

Shaping a New Era in Health and Sustainability with Glycomics



IN THE CONTINUALLY EVOLVING FIELD OF BIOTECHNOLOGY, ONE AREA IS EMERGING AS A GAME-CHANGER, poised to redefine our pathways to health and greener living: glycomics. The study of glycomics examines sugars called glycans, which coat every cell in organisms—plants, animals, humans, even bacteria and viruses. Glycans play critical roles in almost every biological process, from determining cell structure and function to influencing the immune system.

Glycans are far more variable, complex and information-rich than genes and proteins because the “building blocks” of glycans can be linked together in many more different combinations. Understanding glycan changes and interactions not only expands our knowledge of biology, but also equips us with new tools to solve pressing health and environmental challenges. For example, subtle changes in glycans influence blood type and organ donor compatibility—small differences with a big impact on saving lives.

As with genomics and proteomics, breakthroughs in glycomics are now fundamentally revolutionizing life sciences, thanks to critical advances in technology. Glycomics encompasses glycan structure elucidation, chemical and enzymatic synthesis, glyco-proteomics and, most recently, glycoengineering. With these technological leaps forward, glycomics is expected to generate rapid growth, like that of genomics and proteomics, over the next decade in the biotechnology and pharma sectors.

SOLUTIONS TO GLOBAL CHALLENGES

Glycomics offers a fresh lens through which to view biology, medicine, and the sustainability of our planet. The applications of glycomics extend to many industrial sectors that contribute to One Health, including human and animal health, and sustainable agri-food systems.

In health, glycomics is driving the development of novel diagnostics, vaccines, and therapies. Early detection of diseases like cancer, Alzheimer's, and infectious diseases is becoming more refined and new treatments are being pursued thanks to advances in glycan analysis. Glycomics is spurring the development of new drug alternatives and delivery strategies to address global issues such as antimicrobial resistance. Five of the top ten global protein therapeutics are glycan-linked proteins that had total sales of US \$58 billion in 2020.¹ A 2022 analysis by The Insight Partners estimates that the global market for glycomic therapeutics will reach US \$257 billion by 2028².

Glycomics is also at the forefront of establishing eco-sustainable agricultural approaches to bolster global food security. The livestock industry faces significant challenges exacerbated by the effects of global climate change, including heightened heat stress, diminishing reproductive capabilities, and weakened immune systems among animals. Studying distinct glycan profiles in the gut bacteria of healthy versus sick animals uncovers early indicators of vulnerability to illness and disease progression. This insight is enabling glyco-scientists to develop pioneering diagnostic tools and targeted therapies, ensuring timely and precise interventions.

As we look ahead, continued research, collaboration, and investment in glycomics remain important to leveraging its full potential.

GROWING GLYCOMICS TOGETHER

Canada has a history of over 90 years of glycomics research and is now home to one of the world's most impactful glycomics technology clusters. Since 2015, GlycoNet has mobilized scientists across the country—becoming the largest nonprofit glycomics research network in Canada and one of the world's leaders in glycomics research and innovation. As a recipient of funding through the Government of Canada's Strategic Science Fund, GlycoNet continues to grow partnerships and co-fund research and innovation, de-risk technologies, and translate discoveries into made-in-Canada solutions, including diagnostics, vaccines, therapeutics, biomaterials, and biomanufacturing methods.

Under the network, GlycoNet Integrated Services (GIS) operates as a national platform of glycomics services, leveraging state-of-the-art infrastructure investments in seven institutions across Canada. GlycoNet and GIS together provide one-stop access to glycomics tools, specialized expertise, consulting, and collaborative opportunities to academia and industry, both nationally and internationally.

At GlycoNet, we believe collaboration is the cornerstone of groundbreaking scientific advancement. We invite organizations, researchers, and innovators across industries to join us in this exciting journey to accelerate research, development, innovation, and commercialization of tomorrow's glycomics-based solutions, leading to a healthier, more sustainable world.

If you share our passion for innovation, we would love to hear from you. Whether you're in the biotech sector, pharmaceuticals, or agri-food systems, we're open to exploring new partnerships and discussing how glycomics can advance your research and development goals. Together we can unlock new possibilities and make significant strides toward a healthier and more sustainable future.



GlycoNet Integrated Services

- **Detailed screening of glycan interactions**, using a variety of glycan-binding proteins to identify natural glycans with biological relevance.
- **Identification of glycans** carried by proteins and lipids in cells and tissues and as isolated molecules.
- **Synthesis of glycans** by conventional or enzyme-assisted synthesis, plus automated glycan assembly with the Glyconeer system.
- **Ligand discovery** using phage display libraries, giving access to a genetically encoded glycan ligand discovery technology—liquid glycan array (LiGA).
- **Screening of large ligand libraries** or high throughput screening to identify compounds that block or enhance functions of proteins and enzymes of interest.
- **Biophysical characterization of glycan–protein interactions** for binding affinity, stoichiometry, and other physicochemical parameters.
- **Molecular glycobiology** using cell engineering to identify glycan ligands and their binding partners, for developing new assays to determine biological outcomes of glycan binding.
- **Microbial glycan analysis** of extracellular glycans on human, animal, and plant pathogens.
- **Recombinant glycoengineering** of biologicals, including in vitro remodelling of glycans from a library of recombinant enzymes to prepare glycoconjugates for biological testing.



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¹Sagonowsky, E. The top 20 drugs by worldwide sales in 2020. <https://www.fiercepharma.com/special-report/top-20-drugs-by-2020-sales> (accessed Dec 15, 2021).

² Glycomics Therapeutics Market: Forecast to 2028, The Insight Partners, 2022