

Exercise walk-through

Fluid mosaic membranes ■ 4.1

eXercise

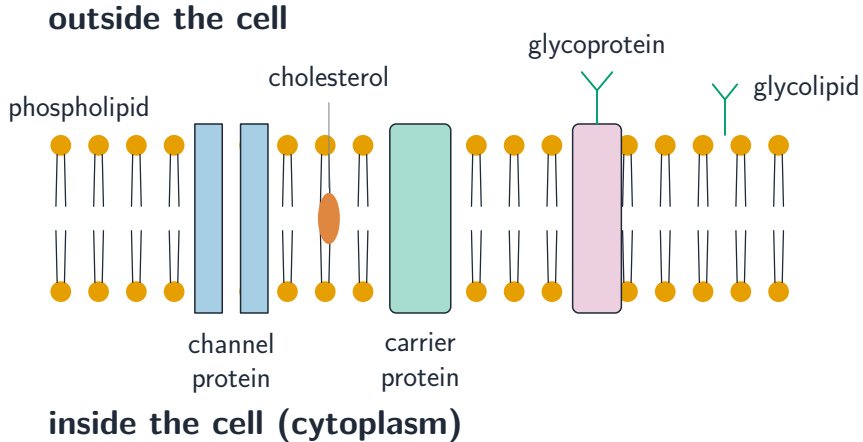
You must be able to

- describe the **fluid mosaic model** 流动镶嵌模型 and the hydrophobic/hydrophilic interactions that form the **bilayer** 双层
- describe the roles of phospholipids, **cholesterol** 胆固醇, proteins and **glycoproteins** 糖蛋白
- outline the stages of cell signalling (ligand → receptor → response)

Method — The fluid mosaic model

The membrane is a **bilayer** of **phospholipids** 磷脂: **hydrophilic** 亲水 heads face the water, **hydrophobic** 疏水 tails hide inside. It is “fluid” because the phospholipids slide past each other, and a “mosaic” because proteins are dotted through it.

Method — The fluid mosaic model



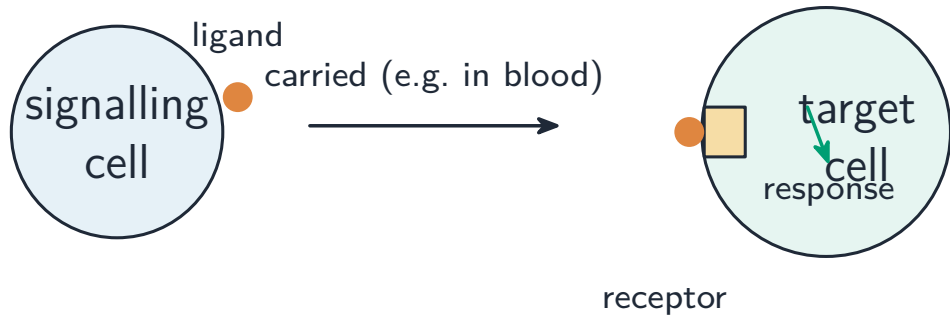
Method — Roles of the components

component	role
phospholipids	form the basic barrier
channel/carrier proteins 通道/载体蛋白	transport substances across
cholesterol	controls fluidity 流动性 and adds strength
glycoproteins / glycolipids	cell recognition; some act as antigens 抗原
surface receptor proteins	bind signalling molecules (cell signalling)

Method — Cell signalling

A cell secretes a **ligand** 配体 (e.g. a **hormone** 激素); it travels to a **target cell** 靶细胞; it binds a **receptor** 受体 of matching shape, triggering a response inside.

Method — Cell signalling



Practice 2.1 ■ 3 marks

State the role of each membrane component.

component	role
cholesterol	
carrier protein	
glycoprotein	

Solution 2.1

Method: Roles of the components

Worked steps

cholesterol — controls fluidity / adds strength; carrier protein — carries specific molecules across; glycoprotein — cell recognition / receptor / antigen **B1** *each*.

Practice 2.2 ■ 2 marks

Explain why the phospholipids form a bilayer in water.

Solution 2.2

Method: The fluid mosaic model

Worked steps

the hydrophilic heads are attracted to water on both sides while the hydrophobic tails are repelled by water **M1**; so the tails face inward and heads outward, forming two layers **A1**.

Exam-style 3.1 ■ 1 mark

Which part of the membrane is responsible for cell recognition?

A cholesterol

B glycoproteins

C the hydrophobic tails

D channel proteins

Solution 3.1

Method: Roles of the components

- A cholesterol
- B glycoproteins
- C the hydrophobic tails
- D channel proteins



Worked steps

B. Glycoproteins (carbohydrate chains) are used for cell recognition.

Exam-style 3.2 ■ 1 mark

Why does only the target cell respond to a particular hormone?

- A** only the target cell is near the gland
- B** only the target cell has a receptor with a complementary shape
- C** the hormone is only made near the target cell
- D** the hormone is hydrophobic

Solution 3.2

Method: Cell signalling

- A only the target cell is near the gland
- B only the target cell has a receptor with a complementary shape 
- C the hormone is only made near the target cell
- D the hormone is hydrophobic

Worked steps

B. The receptor's shape is complementary to that ligand only.

Exam-style 3.3 ■ 2 marks

An electron micrograph shows a cell surface membrane that is 7.0 mm thick at a magnification of $\times 1\,000\,000$.

- (a) Calculate the actual thickness of the membrane, in nm.
- (b) Explain why a phospholipid bilayer forms a good barrier to ions and large polar molecules.

Solution 3.3

Worked steps

(a) $\frac{7.0 \text{ mm}}{1\,000\,000} = 7.0 \times 10^{-6} \text{ mm} = 7.0 \text{ nm}$ **M1** **A1**.

(b) the hydrophobic tail region repels charged/polar molecules **M1**, so ions and large polar molecules cannot pass straight through **A1**.

Exam-style 3.4 ■ 3 marks

Describe the main stages of cell signalling that lead to a response in a target cell.

Solution 3.4

Method: Cell signalling

Worked steps

a cell secretes a ligand (B1); it is carried to and binds a complementary receptor on the target cell's membrane (B1); binding triggers a specific response inside the target cell (B1).