

## Microbial Carbohydrates

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The microbial glycome consists of a wide repertoire of specific cell-surface polysaccharides and glycoconjugates, including lipopolysaccharides (LPS) of Gram-negative bacteria, cell-wall anionic polysaccharides of Gram-positive bacteria, bacterial extracellular polysaccharides and S-layer glycoproteins, mycobacterial lipoglycans, and lipophosphoglycans and proteophosphoglycans of protozoa. These glycopolymers play important roles in the life of microorganisms, particularly in recognition and virulence of pathogens. They determine the immunospecificity of microbial cells, and various immunogenic forms of the polysaccharides or their fragments are used as vaccine components. The biosynthesis of cell-surface polysaccharides is a multi-step process that involves membrane and soluble enzymes as well as complex systems of membrane transport proteins.

The microbial polysaccharides attract increasing attention of researchers in virtually all fields of life sciences, including chemistry, biochemistry, biophysics, genetics, microbiology, immunology, and vaccinology. Hundreds of thousands publications on the glycopolymers of microorganisms are cited in PubMed, and every year reports on their studies become an integral part of international and European carbohydrate symposia as well as a variety of general meetings in the disciplines mentioned above. In addition, specialized conferences, such as the Baltic Meetings on Microbial Carbohydrates and the FASEB Summer Research Conferences on Microbial Polysaccharides of Medical, Agricultural, and Industrial Importance, are regularly organized in North Europe and the USA, respectively. The international journal *Carbohydrate Research* published thematic issues devoted to microbial polysaccharide (1992) and bacterial carbohydrate antigens and vaccines (2003). Now, these are followed by a special issue of *Biochemistry (Moscow)* on microbial carbohydrates, in which we attempt to show the most recent scientific activities in the field.

Encouragingly, studies of microbial carbohydrates are successfully performed in Russia. They are hosted by the N. D. Zelinsky Institute of Organic Chemistry, M. M. Shemyakin–Yu. A. Ovchinnikov Institute of Bioorganic Chemistry, Pacific Institute of Bioorganic Chemistry, and Institute of Biochemistry and Physiology of Plants and Microorganisms, all belonging to the Russian Academy of Sciences, as well as by the Faculty of Biology of the

M. V. Lomonosov Moscow State University and several other institutions. Considerable progress is made by Russian scientists in structure elucidation of LPS and polysaccharides of Gram-positive bacteria, which is a prerequisite for understanding mechanisms of manifestation of their bioactivities and functioning of the cell walls of microorganisms. Together with elucidation of biosynthetic pathways of microbial glycopolymers, this opens new ways for design and preparation of more efficient vaccines against infections using both chemical approaches and genetic manipulations. Some of the latest findings in these directions are presented in the current journal issue.

The issue comprises five reviews and 11 experimental papers written by Russian and foreign authors, many of whom were participants of the 4th Baltic Meeting on Microbial Carbohydrates held in September 2010 in Finland. It features a review on the biogenesis of the glycan chain (O-antigen) of LPS by Miguel A. Valvano (University of Western Ontario, Canada), who is one of the leading researchers in the field of glycoconjugate assembly. The topic of a review by Dana Kocincova and Joseph S. Lam (University of Guelph, Canada) is the structural diversity of another LPS domain, the central oligosaccharide called core, in medically important bacteria *Pseudomonas aeruginosa*. Two other reviews summarize data on the structures of teichoic acids and other anionic cell-wall polysaccharides of actinomycetes, including new types of the glycopolymers discovered recently. They both are written by two teams of Russian scientists working in the M. V. Lomonosov Moscow State University and the N. D. Zelinsky Institute of Organic Chemistry. A final review by Andrei V. Nikolaev and Olga V. Sizova (University of Dundee, UK) is devoted to phosphoglycans of the parasitic *Leishmania* protozoa with emphasis on chemical synthesis and immunological evaluation of neoglycoconjugates based on the phosphoglycan structures as potential anti-leishmaniasis vaccines. Experimental papers included in the issue cover general characterization of LPS and structures of their O-antigen and core parts in various bacteria, genetics of LPS core biosynthesis of the plague microbe, immunochemistry of bacterial carbohydrate antigens and serotyping of strains on their basis, and correlation between the structure and biological activities of the LPS of human and plant pathogens.

Thus, the present thematic issue is a collection of papers on various aspects of studies on specific polysaccharides and glycoconjugates of microorganisms. There is little doubt that, being in practical demand and promoted

by further improvements of research tools, investigations of these fascinating biomolecules will continue and extend in future and their results will have an impact on the progress in allied sciences.

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