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Working Together to Address Challenges to the Teaching of Evolution

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INTRODUCTION

Evolution has been used by some to persuade people in this country that they must accept either science or their personal faith, creating false divisions. The supposed “controversy” surrounding evolution and related topics also has compelled a growing number of scientific and professional societies to begin working together to improve the public’s understanding about this subject in particular and about the nature, processes, and limits of science more generally. These 39 associations represent all disciplines: physics, chemistry, earth and space sciences, biomedical sciences, biological sciences, anthropology, social sciences, and psychology. Some 2.5 years ago, representatives of several of these disciplinary organizations, together with others representing teachers, civic groups, industry, and the National Academy of Sciences (NAS), formed a coalition whose purpose is to collaborate on confronting challenges to the teaching of evolution and related issues (e.g., the Big Bang, the age of the ancient Earth). The coalition has jointly sponsored audience research to find out how best to dispel those divisions.

This coalition sees the situation with evolution as indicative of a larger problem with the public’s perception of broad areas of science. Recently, bills have been introduced in the legislatures of at least five states calling for “critical analysis” of “controversial” topics such as evolution, global warming, and human cloning.¹ However, as with any scientific conjecture, data are required and the coalition worked with the same research organization in Washington, DC, that the NAS had commissioned for its audience research on *Science, Evolution, and Creationism* (National Academy of Sciences and Institute of Medicine, 2008; also see Labov and Pope, 2008). Together, the partners in this effort designed a survey and the research organization collected those data. Based on the results of this study, a paper was

prepared and published simultaneously in the January 2008 issue of *FASEB Journal* and in some of the coalition societies’ own journals and newsletters.²

Why is a description of these activities of the coalition worthy of space in this journal? Don’t scientists collaborate all the time? Individually they usually do. But when it comes to scientific societies or associations, disciplinary boundaries can occur, especially when the disciplines are so diverse and funding is tight. However, many disciplines have long faced challenges related to the teaching of evolution. Topics under attack have included teaching about the Big Bang and scientific explanations for the origins of the universe, that the age of the Earth is billions rather than thousands of years old, and that the molecules of life could have arisen through natural chemical processes. There also have been increasingly strident calls from a highly organized and amply financed movement (e.g., Wilgoren, 2005) for including non-scientific “alternatives,” such as intelligent design creationism in public school science classes. Collectively, these challenges convinced the organizations in this Coalition of Scientific Societies almost three years ago that more coordinated efforts and effective communication approaches were needed to address them. Furthermore, they felt that working together would be more effective than individual societies moving along nonintersecting, parallel paths. Thus, they agreed (not without some arguments and mild tension) upon strategies for designing and conducting surveys that would examine in greater detail what American voters understand about evolution specifically and about science more broadly. The results from this research prompted the coalition to jointly publish the results, to continue to meet regularly, and to agree to work together on collaborative activities in the future.

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¹ For the latest update on these bills, see the website of the National Center for Science Education at <http://ncseweb.org> (accessed 9 June 2008).

² In addition to publication in *FASEB Journal*, the paper was also published simultaneously in the winter 2007 issues of *ACA RefleXions* (American Crystallographic Association), *The Pharmacologist* (American Society for Pharmacology and Experimental Therapeutics), and the 1 April 2008 issue of Society of Developmental Biology’s official journal, *Developmental Biology*. For access to the paper, links to these other publications, and additional information, see <http://opa.faseb.org/pages/PolicyIssues/sciencecoalition.htm> (all accessed 9 June 2008).

The 1925 Scopes “monkey trial” in Tennessee exposed the deep-seated feelings and visceral rejection by many about the teaching of evolution. That trial and many subsequent events in this ongoing saga also highlighted the kinds of misunderstandings that people have about the issue based on their religious upbringing. Laws banning the teaching of evolution in public schools remained in place in many states and school districts for another 40 years until the U.S. Supreme Court struck them down as unconstitutional in 1968 in the *Epperson v. Arkansas* decision.³

In response to *Epperson v. Arkansas*, creationists have developed new and skillful strategies, including intelligent design, teach the controversy, alternatives to evolution, and most recently the academic freedom campaigns. Stickers disclaiming evolution as “a simple unproven theory” have been inserted into biology textbooks (and subsequently challenged in court) in several states. School board members, administrators, and parents have pressured teachers to avoid teaching evolution, something easily done because teachers cannot cover all required topics in biology during the school year anyway. Anti-evolution directives or statements couched as “critical analysis” have been introduced in many states’ science education standards and adopted in some. A very large and concerted effort by the well-funded Seattle-based Discovery Institute helped propel the concept of intelligent design/creationism into view nationwide.⁴

Scientific and professional societies based in the nation’s capital area have long realized that those who continually attempt to introduce nonscientific alternatives to evolution in science classrooms are very skillful in their use of words and phrases and in their overall efforts in communicating with the public. Resolutions defending the teaching of evolution⁵ and other efforts carried out by individual organizations to fight these antievolution campaigns have been limited by low funding and by the constraints of discipline-specific expertise and communication methods not well suited to audiences outside the scientific community. Importantly, professional societies and organizations increasingly have realized that these individual efforts have not produced detectable changes in the public’s view about evolution, as evidenced by 40 years of polling by organizations such as Gallup⁶ and more recently the Pew

Research Center for the People and the Press.⁷ In response, representatives from the American Institute of Physics, American Physical Society, American Chemical Society, American Institute of Biological Sciences, National Science Teachers Association, and NAS convened a meeting of the organizations’ education/public affairs/policy staff. They discussed how scientific and professional societies might better coordinate their efforts and resources to become more effective in educating the American public about evolution and the deleterious results to science education when evolution is omitted. Additional disciplinary societies were invited to join, and currently there are 39 scientific, professional, and civic groups on the list of members (Table 1).

⁷ For more information, see the links at www.google.com/u/peoplepress?q=evolution (accessed 9 June 2008).

Table 1. Current member organizations of the Coalition of Scientific Societies

Alliance for Human Research Protection
Alliance for Science
American Anthropological Association
American Association for the Advancement of Science
American Association of Community Colleges
American Association of Physics Teachers
American Astronomical Society
American Chemical Society
American Civil Liberties Union
American Crystallographic Society
American Geological Institute
American Geophysical Union
American Institute of Biological Sciences
American Institute of Physics
American Physical Society
American Physiological Society
American Phytopathological Society
American Psychological Association
American Society for Biochemistry & Molecular Biology
American Society for Human Genetics
American Society for Investigative Pathology
American Society for Pharmacological and Experimental Therapeutics
American Sociological Association
Biophysical Society
Biotechnology Institute
Coalition on Public Understanding of Science
Consortium of Social Science Associations
Ecological Society of America
Environ Corp
Federation of American Societies for Experimental Biology
Geological Society of America
National Academy of Sciences
National Association of Biology Teachers
National Science Teachers Association
Research! America
Sigma Xi
Society for Developmental Biology
Society for Neuroscience
Society for the Study of Evolution

³ For more information about this case, see <http://www.law.umkc.edu/faculty/projects/ftrials/conlaw/Epperso.htm>.

⁴ For additional references about the history of these controversies, refer to pages 58 and 59 in NAS and Institute of Medicine (2008) or Matsumura and Mead (2007).

⁵ To date, 70 state, national, and international scientific organizations and 17 Christian and Jewish clerical organizations have published statements defending the teaching of evolution. Some of the scientific organizations have updated their statements several times. Statements from scientific societies can be accessed through links at www.ncseweb.org/resources/articles/2712_statements_from_scientific_an_12_19_2002.asp (accessed 9 June 2008). Links to statements from religious organizations are available at www.ncseweb.org/resources/articles/5025_statements_from_religious_orga_12_19_2002.asp (accessed 9 June 2008).

⁶ For more information, see the links at <http://gallup.com/search/default.aspx?q=evolution&s=> (accessed 9 June 2008).

When the coalition first convened, in 2005, participants asked the following questions:

1. Did the polls available at the time (Gallup, CBS News, Pew Research Center, and others [see Labov (2005)]) accurately describe the American public's opinions on teaching evolution in public schools and their acceptance of creationism as an "alternate"?
2. Could the general public explain what "evolution" actually means?
3. How could the scientific community (both individual scientists and scientific organizations) become more effective in helping the public to understand concepts of evolution as well as the nature, processes, and limits of science, so the public would be less likely to be misled by skillful (mis)use of words by those who promote the teaching of nonscientific alternatives?

The coalition needed to understand what the public is willing to accept about evolution if these issues were framed scientifically rather than in terms of personal belief versus evolution. Member societies also were interested in understanding more effective ways to deliver messages about science and evolution to the general public without compromising the scientific integrity of that information. By pooling the coalition's resources coupled with funds authorized by the NAS, a research firm was hired to conduct surveys using questionnaires that were developed in part with input from the initial 20 contributing societies.

THE JOINT STUDY

Three research studies were conducted. Two of these efforts were aimed specifically at helping the NAS to update and revise its 1999 publication *Science and Creationism*, 2nd ed. (NAS, 1999). They consisted of 1) a series of focus groups before any revisions and 2) in-depth interviews with intended audiences after the document had been revised and before it went to final review by the Academy (see Labov and Pope, 2008, for details). Results from the focus groups helped the coalition and its research firm to develop questions for a telephone survey of 1000 likely U.S. voters about their acceptance of various aspects of evolution and their attitudes about science more generally. The focus groups and the telephone survey also tested various messages about evolution to assist the professional societies in their future education activities in this realm.

Detailed results from the nationwide survey of voters are described in an article published in several scientific societies' journals and newsletters (Coalition of Scientific Societies, 2008, and related references in footnote 2). In general, the data were more positive concerning this cohort's acceptance of evolution and their embracing of science than previous surveys. For example, because of the design of the survey, one-half of those interviewed were asked to respond to the statement that "*all living things* [emphasis ours] have evolved with time"; 61% accepted this statement. Thirty-six percent of these respondents agreed that evolution occurs through "natural processes such as natural selection," whereas 25% agreed that "a supreme being guided the evolution." The other half of respondents were asked

whether "*humans and other* [emphasis ours] living things evolved"; a total of 53% agreed with this statement, with 32% accepting through "natural selection" and 21% invoking superior "guidance" in the process. The majority (53%) of all respondents also favored teaching evolution in public school science classes, whereas 36% supported teaching creationism and 27% responded that it is acceptable to include intelligent design creationism in public school science curricula.

Not surprisingly, most respondents (78%) who correctly answered three science-related statements⁸ also accepted evolution of humans and other living things and favored teaching only evolution. Eleven percent of those who answered these questions correctly thought "humans and other living things were created in their current form." About one-quarter of the three-correct respondents favored teaching intelligent design creationism. Importantly for readers of *CBE—Life Sciences Education*, only 23% of respondents with some college education answered these three statements correctly. Although these results are more positive than previous surveys, they still indicate how much we need to improve undergraduate science education, especially at the introductory level (Seymour and Hewitt, 1997; National Research Council, 1999; Labov, 2004).

Among respondents who answered correctly two or fewer science-related statements, 47% stated that humans and other living things were created in the present form; these respondents distributed almost equally for teaching evolution (37%), creationism (38%), and intelligent design (29%).

The survey indicated that respondents hold certain aspects of science in high regard and are willing to trust people with scientific expertise for information about science. For example, regardless of their views on evolution, when asked about how they saw science being relevant to their lives, a majority of all respondents (63%) volunteered that science's contributions to advances in medicines and to curing diseases were most important. Respondents also indicated that they trust some combination of scientists, science teachers, medical doctors, and nurses as sources of information on scientific issues (vs. other spokespeople such as Hollywood celebrities). Members of the clergy were added to this trusted group when respondents were asked about the kinds of "influentials" to whom they would turn to learn more about evolution, creationism, and intelligent design.

Consistent with other surveys, religious influences in respondents' upbringing has a strong influence on how they view the teaching of evolution versus other nonscientific alternatives. The scientific community needs to understand and appreciate the continuing vitality and strength of religious convictions in American life and be respectful of these convictions when talking about evolution with any audience (including their own students). Any suggestion that scientists are attempting to denigrate religion will likely close

⁸ Questions that assessed respondents' factual knowledge about science included 1) the continents or land masses on which we live have been moving for millions of years and will continue to do so in the future (true), 2) antibiotics kill viruses as well as bacteria (false), and 3) the earliest humans lived at the same time as the dinosaurs (false).

paths to understanding of evolution for many people and will be counterproductive. *Science, Evolution, and Creationism* (NAS and Institute of Medicine, 2008) considers these issues at some length by explaining the differences between science and other ways of knowing and emphasizing that, for many people, science and religious faith need not be in conflict.

LESSONS LEARNED

This work has clearly demonstrated that it is both possible and highly rewarding when professional societies from disparate disciplines work together on issues of common interest such as the teaching of evolution and promoting better understanding of the nature of science. There were heated discussions, especially during the meetings when we were working on specific survey questions and on how to prepare the joint article (Coalition of Scientific Societies, 2008). However, the members of the coalition agreed to follow some implicit ground rules. We took a consensus approach that respected differences of opinion while focusing on matters of common interest, for example, how to collect data that everyone needed. We also enjoyed learning about how different disciplines have viewed and responded to these challenges. This experience has been very positive. After the completion of the surveys and publication of the book and the joint article, the coalition has continued to hold meetings and to keep each other informed about new events of common interest. The coalition's structure and leadership (a group of seven liaisons who report to and receive feedback from societies in a given discipline) also promote coordinated delivery of information, enforcement of deadlines to help keep all participants on task, and the acceptance of the notion of a common good in lieu of many disciplinary interests.

The group also has remained focused because there is a well-defined final product from our joint efforts and expenditures: something all societies can use and adapt to their own disciplinary needs and perspectives. The information that we gathered will help each participating organization more effectively educate its own members about what and how the public thinks about evolution (not necessarily as reported in the media). A better appreciation of the public's understanding of and its attitudes toward science will also help the larger scientific community design and plan activities to clarify the importance of teaching evolution in the science curriculum.

WHAT NEXT?

It would be naïve to think that Judge John Jones's decision in the 2005 *Kitzmiller et al. v. Dover School Board et al.*⁹ case would put an end to antievolution campaigns. A new strategy is to have state legislators introduce legislation purportedly supporting "academic freedom." Most of these bills

specify that teachers who want to teach alternative ideas to biological and chemical evolution and other controversial scientific topics (specifically mentioned to date are global warming and human cloning) would not face sanctions. Some bills also indicate that students who want to write about their personal beliefs when answering science questions on examinations would not receive a failing grade.

"... I see this as an educational issue that has very little to do with academic freedom. The way science is taught in the classroom should mirror as closely as possible the way science is done by scientists... The issue of academic freedom is misleading. All of our published science is vetted and reviewed by our peers. ... When an individual high school teacher presents his or her personal views as science, it is not an issue of "academic freedom". What we teach in the classroom must be based on evidence and on the consensus that arises following debate in the scientific community."

E. Wieschaus, President, Society for Developmental Biology¹⁰

The scientific community must continually monitor what goes on in our nation's science classrooms and support teachers fully so that they have the latest information and the professional confidence to teach evolution. Individual scientists and scientific organizations must help members of local and state boards of education as well as legislators understand how academic standards and economic advances that are based on modern science and technology would be compromised if "academic freedom" and similar bills that are likely to occur in the future are approved. We also need to take advantage of opportunities, both formal and informal, to speak with the public about the importance of understanding evolution, and the contributions this understanding brings to improving human health, maintaining biodiversity, and the myriad other ways that this fundamental concept in science has provided a framework for understanding nature.

This Coalition of Scientific Societies has shown that working together brings synergy. An even larger coalition (Coalition on the Public Understanding of Science¹¹) is working toward celebrating the Year of Science 2009¹² that will, in part, acknowledge and celebrate the contributions of evolution and other areas of science through the perspective of "how we know what we know." If scientists and scientific organizations continue to work together to confront these challenges and redouble our efforts to improve science education and the preparation of science teachers, perhaps by the time the Scope trial's centennial is commemorated in 2026, the divisiveness around the teaching of evolution in the United States will be a relic of the past.

¹⁰ The full text of this statement is available at www.sdbonline.org/SDBPrez_on_teachevo.pdf.

¹¹ Additional information is available at www.copusproject.org.

¹² Additional information is available at www.copusproject.org/yearofscience2009.

⁹ Available at www.pamd.uscourts.gov/kitzmiller/kitzmiller_342.pdf (accessed 9 June 2008).

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