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The series *Topics in Current Chemistry* presents critical reviews of the present and future trends in modern chemical research. The scope of coverage includes all areas of chemical science including the interfaces with related disciplines such as biology, medicine and materials science. The goal of each thematic volume is to give the nonspecialist reader, whether at the university or in industry, a comprehensive overview of an area where new insights are emerging that are of interest to a larger scientific audience.

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Preface

In the last 50 years molecular biology was dominated by the exploration of proteins and nucleic acids. Beside their role in energy metabolism, oligosaccharides, which represent the third class of biomacromolecules, have received less attention. Today it is well established that oligosaccharides are involved in many important biological regulation and recognition processes from protein folding to cell–cell communication. Glycosylation of proteins is the most complex form of co- and posttranslational modification. The determination of structure-function relationships, however, remains difficult due to the microheterogeneity of glycoproteins that exist in many different glycoforms. Thus chemical synthesis of glycoproteins and glycopeptides with defined glycan structures plays a pivotal role for the detailed determination of the role of protein glycosylation. This topic is covered by the first two chapters of this book dealing with the chemical and enzymatic synthesis of glycopeptides and glycoproteins. The third chapter describes the construction of glycopeptide and glycoprotein mimetics containing non-natural structural elements. These so-called neoglycopeptides and neoglycoproteins, respectively, can provide insight on the importance of distinct structural elements on biological activity and may have improved properties such as an increased stability. The application of synthetic glycopeptides, in many cases at the clinical level, as vaccines for both cancer and HIV is the subject of the fourth chapter. Glycopeptide antibiotics are glycosylated secondary metabolites of bacteria and fungi that are synthesized by non-ribosomal peptide synthetases. Some of them serve as antibiotics of last resort in the treatment of nosocomial infections with enterococci and methicillin-resistant *Staphylococcus aureus* (MRSA) strains. Their structure, biosynthesis, and mode of action are summarized in the fifth chapter. The last chapter covers current methods for the determination of high-resolution structures of glycopeptides and glycoproteins mainly based on NMR spectroscopy, X-ray crystallography, and molecular modeling.

It was my intention to provide a cross-section of modern methods in glycopeptide chemistry and I thank all the authors for their contributions. It is the interdisciplinary combination of these synthetic, biophysical, and genomic methods that will advance the field of glycobiology in future.

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Glycoscience – Chemistry and Chemical Biology I–III

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Glycostructures play a pivotal and crucial role in a myriad of organisms and important systems in biology, physiology, medicine, bioengineering and technology. Within recent years tools have been developed to promote the understanding of their highly complex functions and the associated chemistry and chemical biology, however, many facts still remain undiscovered. These days the area is experiencing a “quantum jump”. Therefore the Editors in collaboration with six responsible Section Editors completely revised and updated the 1st edition to give up-to-date information on glycostructures, their chemistry and chemical biology, and present them in the form of a comprehensive and strictly systematic survey. The texts are furnished by more than 2500 figures, chemical structures and reaction schemes (including more than 12.000 individual chemical reactions), and more than 9.000 references.

In concept and content this Major Reference Work received an essential improvement and expansion. Whereas chapter 1, 2, 3, 7, 8, and 9 are updated, expanded and rearranged versions of the 1st edition, many new subchapters are included in the chapters on monosaccharides, oligosaccharides and polysaccharides. The importance of the saccharide metabolism as well as the involvement of complex glycostructures in biologically and medically relevant processes are considered by addition of two large totally newly conceived chapters. Further, another novel chapter featuring key technologies and tools for functional glycobiology is incorporated. Responsible for this major update are the Section Editors who solicited a large number of highly reputed new authors to cover the changes in the content and to write the major supplements.

- 1 General Principles**
- 2 General Synthetic Methods**
- 3 Chemical Glycosylation Reactions**
- 4 Monosaccharides**
- 5 Oligosaccharides**
- 6 Complex Polysaccharides**
- 7 Glycolipids**
- 8 Glycoproteins**
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- 10 Key Technologies and Tools for Functional Glycobiology**
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