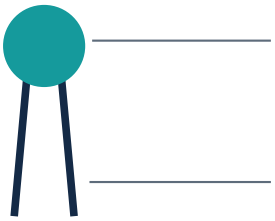
Why a bilayer forms

The cell surface membrane separates cytoplasm from the surroundings. Its basic structure is a phospholipid bilayer: two layers, each one molecule thick.

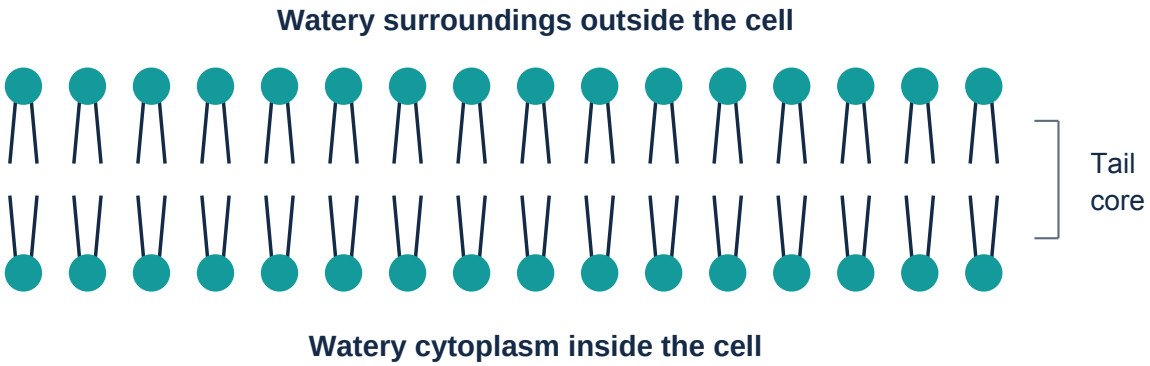
1. ONE MOLECULE, TWO DIFFERENT REGIONS



Hydrophilic head: polar, phosphate-containing; interacts with water.

Two hydrophobic fatty acid tails: non-polar; avoid contact with water.

2. HEADS FACE WATER; TAILS FACE INWARDS



3. WATER INTERACTIONS EXPLAIN THE ARRANGEMENT

Heads remain in contact with water on both surfaces. Tails cluster in the interior, minimising their exposure to water. The phospholipid is amphipathic: it contains both hydrophilic and hydrophobic regions. No covalent links between neighbouring phospholipids are needed to assemble the bilayer.

Diagrams are schematic. A cell membrane forms a closed boundary, not an open sheet with exposed tail edges.

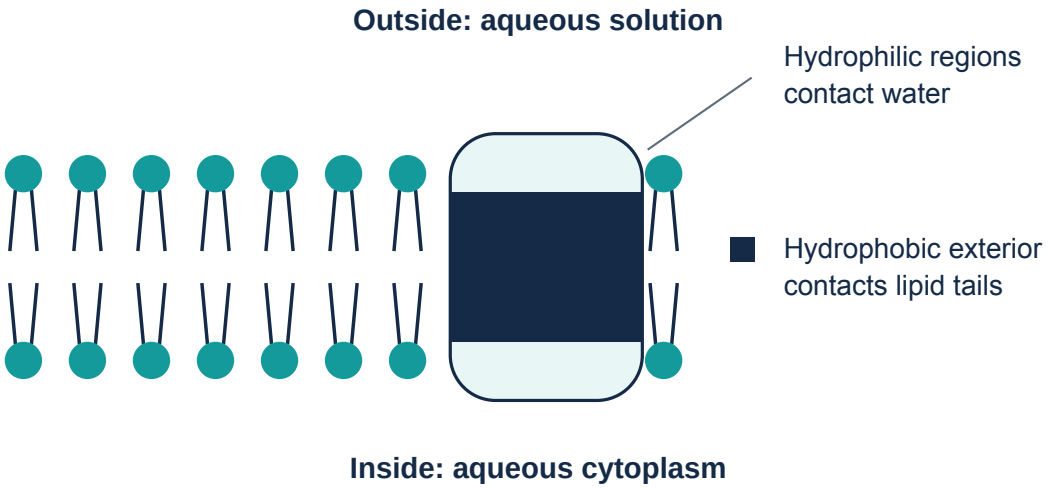
Bilayer formation and amphipathic lipids: Alberts et al., The Lipid Bilayer.

Scope: Cambridge Biology 9700 syllabus, section 4.1, outcome 1, p. 21.

Proteins fit the bilayer

Proteins do not form two continuous coats on the membrane. Some are embedded in the bilayer, some span it, and others associate with a membrane surface.

1. A TRANSMEMBRANE PROTEIN



Colour regions show interactions, not separate protein molecules. Other membrane components are omitted for clarity.

2. INTEGRAL AND PERIPHERAL PROTEINS

Integral proteins are embedded in the membrane; transmembrane proteins extend across the whole bilayer. Peripheral proteins attach at a surface, often to other proteins, without entering the hydrophobic core.

3. MATCH THE SURFACE TO ITS SURROUNDINGS

Non-polar amino acid side chains on the membrane-spanning exterior interact with fatty acid tails. Polar or charged regions face water. A channel can have a hydrophobic outside and a hydrophilic lining, allowing a water-filled passage through the core.

Not every membrane protein is a channel, and not every integral protein spans the entire bilayer.

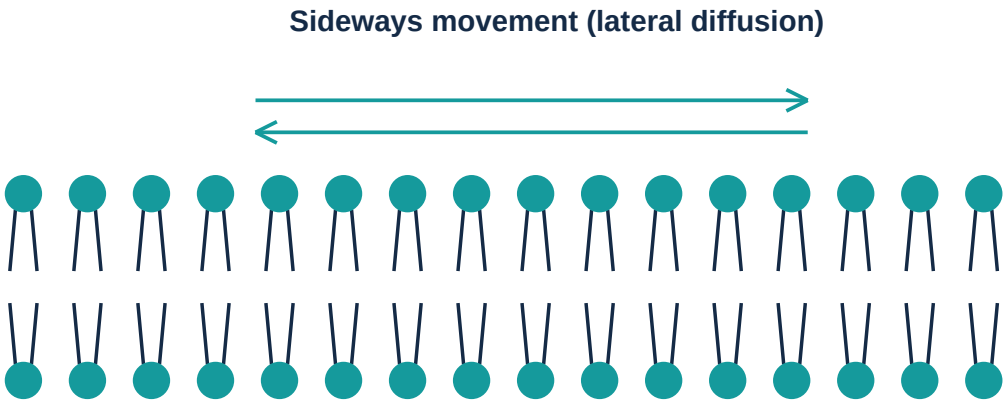
Protein positions and hydrophobic matching: Alberts et al., Membrane Proteins.

Scope: Cambridge Biology 9700 syllabus, section 4.1, outcome 1, p. 21.

Fluid + mosaic

The membrane is a dynamic structure, not a rigid wall. Its components remain organised even while many of them move within the membrane.

1. FLUID: MOVEMENT WITHIN THE LAYER



Arrows show movement parallel to the membrane, not transport across it.

2. MOSAIC: DIFFERENT PROTEINS IN A LIPID MATRIX

Phospholipids and many proteins can move laterally. Different proteins are distributed within or on the bilayer, producing the mosaic pattern. Some proteins are anchored or confined, so fluid does not mean that every component moves freely.

3. CHECK THE MODEL

Why are heads on both surfaces?

Both the surroundings and the cytoplasm contain water.

Does fluid mean leaky to everything?

No. The non-polar core remains a barrier to ions and many polar solutes.

Does a protein replace the whole bilayer?

No. Proteins occupy particular positions within or on the lipid matrix.

Next: cholesterol, glycolipids and glycoproteins in Lesson 4.1.2.

Fluid mosaic model and selective barrier: OpenStax Biology 2e, section 5.1.
Lateral movement and protein constraints: Alberts et al., Membrane Proteins.

Scope: Cambridge Biology 9700 syllabus, section 4.1, outcome 1, p. 21.