

Membranes and membrane transport

What does amphipathic mean?

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Why do phospholipids form bilayers in water?

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Why is a lipid bilayer a barrier to ions and polar molecules?

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Name two molecules that cross membranes by simple diffusion between phospholipids.

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Define osmosis.

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What are aquaporins?

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How do channel proteins make membranes selectively permeable?

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What do pump proteins use to move particles against a concentration gradient?

Hydrophilic heads face the water on both sides and the hydrophobic tails point inwards, away from water, forming the core.

Having a hydrophilic part and a hydrophobic part, like a phospholipid with its phosphate head and hydrocarbon tails.

Oxygen and carbon dioxide (small, non-polar molecules).

Its hydrophobic hydrocarbon core has low permeability to hydrophilic particles and large molecules.

Integral channel proteins that let water molecules cross the membrane rapidly, in single file.

The net movement of water across a partially permeable membrane from a lower to a higher solute concentration.

Energy from ATP (active transport).

The size and charges of the pore let only specific ions through, and only when the channel is open.

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What does permeability by simple diffusion depend on?

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Distinguish integral and peripheral proteins.

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Where are the carbohydrate chains of glycoproteins and glycolipids?

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Give two roles of glycoproteins and glycolipids.

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What should a drawing of the fluid mosaic model include?

Organelles and compartmentalization

Define organelle.

Organelles and compartmentalization

Which three structures are not considered organelles?

Organelles and compartmentalization

Which invention made it possible to study the function of individual organelles?

Integral proteins are embedded in one or both lipid layers. Peripheral proteins are attached to one surface of the bilayer.

Only the size of the particle and whether it is hydrophilic or hydrophobic. It is not selective.

Cell recognition and cell adhesion.

On the extracellular side of the plasma membrane.

A discrete subunit of a cell that is adapted to perform a specific function.

Phospholipid bilayer, integral and peripheral proteins, glycoproteins, cholesterol, and labelled hydrophilic and hydrophobic regions.

The ultracentrifuge, used for cell fractionation.

The cell wall, the cytoskeleton and the cytoplasm.

Organelles and compartmentalization

What is the advantage of separating the nucleus from the cytoplasm?

Organelles and compartmentalization

Why are lysosomal enzymes kept in a compartment?

Cell specialization

What is differentiation?

Cell specialization

How do gradients affect gene expression in an early embryo?

Cell specialization

What are the two properties of stem cells?

Cell specialization

Name two stem cell niches in adult humans.

Cell specialization

Totipotent, pluripotent, multipotent: what can each form?

Cell specialization

Name some of the largest and smallest human cells.

They are hydrolytic enzymes that would digest the cell's own components if free in the cytoplasm.

mRNA can be modified after transcription before it meets ribosomes for translation.

The concentration of a signal molecule differs with position, so cells in different positions express different genes.

The development of unspecialized cells into specialized cells by expressing different genes.

Bone marrow and hair follicles.

They can divide endlessly and differentiate along different pathways.

Large: egg (about 110 μm), neurons with long axons, striated muscle fibres. Small: sperm, red blood cells (about 7-8 μm).

Totipotent: any cell type, including placenta. Pluripotent: any body cell. Multipotent: a limited range of related cells.

Cell specialization

What is the SA:V of a cube of side L?

Cell specialization

Why does SA:V constrain cell size?

Exchange depends on surface area but the need for exchange depends on volume, which increases faster as a cell grows.

$$6L^2 \div L^3 = 6 \div L, \text{ so SA:V falls as } L \text{ increases.}$$