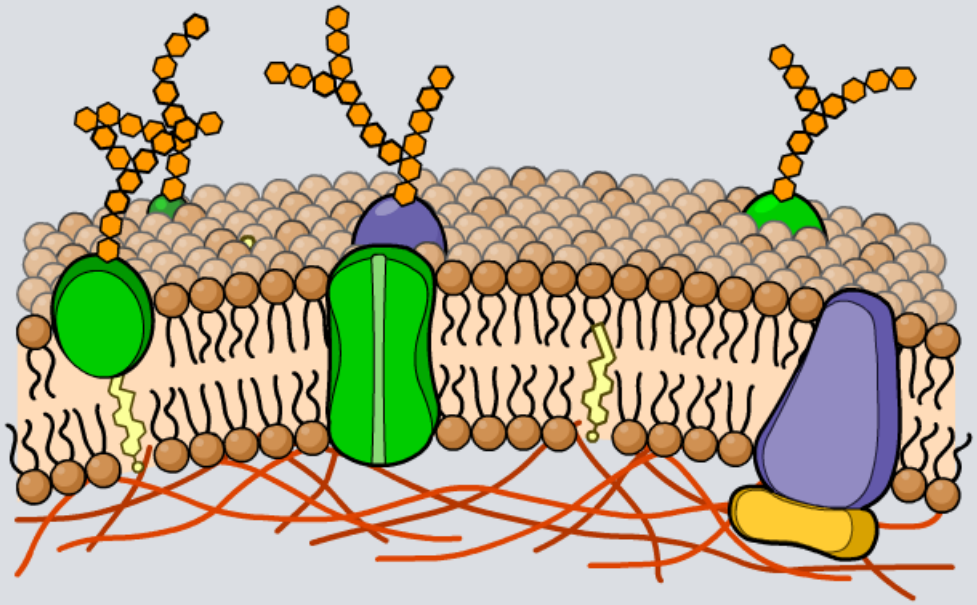
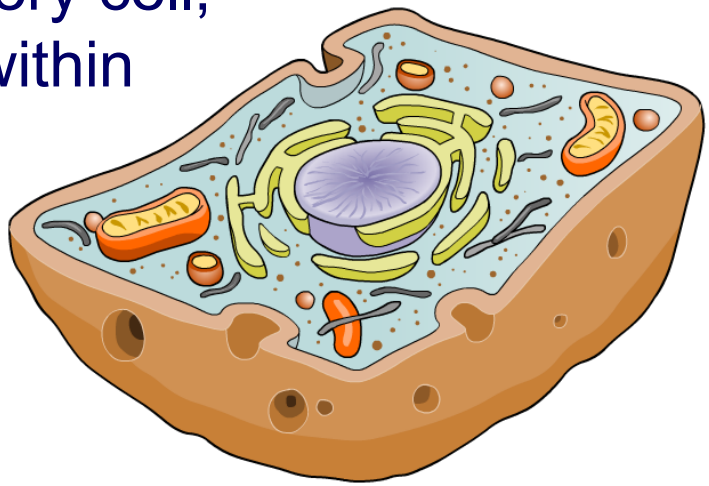
The Fluid Mosaic Model



What are membranes?

Membranes cover the surface of every cell, and also surround most organelles within cells. They have a number of functions, such as:

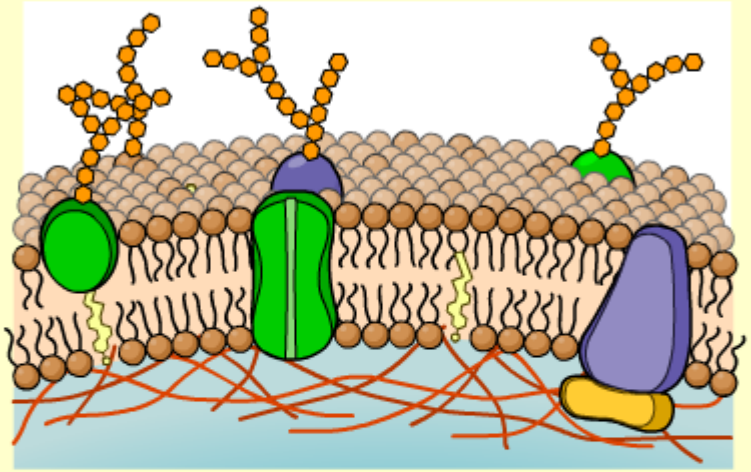


- keeping all cellular components inside the cell
- allowing selected molecules to move in and out of the cell
- isolating organelles from the rest of the cytoplasm, allowing cellular processes to occur separately
- a site for biochemical reactions
- allowing a cell to change shape.

Membranes: timeline of discovery

The discovery of the structure of the cell membrane

Click on the dates on the timeline to find out more details about how the structure of the cell membrane was discovered.

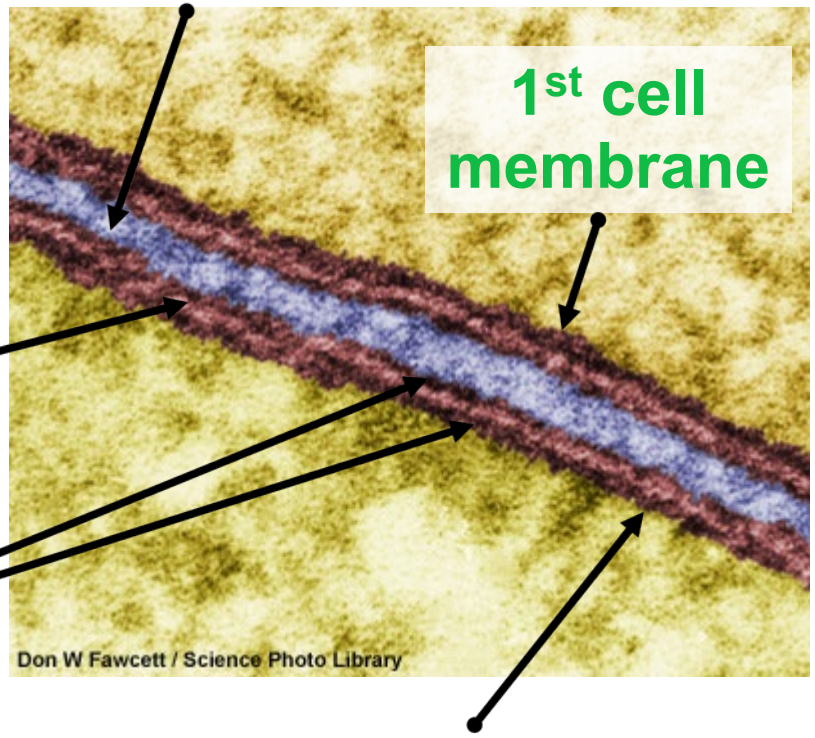


1895 — 1917 — 1925 — 1935 — 1972

Evidence for the Davson–Danielli model

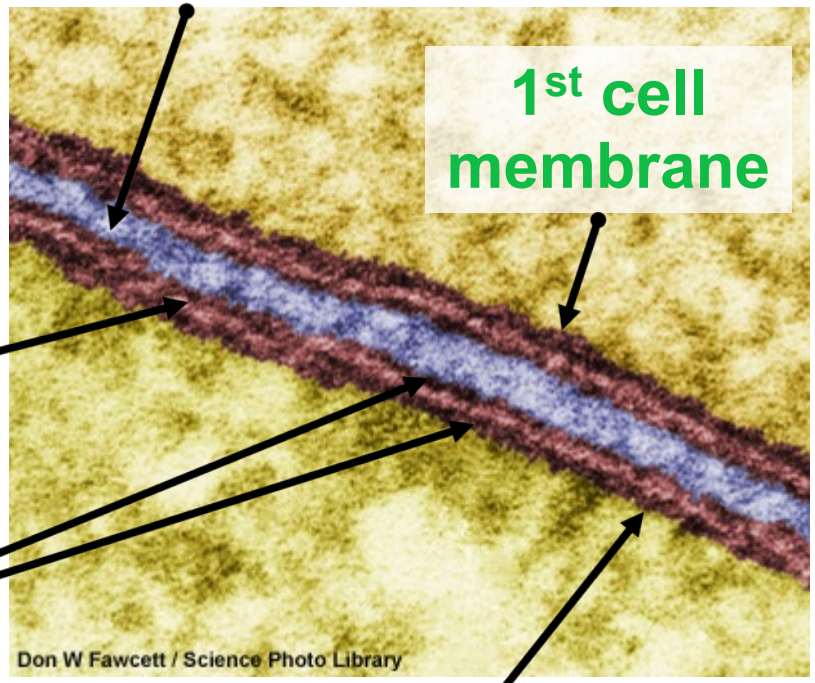
When clear electron micrographs of membranes became available, they appeared to show support for Davson–Danielli's model, showing a three-layered structure.

This was taken to be the phospholipid bilayer (light) surrounded by two layers of protein (dark).



Evidence for the Davson–Danielli model

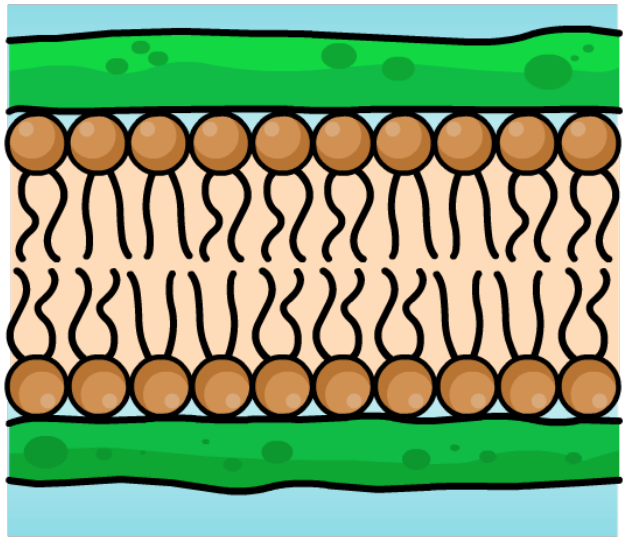
Later, it was discovered that the light layer represented the phospholipid tails and the dark layers represented the phospholipid heads.



Problems with the Davson–Danielli model

By the end of the 1960s, new evidence cast doubts on the viability of the Davson–Danielli model.

- The amount and type of membrane proteins vary greatly between different cells.
- It was unclear how the proteins in the model would permit the membrane to change shape without bonds being broken.



- Membrane proteins are largely hydrophobic and therefore should not be found where the model positioned them: in the aqueous cytoplasm and extracellular environment.

Evidence from freeze-fracturing

In 1966, biologist Daniel Branton used freeze-fracturing to split cell membranes between the two lipid layers, revealing a 3D view of the surface texture.

This revealed a smooth surface with small bumps sticking out. These were later identified as proteins.

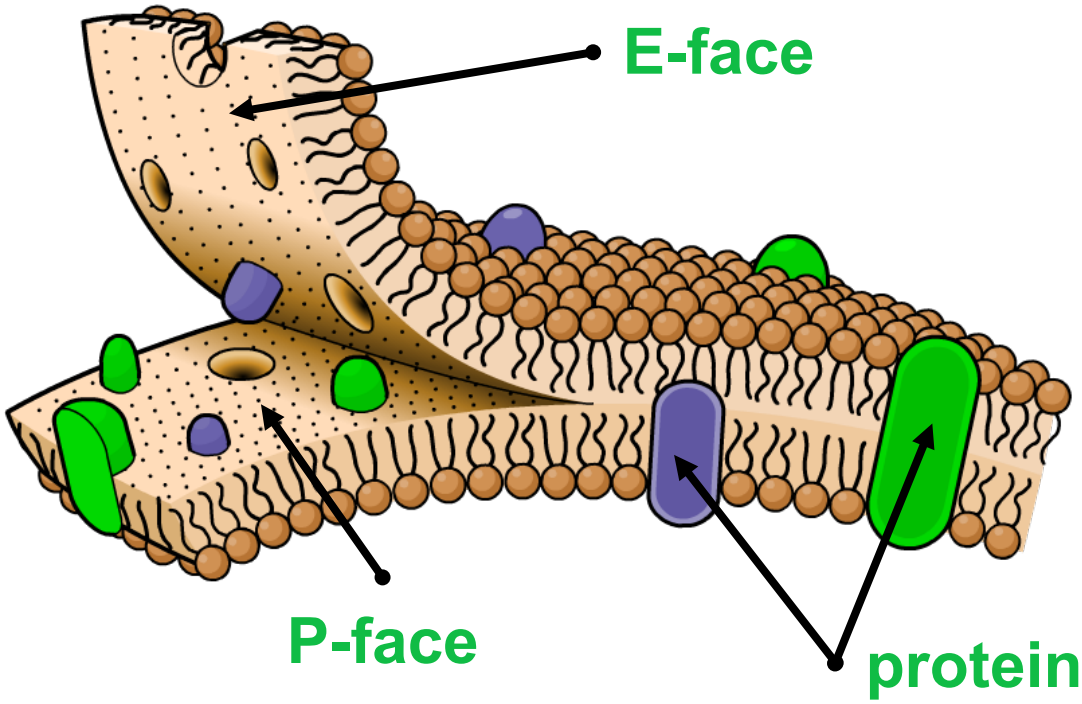
E-face: looking up at outer layer of membrane

P-face: looking down on inner layer of membrane

The fluid mosaic model

The freeze-fracture images of cell membranes were further evidence against the Davson–Danielli model.

They led to the development of the **fluid mosaic model**, proposed by Jonathan Singer and Garth Nicholson in 1972.



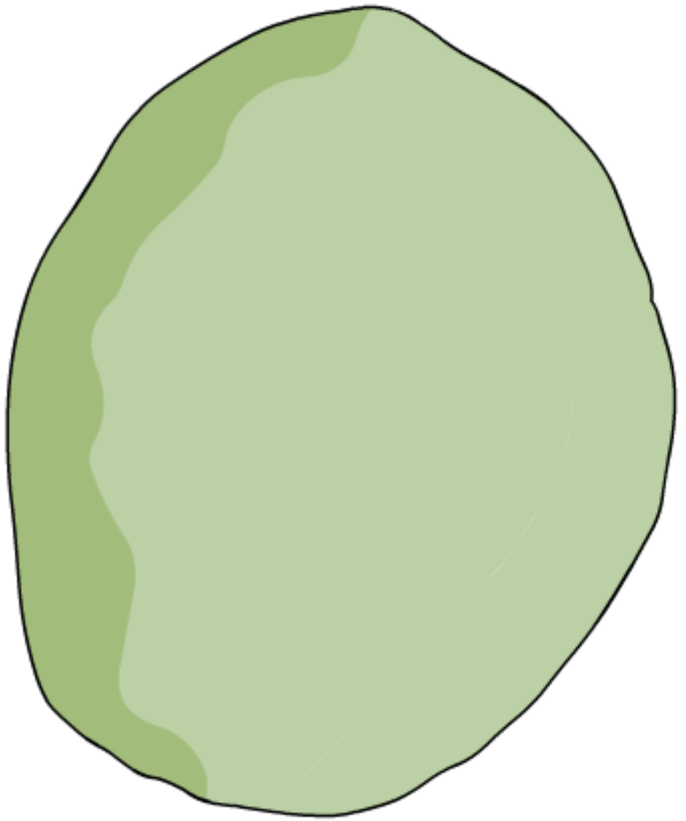
This model suggested that proteins are found **within**, not outside, the phospholipid bilayer.

Exploring the fluid mosaic model

What is the fluid mosaic model of cell membranes?

The **fluid mosaic model** is the currently-accepted model of the structure of cell membranes.

Click "**play**" or the cell to find out more about it.



Membrane models: true or false?