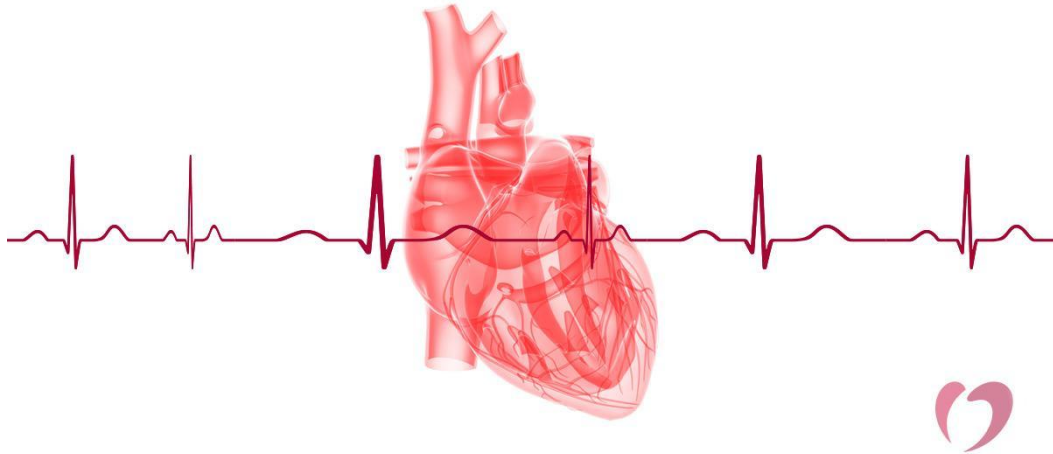


Year 12 HL

IB BIOLOGY

6.2 The Blood System



Name:

Teacher: Mr Trent

Essential idea: The blood system continuously transports substances to cells and simultaneously collects waste products.

Understandings

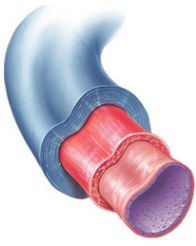
- Arteries convey blood at high pressure from the ventricles to the tissues of the body.
- Arteries have muscle cells and elastic fibres in their walls.
- The muscle and elastic fibres assist in maintaining blood pressure between pump cycles.
- Blood flows through tissues in capillaries. Capillaries have permeable walls that allow exchange of materials between cells in the tissue and the blood in the capillary.
- Veins collect blood at low pressure from the tissues of the body and return it to the atria of the heart.
- Valves in veins and the heart ensure circulation of blood by preventing backflow.
- There is a separate circulation for the lungs.
- The heartbeat is initiated by a group of specialized muscle cells in the right atrium called the sinoatrial node.
- The sinoatrial node acts as a pacemaker.
- The sinoatrial node sends out an electrical signal that stimulates contraction as it is propagated through the walls of the atria and then the walls of the ventricles.
- The heart rate can be increased or decreased by impulses brought to the heart through two nerves from the medulla of the brain.
- Epinephrine increases the heart rate to prepare for vigorous physical activity.

Applications and Skills

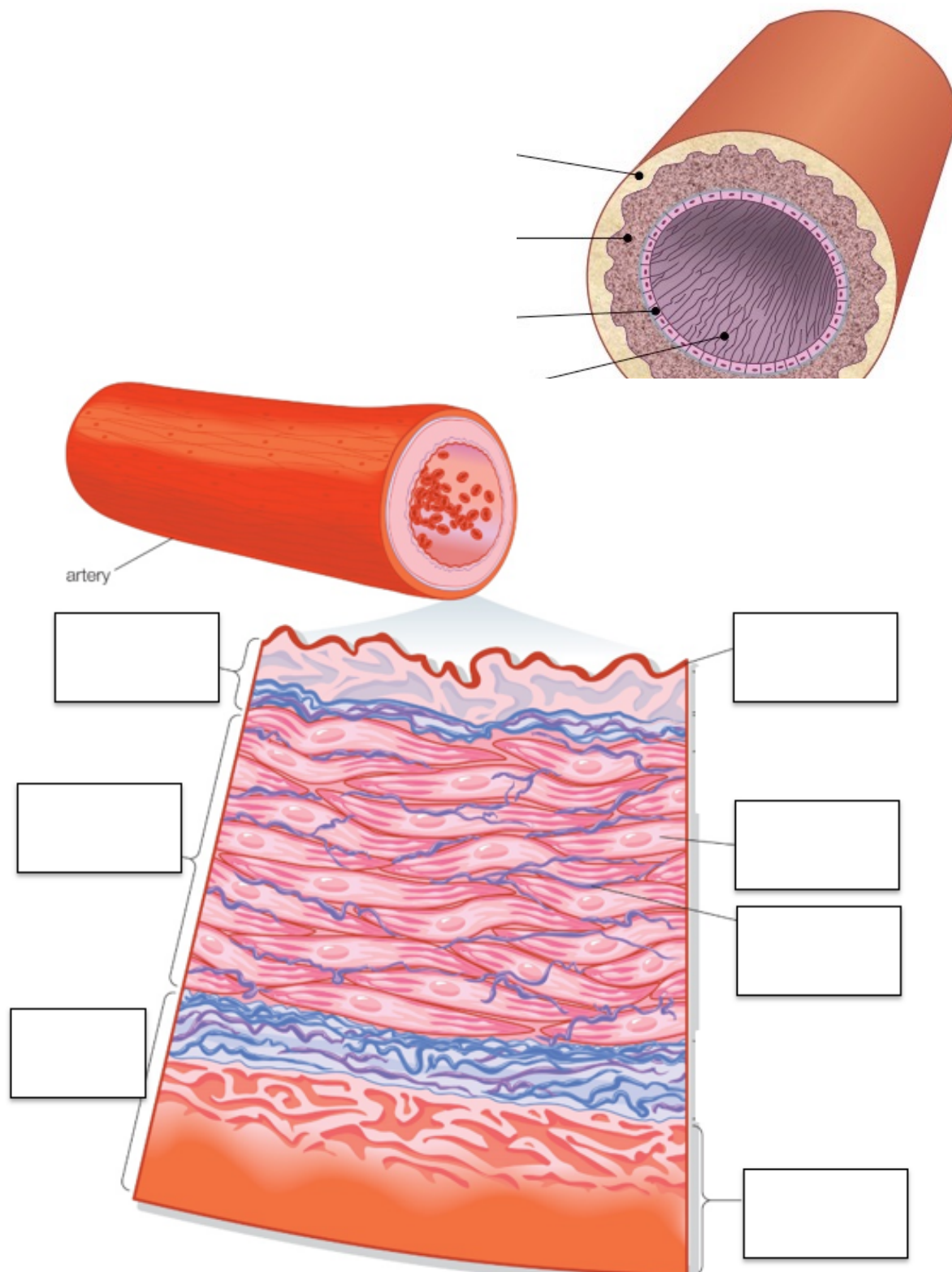
- William Harvey's discovery of the circulation of the blood with the heart acting as the pump.
- Pressure changes in the left atrium, left ventricle and aorta during the cardiac cycle.
- Causes and consequences of occlusion of the coronary arteries.
- Identification of blood vessels as arteries, capillaries or veins from the structure of their walls.
- Recognition of the chambers and valves of the heart and the blood vessels connected to it in dissected hearts or in diagrams of heart structure.

6.2U3 The muscle and elastic fibres assist in maintaining blood pressure between pump cycles.

Blood Vessels

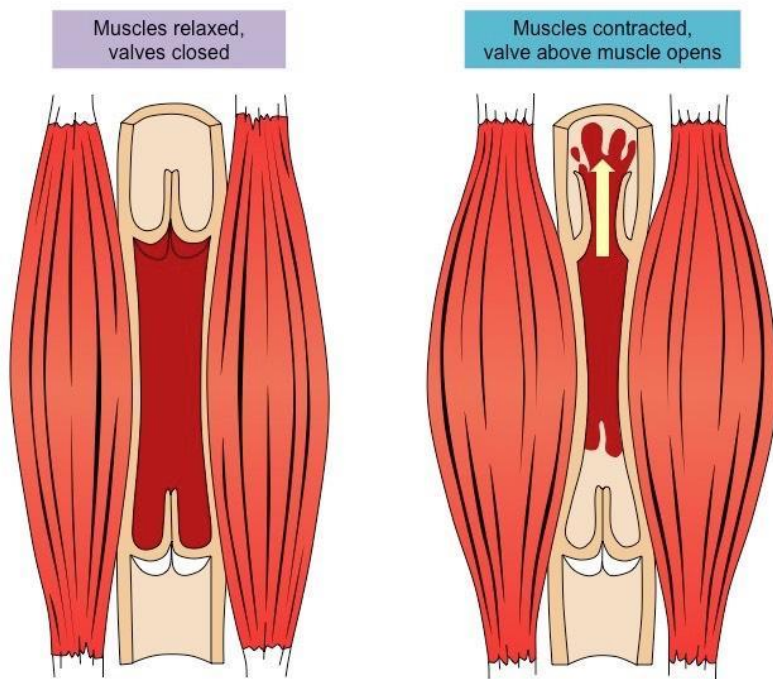
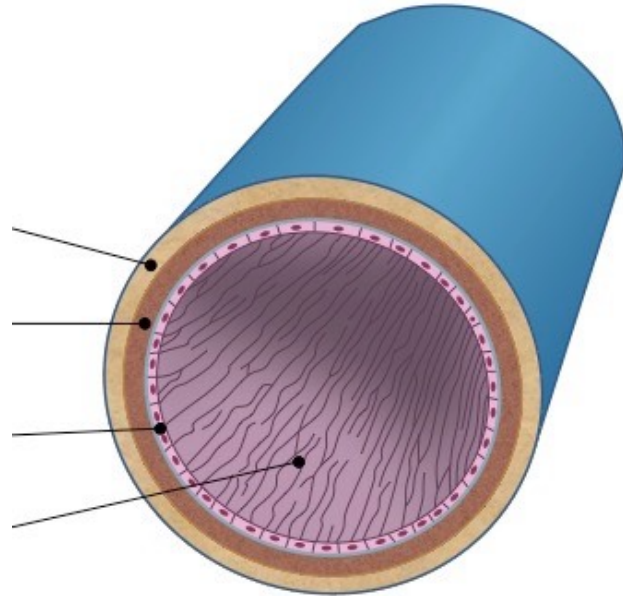
Artery	Capillary	Vein
		
Function:	Function:	Function:
Features:	Features:	Features:

- 6.2U1 Arteries convey blood at high pressure from the ventricles to the tissues of the body.
- 6.2U2 Arteries have muscle cells and elastic fibres in their walls.

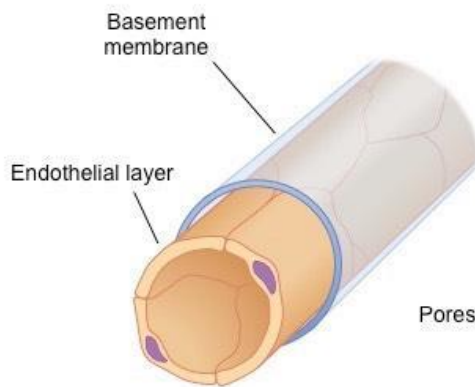


6.2 U5 Veins collect blood at low pressure from the tissues of the body and return it to the atria of the heart

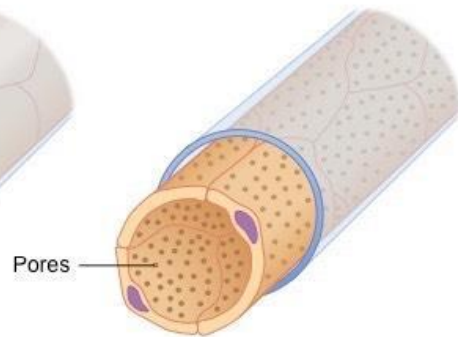
6.2 U6 Valves in veins and the heart ensure circulation of blood by preventing backflow.



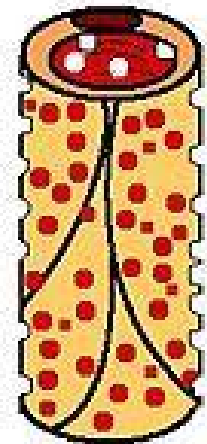
6.2U4 Capillaries have permeable walls that allow exchange of materials between cells in the tissue and the blood in the capillary.



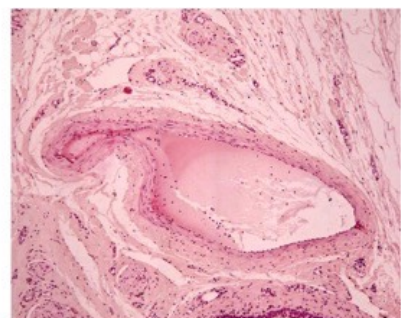
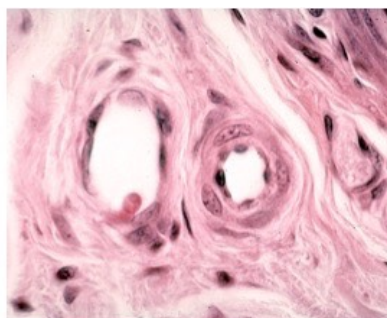
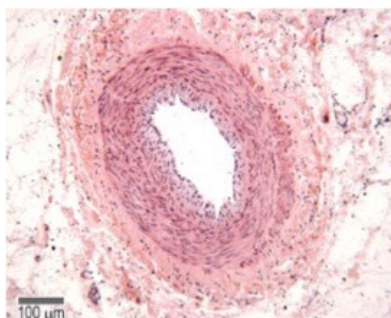
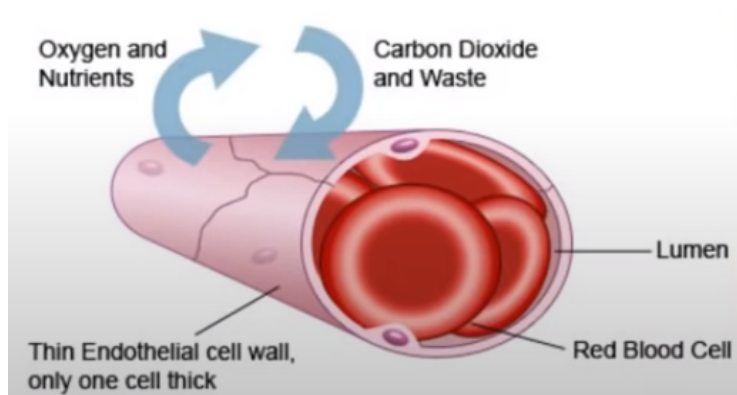
Continuous



Fenestrated



Fenestrated Capillary

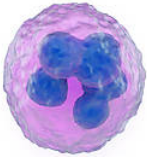
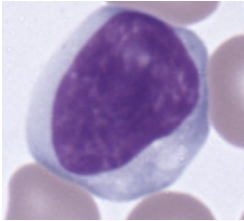
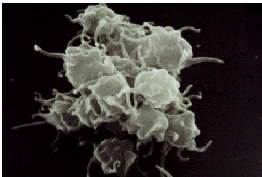


Compare endothelial and epithelial cells.

Try the histology lab here to identify the layers in the different blood vessels

http://medcell.med.yale.edu/histology/blood_vessels_lab.php

Composition of Blood

Blood Component	Function	Features
<u>Erythrocyte</u> 		
<u>Leucocyte</u> Phagocyte  Lymphocyte 		
<u>Platelets</u> 		
<u>Plasma</u> 		

Functions of the Blood

List some substances carried by the blood:

Heat is also carried in blood plasma. Why is this important?

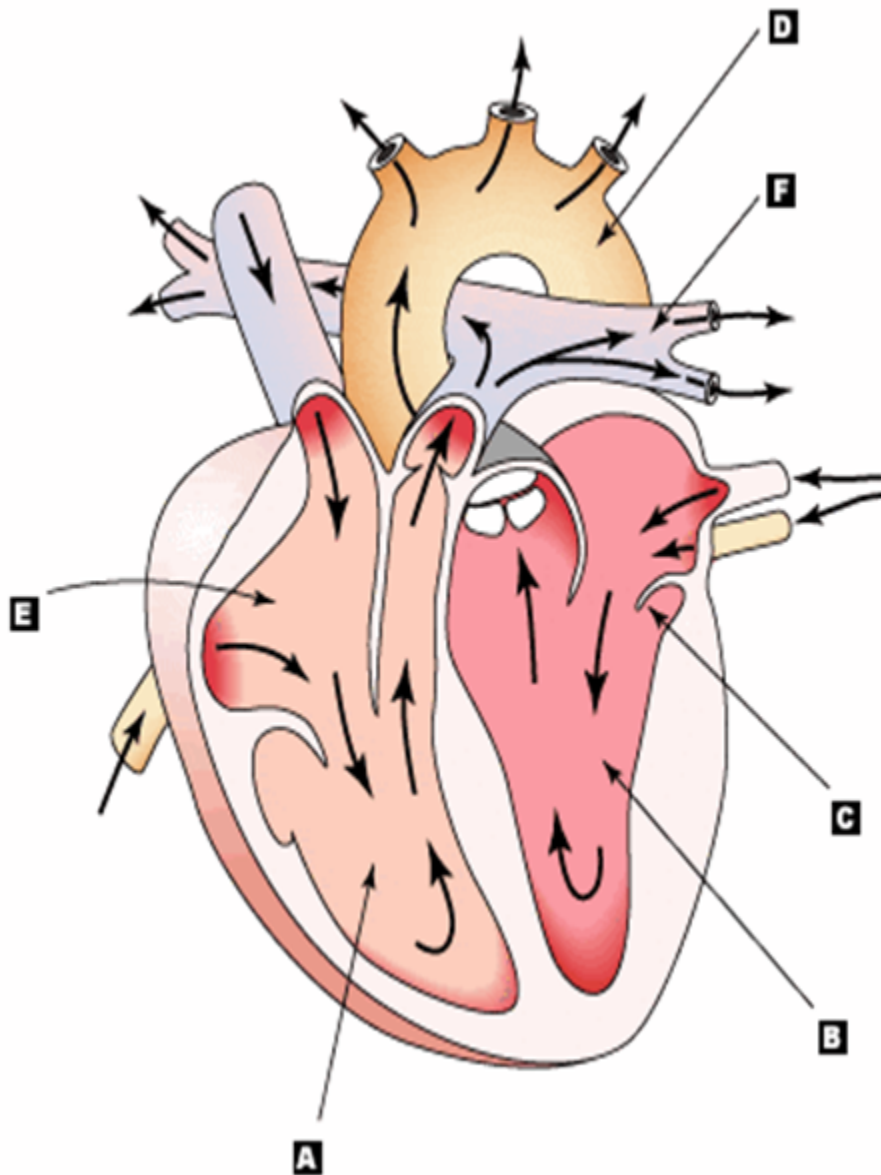
Complete the table:

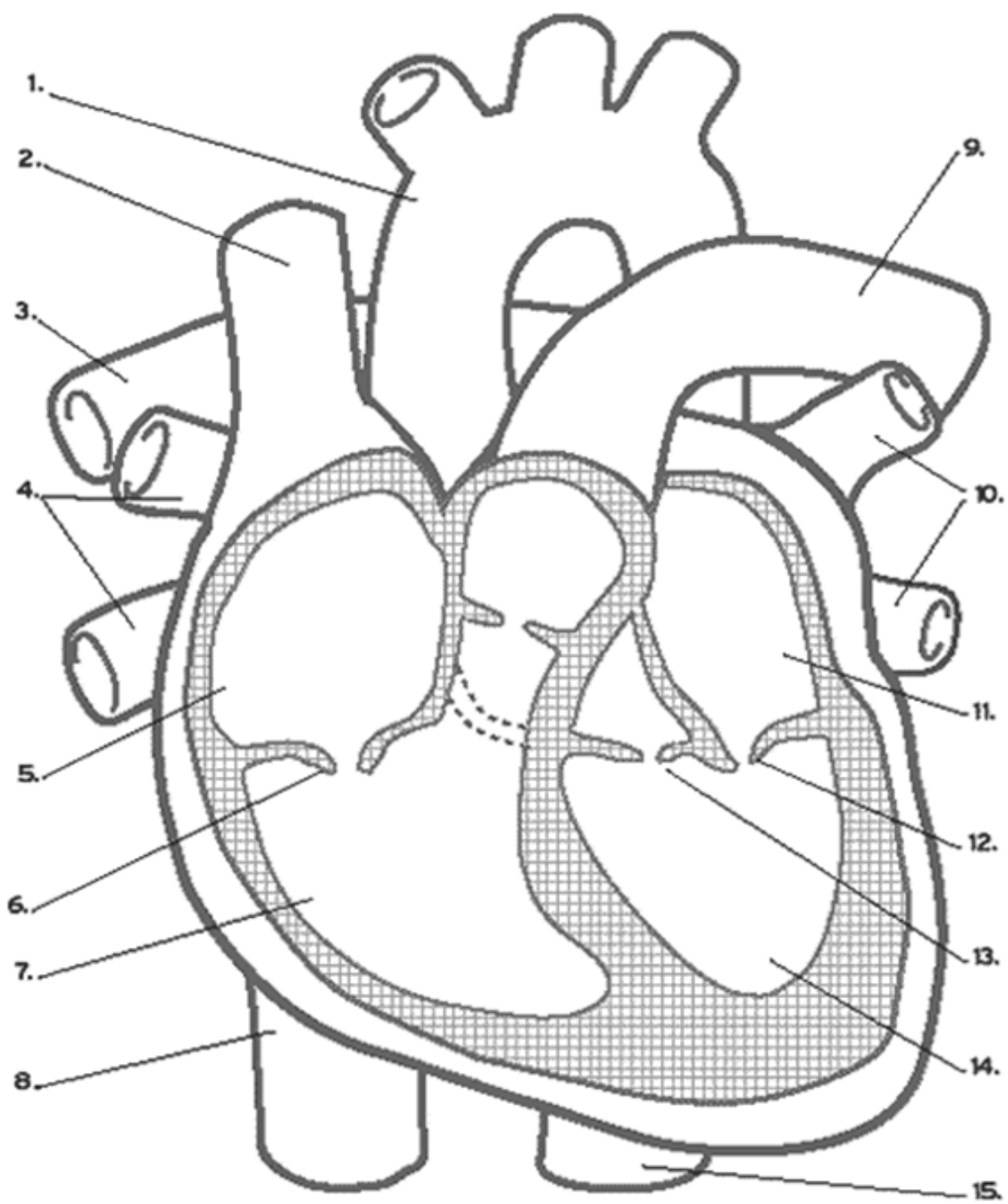
Substance	Exchange surface where substance enters blood	Exchange surface where substance leaves blood
Nutrients from digestion		
Oxygen		
Carbon dioxide		
Urea		
Hormones		

The Structure of the Heart

Watch the video <http://www.youtube.com/watch?v=w7uB6rmGkoE> and practice drawing the heart.

Add labels to the diagram below:



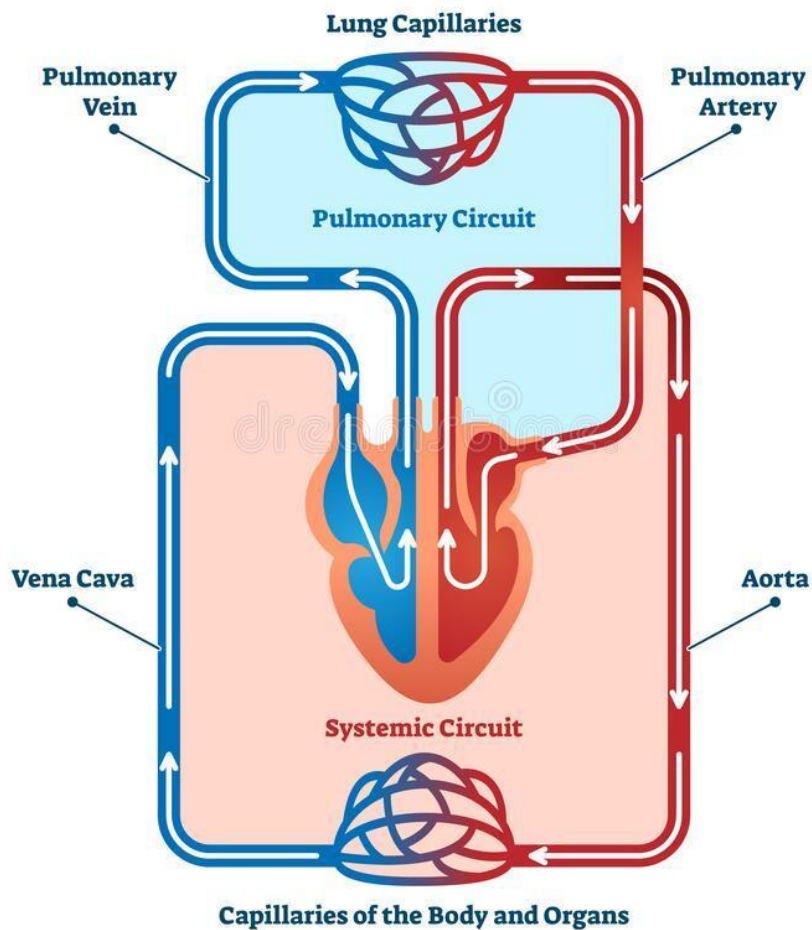


Define the term double circulation:

The human circulatory system is a _____ circulatory system. It has two separate circuits and blood passes through the heart twice:

- the _____ circuit is between the heart and lungs
- the _____ circuit is between the heart and the other organs

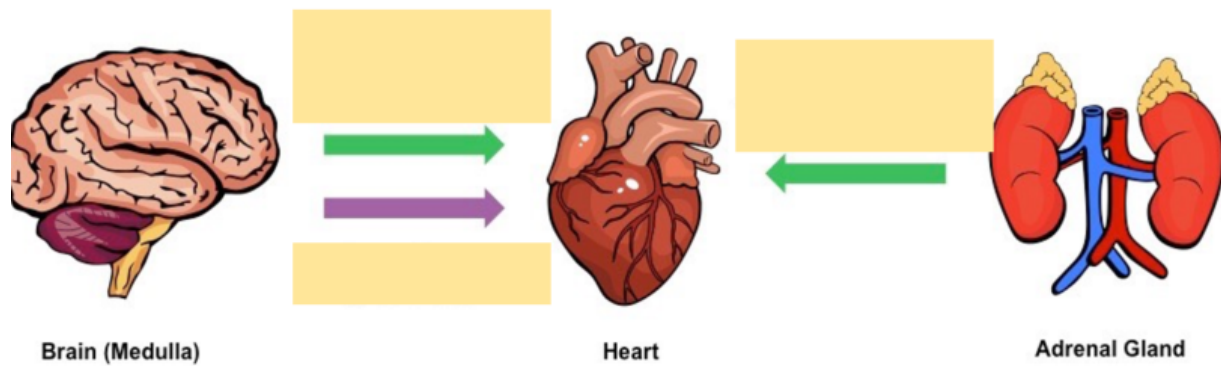
Describe the advantages of this type of circulation:



Draw a flow diagram to show the flow of blood through the heart starting and finishing with the body.

- _____ refers to a nervous impulse originating in muscle tissue itself.
- The _____ (SA node) is a specialized myocardial structure that initiates the electrical impulses to stimulate contraction, and is found in the _____ wall of the right atrium.
- _____ cardiac contractions per minute
- The sinoatrial node sends out an _____ that stimulates contraction of the myocardium (heart muscle tissue)
- This impulse directly causes the atria to contract and _____ at the junction between the atrium and ventricle
- The _____ (AV node) delays the signal, to allow time for the ventricles to fill with blood.
- The AV Node sends signals down the septum via a nerve bundle (_____).
- The _____ innervates nerve fibres (_____) in the ventricular wall, causing ventricular _____.



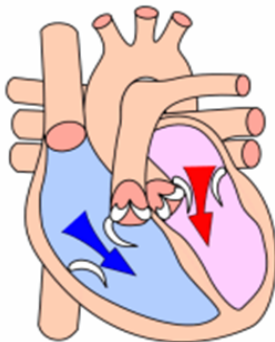


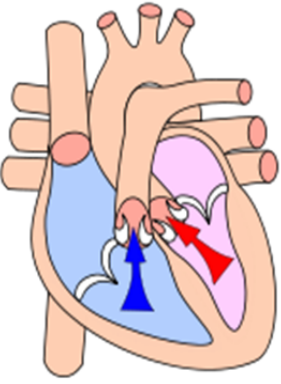
The Cardiac Cycle

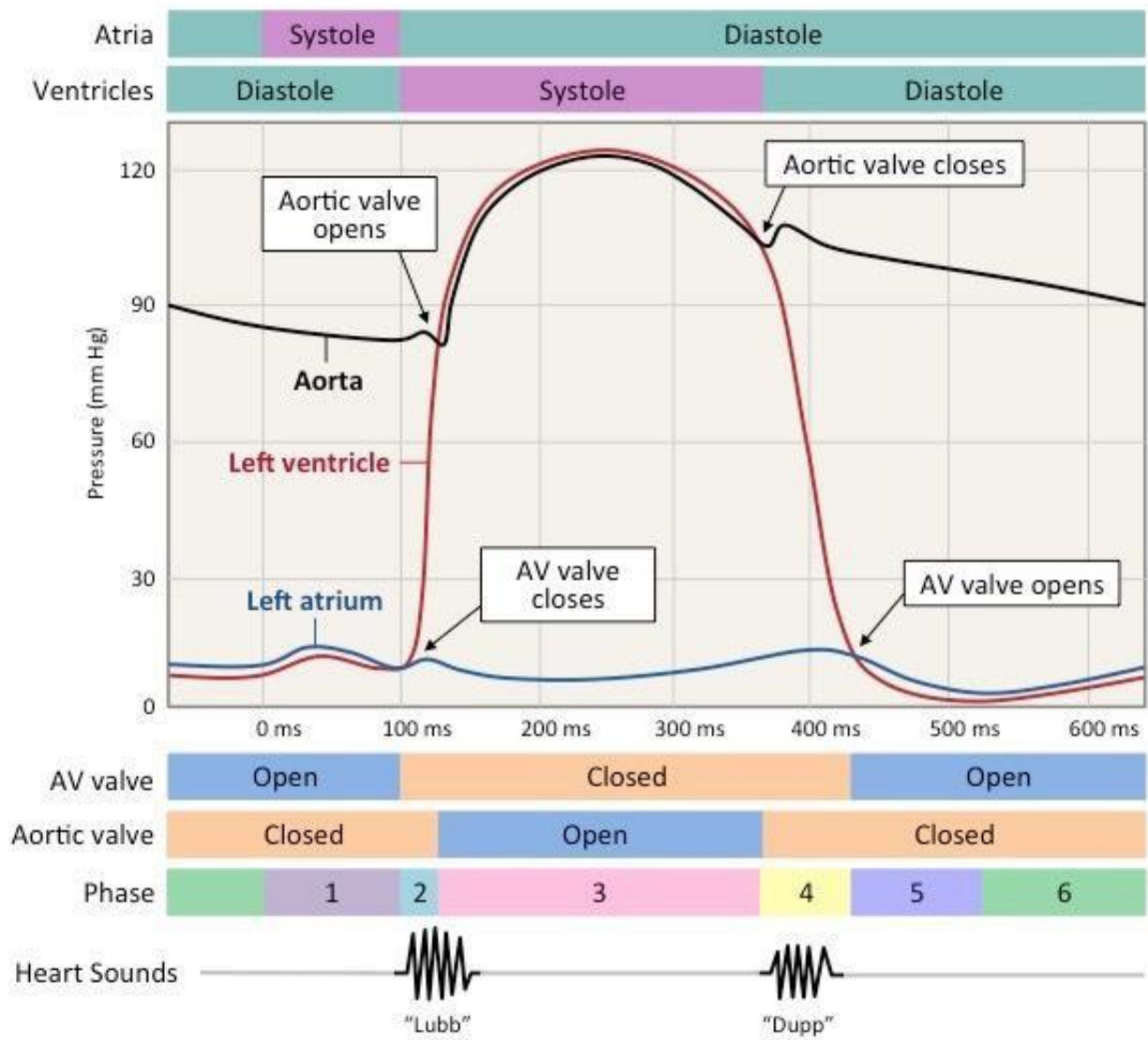
Watch this video http://www.youtube.com/watch?v=Rj_qD0SEGGk and this animation

Annotate these diagrams to explain the cardiac cycle:

It is comprised of a period of contraction () and relaxation ()







Coronary Arteries

How many coronary arteries supply the heart?

Where do the coronary arteries carry blood from/to?

What is meant by the term **coronary occlusion**?

Read this: [Atherosclerosis | NHLBI, NIH](#)

_____ is a disease in which _____ builds up inside your arteries.

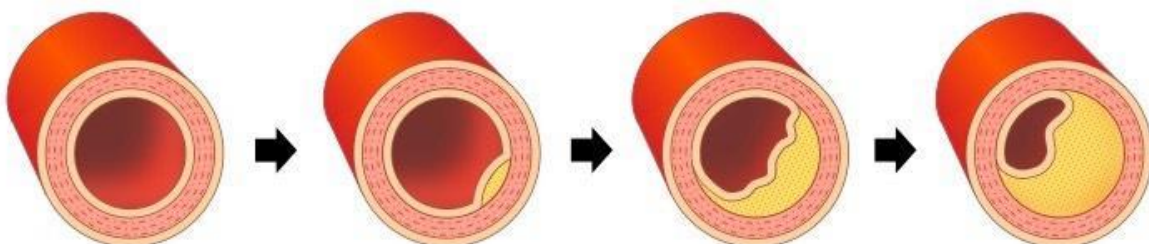
Plaque is made up of fat, cholesterol, calcium, and other substances found in the blood. Over time, plaque _____ and narrows your arteries. This limits the flow of oxygen-rich blood to your organs and other parts of your body.

Atherosclerosis can lead to serious problems, including heart attack, stroke, or even death.

What conditions may arise as a result of a coronary occlusion?

Go here https://www.youtube.com/watch?v=3_PYnWVoUzM and then explain what happens during a heart attack.

Annotate the diagram to explain how a coronary occlusion may arise:

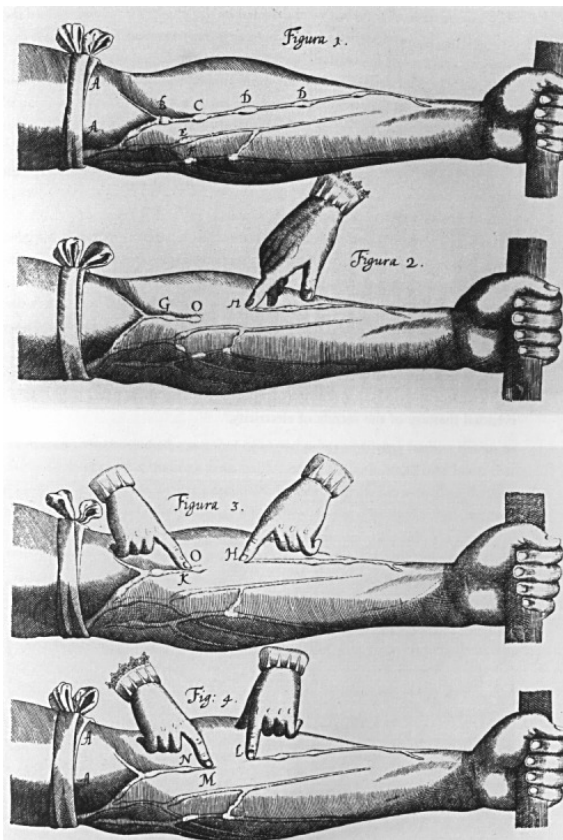


What factors can cause this?

A G O D D E S S

William Harvey

Describe Harvey's experiment and explain how this led to our knowledge of circulation.



1. Is the blood in the aorta, left ventricle and pulmonary artery oxygenated or deoxygenated?

	Aorta	Left ventricle	Pulmonary artery
A.	oxygenated	deoxygenated	deoxygenated
B.	deoxygenated	oxygenated	oxygenated
C.	oxygenated	oxygenated	deoxygenated
D.	oxygenated	oxygenated	oxygenated

(Total 1 mark)

2. Which vessel directly supplies the heart muscle with blood?

- A. The aorta
- B. The pulmonary artery
- C. The coronary artery
- D. The pulmonary vein

(Total 1 mark)

3. Which of the following is transported by the blood?

- A. Gametes
- B. Glycogen
- C. Heat
- D. Starch

(Total 1 mark)

4. Which part of the brain has a role in the control of the heartbeat and how are messages passed from this part of the brain to the heart?

	Part of the brain	Type of message
A.	hypothalamus	hormone
B.	hypothalamus	nerve
C.	medulla	hormone
D.	medulla	nerve

(Total 1 mark)

5. What is a role of the pacemaker or sinoatrial node (SAN)?

- A. To initiate contraction of the ventricle
- B. To pass the excitation through Purkinje fibres
- C. To originate excitation in myogenic muscle
- D. To cause the relaxation of the atria

(Total 1 mark)

6. The pumping of blood is a vital process. Explain the roles of the atria and ventricles in the pumping of blood.

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(4)

7. Explain how the structure of an artery allows it to carry out its function efficiently.

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(5)

8. Explain the role of pacemaker cells in controlling the heart rate (7)

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9. Describe the double-circulatory system and explain how it is beneficial for humans (7)

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- [1]
2. C [1]
3. C [1]
4. D [1]
5. C [1]
6. atria collect blood from veins (vena cava/pulmonary);
 collect blood while ventricles are contracting;
 atria pump blood into ventricles/ensure ventricles are full;
 ventricles pump blood into arteries/out of the heart;
 ventricles pump blood at high pressure because of their thicker, muscular walls;
 mention of heart valves working with atria and ventricles to keep blood moving;
 left ventricle pumps blood to systems and right ventricle pumps blood to lungs;
 Both left and right ventricles with correct function required for mark to be awarded.
 4 max
7. thick wall to withstand high blood pressures/avoid bursting/leaks;
 many muscle fibres to help pump blood;
 many elastic fibres to stretch and pump blood after each heart beat;
 narrow lumen to maintain high pressure/because blood flows along rapidly;
 thick outer layer of collagen to give strength/prevent aneurism;
 no valves as pressure is high enough to prevent backflow;
 endothelium/smooth inner lining to reduce friction;
 5 max
- (c) one gene determines (ABO) blood groups / one gene for ABO blood groups;
 genes have different/alternative forms called alleles;
 there are three alleles (I^A , I^B and i) of the gene for (ABO) blood groups;
 (ABO) blood groups are an example (of the effect of) multiple alleles
 (in this instance three alleles can result in four phenotypes);
 each individual has two alleles of the gene but only one is passed to
 offspring;
 alleles that are codominant both affect the phenotype in a heterozygote;
 (alleles) I^A and I^B are codominant;
 (alleles) I^A and I^B are dominant over i / i is recessive to I^A and I^B ;
 (genotypes) $I^A I^A$ and $I^A i$ both give blood group A;
 (genotypes) $I^B I^B$ and $I^B i$ both give blood group B;

(genotype) $I^A I^B$ gives blood group AB;
(genotype) ii /homozygous i gives blood group O;
example of a cross involving ABO blood groups;

9 max

(Plus up to **[2]** for quality)