



# Museum of Science®

FALL 2009

## The Natural & Designed Worlds: Two Systems United

### **Museum Factor**

Vanu Bose: Transformative Technology

### **In Gratitude**

Deshpandes make \$1 million gift for Women in Science

### **Signature Event**

The Elements Come Together at *The Science Behind...*

### **Fiscal Year 2009 Annual Report**



> Patti Curtis, managing director of the NCTL, Yannis Miaoulis, president and director, and Yvonne Spicer, vice president of advocacy and educational partnerships of the NCTL.

## The Museum of Science Goes to Washington

When Museum of Science president and director Ioannis (Yannis) Miaoulis went to Washington, DC, in August to meet Secretary of Education Arne Duncan, he and his team, including Yvonne Spicer and Patti Curtis, urged the secretary to support the introduction of K–12 engineering education in states throughout the country.

“It is critically important that our nation solve the many problems facing our planet today,” says Yannis. “Our future depends on teaching young people how engineering can address issues such as alternate energy sources and water purification.”

The Museum of Science has become the primary national driver of the K–12 engineering education movement. According to Patti, managing director of the Museum’s National Center for Technological Literacy’s® (NCTL) Washington office, “We want Congress, agency heads, and state organizations to understand that technology and engineering are as important as science and mathematics.” Patti advocates for K–12 technology and engineering education to leaders in Washington by working with professional societies and teacher organizations. She also ensures that federal funding agencies are aware of the Museum’s success in technological literacy outreach and informal science education.

Joint lobbying efforts and the meeting with Arne Duncan are examples of Patti’s many consensus-building activities. As a member of the U.S. House STEM (Science, Technology, Engineering, and Mathematics) Caucus steering committee, she has helped promote the Museum’s NCTL curricula, the National Academy of Engineers’ study on the feasibility of nationwide K–12 engineering education standards, and the National Governors Association’s STEM agenda. She has worked with President Barack Obama’s and the late Senator Ted Kennedy’s education staffs, and made substantive contributions to several education bills and public laws. Recently she was asked to advise Senator John Kerry on a nanotechnology bill. “Technology and engineering are often not considered when policymakers talk about education reform. My job is to make sure they are part of that discussion,” Patti says.

Yvonne, NCTL’s vice president of advocacy and educational partnerships, takes this discussion to the state level, working across the country to transform educational standards. Using Massachusetts as a successful model (the Commonwealth adopted a technology and engineering framework in 2000), Yvonne works state by state, helping each one add engineering to its educational standards. She also advocates for the implementation of standards to states that do not have them.

“It is an arduous task, but the conversation *is* happening,” Yvonne says. “We are beginning to transform how state educational leaders view technology and engineering as fields that bridge the gap between science and math and have important economic and career implications.”

The high point of the Museum’s work would be the adoption of nationwide common core standards—standards that would unify the teaching and assessment of engineering and technology. “If everyone is working from a similar standard, then we have a sustainable system for the future,” says Yvonne. ■



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Fiscal Year 2009 Annual Report



## Museum of Science

Transforming the Nation's Relationship  
with Science and Technology







The next time you enjoy a dish of Dippin' Dots ice cream at the Museum, think about this: if you lived 7,000 years ago, you probably would not be able to eat ice cream—or any other dairy product—because chances are you would be unable to digest milk as an adult.

# The Natural & Designed Worlds:

TWO SYSTEMS UNITED



The evolution of lactose tolerance among adult humans corresponds roughly with the invention of a transformative human technology: dairy farming. Humans started domesticating cows approximately 9,000 years ago; during the next 3,000 – 4,000 years, our bodies developed, through natural selection, the ability to digest milk—a.k.a. lactose tolerance.

In the Museum's *Human Body Connection* exhibit, you can learn more about the evolution of lactose tolerance, as well as other ways technology has influenced our bodies. Did you know that exposure to artificial light can influence our circadian rhythms, just as natural light does? Or that the human jaw is not as strong as it used to be because the technology of cooking has softened our food?

These are just a few examples of the ways technology (i.e., *the human-made or designed world*) is inextricably linked with science (i.e., *the natural world*). And this very concept is now transforming the Museum of Science. According to Museum president and director Yannis Miaoulis, “The intertwining of science and technology is critical to our thinking in the 21st century. Humans create and innovate to solve problems, and in so



doing, change the environment that is itself a complex system, of which we are an integral part.” So, for example, our ancestors develop dairy farming and our species’ ability to digest milk evolves. Or scientists invent antibiotics that, over time, alter the human immune system and the resistance of the very microbes those medications are designed to eradicate. Or engineers create new fuel-efficient cars that help reverse the effects of ozone depletion.

This interconnectedness between the natural and designed worlds is the defining principle behind a new organizational plan for the Museum. For the past few years, Museum executives and education staff have been rethinking the building’s structure and exhibit spaces, informed by the notion that these two worlds are interdependent. “We are thinking about science and technology differently than we did 20 years ago, and therefore need to reorganize the Museum accordingly,” says Paul Fontaine, vice president of education at the Museum. “We need to combine the best of science to understand the world and the best of engineering and technology to design appropriate solutions with predictable results. Putting these two together will allow us to create a better future.”

This philosophy will soon be echoed in significantly redesigned lobby and exhibit spaces that will include green building upgrades, clearer connections between the Museum and the ecology of the Charles River basin, and two new conceptual portals of entry for visitors—the *natural world portal*, which will introduce human beings as part of a global ecosystem, and the *designed world portal*, which will show how humans create things that change the world.

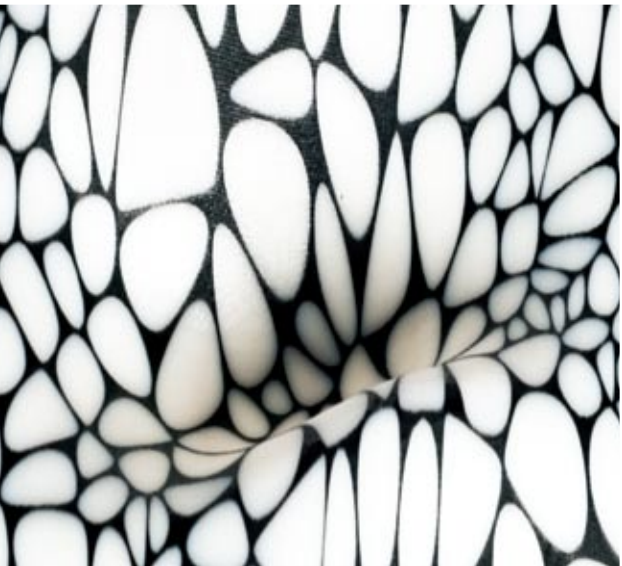
“As an institution designed to inspire and inform the public about science, technology, and engineering, we want our visitors to develop an appreciation for and understanding of this interconnectedness,” Yannis says. “We are therefore rethinking the Museum’s designing principle to better integrate these two worlds into our exhibit spaces.”

Although the specifics of the redesign are still under consideration, exhibit developers are already adding the new design principle to existing spaces and are considering how to incorporate these ideas into upcoming exhibits. For example, *Catching the Wind* was recently revamped to include details about the wind turbines that were installed on the Museum roof this year. This exhibit now links the wind’s natural power to our engineered contributions for a sustainable future.

A new temporary exhibit, *Neri Oxman: At the Frontier of Ecological Design*, illustrates how biology can inform and inspire the work of human beings. A world-renowned artist, Oxman studies natural structures such as bones or butterfly wings, then uses algorithms to translate principles of the natural world into performance-based materials and designs. For example, she has created novel ways to design and fabricate building “skins” that can respond to load, light, and heat, sweating and bending in response to natural stimuli like heat and wind. Oxman predicts that in the future, buildings will be designed and constructed like biological tissues. Oxman’s artwork draws from nature to find sustainable solutions to human problems.

As the Museum is restructured, the confluence of the two worlds will guide the creation of new exhibits. For example, the *Hall of Human Life (HHL)*—a new life sciences exhibit—will explore the human story through evolutionary, environmental, and cellular and microbiological forces. According to Lucy Kirshner, manager of discovery spaces and leader of the *HHL*’s content team, “The power of this idea is that there really aren’t two different worlds. You simply cannot talk about one without the other.”

- > *(right)* Detail from X, Y, Z, S, S, T by Neri Oxman.
- > *(below, left)* Detail from Monocoque, Prototype for a Structural Skin, a piece by Neri Oxman in the collection of the Museum of Modern Art in New York.
- > *(below, right)* Neri Oxman, whose work is currently on exhibit in the Blue Wing, at work on one of her pieces, which are informed by natural structures such as butterfly wings.



Lucy points to countless examples of this intersection—from why we can eat ice cream to how technology has afforded us remarkable insight into the human genome, and from how deforestation has driven animals to adapt to changing habitats to how computers have launched novel methods of human communication. She explains that the Museum’s new organization will heighten visitors’ appreciation for the connectedness of all things, and will offer new insights into how the world works.

With new insights come new challenges. “Our technologies push our science and our science pushes our technologies,” Yannis says, leading to exciting questions that arise at the intersection of the two worlds, such as: What kinds of novel medications will scientists engineer in response to antibiotic resistance? Will nanotechnology—the manipulation of molecules and atoms—find a cure for cancer and might it alter our DNA? Will new methods of online communication ultimately, through evolution, transform the human brain?

The next time you visit the Museum, you might think about these questions—and come up with many of your own. As you laugh at the antics of the colony of cotton-top tamarins, think about the humans who have invaded their habitats or the researchers who have studied them to find a cure for colon cancer. As you gaze upon “Triceratops Cliff’s” skeleton, contemplate the sophisticated technologies that helped scientists date the bones. As you learn about the power of medical imaging, imagine what is yet to be discovered about the inner workings of the human body.

And don’t forget to have some ice cream! ■

# Shining a Light on Fireflies:

## A Citizen Science Project Tracks Firefly Activity



It's a summer ritual: venturing outside after dusk to watch as tiny lights appear in the grass, blinking and flitting like dozens of busy fairies. The lights are actually fireflies, and many people who find joy in their nightly show fear they are disappearing. To learn more about the brilliant insects and to determine if they really are vanishing, Museum educators and researchers from Tufts University and Fitchburg State College created Firefly Watch.

### Collecting Backyard Data

Firefly Watch is a citizen science project that tracks firefly activity and distribution in an effort to show how the insects may be affected by light and by pesticides. Interested people—citizen scientists—sign up through the project's website ([mos.org/fireflywatch](http://mos.org/fireflywatch)) and spend at least ten minutes a week observing the insects. Participants report their findings through the website, where users can access everyone's data in real time.

"It's a great way to get people involved in science because everyone loves fireflies," says Don Salvatore, a science educator at the Museum and one of the founders of the project. "If people learn about nature through something they love, they start to pay attention to

nature and become more aware that anything they do in their environment has consequences. We don't know that pesticides have an effect on fireflies, for example, but just by asking [about chemicals used on their lawn], people become conscious of their environment."

### A High-Tech Approach

Although firefly observation occurs in the field, every other aspect of Firefly Watch participation is done online. Citizen scientists log in to the website to create a virtual habitat, which includes details of their environment (e.g., light source, vegetation, chemicals, and water). They then use the site to upload their observations and, if they wish, analyze their data as well as data gathered from across the country. Community message boards and interactive tools that teach about flash colors and patterns are also available on the site.

The virtual setup of Firefly Watch doesn't simply make it easy for people to participate in the program. It also meets the Museum's goals of promoting active citizenship in science and leveraging technology in new ways. "When we conceived of Firefly Watch, we saw a perfect opportunity to employ the concept of user-generated content to fulfill the Museum's mission. The Museum hadn't used the Internet in this way before," says Emily Bottis, director of information and interactive technologies at the Museum and a founder of the project.

Bottis and Salvatore originally hoped 100 people would participate in 2008, the first year of the project. However, by the end of that summer, more than 1,450 people had signed up. "We had the problem of data coming in for months longer than we had anticipated," says Salvatore. "That's the type of problem we like." As of August 2009, 3,148 participants from 43 states had registered.





# network

The Museum's first foray into turning online users into active participants in science not only broke new ground for the Museum, but also earned recognition among high-tech companies. Bottis's interactive media team designed and developed the project's site in-house, taking home a coveted Massachusetts Interactive Technology Exchange award last year.

## A Lifetime of Learning

Fireflies, sometimes called lightning bugs, are winged beetles with light organs that serve as both a communication system (males flash as they fly, females reply from a perch) and as a defense mechanism. Fireflies have a poison in their blood to deter predators, so what humans see as a pretty glow is a bright "stay away" signal to birds, frogs, and spiders.

Much about fireflies is unknown, such as their geographical range and how much time they spend in each area. "We hope to learn whether firefly numbers are decreasing, and if so, why? Are lawn pesticides killing them off? Do people who leave their lights on have fewer fireflies? Are [firefly] populations shifting due to lights?"

So what have Salvatore and his team learned through Firefly Watch so far? "People don't like to count on rainy nights," jokes Salvatore. "But really, nothing definitive yet. For the data to be valuable, we need many *years* of data. I hope this program outlasts me." ■

As a seven-year-old Museum of Science visitor, Vanu Bose knew exactly where he wanted to be. “I would always go right,” he remembers, drawn to the technology-themed exhibits there, “and get stuck.” This immersion became his vocation. Son of Bose Corporation founder Amar Bose, Vanu has made a name for himself as the principal inventor of software radio, an innovation on the verge of revolutionizing wireless communication.

## Transformative Technology



> *(above, left)* A remote lodge near the Talkeetna Mountains, Alaska.

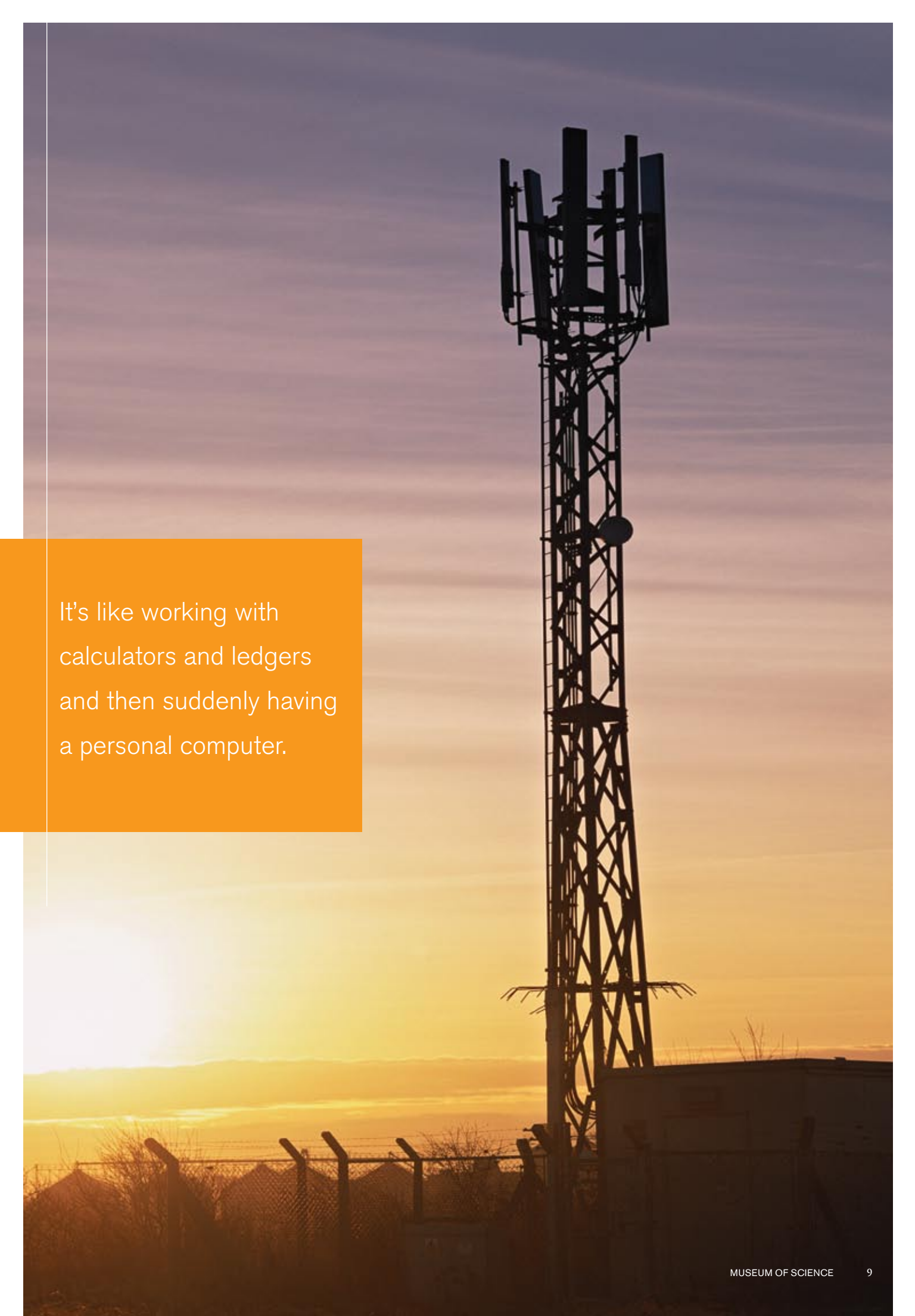
> *(above, right)* Three women use technology inside a rickshaw, Bangalore, India.

Vanu’s father recalls that both his children were inspired by concepts that sparked their intellectual curiosity. “Whatever they did in the field of science helped their thinking processes,” says Amar. “And it has helped them in whatever direction they have pursued in their lives.”

The Museum was an early inspiration to Vanu. “He was one of the many bright faces at the Museum on Saturdays,” says Ken Pauley, education associate, who taught science and technology to Museum visitors for more than 43 years. Throughout the fall and spring, Vanu would join approximately 80 peers and their parents for the latest Explorer class in what was then known as the Lower Morse Auditorium (underneath what is now the Charles Hayden Planetarium).

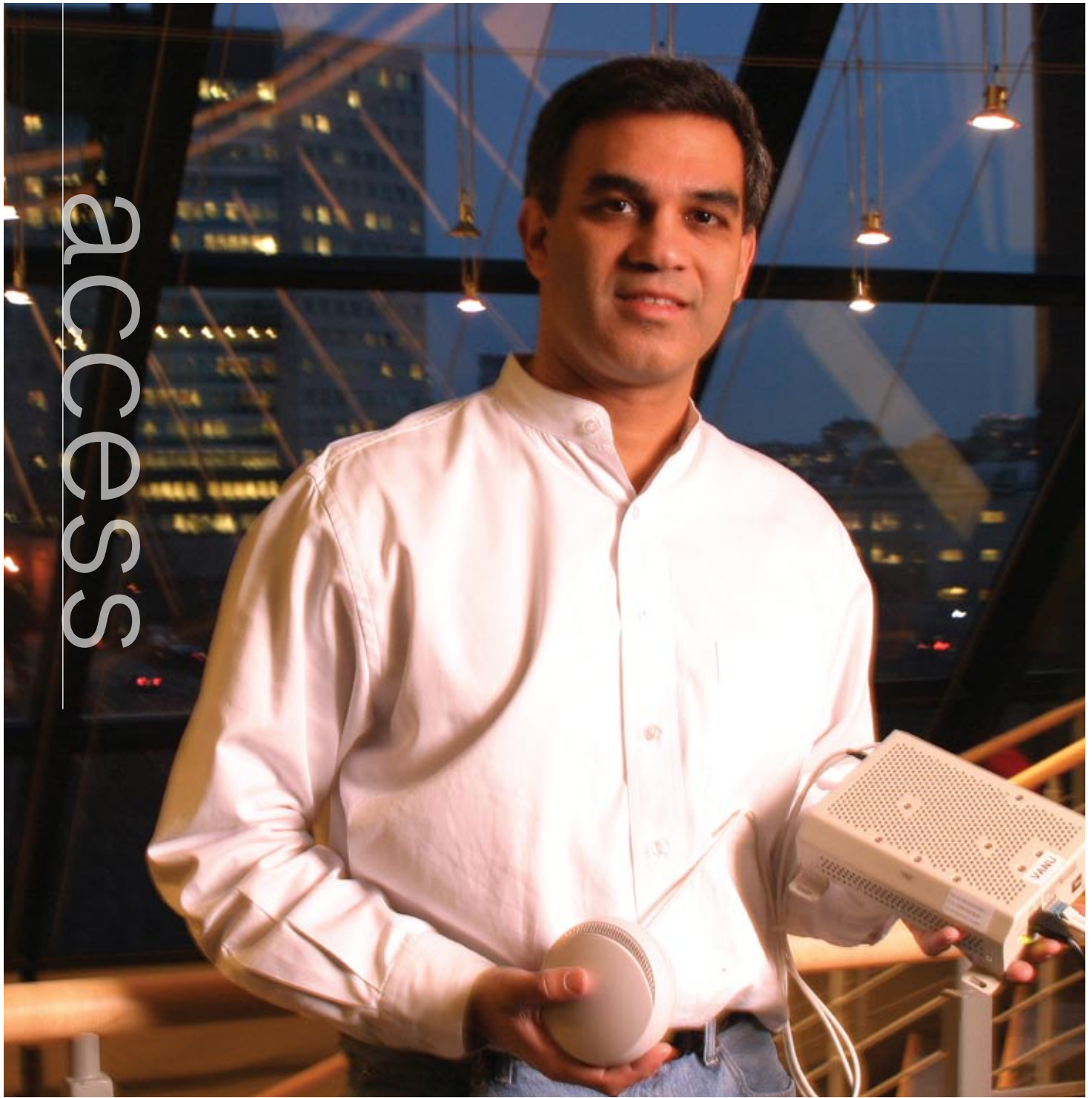
“Ken Pauley was an amazing teacher and performer,” says Vanu. “He never lectured—just gave these incredible demonstrations.” Thirty-seven years later, the image of Ken dressed as Galileo dropping basketballs, baseballs, tennis balls, and golf balls from a 20-foot replica of the Tower of Pisa is still fresh in Vanu’s mind.





It's like working with  
calculators and ledgers  
and then suddenly having  
a personal computer.

# access



“I wanted to make science real,” says Ken. Whether squirting the audience with milk from a cow to talk about pasteurization, putting a goldfish under a microscope to examine the “ocean within” and then returning it, unharmed, to its bowl, or eating mealworms (really!) with a bowl of cereal to demonstrate the quantity of insects we eat every day, Ken combined basic concepts of science with mesmerizing examples. “I broke it down in ways that kids would remember it,” he says.

Free from quizzes, outlines, or tests, Ken’s mission was nonetheless serious: to teach science literacy. “Mathematics is nothing but a language, another tool we use to understand the universe,” he says. “Biology, astrophysics, or chemistry—it’s all the same science and we need to learn how to communicate better.”

Challenging communication barriers is at the crux of Vanu, Inc. Vanu, president and CEO, founded the company in 1998 as a start-up inspired by his doctoral thesis at MIT. It grew from an idea to build radio receivers that use software (rather than hardware) to transmit signals. With this software, anything that uses wireless communications—think cell phones, walkie-talkies, public safety systems, or broadcast television—can be used as a radio.





> (left) Vanu Bose in the Cambridge, Mass., office of Vanu, Inc.

Vanu, Inc. pioneered this technology to develop the Anywave Base Station, the first FCC-certified software radio in the United States. This innovation transcends previously limiting wireless standards; its base stations are designed to handle multiple signals at a time, across multiple networks. In the case of an everyday mobile phone user, it wouldn't matter whether a person used Sprint or T-Mobile; cellular towers powered by Vanu's software could transmit any signal from any network.

Where coverage is plenty, wireless communication may seem like a given. For developing countries and rural areas where service is spotty or nonexistent, it can provide vital connections for a community. "It's like working with calculators and ledgers and then suddenly having a personal computer," says Vanu, whose company is providing service to areas in Vermont, Texas, Alaska, and India.

Vanu has been heralded as a "wireless warrior" by *Forbes Magazine* and voted one of 29 Technology Pioneers for 2005 by the World Economic Forum. Sharing a conviction that access to information is transformative, Vanu has returned to the Museum as an adviser, first as an overseer and then as a member of the board of trustees for the past three years. "Technology is so poorly understood by schools and governments," says Bose. "The Museum's focus on science and technology education is critical." ■

## A LASTING INFLUENCE

It is not unusual for adults to introduce themselves to Ken Pauley and tell him, "I took your Explorer class when I was a kid... You changed my life." Following his retirement in April 2009, the Museum established the Kenneth E. Pauley Endowed Internship Fund to honor the longtime educator for his enthusiasm, creativity, and humor.

"All I wanted to do was teach," he says of his decades-long career as an educator at the Museum. Ken reached out to thousands of Museumgoers with unconventional, grand-scale demonstrations of physical science concepts that became his signature.

To Ken, advancing science literacy inspired every lesson. Knowing that he had limited time to present major ideas, he approached his class as if it were just the beginning of a conversation. "We're going to explore this topic together," Ken told his audience, purposely putting out more props on the stage than he would use. "I wanted to get the ball rolling and for parents to continue the discussion at home," he says.

Ken's influence was wide ranging, both as an educator and later as a guide for the Museum's annual safaris to Tanzania. To recognize this dedication, friends of Ken established an endowment in his name in June. In the two months following its launch, donors gave nearly \$40,000 for the fund.

This new Ken Pauley internship, which is dedicated to advancing science literacy, will rotate among departments. With four to five applications for each of the 200 or so internship positions, this endowment will fill a real need and promote a dedication to science education—a fitting tribute to Ken's legacy.



> Vanu Bose, Ken Pauley, and Amar Bose at the home of Museum president Yannis Miaoulis.

Humanity has, without question, altered the natural world. From domesticating its inhabitants to changing its climate, we've left countless marks—both deliberate and accidental—on this thriving planet. But while we may have altered Earth over the millennia, Earth has also changed us by opening our minds to different ways of accomplishing our own tasks.

## How Leaves Cool (And How to Bake a Frozen Pizza)

By Dr. Steven Vogel, James B. Duke professor, emeritus, at Duke University



> These two images show the range of leaf shapes that can be found on a single white oak tree. The image on the left shows the leaves in the sun while the one on the right shows the leaves in the shade.

Gaining a greater understanding of nature can provide solutions to problems ranging from how to make paper out of inexpensive wood pulp rather than from recycled rags to something as mundane as baking a frozen pizza—as we'll see here.

Consider a leaf on a large white oak tree. When exposed to full sunlight on a hot, windless summer day, the leaf can heat up by as much as 30 degrees Fahrenheit. That brings the leaf dangerously close to the point where its proteins will cook, rather like egg whites in a frying pan.

As it happens, without some clever tricks, the leaf might get even hotter. For example, leaves at the top and on the south-facing side of the oak look quite different from leaves within the tree and on the side facing north.



PLANT NAME **Albizzia** LOCATION **Sun**



PLANT NAME **Albizzia** LOCATION **Shade**





Those top leaves, normally sunlit, are smaller and more deeply indented along the edges, while leaves normally in the shade are larger, with only minor indentations. Heat dissipation, far more important for the sun leaves, works better if no part of the leaf is very far from an edge.

This happens because as hot air rises, the leaf itself, when warm, generates air movement. And that limits further heating. The photographs on the left show models of sun and shade leaves coated with temperature-indicating film and exposed to the same level of illumination. Hottest areas are green, coolest are black. Clearly the sun leaf stays cooler. The difference is apparent both when the leaves make their own “microwind” by heating the surrounding air (“free convection”) and when exposed to very slight air movement (“forced convection”). Reality seems to be a mixture of the two, all happening at air speeds below what we ourselves can feel.

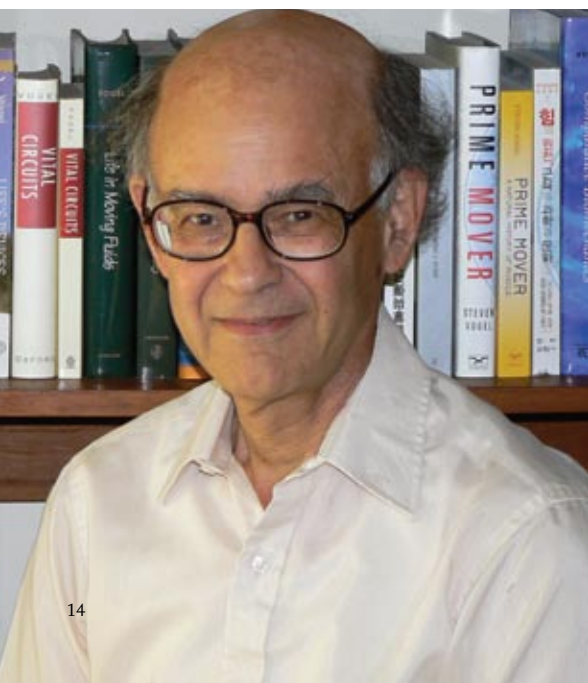
Unlike the oak leaves, the metals ubiquitous in our modern-day technologies conduct heat so well that we rarely need to resort to indentations and similar devices. But materials used in less-advanced technologies tend to conduct heat poorly. For example, frozen pizzas that come with raw crusts are often cooked on oven racks rather than on pans. These pizzas tend to overbake near their edges while remaining soggy in the middle. A pizza shaped like the sun leaf of an oak should cook better—and, it turns out, one with a hole in the middle bakes as well as a leaf-shaped pizza would. Try it—a central hole, about three inches in diameter, gives a more uniform result and takes less time to cook. Bake the cut-out as well. Nature can teach, but slavish imitation is neither necessary nor desirable!

Some leaves have no indentations—what might they do when faced with too much sun and too little wind and soil moisture? Many wilt or, in nonpathological terms, they reorient vertically. This reduces their exposure to the sun and also makes them better at generating convection. Leaves with leaflets growing outward from a central stalk often use another trick. Each leaflet rotates so it intercepts much less sunlight. Thus the leaf as a whole lets most of the sunlight pass through, casting a minimal shadow. A few kinds of big leaves with no indentations just never grow in a hazardous horizontal orientation, giving the tree as a whole a ragged, disorderly appearance.

Living nature offers us a treasure of evolutionary ingenuity, and appreciating it enriches our view of our world. On occasion, it can even teach us a bit about how we might better do some of our own tasks. ■



> Models of a sun leaf made of a liquid crystal sheet with a temperature range of 30° C (black) to 35° (blue); the two models have been subjected to the same mild radiant heating from above with negligent airflow at an ambient temperature of 21° C.



**STEVEN VOGEL, PhD**, looks at the way animals and plants deal with the mechanical and thermal aspects of their immediate worlds—how they use flexible materials, how they harness the forces of wind and water currents, and how they are shaped so they spend the least energy managing such affairs. He has written for several science magazines, produced both formal textbooks and books for a wider readership, and acted as a consultant for science museums. He is the James B. Duke professor, emeritus, in biology at Duke University, where he has taught for 40 years.



PLANT NAME **Black Locust** LOCATION **Shade**



Some leaves have no indentations—what might they do when faced with too much sun?



PLANT NAME **Black Locust** LOCATION **Sun**





## Exploring the Residual Landscape



- > (top) Nanpu Bridge Interchange, Shanghai, 2004.
- > (bottom) Nickel Tailings No. 35, Sudbury, Ontario, 1996.
- > (right) Silver Lake Operations # 1, Lake Lefroy, Western Australia, 2007.

As the first exhibit in the Museum's new art and science gallery (Blue Wing, Level 2), *Manufactured Landscapes: Photographic Works* by Edward Burtynsky depicted real scenes of nature transformed by industry. From April through September, Burtynsky's sweeping landscapes introduced the public to the new exhibit area, which is dedicated to presenting new perspectives of our world, inviting visitors to reshape their thoughts and influence their actions.

The current exhibit, *Running the Numbers: Portraits of Mass Consumption* by Seattle photographer Chris Jordan, is now on display. Jordan's large-format prints, assembled from thousands of smaller photographs, dramatically translate the raw language of statistics into powerful images of global mass culture that we can respond to emotionally. Seeing the cumulative impact of individual actions through this talented artist's lens awakens us to the enormity of our personal choices. ■

*Running the Numbers: Portraits of Mass Consumption* is on exhibit **November 12, 2009 – May 9, 2010.**





**IN BURTYNSKY'S OWN WORDS:**

“Recycling yards, mine tailings, quarries, and refineries are all places that are outside of our normal experience, yet we partake of their output on a daily basis... These images are meant as metaphors to the dilemma of our modern existence; they search for a dialogue between attraction and repulsion, seduction and fear. We are drawn by desire—a chance at good living, yet we are consciously or unconsciously aware that the world is suffering for our success. Our dependence on nature to provide the materials for our consumption and our concern for the health of our planet set us into an uneasy contradiction. For me, these images function as reflecting pools of our times.”

# Making History with Ken Burns

Celebrated documentary filmmaker Ken Burns previewed his new six-part PBS documentary, *The National Parks: America's Best Idea*, at the Museum Thursday, September 10, to a sold-out audience. Burns and writer and coproducer Dayton Duncan screened highlights from the 12-hour series, which included scenes from Denali National Park in Alaska, stunning photographs by late Museum founding director Bradford Washburn, and interviews of Brad and his wife, Barbara.

Burns decided to film Denali because it is “one of the most spectacular landscapes on Earth.” It was a shared love of this great mountainous region that led Burns in 2005 to interview the Washburns about their historic June 1947 ascent of Denali’s Mount McKinley, where the couple braved high winds, storms, severe cold, sleepless nights, and altitude sickness. Barbara, the first woman to reach North America’s highest peak (at 20,320 feet), related her challenges as a woman who didn’t want to disappoint the “boys.”

According to Burns, their interview was “a perfect coda to the Denali scene.” Brad and Barbara were “funny and warm, loving and generous. It’s one of the most beautiful scenes in the film.” Burns highlights several of Washburn’s photos—a favorite is of Barbara looking down the backside of Denali—along with 1940s footage of the expedition, appropriate “cold” sound effects, and music.



Burns chose the Museum for an advance screening of *The National Parks* because it’s “the perfect place to tell the story of Brad and Barbara and what their ascent means in history and in our hearts. The Museum is also one of our favorite places,” says Burns, who has often taken his own children here because “the interactivity fascinated them.”

Interweaving archival photographs, first-person accounts of historical characters, personal memories, and more than 40 interviews, Burns chronicles the evolution of the national parks over nearly 150 years. Some of the film’s stars are the nation’s spectacular landscapes and icons, from Acadia to Yosemite, Yellowstone to the Great Smoky Mountains, the Everglades to the Gates of the Arctic. Says Burns, “It’s no accident that Wallace Stegner called the national parks ‘the best idea we ever had!’ But our series is not a travelogue or a nature film. It’s the Declaration of Independence applied to the landscape. It’s about several dozen people, from every conceivable background, who fell in love with these places and worked their lives to save them for the rest of us.”

Burns shot his first documentary in 1974 at Old Sturbridge Village and has been transforming his passion for films and history into documentary storytelling artistry ever since. The late historian Stephen Ambrose said, “More Americans get their history from Ken Burns than any other source.” His documentaries have been nominated for two Academy Awards and he has won ten Emmys. *Baseball*, the most-watched series in PBS history, attracted more than 45 million viewers. *The Civil War* was the highest-rated series in the history of American Public Television. *The New York Times* called it a masterpiece and Burns “the most accomplished documentary filmmaker of his generation.”

At the heart of his storytelling is “a deep respect for the power of the individual image. To resurrect the moment in which a picture is taken, I try to get inside the landscape of that image and treat it energetically as a feature filmmaker would,” says Burns. Currently, he’s editing *The Tenth Inning*, a two-part sequel to *Baseball*, airing in 2010. Other projects involve a history of Prohibition, the Central Park Jogger case, a triple biography of Theodore, Franklin, and Eleanor Roosevelt, and a series on the Vietnam War.

“Not a day goes by that someone doesn’t tell me one of my films changed his or her life,” says Burns.

“I have the best job in the country.” ■





> *(facing page)* Brad and Barbara Washburn.

> *(top left)* Stephen Woods, president of Citizens Bank, with his daughter Jill Woods.

> *(top right)* Phil Kistler, Laura Cutler, Wendy Kistler, Brit d'Arbeloff, Laura Barker Morse, and Kay Allard.

> *(middle left)* Ken Burns, Dayton Duncan, Yannis Miaoulis, and Barbara Washburn.

> *(middle right)* Grand Teton.

> *(bottom left)* Former Museum Board of Trustees Chairman Ira Stepanian, Ken Burns, and Robert Gallery, president of Bank of America in Massachusetts.





> (this page, clockwise from top left)  
 Belinda and Henri Termeer, CEO of Genzyme Corp.

> Dancing on the elements!

> Gary Gregg, Wes Kussmaul, Maria Kussmaul, and Paul Hanley.

> Mary Jo Meisner, Darren Yong, and Alicia Verity of Bank of America.

> Erin Brooks from Suffolk Construction's Red & Blue Foundation.

> Jonathan and Amy Fleming and Bettina and John Dee.



Discovery, design, dinner, and dancing—  
what more could guests ask for during a  
celebration of the Museum’s 180-year history?

## The Elements Come Together at *The Science Behind...*



- > (above, left) Museum staffer Kelley Schultheis demonstrates a scientific process to Hilary Gabrieli, Anne Marcus, and Ann Kania.
- > (above, right) Yolanda Darnell and Henry Darnell.

Held Friday, October 23, the Museum’s inaugural signature fundraising event attracted more than 300 guests, who enjoyed cocktails, previewed *Harry Potter™: The Exhibition*, visited *Wild Music: Sounds & Songs of Life*, and engaged in *Design Challenges* to uncover *The Science Behind...* natural and designed phenomena. Adding to the air of discovery were actors dressed as well-known scientific pioneers (e.g., Charles Darwin, Mary Anning, and Sir Edmund Hillary). The evening enhanced the Museum’s reputation as a place where imagination and fun combine to create a unique—and often magical—learning experience.

The event, which raised \$392,000, will benefit the Museum’s capital projects, programs, educational outreach, internships, and community-based services. Many thanks go to our supporters, especially our presenting sponsor, Suffolk Construction’s Red & Blue Foundation, and our leadership sponsors, Bank of America, Genzyme, and Belinda and Henri Termeer. ■

# Gecko-Inspired Robotics: Youth Volunteers Engage Visitors in Discovery



Volunteer Jeff Lau, age 17, remembers bolting into *Cahners ComputerPlace* nine years ago after an electrifying *Lightning!* show in the neighboring Theater of Electricity.

He recalls feeling intrigued by the open space lined with computer terminals. This summer, as one of the front-line workers in a landscape of Mars rovers, lively robotic puppies, and challenging games of logic, Jeff helped demystify computers, robots, and communication for visitors of all ages.

Jeff is one of eight teenage volunteers who assisted *Cahners ComputerPlace* last summer (one of 51 youth volunteers throughout the Museum), helping visitors use the scientific method to ask questions and reach conclusions.

Museum staff and volunteers, who help visitors understand that computer science is based on simple, comprehensible concepts, often make *Cahners ComputerPlace* a location for discovery.

> (above) The Museum's Mars rover.

> (right, top) Volunteer Jeff Lau with a gecko-inspired robot.

> (right, bottom) Another gecko-inspired robot.

The center encourages visitors to become active learners who make informed decisions in a rapidly changing world of unprecedented sophistication in science and technology. In this way, *Cahners ComputerPlace* supports the Museum's mission of enhancing our knowledge of science and technology.

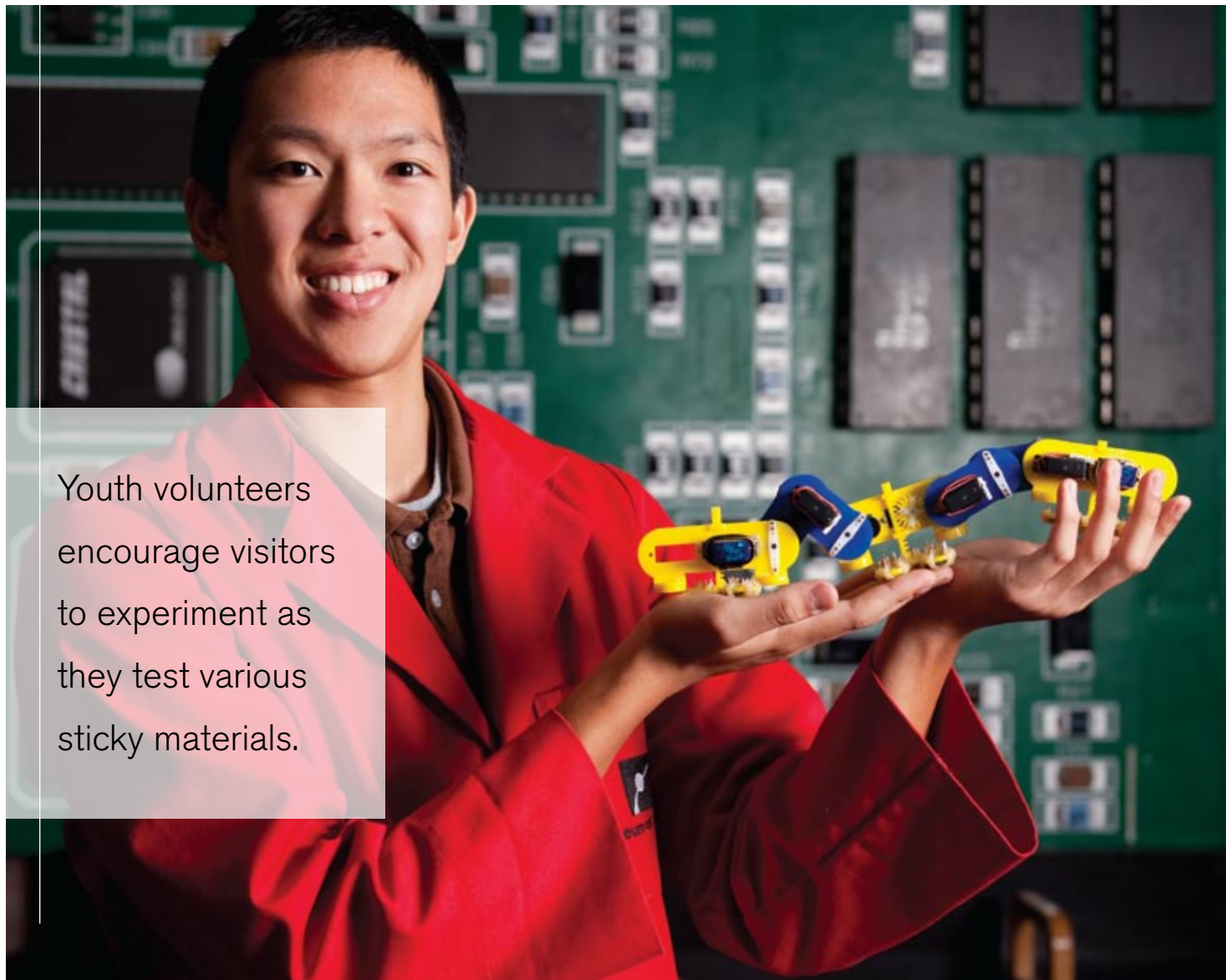
Exhibits and activities in *Cahners ComputerPlace* show the intersections of the natural and designed worlds. A great example of these intersections is biomimicry, the application to technology of methods and systems found in nature. Intern Brandi Benkert from Chicago spent her summer working on a gecko-inspired robotics display featuring living geckos and the cleverly designed robots they inspired. We know that a gecko can scurry—even run—up a wall, but how does the gecko accomplish such a feat? The gecko's exquisitely designed feet are key; they come equipped with intricate rows of a million superfine hairs, each divided into more than 100 split ends. These hairs form a super-high contact by conforming perfectly to any surface at the molecular level.

Carnegie-Mellon University NanoRobotics Laboratory and others have contributed robots designed to do what nature perfected millions of years ago. Robots that defy gravity by traveling up vertical surfaces or even upside down will have numerous commercial and military applications.

Youth volunteers encourage visitors to experiment like engineers as they test various sticky materials for use in building robot prototypes. A device simulates climbing a vertical surface and gauges the speed of ascent as visitors use paddles made from different sticky materials to move a treadmill.

In doing so, our front-line volunteers will further a part of the Museum's larger mission—to promote active citizenship informed by science and technology. ■





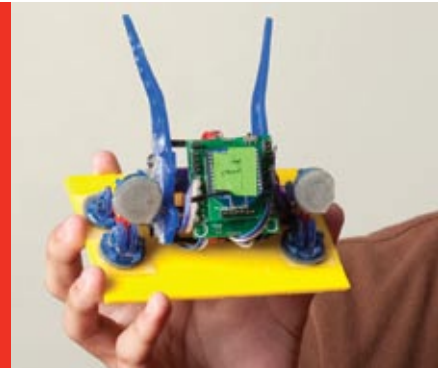
Youth volunteers encourage visitors to experiment as they test various sticky materials.

### **YOUTH VOLUNTEER PROGRAM THRIVES**

Young people are not only some of the Museum's most avid visitors; they are also among its most enthusiastic volunteers, who learn while working and teaching others. Some 130 youth volunteers (ages 14 – 18) work at the Museum each year. They may begin while in high school and may eventually move into positions as paid interns. But first they must prove their reliability, commitment, enthusiasm, and effectiveness. They accomplish this by applying for a volunteer position online, being interviewed and chosen by a human resources specialist, and committing to 50 hours of service. (Summer volunteers work 3.5-hour shifts two times per week between July 6 and Labor Day.)

Youth volunteers appear throughout the Museum in many different capacities—from feeding and caring for the Museum's live animals to working behind the scenes or leading groups of second-graders on adventures of discovery. As young people deeply engaged in science and technology, they communicate their curiosity about the world to other young visitors in an especially powerful way.

**For more information on volunteering at the Museum, go to [mos.org/support](https://mos.org/support) and click “Volunteering.”**



Museum of Science trustee Jaishree Deshpande climbed 17,600 feet to the Mount Everest base camp in 2004 because, as she puts it, “I wanted to test my limits.”

## Dream. Anything Is Possible.



> Since 2003, Museum educators have engaged more than 76,000 young visitors in *Design Challenges*. (above left) Grace McGovern, age 9, of North Haven, Conn., intently pieces together her creation. (above right) Karina Flores, 10, of East Boston, Melissa Mendez, age 9, of Everett, Alexandra Rene, 8, of Milton, and Molly McGovern, 8, of North Haven, Conn., work on their design challenges.

This idea—of pushing herself to achieve a goal—is something she learned as a young girl in India. “At our home, education meant everything,” she says. “My parents and teachers inspired me to explore and learn science, and I began to dream I could be a doctor, an engineer, or a scientist.”

Her advice to young people today—girls especially—remains the same: “Dream. Anything is possible.” This is why she and her husband, Gururaj “Desh” Deshpande, established the Deshpande Endowment Fund for Girls in Science, Technology, Engineering, and Math (STEM) at the Museum of Science. “We are impressed with how the Museum teaches and engages children, especially girls,” she says. “My hope is that our gift will inspire girls to be excited about careers in science and engineering.” While the fund is geared toward girls specifically, Jaishree and her husband hope their gift will help address the well-known achievement gap between males and female students in the STEM arena. “We want to create environments where everyone can bloom,” she says.

As a Museum trustee and co-chair (with Beth Miaoulis) of the Women in Science Committee, Jaishree enjoys bringing distinguished women scientists and engineers to share their stories at the Museum’s biannual Women in Science Luncheons. For her, the Museum is “a living thing; every time I visit, I find something new.”

The Deshpandes have long believed in the Museum’s commitment to developing hands-on engineering activities and advancing K – 12 learning. Their 2007 gift brought the Museum’s Engineering is Elementary® curriculum to elementary schools in Andover, Massachusetts, and the Deshpande Endowment Fund will support STEM activities for girls, including overnight programs and the annual Inspiring Minds presentations, which highlight female engineers and researchers and promote relationships among women scientists.



> Jaishree Deshpande





> Emanuella Rene, 8, of Milton, Jaishree Deshpande, and Melissa Mendez, 9, of Everett, try to balance a cart on a wire.

Jaishree’s love of physics led her to pursue a master’s degree at the Indian Institute of Technology in Madras. She later worked at the Indian Space Research Organization. In 1980, after moving to Toronto with her husband, Jaishree earned a bachelor’s degree in computer science from York University and worked as a programmer for the Ontario Geological Survey. When Desh “got a bug” to start his own company, they moved to Boston, where he launched Cascade Communications Corp. and she earned a master’s degree in computer science from Boston University. Later, after becoming a software engineer, she often brought her two young sons, now engineers, to the Museum of Science.

In 2002 the couple established MIT’s Deshpande Center for Technological Innovation. “Innovation cannot have impact unless it’s relevant to the world’s problems—the need for energy, clean water, clean air, climate change, and health care,” she says. “We can solve these problems but we need everyone—men and women—to make a better world.” ■

# The Colby Society: A Preview

In the last two magazines we introduced to you the Museum's new Colonel Francis T. Colby Society, which pays tribute to the loyal and generous donors who, over time, have had a major impact on the Museum. The Colby Society recognizes donors whose cumulative lifetime giving equals a minimum of \$100,000.

We are pleased to provide a special preview of founding Colby Society members below. **Members of the Colby Society will be invited to the inaugural Colby Society dinner, to be held Wednesday, March 31, 2010.** That evening we will celebrate the many generous philanthropists whose contributions of time, treasure, and talent have enriched the Museum. We will also bestow the first Colby Award, which recognizes individuals or family foundations for their extraordinary impact on the Museum.

During the Colby Society celebratory dinner we will also present the Walker Prize to John P. Holdren, PhD (left), who is the assistant to President Barack Obama for science and technology and director of the office of science and technology in the executive office of the president of the United States.

The mission of the Museum of Science is immeasurably deepened by the individuals, corporations, and foundations who are charter members of the Colby Society. We profoundly thank them for their generosity.



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\* Deceased

If your name does not appear and you are interested in joining the society this year, please contact Joan Hadly at 617-589-0148 or jhadly@mos.org by December 31, 2009.



> Richard Burnes and Yannis Miaoulis.

## A Time of Challenge, a Year of Commitment

During the past year, we as a nation faced significant economic challenges. These difficulties, however, make us even prouder of our extended Museum family. You have continued to support our efforts to educate young people and adults alike about science and technology, and for this we are most grateful. Only through your donations can we provide unparalleled access to informal science education both here at home and across the nation.

We hope you enjoy this issue of the Museum magazine, which celebrates our new mission statement (see the inside back cover). To illustrate this mission, we highlight in these pages the many ways we are working to transform the nation's relationship with science and technology.

Once again, thank you for your vital contributions. Without you, we would not be able to reach our goals.

Sincerely,

A handwritten signature in white ink that reads "Rick Burnes".

Richard M. Burnes Jr.  
CHAIR, BOARD OF TRUSTEES

A handwritten signature in white ink that reads "Ioannis Miaoulis".

Ioannis Miaoulis  
PRESIDENT AND DIRECTOR,  
MUSEUM OF SCIENCE



The Museum of Science relies on the generous philanthropic assistance of individuals, companies, foundations, and organizations to thrive and grow. Our 2009 Honor Roll recognizes the importance of this support and allows us to acknowledge those commitments by publicly saying "Thank you."

## Contributions Fiscal Year 2009

(July 1, 2008 – June 30, 2009)

### Key

\* Deceased

■ Matching support

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We are pleased to recognize the generous donors who have made leadership gifts and pledges during fiscal year 2009. Total giving during the year reflects both restricted and unrestricted gifts and pledges.

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CHAIRMAN'S CIRCLE | 11.20.2008  
Richard Burnes and Joshua Boger.

## ANNUAL FUND GIFTS

Annual Fund contributions provide the Museum with unrestricted resources to develop and maintain world-class exhibits, present educational programs, conduct community outreach efforts, and continue essential day-to-day operations.

The Museum gratefully acknowledges the work of the Co-Chairs of the Annual Giving Committee Laura Barker Morse and Ralph Sheridan for their exceptional service in helping to grow the 2008 - 2009 Annual Fund.

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THE LOST CITY OF Z RECEPTION | 2.25.2009  
Sandy and Dozier Gardner, Don Kaplan, and  
David Grann, author of *The Lost City of Z*.



WOMEN IN SCIENCE | 4.30.2009  
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The Museum is grateful for the many contributions from companies that matched gifts by their employees this past year. Matching gifts often double or triple a donation and many companies match gifts of retirees, an employee's spouse, and corporate board members. Your employer's human resources office is the place to inquire if you might qualify.

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WOMEN IN SCIENCE | 4.30.2009  
 Elizabeth Riley and Ellen Piccioli.

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WASHBURN SOCIETY LUNCHEON | 6.17.2009  
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The Washburn Society honors Brad and Barbara Washburn and recognizes the many generous individuals, past and present, who have included the Museum in their wills and estate plans, or who have otherwise entered into life income arrangements with the Museum. The lives of our future scientists and engineers will be greatly enriched thanks to the foresight and generosity of these dedicated individuals.

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WASHBURN CLIMB | 7.13.2009

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A bequest is a special way of demonstrating faith in the mission and ideals found at the Museum. Bequests also afford opportunities to create perpetual memorials for the maintenance of vital programs and for endowed funds to assure continued excellence. The Museum is forever indebted to the following individuals for remembering its work through their estates.

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 Francis T. Colby Trust Under Will  
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WASHBURN CLIMB | 7.13.2009  
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PREVIEW OF MYTHIC CREATURES | 10.24.2008  
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Tribute gifts to the Museum of Science both honor someone special and benefit those whose lives are touched by the Museum.

Unrestricted tribute gifts will be used where the need is greatest within the Museum, or may be directed to benefit a particular program or department. Each gift will be thoughtfully acknowledged, as will the individual or family of the individual being honored.

The Museum is grateful to the many donors who chose to honor the following friends or loved ones through gifts to the Museum.

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ADULT SCIENCE FAIR | 03.19.2009  
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### ABOUT THE COVER IMAGE

Crossing the Colorado River in Arizona, the Navajo Bridge is the only roadway spanning the river and the Grand Canyon for nearly 600 miles. The connection actually comprises two bridges, one completed in 1929 (open for pedestrian and equestrian use—and the occasional bungee jumper) and the other in 1995 (open to vehicles). This feat of engineering is a stunning representation of the intersection of the natural and designed worlds.

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# a new mission

To reflect the Museum's position as a national center for science and technology, and its leadership in science, technology, engineering, and mathematics education, the Board of Trustees unanimously approved a new mission statement for the Museum in June 2009:

**The Museum's mission is to play a leading role in transforming the nation's relationship with science and technology. This role becomes ever more important as science and technology shape and reshape our lives and world, and it means we:**

- **Promote active citizenship informed by the world of science and technology**
- **Inspire lifelong appreciation of the importance and impact of science and engineering**
- **Encourage young people of all backgrounds to explore and develop their interests in understanding the natural and human-made world.**

**To do this, we will continue to build our position as a leader in the world's museum community and use our educational perspective as an informal learning institution to help the formal pre K-12 education system.**

This mission statement distinguishes the Museum as having a unique role in the continuing national conversation about the importance of science and technology.



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