

The Importance of Glycan Analysis in Biomedical Analysis

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DESCRIPTION

Glycans are complex carbohydrates that play a crucial role in numerous biological processes. They are composed of multiple monosaccharide units that are linked together through glycosidic bonds. Glycans are ubiquitous in nature, and their diverse structures and functions make them important molecules in many biological processes.

Structures of Glycans are composed of monosaccharides that are linked together through glycosidic bonds. The monosaccharides can be simple sugars such as glucose, fructose, and galactose, or they can be more complex sugars such as N-acetylglucosamine, N-acetylgalactosamine, and sialic acid. The complexity of the glycan structure arises from the type of monosaccharides, the linkage between them, and the presence of various modifications. Glycan structures can be broadly classified into two categories - N-linked and O-linked glycans. N-linked glycans are attached to proteins through an N-glycosidic bond between the amide nitrogen of asparagine and the anomeric carbon of N-acetylglucosamine. O-linked glycans, on the other hand, are attached to the hydroxyl group of serine or threonine residues in proteins through an O-glycosidic bond.

Glycan functions

Glycans have diverse functions in various biological processes, including cell adhesion, cell signaling, and immune response. The structure of glycans can affect their function, and the same glycan structure can have different functions in different biological contexts.

Cell adhesion: Cell adhesion is a crucial process in the development and maintenance of tissues. Glycans play an essential role in cell adhesion by mediating the interactions between cells and the extracellular matrix. Glycans on the surface of cells can interact with glycoproteins and proteoglycans in the extracellular matrix, facilitating cell migration, tissue development and wound healing.

Cell signaling: Glycans can also play a role in cell signaling by modulating the activity of signaling proteins. For example, the presence of specific glycans on the surface of cells can affect the

binding of growth factors to their receptors, leading to altered signaling pathways. Similarly, glycan modifications on proteins can affect their stability, localization, and activity, leading to changes in cellular function.

Immune response: Glycans are involved in immune recognition and response. The presence of specific glycans on the surface of pathogens can act as a signal to the immune system, leading to the recognition and clearance of the pathogen. Similarly, changes in glycan structures on self-antigens can lead to the recognition of these antigens as foreign, leading to autoimmune diseases.

Glycans in health and disease

Glycans play a critical role in various biological processes, and alterations in their structures can lead to disease. Changes in glycan structures can arise from genetic mutations, environmental factors, and disease processes.

Cancer: Altered glycan structures have been implicated in cancer development and progression. Changes in the glycan structures of cell surface proteins can affect cell adhesion and signaling, leading to increased migration and invasion of cancer cells. Similarly, changes in glycan structures on circulating proteins can affect immune recognition and clearance, leading to the evasion of the immune system by cancer cells.

Autoimmune diseases: Glycan alterations have also been implicated in autoimmune diseases. Changes in the glycan structures on self-antigens can lead to the recognition of these antigens as foreign, leading to autoimmune responses.

CONCLUSION

Biotherapeutics in vivo bioactivity, stability, solubility, and metabolic fate can all be significantly influenced by protein glycosylation. In contrast to transcription, which is a template driven enzymatic modification process, glycosylation is a post-translational modification whose structural status is largely determined by production methods and conditions. As a result, the finished product may vary during production. Since more novel recombinant glycoprotein therapeutics, such as

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glycoprotein hormones, cytokines, clotting factors, and monoclonal antibodies, are being used in clinical settings, it is

becoming increasingly important to monitor protein glycosylation.