Edexcel IAL Biology A-level

1.6-1.9 - Circulation

Flashcards

Why do large multicellular organisms need transport systems?

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They have a small surface area to volume ratio and high metabolic rate, therefore the rate of diffusion alone would not be fast enough to transport substances to where they are needed.

Give 4 examples of substances transported within organisms

- Oxygen is transported in for respiration
- CO_2 is transported out from respiration
- Dissolved food molecules from digestion
- Waste products such as urea in humans

What is mass transport?

What is mass transport?

The bulk transport of substances to all parts of an organism using mass flow.

Give features of a mass transport system.

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- Vessels
- Transport medium
- A mechanism for maintaining a flow

What is the difference in function between veins, arteries and capillaries?

What is the difference in function between veins, arteries and capillaries?

Arteries carry blood **a**way from the heart

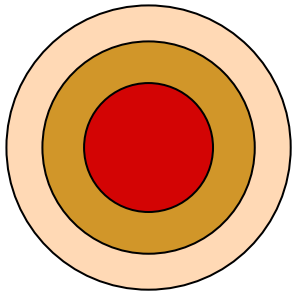
Ve**in**s carry blood towards (**in**to) the heart

Capillaries flow close to tissues for exchange

Describe the structure of arteries

Describe the structure of arteries

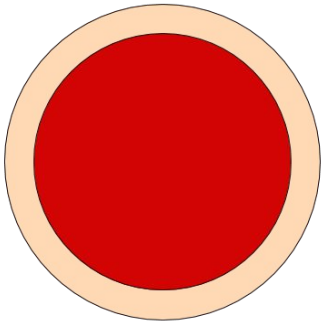
They have thick walls made of muscle and elastic tissue and a small lumen to transport blood under high pressure



Describe the structure of capillaries

Describe the structure of capillaries

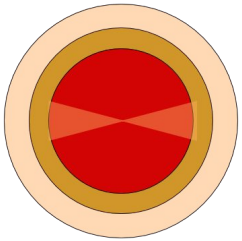
They have thin walls about one cell thick to allow for the easy exchange of substances at the tissues



Describe the structure of veins

Describe the structure of veins

Veins have less muscle and elastic tissue than arteries and they have a larger lumen as the blood is at lower pressure. They also have valves to prevent backflow



Draw a diagram of the human heart, including names of chambers, vessels, and valves

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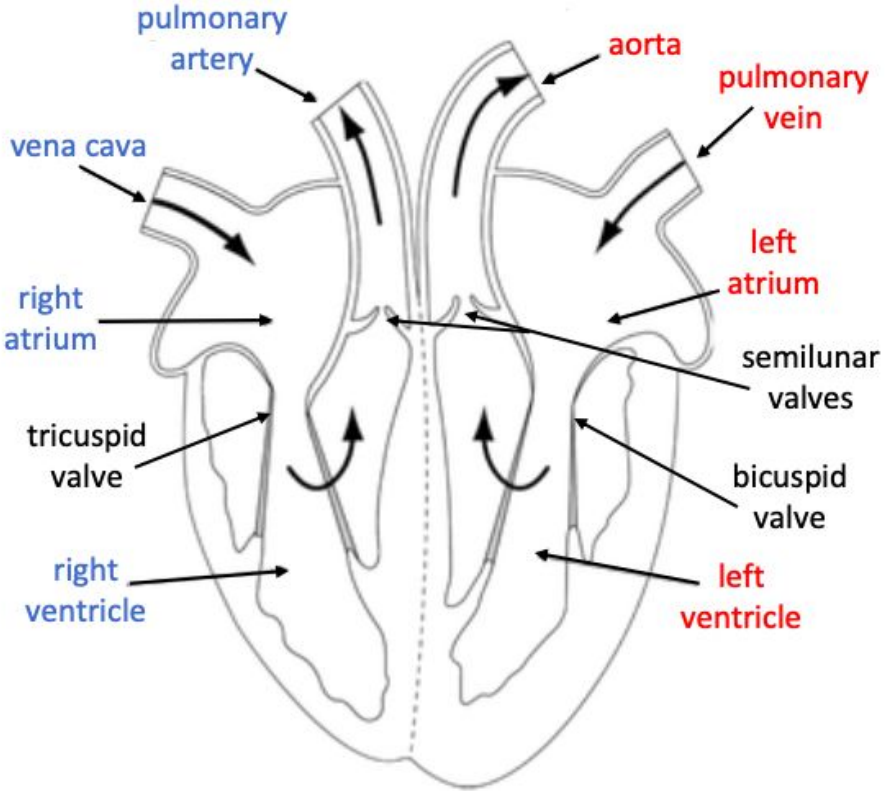

What is the name of the main artery which takes oxygenated blood out of the heart for transport around the body?

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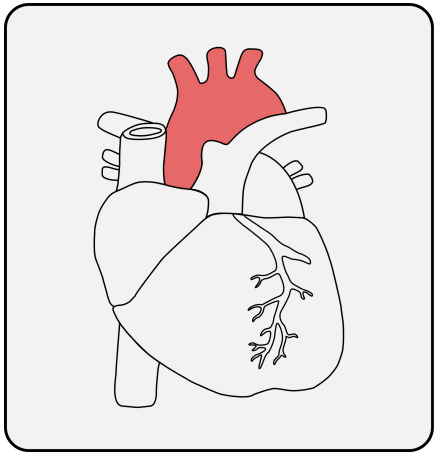
The aorta



What is the name of the main vein which carries deoxygenated blood from the body into the heart?

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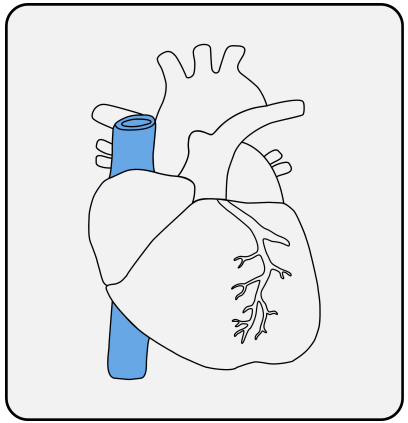
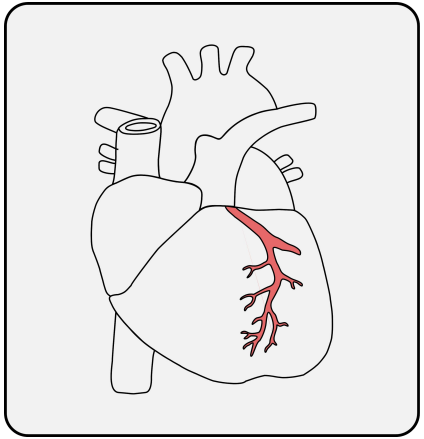
The vena cava



What is the name of the main artery which supplies the heart tissue with oxygenated blood?

What is the name of the main artery which takes oxygenated blood out of the heart for transport around the body?

The coronary artery



What is the name of the artery which transports deoxygenated blood from the heart to the lungs?

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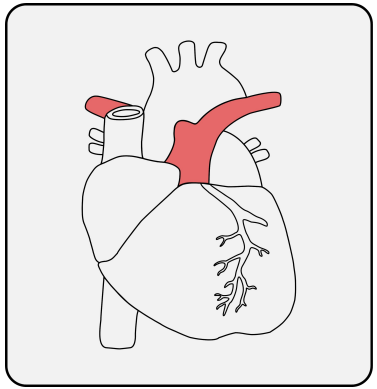
The pulmonary artery



What is the name of the vein which transports oxygenated blood from the lungs back to the heart?

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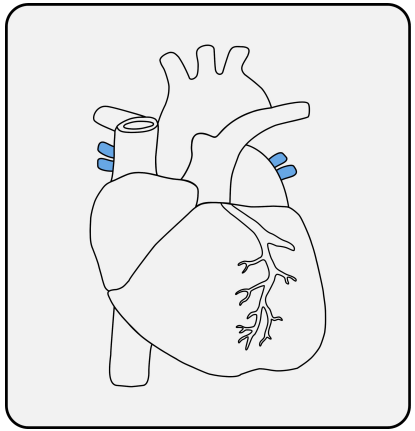
The pulmonary vein



What is the cardiac cycle?

What is the cardiac cycle?

The sequence of events involved in one cycle of contraction and relaxation of the heart. It involves 3 stages: atrial systole, ventricular systole and diastole.

Describe what happens during cardiac diastole.

Describe what happens during cardiac diastole.

The heart is relaxed. Blood enters the atria, increasing the pressure and pushing open the atrioventricular valves. This allows blood to flow into the ventricles. Pressure in the heart is lower than in the arteries, so semilunar valves remain closed

Describe what happens during atrial systole.

Describe what happens during atrial systole.

The atria contract, pushing any remaining blood into the ventricles

Describe what happens during ventricular systole.

Describe what happens during ventricular systole.

The ventricles contract. The pressure increases, closing the atrioventricular valves to prevent backflow, and opening the semilunar valves. Blood flows into the arteries

Which side of the heart receives blood from the body and pumps it to the lungs?

Which side of the heart receives blood from the body and pumps it to the lungs?

The right side of the heart

Which side of the heart receives blood from the lungs and pumps it to the body?

Which side of the heart receives blood from the lungs and pumps it to the body?

The left side of the heart

Why is the wall of the left ventricle thicker than the wall of the right ventricle?

Why is the wall of the left ventricle thicker than the wall of the right ventricle?

The left ventricle has to pump blood around the whole body so the blood needs to be at a higher pressure

Describe the blood flow through the right side of the heart

Describe the blood flow through the right side of the heart

- Deoxygenated blood flows into the right atrium from the vena cava
- This blood passes through the right AV valve into the right ventricle
- The blood is then pumped out of the heart to the lungs through the right SL valve and into the pulmonary artery

Describe the blood flow through the left side of the heart

Describe the blood flow through the left side of the heart

- Blood enters into the left atrium from the pulmonary vein
- The blood is then pumped through the left AV valve into the left ventricle
- The blood is then pumped out through the left SL valve and into the aorta

What is the function of the valves in the heart?

What is the function of the valves in the heart?

The valves prevent backflow of the blood so that it only flows in one direction

What is the name of the wall that separates the right and left sides of the heart?

What is the name of the wall that separates the right and left sides of the heart?

The septum

What type of muscle is the heart made of?

What type of muscle is the heart made of?

Cardiac muscle

Relate the structure of the chambers to their function

Relate the structure of the chambers to their function

- Atria: thin-walled and elastic, so they can stretch when filled with blood
- Ventricles: thick muscular walls pump blood under high pressure. The left ventricle is thicker than the right because it has to pump blood all the way around the body

Relate the structure of arteries to their function

Relate the structure of arteries to their function

Thick, muscular walls to handle high pressure without tearing. Elastic tissue allows recoil. Narrow lumen to maintain pressure

Why are two pumps (left and right) needed instead of one?

Why are two pumps (left and right) needed instead of one?

To maintain blood pressure around the whole body. When blood passes through the narrow capillaries of the lungs, the pressure drops sharply and therefore would not be flowing strongly enough to continue around the whole body. Therefore it is returned to the heart to increase the pressure

Describe the structure of erythrocytes and their function

Describe the structure of erythrocytes and their function.

Biconcave shape, no nucleus, contain lots of haemoglobin. Function is to carry oxygen

Describe the structure of haemoglobin

Describe the structure of haemoglobin

Haemoglobin is a **globular conjugated protein** which has a **quaternary structure** consisting of 2 alpha chains and 2 beta chains which each contain a **haem prosthetic group** which have iron ions that can bind to **oxygen.**

Describe the role of haemoglobin

Describe the role of haemoglobin

Present in red blood cells. Oxygen molecules bind to the haem groups and are carried around the body to where they are needed in respiring tissues

How does partial pressure of oxygen affect oxygen-haemoglobin binding?

How does partial pressure of oxygen affect oxygen-haemoglobin binding?

As partial pressure of oxygen increases, the affinity of haemoglobin for oxygen also increases, so oxygen binds tightly to haemoglobin. When partial pressure is low, oxygen is released from haemoglobin

State 3 ways that carbon dioxide (CO_2) is transported in the blood

State 3 ways that carbon dioxide (CO_2) is transported in the blood

- Some is transported combined with haemoglobin as **carbaminohaemoglobin**
- **Dissolved** in the plasma
- As **hydrogencarbonate ions** (HCO_3^-) from the dissociation of carbonic acid

Explain the Bohr effect

Explain the Bohr effect

As partial pressure of carbon dioxide increases, the conditions become acidic causing haemoglobin to change shape. The affinity of haemoglobin for oxygen therefore decreases, so oxygen is released from haemoglobin

What do oxyhaemoglobin dissociation curves show?

What do oxyhaemoglobin dissociation curves show?

Saturation of haemoglobin with oxygen (in %), plotted against partial pressure of oxygen (in kPa). Curves further to the left show the haemoglobin has a higher affinity for oxygen

Explain the role of carbonic anhydrase in the Bohr effect

Explain the role of carbonic anhydrase in the Bohr effect

- Carbonic anhydrase is present in red blood cells.
- Converts carbon dioxide to carbonic acid, which dissociates to produce H+ ions.
- These combine with the haemoglobin to form haemoglobinic acid.
- Encourages oxygen to dissociate from haemoglobin.

Explain the role of bicarbonate ions (HCO_3^-) in gas exchange

Explain the role of bicarbonate ions (HCO_3^-) in gas exchange

Produced alongside carbonic acid. 70% of carbon dioxide is carried in this form. In the lungs, bicarbonate ions are converted back into carbon dioxide which we breathe out.

Describe the chloride shift

Describe the chloride shift

The intake of chloride ions across a red blood cell membrane. This repolarises the cell after bicarbonate ions have diffused out