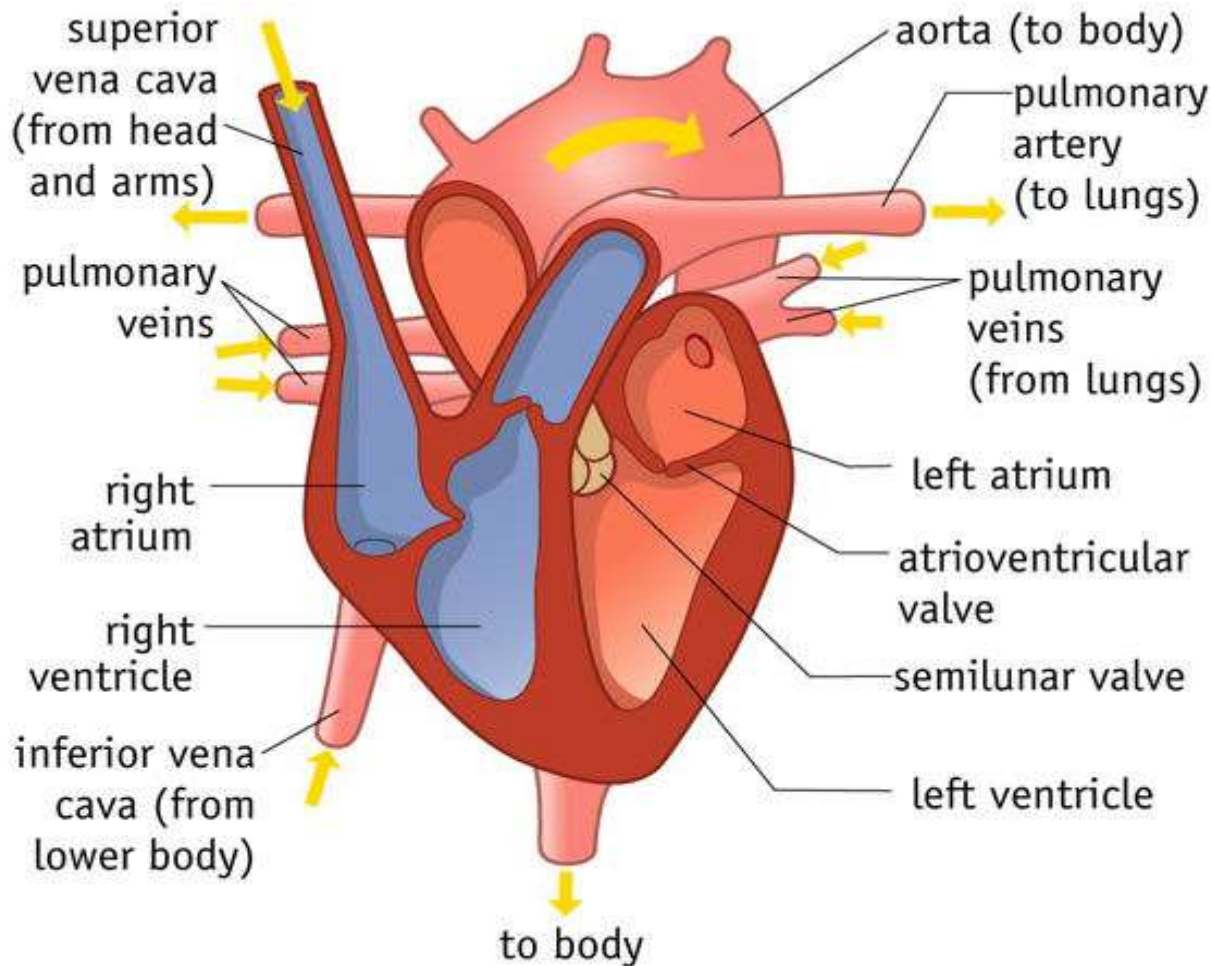


B3.2 Transporting materials



Improving efficiency

- Humans have a double circulatory system.
- Blood can be pumped at a higher pressure.
- More areas of the body receive fully oxygenated blood quickly.

In order to have the double circulatory system we need two pumps...

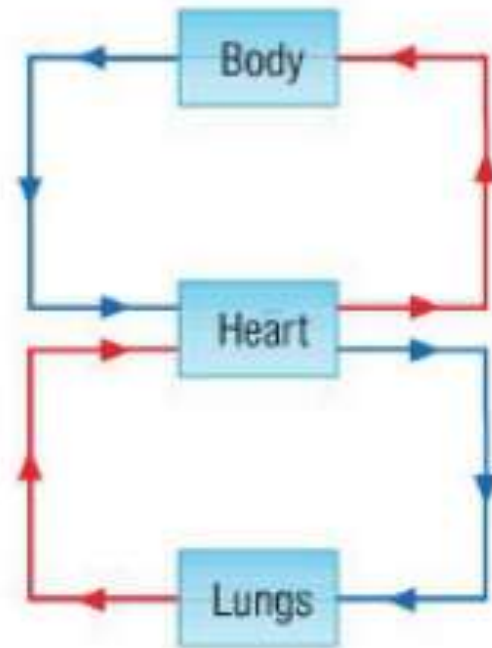


Figure 1 The two separate circulation systems supply the lungs and the rest of the body

Keywords: oxygenated blood, deoxygenated blood, atria, ventricles, vena cava, pulmonary vein, pulmonary artery, aorta.

1. The blood is through the **vena cava** into the **right atrium**
2. The blood moves through the valve and into the **right ventricle**
3. It is pumped through the **pulmonary artery** to the **lungs** to become **oxygenated**
4. The blood travels back to the heart through the **pulmonary vein** and into the **left atrium**
5. It is pumped into the **left ventricle** and out through the **aorta**
6. The blood travels around the body

Vessels

Veins

Carry blood towards the heart that is usually low in oxygen and a deeply purple-red colour. These do not have a pulse and often have valves to prevent backflow as it moves back to the heart.

Venules

Branches of veins that connect the capillaries to the veins.

Capillaries

These form a huge network of tiny vessels linking the arterioles and venules. They are narrow and have very thin wall which enables substance like oxygen and glucose to easily diffuse through. Waste products, like carbon dioxide, can move back across as waste.

Arterioles

Branches of arteries that connect the capillaries to the arteries.

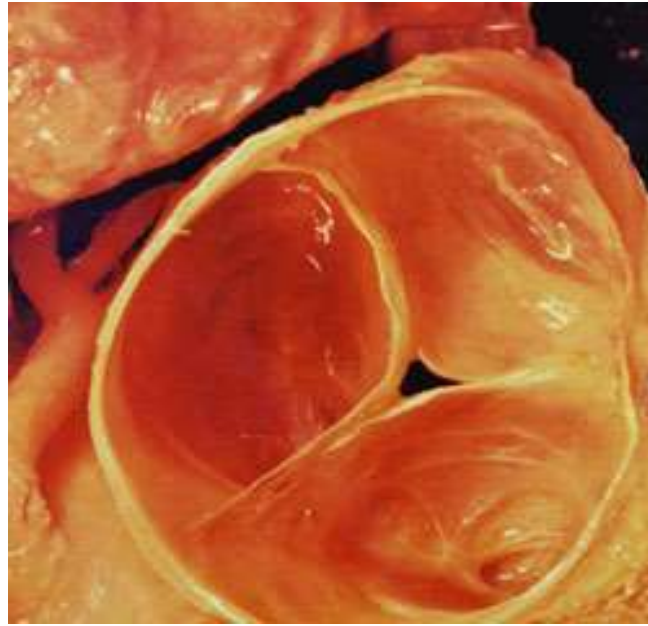
Arteries

Carry blood away from the heart that is bright red and oxygenated.

The arteries stretch as the blood is forced through them and go back into shape afterwards, the blood in these is under pressure so you can use them to feel a pulse.

The coronary arteries that take blood to the heart can narrow as you age. They can also become narrow when fatty deposits form a lining in the vessel.

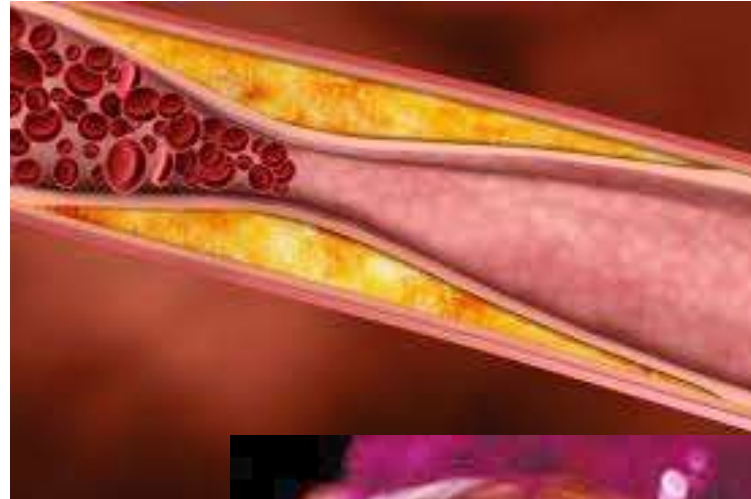
This can cause pain, a heart attack and even death.



The heart valves keep blood flowing in the right direction. They withstand a lot of pressure and can begin to weaken and leak.

This can cause breathlessness and if left unsolved can cause death.

My heart
hurts!

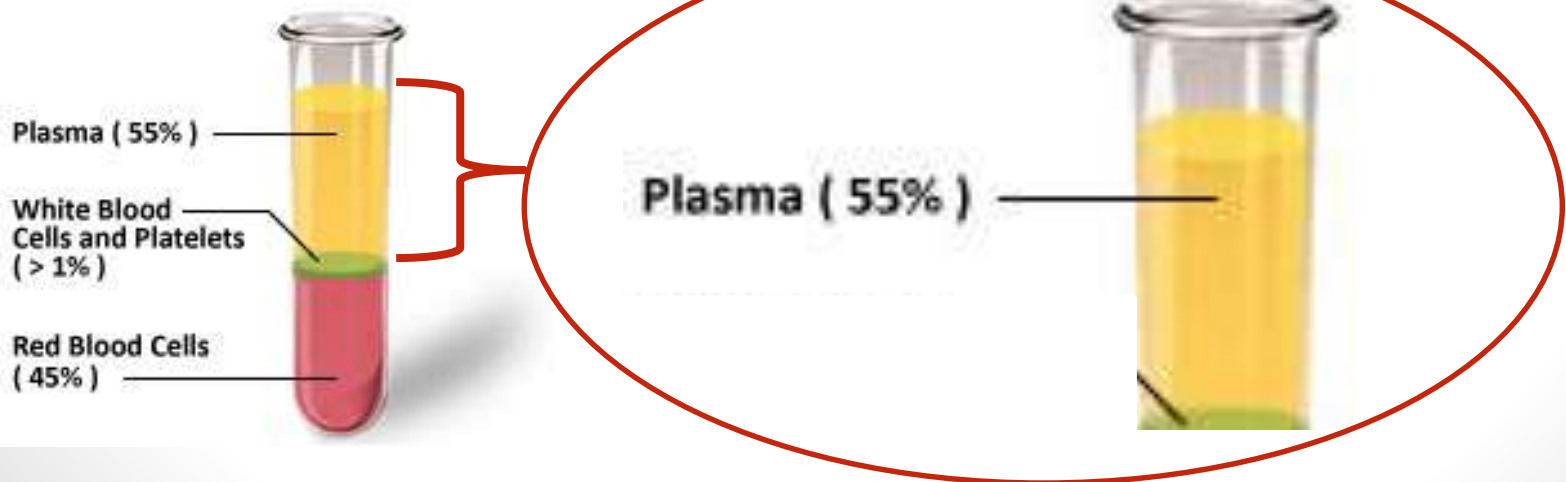


The coronary arteries that take blood to the heart can narrow as you age. They can also become narrow when fatty deposits form a lining in the vessel.

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Plasma

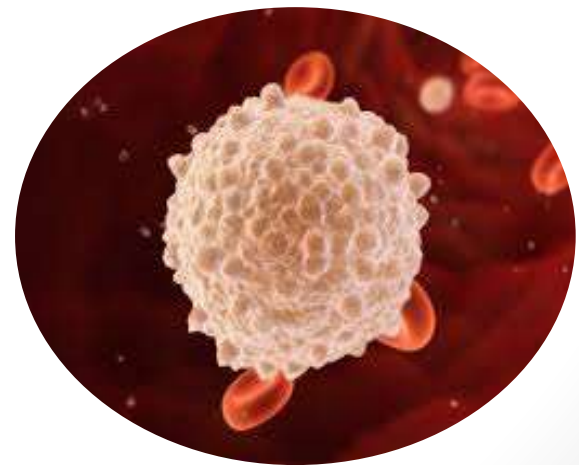
- Plasma carries red blood cells, white blood cells and platelets.
- A yellow liquid
- Plasma carries carbon dioxide to the lungs
- It carries urea to the kidneys (a waste product from the liver breaking down protein)
- All the small, soluble products of digestion are carried in the plasma



White blood cells

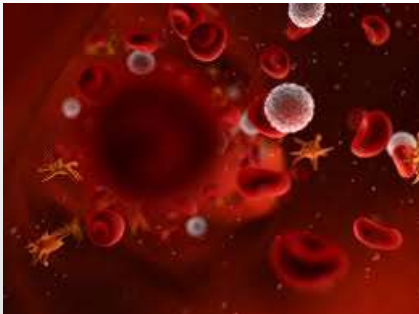
- White blood cells are much bigger than red blood cells and there are fewer of them
- They have a nucleus and form part of the body's defence system against pathogens
- Some white blood cells form antibodies
- Other digest bacteria and viruses

Draw a picture of this big guy and label with the information



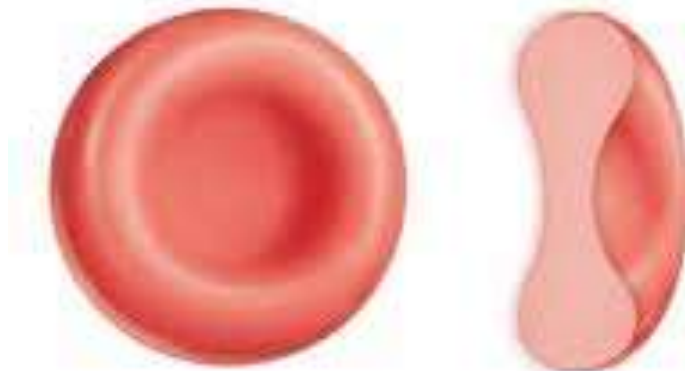
Platelets

- Small fragments of cells with no nucleus
- Help to clot wounds and produce protein threads
- These threads capture red blood cells and make more platelets to form a jelly-like clot
- This stops you bleeding
- The clot dries and hardens to form a scab
- The scab protects the next skin as it grows and stops pathogens entering the body



Red blood cells

- Have no nucleus to SA
- Are concave to increase SA
- More haemoglobin can be packed in.
- Haemoglobin reversibly binds loosely with oxygen to become oxyhaemoglobin (bright red in colour), so it can transport more oxygen around the body for respiration



Plasma or saline

- The simplest way to replace blood in an emergency is with donated plasma or even saline (salt water).
- Plasma carries a little dissolved oxygen. However, saline does not carry oxygen or food. It just replaces the lost blood volume to keep your blood pressure as normal as possible.

Perfluorocarbons (PFCs)

- Perfluorocarbons are more sophisticated form of artificial blood. These are very non-reactive chemicals that can carry dissolved gases around your body. Oxygen dissolves readily in PFCs.
- However, PFCs do not dissolve in water so getting them into the blood is difficult. They do not carry as much oxygen as real whole blood so large amounts are needed to supply the body. PFCs are also broken down very quickly and can cause severe side-effects.

Haemoglobin-based products

- A solution is made that does not contain any red blood cells. The haemoglobin is often taken from human or animal blood. However, it can be made synthetically or by genetically engineered bacteria.
- The haemoglobin in the solution carries even more oxygen than normal blood. Another advantage is that it does not always need to be kept in a fridge.
- However, this type of artificial blood is broken down very quickly in the body. It only lasts for 20 to 30 hours and does not clot or fight diseases. It has also caused severe problems in patients in trials.

Artificial hearts

- When people need a heart transplant they need to find an organ donor whose tissue matches
- Unfortunately, there are never enough hearts to go around and many people die before they can get new hearts
- Scientists have been trying to discover an artificial heart for years



Temporary hearts can support your natural heart until it can be replaced.

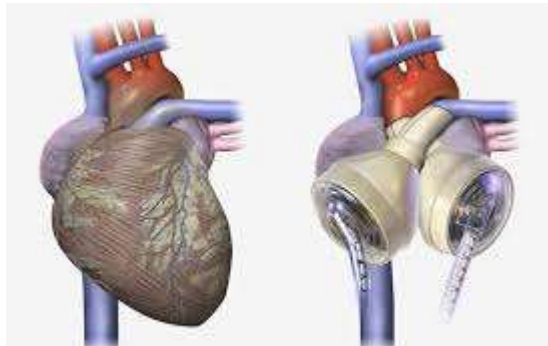
Replacing hearts permanently with artificial ones is still a long way off.

Since 2004, 1000 people worldwide have been fitted with a completely artificial heart.

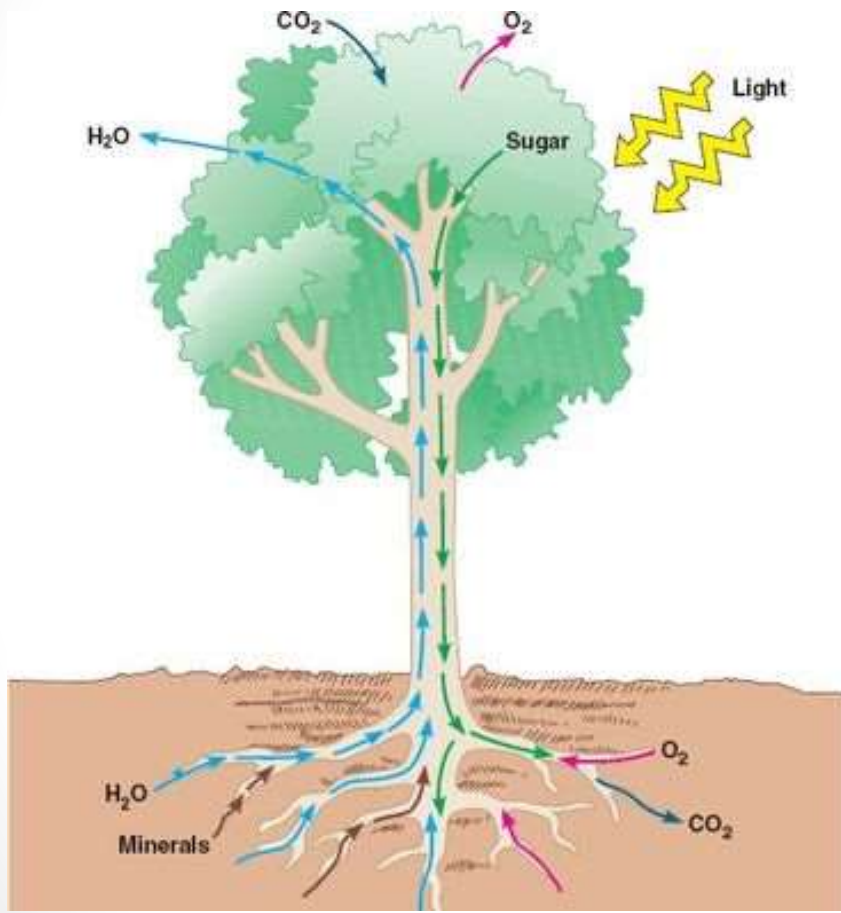
Artificial hearts need a lot of machinery to keep them working, most people have to remain in hospital until a real one can be found

There is always a risk of blood clotting with an artificial heart, which can kill the patient.

However in 2010, one man left hospital to go home with a completely artificial heart, he used a backpack for all the machinery.



Transport in plants



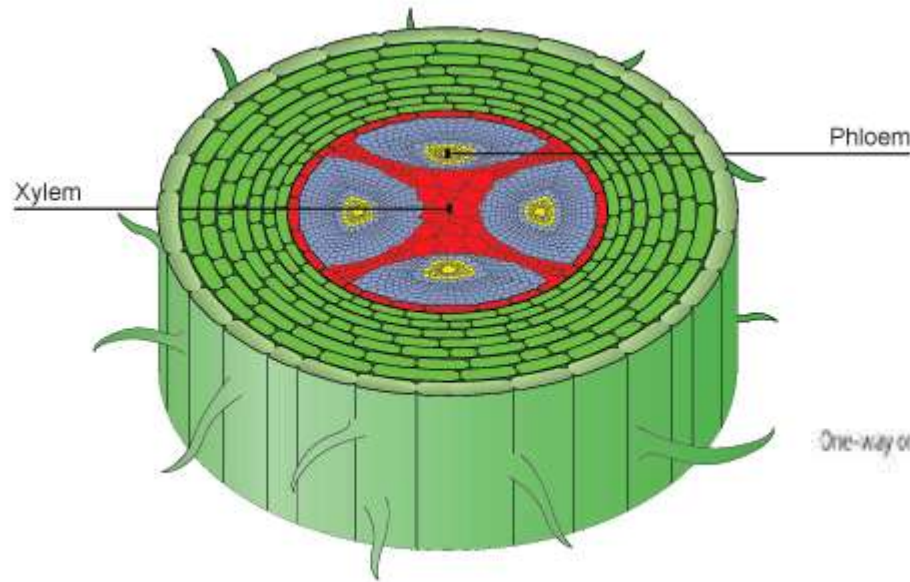
Just like us plants have intricate transport systems to function.

They have 2 main transport systems:

Phloem

Xylem

Phloem VS Xylem



dead tissue
 transports water
 from roots to the
 top of the tree
 for photosynthesis

transports organic
 nutrients from
 leaves to storage
 organs where it is used
 for energy in winter

- Phloem is living tissue

