



REVIEW

Why Evolution Works (and Creationism Fails)

by Matt Young and Paul K Strode

New Brunswick (NJ): Rutgers University Press, 2009. 224 pages

reviewed by Mike Klymkowsky

This book is part of a grand tradition, with ambitious and laudable goals, namely to clarify for the curious reader what distinguishes science from non-science. Young (a physicist) and Strode (a high school and college teacher) have a specific audience (college students), a particular science (evolutionary biology), and a uniquely vocal “opposition movement” (creationist ideologues) in mind. Like a textbook, their book include a number of “thought questions” at the end of each chapter, a clear effort to provoke readers to clarify their thinking through introspection and metacognition (why do I think what I think?) Overall, their approach succeeds, but with two provisos: readers must take the time to consider their questions seriously, and they must have enough of an understanding of the basic concepts involved to produce clear answers for themselves. Thus the book could well serve as a foundational text for courses that compare and contrast scientific and non-scientific approaches to biological questions.

As befitting their goals, Young and Strode present a broad array of examples of how a scientific approach makes sense of biological systems. (Perhaps because of its ambitious scope, the authors make a few mistakes that I hope will be corrected in a second edition: for example, *E coli* is not a “purple bacterium” and Darwin produced lineage trees before Haeckel.) Their writing is largely jargon-free and accessible, but herein lies a potential problem – jargon is often shorthand for specific, complex, and not infrequently counterintuitive, ideas, and as such it can be useful. For example, it is unclear how compelling their readers will find their critique of Dembski’s probability arguments (chapter 10), precisely because their avoidance of jargon necessitates a longer, and more confusing (at least to me), treatment of a difficult subject. Their use of boxes to present material also strikes me as problematic, since material presented in boxes is often recognized by students as “skippable”. In particular, the discussion of HJ Muller’s explanation of apparent (but not real) irreducible complexity (p 73) should have escaped the text box and been elaborated on further.

There are tricky issues associated with the presentation of any scientific topic, particularly one as publicly controversial as evolutionary biology. While simplification is necessary, it can lead to a situation in which the reader is asked to accept various statements essentially on faith, while leaving them without the knowledge needed to confirm for themselves the reasonableness and validity of these assertions. This is one reason that the common creationist tactic of questioning well-established science works – the general public (understandably) does not have the knowledge or confidence to dismiss frivolous objections, they cannot easily identify the absurd (Skrabanek 1986). How many could profitably read

Lynch's (2005) critique of Behe and Snoke's (2004) flawed reasoning, or appreciate the role of historical contingency in the in vitro evolution of citrate utilization in *E coli* (Blount and others 2008)? It is perhaps not entirely clear what foundational ideas must be grasped in order for evolutionary mechanisms to be compelling, and it is unfair to expect Young and Strode to remediate the failings of our educational system, but there are points in their book where it would have been helpful and more persuasive if more of the scientific background had been explained.

As an example from molecular evolution, Young and Strode (p 116) note that lampreys, which are thought to share similarities with the ancestral vertebrate, have a receptor protein that can interact with aldosterone, even though they do not make aldosterone themselves. But they fail to explain how such a thing is possible. The explanation relies on an understanding of the factors that mediate intermolecular interactions and can lead to "promiscuous" interactions. In fact, molecular promiscuity, together with gene duplication and the effects of molecular chaperones (which stabilize proteins), combine to facilitate evolutionary adaptation (Copley 2003, Tokuriki and Tawfik 2009a,b). One can argue that ignorance of life's molecular mechanisms led to what has been called the "eclipse of Darwinism" (Bowler 1992, 2005) and that our deepening molecular understanding provides the most compelling evidence for accepting evolutionary mechanisms. The difficulty in imagining how random mutation could produce useful adaptation has driven many, including Darwin and Wallace, to seek various alternatives, such as orthogenesis, neo-Lamarckian mechanisms, and even divine intervention. Young and Strode's relative neglect of molecular-level mechanisms may leave their readers unable to grasp how modern discoveries have removed the need for metaphysical explanations, and allowed Darwinian theory to reappear, essentially intact (albeit more subtle in its details).

A larger question is whether any presentation of the logic of the scientific enterprise can be compelling to those who have embraced an anti-scientific mind-set? Probably not, but that is not Young and Strode's target audience. They are after the open-minded, rational, and intellectually curious, and I think that for such an audience their presentation of how science works will be particularly compelling. In contrast to its dogmatic opposition, the scientific community displays a remarkable level of intellectual honesty, flexibility, and humility. As captured by the words of Richard Feynman, "Scientific knowledge is a body of knowledge of varying degrees of certainty – some most unsure, some nearly sure, but none *absolutely* certain ... Now we scientists are used to this, and we take it for granted that it is perfectly consistent to be unsure, that it is possible to live and *not* know" (2000: 146, emphasis in original). Science has produced a logical, testable, robust, and increasingly accurate model of the world around us, but this progress was possible only because of its willingness to abandon supernatural stories since, if permitted, they make any model possible and progress impossible. Creationists, of whatever ilk, rarely display a similar level of intellectual candor – their foundational assumptions are carved in stone (or perhaps the rock of ages).

The playing field is therefore biased in favor of the supernaturalist, for whom all things are possible (a 6000-year-old earth? No problem!) Science, in contrast, embraces its vulnerability – it could well be that rigorous naturalistic laws do not exist because the world requires constant divine interventions to exist. While this latter scenario posits a rather inept designer, it is nevertheless logically possible. But amazingly enough, no matter how hard or esoteric the problem, this does not appear to be the case. Notwithstanding the claims of

various religious biologists (most notably at the moment, Francis Collins), an unbiased view of the world as a whole, and biological systems in particular, fails to reveal any need for, or examples of, supernatural intervention. The authors' discussion of the biological origins of morality speak to this point, a point strengthened by recent observations on the role of "mirror neurons" in learning and empathy (reviewed by Iacoboni 2009).

Young and Strode argue against the notion that science and religion occupy distinct domains, and point out that scientific and religious beliefs can directly contradict one another. But these conflicts exist only for the dogmatic. It seems to me that a religious perspective can be reconciled with a scientific one, once we accept that science has essentially nothing to say about what we should do, but only provides insights as to what might be possible, and if possible, how our goal might be achieved. In that light, it is important to reject scientism, the belief that science provides ultimate truth. Science requires us, like the White Queen in *Through the Looking-Glass*, to think "impossible things", such as quantum entanglement, bent space, wave-particle duality, and the creative effects of random mutations. Unlike religion, however, it provides us clear and testable reasons that such impossible things (or something quite like them) must be in play. This book provides compelling examples of how science works. With any luck, it will entice its readers to delve further into these impossible, yet compelling and empirically-based, ideas, and help them to recognize what distinguishes the "impossible" ideas of science from the impossible ideas of religion and other ideologies.

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