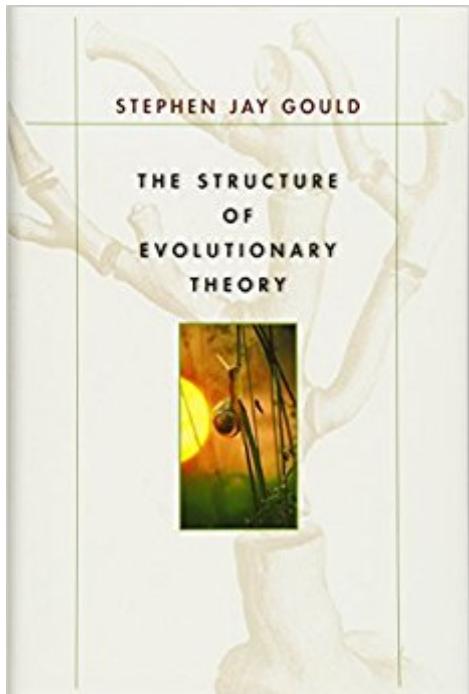


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The Structure Of Evolutionary Theory



Synopsis

The world's most revered and eloquent interpreter of evolutionary ideas offers here a work of explanatory force unprecedented in our time--a landmark publication, both for its historical sweep and for its scientific vision. With characteristic attention to detail, Stephen Jay Gould first describes the content and discusses the history and origins of the three core commitments of classical Darwinism: that natural selection works on organisms, not genes or species; that it is almost exclusively the mechanism of adaptive evolutionary change; and that these changes are incremental, not drastic. Next, he examines the three critiques that currently challenge this classic Darwinian edifice: that selection operates on multiple levels, from the gene to the group; that evolution proceeds by a variety of mechanisms, not just natural selection; and that causes operating at broader scales, including catastrophes, have figured prominently in the course of evolution. Then, in a stunning tour de force that will likely stimulate discussion and debate for decades, Gould proposes his own system for integrating these classical commitments and contemporary critiques into a new structure of evolutionary thought. In 2001 the Library of Congress named Stephen Jay Gould one of America's eighty-three Living Legends--people who embody the "quintessentially American ideal of individual creativity, conviction, dedication, and exuberance." Each of these qualities finds full expression in this peerless work, the likes of which the scientific world has not seen--and may not see again--for well over a century.

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Customer Reviews

The theory of evolution is regarded as one of the greatest glimmerings of understanding humans

have ever had. It is an idea of science, not of belief, and therefore undergoes constant scrutiny and testing by argumentative evolutionary biologists. But while Darwinists may disagree on a great many things, they all operate within a (thus far) successful framework of thought first set down in *The Origin of Species* in 1859. In *The Structure of Evolutionary Theory*, a monumental labor of academic love, Stephen Jay Gould attempts to define and revise that framework. Using the clear metaphors and personable style he is so well known for, Gould outlines the foundation of the theory and attempts to use it to show that modern evolutionary biology has lost its way. He then offers his own system for reconciling Darwin's "basic logical commitments" with the critiques of modern scientists. Gould's massive opus begs a new look at natural selection with the full weight of history behind it. His opponents will find much to criticize, and orthodox, reductionist Darwinists might feel that Gould has given them short shrift. But as an opening monologue for the new century's biological debates, *The Structure of Evolutionary Theory* sets a mountainous precedent in exhaustive scholarship, careful logic, and sheer reading pleasure. --Therese Littleton

Over the past few years, a series of big books on evolution have been published: *Human Natures* by Paul Ehrlich, *Consilience* by E.O. Wilson and *What Evolution Is* by Ernst Mayr, to name just three. Now comes the biggest of them all (physically, at least) a 1,400-plus-page cinderblock of a book from Harvard zoology professor Stephen Jay Gould (*The Lying Stones of Marrakech; Ontogeny and Phylogeny*). The culmination of about 25 years of research and study, this book traces the history of evolutionary thought and charts a path for its future. After Darwin wrote *The Origin of Species* in 1859, scientists created a synthesis of genetics, ecology and paleontology to explain how natural selection could produce change and form new species. Gould thinks that this "modern synthesis" has hardened into a dogma stifling the science. Gould claims that an obsession with "selfish genes" and simplistic versions of natural selection blinds researchers to the significance of new discoveries about how evolution really works. The rules by which embryos develop, for example, create constraints that channel the flow of evolution. Asteroid impacts and other catastrophes can send evolution off on unpredictable trajectories. And selection, Gould contends, may act not just on individuals or their genes, but on entire species or groups of species, and in ways we've only begun to understand. This book presents Gould in all his incarnations: as a digressive historian, original thinker and cunning polemicist. It is certainly not a perfect work. Gould gives short shrift to the tremendous discoveries spurred by "Darwinian fundamentalism," while he sometimes overplays the importance of hazy theoretical arguments that support his own claims. But even Gould's opponents will recognize this as the magnum opus of one of the world's leading

Stephen Jay Gould (1941-2002) wrote many other important books, such as *A Ontogeny and Phylogeny*, *Ever Since Darwin*, *The Panda's Thumb*, *Hen's Teeth and Horse's Toes*, *The Flamingo's Smile*, *Wonderful Life: The Burgess Shale and the Nature of History*, *Eight Little Piggies*, *Dinosaur in a Haystack*, *The Lying Stones Of Marrakech*, etc. He wrote in the first chapter of this 2002 book, "This book asserts, as its key premise and one long argument, that such an understanding of modern evolutionary theory places the subject... with the central core of Darwinian logic sufficiently intact to maintain continuity as the centerpiece of the entire field, but with enough important changes ... to alter the structure of evolutionary theory into something truly different by expansion, addition, and redefinition. In short, 'The structure of evolutionary theory' combines enough stability for coherence with enough change to keep any keen mind in a perpetual mode of search and challenge." (Pg. 6) Later, he summarizes, "This book presents, as its primary thesis, the notion that (i) Darwinism may be viewed as a platform with a tripod of essential support; (ii) each leg of the tripod now faces a serious reforming critique acting more as an auxiliary than an alternative formulation; and (iii) the three critiques hold strong elements in common, and may lead to a fundamentally revised evolutionary theory with a retained Darwinian core." (Pg. 166) He reveals, "Far more than most colleagues, I have tended to work alone in my professional life and publication. But for each of the conceptually difficult and intellectually manifold issues of reevaluation of the central logic of the three essentially Darwinian postulates, I desperately needed advice, different skills... from colleagues who complemented my limited expertise with their equally centered specialties and aptitudes... Thus... I worked with Niles Eldredge on punctuated equilibrium..." (Pg. 27) Later, he explains, "I wrote most of our 1972 paper, and I did coin the term punctuated equilibrium---but the basic structure of the theory belongs to Eldredge, with priority established in his 1971 paper." (Pg. 775) Later, he rejects the argument that "I advanced punctuated equilibrium in order to foster a personal political agenda [i.e., Marxism]. I resent this absurd misreading... I said nothing about my political beliefs ... a private matter that I do not choose to discuss in this forum." (Pg. 1018) He suggests, "the theory of natural selection is, in essence, Adam Smith's economics transferred to nature." (Pg. 122) He adds, "By interpreting Darwin's radical theory as a response to [William] Paley... based on an importation of the central argument from Adam Smith's laissez-faire economics, I believe that we achieve our best insight into the essential claims of Darwinism and natural selection." (Pg. 124-125) He asks, "Does Darwinism truly require the following extreme formulation: 'Natural selection can only act by the preservation and accumulation of infinitesimally

small inherited modifications.' At some level of discontinuity, of course, Darwin's strong statement must prevail... But can we justify Darwin's application of the same claim to single organs? Suppose (as must often happen) that developmental heterochrony produces a major shift in form and function by two or three steps without intermediary stages. The size of these steps may lie outside the 'normal' variation of most populations at most moments, but not beyond the potential of an inherited developmental program." (Pg. 150-151) He wonders, "what conceivable pressure of natural selection could account for gradual stages in the disappearance of a functionless organ---for the loss of function should remove a structure from the domain of selection entirely, and knowledge about an eventually adaptive state could not be invoked to guide an explanation for intermediary stages along such a functionless path." (Pg. 203) He criticizes Richard Dawkins: "Dawkins's first book says, in no uncertain terms... that genes are exclusive units of selection... and that bodies... cannot play such a role. The second book says that we can view evolution equally well from either the gene's or the organism's point of view, [although] Dawkins still prefers genes... These two positions connote... mutually exclusive, accounts of causality in evolution... I do not know why Dawkins altered his view so radically. But may I suggest that he simply could not... maintain full allegiance to the fallacious argument of strict gene selectionism. Dawkins... ultimately needed to make so many statements from the organism's point of view that he must have begun to wonder whether he could really continue to regard such organismal language a mere convenience, while touting the genic formulation as a unique reality... With such an admission, the selfish gene becomes an impotent meme." (Pg. 641) He explains, "By 'random'... I only mean to assert the hypothesis of no overall preference for increasing complexity ... a system in which each speciation event has an equal probability of leading either to greater or to lesser complexity from the ancestral design... the overall system (all of life, that is) need not display any overall bias---for just as many individual lineages may become less complex for equally adaptive reasons. In a world where so many parasitic species usually exhibit less complexity than their freeliving ancestors, and where no obvious argument exists for a contrary trend in any equally large guild, why should we target increasing complexity as a favored hypothesis for a general pattern in the history of life?" (Pg. 900) He argues, "Yes, five percent of a wing offers no conceivable aerodynamic benefit, and could not therefore be formed, or converted into a full wing, under a smooth regime of natural selection FOR FLIGHT. But sequences forged by selection only presuppose continuity in differential reproductive success, not continuity in a single function. Thus, the incipient stages may have performed a different function, for which their 5 percent of a wing imparted benefits. Eventually, the enlarging proto-wing entered the domain of aerodynamic benefit, and the original function changed

to the primary utility now exploited by birds. Current function cannot be equated with reasons for historical origin." (Pg. 1223) But he adds, "natural selection cannot act as a magic wand for a immediate construction of any urgent need... a large component of evolvability must be attributed to inherent structural properties of features that ... manifest a capacity for subsequent recruitment (with minimal change) to substantially different and novel functions. The study ... of these formal and structural reasons for evolvability sets an important agenda, now largely unfilled but attracting considerable interest, for evolutionary biology." (Pg. 1228) He concludes, "This book attempts to expand and alter the premises of Darwinism, in order to build an enlarged and distinctive evolutionary theory that, while remaining within ... Darwinian argument, can also explain a wide range of macroevolutionary phenomena lying outside the explanatory power of extrapolated modes and mechanisms of microevolution... (1) punctuated equilibrium establishes... a general speciational theory of cladal trending... (2) catastrophic mass extinction ... suggests a general theory of faunal coordination far in excess... of what Darwinian microevolutionary assumptions about the independent history of lineages under competitive models of natural selection could possibly generate." (Pg. 1339-1340) Besides being a highly creative evolutionary theorist, Gould was also a brilliant writer and an engaged "public intellectual." His presence is sorely missed on the scientific and literary scene.

His harshest critics now explain his insight away by (disingenuously) saying it was trivial - "everyone has always really thought/meant that to be true"... This is the true sign of triumph! If you have a couple of years of insomnia ahead, this is the book for you! And if you can actually manage to read it all from cover to cover, you be in very rarified company, because most evolutionary biologists I have met (even the one's who own it) admit they have not managed to read it.

Highly insightful work.

The field of evolutionary biology is changing so fast that this book will need to be supplemented. But this book tells you all you might ever wish to know about the state of the art early in the 21st century.

I thoroughly enjoyed the *Structure of Evolutionary Theory*. It is well written, concise, and easy for a man like me (art major) to understand. The production value is high: nice hardcover binding, good heft, nice diagrams. The picture of Stephen J. Gould on the back could be more flattering. The only

problem I have with the book, is that it proposes a theory, less than a structure- which would be a bit presumptuous. A more appropriate name would be the Theory of Evolutionary Theory.

How much more complex the theory of evolution has been. Perhaps this sort of history is a perfect way to engage those who wish evolution would just go away.

excellent!

Cleary the capstone to Stephen Jay Gould's life and career. While his hundreds of articles in NATURE put him at the same cocktail party with Carl Sagan, this tome puts him at the same party with Charles Darwin. Another reviewer hit it on the head. This book is not as accessible as his other writings. The Structure of Evolutionary Theory is intended for the experts in the field of Evolution. It presumes a lot of the reader, background that frankly even with a BS in Zoology, I don't have. At 30 bucks, it's a great value for the money, one of those books you'll keep around and read a chapter or section at a time. I don't think Gould intended to be pedantic, but he was clearly thinking at a level above most of us. A quick excerpt to demonstrate my point. From the bottom of page 152: "The challenge of punctuated equilibrium to natural selection rests upon two entirely different issues of support provided by punctuational geometry for the explanation of cladal trends by differential species success and not by extrapolated anagenesis, and for the high relative frequency of species selection, as opposed to the exclusivity of Darwinian selection on organisms." If you can figure this out, even in context, you can have my Mensa card.

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