEART BEAT]

Artificial Pacemaker

- Mechanical pacemaker
- Placed surgically in humans if SA node becomes faulty.

The Blood Vessels

- Arteries – Carry blood away from heart to different body parts
 - Thick, elastic muscular walls
 - Blood flows with jerk (Pulse)

- Veins – carry blood towards heart from different body parts
 - Thin muscular walls
 - Valves

- Capillaries – finest blood vessel in the body interconnecting arteries and veins
 - Principle site for exchange of substances
 - Single layer of cells (endothelium)

Difference between Arteries and Veins

ARTERIES	VEINS
Carry blood from heart to various parts of the body	Carry blood from different parts of the body to the heart
Carry oxygenated blood (except pulmonary artery)	Carry deoxygenated blood (except pulmonary vein)
Blood flows with high speed & under high pressure	Blood flows with low speed and under low pressure
Valves are absent	Valves are present

Deeply placed in body	Placed more superficially
-----------------------	---------------------------

Blood Vessels of Heart

Vena cava

- Superior vena cava is a large vein that brings in deoxygenated blood from upper parts of body like head & shoulders
- Inferior vena cava is large vein that brings in deoxygenated blood from the lower parts of the body like trunk & legs

Pulmonary Veins

- Bring in oxygenated blood from left and right lung

Pulmonary Artery

- Pulmonary artery branches into left and right carrying deoxygenated blood to both lungs for oxygenation

Aorta

- Leaves left ventricle carrying oxygenated blood to all parts of the body

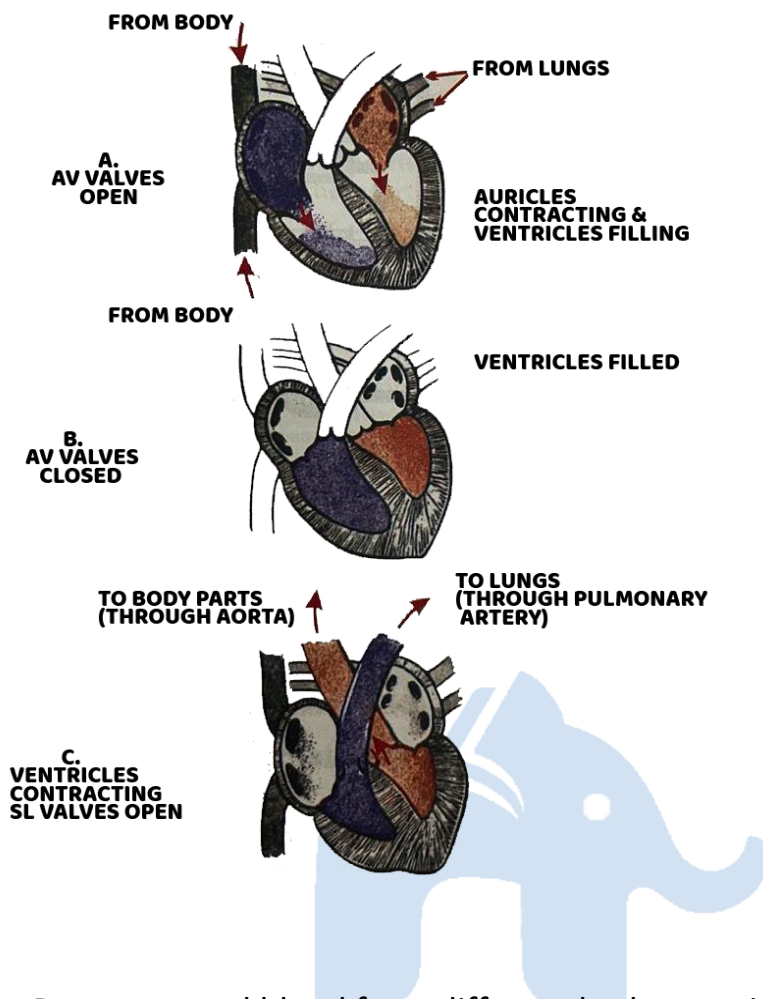
Coronary Artery

- Blood vessel that distributes oxygenated blood to the walls of the heart.

Coronary veins

- Brings back deoxygenated blood from the walls of the heart and pour it into opening of right auricle

Blood Circulation



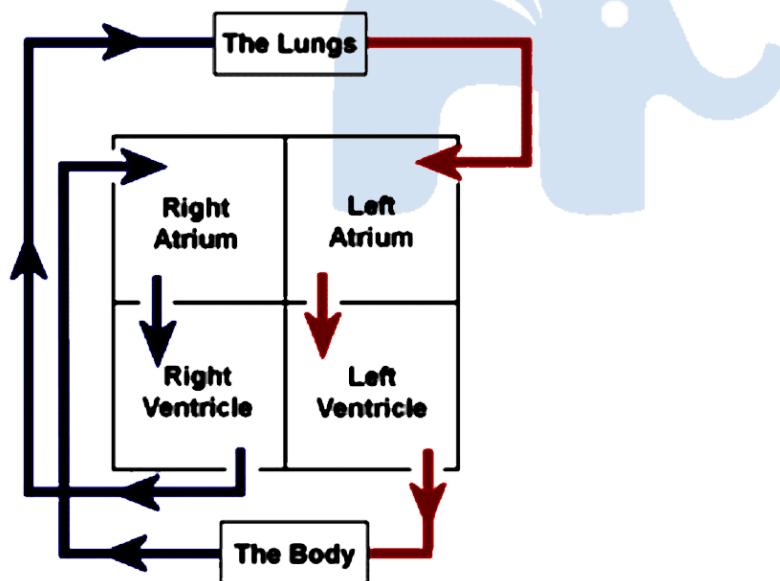
- Deoxygenated blood from different body parts is received in right auricle; at the same time, oxygen rich blood returning from lungs is received in left auricle.
- Right auricle contracts and pumps deoxygenated blood into right ventricle; left auricle contracts and pumps oxygenated blood into left ventricle.
- AV valve close when ventricles are full, at the same time SL valve opens.
- Right ventricle begins to contract, deoxygenated blood is pushed into pulmonary artery (transport blood into lungs for oxygenation); left ventricle contracts, oxygenated blood is pushed into aorta (blood reaches all the parts of body, blood is under great pressure)

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- Semi-lunar valve close with sound when blood into ventricles pushed into arteries.

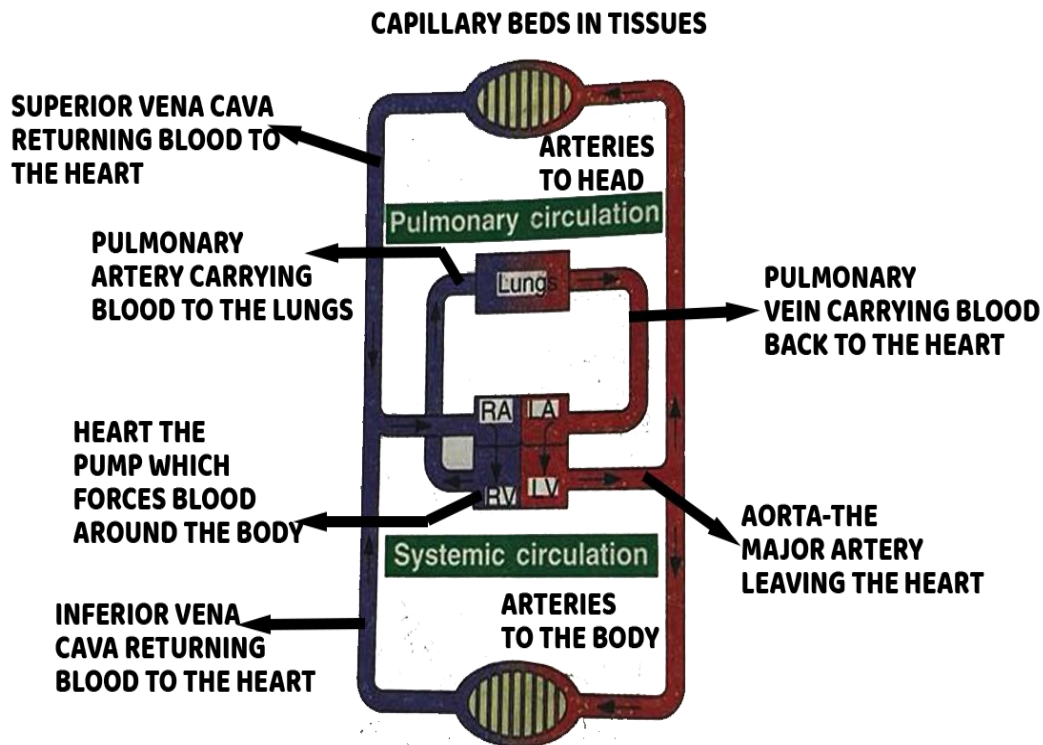
Important Points to Remember:

- When heart chambers relax, blood is filled in them
- When heart chambers contract, blood is pushed out of them
- Both auricles relax and contract together. Same is for ventricles.
- Contraction of auricles is quickly followed by contraction of ventricles.
- Right half of heart receives deoxygenated blood, left half of heart receives oxygenated blood.
- Process happens in rhythmic manner, 72 times per minute.
- Blood on right side of heart never mixes with that on the left side.



Double Circulation

Blood flows through the heart twice to complete one full circulation throughout the heart.



1. **Pulmonary circulation** - Pulmonary Circulation transports blood only between the heart and the lungs.

Lungs \rightarrow La \rightarrow LV

Oxygenated blood from lungs returns to the left auricle via pulmonary veins.

2. **Systemic circulation** - Systemic Circulation transports blood only between the heart and the entire body.

LV \rightarrow Body \rightarrow RA \rightarrow RV

Deoxygenated blood is collected by two major events superior vena cava and inferior vena cava.

Tissue Fluid and Lymph

Tissue Fluid

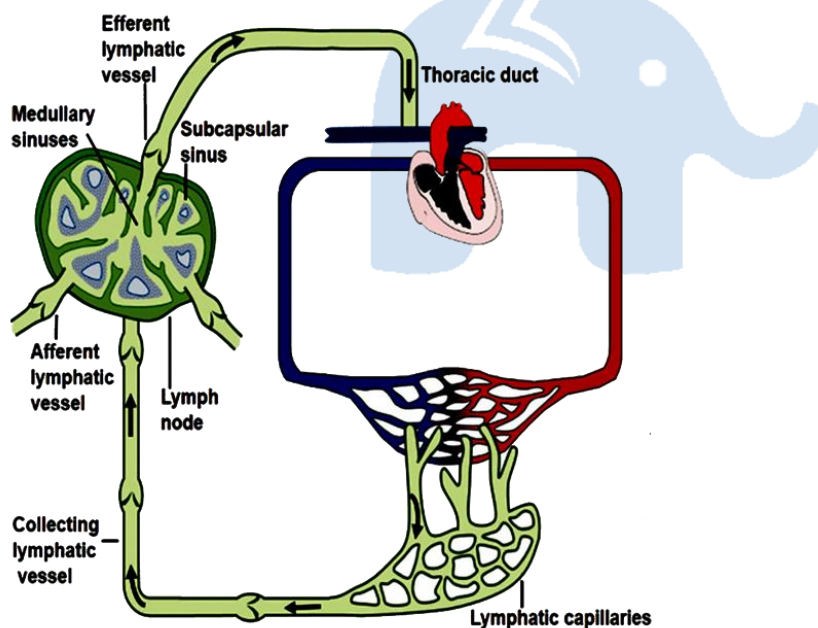
- Intercellular or Extracellular Fluid

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- Plasma and leukocytes leak out through the walls of capillaries and bathes cells.
- Cells absorb oxygen and other required substances from this fluid

Lymph

- Tissue fluid may be reabsorbed into blood vessels, most of it enters into another set of minute channels named lymph vessels.
- Lymph flows in vessels due to contraction of surrounding muscles.
- On the way, lymph vessels drain lymph into lymph nodes from where fresh lymph channels arise.
- These pour lymph into anterior veins near to the entry into right auricle.
- This comes into circulation again.



The lymphatic system consists of lymphatic organs like spleen and tonsils, a conducting network of lymph vessels and circulating lymph.

Composition of Lymph

Cellular Part

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- Leukocytes (mostly lymphocytes)
- RBCs and Platelets are absent

Non-cellular Part

- Water (94%)
- Proteins, Fats, Carbohydrates
- Enzymes
- Antibodies

Functions of Lymph

- Nutritive – Supply nutrients and oxygen to those parts where blood cannot reach
- Drainage – excess tissue fluid and metabolites, return proteins to blood
- Absorption – fats in the intestine are absorbed from lymph vessels
- Defence – Lymphocytes & monocytes protect body. It also removes bacteria from tissues.

Difference between Lymph and Blood

LYMPH	BLOOD
Part of open circulatory system.	Part of closed circulatory system.
Circulate through lymph capillaries, lymph nodes, lymph vessels	Circulate through arteries, veins, capillaries and heart
Pale yellow, no RBCs & HB	Red

WBCs and blood plasma (no platelets, proteins)	Contain WBCs and blood plasma
Part of immune system, part of body, builds immunity	Transport respiratory gases, nutrients and hormones








Blood Groups

Karl Landsteiner

- Blood groups differentiated on the basis of proteins (antigens) found on the surface of RBCs.
- Two types of antigens – A and B

Conclusions:

1. A person with AB blood group can receive blood from all types (UNIVERSAL RECIPIENT)
2. A person with O blood group can give blood of any blood type (UNIVERSAL DONOR)

ABO BLOOD GROUPS	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies in Plasma	 Anti-B	 Anti-A	NONE	 Anti-A and Anti-B

Heart-Related Conditions

Palpitations:

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- Heart beating too hard or too fast or skipping a beat
- Caused by stress or anxiety
- Can be caused due to food
- Can be serious if accompanied by shortness of breath, dizziness or chest pain

Hypertension:

- Blood flows through blood vessels with a force greater than normal
- Also called High Blood Pressure
- Strain the heart, damage blood vessels, increase the risk of heart attack or stroke

Heart Attack:

- Sudden interruption of blood supply to heart
- Occurs due to blood clot that prevents the flow of oxygen-rich blood to the cardiac muscles
- Part of cardiac muscle dies and causes permanent damage

Symptoms:

1. Uncomfortable pressure
2. Tightness or squeezing pain in the centre of chest
3. Discomfort or pain spreading beyond chest to shoulders, neck, jaw, teeth, arms
4. Shortness of breath
5. Dizziness
6. Sweating and nausea

Cardiac Arrest:

Occurs when the heart suddenly stops pumping blood around the body.

- Person will stop breathing or breathes heavily

Symptoms:

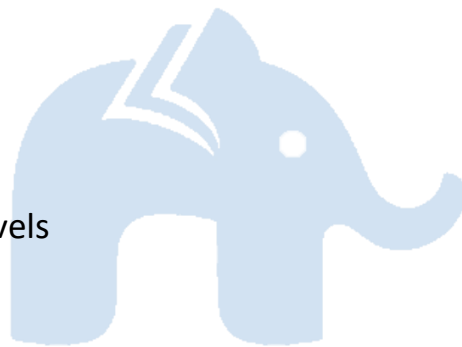
1. Chest pain
2. Shortness of breath
3. Nausea before the cardiac arrest

Cardiac Arrest: Most Common Cause

Coronary artery disease, where walls of arteries thicken as a result of fat or plaque deposition

Less common causes:

- Blood loss
- Lack of oxygen
- Low potassium levels
- Heart failure
- Intense physical exercise



Difference between Heart Attack and Cardiac Arrest

Heart Attack – Flow of blood is interrupted

Cardiac Arrest – Heart stops pumping blood to other parts of the body

Emergency situation:

1. Calling an ambulance or doctor
2. Help person to sit or lie down in a comfortable position
3. Perform chest compression
4. Mouth to mouth resuscitation so that lungs get filled with air

Keeping Heart Healthy

- Eating healthy food and regular exercise
- Regular walking, cycling, jogging
- Playing games
- Avoid too much oily, fried foods, fast foods
- Plenty of fibres like whole grain cereal, oats
- Avoid eating excessive sweet food, it can cause obesity

