

Membranes and membrane transport

What does amphipathic mean?

Membranes and membrane transport

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.

Membranes and membrane transport

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?

Membranes and membrane transport **HL only**

Why do unsaturated fatty acids keep membranes fluid?

Membranes and membrane transport **HL only**

Give an example of membrane composition adapted to habitat.

Membranes and membrane transport **HL only**

How does cholesterol modulate membrane fluidity?

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.

Cis double bonds kink their chains so they pack loosely, giving lower melting points.

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

It stabilises membranes at higher temperatures and prevents stiffening at lower temperatures.

Antarctic fish have more unsaturated fatty acids in their membranes than related fish from warmer waters, keeping membranes fluid in the cold.

Membranes and membrane transport **HL only**

Distinguish endocytosis and exocytosis.

Membranes and membrane transport **HL only**

Give an example of a neurotransmitter-gated ion channel.

Membranes and membrane transport **HL only**

Name two voltage-gated channels in neurons.

Membranes and membrane transport **HL only**

What does one cycle of the sodium-potassium pump do?

Membranes and membrane transport **HL only**

Why is sodium-dependent glucose cotransport called indirect active transport?

Membranes and membrane transport **HL only**

Where are sodium-dependent glucose cotransporters important?

Membranes and membrane transport **HL only**

What are CAMs?

Membranes and membrane transport **HL only**

Do all cell-cell junctions use the same CAM?

The nicotinic acetylcholine receptor, which opens when acetylcholine binds, letting Na^+ in.

Endocytosis: membrane folds in to form a vesicle, taking material in. Exocytosis: a vesicle fuses with the plasma membrane, releasing its contents.

Uses one ATP to pump three Na^+ out of the cell and two K^+ in.

Voltage-gated sodium channels and voltage-gated potassium channels.

Glucose absorption by small intestine cells and glucose reabsorption by proximal convoluted tubule cells in the nephron.

It uses the Na^+ gradient made by the ATP-driven sodium-potassium pump, not ATP directly, to move glucose against its gradient.

No. Different forms of CAM are used for different types of cell-cell junction.

Cell-adhesion molecules: membrane proteins that bind cells together to form tissues.

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What kind of molecules are most CAMs?

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?

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?

Organelles and compartmentalization **HL only**

Why is the intermembrane space of a mitochondrion small?

Organelles and compartmentalization **HL only**

What is the role of cristae?

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

Membrane glycoproteins that project from the cell surface and bind to CAMs on neighbouring cells.

The ultracentrifuge, used for cell fractionation.

The cell wall, the cytoskeleton and the cytoplasm.

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.

Folds of the inner membrane that give a large surface area for electron transport chains and ATP synthase.

So a high proton concentration builds up quickly, giving a steep gradient for ATP production.

Organelles and compartmentalization **HL only**

Where are the photosystems of a chloroplast?

Organelles and compartmentalization **HL only**

What is compartmentalized in the stroma?

Organelles and compartmentalization **HL only**

Why does the nuclear membrane need pores?

Organelles and compartmentalization **HL only**

What happens to the nuclear membrane in mitosis and meiosis?

Organelles and compartmentalization **HL only**

Contrast the proteins made by free ribosomes and by ribosomes on the rER.

Organelles and compartmentalization **HL only**

What is the role of the Golgi apparatus?

Organelles and compartmentalization **HL only**

What is the role of clathrin?

Organelles and compartmentalization **HL only**

Give two functions of vesicles.

The enzymes and substrates of the Calvin cycle.

In the thylakoid membranes, which have a large surface area.

It breaks into vesicles so spindle microtubules can reach the chromosomes, then re-forms afterwards.

So mRNA can leave the nucleus and proteins needed inside the nucleus can enter.

Processing proteins from the rER, for example adding carbohydrate, and packaging them into vesicles for secretion.

Free ribosomes: proteins retained in the cell. rER ribosomes: proteins for transport within the cell or for secretion.

Any two: carrying proteins from rER to Golgi; secretion by exocytosis; lysosomes; taking material in by endocytosis.

It forms a lattice coat on the cytoplasmic side of a membrane that curves it into a bud, forming a vesicle.

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.

Cell specialization

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

Cell specialization

Why does SA:V constrain cell size?

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.

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

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

Cell specialization **HL only**

Name three adaptations that increase the SA:V of cells.

Cell specialization **HL only**

How are type I pneumocytes adapted?

Cell specialization **HL only**

How are type II pneumocytes adapted?

Cell specialization **HL only**

Compare cardiac muscle cells and striated muscle fibres.

Cell specialization **HL only**

Suggest why cardiac muscle cells are branched.

Cell specialization **HL only**

Why is a striated muscle fibre an atypical cell?

Cell specialization **HL only**

What are the acrosome and midpiece of a sperm for?

Cell specialization **HL only**

How do cortical granules prevent polyspermy?

They are extremely thin, giving a short diffusion distance for gases.

Flattening (erythrocytes), microvilli and invagination (proximal convoluted tubule cells).

Both have contractile myofibrils. Cardiac: branched, short, one nucleus. Striated: unbranched, long, many nuclei.

Many lamellar bodies (secretory vesicles) that discharge surfactant into the alveolar lumen.

It has one continuous plasma membrane but forms by fusion of cells and has many nuclei.

Branches joined at intercalated discs form a network, so impulses spread quickly and the heart contracts as a unit.

After one sperm enters, they release their contents by exocytosis, hardening the zona pellucida.

Acrosome: enzymes to digest a path through the zona pellucida. Midpiece: mitochondria making ATP for the flagellum.

Cell specialization **HL only**

Name three adaptations of the human egg.

Large size with nutrients in the cytoplasm; a zona pellucida; cortical granules.