

believe that the many illustrations and diagrams alone are worth its price. For anyone who is new to the history of biology, *Haeckel's Embryos* will show you just what you have been missing and how applicable visual culture is to the teaching of biology.



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"Ontogeny recapitulates phylogeny." This dictum of Ernst Haeckel led to his creation of a series of diagrams showing the similarity of embryonic stages across phyla. In our post-Modern Synthesis world, it is hard to see why Haeckel's embryos should still raise hackles. But here we are, still discussing them.

Was Haeckel a villain or victim? Was he guilty of perpetrating outright fraud, in the spirit of Piltdown? Did he forge his embryonic grids with the intent to deceive and convince? Or did he innocently fill in gaps in his embryonic series because of the paucity of available material and "touch up" images produced by others? Or was he a bold pioneer, who fearlessly – but mistakenly – drew what he saw, as did Percival Lowell, Haeckel's contemporary, with his Martian "canals"?

If you have already made up your mind on these questions, then you will be both thrilled and dissatisfied by Hopwood's careful recounting of the times and tribulations of Haeckel and his embryos, a story that spanned 140 years and the development of imaging technology that grew through lithography, woodcuts, photogravure, daguerreotypes, and halftones. Ten years in the making, *Haeckel's Embryos* is neither a plug nor a pan of Haeckel or his images, but rather a "most comprehensive history of a scientific image" (p. 3).

Larger than Haeckel's images, Hopwood's grander purpose is to explore "how pictures of knowledge succeed and fail, become accepted and cause trouble . . . . This book focuses on Haeckel's embryos . . . the most fought-over images in the history of science" (p. 3). *Haeckel's Embryos* is presented in a beautifully illustrated, cloth-bound, 8½ by 11 inch edition with over 200 historical plates and images. Many appear for the first time outside their original publications.

After an Introduction that describes the author's purpose and premise, chapters 2–4 recount the growth of embryological studies and the development of embryological and developmental images. They then trace Haeckel's rise to become the most prominent Darwinist in Germany. Chapters 5–8 track how Haeckel's embryonic images were made and disseminated,

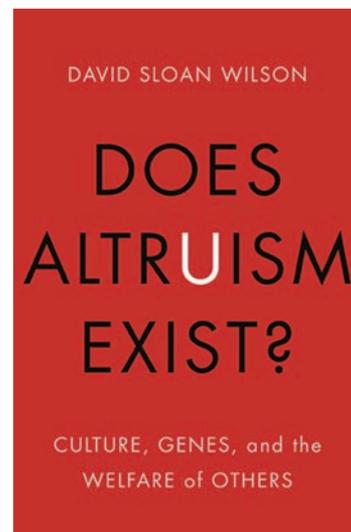
and end with the first controversy and accusations of forgery in 1875 by Rüttimeyer and His – claims exploited by antievolutionists and religious conservatives at the time. Chapters 9–13 follow the expansion of Haeckel's embryonic grids, his rise to celebrity status, and the social/political/religious polarizations that surrounded Haeckel and his embryos. These chapters record the ratcheting-up of vitriolic exchanges between Haeckel and his detractors.

The final chapters (14–18) recount the dust-up of the second controversy and accusations of forgery by Arnold Brass and the religious conservatives of the Kepler League that first brought the scandal of fraud before the public in 1909. Tarnished in Germany, Haeckel's embryos became widely disseminated in textbooks in the United States and Britain, where the forgery accusations were less well known. Interestingly, they were even included in the approved Tennessee biology textbook following the Scopes "Monkey" trial in 1925. The section ends with the "rediscovery of Haeckel's forgeries" by American biologist Michael Richardson in 1997, who declared them "fakes" (p. 286) – a claim that inflamed the Intelligent Design firestorm led by Phillip Johnson and the Discovery Institute. Hopwood also mentions Jonathan Wells's antievolutionary shot-across-the-bow in the *American Biology Teacher* in May 1999.

*Haeckel's Embryos* is not a stodgy tomb covered in archival dust, as are some histories of science. Hopwood's writing is not only clear but highly engaging. This book is fun to read, chock-full of exhaustive detail made palatable by entertaining turns of phrase, word pictures, and puns. But *Haeckel's Embryos* may not be for everyone. If your primary interest (or need) is simply countering creationist intrusions into your already packed biology curriculum, you may be better served by reading the short essays found on the National Center for Science Education (NCSE) website. But if you are curious to learn the definitive and nuanced story of Haeckel and his embryos, or have an abiding interest in the philosophy and history of science, then this book is for you. Many of my scientific heroes are woven into the fabric of this fascinating story. I found myself fully engaged and repeatedly chuckling over Hopwood's wordsmithery. Then, on practically every page, I was forced to loiter and savor the beauty of the historical plates and images. Through it all, I learned so much. *Haeckel's Embryos* is a wonderful book.



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## ALTRUISM

*Does Altruism Exist? Culture, Genes, and the Welfare of Others.* 2015. By David Sloan Wilson. Yale University Press and Templeton Press. (ISBN 978-0-300-18949-0). 180 pp. Hardcover. \$27.50.

In all honesty, I found this book to be a slog. It is part of the "Foundational Questions in Science series" and, as such, is written by a well-respected leader in this field, David Sloan Wilson. He took the opportunity to reflect over the vast quantity of literature in this area and attempt to distill what is currently known or unknown and some of the implications of the field. Wilson's writing style, while lucid and concise, is very academic rather than grippingly narrative. He typically writes abstract philosophical arguments, illustrated eventually with a few real-world examples. The reader needs to be willing to really concentrate as she reads to watch the argument gradually build. Thus, the appropriate audience likely will be more students than lay readers. The book is predominantly human-centered, with few references to other species. I expected this to be a case-by-case examination of seemingly altruistic behaviors throughout the animal kingdom, so I was disappointed, but examining other species was clearly not Wilson's original goal. Why focus so intently on the human species in this book? Beyond the obvious self-interested reason, Wilson claims that "Alone among primate species, we crossed the threshold from groups of organisms to groups as organisms . . . . Our ancestors managed to suppress disruptive forms of within-group competition, making benign forms of within-group selection and between-group selection the primary evolutionary forces" (p. 49).

Altruism, as defined by Wilson, is “a concern for the welfare of others as an end in itself” (p. 3), which often incurs an unreciprocated cost to the one providing the benefit. As such, the behavior has seemed an evolutionary mystery in many respects. How could natural selection, which should promote traits that increase survival and reproduction of the individual, have produced altruistic behaviors? Behaving for the good of society typically does not maximize relative fitness within the group (even if absolute fitness might increase), and in evolutionary biology, relative fitness is what counts because evolution by natural selection results from fitness differences. Indeed, some scientists claim that there may be “seemingly altruistic acts but question whether they are based upon altruistic motives” (p. 3) – in other words, is concern for others really what drives the behavior? Wilson argues that the motives are irrelevant, only the resulting behavior matters, and the levels of selection are critical: one must examine natural selection acting both within and between groups. As he and E. O. Wilson succinctly stated: “Selfishness beats altruism within groups. Altruistic groups beat selfish groups. Everything else is commentary” (p. 23).

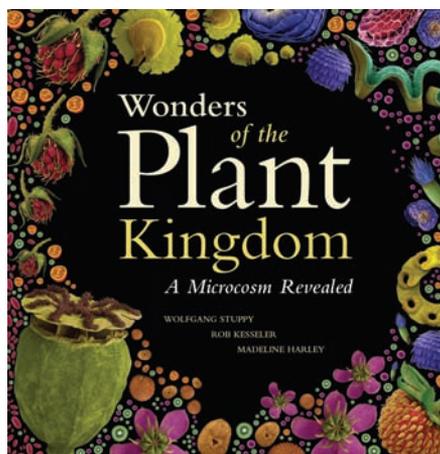
Wilson covers topics as wide as religion and economics, and smaller-scale issues such as what makes certain group-work successful. Still, I was disappointed that the book did not take on a wider range of species. Additionally, some of Wilson’s declarative statements seem easily arguable, yet he does not address those obvious protests. For instance, discussing the religion of the Hutterites, Wilson categorizes phrases in the text into a 2 × 2 table of effects on self × effects on others, and lists “obedience,” “sacrifice,” and “surrender” in the ++ category. It is clear as to why something like “brotherliness” would be in that category, but without an explanation as to why “sacrifice” has a benefit, his ensuing claim that “the top left quadrant of the table (negative for self, positive for others) . . . [was] empty” (p. 84 and fig. 6.1) falls flat. It is empty only because it appears he has misassigned behaviors, unless he explains his reasoning. Other claims that conveniently fit his trajectory similarly seem arguable: “There’s a world of difference between socially dominant individuals in most primate groups, who simply appropriate the best mates and resources for themselves, and high-status individuals in small-scale human societies, who must earn their status by cultivating a good reputation” (p. 49). This seems highly prejudiced (and overly optimistic) toward humans as a species. I can think of some powerful human leaders who seem to have also just “appropriated” what they wanted, regardless of reputation. I would

have liked to see some concrete examples to back up this claim. However, these small issues notwithstanding, most of Wilson’s arguments are laid out well.

There is much fodder for reflection on a wide variety of aspects of human society. Wilson argues that the question of why altruism exists is one that is just entering its resolution phase and will be something that future scientists look at and wonder how smart people could have floundered while pondering this straightforward question for so long. Wilson provides many chapter endnotes with a plethora of good-quality references for those interested in delving deeper into certain areas. While *Does Altruism Exist* is not a book to read in small segments or right before drifting to sleep, this is a work that will make you reflect on your own behavior and how evolution has influenced many aspects of human society, so much of which depends on group-functioning. For someone interested in reading biological philosophy (or philosophical biology): you will be intrigued.



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## PLANTS

***Wonders of the Plant Kingdom: A Microcosm Revealed.*** By Wolfgang Stuppy, Rob Kessler, and Madeline Harley. 2014. University of Chicago Press. (ISBN 978-0-226-21592-1). 190 pp. Paperback. \$25.00.

The purpose of this square-format, large-page, paperback “coffee-table” book is to reveal “the evolution of pollen and seeds, two of the most crucial innovations in the history of all life

on our planet” (p. 7). The cover indicates that the images inside are enlargements of very small botanical objects: spores, pollen grains, flowers, fruits, and seeds. The images filling the book are mostly colorized SEMs (scanning electron micrographs) of small botanical specimens. Other images are extreme close-ups of flowers or fruits. The beautiful and colorful images float on black pages, which intensifies their visual impact. Between the images, the text tells the story of botany in pastel type. The font is small, but the informational content is dense, providing the reader with a good explanation of the natural history of spore- and seed-bearing plants. The vocabulary used is fully professional and not euphemized, except as is common in science books.

One has to wonder about a coffee-table book with paper covers; at first, turning the pages, it seemed like the spine was breaking as gaps appeared between the sheets. However, this is an intentional design feature: the pages are well sewn, and the stitching is loose so that the pages lie flat. It is a beautiful book, suitable for gift-giving to a friend or relative who is interested in plants.

The book opens with a discussion of the life cycle of spore-bearing and seed-bearing plants. The early chapters deal with spores, and later chapters move to pollen grains, then fruits and seeds. This is a natural progression through the evolution of the natural history of plants. Along the way, sections devoted to pollination biology are also beautifully photographed and described, sorted in the traditional syndromes showing the interaction between flowers and wind, water, bees, moths, butterflies, birds, and bats.

The book transitions through the philosophical question of the results of pollination: the fruit-or-vegetable debate. This book presents the arguments fairly and with citations showing how government decisions on fruit and vegetable classifications have come down on the side of “food science” rather than “botany.” Yet the book clearly supports the correct botanical nomenclature. A range of fruit types are shown and described nicely.

Getting “diaspores” or “propagules” or “disseminules” distinguished could be a bit cleaner, but the authors clearly have a wonderful discussion of the various mechanisms of distributing plant progeny into the environment. Seed or fruit dispersal by wind, on the outside or inside of animals, and by explosive propulsion or catapult are covered thoroughly. Water dispersal in *Heritiera littoralis* is described as a floating round seed with a “prominent keel, which acts like the sail of a sailing boat” (p. 89). This is confusing,