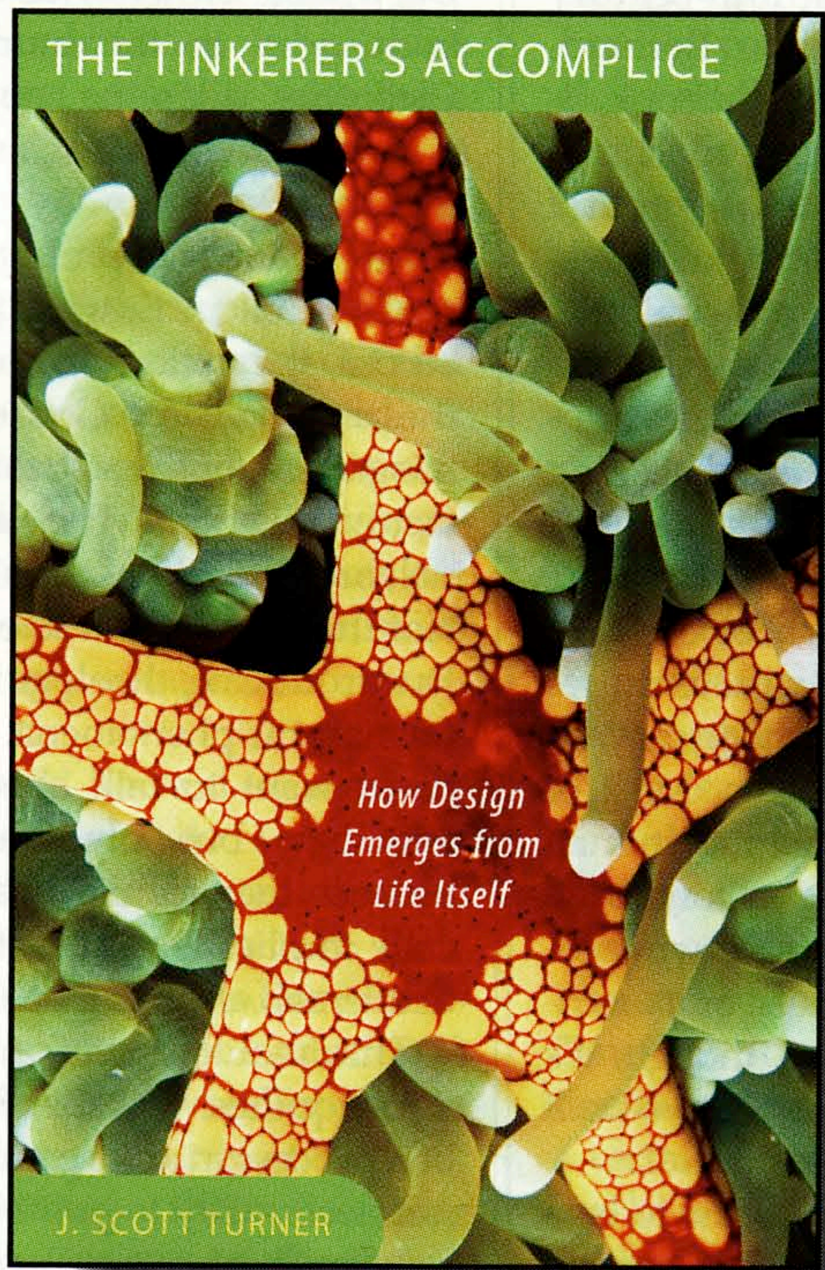

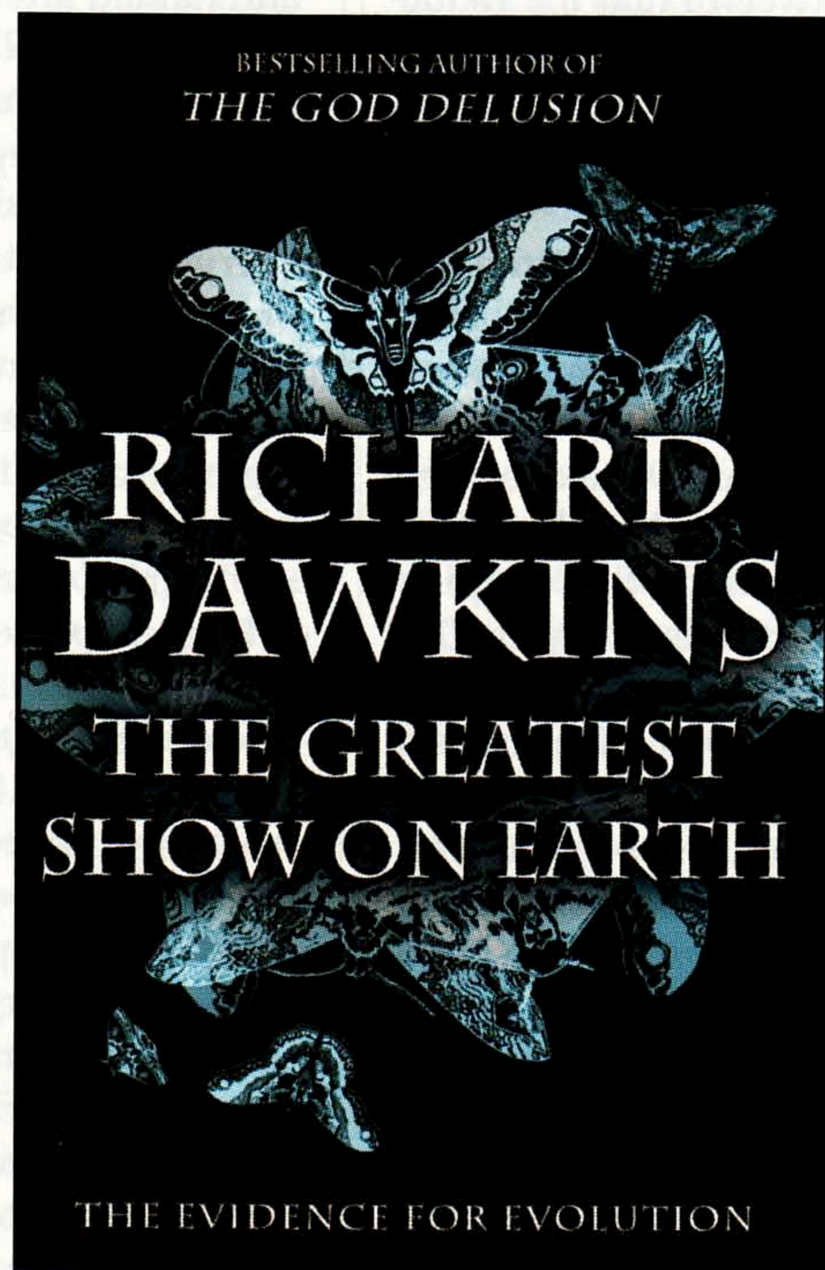

A Republic of Natures

Though Richard Dawkins tries to ignore it, classical teleology has resurfaced in the evolution debate.

by John Farrell

It's hard not to wonder what St. Thomas Aquinas might have thought of the current debate between Darwinian materialists and Intelligent Design advocates. The ultra-Darwinists, who insist evolution proceeds without any direction whatsoever, would no doubt have St. Thomas cocking a puzzled eyebrow. But he would also be scratching his head over the natural theology of William Paley, which inherited the 18th-century assumption that the universe is a Newtonian machine designed by the ultimate craftsman—and that biological entities themselves are basically machines.

Imagine the portly Dominican standing at his lectern in the medieval classroom at the University of Paris simply shaking his head and finally saying in eloquent medieval Latin: "Non."

Aquinas might argue that you can have a teleology without "design" in the sense that modern Intelligent Design advocates propose without falling back on appeals to pure chance. But it requires dispensing with the notion that cells and genes are little machines in a clockwork universe, and requires rather that we regard the living world as a sort of republic of natures, something more in line with the classical teleology of Aristotle, which Aquinas adopted and revised. It may seem trivial to argue that it is the *nature* of the eye to see, rather than insist it is the *purpose* of the eye to see, but as J. Scott Turner shows in his delightful book, *The Tinkerer's Accomplice*, what comes naturally to genes, cells, and organisms need not require an architectural blue print, nor throwing up one's hands to blind chance either.

Turner is a professor in the Department of Environmental and Forest Biology at State University of New York, Syracuse. His early work in South Africa and Namibia studying termite mounds—prodigious natural chimneys of earth out of all proportion in size to the small termites that build them—did not turn him into a Darwin skeptic, but

it did prod him to realize how important the role of environment is to the survival and flourishing of a species. In his own words, it made him wonder about the old dilemma of Cleanthes, presented in Hume's *Dialogue Concerning Natural Religion,* caught between Philo the reductionist skeptic and Demea the Platonist. Is there room for talk of intentionality in nature without causing both sides to run for the barricades?

Turner thinks there is, and the key is what he calls embodied physiology. Variation via genetic drift, mutations, and duplications combined with the pruning filter of natural selection certainly explains a great deal. But these mechanisms of evolution don't explain everything. Instead of looking for God in the gaps, however, Turner's work prompts the reader to hearken back to what Aristotle and the Greeks called the *physis,* or nature of organisms. Turner finds homeostasis (defined as environmental equilibrium) and the agents that manifest it as processes that work along side Darwinian evolution to bring about successful function.

> Though Darwin and Wallace delivered the death blow to the purported intentionality of what organisms *are,* they did not invalidate the very different kind of intentionality that underpins what organisms *do.* At first glance, this might seem a trivial shortcoming. Darwinism requires only that good function be possible and that it be heritable; beyond that Darwinism is agnostic about the details of either. That is why Darwin himself could credibly propose his theory while being completely ignorant of the mechanisms of heredity. Yet the intentionality implicit in physis is at the very core of the Darwinian concept of adaptation: forming well-functioning machines that can carry an organism through the filter of natural selection. It is no wonder, then, that intentionality is such an emotive issue for evolutionary biology. The *fact* of evolution itself cannot be rationally explained *with* intentionality, but the means whereby evolution works cannot be explained rationally *without* it. Arguably, modern biology has broken under the strain. (p.149)

Turner's answer to the question of how intentionality arises in nature is to argue that biological intentionality is itself a form of homeostasis.

The agents of homeostasis Turner calls Bernard machines, a term first coined by Cosma Shalizi, professor of statistics at Carnegie Mellon, and named after the great 19th-century French physiologist Claude Bernard. As each chapter of Turner's book illustrates in depth, Bernard machines are organic devices that can be found everywhere—osteoblasts in the bones, fibroblasts in the blood, epithelial cells in the eye, and nerve cells in the brain—that are, Turner writes, "frankly teleological, imbued with the goal-seeking behavior and purposefulness that is at the heart of homeostasis."

Each chapter of Turner's book explores how Bernard machines in various guises work to bring about designedness in a wide range of living systems. Most of these treat systems within the human body. The eye, of course, has long been a favorite example for both Darwin proponents and skeptics because of its intricacy. As Turner points out, though, it's not merely a matter of how the eye itself is designed to capture an image.

"Indeed, an optical eye seems to be a fairly easy thing to evolve," he writes. "Photosensitivity is not much of a big deal: many common membrane lipids can act as 'light antennas,' complicated molecules whose electrons are put into a tizzy when a photon crashes into them." The real miracle, he goes on, lies not so much in the optical eye, but in the computational process that produces vision in the brain. And that visual system, he argues, represents an embodied physiology, melded structure and function both wrought by systems of Bernard machines—in this case, synaptic alliances between brain cells—that impose homeostasis on the environments in the brain they create. The visual system comprises not just the retinas in our eyes, but many "retinas" located throughout the brain, each of which "sees" the world differently but all of which come together into a coherent vision in the primary visual cortex.

This is just one sample in very general terms. Turner's book is not light reading. Each chapter is dense with detail and it is easy for the reader to get overwhelmed with some of the technical terms. A glossary at the back, as featured by many other books on evolutionary biology, would have been helpful. But this is a minor quibble, for the book richly rewards more than one reading.

The Tinkerer's Accomplice has not drawn a great deal of attention from Design proponents. But Turner hasn't drawn much attention from the ultra-Darwinists either. This is a shame, for both sides in the modern replay of Cleanthes' dilemma could benefit from a re-introduction of classical teleology into the discussion.

As professor of philosophy at Pasadena City College Edward Feser has pointed out, the notion that teleology makes the argument for God a slam dunk is misguided, but one that both sides have tacitly accepted. The ultra-Darwinists will brook no discussion of teleology for fear that it will stunt science by forcefully introducing theological explanations for natural phenomena. Design proponents want to talk about nothing but teleology—but only in terms of Paley's, because they think teleology automatically implies Design in the sense of the Craftsman and his machine shop.

This would have puzzled Aristotle and Aquinas. To talk of the final cause of a process in an organism or species is not necessarily to point beyond its own nature. This is what Turner's book is arguing and it is an important point that needs to be brought back into the debate. It ought to be possible to develop a healthy pedagogy around the teaching of evolutionary biology without resorting to crass dogmas of materialism ("It's all a glorious accident!") or to the whistling-past-the-graveyard claims of Design proponents continually pointing at "gaps" in the current knowledge in order to shore up claims for an incompetent Cosmic Craftsman.

This is why Turner's book is so good, and why Richard Dawkins' latest book is so frustrating.

It's probably unlikely Professor Dawkins would agree with Turner about intentionality, as he doesn't discuss the subject beyond noting only that it's acceptable to use the language of purpose to explain natural selection, the proviso being that one mustn't conclude that there is in fact any grand purpose to evolution (meaning, us). This is disappointing, because it is one of the major stumbling blocks to many people's willingness to accept evolution wholeheartedly, whether they're religious or not.

Dawkins is disturbed by some overly-referenced poll numbers that more than 40 percent of Americans do not accept evolution, and he devotes an entire appendix to the subject. (His countrymen are not far behind, it seems, and this is cause for added dismay.) His appendix does not provide any detailed break-down of who these Americans are (i.e., what professions they tend to fill, what level of education they have completed, etc.), but it would come as no surprise, perhaps, as he traveled around the US, if it turned out that the pilots flying his commercial airliner were biblical creationists. And it's safe to say that whether Bible-believing pilots accept or deny evolution makes not a whit of difference to their critical skills in flying massively complex aeronautical machines.

The same could be said of virtually any other professionals (engineers, lawyers, doctors, nurses, radiologists, computer technicians) who take their Bible literally. And yet ultra-Darwinists claim that failure to accept evolution is itself the benchmark of whether people exercise *any* critical faculties at all.

It's well known that Professor Dawkins has a reputation for being sharp-tongued in print. Presumably, a book written to expound the evidence for evolution would address itself as persuasively as possible precisely to those readers whose skepticism most disturbs him. But beyond being utterly frustrated and baffled (and indeed, an exchange he has with the head of Concerned Women of America, described on p. 198, would have had any biologist banging his head against the wall), Dawkins never tries to step into the shoes of an American evolution skeptic, and in this sense the book represents a missed opportunity to address seriously the concerns of people disturbed by evolution. Considering he was himself raised in a tradition that took the Bible literally, he might have seen here an opportunity to write in a more biographical spirit, in essence saying, "Look, I started from the same place as you, dear skeptic, but let me tell you what changed my mind and why it's truly awe-inspiring." It becomes clear from the opening pages, however, that Dawkins' readers are the people who already agree with him, and whom he hopes to arm with the best facts to dispute with creationists.

Fair enough, but the preoccupation with creationists unfortunately mars more than a few otherwise excellent expositions of evidence about the common ancestry of living things, the gradual process of complexity building in living organisms as they have spread throughout the earth over the eons, and the fascinating confirmation that molecular biology adds to what—until the dawn of population genetics—was a theory that had to make due with the inferences that could be drawn from fossil and geological evidence alone. Chapters six through ten are substantively the best chapters, dealing with transitional species, human origins, embryology, continental drift and geographic distribution of species, and common ancestry on the Tree of Life. This is Dawkins as good as he gets (as in his earlier books, *Extended Phenotype* and *Unweaving the Rainbow*).

The earlier chapters, however, can be a chore to read, especially if you've already dipped into the subject in the work of other authors, such as Carl Zimmer or the late Stephen Jay Gould. Dawkins doesn't address natural selection directly until page 71, and although a certain amount of preliminary spade work is necessary leading up to the subject, the opening chapters seem both overly long and a bit rushed. Aspects of evolution that other specialists would find a delight to describe in more detail, such as the determination of fossil age by radioactive carbon dating, merit only a short subsection of a chapter.

For all of the book's content—well over 400 pages and two sections featuring beautiful color photos of various species—the explanation of Darwinian evolution never really reaches beyond natural selection. For Professor Dawkins, it seems (at least in this book), evolution really is just natural selection. This is an exaggeration, of course, but what he fails to include in his discussion is as telling as what he includes. (As one University of Toronto biochemistry professor groused on his blog, there is no *theory* of evolution; there are *theories* of evolution.) Many people—even those who are not biblical literalists—find it implausible that natural selection *alone* can explain the diversity of life.

Dawkins would be the first to admit that natural selection alone cannot explain it, and he says so in the very first chapter, but for the remainder of the book he really doesn't delve into what other explanations there may be, and this leaves the reader wondering. There is a name for zoologists who try to spread the natural selection answer across too broad a canvas, and one which, to his credit, Dawkins does not shrug off. They're called adaptationists, although it's often not meant as a compliment by colleagues. And the problem with Dawkins' book is that it does not explain why specialists in the related fields of evolutionary biology believe that there is more to evolution than natural selection alone.

This is not to say such specialists dismiss natural selection or deny its force. But many biochemists and molecular geneticists insist on a deeper appreciation for the role that genetic drift and other stochastic processes play in the origin of species. Dawkins doesn't mention drift in his book (in fact, it doesn't even merit a listing in the index). Neither does he treat sexual selection in any depth beyond Darwin's initial observations on the subject. There is no reference to recent studies that have shown more complex dynamics at work in the mating rituals of many species. For one example, Joan Roughgarden's work on what she terms "social selection" points to a far more cooperative dynamic going on in the natural order than the conflict-based generalizations of classical sexual selection theorists.

In summary, readers who want a broader introduction to evolutionary biology should consider Sean Carroll's *Making of the Fittest*, Neil Shubin's *Your Inner Fish*, Daniel Fairbanks' *Relics of Eden*, and Scott Turner's thought-provoking book. For that matter, the new *Britannica Guide to Genetics* contains an almost 100-page chapter on the evidence for evolution that superbly summarizes the field. *The Greatest Show on Earth* represents a missed opportunity to paint the bigger picture. ■

JOHN FARRELL *is the author of* The Day Without Yesterday: Lemaître, Einstein, and the Birth of Modern Cosmology *(Basic Books).*

***The Tinkerer's Accomplice: How Design Emerges from Life Itself*, by J. Scott Turner, Harvard University Press, Cambridge, 282 pages, $27.95**

***The Greatest Show on Earth: The Evidence for Evolution*, by Richard Dawkins, Free Press, New York, 470 pages, $30.00**