SCIENCE COMMUNICATION

Public Acceptance of Evolution

The acceptance of evolution is lower in the United States than in Japan or Europe, largely because of widespread fundamentalism and the politicization of science in the United States.

Jon D. Miller,[1]* Eugenie C. Scott,[2] Shinji Okamoto[3]

The concept of the evolution of humans from earlier forms of life is unacceptable to biblical literalists and causes concern even among some holders of less conservative religious views. Catholics and mainstream Protestants generally accept variations of a theological view known as theistic evolution, which views evolution as the means by which God brought about humans, as well as other organisms. Evolution is nonetheless problematic to some of these nonliteralist Christians, because it implies a more distant or less personal God (*1*–*3*). Efforts to insert "intelligent design" into school science curricula seek to retain the divine design of humans while remaining agnostic on earlier creationist beliefs in a young Earth and the coexistence of humans and dinosaurs (*2*, *4*).

Beginning in 1985, national samples of U.S. adults have been asked whether the statement, "Human beings, as we know them, developed from earlier species of animals," is true or false, or whether the respondent is not sure or does not know. We compared the results of these surveys with survey data from nine European countries in 2002, surveys in 32 European countries in 2005, and a national survey in Japan in 2001 (*5*). Over the past 20 years, the percentage of U.S. adults accepting the idea of evolution has declined from 45% to 40% and the percentage of adults overtly rejecting evolution declined from 48% to 39%. The percentage of adults who were not sure about evolution increased from 7% in 1985 to 21% in 2005. After 20 years of public debate, the public appears to be divided evenly in terms of accepting or rejecting evolution, with about one in five adults still undecided or unaware of the issue. This pattern is consistent with a number of sporadic national newspaper surveys reported in recent years (*6*–*10*).

A dichotomous true-false question format tends to exaggerate the strength of both positions. In 1993 and 2003, national samples of American adults were asked about the same statement but were offered the choice of saying that the statement was "definitely true, probably true, probably false, definitely false," or that they did not know or were uncertain. About a third of American adults firmly rejected evolution, and only 14% of adults thought that evolution is "definitely true." Treating the "probably" and "not sure" categories as varying degrees of uncertainty, ~55% of American adults have held a tentative view about evolution for the last decade.

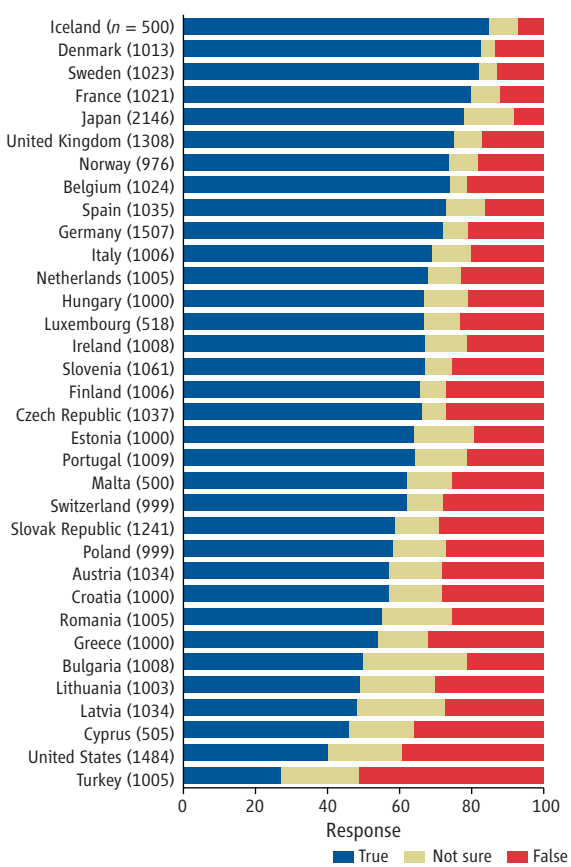
This pattern is different from that seen in Europe and Japan. Looking first at the simpler true-false question, our analysis found that significantly (at the 0.01 to 0.05 level by difference of proportions) (*11*) more adults in Japan and 32 European countries accepted the concept of evolution than did American adults (see figure, right). Only Turkish adults were less likely to accept the concept of evolution than American adults. In Iceland, Denmark, Sweden, and France, 80% or more of adults accepted the concept of evolution, as did 78% of Japanese adults.

A cross-national study of the United States and nine European nations in 2002–2003 used the expanded version of the question. The results confirm that a significantly lower proportion of American adults believe that evolution is absolutely true than adults in nine European countries [see fig. S1 in the Supporting Online Material (SOM)]. A third of American adults indicated that evolution is "absolutely false"; the proportion of European adults who thought that evolution was absolutely false ranged from 7% in Denmark, France, and Great Britain to 15% in the Netherlands.

Regardless of the form of the question, one in three American adults firmly rejects the concept of evolution, a significantly higher proportion than found in any western European country. How can we account for this pattern of American reservations about the concept of evolution in the context of broad acceptance in Europe and Japan?

First, the structure and beliefs of American fundamentalism historically differ from those of mainstream Protestantism in both the United States and Europe. The biblical literalist focus of fundamentalism in the United States sees Genesis as a true and accurate account of the creation of human life that supersedes any scientific finding or interpretation. In contrast, mainstream Protestant faiths in Europe (and their U.S. counterparts) have viewed Genesis as metaphorical and—like the Catholic Church—have not seen a major contradiction between their faith and the work of Darwin and other scientists.

To test this hypothesis empirically, a two-group structural equation model (SEM) (*12*, *13*) was constructed using data from the United States and nine European countries (see statistical analyses in SOM). The SEM allows an examination of the relation between several variables simultaneously on one or more outcome variables. In this model, 10 independent variables—age, gender, education, genetic literacy, religious belief, attitude toward life, attitude toward science and tech-



Public acceptance of evolution in 34 countries, 2005.

[1]Michigan State University, East Lansing, MI 48824–1115, USA. [2]National Center for Science Education, Oakland, CA 94609, USA. [3]Kobe University, Rokkaido, Hyogo, Japan.

*Author for correspondence. E-mail: jdmiller@msu.edu

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nology (S&T), belief in S&T, reservations about S&T, and political ideology—were used to predict attitude toward evolution. The total effect of fundamentalist religious beliefs on attitude toward evolution (using a standardized metric) was nearly twice as much in the United States as in the nine European countries (path coefficients of –0.42 and –0.24, respectively), which indicates that individuals who hold a strong belief in a personal God and who pray frequently were significantly less likely to view evolution as probably or definitely true than adults with less conservative religious views.

Second, the evolution issue has been politicized and incorporated into the current partisan division in the United States in a manner never seen in Europe or Japan. In the second half of the 20th century, the conservative wing of the Republican Party has adopted creationism as a part of a platform designed to consolidate their support in southern and Midwestern states—the "red" states. In the 1990s, the state Republican platforms in seven states included explicit demands for the teaching of "creation science" (*1*). There is no major political party in Europe or Japan that uses opposition to evolution as a part of its political platform.

The same SEM model discussed above offers empirical support for this conclusion. In the United States, the abortion issue has been politicized and has become a key wedge issue that differentiates conservatives and liberals. In the SEM, individuals who held strong pro-life beliefs were significantly more likely to reject evolution than individuals with pro-choice views. The total effect of pro-life attitudes on the acceptance of evolution was much greater in the United States than in the nine European countries (–0.31 and –0.09, respectively) [see Statistical Analyses section of Supporting Online Material].

The same model also documents the linkage of religious conservative beliefs and a conservative partisan view in the United States. The path coefficient for the relation between fundamentalist religious views and self-identification as a conservative was 0.26 in the United States and 0.17 in the nine European countries. The path coefficient between pro-life views and self-identification as a conservative was 0.20 in the United States and 0.06 in the nine European countries. Because the two-group SEM computes path coefficients on a common metric, these results are directly comparable and the impact of fundamentalist religious beliefs and pro-life attitudes may be seen as additive (*12*, *13*).

Third, genetic literacy has a moderate positive relationship to the acceptance of evolution in both the United States and the nine European countries. This result indicates that those adults who have acquired some understanding of modern genetics are more likely to hold positive attitudes toward evolution. The total effect of genetic literacy on the acceptance of evolution was similar in the United States and the nine European countries.

Although the mean score on the Index of Genetic Literacy was slightly higher in the United States than the nine European countries combined, results from another 2005 U.S. study show that substantial numbers of American adults are confused about some of the core ideas related to 20th- and 21st-century biology. When presented with a description of natural selection that omits the word evolution, 78% of adults agreed to a description of the evolution of plants and animals (see table S2 in SOM). But, 62% of adults in the same study believed that God created humans as whole persons without any evolutionary development.

It appears that many of these adults have adopted a human exceptionalism perspective. Elements of this perspective can be seen in the way that many adults try to integrate modern genetics into their understanding of life. For example, only a third of American adults agree that more than half of human genes are identical to those of mice and only 38% of adults recognize that humans have more than half of their genes in common with chimpanzees. In other studies (*1*, *14*, *15*), fewer than half of American adults can provide a minimal definition of DNA. Thus, it is not surprising that nearly half of the respondents in 2005 were not sure about the proportion of human genes that overlap with mice or chimpanzees.

These results should be troubling for science educators at all levels. Basic concepts of evolution should be taught in middle school, high school, and college life sciences courses and the growing number of adults who are uncertain about these ideas suggests that current science instruction is not effective. Because of the rapidly emerging nature of biomedical science, most adults will find it necessary to learn about these new concepts through informal learning opportunities (*15*–*17*). The level of adult awareness of genetic concepts (a median score of 4 on a 0-to-10 scale) suggests that many adults are not well informed about these matters. The results of the SEM indicate that genetic literacy is one important component that predicts adult acceptance of evolution.

The politicization of science in the name of religion and political partisanship is not new to the United States, but transformation of traditional geographically and economically based political parties into religiously oriented ideological coalitions marks the beginning of a new era for science policy. The broad public acceptance of the benefits of science and technology in the second half of the 20th century allowed science to develop a nonpartisan identification that largely protected it from overt partisanship. That era appears to have closed.

References and Notes

1. F. R. A. Paterson, L. F. Rossow, *Am. Biol. Teach.* **61**(5), 358 (1999).
2. E. C. Scott, *Evolution vs. Creationism* (Greenwood Press, Westport, CT, 2004).
3. S. M. Barr, *First Things Monthly J. Relig. Public Life* **156**, 9 (2005).
4. *Tammy Kitzmiller et al.* v. *Dover Area School District et al.*, 2005 WL 578974 (MD Pa. 2005), 20 December 2005.
5. Materials and methods are available as supporting material on *Science* Online.
6. Harris poll no. 52, "Nearly two-thirds of U.S. adults believe human beings were created by God" (Harris Interactive, New York, 6 July 2005).
7. Scripps Howard News Service, Evolution poll results, 15 November 2005 (www.knoxstudio.com/shns/story.cfm?pk=EVOLUTION-CHART1-11-15-05&cat=AN).
8. NBC News poll, 8 to 10 March 2005 (www.pollingreport.com/science.htm).
9. CBS News/*New York Times* poll, 18 to 21 November 2004 (www.pollingreport.com/science.htm).
10. Gallup poll, 7 to 10 November 2004 (www.pollingreport.com/science.htm).
11. H. M. Blalock, *Social Statistics* (McGraw-Hill, New York, 1960).
12. L. A. Hayduk, *Structural Equation Modeling with LISREL* (Johns Hopkins Univ. Press, Baltimore, 1987).
13. K. Jöreskog, D. Sörbom, *LISREL 8* (Scientific Software International, Chicago, 1993).
14. J. D. Miller, R. Pardo, F. Niwa, *Public Perceptions of Science and Technology: A Comparative Study of the European Union, the United States, Japan, and Canada* (BBV Foundation Press, Madrid, 1997).
15. J. D. Miller, L. G. Kimmel, *Biomedical Communications* (Academic Press, New York, 2001).
16. J. D. Miller, *Sci. Commun.* **22**(3), 256 (2001).
17. J. D. Miller, in *Free-Choice Science Education*, J. H. Falk, Ed. (Teachers College Press, New York, 2001), pp. 93–114.

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Supporting Online Material

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