



Functions, Types of Peptides and its Role in Research and Medicine

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Description

In the realm of biology, the intricate machinery of life operates at various levels of complexity. Among the unsung heroes of this intricate machinery are peptides – small yet mighty molecules that play crucial roles in the functioning of organisms. This article discusses about the structure, functions and the significant impact of peptides on various aspects of life.

Peptides are short chains of amino acids, the building blocks of proteins. Amino acids are organic compounds that contain an amino group ($-NH_2$) and a carboxyl group ($-COOH$), along with a side chain. These side chains confer unique properties to different amino acids, allowing for the diversity observed in peptide and protein structures.

Peptides consist of two or more amino acids joined together by peptide bonds, formed through a condensation reaction between the carboxyl group of one amino acid and the amino group of another. The resulting chain of amino acids is known as a peptide, while longer chains are referred to as polypeptides or proteins.

Functions of peptides

Peptides exhibit a remarkable range of functions within living organisms. They participate in numerous biological processes, including hormone regulation, immune response, cell signalling, and antimicrobial defence.

Types of peptides and their roles

Hormones: Peptides serve as signalling molecules and regulate various physiological processes. For instance, insulin, a peptide hormone, plays a cru-

cial role in glucose metabolism, while oxytocin is involved in social bonding and childbirth.

Neuropeptides: These peptides act as neurotransmitters or neuromodulators in the nervous system. They regulate processes such as pain perception, mood, and appetite. Examples include endorphins, substance P, and neuropeptide Y.

Antimicrobial peptides: These peptides act as a defence mechanism against pathogens by disrupting microbial membranes. They play a vital role in the innate immune system, protecting organisms from infections. Examples include cathelicidins and defensins.

Enzyme inhibitors: Some peptides can inhibit the activity of specific enzymes, regulating biochemical reactions in the body. They act as modulators and help maintain homeostasis.

Peptides in research and medicine

The unique properties and functions of peptides have made them valuable tools in both research and medicine. Here are a few significant applications:

Drug development: Peptides are increasingly being explored as therapeutic agents due to their high specificity and low toxicity compared to traditional drugs. They can target specific receptors or enzymes involved in diseases, such as cancer or diabetes. For instance, peptide-based drugs like leuprolide and bortezomib are used in cancer treatment.

Diagnostic tools: Peptides can be utilized as diagnostic markers for specific diseases. By detecting the presence or levels of certain peptides in biological samples, clinicians can diagnose and monitor

various conditions.

Biotechnology: Peptides have found applications in biotechnology, particularly in the field of biosensors and biomaterials. Their ability to recognize and bind to specific targets enables their use in detecting and capturing molecules of interest.

Limitations

Despite their immense potential, peptides also present challenges. One major obstacle is their susceptibility to enzymatic degradation, limiting their stability and bioavailability. However, advance-

ments in peptide engineering, such as modifications to enhance stability or delivery systems, are being explored to overcome these limitations.

The future of peptide research is promising. Scientists are actively developing novel peptide-based drugs and therapies, utilizing advances in peptide synthesis techniques and computational design. Additionally, the use of peptide libraries and high-throughput screening methods has accelerated the discovery of new peptides with diverse functionalities.