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Cell membrane overview

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WHAT IS CELL MEMBRANE ?

It is the boundary that separates the living cell from its nonliving surroundings The plasma membrane exhibits **selective permeability**

It allows some substances to cross it more easily than others

Can we see cell membrane by ordinary light microscope??



It is invisible with **light microscope** in electron micrographs appears as a thin dense line (8.5 - 10 nm thick)And In electron micrographs of high magnification three parallel lines can be seen in thin sections of the cell membrane – two electron dense layers (2.5 - 3.0 nm) separated by an electron-lucent intermediate layer (3.5 - 4 nm)





Carbohydrates





Phospholipids

Are the most abundant lipid in the plasma membrane Are amphipathic, containing both hydrophobic and hydrophilic regions









The Davson-Danielli sandwich model of membrane structure Stated that the membrane was made up of a phospholipid bilayer sandwiched between two protein layers



In 1972, Singer and Nicolson Fluid mosaic model Proposed that membrane proteins are dispersed and individually inserted into the phospholipid bilayer







The Fluidity of Membranes Phospholipids in the plasma membrane Can move within the bilayer



The steroid cholesterol Has different effects on membrane fluidity at different temperatures



The Permeability of the Lipid Bilayer Hydrophobic molecules Are lipid soluble and can pass through the membrane rapidly **Polar molecules** Do not cross the membrane rapidly

Membrane Proteins

A membrane Is a collage of different proteins embedded in the fluid matrix of the lipid bilayer



Integral proteins Penetrate the hydrophobic core of the lipid bilayer Are often trans membrane proteins, completely spanning the membrane



Peripheral proteins Are appendages loosely bound to the Cytoplasmic surface of the membrane





The carbohydrates are found on the outer surface of all eukaryotic cell membranes, and are attached to the membrane proteins or sometimes to the phospholipids





The carbohydrates are short polysaccharides composed of a variety of different monosaccharaides, and form a cell coat or glycocalyx outside the cell membrane. The glycocalyx is involved in protection and cell recognition, and antigens such as the ABO antigens on blood cells are usually cell-surface glycoproteins

From the previous structures of different constituents of cell membrane Can we conclude the molecular function of it??









3- Related to carbohydrates



Phospholipids

 Forms boundary to isolate cell contents from environment

 Restricts passage of hydrophilic substances across the membrane



Reduces membrane fluidity Reduces permeability to water-soluble substances

2- Related to proteins

- 1. Transport
- 2. Enzymatic activity
- 3. Signal transduction
- 4. Cell-cell recognition
- 5. Intercellular joining
- 6. Attachment to the cytoskeleton and extracellular matrix (ECM)



Transport



Intercellular joining



Enzymatic activity



Cell-cell recognition



Signal transduction

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Attachment to the cytoskeleton and extracellular matrix (ECM)



Allow passage of hydrophilic substances across the membrane



Passive transport Substances move from [high]→[low] No energy input required Simple Diffusion, Facilitated Diffusion

Passive transport aided by proteins In facilitated diffusion

Transport proteins speed the movement of molecules across the plasma membrane



Channel proteins

Provide corridors that allow a specific molecule or ion to cross the membrane



Carrier proteins

Undergo a subtle change in shape that Translocate the solute-binding site across the membrane Carrier



Active transport Substances move from [low]→[high] Requires energy input



Enzymatic activity





2 Na⁺ binding stimulates phosphorylation by ATP.



3 Phosphorylation causes the protein to change its conformation, expelling Na⁺ to the outside.



group.

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Markers of Self: Major Histocompatibility Complex



Cell Attachment Structures



The Role of Membrane Carbohydrates Interact with the surface molecules of other cells, facilitating cell-cell recognition



General functions of cell membrane

Large proteins Cross the membrane by different mechanisms



In exocytosis

Transport vesicles migrate to the plasma membrane, fuse with it, and release their contents

In endocytosis

The cell takes in macromolecules by forming new vesicles from the plasma membrane

Endocytosis





(a)

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