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## Preface

Despite major scientific efforts over more than half a century infectious diseases and cancer remain important threats to human health. The increasing resistance against chemotherapeutics currently in medical use presents a new challenge to develop additional strategies for treatment of these diseases.

The unique carbohydrate signatures at the cell surface of infectious pathogens, bacteria, viruses, fungi and parasites, or aberrant cancer cells and their exposed location at the cell surface render carbohydrates ideal targets for vaccination and the development of therapeutic or diagnostic antibodies.

Recent advances in the identification, structural analysis and chemical synthesis of protective epitopes and an improved understanding of carbohydrate – protein interactions have paved the way for numerous efforts currently under way to exploit anticarbohydrate antibodies for the treatment of human infectious and non-infectious diseases such as cancer. Moreover, anticarbohydrate antibodies play an important role in xenotransplantation and may be used as diagnostic tools in inherited diseases. For the development of advanced diagnostics as well as therapies an in-depth understanding of the antigenic and immunogenic properties of carbohydrates is a prerequisite.

The book **Anticarbohydrate Antibodies – from molecular basis to clinical application** – provides an account of the current methodological approaches for the identification of carbohydrate epitopes in saccharides, glycopeptides and glycolipids, and their presentation and recognition by antibodies at atomic resolution.

Contributions written by experts in the field outline how anticarbohydrate antibodies may be used for the diagnosis of, e.g., inherited and infectious diseases and how novel vaccination strategies may be derived from this knowledge, including the reverse engineering of protective antibodies and the development of mimetic peptides. Thus, major carbohydrate epitopes from biomedically important pathogens such as *Bacillus anthracis*, *Vibrio cholerae*, *Shigella flexneri*, *Neisseria meningitidis*, group B *Streptococcus*, *Escherichia coli*, *Chlamydiae*, *Candida albicans*, and human immunodeficiency virus have been thoroughly defined. These studies have been aided by x-ray diffraction data, nuclear magnetic resonance spectroscopy, oligosaccharide synthesis and isolation of native glycan fragments, respectively, providing an insight into the immunological recognition of carbohydrates in general

and a basis for rational-vaccine design including the options for fully synthetic vaccines in the future for a number of diseases.

A substantial part of the volume addresses antibody-dependent features of xeno-transplantation, tumor biology and the prospects of carbohydrate-based tumor therapies, including strategies to enhance the inherently weak carbohydrate-protein binding interactions by peptide mimetics. In addition, increasing evidence of the importance of the peptide portion towards glycopeptide recognition and antigenicity has been demonstrated.

The controversial discussion on the impact of cross-reactive IgE antibodies directed against insect and plant *N*-glycans and their contribution to allergic responses has been summarized and extended with recent data on allergenic *O*-glycan and  $\alpha$ -Gal epitopes.

The valuable application of well-defined epitopes and antibody specificity is reflected in chapters focused on diagnostic applications using modern glycoarray technology for detection and evaluation of tumor-associated antibodies as well as on specific diagnosis of mucopolidosis.

The book concludes with insightful coverage of relevant techniques to generate valid binding and structural data by surface plasmon resonance and NMR spectroscopy, supported by the increasing power of modern modeling approaches.

Long neglected due to the tremendous success of antibiotics and due to the particular immunological properties of carbohydrates, being T-cell independent antigens and often only weakly bound by antibodies, characteristics which have prevented their introduction into the clinics apart from a few successful examples so far, the recent launch of a large number of clinical trials and examples summarized in this book show that carbohydrates and anticarbohydrate antibodies are on the way to play a major role in future medicine.

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Anticarbohydrate Antibodies

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