Normal and Pathological Aspects of Protein Metabolism

Mammalian Protein Metabolism. vols. 1 and 2. H. N. Munro and J. B. Allison, Eds. Academic Press, New York, 1964. vol. 1, xiv + 566 pp., $18.50; vol. 2, xiv + 642 pp., $21. Illus.

The years that have passed since the appearance of the last comprehensive treatise on protein metabolism have witnessed a great expansion of our knowledge of this subject. The influence and role of hormones in processes of mammalian nitrogen metabolism and the rather more detailed reactions of peptide-bond biosynthesis are examples of two areas to which extensive new information has been added. The appearance at this time of a comprehensive treatment of mammalian protein metabolism is therefore welcome. Moreover, it is fortunate that the planning of this contribution was directed by two experienced investigators and teachers, H. N. Munro of the University of Glasgow, and the late J. B. Allison of Rutgers University. These editors sought and had the good fortune to obtain able contributors. In consequence, the two volumes *Mammalian Protein Metabolism* will be valuable additions to the libraries of investigators in the broad field of biochemistry, as well as a useful reference source for students of the discipline.

The first volume encompasses knowledge of protein metabolism in its various aspects. An initial chapter, by Munro, is entitled, "Historical introduction: The origin and growth of our present concepts of protein metabolism." This scholarly chapter is most welcome in a period of biochemistry in which there would appear to be a declining emphasis on the historical background of the discipline.

In the second chapter of volume 1, "Protein digestion and absorption in nonruminants," Carlos Gitler provides an account of the specificity of the proteolytic enzymes and of factors concerned with the rate of movement of digestion products through the gastrointestinal tract. In addition to a consideration of the digestive fates of ingested protein derived from the diet, Gitler provides an interesting, seldom encountered treatment of protein that enters the alimentary tract from endogenous sources. This chapter includes a section on the absorption of proteins, peptides, and amino acids from the intestine, and a description of the influence of individual amino acids on the absorption of other amino acids.

The third chapter, "The digestion and absorption of nitrogenous compounds in the ruminant," by A. T. Phillipson, is a valuable chapter that brings together information not readily available to students of mammalian nitrogen metabolism. In particular, the role of the bacterial flora in the digestion of proteins and in the further degradation of products of protein digestion is a valuable contribution to comparative biochemistry.

Chapter 4, by H. N. Christensen, is entitled "Free amino acids and peptides in tissues." Christensen discusses in turn each of the following topics: The fate of amino acids disappearing from the circulation; the general biological significance of the cellular uptake of amino acids; the influence of this uptake on the direction of amino acid metabolism; the mode of amino acid transport; peptides in tissues; intravenous amino acid nutrition; and homeostasis of the plasma amino acid levels.

In chapter 5, "The metabolic fates of amino acids," by H. A. Krebs, consideration is given to pathways of amino acid degradation, synthesis of urea, formation of nitrogenous cell constituents from amino acids, urinary excretion of amino acids, biosynthesis of nonessential amino acids in mammals, gluconeogenesis from amino acids, nutritional adaptation of amino acid metabolism, and the cause of the specific dynamic action of proteins. This scholarly presentation of a large area of information is a valuable summary of present-day knowledge.

A. Korner's essay, "The mechanism of protein synthesis" (chapter 6), is the first part of a two-part presentation entitled "Protein Biosynthesis in Mammalian Tissues." The presentation provides a comprehensive treatment of developments since 1952 in a very rapidly expanding and actively investigated area of protein metabolism. The author discusses the following major topics: Developments of the past decade relating to the problem of protein synthesis; events leading to a hypothesis of protein synthesis, including a presentation of the present-day scheme of the individual steps of protein biosynthesis; amino acid activating enzymes; soluble ribonucleic acid; ribosomes; ribosomes and protein synthesis; genetic control of protein synthesis; protein synthesis in mitochondria; and protein synthesis in isolated nuclei. The evidence and conclusions provided in this chapter are based primarily on studies with broken-cell preparations or purified fractions derived from such preparations. The next chapter (the second part of "Protein Biosynthesis in Mammalian Tissues"), "Studies on turnover in the whole animal," is by A. Neuberger and F. F. Richards. After an introduction devoted to a description of the use of isotopically labeled compounds in the study of protein metabolism, the authors discuss different types of protein turnover; general problems arising in interpretation of turnover data; protein turnover in specific systems—for example, collagen, the nervous system, the formed elements of the blood, and muscle; and attempts to assess the overall rate of protein synthesis in the whole animal.

In chapter 8, "Metabolism of plasma proteins," A. S. McFarlane considers the following topics: Distribution of proteins between plasma and lymph; sites of catabolism and replacement of plasma proteins; interpretation of plasma and total body radioactivities when utilizing radioactive-iodine-labeled proteins; absolute measurement of the rate of protein synthesis; role of the liver in plasma protein metabolism; rates of plasma protein catabolism and synthesis; and plasma protein metabolism as influenced by dietary deprivation. An appendix to this chapter describes the preparation and testing of proteins labeled with radioactive iodine, carbon, or sulfur.

In chapter 9, "Some aspects of hormone and protein metabolic interrelationships," J. A. Leathem presents a rather comprehensive review that includes sections on hormones and fetal growth; hormones and prepubertal growth; hormones, body growth, and nitrogen balance; hormones and serum proteins; hormones in relation to protein metabolism in specific tissues and organs; pregnancy; protein nutrition and hormone action; steroids in recovery from protein depletion; and hypophysectomy and protein repletion.

In chapter 10, "General aspects of the regulation of protein metabolism by diet and hormones," another chapter contributed by Munro, the author discusses tissue response to dietary protein intake, with reference to labile or reserve body protein; the influence of

dietary carbohydrate and fat on protein metabolism; hormonal action and body protein distribution; and interaction of diet and hormones in the regulation of protein metabolism. This comprehensive and well-written chapter reflects the author's own long experience in, and contributions to, studies of protein metabolism.

The final chapter of this volume, "Elimination of nitrogen from the body," by J. B. Allison and J. W. C. Bird, includes consideration of the excretion of nitrogenous compounds via the three excretory pathways available to mammals—the kidney, the skin, and the gut. A section presenting the concept of nitrogen balance, and considering the above three excretory routes, completes this chapter and the first volume.

The second volume is concerned primarily with the role of protein in nutrition, and with aspects of protein metabolism in diseased states. Chapter 11, "An introduction to nutritional aspects of protein metabolism," by Munro, considers the measurement and quality of dietary protein and the assessment of protein requirements. Chapter 12, "The nutritive value of dietary proteins," by J. B. Allison, includes a discussion of the relation of the nutritive value of dietary proteins to growth and maintenance, the supplementary and complementary relationships of mixed protein diets, and problems of dietary protein depletion and repletion. Chapter 13, "Amino acid toxicities and imbalances," by A. E. Harper, deals with problems of amino acid imbalance and excess.

In chapter 14, "Protein requirements," D. M. Hegsted discusses the protein requirements of infants, children, and adults; pregnancy and lactation; and concludes with a section on amino acid requirements. K. L. Blaxter (Hannah Dairy Research Institute, Ayr, Scotland) prepared chapter 15, "Protein metabolism and requirement in pregnancy and lactation." Blaxter presents a section on protein synthesis in pregnancy and lactation, and then considers the comparative biology of pregnancy and lactation. The chapter concludes with detailed consideration of protein metabolism in pregnancy and in lactation. Chapter 16, by R. A. McCance and E. M. Widdowson, describes protein-metabolism requirements in the newborn. These authors discuss, in turn, growth and mother's milk, amino acid requirements, molecular protein metabolism (largely a consideration of the ability of the newly born to absorb antibody globulins), and renal function in relation to food and growth.

Chapter 17, "Protein metabolism and requirements in the elderly," by D. M. Watkin, includes discussion of plasma proteins as a measure of nutritional status, the effects of anabolic agents, protein requirements and allowance, protein withdrawal, amino acid requirements of the elderly, digestion and absorption changes with age, aspects of loss of cell function versus cell death, and nucleic acid metabolism in relation to the process of aging.

The last part of this volume is devoted to pathological aspects of protein metabolism, and begins with an excellent contribution by Munro—"A general survey of pathological changes in protein metabolism." These changes are summarized well, in tabular form, under six general headings: Abnormalities of Protein Metabolism in the Alimentary Tract; Changes in Intermediary Protein Metabolism Associated with Disease; Conditions Directly Affecting the Mechanism of Protein Synthesis; Changes in the Protein Metabolism of Individual Organs and Tissues; Protein Intake and Disease; and Effects of Treatment on the Course of Protein Metabolism. In chapter 18, "Anomalies of amino acid metabolism," L. E. Holt and S. E. Snyderman discuss these anomalies under two major headings: The Congenital Anomalies and The Acquired Disturbances of Amino Acid Metabolism. In chapter 19, "Physical injury and its effects on protein metabolism," D. P. Cuthbertson, a pioneer in the field of protein metabolism, presents a scholarly consideration of the nature of the inflammatory reaction, the general response to physical injury and the general disturbance of protein metabolism following this injury, physical injury in relation to endocrine function, and nutritional aspects of the injured individual.

"Protein metabolism and tumor growth" is the title of chapter 20, by G. A. J. Goodlad. The author describes the protein and amino acid metabolism of tumors, protein metabolism in precancerous tissue, the protein and amino acid metabolism of the tumor-bearing host, and the mechanism by which the tumor influences host protein metabolism.

Chapter 21, "Experimental protein-calorie deficiency," by B. S. Platt, C. R. C. Heard, and R. J. C. Stewart, describes with thoroughness investigations designed (i) to study the effects on animals of diets and regimens which in human subjects produce protein-calorie deficiency; (ii) to devise methods of defining the nutritional values of such diets and regimens; (iii) to attempt to equate the clinical and pathological conditions in man and experimental animals; and (iv) to determine the contribution of various nonnutritional factors.

Chapter 22, "Clinical aspects of protein malnutrition," by Viteri, Behár, Arroyave, and Scrimshaw, is divided into two sections: (i) Protein-calorie malnutrition in children and (ii) Protein malnutrition in adults.

The final contribution to this treatise, chapter 23, "Protein deficiency and infective disease," is by Scrimshaw. Consideration is given to the effect of protein malnutrition on infection and to factors that are determinants of this effect.

Each of these volumes contains its own subject and author index. The authoritative nature of each review, and the extensive bibliographies at the end of each chapter, make these volumes valuable sourcebooks for the many diverse areas that are discussed in this treatise. The volumes present a modern picture of the normal and pathological aspects of protein metabolism in mammals, with significant emphasis on man. One must view with awe and approval the enormous and valuable task that has been accomplished by the editors and contributors.

ABRAHAM WHITE
Department of Biochemistry,
Albert Einstein College of Medicine,
Yeshiva University

Powder X-Ray Analysis

Handbook of X-Ray Analysis of Polycrystalline Material. Lev Isoifovich Mirkin. Translated from the Russian edition (Moscow, 1961) by J. E. S. Bradley. Consultants Bureau, New York, 1964. xx + 731 pp. Illus. $35.

X-ray methods for the identification and analysis of crystalline substances are now widely used throughout the world in a great variety of studies. The use of computers is essential in crystal-structure investigations, but the powder method still requires a large number of tables, charts, and other