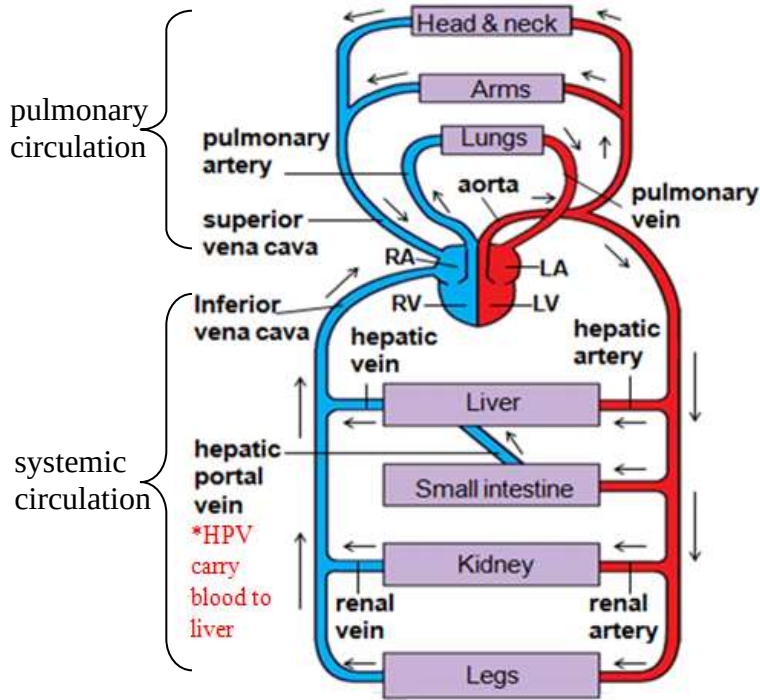


TRANSPORT IN HUMANS

1. Blood vessels

- Main blood vessels in circulatory system



Artery: carry blood **away** from heart to organ

Vein: carry blood towards the heart from organ

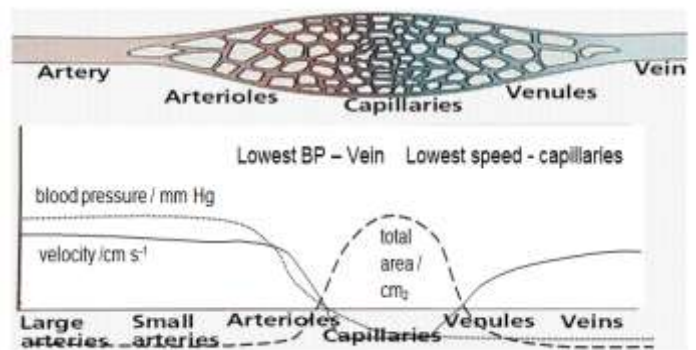
Terminology

Lung → pulmonary

Heart: → coronary

Liver → hepatic

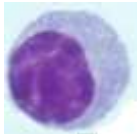
Kidney → renal

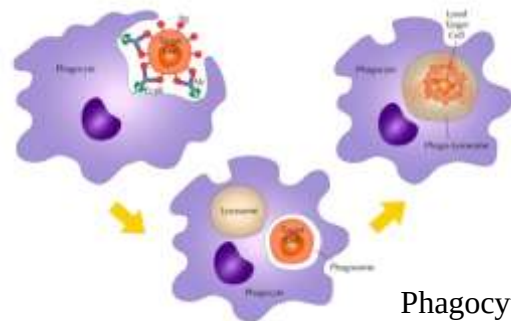
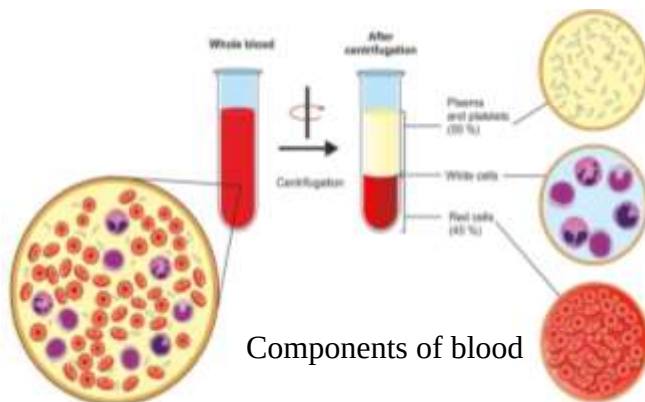


- Types of blood vessels

Artery	Vein	Blood capillaries
Function: Transport blood away from heart	Function: Transport blood towards from heart	Function: Substances exchange between blood & tissue cells
- Small lumen due to thick muscular wall , to withstand high blood pressure - Elastic wall to maintain high blood pressure	- Large lumen due to thin muscular , elastic wall to allow more blood to flow	- No muscular wall, one-cell thick endothelium , shorter diffusion distance for substance to diffuse quickly
- High blood pressure: closest to heart	- Lowest blood pressure: further from heart	- Lower blood pressure
- No valves	- Semi-lunar valves to prevent backflow of blood	- No valves.
Aorta → artery → arterioles	Vena cava → vein → venules	Branching increased total cross-sectional area, blood flow slower , more time for exchange
Carry oxygenated blood except pulmonary artery and umbilical artery	Carry deoxygenated blood except pulmonary vein and umbilical vein	Mixture of oxygenated and deoxygenated blood

2. Components of blood

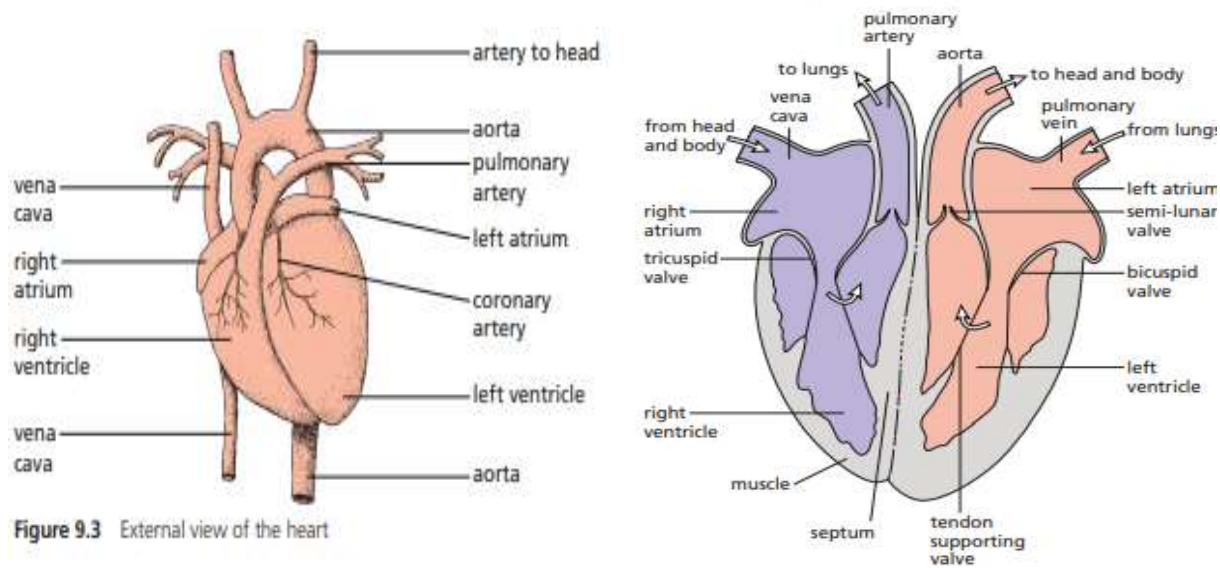
	Structure/description	Function
Red blood cell (transport function)	- Produced in bone marrow - Destroy in spleen 	- To transport oxygen around body. - Oxygen binds reversibly with haemoglobin to form oxyhaemoglobin (bright red colour)
Plasma (transport function)	90% water, contains - soluble protein: - mineral salts: Ca^{2+} - food materials: glucose, amino acid - excretory products: urea - hormones: insulin, glucagon	- To transport substances and blood cells around the body - To distribute heat throughout body
Platelets (protect function)	- Not true cells - Membrane-bound fragments of cytoplasm from certain bone marrow cells.	To cause blood clot to protect the body from infection and prevent excessive blood lost during tissue damaged.
White blood cell (protect function)	Phagocytes - Lobed nucleus & granular cytoplasm. - Can squeeze through blood capillary wall into cells  Lymphocytes - Large, rounded nucleus and non-granular cytoplasm 	Phagocytes: engulf, ingest and digest foreign particles by phagocytosis Lymphocytes: produce antibodies to - Destroy bacteria by causing it to agglutinate (easy for phagocytosis) and rupture its membrane, - Neutralise toxin produced by bacteria



3. Heart

- Function of heart: To pump blood to the lungs for gaseous exchange and pump blood around the body.

Structural adaptations	Function
4 chambers beat continuously	Allow the blood to flow continuously for higher efficient.
Septum	Prevent mixing of oxygenated and deoxygenated blood to maintain steep concentration gradient for diffusion
Valves	Prevent the backflow of blood and ensure one-way flow of blood
Thicker cardiac muscle wall on left	To generate more force when muscles contract as higher blood pressure is needed for the blood to travel around the body due to longer distance.



- Double circulation in mammals

- Blood passes through the heart twice in a complete circuit
- Consists of pulmonary circulation (lungs) and systemic circulation (body)

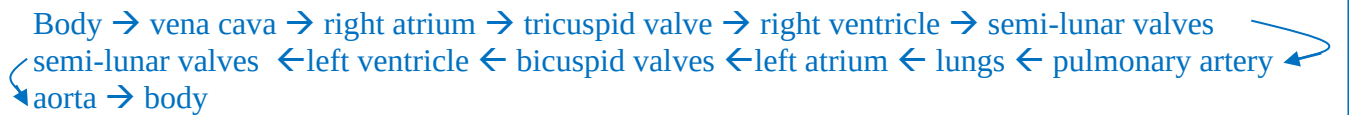
- Advantage of double circulation:

- Increase blood pressure, allowing blood to flow faster
- No mixing of oxygenated and deoxygenated blood, so oxygen concentration is higher

- How the heart pump the blood:

- Deoxygenated blood returns back to the right atrium from the vena cava
- Muscles of the right atrium to contract, decrease in volume causes blood pressure to increase.
- Tricuspid valve to open and deoxygenated blood is forced into the right ventricle.
- Muscles of right ventricle contract, decrease in volume causes blood pressure to increase.
- Semi-lunar valves open and deoxygenated blood is forced into the lungs through the pulmonary artery. Tricuspid valve closes to prevent backflow of blood.

- Gaseous exchange occurs in the lungs and oxygenated blood is returned to the left atrium through pulmonary vein.
- Muscles of left atrium contract, decrease in volume causes blood pressure to increase
- Bicuspid valves open and oxygenated blood is forced into the left ventricle
- Muscles of left ventricle contract, decrease in volume causes blood pressure to increase
- Semi-lunar valves to open and oxygenated blood is forced into the rest of the body through the aorta. Bicuspid valve closes to prevent backflow of blood.



Qn 1. Why is the cardiac wall of left ventricle is thicker than right ventricle?

Ans: Thicker muscular wall contract to generate a large force to increase blood pressure so that oxygenated blood have enough energy to travel to the left of the body through the aorta. (similar explanation to 'why cardiac wall of ventricles is thicker than atria?')

Qn 2. What is the function of coronary arteries?

Ans: To bring oxygen and nutrients to the heart muscles

4. Coronary heart disease

- Coronary heart disease occurs when the coronary arteries are blocked or narrowed, reducing the amount of oxygen and nutrients supplied to heart muscle tissues. This can cause a heart attack.

- Due to:

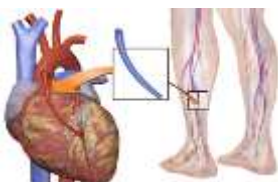
- Fatty deposits/ plaque → atherosclerosis
- Blood clot → thrombosis

- Causes:

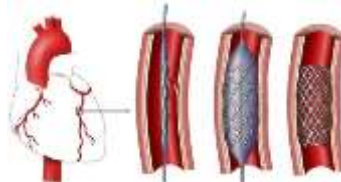
- High emotional stress, high blood pressure: increase risk of thrombosis
- Smoking → Nicotine in smoking increases blood pressure
- Genetics
- Diet high in saturated fat, lack exercise or obesity : increase fatty deposits in blood vessels

- Solution:

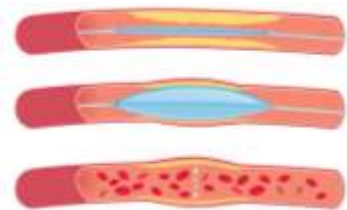
- Bypass surgery - a vein is obtained from the leg muscle and joined to the blocked artery to provide an alternative pathway for the blood to flow through, bypassing the plaque
- Stent insertion - a small mesh tube is inserted into the artery which opens to support the narrow lumen of the blocked artery.
- Balloon angioplasty - a catheter/tube with balloon is inserted into the blocked artery. The balloon will inflate to widen the lumen of the artery



Bypass surgery



Stent insertion



Balloon angioplasty