PLASMA MEMBRANE

Plasma membrane is thin, film like, elastic, selective permeable, quasifluid, asymmetrical sheet like outermost covering of the cells, which separates protoplasm from the outer environment and control the exit and entery of molecules and ions into and out of the cells.

Discovery: Plasma membrane was discovered by Overton (1841). It is also known as —

1. Cell membrane — Nagli and Cramer (1885)
2. Protoplasmic membrane - Pfeffer (1877)
3. Plasmalemma — Plowe (1931)
4. Unit membrane — Robertson (1959)
5. Bio-membrane - Singer and Nicolson (1972)
6. cytoplasmic membrane
7. Lipoprotein membrane
8. Quasi fluid membrane

Position:

On plant and bacterial cell, plasma membrane is present between protoplasm and cell wall, whereas outer boundaries in animal cells.

Distribution: P.M is present in all living cell outside the protoplasm. It is also present in cell organelles like mitochondria, golgi body, E.R., vacuole, lysosome etc.

Chemical Composition:

Protein — 55 - 60%
Lipid — 40%
carbohydrate — 1%

Protein — three types

① structural protein — It forms the structure of P.M
② Enzymatic protein — It performs the physiological function of P.M.
③ Carrier protein: It carries the ions or molecules.

Enzymes: About 30 types of enzyme are found in plasma membrane. Out of which some are as follow ATPase, cytochrome oxidase, cytochrom P-450

nuclease, phosphotase, etc.

Physical Structure of Lipids:

Due to hydrophilic and hydrophobic ~~and~~ nature, lipid is amphiphatic in nature.

- Head - made up of glyceral (hydrophilic)
- Tail - Madeup of fatty acid (hydrophobic)

Common carbohydrates present in P.M are hexose (glucose) and hexosamine. This glucose is attached with protein to form glycoprotein and with lipid to form glycolipid. Scialic acid is also present in plasma membrane.

DNA is present but RNA is absent in membrane.

Thickness of membrane:

50 - 215 A°, general 75 A°.

Molecular Organization or Structure of P.M

Various model have been proposed to [illegible] orientation of various chemical compounds in the biomembranes.

(1) Unit membrane:

This model was proposed by Robertson in 1959. According to this model plasma membrane is composed of two layers of protein molecules and a thick layer of lipid lying between them. According to Robertson, thickness of typical plasma membrane is about 75A°. Out which outer layer of protein 20A° thick, middle layer of lipid which is divided into two sublayer including both hydrophilic polar groups each of 5A° cover a distance of 35A° and inner layer of protein 20A°.

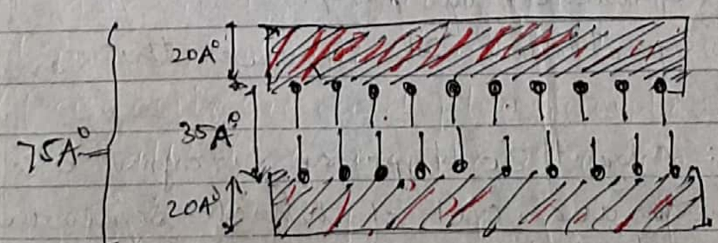

Fig - unit membrane model.

Unit membrane model of Robertson is some time considered as double layered membrane each layer of which is comprised of outer protein layer and inner lipid layer.

2. Fluid Mosaic model:

This model is given by Singer and Nicolson(19 This is accepted model of plasma membrane because it explain dynamic nature of P.M.

According to this model P.M is made up of protein & lipid. Lipid is comparable to fluid (sea) and protein is comparable to Mosaic (ice-berg). This protein is of three types —

1) Peripheral (Extrinsic) protein — Easily remove from P.M
2) Integral (Intrinsic) protein — Not easy to remove from P.M
3) Bounded protein

Flip flop movement:

from outside to inside or vice-versa within the P.M is known as flip flop movement.

The amount of lipids and amounts of prote provide structural and functional specificity to membrane.

The quasifluid nature of membrane help i quick repairing, expansion and ablity to fuse.

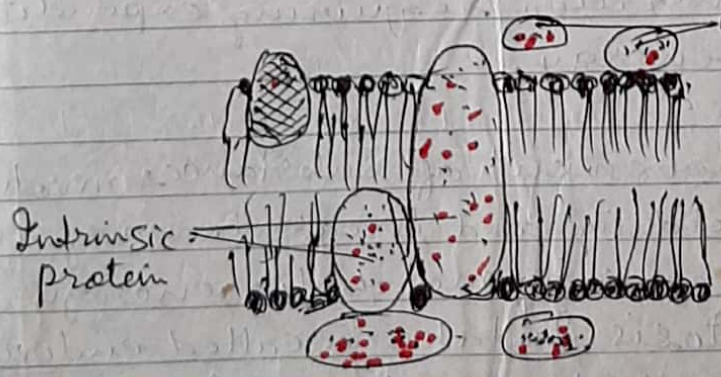

Fig - Fluid - Mosaic model.

Function:

① It provide a definite shape to the cell.
② It separates the cell from external environment and protect from external pressure.
③ It regulates the passage of substances in and out of the cell.

Exchange of materials occurs by the following three processes.

1) Passive transport:

Movement of substances occurs from a region of higher concentration to the region of low concentration. This require neither any activity nor metabolic energy or part of the cell. This process is further subcategorized as:

(i) Simple diffusion:

Movement of solute or gas particles without the help of a carrier.

(ii) [illegible]

Transportation of molecules with the help of a carrier (Permease).

(iii) Osmosis: Diffusion of water from a region of high to low concentration of water.

2) Active transport:

The movement of substances across the membrane from a region of low concentration to high concentration requiring expenditure of metabolic energy.

3) Cytosis:

Bulk movement of substances involving movement, folding and break down of membrane and requiring metabolic energy is known as cytosis. Intake is called endocytosis (Pinocytosis and phagocytosis) while expulsion is called exocytosis (Secretion)

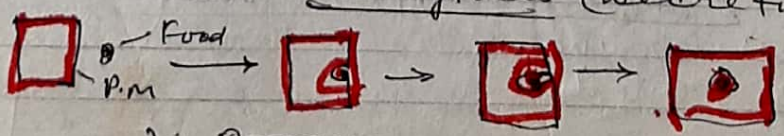

Fig. Process of Endocytosis