Glycoproteins and Proteoglycans is therefore a timely addition to the literature. Although most of the papers in the book are of excellent quality, much of the material they cover has appeared in review articles elsewhere. The book's main strength lies in its compilation of seven good reviews on topics that have not until now appeared together in one volume.

In the opening chapter, on the structure of glycoproteins and their oligosaccharide units, Kornfeld and Kornfeld give an overview of the biochemical techniques and protocols that have elucidated these structures. In chapter 2, Struck and Lennarz describe the synthesis and processing of lipid intermediates in glycoprotein synthesis. They evaluate the use of specific and nonspecific inhibitors of glycosylation, which have been instrumental in the discernment of the role of oligosaccharide moieties of glycoproteins. Our current understanding of protein glycosylation is brought together in a generalized model that serves to orient the reader for subsequent chapters.

Schachter and Roseman author an impressive review of mammalian glycosyltransferases. In the first part of the chapter they discuss the tissue and subcellular distribution, purification protocols, and kinetic requirements of the enzymes responsible for the addition of each monosaccharide moiety found in mammalian oligosaccharides. There is a structural analysis of the A, B, H (O), and Lewis blood group antigens, which gives a welcome physiological and genetical aspect to the chapter. The second part of the chapter contains the only detailed discussion of glycolipids in the book. Recent reports of the occurrence of gangliosides containing glucosamine are discussed, as are the subcellular distribution and metabolism of these compounds. This section contains one of the few discussions in the book of postulated functions for complex carbohydrates. Particular attention is paid to the role of gangliosides in development and differentiation and as receptors for hormones and toxins.

Mutant cell lines resistant to toxic plant lectins are characterized by alterations in their surface complex carbohydrates. In chapter 4, Stanley illustrates the use of such cell lines in elucidating the pathways of oligosaccharide biosynthesis. It was through the use of such cell lines that two independent mannose:*N*-acetylglucosaminyl transferases, each with its own linkage specificity, were identified. A biochemical catalog of cell lines resistant to a variety of lectins serves to emphasize the enormous value of cells such as these.

The pitfalls that have made difficult the analyses of surface carbohydrate alterations accompanying growth and transformation are well documented by Atkinson and Hakimi in chapter 5. The authors carefully criticize the biochemical and cell biological techniques used in these controversial studies. They set out broad categories of specific, surface-carbohydrate alterations that, even if they prove inaccurate, suggest ways in which future experimentation can be more carefully controlled. Although all the chapters touch upon the methods used for structural analysis, Atkinson and Hakimi give considerable attention to the use of endoglycosidases, which have proved invaluable in these studies.

The pioneering work of Ashwell and his colleagues on the hepatic clearance of circulating desialyzed glycoproteins has led to widespread interest in the role of lectin-like cell surface proteins in physiological regulation. The clinical significance of this subject is shown by the work of Neufeld and her colleagues on mucopolysaccharide "storage" diseases, one of which, I cell disease, appears to result in defective recognition of some mucopolysaccharidases by lectin-like membrane receptors. Chapter 6, by Neufeld and Ashwell, beautifully illustrates the historical development of two independent research avenues that eventually came to similar working hypotheses fundamental to cell biology.

The final chapter, by Rodén, is an excellent and exhaustive review of the structure, synthesis, and degradation of the known proteoglycans. The tissue source, purification, substrate specificity, and kinetic requirements of the enzymes responsible for the synthesis and hydrolysis of the 33 individual linkages that make up proteoglycan polysaccharides are discussed. Technical protocols for the isolation of proteoglycan are presented, as are biosynthetic pathways for the synthesis of some specific proteoglycans.

As is often the case with books of this type, this one is already somewhat dated. Since these chapters were compiled, for example, the continued isolation of highly purified glycosyltransferases by Hill and his colleagues and the recent characterizations of glucosidases involved in glycoprotein processing have added to our understanding of complex carbohydrate biosynthesis.

As is evident from the foregoing discussion, the quantity of data (and references) in the book is overwhelming. However, it is unfortunate that glycoproteins of wide abundance and significance such as collagen and fibronectin are scarcely mentioned. Likewise, there is no discussion of the structurally interesting glycoprotein erythroglycan, of glycoproteins on teratocarcinoma cells, or of the basement membrane glycoprotein laminin. On the other hand, authors draw upon clinical correlatives whenever possible, broadening the book's scope. The extensive bibliographies following each chapter add considerably to the book's usefulness.

For the investigator or student who is seeking a broad, comprehensive book on the technical, structural, and enzymological aspects of complex carbohydrate metabolism, this book is strongly recommended.

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Human Nutrition

Nutrition and Growth. DERRICK B. JELLIFFE and E. F. PATRICE JELLIFFE, Eds. Plenum, New York, 1979. xx, 452 pp., illus. $37.50. Human Nutrition, vol. 2.

I found this book an excellent source of information. It is divided into a short preliminary section describing the modification of nutritional requirements and processes by genes and environmental factors, a long middle section on developmental nutrition from fetal to adult life, and a final section on the assessment of nutritional status by anthropometry. The book is the second of a series of four, the first of which is concerned with prenatal and postnatal requirements, the third with adult nutrition, and the fourth with nutrition in disease. Its contents overlap to some extent those of the other volumes; for example, it includes papers on the mother and fetus (Lechtig *et al.*), the adult (Wolanski), and such disorders as obesity (Lloyd) and protein-energy malnutrition (Gurney).

The middle section of the book follows a conventional "conception to coffin" developmental approach except that the first trimester of pregnancy receives scant attention. Parts of some papers are particularly useful; for example, the discussions of the effect of birth interval on maternal nutrition and fetal growth (Lechtig *et al.*), the social and emotional factors in the failure-to-thrive syndrome (Brown), and the etiology of obesity (Lloyd). Despite a feeling of déjà vu

(most of the information presented is available in previous reviews) the section is a good starting point for tracking down relevant literature, even for the "researcher or advanced student of nutritional science," the readership envisaged by the series editors, Alfin-Slater and Kritchevsky.

The other two sections provide more than a good starting point. Part 1 has concepts and part 3 methods. A paper on genetic and nutritional interactions (Garn *et al.*) in part 1 examines such strategies as relating the size of children to the size of their parents and the use of multiple births and adoption to unravel the relationships of nature and nurture. The paper is a useful preliminary to some of the papers in part 3. The ideal assessment of nutritional status is described by Garn. Practical field methods are discussed by Zerfas, who includes a useful comparison of their cost and effectiveness. Habicht *et al.* describe the value of individual measurements as indicators of a need for nutritional intervention and make the distinction between "nutriture" (nutritional intake minus expenditure and losses) and nutritional status, a point often ignored—not all thin dwarfs are undernourished.

The outstanding paper in the third section and indeed in the whole book is Neumann's "Reference data." Neumann cautions that "reference data for growth are not necessarily optimal, normal, ideal, desirable, or to be considered a target," but she nevertheless sees "a great need for a single set of international reference data for growth . . . based on a well-nourished, but not overnourished, well-cared-for population." In my view an international standard, if taken as a standard of reference rather than as a standard of excellence (to use a phrase from Jelliffe and Jelliffe), is helpful. Neumann reviews principal reference data and classification systems for a number of anthropometric measurements. She concludes that the National Center for Health Statistics growth standards published in 1976 "carry great promise as serving the 'new improved' international standard, currently for weight, stature, and head circumference, and shortly for arm circumference and skinfolds as well."

This review has mentioned only 11 of the 21 papers, and, of course, there are other highlights, such as Gopalan and Rao's discussion of protein requirements and Robinow's brief review of growth failure in renal disease.

The book lacks a critical discussion of the critical period hypothesis as applied to growth, or indeed any detailed discussion of the prognosis of growth failure occurring at different times of life. I believe that the critical period concept is in danger of being applied uncritically to human nutrition and would have valued a deeper consideration of the subject than the passing references in the editors' introduction and the odd chapter. I have no doubt, however, that I shall consult the book, particularly the chapters on methods, a lot in the coming year.

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