

## Book reviews

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*Molecular Biophysics of the Extracellular Matrix*, edited by STRUTHER ARNOTT, D. A. REES, AND E. R. MORRIS, Humana Press, Clifton, NJ, 1984, xii + 170 pages + 261 References + Subject Index, \$39.50, \$49.50 outside U.S.A.

This volume had its origin in a workshop meeting held in England under the sponsorship of the Biochemical Society. Research on the extracellular matrix was beginning to shed light on its biological function, now that a good deal was known about the molecular structure and physical properties of species comprising the matrix. It therefore seemed an appropriate moment to present a "coherent, critical survey of the field" (Preface). For this reason, the book is timely. Also, in my opinion, it constitutes a highly worthwhile, stimulating contribution to the literature on the subject.

There are seven chapters in all, contributed by an international group of authorities in the field. Especially noteworthy is a "Summary of Conclusions", presented in the final chapter by D. A. Rees (U.K.), because it so nicely gives an overall perspective of the material in the remainder of the book. Indeed, I recommend that this chapter be read at the outset, rather than last, particularly if one is not already familiar with the subject.

In Chapter 1, T. E. Hardingham (U.K.) provides a useful summary of the composition and structure of the proteoglycans. His focus, however, is on cartilage, stressing the importance of non-degradative methods in the isolation of its proteoglycans, and describing the secretion and assemblage of the proteoglycan aggregates. There is also a lucid discussion of the physiological function of the aggregates and of the protein components of cartilage. Chapter 2, by C. F. Phelps (U.K.), deals with hydrodynamic properties of solutions of glycosaminoglycans and proteoglycans, mainly as measured by sedimentation, viscometric, and light-scattering techniques. There is an interesting evaluation of the significance of the concentrations at which these macromolecules occur in tissue, as well as a critical overview of limitations in the techniques employed in hydrodynamic studies. Data on molecular-weight ranges and mean-square radii of gyration are summarized, and the importance of such factors as polydispersity and heterogeneity, as well as charge density, are assessed. An unexpectedly pessimistic note is sounded by Phelps, who, after posing the question "Have we obtained good value for our money in hydrodynamic studies?", answers "no". This appraisal may neither sit well with funding agencies, who are more accustomed to having scientists extol their individual specialty and promote its achievements, nor find agreement among other researchers in the field.

A more "upbeat" tone characterizes the next two offerings. Chapter 3, by S. Arnott and A. K. Mitra (U.S.A.), gives a fine account of major advances in structure determination afforded in recent years by X-ray fibre diffraction analysis of glycosaminoglycans. Improvements in technique, and the use of computer methods for molecular-model building and refinement, are seen to have generated an impressively detailed picture of molecular shapes adopted by glycosaminoglycans and, in a number of instances, of the modes of association of these polymers with water molecules and counter-ions. The authors note, however, that less is known about the organization of glycosaminoglycan chains linked to protein in the proteoglycan, and that the order observed in the condensed phase may undergo modification in solution. The latter question is also addressed in Chapter 4, by B. Casu (Italy), in dealing with applications of n.m.r. spectroscopy in the conformational analysis of glycosaminoglycans in solution. Here again, developments in instrumentation and technique are shown to have greatly facilitated the search for structural detail in macromolecules obtained from the extracellular matrix. Most of the discussion concerns the conformations of individual types of residues, particularly the apparent susceptibility of the  $\alpha$ -L-iduronic acid residues in heparin, dermatan sulfate, and heparan sulfate to undergo chair-chair interconversion. Also considered are the conformations of segments of glycosaminoglycan chains, as well as evidence for inter-residue hydrogen-bonding, phase transitions, and specific binding by counter-ions.

The intact, extracellular matrix is preserved by interactions between carbohydrates and proteins, as well as by the interpenetration of macromolecules. According to the evidence presented in Chapter 5 by L.-Å. Fransson and L. Cöster (Sweden), and I. A. Nieduszynski, C. F. Phelps, and J. K. Sheehan (U.K.), additional stability may be imparted by self-association of proteoglycans. Interactions involving specific structural arrays in dermatan sulfate and heparan sulfate are demonstrated here by the results of an elaborate series of experiments. Although the findings are fascinating, this article offers less of a survey than the others because, more in the manner of a journal article, it goes heavily into experimental detail.

Chapter 6, by B. N. Preston and W. D. Comper (Australia), and T. C. Laurent (Sweden), appraises the fundamental question of how the transport of molecules and ions in connective tissue is regulated. This is by far the longest chapter, and it includes a substantial treatment of transport and diffusion processes in model experiments with neutral polymers [*e.g.*, dextran and poly(vinylpyrrolidinone)], in addition to the (more pertinent) survey on the glycosaminoglycan polyelectrolytes. Particularly noteworthy is a section dealing with a recently discovered, "anomalous" transport-mechanism which may be of great biological significance, whereby the rate of diffusion of one polymer is accelerated by the presence of another.

The type used throughout the text is large and clear, and the paper has but little gloss, qualities that I found easy to take, although some of the Figures (on pp.

25, 27, 77, and 159) are not well reproduced. I noticed only a few typographical errors: "glycosminoglycans" (p. 121, l. 3), "the" for "that" (p. 137, l. 17), and "lead" for "led" (p. 147, l. 9). Also, there are many instances where "sulfate" is preceded by "O-", incorrectly, because the oxygen atom involved is not a part of the sugar moiety, and the etymologically erroneous, alternative spelling ("sulphate") is occasionally thrown in. Only ten percent of the references are more recent than 1980; this, I assume (as the date of the workshop meeting is not given), is a reflection of the delay that so frequently plagues the shepherding of a collected work of this kind into print.

Overall, this work is of high quality and constitutes a valuable addition to the carbohydrate literature.

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*Chitin, Chitosan, and Related Enzymes*: edited by JOHN P. ZIKAKIS, Academic Press, Orlando, FL, 1984, xxiv + 415 pages + Subject Index, \$39.50, £ 30.50.

This book consists of the papers presented at a joint United States-Japan seminar which brought together 12 Japanese and 12 American scientists, accompanied by a very small number of observers (10 from the U.S.A., 1 from Italy, and 1 from Panama), to discuss several aspects of applied research on chitin. The book offers 24 articles grouped into 5 sections, namely, (1) drug delivery, sustained release, and pharmaceutical; (2) novel applications of chitin, chitosan, and their derivatives; (3) enzymology and genetic enzyme engineering; (4) chemical and physical structure of chitin and chitosan; and (5) biological and physicochemical properties of chitin and its derivatives. The purpose of the book is clearly defined, and discussion is restricted to some of the applicative aspects of chitin. The book does not mention research on the occurrence of chitin in animals and fungi, chitin ecology, and chitinases, and gives very little information on the chemistry of chitin.

The general style of these contributions is that of journal articles, but, in most of the articles, the introductory sections contain obvious and superficial statements. For instance, an article dedicated to chitosanases begins with sentences recalling studies, made on chitosan in 1859, which are absolutely irrelevant, in addition to containing a Table on the potential applications of chitosan (erroneously entitled "Potential applications of chitosanases") which is misleading and distracts from the subject treated. More than one article describes non-rewarding research projects, such as one on the chitinolytic activity of  $\beta$ -D-glucosidase, in which an attempt to modify the method of Reissig *et al.* for the determination of N-acetylglucosamine is described, and another on the spectrophotometric determination of chitin in complex solvents. In both cases, undesirable properties of the sys-