

## Fluid Mosaic Model

It describes the structure of the cell membrane. According to this, the membrane is made up of a lipid bilayer in which protein molecules are floating.

It is called fluid because the membrane is liquid thus the lipid molecules are floating within it.

Mosaic because protein molecules are embedded in lipid-like mosaics.

### Features Of Fluid Mosaic Model:

1. The cell membrane is made by a phospholipid bilayer. The hydrophilic part is facing outside of the membrane while hydrophobic parts are present inside.

This is because the intracellular and extracellular compartment is made up of water.

2. Some phospholipid tails are saturated while some are unsaturated. The amount of unsaturated fatty acid chains present will determine the fluidity of the membrane. More unsaturated fatty acids mean it will be more fluid in nature.

3. Protein molecules are floating in a phospholipid bilayer like icebergs. Although some of them are fixed like islands.

4. Cholesterol is also present in the phospholipid layer. It controls the fluidity of the cell membrane.

5. Most of the proteins and lipids also have short-chain carbohydrates

attached to them hence called glycoproteins and glycolipids.

## **Type Of Proteins**

There are two types of proteins present:

### **1) Intrinsic Proteins**

Intrinsic proteins span the whole membrane.

### **2) Extrinsic Proteins**

Extrinsic proteins are present on the outer layer or inner layer only.

## **Roles Of Components Of Cell Membrane**

The cell membrane is composed of different molecules. Each of them plays a different role.

### **1) Phospholipids**

Phospholipid makes the basic layer of the cell membrane. It has a hydrophobic centre that forms a barrier preventing polar substances from crossing the membrane.

### **2) Cholesterol**

Cholesterol has the same amphipathic (having both hydrophobic and hydrophilic end) structure. Thus, it fits correctly with phospholipid molecules. They help in controlling the fluidity of the cell membrane.

They are also important for providing mechanical support to the membrane as they help in sticking phospholipids molecules together.

### **3) Proteins**

They have different roles. Some proteins act as channels to allow passage to polar molecules. They can be opened or closed.

Others are carrier proteins. These proteins actively transport polar molecules in and out of the cell membrane.

Some membrane proteins also have enzymatic properties. Like those present in the cells of intestinal walls. They catalyze the breakdown of different molecules.

#### **4) Glycoproteins And Glycolipids**

Glycoproteins act as receptors that bind with particular molecules. Like cells on the liver and muscles have receptors for insulin.

Insulin binds with these receptors and produces a series of chemical changes inside the cell. Thus, they help in the cell to cell communication.

They also function as antigens through which cells recognize each other. Different cells have different antigens.

#### **Function Of Cell Membrane**

It separates the intracellular component from the extracellular component.

It helps in cell signalling.

Selectively permeable thus allowing transport of specific molecules only.

## Cell Membrane

The cell membrane is semi-permeable. Thus, it allows some substances to pass through while blocking others.

- Hydrophobic molecules like Oxygen,  $\text{CO}_2$ , etc can diffuse easily through the membrane. This is because the core of the membrane is made up of lipids.
- Small charged particles like  $\text{H}_2\text{O}$  can move through cell membrane but it needs a channel to do so.
- Large uncharged polar molecules and ions cannot move through cell membranes on their own. As they have charged they are repelled by the cell membrane.

## Passive Transport

Movement of substances from high concentration to low concentration without using energy is called passive transport.

- Diffusion
- Osmosis
- Facilitated diffusion

### Diffusion:

Molecules can move freely in gases and liquids. They occupy the space available.

### Diffusion is:

The net movement of molecules

From the region of high concentration to low

Thus, it does not need energy as the transport is down the concentration gradient.

### **For Example:**

Co<sub>2</sub> is at high concentration outside the cell. As it has no charge it can easily diffuse through the hydrophobic cell membrane. The movement of Co<sub>2</sub> will be from outside to the inside of the cell across the concentration gradient.

### **Facilitated Diffusion:**

The movement of molecules from high concentration to low concentration via a channel protein is called facilitated diffusion.

The movement takes place across a concentration gradient and thus does not need energy.

Ions or charged particles cannot diffuse through the cell membrane. This is because of the hydrophobic core of the cell membrane. Thus, these particles need a channel through which they can move. This is provided by proteins in the cell membrane.

Each channel protein transports only a specific molecule. Thus, there are different proteins for the transport of different substances.

### **Example:**

Amino acids are transported by facilitated diffusion.

### **Osmosis:**

Movement of water molecules from high concentration to low concentration through a semi-permeable membrane is called osmosis.

Water molecules are polar but have a small size thus they can easily move through the cell membrane.

Solution with greater water concentration has more energy thus more molecules can move and diffuse the solution is said to have greater potential.

That is why solutions with more water concentration are said to have greater water potential.

Thus, osmosis can be defined as the movement of water from high water potential to low water potential.

## **Water Potential**

Pure water = 0 kPa

Solutions = -ve kPa

The more solute is added to water the negative the water potential will be,

Thus, dilute solutions have less negative potential than concentrated solutions.

## **Active Transport**

Sometimes molecules have to be transported against the concentration gradient in that case energy has to be used by cells.

Transport which takes place against the concentration gradient by using energy is called active transport.

### **For Example**

Minerals and ions are pumped actively from the soil into the root hair cells. The concentration of ions is greater in the root hairs. Thus, the concentration gradient is from root hairs to soil. In order to absorb more minerals, the ions have to be pumped actively into the root hairs. This needs energy.

Active transport needs carrier proteins. These carrier proteins break down ATP to release energy. This energy is used to pump ions across the cell membrane.

### **Endocytosis And Exocytosis (Bulk Transport)**

Transport of macromolecules across the cell membrane cannot take place through proteins. It takes place through vesicles.

#### **Exocytosis**

Molecules that need to be transported out area surrounded by vesicles inside the cell.

These vesicles are then moved towards the cell membrane.

The membrane of the vesicle fuses with the cell membrane.

The molecules are then transported out of the cell.

#### **Endocytosis**

Movement of molecules inside the cell takes place in the same way as exocytosis.

The cell sends out the projection of the cell membrane around the molecules to be transported in.

The membrane then fuses around the molecule to form a vesicle. This vesicle then pushes the molecule inside the cell membrane.

## **Movement Of Water Between cells and Solution Of Different Water Potential**

### **Hypertonic Solution**

A hypertonic solution has a lower water potential than the cell. Thus, the potential gradient is outside the cell. This results in osmosis of water out of the cell in the solution which will result in plasmolysis or shrinking of cell cytoplasm.

### **Hypotonic Solution**

A hypotonic solution has greater water potential than the cell. The potential gradient is towards the inside of the cell. Thus, water moves inside the cell through osmosis.

### **Isotonic Solution**

An isotonic solution has the same water potential as the cell. Thus, there will be no net movement of water.

## **Difference Between Animal And Plant Cells**

Plant cells have a cell wall. Thus, they generate pressure potential which resists further movement of water inside or out of the cell. This prevents the bursting of the cell.