curriculum in which there is a separate course on fibers that emphasizes fundamentals over applications and also a separate course on optoelectronics. It should also be useful as a supplementary text in introductory and advanced courses, because it provides more information on specialized topics and it contains clear and generally accurate explanations.

IRA JACOBS
Virginia Polytechnic and State University
Blacksburg, Virginia

Theoretical Nuclear and Subnuclear Physics

J. Dirk Walecka
Oxford U. P., New York, 1995.
610 pp. $65.00 hc
ISBN 0-19-507214-6

As a result of recent discoveries, the practicing nuclear physicist must be knowledgeable in many-body theory, scattering theory and relativistic field theory. Those, plus the standard model of electroweak interactions, quantum chromodynamics and effective chiral Lagrangians, are all relevant for today's nuclear physicists. The problem of learning all the different kinds of relevant physics quickly is especially pressing for graduate students in nuclear physics. As a university researcher in nuclear theory who is concerned with educating graduate students, I deal with this issue daily. So must the instructor charged with designing a graduate course in nuclear physics and choosing a book.

J. Dirk Walecka's new text, *Theoretical Nuclear and Subnuclear Physics*, fills a long-standing need for a graduate-level text in nuclear physics. It begins—at the beginning—with a brief but usable description of the nucleon–nucleon interaction and proceeds deftly through conventional many-body theory to arrive at the many-body relativistic theory, which Walecka and his colleagues have pioneered. Chiral symmetry, which controls pionic interactions with nucleons and provides a connection between QCD and hadronic Lagrangians, is described in detail. QCD and its path integral and lattice gauge techniques are prominent in the text, which ends with a detailed discussion of the standard model.

Walecka is well known for writing clear articles and presenting excellent talks. His strong pedagogic style shines through the entire book. The discussions are clear, precise and concise and stress basic principles rather than the latest calculations, which can become obsolete quickly in so rapidly moving a field. The text is not a historical treatment of the field, and some central discoveries are mentioned only in passing. However, adequate references to relevant reviews are presented. There are few misprints or misleading statements. The figures, though not sophisticated, mainly are very good.

This book has some very useful pedagogical features: Many calculations are presented in far greater detail than in the original literature. Furthermore, Walecka has provided an excellent set of problems summarizing many useful results. These are clearly intended to provide students with the techniques necessary to perform useful research.

The interactions of leptons with nuclei at high momentum transfer, including the influence of the weak neutral current, are expected to play a key role in providing data to unravel the mysteries of the nucleus. The use of such tools, provided by the Continuous Beam Electron Accelerator Facility in Newport News, Virginia (where Walecka is a senior fellow), is a central aspect of this book.

The treatment of CEBAF physics is exhaustive. In a book of finite size, this means that other important topics of current nuclear research, such as the physics of the quark–gluon plasma, nuclear astrophysics and new aspects of nuclear structure, are not covered. However, the book does provide the necessary background in many-body theory and lattice QCD.

Much of nuclear reaction theory is covered only in the problem sets; the recent technique of using effective Lagrangians, such as embodied in chiral perturbation theory, is absent. These are the only significant lacunae. Other books on nuclear physics theory might be better for certain specific topics, but this book stands alone for its utility in graduate courses. I would certainly choose it if I were teaching a course in theoretical nuclear physics.

GERALD A. MILLER
University of Washington
Seattle, Washington

Understanding Nonlinear Dynamics

Daniel Kaplan and Leon Glass
Springer-Verlag, New York, 1995.
419 pp. $29.95 pb
ISBN 0-387-94440-0

The authors of *Understanding Nonlinear Dynamics*, both professors in the department of physiology at McGill University, have written a readily accessible introduction to nonlinear dynamics based on a one-semester undergraduate course at McGill. Since the audience consists of students studying biological sciences who have completed only a year of calculus, the book presents the main concepts and applications of nonlinear dynamics at an elementary level.

It begins with a consideration of simple finite-difference equations to initiate the reader into three important mathematical themes: local stability analysis, global multistability and problem solving using both an algebraic and a geometric approach. At this point the reader is also introduced to chaos and quasiperiodicity. The next two chapters continue the study of discrete time systems, beginning with networks and cellular automata and continuing with self-similarity and fractals, including the notion of fractal dimension.

Continuous time systems are the focus of much of the second half of the book, beginning with separate chapters on one-dimensional and two-dimensional differential equations, the latter being particularly relevant to the study of compartmental models, used in fields as diverse as pharmacokinetics and ecological systems; included is a discussion of the use of the phase plane to analyze local stability, and the occurrence of limit cycles. Finally, in chapter 6, on time-series analysis, the authors discuss classical and modern methods of data analysis, the latter derived from nonlinear dynamics, to serve as a bridge between theory and applications.

Interspersed in the text are delightful short essays of a page or two each, ranging widely from the random drift of molecules to the patterns underlying global climate changes. These are intended to illustrate the practical applications of the theoretical concepts presented.

Courses on nonlinear dynamics rarely present these topics at the level used in the book. On the other hand, the topics discussed are increasingly affecting much of the physical and biological sciences. Thus, as the authors suggest, their book might profitably be used as a supplement for a wide variety of undergraduate courses in mathematics and the sciences. It is written in a "user-friendly" colloquial style and is a delight to read. While it would be particularly useful for a student in the biological sciences, no reader is likely to encounter a more accessible elementary introduction to nonlinear dynamics.

STANLEY A. BERGER
University of California
Berkeley, California