BOOK REVIEW

A Season with Steve Gould

The Structure of Evolutionary Theory; by Stephen Jay Gould, 2002: Cambridge, Massachusetts, The Belknap Press of Harvard University Press, 1433 pages, $39.95.—T.S. Eliot, wrote in Burnt Norton, from his famous Four Quartets,

"Time past and time future
Allow but a little consciousness.
To be conscious is not to be in time
But only in time can the moment in the rose-garden,
The moment in the arbour where the rain beat,
The moment in the draughty church at smokefall
Be remembered; involved with past and future.
Only through time time is conquered."

Eliot knew time the way a physicist or paleontologist or historian knows time, delimited or defined by events, time not as a "thing," a fourth dimension or a vector, but emerging or drawing meaning only in the context of an event or sequence of events. For paleontologists, thinking about time is second nature. Understanding time may be another thing, though – there may be many kinds of time.

Stephen J. Gould's masterwork can be conceived as a book about time in its many manifestations. Gould brought the time scales of paleontology to questions of evolutionary theory for most of his professional career. Now, as his final work he has given us a book, an enormous, long, heavy book, that, at its core, is about time. About historical time and the development of evolutionary theory, the minds and lives of the scientists through whose steps and missteps we have come to our current understanding. About "deep time," and how the history of life, in the right hands, can inform and challenge our thinking about evolutionary processes. About time as hierarchically organized into tiers, each level encompassing distinct dynamics and patterns. And about the intersection of these threads, people in time thinking about time – or not thinking about it, when they should have been. The book is also about "real time," because it is not to be read lightly; it took me more than five months to finish.

As his rationale for the book, Gould offers the following (from p. 55, but said in so many words in many other places):

"In his description of the reductionist view of classical Darwinism . . . Hoffman (1989, p. 39) writes: "The neodarwinian paradigm therefore asserts that this history of life at all levels – including and even beyond the level of speciation and species extinction events, embracing all macroevolutionary phenomena – is fully accounted for within populations and species." I dedicate my book to refuting this traditional claim, and to advocating a helpful role for an independent set of macroevolutionary principles that expand, reformulate, operate in harmony with or (at most) work orthogonally as additions to, the extrapolated, and persistently relevant (but not exclusive, or even dominant) forces of Darwinian microevolution."

Gould divides the book into three major parts. The introductory chapter sets the stage for the rest, and includes a 36-page (not very useful in my opinion) abstract largely devoted to a brief summary of each chapter. Part I: The History of Darwinian Logic and Debate, includes Chapters 2-7 and is 499 pages long. Part II: Towards a

Revised and Expanded Evolutionary Theory, includes chapters 8-12 and is 749 pages long.

But why is this book so long? Well . . . he wants us to have more than a superficial understanding, and on page 56 we find the following:
"Of all genres in scholarship, I stand most strongly out of personal sympathy with broad-brush views that attempt to encompass entire fields . . . in a breathless summary paragraph for each of many thousand incidents." Thus: *"I vowed that I would try to encompass the structure of evolutionary theory in its proper intellectual richness, but that I would do so by exhaustive treatment of well-chosen exemplifying details, not by rapid summaries of inadequate bits and pieces catalogued for all relevant participants."*

I guess I would add that the length of the book is also a consequence of the old philosophy, "say it till they hear you." The main points are addressed in many guises and in many contexts as threads that run through the entire book. Consequently, there are many opportunities to encounter and consider them.

The first section, on the history of evolutionary thought, is a wonderful deep summary, from Lamarck to the architects of the neo-Darwinian "New Synthesis" of the mid-20th century, including the major anti-Darwinian theorists, such as Bateson, De Vries and Goldschmidt. The rationales of these ancestral thinkers are carefully and patiently explained, and the influences of their times and cultures explored, where appropriate. We can find in these pages many viewpoints that still hold currency with the press and in popular understanding (misunderstanding) of evolutionary theory (inheritance of acquired characters, for example). Were I still teaching a course in evolutionary biology, this section would be required reading early on. It demonstrates how, through analysis of the genesis of evolutionary thought, we can see the emergence of modern ideas and have a much richer understanding of current debates, doubts and fixations. Gould has a lot to say beyond what he chose to put in the main text—in Part I there are 3.3 linear meters of footnotes in small typeface. The rationale for such a major focus on the history of evolutionary thought can be found on page 57: *"My historical treatments tend to resolve themselves into a set of mini intellectual biographies- . . . for almost all the central players in the history of Darwinian traditions in evolutionary thought. I can only hope that this peculiar kind of intellectual comprehensiveness will strike some readers as enlightening for the "quick entrée" thus provided into the essential work of the people who led, and the concepts that defined, the history of the greatest and most consequential revolution in the history of biological science."*

Part II, focused on Gould's version of evolutionary theory, includes expansions and refinements of his long-standing themes: hierarchical selection, punctuated equilibrium, historical constraints and developmental biology, structural constraints, the tiering of time. The core of the book is Chapter 9, Punctuated Equilibrium and the Validation of Macroevolutionary Theory, which is a wide-ranging analysis of this macroevolutionary theory, responses to both critics of his ideas and of Gould himself, and consideration of the broad impact of the theory, including the tensions brought on by creationism.

It is not my intent to criticize, critique, or attempt to defend Gould's theories on the nature of selection or time, or his belief in the emergence of distinct phenomena at different spatio-temporal scales. What is important is that *he* defends them and in a way that presents an internally coherent and vastly interconnected web of logic. Punctuated equilbrium, a theory that has unquestionably changed in various ways between 1972 and 2002, the concept of species selection, time as a "*series of discrete tiers, or at least "regions of coagulation" that pull phenomena away from boundaries and towards more central nucleating places*," are all ideas that Gould interweaves again and again with his quirky acceptance and simultaneous rejection of Darwinian principles. This is not a summary

book about evolution, it is a summary of Gould's vision of the world, of how things work and how life as we know it came to be. It is his understanding.

As a reader, I found the book to be challenging. In places it is eloquent, almost Shakespearean. You may go back over a passage again and again, marveling at Gould's fluency in our language. Other sections were editorial abominations – long, redundant, boring, infuriating. Overall, though, reading Gould's words was like listening to him speak: charming, powerful, meandering without losing sight of the destination, occasionally contemptuous of poorly reasoned (in his view) opposition, and always erudite. There is so much to stimulate thought that I had to develop a system of marginal notation, separating quotable passages, major points, and points to argue. My copy is heavily annotated.

In the end, we must respect the fact that Gould worked at the theoretical edge, out on the frontier of conceptual conflict, not behind the lines, preening on the parade grounds, stepping smartly to the old tunes in shiny boots and clean uniform. His ideas were and are yet threatening to the smug status quo of the neo-Darwinian synthesis. Whether this challenging book will further his cause only time will tell.

(We can turn again to Eliot, who seems to understand intellectual ambitions:

"Men and bits of paper, whirled by the cold wind

That blows before and after time . . .").

I believe this book will take a rightful place next to the books of the great evolutionary thinkers of the 19th and 20th centuries. It should be read or at least skimmed, by everyone who calls himself or herself an evolutionary biologist and certainly by everyone who evermore looks at a fossil with theoretical intent. And for those of thrifty mind, looking for a real deal, at around $40, 1433 pages and five pounds, it is a great buy, either by the page or by the pound.

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