

Contents

Foreword, ix
Preface, xi
Contributors, xv
Consultant Reviewers, xix
Classic Books and Monographs, xxi
Abbreviations, xxiii

GENERAL PRINCIPLES

- 1 Historical Background and Overview, 1
Ajit Varki and Stuart Kornfeld
- 2 Monosaccharide Diversity, 19
Peter H. Seeberger
- 3 Oligosaccharides and Polysaccharides, 31
James H. Prestegard, Jian Liu, and Göran Widmalm
- 4 Cellular Organization of Glycosylation, 41
Karen J. Colley, Ajit Varki, and Taroh Kinoshita
- 5 Glycosylation Precursors, 51
Hudson H. Freeze, Gerald W. Hart, and Ronald L. Schnaar
- 6 Glycosyltransferases and Glycan-Processing Enzymes, 65
James M. Rini and Jeffrey D. Esko
- 7 Biological Functions of Glycans, 77
Ajit Varki and Pascal Gagneux
- 8 A Genomic View of Glycobiology, 89
Bernard Henrissat, Avadhesh Surolia, and Pamela Stanley

STRUCTURE AND BIOSYNTHESIS

- 9 N-Glycans, 99
Pamela Stanley, Naoyuki Taniguchi, and Markus Aebl
- 10 O-GalNAc Glycans, 113
Inka Brockhausen and Pamela Stanley
- 11 Glycosphingolipids, 125
Ronald L. Schnaar and Taroh Kinoshita
- 12 Glycosylphosphatidylinositol Anchors, 137
Michael A.J. Ferguson, Gerald W. Hart, and Taroh Kinoshita

- 13 Other Classes of Eukaryotic Glycans, 151
Robert S. Haltiwanger, Lance Wells, Hudson H. Freeze, and Pamela Stanley
- 14 Structures Common to Different Glycans, 161
Pamela Stanley and Richard D. Cummings
- 15 Sialic Acids and Other Nonulosonic Acids, 179
Ajit Varki, Ronald L. Schnaar, and Roland Schauer
- 16 Hyaluronan, 197
Vincent Hascall and Jeffrey D. Esko
- 17 Proteoglycans and Sulfated Glycosaminoglycans, 207
Ulf Lindahl, John Couchman, Koji Kimata, and Jeffrey D. Esko
- 18 Nucleocytoplasmic Glycosylation, 223
Christopher M. West and Gerald W. Hart
- 19 The O-GlcNAc Modification, 239
Natasha Zachara, Yoshihiro Akimoto, and Gerald W. Hart

GLYCANS IN EVOLUTION AND DEVELOPMENT

- 20 Evolution of Glycan Diversity, 253
Pascal Gagneux, Markus Aebi, and Ajit Varki
- 21 Eubacteria, 265
Chris Whitfield, Christine M. Szymanski, and Markus Aebi
- 22 Archaea, 283
Sonja Albers, Jerry Eichler, and Markus Aebi
- 23 Fungi, 293
Tamara L. Doering, Richard D. Cummings, and Markus Aebi
- 24 Viridiplantae and Algae, 305
Malcolm A. O'Neill, Alan G. Darvill, Marilyn E. Etzler, Debra Mohnen, and Serge Perez
- 25 Nematoda, 321
Iain B.H. Wilson, Richard D. Cummings, and Markus Aebi
- 26 Arthropoda, 335
Michael Tiemeyer, Hiroshi Nakato, and Jeffrey D. Esko
- 27 Deuterostomes, 351
Michael Pierce and Pamela Stanley

GLYCAN-BINDING PROTEINS

- 28 Discovery and Classification of Glycan-Binding Proteins, 361
Maureen E. Taylor, Kurt Drickamer, Ronald L. Schnaar, Marilyn E. Etzler, and Ajit Varki

- 29 Principles of Glycan Recognition, 373
Richard D. Cummings, Ronald L. Schnaar, Jeffrey D. Esko, Kurt Drickamer, and Maureen E. Taylor
- 30 Structural Biology of Glycan Recognition, 387
Anne Imberty and James H. Prestegard
- 31 R-Type Lectins, 401
Richard D. Cummings and Ronald L. Schnaar
- 32 L-Type Lectins, 413
Richard D. Cummings, Marilynn E. Etzler, and Avadhesh Suroolia
- 33 P-Type Lectins, 423
Ajit Varki and Stuart Kornfeld
- 34 C-Type Lectins, 435
Richard D. Cummings and Rodger P. McEver
- 35 I-Type Lectins, 453
Ajit Varki, Ronald L. Schnaar, and Paul R. Crocker
- 36 Galectins, 469
Richard D. Cummings, Fu-Tong Liu, and Gerardo R. Vasta
- 37 Microbial Lectins: Hemagglutinins, Adhesins, and Toxins, 481
Victor Nizet, Ajit Varki, and Markus Aebi
- 38 Proteins That Bind Sulfated Glycosaminoglycans, 493
Jeffrey D. Esko, James H. Prestegard, and Robert J. Linhardt

GLYCANS IN PHYSIOLOGY AND DISEASE

- 39 Glycans in Glycoprotein Quality Control, 503
Armando Parodi, Richard D. Cummings, and Markus Aebi
- 40 Free Glycans as Signaling Molecules, 513
Malcolm A. O'Neill, Alan G. Darvill, Marilynn E. Etzler, and Jeffrey D. Esko
- 41 Glycans in Systemic Physiology, 521
Hudson H. Freeze, Linda Baum, and Ajit Varki
- 42 Bacterial and Viral Infections, 527
Christine M. Szymanski, Ronald L. Schnaar, and Markus Aebi
- 43 Parasitic Infections, 539
Richard D. Cummings and Irma van Die
- 44 Genetic Disorders of Glycan Degradation, 553
Hudson H. Freeze, Taroh Kinoshita, and Ronald L. Schnaar
- 45 Genetic Disorders of Glycosylation, 569
Hudson H. Freeze, Harry Schachter, and Taroh Kinoshita

- 46 Glycans in Acquired Human Diseases, 583
Hudson H. Freeze, Taroh Kinoshita, and Ajit Varki

- 47 Glycosylation Changes in Cancer, 597
Ajit Varki, Reiji Kannagi, Bryan Toole, and Pamela Stanley

METHODS AND APPLICATIONS

- 48 Glycan-Recognizing Probes as Tools, 611
Richard D. Cummings, Alan G. Darvill, Marilyn E. Etzler, and Michael G. Hahn
- 49 Glycosylation Mutants of Cultured Mammalian Cells, 627
Jeffrey D. Esko and Pamela Stanley
- 50 Structural Analysis of Glycans, 639
Barbara Mulloy, Anne Dell, Pamela Stanley, and James H. Prestegard
- 51 Glycomics and Glycoproteomics, 653
Pauline Rudd, Niclas G. Karlsson, Kay-Hooi Khoo, and Nicolle H. Packer
- 52 Glycoinformatics, 667
Matthew P. Campbell, Kiyoko F. Aoki-Kinoshita, Frederique Lisacek, William S. York, and Nicolle H. Packer
- 53 Chemical Synthesis of Glycans and Glycoconjugates, 681
Peter H. Seeberger and Hermen S. Overkleeft
- 54 Chemoenzymatic Synthesis of Glycans and Glycoconjugates, 691
Hermen S. Overkleeft and Peter H. Seeberger
- 55 Chemical Tools for Inhibiting Glycosylation, 701
Jeffrey D. Esko, Carolyn Bertozzi, and Ronald L. Schnaar
- 56 Glycosylation Engineering, 713
Henrik Clausen, Hans H. Wandall, Catharina Steentoft, Pamela Stanley, and Ronald L. Schnaar
- 57 Glycans in Biotechnology and the Pharmaceutical Industry, 729
Peter H. Seeberger and Richard D. Cummings
- 58 Glycans in Nanotechnology, 743
Soledad Penadés, Benjamin G. Davis, and Peter H. Seeberger
- 59 Glycans in Bioenergy and Materials Science, 755
Malcolm A. O'Neill, Robert J. Moon, William S. York, and Alan G. Darvill
- 60 Future Directions in Glycosciences, 761
Gerald W. Hart and Ajit Varki

Glossary, 769

Study Guide, 777

Index, 789