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Development of Glycoscience in China

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It is my great honor to receive the invitation from Glycoconjugate Journal to prepare a special issue of Glycobiology in China. The history of glycoscience in China started in 1958 when the Institute of Microbiology, Chinese Academy of Sciences (IMCAS) was established in Beijing, focusing on microbial glycosidases studies, while the glycoscience has been well-known from the beginning of the 90's last century in China. With the upsurge of research in genes and proteins for decades of years, we usher in the spring of glycoscience.

There are many researchers in China engaged in glycoscience, including Glycobiology, Glycochemisty, Glycomics Research and Traditional Chinese Medicine etc. This special issue embraces their representative work regarding these fields recently.

Among which, Glycobiology is the earliest field carried out in China. Key Laboratory of Glycoconjugate, Ministry of Public Health was founded by Prof. Chen Huili in 1994, and is leading the development of glycobiology in China. The study on glycosyltransferases is the major direction in Key Laboratory, especially the function of glycosyltransferases in tumor etc. The changes of glycosyltransferases and glycan chain structures are responsible in tumor development, metastasis and prognosis. Furthermore, the effects of lectins, such as Dectin, Clec-2, are also focused in the tumor microenvironment, especially the immunoregulation of tumor. There are also certain characteristic researches in China. Kashin-Beck Disease (KBD) is an endemic, chronic and degenerative osteoarthropathy affecting approximately 3 million people in China. Researchers from Xi'an Jiaotong University are engaged in the potential mechanism of KBD, which might be related with disrupted proteoglycan metabolism.

While some glycobiologist study the structure and function of glycans or glycoconjugates expressed by cells, some are focusing on understanding the structure, bioactivities, structure activity relationship (SAR) of polysaccharides and oligosaccharides from herbal medicines. Traditional Chinese medicine, especially herbal therapy, has been developed for more than 2000 years. Modern medicine has proved the efficiency of herb. For example, astemisinin, isolated from the plant Artemisia annua, and its derivatives are now standard treatment worldwide for malaria. The combination of traditional Chinese medicine and modern western medicine renders it possible to make Chinese herb be accepted by the whole world. To date, Chinese glycobiologists have discovered many novel bioactive polysaccharides, which may have potential for disease therapeutics. Those interesting polysaccharides include immnunostimulants, anti-coagulants, anticancer, anti-diabetes, and anti-angiogenesis compounds In addition, some polysaccharides may decrease the blood glucose level, protect the liver damage. Interestingly, Chinese glycobiologist discovered some polysaccharides that might target EGF, BMP2, PI3Kinase, Dectin-1 to hinder tumor cells growth. The study could be helpful for understanding the function of the endogenous glycans expressed in the cells as well.

Based on the studies on the endogenous glycans and bioactive polysaccharides in plants, it is demanding to synthesize compounds to influence the function of glycosyltransferases or endogenous glycans, and also to reconstruct the bioactive glycoconjugates to obtain more active and lead components for drugs. To this end, our chemist colleagues have developed a number of the methods for construction of the glycosidic linkages, such as the glycosylation protocols with glycosyl *N*-phenyltrifluoroacetimidates and ortho-alkynylbenzoates as

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donors and the sequential glycosylation based on pre-activation of donors. Numerous glycans, glycoconjugates, and glyco-mimics with potent bioactivities have thus been attained.

With the development of functional research of glycoconjugate, efforts towards development of mass spectrometric analysis methods for protein-based glycomics and glycoproteomics workflows have also grown rapidly and impressively in recent years in China. The related publications cover almost all of the fields in this area, from the enrichment and isolation of glycoproteins/glycopeptides to identification of glycoproteins and their glycosylation sites, from glycan structure analysis to the methodology for the systematic quantification of glycoproteins and their glycosylation site occupancy.

In summary, there is still a certain gap in glycoscience between China and other international top laboratories. However, with the increase of government investment (National Basic Research Program of China: 973 Program, National High-tech R&D Program: 863 Program, and National natural science fund, etc), the research groups are growing. More and more groups are interested in this field and start to focus on it. The quantity and quality of publications are improving, which indicate brighter future of glycoscience in China.

At last, I'd like to express my appreciation to Dr. Hans Vliegenthart for constantly showing concerns and giving supports. Without his help, this special issue wouldn't be put into practice.