THE SWEET PROMISE OF GLYCOMIC ANALYSES

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The analyses of short carbohydrate chains known as oligosaccharides are significantly more difficult than proteins. Monosaccharide residues have numerous stereoisomers, numerous linkage arrangements, and potential for branching, which significantly complicate the analyses. The lack of analytical tools has severely hindered the progress in the area. However, oligosaccharides are key in a host of cell-cell processes including recognition, fertilization, infection, division, and cancer metathesis. The biosynthesis of oligosaccharides are highly sensitive to the biochemical environment. Glycoproteins are aberrantly glycosylated in many disease states. Glycans may therefore provide a more sensitive marker for diseases than proteins.

Glycans are oligosaccharide chains attached to proteins or lipids. Glycomic analysis is the examination of all glycans released from a specific biological source. What has hindered glycomic research in the past was the lack of analytical tools to deal with the diversity and the complex structures. The central theme of our research is to understand and characterize oligosaccharide diversity with mass spectrometry as the central tool of analysis. In this lecture, new mass spectrometry and separation tools for the emerging field of glycomics research will be discussed. These tools include ultrahigh resolution and mass accuracy mass spectrometry (MS), infrared multiphoton dissociation for tandem MS, microchip nanoflow liquid chromatography, and specific enzymes and glycosidases for structural elucidation. Mass spectrometry provides both high sensitivity and speed. It can also provide structural information. The application of these tools to the the glycomic analysis of serum for cancer markers will be discussed as well as specific biomarkers for ovarian, breast, and prostate cancer. The analysis of free oligosaccharides and glycans in mammalian milk and their roles as prebiotics will also be descrived.