and assume too varied a background, particularly an awareness of what is going on in other, related fields. Second, all of the articles are old—about half of them more than 20 years old. Most are badly obsolete. The reader who took them at face value would come away with very incomplete, outdated and sometimes distorted views.

But happily, help is at hand. The new special issue of *Los Alamos Science* (number 15, 1987) is a 300-page volume devoted entirely to Ulam. The reader can now read Ulam's own words and wisdom in *Science, Computers and People* and follow them up in *Los Alamos Science* to see how they developed. For example, from the modest beginnings described by Ulam one can trace the development of the "cellular automaton" into a major new tool of computational nonlinear mechanics. And readers can get some sense of the incredible steps being made toward massive parallelism in machines like the Connection Machine or the University of Illinois CEDAR project. Or how Ulam's fruitful ideas in the celebrated Monte Carlo technique make possible huge computations of awesome complexity, which would otherwise be intractable. And finally one can discern how computational physics has continuously moved its focus away from "solving equations," first to "modeling" and most recently to "simulation"—a choice of words meant to imply a progressive increase in realism and a progressive diminution of numerical or technical issues in favor of physical insight.

While I would not put this book on my list for personal purchase, I recommend it to those who have a particular interest either in Ulam himself or in those fields he touched with his genius.

Dimitri Mihalas
University of Illinois, Urbana–Champaign

Principles and Models of Biological Transport

Morton H. Friedman
Springer-Verlag, New York, 1986. 260 pp. $39.00 hc ISBN 0-387-16370-0

Out of the notes for the course he teaches at Johns Hopkins, Morton Friedman has fashioned an excellent introductory text on biological mass transport. The material is presented at a level amenable to advanced undergraduates or beginning graduate students in biophysics and is more physical and mathematical than what one finds in a standard physiological text. The book presents the biological processes first, then the physical principles and mathematical tools needed to describe and analyze them. By this organization the author hopes to give the reader a physical perspective on the methodologies needed to deal with real biological transport processes, which are often poorly defined or understood systems and so call for more phenomenological and simpler physical models.

The first part of the book is devoted to principles. The first chapter presents basic ideas of equilibrium thermodynamics. The next three chapters describe in general terms the primary solute transport mechanisms seen in biological systems—free diffusion, facilitated diffusion and active transport. Solvent flow and flux coupling are treated in the following chapter on nonequilibrium thermodynamics. The chapter after that describes cell membranes and several models of transport across them. The final three chapters illustrate the earlier concepts by applying them to single cells—erythrocytes and excitable cells (nerve and muscle)—then to epithelia and lastly to oxygen transport.

While not a comprehensive reference, the book does discuss the more important aspects of the field, with emphasis on mechanisms, models and the underlying assumptions. I can think of no better text for a student beginning a study of biological transport or for the practicing scientist who wishes to learn about this exciting field of so much current interest.

Stanley A. Berger
University of California, Berkeley

Principles of Charged Particle Acceleration

Stanley Humphries
Wiley, New York, 1986. 573 pp. $65.95 hc ISBN 0-471-87878-2

The education of designers and builders of particle accelerators has not kept up with the blooming of the field. More and more engineers are finding themselves in a technical area for which schools did not give them the necessary background. Acutely aware of this need, a few institutions are trying to fill the gap. The summer accelerator schools that are organized to encourage more scientists and students to work in the accelerator field are helpful. Progress at universities is slow because trained instructors, proximity to accelerator research facilities and textbooks geared at the appropriate level are all lacking. Using nearby accelerator research facilities, Stanley Humphries is addressing this need at the University of New Mexico in a two-term course on the physics of charged-particle acceleration for physics and engineering students with no previous background in accelerator theory. *Principles of Charged Particle Acceleration* evolved from the first term of this course.

Charged-particle acceleration is a vast and rich field covering a broad range of applications and using a diverse set of technologies. It is difficult to cover in a single book at the introductory level. Humphries assumes minimal preparation in related fields. He provides an extensive review of the basic principles, devoting seven chapters to the basic concepts of motion of charged particles under the influence of an electromagnetic force. He simplifies derivations introducing approximations as early as possible rather than at the end. Lenses and orbits are treated in the single-particle limit, an approach that precludes discussion of collective particle effects and beam instabilities. The concept of beam emittance is not introduced. Apparently these important concepts are dealt with in the second term of the accelerator curriculum.

The author's background in pulsed-power devices is readily apparent since these types of devices receive more extensive treatment than cyclic accelerators. For example, 129 pages are devoted to electrostatic accelerators, pulsed high-voltage devices and induction accelerators, compared with 55 pages for cyclotrons and synchrotrons. The modest, three-chapter treatment of resonant cavities, waveguides and rf linear accelerators reflects strongly the University of New Mexico's proximity to Los Alamos National Laboratory, where linac development has prospered for almost three decades.

Accelerator specialists may be disappointed at not finding adequate treatments of their favorite topics. For example, the principle of strong focusing, one of the great advances in the art, is only briefly mentioned—in the last five pages of the book. The book is also aimed more at engineers than at physicists. But one should not lose sight of the goal of the book: "to present the theory of accelerators on a level that facilitates the design of accelerator components and the operation of accelerators for applications." In the introduction Humphries readily admits the unevenness and deficiencies in coverage, and they are partly compensated by a tabulation of more detailed books and papers in the bibliography. This book could be a