# A wall two molecules thick

60 minutes • B2.1.1 to B2.1.3 • Chapters 1, 2

**Why phospholipids form a bilayer, the bilayer as a barrier, and simple diffusion of oxygen and carbon dioxide**

## BY THE END, STUDENTS 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

## TIMING

| | | | |
|---|---|---|---|
| 0–6 | 6 min | **Do now: the Venn** |  |
| 6–18 | 12 min | **A bilayer builds itself** | |
| 18–34 | 16 min | **Human membrane** | |
| 34–54 | 20 min | **What gets through** | |
| 54–60 | 6 min | **Exit** | |
| | 60 min | **One lesson** | |

## STARTER

**6** min

### Do now: the Venn

A Venn diagram of fats and phospholipids: what they share and what only a phospholipid has. Take answers until someone says "a part that likes water".

## ON THE BOARD, FROM THE GUIDE

Open the guide on the projector at each chapter (the links work in this PDF). Every figure plays from its own buttons, and the lesson's slides have the same figures, step by step, in the order of this plan.

### 01 A skin that builds itself

CHAPTER 01 IN THE SLIDES

**Play the animation, Watch it happen: a bilayer builds itself.** It loops; pause it on each moment below and ask what is happening (in the lesson slides it is a video).

1. Phospholipids stirred into water point every which way.
2. The tails cannot form hydrogen bonds with water, so water crowds the **tails** together.
3. No enzyme placed them and no energy was spent: **water** arranged them.

> **Predict box:** Phospholipids are shaken in oil instead of water. How would they arrange themselves? Hands up or mini whiteboards first.
>
> **Answer B: Turned the other way, tails out into the oil and the heads hidden together in the middle**

### 02 A wall with gaps for small things

CHAPTER 02 IN THE SLIDES

**Step through the figure** (3 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. **Oxygen** diffuses in and **carbon dioxide** out, between the phospholipids.
2. **Water** is polar but small: a little crosses the bilayer, slowly.
3. **Ions** and **polar molecules** such as glucose cannot pass the hydrophobic core.

**Play the animation, Who smelt it first?.** It loops; pause it on each moment below and ask what is happening (in the lesson slides it is a video).

1. A quiet classroom. Nobody has noticed anything yet.
2. Somebody lets one go. The gas particles start crowded together in one place: a **high concentration**.
3. Each particle moves at **random**, yet more wander out of the crowd than back into it. That net movement from high to low concentration is **diffusion**.
4. The nearest nose smells it first, because the concentration is still highest close to the source. Whoever smelt it first is probably sitting beside whoever dealt it.
5. Given time the particles spread through the whole room. Nobody pushed them: diffusion needs no energy, only random motion and a **concentration gradient**.

**Play the animation, Diffusion across a membrane.** It loops; pause it on each moment below and ask what is happening (in the lesson slides it is a video).

1. Every particle moves at **random**, bumping into the others and the walls.
2. **Net movement** down the concentration gradient: more cross from the left.
3. **Dynamic equilibrium**: still crossing both ways, at about the same rate.

> **Predict box:** Rank these from fastest to slowest across a bare bilayer: oxygen, glucose, sodium ions. Hands up or mini whiteboards first.
>
> **Answer B: Oxygen, glucose, sodium ions: non-polar first, then the polar molecule, and the charged ion last**

## THE LESSON

**12** min

### A bilayer builds itself

Chapter 1 and the film. Students sketch a phospholipid, label hydrophilic and hydrophobic, then draw how many of them sit in water and say why.

**16** min

### Human membrane

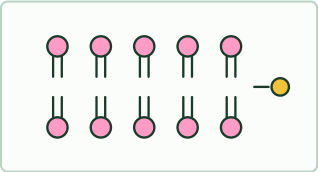
The model below: the class becomes a bilayer and the teacher sends "molecules" at it.

**20** min

### What gets through

Chapter 2, its figure and the diffusion film. Students rank oxygen, carbon dioxide, urea, glucose and sodium ions by how easily they cross, with a reason for each.

## ACTIVITIES



MODEL

### Human membrane

Students stand in two rows, back to back, as phospholipids: arms out are the heads, backs together are the tails. The teacher rolls soft balls at them labelled oxygen, sodium ion and glucose; only the small uncharged ones may slip between people. Then two students join hands across the rows as a channel, and only a ball of the right colour may go through it. Finish by asking the rows to drift sideways without letting go: the fluid in fluid mosaic.

**Needs:** soft balls in three colours, labels, space.

## PLENARY

**6** min

### Exit

Why can a sodium ion, smaller than an oxygen molecule, not cross a bilayer?

WHAT STUDENTS GET WRONG

**"Small things cross a membrane, big things don't."** Charge and polarity matter as much: a sodium ion is tiny but cannot cross the bilayer.

STRETCH AND SUPPORT

**Support:** give the captions of each figure and film as a cut-up storyboard to put in order, and use the key terms (tap the dotted words) as a glossary.

IN THE GUIDE

1 A skin that builds itself

2 A wall with gaps for small things

All The whole guide, with the figures that play

PPTX This lesson's slides, in the order of this plan

EXAM PRACTICE

## Check yourself

Set it for homework: a fresh paper of exam-bank questions on B2.1 at standard level each time, marked as students go and saved to their Exam practice when they are signed in.

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

PRACTISE AND REVISE

BUILD FOR YOUR CLASS

- Tarsia puzzle, dominoes and picture reveal on B2.1, built from its key terms and ready to print
- A pub quiz with rounds on B2.1, to present or run with no projector
- An escape room built from the question bank on B2.1

ALREADY ON THE SITE FOR B2.1

- Lesson: Membrane Transport
- Lesson: Membranes
- Lab: Osmolarity of a Potato
- Lab: Plasmolysis & Microscope Skills
- Summary doodle: Membranes & Membrane Transport
- Quiz: Membrane Transport
- Quiz: Membranes & Transport (HL)
- Revision map: B2.1 Membranes and membrane transport, to fill in
- Exam questions: B2.1 in the exam maker, a paper with its markscheme

CARD SETS ON SPLYCR

Open a set to host it as a class game, or make a copy to edit.

- B2.1 Membranes
- B2.1b Membrane transport

**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.