2. From Glycogene (GG) Project to Structural Glycomics (SG) Project

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Twenty years have passed after the first mammalian glycosyltransferase was cloned. At the beginning of April, 2001, 110 genes for human glycosyltransferases, including modifying enzymes for carbohydrate chains such as sulfotransferases, had been cloned and analyzed. We started the Glycogene Project (GG project) in April 2001, a comprehensive study on human glycogenes with the aid of bioinformatic technology. Firstly, as many novel genes, which are the candidates for glycogenes, as possible were searched using bioinformatic technology in databases. They were then cloned and expressed in various expression systems to detect the activity for carbohydrate synthesis. Their substrate specificity was determined using various acceptors.

Second, it is possible for systematic preparation of oligosaccharide and glycopeptide libraries using a library of recombinant enzymes. For the synthesis of *O*-glycan peptide, the basic structure was synthesized chemically. Extension of *O*-glycans was achieved by sequential addition of each enzyme in a single tube. For the synthesis of *N*-glycans, the basic structures were commercially obtained. Further extension of *N*-glycans was achieved using a variety of the enzymes.

Third, these glycan libraries were supplied to MS^n analysis as structurally defined glycans. An observational database by acquiring MS^n spectra of a large variety of structurally defined oligosaccharides was built up and utilized for the rapid identification of glycan structures using only mass spectrometry. By this strategy we were able to identify the structure of *N*-linked oligosaccharides in transferrin and immunoglobulin G as examples.

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