INFORMAL LEARNING

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STUDIES OF INFORMAL GEOLOGIC TIME LEARNING AT THE "TRAIL OF TIME" IN GRAND CANYON NATIONAL PARK

Steven Semken, Jeff Dodick, Rebecca Frus, Marcella Wells, Deborah Perry, Judy Bryan, Michael Williams, Ryan Crow, Laura Crossey, and Karl Karlstrom

Introduction

Geologic time, or "deep time" (a term first attributed to Thomas Carlyle and popularized by the author John McPhee), is recognized as one of the fundamental concepts of the natural sciences. It has also been called a "threshold concept": an idea that, once understood, transforms a learner's worldview and serves as a portal to more in-depth study of a subject (Meyer & Land, 2003; Trend, 2008). Without a grasp of the magnitude of the history of Earth and life, it is generally difficult to make sense of biological evolution or the time scales of natural processes of change, many of which are relevant to environmental sustainability. Although geologic time is specifically addressed by the U.S. national and most state science education standards for high school (e.g., American Association for the Advancement of Science, 1993; National Research Council, 1996), many students never engage with it because Earth science is not widely taught at the secondary level in this country (American Geological Institute, 2009).

National Parks and Monuments, many located within spectacular landscapes, offer alternative opportunities for informal learning about geo-

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EAST ASIAN HISTORY AND CULTURE HITS THE U.S. – IN DIFFERENT WAYS

Alison Dineen and Robert Mac West

Two major exhibitions highlighting historic Asian characters, cultures, and significant cultural and political events are currently touring the United States. Our particular locations and personal schedules allowed us to visit both as "typical" guests and then to have time with museum staff to discuss the impact and significance of the exhibitions. The presentations we are discussing here are Genghis Khan at the Denver Museum of Nature and Science from October 16, 2009 through February 7, 2010, and The Terra Cotta Warriors: Guardians of China's First Emperor at the National Geographic Museum in Washington, DC, from November 19, 2009 through March 31, 2010.

These two exhibitions, conceived and developed completely independently and under very different circumstances, nonetheless have both similarities and differences – quite apart from the fact that they both are dealing with major events that emerged in eastern Asia.

As will be detailed in our discussion, both exhibitions have two stories, each featuring a powerful personality who forced major cultural changes and the tangible results of those changes. However, the emphases of the exhibits and their ability to resonate with their audiences are reversed. The Genghis Khan exhibition uses that iconic (and usually despised) 12th Century Mongolian leader as the attractant, with the cultural and political ramifications of his military triumphs very much an unexpected revelation in the second part of the exhibition. The Terra Cotta Warriors exhibition uses the remarkable assemblage of clay statues found near Xian and part of the current iconography of China as the "come-on" for the exhibition. However, once in the exhibition, visitors are presented with a fascinating picture of the unification of China in the 2nd Century B.C. by the youthful emperor Qin.

Thus, in the first instance, the personality (Genghis Khan) is the icon, and the effects

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logic time, natural processes of change, and how human time scales and geologic time scales entwine. Of these, none is better suited to such learning than Grand Canyon National Park, where mile-deep, horizon-to-horizon exposures of rock reveal nearly two billion years of geologic history - an arresting site and teachable moment even to the casual visitor who ventures only to the rim. The idea of establishing a permanent outdoor exhibition on geologic time that leverages the spectacular views from the accessible and well-traveled South Rim Trail occurred nearly two decades ago to longtime Grand Canyon geologic researchers Karl Karlstrom and Laura Crossey of the University of New Mexico, and Michael Williams of the University of Massachusetts. Their persistent effort gradually brought other university researchers, interpretative design and evaluation specialists, and the National Park Service itself as collaborators. Following several planning grants, the Trail of Time Exhibition was funded by the National Science Foundation in 2006.

The Trail of Time, the world's largest interpretive geoscience exhibition (Figure 1; Karlstrom et al., 2008), is now nearly complete and will be dedicated in the fall of 2010. The heart of the exhibition is a horizontal timeline that can be walked along 2 kilometers of the existing paved South Rim Trail; it is marked with inset 5-cm circular bronze markers at one-meter intervals, and 10-cm numerically labeled circular bronze medallions every 10 meters (Figure 2). Each meter along the Trail of Time represents one million years of elapsed time: 1 meter = 1 million years. Another Trail segment leads 315 meters from the Park's own Yavapai Geology Museum to the start of the 2-kilometer main trail. This 315-m segment has a logarithmically increasing time scale that changes from 1 year per meter at its start to 100,000 years per meter at its end, where it dovetails with the main trail. This segment is intended to help Grand Canyon visitors adjust their temporal frames of reference from personally familiar time scales (birthdays, years, and decades), through historic and archaeological time scales (centuries to millennia) to deep time (millions of years).

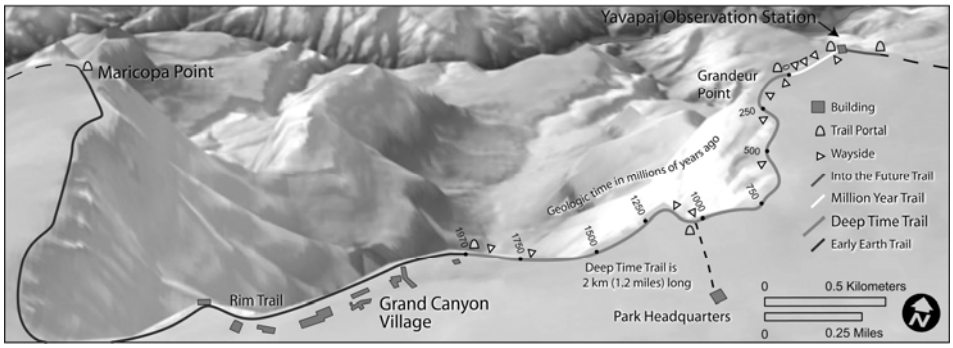

Figure 1. Map of the Trail of Time exhibition at Grand Canyon National Park (from Karlstrom et al., 2008).

Figure 2. Rendering of the Trail of Time (from Karlstrom et al., 2008): small circular markers are spaced at one-meter (one million year) intervals, and labeled medallions (inset) are deployed every ten meters (ten million years).]

At important points on the timeline that correspond to major geologic or cultural events significant in Grand Canyon history, interpretive signage and large, permanently mounted rock specimens are placed to provide context for the quantitative progression of time. Additional interpretive materials (e.g., brochures, publications) and curriculum resources will be made available on-site and online.

Simple linear timelines, forerunners to the Trail of Time, have long been made by geoscience teachers using yardsticks, rolls of paper, or lengths of rope; by marking intervals around a classroom, down a hallway, or along a football field. These have long been used in formal and informal learning settings to teach about geologic time. However, their effectiveness has not been fully assessed. From the start of project planning for the Trail of Time, it was understood that this interpretive exhibition also constitutes a unique and valuable field-based laboratory for research on the use of timelines and other analogical models for informal learning about deep time. Thus cognitive research is an integral part of the Trail of Time project, and, led by Steven Semken of Arizona State University and Jeff Dodick of Hebrew University of Jerusalem, has been ongoing through the development of the Trail.

The "Time Accelerator" Experiments

In advance of the construction of the permanent Trail of Time at Grand Canyon, we conducted two off-site studies (in Tempe, Arizona and Jerusalem, Israel; Semken *et al.,* 2009) to investigate how visitors navigated and interpreted the planned logarithmically changing "time accelerator" trail segment described above. We wished to learn whether visitors understood that the trail was a model timeline, and whether they could make sense of its regular changes in scale. For this experiment we used a scaled simulation of the trail made from a 74-m long by

Figure 3. The experimental "time accelerator" trail at Arizona State University. An identical trail was used for the experiments in Israel.

0.7-m wide strip of durable white paper, to which realistic time markers were affixed at 1-m intervals (Figure 3). The time scale on this experimental trail increased logarithmically every 10 meters, from 1 year per meter at one end to 100 million years per meter at the other. We deliberately exceeded the scale range of the actual Trail of Time to allow study of respondent cognition over a longer expanse of time.

The experimental protocol (described in detail in Semken *et al*., 2009) focused on uncovering behaviors and comments that visitors would be expected to reveal while exploring the actual Trail at Grand Canyon. This was done by asking respondents (40 in Arizona in summer 2007 and 30 in Israel in 2008) to walk from one end of the model timeline to the other, while "thinking aloud" and also responding to questions and tasks posed at certain points by an accompanying interviewer (who was a geologist and geoscience teacher). Each respondent participated individually and was also accompanied by a second researcher who video-recorded the experiment. The respondent was given placards that represented various events or phenomena in Grand Canyon or Arizona history, and one that represented his or her own age. Respondents were asked to place each of the placards at the correctly corresponding point in time along the timeline. While engaged in these tasks, respondents were also asked purely mathematical questions about the timeline and its scale changes. All of these responses were recorded and subsequently transcribed, and the exact placard placements made by respondents were noted and recorded. These data were compiled and coded by the research teams in Arizona and Israel.

Findings from both experiments (Semken *et al.,* 2009) showed that when the time corresponding to each point along the timeline is clearly indicated with a marker, respondents immediately grasp the logarithmic nature of the timeline and can understand it, even if the points where the scale increases are not marked by additional signs. We concluded that the predictable, logarithmic increase in scale will cognitively prepare visitors to understand and navigate the main Trail of Time with its constant 1 million year per meter scale. This desired effect will be enhanced at Grand Canyon by the interpretive signage and rock displays, which contextualize time within actual events. Thus, our research has directly informed the design and placement of time markers along the actual Trail of Time in advance of its construction.

The Trail of Time Experiments

The Trail of Time became a functional exhibition at Grand Canyon in the spring of 2009 when the permanent bronze time markers were installed along the 2-kilometer main trail segment. The Trail is more cognitively complex than the off-site simulations used for the earlier experiments because here, visitors are invited not only to traverse and make sense of a horizontal timeline, but to reconcile it with the vertical record of time and past environments encoded by the rock layers exposed in Grand Canyon. Mixed-methods research is now underway along the main Trail of Time to determine (1) how easily Park visitors can reconcile the horizontal and vertical representations of time, (2) whether they can grasp the concept of deep time, (3) whether they can understand two basic principles the Trail of Time is designed to teach: superposition (in an undisturbed stack of rock layers, the youngest is at the top) and lateral continuity (corresponding layers on opposing sides of the canyon were originally continuous before being separated by the downcutting river), and (4) whether they understand that the different layers in the Canyon walls represent changes in past environments through time.

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The first stage of this research consisted of semi-structured interviews (Figure 4) conducted along the Trail of Time (with a permit from the National Park Service) in the summer of 2009. Permanent interpretive wayside signs and rock displays were not yet installed at this time, so temporary but accurate versions of these displays were placed at appropriate places to render the Trail of Time as realistically complete as possible. The research team (one interviewer and one recorder) stationed themselves at two waysides characterized by especially rich vistas, and solicited visitor responses to five questions (Frus *et al*., 2009) designed to test visitors' comprehension of the geological landscape before them (in particular, the relative geologic time, superposition, and lateral continuity visible therein) and the function of the Trail of Time exhibition. While the interviewer drew the respondent's attention to the Canyon and the Trail and audio-recorded the exchange, the second researcher took notes on the respondent's answers and comments.

Figure 4. ASU researchers conducting an interview along the Trail of Time.

The recordings were subsequently transcribed, verified by comparison with the written notes, and coded to yield quantitative (percentage correct responses to the questions) and qualitative (visitor explanations and other observations) data. Preliminary analysis of the quantitative results (Frus *et al.,* 2009) indicates that not only do most visitor respondents understand the function of the horizontal timeline, but they can also correctly relate its horizontal representation of time to the stratigraphic (vertical) encoding of time in the walls of Grand Canyon. A majority of respondents were also able to correctly explain the significance of superposition and lateral continuity. Work is now underway to characterize and classify visitor preconceptions and recommendations obtained in these interviews. These will be used in the final stage of the Trail of Time project: the development of on-site and online interpretive materials and programs for visitors.

Implications for Informal Geoscience Education and Interpretation

Our findings and conclusions (some still preliminary for the on-site experiments) indicate that a thoughtfully designed (i.e., appropriately sited, adequately marked and signed but not obtrusive) outdoor timeline trail is an effective means of teaching curious National Park visitors about the magnitude of geologic time, the processes that form rocks and shape the Earth's crust, and the elaborate history that can be read directly from landscapes such as the Grand Canyon. Millions of visitors will encounter and learn from this exhibition, but the potential impact is far greater as interpretive specialists from other parks have expressed strong interest in reproducing the Trail of Time in their own settings. These informal geoscience education efforts are important for improving public understanding of societally important topics that involve extended time scales, such as climate change, fossil-fuel sustainability, waste disposal, and extinctions.

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(politics, social structures, etc.) the revelation; in the second instance, the effects (warriors) are the icon, and the impetus for their development (the Qin dynasty) the revelation.

Given these fascinating similarities and differences, let's look at the two exhibitions.

Terra Cotta Warriors

The Terra Cotta Warriors: Guardians of China's First Emperor exhibition opened with considerable fanfare at the National Geographic Museum in Washington, DC, in November 2009. While the life-size terra cotta sculptures featured number just fifteen (including musicians, a hefty (headless) strongman, horses, and a variety of warriors, accompanying artifacts and text illuminate the gritty and engrossing sub-themes of China's unification under Emperor Qin Shihuangdi, who ruled from 221 B.C. to 210 B.C.--as well as the immense-beyond-belief tomb complex and its cultural contents that have fascinated the world since Chinese farmers accidentally discovered them near Xian in 1974.

Co-organized by the Bowers Museum, Santa Ana, CA, the Houston Museum of Natural Science, and the National Geographic Museum, the exhibition content was guest-curated by Dr. Albert E. Dien, professor emeritus, Stanford University. National Geographic is the final venue for this exhibition; a different version of the exhibit was recently at the High Museum in Atlanta.

Many, if not most, adult (as well as younger) visitors have at least seen pictures of these serene, aloof, and individually-unique terra cotta (clay) sculptures before. It is, perhaps, this visual familiarity along with intense curiosity about the emperor's tomb that facilitates visitors' engagement with the supporting cultural objects and themes in the exhibition.

After being herded in a timed-entrance ticket line (this is the first admission-charged exhibition in the history of the museum) ringing the exterior of the National Geographic building, one enters a foyer space with photographs, a coat check, and acoustic guide rental counter. Visitors then briefly line up again to enter the first rather small gallery, offering a 360-degree, in-your-face encounter with a stunning terra cotta cavalry soldier and horse. Cleverly, the exhibition gives this dramatic introduction to what you've purchased a ticket to see and then immediately transitions into the historical narrative about China's first emperor Qin Shihuangdi—about whom it is presumed most visitors know little—offering context and meaning.

On the day we visited, a rainy weekday afternoon and reportedly less crowded than at other times, the galleries were quiet—obviously this would likely not be the case when school-age groups are present. One suggested possibility for the hush may well have been the lengthy explanations provided on the labels and acoustic guide tour—visitors tended to listen or read rather than engage in conversation.

The wall and label text includes fulsome detail. An interactive map of China's "Warring States" period provides a visual timeline for visitors of all ages on the building of the Chinese empire. The concept of nation-building is explored and the administrative means by which this was accomplished examined, including the imposition of a common script, measures, taxes, laws, and coinage. A display of early coins (from the collection of the American Numismatic Museum), some of which looked more like hooks and knives, demonstrates the utility of standardized coins with holes in the center that allow them to be strung and carried easily. The mundane notion of standard axel sizes for wagons makes sense in that irregular ruts in dirt roads break wooden wheels and hinder the efficient transportation of goods. The consideration of these factors is an "aha moment," offering an understanding of systems used to both control and unify principalities and peoples.

Further along, Terra Cotta Warriors considers cultural beliefs, architectural conventions, and the Emperor's elaborate preparation for the afterlife. The incredible tomb complex included a pleasure palace for the Emperor's amusement in his next life, including running rivers believed to have been filled with mercury. Two graceful bronze birds, a goose and a swan, from Qin Shihuangdi's mausoleum have been included. A map of the tomb complex, constructed over a period of thirty-six years, offers graphic evidence of the site's incredible proportions—19 square miles—most of which is unexcavated. The 1,000 terra cotta sculptures unearthed to date are believed to represent one-sixth of the total. [For those who have had the singular experience of visiting the site (and, fortunately, that includes Mac and Jean West), this array of clay figures is absolutely staggering.]

Necessarily, the accouterments of war are also described and displayed. The powerful crossbow used by Qin's army, points to the brutal, bloody aspects of nation-building and was a technological advantage. The robes, tunics, armor, belts, buckles, hairstyles, and shoes of the sculptures are descriptive of their roles/status as archers, charioteers, infantry, officers, and generals, as well as musicians. Hand positions on some indicate actual swords held, but stolen when the empire floundered after Qin's death.

The question of how the terra cotta sculptures were created is demonstrated through an appealing series of three-dimensional models of the artisans working in assembly-line fashion (think of the wonderful Diego Rivera murals in the Detroit Institute of Arts that represent the automobile assembly lines of the 1930's). The hollow segments made from molds and solid pieces are joined and then moved forward to include the

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modeling of clothing, hair, and individual facial characteristics. Horses, too, were created with unique features. All were painted in brilliant colors that, except for a few remaining traces, are lost after excavation and exposure to air and light. The exhibition text suggests that the large number of artisans required for the project might have been filled via conscripted service.

At last, the visitor arrives at the tomb-like room that holds the terra cotta warriors. The design goal was to minimize visual distraction and it is possible to study many of the sculptures closely and from various angles. While this stark treatment is understandable—there are, after all, only fifteen sculptures—it means there is limited effort to convey the panoramic drama of the hundreds and hundreds of warriors found standing ready in situ. And, perhaps, surprising only given the photographic resources of the National Geographic Society. The finale also includes two somewhat smaller reproductions of the emperor's chariots found with horses. Just as impressive are the painstaking efforts of those who have unearthed and pieced these astounding treasures back together.

Genghis Khan

The Genghis Khan exhibition is a production of Exhibits Rex, Inc., in cooperation with the Houston Museum of Natural Science, the Mongolian Ministry of Education, Culture and Science, and the State Hermitage Museum in Russia, and the Kooros, Gotuaco, Qinxuan, and Leeper Collections. The exhibition was designed, coordinated, written, and funded by Don Lessem, the owner of Exhibits Rex, with curatorial assistance from Dr. William Fitzhugh of the Smithsonian Institution and Dr. Morris Rossabi of Columbia University. Lessem, well known for his various large-scale dinosaur exhibitions, has worked with various institutions and officials in Mongolia for over ten years to assemble the exhibition and bring the various cultural and historic objects and artifacts to the U.S.

Two short articles by and about Lessem's creation of this exhibition, go a long way toward explaining the origins and contents of this exhibition:

Bringing Genghis Khan to America: http://asianhistory.about.com/od/profilesofasianleaders/a/genghisexhibit.htm.

Bringing Genghis to Denver:http://www.denver.magazine.com/culture/2009/10/bringing-genghis-denver.

As is the case with the Terra Cotta Warriors, the Genghis Khan exhibition is accessed by timed tickets – though the line is indoors, on the second level of the museum.

The staff of the Denver Museum of Nature and Science enhanced the exhibition significantly for its presentation in Denver. In addition to adding a section on a recently-excavated Mongolian burial, they significantly improved the exhibition entry with a panel that alerts visitors to the two stories they are about to experience. This panel, "Two Faces of Genghis Khan: Warrior and Statesman," sets the stage for the experience with Mongolian cultures, the evolution and equipping of the armies that enabled Khan to create the largest empire in history, and then the influences of his political and social organization on the creativity and lifestyles within that empire.

The exhibition makes excellent use of video segments from the BBC and Arts & Entertainment Network (A&E). It also includes several large (ten by twenty foot) wall murals prepared by Chinese artist Yu Shan, commissioned for this exhibition, that show both the Mongolian natural environment and interpretations of aspects of the military conquest of the empire.

The initial set of exhibits illustrates the everyday life of the Mongolian nomads. In addition to a traditional yurt, staffed by a trained docent, there is a remarkable shaman's costume. Here Khan's life and the rise of the Mongolian empire are set into the time frame of world events and the circumstances of Khan's birth and lifestyle are established. His humble origin and lack of formal education make his accomplishments, both military and cultural, all the more astonishing.

The exhibition quickly moves into the topic with which we presume most visitors are familiar and a primary reason they are attached to the exhibition--the development, organization, and functions of the Mongolian military under the leadership of Genghis Khan. Cases contain various weapons and military artifacts that demonstrate the seemingly primitive yet remarkably sophisticated apparatus used by Khan's forces. The A&E videos of Mongolians at war, such as the siege of Beijing, are a dramatic amplification of the objects and artifacts.

A map projected on the floor details the course of the Mongolian Empire from 1206 to 1279; the empire continued to expand after Genghis Khan's death in 1227 until, at its height, it extended from modern-day Mongolia, south into China to Eastern Europe and the western end of the Himalayas.

A modest adjacent gallery contains the contents of a recently-excavated 13th Century royal burial, including a mummified woman, with suitable warning signage. In addition to the casket and the mummy there are several pieces of fabric robes found with the body. This is an anomalous placement--until one encounters the archeology area later in the exhibition.

This militaristic section of the exhibition concludes with an area devoted to the death of Genghis Khan, whose final burial place has never been located. This area does an excellent job of placing Khan's societal accomplishments in front of the visitor -- the establishment of a consistent rule of law, the right of self-determination, the presence of a form of democracy (at least among the Mongolians), and the secret Yasa Code that formalized the rule of law which continued for several generations after Genghis' death.

At this point the tenor of the exhibition changes dramatically. It now looks at the importance of the Silk Road as a commercial corridor that held the empire together and brought wealth and culture to the Mongols. Materials from Europe and Asia came together; cases contain various ceramics, religious icons (the Mongolian empire was tolerant of all religions), and fabrics. An open space, themed as the public Kharakhorum Market, is the setting for regular dance and music performances by members of the local Mongolian community. Denver has

the largest concentration of Mongolians in the United States, over 2,500, who participated in the development of the exhibition and proudly provide frequent demonstrations of their culture. The Kharakhorum story continues with an exhibit area devoted to ongoing archeological exhibitions of this city, the desert capital of the empire.
At the end of the exhibition the sense of the exhibition is definitively Chinese. Here are materials from the time of Kublai Khan, Genghis' grandson, who brought much of China together with Mongolia. The final historical account in the exhibition is the Mongols' failed invasion of Japan under Kublai's direction.

Comments

As discussed above, in many ways these are very distinctive exhibitions. However, despite their different origins, motivations of visitors, and environments (the Terra Cotta Warriors show is almost tomb-like in its quiet while Genghis Khan was filled with the sounds of school groups, musicians, and generally talkative guests). the stories they tell are remarkably similar. And, at the end of the experience, visitors at both should come away with a dramatically-altered appreciation for the two historical figures profiled. In the first case, the how and why for the immense terra cotta armies of Qin are unveiled, and in the second the tremendous accomplishments of a man generally reviled as a barbaric nomad are given their due.

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PLEASE SEE PICTURES ON PAGES 8-9

ACTUAL CALL CENTER CONVERSATIONS

Customer: "I've been calling 700-1000 for two days and can't get through; Can you help?"
Operator: "Where did you get that number, sir?"
Customer: "It's on the door of your business."
Operator: "Sir, those are the hours that we are open."

This has to be one of the funniest things in a long time.. I think this guy should have been promoted, not fired. This is a true story from the WordPerfect Helpline, which was transcribed from a recording monitoring the customer care department. Needless to say the Help Desk employee was fired; however, he/she is currently suing the WordPerfect organization for "Termination without Cause."

Actual dialogue of a former WordPerfect Customer Support employee: (Now I know why they record these conversations!)

Operator: "Ridge Hall, computer assistance; may I help you?"
Caller: "Yes, well, I'm having trouble with WordPerfect."
Operator: "What sort of trouble?"
Caller: "Well, I was just typing along, and all of a sudden the words went away.
Operator: "Went away?"
Caller: "They disappeared."
Operator: "Hmm. So what does your screen look like now?"
Caller: "Nothing."
Operator: "Nothing?"
Caller: "It's blank; it won't accept anything when I type."
Operator: "Are you still in WordPerfect, or did you get out?"
Caller: "How do I tell?"
Operator: "Can you see the "C: prompt" on the screen?"
Caller: "What's a sea-prompt?"
Operator: "Never mind, can you move your cursor around the screen?"
Caller: "There isn't any cursor; I told you, it won't accept anything I type.
Operator: "Does your monitor have a power indicator??"
Caller: "What's a monitor?"
Operator: "It's the thing with the screen on it that looks like a TV."
Does it have a little light that tells you when it's on?"
Caller: "I don't know."
Operator: "Well, then look on the back of the monitor and find where the power cord goes into it. Can you see that?"
Caller: "Yes, I think so."
Operator: "Great. Follow the cord to the plug, and tell me if it's plugged into the wall."
Caller: "Yes, it is."
Operator: "When you were behind the monitor, did you notice that there were two cables plugged into the back of it, not just one?"
Caller: "No."
Operator: "Well, there are. I need you to look back there again and find the other cable."
Caller: "Okay, here it is."
Operator:"Follow it for me, and tell me if it's plugged securely into the back of your computer."
Caller: "I can't reach."
Operator: "OK. Well, can you see if it is?"
Caller: "No."
Operator: "Even if you maybe put your knee on something and lean way over?"
Caller: "Well, it's not because I don't have the right angle -- it's because it's dark."
Operator: "Dark?"
Caller: "Yes - the office light is off, and the only light I have is coming in from the window."
Operator: "Well, turn on the office light then."
Caller: "I can't."
Operator: "No? Why not?"
Caller: "Because there's a power failure."
Operator: " power ... A power failure? Aha. Okay, we've got it licked now. Do you still have the boxes and manuals and packing stuff that your computer came in?"
Caller: "Well, yes, I keep them in the closet."
Operator: "Good. Go get them, and unplug your system and pack it up just like it was when you got it. Then take it back to the store you bought it from."
Caller: "Really? Is it that bad?"
Operator: "Yes, I'm afraid it is."
Caller: "Well, all right then, I suppose. What do I tell them?"
Operator: 'Tell them you're too stupid to own a computer!"

TERRA COTTA WARRIORS

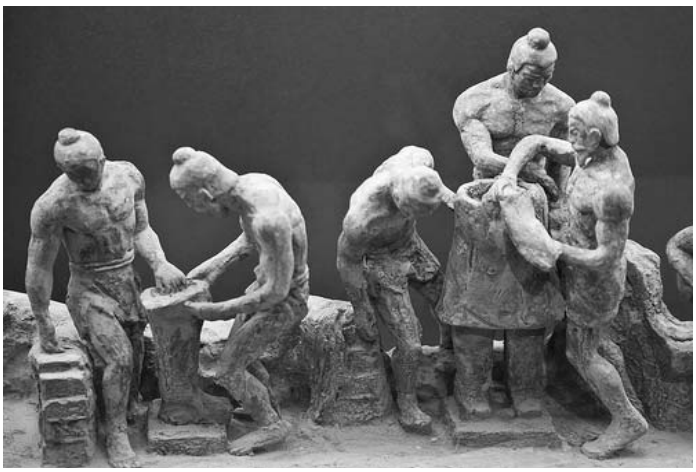
Warrior and horse at exhibit entrance

Standing figures – charioteer in center

Chinese coin

Chariot

Bronze goose



Modern model of Terra Cotta Warrior assembly line

GENGHIS KHAN

Exhibition entrance

Extent of Mongolian empire

Costumed shaman

Model trebuchet

Mural of Siege of Beijing

Mongolian musician at Denver Museum of Nature and Science

PARTNERSHIP BETWEEN GLASGOW SCIENCE CENTRE AND SCOTTISH POWER RENEWABLES

Kirk Ramsay

Wind Energy in the UK

The United Kingdom (UK) is the windiest country in Europe, so much so that theoretically we could power the country several times over using wind generated power. A modern 2.5MW (megawatts) turbine at a reasonable site will generate 6.5 million units of electricity each year, enough to meet the annual needs of over 1,400 households. Every unit of electricity from a wind turbine displaces one from conventional power stations: in January 2009, wind turbines in the UK had the capacity to prevent the emission of 3,682,563 tons of carbon dioxide per annum.

In 2007 wind energy overtook hydropower to become the largest renewable generation source, contributing 2.2% of the UK's electricity supply, with onshore wind comprising the bulk of this. Wind has been the world's fastest growing renewable energy source for the last seven years, and this trend is expected to continue with falling costs of wind energy, energy security threats and the urgent international need to tackle CO_2 emissions to prevent climate change.

The UK Government's Renewable Energy Strategy states that the ambitious target of generating 15% of all the UK's energy from renewables by 2020 means that 35-45% of electricity will have to come from green sources. The lion's share of these renewables will have to be wind, some 33GW (gigawatts) of capacity.

At this time there are 262 wind farms operational in the UK with total generating capacity of 4,028.14MW, of which 3,339.94MW is from onshore wind farms and 1,940.48MW of that in Scotland.

Total UK onshore wind farm capacity in operation or planned is currently 15,066.53MW and 8,699.60MW of that will be in Scotland. With this level of growth across Scotland there is great need for developing popular understanding of such operations and the impacts they create.

The Partnership – Glasgow Science Centre + Scottish Power Renewables

Scottish Power Renewables (SPR) has been at the forefront of developing energy production capacity from renewable sources and is currently the largest operator in the Scottish area. In planning for the biggest windfarm development in Europe they realized that with its location being in close proximity to the largest population center in Scotland there was an opportunity to engage public interest in the development in a way that is not usually possible because such sites are normally located well away from major cities and high density populations. Glasgow Science Centre (GSC) is the largest science center in Scotland and one of the largest in the UK. We have operated a Climate Change theatre for over 4 years which has helped engage our population in issues associated with climate, energy production and environmental issues. Our large-scale outreach programs now extend coverage to all of Scotland, including the outer islands. We have been looking for opportunities to extend our activities in climate change and related topics and to consolidate our outreach by having satellite operations in key locations around the country. The idea of a visitor center located within a large windfarm and in easy reach of the biggest city in the country seemed to be almost the perfect fit for our ambitions.

Building the working partnership was also assisted by the fact that Scottish Power, the parent company of SPR, has been a sponsor of GSC for most of our existence and therefore there was common understanding, knowledge and experience of each other that helped build high quality working relationships quickly.

GSC was particularly interested in the Whitelee windfarm development as one of the most significant in building Scotland's energy futures and because of its scale capable of being influential at national level in developing practical understanding of renewable energy sites and technologies. Our future social, economic, environmental and health wellbeing is dependent upon reliable and cost effective energy production and distribution, the nature of which is likely to be challenging to much of our population. Successful engagement of families, school children and adult groups through the Whitelee Visitor Centre (WVC) in this critically important area is likely to become a strategic tool in helping develop broad-based understanding of the need for new developments and technologies in the energy sector.

GSC is in the public engagement with science business for the long term and a 'not for profit' operator. Our outlook is highly optimistic and open to risk but our operating plans are robust, reliable and reflect market realities. The same attributes have applied in setting up the WVC operation and our partnership with a key player in the form of SPR has been very beneficial since their 'for profit' model within a very sensitive operating area of energy and environment complements ours. Our openness to new business opportunities and proven success in building accredited high quality services in the public engagement field bring high value to SPR and confidence that rapid start-up can lead to high quality and reliable visitor experience. GSC is one of only about 30 centers in Scotland rated as "Five Star" by the national tourism organization, Visit Scotland. SPR had ambitions to have WVC rated as a "Five Star" center at the earliest opportunity and valued our track record in that very highly. SPR bring "leading corporate" standing to our partnership with a rigor to policies and practice that their size and industry sector demands at a level we would on our own find difficult to achieve. Consequently both organizations have gained new insights, skills and knowledge that improve our activities well beyond those associated directly with the project.

In public awareness terms, GSC has very high recognition within the population of Scotland, which brings advantage to the WVC development because SPR is much less known, and even those who do know it would not normally associate it with a visitor center or public engagement in science.

Building the partnership was and continues to be a rewarding process as we each learn more about what the other has to offer and how intrinsic qualities can be drawn out in practice to the benefit of our common aims.

Joint branding of the WVC operations brings together all the positive attributes of the partnership.

Whitelee is Europe's largest onshore wind farm with investment to date of £300m and covering an area of 55km² with 140 turbines and 82km of roads.

Whitelee Wind Farm Aerial View

Whitelee Windfarm

The windfarm is owned and operated by Scottish Power Renewables and has capacity to generate enough energy to power 250,000 homes (all of the domestic residences of Glasgow). Consent has been given for the first phase of expansion adding another 36 turbines and a second phase expansion of a further 39 turbines. Ultimately there will be 250+ turbines. The turbines are manufactured by Siemens and each is 110m high and generates 2.3MW of electricity.

Whitelee Visitor Centre Reception

Construction of the windfarm started in 2007 and the first phase of 140 turbines was completed in summer 2009.
The windfarm is also part of the Whitelee Forest outdoor access strategy providing new opportunities for the population in the area to access areas of great environmental interest and natural beauty with views extending to the Ayrshire coast on the west of Scotland. The access strategy is well developed catering for walking, horse-riding and family level mountain bike riding. There will be further access developments as the site becomes fully established and its role within the local tourism strategy becomes well understood by all stakeholders.

Whitelee Visitor Centre

Whitelee Visitor Centre (WVC) is located on Eaglesham Moor at Whitelee Windfarm, the largest onshore windfarm in Europe and is 15km south of Glasgow. The development of the center is a formal partnership with Scottish Power Renewables (SPR), owner and operator of the windfarm. They supported all capital costs of design and construction. GSC operates the center and will continue development of the facilities and programs in partnership with SPR.

The intention was to create a visitor center that becomes an educational hub for schools and the wider public (locally, nationally and internationally) to learn about climate change, renewable energy technologies and the workings of a windfarm.

The objectives of the development were:

- To establish WVC as a key educational resource to support learners' engagement with climate change, renewable energy technologies and gain insight into the workings of a windfarm.
- To work in partnership to establish the overall site as a recreational site that promotes positive engagement with environmental awareness, healthy living, and science and technology.
- To deliver a high quality customer experience and achieve "Five Star" VisitScotland Visitor Attraction rating.
- To extend GSC's existing good practice and high quality services to new audiences and science and technology topics.

The WVC is the first of its kind in Scotland, opened in mid-September 2009, and we believe unique in Europe. The building has total floor area of 500m². It includes a detailed exhibition explaining the construction of the windfarm and a unique education hub where both children and adults will be able to learn about the operation of windfarms and renewable energy. There is a small café and shop. The spaces available are:
An electric tour bus provides guided tours of the wind farm for schools and the public for a small charge.

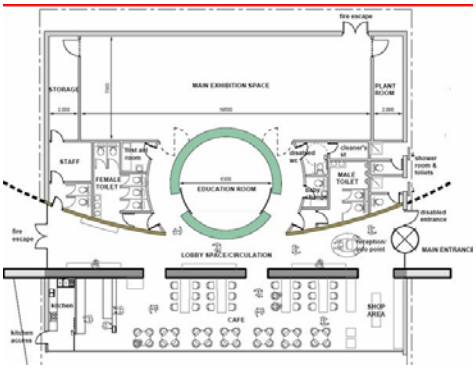
Area	m²	Notes
Main exhibition area	136.	
Lobby Space / Circula-	85.2	
Education room	38.5	37 seats
Café	78.5	50 Covers
Kitchen	23.2	
Shop area	17.9	

Whitelee Visitor Centre also plays a key role in a new Eaglesham Moor/Whitelee Forest access initiative. As part of the windfarm construction 82km of roads and tracks have been built that are being opened up to cyclists and ramblers who will be able to enjoy the views that stretch all the way over to the west coast and observe the wildlife that forms part of

Whitelee Visitor Centre

"Wind," continued on following page

"Wind," continued from previous page



Plan of Whitelee Visitor Centre

the 25.5km² of habitat management areas – including Merlin and Black Grouse.

The center building is a sustainable design which draws electric power from the windfarm, incorporates solar water heating and ground source heat pump and draws water from a local bore-hole as well as having its own waste-water and sewerage processing.

Management & Operation of WVC

Given the complementary relationship with SPR, we were keen to take advantage of spinout of Whitelee interests through the GSC main site, and our national outreach and associated operations. To do that and to achieve quick start-up of WVC we integrated the management and operation of the new center with our core operations at GSC.

The partnership is represented at the strategic level by the WVC management group with the operation itself the responsibility of GSC staff within the normal GSC management and operations structures.

A small core team was appointed as dedicated WVC staffing with all other operating support supplied from the main GSC teams on a rota or planned support basis. There are three dedicated staff members: Visitor Centre Manager, Senior Science Communicator and Technical Assistant (also driver of the Tour Bus) with the rest of the staff being provided through the GSC rotas and allocated Manager time.

The WVC manager has full operational responsibility and reports within the GSC Customer Experience framework and to the same standards as required by the main center. Flexibility in staff support to meet variable demand has proven to be extremely valuable as the center came in to operation. Early attendance levels exceeded expectations by huge margins and without the ability to rapidly bring experienced and knowledgeable staff in to WVC from GSC there would have been major failures and possibly serious safety issues from overcrowding in the center and traffic problems on surrounding roads. Although we were sure that integrating staff resources would give us flexibility and certainty of service, the extreme levels of demand proved the benefits of that approach far beyond our wildest thoughts.

The education program for schools is also aligned with our main school activities and is designed to enable joint visits to GSC and WVC on the same day.
In order that the program covers the 3-18 year-old curriculum we include:

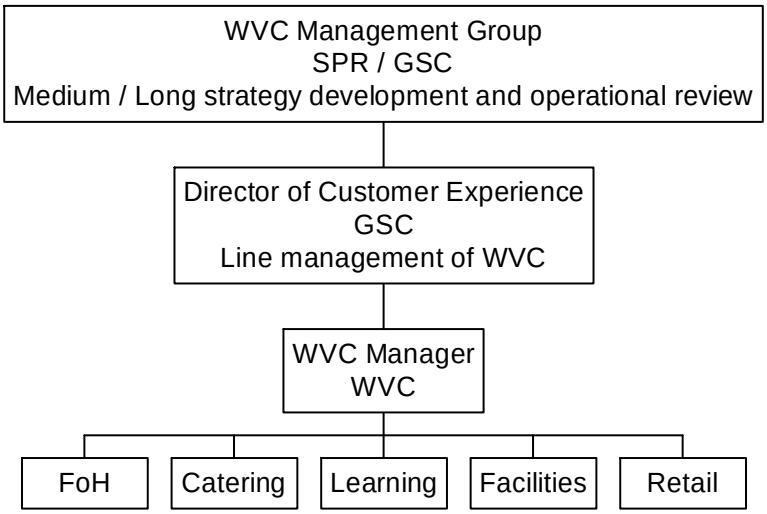
- An early years (pre school-P4) activity and exhibition trail
- Science show, workshop and exhibition trail for late primary-early secondary (P4-S2) – programs which can be repeated for outreach.
- Debate program for late secondary (S3-S6)
- Two annual teacher Continuing Professional Development sessions in partnership with SPR.

Three packages are offered to schools: (see chart at top of page)

The school program operates on an advance booking model so there is no fixed schedule.

The public program offers a regular schedule of activities each weekend and during school holidays. A typical program is:

Package 1	Package 2	Package 3
60 min Exhibition +trail	60 min Exhibition + trail	Joint visit to WVC and GSC
60 min Activity 1*	60 min Activity 1	
30 min Refreshment / Shop	40 min Activity 2	
	20 min Refreshment / shop	
Duration: 2 hr 30 min	Duration: 3 hr 00 min	Duration: 5 hr 00 min



Timings	Activity
1000	Center Open
1000 – 1100	
1100 – 1200	Workshop
1200 – 1300	
1300 – 1400	Science Show
1400 – 1500	Workshop
1500 – 1600	Science Show
1600 – 1700	
1700	Close

A regular schedule of bus tours operates depending on seasonality/demand. The bus tour operates daily from Easter to mid-October.

Bus tours generally operate from 1200 to 1600 on an hourly departure schedule. This may be increased/decreased depending on customer demand/ educational usage.

Each trip last about 30 minutes with an audio commentary on-board.

The Exhibition

The exhibition space is populated by interactive exhibits, information panels and a full-size replica of a turbine nacelle to give visitors an impression of the actual size of the turbine equipment. Adjacent to the exhibition area is the education room which is circular and exactly the same size as the base of a turbine tower, again to give an experience of the actual size.

Operating Facts

The Visitor Centre has free admission to the public (subsidized by SPR). Charges are levied to schools for structured education programs (£3.50 per pupil). WVC opened in mid-September. Estimated annual public visitors of 23,850 plus 3,000 education visitors were expected.

In the 10 weeks of operation before winter closure, over 26,000 visitors were received with 55% of those aged 35 or older.

The Visitor Centre is open seven days a week from 10.00 am to 5.00 pm from 1 March to 30 November. It is now closed until 28 February.

Kirk Ramsay is Chief Executive of the Glasgow Science Centre, Glasgow, Scotland, UK. He may be reached at margaretta.richards@glasgowsciencece.org.

Entry to Exhibition

Site Information Wall

Site Information Wall

Climate Change Introduction

"Make Your Own Windfarm"

CREATIVE COLLABORATION MAKING TRAVELING EXHIBITIONS LOCALLY RELEVANT AND ECONOMICALLY EFFICIENT

Amy Bornkamp

Loosely defined, collaboration is the idea of working jointly with others, especially on an intellectual endeavor. The theme of the ASPAC conference in Kaohsiung, Taiwan, this past year explored collaborative innovation and partnerships and encouraged alliances between those creating science knowledge and those disseminating it to the public. The message was both timely and relevant: working together can not only strengthen the exhibition experience, but provide much needed cost savings during challenging economic times. Traveling exhibitions—which bring together partners locally, nationally, and often internationally—are a perfect example of this kind of innovative collaboration.

When The Field Museum speaks with potential host clients, very early on in the conversation we introduce the idea of collaboration. Collaboration opens the door to making the experience more economically efficient and broadens the scope of locally relevant contributions that may be added. One must begin by looking at some of the answers to the question, "why collaborate?" At the top of the list is shared expenses—a prime motivating factor in this current global economic climate. When several institutions within a common geographic area—as small as a city, and as large as a continent—decide to host the same exhibition as part of a regional tour, collaborators can disperse costs such as shipping, customs, and travel and logistical fees over a number of venues. Language translation and graphic reprinting no longer become the responsibility of just one group, and operational needs, such as equipment and labor, become more feasible when partners work together. Sharing costs in this way can sometimes be the deciding factor for a host institution considering the feasibility of a particular traveling exhibition from outside its region.

"Creative," continued on following page

"Creative," continued from previous page

Collaboration also fosters future partnerships and institutional relationships. Not only will it strengthen regional relationships that may already exist, but it lays the foundation for building international relationships for future work. Shared cultural adaptations, which local partners can reflect by adding to or customizing exhibition content, not only benefit local audiences, but could live on as the exhibition continues its travel around the region and/or world.

The opportunity to bring an exhibition to multiple—and sometimes underserved—audiences is yet another benefit of collaboration. When larger institutions take on the logistical coordination of a regional tour, they may make it possible for smaller communities with less experience or resources to participate in the tour of a major exhibition. While traditional venues such as science centers and natural history museums are regularly able to expose their audiences to new content and large, well-known exhibitions, collaboration may allow non-traditional venues such as community centers and local heritage museums to explore being part of a national tour, too.

When an institution considers participating in a collaborative model, it is important for them to know what to look for as part of that experience. One area to evaluate is their return on investment. Tangible returns that address the economic impact of collaboration could include lower expenses, higher exhibition revenue, greater sponsorship revenue (due to a larger geographic area covered), and increased visitorship and museum memberships. Intangible returns present themselves in the form of improved relationships with fellow institutions, donors, and communities, and firm groundwork laid for future partnerships.

Establishing or enhancing scientific alliances is another potential reward of collaboration that often takes place behind the scenes. The Field Museum, for example, has long enjoyed a Memorandum of Understanding with research colleagues in Thailand. By investigating and honoring these scientific partnerships, the Museum was able to make contacts that enabled it to send one of its traveling exhibitions to Bangkok. During the exhibition, the Museum's scientific partners collaborated on additional displays and programming for the Thai presentation, and the Field's partnership, originally only scientific, gained a valuable public dimension.

The exhibition that traveled to Bangkok, and which has traveled to many other countries as part of collaborative models, is one of The Field Museum's most popular exhibitions, *A T. rex Named Sue*. This 3,500 square foot exhibition (300 square meters) has traveled throughout North America, Asia, New Zealand, Central America, and the Middle East, delighting over 6 million visitors with the story of the largest, most complete, and best preserved *T. rex* ever discovered.

In 2006 and 2007, Sue made her debut in Taiwan when the National Museum of Natural Science in Taichung and the National Museum of Prehistory in Taitung collaborated to host the exhibition in their country for the first time. As recently as 2008, Puke Ariki in New Plymouth and the Auckland War Memorial Museum worked together to bring Sue to New Zealand for her premier showing there. Each of these two collaborative relationships demonstrated the benefits of partnership explained here: shared expenses for shipping, translation, and reprinting; the addition of local content and programming; and travel to communities that might not otherwise have been able to host the exhibition. Between these four partnering institutions, over 265,000 visitors met Sue. The Field Museum was proud to share the success of both of these partnerships,and gained insight into ways that organizers can enable successful collaborations. Excellent communication and organization are key to any collaboration and can manifest themselves in well-organized, thorough, and effective host materials, frequent communication, and open dialogues about content additions and shared costs. Between collaborating venues, clear communication is vital to define partnership expectations, draft letters of agreement, and discuss ways in which partners can share costs, divide responsibilities, and manage a regional tour.

In conclusion, it is vital for exhibition organizers to provide exceptional service. Building a relationship with host venues, adapting to their institution's needs quickly, and supporting the collaboration are all part of an organizer's responsibilities. With clear and frequent communication and a spirit of working together, regional partnerships around traveling exhibitions can lead to profitable, rewarding, and satisfying results for all involved.

Amy Bornkamp is Traveling Exhibitions Manager at The Field Museum, Chicago, IL. She may be reached at abornkamp@fieldmuseum.org.

LIVE ANIMAL TRAVELING EXHIBITIONS FOR YOUR INSTITUTION?

Clyde Peeling

Over the past few decades there has been a subtle hybridization between zoos and museums. Zoos (including aquariums) have increasingly incorporated museum techniques to better interpret live animals, while museums have discovered the value of live animals to enhance natural history exhibits. For museums and science centers, live animal traveling exhibitions have played a significant role in this crossover. The best of these exhibitions incorporate a blend of interactive exhibits, interpretive graphics, naturalistic habitats, and appropriately chosen species.

As a category, however, live animal traveling exhibits have a bad reputation, much of it earned. Decades of poorly designed exhibits and inadequate animal care have left some museum professionals, and even visitors, with a bad taste. We once talked with a father who drove his family a considerable distance to a major metropolitan museum where a temporary animal exhibition was being promoted only to be sorely disappointed. They found habitats with dirty viewing glass, dying plants, and even a dead exhibit animal that had apparently been overlooked by museum staff. A negative experience like that is unforgivable, and it illustrates the consequences of exhibiting live animals hastily.

Given this history, why bother considering live animals at your institution? The answer, in a word, is *charisma*. Live animals have enduring appeal—they at-

tract audiences and offer an opportunity to connect with visitors in a personal way. Excellent live animal traveling exhibitions do exist, but museum selection committees need to know how to sort out the good from the questionable.

Let's be right up front. We are in the business of designing, building, and managing live animal traveling exhibitions, so we are not impartial. That said, we know what a host institution should expect, and demand of any vendor offering an exhibition with living animals. If your institution is considering hosting a live animal exhibition, here are some issues we think you should consider, questions you should ask, and a few examples of how our organization addresses them.

Who is traveling the exhibition?

It is important to know whether a vendor of live animal exhibitions has experience working with animals. Just because a company or institution is well respected for exhibit design doesn't mean it is qualified to support an animal exhibition. Lack of follow-through is one of the biggest complaints among institutions that host traveling exhibitions in general, and follow-through is absolutely crucial when animals are involved. A good start is to learn from the experience of others. Contact institutions that have hosted the exhibition you're considering and ask for candid opinions. Did the sales person promise more than the exhibition delivered? Was the exhibition well-designed and maintained? Was animal care a top priority? Was the vendor responsive to host institution needs/requests? Were problems and repairs addressed quickly?

Fabrication artist puts finishing touches on animal habitat

Consider the depth of support that an exhibition vendor can provide. Does it employ staff with animal husbandry expertise, and will you have access to them if troubleshooting is needed? Is there a system to deliver veterinary care while the animals are at your institution? Is the exhibition backed by a professional zoo or aquarium? Ask if the vendor's facility is accredited by the Association of Zoos and Aquariums (AZA). This professional organization sets standards for animal care among North American zoos and aquariums, and member institutions submit to regular inspections by a team of curators, directors, and veterinarians. AZA accreditation is not the only measure of quality, but it holds small and large zoological facilities to the same high standards of husbandry, record keeping, ethics, aesthetics, education, conservation, and safety. An AZA accredited institution is expected to uphold these standards whether animals are exhibited at its permanent facility or at an offsite location.

Who designed the animal habitats?

Exhibiting live animals is more difficult than exhibiting static objects, because aesthetics must be worked around the requirements of the animals—not the reverse. Designers who lack animal husbandry experience often plan beautiful exhibitions but fail to adequately consider the needs of the animals or the keepers who must care for them. Things may look great for opening day, but after months of operation impractical designs inevitably suffer poor maintenance, and visitors notice. Live animal exhibits should be held to similar aesthetic standards as static natural history exhibits, and good design is a key ingredient.

Who supplies and cares for the animals?

Some animals (hardy insects, common rodents, etc.) are easy for host institutions to acquire, but rounding up a large temporary collection is far more difficult and

This modular gecko exhibition packs into a single trailer

may present legal and ethical problems. Are animals available from reputable sources, and what will you do with them when the exhibition ends? Exhibitions with more than a handful of animals should be stocked and supported by the vendor. For that, a permanent facility to house a backup animal collection is essential. We maintain a permanent collection of nearly 1,000 animals to back our fleet of traveling exhibitions.

Exhibitions that include only a few live animals may be managed by host institutions, but those with substantial living collections should come with a full time professional keeper to provide consistent care. Live animals require everyday care, including weekends and holidays. Many host institutions have one or more qualified people on staff with experience caring for spiders, frogs, turtles, or small mammals, and it's tempting to think they can take on care of a temporary collection for a few months. In my opinion, this is a recipe for disaster. Caring for a large collection is not a part-time activity, and overloading existing staff, however competent, usually shortchanges both the institution's permanent collection and that of the temporary exhibition. In most cases, animal care must be completed before visitors are admitted to the gallery. We employ a team of full-time animal keepers who rotate between work at our permanent facility and on-site care of our traveling exhibitions at host institutions throughout the country. This allows us to maintain continuity of care and standardize training.

Despite the best husbandry and veterinary care, animals sometimes get sick or die unexpectedly. How long will it take to

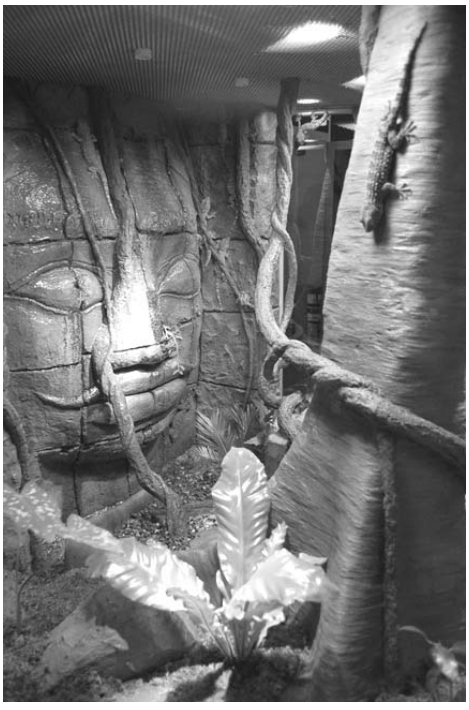
"Live," continued on following page

"Live," continued from previous page

replace an animal should it become necessary? The exhibition vendor should have available backup animals and a means of getting replacements to your location to ensure minimum down time for an empty habitat. Animals should be moved expeditiously from venue to venue, so ask how the vendor intends to transport them. Many commercial air carriers no longer accept live animal shipments and the few that do will seldom transfer them via a commuter line into a small city. Personally transporting animals is the best—sometimes the only—option. We deliver by private aircraft wherever possible.

What kinds of animals are we talking about?

Animals suitable for traveling exhibitions must be evaluated based on the size of the species, its metabolism, space requirements, and temperature/humidity parameters. It should be obvious that large mammals and birds are not suitable for indoor gallery exhibitions. Generally, invertebrates, fish, amphibians, reptiles, small birds, and rodents are reasonable choices, but there are exceptions. Knowing an animal's natural behavior is critical. An active predator, always on the move, probably will not be a good choice. Secretive species may suffer stress unless the habitat design provides the animal with adequate cover, while still remaining visible. Failure to select species responsibly or design around the needs of the animals risks a bad outcome, and invites justifiable criticism from animal rights groups.



An example of a lizard habitat

Who is responsible for wildlife permits?

Local, state, and Federal permits are required to transport or exhibit many animal species, and the complexity of regulation continues to grow. Moving animals internationally presents an even greater challenge. Staying on top of permits is a full time job in our organization, requiring applications, inspections, and regular reporting. If the exhibition vendor will not provide permits, be prepared to take on a significant workload. The last thing your institution wants is to be dragged into an embarrassing and potentially costly infraction of wildlife laws.

What about safety?

A properly designed exhibition is virtually risk-free to museum visitors, but if potentially dangerous animals are displayed, provisions must be in place to protect the keeper. If venomous snakes are part of the exhibition, appropriate snakebite antivenin should be available. Will the vendor provide for these safety measures or is it the responsibility of the host? In most cases the perception of danger exceeds the reality, but emergency procedures should be in place to protect everyone involved.

Habitats should be designed to prevent escapes, and husbandry staff must be vigilant about locking doors. While many live animal exhibits can be safely accessed from the public area, most venomous species should be serviced through rear access in a non-public area.

Who is responsible for setup and teardown?

Setting up exhibition components is particularly critical for exhibitions that include live animals. Enclosures must be escape-proof and filtration and other life support systems must be properly activated. It's critical that habitats are ready to receive animals upon arrival, and the vendor should oversee setup and teardown.

Will live animals boost attendance?

Like all promotions, the success or failure of live animal exhibitions depends on marketing. If a host institution contracts for an exhibition expecting it to work miracles, but spends little on advertising and promotion, attendance probably will not meet expectations. Animals generate excitement and typically garner plenty of free media, but advertising dollars are required to get maximum results. The exhibition vendor should be expected to provide the host with marketing materials, including logos, images, and sample advertising layouts. In our experience animals are reliably popular. One of our clients, for example, admitted nearly half a million visitors over an eight-month period to see a live animal exhibition—the largest attendance of any traveling exhibition in the museum's history. It is not unique for museums to experience record attendance, and many repeatedly host the same or similar live animal exhibitions.

Visitors view Gila monsters in a naturalistic habitat

Facility requirements

Some traveling animal exhibits require host institutions to build walls or otherwise modify gallery space. But exhibits designed to travel should be self-contained and flexible enough to fit a variety of gallery configurations. Many live animal exhibitions require 2,500 to 5,500 square feet and, if modularly designed, may be divided into two or more rooms as needed.

Water and drainage are often needed within a reasonable distance of the exhi-

bition gallery to accommodate routine service. Ambient temperature should be between 65 and 80 degrees F, and there must be adequate electrical service available. Live animals require regular light cycles, so gallery lighting must be switched off/on daily. Although animals are seldom stressed by occasional exposure to extended light hours, after-hours events must be coordinated with animal staff. Adequate visitor supervision is required to limit animal stress.

Summary

The above considerations are not intended to discourage you from hosting a live animal exhibition at your institution. On the contrary, if you choose a reputable vendor, an animal exhibition can provide tremendous educational value, create excitement, and increase attendance. The requirements may be slightly different from those to which you have been accustomed, but extra vigilance at the front end will help ensure a successful exhibition.

Clyde Peeling is the owner/director of Clyde Peeling's Reptiland, of which Peeling Productions is the exhibit design and fabrication arm. He may be reached at clyde@reptiland.com.

2010 FEDERAL FUNDING GUIDE

Compiled by Robert L. Russell

This report provides a current listing of federal funding opportunities that appear to have the greatest significance for museums and informal education projects. Only brief descriptions are provided. If a particular program seems relevant for your project, you should consult detailed funding guidelines and other information available directly from the agency. Federal agency program staffs are generally very helpful in providing additional information and in discussing the details of your project. Some agencies, such as the National Science Foundation, have a formal mechanism for providing feedback on project ideas before submission of a full proposal. You should contact agency program staffs to determine what kinds of assistance they can provide to you as you develop your project.

The listing provided in this report should not be considered comprehensive or complete. Museums are often funded as a partner in projects with another organization, such as a university or school system, as the lead. In some of these instances, museums may not be eligible to apply, but can participate as a subcontractor or as a member of a collaborative project.

The information, compiled and condensed directly from agencies, is the most current available, as of December 2009. Funding guidelines and application deadlines may change at any time, so it is essential that applicants contact agencies directly or consult their websites to obtain the most accurate information, guidelines, and application deadlines.

The Internet provides some of the best and most current information on federal agencies. In most cases, applications are available online. Most agencies, such as the National Science Foundation, require the electronic submission of proposals. Virtually all agencies have web sites which can be easily found using any of the Internet search tools available through Netscape, Microsoft Explorer, or other browsers. For convenient "gateways" and web addresses for federal and private funders, see the listing at the end of the Federal Funding Guide.

I. National Science Foundation (NSF)

The National Science Foundation (NSF) has provided funding for science education ever since its founding as an independent Federal agency in the early 1950s. The agency currently funds hundreds of millions of dollars of science education projects serving participants from preschool through adulthood, in informal and formal education settings. The NSF website is very rich in resources (nsf.gov). Most of the programs of interest to science museums, media, and other informal science education projects fall within the domain of the Directorate for Education and Human Resources (EHR), which includes all major NSF education programs covering students through graduate school. An overview of EHR can be found at: http://www.nsf.gov/dir/index.jsp?org=EHR.

NSF proposals must be submitted through NSF's own Fastlane system or through grants.gov. Both systems require pre-registration, so it pays to sign up weeks in advance to make sure your organization and you (as a potential Principal Investigator) are properly registered so that you can access the systems when you are ready to submit your proposal. There are two publications that provide important requirements for submission of proposals to NSF. The first publication, the Grant Proposal Guide, should be used if the proposal is submitted through NSF's Fastlane system. This publication is available at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=GpG. The second publication,

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NSF Grants.gov Application Guide, should be used if the NSF proposal is submitted through grants.gov, the federal government's electronic proposal submission platform: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide.

Planning grants supporting conferences, symposia, small research projects, and workshops are supported for all programs. For further details, consult the relevant program at nsf.gov.

Correspondence to any of the programs described below can be addressed to an individual staff member and the name of the program at: National Science Foundation, Arlington, VA 22230. It is also easy to communicate with program staff via e-mail. Most e-mail addresses at NSF take this format: (first initial last name)@nsf.gov.

1. Informal Science Education (ISE): The ISE program invests in projects that promote lifelong learning of STEM in a wide variety of informal settings. Funding is provided for projects that advance understanding of informal STEM learning, develop and implement innovative strategies and resources for informal STEM education, and build the national professional capacity for research, development, and practice in the field.

There are five categories of ISE program grants: Research; Pathways; Full-Scale Development; and Broad Implementation. Thus, ISE funds projects ranging from research on informal learning and planning grants to the development of major projects and dissemination of successful programs. Details concerning the criteria and specific amounts of funding that may be requested for each type of project may be found in the ISE Program Announcement, which can be found at: http://www.nsf.gov/pubs/2009/nsf09553/nsf09553.htm.

In addition, ISE funds Communicating Research to Public Audiences (CRPA) grants, which enable scientists to work with educators to develop exhibits or other means to communicate the results and significance of their research to the general public. Consult the Program Announcement for additional information.

Estimated Number of FY 2010 ISE Awards: 40. Approximately six Research, six Pathways, twenty Full-Scale Development, three Broad Implementation, and five Communicating Research to Public Audiences awards will be made per year.

Anticipated Funding Amount: $25,000,000 in FY 2010 and FY 2011 for new awards, pending availability of funds.

Preliminary Proposals are required and are due on June 24, 2010, except CRPA proposals. Full Proposals are due on November 18, 2010, except CRPA proposals. Contact ISE program staff for more information: (703) 292-8620.

2. Discovery Research: The Discovery Research K-12 (DR K-12) program seeks to enable significant advances in preK-12 student and teacher learning of the STEM disciplines through development, study, and implementation of resources, models, and technologies for use by students, teachers, and policymakers. Projects funded under this solicitation begin with a research question or a hypothesis about how to improve preK-12 STEM learning and teaching. Projects create or adapt and study innovative resources, models, or technologies and determine how and why implementation affects STEM learning. DR K-12 invites proposals that meet a variety of educational needs, from those that address immediate and pressing challenges facing preK-12 STEM education to those that anticipate opportunities for the future. DR K-12 especially encourages proposals that challenge existing assumptions about learning and teaching within or across STEM fields, envision needs of learners in 10-15 years, and consider new and innovative ways to educate students and teachers. Project goals, designs, and working strategies should be informed by prior research and practical experience drawn from all relevant disciplines, while focusing on concepts and skills that are central to STEM education.

The DR K-12 program is primarily concerned with improving education of students and teachers in formal settings. As appropriate, the program encourages projects also to draw from knowledge and practice of learning in informal settings. While many projects supported under this solicitation will focus on exploratory development and testing of innovative ideas for some specific facet of STEM education, all proposals must explain how the work can lead ultimately to successful adoption of findings or products in the K-12 enterprise on a national scale. The DR K-12 program accepts proposals for exploratory projects, full research and development projects, and synthesis projects, as well as for conferences and workshops related to the mission of the program.

The deadline for required letters of intent has passed; full proposals are due Jan. 7, 2010.
Current guidelines may be found at: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=500047&org=DRL&from=home.

Check in early 2010 for new guidelines.

3. Research on Gender in Science and Engineering supports efforts to understand and address gender-based differences in science, technology, engineering, and mathematics (STEM) education and workforce participation through research, the diffusion of research-based innovations, and extension services in education that will lead to a larger and more diverse domestic science and engineering workforce. Typical projects will contribute to the knowledge base addressing gender-related differences in learning and in the educational experiences that affect student interest, performance, and choice of careers; how pedagogical approaches and teaching styles, curriculum, student services, and institutional culture contribute to causing or closing gender gaps that persist in certain fields. Projects will communicate and apply findings, evaluation results, and proven good practices and products to a wider community. The program does not currently fund intervention or education projects that directly serve students as their primary purpose, or that focus solely on evaluating a student intervention. Research projects may involve an intervention with students as subjects only if the intervention is an integral part of creating a context for gathering data and if the findings from the intervention would substantially answer the research questions posed within the context of theory, concepts or frameworks of interest.

Required Letters of Intent are due February 10, 2010. Full Proposals are due March 23, 2010.
For details, consult the current Program Announcement: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5475&org=HRD&from=home.

4. The Research and Evaluation on Education in Science and Engineering (REESE) The Research and Evaluation on Education in Science and Engineering (REESE) program seeks to advance research at the frontiers of STEM learning, education, and evaluation, and to provide the foundational knowledge necessary to improve STEM teaching and learning at all educational levels and in all settings. This solicitation calls for four types of proposals—Pathways, Knowledge Diffusion, Empirical Research, and Large Empirical Research.

The goals of the REESE program are: (1) to catalyze discovery and innovation at the frontiers of STEM learning, education, and evaluation; (2) to stimulate the field to produce high quality and robust research results through the progress of theory, method, and human resources; and (3) to coordinate and transform advances in education, learning research, and evaluation. REESE pursues its mission by developing an interdisciplinary research portfolio focusing on core scientific questions about STEM learning in current and emerging learning contexts, both formal and informal, from childhood through adulthood, and from before school through to graduate school and beyond into the workforce. REESE places particular importance upon the involvement of young investigators in the projects, at doctoral, postdoctoral, and early career stages, as well as the involvement of STEM disciplinary experts. In addition, research questions related to educational research methodology and evaluation are central to the REESE activity.
Current application deadlines have passed. Check in early 2010 for new guidelines.
Previous guidelines are available at: http://www.nsf.gov/publications/pub_summ.jsp?WT.z_pims_id=13667&ods_key=nsf09601.

II. National Endowment for the Humanities (NEH)

NEH is an independent grant-making agency of the United States government dedicated to supporting research, education, preservation, and public programs in the humanities. Museums and public television projects presenting substantial humanities content have been funded by NEH. Grant funding may support exhibition development, institutional development (i.e., challenge grants) and planning grants for project development. Information on programs, deadline dates, and other areas is available at NEH's website: http://www.neh.gov. In the current announcements, a variety of deadline dates for 2010 and 2011 are listed. For more information, call program staff at (202) 606-8400.

III. National Institutes of Health (NIH)

NIH is organized as 15 separate institutes focusing on specific health issues (e.g., National Cancer Institute) and each institute functions semi-autonomously. Although NIH devotes a relatively small amount of funding to K-12 science education, funding opportunities arise from time to time. Individual institutes often initiate their own small programs (e.g., the National Institute of Environmental Health Sciences has sponsored several teacher enhancement projects).

NIH can be a rich source of public information. Various institutes publish brochures and produce videos for the general public. Museums may be able to obtain large quantities of such materials for distribution in relation to an exhibition or program. There is no overall public information catalogue for NIH. The best strategy is to contact individual institutes or programs.

NIH's Office of Science Education Policy (OSEP) works with NIH institutes to develop curriculum resources, coordinates science education activities across the agency, operates local science partnership programs with area school systems, initiates model programs such as the Mini-Med School, and has a compendium of science education activities conducted by NIH.

For more information, access the OSEP website: http://science-education.nih.gov.

You may contact OSEP Director Dr. Bruce Fuchs (coordinator of the Mini-Med School and other programs) at (301) 402-2469.

There are currently two grant programs that support informal and formal K-12 science education activities:

1. Science Education Partnership Awards (SEPA):

SEPA supports creative and innovative research education programs to increase the public's understanding of medical research and deliver information about healthy living and career opportunities in science to children and the general public. The overall goal of the NCRR's research education programs are (1) to ensure that highly trained scientists will be available in adequate numbers and in appropriate scientific areas to address the Nation's biomedical, behavioral, and clinical research needs in the NCRR's mission areas and (2) to provide public education and outreach on NIH-funded research and the clinical trials process to

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a variety of audiences through science centers and museums. The NIH encourages all proposed programs to foster the participation of individuals from racial and ethnic groups underrepresented in biomedical and behavioral research, individuals from disadvantaged backgrounds, individuals with disabilities, and women.

Examples of SEPA activities include:

- Developing, implementing and evaluating content-rich, inquiry-based science education programs, including innovative curricula, designed to enhance science teaching and learning with populations of underrepresented minority, underserved, rural and other disadvantaged students.
- Increasing the interest or participation of underrepresented groups in basic and clinical research career pathways.
- Developing and implementing professional development for in-depth school or summer K-12 teacher enhancement in scientific content with appropriate pedagogical methods that are aligned with applicable professional, national, state and local standards.
- Developing science center and museum exhibits, research opportunities, traveling exhibits, programs and public outreach activities that excite, engage and educate the general public on NIH-funded basic and clinical research.
- Designing appropriate evaluation plans to assess efficacy and impact for K-12 and museum/science center-based curriculum development projects, teacher enhancement efforts, exhibits and informal science education programs.
- Educating the K-12 community and the general public on topical issues such as stem cells and regenerative medicine, ethics of research and medicine, the clinical trials process and patient safeguards.
- Exploring innovative approaches, including applications of technology and assessment tools, to strengthen public or K-12 understanding of science and the nature of science.

Current application deadlines have passed. Previous guidelines and listing of funded projects are available at: http://www.ncrrsepa.org/.

The program is likely to release new guidelines in early 2010 for funding projects that will begin in late 2010.

2. Science Education Drug Abuse Partnership Award Program: The purpose of the SEDAPA Program is to fund the development and evaluation of innovative model programs and materials for enhancing knowledge and understanding of neuroscience and the biology of drug abuse and addiction among K-12 students, the general public, health care practitioners, and other groups. The award provides support for the formation of partnerships between scientists and educators, media experts, community leaders, and other interested organizations for the development and evaluation of programs and materials that will enhance knowledge and understanding of science related to drug abuse. The intended focus is on topics not well addressed in existing efforts by educational, community, or media activities. Applications are due on May 25, 2010.

Program guidelines are available at: http://grants.nih.gov/grants/guide/pa-files/PAR-08-145.html.

For further information, contact: Catherine A. Sasek, Ph.D., Office of Science Policy and Communications, Science Policy Branch, National Institute on Drug Abuse, 6001 Executive Blvd. Room 5226, MSC 9591, Bethesda, MD 20892-9591; telephone: (301) 443-6071; email: csasek@nih.gov.

IV. Environmental Protection Agency (EPA)

The Grant Program sponsored by EPA's Office of Environmental Education supports environmental education projects that enhance the public's awareness, knowledge, and skills to help people make informed decisions that affect environmental quality. EPA awards grants each year based on funding appropriated by Congress. Annual funding for the program ranges between $2 and $3 million. More than 75 percent of the grants awarded by this program receive less than $15,000. The grants, up to $25,000 through the regional offices and up to $250,000 at the national level, support a wide range of environmental education projects at schools, nature centers, museums, and other organizations. Applications are typically due in December; check the website below for further information.

For current information, check: http://www.epa.gov/enviroed/grants.html.

Additional information on environmental education funding and resources can be obtained from two sites on the World Wide Web: http://eelink.umich.edu and http://eelink.umich.edu/grant.html.

V. National Fish and Wildlife Foundation

NFWF (www.nfwf.org) is another private tax-exempt organization established by Congress. The National Fish and Wildlife Foundation funds projects to conserve and restore fish, wildlife, and native plants through challenge grant programs. The Foundation awards grants to projects that address priority actions promoting fish and wildlife conservation and the habitats on which they depend, work proactively to involve other conservation and community interests, leverage Foundation-provided funding, and evaluate

project outcomes. Federal, state, and local governments, educational institutions, and nonprofit organizations are welcome to apply for a variety of grant opportunities that are described on NFWF's website: http://www.nfwf.org.

VI. Department of Education

The Department of Education supports two basic types of programs: State formula grant programs and discretionary grant programs. State formula grant programs, such as ESEA Chapter 1, provide grants to State education agencies that, in turn, send the funds to local school districts to serve students. State education agencies receive funds based on formulas specified in program regulations. Science museums and other organizations should contact state and local education agencies for collaborative involvement in state formula grant programs.

Discretionary grant programs, on the other hand, usually award funds following a competitive review process. This means proposals are reviewed and scored by knowledgeable individuals outside the federal government. Awards are then made to the high scoring proposals. There are eligibility requirements for discretionary grant competitions, which limit that, may compete for a grant. For example, some programs are open to local school districts, while others are open to colleges and universities.

Museums have received funding under many of the Department of Education's programs. Because there are such a rich variety of potential museum and informal education funding sources within the Department of Education, they will not be discussed in detail here.

To get the most current information, access the Department of Education's web site. In general, most discretionary grant programs are announced annually in the Federal Register as Notices Inviting Applications. Those announcements include information on who is eligible to apply, when applications are available and when they are due, any special priorities, and the criteria that will be used to evaluate the applications. Prospective applicants are encouraged to read the Notice(s) Inviting Applications carefully and to contact program offices directly for further information. Much grant information is also available on the Department's web site (http://www.ed.gov). Information about grant opportunities for the next fiscal year is often released in January.

Two programs of particular interest for informal education organizations are described below:

1. 21st Center Community Learning Centers:

21st Century Community Learning Centers are school-based learning centers that provide a safe, drug-free, supervised and cost-effective after-school, weekend or summer haven for children, youth and their families. These programs can offer services that meet the educational, health, social service, and cultural and recreational needs of the community.

The program was formerly administered as a federal discretionary grant program, but the Department of Education will no longer hold discretionary grant competitions for the 21st Century Community Learning Centers. Discretionary grantees remain eligible for continuation funding through the end of their grant terms. Consistent with the Elementary and Secondary Education Act as reauthorized by the No Child Left Behind Act of 2001, the program is transitioning to a state administered program. For information on the program in your state, you should reach the state contact, which can be found at: http://www.ed.gov/programs/21stcclc/applicant.html.

2. GEAR-UP

The GEAR UP program is a discretionary grant program designed to increase the number of low-income students who are prepared to enter and succeed in post-secondary education. GEAR UP provides five-year grants to States and partnerships to provide services at high-poverty middle and high schools. GEAR UP grantees serve an entire cohort of students beginning no later than the seventh grade and follow the cohort through high school. GEAR UP funds are also used to provide college scholarships to low-income students.

The program ensures that students (and their parents) are aware of the benefits obtained from a secondary education, and have access to financial aid support and information. GEAR-UP also provides for supportive services that would encourage elementary, middle and secondary students to remain in school and prepare for college. Mentoring is included in the list of supportive services. Only states or "eligible" partnerships are authorized to receive a GEAR-UP grant. An "eligible" partnership consists of the following partners: one or more local education agencies representing one or more elementary schools and the secondary school for which the elementary schools are feeder schools; one or more institutions of higher education; and at least two community-based organizations.

GEAR UP is unique from other initiatives. This program employs partnerships committed to serving and accelerating the academic achievement of cohorts of students through their high school graduation. GEAR UP partnerships supplement (not supplant) existing reform efforts, offer services that promote academic preparation and the understanding of necessary costs to attend college, provide professional development, and continuously build capacity so that projects can be sustained beyond the term of the grant.

The Department of Education website for the GEAR-UP program is http://www.ed.gov/programs/gearup/index.html.

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VII. Institute of Museum & Library Services (IMLS)

Guidelines with complete information for the museum programs described below can be found at: http://www.imls.gov/applicants/applicants.shtm. Current guidelines are generally released 90 days prior to the application deadline; most of the guidelines available on the IMLS website are last year's. However, program guidelines are often similar from year to year, so these past guidelines can provide general guidance on program design.

1. Museums for America (MFA) grants benefit museums of all sizes and are awarded in three broad categories – Engaging Communities, Building Institutional Capacity, and Collections Stewardship – which give applicants the flexibility to mold their projects to best fit their needs and goals. Applicants must demonstrate the proposed grant activities are clearly linked to their institution's strategic plan and enhance the museum's ties and value to its community is the Institute's largest grant program for museums, supporting projects and ongoing activities that build museums' capacity to serve their communities.

MFA grants benefit museums of all sizes and are awarded in three broad categories. The deadline for application is Nov. 1, 2010.

2. Museum Assessment Program (MAP): The Museum Assessment Program (MAP) is supported through a cooperative agreement between the Institute of Museum and Library Services and the American Association of Museums. It is designed to help museums assess their strengths and weaknesses, and plan for the future.

The program provides technical assistance for four kinds of assessments: (1) collections management; (2) governance; (3) institutional; and (4) public dimension. Assessments are funded on a first-come, first-served basis. Museums may apply for MAP assessments in any sequence. Museums that received a MAP assessment grant on or before September 2003 may apply for a grant to fund participation in that assessment a second time. Application materials can be obtained by contacting the American Association of Museums.

In all MAP assessments, members of the museum staff and governing authority complete a self-study, and receive a site visit by one or more museum professionals, who tour the museum and meet with staff, governing officials, and volunteers. The surveyors work with the museum and MAP staff to produce a report evaluating the museum's operations, making recommendations, and suggesting resources.

The next MAP application deadline will likely fall in late 2010; however, check the IMLS.gov for new guidelines.

3. Conservation Project Support (CP): The CP program awards matching grants to help museums identify conservation needs and priorities and perform activities to ensure the safekeeping of their collections, including environmental improvements, research, surveys, training, and treatment. Check IMLS.gov for new guidelines and the next application deadline, which will likely fall in late 2010.

4. Conservation Assessment Program (CAP): Serves as an adjunct to the IMLS Conservation Project Support (CP) program and provides eligible museums with an alternative source of general conservation survey grants. CAP supports a 2-day site visit by conservation professional to perform the assessment and up to 3 days to write the report. Check IMLS.gov for new guidelines and the next application deadline, which will likely fall in late 2010.

5. National Leadership Grants for Museums: National Leadership Grants (NLG) support projects that have the potential to elevate museum and library practice. The Institute seeks to advance the ability of museums and libraries to preserve culture, heritage and knowledge while enhancing learning.

Successful proposals will have national impact and generate results—new tools, research, models, services, practices, or alliances—that can be widely adapted or replicated to extend the benefit of federal investment. The Institute seeks to fund projects that have the following characteristics:

- Strategic Impact—Proposals should address key needs and challenges that face libraries and museums. They should expand the boundaries within which libraries and museums operate, show the potential for far-reaching impact, and influence practice throughout the museum and/or library communities.
- Innovation—Proposals should demonstrate a thorough understanding of current practice and knowledge about the project area, and show how the project will advance the state of the art of museum and library service.
- Collaboration—While partners are not required in all NLG categories, the Institute has found that involving carefully chosen partners with complementary competencies and resources can create powerful synergies that extend project impact. Proposals should show understanding of the challenges of collaboration and propose means for addressing them.

Collaborative Planning Grants are also available in any of the four categories to enable project teams from more than one institution to work together to plan a project for a National Leadership Grant.

Guidelines are available at IMLS.gov. The application deadline for all categories is Feb. 1, 2010.

6. 21st Century Museum Professionals: Museum professionals need high levels of knowledge and expertise as they help create public value for the communities they serve. The purpose of the 21st Century Museum Professionals program is to increase the capacity of museums by improving the knowledge and skills of museum professionals. 21st Century Museum Professionals grants are intended to have an impact upon multiple institutions by reaching broad groups of museum professionals throughout a city, county, state, region, or the nation. Grants fund a broad range of activities, including the development and implementation of classes, seminars, and workshops; resources to support leadership development; collection, assessment, development and/or dissemination of infor-

mation that leads to better museum operations; activities that strengthen the use of contemporary technology tools to deliver programs and services; support for the enhancement of pre-professional training programs; and organizational support for the development of internship and fellowship programs.
Deadline for application is March 15, 2010.

VIII. National Endowment for the Arts

The National Endowment for the Arts (http://www.nea.gov) offers assistance to a full range of sizes and types of nonprofit organizations that are involved in the arts.

For most organizations, the Grants for Arts Projects guidelines represent the full range of funding options for the entire year.

Eligible applicants must be nonprofit, tax-exempt 501(c)(3), U.S. organizations; units of state or local government; or federally-recognized tribal communities or tribes.

Organizations may apply through one of the following categories:

- Access to Artistic Excellence: To foster and preserve excellence in the arts and provide access to the arts for all Americans.
- Challenge America Fast-Track Review Grants: To support small and mid-sized organizations for projects that extend the reach of the arts to underserved populations. This category expands the support that was available previously for *Challenge America: Access to the Arts* Fast-Track Review Grants.
- Learning in the Arts for Children and Youth: To advance learning in the arts for children and youth.

New deadline dates for FY 2010 will likely be released in early 2010.

NEA grants are also available for performing arts and media organizations. Check the NEA website for further information.

IX. National Oceanic and Atmospheric Administration (NOAA)

NOAA is an agency that administers a variety of research and programs involving the oceans and the atmosphere, including the Sea Grant Program and the National Weather Service. For the past several years, NOAA has awarded grants to support literacy projects. Guidelines for a new theme may be released later this year.

In late December 2009, NOAA's Office of Education plans to announce the next ELG funding opportunity for informal/non formal science education supporting projects that engage the public in educational activities that utilize emerging and/or advanced technologies and leverage NOAA assets to improve understanding and stewardship of the local and global environment. It will include support for the following activities:

- Technologically facilitated outdoor experiential learning for youth and adults,
- Public participation in science related to one or more of NOAA's mission goals,
- Data visualizations supporting the interpretation of ocean, coastal, Great Lakes, weather and climate sciences in informal/nonformal learning settings for public audiences,
- Spherical display system (including NOAA's Science On a Sphere) installations and programming, and
- Professional development programs for informal/nonformal education staff.

To review the types of projects that have been funded in past years and to obtain the new guidelines, when released, consult NOAA's education programs web page: http://www.oesd.noaa.gov/funding_opps.html.

X. National Aeronautics and Space Administration (NASA)

NASA has released a new solicitation for its Competitive Program for Science Museums and Planetariums, which could result in awards totaling approximately $6 million. Full proposals are due September 10. U.S. science centers, museums, and planetariums - broadly defined - are eligible to apply. Projects are expected to "use NASA resources to enhance informal education programs related to space exploration, aeronautics, space science, Earth science or microgravity." The Jet Propulsion Laboratory in Pasadena, California, manager of NASA's Museum Alliance will manage peer review and grants will be awarded by the Office of Education at NASA Headquarters in Washington, D.C.

Details about NASA's Competitive Program for Science Museums and Planetariums are available at: http://nspires.nasaprs.com/external/solicitations/summary.do?method=init&solId=%7bF6425211-4E48-A735-A46E-75FB5774AAC6%7d&path=past.

If that website address is too formidable, google Competitive Program for Science Museums and Planetariums (CP4SMP) or solicitation number NNH09ZNE005N.

Websites to locate Federal funding sources

The Catalog of Federal Domestic Assistance (CFDA) is a government-wide compendium providing information on nearly 1,400 grant and loan programs administered by more than 50 federal agencies. The primary purpose of the Catalog is to assist users in identifying programs that meet specific objectives of the potential applicant, and to obtain general information on federal assistance programs, as well as appropriate contact information for those programs. The Catalog is published annually in two editions using the most current data available at the time either edition of the Catalog is compiled. The Catalog is available online at http://www.cfda.gov, and can be searched by keyword, agency, program function or applicant eligibility.

U.S. Government's Nonprofit Gateway: Web pages of interest to nonprofits across the federal government, allowing searches of the over 300,000 federal agency Web pages: http://www.firstgov.gov/Business/Nonprofit.shtml.

http://www.researchresearch.com links to a variety of sources of science research and education funding.

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THE INFORMAL LEARNING REVIEW
P.O. Box 42328
Washington, D.C. 20015

THINGS TO PONDER

The roundest knight at King Arthur's round table was Sir Cumference. He got his size from too much pi.

I thought I saw an eye doctor on an Alaskan island, but it turned out to be an optical Aleutian.

She was only a whiskey maker, but he loved her still.

A rubber band pistol was confiscated from algebra class because it was a weapon of math disruption.

The butcher backed into the meat grinder and got a little behind in his work.

Now matter how much you push the envelope, it'll still be stationery.

A dog gave birth to puppies near the road and was cited for littering.

A grenade thrown into a kitchen in France would result in Linoleum Blownapart.

Two silk worms had a race. They ended up in a tie.

Time flies like an arrow. Fruit flies like a banana.

A hole has been found in the nudist camp wall. The police are looking into it.

Atheism is a non-prophet organization.

Two hats were hanging on a hat rack in the hallway. One hat said to the other, 'You stay here, I'll go on a head.'

I wondered why the baseball kept getting bigger. Then it hit me.

A sign on the lawn at a drug rehab center said: 'Keep off the Grass.'

A small boy swallowed some coins and was taken to a hospital. When his grandmother telephoned to ask how he was, a nurse said, 'No change yet.'

A chicken crossing the road is poultry in motion.

It's not that the man did not know how to juggle, he just didn't have the balls to do it.

The short fortune-teller who escaped from prison was a small medium at large.

The man who survived mustard gas and pepper spray is now a seasoned veteran.

A backward poet writes inverse.

In democracy it's your vote that counts. In feudalism it's your count that votes.

When cannibals ate a missionary, they got a taste of religion.

Don't join dangerous cults: Practice safe sects!