

1-1-2023

The glycome and glycomedicine

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10.1016/j.eng.2023.05.007

Wang, W., & Yang, B. (2023). The glycome and glycomedicine. *Engineering*. Advance online publication.

<https://doi.org/10.1016/j.eng.2023.05.007>

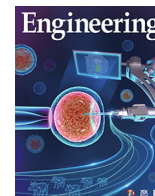
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Contents lists available at ScienceDirect

Engineering

journal homepage: www.elsevier.com/locate/eng

Editorial

The Glycome and Glycomedicine

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“Life requires more than nucleic acids and proteins; sweet sugar molecules could be another life code beyond the central dogma of molecular biology.”

Among the four equally important major building blocks of life—that is, nucleic acids (DNA and RNA), proteins, lipids, and carbohydrates (glycans)—the first two, DNA and RNA, follow the well-established principle of the “central dogma” of transcription (DNA to RNA) and translation (RNA to protein). However, the latter two, glycans and lipids, are missing from biology’s central dogma. In fact, there may be an undiscovered law regarding communication between DNA, RNA, glycans, and lipids, and their roles in immunomodulation. Thus, it becomes necessary to ask: Does a paracentral dogma exist? Can glycans be the third life code—after the first and second life codes of nuclei acids and amino acids—for the materiality of the cell?

To address these questions, this special issue focuses on the roles of glycomics, genetics, epigenetics, and beyond in the areas of immunity, immune disorders, infectious disease, non-communicable chronic diseases, cancers, glycan analyzing methods, and

glycomedicine. We are privileged to present two Views & Comments articles, one Review article, and 11 Original Research articles covering a range of subtopics:

- Glycomedicine: the current state of the art
- Extending the “paracentral dogma” of biology with the metabolome: implications for understanding genomic–glycomic–metabolic–epigenomic synchronization
- Twelve years of genome-wide association studies of human protein N-glycosylation
- Profound diversity of the N-glycome from microdissected regions of colorectal cancer, stroma, and normal colon mucosa
- High-throughput profiling of serological immunoglobulin G N-glycome as a noninvasive biomarker of gastrointestinal cancers
- Differences in immunoglobulin G glycosylation between influenza and COVID-19 patients
- Novel insight into the etiology of Haff disease by mapping the N-glycome with orthogonal mass spectrometry
- Bidirectional causality between immunoglobulin G N-glycosylation and metabolic traits: a Mendelian randomization study
- Serum IgG glycan hallmarks of systemic lupus erythematosus
- IgG N-glycosylation cardiovascular age tracks cardiovascular risk beyond calendar age
- N-glycosylation of immunoglobulin G changes periodically during the menstrual cycle
- Human prostate-specific antigen carries N-glycans with ketodeoxynononic acid
- Removable dyes—the missing link for in-depth N-glycan analysis via multi-method approaches
- Serum N-glycan markers for diagnosing significant liver fibrosis and cirrhosis in chronic hepatitis B patients with normal alanine transaminase levels

These articles discuss recent progress at the frontier of glycoscience, including:

<https://doi.org/10.1016/j.eng.2023.05.007>

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- Glycomedicine and health
- Bioglycoengineering: glycan analysis and glycan dye labeling
- Congenital disorders of glycosylation
- Immunomodulation: the roles of methylation, glycosylation, phosphorylation, histone modification, ubiquitination, lipi-
domics, and RNA modification
- How the glycome affects immunity, immune disorders, can-
cers, and susceptibility to infectious diseases

This special issue also provides expert recommendations on basic glycomics research and its application in glycomedicine, which may guide researchers as we enter the new era of glycomedicine: a new discipline that employs glycomics approaches with the aim of better targeting disease diagnostics, as well as for drug discovery, prescription choice, and dosing based on individual glycomics profiles to enable preventive, predictive, and precision medicine.