The fields of “Glycobiology” and “Glycotechnology” are gaining an increasing amount of attention. Glycoconjugates, such as glycoproteins, glycolipids, proteoglycans, and microbial cell-surface components, consist of glycan chains. A major part of our research has been directed at the synthesis and functional analysis of glycoconjugate oligosaccharides of various origins.

Biological functions of glycoconjugate glycan chains are numerous. Most typically, these molecules exist at the cell surface and play numerous roles in cellular communication events, such as cell migration, cell-matrix and cell-cell attachment, signal transduction, microbial transfection, cancer metastasis, cell differentiation, and immune responses. They also play fundamental roles in the stabilization of glycoproteins, modulating the 3-D structure and inter- and intracellular transport of proteins. Recently, functions of glycoprotein oligosaccharides in protein quality control (protein folding, transport and degradation) have become important issues.

In order to gain a precise understanding of the functions of glycan chains, access to structurally defined oligosaccharides is required. Eukaryotic cells contain a huge number of glycoproteins. Furthermore, structures of glycoprotein glycan chains are highly diverse. In many cases, glycoproteins consist of various glycoforms, which differ in the number, composition, branching, or terminal modification of glycan chains. Therefore, the isolation of a homogeneous glycoprotein with a defined structure is an extremely difficult task, unless the target protein is exceptionally abundant.

Glycoprotein structures are characterized by their complexity and diversity. To clarify their functions, synthetic approaches are considered to be promising. Development of synthetic methodologies useful for efficient and facile preparation of oligosaccharides is a focal issue in carbohydrate chemistry. In light of their structural diversity, practical strategy to facilitate the synthesis of oligosaccharide is expected to be highly valuable. Glycoprotein glycans are known to play numerous biological roles, both intra- and intra-cellularly, through their interaction with various proteins such as lectins, glycosidases, and glycosyltransferases. However, their precise analysis has been hindered by structural heterogeneity of glycoproteins.

This talk will summarize our recent results on 1) development of novel methods for selective formation of glycosidic linkages [1-3], 2) target-oriented as well as library oriented synthesis of glycoprotein glycans [4], 3) analysis of glycan-protein interactions in the ER using synthetic substrates [5-9], and 4) mechanistic studies on carbohydrate binding agents [10].

Reference