2. PLASMA MEMBRANE

OCCURANCE

Plasma membrane or cell membrane is the outermost boundary of animal cells and inner to cell wall in plant cells.

COMPOSITION

Cell membrane is chemically composed of 20-40% lipids and 60-80% proteins. In addition there is small quantity of carbohydrates present.

SIZE

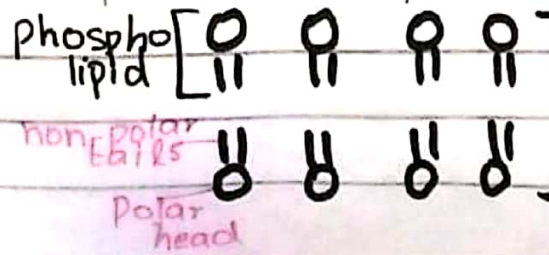
(It ranges from 7.5 nm - 10.5nm)
It is about 7nm wide

STRUCTURE OF CELL MEMBRANE

Different models were suggested for the structure of plasma membrane:

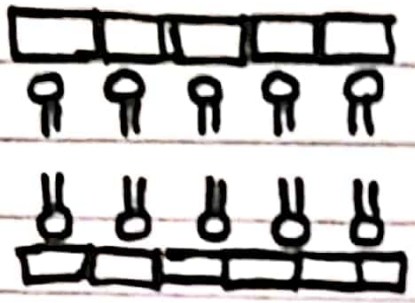
1. LIPID BILAYER

In 1925, Gorter and Grendel / Gandal and Govte suggested that plasma membrane is composed of lipid bilayer.



2. SANDWITCH OR MEMBRANE

In 1935 JF Danial and Davson proposed that lipid bilayer is sandwitched between monolayer of proteins.



4. FLUID MOSAIC MODEL

1972, by Singer and Nicolson

Fluid mosaic model is the most acceptable model. According to this model cell membrane consists of lipid bilayer in which protein molecules float about while some stay embedded in the membrane. It explains that: the membrena is like a "sea of lipids in which protein are floating".

3. UNIT MEMBRANE MODEL

It was proposed by Robertson in 1959. He proposed that plasma membrane is only one layer of protein and lipids.

PROTEINS

Certain types of proteins are present in cell membrane:

1. INTRINSIC PROTEINS

Some proteins extend completely through the double layer of lipids from one side to the other and are called intrinstic proteins.

2. EXTRINSIC PROTEINS

Those proteins which are smaller and are placed between the phospholipid molecules. These are on one side of the membrane and are called extrinsic proteins.

3. GLYCOPROTEINS

Carbohydrates extend out from the outer surface of the membrane and are attached to proteins are known as glycoproteins. These proteins act as permeases.

ROLE OF PROTEINS

The proteins within a membrane determine most of the functions. These include:

1. CHANNEL PROTEINS AND CARRIER PROTEINS

Certain plasma membrane proteins are involved in the passage of molecules through the membrane. Some of those have a channel through which a substance simply can move across the membrane, other are carriers that combine with a substance and help it to move across the membrane.

2. PERMEABILITY

Membrane proteins makes the cell membrane selectively permeable that select materials according to cell's need. If glucose concentration inside the cell is proper, no more glucose can enter the cell.

Integral proteins are also called as "permeases" bcz they regulate diffusion, osmosis and active transport of ionic materials.

3. ENZYMES

Some plasma membrane proteins have enzymatic functions. They perform metabolic reactions directly, for example the membrane protein, adenylate cyclase, is involved in ATP metabolism.

4. RECEPTOR MOLECULES

Extrinsic proteins function as receptors that receives the stimuli from the environment and thus inform the cell to respond.

5. ANTIGENS (RECOGNITION OF ANTIGENS)

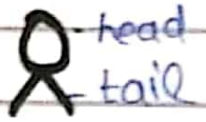
Antigens are glycoproteins. The glycoproteins have an enormous number of possible shapes, so each type of cell can have its own specific markers. This enables cell to recognize other cells for example the foreign antigens can be recognized and attacked by immune system.

LIPIDS

The types of lipids present in the plasma membrane are:

1. PHOSPHOLIPIDS

Phospholipids are composed of phosphate head and lipid tail. Head is hydrophillic (water soluble) while tail is hydrophobic (water repellent)



2. GLYCOLIPIDS

Carbohydrates extend from the outer surface of the membrane and which are attached to membrane lipids are known as glycolipids.

3. CHOLESTROL

Cholestrol is a steroid which is wedged into the bilayer.

ROLE OF LIPIDS

The role of lipids in the plasma membrane include:

1. PERMEABILITY

Lipid bilayer makes the membrane differentially permeable barrier that allows the transport of non-polar materials across it and prevents ionic materials.

2. FLUIDITY OF MEMBRANE

The fluidity of membrane is dependant on its lipid componenents, including phospholipids, glycolipids and cholestrol.

When the concentration of uncaturated fatty acid residues becomes greater, the bilayer becomes more fluid. The fluidity of a phospholipid bilayer means that the cells are pliable i-e flexible.

3. STABILIZATION (THERMOREGULATION)

The cholestrol helps stabilize the phospholipids at body temperature but helps keep the membrane fluid at lower temperature.

ROLE OF CARBOHYDRATES

Carbohydrates also play an important role in cell membrane. They include:

1) GLYCOCALEX

Carbohydrates are attached to the outer surface of proteins or lipids forming glycoproteins or glycolipids. The glycoproteins and glycolipids are collectively known as glycocalex.

2) ENDOCYTOSIS

Membrane carbohydrates are also responsible for endocytosis. Endocytosis is of two types:

i) PHAGOCYTOSIS

It is the eating process of cell. It occurs due to the entry of solid or large molecules.

ii) PINOCYTOSIS

It is the drinking of the cell. It occurs with the entrance of liquid substances or small molecules.

TRANSPORT ACROSS MEMBRANE

Transport across membrane occurs for a number of reasons, for example:

1. To obtain nutrients
2. To excrete waste substances (urea, uric acid etc)
3. To secrete useful substances (hormones, enzymes)
4. To generate the ionic gradients essential for nervous and mascular activity.
5. To maintain a suitable pH and ionic concentration with the cell for enzyme activity.

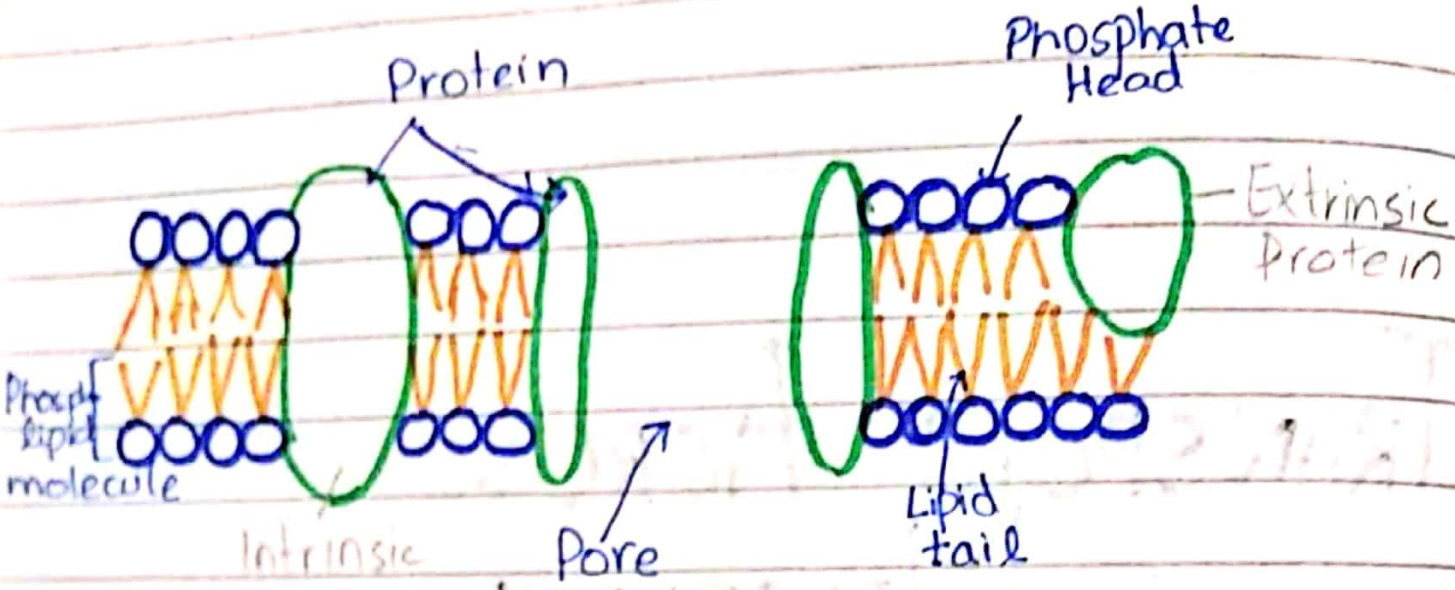


Fig: Fluid Mosaic Model

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