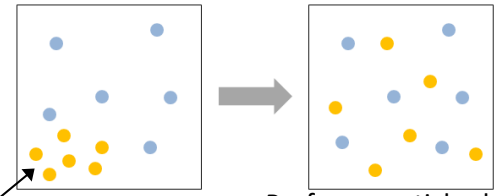
Exchange of Substances

Diffusion (of gases or liquids)

The **spreading out** of particles from an area of **high concentration** to an area of **low concentration**.



High concentration of perfume particles

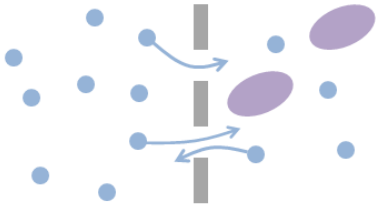
Perfume particles have diffused

The greater the concentration gradient the faster the rate of diffusion. A higher temperature also increase the rate of diffusion as particles have more energy, so move faster.

Osmosis

The movement of **water** particles across a **partially permeable membrane** from a **high concentration** to a **low concentration**.

A partially permeable membrane has very small holes in it, allowing water molecules to pass through but not larger molecules.



Water Sucrose solution

There is a net (overall) movement of water into the sucrose solution.

Exchange Surfaces

Lungs: oxygen diffuses into the blood from the alveoli. CO_2 moves in the opposite direction. Alveoli have a large surface area, very thin walls, a large blood supply and moist lining to maximise the rate of diffusion.

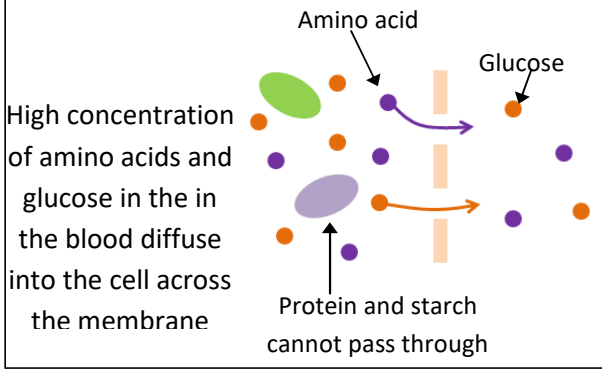
Villi: these increase the surface area of the small intestine. They have a single layer of cells and a large blood supply to maximise the rate of diffusion.

Fish gills: oxygen diffuses from the water into the fish's blood through the gills. Tiny structures called laminae increase the surface area of the gills.

Leaves: CO_2 needs to diffuse into the leaf for photosynthesis, O_2 and water diffuse out through stomata. Leaves are flat to increase the surface area for diffusion. There are also lots of air spaces inside the leaf to increase the area for diffusion to occur.

Diffusion across cell membranes

Cell membranes allow very small substances to diffuse across them (oxygen, glucose, amino acids, water). Large molecules cannot pass (starch, protein).



Diffusion happens both ways but overall particles will move from a high concentration to a low concentration. A larger surface area will increase the rate of diffusion.

Active Transport

A process that moves substances against the concentration gradient (from an area of low concentration to high concentration.

In **root hair cells** there is already a high concentration of **minerals** inside the cell compared to the soil. They take in more minerals by **active transport**. Active transport require **energy** (from respiration).

Active transport allows substances (glucose, nutrients) to **move from the gut** (low concentration) **into the blood** (high concentration).