who are at best secondarily interested in biological phenomena. There are a few of a new breed of students of biomechanics trained in both biology and fluid mechanics. I believe these will make the major advances in biofluid mechanics.

Vogel's style is conversational, and together with his puns and sometimes obscure classical allusions it may be irritating to some readers. Yet the overall approach is successful. It is simply not possible to read the book without itching to adjourn to the laboratory to try out ideas that come to mind under Vogel's stimulation. Whether he likes it or not, Vogel is an evangelist.

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Biomineralization

Silicon and Siliceous Structures in Biological Systems. Papers from a meeting, Richmond, Va., Dec. 1978. TRACY L. SIMPSON and BENJAMIN E. VOLCANI, Eds. Springer-Verlag, New York, 1981. xvi, 588 pp., illus. $98.90.

Silica deposits, in the form of amorphous to poorly crystalline opal, are widely distributed in the biological world. The involvement of silica in biomineralization has been documented in both animal and plant protists and in higher animals and plants. Because of this wide phylogenetic distribution, the literature on siliceous organisms is scattered. Simpson and Volcani have done a great service in attempting to bring together in this volume a sampling of recent assessments of most of the known occurrences of biogenic silica.

There are chapters dealing with silicified algal groups, especially the diatoms and chrysophytes, and with protozoans, especially the radiolarians, choanoflagellates, and rhizopod amebas. Among the higher organisms there are chapters devoted to silica in higher plants and in the sponges, including the coralline sponges. Most of the authors have concerned themselves with the fine structure and deposition of silica, but a few deal with physiological aspects, especially the effects of germanium as a metabolic analog for silicon. Except for the occurrence of opal known in mollusks (patellacean gastropods), the biological coverage is reasonably complete.

Papers authored by the two editors and their collaborators account for about one-third of the book. A chapter on cell wall formation in diatoms is noteworthy because it describes a variety of unpublished results from Volcani's laboratory, such data being otherwise generally unavailable. Only the paper by Riedel and Sanfilippo on radiolarian evolution seems out of place. It is an interesting account of radiolarian morphogenesis through time, but its relationship with silica is clearly subordinate. It is a paper for paleontologists, especially those concerned with the nature of evolutionary change as discerned from the fossil record. It should have been published elsewhere (and I hope that it will be).

Although there are very few typographical errors, there are a disturbing number of substantive errors and sources of confusion. The most frequent error and source of potential confusion concerns the use of the term "silicon." Where "silica" would better have been used silicon is variously described as dissolved, soluble, polymerized, or amorphous. Silicon granules, flakes, and capsules are discussed. Silicon is even referred to as an anion in one place and silica as an element in another. Quartz is parenthetically listed as obsidian flakes and blue glass, neither being correct. An introductory chapter on the chemistry of silica and the mineralogy of siliceous deposits would have been a very useful addition to the book.

Phytoflagellates are discussed under the heading of algal groups by several authors, but appear under Protozoa in another case, serving to confuse anyone attempting to sort out a phylogenetic history of silica deposition. The unfortunate impression is created in the introduction that the coralline sponges are newly discovered, when in fact they have been known since the turn of the century. It is suggested that diatoms must have developed the ability to capture silicic acid from very dilute solutions because concentrations in natural water are so low. Most geochemists would reverse this argument to state that natural water concentrations are low because diatoms (and other organisms) so effectively sequester silica.

The status of research on the process of silica biomineralization may be compared with that of research on calcification. Siliceous structures lack the complication imposed by the crystallography of the carbonate and phosphate minerals, but the morphological complexities are similar. Volcani concludes that "the mechanism of silicification is largely *terra incognita* about which there are far more questions and speculations than answers." A similar statement applies to calcification. Thus, this book should be of interest to anyone investigating biomineralization and may provide some insights to those concerned with calcareous structures in biological systems. For anyone interested in silica deposition or siliceous organisms it is a useful compendium, but one that needs careful reading in one or two chapters to avoid the errors.

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Muscle Structure

The Structural Basis of Muscular Contraction. JOHN SQUIRE. Plenum, New York, 1981. xviii, 698 pp., illus. $65.

Since the 1972 Cold Spring Harbor Symposium on Muscle Contraction, the published proceedings of which became a standard work of reference, many reviews and monographs dealing with muscular and nonmuscular motility have appeared. There has, however, been a dearth of major single-author books dealing with muscle, *Machina Carnis*, the monumental, essentially historical, book by Dorothy Needham being an exception. On this score alone the present volume is a most welcome addition to the literature on muscle.

Squire deals primarily with muscle structure as revealed by electron microscopy and x-ray diffraction. Throughout the book, however, structural information is presented and discussed with an eye to major issues that are of interest to muscle physiologists, biophysicists, and biochemists. Thus muscle structure at the molecular level is looked upon as a means of answering questions concerning the conversion of chemical energy from adenosine triphosphate (ATP) into mechanical work, the changes in myosin crossbridge configuration, including its relation to the actin filament, as adenosine diphosphate and phosphate are released, and the finer details of the control by calcium of the actin-myosin interaction.

The introductory chapter reviews the fundamentals of muscle physiology and provides a bird's eye view of muscle structure, including an account of the sliding filament model. The ideas that independent force generators reside in the crossbridges formed by myosin attachments to actin and that ATP hydrolysis serves as the immediate source of energy are introduced, and the chapter is