Subject: Zoology

Production of Coursework Content for

Undergraduate Course

Paper No: II Cell Biology

Module: 1 Fluid- Mosaic model

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Description of Module	
Subject Name	Zoology
Paper Name	Cell Biology
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Module Name/Title	Fluid-Mosaic model
Module Id	ZOO/P-IICB/I
Pre-requisites	Plasma membrane
Objectives	In this module we will learn about: ▪ Structure of Plasma membrane ▪ Chemical composition of plasma membrane ▪ Function of plasma membrane
Keywords	Phospholipids, Integral membrane proteins, Cholesterol, Lipid bilayer

❖ **Introduction**

The cytoplasm of every cell is bounded by thin delicate membrane called plasma membrane.

Plasma membrane is extremely thin so that it cannot be seen under light microscope.

Plasma membrane play key role in most of the cellular functions which are follows.

i. Controls entrance & exit of molecules & ions.
ii. Play Imp role in signal transduction.
iii. Play enzymatic role (ETC)
iv. PM involved in transport.
v. PM involved in cell to cell interaction.
vi. Provide stability to cell.

Acts as a permeability barrier.

Fluid-mosaic Model

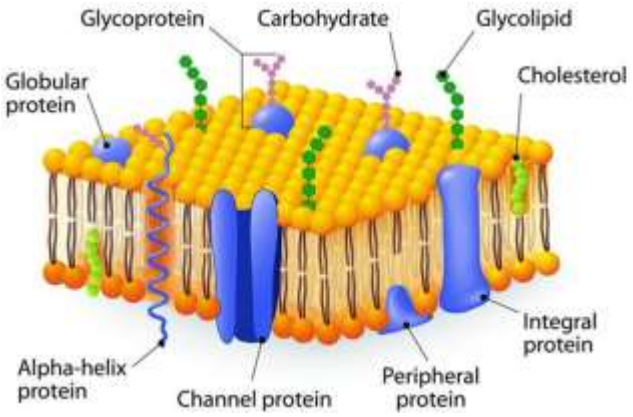
- ✓ Proposed by S.J.Singer & G.L.Nicolson in 1972.
- ✓ These model best explaining **properties of membrane.**
- ✓ This model assumes that all biological membranes are quasifluid(Semifluid) structure where the lipid molecules form a continuous bilayer in which globular proteins are embedded.
- ✓ The protein molecules have been compared to iceberg floating in sea of lipid bilayer giving a mosaic appearance.

Two types of membrane protein i.e.

a. Extrinsic (Peripheral) protein
b. Intrinsic (Integral) protein

Extrinsic proteins are found entirely on outer side of lipid bilayer

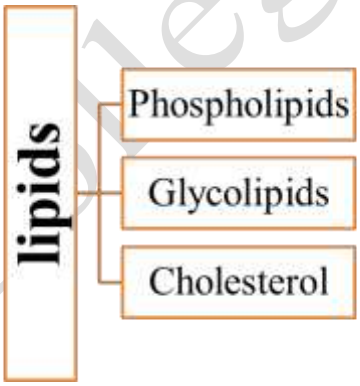
Intrinsic proteins penetrate partially or fully lipid bilayer.



- **Chemical Composition**
  - ✓ Chemically all membranes are assemblies of lipids & proteins.
  - ✓ These molecules are held together in thin sheet by noncovalent bonds.
  - ✓ In addition to lipids & proteins membranes also contain carbohydrates.

I. **Lipids:**

- ✓ Lipid molecules are insoluble in water but dissolve in organic solvent. Membrane contain three major types of lipids.
- ✓ All 3 are amphipathic i.e. they having both hydrophobic & hydrophilic end.



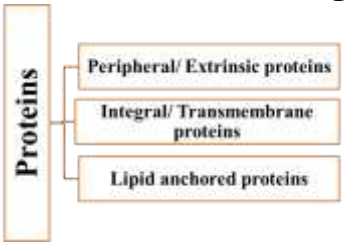
Phospholipid: These lipids contain phosphate group in hydrophilic head. These can be distinguished into **glycerophospholipids** with glycerol backbone & **sphingophospholipids** base on sphingosine.

Glycolipids: These contains one or more carbohydrate residues. If the carbohydrate is simple sugar (Monosaccharide) the glycolipid is called a **cerebrocide** & if it is an oligosaccharide the glycolipid is called a **ganglioside.**

Cholesterol: It is a steroid & is most abundant in animal tissue. It regulates the fluidity of the membrane & also enhances its mechanical stability

Proteins:

- ✓ Specific function of plasma membrane are carried out by proteins.
- ✓ Proteins provide : a) mechanical structure
  b) Acts a transport molecules into and out of cells,
  c) Serves as specific receptors
  d) Serves as enzymes.
- ✓ Membrane proteins can be divided into 3 groups.



i. Peripheral or extrinsic proteins:

- ✓ Peripheral proteins are located entirely on the outer side of lipid bilayer (Plasma membrane) i.e. on extracellular surface.
- ✓ They are associated with the membrane by weak electrostatic bonds either to the hydrophilic head groups of the lipids.
- ✓ They are soluble in aqueous solution & can be removed from the membrane by solutions of high ionic strength.
- ✓ Example of best studied peripheral protein are a) Spectrin b) Ankyrin

ii. Integral or Transmembrane proteins:

- ✓ These protein penetrate into the lipid bilayer, in fact, they pass entirely through the lipid bilayer.
- ✓ Like phospholipids, they are also amphipathic i.e. having both hydrophilic and hydrophobic portions.
- ✓ They are tightly bound to the lipid bilayer and cannot be easily dissociated.
- ✓ They have higher percentage of non-polar amino acids.

iii. Lipid-anchored proteins:

- ✓ They are located outside the lipid bilayer and are linked to a lipid molecule that is situated within the bilayer.

Carbohydrates:

- ✓ Carbohydrates are present only in the plasma membrane and no carbohydrate is located at the cytoplasmic or inner surface of plasma membrane.
- ✓ Plasma membrane carbohydrates are in the form of glycoproteins and glycolipids.
- ✓ They are covalently linked to both lipid and protein components.
- ✓ The glycoproteins are present in the form of branched oligosaccharide chains with sialic acid terminals.