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Short Communication

General Introduction of Cell-Signal Transduction Pathway: A Short Communication

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DESCRIPTION

The transduction process, which can begin in a single step or as a series of changes in a succession of other molecules, is started when the receptor protein binds to the signaling molecule and undergoes some kind of change (called a signal transduction pathway). Relay molecules are the molecules that make up these pathways. Activation of proteins through the addition or removal of phosphate groups, or even the release of additional small molecules or ions that can function as messengers, are frequent components of the multistep transduction stage process. One advantage of this multi-step process is the signal amplification. Additional advantages include the ability to fine-tune the response in both unicellular and multicellular organisms, as well as more opportunities for regulation than simpler systems do [1].

In some circumstances, the cell's reaction to the ligand is directly associated with the receptor activation brought on by the ligand binding to a receptor. For instance, the neurotransmitter GABA has the ability to open an ion channel by activating a cell surface receptor. A chloride-selective ion channel that is a component of the receptor is opened when GABA binds to a GABAA receptor on a neuron. Chloride ions can enter the neuron when the GABAA receptor is activated, which prevents the neuron from firing action potentials [2].

The response of the cell is not always closely correlated with ligand-receptor interactions for many cell surface receptors, though. Before the ligand has its full physiological impact on the behaviour of the cell, the activated receptor must first interact with other proteins within the cell. Following receptor activation, a chain of numerous interacting cell proteins frequently exhibits changed behaviour. A signal transduction mechanism or route is the collective name for the collection of cellular changes brought about by receptor activation.

The MAPK/ERK route, which involves modifications of intracellular protein-protein interactions brought on by an external signal, is a more complicated signal transduction system. Many growth factors bind to receptors on the surface of cells, causing cells to cycle through and divide. Many of these receptors are kinases, which begin phosphorylating other proteins and themselves when they attach to a ligand. A other protein may be able to connect to this phosphorylation and cause a protein-protein interaction. The ligand in this instance, known as Epidermal Growth Factor (EGF), interacts to the receptor (called EGFR). The receptor is subsequently activated, phosphorylating itself.

An adapter protein (GRB2) that the phosphorylated receptor binds to connects the signal to additional downstream signalling steps. The Mitogen Activated Protein Kinase (MAPK) pathway is one of the signal transduction pathways that is activated. The pathway is known as the MAPK/ERK pathway because the signal transduction element designated as "MAPK" in the pathway was formerly known as "ERK." The MAPK protein is a protein kinase enzyme that can attach phosphate to target proteins like the transcription factor MYC and, as a result, change gene transcription and, ultimately, cell cycle progression. Following the activation of growth factor receptors (like EGFR) that start this signal transduction pathway, a large number of cellular proteins are involved.

Depending on how much signal a cell receives, some signal transduction pathways react in different ways. For instance, depending on the quantity of hedgehog protein present, different genes are activated. Complex multi-component signal transduction pathways enable interactions between several signals and signalling pathways inside one cell, as well as feedback and signal amplification.

The transduced signal in the last phase of cell signalling causes a particular cellular response. Practically any cellular activity that exists in a body can trigger this response. It might potentially act as an enzyme's catalyst in the catalysis of the cytoskeleton's reorganisation. The right cells are acting as instructed, at the appropriate moment, and in synchrony with other cells and their own tasks inside the organism thanks to these three cell signalling stages. The regulation of cellular activity results from the termination of a signal pathway. The cell's cytoplasm or nucleus may be the site of this reaction. The majority of signaling pathways activate specific genes to influence protein synthesis [3].

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Signaling can be utilized in unicellular organisms like bacteria to "activate" peers from a dormant state, increase virulence, protect against bacteriophages, and other things. The plurality of individual signals in quorum sensing, which is also present in social insects, has the ability to establish a positive feedback loop and produce coordinated action. The signaling molecules are referred to as auto inducers in this context. This signaling mechanism might have had a role in the evolution of single-celled species into multicellular ones. Additionally, bacteria use contact-dependent signalling, particularly to control their development. Pheromones are frequently used to refer to the signaling chemicals employed by multicellular organisms. They may serve as a warning system for danger, a food supply indicator, or a reproductive aid [4].

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