

CIE Biology GCSE

3: Movement in and out of cells

Notes

The **cell membrane** and **cell wall** control what substances enter and exit the cell. Molecules such as glucose and proteins move into the cell for use in **metabolic reactions** and **storage**. Whereas **waste products** such as carbon dioxide and lactic acid are transported out into the blood to be excreted from the body.

Diffusion

Diffusion is the **net movement** of particles from an **area of high concentration to an area of low concentration** down the **concentration gradient**, as a result of their random movement. The energy for diffusion comes from the **kinetic energy** of the molecules.

Solutes and gases, such as carbon dioxide and oxygen, are able to diffuse in and out of cells across the cell membrane. This is important as these substances are crucial to **metabolic reactions** which occur within the cell, for example respiration and photosynthesis. Without them, the processes would not occur, and the cell would die.

Factors affecting rate of diffusion:

- **Surface area** - As the surface area increases, the rate of diffusion increases. This is because there is more space available for the substances to diffuse through.
- **Temperature** - As temperature increases, the rate of diffusion increases. This is because the molecules gain kinetic energy and thus move faster.
- **Concentration gradient** - As the concentration gradient increases, rate of diffusion increases.
- **Diffusion distance** - A greater diffusion distance slows the rate of diffusion as molecules must travel further.

Osmosis

Osmosis is the **net movement** of water molecules from an **area of higher water potential to an area of lower water potential** through a **partially permeable membrane**.

Key terms:

- **Turgid** - cells are described as turgid when they are swollen due to a high-water content.
- **Turgor pressure** - The pressure on the cell wall from the cell membrane pushing upon it. This is a result of the cell becoming turgid as water moves into the cell via osmosis.

- **Flaccid** - Occurs when water moves out of the cell via osmosis. The cell shrinks but the cell membrane does not peel away from the cell wall. If more water leaves the cell, it becomes plasmolyzed.
- **Plasmolysis** - Occurs when there is too little water in cells. In plant cells, the cell membrane peels away from the cell wall.

Water moves in and out of cells through the cell membrane via osmosis. Water is important to **provide support** for the cell structure through maintaining the **turgor pressure**. It also provides a **medium in which metabolic reactions occur**. Water has a high specific heat capacity, thus acts as a temperature buffer. This is important as it **maintains the optimum temperature for enzyme reactions**.

Water particles diffuse from regions of high-water potential to regions of low water potential, i.e. they move from **dilute solutions to concentrated solutions**. When the cell is more concentrated than the surrounding cells, water molecules diffuse into the cell via osmosis, making it **turgid**. When it is less concentrated than the surrounding cells, water molecules will leave the cell, making it **flaccid** and leading to **plasmolysis**. This effect can be investigated by placing cells in solutions of different concentrations.

Active transport

Active transport is the movement of molecules **against a concentration** gradient using **energy from respiration**. Molecules are actively transported from **regions of low concentrations to regions of higher concentration**.

Carrier proteins:

Carrier proteins facilitate active transport. They are **embedded in the cell membrane** and allow passage through it. Molecules from the side with lower concentration **bind** to the carrier protein. The carrier protein then **changes shape using energy** from respiration. This forces the molecule to **move through the membrane** to the side with high concentration, where it is released.

Examples of active transport:

- **Uptake of ions by root hair cells** - plants take up ions such as nitrates and magnesium from the soil via root hair cells. The concentration of ions in the root hair cell is greater

than the concentration of ions in the soil. Energy from respiration is therefore used to transport ions into the cell against the concentration gradient.

- **Uptake of glucose** - glucose is taken up in the small intestine and kidney tubules. Glucose moves against the concentration gradient through **carrier proteins**.