

Osmosis is the diffusion of water through a **partially permeable membrane**.

Partially permeable membranes have tiny holes in them.

Plant cells have inelastic cell walls. Water enters the cell by osmosis and fills the vacuole. This pushes against the cell wall, making the cell **turgid**.

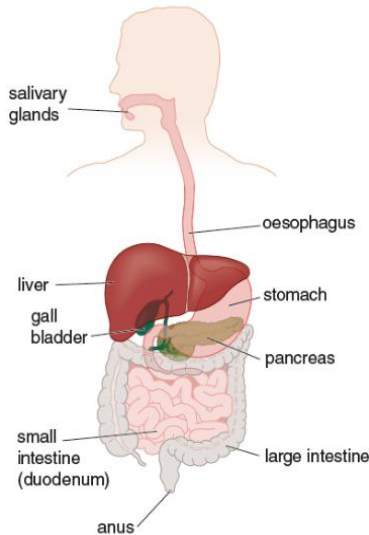
If water moves out the cell by osmosis, the vacuole shrinks and the cell becomes **flaccid**.

Cells can absorb substances that are at low concentration in their surroundings by **active transport**.

The **DIGESTIVE SYSTEM** is a long tube that runs from the mouth to the anus.

The **small intestine** is an effective exchange surface because:

- 7m long, there is ample time for absorption of soluble molecules as food travels along
- Very thin, permeable membrane for easy diffusion
- Villi, with tiny projections called microvilli, increasing the surface area for absorption
- Blood capillaries transport molecules away, maintaining the concentration gradient for diffusion



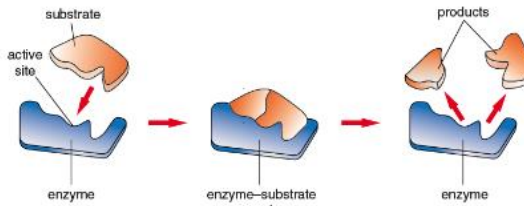
Enzyme	Site of production	Reaction
Carbohydrase	Salivary glands, pancreas, small intestine	carbohydrates → simple sugars
Protease	Stomach, pancreas, small intestine	proteins → amino acids
Lipase	Pancreas	lipids (fats) → fatty acids + glycerol

ENZYMES are **biological catalysts**. Enzymes catalyse most chemical reactions that happen in cells, for example, respiration, protein synthesis and photosynthesis. Enzymes help to:

- Break down large molecules into smaller ones
- Build large molecules from smaller ones
- Change one molecule into another molecule.

Enzyme-controlled reactions are affected by:

1. **PH**
2. **Temperature**



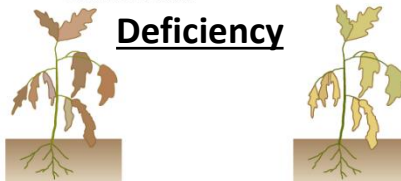
PLANTS & MINERALS - Fertilisers containing minerals can be added to the soil to improve plant growth. Fertilisers contain **nitrates**, **phosphates**, **potassium** and **magnesium**. It is the root hairs that absorb the water and the minerals.

Each root hair cell has a long thin exchange surface reaching out between the soil particles. Water is absorbed by osmosis and mineral ions are absorbed by active transport.

lacking nitrates → poor growth • yellow leaves
lacking phosphate → poor root growth • discoloured leaves



lacking potassium → poor fruits and flowers • discoloured leaves
lacking magnesium → yellow leaves



Deficiency

Exchange Surface	Adaptation
Skin	Thin membrane for diffusion. Moist for dissolving gases. Organisms usually have a large SA:V.
Tracheae	Spiracles can close to prevent evaporation, to keep exchange surfaces moist. Tracheae have many branches to increase surface area insects pump air in and out of tracheae. Tracheae are stiffened to prevent collapse short diffusion distance.
Gills	Feathery projections to increase the surface area. Very thin walls for diffusion. Water pumped over the gills .
Lungs	Alveoli have thin membrane. Millions of alveoli to provide large surface area Moist for dissolving gases. Constant ventilation to maintain the concentration gradient.

All respiratory exchange surfaces have:

1. Large surface area
2. Thin permeable membrane
3. A moist exchange surface.

Gas exchange happens at a respiratory surface.

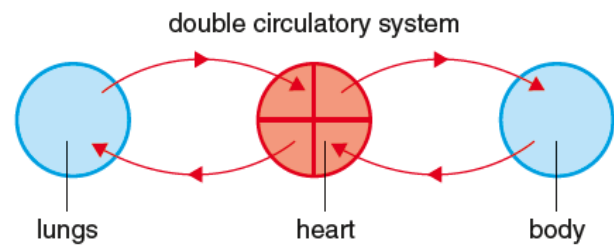
This is a membrane that separates the external environment and the interior of the body.

Unicellular organisms use their cell membrane for gas exchange, but for large organisms the exchange surface is part of specialised organs like

Mineral	Use in the plant
nitrate, containing nitrogen (N)	to make amino acids for protein synthesis
phosphate, containing phosphorus (P)	in respiration to make DNA and new cell membranes
potassium (K)	in respiration in photosynthesis to make enzymes
magnesium (Mg)	needed to make chlorophyll for photosynthesis

In closed **circulatory systems**, blood flows in vessels. There are two types of closed circulatory systems: a single circulation (for example, in fish); the blood flows in one circuit around the body

1. A **double circulation** (for example, in humans); the blood flows in two circuits around the body: from the heart to the lungs
2. From the heart to the rest of the body.



Arteries	Veins	Capillaries
Carry blood from the heart	Carry blood to the heart	Carry blood from arteries to veins
Blood under high pressure with a pulse	Blood under low pressure, flows smoothly	Pressure falls and pulse disappears
Thick walls, not permeable	Thinner walls, not permeable	Walls are one cell thick and permeable
Small lumen	Large lumen	
No valves	Valves along their length prevent backflow of blood	No valves
Carry oxygenated blood (except pulmonary artery)	Carry deoxygenated blood (except pulmonary vein)	Blood slowly loses its oxygen

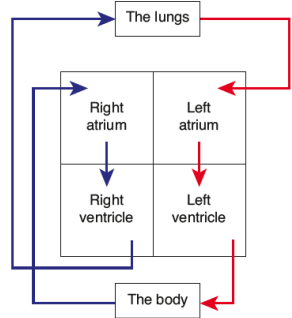
The Heart!

Each pump has an upper chamber (**atrium**) that receives blood and a lower chamber (**ventricle**) that pumps blood out. Both **atria** fill and pump blood out at the same time, as do both ventricles. The natural resting heart rate is controlled by a group of cells located in the right atrium that act as a **pacemaker**.

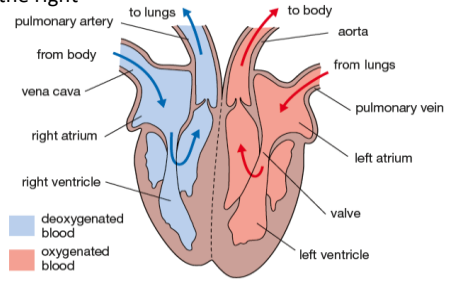
Blood from the lungs contains **oxygen** and enters the heart at the left atrium. It passes into the **left ventricle** and is pumped out to the body. Blood from the body contains very little oxygen and enters the heart at the right atrium, passes into the right ventricle and is pumped to the lungs to be oxygenated

The heart has four main blood vessels:

- The **pulmonary vein** transports oxygenated blood from the lungs to the left atrium.
- The **aorta** (main artery) transports oxygenated blood from the left ventricle to the body.
- The **vena cava** (main vein) transports blood from the body to the right atrium.
- The **pulmonary artery** transports deoxygenated blood from the right ventricle to the lungs.



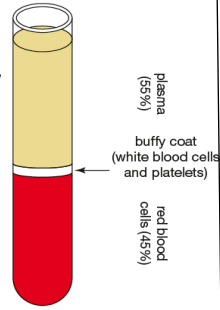
Valves between the atria and the ventricles prevent the backflow of blood. They open to let blood through and then shut!



Blood!

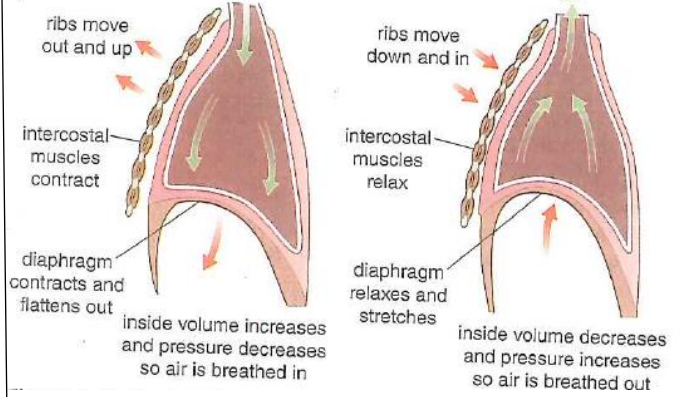
The blood is made up of four key parts:

- Plasma** transports substances around the body for example, carbon dioxide.
- Red blood cells** carry oxygen from the lungs to body cells.
- White blood cells** help to protect the body against infection.
- Platelets** are cell fragments which help the clotting process at wound sites.



The **lungs** are in the thorax. They are surrounded by the ribcage to protect them. **Between the ribs are the intercostal muscles.** These help to **ventilate** (move air into and out of) the lungs. Gas exchange happens in the **alveoli (ADAPTATIONS – THIN and around lots of CAPILLARIES).**

Under the lungs is the **muscular diaphragm.** This also helps to ventilate the lungs. Air is filtered, warmed and moistened in the mouth and nasal passages. It passes into the trachea, through one of the bronchi into the lungs. In the lungs, air passes through the many bronchioles until it reaches an **alveolus** (air sac). **Oxygen then passes across the specialised cell membrane of the alveolus into the blood.**



In **coronary heart disease**, fatty material builds up inside the coronary arteries. Blood flow is reduced and less glucose and oxygen reach the heart for respiration. Less energy is available for the heart to contract. If cells are starved of nutrients, they can die and a heart attack may happen.

Factors:

Gender, age, diet and if they smoke or not.

Treatments:

1. Artificial pacemakers
2. Heart valve replacement
3. Statins
4. Stents

