Media Reviews

Lehninger Principles of Biochemistry, 3rd edition; By David L. Nelson and Michael M. Cox. Worth Publishers: New York, 2000. ISBN 1-57259-9316. 1255 pp. $116.45.

For decades, Albert Lehninger's biochemistry textbooks were universally recognized as classics in the field. In 1982, Lehninger authored *Principles of Biochemistry*, a complete revision and reorganization of his earlier *Biochemistry*. Upon Lehninger's death in the late 1980s, the responsibility of authorship fell to David Nelson and Michael Cox, both of the University of Wisconsin. Their efforts resulted in a second edition of *Principles of Biochemistry* in 1993 and a brand new third edition published this year.

The third edition of what is now titled *Lehninger Principles of Biochemistry* largely follows the same format as earlier editions. The first section, "Foundations of Biochemistry" provides an overview of broad themes in biochemistry and includes several chapters that review material students have presumably seen in earlier courses—cell structure and function, chemical bonding and three-dimensional structure, chemical reactivity, and the chemistry of water and aqueous solutions. The second section, "Structure and Catalysis," starts with the structures of amino acids and proteins, then goes on to cover protein function, enzymes, carbohydrates, nucleotides, nucleic acids, lipids, biological membranes, transport, and signal transduction. "Bioenergetics and Metabolism" is the focus of the third section, and here can be found all the major catabolic and anabolic pathways that are traditionally covered in upper-level biochemistry courses. Finally, the fourth section covers "Information Pathways" such as DNA replication, RNA metabolism, protein synthesis and degradation, as well as an overview of genes, chromosomes, and recombinant DNA technology.

Principles of Biochemistry has always, in my opinion, taken a perspective that is slightly different than other biochemistry textbooks, a perspective that places more emphasis on balancing biological and chemical concepts. A quick glance at similar textbooks in my office showed that only Nelson and Cox include an entire chapter that reviews cell structure and function. While many other biochemistry textbooks place a chapter that reviews thermodynamics early in the text, *Principles of Biochemistry* instead includes a chapter that reviews important concepts from organic chemistry such as chemical bonding, chemical reactivity, and three-dimensional structure. While thermodynamics is mentioned throughout the first two sections, it is only at the beginning of the section on bioenergetics that a review of concepts such as the First and Second Laws and chemical potential can be found.

Nelson and Cox include topics such as cell-cycle control by protein kinases and apoptosis in this text; these are topics that I see as being closer to what some instructors would cover in a molecular cell biology course. At the same time, the text does not come across as presenting some chemical concepts with the same rigor as some other textbooks. Consequently, I think it would be more understandable for a wider range of students, including those more interested in the biological aspects of biochemistry. None of my comments should be taken as criticisms of *Principles of Biochemistry*; my point is simply that it takes a particular approach that will be very appropriate for some courses and less so for others.

Several revisions in this edition serve to improve the textbook significantly. What were two separate chapters on amino acids and an overview of proteins/peptides have been combined into a single chapter that reads much more smoothly and succinctly. Boxed supplementary information was a feature of the earlier edition, but the number of boxes has been greatly expanded, from 36 to 52, in the new edition. In addition to expanding the amount of supplementary information, Nelson and Cox have emphasized in these boxes the relevance of biochemistry to medicine, biotechnology, and other areas. More descriptions of experimental techniques have been incorporated. The chapter on carbohydrates has been significantly strengthened by the inclusion of new information on the role of glycoproteins in processes such as cell–cell recognition and adhesion.

Signal transduction now has a chapter to itself, rather than being grouped with hormonal control and integration of metabolism. The material in this chapter is generally quite good, covering several different classes of signal transduction mechanisms: gated ion channels, receptor tyrosine kinases, and G-protein–coupled receptors in both metabolic pathways and sensory pathways such as vision and olfaction.

I have always been impressed with the quality of the problems found at the end of each chapter; the authors have revised some problems for this new edition and added several problems that require students to use Internet resources such as the Protein Data Bank. And it should come as no surprise that the authors have incorporated more recent findings—such as three-dimensional structures of biochemically significant molecules like the potassium ion transporter and the mechanism of ATP synthase—throughout the text where appropriate.

At the same time, the new edition suffers from some of the same weaknesses that I found with its predecessor. I find the presentation of the MWC symmetry and KNF sequential models for allosteric regulation to be much weaker than other texts, in part because Nelson and Cox completely avoid any of the quantitative aspects of MWC theory. Unlike every other biochemistry textbook that I know of, Nelson and Cox continue to fragment their presentation of photosynthesis, with photophosphorylation covered in the same chapter as oxidative phosphorylation and the Calvin cycle reactions covered in a separate chapter with glycogen synthesis and gluconeogenesis. Several other textbooks cover regulation of gene expression in a separate chapter from the one where basic concepts of RNA synthesis and editing are presented. However, *Principles of Biochemistry* places the chapter on regulation several chapters after the section where RNA synthesis is described. In addition, the organization of the gene regulation chapter is weak, with a section on structural characteristics of domains in DNA binding proteins inserted in the middle of the section that covers how the *lac* operon works. The same chapter also appears to lack any structural information about TBP and current models for how it might interact with TBP associated factors.

As with many textbooks published today, *Principles of Biochemistry* is accompanied by a CD-ROM and a Website (Avail. URL: http://www.worthpublishers.com/lehninger). The CD is a special version designed to accompany this particular

text of the *Understand! Biochemistry* software developed by the Mona Group. It consists of an index of terms, a number of minicourses, web links, and 30 quizzes organized by topics. I examined several minicourses—Proteins in Action: Allosteric Enzymes, Catalysis and Regulation; Citric Acid Cycle; and Signal Transduction. The quality of the minicourses varied; that for the Citric Acid Cycle added nothing to the material presented in the text, while the Signal Transduction minicourse did add more detail to concepts presented in the book.

I had mixed feelings about those covering Allosteric Enzymes and Catalysis and Regulation. Sometimes they gave a very nice perspective on the material and made excellent use of structural graphics; at other times I felt some material in these minicourses added nothing to a student's learning experience or even served to make some concepts more confusing. The quizzes are generally well-designed and focus on important lower-level thinking skills such as defining, explaining, and relating. I was quite pleased to see that the quizzes were structured to provide commentary on student responses so that students who provided incorrect responses could be helped to see where they misunderstood the material. Each of the quizzes provided a student with the opportunity to review or retake a quiz and to have the software provide the correct answer. Overall, I felt that the CD was a nice supplement with some limited applications, and that it marginally enhanced the quality of the textbook.

The Website appears to be in the early stages of development, but there are links for 3-D structural tutorials and links to Internet sites that can be used to answer some of the end-of-chapter problems. There are also links to sites where RasMol and MDL Chemscape Chime can be downloaded, a section under development that will provide suggestions for using Chime, and Microsoft PowerPoint slides for each chapter that can be downloaded. When I looked at this site at the end of June 2000, there were six 3-D structural tutorials available online. These tutorials utilize the Chime plug-in to guide students through material designed to enhance their understanding of the structural bases of many biochemical phenomena. While much of the Website appears to be under development at this point, I was quite pleased with what I saw and believe that the completed site will be a very useful resource for instructors.

Overall, the third edition of *Lehninger Principles of Biochemistry* has maintained many of the strengths found in earlier editions while incorporating some very nice improvements along with recent discoveries in biochemistry. This textbook would be an excellent choice for two-semester undergraduate courses, particularly those courses with a broad range of students who are likely to have varying backgrounds in biology and chemistry.

Matthew Fisher, St Vincent College
mfisher@stvincent.edu

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Nucleic Acids: Structures, Properties, and Function. By Victor A. Bloomfield, Donald M. Crothers, and Ignacio Tinoco, Jr. University Science Books: Sausalito, CA; 2000. Clothbound, 800 pp, $88.00, ISBN 0-935702-49-0.

Nucleic Acids: Structure, Properties, and Functions is an updated and expanded version of the successful 1974 book *The Physical Chemistry of Nucleic Acids* by the same authors. This newest version is a welcome addition to the rapidly changing and growing field of nucleic acids. A brief review of the book's 14 chapters follows.

Chapter one consists of a brief overview of the biological roles of the nucleic acids and contains an outline of the book. Also included in this chapter are discussions of how nucleic acids are obtained for physical study, the nucleic acid periodical literature (including a list of books and monographs), and a section on computer analysis of sequences and structures.

The next seven chapters examine the properties of the nucleic acids, mainly at the atomic and molecular level. Chapter two covers the physical and chemical properties of monomeric building blocks of nucleic acid structure. Chapter three proceeds with a presentation of the chemical and photochemical reactivities of nucleic acids and their importance in structural determination and mutagenesis. The next three chapters describe how X-ray diffraction, and NMR, electronic, and vibrational spectroscopy are used to study the structure and dynamics of nucleic acids. In these chapters the reader is given the basic principles and results for each method. The X-ray chapter points out the need for fiber diffraction data to delineate helical parameters for long sequences that cannot be crystallized. The chapter concludes with results on nucleic acids complexed with proteins, metal ions, water, and drugs.

The chapter covering NMR describes how this technique has enhanced our understanding of the structure of mononucleotides in solution and how NMR is being used to determine the three-dimensional structure of various RNA molecules. The optical spectroscopy chapter illustrates how methods such as circular dichroism, infrared, and Raman spectroscopy are providing critical information on nucleic acid backbone and base geometry, as well as the use of these methods to give insight into the conformation of DNA inside viruses.

Chapter seven describes various computational methods currently used to provide a detailed model of the structural, energetic, and reactive properties of nucleic acids and their complexes. By contrast, chapter eight deals with nucleic acid conformational transitions from thermodynamic and kinetic points of view. In it, the various interactions that lead to the formation of helices are discussed. There is also a brief discussion of the prediction of secondary and tertiary structure of nucleic acids. Chapter nine surveys the major experimental methods used to characterize the size and shape of nucleic acids, including models of molecular structure, diffusion, rotational dynamics, scattering, viscosity, and frictional coefficients for model shapes. These are important in the interpretation of data from electrophoresis, sedimentation, dynamic light scattering, and microscopy experiments.

Chapter ten focuses on supercoiled DNA. Much of the chapter discusses the geometry and topology of DNA supercoiling with some consideration of the experimental measurement of the linking difference. The next three chapters cover the noncovalent interactions between nucleic acids and other types of molecules that affect stability or regulation function.

Chapter eleven introduces the interactions of nucleic acids with water and ions. In this chapter, topics such as hydration, polyelectrolyte behavior, hydration in ionic solutions, specific binding of metal ions, and mixed aqueous–nonaqueous

solvents are presented. I found the section on metal binding to be somewhat weak, considering the amount of work being done in this area.

The interaction and reaction of nucleic acids with drugs is the topic of chapter twelve. Here the authors present both theoretical descriptions and experimental studies of binding equilibria. One section in this chapter covers natural products that react covalently with DNA. Chapter thirteen covers protein–nucleic acid interactions and is by far the largest chapter in the book. Nucleic acid–protein complexes stretch the limits of biophysical methods; however, as the authors show, these experimental methods, coupled with computer analysis characterizing binding domains, can provide a remarkable insight. The final chapter is a discussion on the higher-order structures and mechanisms in the packaging of DNA in viruses and chromatin.

Four chapters in this book are contributions from John E. Hearst ("Chemical and Enzymatic Methods"), David E. Wemmer ("Structure and Dynamics by NMR"), Peter A. Kollman ("Theoretical Methods"), and Douglas H. Turner ("Conformational Changes"). Overall this is an excellent introduction and review of the structure, properties and function of nucleic acids. The level of detail in this book is sufficient for graduate and upper-level undergraduate students to begin to explore the area of nucleic acids. The references at the end of each chapter, which are both up to date and numerous (typically more than one hundred per chapter), encourage the interested reader to pursue topics in greater depth.

Jeffry D. Madura, Duquesne University
madura@duq.edu

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Electronic Expectations: Science Journals on the Web. By Tony Stankus. Haworth Press: New York, London, Oxford; 1999. 204 pp 15.2 x 21.2 cm. $59.95, hardbound; $24.95, softcover. ISBN 0-7890-0846-7.For U.S. & Canada, Tel.: (800)-HAWORTH; Fax: (800) 895-0582; Outside U.S. & Canada, Tel.: (607) 722-5857; Fax: (607) 771-0012. E-mail: getinfo@haworthpressinc.com. Avail. URL: http://www.haworthpressinc.com.

Tony Stankus, who received his MLS degree from the University of Rhode Island's Graduate School of Library and Information Studies in 1975 and has been Adjunct Professor at URI since 1982 and Science Librarian at the College of the Holy Cross, Worcester, Massachusetts since 1974, is a well-known authority on sci-tech libraries. He is the author of more than sixty articles and nine books on the subject (see, e.g., G. B. Kauffman, *Journal of Chemical Education* **1992**, *69*, A188 for a review of his *Biographies of Scientists for Sci-Tech Libraries: Adding Faces to the Facts* (Haworth, 1992)). His latest book is a collected series of six tutorial reviews of the literature, each accompanied by useful bibliographies related to the ever-expanding world of electronic journals that can be accessed through the Internet. It is a "separate," a serials librarianship term for a special issue simultaneously published as a special journal issue or double issue (in this case, *Science & Technology Libraries*, Volume 18, Nos. 2/3 (1999)) as well as a "separate" hardbound monograph.

In a 4-page introduction Stankus states that the reviews "were based on some traditional literature searching techniques, a good deal of web surfing, and a reformulation of the discovered material in the light of two overriding themes that came to the fore early on in this process." Although a survey of librarianship on Internet science journals is sorely needed, it does not provide sufficient perspective on a development involving many other players and factors. Second, although the advent of electronic journals is "revolutionary" to some extent, it will not "dramatically change or improve everything about science in libraries."

Of course, Stankus writes from the perspective of a science librarian, and the reviews in this volume will be useful not only for science librarians, those in training and those seeking to get up to speed, so-to-speak, but they will also be valuable for "scientific authors, publishers, aggregators, and Internet managers." In the first review, "The Key Trends Emerging in the First Decade of Electronic Journals in the Sciences" (16 pp), he recognizes five trends:

1. Electronic journals will not replace print journals any time soon; subscription prices are the biggest threats to print subscriptions.
2. In the long run, electronic journals will not be substantially cheaper than print. Mergers and partnerships among publishers will increase in order to spread technology costs, maintain cash flow, and reduce the risks of electronic publishing systems.
3. Libraries and librarians will remain important because of buying power, technical complications, and lack of resolution to electronic archiving that favors sustaining print archives.
4. Libraries are not likely to become successful electronic publishers if they keep trying to change heavily published scientists into publishing executives.
5. Middlemen will still be able to make money by doing more than their traditional job descriptions might suggest.

The trends illustrate an overall trend in the electronic-world—that of change and the redefinition of functions and roles for all businesses connected to the Internet and the virtual world.

In the second review, "A Review of the Print Journal System in the Sciences, with Prospects for Improvement in Deficiencies and Costs Through Electronic Publishing: Practices and Attitudes of Publishers and Printers, Librarians, and Scientific Authors" (21 pp), Stankus explains the advantages and disadvantages of print journal publications. He illustrates the costs of subscription, maintenance, replacement of lost or damaged issues, and the binding of journals. In so doing, he cogently argues for a much-needed, electronic-based scientific journal publication by showing the major shortcomings of print journals. One such drawback, especially prevalent today, is the issue of the conservation of forest products and the use of nontoxic inks and other compounds. An electronic publication requires no paper or ink. In one stroke, two potentially serious problems are eliminated.

In the third review, "The Business and Technological Warfare Affecting the Internet and Electronic Journals: Terminology of Major Hardware and Software Components and Competing Strategies of Major Players" (32 pp), Stankus deals with key e-journal terminology and gives a basic explanation of the hardware and software necessary for utilizing e-journal publications. At the end of the review he considers ongoing issues of importance to the future of electronic publications and their library usage. The level of

explanation allows an individual with limited computer exposure to gain valuable understanding of the computer world and how it pertains to the publishing and transmission of information. He explains topics such as Script and Adobe pdf formats, HTML and Java applets, and many others. He even includes a brief history of the two dominant Internet browsers—Netscape Navigator/Communicator and Microsoft Internet Explorer.

Stankus explains the origins of the bitter rivalries between Microsoft and many other software manufactures—for all intents and purposes, Microsoft vs. everyone else. This is now especially pertinent after the recent antitrust court ruling against Microsoft that has left many wondering how this concerns them as computer users. Libraries will also be affected by this problem because many use Microsoft operating systems in their computers. As Stankus explains, a new platform is introduced about every 12 to 18 months, which coincides with the introduction of new microprocessor architecture. Incidentally, in 2000 alone, Microsoft unveiled two new operating systems. Such frequent upgrading would be cost-prohibitive for most libraries, considering the cost of the new hardware, cost of the software required for each workstation, and cost for the installation.

In the fourth review, "Electronic Journal Concerns and the Strategies of Science Publishers" (22 pp), Stankus deals with the major sources of conflict that have arisen between those within the library structure and the publishers. The primary source of these conflicts is undoubtedly budgetary constraints and cutbacks. During the 1980s many universities and library systems spent large amounts on computer infrastructure and networks. These expenditures encroached upon available funds that would have been spent on journal subscriptions and books. This problem resulted in an alliance between the scientist and the journal or society within his or her particular specific discipline. In this age of reduction in journal subscriptions, this alliance is a natural one because the scientist is apt to feel more support from his or her journal or society than from the library at his or her institution.

Stankus also explains other alliances that have formed in the publishing arena. He begins by explaining the three main publishing groups—for-profit, nonprofit, and university presses. With a few notable exceptions, university presses have had a difficult time competing with for-profit and nonprofit publishers. University presses haves also been slow to form collaborative partnerships with the first two types of publishers. However, for the survival of both groups, for-profit and nonprofit publishers have begun to cooperate on some ventures, specifically into the World Wide Web via electronic journal publications. Stankus contrasts the European system of journal publication (primarily by for-profit publishers with very little university press activity) with the American system. One solution toward which some publishers are moving is that of eliminating the middleman. By publishing an e-journal, many middlemen, such as delivery services, aggregators, and subscription services, can be bypassed.

In the fifth review, "Electronic Journal Concerns and Strategies for Aggregators: Subscription Services, Indexing/Abstracting Services, and Electronic Bibliographic Utilities" (14 pp), Stankus examines the strategies that are being pursued to remain competitive in the changing publication landscape. He illustrates the precarious state of these services by contrasting the secure status of subscription services in the print world with their uncertain futures in the new paradigm of electronic journals sold directly to the user. This type of move has and will continue to affect all the intermediaries between publisher and user. Ultimately, publishers will need to adapt to the changes and to invent new services to provide or they will not have a service to sell.

The last review, "The Best Original Scientific Research, Review, Methods and Symposia Journals with Their Current Web Addresses Ranked Within Their Primary Subject Category" (72 pp, the volume's longest section, coauthored with Jeanne Marie Clavin and Richard Joslin) is an exhaustive compendium that is perhaps the most useful part of the book. In the vast maze of the WWW, this type of "roadmap" could be a powerful tool for the researcher looking for a journal article or reference on a particular subject. Furthermore, on many webpages the cross-linking with other sites provides a huge potential source of new information as well as answers to existing questions.

Stankus explains many of the forces at work today that are affecting libraries and librarians. The last two decades have brought about, via the computer revolution, a change in paradigm for the librarian and library science. With the advent of online e-journals, the ever-increasing number of publications, and with limited and often decreasing funds, librarians are being forced to make difficult choices. Understanding the forces at work can provide solutions to fit a specific situation. The local junior college library and the large university library often have very different problems, but their causes may possibly be identical.

The volume works well as a sourcebook or roadmap to many of the scientific sites on the WWW. Stankus' exhaustive bibliographic sections at the end of each chapter and the detailed index (22 double-column pages) are also very useful reference tools. These two features alone make the book invaluable. In scientific work any tool that can reduce the time required for research is a desideratum, and *Electronic Expectations: Science Journals on the Web* amply fulfills this purpose.

George B. Kauffman, and Hiram William Blanken
California State University Fresno
george_kauffman@csufresno.edu

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