Biology A-level: Transport

Transport in Mammals

A recurring theme in biological systems is the surface area to volume ratio. All cells require nutrients and most re need to be removed.

With a small organism this demand can be met by simple diffusion over the body surface but larger or very activ with a pump to ensure that the supply meets the demand of all cells, even those deep within the body.

In mammals, the pump is the heart. Substances are carried in a transport medium of the blood. The blood is con being released out of, or into the blood as it flows through certain vessels called capillaries.

Blood vessels

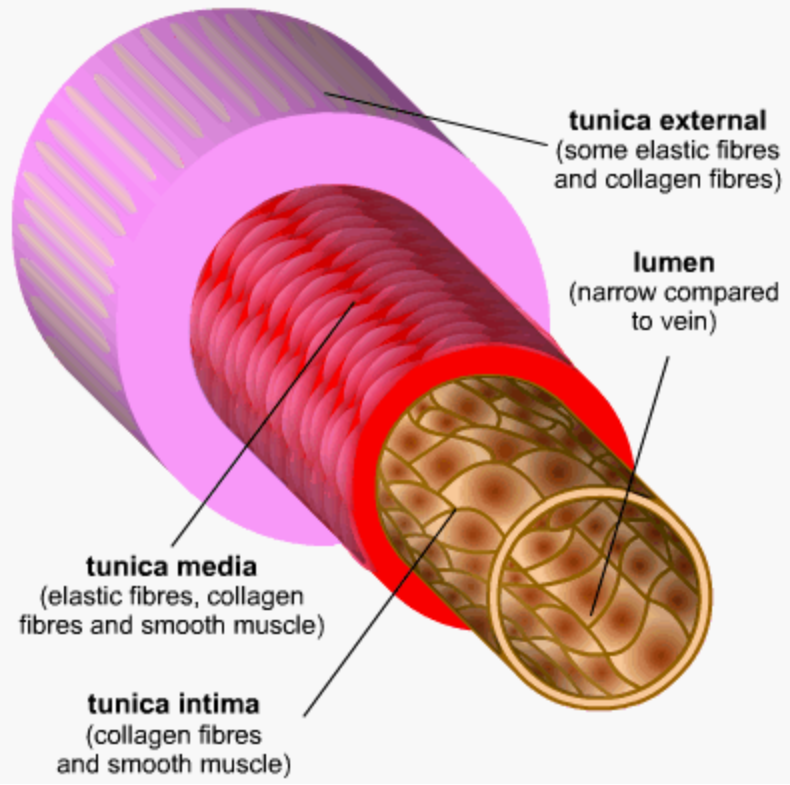
Blood is carried within a closed transport system that is made up of three types of vessel:

- arteries
- capillaries
- veins.

Arteries carry blood **away** from the heart.

Capillaries are the site of the exchange of materials between the blood and tissues. **Veins** take blood **back** into

Arteries



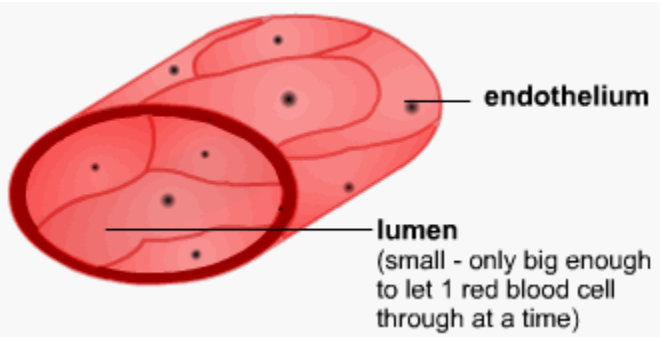
Blood pumped out of the heart is at a very high pressure, so the structure of the arteries must be adapted to this having very thick walls made up of elastic fibres and smooth muscle. These allow the wall to stretch as blood su burst or rupture.

It also means that as the artery increases in diameter, the pressure is reduced a little. After they 'give', the elasti pressure falls. The artery decreases in diameter thus raising the pressure a little.

The lowering of the pressure when it is high, and the raising of it when it is lower produces some smoothing out obvious though when you feel your neck or wrist that it is by no means complete - you can still feel the pulses of heart.

A large artery will split into smaller arterioles that then branch further into many tiny capillaries. Arterioles have w but have a greater proportion of smooth muscle and less elastic tissue. They do not have to withstand as high a ability to contract because of the smooth muscle and regulate the flow of blood to a tissue.

Capillaries



To work efficiently, the capillaries need to be small enough to be in close proximity with small groups of cells anc allow substances to move in and out of the blood.

To enable this there are tiny gaps between the cells making up the wall of the capillary. These allow substances of the tissues. The fluid made up of plasma and dissolved substances is called tissue fluid.

Tissue fluid

Tissue fluid is formed because of the high hydrostatic pressure of the blood at the arteriole end of the capillary th

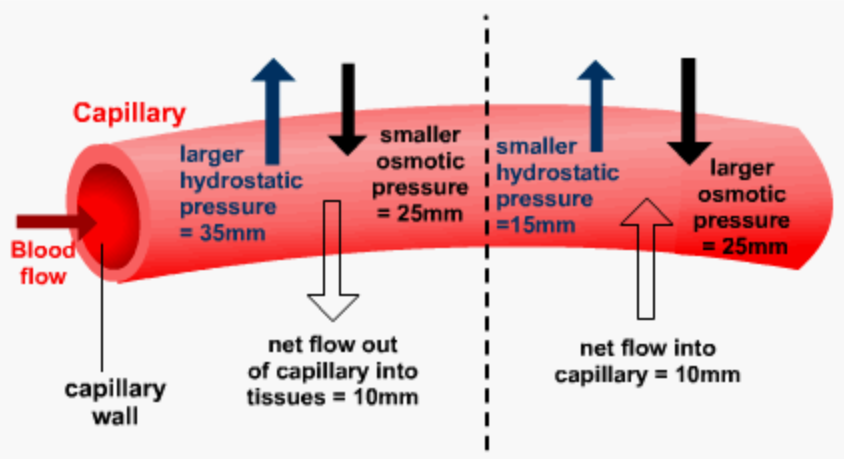
The blood contains plasma proteins giving the blood a relatively high solute potential (and therefore a low water the blood. Since the hydrostatic pressure has a greater effect than the solute potential at the arteriole end, the ne capillary. No blood cells or large proteins leave as they are too big to fit through the gaps.

At the venule end of the capillary, since fluid has been lost, the hydrostatic pressure of the blood is lower and the this, fluid drains back into the blood. At this stage, the useful materials such as amino acids and glucose will hav tissue fluid will now contain waste substances such as carbon dioxide and urea.

About 90% of the fluid which leaks out of the capillaries seeps back in, the remaining 10% is returned to the bloc called lymph. This system is made up of many blind-ending lymph vessels, which allow tissue fluid to flow into th are large enough to allow proteins, which are too big to get into the capillaries, into the lymph vessels. If tissue fl returned to the blood by the lymphatic system, bloating or oedema is the result.

Blood consists of cells bathed in a liquid plasma. When this plasma leaks out of the capillaries, it is called tissue composition to plasma but contains less protein molecules and no red blood cells. White blood cells can escape Lymph is virtually identical in composition to tissue fluid and just has a different name due to its different location

This diagram shows the formation of tissue fluid:

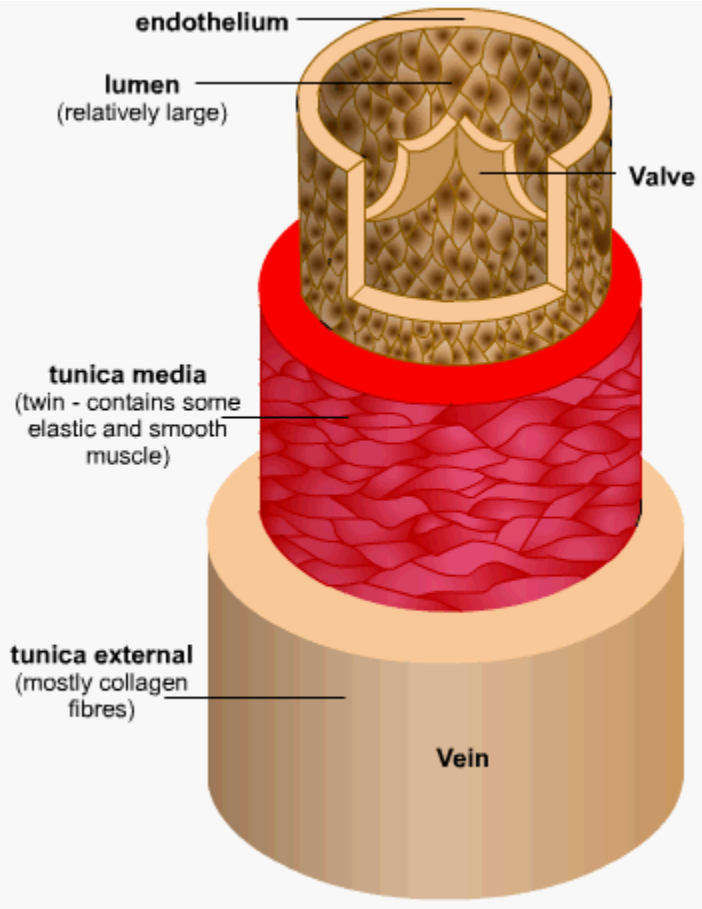


Veins

The capillaries then join to form larger venules which themselves then join to form veins.

Since at this stage, the pressure of the blood is low, blood needs to be 'encouraged' to flow back to the heart. To (particularly important if blood is flowing against gravity) there are valves in the veins. Also the veins pass throug muscles are active in contracting and relaxing, the squeezing on the veins moves blood along but due to the valv

As the pressure is so much lower in the veins than in the arteries, there is little need for the elastic fibres and sm



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