



## **The Paleobiological Revolution: Essays on the Growth of Modern Paleontology**

Reviewed by Brian Switek

David Sepkoski and Michael Ruse (editors)  
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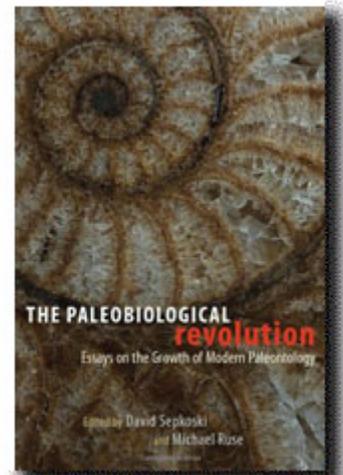
By the middle of the 20<sup>th</sup> century a great divide had opened within evolutionary biology. As summarized by paleontologist George Gaylord Simpson, many geneticists “said that paleontology had no further contributions to make to biology”, while paleontologists believed that the emerging science of genetics “had no significance for the true biologist.” (Simpson, 1944). Simpson, for his own part, attempted to bring the disciplines into accord in his classic *Tempo and Mode in Evolution*, but despite his efforts genetics eventually outstripped paleontology as the evolutionary science *du jour*. Paleontology, some evolutionary theorists believed, could only testify to the fact of evolution while telling us nothing of how such changes actually occurred. Fortunately, however, some paleontologists were not satisfied with this blinkered view of their discipline, and they began what historians David Sepkoski and Michael Ruse have called *The Paleobiological Revolution*.

The “Modern Evolutionary Synthesis” of the mid-20<sup>th</sup> century, in which natural selection was reaffirmed as evolution’s primary driving force by a confluence of new research from multiple biological disciplines, was a turning point for paleontology. On the one hand the synthesis established the importance of selection and populations to questions about evolution, but it also denigrated paleontology as a kind of glorified stamp collecting. If you wanted to determine the mechanisms of evolution you studied genetics in the laboratory, and the

belief that paleontology was more closely related to geology reinforced the idea that it had little to contribute to the life sciences. Despite this widespread reticence to treat paleontology as an evolutionary discipline, however, paleontologists such as G.G. Simpson and Norman Newell

fostered paleobiological research through the 1950’s and 1960’s, setting a long fuse that finally exploded in the 1970’s. Thomas Schopf, Niles Eldredge, Stephen Jay Gould, Elisabeth Vrba, David Raup, James Valentine, Jack Sepkoski, and many others transformed paleontology from a relatively passive consumer of evolutionary theory into a producer of new theoretical ideas. Punctuated equilibrium, hierarchical levels of selection, and the great controversies (many of which are still brewing) about mass extinctions; all of these stemmed from this revitalization of paleontology as a biological, evolutionary discipline.

*The Paleobiological Revolution* is both an assessment and a celebration of these changes, and much of the background information just recited is covered in the first section of the anthology under the title “Major Innovations in Paleobiol-



ogy.” While David Sepkoski and Patricia Pricehouse delve into the historical context of the scientific shift, paleontologists such as Richard Fortey, Jack Horner, and Tim White discuss how these changes in paleobiology have influenced the study of Paleozoic invertebrates, dinosaurs, and hominids, respectively. The essay “The Discovery of Conodont Anatomy and Its Importance for Understanding the Early History of Vertebrates” by Richard Aldridge and Derek Briggs is particularly noteworthy. Not only is it well-written enough to be accessible to most general readers, but the story of discovery is told from a personal perspective; a rare treat in an academic volume.

Part II, “The Historical and Conceptual Significance of Recent Paleontology”, is a more varied complement to Part I. Some essays, such as Derek Turner’s discussion of “Cope’s Rule” and the running speed of *Tyrannosaurus* as testable paleontological questions, focus on methods and techniques in paleobiology, while an essay in the form of a historical narrative by Susan Turner and David Oldroyd recount how Reg Sprigg discovered South Australia’s Ediacaran fauna. The work of Stephen Jay Gould is also scrutinized in this section, with David Sepkoski’s reevaluation of just how “radical” a notion punctuated equilibrium was and Joe Cain’s examination of why Gould committed academic “patricide” against G.G. Simpson. Due to his academic and popular influence Gould was the most prominent spokesman for paleobiology during the last three decades of the twentieth century, and these contributions provide the social and scientific context for some of his most controversial ideas about evolution.

The last section of the book is called “Reflections on Recent Paleobiology”, and where the preceding essays centered around the question of “How did we get here?” the last entries take stock of where paleobiology is today (and where things might be going). A disavowal of punctuated equilibrium by Arthur Boucot hits a sour note, but the remaining essays by writers such as James Valentine, Rebecca German, and Michael Ruse confirm that paleontology has undergone major changes stirred by new approaches and perspectives. Discovering, excavating, cataloging, and comparing fossils is still a major part of what paleontologists do, but the discipline is hardly restricted to these activities. As paleontologists add to our knowledge of life’s history we can look back to detect what Simpson called the “tempo and mode” of evolutionary change.

And, as David Jablonski points out in his excellent summary of current paleobiology, “many of the most vital research areas [in paleontology] have lain, and will lie, at its intersection with other disciplines in the biological and physical sciences.” While geology and comparative anatomy will always remain central to paleontology, many paleobiologists are crossing disciplinary boundaries to bring in genetics, microbiology, and “evo-devo” into discussions of life’s history. It is not uncommon to see paleontologists discuss *Hox genes*, proteins, molecular phylogenies, and other subjects more often associated with neontological approaches to evolution. Paleontologists are no longer just documenting transitions, but are using techniques from other biological disciplines to figure out how those transitions actually occurred. If anything, modern paleobiology has emerged as a more synthetic discipline, or one more welcoming to lines of evidence from relevant fields, than genetics.

All of this comes with a fair bit of hand-wringing, of course. In 1984 the evolutionary theorist John Maynard Smith welcomed paleontologists back to the “high table” of evolutionary theory based upon a lecture series delivered by Stephen Jay Gould. Despite this invitation, however, Maynard Smith (as well as intellectual allies Richard Dawkins and Daniel Dennett) would later denigrate ideas such as punctuated equilibrium and hierarchical levels of selection in a public back-and-forth with Stephen Jay Gould and Niles Eldredge. Perhaps we are not as welcome at the “high table” after all, some paleontologists lament, but this perspective does not allow us to properly take stock of modern paleontology. To fret over whether paleontology is at the scientific “high table” is to let an entirely separate discipline, one largely unconcerned with the history of life, dictate how we should value paleontology. This is not healthy. Instead, as the contributors to *The Paleobiological Revolution* have done, we should look at how paleontology has changed during the past fifty years and how it has affected research in other disciplines. Perhaps paleobiology is not as widely recognized as it should be by modern evolutionary theorists, but the contributions to the new volume make it absolutely clear that paleontology has been revitalized into a theory-producing science which is increasingly incorporating techniques and ideas from other biological disciplines to better understand how life on earth has changed.

While each contribution to *The Paleobiological Revolution* must stand on its own, with some contributions being stronger than others, as a

whole the book is an excellent overview of the recent renaissance in paleontology. It is a book that belongs in the library of any working paleontologist who is at all concerned with evolution, and it also provides a solid base for historians of science to understand how this scientific revolution came about. Even better, the paleobiological revolution

continues to this day, and I look forward to seeing how paleontology will continue to evolve.

#### **REFERENCE**

Simpson, G.G. (1944) *Tempo and Mode in Evolution*.  
Columbia University Press, New York.