Book Reviews

Techniques in Glycobiology Edited by R. Reid Townsend and Arland T. Hotchkiss, Jr. Marcel Dekker, Inc., New York, 1997. xiii + 648 pp. $ 65.00 (hc). ISBN: 0-8247-9822-8

The recognition that complex carbohydrates are ubiquitous throughout the plant and animal kingdoms and that some of their recognized roles include conferring unique properties on proteins and lipids has resulted in increasing interest in the structural and functional properties of such compounds. Therefore several monographs have appeared during the last couple of years to address the description of such phenomena. The structural elucidation of the complex carbohydrates, however, remains a challenging analytical problem and the most recent book *Techniques in Glycobiology*, edited by R.R. Townsend and A.T. Hotchkiss, Jr., presents a collection of 37 chapters describing sensitive methods which can determine monosaccharide composition (including the distinction between D and L sugars), sequence, anomericity, linkage positions, and branching and also biological recognition phenomena. The chapters were selected from presentations at the Third International Glycobiology Symposium on Current Methods, held in San Diego, California.

Although many structural features can be determined using high-resolution proton nuclear magnetic resonance (^{1}H-NMR), in many cases sufficient amounts of a sample cannot be obtained. Chapter 1 describes a new method for analyzing smaller quantities of oligosaccharides using nanoprobe NMR. The greater sensitivity of mass spectrometric methods remains an impetus to develop strategies described in Chapters 2–5. The utility of mass spectrometry (MS) for analyzing carbohydrate-protein interactions is detailed in Chapter 6. Chapter 7 incorporates both NMR and MS methods for the structural elucidation of bacterial oligosaccharides.

Microscale analysis and quantification for glycolipids using novel blotting methods, high-performance liquid chromatography (HPLC), and enzyme-linked immunoassays are detailed in Chapters 8–10, respectively. The modification of lipids with oligosaccharide chains gives unique characteristics to plasma membranes as inferred from studies described in Chapter 11. The physical properties of large carbohydrate polymers using non-contact atomic force microscopy are described in Chapter 12. Two novel biosensor methods for measuring carbohydrate-protein interactions are described in Chapters 13 and 14.

The glycosylation of proteins in specific Ser or Thr residues significantly alters the conformation of the polypeptide backbones as reviewed in Chapter 15. Computer algorithms that predict the sites of *O*-glycosylation are presented in Chapter 16 and a novel in vivo method for confirming these predictions is described in Chapter 17. Chapters 18–20 review two sensitive approaches, MS and modified Edman sequencing, to determine the sites of *O*-glycosylation and for characterizing the attached oligosaccharide chains.

Complex carbohydrates invariably occur as an array of different structures, even at a single glycosylation site on a protein. Methods to separate these naturally derived mixtures have evolved considerably in recent years. Complex carbohydrates neither are fluorescent nor absorb significant amounts of UV light for detection during chromatography. Novel labeling approaches are presented in Chapters 21–23. New exoglycosidases for use with high-resolution separation techniques are described in Chapter 25. Modern high-performance separations have developed such that a single peak will likely contain one oligosaccharide structure, which is the basis of oligosaccharide mapping. Chapters 26 and 27 outline mapping methods using gel electrophoresis, HPLC, and capillary electrophoresis. New sample preparation protocols for HPLC mapping are detailed in Chapter 28. The use of high-resolution separations for assessing the fidelity of glycosylation of recombinant glycoprotein therapeutics is addressed in Chapters 29 and 30. Chapters 31 and 32 discuss strategies incorporating HPLC, reagent array exoglycosidase analysis, NMR, and MS.

New methods are described that utilize a DNA sequencer (Chapter 33) or a post-column enzyme reactor for high-pH anion exchange chromatography with pulsed amperometric detection (Chapter 34) for chain length analysis of depolymerized amylopectin or other plant polysaccharides. Acidic matrix polysaccharides such as pectin and galactan contribute structural support to plant cell walls. In Chapter 35, a new derivatization method is described for the preparation of 1-amino-1-deoxyalditol acetates, which are used for GC-MS analysis of enantiomeric sugars in the red algal galactan, corallinan. A novel class of pectin esters that may be involved in crosslinking the pectin matrix to other cell wall polysaccharides is characterized in Chapter 36 by using gas chromatography-MS (GC-MS), FTIR microspectroscopy, and immunocytochemical electron microscopy. In Chapter 37, the cellulose and carrageenan structure of red algal cell walls is characterized by using various methods including light and electron microscopy, GC-MS, NMR, X-ray diffraction and a novel reductive hydrolysis procedure that protects acid-labile 3,6-anhydro galactose residues in carrageenan during composition analysis.

The material presented in most of the chapters describes specific examples from the authors' laboratories and areas of expertise and generally does not present a systematic background on the subject as in a review format. The authors generally give a short introduction to the subject, followed by, in most chapters, specific experimental details associated with the technique investigated (which leads to repeated description of particular techniques, e.g. reductive amination in several chapters). The quality of the individual chapters varies, but most of them present the subject in a very practical and useful way for carbohydrate chemists.

Most of the methods presented are considered pioneering research and very relevant for the structural investigations of complex carbohydrates by investigators who lack the necessary expertise in their own laboratory. The shortcoming is, however, that most of the methodologies are presented in connection with the specific topic studied by the individual authors and therefore do not allow a comparison of the methods described with a different type of compounds relevant in another context.

Some of the topics chosen are biased towards special areas with e.g. many chapters about structural studies of *O*-linked glycoproteins, whereas the much more abundant *N*-linked structures are dealt with in relatively fewer chapters. Similarly NMR spectroscopy, one of the most important methods for the structural assignments of complex carbohydrates, is only described in relatively few chapters compared to its wide use in practice. The same applies to FAB MS which also has been used extensively. In contrast, the practical use of MALDI-TOF mass spectroscopy is very relevant and illustrative. However, the focus on many new techniques, although they may become obsolete in the long run, makes this book useful for many laboratories, by providing up-to-date information on the possibilities offered by a particular method. The figures are all presented in clear and illustrative diagrams.

Personally I found the chapters on "Use of a Nano•NMR Probe for the Analysis of Microgram Quantities of Complex Carbohydrates", "Imaging Carbohydrate Polymers with Noncontact Mode Atomic Force Microscopy", and "Glycoprotein Detection Using the Light-Addressable Potentiometric Sensor" novel and interesting. In conclusion, the book is recommended to practising carbohydrate researchers

Information about books for review in FEBS Letters should be sent to: Professor J.E. Celis, Department of Medical Biochemistry, Ole Worms Allé, Building 170, University Park, Aarhus University, DK-8000 Aarhus, Denmark.

PII S0014-5793(97)01427-0

as a laboratory handbook supplementary to another practical approach book like *Methods in Enzymology* from 1994. I am more skeptical about the long-term usefulness of the book, since in the absence of a more general and comprehensive description of the individual methods, it might rapidly be outdated as new and/or modified techniques appear.

Klaus Bock

Immobilization of Enzymes and Cells. Edited by G.F. Bickerstaff, Humana Press, Totowa, New Jersey, 1997; xiv + 367 pp. $ 79.50 (hc). ISBN 0-89603-386-4

Immobilization of biological catalysis (enzymes, organelles, and cells) in biotransformation, analytical, and medical applications has expanded greatly in both industrial and research laboratories in the past 30 years. Therefore, there is now a bewildering array of methods for immobilization and of support materials. The advances in genetic technology have increased the interest in the immobilization of enzymes and cells.

Immobilization of Enzymes and Cells, the first book in the new *Methods in Biotechnology* series from Humana Press, provides a good collection of well presented protocols to immobilize enzyme and cells by various support substances and methods. Several alternative ways of immobilization which are handy for researchers are presented. Therefore, the aim of *Immobilization of Enzymes and Cells*, which is to provide a wide range of representative examples of immobilization techniques for use by postgraduate, postdoctoral, senior research workers, and technicians throughout academic, industrial, government, and medical research establishments, is reasonable.

Immobilization of Enzymes and Cells consists of 39 chapters, each consisting of around 10 pages. The first chapter provides some background to assist in choice evaluation for the support material and the method of immobilization. It gives concepts underlining the five principal methods for immobilization of enzymes and cells (adsorption, covalent binding, entrapment, encapsulation, and crosslinking) and discusses briefly the relative merits of each method. The remaining 38 chapters of the book deal with protocols for immobilization of enzymes, proteins, and cells on various support materials using adsorption, crosslinking, entrapment, covalent binding and encapsulation methods. The individual chapters are well laid out with the same outline for each chapter: introduction, materials, methods, notes, and references. A short introduction provides the rationale of the particular method. A comprehensive list of materials including the preparation of the particular kind of each materials is described. The protocol itself is provided step by step which is straightforward and easy to follow. The notes section gives helpful hints, trouble-shooting, and safety warnings and precautions. The reference section provides further sources and examples of using that technique.

In conclusion, this is an excellent protocol book on immobilization of enzymes and cells. It is well written and the protocol itself is short and precise. This manual will be undoubtedly very useful to researchers who are searching for immobilization techniques.

F. Götz

Buffer Solutions: The Basics. Edited by R.J. Beynon and J.S. Easterby, IRL Press at Oxford University Press, Oxford, 1996. viii + 87 pp. £ 12.99 (pb). ISBN 0-19-963442-4

From the preface: "This book adopts a pragmatic approach to the use of buffers for pH control in aqueous solution. It presents the information that is necessary to understand how buffers function, and shows how it is used to make choices of experimental systems"; and indeed it does so – excellently.

Chapter 1: Basic concepts

For those equipped with enough elementary background in logarithmic functions to relate the pH scale to proton concentrations, this chapter can safely be skipped. But, being Danish, this reviewer has enjoyed the multiple references to S.P.L. Sørensen (and J.N. Brøndsted in later chapters).

Chapter 2: Acids and bases

This chapter takes the reader through the basics of acid/base theory. Wisely enough, the derivations are based on the Lowry-Brøndsted concept, but references to Lewis' more general definitions on acids and bases are missed. Sound advice is given about when not to use the simplified pH equation. The chapter concludes with a short and clear account of structural effects on acidity among organic acids.

Chapter 3: Theory of buffer action

This covers the basic theoretical principles of buffer behavior. The Henderson-Hasselbach equation is derived, and the concept of buffer capacity is introduced by graphical analysis of this equation (in the form of a Bjerrum diagram) to be followed, later, by a simplified definition of 'buffer capacity' (β-values) that demonstrates the importance of the total concentration of buffer. The rest of the chapter deals with the important effects of solution conditions such as ionic strength and temperature on pK_a of the present acids and, by implication, on pH of the solution. Tris buffer, due to its high sensitivity to temperature, is of course a favored scapegoat. This treatment is not an easy reader, but numerous examples – such as Figure 3.5, showing the effect of temperature cycling in PCR on the pH of the reaction mixture – are very illustrative. The chapter concludes with some useful comments (and warnings) regarding the use of polyprotic and 'mixed' buffers such as Tris-acetate.

Chapter 4: Measuring of pH

This gives a lot of background, and sound practical advice on the use and care of pH meters and electrodes. In fact, this chapter assumes the character of a highly readable manual dealing with all the practical conditions for pH measurements as well as a number of error sources that this reviewer has never heard about. Perhaps other readers will be tempted to reconsider their routines?

Chapter 5: Preparation of buffer solutions

This discusses the practicalities of buffer preparations, and includes a series of 'case studies' that are worked examples of the design of buffers for particular purposes such as external control of ionic strength by added salt. For readers used to choosing buffers from criteria giving priority to easy availability, a fresh starting point will be the flow chart in Figure 5.2, illustrating an overall strategy of buffer design. The need of careful specification of buffer composition is treated in section 5.1, describing preparations of 0.1 M Tris buffer at $pH = pK_a$ starting from either Tris-HCl or Tris base, in both cases ending up with the wanted total concentration of buffer and pH, but with a different ionic strength! The chapter also includes an account of advantages and pitfalls in the use of concentrated stock solutions. I only miss a terrifying description of acidity run amuck when a nasty scientist sneaks to lyophilize protein samples in volatile buffers.

Chapter 6: Automatic buffer calculations

This describes briefly the software that the authors have written to ease buffer design. Four possibilities are covered, a Macintosh Hypercard stack, a MS-DOS program running in the Windows environment, a 'non-Windows' DOS program, and a program that is accessible over the World Wide Web.

Appendices

These present detailed data on the most common buffers that are used in the biological sciences. Tables A1.1 and A1.2 make a good starting point giving thermodynamic values of pK_a and dpK_a/dT (i.e. temperature sensitivity) for 40 relevant buffer acids, including the 'good' buffers. For calibration purposes, this section concludes with

recipes for preparing three primary pH standards – potassium hydrogen phthalate, potassium sodium phosphate, and sodium tetraborate – with tables of pH versus temperature.

In conclusion, this book provides a highly readable account of the basic theory, necessary to understand the mechanisms of pH control through buffer capacity in aqueous solutions. Scientists from the biological and biochemical environment should greatly benefit from this user-friendly guide to correct design and use of equipment and buffer compounds in pH control of (bio)chemical reactions under experimental conditions.

In addition, the readers of this little book may get the feeling that the authors have enjoyed writing it – I enjoyed reading it!

Anders Overgaard Pedersen

Lactoferrin. Interactions and Biological Functions. Edited by T.W. Hutchens and B. Lonnerdal, Humana Press, Totowa, New Jersey, 1997. xvi + 408 pp. $ 110.00 (hc). ISBN 0-89603-366-X

This book describes the proceedings of the Second International Symposium on Lactoferrin Structure and Function, which was held in Honolulu in February 1995. Lactoferrin is a metal binding glycoprotein which plays an important role in the host defense against infection and severe inflammation. A need to understand the diverse biological actions of lactoferrin and the prospect of a wide variety of potential applications in human health care have stimulated many studies on the protein. In order to cover the many disciplines of lactoferrin research, the book has been arranged into five parts. Part I, "Lactoferrin structure and function", provides a clear synthesis of the structure and function of lactoferrin. By far the largest part is Part II, entitled "Lactoferrin gene expression", which contains chapters describing recombinant expression of human lactoferrin in various expression systems, lactoferrin gene regulation and expression and lactoferrin-receptor interactions. Some of these chapters might have been better off in Part III "Functions related to lactoferrin interactions with prokaryotic and eukaryotic cells". Now, the title of this part is somewhat misleading because it only contains chapters on the binding of lactoferrin to prokaryotic cells and functional consequences thereof. After the short Part IV "Lactoferrin metabolism" (only a chapter on lactoferrin metabolism in rats and a chapter on the possible role of lactoferrin as a transcriptional regulator), the book ends with Part V "The use of lactoferrin as a food additive", describing the rationale for adding lactoferrin to infant formulas. No chapters deal with the potential nutraceutical or parenteral use of lactoferrin.

Unfortunately, it took two years for these proceedings to appear, and in the meantime, the Third International Symposium on Lactoferrin Structure and Function was held in May 1997 in Le Touquet, France. Due to the delayed appearance of the book and the third lactoferrin symposium already behind us, most articles do not provide new data or insights. However, most chapters are well written and clearly illustrated with uniform pictures and tables. Furthermore, the chapters are generally well referenced for those wishing to get more in depth with the various subjects. This makes this book a very useful up-to-date reference book for everybody active in the field of lactoferrin.

Patrick H.C. van Berkel

Booklist no. 141 December 1997

1. Wilkins, M.R., Williams, K.L., Appel, R.D. and Hochstrasser, D.F. (eds) Proteome research: New frontiers in functional genomics. Springer; Berlin Heidelberg New York, 1997. xviii + 243 pp. $ 49.95 (pb).
2. Campos-Ortega, J.A. and Hatenstein, V. (eds) The embryonic development of Drosophila melanogaster. Second edition. Springer; Berlin Heidelberg New York, 1997. xvii + 405 pp. $ 199.00 (hb).
3. Heilmeyer, L. (ed) Interacting protein domains. The role in signal and energy transduction. NATO ASI series. Series H: Cell biology, vol. 102. Springer; Berlin Heidelberg New York, 1997. x + 292 pp. $ 109.00 (hb).
4. Bender, D.A. (ed) Introduction to nutrition and metabolism. Second edition. Taylor and Francis; London, 1997. x + 355 pp. £ 17.95 (pb).
5. Eckstein, F. and Lilley, D.M.J. (eds) Mechanisms of transcription. Nucleic acids and molecular biology, vol. 11. Springer; Berlin Heidelberg New York, 1997. xi + 327 pp. $ 160.00 (hb).
6. Potter, M. and Melchers, F. (eds) C-myc in b-cell neoplasia. 14th workshop on mechanisms in b-cell neoplasia. Springer; Heidelberg New York, 1997. xii + 291 pp. $ 119.00 (hb).
7. Practical approach on CD-ROM. IRL Press at Oxford University Press; Oxford, 1997. 5000 protocols. £ 595.
8. Corbin, J.D. and Francis, S.H. (eds) Signal transduction in health and disease. Advances in second messenger and phosphoprotein research. Lippincott-Raven; Philadelphia, 1997. xxvi + 306 pp. $ 143.75 (hc).
9. Rhodes, J.D. and Milton, J.M. (eds) Lectin methods and protocols. Methods in molecular medicine. The Humana Press; Totowa, 1997. xviii + 616 pp. $ 99.00 (hb).
10. Guzman, N.A. (ed) Prolyl hydroxylase, protein disulfide isomerase and other structurally related proteins. Marcel Dekker; New York, 1997. xvii + 530 pp. $ 185.00 (hb).
11. Johnstone, A.P. and Turner, M.W. (eds) Immunochemistry 1. A practical approach. IRL Press at Oxford University Press; Oxford New York, 1997. xxix + 288 pp. £ 27.95 (pb).
12. Dodds, A.W. and Sim, R.B. (eds) Complement. A practical approach. IRL Press at Oxford University Press; Oxford New York, 1997. xxi + 274 pp. £ 29.95 (pb).

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No. 136 (February, 1997) FEBS Lett. 403, 108.
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No. 138 (July, 1997) FEBS Lett. 411, 149.
No. 139 (August, 1997) FEBS Lett. 412, 650.
No. 140 (September, 1997) FEBS Lett. 415, 350.