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History of Cell Membrane

With Teacher

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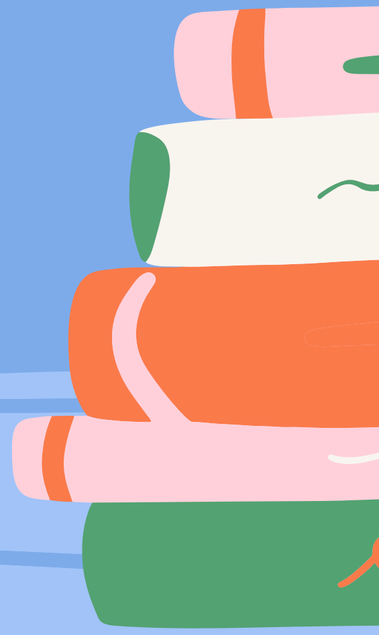

OUTLINE

Establishment of the Idea of a Cell Barrier

Robert Hooke's Study of Cork Cells through a Microscope

Establishment of Cell Membrane Semi-Permeability

Development of Lipid Bilayer Membrane and Various Membrane Models

Davson-Danielli Model

Fluid Mosaic Model

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Establishment of the Idea of a Cell Barrier

17th century: Invention of microscopes enabled closer examination of various tissues. Upon looking at the tissues under a lens, scientists discovered small, room-like spaces that they gave the name "cells," with barriers between each space. Similar barriers were assumed to exist in animal cells, though they could not be seen.

Fun Fact: Early microbiologists were not actually looking at the membrane when they established the idea of a cell barrier--early microscopes were not sharp enough to see it. They were really looking at the plant's cell wall.

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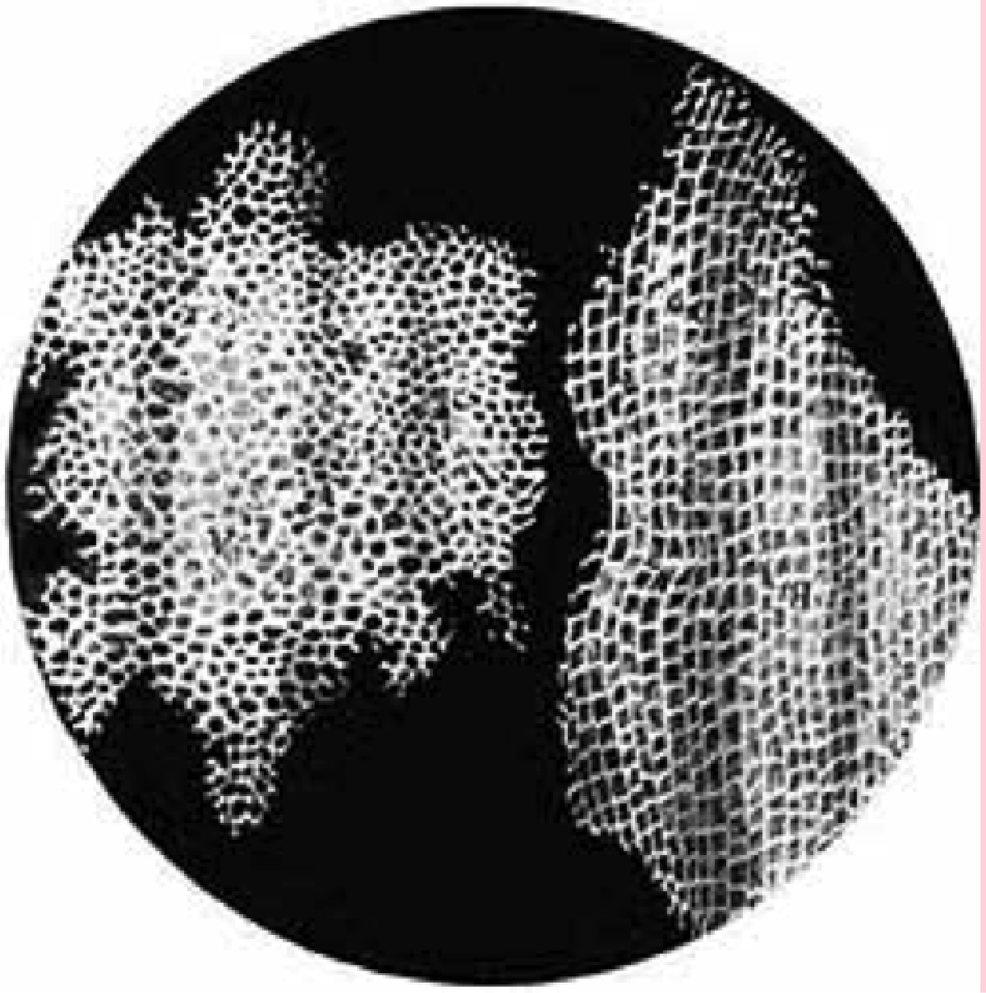
Robert Hooke's Study of Cork Cells through a Microscope



STORY

The 17th-century English physicist Robert Hooke was curious about the remarkable properties of cork--its ability to float, its springy quality, its usefulness in sealing bottles. Hooke investigated the structure of cork with a new scientific instrument he was very enthusiastic about called a microscope.

Hooke cut a thin slice of cork with a penknife, put it under his microscope, focused sunlight on it with a thick lens, and looked through the eyepiece.

What Hooke saw looked like a piece of honeycomb. The cork was full of small empty compartments separated by thin walls. He called the compartments "pores, or cells." He estimated that every cubic inch of cork had about twelve hundred million of these cells.

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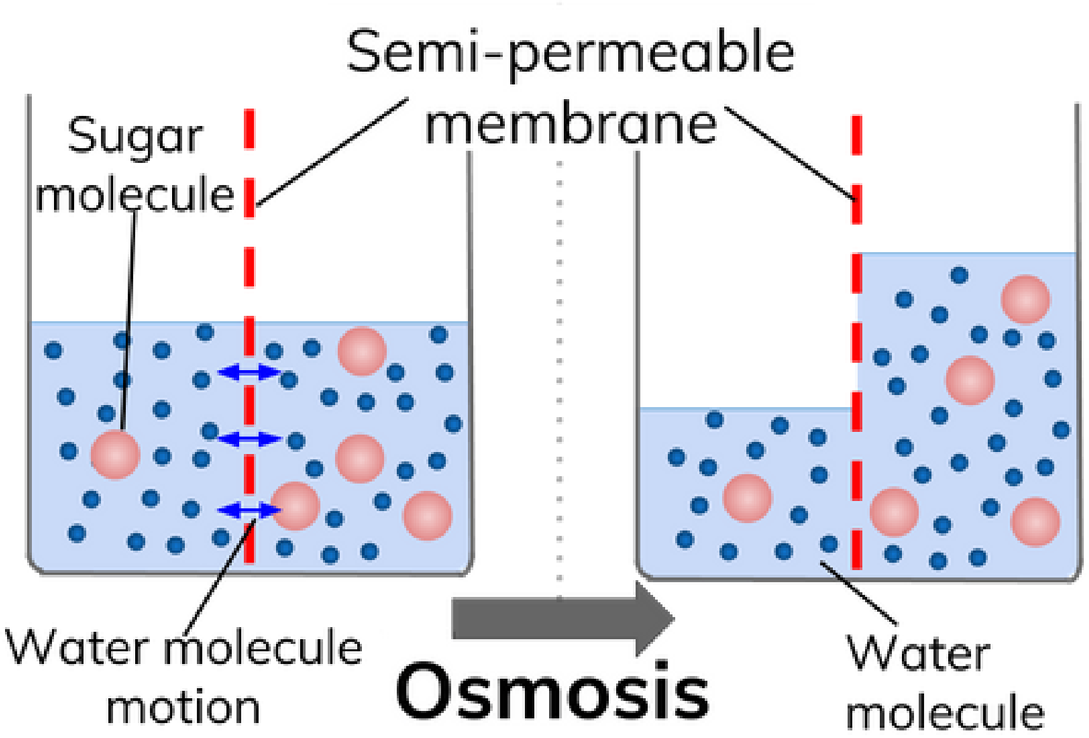
Establishment of Cell Membrane Semi-Permeability



T I M E L I N E

Mid-19th century: Development of colloidal chemistry and coining of the term "osmosis."

1855: Botanists Naegeli and Cramer state that cell membrane plays essential role in osmosis in cells.

1871, 1888: de Vries observes cell membrane permeability for ammonia and glycerol.

1877: Botanist Pfeffer proposes that cells were entirely covered by a thin surface called a plasma membrane, which contains the cell water and solutes.

1889: Hamburger observes red blood cell permeability

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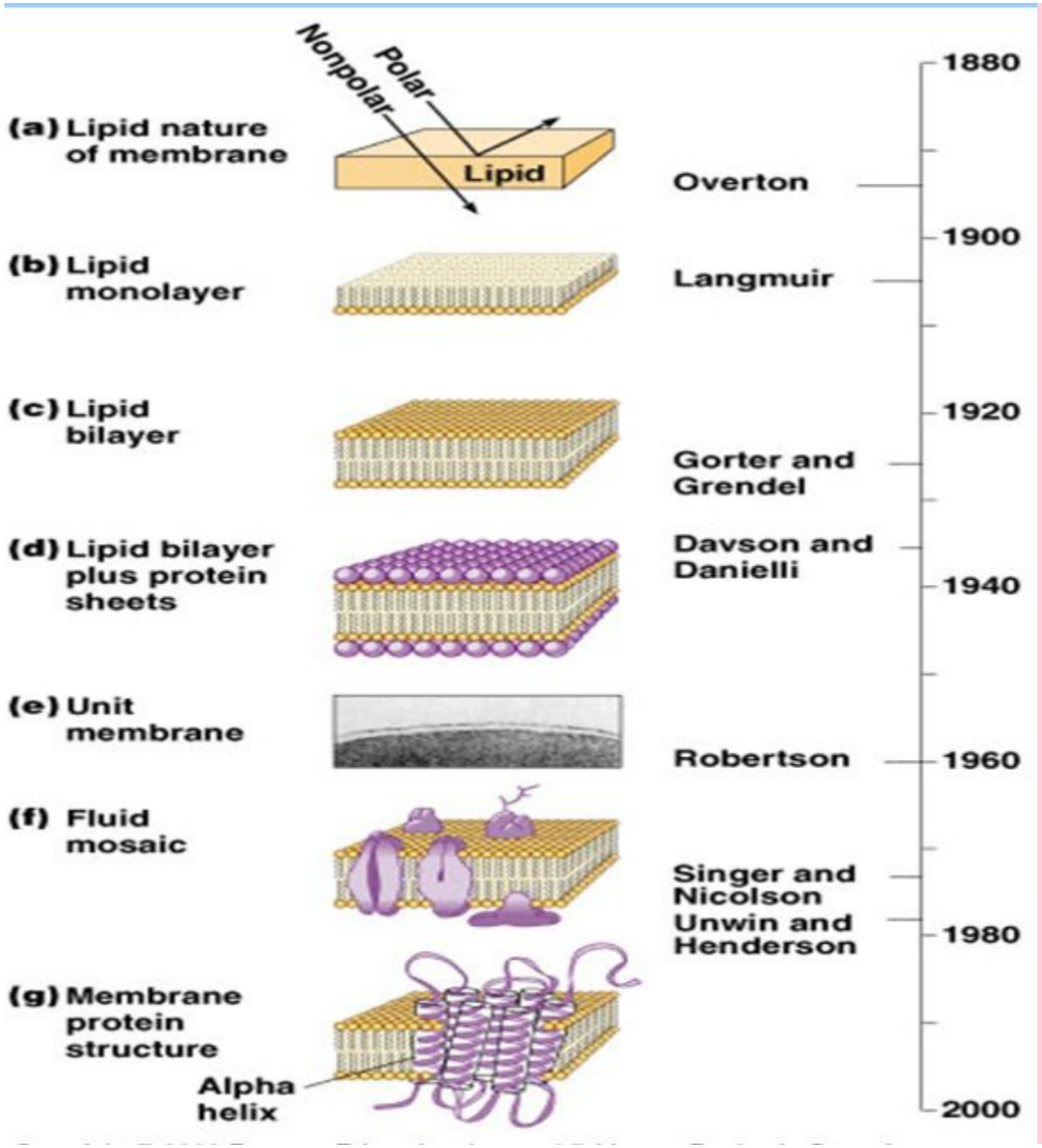
Development of Lipid Bilayer Membrane and Various Membrane Models



DISCOVERY

1895-1899: Overton develops concept of a lipid membrane. (Flaw: Lack of explanation for high permeability of water.) Also proposed idea of active transport requiring energy.

1904: Nathansohn proposes the mosaic model: Membrane is a mosaic with lipid areas and areas with semipermeable gel, which would allow water in.

Refining the Model:
Ruhland: Membrane contains pores as additional passages for molecules.

1935: Davson-Danielli model proposes that the phospholipid bilayer is surrounded by protein layers on either side. (Incorrect: Attributed barrier properties to proteins' electrostatic repulsion, rather than the energy it takes to cross a hydrophobic core.)

1972: Singer-Nicholson's Fluid Mosaic Model: Membrane is a fluid structure with a "mosaic" of proteins embedded in or attached to the phospholipid bilayer.

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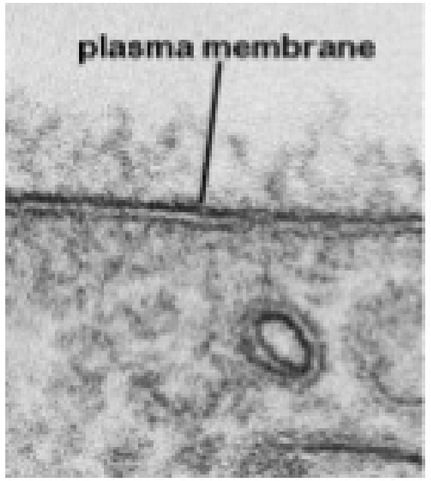
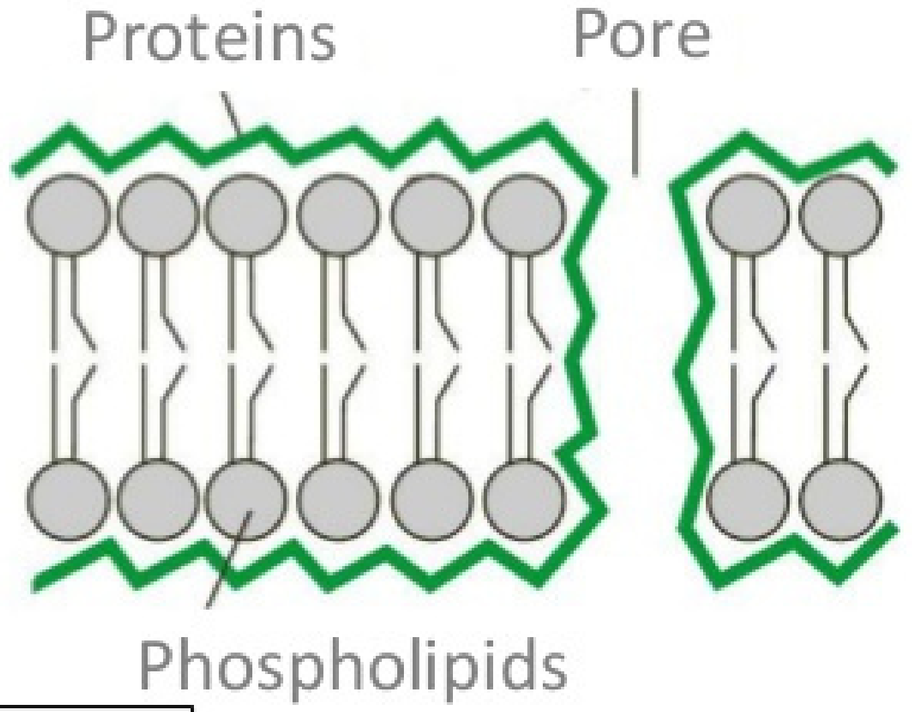
Davson-Danielli Model



The Evidence: In high magnification electron micrographs membranes appeared as two dark parallel lines with a lighter colored region in between. Proteins appear dark in electron micrographs and phospholipids appear light - possibly indicating proteins layers either side of a phospholipid core.

Davson-Danielli Model



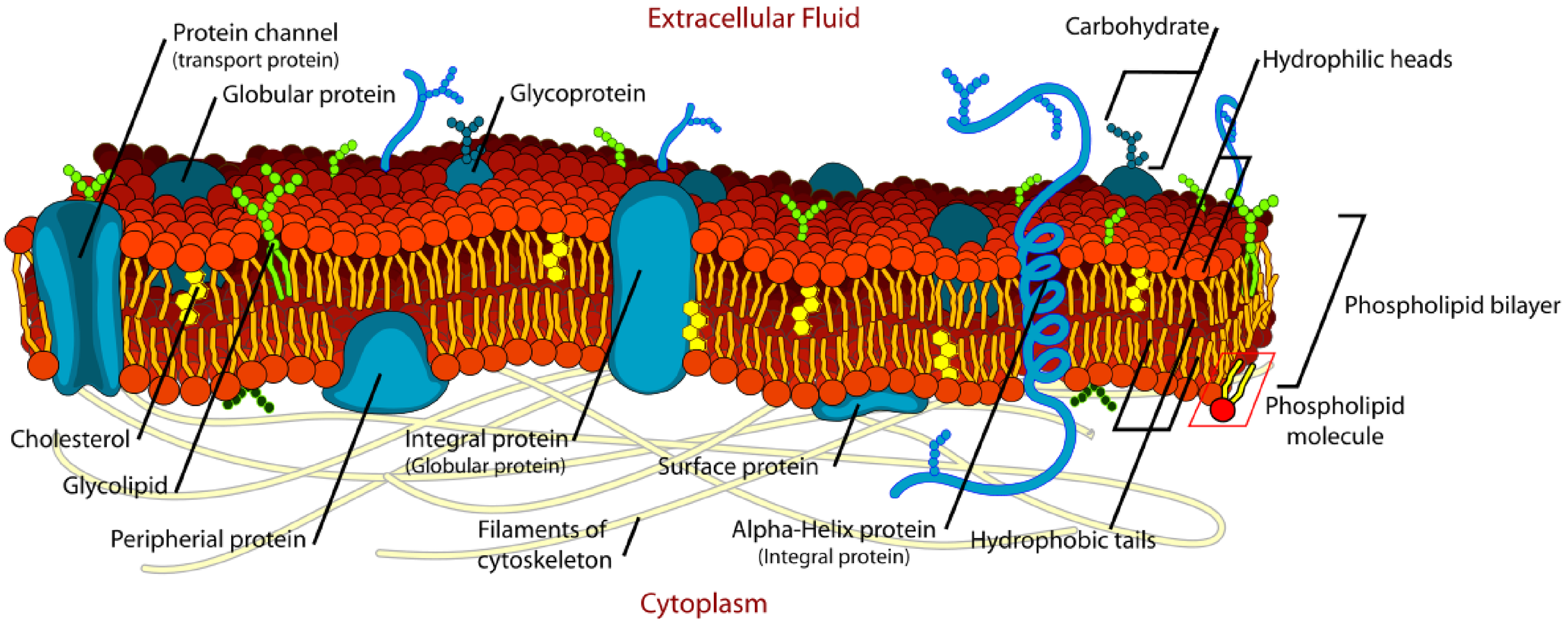
The model:

- *A protein-lipid sandwich*
- Lipid bilayer composed of phospholipids (hydrophobic tails inside, hydrophilic heads outside)
- Proteins coat outer surface
- Proteins do not permeate the lipid bilayer

This explains: Despite being very thin membranes are an effective barrier to the movement of certain substances.

M O D E L

Fluid Mosaic Model



MODEL

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Thank you

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Don't forget to remind