

Highlights 2014 on glycoscience; glycosyltransferases and glycobiomarkers

Perumana R. Sudhakaran · Avadhesh Surolia ·
Chitra Mandal

Published online: 15 October 2014
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Preface

The field of glycobiology has continued to grow and mature, establishing the role of glycans in a myriad of biological processes. Many new functions of glycans have emerged from studies on different eukaryotic and prokaryotic organisms. The development of new analytical tools and techniques have fuelled the generation of a lot of information on the structure of glycans, factors determining their structure and their derangement in several pathological conditions. One of the major themes of the recently held International Symposium on Carbohydrates in Bangalore, India was glycoconjugates and glycobiology, in which scientists working at the forefront of research in these areas reported their findings on different aspects of glycans in physiology and pathology. Selected contributions from these sessions are presented in this special issue of the journal. These contributions comprise short critical reviews or original research papers focusing on (a) glycosyl transferases in physiology and pathology (b) glycobiomarkers and (c) structural analysis of glycans.

Critical information embedded within the oligosaccharides on the glycoconjugates as represented by the structural features of the glycans are important in specific biological processes however alterations in glycan structures occur during development of diseases such as cancer. Glycosyl transferases, which constitute a large family of enzymes displaying exquisite specificity for both glycosyl donor and the acceptor, are largely responsible for glycosyl transfer reactions that generate a diversity of glycan structures on glycoconjugates. Many substances including natural compounds are known to affect the activity of these enzymes, making them potential drug targets. At least six articles in the ensuing pages describe the biological importance and features of glycosyl transferases. These include data relating to (a) resiliency to mutagenicity of glycosyltransferases involved in bloodgroup antigen synthesis (b) role of O-linked glycans and protein N -glycosylation in protein folding (c) microbial cell wall biosynthesis as well as formation of GPI anchors (d) characterisation of glycosyltransferases from new sources (e) glycosyl transferase-based assays to demonstrate glycan changes in cancer tissues.

A number of changes can occur in glycan expression during the development of pathological conditions. Identification and validation of these glycan changes in disease conditions make them useful surrogate markers for the disease or drug response. A strategy for developing glycobiomarkers for disease has been described in one of the contributions while another paper reports the potential of 9-*O*-acylated sialic acids in differentiating normal haematopoietic stem cells from leukemic stem cells. Further, changes in cell surface proteoglycans in tumor cells and the potential of cell surface molecules such as receptor for advanced glycation end-products in recognising such molecules and development of glycomimetics based on these, have been discussed.

P. R. Sudhakaran (✉)
Department of Computational Biology and Bioinformatics,
University of Kerala, Karyavattom, Trivandrum, Kerala, India
e-mail: prslab@gmail.com

A. Surolia
Molecular Biophysics Unit, Indian Institute of Science, Bangalore,
India
e-mail: surolia@mbu.iisc.emet.in

C. Mandal
Cancer Biology and Inflammatory Disorder Division, CSIR-Indian
Institute of Chemical Biology, 4, Raja S. C. Mullick Road, Jadavpur,
Kolkata, India
e-mail: cmandal@iicb.res.in

Apart from glycosyl transferases, a number of factors including levels of sugar nucleotides, competition between different glycosyl transferases for common substrates, Golgi transporter activity, topography of the biosynthetic organelle can regulate glycoconjugate biosynthesis. Therefore, alteration in cellular homeostasis may affect levels of expression and the nature of glycoconjugates in the cell. This issue has been examined in a contribution demonstrating changes in the level of expression and the potency of angiogenic factors in a metabolite - dependent manner. This is further reflected in another paper, which reported the molecular mechanisms of accumulation of ceramides and cell death on exposure to ionising radiation.

Biophysical methods have proven to be extremely useful in structure analysis of glycans . While one of the research papers in this special issue reported the application of nuclear magnetic resonance spectroscopy to study lectin structure and interaction, a review critically examines the structure of glycolipids . Structure -function relation of heparin, particularly focusing on minimal oligosaccharide structures required for antithrombin activity has also been examined.

It has been possible to bring together a large number of glycoscientists working on different aspects of carbohydrates, primarily through the efforts of Professor N. Jayaraman, the organising Chairman of the 27th International Carbohydrate Symposium, the bi-annual symposium of the International Carbohydrate Organisation, held at the Indian Institute of Science Bangalore, during January 12–17th 2014. The support received from him to assemble the material presented in this symposium relating to glycoconjugates and glycobiochemistry is gratefully acknowledged. It would not have been possible to complete this project but for the timely response from the contributors. We would like to acknowledge the efforts of all the contributors and referees who critically reviewed the manuscripts. We are extremely thankful to Professor Hans Vliegthart, Editor-in-Chief of Glycoconjugate Journal who had graciously agreed to publish a special issue of the journal. The support received for editing and publishing this special issue from Ms.MA Joanne Cabato, Editorial assistant, and Ms. Leonora M Panday, from the Production division of Springer publication is greatly appreciated.