

EDITORIAL Addressing Evolutionary Concerns

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John Moore, in “From the President” in the February issue (Vol. 71, No. 2, p. 68) asks the question “Why is evolution singled out?” (as an area of social dispute and educational controversy). His answer is the lack of scientific understanding of evolution and the nature of science by some teachers, as well as the public at large. Unfortunately this is true.

One particularly troublesome aspect of this problem is that understanding and accepting evolution requires a sense of scale and ability to comprehend the very large numbers of years that represent deep time.

Yes, we teach powers of 10 as early as in middle school mathematics but are numbers as great or greater than 10^6 really understood? To those who are numerically challenged, a million may as well be a billion or a trillion. For example, one has to wonder if the magnitude of a number such as 10 trillion dollars (our national debt) or an 800 billion dollar government economic stimulus are understood by a majority of adults, let alone high school students. Why is this? It is possible that the sense of scale

and the use of large numbers is not taught well in school, particularly to those students who are concrete operational. For non-formal operational students, large numbers need to be experienced, not just discussed, to provide a fuller understanding.

Here are a couple of suggestions. One is to have your students watch the very clever 1977 film, *Powers of Ten* produced by Charles and Ray Eames. A computerized simulation of *Powers of Ten* can be viewed conveniently on YouTube at <http://www.youtube.com/watch?v=A2cmlhfdxuY> or you can purchase your own DVD for about \$22 at <http://www.amazon.com/Films-Charles-Ray-Eames-Powers/dp/6305943877>. This production is very visual and can be a highly engaging teaching tool. It needs to be shown several times with some teacher explanation because it contains a lot of information. When it can be viewed again at the point where students can explain the concepts to each other, there is a good chance they understand scale and powers of 10.

Another idea is to have your students try the activity “How Many Years is Five

Billion?” that appears in this issue as a Quick Fix (see the following page). This is an attempt to develop a deeper understanding of large numbers through direct experience. In this activity, students generate many dots by tapping on a paper for 10 seconds and progressively multiply that number by several units of time. Eventually they achieve a number that is close to five billion or approximately the number of years that life has been on Earth. The activity only takes about 20 minutes and can be done in class or at home with a friend or family member who can serve as a timekeeper.

These two activities should help students develop a more thorough understanding of scale and large numbers as they relate to deep time, all of which are essential to understanding, and therefore accepting, the scientific basis of evolution. Perhaps engaging in these activities will also help to reduce unwarranted and unscientific criticism of evolution.

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LETTERS The Goal of Teaching Evolution ...

The article “Seeing May Not Mean Believing: Examining Students’ Understanding & Beliefs in Evolution” by Ann Cavallo and David McCall (November/December, 2008) was extremely interesting. I am two years retired from 41 years of teaching Biology, AP Biology, General Science, Anatomy & Physiology, and Chemistry at the middle school, high school, and two year college levels.

In the early years of my career I, like many other biology teachers, struggled with the idea of teaching evolution partly because my own strong Christian beliefs often conflicted with many of Darwin’s ideas; yet evidence for evolution, especially microevolution, was overwhelming. Many of my colleagues simply avoided the subject entirely. Over the years I tried many approaches and techniques and usually felt inadequate before, during, and after. I

have been a member of NABT since 1990 and read with interest every article about the topic, especially the ones that involved teaching strategies. I always felt that evolution was not only the most misunderstood topic in biology by my students and the general public (and perhaps myself, too) but also the most controversial. However, I probably never made the connection that my students’ lack of understanding of evolutionary theory was probably related to their limited knowledge of the nature of science. That too was an area of student weakness that was quite evident but I must confess that in the early years of my career, I, following many textbook authors of the time, taught my students that a hypothesis was an “educated guess” and that a theory was a hypothesis that had stood the test of time. Perhaps that also reflects deficiencies in undergraduate science and

education courses of the 1960s and 1970s. Fortunately, many deficiencies were corrected by outside sources such as contributors to the NABT Journal, graduate and post graduate classes, and teaching seminars.

I completely agree that the goal of teaching evolution should not be to change personal beliefs but to foster an understanding of evolutionary theory. Do we as teachers want to change students’ beliefs on religion and risk total alienation of evolution and other concepts of science or do we want to broaden their understanding of evolution and the nature of science? I also agree with those writers who believe that the choice is not an either/or situation.

In summary, I congratulate the authors of the aforementioned article and the editor for printing it. I regret that such an article didn’t appear many years earlier.

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