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Letters

What is right with ‘teaching the controversy’?

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In an important recent Opinion article in *TREE* [1], Eugenie Scott and Glenn Branch propose five criteria for evaluating whether it is appropriate to teach a controversy in a public school science class. They argue that anti-evolutionary alternatives to the standard science account of organic evolution fail on most of the five criteria and, therefore, should not be discussed within the framework of a science course.

I propose a sixth criterion: the controversy should be taught if it clarifies the demarcation between science and other ways of knowing about nature. Most introductory biology texts (e.g. [2–4]) begin with a chapter that reviews both the foundational assumptions about nature that underlie science (e.g. natural phenomena have natural causes, natural ‘laws’ operate everywhere and for all time), and the ethical ideals that the scientific community recognizes as being essential for scientific knowledge to progress (e.g. detailed public reporting of scientific research so that peers can accurately evaluate and replicate it, all accepted scientific claims are provisional and therefore might be revised or rejected upon further review). US national science education standards direct high-school science teachers to cover the assumptions and ethics of science [5].

The most popular antievolutionary alternatives to the standard scientific account, young earth creationism and ‘intelligent design theory’, reject or weaken several of the foundational assumptions and ethical ideals of science. For example, young earth ‘creation science’ adds an additional assumption that supercedes all others: the Bible is inerrant and literally true, therefore scientific claims about nature can only be valid if they do not violate this assumption. Because so many forms of material evidence indicate that the Earth is far older than 6000 years, creationists are forced to infer that natural processes were radically different in the past compared with what is observed

today; for example, radioactive decay rates were far more rapid a few thousand years ago, making the Earth seem older than it really is*.

I teach an introductory biology class to first-year college students who are not specializing in science. They are not far removed from the high-school classroom, and their science literacy is generally rudimentary and rife with the fundamental scientific misconceptions reviewed in [6]. After an introduction to the beliefs and practices of science, I spend much of my course focusing on Darwin, Mendel, the modern synthesis, and the history of life on Earth. I then tackle the issue of antievolutionary alternatives to the standard scientific account; I provide an overview of the basic claims of young earth creationism and intelligent design theory, and then have students evaluate them in relation to the foundational assumptions and ethical ideals of science. I provide my opinion about why these antievolutionary theories are merely pseudoscientific alternatives to the standard scientific account, followed by a discussion among the students on whether these popular antievolutionary alternatives can truly be categorized as science.

It has been my experience that many students are skeptical of professorial dogma, especially on a subject of popular controversy, such as organic evolution, and consider it disingenuous when a teacher avoids presenting popularly held beliefs that differ from the instructor’s own. To ignore antievolutionary theories in the science classroom because they are not accepted science beggars the question what, indeed, is accepted science? Examining antievolutionary theories in relation to the assumptions and ideals of standard accepted science can help to clarify on what ethical and epistemological grounds most scientists come to vehemently reject antievolutionary claims as coequal rivals to the standard evolutionary account. When I assess students, I find that most, including committed

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* Chafin E.F. (2003) Accelerated decay: Theoretical Models. *Proceedings of the International Conference on Creationism 2003* (<http://www.icr.org/research>)

creationists, appreciate having a chance to examine the assumptions and beliefs about science that provide the foundations of standard accounts of evolution and the antievolutionary rivals, because it helps them reason for themselves what can be appropriately labeled as 'science'.

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Teaching about scientific dissent from neo-darwinism

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In their recent Opinion article in *TREE* [1], Eugenie Scott and Glenn Branch argue that teaching students that there is a scientific controversy about the 'validity of evolution' is 'scientifically inappropriate and pedagogically irresponsible'. In so doing, Branch and Scott assume that they have critiqued my position on the teaching of evolution. But they fail to define their terms and engage the main arguments for my position, misrepresenting it as a consequence. My position is not that students should be taught that there is a scientific controversy over the validity of evolution per se, but that they should be informed about the scientific controversies that exist about neo-darwinism, the long-dominant theory of evolution.

I recently co-authored a major law review article [2] arguing for this pedagogical proposal and have co-edited a peer-reviewed volume about the subject [3]. The book develops a comprehensive pedagogical, legal and scientific case for exposing students to the scientific controversies that exist about the key claims of neo-darwinism, including the claim that the selection–mutation mechanism can fully account for the appearance of design in biological systems. Scott and Branch mention neither of these works, although my co-editor, the distinguished Darwin-scholar John Angus Campbell, asked Scott to contribute a critical response to the book, which she declined.

Instead of engaging the arguments of these works, Scott and Branch attempt to associate our position with that of holocaust deniers and creation scientists. They also repeatedly use the perjorative term 'anti-evolutionist', thereby confusing the issue [4] and mischaracterizing the motives and rationale of those of us who want to see students informed of the scientific controversies that exist within and about aspects of contemporary darwinism.

Scott and Branch deny the existence of any significant scientific controversies about the 'validity of evolution'. But the credibility of their position depends on definitional equivocation. All reputable scientists agree that 'evolution happened', they insist. Overwhelming evidence reinforces

this opinion. And, of course, they are right if they equate 'evolution' with 'change over time' or 'descent with modification' (as they do when pressed).

Yes, life has changed over time. But, of course, neo-darwinism affirms a good deal more than that. In particular, it affirms that: (i) that an undirected processes, principally natural selection acting on random mutations, is sufficient to generate biological complexity; and (ii) all organisms have descended from a common ancestor.

Scott herself acknowledges significant scientific debate about the sufficiency of the neo-darwinian mechanism. Recently, in a public forum at the University of San Francisco, she also acknowledged that many evolutionary biologists now disagree about the truth of universal common descent. Our position, radical though it might seem, is that students should be informed about such dissenting opinion and, furthermore, that they should be told why some scientists doubt aspects of neo-darwinism.

Thus, Scott and Branch misrepresent our position when they suggest that we justify it mainly by an appeal to fairness. Teaching students about scientific controversies is less a matter of fairness (still less, to religious sensibilities as they imply) than it is a matter of full scientific disclosure. Students should know, for example, that many embryologists dispute that different classes of vertebrate embryos strongly resemble each other during their earliest stages of development [5], although many American biology textbooks claim or show the opposite in their presentations of evolution (often using misleading photos or Haeckel's famously inaccurate drawings). Students should also know that many scientists now question whether micro-evolutionary processes can be extrapolated to account for macroevolutionary innovation and that the lack of such a mechanism leaves unexplained the origin of major groups of animals, such as the Cambrian Metazoa [6].

Scott and Branch acknowledge the existence of disputes about the sufficiency of the neo-darwinism mechanism, but dismiss them as being of little consequence to the status of contemporary evolutionary theory, as if the absence of an agreed mechanism of macroevolutionary change constituted

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