power. The authors have been deeply interested in this important work in their own research, and do an excellent job discussing the difficulties. Further, they also discuss important issues of configurational entropy calculations and structural relaxation.

The most interesting—and disturbing—section of the book occurs in the "Concluding Discussion." The authors clearly address in this well-written section the basic problem that physicists have with biomolecules: We like to make unifying models. For example, Hans Frauenfelder has stressed the utility of the hierarchicial description of protein dynamics, with a Caley-treelike branching of progressively smaller amplitudes and motions. Like John Muir's Sierra wilderness, pull on one part of it and you find that it is connected to everything else.

The authors of *Proteins* are doubtful about the utility of this idea. For example, they cite aromatic ring flips in proteins that occur very slowly in spite of the small physical size of the displacement. In their view the ring-flip motion is disconnected from other parts of the protein, and thus each motion must be treated individually. Frauenfelder would like to say that it is not the Euclidean distance but the configurational distances—the generation number—between conformations that determines the rates of seemingly small events. Can the computer simulations reach out long enough in time to test that hypothesis? I'll quote the authors' response based upon their experience with computer dynamics: "An alternative possibility, far less pleasing, is that the specifics of each motion determine its character and no such general scaling relation holds. . . . Since each motion then becomes a problem in itself . . . a conceptual approach to protein dynamics would have to include the complexity that is embodied in chemistry rather than the simplicity that is often assumed in physics." Say it ain't so, Joe.

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The Michelson Era in American Science: 1870–1930

Stanley Goldberg and Roger H. Stuewer
AIP Conference Proceedings 179, AIP, New York, 1988. 300pp. $54.00 ($43.20, AIP members) hc ISBN 0-88318-379-X

About half the articles in this wide-ranging anthology were initially pre-

sented at a two-day symposium at Case Western Reserve University in October 1987, commemorating the Michelson–Morley experiment. This famous experiment, performed at Case Institute of Technology a century earlier, is considered—wrongly—to have led directly to the overthrow of the ether theory and to the rise of special relativity.

The editors of this collection of articles are respected historians of physics at the universities of Maryland and Minnesota. The articles included are extremely diverse, and, as one of the contributors, Nathan Reingold, points out, they by no means fit easily under the chosen title. Was 1870 to 1930 the "Michelson era" in American science? For more than half that period—or until he obtained the Nobel prize in 1907 (significantly *not* for the crucial experiment)—Michelson was not particularly well known. And only a few years later he was largely overshadowed by his colleague, Robert Millikan. Michelson's impact on American science outside experimental physics was at best minimal. Albert Moyer, in one of the articles setting the 1887 context, presents him as part of a tradition of what Europeans saw as "measuring," in contrast to more wide-ranging, experimental physics. Another significant article, by Barbara and Hans Haubold and Lewis Pyenson, connects the famous Case interferometer experiment with an earlier one Michelson set up as a graduate student in 1881 in Herman von Helmholtz's laboratory in Berlin.

The most informative discussion of whether or not the crucial experiment was related to relativity is contained in Part II of the volume, in the especially valuable articles by Jed Buchwald, Nancy Nesserian and Stanley Goldberg. This is by no means entirely new material and indeed previously formed part of the basis for Thomas S. Kuhn's discussion of *The Structure of Scientific Revolutions* (Second Edition, University of Chicago Press, Chicago, 1970). Nevertheless, these authors convincingly demonstrate that the Michelson–Morley experiment for a long time attracted at best minimal attention from followers of James C. Maxwell, and was interpreted by everyone (including the experimenters themselves) to be a *confirmation* of existing ether theory. The results of the experiment became a mild anomaly only within the wider theoretical context provided after 1895 by the new Lorentzian electrodynamics. Indeed it was only with the development of the alternative theoretical framework provided beginning in 1905 by Einstein's special theory that the "negative result" of the experiment could even begin to be reinterpreted as invalidating the ether theory. More thorough discussions of these issues are given in Gerald Holton's *Thematic Origins of Scientific Thought: Kepler to Einstein* (revised edition, Harvard University Press, Cambridge, Mass., 1988), and in Buchwald's recent *From Maxwell to Microphysics* (University of Chicago Press, Chicago, 1985).

Holton, in his article in the present volume, "On the Hesitant Rise of Quantum Physics Research in the United States" (also reprinted in the new edition of *Thematic Origins*), is somewhat hesitant about discussing in any detail the attitudes toward the new theoretical physics of the Michelson generation of experimenters. His focus is rather the positive achievements of an isolated "lone wolf," an early, American quantum theorist, Edwin C. Kemble, who in the 1920s and 1930s trained in this new specialty a large number of the first American generation of practitioners, including his first graduate student, John Van Vleck, and an undergraduate, J. Robert Oppenheimer. Oddly, Kemble himself earned his undergraduate degree at Case with Dayton C. Miller, one of the strongest opponents of the new physics, who claimed that his experiments refuted the special theory of relativity. In graduate work at Harvard, Kemble and other succeeding research students, including Van Vleck and John C. Slater, came under the influence of the philosophical operationalism of Percy W. Bridgman. This led to a uniquely American approach to theoretical physics that more closely united it to experiment; as Sam Schweber put it in a recent *Osiris* article, it left the "empiricist temper regnant."

This anthology certainly unites—if sometimes tenuously—the conceptual and social approaches to the history of physics. The former orientation, which may possibly be declining, is well represented here by the contributions on the various ether models, produced here by Buchwald, Nesserian and Ole Knudsen. On the other hand, an almost exclusively social–institutional approach to the history informs the articles of Edwin Layton, Daniel Kevles, Reingold and Elizabeth Crawford. This was all predictable. The editors are nevertheless to be congratulated on bringing together such a readable and informative collection.

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Electronic Structure and Optical Properties of Semiconductors

Marvin L. Cohen and James R. Chelikowsky
Springer-Verlag, New York, 1988. 264 pp. $59.00 hc
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Electronic Structure and Optical Properties of Semiconductors provides a well-written and well-documented summary of our present theoretical and experimental knowledge of semiconductors. The principal focus is on tetrahedrally coordinated elements and compounds, although there are also brief discussions of other structures. Partly textbook, partly reference, this volume includes detailed band-structure diagrams, lists of important interband transitions, discussions of the most successful experimental techniques used to elucidate band structures, and critical comparisons between experimental and theoretical results, as well as an extensive bibliography. The authors have made major contributions to this subject, and their treatment is both insightful and authoritative. This book will prove useful to students as well as seasoned semiconductor physicists.

Most of the theoretical results presented are based on the empirical pseudopotential method and were obtained during the 1960s and 1970s. These results represent a nearly closed chapter in solid-state physics: During the 1980s the theoretical emphasis has shifted to first-principles methods and to inhomogeneous structures, including surfaces, overlayers and heterostructures, as well as chemical and structural defects. Of course, the study of bulk semiconduc-