Difference Between Transmembrane and Peripheral Proteins

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Key Difference - Transmembrane vs Peripheral Proteins

The fluid mosaic model that was discovered in 1972 by Singer and Nicolson explains the structure of universal cell membrane that surrounds cells and its organelles. It has been evolved over the years, and it explains the basic structure and function of the cell membrane. The plasma membrane is the model which protects the cells from damages, and it provides protection against foreign agents. According to fluid mosaic model, the plasma membrane is made up of bilayered lipids sheets (phospholipids), cholesterol, carbohydrates, and proteins. Cholesterol is found attached to the lipid bilayer. The carbohydrates are either attached to lipids or proteins in the membrane. The membrane proteins are of three types: integral, peripheral and transmembrane proteins. The integral proteins are integrated into the membrane. The **key difference** between transmembrane proteins and peripheral proteins is, **transmembrane proteins extend all the way across the membrane while the peripheral proteins are attached loosely to the inside and outside surfaces.**

What is a Transmembrane Protein?

The transmembrane proteins are special types of integral proteins that extend through the biological cell membrane. It is permanently attached and can be found entirely spanning across the membrane. Most of the transmembrane proteins are working as gateways that permit the transportation of other substances to the cell inside. The transmembrane proteins have hydrophobic coils and helix that stabilized its position in the lipid bilayer. The structure of the transmembrane protein is divided into three domains. The domain in the lipid bilayer is called as lipid bilayer domain. The domain that is found in the cell outside is called as an extracellular domain. The domain inside is known as an intracellular domain.

Though the plasma membrane is fluidic, the orientations of the transmembrane proteins do not change. These proteins are so large and have high molecular weight. So the rate of changing orientation is very small. The extracellular part is always outside the cell, and intracellular part is always inside the cell.

The transmembrane proteins are playing several very important functions in the cell. They play a pivotal role in cell communication. They signal information regarding the external environment to the cell inside. The receptors can be attached to the substances in the extracellular domain. Once the protein binds to the substrates, it brings geometrical changes to the intracellular domain of the protein. These changes bring several changes in the geometry of proteins in the cell inside producing a cascade reaction. The transmembrane proteins are capable of acting as a signal transducer to cell inside. They initiate signals which are responsive to the external environment, and it leads to the actions that take place in the other parts of the cell.

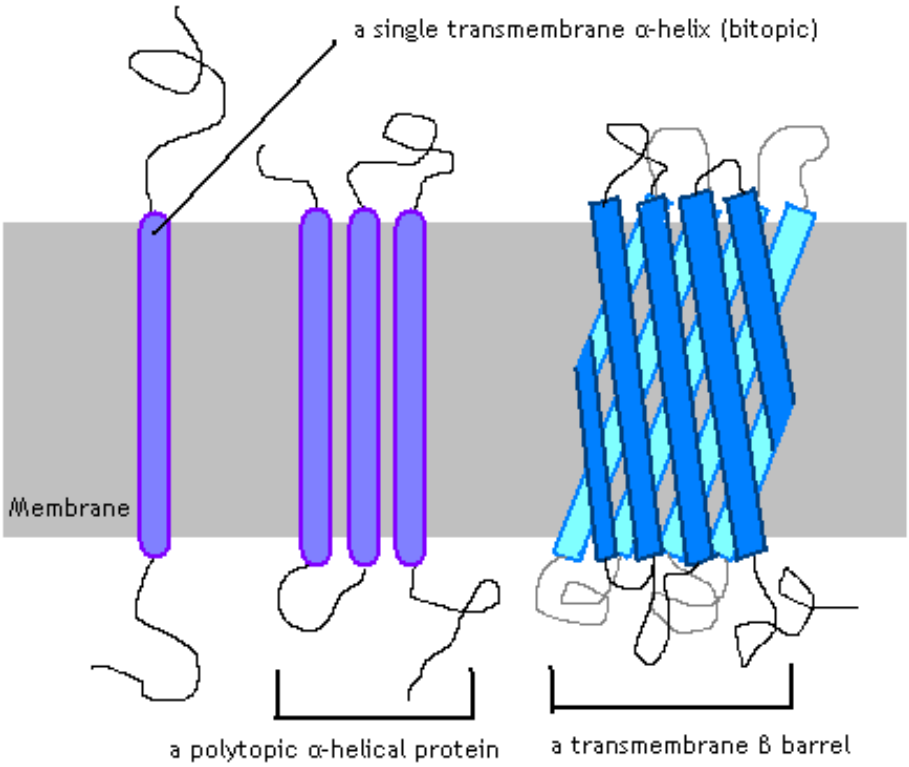

Figure 01: The Transmembrane Proteins

The transmembrane proteins are also capable of controlling the exchange of materials and substances across the cell membrane. They can form specialized channels or passageways called as “porins” that can pass through the cell membrane. These porins are regulated by other proteins which are sometimes closed and sometimes opened. The best example of this is nerve cell signal transduction. A receptor protein is binding to a neurotransmitter. This binding allows opening of ion channels (voltage-gated or ligand-gated channels). And it makes the flow of ions across the channels. Hence, it transmits nerve impulses. The nerve cells transmit electrical signals known as an action potential by the flow of ions across the cell membrane.

What is a Peripheral Protein?

These proteins are temporally attached to the plasma membrane. They are either attached to the integral membrane proteins or lipid bilayer. Peripheral proteins bind to the cell membrane through hydrogen bonds. They have several important biological functions. Most of them are working as cell receptors. Some of them are very important enzymes. As they are in the cytoskeleton, they give shape and support. They facilitate movement through three main components: microfilaments, intermediate filaments, and microtubules. Their main function is transportation. They carry molecules between other proteins. The best example is “Cytochrome C,” which carries electron molecules between proteins in the electron transport chain of energy generation.

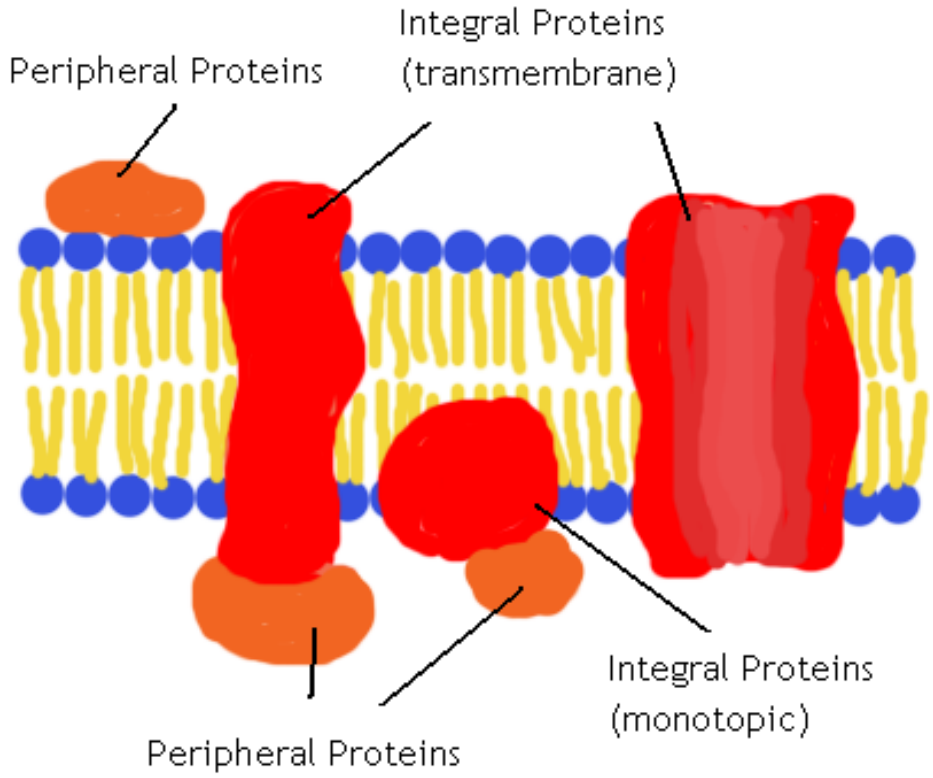

Figure 02: The Peripheral Proteins

So, peripheral proteins are extremely important for cell survival. When the cell damages, "Cytochrome C" is released from the cell. This is led to the apoptosis of the cell. Some of the peripheral enzymes participate in the metabolism are; lipoxygenase, alpha-beta hydrolase, phospholipase A and C, sphingomyelinase C and Ferrochelatase.

What are the Similarities Between Transmembrane and Peripheral Proteins?

- Both are proteins.
- Both are involved in molecular transportation.
- Both are found in the plasma membrane.
- Both are extremely important for cell survival.

What is the Difference Between Transmembrane and Peripheral Proteins?

Transmembrane vs Peripheral Proteins	
Transmembrane proteins are membrane proteins which extend all the way across the membrane.	Peripheral proteins are membrane proteins which attach loosely to the inside and outside surfaces.
Function	
Transmembrane proteins help in cell signaling.	Peripheral proteins maintain cell shape and support cell membrane to maintain its structure.
Nature of the protein	
Transmembrane proteins are a type of integral proteins.	Peripheral proteins are not integral proteins.
Location	
Transmembrane proteins are extending across the cell membrane.	Peripheral proteins are attached to the surface outside or inside the cell membrane.
Binding	
Transmembrane proteins are attached permanently to the cell membrane (orientation is fixed).	Peripheral proteins are attached temporally or loosely to the cell membrane (orientation is changing).

Summary - Transmembrane vs Peripheral Proteins

The plasma membrane is the model which protects the cells from damages, and it provides protection against foreign agents. The fluid mosaic model of plasma membrane explains it is made up of the lipid bilayer, cholesterol, carbohydrates, and proteins. Cholesterol is found attached to the lipid bilayer. The carbohydrates are either attached to lipids or proteins in the membrane. The proteins are three types: integral, peripheral and transmembrane proteins. The integral proteins are integrated into the membrane and extend all the way across the membrane. And peripheral proteins are attached loosely to the inside and outside surfaces. This is the difference between transmembrane and peripheral proteins.

Reference:

1.“Transmembrane Protein.” Chemistry Explained. Available here
2.“Peripheral membrane protein.” Wikipedia, Wikimedia Foundation, 11 Nov. 2017. Available here

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