

# Exploring Issues in Evolutionary Science and Society

Educators flock to AIBS-cosponsored event

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The skirmish over evolution's place in biology classrooms continues in Kansas, Ohio, Georgia, Pennsylvania, Texas, and elsewhere, so it was no surprise that teaching sound science and coping with aggressive creationists were on the minds of many teachers who attended the annual meeting of the National Association of Biology Teachers (NABT), held 12–13 November 2004 in Chicago. More than 500 educators came to a special two-day symposium, "Evolutionary Science and Society: Educating a New Generation," cosponsored by

AIBS, the Biological Sciences Curriculum Study (BSCS), and NABT.

Some of the educators were looking for new strategies to improve their teaching of evolution. "How can I explain to students that prokaryotes are species even though they reproduce asexually?" asked one teacher. "How important is the teaching of the Hardy–Weinberg law in understanding evolution?" asked another. Some came looking for curricular ideas. "What activities could be used with high school biology classes to best illustrate various tenets of evolution?"

Others wanted suggestions for classroom material on evolution: "What are good resources for phylogenetic data to use for tree development?"

Their concerns were addressed by some of the finest minds in the fields of evolutionary biology and science education. In all, 17 speakers and 22 panelists engaged the audience, summarizing up-to-date research, articulating the importance of evolutionary biology to society, and strengthening education and outreach (for a complete roster, see [www.aibs.org/special-symposia/2004.html](http://www.aibs.org/special-symposia/2004.html)).

The symposium was the brainchild of Joel Cracraft, the American Museum of Natural History's curator in charge and immediate past president of AIBS. Together with Gordon Uno, botany professor at the University of Oklahoma and chair of the AIBS Education Committee, and Rodger Bybee, executive director of BSCS, Cracraft developed a stellar agenda. It was divided into four major themes: "Introduction to Evolutionary Thinking," "The Tree of Life," "How Evolution Works," and "Evolutionary Science: Advancing Societal Well-being." Three or more speakers presented the latest information on each theme; then a panel of education experts followed, offering teaching ideas for the topics discussed by the speakers.

In an evaluation of the symposium, teachers indicated that their greatest challenge in teaching evolution was resistance from students, parents, or administration. Recent polls illustrate how



*Joel Cracraft, American Museum of Natural History's curator in charge and immediate past president of AIBS, presents an overview of the tree of life. Cracraft was instrumental in developing the special symposium on evolution. Photograph: Richard O'Grady.*

difficult it is to be a biology teacher today. A November 2004 Gallup News Service poll (available at <http://gallup.com/poll/content/login.aspx?ci=14107>) showed that “about a third of Americans believe that Charles Darwin’s theory of evolution is just one of many theories and has not been supported by the evidence. Forty-five percent of Americans believe that God created human beings pretty much in their present form about 10,000 years ago.” Another November 2004 poll, this one from CBS News (available at [www.cbsnews.com/stories/2004/11/22/opinion/polls/main657083.shtml](http://www.cbsnews.com/stories/2004/11/22/opinion/polls/main657083.shtml)), revealed that 65 percent of respondents felt that creationism should be taught alongside evolution.

Teachers who came to the symposium wanted to know how to deal with these challenges, asking

- How can we respond to the argument that “majority rules” about what should be taught in schools?
- Should we address the issue of science and religion directly in regard to evolution to clarify the differences in these disciplines in the classroom?
- If a good segment of the population supports and admits that evolution occurred, where are they when a teacher is challenged and intimidated by creationist parents and administration?
- How useful is it to spend class time refuting Wells’s *Icons of Evolution* point by point?

All the speakers encouraged teachers to demonstrate how evolution works in real-life situations to make it meaningful to students. “Refer students to the television series *CSI*,” proposed Robert Pennock, a philosophy of science professor at Michigan State University. “In any given episode, you’ve got a whole bunch of suspects, possible murder weapons, and different locations. All of these constitute multiple hypotheses. In the course of a show, the characters will refine or find new data, going through many hypotheses that get tested against



*Eugenie Scott, founder and executive director of the National Center for Science Education, shown here with AIBS Executive Director Richard O’Grady, offered ideas for correcting student misconceptions about evolution during a panel discussion. O’Grady and AIBS Education and Outreach Program Manager Susan Musante coordinated the symposium. Photograph: M. Patricia Morse.*

the evidence. They look at data that illustrate what happened in the past, leading to a high degree of confidence in the conclusion. Evidence can be very strong even if not seen directly.”

“Did you know that Google is advertising for workers who understand genetic algorithms?” Pennock continued. “Genetic algorithms are now applying random mutations, self-replication, and natural selection to a population of possible solutions. You vary the solution randomly, select the function for what you are trying to achieve, and then let the system evolve solutions. In other words, Google is looking for people who understand evolution. If your students understand how evolution works, they can get a job!”

“You can’t study human diseases without studying phylogenetics,” said evolutionary biologist David Hillis, from the University of Texas–Austin. “Do you remember the original *Star Trek* television episodes? Spock would land on an alien planet, pull out his tricorder, and immediately be able to identify all the species around him. Wouldn’t it be nice to have such a device, especially for health applications? A technology now in development would allow us to isolate and amplify target genes, rapidly

sequence those genes, and place them within the known tree of life using a hand-held device that can do each one of these steps.”

“Selection is X-rated,” mused Kerry L. Shaw, a biology professor at the University of Maryland. “It’s easy to get students interested in the role of sexual selection in evolution.” She gave several examples that students can relate to: Males attract females by sheer size or beautiful bodies, by winning over competition, by singing alluring songs, by producing elaborate visual displays or attractive scents, by offering food, and by providing a nice place to nest.

This real-life relevance of evolution was picked up by the panelists, who provided a wealth of information about readily available teaching resources—from books to Web sites, exhibits, and interactive materials. Judy Scotchmoor, former middle-school teacher and education director of the Museum of Paleontology at the University of California–Berkeley, introduced “Understanding Evolution,” a Web site especially designed for teachers. Ethel Stanley and John Jungck, of Beloit College, described interactive resources, such as simulations, data sets, and analytical tools (in particular, *Evolve*, a population genetics



*Judy Diamond, from the University of Nebraska State Museum, offers ideas for teaching the mechanisms of evolution. She is accompanied by panel moderator John Jungck, of Beloit College, Beloit, Wisconsin, and copanelist Stacey Kiser, from Lane Community College, Eugene, Oregon. Photograph: Richard O'Grady.*

simulation), available online from Bio-QUEST Curriculum Consortium. Judy Diamond, from the University of Nebraska State Museum, described curricular materials, such as a book of essays and inquiry-based activities for formal and informal education, that will augment the museum exhibit "Explore Evolution." Bybee announced that BSCS is developing a virtual field trip to the Galápagos Islands, which will allow students to collect, observe, and measure organisms.

And there are more resources to come. AIBS, BSCS, and NABT plan to release additional education and outreach materials to complement the symposium. First, BSCS will produce a short book based on the invited talks, written for a general audience but also useful to teachers, students, school boards, and state and local textbook committees. The book will be sold at an affordable price in hard copy, but the full text, along with PowerPoint slide presentations, will be available online for free viewing. Second, classroom materials will also be published and available on all three societies' Web sites ([www.aibs.org](http://www.aibs.org), [www.bscs.org](http://www.bscs.org), and [www.nabt.org](http://www.nabt.org)), as well as on AIBS's free-access education Web site ([www.actionbioscience.org](http://www.actionbioscience.org)). Lastly, a short film called *Evolution: Why Bother?* is being produced that will feature some of the symposium speakers.

At the end of the symposium, teachers were interviewed and asked, "What will you be taking to the classroom from the symposium?" Their answers illustrate that they took home what they came for, and perhaps more:

One of the things I'll be taking with me is the idea of evolution as the driving force for change and the large unifying theory in biology. The symposium has once again brought home the idea that evolution really affects all living things. (Victoria Crnekovic, Parkland College, Champaign, Illinois)

I will bring some really good examples that will help me explain some of the mechanisms of evolution, for example, natural selection. That's why I attended—because I want to enhance how I teach evolutionary theory to my students. (Andrea E. Allio, Westminster Schools, Atlanta, Georgia)

It really has to do with course content more than anything else. I've been hired to develop an evolution class. Some of the things that I was concerned about were spending time on topics such as the nature of science and creation versus evolution. It seemed from the speakers and the

panelists that these are two good issues to integrate in the classroom. (Linda Fuselier, Minnesota State University, Moorhead, Minnesota)

I'm bringing back lots of ideas for my colleagues and myself. I teach a seminar on evolution and I was looking for hands-on activities and applications, and I found both at this symposium. (Kathleen R. Marr, Lakeland College, Sheboygan, Wisconsin)

I'm bringing back some simulations that I can use with high school biology students to explore evolution actively. Even the ideas presented here, aimed at the junior college level, can [be] modified for the high school level. (Lora L. Marschall, Tulsa Public Schools, Tulsa, Oklahoma)

I'll be taking five or six things back; most of them are Web activities and Web sites, some for my ninth grade biology class and some for my AP biology class. Some information I will share with my colleagues. (David Devore, University School, Hunting Valley, Ohio)

I've received a lot of background information for myself from this symposium and some great ideas for activities to do with students. What's most important to me is that I'm bringing to the classroom a renewed confidence in the importance of evolution across the biology curriculum. (Judith Allard, Burlington High School, Burlington, Vermont)

The symposium was such a success that NABT has invited AIBS to present a second one this fall at the NABT annual convention in Milwaukee, Wisconsin.

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