CAIE Biology A-level

Topic 4: Cell Membranes and Transport

Flashcards

State the components of the phospholipid bilayer.

State the components of the phospholipid bilayer.

- Phospholipids
- Cholesterol
- Extrinsic & intrinsic proteins
- Glycolipids
- Glycoproteins

Describe the fluid mosaic model of membranes.

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- **Fluid** - individual phospholipids can move laterally or flip between monolayers, membrane is flexible
- **Mosaic** - extrinsic and intrinsic proteins of different sizes and shapes form a pattern

State the role of phospholipids in the phospholipid bilayer.

State the role of phospholipids in the phospholipid bilayer.

Form basic structure. Hydrophilic heads face outwards and hydrophobic tails face inwards on either side of the bilayer. These interactions allow lipid-soluble molecules to cross but prevent water-soluble molecules from crossing.

Explain the role of cholesterol in membranes.

Explain the role of cholesterol in membranes.

- Steroid molecule
- Connects phospholipids, providing strength to membrane and regulating its fluidity

State the role of glycolipids in cell membranes.

State the role of glycolipids in cell membranes.

Involved in cell signalling and cell recognition.

Outline the functions of extrinsic proteins in membranes.

Outline the functions of extrinsic proteins in membranes.

- Binding sites/receptors e.g. for hormones and drugs
- Help cells adhere to each other
- Involved in cell signalling

State the role of glycoproteins in cell membranes.

State the role of glycoproteins in cell membranes.

Serve as recognition sites for chemicals.

Outline the functions of intrinsic proteins in membranes.

Outline the functions of intrinsic proteins in membranes.

- Electron carriers (respiration/photosynthesis)
- Channel proteins (facilitated diffusion)
- Carrier proteins (facilitated diffusion/active transport)

How are cholesterol, glycolipids and glycoproteins arranged in the bilayer.

How are cholesterol, glycolipids and glycoproteins arranged in the bilayer.

- **Cholesterol** is dispersed in the membrane alongside the phospholipids
- **Glycolipids** and **glycoproteins** extend from either lipid or protein components within the membrane. This region is known collectively as the glycocalyx

Describe the functions of the cell surface membrane.

Describe the functions of the cell surface membrane.

- Isolates cytoplasm from extracellular environment
- Selectively permeable to regulate transport of substances
- Involved in cell signalling/cell recognition

Outline the process of cell signalling.

Outline the process of cell signalling.

Specific **stimulus** (e.g. light) → **sender cell** manufactures chemical to be sent → molecules (e.g. ligands) released by **exocytosis** and transported through bloodstream to **target cell** → binds to **complementary receptor** → effector cell **stimulated**

Define osmosis.

Define osmosis.

The diffusion of water across a **partially permeable membrane** from an area of **higher water potential** to an area of **lower water potential**. This occurs until a **dynamic equilibrium** is established.

What is water potential (ψ)?

What is water potential (ψ)?

- Pressure created by water molecules, measured in kPa
- Ψ of pure water at 25°C and 100 kPa is 0
- More solute, ψ more negative
- Movement always from a region of high ψ to a region of low ψ

How does osmosis affect plant and animal cells?

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Osmosis **INTO** cell:

- **Plant** - protoplast pushes against cell wall, turgid
- **Animal** - lysis

Osmosis **OUT** of cell:

- **Plant** - protoplast pulls away from cell wall, flaccid
- **Animal** - crenation

Define simple diffusion.

Define simple diffusion.

- Net spreading out of particles from an area of higher concentration to an area of lower concentration, down their concentration gradient
- **Passive process** requiring **no energy** from hydrolysis of ATP

Define facilitated diffusion.

Define facilitated diffusion.

The net movement of substances from a higher concentration to a lower concentration (down their concentration gradient) through **transport proteins without the use of energy**.

Explain how channel proteins work.

Explain how channel proteins work.

- Form **selective pores** in phospholipid bilayer
- Allow polar and charged molecules to pass through
- Some channel proteins may be **gated**, opening or closing depending on the binding of a specific molecule or ion

Explain how carrier proteins work.

Explain how carrier proteins work.

- **Specific** shape for the molecule they transport
- Binds to complementary molecule, **conformational change** passes molecule to other side of membrane

Define active transport.

Define active transport.

Active movement of substances from a low concentration to a higher concentration (**against** the concentration gradient) with the use of energy in the form of **ATP**.

Outline the process of active transport in cell membranes.

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- Molecule binds to **carrier protein** with **complementary** shape
- **ATP** binds to **separate binding site** on carrier protein
- Carrier protein changes shape, moving molecules to the other side of the membrane
- Molecules released via **ATP hydrolysis**
- Carrier protein changes back to original shape

Define exocytosis.

Define exocytosis.

The **bulk transport** of substances **out** of a cell via a vesicle that fuses with the plasma membrane using energy in the form of **ATP**.

Define endocytosis.

Define endocytosis.

The **bulk uptake** of substances **into** a cell by invagination of the membrane to form a vesicle trapping the substances inside the cell with the use of energy in the form of **ATP**.

Name 5 factors that affect the rate of diffusion.

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- Temperature
- Diffusion distance
- Surface area
- Size of molecule
- Difference in concentration (how steep the concentration gradient is)

How would you calculate the surface area to volume ratio of a cube?

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First:

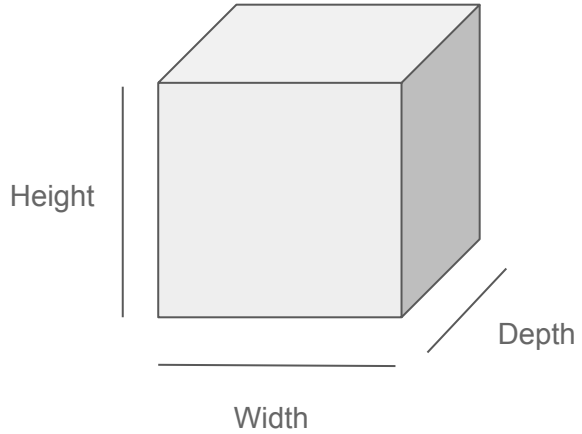
Surface area = 6 × (height × width)

Then:

Volume = depth × (height × width)

Finally:

State the surface area to volume ratio and simplify. As size increases, SA:V decreases.



How does surface area to volume ratio impact the rate of diffusion?

How does surface area to volume ratio impact the rate of diffusion?

The greater the surface area to volume ratio, the greater the rate of diffusion.