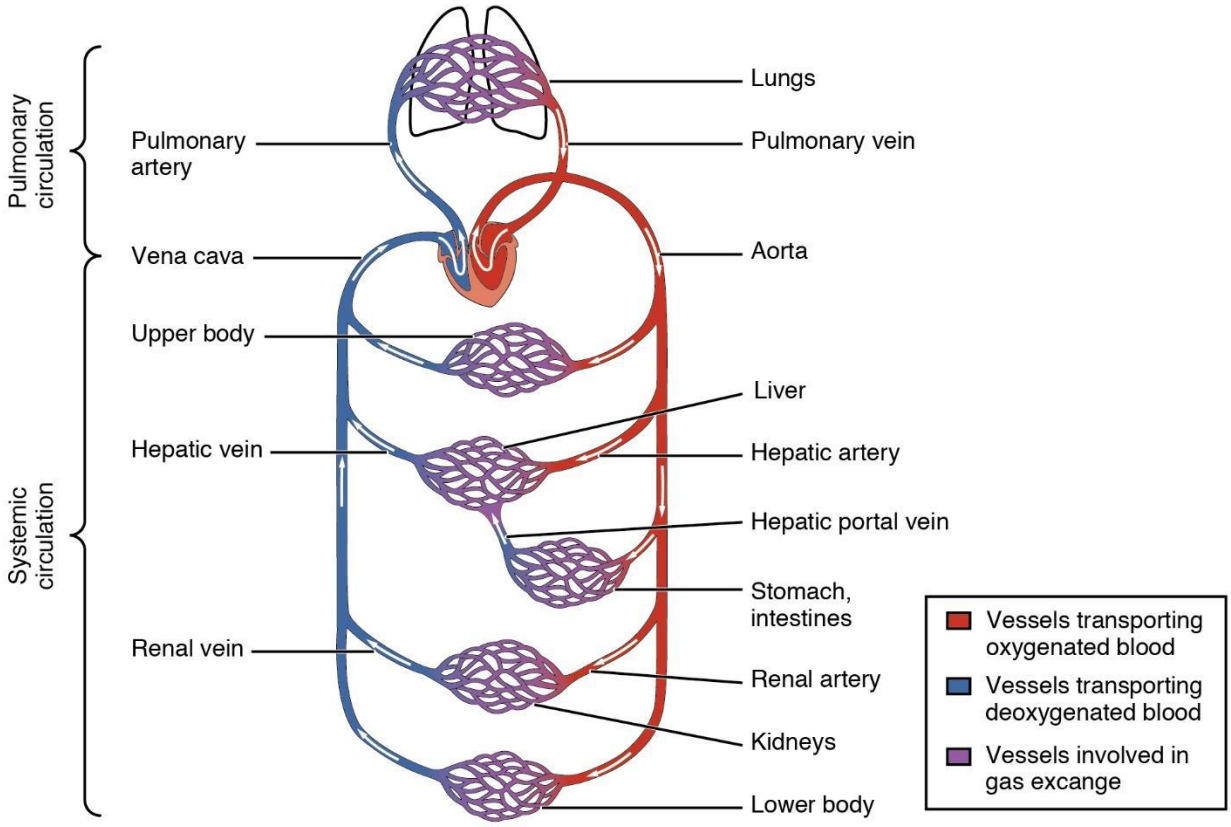
LO: Identify the main blood vessels to and from the heart, lungs, liver and kidney



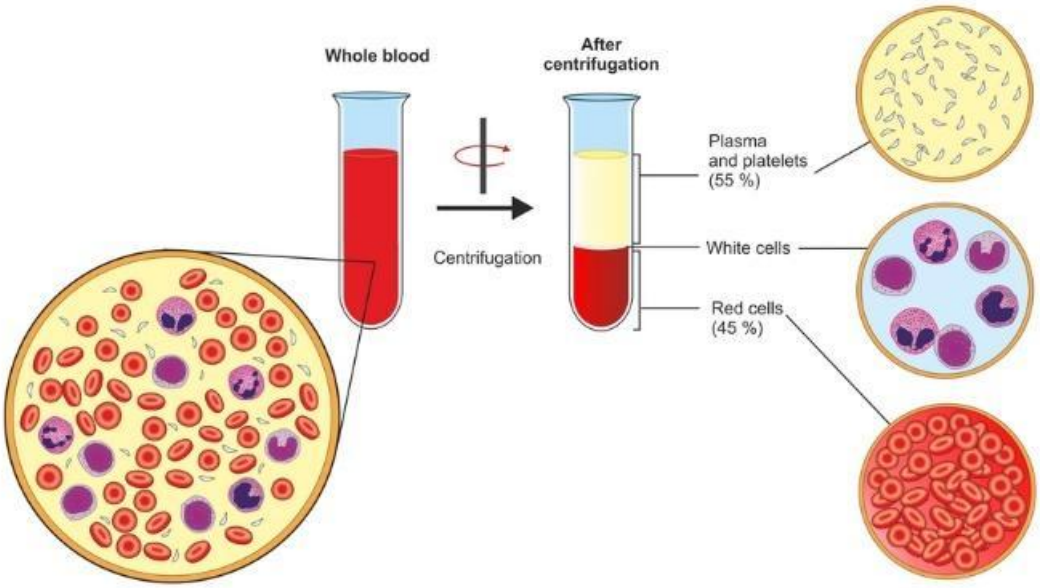
In summary, blood vessels are generally named after the parts they are connected to.

- Blood vessels connected to the kidneys always start with '**renal**'
- Blood vessels connected to the liver always start with '**hepatic**'
- Blood vessels connected to the lungs always start with '**pulmonary**'
- Blood vessels that transport substances to/away from the heart always start with '**coronary**'

LO: State the role of blood in transport and defence

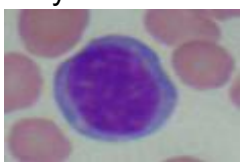
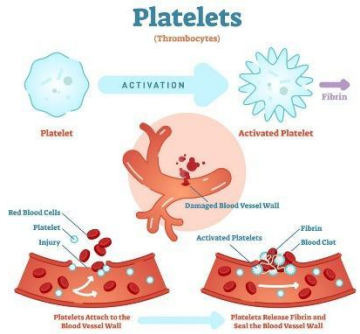
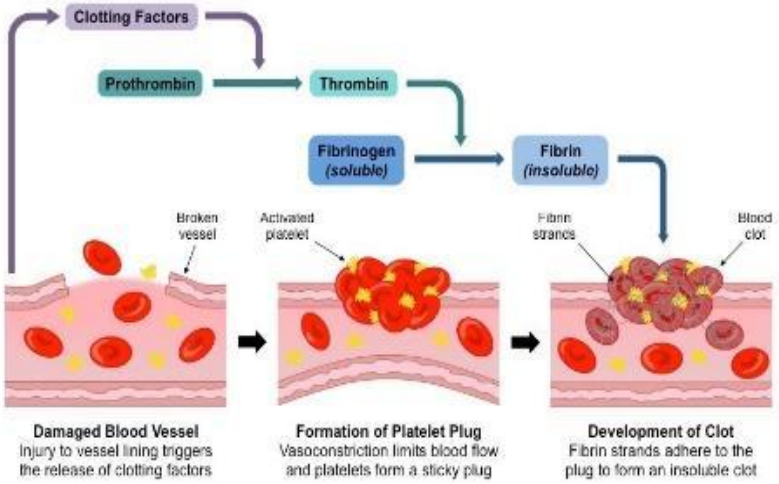
- red blood cells – haemoglobin and oxygen transport
- plasma – transport of blood cells, ions, soluble food substances, hormones, carbon dioxide, urea, vitamins, plasma proteins
- white blood cells – phagocytosis, antibody formation and tissue rejection
- platelets – fibrinogen to fibrin, causing clotting

The two main functions of blood are to transport substances and for defence.

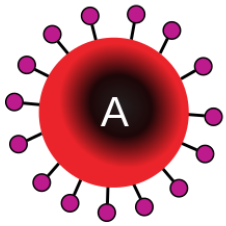
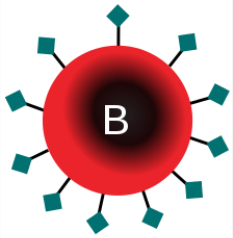
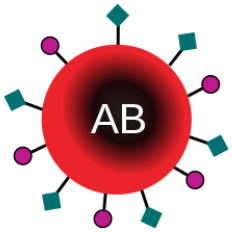
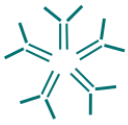
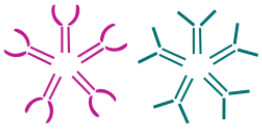


Functions and Adaptations of Blood Components

Component	Function	Adaptation
Red blood cells 	Transports oxygen from the lungs to the rest of the body	Circular and biconcave shape to increase surface area for faster diffusion of oxygen Contains haemoglobin for oxygen to bind loosely to form oxyhaemoglobin Has no nucleus to store more haemoglobin to transport more oxygen

Plasma	Transport dissolved substances to the rest of the body e.g. nutrients, hormones, vitamins, proteins, waste products	Made up of mostly water which is the solvent for various substances
White blood cells: Lymphocytes 	To produce antibodies which agglutinate pathogens for phagocytes to engulf and ingest, and neutralise toxins.	Large nucleus to produce antibodies
White blood cells: Phagocytes 	To engulf and ingest pathogens through phagocytosis.	Lobed nucleus to allow the cell to move towards the bacteria and change shape to engulf it
Platelets (thrombocytes) 	 To aid in blood clotting by ● Damaged tissues and blood platelets release thrombokinase ● Which converts prothrombin to thrombin with the help of calcium ions ● Thrombin catalyses the conversion of soluble fibrinogen to insoluble fibrin threads. ● Fibrin threads entangle blood cells and forms a clot to seal the wound.	

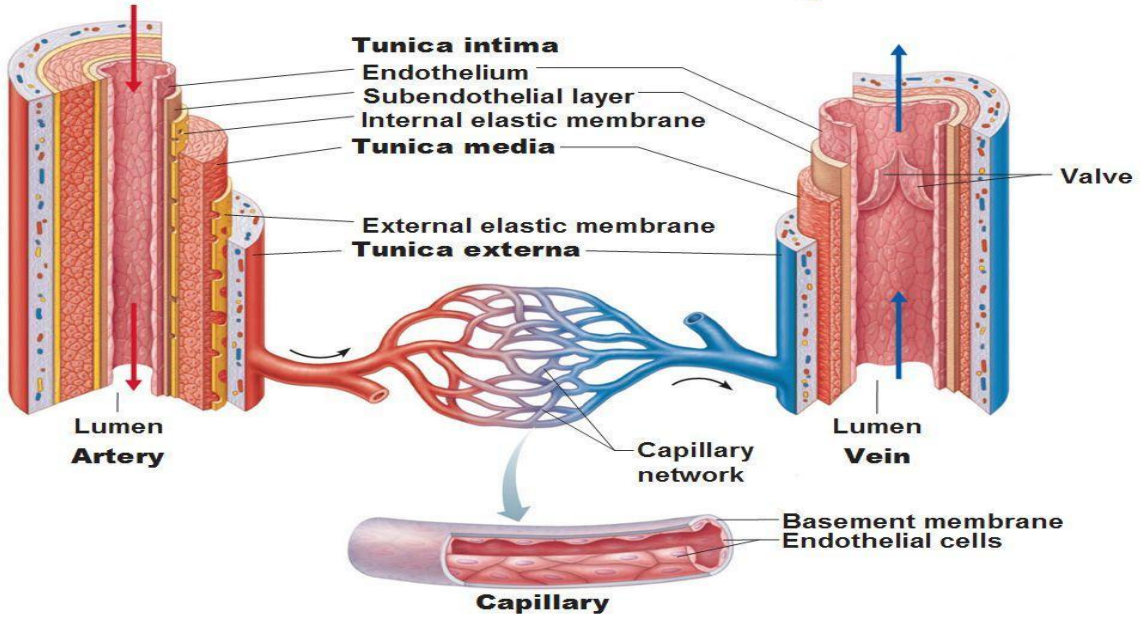
LO: List the different ABO blood groups and all possible combinations for the donor and recipient in blood transfusions

	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
Antigens in red blood cell	 A antigen	 B antigen	 A and B antigens	None

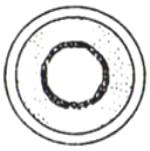
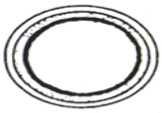
		Recipient			
		A	**B**	**AB**	**O**
Donor	**A**	√		√	
	B		√	√	
	AB			√	
	O	√	√	√	√

Recipient's antibodies VS Donors antigens
√ = Successful transfusion from donor to recipient without blood agglutination

Structure of Blood Vessels – 3 Layers "Tunics"

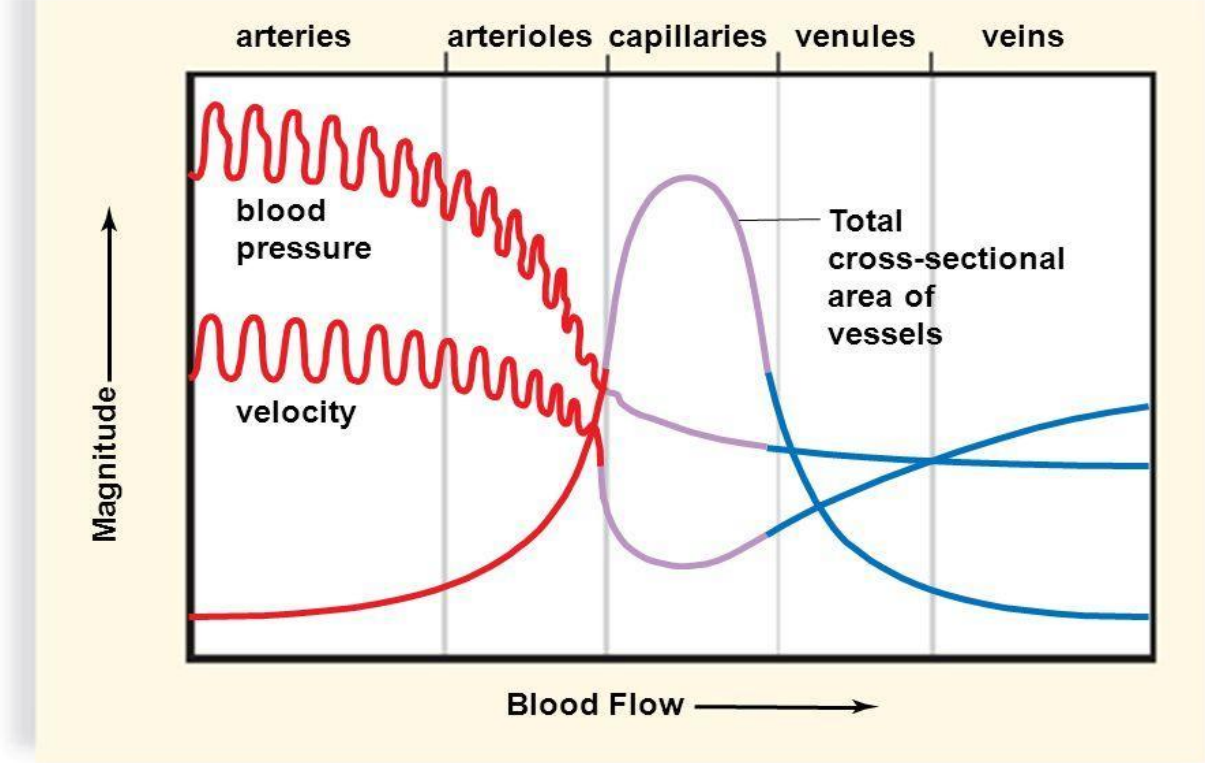


LO: Relate the structure of arteries, veins and capillaries to their functions

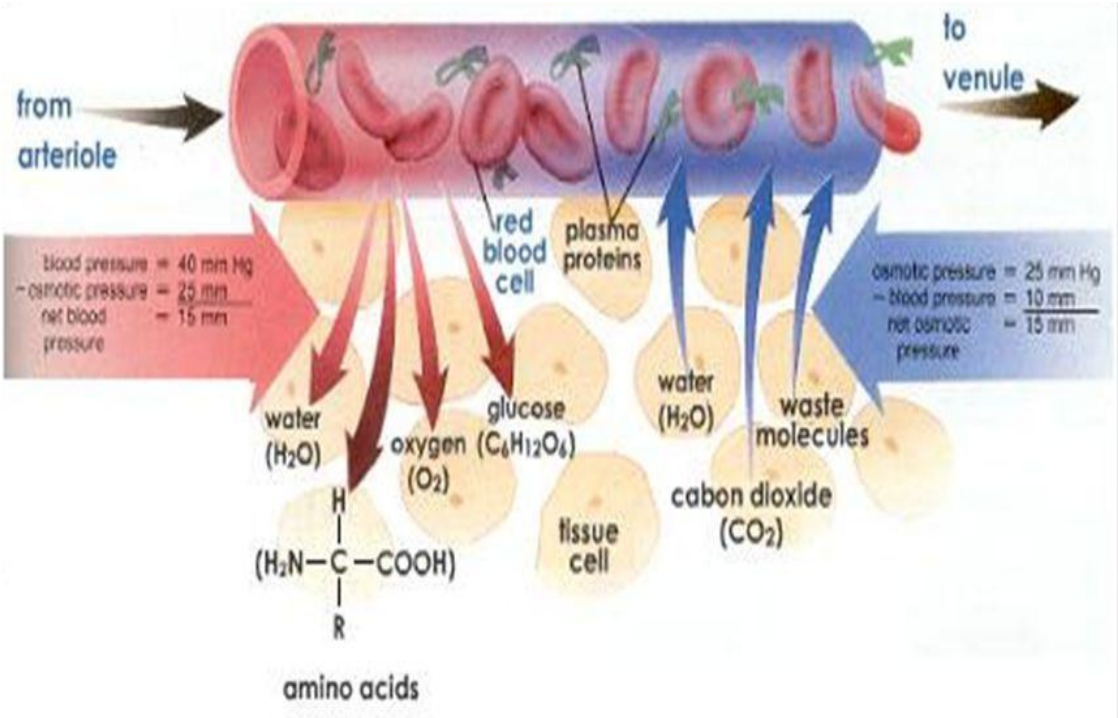
	Arteries	Veins	Capillaries
			
Functions	Carry blood <u>away</u> from the heart	Carry blood <u>towards</u> the heart	<u>Site of exchange of substances</u> (Oxygen, glucose, amino acids, carbon dioxide, urea) between blood and the tissue cells

Structure and Adaptation	Thick muscular walls to withstand high blood pressure Elastic walls to stretch and recoil to maintain the high blood pressure	Less muscular walls as blood pressure is lower Presence of valves to prevent backflow of blood	Wall is one-cell thick to decrease the distance for diffusion and increases the rate of diffusion of substances Partially permeable to allow only some substances to pass through Highly branched to increase surface area and increases rate of diffusion of substances

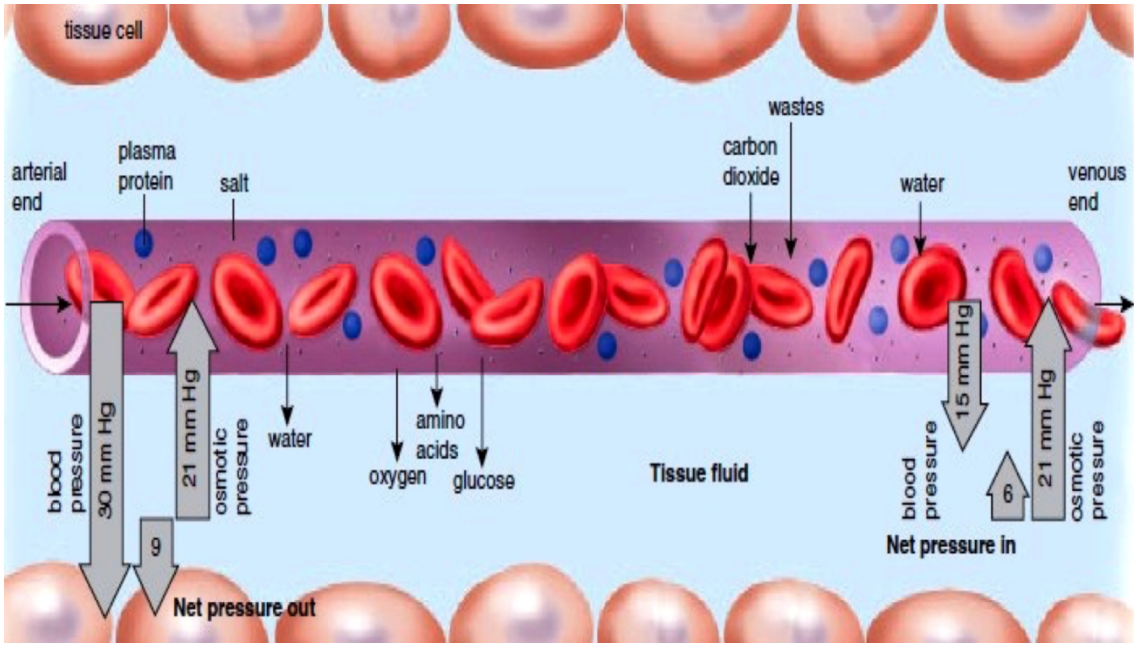
Blood pressure, velocity and total cross-sectional area in blood vessels



LO: Describe the transfer of materials between capillaries and tissue fluid

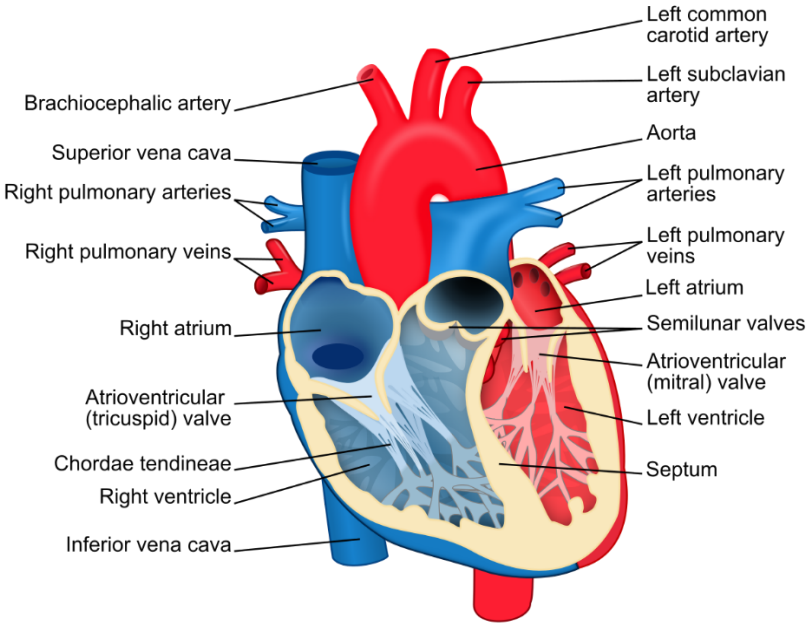


- Plasma proteins, red blood cells, platelets remain in the blood plasma.
- Only small molecules like glucose, oxygen, amino acids, urea, carbon dioxide, water, hormones and white blood cells can diffuse out into the tissue fluid from the blood capillary.
- Blood flows from the arterial end to the venous end due to higher blood pressure at the arterial end.

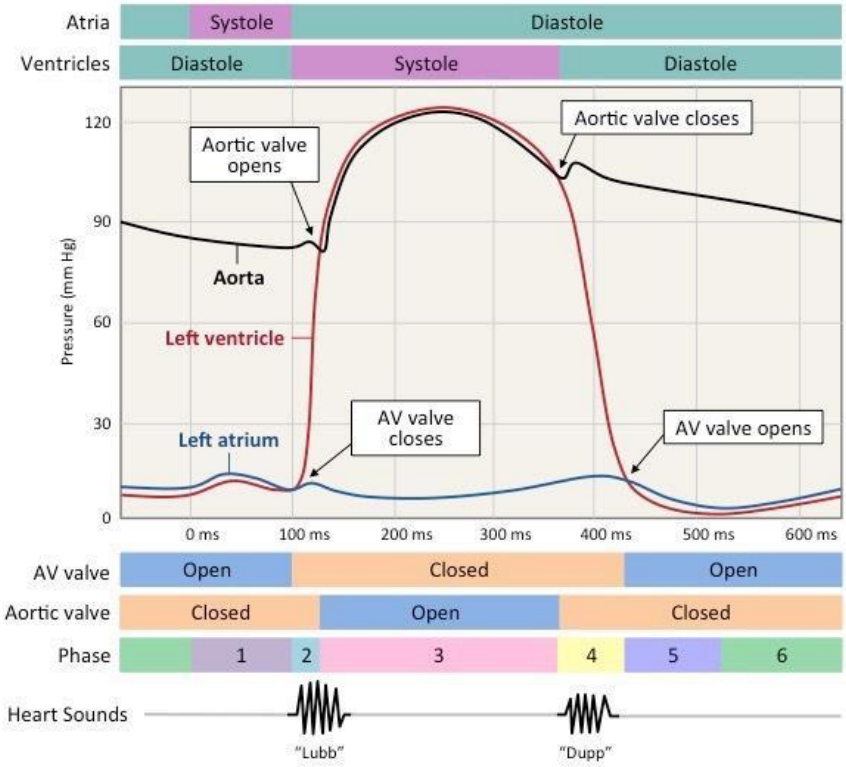


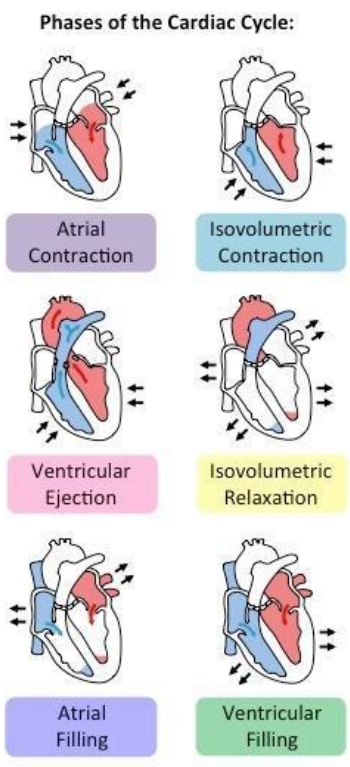
LO: Describe the structure and function of the heart in terms of muscular contraction and the working of valves

- The heart functions by <u>contractions and relaxation of the cardiac muscles</u>.
- The two atria and ventricles work alternatively. When <u>both atria contract, both ventricles relax</u>. When both atria relax, both ventricles contract.
- Valves are present to prevent the backflow of blood.
- Chordae tendineae are tendons to hold the valves in position.
- Median septum separates the heart chambers to prevent mixing of blood.



LO: Outline the cardiac cycle in terms of what happens during systole and diastole (histology of the heart muscle, names of nerves and transmitter substances are not required)





Before phase 1: Atria and ventricles relax

- Right atrium receives deoxygenated blood from the rest of the body via vena cava while the left atrium receives oxygenated blood from the lungs via pulmonary veins.

Phase 1: Atria systole

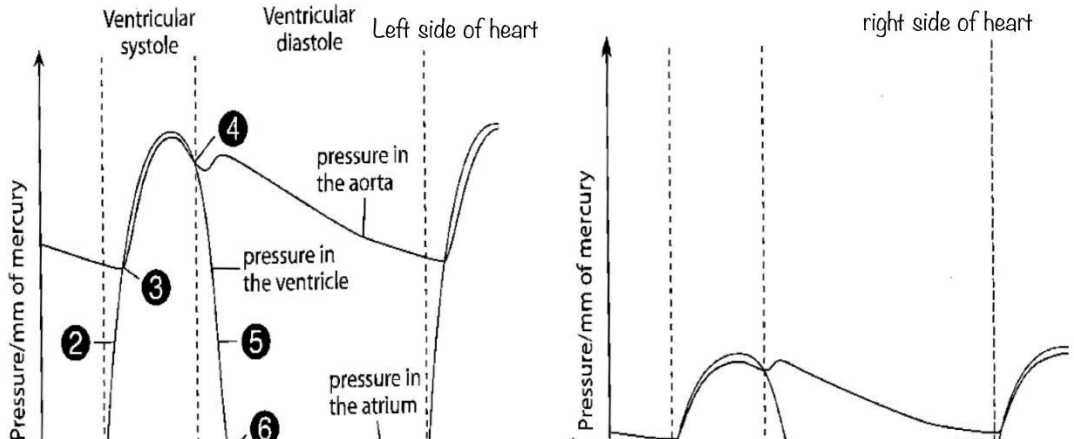
- Muscles of both atria contract when they are filled with blood.
- Blood pressure in atria increases and becomes higher than that of ventricles.
- The tricuspid valve between the right atrium and right ventricle opens and deoxygenated blood enters the right ventricle from the right atrium.
- While the bicuspid valve between the left atrium and left ventricle opens and oxygenated blood enters the left ventricle from the left atrium.
- Both ventricles contract when full.

Phases 2 and 3: Ventricular systole

- Muscles of both ventricles contract and blood pressure in ventricles increase.
- Blood pressure in ventricles becomes higher than that of atria.
- Both the tricuspid and bicuspid valves close, resulting in the 'lub' sound.
- Closure of the AV valves prevent backflow of blood from both the ventricles back into the atria.
- During phase 2, both the AV and semi-lunar valves are closed.
- When blood pressure of ventricles becomes higher than that of pulmonary arteries and aorta, the semi-lunar valves (pulmonic and aortic valves) open. Blood is forced into the pulmonary arteries and aorta.
- Deoxygenated blood forced into the pulmonary arteries is carried to the lungs for gaseous exchange while oxygenated blood forced into the aorta is carried to all parts of the body.

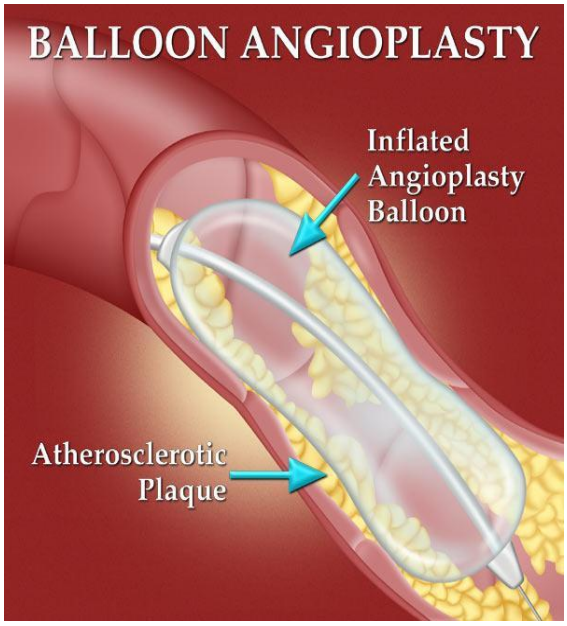
Phases 4, 5 and 6: Ventricular and atrial diastole

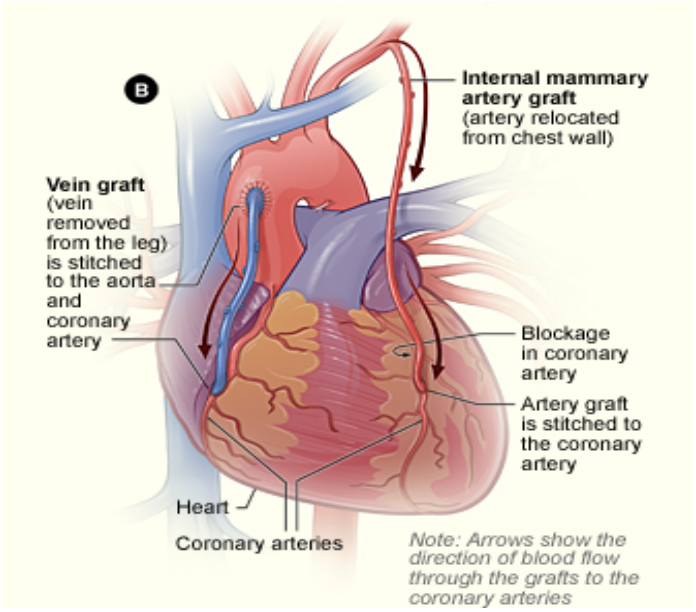
- Muscles of both ventricles relax and pressure of ventricles becomes lower than that of pulmonary arteries and aorta
- Semi-lunar valves close to prevent backflow of blood into the ventricles from the pulmonary arteries and aorta, resulting in 'dub' sound.
- During phase 4, both the AV and semi-lunar valves are closed.
- At phase 5, bicuspid and tricuspid valves open as pressure in ventricles become lower than that in the atria.



LO: Describe coronary heart disease in terms of the occlusion of coronary arteries and list the possible causes, such as diet, stress and smoking, stating the possible preventative measures

- Excess fats would be deposited on the inner walls of the coronary artery.
- As fats accumulate, they cause the artery walls to become rough and hard and the lumen becomes narrower.
- This reduces the blood supply. Less oxygen and glucose are supplied to the heart muscles. Blood clot blocking coronary artery carrying blood to heart muscles will cause heart attack – coronary thrombosis. Heart muscles will die and lead to coronary heart disease.
- Atherosclerosis is the condition where fatty substances (cholesterol and fats) are deposited on the inner walls of arteries, narrowing and hardening the lumen of the artery.
- Balloon angioplasty/ coronary artery bypass can be carried out.





Causes of coronary heart disease:

- Diet rich in cholesterol and fats
- Stress
- Smoking
- Lack of exercise

Ways to prevent coronary heart disease:

- Exercise
- Healthy diet

- Stress Management
- Do not smoke