A-LEVEL BIOLOGY • EXERCISE SHEET

4.1 Fluid mosaic membranes

Name: _____ Class: _____ Date: _____ **Total: 14 marks**

KEY WORDS cell surface membrane 细胞膜 • protein 蛋白质 • phospholipid 磷脂 • bilayer 双层 • cholesterol 胆固醇

Objective

Build the skills to answer exam questions on **fluid mosaic membranes** — the structure and roles of the membrane components, and the stages of **cell signalling** 细胞信号传递.

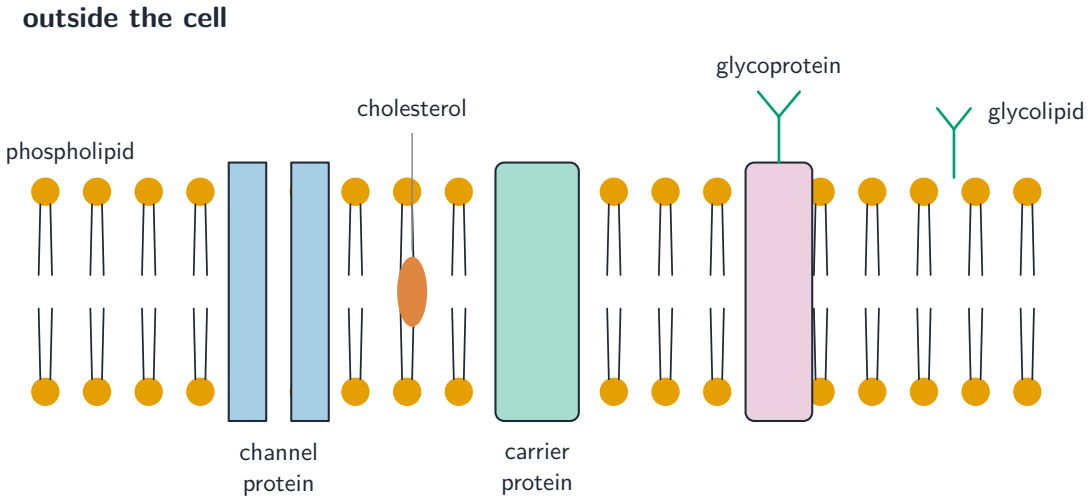
You must be able to:

- 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)

1 Worked examples

■ 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.



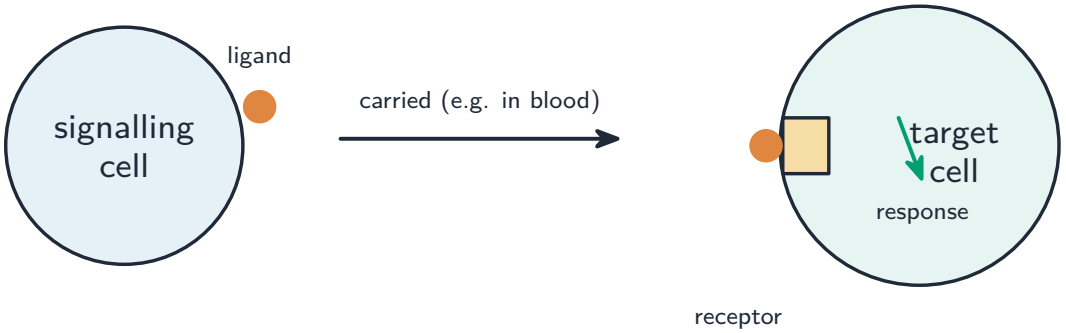
Proteins, cholesterol and carbohydrate chains sit in a fluid phospholipid bilayer

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)

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.



The ligand fits one receptor shape only, so only cells with that receptor respond

2 Practice

2.1 State the role of each membrane component. [3]

component	role
cholesterol	
carrier protein	
glycoprotein	

2.2 Explain why the phospholipids form a bilayer in water. [2]

3 Exam-style questions

3.1 Which part of the membrane is responsible for cell recognition? [1]

A | B
C | D

A cholesterol
B glycoproteins
C the hydrophobic tails
D channel proteins

3.2 Why does only the target cell respond to a particular hormone? [1]

A | B
C | D

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

3.3 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. [2]

(b) Explain why a phospholipid bilayer forms a good barrier to ions and large polar molecules. [2]

3.4 Describe the main stages of cell signalling that lead to a response in a target cell. [3]