are nearly all effects of any internal thermonuclear evolution of the separate stars in the clusters, such as the mass loss via strong stellar winds or even explosions that must have occurred especially during the first billion years as any original massive stars ran out of accessible fuel. Likewise we find only a few asides about x-ray sources, black holes, and similar exotic topics in this book. After all such omissions, what is left for Spitzer to tell? The answer: a great deal.

Indeed, the charm of this monograph is that it skips all the bells and whistles of excessive realism and instead proceeds to idealize a typical globular cluster from the outset as nothing more than a quasi-steady collection of (possibly unequal) mass points subject only to Newton's laws of inertia and gravity. Predicting the gradual evolution of such an assembly sounds at first almost trivial, given the power of modern computers. But in fact it is nothing of the sort, once the number of players, as here, approaches one million and the time scales turn out to involve many thousands of internal orbits. Physical insight is still needed badly, and here Spitzer is at his best: He reviews how the slight "granularity" of the discrete masses tends to deflect or diffuse any given particle from the orbit it would have had in a truly smooth equilibrium; he discusses how such a diffusion must lead to a gradual shrinkage of the central regions of a cluster and to a gradual swelling and even evaporation of its outer parts; he points out how this same tendency toward equipartition can be exacerbated by a "mass segregation instability" whenever the masses of the individual particles or stars differ enough; and he also explains the curious thermodynamics involved in the phenomenon of "core collapse," or fairly rapid shrinkage of the innermost parts of a cluster, that occurs once the ratio of its central to its mean density comes to exceed a sizable critical value.

Much as in Spitzer's earlier books on ionized gases and the interstellar medium, the style here is terse and deductive. The author clearly enjoys noting once again how relatively simple laws applied to individuals can lead to complex collective phenomena, and without wasting too many words he shares his enthusiasm with us. One effect of this crisp exposition is to lure the reader before the book is even half done into the essence of some quite subtle matters like the Fokker-Planck equation or various Monte Carlo simulations and to leave one with the nice feeling that with just a little more effort one too can really understand them. Another benefit is that the swift trot through the basics of very idealized clusters in the first four chapters of this rather slender volume leaves one ready and almost eager to tackle in its last three chapters such realistic complications as the cumulatively damaging tidal shocks from the Galaxy, the development of binary stars and the surprisingly strong heating that results therefrom, and the still largely unfinished business of post-collapse evolution.

All in all, here is a very lucid and not too technical account of one corner of stellar dynamics that has witnessed a great deal of progress during the past one or two decades, written by one of its principal contributors. It should appeal to graduate students and other researchers in astronomy not only for its contents but also as a fine example of how to reexplain things. Just possibly, it might even inspire some readers to turn their thoughts much further back and finally conquer those murky but very challenging problems of origin and early evolution on which I was musing at the outset.

ALAR TOOMRE
Department of Mathematics, Massachusetts Institute of Technology, Cambridge, MA 02139

Some Other Books of Interest

Plant Migration. The Dynamics of Geographic Patterning in Seed Plant Species. JONATHAN D. SAUER. University of California Press, Berkeley, 1988. xvi, 282 pp., illus. $45.

In the preface to this volume Sauer notes that the field of historical plant geography "has always depended on a typological approach [in which] distributions of species or other taxa are classified on the basis of rough similarity into types, such as arctic-alpine, eastern North America–western Europe disjuncts, and South African endemics," a basic assumption being that "taxa have similar present ranges because of shared migrational patterns rather than because of convergence from formerly dissimilar ranges." Acknowledging the value of this approach, he wishes in this book to try a different one: "a survey of case histories for which there is direct [fossil and historical] evidence of the process of migration through time." To that end he presents some 140 case histories, averaging about a page in length. The opening group, on migrations in modern times, is arranged by type of habitat, including shoreline and other naturally open habitats, with ten subdivisions, vegetation subject to natural perturbation or invasion, and artificially modified habitats. The second section represents prehistoric migrations, beginning with the last glacial and Holocene and moving backward in time, and is arranged according to fossil assemblage. A final, briefer section deals with migration as related to evolution. The various sections and subsections include comment on theoretical or methodological issues, and the volume concludes with the statement that the author is "pleased rather than disappointed" that he "can see no prospect of easy, simple generalization about seed plant migration."—**K.L.**

Phytolith Analysis. An Archaeological and Geological Perspective. DOLORES R. PIPERNO. Academic Press, San Diego, CA, 1987. xiv, 280 pp., illus. $49.

"There exists a group of plant microfossils that exhibit all the attributes necessary to achieve legitimacy and prominence in paleoethnobotany and paleoecology: production in large numbers, durability in ancient sediments, and sufficient morphological specificity to allow identification of a wide range of taxa." These microfossils—phytoliths, in the sense of silicified particles from higher plants—have not received sufficient attention in the view of the author of this book, and the book is intended to demonstrate and encourage their use. The book opens with a brief history of phytolith research. Chapters 2 and 3 describe the production, deposition, and dissolution and the morphology of phytoliths. Chapters 4 and 5 describe field (sampling) and laboratory techniques. Chapter 6 is devoted to method and theory in interpretation of phytolith assemblages. Two final chapters deal with the role of phytoliths in archeological reconstruction and in regional paleoecology. The text includes consideration of several "special topics"—attributes of maize phytoliths and phytolith data from the New World tropics, areas of the author's own research—and is augmented by a 24-page section of plates and two phytolith keys.—**K.L.**

Books Received

Analytical Gas Chromatography. Walter Jennings. Academic Press, San Diego, CA, 1987. x, 259 pp., illus. $39.95.

Atlas and Dissection Guide for Comparative Anatomy. Saul Wischnitzer. 4th ed. Freeman, New York, 1988. xx, 264 pp., illus. Paper. $16.95.

Atlas of Blood Cells. Function and Pathology. D. Zucker-Franklin *et al.* 2nd ed. Ermes, Milan, and Lea and Febiger, Philadelphia, 1988. Two volumes. xxx, 777 pp., illus. $225.

A Bibliography of Matrix Isolation Spectroscopy. 1954–1985. David W. Ball *et al.*, Eds. Rice University Press, Houston, TX, 1988. xvi, 643 pp. $90.

The Biochemistry of Plants. A Comprehensive Treatise. David D. Davies, Ed. Academic Press, San Diego, CA, 1987. Vol. 11, Biochemistry of Metabolism. xiv, 388 pp., illus. $85. Vol. 12, Physiology of Metabolism. xiv, 357 pp., illus. $85. Vol. 13, Methodology. xiv, 294 pp., illus. $65.

Biologically Active Ether Lipids. P. Braquet, H. K. Mangold, and B. B. Vargaftig, Eds. Karger, Basel, 1988. vi, 196 pp., illus. $110. Progress in Biochemical Pharmacology, vol. 22.