



expl^oratorium[®]

the museum of science,
art and human perception

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Exploratorium Overview

THE EXPLORATORIUM A MUSEUM OF SCIENCE, ART AND HUMAN PERCEPTION

History

Housed within the walls of the Palace of Fine Arts, the Exploratorium is a collage of over 400 interactive exhibits in the areas of science, art, and human perception. Over 700 have been created. The Exploratorium stands in the vanguard of the movement of the “museum as educational center.” It provides access to, and information about, science, nature, art and technology.

Since the Exploratorium’s inception, the museum’s exhibits and programs have focused on human perception: how do we see, hear, smell, feel and otherwise experience the world around us? We now have begun to inquire beyond simple perception to include all of cognition, in other words, using the mind to understand the very workings of the mind itself. In the area of Life Sciences, we explore the characteristics that define all living things.

Noted physicist and educator Dr. Frank Oppenheimer, who devoted his efforts as Director until his death in 1985, founded this unique museum in 1969. Dr. Goéry Delacôte, a renowned French scientist, educator and public servant, was Executive Director of the Exploratorium from 1991 to 2005. In 2006, Dr. Dennis Bartels, a nationally known science education and policy expert, became the Exploratorium’s Executive Director.

Informal Science Education through Public Exhibition

The Exploratorium’s educational approach provides maximum exposure to the phenomena of science. Amidst the excitement of blinking and beckoning exhibits is a carefully devised science curriculum, appropriate for the informal and formal teaching of science. It stresses the presentation of authentic experiences, in an unpretentious manner, in a public learning environment.

Three-dimensional exhibits, built on site, offer the kind of experimental learning that is difficult, if not virtually impossible, to obtain through any other medium, whether it be the classroom, books, television or the Internet. Yet, media and technology innovations are used in exhibitry and public programs, as well as to extend the Exploratorium beyond its walls.

The Exploratorium, known for its unconventional approach to “culture” in a scientific and technological age, explores the impact of culture and context on human perception and cognition through its collection and special exhibitions. The exhibits currently fall within broad subject areas: Seeing, Traits of Life, Matter/World, Mind, and Listening. In addition to this core

collection, there are experimental spaces for new and developing exhibits, as well as for temporary exhibitions, some of which the museum develops and some of which it hosts from other organizations. A recent temporary exhibition created by the Exploratorium, *Revealing Bodies*, examined the ways we inspect, diagnose and depict bodies, and the cultural and social implications of these efforts. The New York Times described the show as the “multicultural, cross-disciplinary blend of art, science and participatory technologies very much in the institution’s mold-breaking tradition.”

In addition, the Exploratorium invites visual and performance artists to create works while in residence at the Exploratorium. The Osher Fellowship Program brings scholars, artists and scientists in all fields. Public Programs supports such ongoing activities as a curated film series related to exhibitions; innovative special events; demonstrations where artisans conduct informal, hands-on workshops with the public; and webcasts from scientific research sites around the world.

While the Exploratorium’s leisure-time visitors usually attend individually and in family or social groups, the interactive exhibits are also core curriculum materials for the work of the Exploratorium’s learning and teaching efforts, which focuses on supporting educators and science education in schools. Finally, the exhibits developed here are replicated and rented or sold to museums around the world through our museum partnerships.

Formal Science Education through Learning and Teaching

More than 500 elementary, middle and high school science and mathematics teachers from the Bay Area and the nation annually attend Exploratorium institutes that use our exhibits as the basis for inquiry-based training of educators. In a unique collaboration of informal and formal educational institutions, the Exploratorium’s Teacher Institute has partnered with school districts, universities, business and government to improve science instruction and decrease the number of teachers leaving the profession. The Teacher Institute’s Novice Teacher Program, for example, offers professional development and support to beginning teachers in middle and high schools. The Exploratorium staff have testified before education committees of both houses of Congress about its national model.

The Exploratorium’s Institute for Inquiry © is a national center that supports educators from districts, museums and universities who are dedicated to developing innovation and leadership in elementary science education. The Institute provides a variety of workshops, forums and an on-line professional development curricula designed to increase an understanding of the true nature of the scientific process, and how that process leads to developing an understanding of important science content in a deep and personal way. Recently, the Institute has expanded its work to include new audiences in Latin America, out-of-school leaders, education and science faculty at universities and post-docs and grad students engaged in educational outreach. The Institute is also engaged in several new projects which explore the integration of inquiry with English Language Learning, use of school gardens as a laboratory for science investigations and the collaboration with other science institutions and Bay Area Elementary School Districts to develop approaches to advance science education.

Another program is CILS. Taking a cue from the public's enthusiastic response to "informal science centers" like science and natural history museums, zoos, and aquaria, the Center for Informal Learning and Schools (CILS) integrates the best of the "informal science learning" with the formal learning that takes place in schools. A collaboration between the Exploratorium, King's College London (KCL), and the University of California, Santa Cruz (UCSC), CILS trains in informal science instruction and examines the strategies that make such centers powerful learning venues. CILS prepares leaders in informal science education, conducts research, supports students pursuing advanced degrees in science education, and provides professional development opportunities for science museum staff. The Center is headquartered at the Exploratorium, and began operation in fall 2002.

Each year, 100,000 school children visit the museum with their teachers through the Field Trips Program. The Explainer Program, also a model for museums around the world, trains 100 high school students a year in the science behind the exhibits, giving them the knowledge to act as explainers for museum visitors, proving the age-old adage that "the best way to learn is by teaching." The Children's Educational Outreach Program provides educational services to 7000 young people in underserved areas.

Science Teaching through Media and Communication

The Exploratorium uses interactive and traditional media to extend the Exploratorium's learning approach to audiences — teachers, students, the general public — within and outside the museum.

An example is the Exploratorium's 4-time Webby-award-winning Web site, a true extension of the museum. A resource without walls, free to everyone, it offers educational content and experiences to people around the globe. Featured are hundreds of hands-on activities, which give all Exploratorium audiences the ability to explore and interact, and in-depth pages that explore such topics as cooking and food or biodiversity. Noteworthy are the experimental Webcasts in which we send our own crews around the globe to feature live science events from around the world, providing museum and Internet visitors with science as it happens.

Two such characteristic events were the total solar eclipses from both Turkey and Zambia, which were streamed live to museum and Internet audiences; at the same time, scientists from countries on the path of totality talked to Exploratorium scientists and visitors on our Web site. In the summer of 2008, the Exploratorium presented another total solar eclipse from China. The Exploratorium's Web site (www.exploratorium.edu) receives over 28 million distinct visitors a year.

Another focus is trade and educational publishing for children, adults and families. Over 50,000 copies of Exploratorium educational publications are sold annually, with more than 28 titles in print.

Partner Museums: Where in the World Are Our Exhibits?

A partnership composed of the Exploratorium and others from Paris, France to Fort Worth makes it possible to lease the Exploratorium's most popular exhibits for three years at a reasonable cost. Each partner receives 30–35 thematically based exhibits annually, plus educational expertise and support from the Exploratorium. The network forges alliances among partners, and creates new funding, research and collaborative opportunities for them. In addition, several Exploratorium-designed exhibitions are traveling, rented by other institutions. Among them are Memory, which explores how humans process, store, retrieve, and forget memories; Navigation, which explores the diversity and ingenuity of human navigation and has gone to 20 venues since 1993; Turbulent Landscapes, which blends art and science to illuminate the underlying order in the chaotic patterns of nature, and Traces of Time, which tells the story of time through a selection of 30 captivating images. A traveling version of Traits of Life began circulating in early 2004.

International Impact and Influence

The Exploratorium is one of San Francisco's most prominent museums, drawing visitors from across the country and around the globe. In any given year, representatives from some 35 museums in 18 different countries personally visit the Exploratorium for the express purpose of planning a new science museum or enhancing an old one. At least 90 percent of the nation's science museums, and 70 percent of the museums worldwide, have borrowed ideas from Exploratorium exhibits or programs.

The Exploratorium's annual attendance is over half a million. The museum's impact is extended to approximately 20 million people per year through the dissemination of its exhibits and programs to other museums.

The Exploratorium's contribution is especially significant in light of the growing importance of science museums and science centers in general. They are more popular than all other museums combined and, in many metropolitan areas, more popular than any other form of public "infotainment."

Fact Sheet 2009

MISSION

The Exploratorium is a museum of science, art, and human perception founded in 1969. The Exploratorium's mission is to create a culture of learning through innovative environments, programs, and tools that help people nurture their curiosity about the world around them.

AUDIENCES

- 600,000 people annually visit the Exploratorium
- 52% of visitors are adults and 48% are children
- 51% are from the Bay Area, 27% from the rest of California, 16% from other states, 6% outside U.S.
- 115,000 school-age students and their chaperones visit the museum each year, of these, 90,000 participate in the Field Trip program
- 11,500 individuals and families are Exploratorium members
- 44% of visitors receive free or discounted admission
- 44,500 visitors attended on Free Wednesdays (the first Wednesday of every month) last year
- 145 million visit Exploratorium exhibits at science centers and other locations worldwide

EXHIBITIONS AND PROGRAMS

- 700 original interactive exhibits, displays, and artworks have been designed, prototyped, and built on site, with 400 currently on view
- Hands-on exhibits explore biology, physics, visual perception, listening, and mind
- Public programs include hands-on workshops, lectures, performances, films, and other special events. Bilingual programs in Spanish, Cantonese, and / or Mandarin are offered 2-3 times a year.
- The museum has hosted more than 275 artists in residence
- Exhibits are located at 58 international and 66 U.S. science centers
- Partnerships with 11 science centers nationwide offer them exhibit collections and educational training
- Exploratorium exhibitions — Memory and Navigation — travel worldwide

EDUCATION AND RESEARCH

- An estimated 6,000 teachers from 47 states participate in Exploratorium-designed workshops
- 400 U.S. teachers participate in more than 60 hours of intensive professional development each year
- A national model program improves the classroom success of beginning teachers
- Center for Informal Learning and Schools, a partnership with UC Santa Cruz and King's College London, develops leadership in the study of informal science learning and institutions, and their relationships to schools
- Educational Outreach reaches 5,000 underserved children and families in the community
- The Explainer Program hires and trains a diverse group of up to 75 high school students each year
- The Osher Fellows Program hosts 4 to 6 resident scholars, scientists, educators, and artists

- 9 staff members, including 3 PhDs, comprise one of the world's largest museum research and evaluation groups

MEDIA

- 28 million Web visits annually access www.exploratorium.edu, which has 25,000 pages of original content
- 50 live Webcasts originate each year from the Exploratorium and remote locations
- 50,000 copies of Exploratorium-developed publications were sold in the past year, with 28 titles in print
- 12,500 copies of explore, the membership newsletter, are distributed quarterly

FACILITIES

The Exploratorium uses 110,000 sq ft of floor space within San Francisco's historic Palace of Fine Arts, plus offices and exhibit-building shops in adjacent Presidio Buildings. Facilities include:

- multimedia Learning Center with library · 9 wired classrooms · life science laboratory
- Phyllis C. Wattis Webcast Studio · 125-seat McBean Theater · ample free parking
- machine, wood, and electronics shops · store and café

The Exploratorium is available to rent for private events during evening hours.

BUDGET & STAFF

- 2008–09 budget: \$33,317,000
- 495 total employees; 250 full-time equivalent; 42% people of color
- an international team of 200 volunteers contributes more than 12,000 hours annually

Early History

“The whole point of the Exploratorium is to make it possible for people to believe they can understand the world around them,” Frank Oppenheimer said. Oppenheimer, a distinguished experimental physicist and university professor, founded the Exploratorium in San Francisco in 1969 primarily to share his own joy in discovery. His range of experience encompassed both the theoretical and the hands-on, practical side of science, and a knowledge of education and how students learn. Oppenheimer’s three overlapping careers in science reflected his dedication to understanding: he was a brilliant researcher in nuclear and cosmic ray physics, a distinguished teacher and innovator in laboratory instruction, and the creator and guiding genius of the Exploratorium. He was founder and director until his death in 1985.

How Did the Exploratorium Happen?

In 1949, Oppenheimer was forced to resign from his university position as a result of harassment by the House Un-American Activities Committee, this after a distinguished career including having joined the Manhattan Project at Los Alamos, directed by his brother J. Robert Oppenheimer. For the next ten years he was a cattle rancher in Pagosa Springs, Colorado. Banishment from academic physics did not end his career, as much as it marked the beginning of several new ones. One was being drawn into the local small town high school that had 300 students and one science teacher. When Oppenheimer returned to University physics in 1959, he also became a central moving force in improving laboratory teaching, developing a “Library of Experiments,” in which students could explore physical phenomena. Oppenheimer was invited to do the initial planning for a new branch of the Smithsonian, but he turned it down to work on what he called his “San Francisco project.”

He was convinced of the need for public museums of science to supplement science curriculums at all levels. In 1969, with no publicity or fanfare, the Exploratorium opened its doors to display a few exhibits borrowed from NASA and an exhibit on the aesthetics of the Stanford Linear Accelerator, sprinkled through its home, the cavernous Palace of Fine Arts. Today, the near 100,000 square feet of exhibit space overflows with over 400 Exploratorium-made exhibits at any given time, as well as special events and programs. Oppenheimer’s insistence on excellence, knack for new ways of looking at things, sense of humor and whimsy, and high respect for invention and play and his own lack of pretentiousness are captured by the Exploratorium. The Exploratorium provides a carefully controlled chaos in which visitors and students freely pick their paths among a subtle and ingeniously devised science curriculum. Oppenheimer insisted on honesty in exhibit building, an attitude that persists to this day — the exhibits present natural phenomena; they are not rigged to fool the visitor or improve on nature. The exhibitry, programs, and structure of the Exploratorium develop that spark of intrigue, speculation, and questioning that Oppenheimer recognized as the very essence of learning in both the sciences and the arts.

Recent History

The Exploratorium has become internationally known for its innovations in exhibit design and science education. Around the world, museums have emulated the Exploratorium's interactive style of exhibit building, or quite literally become our partners in an international Exploratorium network established in 1999.

From 1991-2005, Dr. Goéry Delacôte served as Executive Director of the Exploratorium. He felt that the Exploratorium was already the most original science museum in the world, but also wanted the museum to make a major impact on the general problem of science education. The challenge was to encourage the public to understand and appreciate their world, to attract talented young people to science, and to provide new ideas for the teaching of science.

Since the Exploratorium's inception, the museum's exhibits and programs have focused on human perception: how do we see, hear, smell, feel, and otherwise experience the world around us? Dr. Delacôte expanded that focus, going beyond perception to include life sciences and biotechnology, sciences of the new frontier in the 21st century. The new Traits of Life collection opened in October 2002. Its Imaging Station includes such cutting-edge wet biology as live mouse stem cells.

Dr. Delacôte reconsidered the concepts underlying the Exploratorium and its exhibits, as well as the organization and focus of major new initiatives within the museum. To address the crisis in science education, the Exploratorium expanded its role. In addition to being a center for exhibit-based public education, it has assumed a leading role for science learning reform efforts and national teacher training efforts, and has become a center for explorations of interactions between science and the tools of the new media. In addition, museum partnerships is the vehicle by which we export the Exploratorium's innovative approaches to exhibit design to established and start-up museums across the US and the world.

Under the direction of Dr. Dennis Bartels — a nationally known science education and policy expert, who in 2006, became the Exploratorium's next Executive Director — the Exploratorium completed exhibits that deal with all of cognition — in other words, using the mind to understand the very workings of the mind itself.

Mind opened in November 2007. It looks at how the questions that the study of cognition poses are basic human questions of how the mind works, and incorporates state-of-the-art research in the field of neuroscience.

Dr. Bartels's vision for the Exploratorium is to change how the world learns, with the goal of changing individuals from passive consumers of information to active, personal explorers, whether adults or children, professional teachers or amateurs, anywhere in the world, given that in today's world, technology enables all. Under Dr. Bartels, the Exploratorium continues its educational research and development capacity as it continues to scale its innovations outwardly, most notably in the field of science education and life-long learning.

Already known for transforming teacher practices in schools, the Exploratorium under Dr. Bartels leadership is now developing alternative educational experiences out-of-school and online; and extending the Exploratorium's reach and impact through online communities, open-source environments, and more user-produced content and experiences; and by serving non-professional teachers, including scientists, alternative education leaders, graduate students, journalists, politicians, and parents.

Public Exhibitions

The Exploratorium has been described by the Encyclopedia Britannica as “the archetype of the experiential, ‘hands-on’ science center.” Scientific American called it “the best science museum in the world.” More than half a million visitors, including 100,000 children and teachers on field trips, come to visit the Exploratorium each year.

The Exploratorium is typically perceived as a science museum. In reality, it is a place that experiments with new practices for discovering the world; a museum filled with interactive science and art exhibits; a national center for teacher development; an award-winning Web site of new teaching resources; and a growing global network of partner museums. The Exploratorium’s museum floor is the public face of the Exploratorium, a laboratory for the research and development of innovations in exhibits for exploring science, art, and human perception.

Developed in-house through extensive research and development, well more than 700 Exploratorium exhibits, with over 400 currently on view, have been designed to spark curiosity, regardless of age or familiarity with science. Exhibits cover a range of subject areas, including human perception (such as vision, hearing, learning and cognition), the life sciences, and physical phenomena (such as light, motion, electricity, waves and resonance, and weather). A wide variety of public programs, artists-in-residence projects, and demonstrations accompany all exhibit collections.

Exhibit content areas include:

SEEING (Opened June 2002)

This exhibit collection presents illuminating insights into the complex process of interpreting our world through our eyes, our brains and our own subjectivity. Conceived and created in-house, Seeing has been part of an intensive effort to strengthen and rebuild the Exploratorium’s core collections, which give visitors an active role in determining their experience and in creating the knowledge they take away with them. Seeing explores how we see, how we interpret what we see, and how culture and environment influence what we see.

TRAITS OF LIFE – A NEW LIVING LABORATORY (Opened October 2002)

The riotous diversity of life masks an underlying unity. Deep down, we’re all alike. We all reproduce, use energy, and change over time. And we’re all made of cells, genes and DNA. The over 30 exhibits and demonstrations in Traits of Life bring these themes to life.

MATTER/WORLD

This section of the Exploratorium includes exhibits on electricity, heat and temperature, motion, weather, and complexity, the “stuff” that composes our world.

LISTEN (Opened October 2006)

Listening is an action. The act of listening in this exhibition is both the means and the ends to learning because sound, by its nature, carries information. But there are many layers of meaning. What we hear is guided by physics — vibrations, materials, space. What we hear is guided by our ears and brains — our physiology, memory, attention, listening conflicts and synergies. And finally, what we hear is filtered by who we are — our choices, culture and history. This exhibition summons them all through our ears.

MIND (Opened November 2007)

Mind asks visitors to observe and reflect upon their own psychological experiences. The collection focuses on three important areas of psychological investigation and experience — attention, emotion, and judgment — that can be experienced, investigated, and pondered by Exploratorium visitors. They compare those experiences with their own ideas and expectations of how minds work, as well as with the experiences of others. They examine how emotional reactions and cognitive assessments from disparate parts of the brain are woven into a cohesive understanding of an event or experience. Visitors may also discover that in many judgments, decisions, and beliefs, their experience of being in control of what they think and feel is, at least in part, illusory. And they consider the implications of these experiences for broader questions of the human condition, such as consciousness, morality, and our understanding of reality.

Traveling Exhibitions

Several Exploratorium exhibitions are in circulation, rented by other institutions. They include Memory, Navigation, Turbulent Landscapes, Traces of Time, and Traits of Life.

Also of note are the following ongoing special features of the Exploratorium's public offerings:

Film Program

The film program is known for screening new, independent work, often with the filmmaker present to speak with the audience. In addition to the Exploratorium's collection of rare films related to art and science, guest curators are invited to plan film series for screening at the museum.

Tactile Dome

The Tactile Dome is a pitch-black geodesic dome with thirteen chambers. Visitors first take off their shoes and then walk and crawl to find their way, using only their sense of touch. Designed by August Coppola and architect Carl Day, its purpose is to disorient the sensory world so that the only sense the visitor can rely on is touch.

Wave Organ

The Wave Organ, an outdoor exhibit of the Exploratorium, by artist Peter Richards and stonemason Richard Gonzalez, is a wave-activated sound sculpture that utilizes wave action from the bay to create a symphony of sound, which emanates from a series of pipes that reach down into the water. A wonderful collection of granite material (including discarded tombstones) creates a series of sculptured terraces and seating areas. The listening pipes extend from the seating area to the water. The intensity and complexity of the wave music is directly related to the tides and weather. Located at the tip of the jetty forming the San Francisco Yacht Club harbor, the seating area also offers a spectacular view of San Francisco.

Exhibit Collection

The Exploratorium's core exhibit collection consists of five broad content areas and a temporary exhibition program, for which the museum develops its own exhibitions, as well as hosts those from other organizations. Exhibit content areas include:

SEEING

The illuminating insights into the complex process of interpreting our world through our eyes, our brains and our own subjectivity. **Seeing** is organized by subject areas as follows:

Light and the Eye

Consider that the images formed by light on the backs of our eyes are flat, upside-down, distorted, full of holes, out of focus and obscured by dark networks of blood vessels. It's amazing that we see at all! *Light and the Eye* deals with the anatomical and physiological features of the light-sensing eye. Exhibits in this area suggest, our eyes, even in the initial stages of vision, are not just passive cameras. The *Eyetracker* follows the motion of your eyes as you study images, showing our continual scanning of our world—and how we each focus on different aspects of the same scene. At *Red/Green Goggles*, saturate your right eye with green light and your left eye with red light. Then look at the world by blinking one eye and then the other—friends go from rosy good health to sickly, to the say the least, as you learn about how your eyes respond to colored light. And the *Fovea Remover* shows how a brief flash of light can eliminate your ability to see details—temporarily, of course!

Seeing Color/Seeing Motion/Seeing Depth

The eye and brain together perform amazing feats. Sometimes you see color where there is only black and white, or black and white where there is color. Sometimes you see three dimensions where there are only two. Using one eye, you may even see two dimensions where there are three. **Seeing Color, Seeing Motion, and Seeing Depth** exhibits demonstrate how our visual system does not simply record the light that enters our eyes—it interprets the light, in often surprising ways. At *Colored Rooms*, illuminated rooms appear to be the same, but when identical objects are placed inside, they seem to have strikingly different colors. *Silage Beach* shows how an environment in motion can cause us to perceive that *we* are moving—even if we're standing still. At *Dancing Dots*, you encounter colored circles on a piece of paper. When the paper is moved, one of the dots appears to slide on the page while the others move along with the paper as expected. *Seeing Yellow* presents two different mixtures of yellow light, which appear to be identical. Your visual system cannot tell them apart, but a two-color filter reveals a striking difference. *Disappearing Act* illustrates how easily objects can blend into their backgrounds—until they move.

Seeing In Context, Paying Attention

We don't see in piecemeal; we always see individual things within a larger environment—like a bright white moon against the black night sky. In fact, the moon is dark gray and only appears bright white because of its context against the black sky. The exhibits in **Seeing In Context, Paying Attention** bring home the way that everything in a scene— noticed or not—affects our perception, and illustrate the powerful role of attention in what we see. For

instance, would you believe that you might perceive a round object on the wall as a clock, and the same object, when on a table, as a plate? Or that there could be more light coming from a chunk of coal in sunlight than from a normal sheet of paper? *Bright Black* explores the powerful roles of context and illumination in how we judge brightness. At *Shadow Colors*, find out that shadows may seem to be colors they're not—even though shadows have no colors at all. These exhibits also illustrate how our brains make choices about *what* to see. At *The Disappearer*, clearly visible objects on a round platform disappear before your eyes when the background begins to rotate. Similarly, find out the shocking truth about all that you can NOT see at *Basketball*. Without giving away what researchers have learned about how easily we can miss even obvious things, suffice it to say that at this exhibit, following the ball is not always the best advice—even if most basketball players are noted for their visual acuity.

Interpreting Images

Interpreting Images reverses the old phrase *Seeing is Believing* to create the equally accurate *Believing Is Seeing*. This section explores the roles of ambiguity, culture, and belief in the process of vision, highlighting the profound subjectivity of seeing. For example, *Blank Comics* are comic strip frames with no dialogue. Insert your own dialogue, and learn the way visual cues cause us to interpret images—and how different people see very different events in the same scenes. *Perspectives* takes this idea one step further, as it lets you be a “director,” putting scenes together in different ways to change the meaning of a complex social event. As you choose different sequences of camera shots of the same scene, discover how such choices impact what viewers see, and therefore understand. This section will also include the *Seeing Gallery*, a space devoted to artworks illustrating the infinite ways we can interpret images. The *Gallery's* rotating exhibitions will feature everything from artworks by visually impaired artists to experiments in multimedia.

Other Features of the Collection

Seeing Station

Supervised and small group activities include the use of lasers to study optics, state-of-the-art medical technology providing views inside the living eye, and demonstrations of how card tricks are based on expectations and attention. Visitors can also experiment with how the eye and brain work together to create illusions.

The Eye Curiosity Shop

Explore the kitsch and culture of the eye. Many cultures have viewed the eye as the window to the soul. The concept of the *Evil Eye* has appeared in many cultures over the centuries, and representations of eyes signifying wisdom or protection from evil abound. In this country, the eye appears on everything from the dollar bill to advertising campaigns for mascara and monster movies. Here, visitors can explore the vast range of depictions of eyes, a range which illustrates the enduring importance humans have always placed on seeing.

Works by Artists

Bill Bell's *Between the Lines*, Gerald Marks's *Professor Pulrich's Universe*, Bob Miller's *Sun Painting* and Paul Kaiser's *Inkblot Perceptions*.

TRAITS OF LIFE — A NEW LIVING LABORATORY

The riotous diversity of life masks an underlying unity. Deep down, we're all alike. We all reproduce, use energy, and change over time. And we're all made of cells, genes and DNA. The over 30 exhibits and demonstrations in **Traits of Life** bring these themes to life. Highlights follow:

LIFE SHARES COMMON MATERIALS.

The directions to create life's diverse forms are stored in an organism's genes, deep inside its cells, written in the language of DNA.

Cell Demo: Some living things are composed of only one cell. A demonstration using a high-quality microscope and single-celled organisms show the components of single cells.

Glowing Worms: A jellyfish gene makes these worms light up. The worms produce the glow protein — green fluorescent protein, or GFP — taken from jellyfish genes, and made visible here under an ultraviolet light that illuminates their nerve cells.

DNA Extraction Demo: All living things contain DNA in their cells. The extraction of DNA from visitors' cheek cells can be examined.

Embryo Station: All multicellular organisms develop from a single cell in similar ways. A presentation of various living embryos in the early stages of differentiation and development.

Research Zoo: Living things share many fundamental parts — including genes, proteins, and cells — that work in similar ways. Scientists study a particular "model organism" to understand how other organisms, including humans work. Those on display include brewer's yeast, roundworm, fruit fly, zebrafish, common wall cress, and mouse.

LIFE CREATES MORE LIFE.

From the division of a single cell to the union of two organisms, life creates more life with — and without — sex.

Sea Urchin Fertilization Demo: Most living things reproduce sexually to create genetically different offspring. In this demo, a visitor witnesses the breathtaking moment of fertilization, when sperm meets egg.

C-Fern Demo: Plants have developed many different strategies to reproduce. These ferns can reproduce sexually. Visitors will witness swimming C-fern sperm — as they move towards eggs before one's eyes — a plant's strategy for reproduction that some associate more with animals. A demonstration using *Ceratopteris fern* and the release of motile sperm illustrates one strategy for plant reproduction.

Self-Propelled DNA/Live Sperm and Eggs: A live microscopic presentation of sea urchin sperm via an interactive microscope illustrates how different species use sperm to fertilize an

egg. Note how sperm and eggs from a sea urchin bear a striking resemblance to sperm and eggs from a human being.

Pollination: We can't see the ultraviolet patterns on these flowers, but bees can. This exhibit uses UV filters to reveal the flower patterns that attract insects so that the flower gets its pollen — male sex cells — to reproduce.

Flower Dissection Demo: Flowers are the reproductive structures of plants. A simple flower dissection.

LIFE CHANGES OVER TIME.

The great variety of forms life has taken as it has evolved is largely the result of changes in DNA.

Mutant Flies

A single change in a gene can create drastic changes in an organism. Whether a fly turns out "normal," or has white eyes, no wings, or a black body, depends on the information carried on its genes.

Goldfish

Selective breeding by humans has generated variety among a species. A large tank of goldfish displaying variants created by humans. The first "mutant" goldfish was noticed some 2,000 years ago and started in Japan and China. The Chinese created many fancy varieties.

Genes Connect Us All.

Organisms from different species share a surprising number of genes with similar functions. This exhibit helps you think of your genes as fossils, holding clues to our ancient origins.

LIFE USES ENERGY.

All living things need energy to survive.

Respirational Interdependence: One organism's waste is another's sustenance. A small scale, interactive community of living organisms (grass and termites) allows visitors to explore the relationship between photosynthesis, aerobic respiration, carbon dioxide and oxygen.

Bacteriapolis: These photosynthetic bacterial communities are striking for their colorful bacteria that use pigments to capture energy from sunlight.

Termitarium: A fascinating colony of termites, which includes three "castes," or roles: workers, soldiers, and reproductives. Wood has energy; the termites use the sun's energy trapped in wood.

Energy from Death/Rotting Carcass: The insects, bacteria, and other organisms in this tank are playing a critical role in the energy cycle.

Microscope Imaging Station (a work in progress)

Even more spectacular is the Imaging Station, the place to witness the amazing development of live embryos — including fish, worms, and fruit flies—in real time, and watch time-lapse movies. The station will be fully operational in the fall of 2003. At that time, visitors can also control the microscope via interactive controls. The completed **Microscope Imaging Station** will have four visitor-accessible microscopes, and be used for scientific research. Major support for this project comes from the National Institutes of Health and The David and Lucile Packard Foundation, with additional support from Carl Zeiss Microscopes, Technical Manufacturing Corporation, Technical Instruments, and Universal Imaging.

MATTER/WORLD

The “stuff” that comprises our world and the expression of this physical phenomena, this section of the Exploratorium includes exhibits on electricity, heat and temperature, motion, weather, and complexity.

MIND & LEARNING

This section includes exhibits on language, memory, psychology, cognition, and learning. Exhibit development efforts continue including the current Exploratorium-produced traveling exhibition called Memory, and plans for expansion into different areas of cognition, including attention, problem-solving, creativity, decision-making, dreams, humor, emotions, and consciousness; and advances in brain-imaging research.

SOUND AND HEARING

This section includes exhibits on auditory perception, music, sound, resonance, and vibration. Exhibits will be expanded to incorporate more cultural and artistic examples, and closer connections to the Life Sciences.

Learning and Teaching

A Leader in Science Education Reform

The Exploratorium seeks to transform K-12 science education practice nationally by extending its museum-based interactive learning approaches in science inquiry to formal education settings.

As the nation calls for higher academic standards in all disciplines, including science, and documents such as the National Science Standards and Science for all Americans advocate for the importance of students doing rather than just reading about science, the Exploratorium offers its over 35 years of experience as an innovator in creating learning experiences and opportunities that blend hands-on and conceptual learning to provoke in the learner deep understanding of the most important concepts in science.

A Design for Impact and Change

The key change strategy is to provide education professionals with carefully staged and transformative learning experiences in science inquiry, while at the same time illuminating the design and decisions behind these teaching and learning experiences. This approach—both experiential and self-conscious—helps educators become advocates for inquiry approaches to science teaching in their home schools and districts, and gives them the rationale and tools to provide their colleagues and students with similar learning experiences.

What We Bring to the Table

Our programs use the museum's 400-plus interactive exhibits on display and its core curriculum. Participating teachers begin investigations at the exhibits, observe students and other visitors in their own inquiries, and then participate in group explorations and lecture/seminars in the museum's classrooms. These classroom experiences are designed to underscore content knowledge emanating from exhibit experiences, and to model inquiry approaches to K-12 science teaching and learning.

The act of genuine inquiry as it is used in the study of art, human perception and other disciplines serves as a vehicle for building among teachers a new view of learning in science classrooms. Often the teacher recognizes in this process that he or she does not have to have (or receive from our faculty) all the answers to science questions in order to have an intellectually stimulating and content-rich experience. Questioning and investigating become real, not words in the latest state science framework or set of standards.

We also produce and disseminate classroom tools for inquiry-based approaches to teaching and learning using multiple methods of delivery—from our widely acclaimed classroom books, and teacher guides to on-line science education expertise and classroom activities and strategies. We also are responsible for developing community outreach programs for youth and moderated learning experiences on the museum floor for the museum’s visitors.

The Programs

The Institute for Inquiry (IFI) ©, was one of the five National Science Foundation-designated centers for accelerating science education reform nationwide. It works with elementary school teachers, administrators, and district leaders from around the country and Latin America in a range of workshops and institutes designed to help districts implement inquiry-based education as a part of their standards-based reform efforts. In November 2006, IFI launched a new online curricula — available at www.exploratorium.edu/ifi — a resource for teachers, professional developers, and district administrators. The Teacher Institute provides teacher development programs for middle and high school science and mathematics teachers, including novice teachers. In a recent blind survey, these programs were rated one of the top two science education resources among teachers and district leaders from throughout Northern California.

Taking a cue from the public’s enthusiastic response to “informal science centers” like science and natural history museums, zoos, and aquaria, the Center for Informal Learning and Schools (CILS) integrates the best of the “informal science learning” with the formal learning that takes place in schools. A collaboration between the Exploratorium, King’s College London (KCL), and the University of California, Santa Cruz (UCSC), CILS trains in informal science instruction and examines the strategies that make such centers powerful learning venues. CILS prepares leaders in informal science education, conducts research, supports students pursuing advanced degrees in science education, and provides professional development opportunities for science museum staff. The Center is headquartered at the Exploratorium, and began operation in fall 2002.

The Children’s Educational Outreach program works throughout Bay Area neighborhoods, focusing in particular on youth at risk and working in collaboration with community-based organizations. The High School Explainer program trains cadres of diverse groups of high school youth in both science content and social skills by employing them to act as the museum’s interface with visitors. This program serves as a model for museums around the world seeking to develop authentic youth programs. Our Science Field Trips program works with teachers to facilitate their and their students’ use of the museum, connecting it with mandated curriculum, and developing classroom extensions of the museum experiences.

Strategies

The Exploratorium has learned how to leverage its experience and resources in many significant ways. Specifically, it works at length with educators, routinely exceeding 100 hours in intensity for its professional development programs. More recently, it is recruiting teacher educators and education administrators who, in turn, develop the skills of hundreds of additional teachers in

their home institutions. These educators must come from school districts that are already deeply involved in science education improvement projects, thus ensuring that the support and resources are available to advance these approaches to science learning with their colleagues when they return.

In another example, the Novice Teacher Program is providing concentrated professional development programs and support to beginning teachers in middle and high schools to increase the likelihood that they will (1) stay in the profession, (2) teach more effectively earlier in their careers, and (3) adopt our approaches for the length of their careers. This program is designed to shore up the national investment in preparing teachers for today's classrooms in light of the alarming attrition rate that exists among beginning teachers.

Our youth and teacher professional development faculty are sought out for consultation and advice from museums around the world.

In summary, the Exploratorium seeks to transform teaching practices by:

- Working at length with teacher educators and education professionals who are deeply engaged in district-wide science reform efforts
- Establishing a unique beginning science teacher program and experimenting with new kinds of relationships with colleges of education
- Building ongoing relationships with reform projects and leading organizations in the national science education community
- Strengthening teaching and learning experiences for visitors to the museum and through local educational outreach programming
- Going into greater depth in evaluation and understanding of our own work
- Harnessing the World Wide Web for maximum educational impact, including a digital asset library for teachers, curricula for professional developers, the Pinhole list-serve that allows science teachers to ask questions of each other and get answers immediately, and over 18,000 pages of science content at www.exploratorium.edu.

Education Fact Sheet

450,000 teachers are reached annually by the Exploratorium's Educational Programs

- 2,500+ teachers and education reform leaders from 161 projects in 47 states have received 100+ contact hours of intensive work in sciences and mathematics over the last 10 years. In turn, these leaders reach 150,000 additional teachers annually.

- 200 museum educators from 150 museums participate in intensive two-week programs in teacher professional development over the last 5 years, in turn reaching 300,000 teachers annually

- 90% of beginning science teachers who have graduated from Exploratorium program since 1998 are still teaching science (compared to 50% national attrition rate of new teachers).

- Annually

- 75 beginning science teachers participate in special 2-year mentoring program

- 400 teachers and educators participate in 60+ hours of intensive training on-site

- 130,000 students and teachers attend field trips

- 5,000 underserved Bay Area children and families participate in outreach activities

- 1,000,000 unique visits are made to Exploratorium online teaching resources

- 6,000 teachers use the Exploratorium's online support network

- 50,000 copies of Exploratorium-developed publications sold; ~30 titles in print

- 600 Bay Area administrators rated the Exploratorium as one of two top science teacher resources (Inverness Research Associates).

- School district reform leaders and professional development leaders showed statistically significant differences in leadership abilities, knowledge of science and inquiry, and effectiveness of professional development designs compared to similar educators in reform projects not associated with the Exploratorium.

- 85% of Exploratorium teacher alumni rate it as their most valuable teaching resource.

PROGRAMS

- The Teacher Institute's discipline-specific teacher induction programs work with novice, middle and high school science teachers to increase effectiveness and raise retention rates.

- The Institute for Inquiry provides inquiry-based workshops and online resources for a national community of K-5 education reform leaders and Bay Area elementary school districts.

- The Center for Informal Learning and Schools examines the impact museums and science centers can have on teacher education and school reform. The Center offers professional certificates for museum educators.

- The Educational Outreach Program partners with more than 30 community organizations to bring free hands-on art and science programs to schools, community centers, children's hospitals, and after-school programs.

- The Explainer Program hires and trains up to 75 high school students annually. The program combines on-the-job experience and academic instruction to encourage them to explore, teach, and learn.
- The Field Trip Program provides online resources for teachers, and on-site Explainers to facilitate visits and conduct demonstrations.
- Learning Tools has over 30 titles in print and annually sells 50,000 copies of Exploratorium-developed publications.
- Live at the Exploratorium produces 50 educational Webcasts from the museum and locations around the world annually.
- The Educator Online Network provides access to thousands of images and other educational resources indexed in the Exploratorium Digital Library.

Science Education through Media and Communication

The Exploratorium has been at the forefront of developing technology-based education programs that reach remote audiences worldwide and explore the use of new media in public learning environments. Firstly, since 1993, the **Exploratorium Website** (www.exploratorium.edu) has been one of the most visited science sites on the Web, with a current annual audience of more than 28 million distinct visits. The site has won four Webby Awards (Best Science Site, 1997-99 and 2004, and Best Education Site, 2002) and received the 2000 Award for Innovation from the Association of Science-Technology Centers for worldwide leadership in the field of Internet-based education. Among the innovative content online is The Accidental Scientist, which engages visitors in the science of everyday activities such as cooking (www.exploratorium.edu/cooking), making music (www.exploratorium.edu/music), and gardening (www.exploratorium.edu/gardening).

The Exploratorium is the locus for a variety of other programs researching the use of new technologies in education. **Live@ Exploratorium** features live webcasts linking museum and Internet audiences with science events and experts from around the globe. Examples include Origins (www.exploratorium.edu/origins), which provides in-depth Webcasts and ongoing links to remote research stations investigating the origins of matter, the universe, the earth, and life itself. Journey to Mars featured the first images from Mars in a month of live webcasts on Mars (including remotes from the Jet Propulsion Laboratory), a full-scale model of NASA's Mars Exploration Rover, and working mini-rovers, for the public and online audiences. In November 2006, the Exploratorium crew went to the National Optical Astronomy Observatory on Kitt Peak, in Arizona, to bring the Transit of Mercury webcast to online audiences worldwide. In 2007-08, the Exploratorium celebrated the International Polar Year with live webcasts from Antarctica and the Arctic Circle. The Exploratorium also regularly brings live solar eclipses from across the world to museum audiences and the public internationally. In the summer of 2008, the Exploratorium team went to China for that year's total solar eclipse.

The Exploratorium is also engaged in several projects investigating how new technologies can enhance the museum learning experience, such as:

- The **PIE Network (Playful Invention and Exploration)**, a consortium led by the MIT Media Lab that tests the use of miniature electronic devices as teaching tools, among other endeavors
- The **Digital Asset Management** project increased audience access to a digital library of unique Exploratorium images, activities, and other media resources.

The **Learning Tools** division produces publications and other media for the public, families, and educators, and currently has more than 28 titles in print. In 2006, Learning Tools released Exploratoria, the recipient of the 2008 AAAS/Subaru SB&F Prize for Excellence in Science Books. It gathers over 25 years of Exploratorium knowledge, experience, and activities in a single book. And, each year, 13,000 copies of the Exploratorium Newsletter are distributed bi-monthly.

The **Department of Learning Research** researches science learning, science teaching, and technology-supported learning. Learning Research also researches both online and onsite audiences, who connect with the Exploratorium through the Exploratorium's webcasts, networked multimedia, wireless technologies, and digital libraries. Learning Research explores changes in teaching practices, and how the Exploratorium's professional development, social learning context, and inquiry-based model of teaching translate into effective practices and improved learning, both locally and nationally. In addition, Learning Research explores how the Exploratorium's museum educator programs affect youth development and participation in science.

Research and Evaluation

Research and Evaluation At the Exploratorium

For over 35 years, the Exploratorium has pioneered the development and definition of new learning environments, programs, and tools that help people nurture their curiosity about the world around them. Research and evaluation are integral parts of these efforts. We believe they are critical in understanding the nature of learning and how to design for learning innovation. There are altogether four PhDs on staff in research and evaluation, and senior researchers and evaluators, with backgrounds in science education, the learning sciences, science teaching, museum studies, psychology, physics, engineering, and computer science. Below is a snapshot and brief description of some past and on-going activities in research and evaluation.

Online Professional Development and Digital Library for Afterschool Educators

The Exploratorium, together with the California School-Age Consortium (CalSAC), an established statewide afterschool leader training network, is creating and offering workshops and online professional development materials for use by state and regional afterschool organizations. The activities, materials, and workshops combine and blend both hands-on science and art activities with web-based activities, making use of the National Science Digital Library. This project is surveying afterschool programs and designing, testing, and evaluating how well afterschool educators can adopt and support a designed in-person and online approach to STEM learning and professional development.

Online Audience Research

The Exploratorium website includes rich media, articles, webcasts, hands-on activities, teaching materials, and other web resources. As many as 27 million unique online visitors have come to the Exploratorium website annually, representing over 200 different countries. Why are online visitors coming to the Exploratorium website? How do online visitors find us on the web? What impact is the Exploratorium website making on science education and learning via the Web? This area of research assesses who is our online audience and investigates a range of existing and new methods used to measure the educational and instructional impact of the Exploratorium website on learning.

Evaluation of the NISE Network: Nanoscale Informal Science Education Network

A new national Nanoscale Informal Science Education Network (NISE Net) launched in the Fall of 2005 with funding from the National Science Foundation with the mission of fostering public awareness, engagement, and understanding of nanoscale science, engineering, and technology through the establishment of a national infrastructure that links science museums and other

informal science education organizations with nanoscale science and engineering research organizations.

Multiple evaluation studies are being conducted with visitors, educators, and scientists to help guide in the planning of public exhibitions, programs, media, and web content for NISE Network. This includes an evaluation of the growth and capacity of the network.

Center for Informal Learning and Schools (CILS)

In 2002, the museum inaugurated CILS, a partnership with the University of California Santa Cruz and King's College London. It offers doctoral, post-doctoral, and professional development programs for educators, scientists, and researchers in the natural and social sciences. CILS aims to develop a better articulation between schools and informal learning institutions (such as museums and zoos), and to understand what makes this articulation a success for the benefit of K-12 science learning and teaching. Several studies taking place at Exploratorium are exploring features of effective museum-based professional programs, museum schools, and teachers' perception of informal science institutions. CILS has also conducted a national survey of informal science institutions.

Center for Informal Learning and Schools: Museum Schools

Recent years have seen a growth in a particular type of partnership between informal education and formal education that is frequently called a "museum-school." Museum-schools integrate formal and informal education by involving the regular use of museum resources within school-based curricular instruction. This project involves in-depth case study analyses of selected museum-schools around the country in order to investigate how and why museum-schools are first established and sustained over time, how they function, and the challenges and solution strategies they encounter in their operation.

Center for Informal Learning and Schools: ISI-Based Teacher Development Study

This study investigates the extent to which informal science institution (ISI)-based professional development incorporates features of how to produce measurable effects on teachers' instructional practice and what factors influence districts' decisions when selecting PD programs. This study is guided by the four central questions: What are the design features of ISI-based PD? To what extent do ISI-based PD programs integrate particular features that we know through research produce measurable effects on teaching practice? What feature of professional development programs do teachers and district leaders report as being valuable? What contextual factors do teachers and district leaders report as influencing their selection of and/or participation in PD programs, specifically ISI-based PD. In the Fall of 2005, 310 informal science institutions received surveys.

GIVE: Group Visitor Inquiry Experiences

A science museum with engaging and interactive exhibits constitutes an ideal and understudied setting for research on inquiry learning by groups. This research study, funded by the National Science Foundation's REESE division, creates a genre of exhibit-based, group inquiry programs for family and field-trip museum visitors. The purpose of such programs is to provide visiting groups with a small set of inquiry skills that can be used at any exhibit or even beyond the museum, to support fruitful and extended investigations. Informed by the existing literature on scientific inquiry as well as formative studies, the project aims to identify suitable skills and pedagogical strategies that are effective in the social environment and on the timescale of a typical museum visit. Exploratorium researchers are currently conducting a set of rigorously controlled experiments to assess the programs' impact on visitors' inquiry skills. This research will yield a series of effective programs and a set of theoretical principles that account for their efficacy.

The Outdoor Exploratorium

www.exploratorium.edu/outdoor

The Outdoor Exploratorium is an exhibit development project funded by NSF to encourage and support people in noticing the world outdoors. Some of the exhibits being developed for this project will sit at the Exploratorium's current location at the Palace of Fine Arts, but a large majority will be situated at a remote site in San Francisco. This project is also developing web-based activities as well as activities using mobile technologies to support people throughout San Francisco in noticing their outdoors. This project's evaluation studies look at questions such as:

- What are our audiences' outdoor habits?
- What do visitors notice about the outdoor environment?
- (How) do the exhibits we develop help visitors notice aspects of the outdoors?

Public Program Evaluation

Public programs mission is "To inspire curiosity, appreciation, understanding and new ways of thinking about the world and our role in it through human interaction, innovative programs, unique experiences and fresh perspectives." Public programs creates uniquely relevant programming for families, kids, adults and new audience groups from the Latino and Chinese communities. Evaluation of public programs investigates the visitor experience in the following ways:

General Audience Questions

- What kind of socially engaging interactions are the visitors experiencing?
- What programming formats are interesting to visitors?
- What kind of inquiry opportunities do visitors like to engage in?
- What are visitors coming away with after experiencing a public program?

New Audience Development Questions

- Which audiences are underserved by the Exploratorium?
- Why is it important to create relationships with new audiences?
- Why are multilingual offerings important?
- What kind of programs interest Latino and Chinese families?

Queens Borough Public Library: Science in the Stacks (SIS)

This NSF-funded project is an exhibit development and public programs collaboration between the Queens Borough Public Library in New York and the Exploratorium. This project integrates hands-on experiences of basic science into children's libraries. SIS aims to provide science learning opportunities for children 3-12, especially those who already use urban public libraries but are typically under-served by science experiences. This project's evaluation studies will investigate the challenges of:

- Presenting STEM-related interactives in a library setting
- Building proper and effective use of the interactives for 3-12-year-olds
- Designing graphics that communicate to the library's diverse patrons

Geometry Playground

Geometry Playground is a traveling exhibition and set of outdoor play environments where visitors explore and experiment with geometric shapes and mathematical models. Funded by the NSF, the project provides an important laboratory for research into the efficacy of immersive experiences for enhancing informal learning. Geometry Playground is a combination of interactive exhibition, artful playground, and research project in the service of creating and evaluating a strong experiential foundation for geometrical learning.

In-depth research is being conducted on (a) immersive exhibits and their linkages with other forms of exhibits, and (b) the impact of curricular packages (Math Pathways) used in schools before, during, and after a visit to the exhibition.

Learning Science in Informal Environments

The National Research Council (NRC) through the Board on Science Education (BOSE) is conducting a synthesis of research on science learning in informal environments, across a broad range of venues (museums, media outlets, state parks, science clubs, after-school programs) and audiences (individuals, schools, families, and society). Sue Allen, the Exploratorium's Director of Visitor Research & Evaluation, has been selected to serve on this committee of 12-14 recognized experts in research and evaluation, exhibit design, program development, and education. This consensus study will draw together the disparate informal science literatures, synthesize the state of knowledge, and articulate a common framework for the next generation of research on informal science learning.

Website at a Glance

www.exploratorium.edu

- The Exploratorium has been on the World Wide Web since 1993.
- The Exploratorium was the first independent museum to build a site on the World Wide Web. The site went live on December 15, 1993.
- The Exploratorium Website has over 25,000 pages.
- The Website averages over 28 million visitors per year.
- The Exploratorium Website has provided coverage of the most recent solar eclipses in Aruba, Turkey, Zambia, and China. Eclipse coverage increased viewership to 500,000 visitors on the web and millions more on broadcast television worldwide.
- The Exploratorium Website was recognized as an Official Honoree in three categories for the 2007 Webby Awards: Science, Education, and Best Visual Design — Function. It was also recognized in three categories in 2008.
- The Exploratorium's Science of Gardening website — www.exploratorium.edu/gardening — took first place in the science category of the American Association of Museums annual MUSE awards, which were presented at the 2006 AAM annual meeting in Boston.
- Named to "Top 100 Educational Websites of 2005" by Homeschool.com
- The Exploratorium website titled, "Saturn: Jewel of the Solar System," received the Scientific American Science and Technology Award for 2004 in the astronomy category.
- The Exploratorium Website received the Webby Award for Education in 2002. It also received the Webby Award for Best Science Site three years in a row (1997-1999), and in 2004. The Science of Hockey Web site was nominated for the Webby Award for Best Sports Site in 1998.
- The Exploratorium Website received the 2000 ASTC Award for Innovation.
- The Exploratorium Website was a finalist in the category of Media Arts and Entertainment for the 1999 Smithsonian Computerworld Award and became part of the Smithsonian's 1999 Permanent Research Collection.
- The Science of Baseball website is one of only 13 award recipients from a field of more than 15,000 entries have been selected for a Distinctive Merit Award from the 78th Annual Art Directors Awards presented in 1999.

Website Background

Exploratorium Website Background

www.exploratorium.edu

Online since 1993, the Exploratorium was the first independent museum to build a site on the World Wide Web. Included in the site are more than 25,000 webpages and many sound and video files, exploring hundreds of different topics. We currently serve 28 million visitors a year on the site—over 50 times the number of visitors who come to the museum in San Francisco. That makes us one of the most visited museum websites in the world.

The Exploratorium's website is an extension of the experiences on the museum's floor. It provides "real" experiences for our online audience, not "virtual exhibits." The medium of the Internet makes it possible to reach homes and schools all over the world. This has changed the way formal and informal learning takes place, both in the classroom and in the home. The Exploratorium online, and the resources it provides, are available 24 hours a day, worldwide, to anyone with an Internet connection.

Many of the resources on the Exploratorium Web site are examples of very simple uses of information technology, but thoughtfully implemented. For example, the site contains instructions for over 500 experiments, all of which may be viewed on any type of Web browser, with even the slowest connection, and are easily printed out.

Other types of content have required more creative use of existing or new technologies. In order to demonstrate certain phenomena, for instance, we have created over 30 interactive online exhibits using Shockwave, Flash, QuickTime VR, and other technologies. Many of these online exhibits are patterned after real exhibits on the museum floor.

The Exploratorium is well known for its use of webcasting, in which we broadcast live video and/or audio directly from the museum floor (or from satellite feeds in the field, at such locations as Antarctica or the Belize rainforest) onto the Internet. Webcasts provide access to special events, scientists, and other museum resources for audiences on the Web. Using video and audio with text-based articles and features allows a visitor to choose among different methods of learning about a particular topic. Video and audio also provide the ability to hear or view interviews with scientists, "meet" interesting people, or tour unusual locations, from factories to particle accelerators.

The Exploratorium's focus is on investigating the science behind the ordinary subjects and experiences of people's lives. The topics themselves provide "hooks" that get people excited about science. The Accidental Scientist project produced online content that engaged visitors in the science of everyday activities of cooking, making music, and gardening. As we investigate these topics, we also look at the historical and social issues surrounding them, thus providing a context for scientific exploration.

Selected Exploratorium Web Projects and Resources

Global Climate Change

www.exploratorium.edu/climate/biosphere/index.html

This site draws together real-time and near-real-time data from multiple sources to bring awareness of how human activity affects the earth's climate. At this website, you can explore scientific data relating to the atmosphere, the oceans, the areas covered by ice and snow, and the living organisms in all these domains. You'll also get a sense of how scientists study natural phenomena — how researchers gather evidence, test theories, and come to conclusions.

Microscope Imaging Station

www.exploratorium.edu/imaging_station/index.php

Get a close-up view of life in action; stem cells, fruit flies, and more!

Ice Stories: Dispatches from Polar Scientists

<http://icestories.exploratorium.edu/dispatches/>

With the International Polar Year, we gave polar scientists cameras and blogs, trained them in telling stories and asked them to document their field work in real time. The public follows along on their adventures and sees what it's like to be a research scientist in the Arctic or Antarctica, in addition to webcasts with our crew.

Remembering Nagasaki

www.exploratorium.edu/nagasaki/commentary/commentary2.html

As part of our investigation into the nature of memory, the Exploratorium invited people to share their recollections of learning about the bombing of Hiroshima and Nagasaki. We were particularly interested in how people receive and remake stories of events they did not directly experience. We received hundreds of replies from all over the world, representing a wide range of age, ethnic background, and perspective. A representative set of comments is posted here.

Mars

www.exploratorium.edu/mars

Since 2004, Mars captures webcasts in conjunction with the landing of Spirit and Opportunity on Mars, including field trips to NASA's Jet Propulsion Laboratory, interviews with scientists, investigations into what it would be like to camp on Mars, and an exploration of Mars in popular culture. When the Mars Phoenix Lander safely parachuted to the surface of the red planet on May 25, 2008, the Exploratorium continued to present Webcasts on this latest Mars mission.

Origins

www.exploratorium.edu/origins/

Scientists around the world are searching for evidence to find the origins of life, matter, and the universe. Through live webcasts and supplementary web resources, the Exploratorium gives visitors a chance to meet the people, places, tools, and current investigations in science today.

The Accidental Scientist

www.exploratorium.edu/cooking/index.html

This site brings science closer to the public by demonstrating science in everyday life. Online visitors can take virtual field trips to a lollipop factory, ask questions in a bulletin board, read articles, and participate in webcast demonstrations. Topics covered include cooking, music, and gardening.

Candy Home Page

www.exploratorium.edu/cooking/candy/index.html

Visit a Lollipop Factory

www.exploratorium.edu/cooking/candy/kendon.html

Sports Science

www.exploratorium.edu/sport/index.html

Online Forum — The Science of Food

http://sodium.exploratorium.edu/cgi-bin/yabb-acc_sci/YaBB.pl

Playful Inquiry Environments

<http://pie.exploratorium.edu/scrapbook/index.html>

The Exploratorium has been engaging educators and visitors in different hands-on workshops to explore the role of playful inquiry in teaching and learning. Educators and visitors are invited to participate in construction activities from building camera kites to sponge-driven water pumps.

Kite Camera

<http://pie.exploratorium.edu/scrapbook/kite/index.html>

Understanding Motion (Making Automata)

<http://pie.exploratorium.edu/scrapbook/cabaret/index.html>

Exploratorium Digital Library

<http://sagan.exploratorium.edu/Cumulus5/ed/edam-ed-search-basket.html>

The Exploratorium has a large collection (9000+) of digital assets that are free to educators. This image library is the start of a larger effort to create a digital library called Exploratorium Online with collections of Exploratorium-inspired teaching and learning materials.

The Electronic Guidebook

www.exploratorium.edu/guidebook

Wireless devices can help extend one's experience in the museum while at the museum and back at home after a visit. We are designing handheld computer content that can be used as a mobile training tool for field trip Explainers, and designing lightweight tokens to allow visitors to bookmark the exhibits they visit and view additional related online resources when they get home.

The Solar Eclipse — View from Zambia, Turkey, China

www.exploratorium.edu/eclipse/

Event-based phenomena, like solar eclipses, attract online visitors to the Exploratorium website from around the world.

Science Snacks

www.exploratorium.edu/snacks/

Science Snacks are no longer only available to teachers. These pages make Science Snacks available to anyone interested in learning about science or helping others learn about science. Try it for yourself! You might be delighted to find how well hands-on discovery works.

Ten Cool Sites

www.exploratorium.edu/learning_studio/sciencesites.html

A regular feature since 1995, online visitors can see the most recent top 10 sites on the Web or search the archive by subject.

Exploratorium Online Audience Research Facts (2006)

1. The words people use most to find us online:

science 3.82%

solar 1.59%

exploratorium 1.43%

2. People most often access the Exploratorium's website through these entry points:

Front Page

(www.exploratorium.edu) 12.74%

Common Cents Interactive Game

(www.exploratorium.edu/exhibits/common_cents) 9.18%

Skateboard Science

(www.exploratorium.edu/skateboarding) 2.41%

Science Explorer

(www.exploratorium.edu/science_explorer) 2.28%

3. The most requested downloaded documents:

· Ron's Ellipse Movie — www.exploratorium.edu/ronh/age/images/ellipse.mov

· Temple Movie — www.exploratorium.edu/exhibits/temple/images/temple.mov

· Cow Eye Dissection — www.exploratorium.edu/learning_studio/cow_eye/cow_eye.pdf

· Hockey Slapshot Movie — www.exploratorium.edu/hockey/movies/slapshot.mov

Arts at the Exploratorium

The Exploratorium is an organization infused with art in its staffing, public programs, and exhibit collection. Although the public often thinks of the Exploratorium as a science museum, art has been integral to the mission and work of the Exploratorium for over 30 years.

Performances, Workshops, Screenings, Temporary Exhibitions, and Other Art Events

Each year, the Exploratorium invites between 30 and 100 artists to present performances, conduct public workshops, screen their films, demonstrate their crafts, or lend their works. One recent program is Second Wednesdays, which presented artists in a variety of disciplines for one-night installations on the second Wednesday of each month. The program showcased artists whose common ground is an experimental approach to their work. Reconsidered Materials, a popular temporary exhibition, fused artists and recycled materials in large-scale works suspended from the rafters and on the museum floor. Another exhibition, 2nd Skin: Imaginative Design in Digital & Analog Clothing, fused art, science, technology, and fashion. The Exploratorium also serves as a venue for collaborative functions with numerous community arts organizations.

Invited Artists (Artists-in-Residence)

Since 1974, over 225 artists working in many disciplines have held residencies at the Exploratorium. Each year, the museum invites ten to twenty artists to participate in residencies ranging from two weeks to two years. Artists-in-residence work with staff and the visiting public to create original installations, exhibits, or performances; to engage in experimentation and research; and to develop new ideas and directions for their work. Artists are given a stipend, housing, travel expenses, and technical support, and they have at their disposal the Exploratorium's full array of metal and woodworking shops and materials. The Exploratorium's residency program is considered one of the first successful residency programs in the country and many museums have since created similar programs. Several former artists-in-residence have been awarded MacArthur Fellowship "genius" grants.

Artists on Staff

Because arts are a key part of the Exploratorium, the museum employs artists in permanent positions in all areas: exhibit development, exhibit construction and repair, graphics, media, film, photography, programs for teachers, public programs, docents, facilities management, finance, and administrative staff. More than 40 Exploratorium employees have degrees in art, many of them with MFAs, and have a broad range of

background in the arts, including film, multimedia, photography, performance, visual arts, sculpture, installation, theater, and crafts.

As an example of the influence of staff artists, the Exploratorium's popular web site has been recognized not only for its content, but also for its excellent design. The Science of Baseball — part of the ongoing Sports Science series — bested thousands of other entries to be awarded the prestigious New York Art Directors' Club Distinctive Merit award. This site was also featured in the international interactive design annual of the graphic design magazine Graphis. Internationally recognized artists, either formerly or currently on staff, include Mildred Howard, Ned Kahn, Walter Kitundu, Peter Richards, Susan Schwartzenberg, and Stephanie Syjuco, as well as such award-winning writers as science fiction writer Pat Murphy.

Funding for the Arts

The Exploratorium receives funding from many government, corporate, and foundation funders for arts projects, including:

- The National Endowment for the Arts, including two prestigious Challenge grants
- San Francisco Grants for the Arts has awarded the Exploratorium major institutional grants every year since 1971.
- California Arts Council Organizational Support. The Exploratorium has received the highest score given to large, multi-arts organizations.
- The Exploratorium is one of the first museums to receive funding from the National Science Foundation to fund artists and is considered an exemplary institution that marries art and science.
- Challenge Grants from the California Arts Council. The Exploratorium received three prestigious Challenge Grants and received the highest ranking given to large, multi-arts organizations during its reviews.
- New Experiments in Art and Technology. The Andy Warhol Foundation for the Visual Arts and LEF Foundation have funded exhibition projects.

Other foundations include the Nathan Cummings Foundation, Zellerbach Foundation, Fleishhacker Foundation, Marin Community Foundation, The David and Lucile Packard Foundation, The Ruby Sisson Trust, the Wattis Foundation, AT&T, and the William and Flora Hewlett Foundation.

Residency Program for Artists

From its beginning, the Exploratorium has used the observations made by scientists and artists as a means of developing a clearer understanding of nature and natural phenomena among its visitors. In the words of Dr. Frank Oppenheimer, founder of the Exploratorium and its director until his death in 1985,

“Art is included, not just to make things pretty, although it often does so, but primarily because artists make different kinds of discoveries about nature than do physicists or geologists. They also rely on a different basis for decision-making while creating their exhibits. But both artists and scientists help us notice and appreciate things in nature that we had learned to ignore or had never been taught to see. Both art and science are needed to fully understand nature and its effects on people. The art in the Exploratorium is therefore blended with the science as part of the overall pedagogy.”

Goals of the Residency Program

- Provide the public access to the investigative processes used by artists.
- Develop new insights and understandings by incorporating the artistic process with other investigative processes.
- Enhance the role of the museum as a center of cultural investigation.
- Provide a laboratory setting for artist-conducted research which, in turn, adds to the overall creative atmosphere of the museum and provides an intellectual and technical basis for artists.
- Initiate internal and public discourse about the relationship among art, science, human activities, and topics related to multidisciplinary and multicultural activities.
- Elucidate, by example, the role that artists can play in modern society.

Overview of the Residency Program

The Exploratorium Residency Program is multidisciplinary in nature and includes a research and development process that may result in temporal works (such as performances, films and videos, workshops, or public presentations) as well as artworks and installations that may become part of the museum’s regular collection. There are two distinct residency opportunities, further described below.

Experimental Residencies

An Experimental Residency is short-term, generally lasting one to two weeks in length. Residency activities are focused on facilitating a dialogue between an artist and the staff, introducing his or her work to the museum. There is no expectation that the artist will develop a physical exhibit or installation during their stay. These low-key, process-

oriented residencies give an artist the opportunity to become a part of the Exploratorium community, to discover whether there are mutually beneficial interests between the museum and the artist, and whether the environment is conducive to the artist's working style. These residencies are often used as an experimental phase for potential candidates for the more formal Artist-in-Residence residencies. Artists are provided with a small stipend, round-trip travel to San Francisco, and living expenses while they are at the museum.

Artist-in-Residence

The Artist-in-Residence (AIR) is a formal residency for the creation of new artworks at the Exploratorium. While still experimental in nature, AIR residencies are focused around a formal proposal for a specific artwork or installation. Artists are expected to be in residence for an extended period of time (anywhere from one to six months), to work closely with staff during the research, development and implementation of their projects, and to contribute to dialogue at the museum through informal staff presentations and more formal talks and programs with visitors. AIR residencies are usually structured in two phases — an experimental phase where the artist develops his or her project ideas, and an implementation phase where the final artwork is completed. Contracts are structured such that a residency is reviewed after the experimental phase and can be ended if it is felt the project will not be appropriate for the museum. AIR Residencies provide an artist stipend, travel and housing expenses as necessary, materials expenses for the project, as well as work space and staff support.

Selection Criteria for Exploratorium Residencies

- quality of concept
- quality of past work
- ability to communicate
- willingness to collaborate and to share new ideas
- relevance of project content to other current projects or investigations at the museum
- expressed staff interest in the project and artist

Partnering with the Exploratorium

Exploratorium Network for Exhibit-Based Teaching (ExNET)

The Exploratorium Network for Exhibit Based Teaching (ExNET)-- a hybrid exhibit and teaching program-- draws from our strengths in exhibit design and education. Since 1998, the Exploratorium has partnered with science centers nationally and internationally to share the fruits of its research: dynamic hands-on exhibits (changed annually).

Exhibit Fabrication

- Since 1982, we have designed and fabricated over 1,500 exhibits for science centers, museums, and other organizations world-wide.
- Over 25 million people a year experience Exploratorium exhibits at science centers and museums around the world.
- Clients in the United States include Detroit Science Center, Liberty Science Center, Pfizer Corporation, Peabody Essex Museum, Maryland Science Center, California Science Center, and Museum of the Rockies.
- International clients include Museo Interactivo Mirador (Chile), Sony Explorasience Beijing (China), Ciencia Viva (Portugal), Museo de las Ciencias (Spain), Trompo Magico (Mexico), Singapore Science Center, Petrosains (Malaysia), Calgary Science Center (Canada), and Technorama (Switzerland).

Fact Sheet

Current ExNET partners include:

- Fort Worth Museum of Science and History – Ft. Worth, TX
- Reuben H. Fleet Science Center – San Diego, CA
- Gulfcoast Wonder and Imagination Zone (GWIZ)– Sarasota, FL
- Rochester Museum of Science and Industry – Rochester, NY
- Fresno Metropolitan Museum – Fresno, CA
- Los Angeles Unified School District/ California Science Center – Los Angeles, CA
- Omniplex – Oklahoma City, OK
- Discovery Center of Springfield – Springfield, MO

Consulting

Drawing from the best of the Exploratorium enables us to focus on the specific needs of an individual institution and provide a quality of service polished by thirty years of experience.

Our team can perform master planning and feasibility studies, architectural schematic design, education and program organization, exhibit planning and development, cost planning and master scheduling, and management consulting.

Traveling Exhibitions

Current traveling exhibitions include *Traits of Life*, *Memory* and *LISTEN: Making Sense of Sound*.

- *Traits of Life* examines the structure and nature of life. It has appeared

at venues throughout North America including Ontario Science Center, Whitaker Science Center, Discovery Center (Idaho), and the Utah Museum of Natural History.

-- *Memory* explores how humans process, store, retrieve, and forget memories.

It has been visited by over 700,000 people and has appeared at venues around the U.S. and Mexico including Liberty Science Center, Danville Science Center, California Science Center, Missouri History Museum, and Science Spectrum.

Impact on International Museums

The following is a partial list of international museums that have been strongly influenced by the Exploratorium through our collaborations with them.

Argentina

Exploratorio, Buenos Aires
Museo de los Niños, Buenos Aires

Australia

Discovery Center, Perth
Museum of Applied Science, Ultimo
The National Science Center, (Questacon),
Canberra
Science Center, Brisbane, Queensland

Brazil

Espaco Ciencia Viva, Rio de Janeiro
Parque de Ciencia, Rio de Janeiro

Canada

Calgary Science & Technology Center,
Calgary, Alberta
Edmonton Space Center, Calgary, Alberta
La Maison des Sciences et des Techniques,
Montreal
Manitoba Museum of Man, Winnipeg,
Manitoba
Ontario Science Center, Ontario
Saskatchewan Science & Energy Center, Inc.,
Regina, Saskatchewan
Vancouver Arts & Science Center, Vancouver,
B.C.
Science World, British Columbia

China

Beijing Science & Technology Museum, Beijing
Children's Museum of Beijing, Beijing
Sony ExploraScience, Beijing

Columbia

Museo de la Ciencia et el Juego, Bogota
Maloka, Bogota

Denmark

Eksperimentarium, Copenhagen

England

Exploratory, Bristol
The Science Museum, London
Magna, Sheffield

France

Atelier Exploration Centre National de la
Recherche Scientifique, Meudon
Cite des Sciences et de l'Industrie,
La Villette, Paris
Exploratoire, Nice
Palais de la Découverte, Paris
Exploradome, Paris

Finland

Heureka, The Finnish Science Center,
Helsinki

Germany

Museum fur Verkehr und Technik, Berlin
Zentrum fur Kunst und Medientechnologie,
Karlsruhe

India

A.P. Science Center, Bombay
Birla Industrial & Technology Museum,
Calcutta
Birla Museum, Rajasthan
Nehru Science Center, Bombay
Rajouri Garden, Delhi
Vikran A. Sarabhai Community Science
Center, Ahmedbad

Indonesia

Science and Technology Center of

Indonesia, Jakarta

Ireland

Ulster Science Centre, Derry, Northern Ireland

Israel

The Rosenblum Science Center, Jerusalem

Technicon, Haifa

Weizmann Institute of Science, Youth

Activities Section, Rehovot

Tamil Nadir Science and Technology Center,

Madres

Jamaica

ICWI Group Foundation, Kingston

Japan

Kyoto Municipal Science Center, Kyoto

National Science Museum of Tokyo, Tokyo

Yokohama Children's Museum / Spacarium,

Yokohama

Electricity Museum, Nagoya

Big Bang Children's Museum, Osaka

Osaka Science Museum, Osaka

Korea

National Science Museum, Seoul

Mexico

Center of Science and Technology, Guadalajara

Centro Cultura Alpha, Monterrey

Universidad Nacional Automa Museo Project,

Mexico City

Museo Interactivo de los Niños, Mexico City

Sol del Niño, Mexicali

New Zealand

Museum of Transport Technology, Auckland

Capital Discovery Place, Te Aho A Maui,

Wellington

Norway

Norsk Science Center, Oslo

Portugal

Ciencia Viva, Lisbon

Puerto Rico

Resource Center for Science and,

Engineering, Rio Piedras

Saudi Arabia

Science Museum, Riyadh

Singapore

Singapore Science Centre

Spain

Museo de la Ciencia, Barcelona

Casa de la Ciencias, La Coruna

Ciudad de las Artes y las Ciencias, Valencia

Sri Lanka

Science Museum of Colombo, Colombo

Sweden

Dalarnes Museum, Falun

Technikens Hus, Lulea

Teknorama, Stockholm

Switzerland

Phenomena, Zurich

Technorama, Zurich

Taiwan

National Museum of Natural Science,

Taiwan

Tasmania

Musbus, Hobart

Trinidad and Tobago

Yapolla, Port-of-Spain

Venezuela

Museo de los Niños, Caracas

Wales

Techniquet, Cardiff

Impact on National Museums

The following is a partial list of museums within the United States that have been strongly influenced by the Exploratorium through our collaborations with them.

Alabama

The Exploreum, Mobile

Alaska

The Imaginarium, Anchorage

Arizona

Arizona Museum of Science, Phoenix

California

Bay Area Discovery Museum, Sausalito

CA Museum of Photography, Riverside

Carter House Science Museum, Redding

Children's Discovery Museum, San Jose

Children's Museum, Los Angeles

Children's Museum of San Diego, San Diego

Sacramento Junior Museum, Sacramento

Santa Barbara Science & Discovery Center,

Santa Barbara

Science Mobile, Humboldt County

Colorado

Children's Museum, Pueblo

U.S. Space Foundation, Colorado Springs

Connecticut

Wadsworth Atheneum, Hartford

Florida

Great Explorations, St. Petersburg

The Discovery Center, Fort Lauderdale

Miami Science Museum, Miami

South Florida Science Museum, West Palm

Beach

Georgia

High Museum of Art, Atlanta

Science of Technology Museum of Atlanta

Hawaii

Bishop Museum, Honolulu

Illinois

Barrington High School Science Place,

Barrington

Children's Museum, Rockford

Museum of Science and Industry, Chicago

Science and Technology Interactive Center,

Warrenville

Indiana

Indianapolis Children's Museum

Kentucky

Museum of History and Science, Louisville

Massachusetts

Boston Children's Museum, Boston

Cape Cod Museum of Natural History, Cape
Cod

Discovery Center, Acton

Green Briar Nature Center, East Sandwich

Somerville Historical Museum, Somerville

Maryland

Maryland Science Center, Baltimore

Michigan

Cranbrook Institute of Science, Bloomfield
Hills

Hands-On Museum, Ann Arbor

Impressions 5, Lansing

Minnesota

Science Museum of Minnesota, Minneapolis

Nebraska

Omaha children's Museum, Omaha

New Hampshire

Montshire Science Center, Hanover

New Mexico

Albuquerque Museum, Albuquerque

New York

Brooklyn Children's Museum, Brooklyn
Manhattan Children's Museum, New York City
New York Hall of Science, Flushing Meadows,
Long Island
Roberson Center for the Arts and Sciences

North Carolina

Catawaba Science Center, Hickory
Discovery Place, Charlotte
Museum of Life and Science, Durham
Nature Science Center, Winston-Salem

Ohio

Center of Science and Industry, Columbus

Oklahoma

Omniplex, Oklahoma City

Oregon

Oregon Museum of Science and Industry,
Portland
Willamette Science and Technology Center,
Eugene

Pennsylvania

Buhl Science Center, Pittsburgh
Franklin Institute, Philadelphia

Museum of Scientific Discovery, Harrisburg
Sesame Place, Oxford Valley

South Carolina

South Carolina State Museum, Columbia

South Dakota

Siouxland Heritage Museum, Sioux Falls

Tennessee

Cumberland Museum and Science Center,
Nashville

Texas

Don Harrington Discovery Center, Amarillo
Fort Worth Museum of Science and History,
Fort Worth
Insights Museum, El Paso
Learning about Learning, San Antonio

Virginia

The Science Museum of Virginia, Richmond
Science Museum of Western Virginia, Roanoke

Washington

Children's Museum, Seattle
Eastern Washington Science Center, Spokane
Pacific Science Center, Seattle

Wisconsin

Discovery World, Milwaukee