

A Textbook Case

[After some spirited debate between myself and Robert Devor (a science teacher from a high school in Texas), I received a Xerox of the following article from BSCS, a textbook publishing company]:

THE TEACHING OF EVOLUTION: BSCS RESPONDS TO A STUDENT'S QUESTIONS

During any given year, BSCS receives thousands of inquiries about its programs, and a fair amount of feedback about its content and instructional strategies. Although we receive our share of compliments, people also write to complain, and they complain most frequently--still--about the treatment of evolution in our programs.

Since the original BSCS textbooks (Blue, Green, and Yellow Versions) put evolution back into the curriculum in the early 1960's, BSCS has been in the middle of an ongoing controversy that has nationwide implications for the content of the curriculum, the control of public education, and even interpretations of the Establishment Clause of the First Amendment to the U.S. Constitution. We have been embroiled in battles that have ranged from local schools and state textbook adoptions, to the national media and the federal courts. Sometimes we have lost, but we have never backed down; we have done our best to protect the integrity of science teaching and to represent evolution as the central organizing theme of biology.

We spend a fair amount of time dealing with creationist complaints and challenges to our programs. Many of those challenges are well-organized, spearheaded by local, regional, or national groups that oppose the teaching of evolution, often as one part of a larger social and political agenda. Among the most interesting critiques we receive, however, are those from students. Such critiques often reiterate misinformation that students have acquired from adults, either formally or informally. Our responses provide opportunities to correct the misconceptions that these young people hold about evolution and about the nature of science. The letter on page 2, written by a high school student who is using the BSCS Green Version, is illustrative. My response follows.

It is difficult to quantify the amounts of time and money we spend responding to attacks on the teaching of evolution, but they are not trivial. Neither, however, are the principles at stake, especially where students are concerned.

Joseph D. McInerney
Director, BSCS

[the letter from the student follows]:

BSCS

Colorado Springs, Colorado,

To whom it may concern:

I am a high school student and am currently enrolled in a biology class. In this class, we are using your books entitled "Biological Science: An Ecological Approach. In chapter 9 ("Continuity Through Evolution"), you presented your ideas about the theory of evolution as fact instead of theory, or in some of the cases, idea. This is prohibited by law, especially if the teacher present sit as a fact. Most of my classmates feel the same way I do. I encourage you to do further research on this subject, especially since Charles Darwin died a Christian. It is not the only process that explains where all living creatures come from, as stated in the book. In closing, please reword this chapter so as not to make any student or teacher actually think that a theory based on teeth and bone fragments (much less head size) is a fact. I thank you for your time.

Dear Student:

Thank you for your letter about the treatment of evolution in our program "Biological Science: An Ecological Approach." I appreciate your taking the time to write, because your letter provides an opportunity to explain our treatment of evolution and to clarify some central misconceptions you hold about this extremely important topic.

1. You are concerned that our "ideas about the theory of evolution [are presented] as fact instead of theory, or in some of the cases, idea." Two points are critical here.

First, the fact of evolution--the fact that species have changed during the immensely long history of life on earth--is not in dispute among scientists. This fact was obvious to many scientists before the time of Darwin, and its validity is clear to anyone who examines the fossil record. There is some disagreement within the scientific community about the exact mechanisms by which evolution occurs. For example, there is some dispute about the nature of adaptation and about the pace of evolutionary change. Such internal disputes, however, are characteristic of science, irrespective of the discipline, and they do nothing to challenge the validity of evolutionary change as an established fact.

Second, your sharp contrast between "theory" and "fact" leads me to suspect that you do not yet understand the concept of theory in science. The public often confuses the term "theory" with the notion of a guess, akin, for

example, to my "theory" about why the Denver Broncos will not win the Super Bowl next year (they need a better offensive line). In contrast to its connotations among the general public, a theory in science is not a guess. It is, rather, an extremely sound conceptual framework that explains numerous observations and experimental results and that generates fruitful scientific hypotheses. Science has a number of great theories: gravitation, the germ theory of disease, atomic theory, plate tectonics, electromagnetism, the chromosome theory of inheritance, cell theory, and evolution. All of these theories are supported by a huge amount of data collected and verified by the methods of science. The fact that scientists refer to these compelling conceptual frameworks as "theories" does not detract from their validity or their explanatory power; the problem is with the public's confusion about what the term means.

2. You have said that the presentation of evolution as fact rather than as theory "is prohibited by law." This emphatically is not the case. Indeed, as the enclosed material on the legal history of the evolution/creation controversy indicates, exactly the opposite is true. One cannot legally prevent the teaching of evolution (as a fact or theory). It is, however, illegal to mandate the teaching of creationism, a doctrine that is rooted in religious beliefs and whose promotion in a public school, therefore, represents a violation of the Establishment Clause of the First Amendment to the United States Constitution which guarantees separation of church and state (see the enclosed copy of the First Amendment).

As the enclosures indicate, several states or counties have enacted or proposed regulations and legislation designed to weaken the treatment of evolution and to promote religious perspectives about life on earth. These attempts are foolish, generally erroneous, and almost certainly unconstitutional.

3. You have encouraged BSCS "to do further research on this subject, especially since Charles Darwin died a Christian." Again, two points are important here.

First, BSCS materials are developed and reviewed by well-trained, knowledgeable biologists. Our programs often are cited as among the best in the United States because of their accuracy and currency. The treatment of evolution--and Darwin--in our programs is consistent with the most widely accepted, up-to-date thinking in the biological community, interpreted at a level appropriate for high school students. You might find some minor errors of fact, but you will find no major faults in the conceptual basis of the biology presented in the program you are using.

Second, whether Charles Darwin "died a Christian" is irrelevant to the validity of the insights he produced, to our presentation of those insights, or to the confirmation of his views by sound research since the publication of "On the Origin of Species by Means of Natural Selection," in 1859. Science does not, indeed cannot, address issues related to religion. Religion is a system

rooted in revealed, unquestioned knowledge and faith; it is based in the supernatural. Science assumes that the universe is explainable without appeals to supernatural events; it depends on knowledge constructed by rational analysis and it is driven by data. Irrespective of his or her religion, a scientist must go where the data indicate, even if the destination calls into question long-standing, comfortable myths such as the Genesis story of creation.

Your statement that "[evolution] is not the only process that explains where all living creatures came from" is germane here. You are quite correct; evolution is not the only process to explain that phenomenon. It is, however, the only scientific process that makes sense and that meets the requirements of a scientific explanation. Others can propose or accept other, non-scientific explanation; that is their right. Our objective, however, indeed our obligation, is to present sound science. Creationism has absolutely no basis in science and we do not, therefore, treat it as a scientific explanation for the origin or diversity of life on earth.

4. You question whether "a theory based on teeth and bone fragments (much less head size)" can serve as an adequate explanation for life on earth. Whether you choose to accept it or not, the evidence for the relatedness of all species by descent with modification is overwhelming. Some of this evidence is derived, as you indicate, from the fossil record. Some is derived from fields such as comparative anatomy and developmental biology, which compare structures, functions, and developmental programs among living representatives of closely related species. Additional evidence comes from cell biology, biochemistry, genetics, and molecular biology. Virtually all life on earth, for example, shares the same central information molecule-- DNA. The sequence of DNA bases in humans and chimpanzees--our closest living relative--is about 99 percent identical.

In short, in the words of paleontologist Niles Eldredge, "all life shares a single, complex history." That history is written in the genes in every cell in your body, and it tells the story of biological diversity produced by descent with modification, with natural selection as the prime mover over enormous expanses of time. You may choose to embrace other explanations, but again, I caution you to be aware of those that meet the requirements of science and those that do not.

I have provided a number of enclosures that may help you understand some of the perspectives I have outlined above. I also have sent a copy of this letter and its enclosures to the biology department at your school so that the biology teachers there can read my response to your concerns. This may help them address questions from your classmates, who, you state, share your concerns.

I thank you again for writing, and I commend you for challenging material with which you disagree. I trust the foregoing information and the enclosed materials will help you understand my views and those of BSCS. Please do not hesitate to contact me should you

have additional questions. I travel to your area on occasion and would be happy to visit your school to explain my views in more detail. Alternatively, you might wish to contact one of the many fine biologists at your local university for more information about evolution.

Best regards,

Sincerely,

Joseph D. McInerney
Director, BSCS

**CHALLENGES TO THE TEACHING OF EVOLUTION:
WHERE TO GO FOR HELP**

BSCS recommends that educators who need information and support for teaching evolution and for preventing the insertion of religious doctrine into the science classroom contact the National Center for Science Education, Berkeley, California. Founded in 1983, the center engages in activities that advance two primary goals: improving and supporting evolution education, and assuring inclusion of evolution (and not sectarian "creation science") in public school curricula.

You may access information from NCSE at the following addresses or telephone numbers: P.O. Box 9477, Berkeley, CA 94709-0477; (800) 290-6006; FAX: (510) 526-1675; ncse@natcensci.ed.org; or <http://www.natcensci.ed.org>.

The National Association of biology Teachers has published a statement of the teaching of evolution that provides helpful guidance for teachers and administrators (see the January 1996 issue of "The American Biology Teacher" [Vol. 58, No. 1]). The National Academy of Sciences is producing two new documents on the evolution/creation issue that will be available later this year. For information, contact Patrice Legro, National Research council, 2101 Constitution Avenue, NW, HA 450, Washington DC, 20418 (plegro@nas.edu).

My response to them was as follows:

Gary Kukis

Dear Humble Science faculty,

I was lucky enough to receive the following informational xerox from one of you (I guess?). I appreciated receiving this, as I too found it tragic that not only did this particular author (who is probably not an author, a scientist or even a teacher, but merely a hawker of textbooks) set up a straw man defense to begin with, and then took his straw man down using a battery of half-truths, lies and deceptions. It is unfortunate that a person who alleges to have such a high regard for intellectual integrity and the first amendment would resort to using duplicitous arguments. I was glad that one of you brought this article to my attention even though it was probably embarrassing to you to have this text book hawker take his stand as a defender of evolution.

What I would most appreciate is if I get the address of this particular book publisher or distributor so that I could redress his poorly-crafted arguments so that in the future his firm see to it that someone more knowledgeable in the field of evolution and who has a lot more personal integrity could handle the questions and objections concerning evolution, and thereby not be an embarrassment to those of you who believe in evolution (I understand how you feel, as I witnessed a debate on evolution many years ago and one of those who sat on the side of the creationists not only had nothing to say, but every time he opened his mouth, I cringed at his lack of knowledge in the field and general goofiness). I am sure that we both felt rather queasy at the condescending attitude of this man to have the gall to send a copy of the First Amendment to this high school student.

I have enclosed a copy of the letter which I intend to send to him. Like many of you, I don't mind a good-spirited, well-thought out debate, as Bob and I had in our little school newspaper; but I know we're all appalled when someone like the author of this article either has no qualms about misrepresenting the truth or doesn't know enough to have a legitimate opinion.

Sincerely,

Gary Kukis

