

Universe and Child: Presiding Over the Meeting

Ann Berry Somers, Department of Biology, University of North Carolina at Greensboro
Greensboro, N.C. 27402-6170

*It takes a universe
to make a child both
in outer form and inner spirit.
It takes a universe
to educate a child.
A universe to fulfill a child.*

*Each generation presides over the meeting of these two in the
succeeding generation...*

~ Thomas Berry

Thomas Berry's poem "It Takes a Universe to Make a Child" presents a challenge for those of us teaching science to consider more deeply the how and why of our approach to the subject of evolution. There are many routes to the same destination and the poem lays out the destination: To acknowledge and celebrate the story of the Universe, to see ourselves as expression of that story, and to seek meaningful roles for ourselves and our species within the context of such a magnificent unfolding. The college-level science professor has an especially important role in presiding over the meeting of the child and the Universe. How we approach this subject can make a difference in how our students perceive themselves, their work, and the direction of their lives. The route the college professor chooses for this journey can launch students into a joyous experience and immense satisfaction and excitement about continuing learning, or it can altogether suppress their desire to learn more about evolution.

It is no surprise to those of us in science in the South that evolution is not well accepted (Item #1 Appendix) and teaching evolution in the South and other regions commonly known as the Bible Belt has been controversial for many years. Many veteran high-school teachers lack content knowledge or are still afraid to teach the topic (Bailey and Bailey 2007), hence students arriving in our college classrooms often have an incomplete or distorted understanding of evolution or its status in the scientific world.

I suspect that college students across the spectrum from non-majors, to secondary science education majors, to biology majors have an abbreviated introduction to the subject of evolution, inadequate for the contemplation of its implications for living, life, or the future of life. At our institution, evolution falls into the second semester of a two semester series, often scheduled near the end of the spring term when instructors are especially stressed for time. Interestingly, this is also where ecology, biodiversity, and conservation are placed in the syllabi. Cellular, molecular, and developmental biology have precedence in the curriculum.

Local high-school science teachers have reported to my colleagues in science education that they did not received adequate instruction about evolution in their college biology classes and did not

discuss evolution in their teaching-science methods classes. Some of them tested out of prerequisite courses in biology where evolution is explicitly covered, albeit briefly, and have advanced to upper level courses where evolution is implied in most of the material, but rarely is addressed specifically.

I teach a large-enrollment non-majors biology course every semester (250-300 students) that fills a general education requirement for the College of Arts and Sciences at UNC-Greensboro. These students are at all levels of their undergraduate experience, but enrollment is weighted towards the earlier years (Sp11: 35% freshmen, 35% sophomores, 19% juniors, 11% seniors). Incoming freshmen at UNCG have an average SAT score of 1044/1400. After my first few years of using traditional techniques for teaching evolution, similar to the way it is presented in most textbooks, I shifted my pedagogical strategy considerably.

Now my course is essentially about the physical and biological story of the Universe. Evolution is taught as a process that begins at the beginning of the Universe and continues today. Early on, students are charged with focusing on the question “*Why is the statement ‘It takes a Universe to make a child’ literally true?*” The techniques I use are somewhat similar to those of Nelson (2008) and involve 1) active participation, 2) focusing on scientific and critical thinking rather than content, 3) directly addressing misconceptions and student resistance, especially as it relates to Young Earth Creationism, the form of creationism which holds that the Earth and the Universe are approximately 6000 years old. I expose students to the topic first in a unit I call The Nature of Science prior to laying out the evidence for organic evolution.

1. Active Participation. Near the beginning of the semester, immediately prior to the *Nature of Science* unit, students answer in-class survey questions to help them clarify their existing ideas about the nature of science and the theory of evolution. They use a remote response system (iClickers) to answer survey questions designed to assess their attitudes and understanding of science (see Appendix). Questions are worded similarly to those used in polls conducted by Gallup, Pew Research Group, and others. For example, students are asked if they “believe in the theory of evolution,” to which more than half answer *no* or *no opinion* (Item #2, Appendix). The results are made available to the students when they are posted on Blackboard™ and used in subsequent in-class lectures. Students are exposed to Gallup Poll results suggesting that the acceptance of evolution increases with education (Item #3, Appendix), which likely accounts for the fact that the number of respondents in our class accepting evolution (44-49%) is about 10% higher than the general public (Item #2, Appendix). I do not repeat the question at the end of the semester because by then they have received instruction about the difference between “believing” and “accepting the evidence” and hopefully understand why using the word “believe” is problematic and reveals a lack of understanding of the process of science.

The evidence for organic evolution is presented in my course mid-semester. During this period of instruction students are introduced to the Modern Synthesis, our current understanding that the forces driving evolution encompass many processes in addition to

natural selection, such as genetic drift, gene flow, and mutation. The evidence for evolution is well beyond that which Darwin provided and there have been many opportunities along the way to discount the theory, for example, the science of genetics, which, instead of refuting evolution has offered strong support.

2. Focusing on scientific and critical thinking rather than content. Students learn about peer review, the value of criticism, the difference between fact and scientific theory, and how the word “theory” has multiple meanings depending on if it is used in a scientific context or not (also see #5 Appendix). The appropriate use of the phrase “just a theory” is discussed. The use of the word “prove” is disallowed in recognition of the fact that all knowledge is provisional in science and absolute certainty is not possible. Science must always be open to change with new evidence. Scientific theories are not casual hunches that can one day become “proven fact” if enough evidence exists to support them. Scientific theories provide coherent frameworks into which observable data fit. The term “embedded theory” is used to describe theories like the theory of evolution, the cell theory, and others that serve as the tested, verified foundation for scientific understanding of life and the processes of life. Embedded theories can be upset with evidence; there is no evidence that refutes evolution.
3. Directly addressing misconceptions and student resistance especially as it relates to Young Earth Creationism. Students benefit from having a bridge from their existing worldview to a new perspective. Methods that have been helpful to me in this pursuit are:
 - a) being direct about the fact that yes, scientific findings do conflict with a literal interpretation of Genesis;
 - b) evoking the words of renowned Christian evangelist Billy Graham as an alternative to literalism (emphasis mine):

*“I don't think that there's any conflict at all between science today and the Scriptures. I think that we have misinterpreted the Scriptures many times and we've tried to make the Scriptures say things they weren't meant to say, I think that **we have made a mistake by thinking the Bible is a scientific book.**”*

***The Bible is not a book of science.** The Bible is a book of Redemption, and of course I accept the Creation story. I believe that God did create the universe. I believe that God created man, and whether it came by an evolutionary process and at a certain point He took this person or being and made him a living soul or not, does not change the fact that God did create man. ... whichever way God did it makes no difference as to what man is and man's relationship to God.”* (Frost and Bauer, 1999)

- c) comparing differing views of how religion and science relate by comparing Graham’s view that “*whichever way God did it makes no difference as to what man is and man's relationship to God*” to that of Albert Einstein (1930) who thought the religion could be ennobled by science, “*After religious teachers accomplish the refining process indicated, they will surely recognize with joy that true religion has been ennobled and made more profound by scientific knowledge.*”

d) teaching that the evolution of all life including human life occurs within the context of the evolution of the Universe, so that it is all one story;

e) giving students a chance to express their views in class, since many Catholics and mainstream Protestants are not faith-conflicted by accepting evolution (this is always a wildcard).

Each semester students approach me after classes and by email to thank and compliment me for presenting the material in a sensitive and clear manner. Dozens mention this as their favorite unit in the end-of-course evaluations.

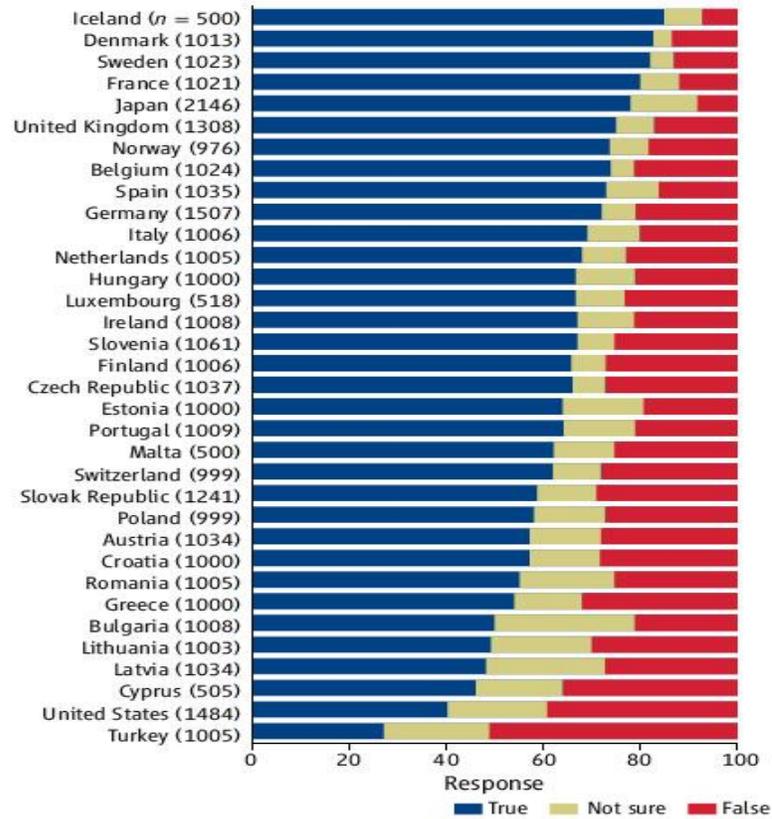
It is profoundly rewarding to preside over the meeting of the Universe and the child, a charge Thomas Berry gave me early in my career. The methods I outline here provide an important bridge between the ideas students in the South bring to college and a new understanding of life, the processes at work in the Universe, and some of the ways we come to know them. The bridge allows new ideas to communicate effectively with existing ones, hence providing opportunity for them to be authentically incorporated into the student's thinking. As Thomas Berry noted, for the first time we can tell the universe story, the earth story, and the human story as a single comprehensive narrative (1987). Every college student should have the opportunity to learn the story.

Literature Cited

- Bailey, Gregory, and Jacqueline Bailey. 2007. Teaching evolution in the south: An overview of state standards relating to evolution and possible obstacles in presenting the standards. Thursday, 29 March 2007. Geological Society of America *Abstracts with Programs*. 39(2):3.
- Berry, Thomas. 1987. The Earth, A New Context for Religious Unity. In *Thomas Berry and the New Cosmology*, eds. Anne Lonergan and Caroline Richards. Twenty-Third Publications. p. 37.
- Einstein, Albert. 1930. Religion and Science. *New York Times Magazine*, November 9, 1930.
- Frost David, and Fred Bauer. 1999. *Billy Graham: Personal Thoughts of a Public Man*. Chariot Victor Publishing. pp.72-74
- Gallup. 2009. *On Darwin's Birthday, Only 4 in 10 Believe in Evolution*. 11 February 2009. Web accessed 12 February 2011.
- Gallup. 2010. *Four in 10 Americans Believe in Strict Creationism*. 17 December 2010. Web accessed 12 February 2011.
- Keeter, Scott, and Juliana Horowitz. 2009. *On Darwin's Birthday Americans Still Divided about Evolution*. Pew Research Center For The People & The Press. 5 February 2009. Web accessed 12 February 2011.
- Miller, Jon D., Eugene C. Scott, and Shinjii Okamoto. 2006. Public Acceptance of Evolution. *Science*. 11 Aug;313(5788):765-6.
- Nelson, Craig E. 2008. Teaching evolution (and all of biology) more effectively: Strategies for engagement, critical reasoning, and confronting misconceptions. *Integrative and Comparative Biology*. 48:213-25.

Appendix

1. Evolution is not well accepted in the United States. The following are results from various nations in response to the statement "*Human beings, as we know them, developed from earlier species of animals.*" (Miller et al. 2006)



Public acceptance of evolution in 34 countries, 2005.

The responses of my college students to the same question yielded results similar to those above.

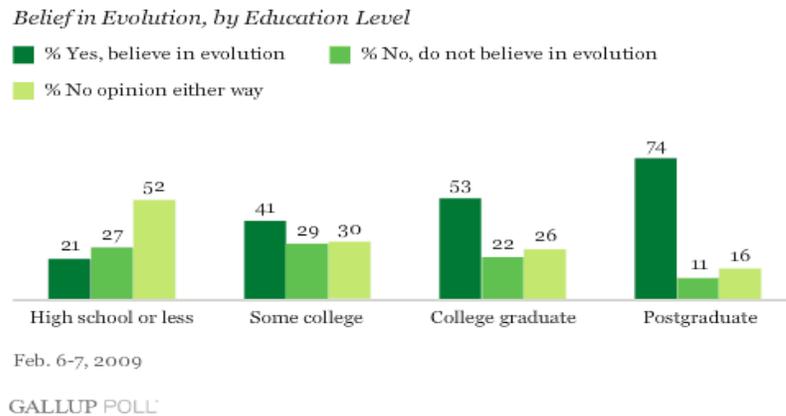
| | Yes | No | not sure |
|-----------------------|-----|-----|----------|
| Bio 105 Fa10, N = 209 | 37% | 44% | 18% |
| Bio 105 Sp11, N = 262 | 39% | 42% | 19% |

2. At the beginning of the semester students are asked the Gallup Poll question "*Do you, personally, believe in the theory of evolution?*" (Note: This question is not repeated because the word "believe" is not an appropriate way to describe the acceptance of vast amounts of evidence generated from rigorous testing in a variety of scientific disciplines.)

| | Yes | No | No opinion |
|----------------------------------|-----|-----|------------|
| Gallup Poll Feb. 2009*, N = 1018 | 39% | 25% | 36% |
| Bio 105 Sp10, N = 225 | 49% | 40% | 11% |
| Bio 105 Fa10, N = 147 | 48% | 42% | 10% |
| Bio 105 Sp11, N = 259 | 44% | 40% | 16% |

*Belief drops to 24% among frequent church attenders

3. There is a strong relationship between education and belief in evolution. (Gallup 2009).



4. Which of the following statements comes closest to your views on the origin and development of human beings?

- Human beings developed over millions of years from less advanced forms of life, but God guided this process.
- Human beings developed over millions of years from less advanced forms of life, but God had no part in this process.
- God created human beings pretty much in their present form at one time within the last 10,000 years or so.
- Other/No Opinion.

| | Man developed with God guiding | Man developed, God had no part | God created man in present form | Other/No opinion |
|----------------------|--------------------------------|--------------------------------|---------------------------------|------------------|
| Gallup '10 Dec 10-12 | 38% | 16% | 40% | 6% |
| Gallup '08 May 8-11 | 36% | 14% | 44% | 5% |
| Bio 105 Sp11, N= 263 | 64% | 19% | 16% | N/A |

5. From what you have heard or read, is there general agreement among scientists that humans evolved over time? Pew results are reported in Keeter and Horowitz (2009).

| | Yes | No | Unsure |
|-------------------------------------|-----|-----|--------|
| Pew Research Center, 2006, N = 2001 | 62% | 28% | 10% |
| Bio 105 Sp11, N = 262 | 64% | 19% | 17% |

6. Theories “graduate” to fact once they are proven.

| | True | False |
|-----------------------|------|-------|
| Bio 105 Sp11, N = 262 | 53% | 47% |

When the units Nature of Science and Origin of the Universe are completed students are asked: *Since covering the Nature of Science unit I have a much better understanding of the way the word theory is used in science as opposed to popular language.*

| | True | False | Unchanged |
|-----------------------|------|-------|-----------|
| Bio 105 Sp11, N = 262 | 75% | 5% | 20% |