Tyrosine kinase

Tyrosine kinase is an enzyme that plays a crucial role in cell signaling and regulation. It is a type of protein kinase that catalyzes the transfer of a phosphate group from ATP (adenosine triphosphate) to specific tyrosine residues on target proteins, a process known as phosphorylation. Tyrosine kinases are essential for a wide range of cellular functions, including cell growth, differentiation, and response to external stimuli. Here are some key points about tyrosine kinases:

Classification: Tyrosine kinases can be categorized into two main classes:

Receptor Tyrosine Kinases (RTKs): These are transmembrane proteins with an extracellular ligand-binding domain and an intracellular tyrosine kinase domain. RTKs are activated by binding to specific extracellular signaling molecules, such as growth factors and hormones. Examples of RTKs include the epidermal growth factor receptor (EGFR), insulin receptor, and vascular endothelial growth factor receptor (VEGFR). Non-Receptor Tyrosine Kinases: These kinases are typically located in the cell's cytoplasm. They are activated by various cellular signals and play roles in intracellular signal transduction. Examples include Janus kinases (JAKs), Src kinases, and Abl kinases. Signal Transduction: Tyrosine kinases are critical components of signal transduction pathways. When activated by extracellular ligands or other stimuli, they initiate intracellular signaling cascades that lead to specific cellular responses. This can involve the phosphorylation of other proteins, the activation of downstream signaling molecules, and the modulation of gene expression.

Phosphorylation: Tyrosine kinases phosphorylate tyrosine residues on target proteins, including other kinases, adaptor proteins, and transcription factors. Phosphorylation can result in changes in protein conformation, activation, or interaction with other signaling molecules.

Cellular Functions: Tyrosine kinases are involved in a wide range of cellular processes, such as:

Cell growth and proliferation Cell differentiation Cell survival and apoptosis (programmed cell death) Metabolism Immune response Angiogenesis (the formation of new blood vessels) Neuronal signaling Dysregulation and Disease: Dysregulation of tyrosine kinase activity is associated with various diseases, including cancer, autoimmune disorders, and metabolic diseases. In cancer, mutations or overexpression of tyrosine kinases can lead to uncontrolled cell growth and survival. Targeted therapies that inhibit specific tyrosine kinases have been developed for cancer treatment.

Drug Targets: Due to their central role in cancer and other diseases, tyrosine kinases have become important drug targets. Tyrosine kinase inhibitors are a class of drugs designed to block the activity of specific kinases. Examples include imatinib (Gleevec) for the treatment of chronic myeloid leukemia (CML) and gefitinib (Iressa) for non-small cell lung cancer.

Research and Therapeutics: Understanding the functions and regulation of tyrosine kinases is a significant focus of research in cell biology and pharmacology. Targeting tyrosine kinases has revolutionized cancer therapy and holds promise for the treatment of other diseases.

In summary, tyrosine kinases are key players in cell signaling, with diverse functions in health and disease. They are essential for transmitting signals that govern various cellular processes and are at the forefront of targeted therapy in medicine.

Tyrosine kinases are enzymes responsible for the activation of many proteins by signal transduction cascades. The proteins are activated by adding a phosphate group to the protein (phosphorylation). TKIs are typically used as anti-cancer drugs.

Tyrosine kinase signaling through the vascular endothelial growth factor receptor 2 (VEGFR2), platelet-derived growth factor receptor- α (PDGFR-α) and KIT cell surface receptors mediates neo-angiogenesis and contributes to cancer cell survival in recurrent anaplastic and low-grade glioma.

see Tyrosine kinase inhibitor.

see Tyrosine kinase receptor