Promising New Directions in Biochemistry

Review of: *Biochemistry*, by Jeremy Mark Berg, John L. Tymoczko, and Lubert Stryer; 2002; 1064 pp; W.H. Freeman (New York); ISBN 071673687X; www.whfreeman.com

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Biochemistry, by Lubert Stryer, has become one of the standard textbooks for the field. The Fifth Edition has two new authors: Jeremy Berg, Professor and Director of Biophysics and Biophysical Chemistry at Johns Hopkins University School of Medicine; and John Tymoczko, the Towsley Professor of Biology at Carleton College. Lubert Stryer, Winzer Professor at Stanford University School of Medicine, is listed as the last author of this edition. It is clear from the Preface that the revisions in the new edition were carried out by Berg and Tymoczko. I was caught by surprise at the change in authorship when the book arrived, since the publisher's representatives had referred to "a Fifth Edition of Stryer" in response to inquiries. It is certainly understandable that the publisher would want to project as much continuity as possible, given the runaway success of previous editions.

The new edition does, in fact, continue the successful approach to *Biochemistry* pioneered by Stryer and retains many of the traditions established in previous editions. The new authors' goal in their revisions was not only to maintain "the clear and inviting style that has distinguished the preceding four editions," but also to introduce new material and new discoveries and to revise the text consistent with a philosophical shift that they feel has occurred because biochemistry is "rapidly progressing from a science performed almost entirely at the laboratory bench to one that may be explored through computers." To a large extent, the new edition has succeeded in these goals; the Stryer style, with its declarative sentence headings and clear and simplified illustrations, is retained, and the general organization of the book is mostly unchanged. The introduction of a molecular evolutionary perspective is laudable and should help to tie the material together.

A subtle shift in emphasis has occurred; in successive previous editions, molecular biology was given an increasingly prominent role. In parallel with the American Society of Biological Chemists' morphing into the American Society of Biochemistry and Molecular Biology, Stryer's textbook incorporated progressively larger chunks of molecular biology. In the new edition, the line has seemingly been drawn: The section in the Fourth Edition that Stryer entitled "Genes: Replication and Expression" is no longer a major division of the

book. Most material included in that section has been incorporated with the biosynthesis section entitled "Synthesizing the Molecules of Life." In general tone, therefore, this edition has become more explicitly biochemistry, with no additional molecular biology, and has concomitantly attempted to become more chemical, with the stated goal of integrating chemical concepts.

Minimizing overlap between this biochemistry text and what might be in a molecular biology or cellular biology textbook is a good move, and expanding the biosynthesis section to include not just the building blocks but macromolecular synthesis is conceptually attractive. The authors have wisely retained one of Stryer's most brilliant chapters, "Integration of Metabolism," but now it is placed farther back in the book, after the chapters on the biosynthesis of membranes, nucleic acids, and proteins. The new format might be even more effective if the authors had incorporated an overview of macromolecule and membrane synthesis into the "Integration of Metabolism" chapter (which is a real challenge!). However, that chapter remains essentially unchanged from the previous edition, focused on "building blocks."

Another major accomplishment, for which the new authors should be strongly commended, is that the book is not any thicker than the previous edition. This is a difficult challenge indeed, given the vast expansion in biochemical knowledge. By and large, the authors have made good choices in what and what not to include. This reviewer uses the text for a one-semester undergraduate biochemistry course; approximately three-fourths of the large class are biology majors, and most of the remainder are chemistry majors. For many of the students, this one-semester course may be the only biochemistry course they will ever take, and many students (I suspect, a common scenario for undergraduate biochemistry classes) are either openly or latently aiming for a career in medicine. This review is from the perspective of an instructor in this particular academic setting. I had apprehensions that the new edition would be much more voluminous than the last one and was gratified to find that it was not.

My reservations are relatively minor; the Fifth Edition of *Biochemistry* is certainly a high-quality text, and I plan to continue using it. For the course that I teach, some of the new emphasis, while praiseworthy in intent, made it more difficult to connect topics together. Thus, chemical structures now emphasize the correct stereochemistry. This probably makes the textbook more suitable for chemistry majors than it was previously. However, it can sometimes be difficult for the

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students to see that the same compound generated in one pathway is used again in a different pathway, since inconsistencies in the presentation of these structures occur. Thus, ribose-5-phosphate in the pentose phosphate pathway (Chapter 20) is represented in the old Stryer style, not even in the ring form; in the chapter on nucleotide biosynthesis, the ribose ring is illustrated using the standard chemical shorthand representation. Such disjunctions make it a challenge for the student to make connections between pathways. My impression is that the original Stryer representation of chemical compounds, while perhaps not as rigorous, made it easier for most students to concentrate on the significance of the entire pathway and to develop a functional intellectual framework from the material in the text.

The simultaneous new emphasis on chemical mechanisms and trying to tie chemical concepts together more rigorously, coupled with the introduction of a molecular evolutionary perspective, sometimes seem like horses pulling the cart in opposite directions, making some sections of the textbook somewhat more unwieldy. Particularly in the treatment of pathways with many metabolic steps, detailed chemical mechanisms can be a distraction for students. In these cases, it may be best to go through the covalent chemistry first and segregate the discussion of enzyme mechanism and transient intermediates into a following section (an approach used in many cases). The clear intent of the authors is to tie topics together using both molecular evolution and similarities in enzyme mechanisms. Using the textbook for a one-semester course, I found that this intent was not always fully realized in practice (this could be much less of an issue for the instruc-

tor of a two-semester biochemistry course). There are quite a few typographical errors, which will probably be mostly corrected in the next printing of the book. A colleague of mine teaches the Structure and the Enzyme Mechanisms sections of the course. He found the choice of examples for enzyme mechanisms better than before—the restriction enzyme was more engaging to the students than the old example, lysozyme. He also found the Web-site images extremely helpful in discussing structure.

Thus, with the Fifth Edition, *Biochemistry* (the text) enters a new phase. The authors have initiated promising new directions. I expect that the few problem areas that inevitably occur when new intellectual directions are initiated and new authors with different styles join in will be resolved in creative ways as the book is more thoroughly “field-tested” by those of us who present the material to the students. Textbooks for students should be judged by how effectively they can be used to provide an intellectual framework that the students can retain years after they take the course; this biochemistry book continues to shine when evaluated by that all-important criterion. The new initiatives introduced in this edition have the potential to provide a framework for biochemistry that is even tighter and more multidimensional. I plan to change the way I teach the course next time to fit the authors’ initiatives more effectively. After 25 years of Stryer’s groundbreaking work on this textbook, Berg and Tymoczko are worthy successors. I hope that in many future editions of the book, they will continue to develop the interesting new directions for teaching biochemistry that they have just initiated.