Plasma membrane structure and functions

Dr Anita Kumari
Dept. of Zoology
L.S.College
B.R.A.B.U.,Muz

History

- Meyer, Overton (1895) suggests membrane is lipid
- •Chemicals which act as general anesthetics are also those soluble in both water and oil.
- •Early criticisms of this theory was that it included no mechanism for energy-dependent selective transport

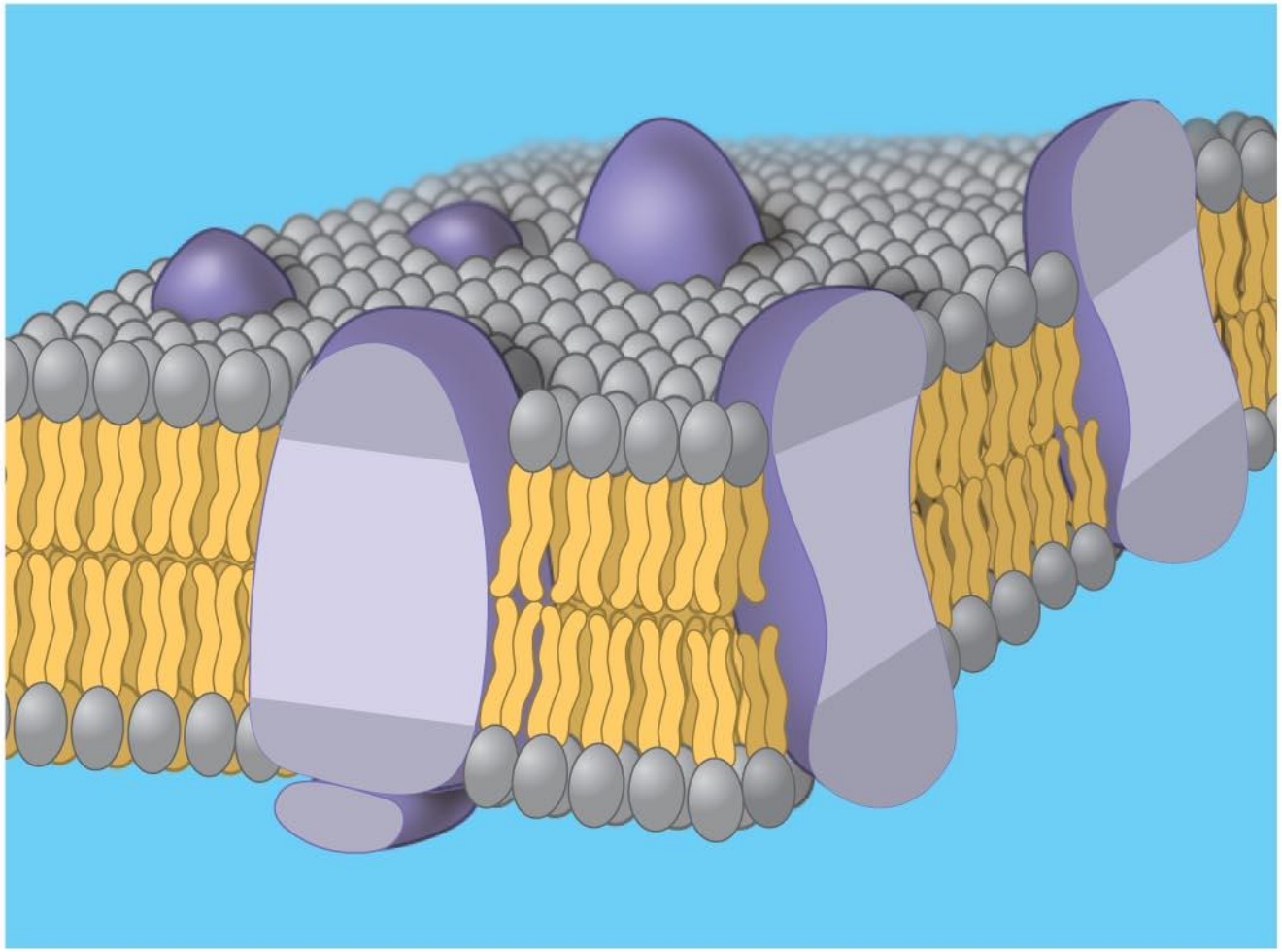
HISTORY

Gorter & Grendel (1925) suggest membrane is phospholipid bilayer

- Must be 2 molecules thick
- A bilayer could exist as a stable boundary between 2 aqueous compartments

HISTORY

- Davson & Danielli (1935) propose a “membrane sandwich” model
- •Accommodates proteins associated with membranes
- •Early TEM support
- •Problems
- •Membranes appear different in different parts of the cell
- •Amphipathic nature of membrane proteins- hydrophobic regions in aqueous environment .
- ▪The fluid mosaic model is published in 1972 by Singer and Nicolson .
- •the only accepted proper description of a biological membrane
- •Proteins are inserted into membrane (amphipathic problem solved.



PLASMA MEMBRANE FUNCTION

- The cell plasma membrane separates the cell contents from the external environment regulating the passage of molecules into and out of the cell.

Membranes organize the chemical activities of cells.

The outer plasma membrane
- forms a boundary between a living cell and its surroundings.
- Exhibits selective permeability
  - Controls traffic of molecules in and out

Internal membranes provide structural order for metabolism

- Form the cell's organelles
- Compartmentalize chemical reactions

Fluid Mosaic Model of the PM

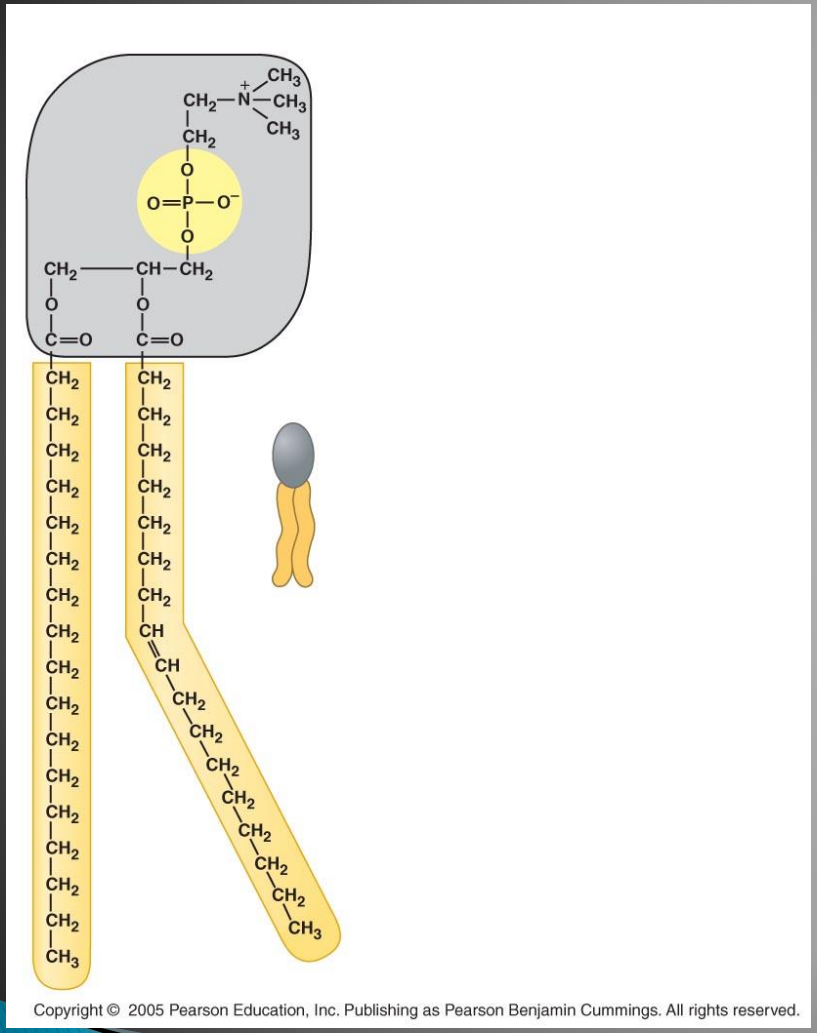
A membrane is a mosaic

Proteins and other molecules are embedded in a framework of phospholipids

A membrane is fluid

Most protein and phospholipid molecules can move laterally

Structure of phospholipid

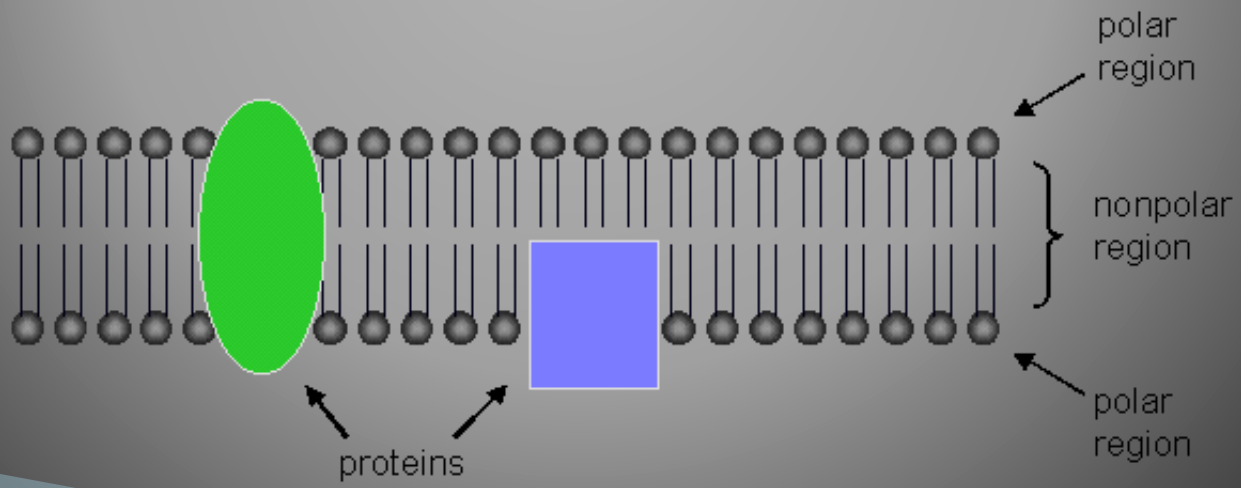


Phospholipids are the major structural component of membranes.

Structure of PM

- Embedded in the bilayer are proteins
  - Most of the membrane's functions are accomplished by the embedded proteins.
    - Integral proteins span the membrane
    - Peripheral proteins are on one side or the other of the

MODEL OF PM



Component of plasma membrane

Glycoproteins and glycolipids are proteins/lipids with short chain carbohydrates attached on the extracellular side of the membrane

Type of protein

1. Cell-cell recognition proteins
2. Integrins
3. Intercellular junction proteins
4. Enzymes
5. Signal transduction proteins

Aka - Receptor proteins

6. Transport

Func….

Cell-cell recognition proteins – identify type of cell and identify a cell as "self" versus foreign

- Most are glycoproteins
  - Carbohydrate chains vary between species, individuals, and even between cell types in a given individual.
  - Glycolipids also play a role in cell recognition

Funct….

Integrins are a type of integral protein
- The cytoskeleton attaches to integrins on the cytoplasmic side of the membrane
- Integrins strengthen the membrane

Intercellular junction proteins – help like cells stick together to form tissues

Funct…

Many membrane proteins are enzymes
This is especially important on the membranes of organelles.

Func…

Signal transduction (receptor) proteins bind hormones and other substances on the outside of the cell.

- Binding triggers a change inside the cell.
  - *Called signal transduction*
  - Example: The binding of insulin to insulin receptors causes the cell to put glucose transport proteins into the membrane.

Type of transport protein

Passive Transport Proteins

- allow water soluble substances (small polar molecules and ions) to pass through the membrane without any energy cost

Active Transport Proteins

- The cell expends energy to transport water soluble substances *against* their concentration gradient