PENANG SANGAM HIGH SCHOOL
P.O.BOX 44, RAKIRAKI
LESSON NOTES

Subject: Biology **Year/Level:** 11

Week 25

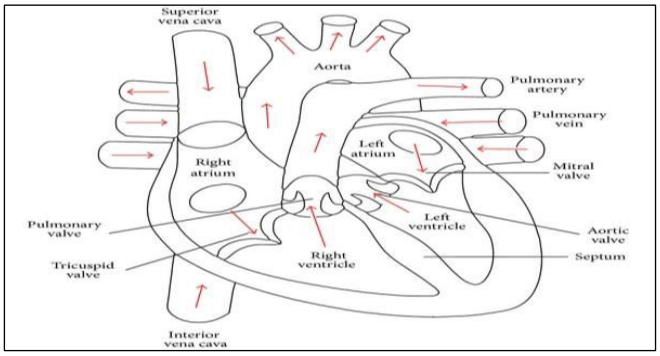
Strand	1 Structure and Life Processes
Sub Strand	1.5&1.6 Structure And Functions In Plants/Animals
Content Learning Outcome	Discuss the human heart, its functions and diseases associated with it.

THE HUMAN HEART

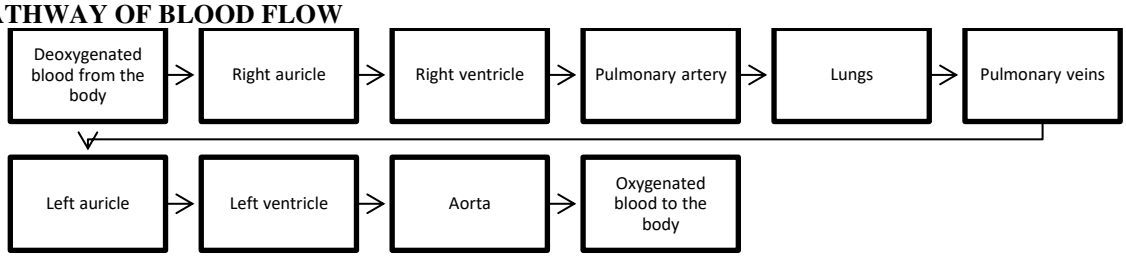
- The heart is a muscular pump that pushes the blood through blood vessels.
- It is made up of cardiac muscles.
- It has 4 chambers: 2 auricles (atrium) and 2 ventricles.
- The left and right side of the heart are separated by a septum.

2 types of arteries:	**2 types of veins:**
1. **Aorta-** carries oxygenated blood to the head and all parts of the body.	1. **Venacava**- brings deoxygenated blood from the head and body to the heart.
2. **Pulmonary artery**- carries deoxygenated blood to the lungs.	2. **Pulmonary veins**- carries oxygenated blood from the lungs to the heart.

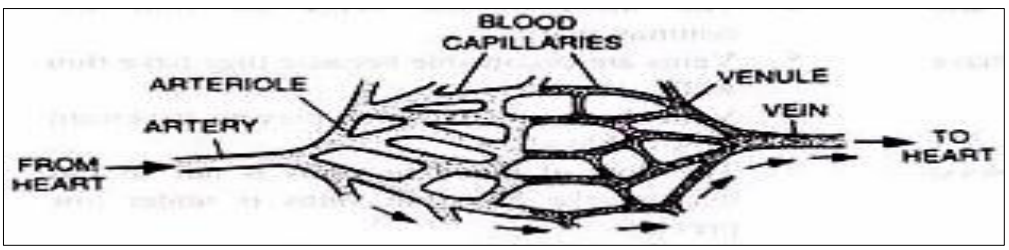
DIAGRAM OF THE HUMAN HEART



PATHWAY OF BLOOD FLOW

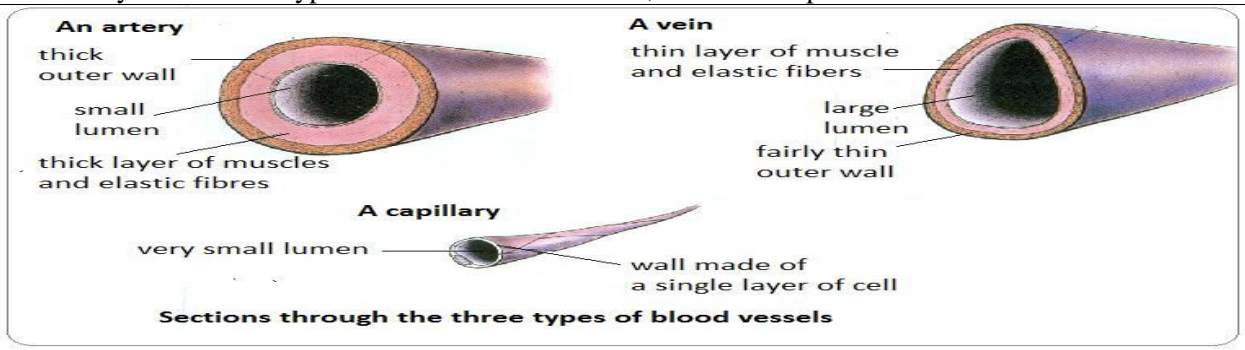


DIGRAM SHOWING THE END OF AN ARTERY AND BEGINNING OF A VEIN



Comparison of Different Blood vessels

The blood vessels are the tubes for the blood to flow through between the heart, lungs and to all other parts of the body. There are 3 types of blood vessels: arteries, veins and capillaries.

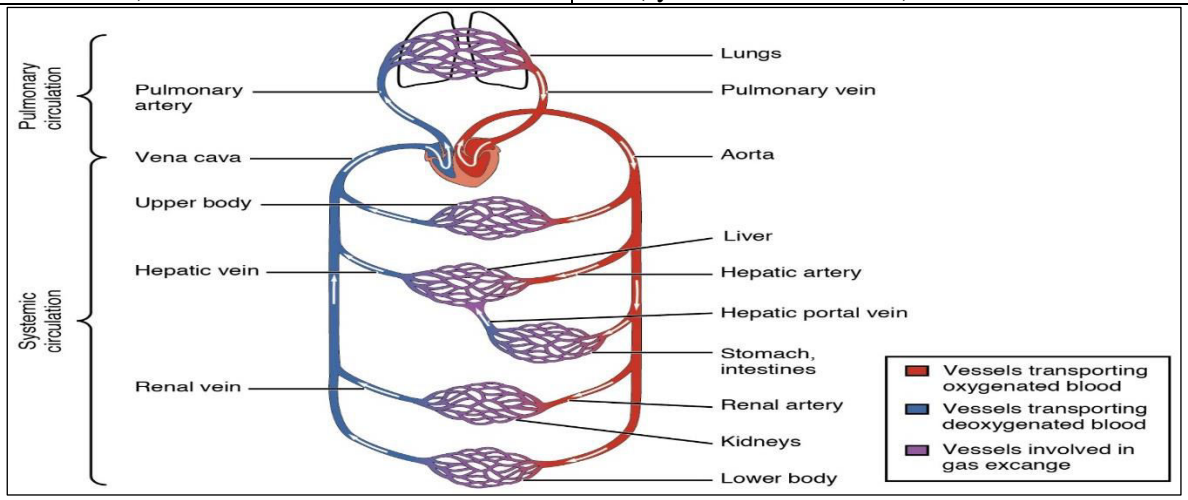


Characteristics	Blood vessels		
	Artery	**Capillary**	**Vein**
1. Walls	Thick walls, contain smooth muscle and elastic fibres	Only one cell thick	Thinner than artery, has less muscle
2. Lumen	Small lumen	10 micrometers (smallest)	Large lumen
3. Shape	Cylindrical, narrower than veins	Narrow, about the size of a red blood cell	Cylindrical, wider than artery
4. Valves	Absent	Absent	Present, to prevent backflow of blood
5. Function	Carries blood away from the heart	Exchanges materials between blood and tissue cells through wall	Returns blood to the heart
6. Blood flow-speed and pressure	Fast, under pressure and in spurts.	Slow and smooth	Slow and smooth, faster than in capillaries
7. How is the blood flow maintained?	By the contraction of heart muscles	Flow is along the gradient of blood pressure	By contraction of skeletal muscles which squeeze the veins between them

<u>Blood circulation</u> (double closed circulatory system)

TWO main circulatory loops:

1. **<u>Heart –Lung Loop</u>**- for the blood to pick up O_2 and gets rid of CO_2 (pulmonary circulation).
2. **<u>Heart –Body Loop</u>**- for supplying the body cells with glucose ($C_6H_{12}O_6$), O_2 and removing wastes (systematic circulation).

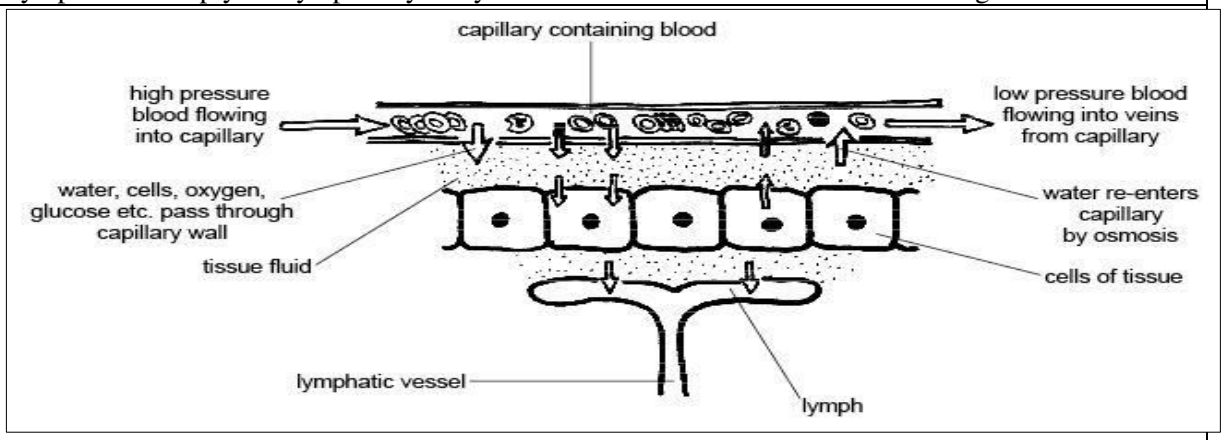


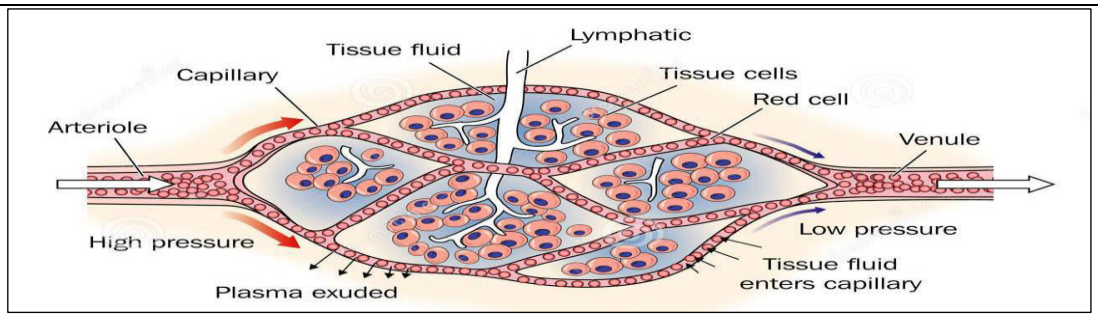
Some especially supplied organs are:

Organs	Reason it needs blood
Brain	Blood supply to the brain is the 1st priority because as blood flow is interrupted, brain cells begin to die.
Heart	Needs a large continues supply of oxygen to do its job Blood is supplied to the heart by the coronary arteries
Liver	Needs blood to filter out the waste It also stress excess glucose and helps maintain the body temperature of 37°C
Kidney	Needs the blood so that it can filter it i.e. nitrogenous waste and salts can be taken out of the blood
Skin	Needs blood to maintain body temperature
Skeletal muscles	Needs blood to carry out its activities
Small intestine	Needs blood to absorb food into the villi.

Capillary function

- Plasma water and simple molecules move back and forth between capillaries and tissues as blood flows through the capillaries between cells:
  - Nutrients an oxygen diffuses from blood to tissues
  - Waste materials and carbondioxide move from tissues into blood.
- The plasma water and its dissolved materials constitutes the tissue fluid **(interstitial fluid)** which surrounds the cells.
- Interstitial fluid may return into the capillary at the **venule end**, or enter into **lymph capillaries.**
- The fluid in the lymph vessels is known as **lymph.**
- Lymph capillaries are present throughout tissues.
- They join into large lymph vessels, which eventually lead into still larger lymph ducts.
- Lymph ducts empty the lymph they carry into the veins in the neck that enter the right atrium.





THE LYMPHATIC SYSTEM

- Another network of fluid filled tubes
- Reaches every part of the body like the circulatory system
- No pump
- Fluid is pushed forward just as low-pressure blood pushes through the veins

- Main function:
  - Absorbs excess extra-cellular fluids surrounding the cells
  - Helping to fight diseases
- It has 2 components:

1. Lymph vessel system	2. Lymphoid organ
- Returns excess extra-cellular fluid to the blood stream - Excess fluid builds up around the body cells as water diffuses back into the blood at the **venule end**. - The lymph vessels absorb the extra-cellular fluid with the help of the lymph capillaries. - Once inside the lymph capillaries, the fluid is known as lymph. - Since the lymphatic system has no pump, the muscle movement pushes the lymph forward and valves prevent the backflow of the lymph. - The lymph vessels dump the lymph into the blood circulatory system near the Venacava.	- Includes the ***lymph nodes, spleen and tonsils.*** - These organs clean up the lymph by filtering out dead cell materials and disease causing organisms. **Lymph Nodes** - Knots of the lymph capillaries that contain a lot of white blood cells. - They are located all over the body especially in the necks, armpits and groin areas. - As the lymph in the capillaries passes through the lymph nodes, the lymphocytes and other dead cells are filtered. E.g. sometimes when you are sick, you can feel a swollen lymph node in your neck and joints as they fight the infection. **Spleen** - also filters the blood and it stores extra red and white blood cells **Tonsils -** 2 round lymph at the back of your throat. While they are supposed to help fight infections, many people actually have severe throat trouble as they get repeated throat infections. Some children get their tonsils removed for this reason.

<u>Malfunctions of the Circulatory System</u>

Disease	Description/ causes	Signs and symptoms	Prevention/ cure/ treatment
1. Cardio vascular disease	CVD is a class of disease that involves the heart or blood vessels. It includes coronary artery diseases (CAD) such as angina and heart attack.	- Chest pain - Chest tightness - Shortness of breath	Prevention: healthy lifestyle choices (eat healthy, exercise regularly, avoid alcohol and smoking)
2. Angina	It refers to severe chest pain and is a warning sign of heart disease	Chest pain or discomfort, possibly described as pressure, squeezing, burning or fullness Pain in arms, neck, jaw, shoulder or back accompanying chest pain	Prevention: healthy lifestyle Treatment: medications (aspirin, beta blockers, statins)
3. Arterio sclerosis/ Athero sclerosis	- A disease affecting the blood vessels caused by the build-up of plaque (fatty tissue), which could consist of fatty and cholesterol deposits, along the inner walls of the vessels - This deposit causes a decrease in flow of blood and can eventually cut-off altogether - The blood vessels can lose its elasticity, harden and break - This can lead to: stroke, heart attack, hypertension		- Exercise regularly - Reduce intake of fatty/ oily food
a. Stroke	- Results when the blood flow to any vessel of the brain is cut-off or reduced	- Sudden numbness or weakness in the face, arm or leg especially on 1 side of the body, confusion, trouble speaking or difficulty understanding speech, trouble in seeing in 1 or both eyes, trouble in walking, dizziness, loss of balance	- Eat a healthy diet - Exercise regularly - Avoid smoking

		or lack of coordination	
b. Heart attack (myocardial infarction)	- Results when the blood flow to one of the blood vessels leading to the heart is cut-off or blocked	Pressure, tightness, pain or a squeezing or aching sensation in chest or arms that may spread to neck, jaw or back. Shortness of breath Cold sweat and Fatigue	- Eat a healthy diet - Exercise regularly - Avoid smoking - Limit calories
c. Hypertension (high blood pressure)	- Many causes: i. Due to plaque build-up in the blood vessels, the heart needs to pump harder to ensure blood circulation ii. Chronic kidney disease (CKD)- kidneys do not filter out fluid, this excess fluid leads to hypertension	- Severe headache - Fatigue or confusion - Vision problem - Chest pain - Difficulty breathing - Irregular heartbeat	- Regular physical exercise - Stress reduction - Medication
4. Varicose veins	Seen as thick, dark purple lines in the back of the legs It I a result of valves of the vein not working properly, causing blood to collect in the vein and enlarging it.	- Large veins that can be seen just under the surface of the skin - Mild swelling of ankles and feet - Painful, achy or 'heavy' legs - Throbbing/ cramping in legs - Itchy legs especially on the lower leg and ankle	Prevention: avoid standing for long period of time, sitting with legs uncrossed Treatment: laser surgeries, high ligation and vein stripping
5. Aneurysm	A balloon-like bulge filled with blood in the wall of blood vessels. They weaken the wall of blood vessels When they increase in size, the likelihood of rapturing increases A rupture aneurysm results in haemorrhaging and possible death.	Signs of raptured aneurysm: - Sudden, extremely severe headache - Nausea and vomiting - Stiff neck - Blurred vision or double vision - A drooping eyelid - Loss of consciousness	Prevention: healthy diet and less salt intake Treatment: surgical clipping can be done to seal the raptured aneurysm
6. Anaemia	Condition where there are fewer than normal RBC or too little haemoglobin and results in lack of oxygen reaching the blood cells	- Easy fatigue and loss of energy - Difficulty concentrating - Dizziness - Pale skin	Prevention: eat food rich in iron Treatment: iron tablets
7. Leukaemia	A type of cancer of the blood characterized by abnormally high number of WBC; *DNA of the immature WBC gets damaged, theses abnormal WBC divides & grows continuously and do not die when they should, eventually outnumber the healthy WBC*	- Fever or chills - Persistent fatigue, weakness - Frequent or severe infections - Swollen lymph nodes, enlarged liver or spleen - Recurrent nose bleed - Tiny red spots on skin (petechiae)	Treatment depends on the type of leukaemia, age, genetic abnormalities and overall health of the individual Treatment options: chemotherapy, radiation therapy, stem cell transplant
8. Filariasis	It is a parasitic disease caused by an infection with the Filarioidea type roundworm. These are spread by blood-feeding black flies and mosquitoes.	Thickening of skin and underlying tissues- elephantiasis which results when parasites lodge in the lymphatic system.	Prevention: avoid mosquito bite, community vector control (vaccinations) Treatment: surgery

9. Thrombosis	Is the formation of a blood clot inside a blood vessel, obstructing the flow of blood through the circulatory system	Swelling in the foot, ankle or leg usually on 1 side Cramping pain in the affected leg that usually begins in the calf. An area of skin that feels warmer than the skin on the surrounding area.	Emergency treatment with blood thinners (anticoagulants) which prevent further clotting. This can be injected or taken as pills.
10. Hole in the heart	A hole in the septum between the heart's two upper chambers is called an Atrial Septal Defect (ASD). A hole in the septum between the heart's two lower chambers is called Ventricular Septal Defect (VSD)	- Tire easily during physical activity - Shortness of breath - A buildup of blood and fluid in the lungs - Swelling in the ankles, feet, legs, abdomen and veins in the neck	Treatment- depends on the type, location and size of the hole - Surgery - Extra nutrition (special feeding in babies)
11. Rheumatic heart disease	- Inflammatory response from rheumatic fever can permanently damage the valves in the heart (the valves thicken and fuse) - An inflammatory disease that begins with strep throat	- Apart from the sore throat caused by the strep infection, individual will develop very painful, swollen and red joint- usually a large joint like a knee, ankle, elbow or shoulder- that goes away after a day or two on to be replaced by the same problem in another joint.	Treat strep throat infection or scarlet fever promptly with a full course of appropriate antibiotics.

Activity

1. Give 3 functions of blood.

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2. How is the lymphatic system different from blood circulatory system?

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3. What 2 parts of the body are the transport systems first priorities to supply with blood?

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4. What is the function of lymph nodes?

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