Card C · Net movement and mechanisms

Particles move randomly in both directions. “Net movement” compares those opposing movements. For a permitted neutral substance, simple diffusion has net movement down its concentration gradient through the bilayer, without cellular energy supplied to that transport. Small nonpolar molecules such as oxygen can take this route.

Facilitated diffusion uses a suitable channel or carrier and moves down the relevant gradient, without cellular energy supplied to that transport. A route being a protein does not make it active. For charged substances the relevant electrochemical gradient combines concentration and electrical effects. Do not settle their net passive direction from concentration alone.

Protein-mediated active transport is coupled to an energy source and can maintain movement against a gradient. Energy can come directly from ATP or indirectly from a stored ion gradient. Our simplified pump cases explicitly use ATP coupling; this does not mean all active transport uses ATP directly. An energy-coupled pump is not just an open channel.

At dynamic equilibrium, opposing molecular movements continue but there is no net movement for that substance under the stated stable conditions. A labelled difference without membrane permeability information is insufficient to predict crossing.

Transport file T: neutral molecule Q is 8 mmol/L outside and 2 mmol/L inside. Q cannot cross the bare bilayer but has a suitable passive carrier. Neutral molecule R is 1 mmol/L outside and 5 mmol/L inside; an ATP-coupled pump is explicitly carrying R inward. Oxygen is 6 mmol/L outside and 2 mmol/L inside and can cross the bilayer. These concentrations are invented teaching values, not physiological records.

Slot 13 · Draw a justified net arrow

Use Card C's Transport File T. For Q, R and oxygen, name the route, net direction and relevant energy statement. Explain why an arrow describes net movement. A separate ion is 10 mmol/L outside and 2 mmol/L inside; a suitable

Route, water, vesicle · continued

channel is open but no electrical conditions are given. Can concentration alone settle its net direction? Explain the information you still need.

Your explanation · words, directed marks or a sketch

Substance / route
Net direction / evidence
Energy / missing information

Route, water, vesicle

Year 11 Biology · ordinary

Card D · Osmosis with stated conditions

Osmosis is net water movement across a selectively permeable membrane down a water-potential gradient. For the simple cases here, one neutral solute cannot cross, water can cross, temperature is equal, and initial hydrostatic pressure is equal. Under those conditions, the side with more dissolved solute has lower water potential, so initial net water movement is toward that side. Solute itself is not the substance moving by osmosis.

File O: a flexible model pouch contains 0.30 mol/L of impermeant neutral solute. Its surrounding solution contains 0.10 mol/L of the same solute. At the stated equal temperature and equal initial pressure, initial net water movement is into the pouch. We have not supplied enough information for final volume, time or how a real cell survives.

If pressure differs or is unknown, solute concentration alone may not determine net water direction. A cell wall can contribute to pressure. Water molecules still move both ways when net movement is zero. These are initial predictions about supplied model conditions, not instructions to prepare solutions or change a person's hydration.

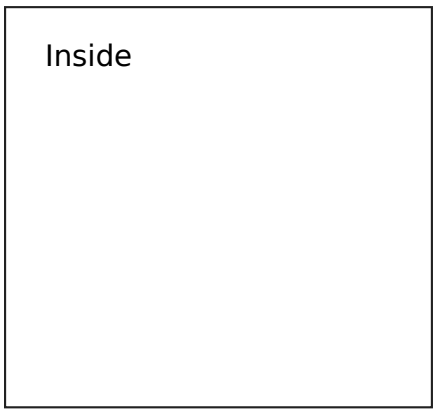
Slot 14 · Which material crosses?

Use File O in Card D. State what can cross, the temperature and pressure conditions, and the initial net water direction. Give a reason without saying that solute moves by osmosis. Use Card E to distinguish V and X, explaining one feature of each sequence. Name one thing these descriptions cannot tell you about a real cell.

Route, water, vesicle · continued

Year 11 Biology · ordinary

Your explanation · words, directed marks or a sketch



Surroundings

Permeability / temperature / initial pressure / net water

Reason / moving substance / model limit

Route, water, vesicle

Year 11 Biology · ordinary

Card E · Crossing by vesicles

Endocytosis encloses material in a membrane-bound vesicle formed from the cell boundary. Exocytosis releases vesicle contents when a vesicle fuses with that boundary. These are energy-requiring cellular processes, different from a single molecule passing through a channel or bilayer. A large particle enclosed by membrane is not simply “diffusing through a large hole.”

File V has three described frames: 1, a large external particle near the plasma membrane; 2, the membrane wraps around the particle; 3, a closed vesicle lies inside. This represents endocytosis. File X has an internal vesicle approaching the membrane, fusion, then contents outside: exocytosis. The frames are original conceptual descriptions, not filmed events. Neither frame set identifies the specific organism, cargo chemistry or measured rate.

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Your explanation · words, directed marks or a sketch

V frame 1	V frame 2	V frame 3
X frame 1	X frame 2	X frame 3