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Journal of Glycobiology

Commentary

An Overview of Glycomimetics and its Applications in the Field of Medicine

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DESCRIPTION

Glycomimetics refer to synthetic or natural compounds that mimic the structure or function of carbohydrates. Carbohydrates play a crucial role in various biological processes, including cell recognition, immune response, and protein folding. Glycomimetics have gained increasing attention in drug discovery due to their potential as therapeutic agents. In this commentary, we will discuss the significance of glycomimetics in drug discovery and their potential applications.

One of the primary applications of glycomimetics is the development of new therapeutics for cancer. Cancer cells often display abnormal carbohydrate structures on their surface, which are recognized by lectins present in the body. These lectins are responsible for binding to the cancer cells and facilitating their growth and proliferation. By developing glycomimetics that mimic the structure of these abnormal carbohydrates, it is possible to disrupt the binding between lectins and cancer cells, thus inhibiting their growth and proliferation. For example, GMI-1271, a small molecule glycomimetic inhibitor of E-selectin, is currently in clinical trials for the treatment of acute myeloid leukemia. Another potential application of glycomimetics is in the development of antiviral agents. Many viruses, including influenza, HIV and SARS-CoV-2, use carbohydrates on their surface to bind to host cells and initiate infection. By developing glycomimetics that can mimic these carbohydrates, it is possible to block the interaction between the virus and host cells, thus preventing infection. For example, the FDA-approved drug oseltamivir, which is used to treat influenza, is a sialic acid mimetic that inhibits the activity of the viral neuraminidase enzyme, which is required for viral replication.

Glycomimetics also have potential applications in the treatment of inflammatory diseases. Carbohydrates play a critical role in the immune response, with lectins and other carbohydrate-binding proteins playing a crucial role in the activation and recruitment of immune cells to sites of inflammation. By developing glycomimetics that can bind to these lectins, it is possible to modulate the immune response and reduce inflammation. For example, the glycomimetic drug GSK2830371 is currently in clinical trials for the treatment of rheumatoid arthritis. In addition to these applications, glycomimetics have potential applications in other areas, such as the development of antibiotics, enzyme inhibitors and imaging agents. However, despite their potential, the development of glycomimetics as therapeutics faces significant challenges.

One of the main challenges in the development of glycomimetics is their structural complexity. Carbohydrates are inherently complex molecules and mimicking their structure can be challenging. Furthermore, carbohydrates can exist in multiple conformations, which can make it difficult to develop glycomimetics that are selective for a particular conformation. Additionally, the synthesis of glycomimetics can be challenging and expensive, which can limit their potential applications.

Another challenge in the development of glycomimetics is their pharmacokinetics and pharmacodynamics. Glycomimetics can have poor oral bioavailability, low solubility and rapid clearance from the body, which can limit their effectiveness as therapeutics. Furthermore, glycomimetics can interact with multiple carbohydrate-binding proteins, which can result in off-target effects and toxicity.

Despite these challenges, there has been significant progress in the development of glycomimetics as therapeutics. Advances in synthetic chemistry and molecular modeling have enabled the rational design of glycomimetics with improved selectivity and pharmacokinetic properties. Furthermore, advances in drug delivery technologies, such as nanoparticle-based delivery systems, have improved the bioavailability and efficacy of glycomimetics. In conclusion, glycomimetics have significant potential as therapeutics in various areas, including cancer.

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Received: 27-Dec-2022, Manuscript No. JGB-22-23640; **Editor assigned:** 29-Dec-2022, PreQC No. JGB-22-23640 (PQ); **Reviewed:** 12-Jan-2023, QC No. JGB-22-23640; **Revised:** 19-Jan-2023, Manuscript No. JGB-22-23640 (R); **Published:** 26-Jan-2023, DOI: 10.35841/2168-958X.23.12.216

Citation: Chowdary N (2023) An Overview of Glycomimetics and its Applications in the Field of Medicine. J Glycobiol. 12:216.