

of biology transformed by his quantitative biochemical studies of stereospecific binding of radiolabeled morphine analogs. Is this the whole story? Compare it with the versions told in Cozzens's book or in the contemporary press (including the pages of *Science*) or with the ongoing description by Candace Pert (Snyder's former graduate student) of her role in the discovery of the opiate receptor (evidenced in 1989 *Current Contents*).

Against this background Snyder's portrayal of the events is too simple and just does not ring true. Nowhere in his description is there evidence pointing to a continuing heated debate in which colleagues and former students publicly dispute Snyder's claims of discovery.

Snyder is at his best when describing the experimental basis of the transformation of neurobiology from a descriptive to a molecular science. The reader will be rewarded by a lucid primer from a master. Less rewarding is the very brief and naive treatment of the politics of drug research in the early 1970s. Also striking in its absence is any mention of Nova Pharmaceuticals, the start-up company built around Snyder whose premise is rational drug development as a consequence of understanding ligand-receptor interactions in neurobiology.

Robert Kanigel's *Apprentice to Genius* seems to place the questions posed by Cozzens and the different versions of discovery in context. In this enjoyable book, Kanigel, a professional science writer, traces the scientific genealogy of Snyder and Pert, two of the most colorful players in the opiate receptor story. Making extensive use of interviews and anecdote, Kanigel depicts how, in a mentor-to-protege chain starting with James Shannon and moving to Bernard Brodie and then to Julius Axelrod, the legacy of creativity and empirical style has passed to Snyder and then to Pert. It appears that a pattern of scientific style as well as competition between mentor and protege is inherited. The personal and scientific rivalry between Pert and Snyder that is detailed by Cozzens and is avoided in *Brainstorming* seems strangely similar to the stories Kanigel tells about Brodie and Axelrod.

The reader interested in the culture of science will be rewarded by reading all three books. Only then is the Rashomon-like, subjective nature of the discovery of the opiate receptor revealed. Who really deserves credit in a field where progress comes about in incremental steps? For those who must choose to read only one book, Cozzens's is richest for data about how credit in science is really established. Snyder will teach the most science by delivering an excellent introduction to modern neurobiol-

ogy. Kanigel is very interesting, a good read, and out of print. Let the reader beware that the answer to the question "Who discovered the opiate receptor?" may not be very clear.

SANDRA PANEM

Salomon Brothers Venture Capital,
New York, NY 10004

Solid Structures

Introduction to Quasicrystals. MARKO V. JARIĆ, Ed. Academic Press, San Diego, CA, 1988. x, 285 pp., illus. \$49.50. Aperiodicity and Order, vol. 1.

Quasicrystals are crystalline solids that have symmetries (icosahedral, for example) that were formerly thought to be forbidden by the laws of crystallography. They were first discovered as icosahedral alloys of aluminum and manganese in 1984. Quasicrystals differ from ordinary crystals in that the atomic arrangement is not a periodic repetition through space; rather, the structure consists of a non-periodic but highly ordered arrangement that mathematicians call "quasiperiodic," which can be thought of abstractly as arising from an irrational projection from a higher-dimensional periodic lattice.

Since its outset, the science of quasicrystals has consisted of two distinct subfields: metallurgy and mathematics. On the one hand, there has been an active search in the laboratory for new quasicrystalline alloys, and progress has been made in making these materials more defect-free, characterizing their mechanical and electrical properties, and understanding the similarities of these new alloys to ordinary crystalline and glassy solids. On the other hand, the discovery of quasicrystals has stimulated advances in theoretical work on the mathematics of non-periodic tilings of space and on physical models for novel kinds of order in matter.

This duality is reflected in the present volume. It contains six chapters, four written by theoretical physicists and two by metallurgists. In its goal of providing an introduction to the subject as a whole and tying together its two parts, the book is a partial success. The chapter by T. C. Lubensky does the best, giving some history of quasicrystals, connections with experimental results, and a general discussion of quasiperiodic-tiling theory. Unfortunately, this contribution appears at the end of the book; the reader encountering the subject for the first time would do best by starting there. Another weakness is that little effort has been made to unify the points of view represented in the different chapters; for example, the introductory remarks of the last chapter are partly undercut by those of the first.

This book will pay the greatest dividends to serious students of quasicrystals. It contains several gems: In a chapter by Schaefer and Bendersky there are the essential details that are the lifeblood of metallurgy, such as the fact that 6% Si in AlMn improves the formation of icosahedral alloys. In the last half of the book (and especially Lubensky's chapter), there is one of the best pedagogical discussions to be found anywhere of the "Landau theory" of solidification—the classic phenomenological theory of structural ordering, excitations, and hydrodynamics—which has been applied extensively and successfully to quasicrystals. And the reader will find in Bak and Goldman's and Lubensky's chapters a wealth of information about the six-dimensional geometry used in the theory of icosahedral quasiperiodic tilings.

A drawback of this book is that the most recent information it contains is from 1987. Quasicrystal science has advanced considerably in the last three years—alloys have been discovered with dramatically fewer imperfections, new models of the stability of quasicrystals have emerged, and the mathematics of tilings has progressed. Fortunately, this book is the first of a planned series, with two other volumes already available. These have kept pace with new developments and offer some particularly noteworthy and readable contributions by Roger Penrose, Linus Pauling, Veit Elser, and others.

D. P. DIVINCENZO

IBM Research Division,
T. J. Watson Research Center,
Yorktown Heights, NY 10598

Parasitology at MBL

The Biology of Parasitism. A Molecular and Immunological Approach. PAUL T. ENGLUND and ALAN SHER, Eds. Liss, New York, 1988. xvi, 544 pp., illus. \$90; paper, \$45. MBL Lectures in Biology, vol. 9.

The Biology of Parasitism course at the Marine Biology Laboratory at Woods Hole, Massachusetts, has been in existence since 1980 to teach modern concepts of molecular biology and immunology to young investigators of parasites responsible for human disease. This collection of essays by current and former faculty attempts to convey the intellectual spirit of the course by presenting major concepts rather than by reviewing the literature or presenting data.

The book is divided into three sections entitled Biology of Parasites and Parasitic Disease, Parasite Immunology, and Parasite Molecular Biology, Biochemistry, and Genetics, with a total of 28 essays from an impressive group of investigators. Notable