BOOK REVIEWS

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DEFENDING EVOLUTION, AS STRANGE AS IT MAY SEEM[1]

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The wake-up call has been sounded many times, and yet scientists and science educators keep trying to ignore it: turning the other cheek, asleep in their ivory towers. Creationists have made steady advances since the 1960s, despite having been repeatedly and soundly defeated in the courtrooms (the last time they won a legal battle was at the Scopes trial in Tennessee in 1925). The advances are being made at the level that is farthest from the everyday concern of most evolutionary biologists: the grassroots level of junior and high school students, their parents and—astoundingly—their teachers.

As unbelievable as it may seem, poll after poll not only confirms that only about 10% of Americans believe that evolution occurs and is entirely a natural phenomenon, but that about a third of high school biology teachers rejects the theory of evolution. Worse, about 56% of science teachers nationwide disagree with or are undecided about the statement ''evolution is scientific fact.'' Even among the biology teachers who would actually like to teach evolution in their classrooms, my first-hand experience is that they simply don't know it. They are themselves the product of an educational system that focuses on *how* to teach instead of *what* to teach, with the result that they are full of innovative pedagogical ideas that they have no way of implementing because they don't know well enough the subject matter they are supposed to teach.

In the public arena, creationism is evolving rapidly. Although many Americans are still enchanted with dinosaurs such as John Morris and Duane Gish (Arthur 1994) of the oxymoronically named Institute for Creation Research, a brand new wave of intelligent design ''theorists'' has been making inroads—with the media, politicians, and even one academic press (Cambridge)—mostly because of the large influx of money from the Seattle-based Discovery Institute and the Templeton Foundation for the Advancement of Science and Religion (Holden 1999).

There is nothing scientific about scientific creationism, with its medieval claims of a universal flood that killed the dinosaurs 4,000 years ago, that the earth was created in six days a couple of thousand years earlier than that, and that there were once only two ancestral erect humans walking on this planet: Adam and Eve. Yet the degree of scientific illiteracy among the U.S. public is so great that half the population gulps down the whole story without the barest inkling of critical thinking.

However, intelligent design theory is a bit more intellectually sophisticated, relying on philosophical arguments about the alleged irreducible complexity of bacterial flagella and the ability to infer design on the basis of probability theory (appropriately misconstrued, of course). Never mind that the philosophical teeth were extracted out of intelligent design by David Hume back in the eighteenth century and that Darwin dealt it a mortal blow by identifying the first known natural mechanism capable of generating design-like structure (Pigliucci 2001; Sober, in press).

On June 14, 2001, the U.S. Senate approved legislation to reauthorize the 1965 Elementary and Secondary Education Act (ESEA). The ESEA bill is a major overhaul of federally supported elementary and secondary education programs and is a Bush Administration priority. Buried in the 796-page bill is a short amendment introduced by Senator Rick Santorum (R-PA) that sets a precedent by involving Congress in the teaching of evolution in public schools (the issue is usually debated at the state and local levels). Santorum tacked his amendment onto the Senate version of the ESEA bill as a ''Sense of the Senate,'' a nonbinding resolution that typically carries symbolic meaning but not the force of law. Ninety-one senators voted for the amendment.

The amendment sounds innocuous enough: ''It is the sense of the Senate that: (1) good science education should prepare students to distinguish the data or testable theories of science from philosophical or religious claims that are made in the name of science; and (2) where biological evolution is taught, the curriculum should help students to understand why this subject generates so much continuing controversy, and should prepare the students to be informed participants in public discussions regarding the subject.'' Heck, it sounded good enough to me that I wanted to sign onto it—until I found out a bit more about the history behind this sudden interest of the U.S. Senate in science education.

First of all, why single out evolution? Shouldn't our students also know how to evaluate other scientific theories, such as general relativity, the atomic theory, and continental drift? Second, consider the source of the amendment. According to the 18 June 2001 *Washington Times*, Berkeley law professor Phillip Johnson, an advisor to the above-mentioned Discovery Institute and a leading proponent of intelligent design creationism, said that he had ''offered some language to Senator Santorum, after [the senator] had decided to propose a resolution of this sort.'' Johnson is perhaps the most influential of the new wave of creationists and has openly declared that his long-term objective is nothing less than the

[1] *Defending Evolution in the Classroom: A Guide to the Creation/Evolution Controversy*. Brian J. Alters and Sandra M. Alters. 2001. Jones and Bartlett, Sudbury, Massachusetts. 261 pp. HB $36.95, ISBN 0-7637-1923-4.

destruction of science as we know it. Third, support for the amendment has promptly been offered by Answers in Genesis, an evangelical creationist group, which has urged its members to write to their representatives and senators in support of the Santorum initiative. Senator Sam Brownback (R-KS) hailed the amendment as vindicating the much derided 1999 decision of the Kansas School Board to eliminate the requirement for the teaching of evolution in that state's classrooms (that decision has been since repealed by a new school board). Fourth, the consequences of the Santorum amendment are already felt at the state level, where, for example, a group of citizens in New Mexico wrote to that state's Board of Education citing the Santorum wording in defense of what they consider the academic freedom of intelligent design creationists to teach this ''important'' alternative theory of life's origin.

In the midst of this appalling state of affairs it is at least encouraging to see a book such as *Defending Evolution*, by Brian and Sandra Alters, not only rejecting so much widespread nonsense, but addressing its message directly to the people on the frontline of the war: the teachers themselves. The Alters are eminently qualified to tackle the problem. Brian holds appointments at McGill University and at Harvard, and is the Director of the Evolution Education Research Centre at McGill; Sandra is a science educator and author of five science textbooks and countless chapters and features about biological education.

Considering that if one runs a search on ''evolution'' on Amazon.com a considerable number of books (especially for children!) are authored by creationists and include disheartening stories of humans and dinosaurs walking side by side à la Flintstones, it is important that scientists, philosophers, and science educators be heard on the other side as loudly as possible. But it is of capital importance that two audiences be targeted: children (e.g., with the marvelous *The Beast in You!* by M. McCutcheon [1999]) and teachers. They truly have the future of science and of the United States in their hands, and it is important that they be educated to the best of our abilities. Creationists understand this very well, which is why they litter cyberspace and bookstores with literature aimed primarily at these two audiences.

The Alters' book gives teachers a splendid introduction to what the evolution-creation war is all about. *Defending Evolution* starts by providing a brief historical background to the controversy and by offering an inside view of creationist students' culture, the main source of direct challenges that teachers now routinely encounter throughout the U.S. A second group of chapters asks the question: Why do students reject evolution? and it provides an account of their religious as well as nonreligious reasons. It is important for science educators to understand all of this because what to do and how to handle the situation depends crucially on a correct view of why we have a problem and what its many manifestations are. Too many scientists and teachers do not know anything about creationist arguments and either dismiss them out of hand (essentially propagating the all too widespread image of intellectual snobbery already attached to them) or attempt to engage in a discussion without preparation, at the risk of coming out of the encounter looking like fools for grossly underestimating the other side's arguments.

A third group of chapters in *Defending Evolution* is structured around a series of questions commonly asked by students about science education and religion. Some of these questions feel like a disheartening jump back into the pre-Enlightenment era: ''How can you teach something that no one can see?'' ''Isn't evolution a theory in crisis?'' ''Why shouldn't scientists invoke the supernatural for creation of first life?'' ''Didn't Darwin recant on his deathbed?'' or ''Are you telling me that miracles don't happen?'' Is it any wonder that the intellectual level of a large number of undergraduate students in American institutions is wanting and that these students' understanding of science and math ranks far behind most industrialized countries?

The questions asked by teachers themselves, according to the Alters, are not much more encouraging: ''Isn't it just better to deemphasize evolution?'' or ''Are creationists the only ones attacking evolution in academia?'' The answer to the latter question, incidentally, is no. Plenty of exponents of the so-called academic left who subscribe to twisted versions of post-modernism and deconstructionism have also criticized evolutionary theory for being just another social construction, not different in kind from any creation story—be that Christian or Native American (Cartmill 1998).

The last chapter of *Defending Evolution* is a brief series of practical suggestions for teachers on how to teach evolution in the classroom. Innovative activities engaging students' critical thinking are discussed and abundant references on how to implement the suggestions are given. The idea is that the best aid one can provide to teachers is a practical one: teach them how to effectively teach evolution, and the effects will ripple over hundreds of thousands of students.

Scientists and educators are finally, slowly, waking up and paying attention to the mortal danger that creationism presents for education and science. We have lost a lot of ground because of our foolish complacency, but things are now moving in the right direction. The National Center for Science Education (http://www.natcenscied.org/) has amassed a huge amount of resources to answer creationist claims and public actions. The National Academy of Science has published a booklet on the evolution-creation debate that presents the most authoritative voice so far to address the controversy. The Society for the Study of Evolution now has a permanent subcommittee of the Education committee devoted to impugn creationism and promote the study and understanding of evolutionary biology (for information, e-mail pigliucci@utk.edu).

Perhaps even more encouraging is the small but growing grassroots effort fueled by the outrage and enthusiasm of graduate students, postdocs, and faculty throughout the United States. In 1996 a few colleagues, students, and I started ''Darwin Day'' at the University of Tennessee as a reaction against yet another attempt of the state legislature to pass an antievolution law (as if we were back to the time of Scopes). Our effort to teach what science and evolution is really like has culminated four years later in the creation of an international Darwin Day organization (http://darwin.ws/day/) presided over by Richard Dawkins, which coordinates efforts in dozens of university campuses to put some sanity back into our science education.

Make no mistake about it. The evolution-creation contro-

versy is a war between intolerant and ignorant ideology on one side and open-ended inquiry on the other, a war that has already spread to other scientific disciplines such as geology, physics, and cosmology. It will not go away and it will drain large resources of time and money from many scientists and educators for decades to come. And yet, if we do not invest those resources to guarantee the future not just of evolutionary biology, but of science and education as well, we may find ourselves in a very sorry state of affairs where ''God did it'' will again become an acceptable answer to fundamental questions, closing the minds of our youth and pushing the United States into a degree of literacy comparable with that of modern theocracies. *Defending Evolution* is not just a book, it's a call to all who care about science education to wake up and smell the coffee, before it's too late.

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