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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.

Konstanz, November 2006 Valentin Wittmann