Ephrussi successfully convinced Warren Weaver of the Rockefeller Foundation that in France he had to tread a narrow path between traditional, ultraconservative neo-Lamarckians and leftist sympathizers of Lysenko. Sapp does not demonstrate a consistent anti-Lysenko position, nor does he answer his more provocative question about a symmetrical Western effort to beat down cytoplasmic studies. What does emerge is a demonstration, perhaps inadvertent, that the pluralism in Western science rendered impotent efforts to establish official scientific positions.

The discovery of the structure of DNA in 1953 altered the conflict between nuclear and cytoplasmic theories of heredity. Sapp sees a shift from disputes about the cellular location of materials of transmission to efforts to develop three-dimensional concepts entailing the processes of message transfer and feedback regulation. This new perspective encouraged Sonneborn and many of his associates to consider morphogenesis and gene regulation in terms of nuclear-cytoplasmic hereditary systems. In Sonneborn's words, "the cytoplasm is more than a bag of chemicals. It is highly structured." The ultimate question became "How is this organization, especially the difference in organization between different cells of the same organism, determined" (p. 213).

A short survey of this book cannot do justice to the rich feast of details and quotations gathered by Sapp. In many ways, however, Sapp's effort to be inclusive robs him of the opportunity to analyze in greater depth the specific conceptual problems having to do with cytoplasmic inheritance and the undifferentiated somatic genome, the inheritance of acquired characters, or the multiple meanings of "heredity." Instead Sapp focuses on another theme. Throughout he identifies events with the "struggle for authority," a concept borrowed from the French sociologist Pierre Bourdieu. By authority in science Sapp means more than the ability to exercise political power; he implies a status conferred by a combination of scientific achievements, institutional associations, and social acceptance by peers and competitors. Throughout his book Sapp constantly suggests that the proponents of cytoplasmic inheritance possessed a smaller degree of authority than did classical geneticists. Sapp's studies of Sonneborn and Ephrussi, however, belie this conclusion. Both appear to have comported extensive authority even as their specific theories were being questioned.

Beyond the Gene will clearly be an important book in the history of 20th-century genetics. It will be controversial because of its double message. At a minimum it will focus attention on an area that has been woefully neglected. That may be the sufficient test of an "authoritative" piece of historical research.

FREDERICK B. CHURCHILL
Department of History and Philosophy of Science, Indiana University, Bloomington, IN 47405

Organisms for Study

Observing Marine Invertebrates. Drawings from the Laboratory. DONALD P. ABBOTT. Galen Howard Hilgard, Ed. Stanford University Press, Stanford, CA, 1987. xxvi, 380 pp., illus. Spiral bound, $29.50.

The late Donald Abbott of Stanford University influenced the direction and style of research on marine invertebrates through the many students who took his course and went on to develop their own varied topics of research. Abbott's own published research, on ascidians, was specialized, and these students were not disciples following his research program. How did he teach them to develop their own questions? This book gives a partial answer.

Because many of the species available at the Hopkins Marine Station were poorly known, Abbott made his own drawings and notes during laboratory sessions. His former students urged him to publish a selection from his notebooks, and Galen Hilgard has served science well in working with Abbott during his final illness to produce this volume.

The drawings and notes, arranged taxonomically, are potentially useful for both content and method. The information on morphology will be useful in invertebrate zoology courses on the west coast of North America. The method of recording observations is of broader application. How to observe an unfamiliar organism and develop questions from the observations is difficult to learn or teach. This book shows Abbott's style of observation. The drawings and notes are simple but effective. No one using the book will be daunted by lack of artistic skill or special equipment. Unresolved points of structure or behavior that interested Abbott are clearly labeled as such. A few drawings by students are included, and these show how easily style and content can be modified to suit individual interests.

Abbott's notes are personal and informal. This is both a strength and a weakness. The approach to particulars and their inherent interest is clear, but the usefulness of such simple observations in challenging general hypotheses and suggesting new ones is not explicitly illustrated.

Introductory material and selected quotations include good advice and add to the charm of the book. Although in most research observation begins with the death of the specimen, Abbott reminds us, "Get the experience of looking at fresh things. If you watch live animals, you gain clearer insights in shorter time than you would watching dead animals for much longer."

Despite much current interest in pattern and mechanism, functional analysis is rare in research. One cannot learn to read the functional implications of form entirely from a book, but this book will help students begin to read animals.

RICHARD R. STRATHMANN
Friday Harbor Laboratories, University of Washington, Friday Harbor, WA 98250

Ontogeny and Phylogeny

Animal Evolution in Changing Environments. With Special Reference to Abnormal Metamorphosis. RYUICHI MATSUDA. Wiley-Interscience, New York, 1987. xviii, 355 pp., illus. $44.95.

Ever since Lamarck, a persistent minority of evolutionists has argued for the inheritance of phenotypically acquired characteristics and their subsequent molding by selection. It is from this perspective that the distinguished insect morphologist Ryuichi Matsuda examines heterochrony and metamorphosis in this posthumous work. Matsuda emphasizes the influence of environmental stimuli on endocrine function and suggests that environmentally induced, hormonally mediated changes in metamorphosis produce the kinds of major structural reorganizations that could account for the origins of major groups such as the animal phyla.

Matsuda begins by asserting the prevalence of metamorphosis among the Metazoa. One has the distinct impression that he is suggesting that metamorphosis is primitive (in the cladistic sense) at some level among the Metazoa, because he goes on to argue that virtually all animals have either the "primary" developmental pattern of pelagic larvae metamorphosing into benthic adults, a "secondary" pattern (larva to pupa to adult), or a modification of these patterns which he calls "abnormal metamorphosis." Thus Matsuda apparently considers reptiles, birds, and mammals to have "abnormal" metamorphosis, although only invertebrates, fishes, and amphibians are discussed in this work. In our vertebrate-centered world, only a cladist or an invertebrate zoologist could view amniote development in this novel way.

Matsuda argues that abnormal metamorphosis is likely to have been induced by environmental factors (especially in new, probably stressful, environments) because environmental factors can strongly influence hormonal action, which in turn mediates gene regulation of metamorphosis. He further contends that fixation of these altered metamorphic patterns occurs through genetic assimilation, and he apparently assumes that the altered patterns resulting are adaptive in their new environments.

Consideration of environmentally induced variation aside, Matsuda's discussions of hormonally controlled changes in metamorphic patterns make it easier to conceptualize the role of gene regulation in heterochrony, and his compilation of examples is impressive. However, the great gap between Matsuda's conceptual framework, presented in the first 50 pages, and the following 250 pages of densely packed examples leaves the reader to rely on scenario, assertion, and conjecture to make the connections between his thesis and the empirical data. Although Matsuda cites much relevant literature relating ontogeny and phylogeny, he has failed to appreciate some important lessons of recent years, making his interpretations of individual examples suspect. For example, he ignores both the necessity of having a well-established phylogeny against which to map the direction of ontogenetic change and the need to assess age, developmental stage, and size independently to determine how a metamorphic pattern has been altered.

I found the relatively brief conceptual part of this book unconvincing, but the rest of the work is a gold mine of examples of heterochrony in many different animal phyla, primarily invertebrates, that will be useful for anyone interested in heterochrony and evolution.

AMY R. MCCUNE
Section of Ecology and Systematics,
Cornell University,
Ithaca, NY 14853

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