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Short Communication

Types of Receptors Involved in Cell Signalling

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DESCRIPTION

Receptors are protein molecules found within or on the surface of the target cell that bind ligands. There are two different categories of receptors.

Internal receptors

Cell-Surface Receptors

Internal receptors

Internal receptors, which are also known as intracellular or cytoplasmic receptors, and are located in the cytoplasm of the cell and respond to hydrophobic ligand molecules that can penetrate the plasma membrane. After entering the cell, many of these chemicals interact with proteins that control the synthesis of mRNA and thus regulate gene expression [1]. Gene expression is the cellular process that converts the information in a cell's DNA into an amino acid sequence that eventually results in a protein. A conformational change on the protein exposes a DNA-binding site when the ligand binds to the internal receptor. The ligand-receptor complex penetrates the nucleus, and binds to specific chromosomal regulatory regions, and promotes the initiation of transcription. Internal receptors don't need to transmit the signal along to other receptors or neurotransmitters to impact gene expression directly.

Cell-surface receptors

Cell surface receptors are also known as transmembrane receptors, membrane-anchored proteins on the cell surface that bind to ligand molecules externally. During signal transduction, such kind of receptor penetrates the plasma membrane and transforms an extracellular signal into an intracellular signal. It is not essential for ligands to enter the cell in order to interact with cell-surface receptors. Because they are specific to different cell types, cell-surface receptors are also known as cell-specific proteins or markers [2]. A cell's intracellular domain, a hydrophobic membrane-spanning region, and an extracellular ligand-binding domain form the three primary parts of each cell-surface receptor. Depending on the kind of receptor, each of these regions has a wide range in size and scope. In multicellular organisms, the majority of signalling is mediated through cell-surface receptors. Cell-surface receptors are broadly divided into three groups. They are:

1. Ion channel-linked receptors,
2. G-protein-linked receptors,
3. Enzyme-linked receptors.

1. Ion channel-linked receptors: These are water soluble molecules and they all bind to cell surface receptors such as insulin, growth factors and glucagon etc., Specific ions might pass through a channel that is activated by ion channel-linked receptors when they bind a ligand. This kind of cell-surface receptor contains a large membrane-spanning region that can be folded into a channel. Many of the amino acids in the membrane-spanning region are hydrophobic in order to interact with the phospholipid fatty acid tails that constitute the plasma membrane's nucleus [3]. On the other hand, the hydrophilic amino acids that surround the interior of the channel permit the flow of ions or water. The structure of the protein changes when a ligand attaches to the extracellular portion of the channel, permitting ions including sodium, calcium, magnesium, and hydrogen to pass through them.

2. G-Protein linked receptors: A membrane protein known as a

G-protein is activated when a ligand is bound by G-protein-linked receptors. The G-protein then participates in an interaction with a membrane enzyme or ion channel. Despite having seven transmembrane domains across the spectrum, each G-protein-linked receptor has a distinct extracellular domain and G-protein binding site. G-protein-linked receptors are used for cell signalling in a cyclical manner. The inactive G-protein has the ability to connect to a newly discovered location on the receptor that is specialised for its binding before the ligand binds. The G-protein is activated after it connects to the receptor; as a result, GDP is released and GTP is taken up by the G-protein. The G-subunits protein's then divided into the subunits, respectively. This may allow one or both of these G-protein fragments to activate other proteins. Later, the GTP on the G-active protein's subunit is hydrolyzed to GDP, which results in the subunit's deactivation. The cycle is resumed when the subunits reassociate to produce the inactive G-protein.

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3. Enzyme-linked receptors: Cell-surface receptors with intracellular regions known as enzyme-related receptors and are coupled to an enzyme. Some receptors have an intracellular region that directly interacts with an enzyme, or the receptor that is coupled to an enzyme has an intracellular region. The membrane-spanning portion of enzyme-linked receptors generally consists of a single alpha-helical segment of the peptide strand, whereas their extracellular and intracellular domains are typically very large [4]. A signal is transmitted through the membrane and activates the enzyme when a ligand attaches to the extracellular domain, initiating a series of processes inside the cell that ultimately result in a reaction.

CONCLUSION

These receptors play a major role in the cell signalling. Cell surface receptors span the cell membrane and provide cellular access for ligands that cannot cross the plasma membrane themselves. This is often because these ligands are hydrophilic or large; making them unable to diffuse through the plasma membrane.

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