Preface

Aims of this book

This book is an outgrowth of courses in glycobiology given in the final year of the undergraduate biochemistry curricula at Imperial College London and the University of Oxford. It is intended to serve the needs of senior undergraduate students and starting graduate students. However, we hope that it will also provide a useful introduction to the field of glycobiology for more advanced researchers, including biochemists, cell biologists, immunologists, and virologists who encounter glycoproteins, glycolipids, and their receptors during the course of their work. Many people from outside the field see the need to understand what the sugars are doing, but they find the field bewildering. They can easily be put off by the enormous amount of structural detail associated with the sugars and the lack of a clear answer to the question 'Why are these sugars there in the first place?' This book will help educators to present a modern view of glycobiology to students and will provide an overview to practising scientists who are trying to come to grips with the flood of information in the field.

The presentation assumes background knowledge in biochemistry and cell biology at an undergraduate level. Our goal is not to undertake an exhaustive survey of the entire field of glycobiology. Instead, we provide an overview of the functions of glycans and an indication of how these functions are performed at the molecular level. Selective examples are used throughout; many interesting and important stories have, unfortunately, been left out in the interests of keeping the presentation short but representative of the whole field. Specifically, the focus of the book is on glycosylation in mammalian systems. This somewhat arbitrary narrowing of the subject has allowed us to make glycosylation in human disease a theme throughout the book.

Suggestions on how to use this book

Different lecturers will have different views about how to organize the teaching of glycobiology. This book is arranged so that the topics can be covered in essentially any order. The material is presented in relatively brief chapters in which individual sections have been given descriptive headings summarizing the main concepts that

are being explained. Key terms are highlighted in the text at the point where they first appear and most are defined in the glossary. The book is divided into two parts. The first part describes the chemical nature of various classes of glycans, their conformations, and their biosynthesis. The second part of the book addresses the biological functions of glycosylation. In this edition, Cross-references have been added in the margins to link topics between chapters, particularly between the two sections.

Within the first section, Chapter 1 provides background on sugar chemistry and oligosaccharide biosynthesis that is essential for most of the topics that follow. In Chapter 2, many of the principles of glycosylation are described in the context of N-linked glycosylation. The roles of different categories of O-linked glycans are described in Chapter 3, with an emphasis on functions that derive from their unique physical properties. This theme is continued in Chapter 4, which is concerned with glycolipids and glycoproteins in membranes. Chapter 5, which is new in this edition, describes the molecular and cellular mechanisms of glycosylation and highlights key outcomes from the study of knockout mice. The material on strategies for analysis of glycans in Chapter 6 and the coverage of glycan conformation in Chapter 7 do not need to be read before the subsequent chapters. These chapters contain material that may be difficult for some students, so many readers will wish to move directly from Chapter 5 to chapters dealing with the biological functions of glycans. Chapters in the second section of the book can be read independently of each other. The ability of glycosylation to affect the behaviour of proteins is discussed in Chapter 8. Chapters 9 and 10 focus on the informational role of glycans and the lectins that decode this information. The roles of lectins in cell adhesion, signalling, and innate immunity are covered in Chapter 9 and lectins that mediate trafficking inside and outside cells are described in Chapter 10.

Because the goal of this book is to provide a concise introduction to glycobiology, the focus is on mammalian systems. However, Chapter 11 provides a glimpse of glycobiology beyond mammalian cells. Chapter 12 focuses on the glycobiology of development. While many of the effects described lack a truly satisfying molecular explanation, this area represents one of the most active in the glycobiology field. The role of glycosylation in disease processes is a continuing theme throughout the book. Marginal notes are provided to highlight points where this subject is discussed and several new boxes devoted to special topics relating to disease and therapeutics have been added to this edition. Further examples are considered in detail in Chapter 13. The final chapter provides some comments on where the field of glycobiology is headed.

Teaching aids are provided with the goal of making the teaching of glycobiology accessible to undergraduates. Learning objectives are presented at the beginning of each chapter. These objectives, as well as the Glossary, are intended to help students to test their understanding of the material. Each chapter and each special topic box ends with a set of Questions and Essay topics. The lists of Key references have been kept brief, with recent review articles cited where possible to provide a broad over-

view of the field. However, many of the problems and figure legends contain references to research articles to encourage students to explore the primary literature.

Online Resource Centre

The **Online Resource Centre** at **http://www.oxfordtextbooks.co.uk/orc/taylor3e/** contains direct links to the Key references. Updates and additional topics of interest will be added to the site at regular intervals. A list of Protein Data Bank codes is provided to allow the viewing of **3D rotatable structures**. As an aid to instructors, **full colour** versions of the figures are provided for downloading from the website. Suggested answers to the problems are also available to registered adopters of the book. The Online Resource Centre can be accessed by visiting www.oxfordtextbooks.co.uk/orc/taylor3e/.

New to this edition

- Updated content to reflect the current state of the field: new chapter on cell biology of glycosylation and, expanded coverage of congenital disorders, proteoglycans, influenza virus, muscular dystrophy, and cancer
- Marginal cross-references between the chemical first part and biological and biomedical second part of the book to emphasize the relevance of structure to function
- New and updated special topic boxes represent current research and applications of glycobiology to disease and therapeutics
- Broadened treatment of analytical methods, including glycoarrays.