

Evolution by Squinches

Evolution: The Story of Life on Earth, Jay Hosler, illustrated by Kevin Cannon and Zander Cannon. New York: Hill and Wang, 2011. Pp. 160. H/b \$18.95, p/b \$14.95

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Published online: 3 July 2012
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Abstract *Evolution: The Story of Life on Earth* provides a lively, accurate, and delightful explanation of evolution in the form of a graphic novel.

Keywords Teaching evolution · Jay Hosler · Kevin Cannon · Zander Cannon · Comics/cartoons/graphic novels

In the far future, or perhaps on a forbidden, doomed, and/or cubical planet, or possibly in a strange parallel dimension, cartoons and comics are, without exception, biologically accurate. There, if the X-Men are regarded as uncanny, it's not because they're mutants. There, when the Apteryx in *B.C.* introduces itself as “a wingless bird with hairy feathers,” it adds, “and a maniraptoran coelosaur to boot.” There, if the Saudi authorities seek to ban Pokémon (see Hawley 2001) on the grounds that it promotes evolution, at least they're not trying to censor a mischaracterization of metamorphosis as evolution. There, no *Peanuts* fan is in any doubt about the exact phylogenetic place of Charlie Brown's kite-eating tree. And there, of course, it would seem strange and unnecessary to applaud a book like *Evolution: The Story of Life on Earth* for the altogether mundane achievement of providing a lively, accurate, and delightful explanation of evolution in the form of a graphic novel. Here, on the other hand, the applause is entirely in order.

Although it presents the story of life on earth, *Evolution* takes place on the planet Glargal, which is inhabited by intelligent aliens that vaguely resemble sea cucumbers. The squinches, as they call themselves, are facing a (never clearly described) genetic crisis, and as part of their efforts to combat it, a squinch scientist, Bloort 183, was dispatched to our planet to investigate life on earth. In the book's

predecessor, *The Stuff of Life* (Schultz 2009), illustrated by Zander Cannon and Kevin Cannon but with a different author, the scientist was reporting to the squinch monarch about genetics and DNA; in *Evolution*, the scientist now is reporting on evolution to both the king and the heir to the Glargalian throne. There's no need to read *The Stuff of Life* to appreciate *Evolution* since enough of the storyline and the scientific content of the former book is unobtrusively recapitulated in the latter book, but anyone who enjoys one of the books is sure to enjoy the other as well.

Evolution opens with a synoptic history of life on earth, which turns out to be “the introductory holographic sequence to welcome visitors to the new ... *Glargalian Holographic Institute of Earth Evolution*,” as Bloort explains (p. 8). Like *Star Trek's* holodeck, it isn't entirely reliable: a few pages on, the prince is accidentally zapped to the Precambrian section of the museum, and later, Darwin escapes from his section. But it is effective as a narrative device, not only explaining the source of the images that the king and the prince are presented with but also freeing Bloort from the task of being the only voice explaining the science: Darwin—backed by a moptopped band called the Beagles—introduces natural selection, Miller and Urey present their famous experiment, Cuvier discusses extinction, Belyaev reports on his work on domesticating silver foxes, and so on. A handful of page-length sidebars on various topics, not integrated with the storyline, provide further variety in the exposition.

With the aid of the holographic Darwin, the rudiments of evolution are introduced, and the squinches embark on a three-chapter journey through the history of life on earth. The first chapter covers the first four billion years, with the Miller–Urey experiment, the RNA world, the three domains of life (bacteria, archaea, and eukaryotes), the Great Oxygenation, and endosymbiosis the major topics. Chapter 1 ends with a beautiful panel teeming with the fauna of the Cambrian Explosion, and Chapter 2 continues from there,

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discussing the Cambrian fauna, radiometric dating methods, and possible explanations for the Cambrian radiation. A quickstep through the following periods ensues, one page each for the Cambrian, Ordovician, Silurian, Devonian, Carboniferous, and Permian. The chapter ends with shattering effectiveness: after the king, looking a tad bored, hazards a guess as to what “stunning” event “happened to life on earth” at the end of the Permian, the next page reveals, with a depauperate version of the previous chapter’s final panel, that “... almost everything died” (pp. 51–52).

Extinction—and subsequent radiation—is thus the first theme addressed in Chapter 3, with Bloort explaining the Triassic radiation of the neopteran insects and the reptiles. Always enthusiastic, he is doubly so after the end-Triassic extinction, when “the table is cleared for the radiation of *dinosaurs* and *giant reptiles*, some of the *coolest* organisms ever!” (p. 57)—a sentiment sure to resonate with the book’s likely readers. Soon the camera pulls back to reveal that the columns in the background are not tree trunks but the limbs of giant sauropods—“Great glargally-margally,” the king croaks (Fig. 1). After the end-Cretaceous extinction and the Cenozoic radiation of birds and mammals, Bloort returns to the idea of extinction, understandably, since the genetic crisis threatens to lead to the extinction of the squinches themselves. The prince pensively offers, “What we really need now is to develop a better understanding of how species arise and adapt to new situations” (p. 68). The king, touchingly, cancels a meeting to continue the briefing.

As the prince hoped, Bloort proceeds to address the processes of evolution in further detail. Chapter 4 introduces the basics of speciation in a straightforward way, with a relevant digression (featuring the escaped holographic Darwin) on sexual selection, which amusingly disquiets the asexual squinches. Chapter 5 begins by discussing artificial selection, offering the chance to introduce the concepts of pleiotropy and functional shift and to sharpen the idea of adaptation. Since a passage in the previous chapter hinted slightly of hyperadaptationism, it is good to read here that “evolutionary biologists are often confronted with amazing traits, but they still must produce evidence that these are adaptations” (p. 96)—and the point is driven home with a fascinating, and hilarious, three-page discussion of how scientists tested the fitness of the three male phenotypes of the marine isopod *Paracerceis sculpta* (e.g., Shuster and Wade 1991). The remainder of the chapter discusses a wonderful array of adaptations of varying degrees of familiarity, properly emphasizing their imperfections and compromises as much as their effectiveness.

Human evolution is the topic of chapter 6, but Bloort takes a running start, beginning with the emergence of vertebrates from the water; the account follows Neil Shubin’s *Your Inner Fish* (2008), especially in its treatment of vertebrate limb homology, and Shubin himself appears

twice on p. 116. All vertebrates presumably looking basically the same to the squinches, Bloort spares a moment to explain the evolutionary place of human beings, and then follows the human line from *Ardipithecus ramidus* through *Australopithecus afarensis* and *Homo habilis* to *Homo sapiens* and its continuing evolution with the expansion out of Africa and the advent of agriculture. Thereafter, the king and prince muse on the lessons for the genetic crisis facing their species. In a snack-cake-fueled epilogue, they discuss evolutionary convergence and contingency—the king plaintively asks, “There’s nothing about our body type that leads unavoidably to our grand squinchiness?” (p. 136)—before the prince petitions, successfully, to be added to Bloort’s next scientific expedition to earth.

A minor scientific glitch occurs in chapter 1, when the prince asks, “what’s the evidence that eukaryote cells incorporated bacteria in symbiotic relationships?” and is led, with Bloort’s help, to articulate three morphological and physiological considerations, including the fact that mitochondria and chloroplasts have a double membrane: “The inner membrane is the bacteria’s original one, and the outer membrane is part of the eukaryote cell that engulfed it” (p. 31). The idea here seems to derive from Lynn Margulis (1970, p. 186; 1981, p. 210) and to be widely repeated in textbooks (e.g., Purves et al. 2004, p. 78). But the ancestral bacteria, like their closest living relatives—alphaproteobacteria and cyanobacteria—already had a double membrane, which “was an integral part of the energy-producing pathway that became so important for the eukaryotic cell” (Moran 2010). Moreover, historically, morphological and physiological considerations such as these seem to have been less than decisive: it wasn’t until genomic methods were employed that the endosymbiotic origin of mitochondria and chloroplasts was truly resolved (Sapp 1994, pp. 179–191).

But overall, *Evolution* manages to explain a remarkable amount of evolutionary biology within its pages, with a dazzling array of interesting, up-to-date, and not yet over-used scientific discoveries presented. (It was refreshing not to see the peppered moth, even though it of course remains a fine example in its own right: Majerus 2009). *Evolution* also succeeds in anticipating the likely misconceptions of its audience. For example, the tendency to think in terms of the Great Chain of Being is neatly subverted when the king, impressed by the “regal bearing” of the Cambrian predator *Anomalocaris*, says, “Clearly this is the ancestor for these highly evolved humans we’ve heard so much about” (p. 37), only to be disappointed on his introduction to the more plausible ancestor, *Pikaia*; the point is reinforced in chapter 3, when the king finds it hard to believe that humans are descended from the mammals scuttling around in the Cretaceous underbrush. A little more bushiness in the human family tree on p. 121 would have helped to reinforce the point.

Fig. 1 The Gargalians meet the dinosaurs. Excerpted from *Evolution: The Story of Life on Earth*, by Jay Hosler with illustrations by Kevin Cannon and Zander Cannon, published by Hill and Wang, a division of Farrar, Straus and Giroux, LLC, in January 2011. Text © 2011 by Jay Hosler. Illustrations © 2011 by Kevin Cannon and Zander Cannon. All rights reserved



More importantly, through its appealing graphics and delightful humor, *Evolution* is likely to attract and retain a readership of young adults. Practically every panel contains a joke—often referring to a cartoon or comic, such as the Cambrian version of the Hulk on p. 43, the arachnid explaining to its prey, “I’m an amazing spider, man” on p. 105, or the Flintstones car on p. 122, or to monster movie conventions, as on p. 32, where bacteria fleeing a monster scream, “Aaeeeeeee! *Vernanimalcula!* The two-micrometer terror

has returned!” (While it might sound like a coeval of Godzilla or Rodin, *Vernanimalcula* is the genus assigned to a fossil from the Ediacaran Period, believed to represent the first bilaterian). The cartoonist’s license to anthropomorphize is used to good effect. Especially clever was the panel showing endosymbiosis as a theatrical audition (p. 30): “And what can you do?” asks a cell lounging in a theater seat. “I can change sunlight into sugary goodness,” responds the aspiring chloroplast on stage in front of a microphone. “You’re in.”

The humor is invariably pitched at the right level of sophistication and knowledge for the intended audience. A clever exchange following Bloort's explanation of fossilization (p. 38) is representative:

The King: Earth life can turn to stone? Their warriors must be *terrifying*.

Bloort: Well, they turn to stone only after they're *dead*.

The Prince: They're *ZOMBIE* stone warriors? *AWESOME!*

The interaction of the characters is a further source of humor, for which it's plausible to credit Jay Hosler, a keen observer and apt recorder of intrafamilial bantering and bickering, particularly in his honeybee epic, *Clan Apis* (2000), and his tribute to Darwin, *The Sandwalk Adventures* (2003). The addition of the third character was a stroke of genius, expanding the range of possible interactions among the characters and leading to amusing scenes possible only with three characters, such as the scientist looking uncomfortable while the prince is teasing the king about his obesity, or the prince looking embarrassed while the king is tormenting the scientist with a bad pun.

According to a recent blog post at the *Chronicle of Higher Education* (Bartlett 2012), a psychology professor, Dan McAdams of Northwestern University, suggests that part of the reason that people fail to accept evolution is because it is impossible to convey in a narrative form, lacking the crucial elements of narrative, such as protagonist, motivation, and purpose: "You can't really feel anything for this character—natural selection." But McAdams errs in thinking that natural selection would have to be a character in the story of evolution; after all, the Russian weather isn't a character in *War and Peace*. Instead, lineages can be characters, à la *Buddenbrooks* or *Roots*, in narratives of the major events in the history of life, and those learning

about evolution—whether researchers or students—can themselves be characters in narratives of progress in knowledge. Among the strengths of *Evolution: The Story of Life on Earth* is that it so effectively and engagingly combines both of these narrative approaches—even if its protagonists look like sea cucumbers.

Acknowledgments I am grateful to Ulrich Kutschera and Susan Spath for discussions of the history of endosymbiotic theory, and to Vikram Branch for his suggestions.

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