On the Inside

Surprises with Slow Quakes 6
Bioelectricity Promises More “Miles Per Acre” than Ethanol 8
Dim Dwarfs Bespeak Dark Galaxies 10
For Collaborative Fellow, Two Labs Are Better than One 12
Scientists are popular with the American people, according to a recent Pew Research/AAAS survey.* The public also believes that scientific research is “overwhelmingly” positive for society and makes life better. The survey contained a short test, which indicated that the average person was fairly knowledgeable about everyday science and technology, such as the fact that GPS systems use satellites. But they fall short on more complex scientific concepts—for example, only 46% know that an electron is smaller than an atom. Scientists are aware that the public’s science knowledge is lacking, and the majority see this as a major problem.

Carnegie scientists have been ahead of the curve in communicating and educating the public for some time. This year is a landmark 20th anniversary of the Carnegie Capital Science Evenings, a free lecture series held at our administration building in Washington, D.C. Lectures cover cutting-edge science and regularly entertain and inform full-house crowds. Recently, the Washington, D.C., chapter of Math for America (MfA) hit a milestone. An outgrowth of Carnegie’s K through 12 education programs initiated in 1989, this program is a partnership between MfA, Carnegie, and American University to train fellows to teach mathematics in D.C. public and public charter secondary schools. With funding help from an NSF grant, the first six of 34 fellows arrived this June to begin training.

The Geophysical Laboratory and the Department of Terrestrial Magnetism cohost a neighborhood lecture series. Visitors have learned about the state of earthquake prediction, how organisms can live in extreme environments, the latest about the planet Mercury, the potential for life to exist elsewhere, and much more. Each summer they also run a summer scholars program for undergraduates.

Two researchers at Embryology are dedicated to educating and exciting the next generation. For years, Marnie Halpern has run a speakers program to encourage girls from Baltimore public schools to pursue science careers. Steve Farber’s BioEYES uses the tiny, transparent zebrafish to teach inner-city students about genetics and the scientific method.

On the West Coast, Plant Biology’s Kathryn Barton recently taught a Stanford freshman seminar about the science behind hunger. And the department’s summer program for undergraduates gives students hands-on exposure to working in a first-rate lab.

In Southern California, the Observatories has joined forces with two underserved elementary schools to inspire young minds with the thrill of astronomy. Staff astronomers also teach Pomona and Harvey Mudd undergraduates. The department has its own lecture series at the Huntington Library and Gardens, and it hosts an open house for the Pasadena community annually.

Researchers at the Department of Global Ecology have been devoted to educating the public and policymakers about the science behind climate change and carbon budgeting since the department’s inception in 2002. They have become respected sources for information on climate change throughout the world.

All of these education and outreach efforts are laudable. I thank everyone who has devoted time to this important pursuit. Science is not just relevant to everyday lives; economic prosperity depends on it.

*The survey results are available online at http://people-press.org/reports/pdf/528.pdf
To combat the trend of a decline in qualified mathematics teachers in middle and high school, the Carnegie Academy for Science Education (CASE) launched a partnership in 2008 with Math for America (MfA) and American University (AU). Math for America in Washington, D.C. (MfA DC) is tasked to improve the mathematics education of the city’s public and public charter secondary school students. The program selects, on a competitive basis, individuals with undergraduate degrees in mathematics or related disciplines to become MfA DC Fellows and educates them to become skilled teachers. Using stimulus funds from the American Recovery and Reinvestment Act of 2009, the National Science Foundation awarded MfA DC a $1.498 million grant to cover the tuition, stipend, and mentoring costs for the first 14 fellows. Carnegie president emerita Maxine Singer, a co-principal investigator (co-PI) on the grant, commented, “This support from the NSF will be a huge boost for math education in D.C. Research shows that rigorous mathematics education in secondary school correlates with success in jobs and college.”

The academic program is a cooperative effort of AU’s School of Education, Teaching, and Health and its Department of Mathematics and Statistics, and includes a 15-month master of arts in teaching (MAT) and a teaching certification program. Altogether, MfA DC plans to recruit 34 fellows over the next four years. In return for a full fellowship and stipend for the academic program, the fellows commit to teach in D.C. public and public charter secondary schools for four years after completing their training. During those years they will each be provided with a personal mentor, ongoing professional development, and a supplementary stipend to support them as new classroom teachers.

James H. Simons, a well-known mathematician and the president of Renaissance Technologies Corporation, founded Math for America in 2004 “to improve the quality of mathematics education in the country’s public schools by recruiting, training, and retaining effective secondary school mathematics teachers.” Currently, MfA has placed fellows in 96 New York City schools. Additional MfA sites have been created in San Diego and Los Angeles. The MfA program was the congressional model for creating the National Science Foundation Teaching Fellowships through the Robert Noyce Teacher Scholarship Program.

“The mission of the Math for America-D.C. program is aligned with AU’s strategic commitment to improving D.C. schools, and we are thrilled to be involved,” said co-PIs Sarah Irvine Belson of AU’s School of Education, Teaching, and Health and John Nolan of the Department of Mathematics and Statistics. “We look forward to the arrival of our first group of MfA Fellows this summer.” The first six fellows, who arrived in June, come from undergraduate colleges and universities across the country, and were qualified by high grades in undergraduate math courses, excellent recommendations, and outstanding performances in rigorous interviews.
“Cellulose is the most abundant reservoir of renewable hydrocarbons in the world,” observed Carnegie’s David Ehrhardt of Plant Biology. Ehrhardt is a coauthor of a study on cellulose that was published in the advance online publication (AOP) of *Nature Cell Biology* on June 14. “To understand how cellulose might be modified and how plant development might be manipulated to improve crop plants as efficient sources of energy, we need to first understand the cellular processes that create cellulose and build cell walls.”

Cellulose is a fibrous molecule that makes up plant cell walls, gives plants shape and form, and is a target of renewable plant-based biofuels research. But how it forms, and thus how it can be modified to design energy-rich crops, is not well understood.

The study, led by researchers at Carnegie’s Department of Plant Biology, discovered that the underlying protein network that provides the scaffolding for cell-wall structure is also the traffic cop for delivering the critical growth-promoting molecules where needed. The research, conducted in collaboration with colleagues at Wageningen University in the Netherlands, is a significant step in understanding how the enzymes that make cellulose and determine plant cell shape arrive at the appropriate location in the cell to do their job.

Plant cells have rigid walls that cannot easily change shape. There are many cell types: spiky trichomes to fend off bugs and sausage-shaped guard cells that regulate the plant’s breathing pores, as examples. In a previous study using the model plant *Arabidopsis*, Ehrhardt and team used groundbreaking imaging techniques to watch the molecules that create this array of shapes. It provided the first direct evidence for a functional connection between synthesis of the cell wall and an array of protein fibers—called microtubules—that provide the scaffolding allowing diverse plant cell shapes to be created as the cell wall pushes outward.

In that study, the group engineered plants to produce a fluorescent version of cellulose synthase, the enzyme that creates cellulose fibers. They also included a fluorescent version of tubulin, the protein from which microtubules are built. Using advanced imaging techniques, they tracked the motion of single fluorescent molecules, and found that cellulose synthase moves along “tracks” defined by the microtubules.

In this paper, the researchers looked at how the association between the cellulose synthase complexes and microtubules begins. The scientists were able to watch individual cellulose synthase complexes as they were delivered to the plasma membrane—the permeable film that surrounds the cell, but is inside the cell wall—and found that the microtubules not only guide where the complexes go as they build the cell wall, but also organize the trafficking and delivery of the cellulose synthase complexes to their place of action.

The researchers also looked at the role in trafficking of a structural element called the actin cytoskeleton that helps move organelles and maintains the cell’s shape. They found that it appears to be required for the general distribution of the cellulose synthase complexes, whereas microtubules appear to be required for final positioning.

When there is a disruption of the complexes through a stressor such as a rapid change in water movement (osmotic stress), active cellulose synthase complexes disappear and organelles accumulate just under the plasma membrane. These organelles contain cellulose synthase and are tethered to the microtubules by a novel mechanism. Previously Ehrhardt and team found that plant microtubules move by shortening at one end while lengthening at the other end, in a process the researchers call treadmilling. They now think that the tethering discovered in this research allows the cellulose synthase-containing organelles to stay with the treadmilling microtubules for prolonged periods in times of stress. They found that when the stress abates, these organelles deliver the cellulose synthase to the membrane.

This work was supported by grants from the National Science Foundation and the EU Commission.
Putting Pressure on a “Colossal” Magnetic Effect

Millions of people today carry around pocket-sized music players capable of holding thousands of songs, thanks to the discovery 20 years ago of a phenomenon known as the giant magnetoresistance effect, which made it possible to pack more data onto smaller and smaller hard drives. Another phenomenon, called the colossal magnetoresistance effect (CMR), is up to a thousand times more powerful and could trigger another revolution in computing technology. But understanding CMR remains a challenge because of competing interactions in manganite, a form of manganese oxide in which CMR was discovered.

To study the magnetic properties of manganites, a research team led by Yang Ding of the Carnegie Institution’s High Pressure Synergetic Center (HPSynC) applied techniques called X-ray magnetic circular dichroism (XMCD) and angular-dispersive diffraction at the Advanced Photon Source (APS) of Argonne National Laboratory in Illinois. High-pressure XMCD is a newly developed technique that uses high-brilliance circularly polarized X-rays to probe the magnetic state of a material under pressures of many hundreds of thousands of atmospheres inside a diamond anvil cell.

The discovery of CMR in manganite compounds has already made manganites invaluable components in technological applications. An example is magnetic tunneling junctions in soon-to-be-marketed magnetic random access memory (MRAM), where the tunneling of electrical current between two thin layers of manganite material separated by an electrical insulator depends on the relative orientation of magnetization in the manganite layers. Unlike conventional RAM, MRAM could yield instant-on computers. However, no current theories can fully explain the rich physics, including CMR effects, seen in manganites. “The challenge is that there are competing interactions in manganites among the electrons that determine magnetic properties,” said Ding. “And the properties are also affected by external stimuli, such as temperature, pressure, magnetic field, and chemical doping.”

“Pressure has a unique ability to tune the electron interactions in a clean and theoretically transparent manner,” he added. “It is a direct and effective means for manipulating the behavior of electrons and could provide valuable information on the magnetic and electronic properties of manganite systems. But of all the effects, pressure effects have been the least explored.”

The researchers found that when a manganite was subjected to conditions above 230,000 times atmospheric pressure, it underwent a transition in which its magnetic ordering changed from a ferromagnetic type (electron spins aligned) to an antiferromagnetic type (electron spins opposed). This transition was accompanied by a nonuniform structural distortion called the Jahn-Teller effect.

“It is quite interesting to observe that uniform compression leads to a nonuniform structural change in a manganite, which was not predicted by theory,” said Ding. “Working with Michel van Veenendaal’s theoretical group at APS, we found that the predominant effect of pressure on this material is to increase the strength of an interaction known as superexchange relative to another known as the double exchange interaction. A consequence of this is that the overall ferromagnetic interactions in the system occur in a plane (two dimensions) rather than in three dimensions, which produces a nonuniform redistribution of electrons. This leads to the structural distortion.”

“This work not only displays another interesting emergent phenomenon arising from the interplay between charge, spin, orbital, and lattice in a strongly correlated electron system, but it also manifests the role of pressure in magnetism studies of dense matter,” commented coauthor Ho-kwang Mao of Carnegie’s Geophysical Laboratory, director of HPSynC.
Surprises with SLOW QUAKES

You don’t hear about slow earthquakes often, but recently two studies from the Department of Terrestrial Magnetism (DTM) were published on the subject. Slow earthquakes are nonviolent. They are fault slippage events that take hours or days instead of a few brutal seconds to minutes to release their potent energy.

Typhoons trigger slow quakes

DTM’s Alan Linde and Selwyn Sacks, with colleague Chi-Ching Liu (Academia Sinica, Taiwan), made the surprising finding that typhoons trigger slow earthquakes, at least in eastern Taiwan. The researchers discuss their data in a study published in the June 11, 2009, Nature.

“From 2002 to 2007 we monitored deformation in eastern Taiwan using three highly sensitive borehole strainmeters installed 650 to 870 feet (200-270 meters) deep. These devices detect otherwise imperceptible movements and distortions of rock,” explained Sacks. “We also measured atmospheric pressure changes, because they usually produce proportional changes in strain, which we can then remove.”

Taiwan has frequent typhoons in the second half of each year but is typhoon free during the first four months. During the five-year study period, the researchers identified 20 slow earthquakes that each lasted from hours to more than a day. The scientists did not detect any slow events during the typhoon-free season. Eleven of the 20 slow earthquakes coincided with typhoons. Those 11 were also stronger and were characterized by more complex waveforms than the other slow events.

“These data are unequivocal in identifying typhoons as triggers of these slow quakes. The probability that they coincide by chance is vanishingly small,” said Linde.

How does the low pressure trigger the slow quakes? The typhoon reduces atmospheric pressure on land in this region, but does not affect conditions at the ocean bottom because water moves into the area and equalizes pressure. The reduction in pressure above one side of an obliquely dipping fault tends to unclamp it. “This fault experiences more or less constant strain and stress buildup,” said Linde. “If it’s close to failure, the small perturbation due to the low pressure of the typhoon can push it over the failure limit; if there is no typhoon, stress will continue to accumulate until it fails without the need for a trigger.”

“It’s surprising that this area of the globe has had no great earthquakes and relatively few large earthquakes,” he continued. “By comparison, the Nankai Trough in southwestern Japan has a plate convergence rate of about 4 centimeters per year, and this causes a magnitude 8 earthquake every 100 to 150 years. But the activity in southern Taiwan comes from the convergence of the same two plates, and there the Philippine Sea Plate pushes against the Eurasian Plate at a rate twice that for Nankai.”

The researchers speculate that the reason devastating earthquakes are rare in eastern Taiwan is that the slow quakes act as valves, releasing the stress frequently along a small section of the fault, eliminating the situation where a long segment sustains continuous high stresses until it ruptures in a single great earthquake. The group is now expanding its instrumentation and monitoring for this research.
Fingerprinting slow quakes

In another study, researchers think they may have found a signature that points to regions of slow quakes. The most powerful earthquakes happen at the junction of two converging tectonic plates, where one plate is sliding (or subducting) beneath the other. The team, led by Teh-Ru Alex Song of Terrestrial Magnetism, found that an anomalous layer at the top of a subducting plate coincides with the locations of slow earthquakes and nonvolcanic tremors. The research was published in the April 24 issue of *Science*.

The scientists analyzed 20 years of seismic data for southern Mexico, where the Cocos Plate is slipping beneath the North American Plate. From observations and modeling, the researchers found that 30 events had similar seismic waveforms and thus provided reinforcing information on structural details in the source region. In particular, they found a layer on top of the subducted plate where the speed of S-waves—which do not travel through liquids and are slower than P-waves—was some 30% to 50% slower than typical water-laden oceanic crust. The anomalous layer, dubbed the ultra-slow-velocity layer by the researchers, is found at depths of 15 to 30 miles (25 to 50 kilometers), somewhat deeper than the portion of the plate interface zone that is strongly coupled and is the site of great earthquakes in this region.

The scientists also examined the locations where slow earthquakes and nonvolcanic tremors have occurred. They found that slow earthquake areas and the ultra-slow-velocity layers cluster together, and that regions of nonvolcanic tremors are adjacent to those clusters.

Song and team believe that these areas may be subducted oceanic crust at unusually high levels of water saturation. The cause of such anomalously high pore pressures is unknown, but a clue might come from the fact that nonvolcanic tremors are concentrated in areas with temperatures around 840°F (450°C). The researchers think that at such temperature and under ambient pressures a combination of fluid release and reduction in permeability may give rise both to the high pore pressures and the stimulation of tremor activities.
Bioelectricity Promises More “Miles Per Acre” than Ethanol

Biofuels such as ethanol offer an alternative to petroleum for powering our cars, but the energy crops that produce them can compete with food crops for farmland, and clearing forests to expand farmland will aggravate global climate change. How can we maximize our “miles per acre” from biomass? Research by Carnegie scientists published in *Science* magazine suggests that the best bet is to convert the biomass to electricity rather than ethanol. Compared with ethanol burned in internal combustion engines, bioelectricity used to charge battery-powered vehicles could deliver an average of 80% more miles of transportation per acre of crops. Using bioelectricity would also double the greenhouse gas offsets for mitigating climate change.

“It’s a relatively obvious question once you ask it, but nobody had really asked it..."
before,” said study coauthor Chris Field, director of Carnegie’s Department of Global Ecology. “The kinds of motivations that have driven people to think about developing ethanol as a vehicle fuel have been somewhat different from those that have been motivating people to think about battery electric vehicles, but the overlap is in the area of maximizing efficiency and minimizing adverse impacts on climate.”

The research team also included former Carnegie postdoc Elliott Campbell, lead author of the paper, now at the University of California, Merced, and former predoc David Lobell, now with Stanford’s Program on Food Security and the Environment. The team performed a life-cycle analysis of both bioelectricity and ethanol technologies, taking into account not only the energy produced by each technology but also the energy consumed in making the vehicles and fuels. For the analysis they used publicly available data on vehicle efficiencies from the U.S. Environmental Protection Agency and other organizations.

In the transportation-miles-per-acre comparison, bioelectricity was the clear winner, regardless of whether the energy was produced from corn or from switchgrass, a cellulose-based energy crop. On average, a small SUV powered by bioelectricity could travel nearly 15,000 miles on the net energy produced from an acre of switchgrass, whereas a comparable internal combustion vehicle could travel only about 8,000 miles (see illustration). “The internal combustion engine just isn’t very efficient, especially when compared with electric vehicles,” said Campbell. “Even the best ethanol-producing technologies with hybrid vehicles aren’t enough to overcome this.”

The researchers also looked at potential impact on climate change. “Some approaches to bioenergy can make climate change worse, but other, limited approaches can help fight climate change,” said Campbell. “For these beneficial approaches, we could do more to fight climate change by making electricity than by making ethanol.”

The energy from an acre of switchgrass used to power an electric vehicle would offset the release of up to 10 tons of CO₂ per acre, relative to a similar-sized gasoline-powered car. Across vehicle types and different crops, this offset averages more than 100% larger for the bioelectricity than for the ethanol pathway. Bioelectricity also offers more possibilities for reducing greenhouse gas emissions through measures such as carbon capture and sequestration, which could be implemented at biomass power stations but not in individual internal combustion vehicles.

While the results of the study clearly favor bioelectricity over ethanol, the researchers caution that the issues facing society in choosing an energy strategy are complex. “We found that converting biomass to electricity rather than ethanol makes the most sense for two policy-relevant issues: transportation and climate,” said Lobell. “But we also need to compare these options for other issues like water consumption, air pollution, and economic costs.”

“There is a big strategic decision our country and others are making: whether to encourage development of vehicles that run on ethanol or electricity,” said Campbell. “Studies like ours could be used to ensure that the alternative energy pathways we choose will provide the most transportation energy and the fewest climate change impacts.”

This research was funded through a grant from the Stanford University Global Climate and Energy Project, with additional support from the Stanford University Program on Food Security and the Environment, the University of California at Merced, the Carnegie Institution for Science, and a NASA New Investigator Program grant.
The missing satellite problem sounds like the stuff of a spy novel. But it’s actually about tiny galaxies surrounding the Milky Way. Cosmological models show there should be hundreds of satellite galaxies circling our galaxy. However, even with the 14 galaxies discovered in the last four years, only some two dozen satellites are known. Most of these are incredibly small, round, and very dim dwarfs. These minigalaxies are so small that some contain only a few hundred stars—fewer stars than the better-known stellar groupings in galaxies called globular clusters, which have tens of thousands to millions of stars. These little galaxies are the dimmest objects found in the universe; some glow with the light of just 1,000 Suns.

Postdoctoral fellow Joshua Simon of the Observatories has been at the forefront of discovering some unique features of these peculiar objects. He, along with colleague Marla Geha, a former Carnegie postdoc and now an assistant professor at Yale, may have solved the missing satellite puzzle. They have also shown that these are the lowest-mass galaxies ever observed, that dim dwarfs have more dark matter than any other type of galaxy, and that they contain some of the most primitive stars known.

It all started with the Sloan Digital Sky Survey, operational from 2000 to 2008, which discovered dim groups of stars around the Milky Way in an area covering about a fifth of the sky. Because of their faintness, many astronomers suspected that they were not galaxies at all, but globular clusters. Simon and Geha measured the motions and chemistry of a few dozen to a few hundred stars in 10 of these unusually faint objects. Generally, small amounts of light indicate small amounts of mass. But when the two analyzed their data, they got a big surprise.

“The galaxies are 100 to 1,000 times more massive than they should be based on their brightness,” commented Simon. To
astronomers, this mass-to-light ratio is extremely important. High values point to dark matter—the mysterious, invisible material that, with dark energy, makes up most of the universe.

Confirming the presence of dark matter and determining masses depends on measuring the speed at which stars travel at varying distances from the center of a galaxy. According to the law of gravity, stars toward the edge of the galaxy should move at different speeds from stars near the center. So if observed stellar speeds don’t obey the law, dark matter is a probable explanation. As it happens, stars in the dim dwarfs move much faster than expected.

The researchers found that the mass to light ratios of dark matter to stars was up to 1,000 for the dim dwarfs. For comparison, the Milky Way has a ratio of about 10. “When we found that these objects were made of 99% dark matter, we knew they had to be galaxies—globular clusters, as far as we can tell, don’t have dark matter,” Simon continued.

By analyzing the spectrum of starlight, astronomers can also tell the relative abundances of different elements. And that’s the key to determining stellar age and how and where the stars in a galaxy formed. Only hydrogen and helium, with a smidgen of lithium, were created during the Big Bang. Everything heavier than beryllium was made later in the nuclear furnaces of subsequent generations of stars. Astronomers dub elements heavier than hydrogen and helium “metals,” which makes stars with fewer heavier elements “metal poor.” Metal-poor stars were created early in the universe when fewer elements were available. When Simon and Geha analyzed the chemistry of the stars in the dim dwarfs, they found that they were among the most metal poor measured and therefore some of the oldest.

They also found that there was a significant spread in chemical composition in each of the dwarfs—providing further evidence that the new dwarfs are not globular clusters, in which all of the stars share the same metal abundance.

Astronomers think that the peculiar nature of most of the dim dwarfs may stem from a period of the universe called the reionization epoch, between about 200 million and 1 billion years after the Big Bang. This is when the first stars, quasars, and galaxies began to form. The ultraviolet radiation from the first stars could have whisked away the hydrogen gas from the galaxies at that time, which would have aborted star formation, leaving many fewer stars and making the galaxies dim or possibly completely dark.

And what about those missing satellites? Now that these dim galaxies have been found, it raises the possibility that there are dimmer or even dark galaxies out there, possibly the hundreds predicted by models. But at the very least, the researchers point out that the Sloan survey only sampled part of the sky, leaving four-fifths untouched, where more dim dwarfs are bound to be found. At the current rate, astronomers think the population of these dwarfs will easily reach 70, with perhaps new populations of other, even darker ones too.

Eventually, astronomers hope that the Giant Magellan Telescope (GMT) and other next-generation facilities will reveal the ultimate secrets these tiny galaxies hold. “Studying the faintest dwarfs with the GMT will help us figure out exactly what dark matter really is and should provide clues about how such unbelievably small galaxies ever managed to form,” Simon concluded.

Dwarf galaxies (far left) surrounding the Milky Way that were discovered before the Sloan Digital Sky Survey are brighter and contain relatively smaller amounts of dark matter than the more recently found very dim and very small dwarfs. Simon and Geha found that these minigalaxies are so small that some formed only a few hundred stars. They are the dimmest objects found in the universe, the lowest-mass galaxies ever observed, and they have more dark matter than any other type of galaxy. These objects point to the possibility that dimmer and perhaps even entirely dark galaxies could surround the Milky Way and thus solve the so-called missing satellite problem.

This Sloan Digital Sky Survey image (right) shows the dwarf galaxy Leo II, a satellite of our Milky Way. Despite its rather faint appearance here, Leo II is about 100 times brighter than the two dozen or so tiny dwarfs recently discovered.
When Mary Goll finished her Ph.D. in the life sciences at Columbia University, she knew she wanted to continue her research in epigenetics, the rapidly expanding field that studies the nongenetic factors controlling gene expression. But she also wanted to explore new techniques and expand her expertise so that she could develop a unique research niche in science. In particular, she was excited by the possibilities offered by zebrafish, whose transparent bodies make it possible to track genetic effects during the development of a living embryo. The problem was, no zebrafish labs she could find had active programs in epigenetics and the capacity for the genetic screens she needed.

The solution turned out to be the Department of Embryology’s newly minted Carnegie Collaborative Fellowship. The fellowship is designed for students capable of thinking outside the mainstream and pursuing research that exceeds the boundaries of any single laboratory. Goll certainly fit the bill. And at Carnegie she found a strong zebrafish program in Marnie Halpern’s laboratory. In Allan Spradling she had a mentor who shared her interest in epigenetics, chromatin, and transposable elements. So in 2006, Goll signed on as the first official Carnegie Collaborative Fellow.

“Because my research is related to but distinct from what both Marnie and Allan are doing, I think I have been especially free to explore my own ideas and to develop a research program that conforms to my interest,” says Goll. “Of course, Marnie and Allan are always there to provide perspective on my ideas and to provide their own ideas.” The Spradling and Halpern labs are adjacent, and postdocs from both labs share research space. “This has been especially nice because it has kept me feeling like I am a part of both labs as opposed to an outsider—which I hear can be a problem for collaborative postdocs elsewhere.”

The collaboration has paid off. At Carnegie, Goll has made great strides in using zebrafish to study the role of epigenetics during development. In a developing organism, genes are turned on and off to produce different types of cells and tissues. This is controlled by epigenetic factors, one of which is methylation, in which genes are silenced by methyl groups attached to the DNA strand. But the precise mechanism is not well understood. By inserting fluorescent “reporter” genes into zebrafish DNA, Goll has developed a system that allows her to visually observe the changes in DNA methylation in a transparent embryo as tissues develop. Already, she has seen surprising differences among different tissues. With Halpern and Spradling, Goll published a paper this past spring in *Genetics* that lays the groundwork for further investigation of new mechanisms underlying the epigenetic regulation of development.

“I have been amazed by the variety of new approaches and perspectives to which I have been exposed to through my interactions with the Spradling and Halpern labs,” she says. “Being constantly exposed to research outside my area of expertise has absolutely pushed me beyond my comfort zone and influenced my research.” Some of these influences have been subtle. “When I presented my work at the international zebrafish meeting, several people asked me if I had previously performed research on flies,” she says. “I have not and am certain that people were picking up on the Spradling lab influence in my research.”

Goll was recently invited to join the staff of the Sloan-Kettering Department of Developmental Biology as an assistant member. “I cannot imagine having a better opportunity than the past three years,” she says. “Not only am I well positioned to initiate my own independent research career, but I feel I have received a unique and broad training experience that will continue to influence me for years to come.”
Terrestrial Magnetism seismologist Paul Gordon Silver died in an automobile accident in North Carolina on August 7, 2009, driving with his daughter Céline returning from a research internship in Florida. Céline perished in the crash as well. A member of the research staff at the Department of Terrestrial Magnetism since 1982, Silver was an international leader in understanding how earthquakes are triggered and how they interact with each other. Born in Los Angeles, Silver obtained a Ph.D. in geophysics from UC San Diego in 1982. Since 1986 he has held a joint appointment as a research associate professor at The Johns Hopkins University Department of Earth and Planetary Sciences.

Silver made a series of important contributions to earthquake research by observing the slow redistribution of stress and strain in the Earth. In one study of small earthquakes triggered by a large event in southern California, he and his colleagues discovered an annual cycle: fall had the greatest number of earthquakes, spring the least. The team found that this pattern could be related to barometric pressure changes—less pressure meant reduced stress on the faults, which permitted them to move more frequently.

Just last year, Silver was coauthor of a paper showing there were subtle changes in the speed of seismic waves that preceded two small earthquakes—encouraging results for the field of earthquake prediction.

Silver’s research took him all over the world. He developed techniques to determine the direction-dependence of seismic wave speeds in the Earth’s upper mantle, now widely used to study the patterns of convective flow in the Earth’s interior and the processes for continent formation.

Silver served as the president of the seismology section of the American Geophysical Union from 2004 to 2006, and he chaired the board of directors of both UNAVCO and the Incorporated Research Institutions for Seismology. He was a leader in proposing the concept of the Plate Boundary Observatory in western North America.

Among his honors, Silver was elected a Fellow of the American Academy of Arts and Sciences in 2007, and he was the Royal Astronomical Society Harold Jeffreys Lecturer in 2005. He was also a Fellow of the American Geophysical Union and the Geological Society of America and a member of Phi Beta Kappa.

Silver served as mentor and collaborator to younger scientists throughout his career. A skilled jazz musician, Silver was also a drummer in a jazz trio that played throughout greater Washington, D.C.

The Paul G. Silver Postdoctoral Fellowship in Seismology has been established at DTM to honor his extraordinary contributions to science. To donate to the fellowship go to http://www.ciw.edu/silver_fellowship.
In Brief

TRUSTEES AND ADMINISTRATION


EMBRYOLOGY

Director Allan Spradling presented lectures at the Columbia Medical School, Yale Medical School, the CNRS-U. of Strasbourg, France, and the Gurdon Inst. of Cambridge, England. He also gave talks at a London Research Inst. Symposium and the International Society for Stem Cell Research Annual Meeting in Barcelona, and attended the Society for Developmental Biology (SDB) meeting in San Francisco.

2. In May Marnie Halpern gave a seminar at the Skirball Inst. at NYU. In July she was session chair and speaker at the European Zebrafish Meeting in Rome and presented a talk at the 60th annual meeting of the SDB.

3. Doug Koshland presented his work at the Weizmann Inst. of Science in Rehovot, Israel. He was an invited speaker at the FASEB Summer Research Conference “Genetic Recombination and Genome Rearrangements” and the Cold Spring Harbor Laboratories meeting “Yeast Cell Biology” in Aug.

4. Chen-ming Fan presented a lecture at SDB’s Mid-Atlantic Regional meeting.

5. Xiyian Zheng presented a lecture at U. Ottawa and was an invited speaker at the FASEB meeting in Lucca, Italy.

6. Steve Farber gave a keynote talk at the HHMI-funded program Maps in Medicine, which develops innovative curricular materials and improves high school biology learning. He also cochaired an educational symposium at the 2009 SDB meeting and gave a talk at Merck Research Laboratories on June 15.

7. Alex Bortvin gave talks at the National Inst. of Child Health and Human Development, the 17th International Chromosome Symposium, and the FASEB Summer Research Conference on Mobile Elements in Mammalian Genomes.

CASE’s Toby Horn to Receive Alberts Science Education Award

Codirector of the Carnegie Academy for Science Education (CASE) Toby Horn will receive the prestigious 2009 Bruce Alberts Award for Excellence in Science Education from the American Society for Cell Biology at their Dec. meeting. Horn a molecular and developmental biologist, is being honored for “her sustained contributions to K-12 science education.”

TRUSTEES AND ADMINISTRATION

Frederick received a three-year fellowship from the American Cancer Society. Alexis Marilones joined the lab as a graduate student.

— Technician Alison Singer left the Gall lab to begin graduate work in the School of Public Health, Johns Hopkins U. Daniel Escobar, a student assistant in the lab, completed his M.S. degree in biology from Hopkins in May and became a lab technician in mid-Aug.

— Halpern lab postdoctoral associate Mary Goll was an invited speaker at the Mount Desert Island Biological Laboratory Stem Cell Symposium Aug. 7-9 and attended the 2009 Gordon Research Conference on Epigenetics, where she won a poster award. Vanessa Matos-Cruz was awarded a predoctoral fellowship from NIH for her collaborative research with Samer Hatler’s lab, Johns Hopkins U. She was also awarded a three-year fellowship from the Neuroscience Scholars Program of the Society for Neuroscience. Baltimore Polytechnic Inst. biology high school

Director Emeritus of Embryology Donald D. Brown received the 2009 Lifetime Achievement Award from the Society for Developmental Biology. It is given to “a senior developmental biologist in recognition of her/his outstanding and sustained contributions in the field . . . [and] for the individual’s excellence in research and for being a superb mentor who has helped train the next generation of exceptional scientists.”

Don Brown (left) talks with Yun-bo Shi, a former Brown lab postdoctoral fellow (center), and Igor Dawid of NIH after receiving the award.

Image courtesy Marnie Halpern

Save the Date
First Lighters’ 20th Reunion
Tuesday, Dec. 22, 2009
4:00 - 8:00 p.m.
Carnegie Administration Building
1530 P St., NW,
Washington, D.C. 20005

Twenty years ago this year, Carnegie founded First Light, the hands-on Saturday science school for Washington, D.C., elementary school children. What a difference 20 years makes! The Carnegie Academy for Science Education (CASE) and First Light team invite all former First Light students and teachers to the reunion. Rekindle old friendships, learn about what’s changed, and catch up on the huge impact the program has had in D.C. over the past two decades.

Cynthia Wagner will become an assistant professor at the Magee-Womens Research Inst. in Pittsburgh beginning in Nov. She gave a talk at the International C. elegans Research Conference in June.

The department’s summer undergraduate seminars were organized by David MacPherson. They expose undergraduate and high school students to the various research projects. Carnegie postdocs and graduate students assist and present their work informally to the students.

Research scientist Cynthia Wagner accepted a position as a lecturer at U. Maryland-Baltimore County. The Spradling Lab’s postdoctoral associate Tina Tootle accepted a faculty position at U. Iowa Medical School; postdoctoral associate Todd Nystul will serve on the faculty of UC-San Francisco; postdoctoral associate Vicki Losick was awarded a three-year fellowship from the Jane Coffin Childs Memorial Fund, and postdoctoral associate Rebecca Van de Matos won a postdoc fellowship from the American Cancer Society. Alexis Marilones joined the lab as a graduate student.

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Image courtesy William Travers
Director Emeritus Charles Prewitt received the first International Mineralogical Society medal at the Goldschmidt Conference in Davos, Switzerland, June 24 for his “invaluable lifelong contribution to mineral sciences.” President of the society and senior visiting scientist at GL Takamitsu Yamanaka (left) presented the medal to Prewitt.

**Embryology’s Marnie Halpern**

**Christoph Lepper**

**Emmy Robbins/center, Connie Bertka (right), Reinhard Boehler (right).**

**Anat Shahar (front row, second from right), son Emerson (on lap), and wife Amanda (second from left)** attended the Bridgman Award Dinner at the AIRAPT-22 & HPCJ-50 conference in July. Dave Mao (back row in Hawaiian shirt), Alex Goncharov (standing seventh from left), president of the International Mineralogical Society and senior visiting scientist at GL Takamitsu Yamanaka (front row, right), and former GL postdocs and visitors also attended.

**Publications**

**GEOPHYSICAL LABORATORY**

- **Director Russell Hemley** presented two invited talks: at the Joint AIRAPT-22 & HPCJ-50, International Conference on High Pressure Science and Technology in Odaiba, Tokyo, Japan, July 26-31, and at the Diamond and Nano Carbons Conference in Traverse City, MI, June 8.
- The Geophysical Lab welcomed its newest staff member, **Anat Shahar**, on July 1. She is pioneering a field that blends iso-tope geochemistry with high-pressure experiments to examine planetary cores and the Solar System’s formation, and has developed numerous new techniques for the research.
- **Connie Bertka** was appointed program director of the Sloan Deep Carbon Observatory on Sept. 1 Reinhard Boehler joined the lab as senior scientist Aug. 17. He was formerly a director of the Max-Planck-Institut für Chemie in Mainz, Germany, and will work on the EFree initiative.
- **Doug Rumble** lectured on the asteroid 2008 TC3 and meteorite, Almahata Sitta, at the Smithsonian Institution; at the Laboratoire de Minéralogie et Cosmochimie du Muséum, Muséum National d’Histoire Naturelle, Paris; and at Dartmouth College. He led a field trip in western New Hampshire and attended the Goldschmidt Conference in Davos, Switzerland.
- **Nabil Docter** presented a paper at the Meteoritical Society Meeting in Nancy, France.
- **Robert Hazen** was named the 2009 Baldwin Lecturer at U. Miami. He presented lectures at U. Alaska and at the annual meeting of the American Chemical Society on aspects of the origins of life.

**Yuming Xiao**

**Anat Shahar** gave a talk at the International Conference on High Pressure Science and Technology in Tokyo July 26-31.
- **Postdoctoral fellow Dominic Papineau** gave a presentation at the Goldschmidt Conference in Davos and an invited seminar at the ETH in Zurich. He was also awarded a grant to do fieldwork in India and China.
- **Postdoctoral associate Subramanian Natarajan** gave a talk at the International Conference on High Pressure Science and Technology in Tokyo July 26-31.
- **Postdoctoral fellow Javier Montoya** was a visiting scientist at the International Centre for Theoretical Physics in Trieste, Italy, May 24-June 23. He gave an invited talk at Symposium 2 of the XVIII International Materials Research Congress in Aug.
- **Research scientist Henderson [Jim] Cleaves** gave a talk in San Sebastian, Spain, in May, at the ETH in Zurich in June, and at Georgia Tech in July. He also hosted Pierre-Alain Monnard of U. Odense in June and two summer interns, **Mickey Kopstein** and **Karina Marshall-Bowman**.
- **Research scientist Dionysis Foustoukos** hosted a summer intern, Niya Grozeva, who will be presenting at the AGU 2009 Fall Meeting. She is a sophomore at Stony Brook U.
- **John Armstrong** presented an invited paper at the International Microscopy and Microanalysis 2009 meeting this July in Richmond, VA.

**Dionysis Foustoukos**

**High Pressure Collaborative Access Team (HPCAT)**

**Stanislav Sinogeikin** gave an invited talk at the COMPRES Workshop on Long Range Plan for High Pressure Earth Sciences in Tempe, AZ, in Mar. In May he gave an invited talk at the HPSynC workshop held in conjunction with the APS User Meeting and one at the AGU Joint Assembly, The Meeting of the Americas, held in Toronto. Sinogeikin was a workshop organizer at APS Sept. 23-25. He is currently chairing an APS Proposal Review Panel.
- In Aug. **Yuming Xiao** presented a poster at the Gordon Research Conference X-ray Science in Waterville, ME.
Wenge Yang and Qiang Mei gave invited talks at the Advanced Crystallography at High Pressure Conference at the Harbin Institute of Technology, Harbin, China, in July.

In July Yue Meng gave an invited talk at Jilin U. China, and at the 22nd AIRAPT International Conference.

**Arrivals:** On June 1 Chongyang Park, from ANL’s Chemical Sciences and Engineering Division, joined HPCAT as a beamline scientist. Curtis Kenney-Benson, from the Dept. of Physics, Allegheny College, joined as a beamline associate Sept. 1. Summer intern Alaina Beres, a senior at Elmhurst College, conducted research on public views of future energy needs.


**High Pressure Synergetic Consortium at the Advanced Photon Source (HPSynC)**

Staff scientist Michael Lerche gave a talk at the High Pressure Synchrotron Science workshop held at ANL, May 6-8.

Staff scientist Yang Ding gave a talk at the Joint AIRAPT-22 & HPCJ-50 conference meeting in Tokyo.

Malcolm Guthrie joined the staff and gave invited talks at the Entropy and Glass II international workshop at Aberystwyth U., UK, Apr. 22-24, and at the International Union of Crystallography High Pressure Commission Meeting in Harbin, China, July 19-23. He attended the AIRAPT meeting in Tokyo July 26-31, and was invited to sit on the international advisory committee for the J-PARC high pressure neutron diffractometer, in Mito, Japan, July 24-25.

Postdoctoral researcher Lin Wang presented a poster at the CDAC Winter Workshop Feb. 27-28. May 4-9 he presented a poster at Users Week 2009 at ANL, and May 6-8 he gave an invited talk at the High Pressure Synchrotron Science workshop.


Melike Abliz, postdoctoral researcher, left in Aug. for a position at Argonne as an assistant physicist with the Magnetic Devices Group at the APL.

**GLOBAL ECOLOGY**

Director Chris Field chaired the content outline process of the IPCC Working Group 2 Fifth Assessment Report in Venice July 13-17.

In June Joe Berry attended the award ceremony for newly elected Fellows of the American Geophysical Union in Toronto.

Greg Asner is a chapter author of a book that synthesizes the decade-long study of the Amazon Basin. It covers the socioeconomic drivers and ecological impacts of the timber industry in relation to deforestation.

Asner and David Knapp, with Guayana Paez-Acosta and Aravind Balaji, met with key institutions in the Andes Amazon region to use the CLASSite system, their user-friendly forest-monitoring tool. They trained about 85 people from 40 different institutions in five countries. The lab’s Angelica Almeyda and Eben Broadbent spent some of July in the Manuel Antonio region of Costa Rica assessing the impacts of tourism on social, economic, and environmental sustainability. In early June, Broadbent presented invited overviews of remote sensing forest cover and degradation to forestry professionals from throughout Central and South America at the Seminario Latinoamericano en Politica y Manejo Forestal in Santa Cruz de la Sierra, Bolivia.

Also in Aug., Asner, Ty Kennedy-Bowdoin, James Jacobson, and Dave Knapp took the CAO on its first mission to the Amazon over a 10-million-acre tropical rain forest region to support an international effort to reduce carbon dioxide emissions from deforestation and forest degradation.

The week of Apr. 20, Ken Caldeira participated in a meeting in Lisbon, Portugal, on the governance of intentional intervention in the climate system and gave a talk on ocean acidification at the Lisbon aquarium. On Apr. 25 he participated in a panel discussion at the San Francisco International Film Festival after a screening of A Sea Change, in which he appeared. Caldeira attended the 9th Scientific Steering Committee meeting of the Global Carbon Project in Beijing in June. On July 3 he gave a briefing in London on geoengineering to advisors of David Cameron, head of the Conservative Party in the UK. On July 6 he spoke at “The Coral Reef Crisis: Addressing the Challenges of Climate Change and Ocean Acidification,” a meeting held at the Royal Society of London. July 25-Aug. 2 he taught classes on ocean acidification and geochemical modeling at the annual summer school at U. Urbino, Italy. In Aug. he traveled to Paramount Studios to participate in the film Acid Test, which premiered Aug. 12 on Discovery Planet Green.

Kyla Dahlin is a recipient of a three-year Stanford Interdisciplinary Graduate Fellowship.

After 26 years, former business manager Mary Smith retired this past June 30. Smith joined Plant Biology in 1983 as the office administrator, which became the business manager position later that year. In 2007 Smith became a part-time employee working on special projects for both Plant Biology and Global Ecology. She organized countless events at the departments over the years.
Visiting investigator Luis Fernández was recognized with the EPA’s highest award in June. Fernández has been at Global Ecology for the past year as part of the bioenergy team. The award was for work he did before coming to Carnegie, pioneering a program to study and reduce the impacts of mercury contamination from artisanal and small-scale gold mining in developing countries.

Luis Fernández receives the EPA’s Gold Medal from EPA administrator Lisa Jackson.
Image courtesy EPA

Kris Ebi, the executive director of the Technical Support Unit (TSU) for Working Group II of the IPCC, arrived at Global Ecology in mid-Aug. The report will be completed in 2014. The group will also be working on a special report on managing the risks of extreme events and disasters to advance climate change adaptation, to be released in 2011. Stanford grad Mike Mastrandrea is the project scientist for Working Group II.

Arrivals: Julia Pongratz joined the Caldeira lab in July as a postdoc research associate. Pongratz came from the Max Planck Institute for Meteorology in Hamburg. Daniel Gorham and Michael Spieler worked at the Caldeira lab as summer interns. The Asner lab hired summer interns Devon Arscott and Elliot Brenner.

Departures: Field lab postdoc Eve-Lyn Hinckley left in Aug. for a postdoc position in Colorado. Claire Lunch successfully defended her dissertation in May and left for a postdoc position at Woods Hole, MA. Jack Silverman, a postdoc in the Caldeira lab, left Carnegie Aug. 31 for a position in Israel.

OBSERVATORIES

On June 1 director Wendy Freedman gave a GMT talk to a group in Santa Barbara. On June 8 she spoke on the Carnegie Hubble Project at the AAS meeting in Pasadena as part of the Spitzer Exploration Science Meeting. She was an invited speaker at the Windows on the Universe conference in Blois, France, where she gave the plenary talk on June 23. Freedman attended the TeV Particle Astrophysics Conference at KIPAC, Stanford, and gave the plenary talk on July 14.

Staff astronomer Alan Dressler attended the Lyman Alpha Universe conference at the Institut d’Astrophysique de Paris July 6-10.

In Aug. staff astronomer Andrew McWilliam gave an invited talk at the IAU General Assembly in Rio de Janeiro. He was awarded the Beatrice M. Tinsley Research Scholarship by U. Texas-Austin in Apr. 2009, where he visited for a week and gave a talk.

Director Wendy Freedman is corecipient of the 2009 Gruber Cosmology Prize, and participated in the IAU XXVII General Assembly Inaugural Ceremony on Aug. 4 and on Aug. 5. She gave a talk with corecipients Jeremy Mould and Robert Kennicutt.

Carnegie’s Wendy Freedman (second from left) is flanked by corecipients Robert Kennicutt (left) and Jeremy Mould. At far right Patricia Gruber holds the award certificate.
Image courtesy Barry Madore
Winslow Briggs, director emeritus, was awarded the 2009 International Prize for Biology given by the Japan Society for the Promotion of Science to be presented at a ceremony in the presence of the emperor and empress of Japan in Tokyo on Nov. 30. He is being honored for his work on light sensing by plants.

Director Emeritus
Winslow Briggs


Winslow Briggs gave the leadoff symposium talk for the American Society of Plant Biologists in Honolulu, HI, on July 18. Bill Eislinger, a visiting investigator in that lab, presented a poster and gave a talk.


Zhi-Yong Wang gave a talk at the 20th International Conference on Arabidopsis Research in Edinburgh on July 2. He also gave a talk at the EU-COST Workshop Systems Biology for Plant Design on July 9 at Wageningen U., Netherlands.

In May 2009 Kathryn Barton was an invited speaker at the Genetics Society UK meeting in Oxford. She was a session chair and speaker at the American Society of Plant Biologists Meeting in Honolulu in July.

Devaki Bhaya was invited to advise five freshmen in the Sophomore Mentoring Program at Stanford U. She contributed movies of cyanobacterial motility to the World Science Festival June 10-14 at Lincoln Center, NYC, for the opening talk. On June 18-23 she spoke at the 15th International Congress on Photobiology in Dusseldorf. In July she was an invited speaker at the annual Microbiology Microbial Diversity course at the Hopkins Marine Station, Stanford U., and in Aug. she spoke at the annual NSF-FIBR workshop.

On July 2 Eva Huala, director of TAIR, along with David Swarbreck and Kate Dreher, TAIR curators, presented a workshop at the International Conference on Arabidopsis Research in Edinburgh.

TAIR curator Tanya Berardini gave a talk at the 3rd International Biocuration Conference in Berlin on Apr. 19. On July 23 she gave a talk at the Plant Development in a Changing World Satellite Symposium of the Society for Developmental Biology meeting in San Francisco. She also attended the society’s meeting.

On July 20 Philippe Lamesch, Donghui Li, and A. S. Karthikeyan, TAIR curators, gave a workshop at the American Society of Plant Biologists Annual Meeting in Honolulu.

On June 24-25 Kate Dreher gave a talk at Cornell U., Ithaca, NY. In July she gave presentations and helped with a course at CIGRAS, U. Costa Rica, San Pedro.

On June 18 Philippe Lamesch gave a workshop in St. Louis. On Apr. 17 he spoke at the International Biocuration Conference in Berlin. On July 20 he gave a talk at the American Society of Plant Biologists meeting in HI and presented a workshop. On July 13 he gave an invited talk at the Translatinal Genomics Research Inst. in Phoenix.

Frommer lab’s Viviane Lanquar was awarded a Marie Curie Fellowship in Feb. Postdoc Clara Bermejo gave a talk on July 20 at the Yeast Genetics 2009 Conference.

Ryan Gutierrez, a Ph.D. student in the Ehrhardt lab, attended the EU-COST Workshop Systems Biology for Plant Design at Wageningen U., Netherlands, July 9-11.
student and postdoc Margaret Olney (St. Martin's U., Lacey) brought her students Amy Campanelli and Rachel Golda to work in the Briggs lab. Richard Fu joined the Wang lab, as did returning intern Daniel Li (UC-San Diego) and Andrew Ma (Lycoming High School). Tony Zhang joined the TAIR group for one month.

— Tina Kubitzki joined the Frommer lab for a month on July 23. Arriving at the Grossman/Bhya lab were postdocs David Dewez (UC-Berkeley) on Mar. 1 and Mark Heinnickel (PENN State) on May 1. Postdoc Susanne Wisen (U. Mich.) arrived June 1. Postdoc Antony Chettoor (Iowa State) joined the Evans lab May 1. Two summer field assistants joined the lab: Duncan Oja (Bard Coll.) on July 6, and Graham Newell on July 1. Pinar Mutluoglu joined the administrative staff as administrative assistant to director Wolf Frommer on June 1.

Departures: Postdoc Christine Chang left the Frommer lab for the EU project NANNOMMUNE at the Karolinska Institutet in Stockholm. Postdoc Guillaume Pilot left on July 31 to start an assistant professorship at Virginia Tech. Fariba Fazelli, a lab technician in the Grossman/Bhya lab, left on July 17 to work at BioTech in Alameda, CA. Ehhardt postdoc Viktor Kirik joined the faculty at Illinois State U.-Normal on Aug. 15. TAIR curator Debbie Alexander left on Apr. 18 for the UCSF Patent Office. Postdoc Stephan Wenkel left the Barton lab for Tübingen U. in Germany. Yu Sun left the Wang lab on July 31, and Azam Nooorani Vatani, lab assistant for the Rhee lab, left on Aug. 31 for the biotech industry.

TERRESTRIAL MAGNETISM

Sean Solomon co-organized and delivered papers at a workshop on spectroscopic observations of the planet Mercury held in Parma, Italy, in June, and at a special session on Mercury at the European Planetary Science Congress held in Potsdam, Germany, in Sept. He also gave an invited presentation on the exploration of Mercury to the 1st Annual Symposium on Planetary Exploration held in May at the Chiba Institute of Technology, Chiba, Japan. In June he served on the visiting committee to the MIT-Woods Hole Oceanographic Institution Joint Program in Oceanography and Applied Ocean Science and Engineering. In late Sept. he chaired meetings of the MESSENGER Science Team timed to coincide with data playback from the spacecraft’s third flyby of Mercury.


— In Sept. Paul Butler participated in an operations meeting for the Keck Observatory at NASA and was featured on the Australian science television program Catalyst for his extrasolar planet research at the Anglo-Australian Observatory.


— John Chambers gave a talk at a meeting of the National Capital Astronomers held at U. Maryland in Sept.

— In Sept. Larry Nittler spoke at a European Space Agency workshop in Noordwijk, the Netherlands.

Steve Shirey carried out fieldwork in July, with son Clayton as a field assistant, on the world’s oldest diamond-bearing volcanic rocks in Wasau, ON. Also in July, Shirey hosted Anriam Van Rythoven of U. Toronto.

Alicya Weinberger gave a colloquium on circumstellar disks at Lowell Observatory in July.

— Hubble Fellow Mercedes López-Morales gave an invited talk at the NASA Exoplanet Science Institute’s 2009 Sagas Summer Workshop on Exoplanetary Atmospheres in Pasadena in July. In Sept. López-Morales hosted graduate student Sergio Hoyer of U. Chile to complete analyses of observations on transiting exoplanet systems.

— In Aug. postdoctoral fellow Nick Schmerr joined David James and field seismologist Steven Golden to retrieve seismometers deployed as part of the High Lava Plains Seismic Experiment in Oregon.

— Postdoctoral fellow Jessica Warren spoke at the Deformation, Rheology, and Tectonics Conference held in Liverpool, UK, in Sept.

— Several DTM staff and postdoctoral fellows presented papers at the 2009 Meteorological Society meeting held in Nancy, France, in June, including Conel Alexander, Alan Boss, Larry Nittler, Jianhua Wang, postdoctoral associate Ming-Chang Liu, and postdoctoral fellow Liping Qin.

— Larry Nittler and geochemistry laboratory manager Mary Horan gave colloquia at the 2009 Goldschmidt conference held in Davos, Switzerland, in June.

— Sean Solomon, Rick Carlson, and postdoctoral fellows Nick Schmerr and Wen-che Yu presented papers at the 2009 Gordon Research Conference on the “Interior of the Earth” held in June at Mount Holyoke College in South Hadley, MA.

— The 2009 Gordon Research Conference on “Origins of Solar Systems” was held at Mount Holyoke College in South Hadley, MA, in July. DTM presenters included John Chambers, Alicya Weinberger and postdoctoral associate Ming-Chang Liu.

— In July Rick Carlson, Steve Shirey, and Tim Mock instructed primary school teachers at DTM in the separation of minerals and the laser-ablation analysis of uranium and lead to determine the age of rock as part of the Smithsonian Institution’s Science Education Academy for Teachers.

— In July Paul Silver, field seismologist Steven Golden, and postdoctoral fellow Wen-che Yu participated in fieldwork in the Cascade Mountains of Washington State.

Postdoctoral fellow Nick Moskovitz arrived in Sept. following the receipt of his Ph.D. at U. Hawaii.

— Administrative assistant Robin Seidel departed DTM in Aug. to begin graduate school in archaeology at California State U., Los Angeles.

DTM/GL

Shaun Hardy attended the Special Libraries Association annual conference in June in Washington, DC.
MOODY’S AFFIRMS
Carnegie’s Aaa/VMIG1 Rating
HIGHEST AWARDED

On August 24, Moody’s Investors Service affirmed its highest rating—Aaa/VMIG1—on the Carnegie Institution’s Series 1993, 2002, and 2006 bonds. Only 37 other higher-education institutions and not-for-profit organizations are currently rated in this category, the highest ranking awarded to this group. The rating is based on Carnegie’s financial strength and reflects Moody’s expectation that “the Institution’s balance sheet and liquidity will continue to provide a solid cushion for debt and operations and that the Institution will successfully manage the impact of lower investment values on its operations.” Moody’s outlook for the rating is stable.

Moody’s cited numerous strengths that led to the rating, including a large balance sheet, a strong market position as an advanced research institution with diversified funding sources, and “improved operating performance in recent years.” Moody’s also believes that the institution has a sufficient “cushion of liquidity” for any short-term needs, if they arise.

“In these challenging economic times, it is particularly gratifying to be given this commendable rating,” remarked Carnegie president Richard A. Meserve. “A strong financial footing is essential for the institution to fulfill its mission of advancing basic scientific research.”

The Series 1993B and Series 2006 bonds are issued through California Educational Facilities Authority, while the Series 2002 bond is issued through Maryland Health and Higher Education Facilities Authority.