that deals with endothelial cell attack as a target for cancer therapy. Although not currently a major focus of genetic research, perhaps the most exciting and potentially useful approach to cancer therapy is described herein. The basis of optimism derives from the necessity that new masses of tissue such as tumors have to generate their own blood supplies; the increased, localized and specific growth of endothelial cells at sites of neovascularization; and the relative fragility of the resultant vascular networks formed. As stated at the end of this chapter, although many of the characters in this act such as angiogenic growth factors and receptors for this class of cytokine are currently known, a plan to exploit the phenomenon of tumor vasculature inadequacy will require the focus to be on understanding endothelial cell biology, rather than on identifying differences between normal and malignant cells. Currently, the latter approach seems to characterize the majority of cancer research.

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Solutions, but no answers

Biophysical Chemistry: Molecules to Membranes

by ***P. R. Bergethon*** *and* ***E. R. Simons,*** *Springer-Verlag, 1990. DM 128.00 (vii + 340 pages) ISBN 0 387 97053 3*

Motivated by the changes in background and ability that have occurred among students of biochemistry and medicine in recent years, this book has its origins in a course entitled *Water and its Properties* taught by the authors at Boston University School of Medicine. The aim, for the benefit of advanced undergraduates or first- or second-year (American) graduates, is to provide the physical background necessary for those wishing to understand the properties of cells in terms of the physical chemistry of aqueous solutions as usually studied by physical chemists. It is here, though, that I think the book falls between two stools: the subject as stated is indeed at the frontiers of research, but the knowledge provided by the book is of the standard text-book variety, and useful only as a starting point for the critical analysis of future work in what is really a very controversial area (the extent to which, say, the cell cytoplasm, or *milieu intérieur,* is like the *milieu extérieur*).

The authors concede that cells and cellular organisms are not dilute, homogeneous solutions, and the third part of the text ostensibly claims to build on the standard, background material presented in the first two parts, in extending the physical principles necessary to understand the non-homogeneous and non-equilibrium character of biological systems and processes. But 'the expectation is that the student studying physical chemistry today will be pushing the frontiers of biophysical chemistry into the realm of nonhomogeneous chemistry tomorrow'. The problem with this correct analysis is that this textbook really represents only background physical chemical material, and the student will have to study a great deal more of the biochemical literature even to get close to the present state of knowledge, and with a much more critical eye than is evident here.

Thus, while the book cannot be greatly faulted either in its aims or in what is written, it does not succeed in bridging the gap between general, textbook knowledge and what is really going on in research. To take three illustrations: generally, we cannot yet measure the thermodynamic activities of cellular constituents *in vivo*; the complexity of numerous ion–ion and ion–solvent (and ion- and solvent–macromolecule) interactions (i.e. the many-body problem) has not yet been solved in physics, let alone biochemistry; and near-equilibrium non-equilibrium thermodynamics (which is the only type presented, even though it merits only four pages) has a rigorous foundation only for systems that are physiologically irrelevant.

Physical chemistry, and especially thermodynamics, is often presented to outsiders as though it had all been solved pre 1940, and if only biochemists could understand it all their problems would disappear. On the basis of the complexity of biological cells alone, this is very far from being the case. Even the 'simple' things, such as how to analyse (and, more importantly, to interpret) binding isotherms according to a Scatchard plot, are fraught with problems (which are not mentioned here at all). All might have been well had we been supplied with an up-to-date, and preferably annotated, list of references for additional reading. What we have instead is a short, highly eclectic and almost completely out-of-date list, mainly of classical textbooks that are out of print.

Certainly, the nature of the subject, by its very breadth and complexity, makes the writing of a textbook in this area a difficult problem. The authors state that the text is designed to be used in a single-semester course; if so, then my conclusion is that they should have covered the subject less broadly but in more detail. Better yet would have been a much more detailed and critical treatment, for a course lasting more than one semester. Physical chemistry textbooks are normally much larger than this, and one can understand why. The problem for the *bio*physical chemist is that (s)he has to start with their contents, and then add the biology. It is not a problem that will be solved simply by reading a précis of a physical chemistry textbook.

Sadly, then (for I was optimistic when I saw the title), I can recommend this book only as a general background, and for this it will fit well in the institutional library.

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