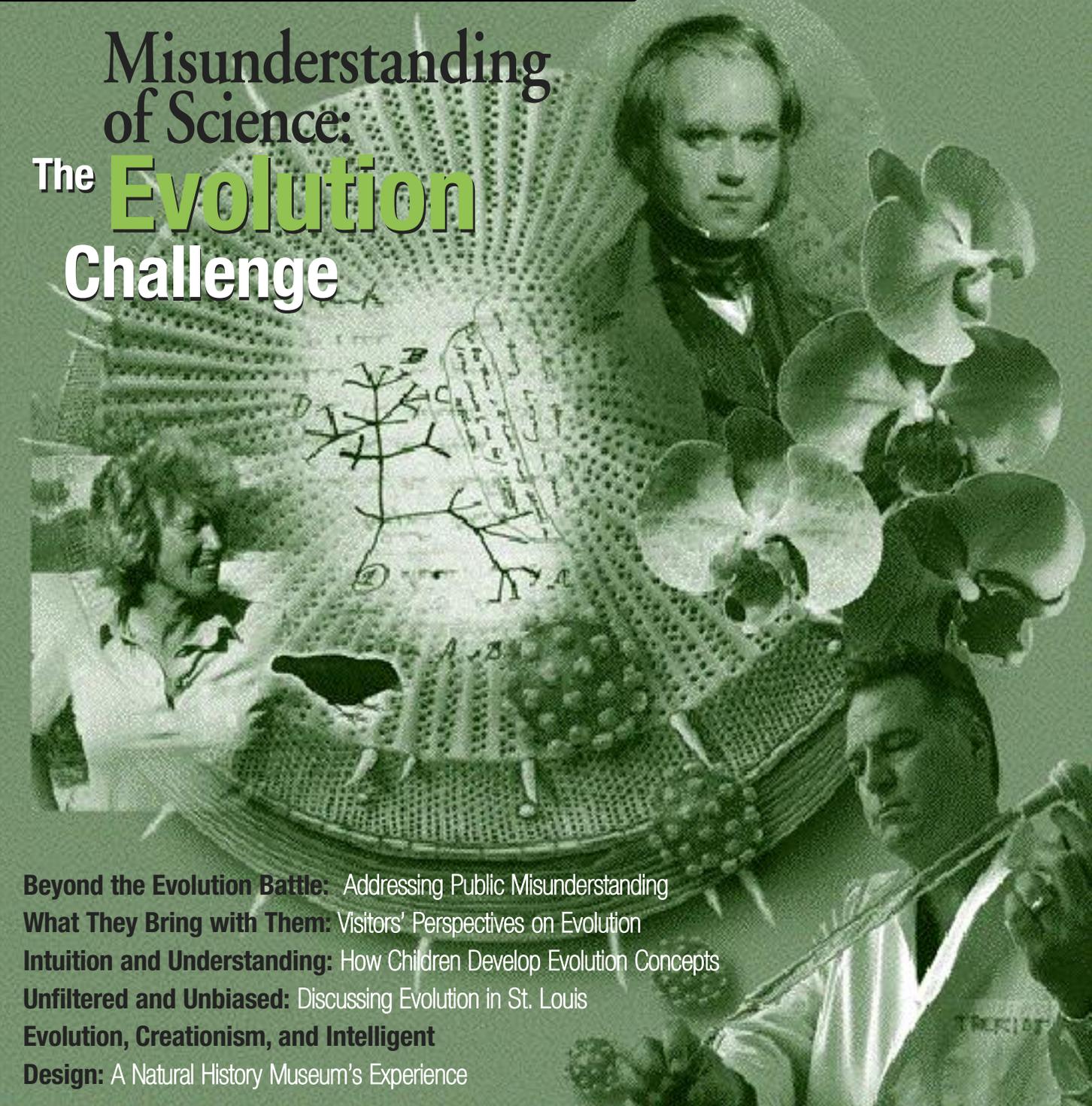


# ASTC Dimensions

Bimonthly News Journal of the Association of Science-Technology Centers

March/April 2006

## Misunderstanding of Science: The **Evolution** Challenge



**Beyond the Evolution Battle:** Addressing Public Misunderstanding  
**What They Bring with Them:** Visitors' Perspectives on Evolution  
**Intuition and Understanding:** How Children Develop Evolution Concepts  
**Unfiltered and Unbiased:** Discussing Evolution in St. Louis  
**Evolution, Creationism, and Intelligent  
Design:** A Natural History Museum's Experience



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March/April 2006

With so many museum- and science-related publications addressing the intelligent design/evolution controversy, what can ASTC's journal contribute to the conversation? Perhaps we can best draw some lessons from our own failure to communicate. Although the science of evolution is not in question, public understanding certainly falls short. In this issue, we examine why that might be, and what science centers and museums can do about it—from surveying visitors' attitudes vis-a-vis those of the public at large, to focusing on staff training, to creating effective exhibits and programming, to opening the floor to community discussion. As Martin Weiss observes in his lead article, "We have the tools, the audience, and their respect: we just need the will."

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Cover: Working in the microsphere (diatom researcher Edward Theriot, lower right) and macrosphere (biologist Rosemary Grant, left), modern scientists advance our knowledge of evolution in the tradition of Charles Darwin. Credits (clockwise from upper right): Darwin portrait © The Richard Milner Archive; orchids by Craig Chesek/AMNH; Edward Theriot, courtesy Marsha Miller; Rosemary Grant, courtesy Rosemary and Peter Grant; Tree of Life sketch, courtesy the Syndics of Cambridge University Library. Diatom, HIV virus, and finch illustrations by Angie Fox/Explore Evolution.

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# Beyond the Evolution Battle: *Addressing Public Misunderstanding*

By Martin Weiss

On December 20, 2005, Judge John Jones III, of the U.S. District Court for the Middle District of Pennsylvania, issued a blistering 139-page memorandum opinion in favor of the plaintiffs in *Kitzmiller v. Dover*. In his decision, the judge referred to the “breathtaking inanity” of the school board’s decision to require an antievolution disclaimer in the ninth grade biology class. He also forcefully noted, “in the hope that it may prevent the obvious waste of judicial and other resources which would be occasioned by a subsequent trial,” that intelligent design (ID) is not science.

The defendants, members of the Dover Area School Board, had required that a statement referring to “gaps” in the theory of evolution and suggesting “intelligent design” as an viable alternative be read to biology students. The plaintiffs were 11 parents who alleged that ID was in fact a religious construct and that presenting it to their children in a public school science class violated the “establishment clause” (regarding the separation of church and state) of the U.S. Constitution’s First Amendment.

Although Judge Jones’ jurisdiction encompasses only his own district, his decision is so clearly reasoned that it is hard to imagine other federal district judges ignoring it. In the battle between religion and science—a conflict eagerly promoted by the media since Anglican bishop Samuel Wilberforce first debated Charles Darwin’s *On the Origin of Species* in 1860 with biologist T.H. Huxley—is this the final salvo? Not likely.

Eugenie Scott, director of the National Center for Science Education (NCSE), a Berkeley, California–based organization that defends the teaching of evolution in public schools, says she has seen the anti-evolution movement rebound from such setbacks before: “It’s like a waterbed,” Scott says. “You push it down in one place, and it bounces up in another.”

Only a month after the *Kitzmiller* ruling, parents sued the El Tejon School District, in Lebec, California, for proposing to offer a course on “The Philosophy of Intelligent Design.” The proposal, a thinly disguised attempt to challenge evolution by promoting ID and creationism, was withdrawn. Surprisingly, this outcome was backed by the Seattle-based Discovery Institute, a leading promoter of ID and a previous supporter of the Dover school board, citing concern for further damage to the ID cause.

Total victory may be long in coming, however, as there are thousands of school boards across the United States making decisions about curriculum. In Kansas, the State Board of Education voted in November 2005 to allow ID to be taught in public schools. Critics fear this decision will encourage other state boards to make similar moves, distracting and confusing teachers and students. A member of the Kansas science standards committee, a math teacher who opposes the changes, told London’s *Guardian* newspaper last year, “They believe that the naturalistic bias of science is in fact atheistic, and that if we don’t change science, we can’t believe in God.... This is really an attack on all of science. Evolution is just the weak link.”

## A communication crisis

It is clear from recent opinion polls that most Americans simply don’t understand science in general, much less evolution. Part of the confusion arises over the definition of terms like “theory” (see “Selections from *Evolution and Creationism: A Museum Docent’s Guide*,” page 7), but there is much more about what science has discovered that educators are failing to convey.

Leonard Krishtalka, director of the University of Kansas Natural History Museum & Biodiversity Research Center, in Lawrence, put his finger on it when he told a *Chicago Tribune* reporter last October, “We have done a terrible job of explaining what science is. I would imagine to non-scientists a lot of science and technology sounds like so much magic. Is it any surprise that people are choosing one kind of magic over another?”

In science centers, where evolution is traditionally viewed as the province of natural history museums, it is unusual to find an exhibit or a program on the topic. Evolution is also not commonly addressed in zoos, aquaria, or botanical gardens—institutions that consider conservation their primary mission. And even in natural history museums, label writers have resorted to euphemisms like “biological change over time” when describing the evolution of species.

Why is evolution avoided in science museums? In an online survey of science center and museum staff conducted by the New York Hall of Science in April and May 2005, the barrier to presenting evolution cited

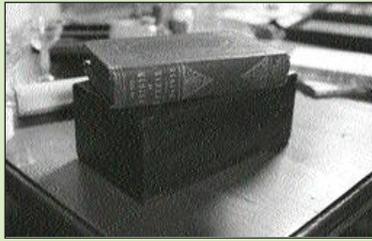
## In Darwin's Footsteps: The Man and His Journey

Planning for *Darwin*, the 6,000-square-foot exhibition that opened at New York's American Museum of Natural History (AMNH) last November, began well before the most recent round of attacks on the teaching of evolution in U.S. schools. Its New York run is the first step in a journey that will culminate, fittingly, at London's Natural History Museum in 2009, the bicentennial of the British naturalist's birth.

But Charles Darwin himself would not be surprised to learn that what he called "transmutation"—the transformation of plant and animal species over millions of years through a process of natural selection—is still exciting controversy. It was concern over that controversy, and the effect it might have on his beloved family, that kept Darwin from publishing his ideas for more than 20 years after he first sketched in a notebook his concept of the Tree of Life.

It was only the prospect of being trumped by a younger scientist, Alfred Russel Wallace, who had been doing similar research, that drove Darwin into print in 1859 with *On the Origin of Species by Means of Natural Selection*. Over the next 12 years, he would publish three more books elaborating his theory.

Visitors to *Darwin* can retrace the



Prominently displayed in the exhibition's reproduction of Charles Darwin's Down House study is an 1859 first edition of *On the Origin of Species*. Photo by Denis Finnin, AMNH

naturalist's journey to discovery, beginning with his five-year voyage to South America aboard the HMS *Beagle* (1831–36). Historic artifacts (Darwin's magnifying glass, his shipboard Bible, specimens collected on the *Beagle* expedition, notebooks and letters, and a reconstruction of his study at Down House in Kent, complete with first editions of his books) convey the careful habits of the scholar/collector. Live animals and plants from the places he visited (horned frogs, a green iguana, a pair of Galápagos tortoises, collections of carnivorous plants and orchids) suggest the wonder he felt at encountering so rich a diversity of life.

In a final section, *Evolution Today*, videos and interactive stations allow visitors to follow the application of Darwin's ideas in today's biological research. One area, *Social Reactions to Darwin*, traces public responses from Social Darwinism to creationism, while a large plasma screen

plays video clips of scientists like Francis Collins of the Human Genome Project, himself a practicing Christian, discussing the relationship between science and faith.

*Darwin* was designed and produced by AMNH in cooperation with English Heritage (the organization that maintains Down House), the Natural History Museum, Cambridge University, and some of Darwin's living descendants. Support for the \$3 million project came from the Austin Heart Foundation, the Carnegie Corporation of New York, and several generous private donors.

AMNH has planned a full schedule of lectures, panel discussions, and family programs to accompany the exhibition. A companion book, *Darwin: Discovering the Tree of Life*, was written by AMNH curator of paleontology Niles Eldredge, who also curated the exhibition.

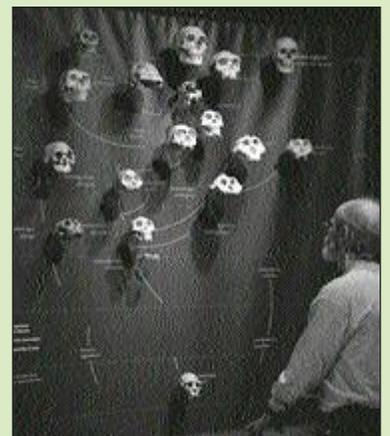
After closing in New York on May 29, *Darwin* will travel to the Field Museum, Chicago; the Museum of Science, Boston; and the Royal Ontario Museum, Toronto, before ending its run in London. The *Darwin* web site at [www.amnh.org](http://www.amnh.org) will be archived online as a research tool and guide to the naturalist's life and work.—Carolyn Sutterfield ■



A giant tortoise (*Geochelone elephantopus*) is one of several live specimens featured in *Darwin*, through May 29 at the American Museum of Natural History, New York. Photo by Joe McDonald, Clyde Peeling's Reptiland



The Evolution of the Horse exhibit explores stages in the development of the species, from the dog-sized *Hyracotherium* to the modern *Equus*. Photo by Denis Finnin, AMNH



A cladogram depicts the evolutionary relationships among groups of primates. Photo by Denis Finnin, AMNH

most often was concerns about negative reaction by the community, followed by questions of marketability, misalignment with mission, lack of staff training, and cost of programs. Museums may also fear losing local and state government funding along with community support.

The result of this abdication of responsibility is public confusion, even among those who regularly visit science centers and museums. When the New York Hall of Science polled visitors at seven museums in 2005 (see “What They Bring with Them,” page 8), nearly a third said evolution “might or might not be accurate, you can never know for sure.”

### An educational opportunity

As often happens, what initially seems to be a difficulty may in fact be an opportunity. Evolution needs better representation to the general public, and science centers and museums are in a unique position to do this. Our institutions are respected as impartial presenters of science and technology (see “Unfiltered and Unbiased,” page 10); we know how to present scientific concepts in an engaging, free-choice atmosphere; and we already support teachers in their efforts to make science more accessible to students.

We have also shown that we can address controversial topics effectively. Consider *What About AIDS?*, a 1991 traveling exhibition developed by a consortium of museums to demystify the science of HIV and AIDS, gather local support, and help staff successfully deal with non-supportive visitors, or *A Question of Truth*, a 1996 Ontario Science Centre exhibition that explored the idea of bias in scientific theories and research. We have the tools, the audience, and their respect; we just need the will.

Fortunately, most museum visitors are interested in learning science, and the general public may not be as antagonistic as we think. In an Octo-

ber 2005 CBS News poll, 67 percent of U.S. respondents said they thought it was possible “to believe in both God and evolution.” And although less than half (48 percent) of British respondents to a January 2006 BBC poll said they accepted evolution as the best description for the development of life, 69 percent still wanted it taught in the science curriculum.

Visitors may listen if science museums make it clear (1) that we consider religion and science to be two different but valid approaches to understanding the natural world—one philosophical, one experimental—and (2) that the absence of religion in our programs means not that we are anti-religion, but merely that science limits its investigations to what can be measured, tested, and possibly disproved. There is no way to test for the cosmic intelligence that ID proponents posit. Speaking at the 2005 ASTC Annual Conference, NSCE’s Scott made this point when she told her listeners, “No one has yet invented a ‘theometer.’”

What can museums do to combat misunderstanding? A review of evolution exhibitions by Judy Diamond and Judy Scotchmoor in the forthcoming journal *Museums & Social Issues* (see “Evolution Resources,” page 14) suggests that museums should adopt new approaches to presenting evolution that will make the science more accessible to visitors. Several institutions are attempting just that.

At the American Museum of Natural History, in New York City, the *Darwin* traveling exhibition (opposite page) shows how the 19th-century naturalist’s personal journey of discovery led to his theory of natural selection and evolution becoming the foundation of modern biology.

The University of Nebraska State Museum, in Lincoln, has worked with five partner museums to develop the interactive *Explore Evolution* exhibition (see page 12). Aimed primarily at visitors to university museums, *Explore Evolution* picks up where the

*Darwin* exhibition leaves off, expanding audiences’ awareness of modern evolution research in readily comprehensible terms.

*Human Evolution*, at the Museum of Science, Boston (see page 13), uses live animal displays and hands-on activities based on genetics to highlight the similarities between humans and other species. And at Chicago’s Field Museum, the former *Life Over Time* exhibit reopens March 10 as *Evolving Planet*, with the museum’s marquee dinosaurs now repositioned in the context of 4 billion years of evolution on Earth.

A major challenge in all informal science settings is how to present basic principles to young children in ways that will help them understand and assimilate more complex scientific concepts as they develop cognitively. In recent years, cognitive science researchers like E. Margaret Evans have begun to study and understand more about the ways that children develop intuitive theories as they grow and move toward adulthood, particularly in terms of their reasoning about evolutionary change in the natural world (see “Intuition and Understanding,” page 11).

If we are to be successful in helping children accept evolution as a description of change in the natural world, we need to understand how to incorporate these new findings into museum exhibitions on evolution. Early in 2006, the New York Hall of Science is planning to begin, with funding from the National Science Foundation, a study to explore how we can best translate this cognitive research into the informal learning environment. The project has the potential to create a paradigm shift in how science centers and museums present evolution and other complex science to children. ■

*Martin Weiss is vice president for science at the New York Hall of Science, Queens, New York.*

# Evolution, Creationism, and Intelligent Design:

## *A Natural History Museum's Experience*

By Warren D. Allmon

Americans as a whole do not know much about evolution. Take, for example, the 1993 International Social Survey poll that queried people in 21 nations on their basic knowledge of evolution; Americans came in last, behind Bulgaria and Slovenia. In a 2000 poll by People for the American Way (PFAW), 34 percent of respondents agreed with an incorrect definition of evolution (“Humans have developed from apes over the past millions of years”), and another 16 percent either thought evolution means something else or didn’t know what it means. In a 2004 U.S. Gallup poll, 30 percent said they didn’t know enough about evolution to have any opinion on it.

Americans also don’t know what scientists think about evolution. In that same 2000 PFAW poll, 69 percent of the respondents who had heard of evolution said they believed either that it is a “mostly” or “completely” inaccurate account of how humans were created and developed, or that “you can never know for sure.” A 2004 *Newsweek* survey found that just 45 percent of Americans think evolution is “widely accepted by the scientific community and well supported by evidence.” And in a 2005 Harris poll, 48 percent disagreed with the statement “Darwin’s theory of evolution is proven by fossil discoveries.”

Fortunately, Americans do go to museums by the millions. And so, in these times when evolution is so much in the news, there is a significant op-

portunity for museums to *do* more to encourage visitors to *learn* more about the idea that essentially all credible scientists agree is the cornerstone of biology.

In 2003 the Paleontological Research Institution (PRI), in Ithaca, New York, opened a new 18,000-square-foot exhibition and education facility, the Museum of the Earth. The museum’s permanent exhibitions include a separate exhibit area on the evidence for and mechanisms of evolution, as well as a strong evolutionary theme throughout.

We knew that to maximize visitors’ exposure to evolution we would need to provide our docents—the volunteer educators who handle most of the staffing on the floor—with specialized training and encouragement. More immediate concerns intervened, however, and the training was put on hold as we worked to complete exhibits.

A few months after opening, we had an incident that put evolution at the center of attention. One of our docents was confronted by a group of creationists, who challenged her to defend evolution and kept her cornered for 45 minutes. She finally had to excuse herself to escape.



**A volunteer docent, left, helps visitors search for 370-million-year-old fossils in the Fossil Lab.** Photo courtesy Museum of the Earth

The next day we began putting together a modest training program that now includes a published short “Guide for Docents” (see opposite page) and quarterly one-hour training seminars by a staff scientist. We also decided to open these training sessions free of charge to the general public, as well as to our volunteers.

Today, almost two years into the program, the responses have been many and varied. We have learned a great deal about public and media understanding of evolution and related topics, as well as about how other museums are dealing (or not dealing) with the subject, and we have tried to adapt our programs accordingly.

The first thing we learned was that very few museums have formal training programs for staff or volunteers in

how to explain evolution to visitors. We had come to that conclusion anecdotally while preparing our own materials, but it was confirmed later by the dozens of inquiries we received about our program from zoos, parks, informal educators, and other museums after the *New York Times* published an article on our training program in September 2005.

Many larger museums apparently offer no such training at all or consider that it is included in the general orientation they provide to all floor volunteers. Smaller museums appear to be more acutely interested in providing explicit training in evolution to their volunteers, but they are not sure how to proceed: Some told us of their own difficult encounters with visitors; others said they wanted to be proactive and develop programs for their staff and volunteers before an incident occurred. Some small institutions

reported difficulty in convincing administrators that this is a subject they should be involved in.

From our own visitors and docents, we have learned that our visitors are very interested in the subjects of evolution, creationism, and intelligent design—particularly following recent legal actions in Kansas and Pennsylvania. Aggressive and dramatic encounters between museum staff and visitors may have attracted media attention, but such occurrences are, in our experience, rare. Much more common are simple and sincere questions about such topics as the evidence for evolution, the meaning of intelligent design, and methods of geological dating (which is not directly relevant to evolution per se, but always comes up).

A common observation of our staff and volunteers is that visitors often do not know how or what to ask about these topics. We therefore encourage

our docents to gently solicit questions from visitors who seem especially interested, and to really listen to these queries before trying to answer. Feedback from both visitors and docents goes into ongoing revisions of the guide. We anticipate continued growth in this area.

Perhaps our most important lesson has been that even a modest (and underfunded) effort to improve the “evolutionary literacy” of museum visitors can produce large results in terms of media exposure and public interest. The need here is so vast, and the stakes so high, that every museum can and must do all it can. ■

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*Warren D. Allmon is an adjunct associate professor in the department of earth and atmospheric sciences at Cornell University and director of the Paleontological Research Institution/ Museum of the Earth, Ithaca, New York.*

## Selections from *Evolution and Creationism: A Guide for Museum Docents*

Evolution is a—perhaps *the*—fundamental idea of modern biology. Every field of biology concerned with whole organisms, including ecology, behavior, and systematics (the study of biodiversity), is based on evolution. Essentially all practicing professional biologists who work on whole organisms accept evolution as an adequate explanation for the order, history, and diversity of life they observe. There is no serious disagreement among such professional biologists about whether evolution is “true.”



Natural selection is a surprisingly simple concept. It is the idea that some individuals survive and reproduce better than others because they have inherited characteristics that help them do so. They therefore contribute, on average, more genes to later generations.



Creationism is the belief that Earth and its life were created, essentially in their modern forms, by a supernatural power. Modern creationism is actually quite diverse; it includes people who think that Earth is 10,000 years old, and those who believe it is much older; people who believe that the Biblical flood explains all of the geological record, and those who accept a more complex history. Most importantly, creationists believe in the action of divine or supernatural forces in shaping the natural world on a regular basis, and creationists reject evolution as an explanation for the order, history, and diversity of life.

A “theory” in science is a structure of related ideas that explains one or more natural phenomena and that is supported by observations from the natural world; it is not something less than a “fact.” Theories actually occupy the highest, not the lowest, rank among scientific ideas; they are systems of explanation that unite many different kinds of data and observations... Evolution is a “theory” in the same way that the idea that matter is made of atoms is a theory, that bacteria cause disease is a theory, that the sun being the center of the solar system is a theory. Any of these theories might be incorrect (and good scientists must always consider that possibility), but scientists accept all of them as provisionally “true” because there is so much evidence to support them.



Evolution challenges some people’s views of religion, morality, and ethics. This is not because evolution is contrary to religion in general, but because it is contrary to *some* religious views. Because of these objections, evolution—almost uniquely among scientific ideas—is often the subject of passionate public, political, and legal debates. Evolution is as well supported as *any* scientific idea, such as atomic theory, gravity, or the heliocentric solar system. Discarding or diluting the teaching or public discussion of evolution is thus a challenge to *all* science, and therefore a fundamental intellectual issue for society. ■

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*Full text of this docent’s guide, written by Warren D. Allmon, can be downloaded in pdf from the Museum of the Earth’s web site, [www.priweb.org](http://www.priweb.org).*

# What They Bring with Them:

## *Museum Visitors' Perspectives on Evolution*

By Martin Storksdieck and Jill Stein

Not surprisingly, the current controversy in the United States over the teaching of evolution, creationism, and/or “intelligent design” in public schools is affecting the science museum and science center world. A few museums, concerned that they might offend or alienate some audiences, have resorted to self-censorship—avoiding the “E” word in their labels, for example, or passing up large-format films that deal directly with evolution. Others have declared themselves squarely in the “science only” camp, refusing to acknowledge any other perspectives on the origin of life.

These are opposite ends of a spectrum, of course, and most museum professionals likely stand somewhere in the middle. Still, the passions involved have created uncertainty about appropriate ways to present Darwinian evolution in science centers and science museums.

In the spring of 2005, we and a number of colleagues at ASTC-member institutions conducted a survey of U.S. science center visitors to gauge public attitudes toward museum exhibitions on evolution. The purpose of the study was: (1) to compare science museum visitors’ understanding of and beliefs about evolution to those of a representative sample of the U.S. population, and (2) to assess visitors’ interest in attending evolution-related exhibitions at science museums. This was preliminary work toward a National Science Foundation project to research whether it is possible to introduce children to conceptual precursors of biological evolution, such as

variation, inheritance, and selection, through informal, museum-based interventions (see “Beyond the Evolution Battle,” page 3).

### Public views of evolution

We administered a one-page questionnaire to a total of 387 museum visitors in seven science museums representing a range of large and small, rural and urban, and regionally diverse institutions. These included the New York Hall of Science; the Miami Museum of Science & Planetarium; the North Museum of Science and History in Lancaster, Pennsylvania; the California Academy of Sciences; the Science Museum of Minnesota; the Academy of Natural Sciences in Philadelphia; and the St. Louis Science Center.

The basis for our work was *Evolution and Creationism in Public Education: An In-depth Reading of Public Opinion*, the report of a prior national survey conducted by People for the American Way (PFAW, 2000). Our

survey included some items from the PFAW study for comparison, as well as items that captured museum visitors’ perspectives on bringing children to exhibitions that feature evolution.

Data collectors were asked to employ a random sampling procedure, although exact procedures at each venue may have varied slightly. Data was entered into an Excel data sheet by staff at the New York Hall of Science, and the present authors analyzed it.

Here are some of the findings that emerged:

1. Both our survey and the PFAW survey probed respondents about their perception and understanding of evolution (see Table 1). While museum visitors were only slightly more likely to select the more accurate definition of human evolution as development from less advanced forms of life over millions of years (56%, versus 48%) and to self-report being “very” or “somewhat” familiar with the topic (90%, versus 83%), the data samples differed significantly in terms of their

**Table 1: Comparison of Evolution Definition between Museum and National Survey**

	Definition of Evolution	
	Museum Percent (n=378)	National Percent (n=1,500)
Evolution means human beings have developed from apes over the past millions of years	32%	32%
Evolution means human beings have developed from less advanced forms of life over millions of years	56%	48%
Means something else	11%	15%
Never heard of evolution	1%	5%

view of evolution as accurate (see Table 2) and their opinions on teaching evolution and/or creationism in the schools. This suggests that *belief* about evolution is not necessarily dependent upon one's level of *knowledge* on the subject.

2. Half of the museum audience (49%) felt that evolution was either a "completely" or "mostly" accurate account of how humans were created and developed, compared to only 27% of the national sample.

3. The museum audience was also far less likely than the national sample to support teaching only creationism in the schools (1%, versus 16%), indicating that visitors to a science museum are in fact more likely to support public communication about evolution.

4. Museum visitors were very supportive of science museums' featuring an exhibition on evolution. Nearly two-thirds (59% of 385 respondents) said that science museums should "definitely" do so, and 27% said "perhaps," likely meaning that their opinion depended on how the topic was presented in the exhibition. Only 14% of the museum visitors felt that science museums should definitely not do an exhibition on evolution.

5. The vast majority of the museum sample (84%) was also interested in bringing children to an exhibition on evolution; only 16% were not interested. Of those 16%, 83% were also opposed to science museums having such an exhibition.

### The educational factor

The two samples were similar in terms of age, gender, and ethnicity, but museum visitors in our sample had achieved a much higher level of education than had respondents in the national sample. This is in accordance with previous studies, such as the National Science Foundation's *Science &*

**Table 2: Comparison of View of Evolution between Museum and National Survey**

	View of Evolution	
	Museum Percent (n=383)	National Percent (n=1,500)
A completely accurate account of how humans were created and developed	20%	5%
Mostly accurate	29%	22%
Might or might not be accurate, you can never know for sure	30%	36%
Mostly NOT accurate	7%	8%
Completely NOT accurate	12%	21%
Not sure	2%	3%
Never heard of evolution	0%	5%

*Engineering Indicators* of 1998 and 2002, which show that museum visitation rates increase with educational attainment. Almost two-thirds of our museum sample (62%) had completed a college degree, and nearly half of those respondents had gone on to attend graduate school. In contrast, only 34% of the national survey sample had completed a college degree.

The museum survey data indicates that educational attainment is strongly correlated with familiarity with and knowledge of evolution. College graduates were twice as likely to state that they were "very familiar" with evolution as were high school graduates, and three times less likely to rate themselves as "not that familiar" with the concept. Highly educated visitors were also more likely to select the most accurate definition of evolution.

Attitudes toward evolution also correlated with educational attainment, with college graduates being more likely to support evolution-related topics in museums. The difference in perspective on evolution between museum visitors and a national sample may thus be a function of

educational attainment.

In conclusion, while museum visitors did not self-report stronger familiarity with or understanding of evolution than the average citizen, they were clearly more accepting of evolution and the public presentation of evolution. The vast majority felt that science museums should "definitely" feature exhibits on evolution and were interested in bringing their children to such an exhibition.

Although a few visitors may feel ambivalent about evolution, they tend to expect science in a science museum, and the fact that they chose to visit such a museum likely makes them tolerant toward the presentation of this topic. ■

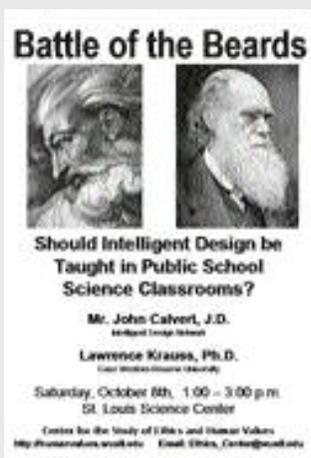
*Martin Storksdieck and Jill Stein are researchers at the Institute for Learning Innovation, Annapolis, Maryland. This article is based on a survey done for a National Science Foundation grant project expected to begin in early 2006 (see page 5). Collaborators included senior staff at the New York Hall of Science, the North Museum, and the Miami Museum of Science; museum consultant Mary Marcussen; and reviewers and data collectors at participating museums.*

## Unfiltered and Unbiased: Discussing Evolution in St. Louis

By Terry Holekamp

**J**udge Says Intelligent Design Not Science." "Christians: Evolution Is 'Anti-God.'" Headlines like these reveal that the cultural divide between religion and science is as deep as ever. One area where the controversy is particularly hot right now is whether U.S. public schools should teach alternatives to Darwin's theory of evolution by natural selection.

It's not the first time. According to the National Center for Science Education ([www.ncseweb.org](http://www.ncseweb.org)), proponents of creationism—the belief that God created the world exactly



as described in the Biblical book of Genesis—have been turned back in their efforts to change curriculum eight times since 1968 by Supreme Court decisions upholding the separation of church and state. In recent years a new group, including some scientists, has emerged to propose an alternate biological theory they call "intelligent design." This concept is the one that the Dover, Pennsylvania school board (see page 3) famously wanted to present to students along with Darwinian science.

As the media flocked to Judge Jones' Pennsylvania courtroom last summer, a group of us at the Center for the Study of Ethics and Human Values (CSEHV) at Washington University in St. Louis proposed holding an open public forum on the topic. Our feeling was that coherent explanations of either intelligent design or evolution by natural selection were almost never found in public discourse. Instead, the controversy was reduced to emotional sound bites, with

evolution proponents labeled as either "anti-God" or "truthful scientists" and ID supporters as either "Bible thumpers" or "good Christians." In holding the forum, our intention would be to provide the public with simple information, unfiltered and unbiased, enabling attendees to make a conscientious decision on their own.

We decided to format the event as a moderated discussion between two opposing speakers on the topic "Should Intelligent Design Be Taught in Public School Classrooms?" CSEHV director Ira Kodner suggested we contact Al Wiman, vice president for the public understanding of science at the Saint Louis Science Center (and a former TV science

reporter), as someone who could help us present scientific issues to the public. To our delight, Al not only agreed to moderate the discussion, but also proposed the science center, a respected public venue, as the host site.

Doug King, president and CEO of the Saint Louis Science Center, readily agreed. "Our mission is to stimulate interest in and understanding of science and technology throughout the community," King said. With science center support, we quickly confirmed two nationally known speakers—Lawrence Krauss, professor of physics at Case Western Reserve University, Cleveland, Ohio, and the author of a number of popular books on science, and John Calvert, a lawyer and onetime geologist who is managing director of the Intelligent Design Network, Shawnee Mission, Kansas.

We soon found ourselves engulfed in a controversy of our own. Shortly after we announced the October 8 event, we received heated messages from community groups, including a number of science teachers, expressing concern that by sponsoring such a discussion CSEHV and the science center were lending credence to the ID movement. Our response was that the public can be fully informed only when all sides are presented in an impartial forum. We further stated our belief that presenting only one viewpoint or filtering the facts would be unethical and would destroy our credibility with the larger public.

A public forum on such a stormy topic caught the attention of the news media. On the second Saturday in October, local reporters joined the more than 400 people packed into the science center's May Auditorium. (Science center staff estimated that at least 200 were turned away after fire regulations closed the doors.)

Turnout is only one measure of success, of course. More indicative is the level of audience involvement. After the first hour, during which each speaker presented his position, the floor was opened to written questions. This catalyzed some of the most interesting discourse of the afternoon, as the speakers addressed queries like "Should science books include all of the world's creation myths?", "Isn't the existence of order in nature proof of intelligent design?", and "What sort of lab investigations would you suggest I use to demonstrate ID to my ninth grade students?"

The more than 200 question cards submitted indicated that we had achieved our goal of engaging and informing the public regarding both sides of this divisive social issue. The fact that dozens of attendees stayed afterward to chat with panelists and with each other showed that productive communication between polarized people had begun.

As members of the civic community, we students see a need for more such public events at science centers and museums. The spirit of science, after all, is to educate. Today, as people worldwide clash over science-related issues from stem cell research to emergency contraception to global warming, perhaps more museums will take up the nonpartisan role of presenting objective information to the public and providing forums for open discussion. ■



Al Wiman, center, of the Saint Louis Science Center, moderates the October 8 discussion between physics professor Lawrence Krauss, left, and ID proponent John Calvert. Top: A poster advertises the event. Images courtesy Center for the Study of Ethics and Human Values

*Terry Holekamp is a medical student at Washington University School of Medicine, St. Louis, Missouri, and an associate of the university's Center for the Study of Ethics & Human Values, <http://humanvalues.wustl.edu/>. He was one of four student organizers of the October 8 forum.*

# Intuition and Understanding:

## *How Children Develop Their Concepts of Evolution*

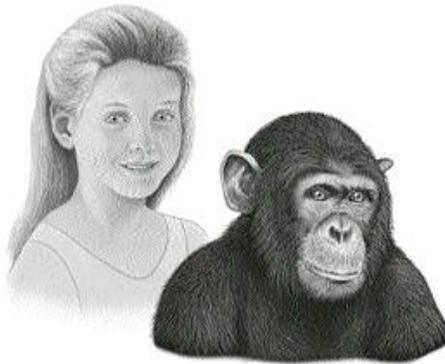
By E. Margaret Evans

Cognitive scientists are interested in the way people reason about the world in the absence of expert training. Such commonsense, or “everyday,” reasoning has been portrayed as a limited series of intuitive theories about the world, each of which potentially describes a different kind of knowledge, such as a “naive” biology or psychology.

Intuitive theories differ from scientific theories in many ways, but like scientific theories they frame the way we view the world and provide both questions and explanations. These are the kinds of everyday explanations, or “hunches,” that most easily come to mind when we try to figure out what is going on in the world.

Over the past 15 years or so, my colleagues and I have begun to map out the emergence of children’s everyday understanding of natural transformations such as metamorphosis and evolutionary change. In the process we have interviewed hundreds of children and parents from different religious backgrounds. To make sure the children really think through the issues, we ask them unexpected questions and give them unusual tasks. We also compare their intuitions about natural transformations, such as seasonal change, with their intuitions about artificial transformations, such as the making of chairs or toys.

What we have found is that children are subject to some prevalent cognitive biases about the biological world: namely, that species are stable and unchanging and that animate behavior is goal directed and intentional. Left unaddressed, these biases often



*Illustration by Angie Fox/Explore Evolution*

persist into adulthood, where they are clearly at odds with an evolutionary perspective.

The following are some observations about the ways that children of different ages reason about different types of transformations.

### **Four- to 7-year-olds**

In preschool through about second grade (ages 4 to 7), most children reject the idea of almost any kind of radical biological change, from metamorphosis to adaptive variation. From the perspective of the young child’s intuitive biology, living things cannot change. Perhaps because this age group is learning so much that is different and new, they find it useful to believe that the world around them is permanent and enduring.

Although young children do know that animals possess adaptive features, such as wings for flying or fins for swimming, they have little sense of what would happen if the environment changed. And if you ask a child from this age group where the first animals came from, you will get a variety of answers. Some are likely to respond that “God made them.” Others

may reply that the first animals came “from someplace else” or that they “came out of the ground.” In other words, they appear to think the animals were always here on Earth, but someplace else, where they could not be seen. This idea may be rooted in everyday experience, such as the burst of new life we see each spring after the snow melts or the first rains arrive.

### **Eight- to 10-year-olds**

From about third grade to the end of fourth grade (ages 8 to 10), there is a gradual shift in children’s reasoning. This age group is more likely to accept some kinds of radical biological change, such as metamorphosis. Interestingly, whatever their family background, most children in this age range endorse the idea that the first kinds of animals were “made by someone,” and often that someone is God.

One reason for this belief is that, unlike their younger siblings, this age group is beginning to think about existential questions. They are more likely to know about death and to understand that animal kinds are not eternal—that they were not always here on Earth, nor will they continue to be on Earth. Intuitively understanding the human as an intentional manufacturer of new tools, they transfer that understanding to objects that have arisen naturally, such as new species.

Simultaneously, children in this age range are starting to integrate different kinds of causes into a complex causal structure. Preschool children, seeing “Josh” knock over a glass and break it, are perfectly capable of reasoning

about the immediate cause: “Josh didn’t see the glass.” But if you ask them to think a little harder about “why” Josh knocked over the glass, they have more difficulty.

Eight- to 10-year-olds are better able to engage in a more complicated reasoning process: Josh knocked over the glass “because he was in a bad mood ... because he didn’t get lunch ... because he forgot his lunch money”... and so on until they arrive at the most distant or original cause. This sort of reasoning is necessary for understanding the origins of novel animal kinds: Why and how did something come into existence in the first place?

### Ten- to 12-year-olds

On the surface, at least, the beliefs of preadolescents (ages 10 to 12) are similar to the beliefs of the adult members of their community, with the same percentage endorsing evolutionist and creationist beliefs. Children exposed to evidence that animals change—metamorphosis, adaptive variation within species, fossils—are the most likely to accept major evolutionary changes. They will agree that one kind of animal could have originated from earlier and very different kinds of living things, although they are likely to exhibit many misconceptions about evolution. For these children who take the perspective of a naturalist, this is

the beginning of a more complex understanding of the fundamental interrelationships among all living things.

Conversely, children who know the least about natural history and fossils and who go to schools that endorse Biblical literalism are likely to endorse the idea that God created each kind of animal with its own unique “essence.” Interestingly, these beliefs seem to vary depending on the organism. For example, many children and their parents agree that butterflies and frogs evolve, but state that God created mammals—and, in particular, humans.

### Older youth and adults

Adolescents (ages 12 and up) are often ready to assimilate basic evolutionary concepts, although their everyday intuitions continue to undermine the teaching of Darwinian theory. Along with many adults, most endorse pre-Darwinian theories of evolutionary change. This makes it difficult for them to grasp contemporary Darwinian concepts. For example, when a visitor interviewed for *Explore Evolution* was asked to explain the changes in the beaks of Galápagos finches, she said, “Well, in order to survive, their body parts had to adjust to certain things, similar to the way giraffes’ necks probably grew long as they reached for the plants at the top of the trees, so the beak grew longer to

deal with the tougher seeds.”

Many adolescents and adults believe that adaptations acquired over the lifetime of an individual animal can be inherited by future generations. Such Lamarckian views appear to have their roots in these respondents’ intuitive understanding of the way humans fit in with or adapt to their environment.

Education researchers have found that science learners also tend to think of evolution as growth and improvement over time. Many adults and children accept the extinction of the dinosaurs, for example, but are less willing to generalize this understanding to include contemporary species, especially humans. Despite scientific consensus to the contrary, they appear to hold to the idea that species continually adapt to new environments and do not really become extinct.

The problem may be less one of ignorance than of existential concern. For many people, the idea that humans and other species alive today might cease to exist is difficult to contemplate. One parent expressed her concern thus: “I don’t know what to believe. I just want my kid to go to heaven.” A visitor to the *Explore Evolution* exhibition commented, “The Bible says, ‘God created the heavens and the earth.’ It also explains that He created mankind in his image. To me it is comforting to know where I’m going when I die.... Where will

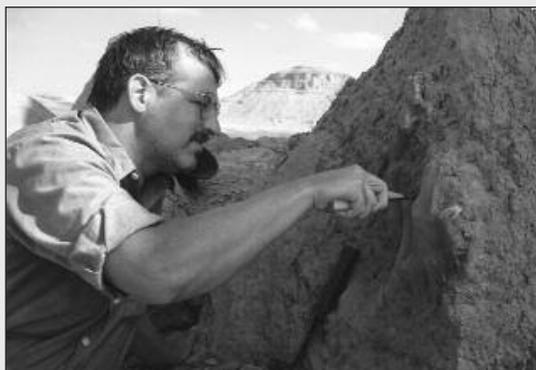


Photo courtesy University of Michigan Museum of Paleontology

### Exploring Evolution in Michigan

On January 14, 2006, *Explore Evolution* opened at the University of Michigan’s Exhibit Museum of Natural History, Ann Arbor. The museum was one of six U.S. science centers, led by the University of Nebraska State Museum, that developed the permanent exhibition in partnership with five statewide 4-H organizations (see Spotlights, *ASTC Dimensions*, November/December 2005). The exhibition highlights the current research of seven evolutionary scientists, including University of Michigan paleontologist Philip Gingerich, left.

The debut in Ann Arbor was also the impetus for a special winter semester on evolution in the university’s school of Literature, Science, and Arts (LSA), organized by Exhibit Museum director Amy Harris. Public events include a speaker series, symposia, films, author readings, exhibit openings, teacher trainings, and family events.

To learn more about *Explore Evolution*, visit [www.explore-evolution.unl.edu/](http://www.explore-evolution.unl.edu/). For details on the LSA semester program, visit [www.lsa.umich.edu/lsthem/exploreevolution/](http://www.lsa.umich.edu/lsthem/exploreevolution/).

you go when you die?..."

These kinds of findings illustrate the importance of developing exhibits that speak directly to visitors' everyday intuitions about the biological world. In many ways, evolutionary theory *is* counterintuitive: It presents a world that is dynamic and ever-changing and, even more critically to some, a world that apparently lacks purpose and design. Perhaps museums could tackle such concerns more openly, pointing out that while evolution does not (and cannot) explain the "final cause" of *why* we are here on Earth, it can address the secondary causes or mechanisms that explain *how* we got where we are. ■

### Related readings

- Evans, E. Margaret. "Cognitive and Contextual Factors in the Emergence of Diverse Belief Systems: Creation Versus Evolution." *Cognitive Psychology*, Vol. 42, Issue 3 (May 2001).
- Rosengren, Karl S., Susan A. Gelman, Charles W. Kalish, and M. McCormick. "As Time Goes By: Children's Early Understanding of Growth in Animals." *Child Development*, Vol. 62, No. 6 (1991).
- Bishop, Beth A., and Charles W. Anderson. "Student Conceptions of Natural Selection and Its Role in Evolution." *Journal of Research in Science Teaching*, Vol. 27, No. 5 (1990).
- Poling, Devereaux A., and E. Margaret Evans. "Are Dinosaurs the Rule or the Exception? Developing Concepts of Death and Extinction." *Cognitive Development*, Vol. 19, Issue 3 (2004).

*E. Margaret Evans is a research investigator at the University of Michigan's Center for Human Growth and Development, Ann Arbor. This article is adapted with permission from her chapter, "Teaching and Learning about Evolution," in Judy Diamond (ed.), Carl Zimmer, E. Margaret Evans, Linda Allison, and Sarah Disbrow, Virus and the Whale: Exploring Evolution in Creatures Small and Large, © 2006, National Science Teachers Association. To order, visit <http://store.nsta.org>.*

## Living Evolution: A Passion for Science Communication

By Gail Jennes

**E**volution has been a topic of investigation at the Museum of Science, Boston (MOS) ever since Harvard geologist Louis Agassiz critiqued Charles Darwin's *On the Origin of Species* at an 1860 meeting of the museum's precursor, the Boston Society of Natural History. (For the record, Agassiz disagreed with Darwin's conclusions.)

Recent polls showing the level of public misunderstanding about Darwinian evolution were thus no surprise to museum staff. Since 2003, they had been planning to upgrade an existing exhibit on the topic. The result, *Human Evolution*, opened in late 2005. With more elements still to come, the exhibition allows visitors to explore the evidence for the development of our own species through interaction with fossils, genetic research, and living animals.

The driving force behind the project is MOS manager of discovery spaces Lucy Kirshner. As a child growing up in Massachusetts, Kirshner was encouraged to pursue her own inquiries, she says. "We lived outside as much as possible and scrutinized the size, shape, and changes in all sorts of living things." The experience taught her that asking good questions is as important as finding answers. After beginning her museum career at Michigan's Ann Arbor Hands-On Museum in 1981, she came to MOS in 1985.

Kirshner's inspiration for *Human Evolution* was the many breakthroughs achieved in genetic research over the past decade, including the Human Genome Project. "Evolution and the genetic mechanisms at its heart are challenging to teach and difficult to grasp," she says, "but public understanding is critical."

Housed in the museum's Human Body Connection discovery space, the exhibition features a variety of interactive exhibits. Museum-goers learn more about themselves as they compare similarities and differences between newly hatched chicks and humans and observe the behavior of live primates (in this case, a family of cotton-top tamarin monkeys). "This is not dusty, but living history," Kirshner says. "Visitors who



**Lucy Kirshner, manager of discovery spaces at the Museum of Science, introduces visitors to the PTC taste test, a harmless indicator of genetic inheritance.**

*Photo by Eric Workman/Museum of Science, Boston*

watch our tamarins care for their children will relate to other species in a whole new way."

At the Hominid Skull Field Station, museum-goers can play a computer-based game to learn about differences among our extinct early relatives—exploring where each skull was found, who discovered it, and what each reveals. In a related component, they can also learn what jaws and teeth reveal about an early hominid's diet, age at death, and relationship to modern humans.

In the genetics area, computer-generated animations demonstrate how DNA turns into proteins in real time. A taste experiment with the harmless but bitter chemical PTC lets visitors explore their own genetic inheritance, and with a spin of a 4-foot dial, they can choose an organism and follow its branching evolution to see how it is related to others.

Throughout, the exhibition presents the evidence for evolution and shows how scientists have interpreted it, allowing visitors to draw their own conclusions. But the museum stands clearly for the science. When people ask about intelligent design, Kirshner says she explains the difference between ID, a "philosophical construct," and scientific theories, "well-documented explanations that have grown out of careful experiments, supported by evidence that is open to scrutiny and test." ■

*Gail Jennes is communications officer at the Museum of Science, Boston. The Human Evolution exhibition is part of an institution-wide natural and life sciences initiative that will include hosting the Darwin exhibition in 2007.*

## EVOLUTION RESOURCES

The following entries represent references and other resources cited by contributors to this issue.

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- Talbot, Margot. "Darwin on Trial." *The New Yorker*, December 5, 2005.
- West, Robert Mac. "The Lay of the Land: The Current Context for Communicating Evolution in Natural History Museums," *Informal Learning Review* 69, November-December 2004.

### WEB SITES

#### ASTC Resource Center: Evolution

[www.astc.org/resource/education/evolution.htm](http://www.astc.org/resource/education/evolution.htm)  
Includes the "Statement on Science" adopted by ASTC's executive committee in September 2005, as well as updated links to what member museums are doing in the area of evolutionary science.

#### Galápagos: Education

<http://pubs.nsta.org/galapagos/resources/page1.html>  
Developed by the National Science Teachers Association (NSTA), in conjunction with the Smithsonian Institution and the 1999 IMAX film *Galápagos*, the site supports teaching and learning about biology, ecology, geology, and the unifying concepts of science.

#### Howard Hughes Medical Institute Holiday Lectures

[www.hhmi.org/biointeractive/](http://www.hhmi.org/biointeractive/)  
On-demand videos of researchers Sean B. Carroll and David M. Kingsley delivering HHMI's December 2005 Holiday Lectures, *Evolution: Constant Change and Common Threads*.

#### National Academies of Science (NAS)

<http://nationalacademies.org/evolution/>  
Reports, statements, and papers on evolution education and research, produced by NAS and other sources.

#### National Center for Science Education (NCSE)

[www.ncseweb.org](http://www.ncseweb.org)  
A central resource for background on evolution, creationism, and ID and news of anti-evolution activities worldwide. Links to *Kitzmiller* proceedings can be found here.

#### PollingReport.com (Science and Nature)

[www.pollingreport.com/science.htm](http://www.pollingreport.com/science.htm)  
Summaries of 2000–2006 Gallup, Harris, CNN, and other polls related to origin of human life, stem cell research, biotech, and more.

#### The Talk Origins Archive

[www.talkorigins.org](http://www.talkorigins.org)  
Usenet newsgroup devoted to the discussion and debate of biological and physical origins.

#### Understanding Evolution

<http://evolution.berkeley.edu/>  
Devoted to the science and history of evolutionary biology, this site is a collaborative project of the University of California Museum of Paleontology and NCSE.

#### New Journal to Address Evolution

Launching this spring, *Museums & Social Issues*, a new biannual journal published by Left Coast Press Inc. and edited by Kris Morissey of Michigan State University, will provide a forum for considering and discussing social issues and the role of museums in engaging those issues.

Vol. 1, No. 1, "Museums and the Public Understanding of Evolution," will have an introduction by NCSE's Eugenie Scott. Among the planned articles will be

- Diamond, Judy, and Judy Scotchmoor. "Exhibiting Evolution."
- Fraser, John. "Group Identity, Protest, and Evolution."
- Scott, Monique, and Ellen Giusti. "Designing Human Evolution Exhibitions: Insights from Exhibitions and Audiences."
- Spiegel, Amy, E. Margaret Evans, Wendy Gram, and Judy Diamond. "Museum Visitors' Understanding of Evolution."

# Science as a World View, or, Can Science Explain Everything?

By Gretchen Jennings

In a September 2005 letter to the *Manchester Guardian*, a thoughtful reader responded to an article the U.K. newspaper had published on the evolution/creationism controversy: “Children should not be taught creationism, which is irrational, but neither should they be taught that scientific investigation is our only tool of thought. Imagination can also bring us close to the unknowable powers of the universe, of which we are a part....”

This quote mirrors the two trends, or strands of thought, that are currently being played out in the museum world. One involves a move toward increased cultural sensitivity and understanding, adopting the view that it is not only important but essential for our society to understand and empathize with groups that may have very different views from our own. The other involves the current debate in which creationists and proponents of intelligent design either oppose the teaching of evolution in schools and other educational settings, such as museums, or propose that evolution should be presented as if it were an alternative view, alongside such views as intelligent design.

A question arises for museums from examining these two cultural trends: Is intelligent design (or creationism) one of those “alternate world views” that ought to be given a voice in a museum setting? If so, in what type of museum and in what context? And if not, why not?

Although this topic is one that affects all museums, natural history museums appear to be affected by it in a special way. On the one hand, the ownership of collections from the

natural world requires them to address evolution in talking about their development, their origins, and so forth. On the other hand, such collections often contain artifacts from non-Western cultures that require culturally sensitive presentation.

It’s interesting that at the same time natural history museums are championing the science of evolution as documented in their collections from the natural world, they are also attempting to undo and rethink their outmoded presentation of human cultures, with its overtones of Social Darwinism. (That now-discredited movement—promulgated by a British philosopher, Herbert Spencer, who freely borrowed Darwin’s ideas for his own purposes—held that you can trace human evolution by looking at present cultures and lining them up on a continuum from the so-called “primitive” to the so-called “more evolved.”)

But natural history museums are not alone in this discussion. Museums that present the art or cultural traditions of non-Western societies are also affected. For example, the National Museum of the American Indian at the Smithsonian has been criticized by some for presenting the origin stories of various tribal groups with little additional commentary from historians, geographers, archaeologists, and others who might explain the Native American presence from a Western perspective. Is this a failure on the part of the museum or an appropriate stance, given its focus and mission?

Questions like this require that all of us, as museum professionals, develop a broad range of thinking tools and skills. Among these are a more

nuanced understanding of the nature of cultural differences, as well as an understanding of the concept of “world view”—i.e., the idea that different groups hold fundamentally different understandings of things like causality, time, what is living, what is not living, how and why we came to be, and that these views work pretty well for those who hold them.

We also need to develop a clear understanding of one of the key pillars of our own world view—the scientific method and its processes. We need to recognize what its characteristics are, what kinds of realities it is designed to elucidate, and what it cannot.

Finally, we need to be able to think about these questions in their societal and civil contexts: about where and how it is appropriate to be inclusive and where it is appropriate to be more selective in what is presented in a museum context.

All of these questions have an impact on how museums develop and view their missions, and thus, in turn, on issues of collecting, interpretation, and exhibition. And they also affect how we educate both new museum professionals and provide professional development for current staff. ■

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*Gretchen Jennings is director of education for interpretation and visitor experience at the National Museum of American History, Smithsonian Institution, Washington, D.C. An extended version of this essay, which served as her introduction to a 2005 ASTC Annual Conference session, will appear in John H. Falk, et al. (eds.), In Principle, In Practice, Lanham, Md.: AltaMira, in press.*

# Calendar

## MARCH

- 22–25 Museums and the Web 2006.** Albuquerque, New Mexico. *Details:* [www.archimuse.com](http://www.archimuse.com)
- 29 Solar Eclipse: Stories from the Path of Totality.** Nine-hour coverage of the eclipse via satellite and the Web, broadcast live from Turkey. Hosted by the Exploratorium, San Francisco. *Details:* [www.exploratorium.edu/eclipse](http://www.exploratorium.edu/eclipse)
- 30–Apr. 1 “Museums and Spirituality.”** Workshop hosted by the Cultural Resource Management Program, University of Victoria, British Columbia, Canada. *Details:* [www.uvcs.uvic.ca/crmp](http://www.uvcs.uvic.ca/crmp)

## APRIL

- 19–21 Astronomy from the Ground Up.** Tucson, Arizona. First in a series of NSF-funded workshops organized by the National Optical Astronomy Observatory, the Astronomical Society of the Pacific, and ASTC. *Details:* [www.astro.society.org/afgu](http://www.astro.society.org/afgu)
- 24–26 Interactivity 2006.** “Growing Healthy Kids, Museums and Communities.” Annual conference of the Association of Children’s Museums. Hosted by the Children’s Museum, Boston, Massachusetts. *Details:* [www.childrensmuseums.org](http://www.childrensmuseums.org)
- 27–May 1 American Association of Museums Annual Meeting.** “A Centennial of Ideas: Exploring Tomorrow’s Museums.” Boston, Massachusetts. ASTC will host a luncheon at the Museum of Science on Thursday, April 27, noon–2 p.m.; event #01, \$50. *Details:* [www.aam-us.org](http://www.aam-us.org)

## MAY

- 10–14 6th ASPAC Conference.** “Engaging and Communicating Science.” Hosted by Scitech Discovery Centre, Perth, Western Australia. *Details:* [www.scitech.org.au](http://www.scitech.org.au)
- 12–13 ASTC RAP Session.\*** “Real Tools, Real Science, & Real Living Things: A Collaborative RAP on New Exhibit Strategies.” Hosted by the Huntington Library, Art Collections, and Botanical Gardens and the California Science Center, Los Angeles.
- 25–27 CASC Annual Conference.** Ottawa, Ontario. Hosted by the Canada Science and Technology Museum and the Canadian Museum of Nature. *Details:* [www.canadiansciencecentres.ca/conferences.htm](http://www.canadiansciencecentres.ca/conferences.htm)

## JUNE

- 8–10 Ecsite Annual Conference.** Hosted by Technopolis, the Flemish Science Centre, Mechelen, Belgium. *Details:* [www.technopolis.be](http://www.technopolis.be)
- 24–25 ASTC RAP Session.\*** “Flexible Spaces Make Dynamic Places.” Hosted by the Buffalo Museum of Science, Buffalo, New York.

## JULY

- 25–29 VSA Annual Conference.** “Counting Visitors or Making Visitors Count.” Grand Rapids, Michigan. *Details:* [www.visitorstudies.org/conference](http://www.visitorstudies.org/conference)

## OCTOBER

- 28–31 ASTC Annual Conference.** “Appropriate Growth: Sustaining Institutional Advancement.” Hosted by the Louisville Science Center, Louisville, Kentucky. *Details:* [www.astc.org/conference](http://www.astc.org/conference)

## Upgraded ASTC Connect Hosts Discussions

If you haven’t been there yet, it’s definitely time to visit ASTC’s newly revamped online professional development site, ASTC Connect. Located at [www.astc.org/astc\\_connect](http://www.astc.org/astc_connect), the site has been reconfigured using open-source software called Moodle to include discussion forums, live chats, and regular RSS feeds of breaking science news and images.

Along with the free “Science Center Basics” tutorial, a self-paced, unmoderated orientation to the field, ASTC Connect now offers occasional moderated workshops. Recent sessions have included “Creating Exhibition Case Studies,” led by museum consultant and exhibit designer Kathleen McLean; “Fostering Dialogue about Science Policy,” led by Andrea Bاندelli, project manager for Ecsite’s *DeCiDe* project; and “Understanding Visitors’ Ideas: Cosmic Conversations,” led by Mary Dussault of the Harvard-Smithsonian Astrophysical Observatory.

In March, a “New Models” forum organized by John Jacobsen of White Oak Associates and David Chesebrough, soon to be of COSI Columbus (see “People,” page 20), will open with a conversation focused on new-style libraries; Marsha Semmel of IMLS will serve as moderator. Coming soon are workshops developed in conjunction with the Astronomical Society of the Pacific’s *Astronomy from the Ground Up* project, as well as two New York Hall of Science projects: *Volunteers TryScience* (VolTS) and *Life Changes* (on evolution).

The site will also host book discussion groups associated with ASTC’s new IMLS-funded *Designed for Learning* project, which will support the sharing of best practices in museum planning and design through the publication of two books—one on “visitor voices” in exhibits, the other on “environments for learning.”

\* Information on ASTC RAP sessions is available at [www.astc.org/profdev/](http://www.astc.org/profdev/). For updated events listings, click on ‘Calendar’ at [www.astc.org](http://www.astc.org).

Online forums based on ASTC Annual Conference sessions are a possibility for the future. To propose a discussion forum or to find out about using ASTC Connect for project dissemination, contact Wendy Pollock, [wpollock@astc.org](mailto:wpollock@astc.org).

## National Science Board's 2020 Vision

Last November, the National Science Board (NSB), the policy-making arm of the U.S. National Science Foundation, released a draft version of a strategic plan for NSF's future, *2020 Vision for the National Science Foundation*, and invited public comment. ASTC's Advocacy Committee, working with others, took a lead role in crafting and submitting a response on behalf of the science center field. The final version was released December 28 (in pdf, NSB-05-142, at [www.nsf.gov/publications](http://www.nsf.gov/publications)).

In *2020 Vision*, the board outlines four "near-term goals" that NSF can achieve to help maintain U.S. viability in the global scientific enterprise. Science centers and museums are specifically mentioned in connection with Goal 3, the evaluation of current education programs and the development of strategies to increase their

impact. Noting their value as a source of further learning for many American parents, students, and teachers, the board wrote, "These 'informal science' institutions have the ability both to improve the teaching of S&E in schools and to serve as natural bridges among academia, the general public, and our school communities."

ASTC is grateful to the NSB—and particularly to board member Kathy Sullivan of COSI Columbus—for supporting the role of museums in "fostering the scientific literacy of all our citizens."

## ExFiles Project Funded

Capturing shared knowledge is key to the vitality of any organization. But for one segment of the informal science education enterprise—exhibition design—access to accumulated knowledge has been difficult.

To help fill that gap, ASTC is launching *ExFiles: An Online Science Community*. The goal of the three-year project, newly funded by a \$725,000 grant from NSF, is to create a convenient system whereby prototypers, content developers, evaluators, graphic designers, project managers, fabricators, and other exhibit practitioners can not only retrieve timely information for their projects but also

contribute to, comment on, and critique a database of shared information.

Principal investigator for *ExFiles* is Wendy Pollock, ASTC's director of research, publications, and exhibitions; museum consultant Kathleen McLean is co-PI. Plans call for establishing a core contributor team, building a critical mass of valued content, designing accessible site features, recognizing the work of contributors, offering conference workshops, and building partnerships with related organizations.

## Film Groups Merge

Effective January 1, the Giant Screen Theater Association and the Large Format Cinema Association have joined forces to create the Giant Screen Cinema Association (GSCA), headquartered in St. Louis, Missouri.

An interim board, including ASTC museum directors Joanna Haas (Carnegie Science Center), Doug King (Saint Louis Science Center), and Emlyn Koster (Liberty Science Center), is overseeing initial operations of the new network. Elections for GSCA board members will be held in March, and a new board will be in place for the organization's first annual conference, to be held March 29–31 in Los Angeles. For more details, visit [www.giantscreencinema.com](http://www.giantscreencinema.com). ■

## Welcome to ASTC

The following new members were approved by ASTC's Membership Committee in October 2005. Contact information is available in the About ASTC section of the ASTC web site, [www.astc.org](http://www.astc.org).

### SCIENCE CENTER AND MUSEUM MEMBERS

- **Marinelife Center of Juno Beach Inc.**, Juno Beach, Florida. Adjacent to a major sea turtle nesting area, this organization's new Loggerhead Marinelife Center, due to open in mid 2006, will include a visitor center, marine laboratory, sea turtle veterinary hospital, and auditorium.
- **Museum of Science and Industry in Manchester**, Manchester, U.K. Occupying the world's oldest surviving passenger railway station and other 19th-century buildings, the museum opened its new *Power Hall* and *Xperiment*, an interactive gallery for children under 5, in 2005.
- **North Carolina Transportation Museum**, Spencer, North Carolina. Located on the grounds of Southern Railway's steam locomotive repair facility, the museum offers 150,000 square feet of visual exhibits and hands-on activities, as well as half-hour train rides around the site.

- **Orpheum Children's Science Museum**, Champaign, Illinois. Entering the third phase of renovations on its 1914 vaudeville theater home, this science museum features an outdoor Dino Dig, a 10-foot water flume, and a tug-boat simulator.
- **Zig Zag Centro Interactivo de Ciencias**, Zacatecas, Mexico. Serving more than 35,000 visitors in its first six months of operation, this new science center's major exhibits are spread among a campus of eight buildings.

### SUSTAINING MEMBERS

- **Crossroads Learning & Entertainment**, Stockholm, Sweden
- **Guard-Lee Inc.**, Apopka, Florida
- **Kraemer Design & Production Inc.**, Cincinnati, Ohio
- **The Mad Science Group**, Montréal, Canada.

By Christine Ruffo



Visitors to Da Vinci Discovery Center treat a virtual patient in What Hurts? Photo courtesy Da Vinci Discovery Center of Science and Technology

### 21ST CENTURY RENAISSANCE—

On October 30, **Da Vinci Discovery Center** opened its 29,000-square-foot center on the campus of Cedar Crest College, Allentown, Pennsylvania (see *ASTC Dimensions*, January/February 2005). With many eastern Pennsylvania companies reporting a lack of skilled workers, the center hopes to encourage young people to pursue careers in science and technology.

To demonstrate the possibilities, staff have developed *Da Vinci in Our Community*, a workstation in the main concourse featuring rotating exhibits that spotlight nearby corporations known for their innovation and creativity. From there, visitors can explore six inquiry-based galleries: What Hurts? (health science), Watt's Up? (energy), What's Alive? (organisms), What's the Matter? (atoms and matter), What on Earth? (earth science), and What Works? (machines).

To further encourage young scientists, the center administers the Da Vinci Institute, a professional development program for teachers. Throughout the year, the Institute's Da Vinci Fellows, selected elementary school teachers from throughout the region, learn how to provide inquiry-based instruction to all children, including those who may not typically succeed in science.

Major funding for the \$7.65 million facility came from Cedar Crest College, Beall and Linny Fowler, and the Commonwealth of Pennsylvania.

**Details:** Dennis Zehner, public relations/marketing specialist, dzehner@davinci-center.org

**EXPLODED PARTICLES—**Four years in the making, the new German science center **Phaeno** opened in Wolfsburg on November 24. Zaha Hadid, winner of the 2004 Pritzker Architecture Prize, designed the concrete-and-glass structure, which rests on conical supports 23 feet above a street-level public plaza.

From the outside, the science center resembles a stylized spacecraft lifting off from the city's core of modern structures. Inside, its 30,000 square feet of activity space is filled with modeled forms reminiscent of craters, caverns, and plateaus; the *New York Times* called the plan "a sequence of exploded particles, where curved floors lead to loosely defined exhibit areas scattered like marbles around the hall."

Visitors to Phaeno (the name comes from the German word for "phenomenon") ascend an escalator in one of the cones—others house a bookstore and a theater—to begin their journey through the exhibition space. "We deliberately set no agenda," says director Wolfgang Guthardt. "Each paves his or her own individual way."

The experimental landscape is divided into nine loosely defined theme areas: Life, Light and Sight, Movement, Wind and Weather, Micro and Macro, Energy, Matter, Games, and Information. Together, they house 250 interactive exhibits designed and built by Ansel Associates of California.

Primary funding for the 80-million-euro project came from the city of Wolfsburg. Private donors included Volkswagen, EnBW Energie Baden-Württemberg AG, and other local companies.

**Details:** [www.phaeno.de](http://www.phaeno.de)



**Phaeno, designed by prize-winning architect Zaha Hadid, opened in Germany last November.** Photo by Klemens Ortmeier

**ECOLOGY UP CLOSE—**In 2003, three New England science centers—the **EcoTarium**, Worcester, Massachusetts; the **Children's Museum of Maine**, Portland; and **ECHO at the Leahy Center for Lake Champlain**, Burlington, Vermont—joined forces to form the Environmental Exhibit Collaborative (EEC).

With an \$840,000 grant from Jane's Trust, EEC undertook to develop three 1,200-square-foot, interactive exhibitions on regional ecology that could be made available to small and mid-sized museums. Two of those exhibitions, *Turtle Travels* and *Tree Houses*, are now on tour.

*Turtle Travels* opened at the EcoTarium in February 2005 and is now at ECHO. Visitors move along a life-sized board game to discover what it's like to be a turtle in different habitats. Activities include crawling under a live-turtle enclosure, trying on a turtle's shell, helping turtles to safety, and following a sea turtle as it swims.

*Tree Houses* opened in January at the EcoTarium. The exhibition features two indoor tree houses connected by a walkway. Approaching the first house, visitors can scan the trees for animals (specimens from the collections), tracks, chew marks, and other clues linked with tree dwellers. In the second house, visitors can light up an animal image and hear the sound associated with that creature. Other activities include a "Build your own tree house" area, a computerized forestry game, and a gallery of tree houses from around the world.

A third collaborative project, *Attack of the Bloodsuckers*, about lampreys, mosquitos, and other blood-sucking creatures, is under development.

**Montshire Museum of Science**, Norwich, Vermont, a founding member of the TEAMS collaborative, provided advisory support, and additional funding came from the Cabot Family Charitable Trust and IMLS. After their EEC tours, the exhibitions will be available for rental.

**Details:** Sally Anne Giedrys, communications manager, sgiedrys@ecotarium.org



A visitor navigates the game board in *Turtle Travels*. Photo courtesy EcoTarium

**SPINNING AN EXHIBITION**—In an unusual design process, the **North Museum of Natural History & Science**, Lancaster, Pennsylvania, invited visitors to join in development of a multidisciplinary temporary exhibition, *Spirals: Whirls Without End*, inspired by the prevalence of spiral forms in nature, science, and art.

The project began last June with an exhibition of images that progressed from microscopic and invisible spiral like spirelli and DNA, to animal horns

and sunflowers, to spirals in human art, tools, and toys, and finally to spirals in space, such as galaxies and black holes.

Visitors were asked to look for spirals in their daily lives and bring them in for display. A wide array of items appeared, including an antique clock with a spiral fuse, a Mason jar of preserved fiddlehead ferns, and even a volunteer's baby curls. A hands-on exhibition incorporating these objects, as well as examples of spirals from the museum's collections, opened in September 2005 and will continue through April.

On display are a 14-foot spiral wave and a tornado machine designed by a local artist, an Archimedes screw, and a Magic Globe on which visitors can follow the paths of hurricanes using information supplied by NOAA. Smaller exhibits throughout the museum include seashells, horns, and a snail aquarium.

After *Spirals* closes, some of the exhibits will move to a smaller gallery for



The 14-foot spiral wave in *Spirals* captivates a pair of visitors. Photo courtesy North Museum of Natural History & Science

permanent display. Funding for the \$100,000 project was provided by the Lancaster Community Foundation, the John Frederick Steinman Foundation, the Armstrong Foundation, and the Kellogg Company.

*Details:* Margie Marino, executive director, marino@fandm.edu ■

## Grants & Awards

The last Institute for Museum and Library Services (IMLS) awards given in 2005 were also the most prestigious. **COSI Toledo**, Toledo, Ohio, was one of three U.S. museums to receive the nation's highest honor for the museum field, the National Award for Museum Service. "From college fairs to camp-ins, from one-time experiences to multiyear programs, COSI Toledo is dedicated to community service that reveals to the world of science," wrote the awards committee. COSI officials received their award, which includes a \$10,000 cash prize, at a January 30 White House ceremony.

### 2005 SEPA GRANTS

The following U.S. ASTC members received 2005 Science Education Partnership Award (SEPA) grants from the National Institutes of Health's National Center for Research Resources:

- **Children's Museum of Houston**, Texas: \$1,319,946 for a new exhibition, *Powerplay: Kids Measuring Their Bodies' Responses to Physical Challenges*.
- **Exploratorium**, San Francisco: (1) \$535,296 Phase II grant for the creation and dissemination of a comprehensive array of biomedically relevant, image-based materials generated by the museum's SEPA-funded Microscope Imaging Station (MIS), and (2) \$1,179,121 for the Caltech-Exploratorium Summer Teacher Institute in the Life Sciences.
- **Great Lakes Science Center**, Cleveland, Ohio: \$1,315,503 for *Mapping the Future of Bioengineering & Technology*, a permanent exhibition and related programs on biomedical engineering.

- **Marian Koshland Science Museum of the National Academy of Sciences**, Washington, D.C.: \$1,348,670 for a new exhibition, *Diseases and Decisions: The Current Science of Emerging Threats*.
- **Maryland Science Center**, Baltimore: \$1,361,048 for an exhibition and update center, *Cellular Universe: The Promise of Stem Cells*.
- **Oregon Museum of Science and Industry (OMSI)**, Portland: \$1,335,603 to create, in collaboration with the Small Museum Research Collaborative (SMRC), four small, bilingual (English and Spanish) touring exhibitions focusing on current clinical research in nutrition and physical activity and its applications to personal and family wellness.
- In addition to these direct SEPA grants, **Discovery World Museum**, Milwaukee, Wisconsin, and Yale University's **Peabody Museum of Natural History**, New Haven, Connecticut, will serve as partners in SEPA grants awarded to academic institutions.

The **Fort Worth Museum of Science and History**, Fort Worth, Texas, was awarded \$200,000 by the Bank of America. The grant, part of an annual Neighborhood Excellence Initiative Awards program honoring the U.S. communities in which the bank does business, will be used to support general operations at the museum.

The **National Maritime Center**, Norfolk, Virginia, received two awards from the National Oceanic and Atmospheric Administration (NOAA): \$29,000 to provide Ocean Exploration Alliance training to middle and high school teachers, and \$24,900 to develop an exhibition about tsunamis and NOAA's related research. ■

The new executive director of the DNA EpiCenter, New London, Connecticut, is **Abby L. Demars**. Formerly senior scientist at the science center, DeMars had been serving as interim executive director since **Jean Caron** departed last August.



**Suzanne Lenz** is the new director of development for the Children's Museum of Portsmouth, Portsmouth, New Hampshire. Lenz was previously membership director for the Wadsworth Atheneum, in Hartford, Connecticut.



**Kevin F. Prihod** is the new president and CEO of the New Detroit Science Center, Detroit, Michigan. A former trustee of the science center, Prihod had served as chief science officer since March 2004; he replaces trustee **Shawn M. Kahle**, president and CEO since April 2002.



**David Chesebrough**, formerly president and CEO of the Buffalo Museum of Science, becomes president and CEO of Ohio's COSI Columbus, effective April 1. He succeeds **Kathy**

**Sullivan**, who has assumed her new role as science advisor to COSI. Vice president **Carroll Simon** will serve as acting president and CEO in Buffalo.



Both good news and sad from the Science Discovery Center at State University of New York (SUNY) College of Oneonta: SUNY physics and astronomy professor **Hugh Gallagher** has assumed the directorship, a role ably filled since 1990 by founder/director and former SUNY professor **Albert J. Read**. A lifelong "tinkerer," Al Read created the science center in a renovated space in the basement of the campus physics building. He was a mentor to many in our field and contributed to both the *Cheapbook* series and *ASTC Dimensions*. The sad news is that **Hazel Read**, whom many knew from her participation at ASTC conferences, died on January 20. She was a true partner to her husband in his work; in 2000, SUNY awarded the couple its Distinguished Service Award.



The new head of the Southern African Association of Science & Technology Centres (SAASTEC) is **Alfred Tsipa**,

programs manager at Unizul Science Centre, Richards Bay, South Africa. Also elected were vice president **Michael Peter** and secretary-treasurer **Graham Darling**.



The Museum of Science (MOS), Boston, has appointed two leaders for its fledgling National Center for Technological Literacy (NCTL): **Yvonne Spicer**, formerly director of career and technical education for the Newton, Massachusetts public schools, is associate director for formal education (K-12), and **Lawrence Bell**, MOS senior vice president for research, development, and production, is associate director for informal education.



ASTC welcomes **Walter Staveloz** as director of international relations. This new position has been created to develop global projects and partnerships that will expand science learning and position ASTC and its members as recognized leaders in the public understanding of science. Walter had served for the past decade as executive director of Ecsite; his successor in Brussels is **Catherine Franche**. ■



**Association of Science-Technology Centers**

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