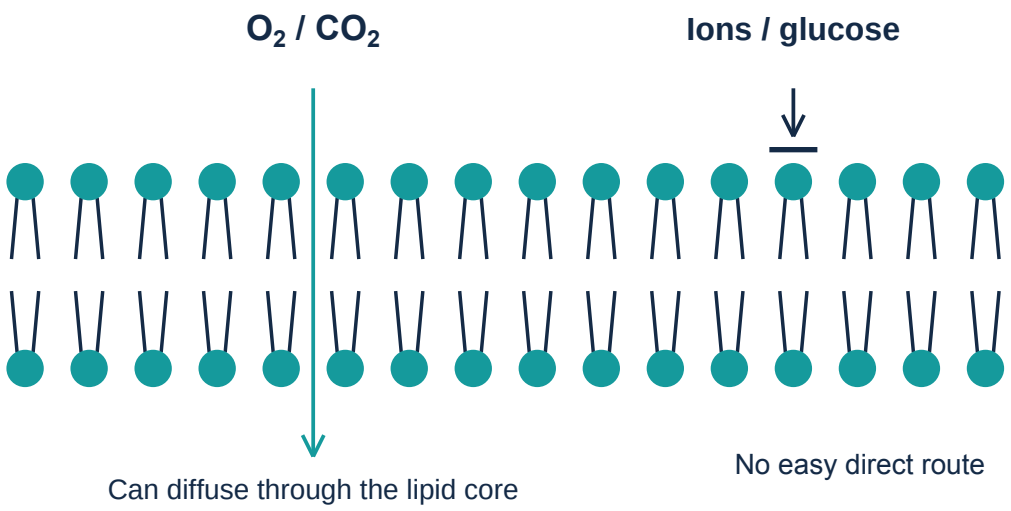
A barrier that stays flexible

Membrane components work together. Phospholipids form the basic barrier; cholesterol helps regulate lipid packing, membrane fluidity and stability in animal cells.

1. PHOSPHOLIPIDS: SELECTIVE PERMEABILITY



2. A HYDROPHOBIC CORE, NOT AN OPEN SIEVE

Small non-polar molecules can dissolve in the lipid region and cross it. Ions and large polar molecules face a strong barrier and usually need transport proteins. Water can cross the bilayer slowly; aquaporins allow much faster water movement.

3. CHOLESTEROL BUFFERS TEMPERATURE EFFECTS

WARMER CONDITIONS

Restrains excessive phospholipid movement and reduces excessive fluidity.

COOLER CONDITIONS

Disrupts tight packing of tails, helping prevent the membrane becoming too rigid.

Cholesterol also reduces permeability to many small water-soluble molecules.

Fluidity = ease of movement within the membrane. Permeability = ease of crossing it. These are related but different properties.

Lipid barrier and cholesterol: Alberts et al., The Lipid Bilayer.
Temperature buffering: OpenStax Biology 2e, section 5.1.

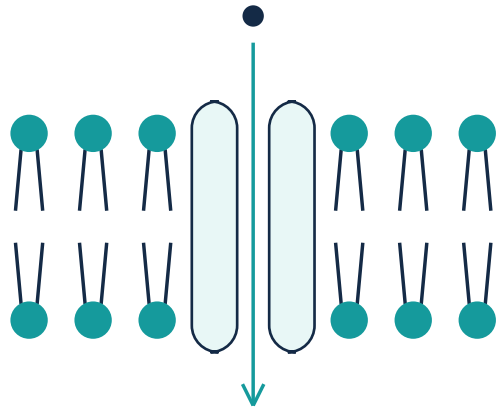
Scope: Cambridge Biology 9700 syllabus, section 4.1, outcome 3, p. 21.

Proteins provide selective routes

Channel and carrier proteins help specific molecules or ions cross the hydrophobic core. They are selective transport routes, not holes that let every substance through.

1. CHANNEL VERSUS CARRIER

CHANNEL



Hydrophilic pore

CARRIER

Bind the specific solute

↓

Change shape

↓

Release on the other side

2. CHANNEL: A WATER-FILLED PASSAGE

An open channel permits passive movement down the relevant gradient. Ion channels are selective; many are gated. Aquaporins are channels specialised for water. For ions, both concentration and electrical differences affect the direction of net movement.

3. CARRIER: BINDING FOLLOWED BY A SHAPE CHANGE

A carrier binds its transported solute and changes conformation. Some carriers mediate facilitated diffusion; others participate in active transport using an energy source. Do not assume that every carrier directly uses ATP or that all protein-mediated transport is active.

Examples: an ion channel provides a pore; a glucose carrier provides a binding-and-release route. Receptors primarily receive signals rather than carry the signal molecule through the membrane.

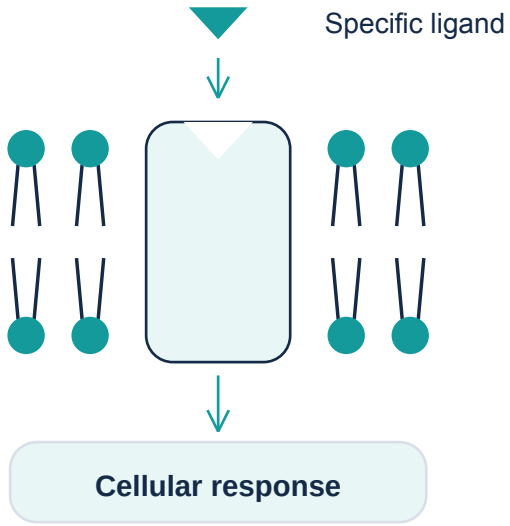
Channels and facilitated diffusion: OpenStax Biology 2e, section 5.2.
Transport protein roles: Alberts et al., Membrane Proteins.

Scope: Cambridge Biology 9700 syllabus, section 4.1, outcome 3, p. 21.

Receive signals, recognise cells

Some membrane proteins act as receptors. Glycoproteins and glycolipids also contribute to exposed surface patterns that support cell recognition and adhesion.

1. A SIGNAL RECEPTOR IS NOT A TRANSPORT PORE



Ligand binds outside.

The receptor changes activity and initiates an internal response.

The ligand need not cross the membrane.

2. GLYCOPROTEINS AND GLYCOLIPIDS: SURFACE IDENTITY

Their outward-facing carbohydrate chains provide distinctive binding and recognition patterns. Some surface structures act as antigens recognised by the immune system. These molecules can also support cell-cell attachment; not every glycoprotein is a signalling receptor.

3. LINK EACH COMPONENT TO A ROLE

Phospholipid bilayer	Selective barrier and flexible framework
Cholesterol	Fluidity, stability and reduced permeability
Channels / carriers	Selective transport across the membrane
Receptor proteins	Specific signal detection
Glycoproteins / glycolipids	Recognition, antigens and cell interactions

Next: the main stages of cell signalling in Lesson 4.1.4.

Cell-surface receptors: OpenStax Biology 2e, section 9.1.
Recognition and carbohydrate-rich cell coat: Alberts et al., Membrane Proteins.

Scope: Cambridge Biology 9700 syllabus, section 4.1, outcome 3, p. 21.