

# Evolution: what's wrong with 'teaching the controversy'

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**A new slogan in the fight against evolution education in the USA and elsewhere is 'teach the controversy'. Although there are scientific controversies about the patterns and processes of evolution that are appropriate topics for the science classroom, and there is a continuing social controversy in certain circles about the validity of evolution, it is scientifically inappropriate and pedagogically irresponsible to teach that scientists seriously debate the validity of evolution.**

Antievolutionists swarmed out of the woodwork recently, as Ohio prepared to adopt new statewide science education standards – guidelines that specify what scientific knowledge and abilities students in the state's public schools are expected to acquire – that accorded a central place to evolution. The situation in Ohio is not unusual for the USA. Although there is no serious dispute among scientists about the scientific credentials of evolutionary biology, a significant proportion of the American public rejects evolution on religious grounds. A recent survey, for example, noted that polls conducted over the past 20 years consistently show a plurality (45% in February 2001) of Americans agreeing with the statement: 'God created human beings pretty much in their present form at one time within the last 10 000 years or so' [1]. Correspondingly, there is a sizeable antievolutionist movement in the USA and other countries (Box 1), characterized by its acceptance of what we elsewhere call the three pillars of antievolutionism: (1) evolution is a theory in crisis; (2) evolution is incompatible with Christianity; and (3) it is only fair to teach both evolution and its alternatives [2].

## Teaching the controversy

What was new in Ohio was the unrelenting antievolutionist emphasis on a variant of the third pillar: the idea that evolution is 'controversial' and, therefore, it is appropriate to 'teach the controversy' about evolution in high school science classes. (In the USA, evolution is typically not studied in any detail before high school.) In a piece entitled 'Teach the controversy', Stephen C. Meyer of the Discovery Institute's Center for Science and Culture, the institutional home of the 'intelligent design' variety of antievolutionism, writes, 'good pedagogy commends this approach. Teaching the controversy about Darwinism as it exists in the scientific community will engage student interest. It will motivate students to learn more about the

biological evidence as they see why it matters to a big question' [3]. The thought does not originate with the 'intelligent design' movement, however. The Institute for Creation Research (ICR), the oldest major antievolutionist organization in the USA, recommends that students and teachers be 'encouraged to discuss the scientific information that *supports* and *questions* evolution and its underlying assumptions, to promote the development of critical thinking skills' (emphasis in original) [4]. The intent is not to have students investigate controversies about patterns and processes within evolutionary theory, but to debate whether evolution occurred.

Presenting all sides of a controversial issue appeals to popular values of fairness, openness and equality of opportunity. It thus plays well with the public. But it is important to examine any such appeal carefully, because it is easy to abuse the public's willingness to be swayed by such a call. Consider the following appeal: 'students should be encouraged to investigate the [...] controversy the same way they are encouraged to investigate every other historical controversy. This isn't a radical point of view. The premises for it were worked out some time ago during a little something called the Enlightenment' [5]. If the rhetoric strikes you as plausible, let us supply the word we omitted: 'Holocaust'. If so vicious and sordid a movement as Holocaust denial is enamored of the call to teach the controversy, and uses it with a degree of success on college campuses [6] [7], it is clear that not all supposed controversies ought to be taught. How is a teacher to decide which controversies are pedagogically valuable (Box 2)?

## Criteria for determining which controversies to teach

We suggest the following five criteria for determining whether a controversy is appropriate to teach in a public school science class:

### 1 *The controversy ought to be of interest to students*

There is, for example, a raging scientific controversy over whether maximum likelihood or parsimony ought to dominate in phylogenetic interpretation. But we suspect that few students will be fascinated by the controversy, however dear it might be to the readers of *TREE*.

### 2 *The controversy ought to be primarily scientific, rather than primarily moral, social or religious*

The controversy over stem cell research, for example, is not about whether embryos can be manipulated to produce stem cells, but about whether it is morally permissible to do so. Questions about the morality of such research are of

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### Box 1. Antievolutionism around the world

The USA remains the bastion of antievolutionism. But antievolutionist propaganda produced in the USA – by the Institute for Creation Research (ICR), Answers in Genesis (AiG), and the Discovery Institute’s Center for Science and Culture, to name only the three most conspicuous antievolutionist organizations – is exported overseas, so readers of *TREE* who are not resident in the USA have no reason for complacency.

Antievolutionism is viewed as a useful tool for evangelism by many creationists. A case in point is AiG, which publishes creationist materials not only in English, but also in Afrikaans, Albanian, Chinese, Czech, French, German, Italian, Japanese, Polish, Portuguese, Romanian, Russian and Spanish. In the UK, under AiG’s influence, ‘creationist teachers at the city technology college in Gateshead are undermining the scientific teaching of biology in favour of persuading pupils of the literal truth of the Bible’ [17]; the sponsor of the college plans to open several more schools at which creationism will be taught [18]. Creationist evangelism occurs elsewhere, if not always so publicly. In the former Soviet Union, for example, evangelical Christian literature is a convenient source of instruction in English, and Russians eager to learn English frequently absorb antievolutionism along with syntax and vocabulary.

Antievolutionist material originating in the USA is also frequently adapted by overseas creationists who might not agree with the particular religious views of its originators. The most astonishing example involves overseas creationists who are not even Christians [19]. In Turkey, Bilim Arastirma Vakfi (BAV; the name translates as Science Research Foundation) produces a series of slick creationist books that rely on the ICR’s products. As the Qur’an and Islamic tradition insist on neither the young age of the Earth nor the global extent of Noah’s Flood, these elements of the ICR’s belief system are absent from its literature. Yet BAV evidently finds the rest of the ICR’s material useful, and thus employs it, with the ICR’s blessing.

The USA does not drive all of the rest of the world’s antievolutionary activity. Antievolutionists overseas become major players in their own right and then are welcomed by the legions of antievolutionists in the USA. The German creationist Siegfried Scherer is a Fellow of the Center for Science and Culture; his compatriot Werner Gitt works closely with AiG. Condemnations of evolution by BAV have been reproduced with approval on young-Earth creationist websites. Perhaps most significantly, AiG, now the largest creationist organization in the USA, is actually run by a group of creationists from Australia and New Zealand. (Adapted from [20].)

course important, but they are not suitable for a science class. Controversies that are primarily religious in nature are especially unsuitable for classes in public schools in the USA, owing to the Establishment Clause of the First Amendment to the Constitution, which prohibits the government from sponsoring religious advocacy.

*3 The resources for each side of the controversy ought to be comparable in availability*

It is difficult to teach the controversy if there is hardly anyone to make the case for one side of it. A teacher who decided to teach the controversy about geocentrism, for example, would find it difficult to locate resources for the geocentric side. (It would, however, be appropriate to teach about the 17th-century controversy as an historical digression.)

*4 The resources for each side of the controversy ought to be comparable in quality*

If the arguments for one side of a controversy are generally poor, then students are not likely to profit by studying it. The scientific evidence that AIDS is caused by a virus, for example, is so strong that there is little point in presenting opposing views.

*5 The controversy ought to be understandable by the students*

Most of the fascinating controversies over the role of epigenetic factors in development, for example, require a great deal more developmental, morphological and genetic training than a high school student can be expected to master in the time available.

Using these criteria, is the antievolutionists’ controversy about evolution one that is worth teaching? We think not. It does satisfy criterion 1: it is probably of interest to students. It also satisfies criterion 3, thanks both to the wide availability of creationist material on the internet and to the advent of ‘intelligent design’, which enjoys a degree of publicity in relatively mainstream venues, although conspicuously not in the peer-reviewed scientific literature [8]. However, the controversy about evolution fails significantly to satisfy the other three criteria.

First, the controversy is not primarily scientific (criterion 2). In spite of their frequent claims to be concerned with the science, for young-Earth creationists (such as the ICR) and the ‘intelligent design’ movement alike, the science is essentially a smokescreen for nonscientific concerns. For the ICR, the problem with evolution is its incompatibility with a literal reading of the Bible; for the ‘intelligent design’ movement’s guru Phillip Johnson, ‘[t]his isn’t really, and never has been, a debate about science. It’s about religion and philosophy’ [9]. Moreover, as far as students are concerned, the controversy about evolution is essentially religious. Are they going to be able to restrict their concerns solely to the science? Even many college students have difficulty studying religion objectively; at the pre-college level, the problem is worse. And are science teachers willing and able to respond properly to their concerns, without appearing to attack religious beliefs? (Ironically, there are young-Earth creationists who are also worried: ‘would

### Box 2. ‘Teaching the controversy’ not a pedagogical concept

In spite of Meyer’s claim ‘When two groups of experts disagree about a controversial subject that intersects the public school curriculum students should learn about both perspectives. ...Educators call this “teaching the controversy”.’ [3], educators themselves appear not to take teaching the controversy seriously. A search of the Educational Resources Information Center (ERIC) for ‘teach the controversy’ and ‘teaching the controversy’ results in only 104 hits, with no apparent connection among them and no particular relevance to evolution education. ERIC is the

largest educational data base in the world, indexing over a million journal articles, research reports, curriculum and teaching guides, conference papers and books. If teaching the controversy were a genuine pedagogical concept with general applicability, it would be prominently reflected in ERIC. It is not. By contrast, a search for the terms ‘constructivism’ and ‘constructivist’ yielded 3824 hits, but then constructivism is a legitimate pedagogical approach. For a discussion of constructivism in evolution education in particular, see Box 3.

Christians want an atheistic teacher to be forced to teach creation, and deliberately distort it?' [10].)

Second, and correspondingly, the scientific quality of the antievolutionist resources is exceedingly poor (criterion 4). The positive claims of young-Earth creationism – that the universe and the Earth were created ~10,000 years ago, that the Earth was inundated by Noah's Flood, and that all living things were created by God to reproduce 'after their kind,' thus setting limits on evolution – are unanimously rejected by the scientific community. The negative claims by young-Earth creationism (the 'evidence against evolution') typically involve either misinterpretation of the scientific literature or arguments from ignorance. The 'intelligent design' variety of antievolutionism is strategically noncommittal, limiting its positive program to the claim that it is possible to identify certain natural phenomena as the products of intelligent design; its proponents disagree about the age of the Earth, common ancestry and a host of other important scientific issues. Its negative claims are already in the repertoire of young-Earth creationism, so the same objection applies.

Finally, students are unlikely to be able to understand both sides of the controversy (criterion 5). The evidence for evolution is easy to understand, at least on a basic level. But the antievolutionist critique of evolution ranges freely and opportunistically through the scientific literature, from astronomy to zymurgy, frequently misrepresenting it in the process [11]. Faced with the ICR's tendentious and eclectic list of 'questions that could be used to critically examine and evaluate evolutionary theory' [4] or the 'Suggested Warning Labels for Biology Textbooks' produced by 'intelligent design' proponent Jonathan Wells [12], even a working research scientist would have a difficult time sorting through the quagmire of misleading and mistaken claims. It is unreasonable to expect teachers, much less their students, to do so.

### Fairness falsely so called

Although 'teaching the controversy' sounds fair, it is unfair to pretend to students that a controversy exists in science where none does. It is unfair to students to miseducate and confuse them about the nature of the scientific process.

Furthermore, there is a fundamental unfairness about the antievolutionist position, which, in essence, is trying to circumvent the normal process of peer review by which scientific ideas work their way into the science curriculum. As Lawrence Krauss, a physicist at Case Western Reserve University who was prominent in the recent struggle to protect the Ohio state science standards from antievolutionist attack, described his opponents, 'They use language that sounds sensible. "We just want fairness," they'll say. "We just want an equal playing field for our ideas." The point is they already have an equal playing field – the field of science. They can submit their ideas to journals, and get peer reviewed, and if their ideas are any good they'll make it into the scientific canon, and make it down into the high schools. What they want is something completely unfair, to bypass the whole process and go directly to the high school students' [13].

To encourage fairness, the antievolutionists who advocate teaching the controversy have taken to citing a passage from Darwin himself, 'A fair result can be obtained only by fully stating and balancing the facts and arguments on both sides of each question' [14]. As is common in what passes for scholarship among antievolutionists, the passage in context provides no support for their position: Darwin's sentence ends, 'and this cannot possibly be here done' – Darwin is merely apologizing for not 'publishing in detail all the facts, with references, on which my conclusions have been grounded' in the *Origin of Species*, which he regarded as a mere abstract of his planned (and never completed) *Natural Selection* [15]. Moreover, antievolutionists such as Meyer offer no reason to think that the appropriate arena in which to search for a fair answer to a scientific question is the science classroom. The National Science Teachers Association, for its part, correctly regards the question of evolution as already settled in the relevant arena – the scientific community – and recognizes that 'evolution is a major unifying concept of science and should be included in [kindergarten]–college science frameworks and curricula' [16].

### Prospects

To recapitulate: there are indeed controversies within evolutionary biology about the patterns and processes of

### Box 3. Constructivism in evolution education

The essence of a constructivist approach to science education is to provide a learning environment in which a student is helped to work through his or her previous misconceptions, building a coherent new understanding based on accurate scientific information. In a recent paper, Brian J. Alters and Craig E. Nelson explore a constructivist approach to evolution education in particular, arguing that to teach evolution properly, it is necessary to help students to examine the adequacy of their previous conceptions about evolution ('since', as they wryly remark, 'many students have had ample formal and informal educational opportunities to misunderstand evolution' [21]). Instructors need to be aware that students tend to hold Lamarckian conceptions of adaptation, regard evolution as occurring at the individual rather than the species level, and think of fitness in terms of health or strength rather than reproduction [22]; it is also helpful to distinguish explicitly between vernacular and scientific uses of certain key concepts (such as cause, purpose, design and chance) that it is antievolutionism's stock in trade to conflate [23].

Adopting a constructivist approach presents a challenge to teachers: it requires careful preparation and thought, and is also likely to consume extra classroom time. But it promises to improve students' understanding of evolution, and because, as Dobzhansky [24] memorably explained, 'Nothing in biology makes sense except in light of evolution', it is a worthwhile project. What is clearly inappropriate, however, is the approach blithely suggested by a few evolutionary biologists. Dawkins, for example, writes, perhaps not entirely seriously, 'By all means let creation science be taught in the schools. It should take all of about 10 minutes to teach it and then children can be allowed to make up their own minds in the face of evidence' [25]. And Provine offers 'a suggestion for evolutionists. Include discussion of supernatural origins in your classes, and promote discussion of them in public and other schools. Come off your high horse about having only evolution taught in science classes. The exclusionism you promote is painfully self-serving and smacks of elitism' [26]. The attitudes of Dawkins and Provine might be good for a chuckle (or a curse), but are not suited to promote good science education.

evolution that are appropriate topics for the high school science classroom, and such controversies are indeed taught. Insofar as the creationism–evolution controversy is a salient aspect of the social scene, teaching about the controversy would be appropriate in classes on history, social studies, or comparative religion. [And, because students are not likely to draw sharp disciplinary boundaries, it might, on occasion, be appropriate to mention antievolutionism briefly in a science class, if only to say that religious objections to evolution exist but are not within the scope of the class. It is also important for teachers to understand such objections (Box 3.)] But what the antievolutionists seek to have students study is not the scientific controversies within evolutionary biology or the social controversies about evolutionary biology. Rather, conflating the two, they pretend that there are scientific controversies about whether evolution occurred.

The story in Ohio with which we began ends happily. The final version of the state science standards requires Ohio's students to be able to '[d]escribe how scientists continue to investigate and critically analyze aspects of evolutionary theory'. But there is no suggestion that the antievolutionist propaganda of young-Earth creationists, such as those at the ICR, is part of the continuing scientific work on evolution, and 'intelligent design', as promoted by the Discovery Institute, is mentioned as something that is specifically not part of the continuing scientific work on evolution. That is just as it should be. But the antievolutionist slogan 'teach the controversy' is bound to appear again, and it is important to know what is wrong with it.

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#### References

- National Science Board, (2002) *Science and Engineering Indicators – 2002*, National Science Foundation
- Scott, E.C. and Branch, G. (2003) Antievolutionism: changes and continuities. *Bioscience* 53, 282–285
- Meyer, S.C. (2002) Teach the controversy. *Cincinnati Enquirer* 30 March, D3
- Buckna, D. and Laidlaw, D. (1996) Should evolution be immune from critical analysis in the science classroom? *Impact* 282, 1–4
- Smith, B. (1992) *The Holocaust Controversy: The Case for Open Debate*, Committee for Open Debate on the Holocaust
- Shermer, M. and Grobman, A. (2000) *Denying History: Who Says the Holocaust Never Happened and Why Do they Say it?*, University of California Press
- Lipstadt, D. (1993) *Denying the Holocaust: The Growing Assault on Truth and Memory*, The Free Press
- Forrest, B. (2001) The wedge at work: how intelligent design creationism is wedging its way into the cultural and academic mainstream. In *Intelligent Design Creationism and its Critics: Philosophical, Theological, and Scientific Perspectives* (Pennock, R.T., ed.), pp. 5–53, The MIT Press
- Belz, J. (1996) Witnesses for the prosecution. *World* 11, 18
- Sarfati, J. (2002) *Refuting Evolution 2*, Master Books
- Branch, G. (2002) Analysis of the Discovery Institute's 'Bibliography of Supplementary Resources for Ohio Science Instruction'. *Rep. Nat. Cen. Sci. Edu.* 22 (4), 12–18.23–24
- Wells, J. (2000) *Icons of Evolution: Science or Myth?*, Regnery
- Benen, S. (2002) Insidious design. *Church State* 55, 8–13
- Darwin, C. (1859) *On the Origin of Species*, John Murray
- Desmond, A. and Moore, J. (1991) *Darwin: The Life of a Tormented Evolutionist*, Warner Books
- National Science Teachers Association, (2000) *The Creation Controversy & the Science Curriculum*, NSTA Press
- Brannigan, T. (2002) Top school's creationists preach value of biblical story over evolution. *Guardian* 9 March, 3
- Brannigan, T. (2003) Dawkins attacks 'educational debauchery' of creationist schools. *Guardian* 29 April, 6
- Edis, T. (1999) Cloning creationism in Turkey. *Rep. Nat. Cen. Sci. Edu.* 19 (6), 30–35
- Branch, G. (2002) Antievolutionism around the world. In *Darwin Day Collection One: The Single Best Idea, Ever* (Chesworth et al., eds), pp. 381–385, Tangled Bank Press
- Alters, B.J. and Nelson, C.E. (2002) Teaching evolution in higher education. *Evolution* 56, 1891–1901
- Alters, B.J. and Alters, S.M. (2001) *Defending Evolution in the Classroom*, Jones & Bartlett
- Scott, E.C. (1999) Problem concepts in evolution: cause, purpose, design, and chance. The evolution–creation controversy II: perspectives on science, religion, and geological education. *Paleo. Soc. Pap.* 5, 169–181
- Dobzhansky, T. (1973) Nothing in biology makes sense except in light of evolution. *Am. Biol. Teach.* 35, 125–129
- Dawkins, R. (1997) The 'Alabama insert': a study in ignorance and dishonesty. *J. Alabam. Acad. Sci.* 68, 1–16
- Provine, W.B. (1993) Scientific supernaturalism. *Biol. Philos.* 8, 111–124

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