

squarely in a declining research tradition. Learning seems moribund now, not as a phenomenon, of course, but as the organizing idea of behavioral science. The organizing idea, at present, is adaptation—both in the course of evolution and during the life cycle. Learning is only a kind of adaptation, and constraints on learning compel our interest as much as does learning itself. How do we test adaptation? We test it by best fit. Sheldon White writes in the foreword to this book, "Science is . . . ultimately an aesthetic affair." The beauty of Darwin's vision, after a century-long latency, is making a major impact on psychology.

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## Biom mineralization

**The Mechanisms of Mineralization in the Invertebrates and Plants.** Papers from a symposium, Georgetown, S.C., Oct. 1974. NORIMITSU WATABE and KARL M. WILBUR, Eds. Published for the Belle W. Baruch Institute for Marine Biology and Coastal Research by University of South Carolina Press, Columbia, 1976. xiv, 462 pp., illus. \$27.50. Belle W. Baruch Library in Marine Science, No. 5.

Traditionally, students of biomineralization (hard-tissue formation) have been divided into two main groups—those who emphasize the process and those who emphasize the product. Studying the process involves the source and concentration of the organic and inorganic components and their movement to the sites of mineralization, and studying the product involves the microarchitecture, mineralogy, crystallography, and organic composition at the sites. Any general model of biomineralization must relate process and product in a comprehensive fashion.

This book is a collection of 21 papers presented at a second international symposium. (The first was held in Mainz, Germany, in 1970.) The papers are generally of high quality and accurately reflect the state of research on invertebrate biomineralization, but serious readers of the volume will be disappointed to find out that no general mechanism has yet been uncovered that ties process and product coherently together. I hasten to add that this is not the fault of the organizers of the symposium or of the 41 contributors but rather is open testimony to the intractability of the problem itself.

The opening review papers desperately seek to grapple with the problem of bringing process and product together.

None is successful, and one even confuses the issue further with semantic recommendations that result in some misleading statements such as, "It is no longer acceptable to consider the occurrence of mineralized deposits as evidence of calcification." In the remaining papers studies of a variety of organisms, dominated, as usual, by the mollusks, are reported. Calcium minerals are seen in all sizes, shapes, and degrees of crystallinity. Organic matrices are recognized and crystal compartments and templates are postulated. Carbonic anhydrases and calcium-binding glycoproteins seem ubiquitous. The variety of minerals grows as the number of organisms studied increases and the data accumulate, yet the underlying mechanism of mineralization seems as exasperatingly remote as ever—process and product remain separated. H. K. Erben in his "Concluding remarks" observes in understated fashion, "This second international symposium [cannot] claim to have given final answers to the fascinating riddles we are confronted with." Unless some new insights or dramatic experimental results are forthcoming a third international symposium is likely to make even less real progress toward the goal of understanding invertebrate biomineralization than did this second.

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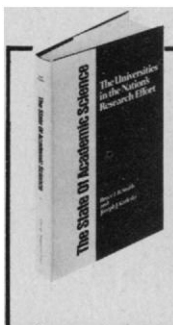
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