NAME _____ CLASS _____ DATE _____

IB BIOLOGY · B2.1

Membranes and membrane transport

Notes to fill in alongside the guide. Each numbered block matches a chapter of the guide, and of the lesson slides. Write in the gaps, answer the cues, annotate the figures, and sum up each section in your own words.

BY THE END YOU CAN

- [ ] Explain why phospholipids and other amphipathic lipids form bilayers in water B2.1.1
- [ ] Explain why the hydrophobic core of a bilayer is a barrier to ions, polar molecules and large molecules B2.1.2
- [ ] Describe simple diffusion of oxygen and carbon dioxide between the phospholipids B2.1.3
- [ ] Tell integral from peripheral proteins by where they sit in the membrane B2.1.4
- [ ] Explain osmosis across membranes and how aquaporins speed it up B2.1.5
- [ ] Explain how channel proteins let specific ions diffuse through when open but not when closed B2.1.6
- [ ] Explain how pump proteins use ATP to move particles against a concentration gradient B2.1.7
- [ ] Compare the selectivity of simple diffusion with facilitated diffusion and active transport B2.1.8
- [ ] Describe glycoproteins and glycolipids, where their sugars face and their roles in adhesion and recognition B2.1.9
- [ ] Draw the fluid mosaic model with integral and peripheral proteins, glycoproteins, phospholipids and cholesterol, and its hydrophobic and hydrophilic regions B2.1.10
- [ ] Relate the fatty acids in a bilayer to its fluidity, with an example of a membrane adapted to its habitat B2.1.11
- [ ] Explain where cholesterol sits and how it moderates membrane fluidity B2.1.12
- [ ] Explain how fluidity lets vesicles form and fuse, in endocytosis and exocytosis B2.1.13
- [ ] Describe neurotransmitter-gated and voltage-gated ion channels in neurons B2.1.14
- [ ] Describe the sodium-potassium pump as an exchange transporter and its role in the membrane potential B2.1.15
- [ ] Explain sodium-dependent glucose cotransport as indirect active transport, in the small intestine and the nephron B2.1.16
- [ ] Describe how cell-adhesion molecules hold cells together in tissues B2.1.17

01 A skin that builds itself

B2.1.1

CUES

Predict: Phospholipids are shaken in oil instead of water. How would they arrange themselves?

What is meant by amphipathic?

What is meant by lipid bilayer?

NOTES

1 A molecule with a hydrophilic part and a hydrophobic part is _____.

2 The result is a sheet two molecules thick: a _____.

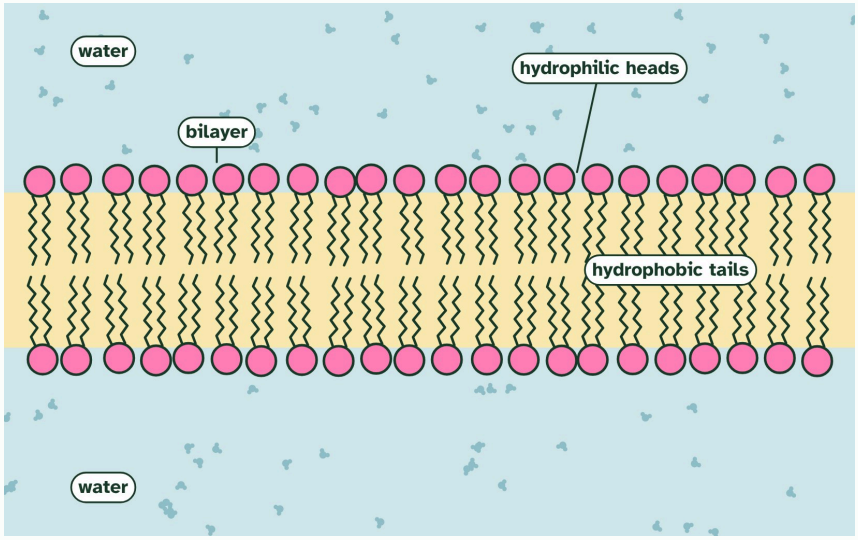
3 Phospholipids are _____: hydrophilic head, hydrophobic tails.

4 The bilayer is continuous: _____.

Your own notes

ANNOTATE THE FIGURE

Annotate this still from the animation (Watch it happen: a bilayer builds itself): what is happening, and why?



SPOT THE MISTAKE

What do students often get wrong about lipid bilayers as the basis of cell membranes? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 01 in two or three sentences of your own.

02 A wall with gaps for small things

B2.1.2 B2.1.3

CUES

Predict: Rank these from fastest to slowest across a bare bilayer: oxygen, glucose, sodium ions.

What is meant by permeability?

What is meant by simple diffusion?

NOTES

1 The bilayer has a low _____ to all of these, so it is an effective barrier between the watery cytoplasm and the watery fluid outside.

2 They cross by _____: random movement carries more of them from the side where they are more concentrated, so the net movement is down the concentration gradient.

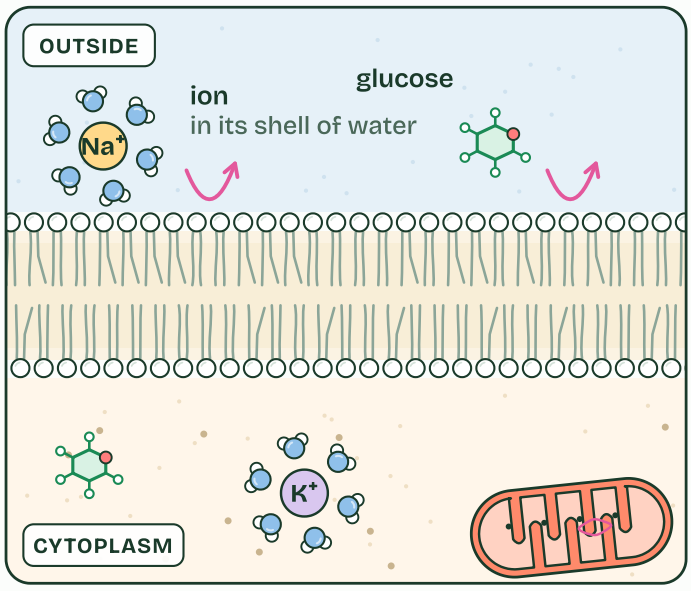
3 Small non-polar molecules such as O_2 and CO_2 cross by _____.

4 _____ is passive and goes down the concentration gradient.

Your own notes

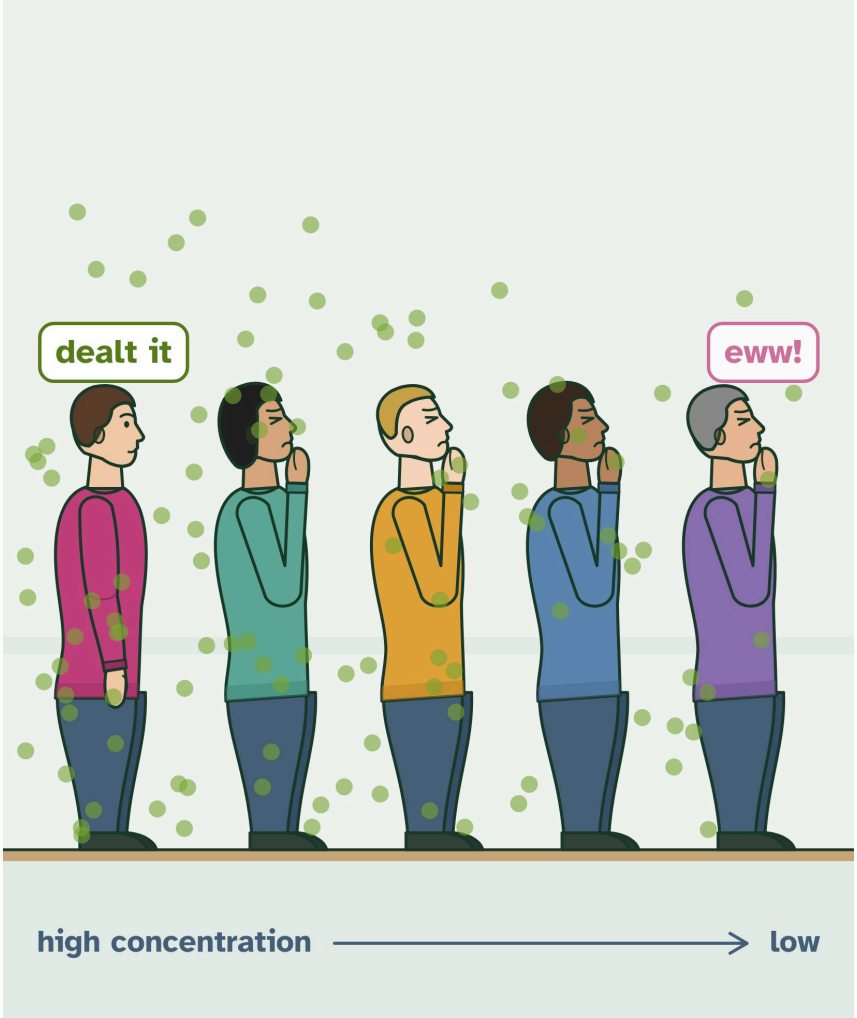
ANNOTATE THE FIGURE

Number the 3 steps on the figure and note what happens at each: 1 Oxygen, carbon dioxide; 2 Water; 3 Ions, polar molecules.



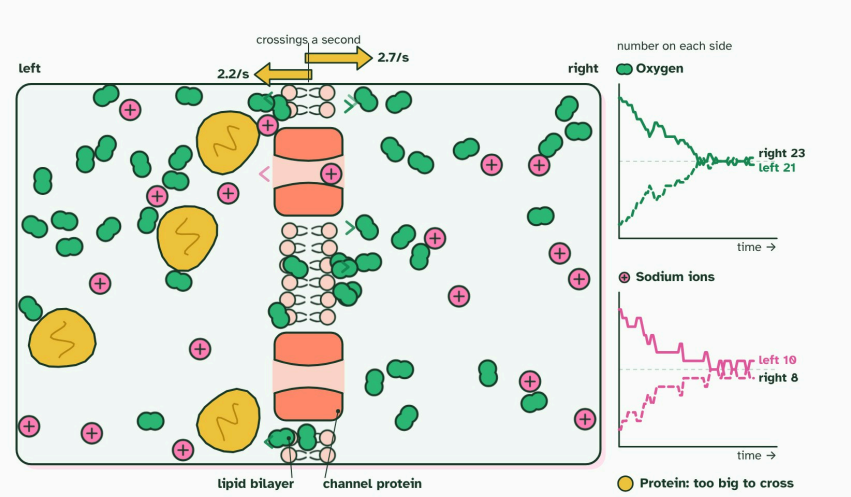
ANNOTATE THE FIGURE

Annotate this still from the animation (Who smelt it first?): what is happening, and why?



ANNOTATE THE FIGURE

Annotate this still from the animation (Diffusion across a membrane): what is happening, and why?



SPOT THE MISTAKE

What do students often get wrong about lipid bilayers as barriers Simple diffusion across membranes? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 02 in two or three sentences of your own.

03 Proteins in it and on it

B2.1.4

CUES

Predict: A protein is removed from a membrane only by a detergent that breaks up the bilayer. What kind is it most likely to be?

What is meant by integral proteins?

What is meant by peripheral proteins?

NOTES

1 _____ are embedded in the bilayer.

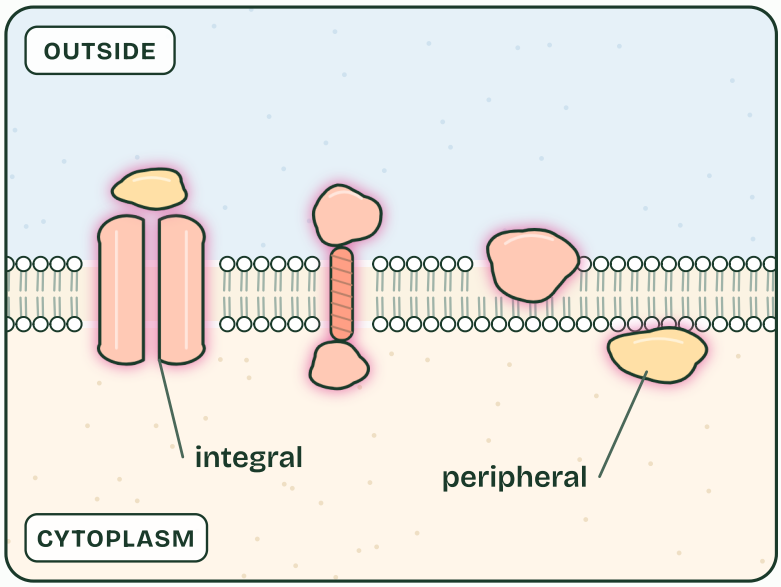
2 The part among the tails is hydrophobic, which holds the protein in place. _____ are not embedded at all.

3 Peripheral: _____.

Your own notes

ANNOTATE THE FIGURE

Label the key parts and add a note on what it shows.



SPOT THE MISTAKE

What do students often get wrong about integral and peripheral proteins in membranes? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 03 in two or three sentences of your own.

04 Water's own door

B2.1.5

CUES

Predict: A drug blocks the aquaporins in a cell placed in pure water. What happens?

What is meant by osmosis?

What is meant by aquaporins?

NOTES

1 So there is a net movement of water towards the higher solute concentration: _____.

2 Many cells have _____: integral proteins with a narrow pore lined with hydrophilic groups.

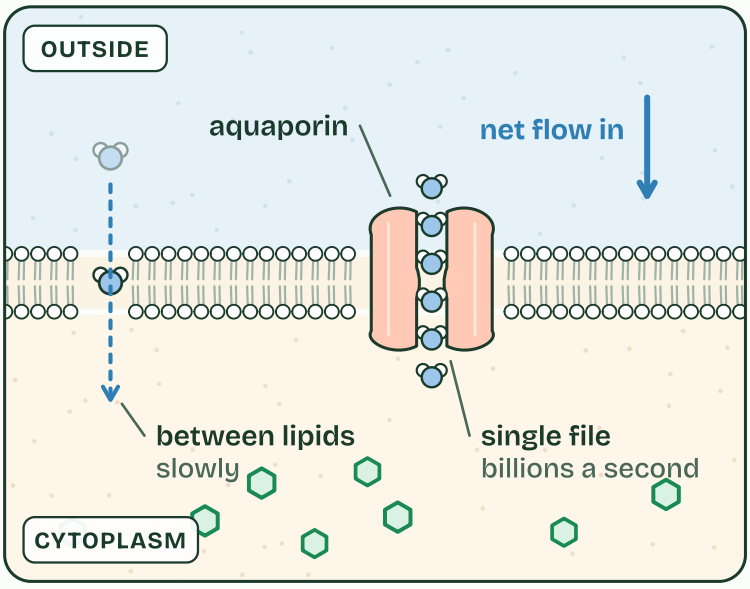
3 _____: net water movement towards the higher solute concentration.

4 _____ let water through much faster, in single file, and keep ions out.

Your own notes

ANNOTATE THE FIGURE

Number the 3 steps on the figure and note what happens at each: 1 between the phospholipids; 2 aquaporin; 3 net flow in.



SPOT THE MISTAKE

What do students often get wrong about movement of water molecules across membranes by osmosis and the role of aquaporins? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 04 in two or three sentences of your own.

05 Channels open, pumps push

B2.1.6 B2.1.7 B2.1.8

CUES

Predict: A poison stops ATP being made in a cell. Which movement stops first?

What is meant by channel protein?

What is meant by facilitated diffusion?

What is meant by pump protein?

What is meant by active transport?

NOTES

1 A _____ has a pore through its middle, lined with hydrophilic groups.

2 When it is open, ions diffuse through, down their concentration gradient; when it is shut, none pass. This is _____: still passive, still down the gradient, but only for the particles that fit.

3 A _____ moves particles the other way, from low to high concentration.

4 It binds a specific particle on one side, uses energy from ATP to change shape, and releases the particle on the other side. That is _____.

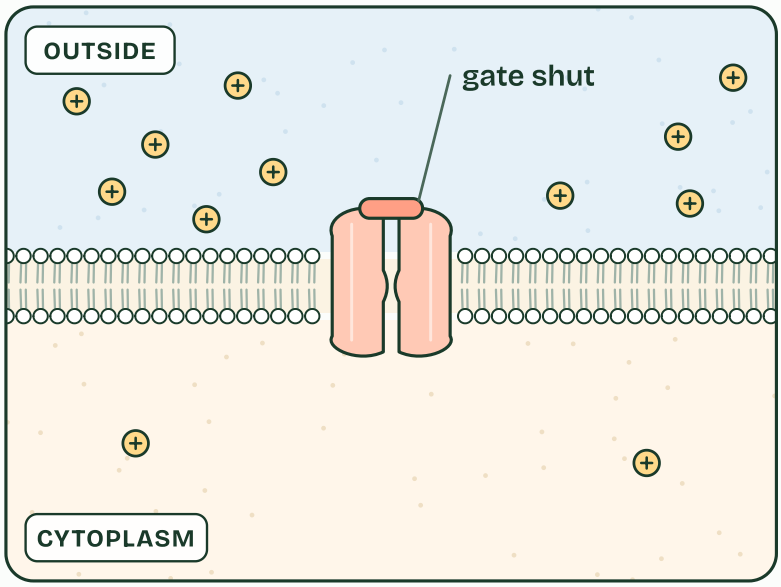
5 Channel: a gated pore for one kind of ion; _____, passive.

6 Pump: uses ATP, can move particles against the gradient; _____.

Your own notes

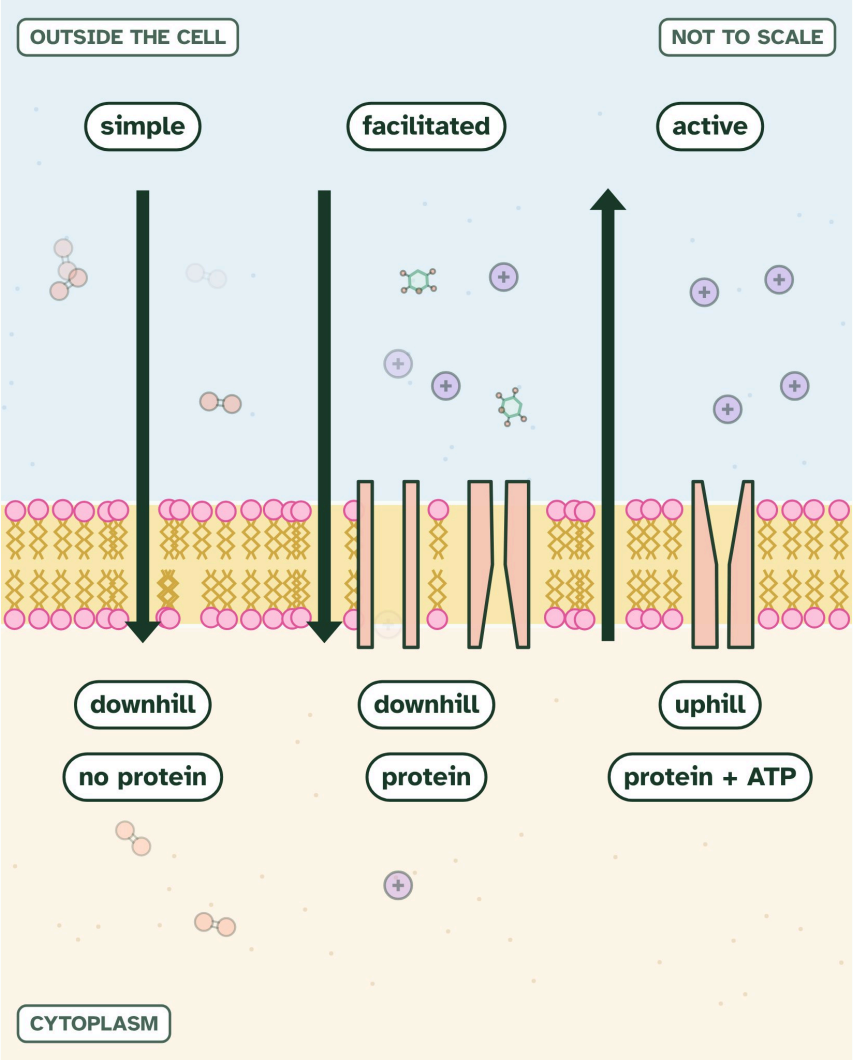
ANNOTATE THE FIGURE

The figure shows it as Channel shut, Channel open and Pump. Note what changes each time.



ANNOTATE THE FIGURE

Annotate this still from the animation (The three ways across a membrane): what is happening, and why?



REMEMBER IT

Down needs no ATP

D Down	U Up
D	U

SPOT THE MISTAKE

A student writes: “Uses a protein.” Spot the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 05 in two or three sentences of your own.

06 A fluid mosaic

B2.1.9 B2.1.10

CUES

Predict: A mouse cell and a human cell are fused, each with its own membrane proteins tagged a different colour. What is seen after 40 minutes at 37 °C?

What is meant by glycoprotein?

What is meant by glycolipid?

What is meant by fluid mosaic model?

NOTES

1 A protein with sugars attached is a _____ and a lipid with sugars a _____.

2 Their exact pattern differs between cell types and between individuals, so they act as identity tags: in _____ (the ABO blood groups are glycolipid and glycoprotein sugars on red blood cells, and immune cells read them to tell self from non-self) and in _____, sticking cells to each other.

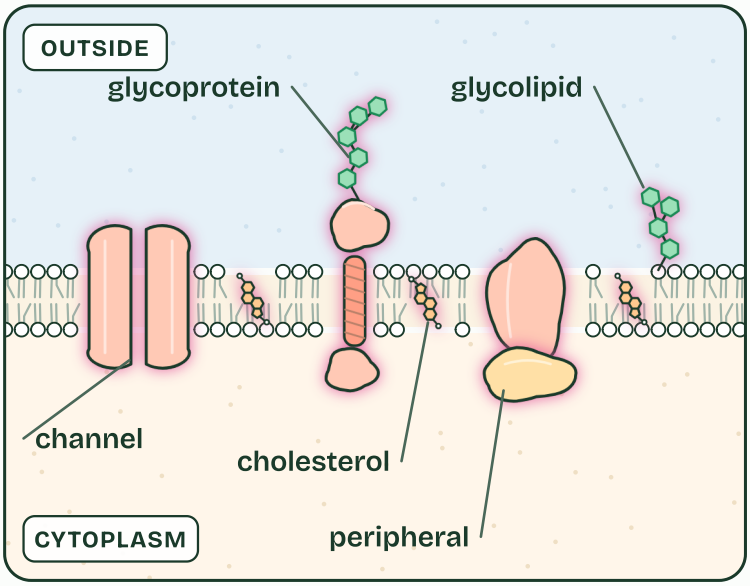
3 All of this fits the _____.

4 A full drawing: bilayer, integral and peripheral proteins, _____, cholesterol, regions labelled.

Your own notes

ANNOTATE THE FIGURE

Label the key parts and add a note on what it shows.



SUMMARY

Sum up section 06 in two or three sentences of your own.

07 Not too stiff, not too runny

B2.1.11 HL B2.1.12 HL

CUES

Predict: Goldfish kept at 5 °C for weeks are compared with goldfish kept at 25 °C. What would you expect in the membranes of the cold fish?

What is meant by cholesterol?

NOTES

1 In animal cells, _____ sits between the phospholipids, its hydroxyl group by the heads and its rigid rings among the tails.

2 Saturated tails: _____.

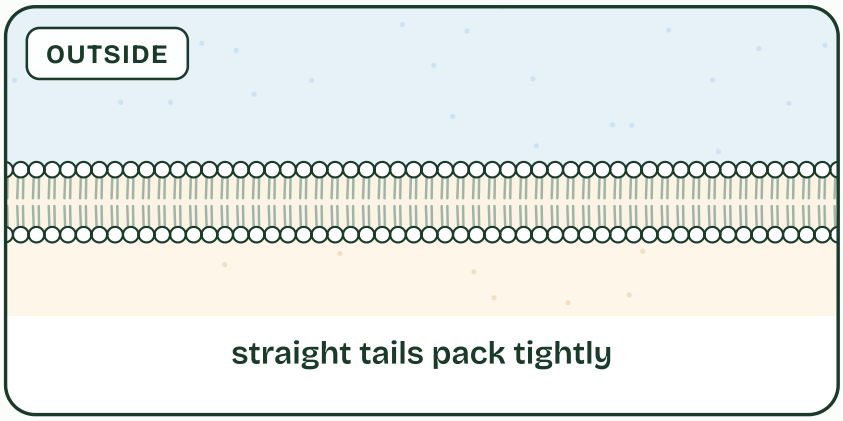
3 Unsaturated tails: _____.

4 _____ buffers fluidity: less fluid when warm, less stiff when cold.

Your own notes

ANNOTATE THE FIGURE

The figure shows it as Saturated, Unsaturated and With cholesterol. Note what changes each time.



SPOT THE MISTAKE

What do students often get wrong about relationships between fatty acid composition of lipid bilayers and their fluidity Cholesterol and membrane fluidity in animal cells? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 07 in two or three sentences of your own.

08 Pinching off, joining up

B2.1.13 HL

CUES

Predict: A pancreas cell secretes enzymes by exocytosis for an hour without taking any membrane back in. What happens to its plasma membrane?

What is meant by endocytosis?

What is meant by exocytosis?

NOTES

1 In _____ the plasma membrane folds inwards round material outside the cell and pinches off, carrying it in.

2 In _____ a vesicle travels to the plasma membrane and fuses with it, its bilayer joining the membrane's, and its contents are released outside.

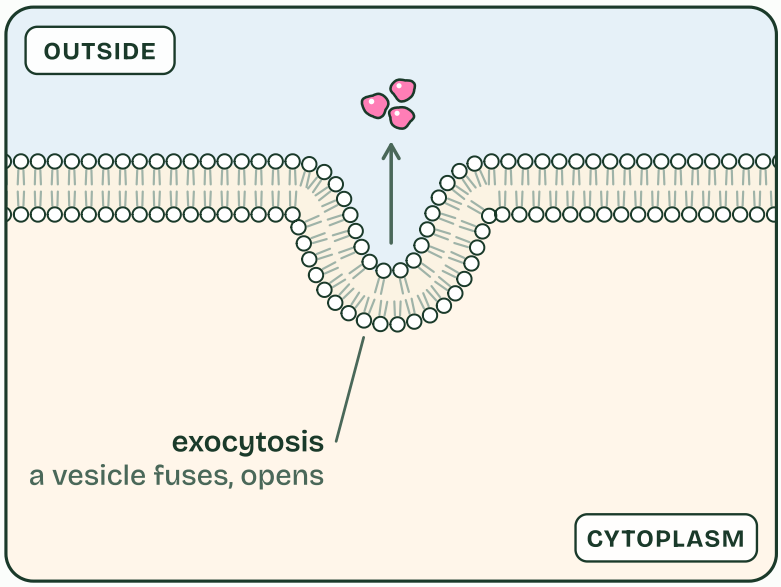
3 _____: material taken in by a vesicle pinching off inwards.

4 _____: a vesicle fuses with the membrane and releases its contents.

Your own notes

ANNOTATE THE FIGURE

Number the 4 steps on the figure and note what happens at each.



SPOT THE MISTAKE

What do students often get wrong about membrane fluidity and the fusion and formation of vesicles? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 08 in two or three sentences of your own.

09 Gates and a pump in every neuron

B2.1.14 HL B2.1.15 HL

CUES

Predict: Ouabain stops the sodium-potassium pump. What happens over the next hours in a neuron treated with it?

What is meant by nicotinic acetylcholine receptor?

What is meant by sodium-potassium pump?

What is meant by membrane potential?

NOTES

1 A _____ channel opens when a signalling molecule binds to it.

2 The _____ is one: when acetylcholine binds to its two sites, the channel opens and sodium ions diffuse into the cell.

3 A _____ channel opens or closes when the voltage across the membrane changes.

4 The _____ makes them.

5 In each cycle it binds three Na^+ from inside, is phosphorylated by ATP, changes shape, releases the Na^+ outside, binds two K^+, loses the phosphate, changes back and releases the K^+ inside. It is an _____: one kind out, another in.

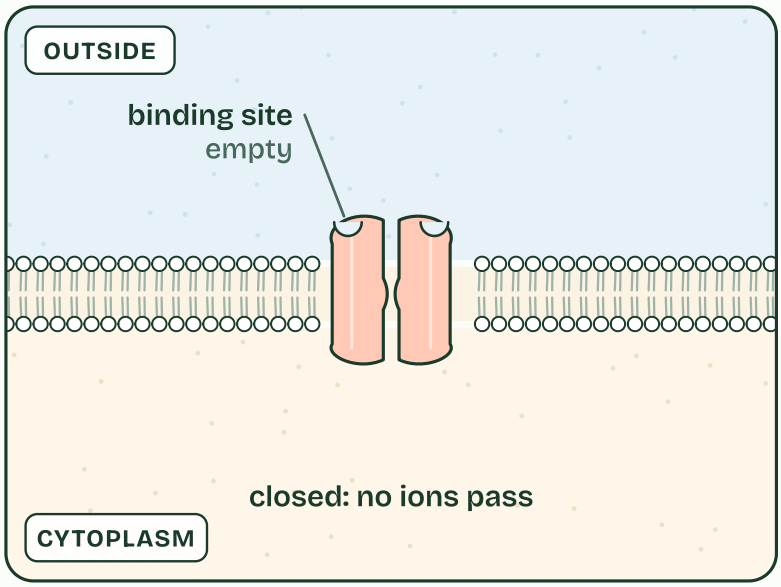
6 Because three positive charges leave for every two that enter, and because K^+ leaks back out through channels, the inside ends up negative: the _____, about −70 mV in a resting neuron.

7 Na^+/K^+ pump: 3 Na^+ out, 2 K^+ in per ATP; builds the _____.

Your own notes

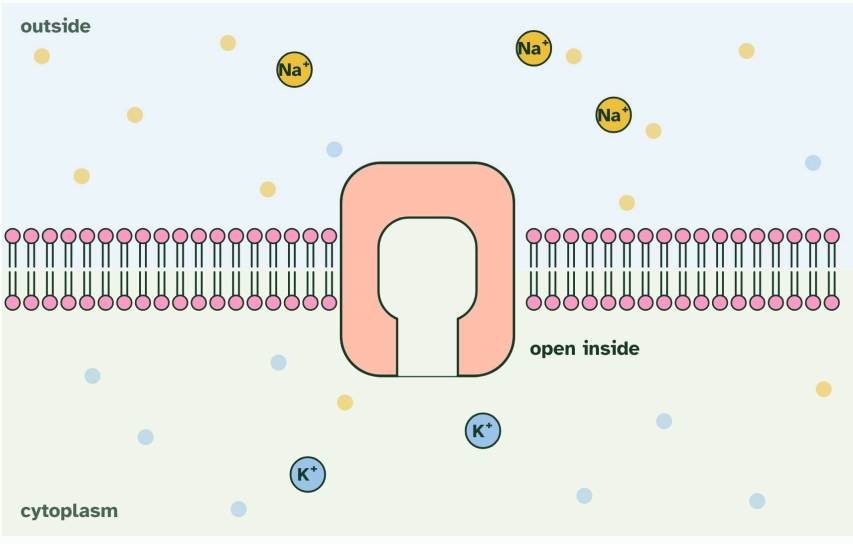
ANNOTATE THE FIGURE

The figure shows it as No acetylcholine, Acetylcholine bound and Voltage-gated. Note what changes each time.



ANNOTATE THE FIGURE

Annotate this still from the animation (The sodium-potassium pump): what is happening, and why?



SPOT THE MISTAKE

What do students often get wrong about gated ion channels in neurons Sodium-potassium pumps as an example of exchange transporters? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 09 in two or three sentences of your own.

10 Glucose hitches a ride

B2.1.16 HL

CUES

Predict: Why does glucose appear in the urine when blood glucose is very high, as in untreated diabetes?

What is meant by sodium-glucose cotransporter?

NOTES

1 A _____ (SGLT) on the gut side lets a sodium ion in only if a glucose molecule comes with it.

2 This is _____: the energy comes from ATP, but it was spent by the pump, building the sodium gradient that the cotransporter uses.

3 Indirect active transport: _____.

4 On the blood side, the _____ _____ _____ _____ _____ uses ATP and keeps Na^+ low inside the cell.

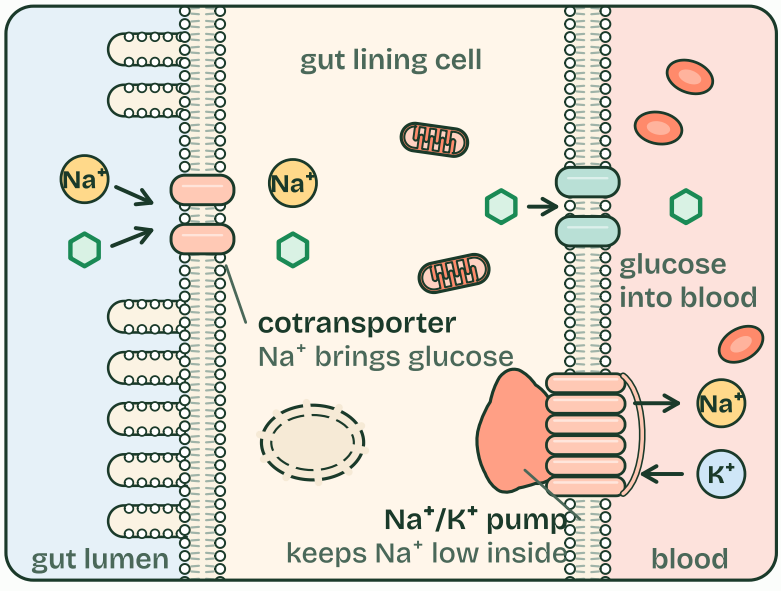
5 On the gut side, the _____ lets Na^+ in down its gradient, and glucose comes with it.

6 Glucose leaves on the blood side by _____.

Your own notes

ANNOTATE THE FIGURE

Number the 3 steps on the figure and note what happens at each: 1 Na+/K+ pump; 2 cotransporter; 3 facilitated diffusion.



SPOT THE MISTAKE

What do students often get wrong about sodium-dependent glucose cotransporters as an example of indirect active transport? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 10 in two or three sentences of your own.

11 Holding tissues together

B2.1.17 HL

CUES

Predict: Cancer cells that spread round the body often make less of one kind of CAM. Why might that help them spread?

What is meant by cell-adhesion molecules?

NOTES

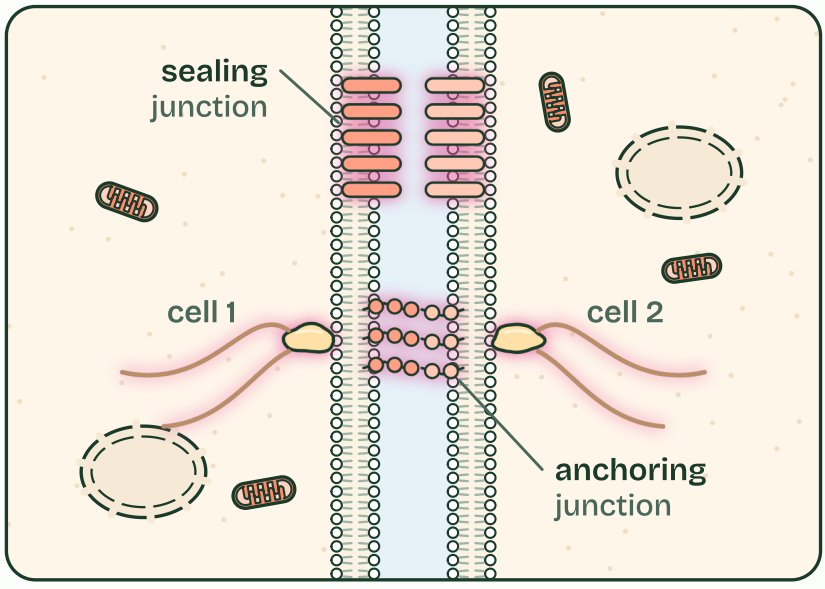
1 The joins are made by _____ (CAMs): proteins in the plasma membrane whose outer parts bind to CAMs on the next cell, or to the material between cells.

2 CAMs: _____.

Your own notes

ANNOTATE THE FIGURE

Label the key parts and add a note on what it shows.



SPOT THE MISTAKE

What do students often get wrong about adhesion of cells to form tissues? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 11 in two or three sentences of your own.

Check yourself

The check for this guide is online: a fresh paper of past-paper style questions from the exam bank on B2.1 each time, marked as you go, and saved to your Exam practice progress when you are signed in. Scan the code, or type the link.

biologybybradford.com/exam-maker/sit?topics=B2.1&level=HL&paper=quiz&marks=15&src=ep

How this was made. The course structure, the activities and the teaching choices come from my own classroom, my presentations and my years of teaching IB and AP Biology. I use Claude, an AI, to help write and build the interactive guides, lesson plans, slides and practice questions, and to draw the diagrams and code the interactives. I direct the work and review it against the IB and AP specifications before it goes live.