

Clinical Advantages and Techniques Involved in High-Throughput Analysis of Glycan's

Heldin Cock*

Department of Chemistry and Molecular Biology, University of Gothenburg, Gothenburg, Sweden

DESCRIPTION

High-throughput glycans analysis refers to the use of automated and high-throughput methods to study the structure, composition, and functions of glycans in a large-scale and efficient manner. This type of analysis is crucial in glycobiology and has applications in various fields, including medicine, biotechnology, and biomarker discovery. Glycans can undergo specific changes in structure and abundance in response to disease-related processes, making them promising candidates for biomarker discovery.

Techniques involved in the analysis of high-throughput glycans

Sample preparation: Start by collecting samples that contain glycans of interest. These samples can include blood, tissue, cell cultures, or glycoproteins. Extract the glycans from the biological samples and purify them to remove interfering substances like proteins and lipids. Common techniques include solid-phase extraction and liquid-liquid extraction.

Glycan release: Glycans are typically attached to proteins (N-glycans) or lipids (O-glycans). Enzymes like PNGase F or O-glycanases are used to release glycans from glycoproteins or glycolipids, respectively. To enhance detection sensitivity, glycans are often labeled with fluorescent tags or labels, such as 2-aminobenzamide (2-AB) or 2-aminobenzoic acid (2-AA). In some cases, glycans are permethylated, which involves replacing hydrogens with methyl groups. This can improve stability and analytical performance in mass spectrometry.

Analytical techniques: Mass Spectrometry (MS) is a powerful technique for high-throughput glycan analysis. It can provide information about the mass, structure, and composition of glycans. MALDI-TOF (Matrix-Assisted Laser Desorption/Ionization-Time of Flight) and ESI (Electrospray Ionization) are common MS methods used in glycans analysis.

Data analysis: Analyzed data is often compared against glycan databases to identify and characterize glycans. Quantify the relative abundances of different glycans in a sample, which can

provide insights into glycan profiles associated with different biological conditions or diseases. Perform statistical analyses to identify significant differences in glycan profiles between sample groups. Software tools are used to interpret mass spectrometry data and elucidate glycan structures, including linkage patterns and branching. Analyze glycan data in the context of biological pathways and functions to gain insights into their roles in specific biological processes or diseases.

Data visualization: Create visual representations of glycan data, such as heatmaps, scatter plots, or hierarchical clustering, to identify patterns and relationships. Validate the findings using additional experimental techniques or biological assays to confirm the functional significance of specific glycan's. Prepare reports, publications, or presentations to communicate the findings to the scientific community.

High-throughput glycan's analysis can be used to identify disease markers

Inflammatory Bowel Disease (IBD): Altered glycosylation patterns on mucin glycoproteins have been observed in individuals with IBD. High-throughput glycan analysis can identify glycans associated with disease severity and progression.

Rheumatoid Arthritis (RA): Glycan modifications of IgG antibodies have been implicated in RA. High-throughput techniques can help identify glycan markers associated with RA diagnosis and response to treatment.

Alzheimer's disease: Glycan alterations in Cerebrospinal Fluid (CSF) glycoproteins have been studied as potential biomarkers for Alzheimer's disease. High-throughput glycan analysis can aid in identifying CSF glycan markers associated with disease progression.

Type 2 diabetes: Altered glycosylation patterns on serum proteins have been associated with type 2 diabetes. High-throughput glycan analysis can identify glycan markers related to insulin resistance and glucose metabolism.

Liver cirrhosis: Changes in glycosylation of serum proteins like alpha-1-acid glycoprotein have been linked to liver cirrhosis.

Correspondence to: Heldin Cock, Department of Chemistry and Molecular Biology, University of Gothenburg, Gothenburg, Sweden, E-mail: helcock@gmail.com

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High-throughput analysis can identify glycan markers for assessing liver health.

Viral infections: Glycan modifications of viral envelope proteins can serve as markers for viral infections such as HIV. High-throughput glycan analysis can help characterize these glycan changes.

Atherosclerosis: Altered glycosylation of plasma proteins has been linked to atherosclerosis. High-throughput techniques can identify glycan markers associated with cardiovascular risk.

Chronic Kidney Disease (CKD): Glycan alterations in urinary proteins have been explored as potential markers for CKD. High-throughput glycan analysis can aid in identifying urinary glycan markers associated with kidney function.

CONCLUSION

In these disease contexts, high-throughput glycans analysis involves profiling the glycan structures and glycoprotein modifications in patient samples (e.g., serum, plasma, urine, CSF) using techniques like mass spectrometry, liquid chromatography, and glycan microarrays. Bioinformatics and statistical analyses are then applied to identify statistically significant glycan markers associated with the disease. Validation studies are often conducted to confirm the utility of these markers for diagnosis, prognosis, and monitoring of disease progression and treatment response.