

## Book review

### **Beyond Heterochrony: The Evolution of Development**

Edited by ML Zelditch

John Wiley & Sons, Inc., New York, 2001; 371 pp.  
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Over the past two decades the study of the relation between evolution and development has blossomed. Much of this growth arose from Steven Jay Gould's book, *Ontogeny and Phylogeny*, published in 1997. Gould's and many subsequent works concentrated on heterochrony – the change in the timing or rate of a developmental event or process in a descendent relative to an ancestor – as a developmental mechanism producing important evolutionary change. In recent years, we have increasingly realized that 'it's not all heterochrony' (in the words of Rudy Raff), and evolutionary biologists have begun to look beyond heterochrony for mechanisms to help understand the complex links between development and evolution.

This book, edited by Miriam Zelditch, presents 10 different such examinations of heterochrony. Half of the chapters (Nehm; Webster, Sheets and Hughes; Zelditch, Sheets and Fink; Guralnick and Kurpius; Roopnarine) are morphometric studies that continue in the Gouldian mode of looking at heterochrony largely as an allometric phenomenon. The other six (Hufford; Frohlich; Parichy; Polly; Head and Cohn; and Shapiro and Carl) provide a variety of approaches to evolution and development. In these latter papers, issues such as modularity, the evolution of developmental sequences, and developmental processes at both morphological and cellular levels are addressed. Many conclude that heterochrony may not be the most important guiding concept in understanding their system.

The book provides an illuminating snapshot of some of the breadth and diversity of current work in evolution and development. The cases are for the most part different from the half-dozen or so that have received the most attention, are generally conducted in the context of well-defined phylogenies, and include studies of diverse taxa and methods. It is somewhat unfortunate that none of the studies address how genetics impacts our understanding of evolution and development. Clearly, one of the fundamental challenges in the future of 'evo–devo' is to understand how morphological and morphometric data may be integrated with the burgeoning variety of genetic approaches.

Although the book presents a variety of views 'beyond heterochrony', it may not be the best introduction to the subject, as it does not confront one of the fundamental problems with the concept of heterochrony: the wide variety of applications of the term. Zelditch briefly reviews this issue in the preface, but many individual authors seem unaware that there is a need for a rigorous definition of heterochrony. Many of the papers use the strict, narrow definition of Gould, which limits heterochrony to cases in which a parallel between ontogeny and phylogeny exists. This definition is diametrically opposite of the original definition of the word heterochrony and is much narrower than is applied by most modern workers. Many of the papers seem to strain to put their work in the context heterochrony, and in so doing use a wide variety of definitions. Anyone not thoroughly familiar with the concept is likely to be confused.

Nonetheless, this book provides a valuable set of case studies that attempt to approach the concept of heterochrony rigorously, and demonstrate when heterochrony is, and is not, important in understanding the relation of evolution and development.

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