CarnegieScience

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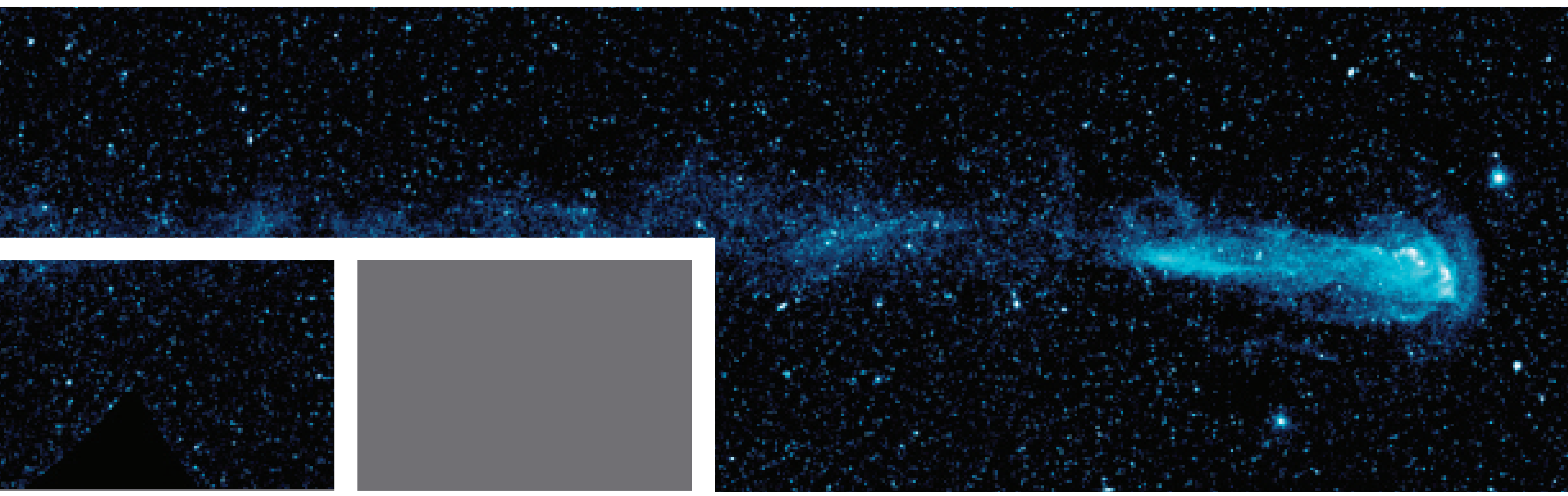
EMBRYOLOGY □ GEOPHYSICAL LABORATORY □ GLOBAL ECOLOGY □ THE OBSERVATORIES □ PLANT BIOLOGY □ TERRESTRIAL MAGNETISM □ CASE: CARNEGIE ACADEMY FOR SCIENCE EDUCATION



On the Inside

Carnegie
Institution for
Science

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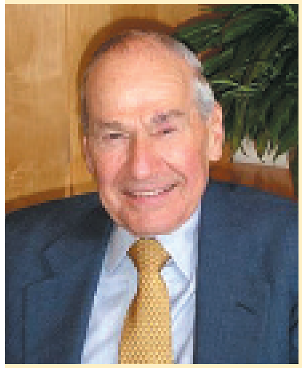


I am sometimes asked about our board's philosophy regarding spending and investing of our endowment and thought I would share a few observations on the subject. Determining spending and investment policy is one of any board's fundamental responsibilities. At Carnegie the underlying philosophy is to balance two competing objectives—providing ongoing financial support for the institution's current activities while simultaneously preserving assets to support our mission in the long term. This balance involves weighing the needs of today's scientists against the requirements for scholars who will come later.

Carnegie's endowment is fundamental to the operations of the institution. It supports slightly more than half of our annual operating budget, whereas institutions with comparable endowments typically support only 17% of their operating budget through endowment spending. The importance of the endowment to the institution is thus as great today as when it was established more than 100 years ago.

The endowment provides an independent source of funding that enables Carnegie scientists to explore questions of their choice. Where these questions overlap with the interests of federal or private funders, outside support is greatly welcomed. But in some areas, Carnegie funds are the only available source of support. These funds are crucial to our mission because they free our scientists from the fads that can govern external, public funding and can support the high-risk, long-term projects that promise paradigm-shifting results.

Carnegie's trustees and presidents have pursued a policy of bringing the annual budgeted spending rate from our endowment down in a gradual fashion from an unsustainably high 6+% of the endowment in the 1990s to 5.0% today. During the last year, the board of trustees reviewed this policy and endorsed maintaining a 5.0% budgeted spending rate, while continuing to monitor actual spending carefully in the future.

Our investment policy is also driven by a long-term perspective. Our investments are heavily diversified, with foreign equity, private equity, absolute-return strategies, and real assets dominating our asset allocation. In making our investment decisions, we rely heavily on the considerable wisdom and experience of our trustees.

What have been the recent results of this approach to spending and investing? First, real spending to meet today's needs has actually increased, even as we have brought down the spending rate. Last year, for example, the amount spent from our endowment was more than 20% higher than it would have been if we had just kept pace with inflation in higher education over the last decade. Our recent investment returns have exceeded the average at higher education institutions, and in many years we have been among the top 10% in performance. As of June 30, 2007, the value of our endowment was approximately $818 million, an increase of 40%, net of spending, over the last three years. Over the last 15 years, the combination of a careful spending policy, good investment returns, and very welcome gifts has resulted in an overall endowment value that is $450 million larger than if we had just kept pace with inflation. Those who contribute generously to Carnegie can take comfort in the careful stewardship of their gifts.

As my personal investment advisors constantly remind me, past performance is no guarantee of future performance. I am convinced that this should be seen not just as legal boilerplate, but as a philosophy under which any diligent board should operate. Satisfaction with the recent past is often a recipe for future problems. You can be assured that the Carnegie board and president will continue to carry out oversight of spending and investment in a manner that weighs the institution's present needs with our responsibilities to the future.

Michael E. Gellert, *Chairman*

Department of Terrestrial Magnetism's newest staff member, Scott Sheppard.

Scott Sheppard's Solar Systems

Since Pluto was demoted, our solar system has been left with eight major planets. They travel around the Sun in fairly circular orbits and on similar planes. However, since the discovery of wildly varying planetary systems around other stars in the Milky Way, and given our increased understanding about small, primordial bodies in our celestial neighborhood, the notion that our solar system has always been so orderly is changing.

To understand solar system evolution in general and how ours came to be, Department of Terrestrial Magnetism (DTM) astronomer Scott Sheppard studies the dynamical and physical properties of small bodies, such as asteroids, comets, satellites, moons, trans-neptunian objects (bodies that orbit at Neptune and beyond), and young objects around other stars. Sheppard, Hubble Fellow since 2004, joined the DTM research staff on July 1, 2007.

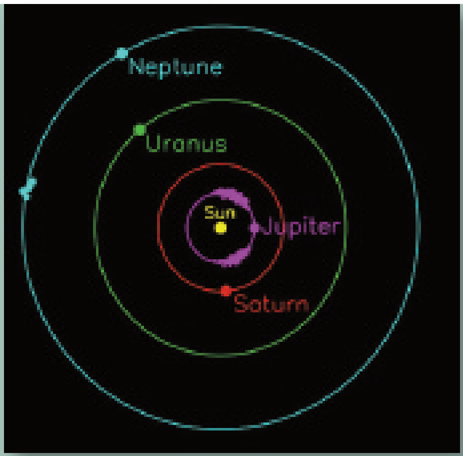
In one research area, Sheppard surveys our solar system for so-called irregular satellites. These bodies are believed to have been captured by their respective planets. Regular satellites, on the other hand, were created during disk accretion. Sheppard and colleagues have discovered over 70 of the irregular objects around Mars, Jupiter, Saturn, Uranus, and Neptune. During the survey, Sheppard determined that the giant planets all possess about the same number of irregular satellites, despite large differences in planetary mass.

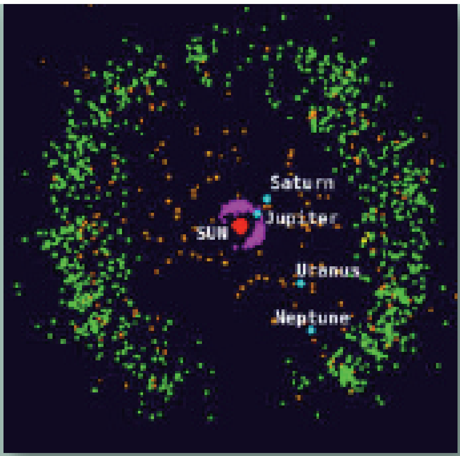
Sheppard is also the codiscoverer of three of the five known Neptune "Trojans." Trojans are asteroids that are locked into the same orbital period as a planet. The Neptune Trojans cluster in the elongated, curved region of a Lagrangian point, an area that is 60 degrees ahead in orbit. At these spots, the gravitational pull of the planet and the Sun combine to lock the asteroids into synchronized orbits with the planet. One of these Trojans is the first known high-inclination Trojan. The presence of this body implies that Neptune was on a much more eccentric orbit in the past. As Neptune went through the process of becoming more circular in orbit, it gained the ability to capture high-inclination objects. Sheppard has also learned that Neptune Trojans share similarities with their Jupiter counterparts.

Bodies called Kuiper Belt objects (KBOs) exist just beyond the orbit of Neptune. They are ancient, relatively small, icy rock bodies. Sheppard observed the brightness of the largest-ever sampling of these objects, discovering that a third of them have highly variable brightness over short periods. The finding implies that KBOs are piles of rubble, lacking internal strength, and points to the possibility that they originated from collisions during Kuiper Belt history.

Sheppard discovered the first contact binary KBO. A contact binary contains two objects that are drawn together by tidal friction—like the Earth and the Moon—to orbit about one another. Similar observations by Sheppard and his colleagues also yielded one of the first measurements of the bulk density of a KBO; the value is sufficiently low that a volatile-rich, porous structure is indicated. According to Sheppard, KBOs, as well as the asteroids, are fossils that reveal aspects of the evolution of the planets. □

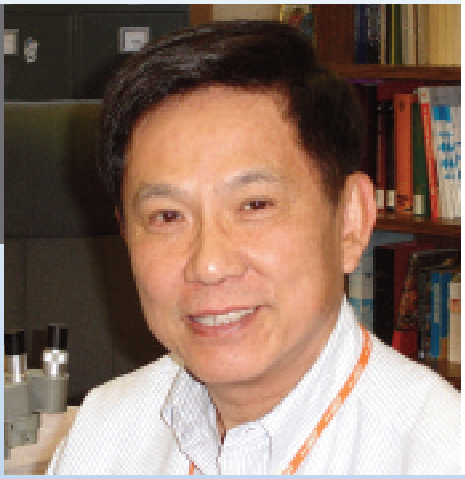
ALICIA CASE

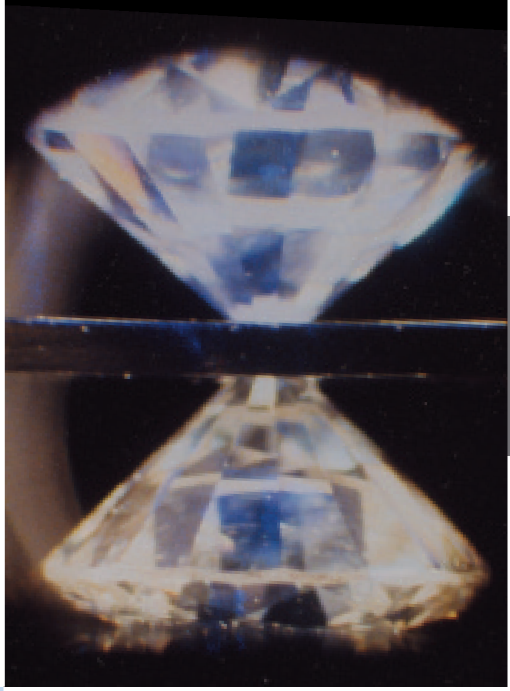




(Left) Trojan asteroids share the orbit of Jupiter or Neptune. They are located at spots where the gravitational pull of the nearby planet and the Sun combine to lock the asteroids into synchronized orbits with the planet.

(Right) Kuiper Belt objects populate the outer part of the solar system, just beyond the orbit of Neptune. They are ancient, volatile-rich bodies. (Images courtesy Scott Sheppard.)





Dave Mao Awarded AGU's Inge Lehmann Medal

(Above right) The diamond anvil high-pressure cell was perfected by Carnegie's Ho-kwang (Dave) Mao (pictured) and his colleague Peter Bell in 1975.

The American Geophysical Union awarded Carnegie's Ho-kwang (Dave) Mao the Inge Lehmann Medal for "outstanding contributions to the understanding of the structure, composition, and dynamics of the Earth's mantle and core." Mao has been a pioneer in high-pressure physics and related technology development for over 30 years.

Mao is a world leader in ultra-high-pressure research and technology development, and in applying that technology to physics, material sciences, geophysics, chemistry, geochemistry, and the planetary sciences. He and colleagues first achieved 1 megabar static pressure in 1976, which doubled the previous pressure limit. Since then, his group has consistently improved the multimegabar technique and coupled it with analytical methods, including synchrotron X-ray diffraction, infrared, Raman, Brillouin, fluorescence, and Mössbauer spectroscopies.

"Dave Mao is a scientist who has been a pathfinder in many diverse areas," remarked Carnegie president Richard Meserve. "Carnegie is very proud of this recognition of Dave's contributions."

The Lehmann Medal was first awarded in 1997. It is named in honor of Danish seismologist Inge Lehmann and her many contributions to understanding the Earth's mantle and core. The medal is given not more often than every other year. The presentation will be made on December 12 at the 2007 AGU Fall Meeting in San Francisco.

"It is especially appropriate for Dave to receive the medal named for Inge Lehmann, the discoverer of the Earth's inner core," commented Russell Hemley, director of Carnegie's Geophysical Laboratory. "The study of core-forming materials—iron alloys—at ever-increasing pressure and temperature has been a constant theme of Dave's work since he was a graduate student. Some of his most recent work has provided important new insights on the nature of the inner core. He has also broadly advanced our understanding of the mantle, through his own research as well as the many people he has trained in high-pressure mineral physics."

Mao received his Ph.D. from the University of Rochester in 1968 and became a postdoctoral fellow at Carnegie's Geophysical Laboratory. In 1972 he was appointed a staff member. He is a corecipient of the 2005 Balzan Prize from the International Balzan Foundation, for mineral physics; the recipient of the 2005 Gregori Aminoff Prize of the Royal Swedish Academy of Sciences, for crystallography; and the recipient of the 2005 Roebling Medal of the Mineralogical Society of America, among other awards. He is a member of the National Academy of Sciences, the Academia Sinica of the Republic of China, and a Foreign Member of the Chinese Academy of Sciences. He is a fellow of the American Geophysical Union, the American Physical Society, and the Mineralogical Society of America. ☐

Gruber Prize winner Mark Phillips, the associate director of Carnegie's Las Campanas Observatory in Chile, studies distant Type Ia supernovae. These objects were instrumental in his role in discovering that the Universe is expanding at an accelerating rate.

Mark Phillips Shares Gruber Prize for Cosmology

Carnegie astronomer Mark Phillips was awarded the 2007 Cosmology Prize of the Peter and Patricia Gruber Foundation for his role in discovering that the Universe is expanding at an accelerating rate.

Phillips was one of 20 members of the High-Z Supernova Search Team, which looked for distant Type Ia supernovae—violent explosions of white dwarfs, stellar remnants that have exhausted their nuclear fuel. Because the supernovae are extremely bright and similar to each other, they can be used as cosmological "standard candles" for accurately measuring distances to galaxies halfway across the Universe. The High-Z team revealed the Universe's acceleration by measuring the expansion rate of the Universe over time, using distant and nearby Type Ia supernovae. The rate of expansion—known as the Hubble constant—is a critical component in calculating the age and size of the Universe.

Phillips, who aided in the discovery while at the Cerro Tololo Inter-American Observatory (CTIO) in Chile, moved to Carnegie from CTIO in 1998. He has been a pioneer in demonstrating that Type Ia supernovae could be used as precise cosmological standard candles, and, with colleagues, he established the techniques used for discovering and measuring distances to these objects.

Phillips's work in determining accurate distances to Type Ia supernovae allowed the team to measure how the Hubble constant has evolved since the Universe was half its present age. If dominated by gravity, the Universe would be decelerating. Yet he and colleagues discovered, to their amazement, that the expansion rate is currently accelerating. The findings were independently confirmed by the Supernova Cosmology Project.

"The Carnegie Institution salutes Mark for the insight his contributions have provided regarding the fundamental nature of the Universe," said President Richard Meserve. "We are very proud of his accomplishments."

Some scientists propose that an unseen force called "dark energy" is driving the acceleration; others interpret the phenomenon as a failure of Einstein's theory of general relativity. Whatever the explanation, the implications for modern physics are profound.

"I am delighted to know that Mark will share the 2007 Gruber Prize. He has played a seminal role in turning supernovae into precise tools for cosmology, a critical ingredient in the discovery of the accelerating Universe," remarked Wendy Freedman, director of the Carnegie Observatories.

The Gruber Cosmology Prize is awarded annually to honor those scientists who make discoveries that alter perceptions and comprehension of the Universe. Two other Carnegie astronomers have held the honor. The Department of Terrestrial Magnetism's Vera Rubin received the prize in 2002 for her work on dark matter in the Universe and her exploration of the rotation of spiral galaxies. In 2000, Allan Sandage, Staff Astronomer Emeritus at the Carnegie Observatories, shared the first Gruber Cosmology Prize for his achievements in observational cosmology. ☐

Nasty Bacteria Need Sun

Certain types of bacteria have sunlight-sensing molecules similar to those found in plants, according to a new study. Surprisingly, at least one species—responsible for causing the flu-like disorder brucellosis, or Bang's disease—needs light to reproduce in its host and cause disease. The work suggests an entirely new model for bacterial virulence based on light sensitivity.

The paper, coauthored by an international team of collaborators including Winslow Briggs and Tong-Seung Tseng of Carnegie's Department of Plant Biology, appears in the August 23, 2007, issue of the journal *Science.* It is the first detailed study into the function of plant-like light-sensing molecules in bacteria.

"The central message is that many bacteria have signaling proteins that contain the same light-absorbing domain as those found in the higher plants," Briggs explains. "One of these proteins is a nasty pathogen called *Brucella.* A species of *Brucella* is a serious pathogen of cattle that causes abortion of calves, and another species is a nasty pathogen of humans."

The bacterial sensors are closely related to phototropins—the light receptor molecules that cause a plant to grow toward a light source. They share a protein sequence called a LOV (pronounced "love") domain, so named because it can detect light, oxygen, and/or voltage. Briggs and his colleagues were the first to discover and describe plant LOV domains in 1998.

LOV-domain proteins have been found in more than 100 different bacteria. For the purposes of this study, the researchers narrowed the field to a handful of candidates with well-known LOV sequences that closely

light to Do Their Worst

resemble those in plants. They eventually settled on four species: *Brucella melitensis, Brucella abortus, Erythrobacter litoralis* and *Pseudomonas syringae.*

In the case of *B. abortus,* and possibly others, the presence of a LOV domain is more than mere coincidence. When the researchers disabled the LOV-domain protein gene in this species, its virulence—measured as the ability to reproduce efficiently enough to cause disease—dropped to less than 10% of normal, "wild-type" bacteria.

In a simple experiment involving two layers of light-blocking aluminum foil, they achieved a similar drop in virulence, demonstrating that *B. abortus* depends on sunlight to do its dirty work.

"*Brucella* has been extensively studied for years because of its threat to livestock and the effect it has on our food supply—one of the key reasons we pasteurize milk is to prevent infection by *Brucella,*" explained Trevor Swartz, lead author on the study and a former postdoctoral researcher* at Carnegie. "But no one has previously demonstrated any type of light response in *Brucella*'s life cycle. This is an exciting result that could possibly provide for a novel therapeutic avenue to treat and prevent infection."

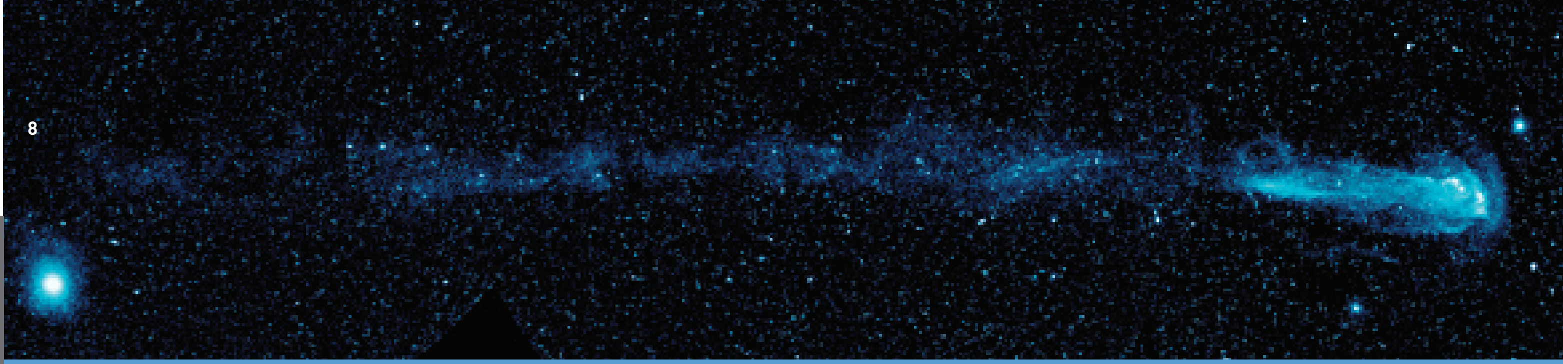
"People studying non-photosynthetic bacteria, whether the bugs are pathogenic or not, pay no attention to light conditions and are completely unaware that light might play some essential role in their physiology," Briggs added.

When it is in the dark, a LOV domain uses weak chemical bonds to hold on to a small molecular group known as a chromophore. When it absorbs light, however, the LOV domain temporarily tightens its grip on the chromophore by forming a more stable bond. This reaction is essentially a biochemical switch, and when the light source is blocked or removed, the LOV domain relaxes its grip on the chromophore once again. Activated LOV domains can switch on yet another signaling molecule, known as a kinase, forming a coupled biochemical pathway referred to as a "two-component system."

The function of LOV proteins is fairly well documented in plants. Although researchers had previously documented LOV proteins in bacteria, Briggs, Tseng, Swartz, and their colleagues are the first to examine their function in detail. They found that bacterial LOV domains activate a common signaling pathway that begins with a specific type of kinase known as histidine kinase.

"Bacteria have a large collection of these so-called histidine kinases that are activated by nutrients such as sugar and amino acids, or toxic substances," Briggs said. "Our work is the first ever to demonstrate a light-activated histidine kinase in a bacterium and demonstrate that it played an essential role in bacterial virulence." □

*Swartz initiated the study while a research faculty member at the University of California, Santa Cruz; he is currently at Genentech, Inc. This research was funded by the National Science Foundation, the National Institutes of Health, the U.S. Department of Agriculture, the Howard Hughes Medical Institute, the Binational Agricultural Research and Development Fund, and the Agencia Nacional de Promoción Científica y Tecnológica (Argentina).



Astro-Surprise: Speeding Star Sports Tail

(Above) A new ultraviolet mosaic from NASA's Galaxy Evolution Explorer shows the red giant star Mira and its tail moving from left to right. The shed material is light blue. The dots are stars and distant galaxies.
(Image courtesy NASA/JPL-Caltech.)

Nothing like it has ever been seen before. NASA's Galaxy Evolution Explorer (GALEX) has spotted a vast comet-like tail behind the star Mira, which is speeding through space at an extraordinary rate. The story was widely covered in the media, from the *New York Times* and the *Washington Post* to outlets in Europe, Australia, China, and elsewhere.

Astronomers have observed Mira for hundreds of years. In an ongoing survey in the ultraviolet part of the spectrum, GALEX scanned the star, and researchers noticed that it looked like a comet with an enormous tail. The tail, visible for the first time, is made as the old, fast-moving red giant star sheds enormous quantities of material. The star has been sloughing off the tail material over the past 30,000 years. The resulting wake is some 13 light-years long—thousands of times the length of the solar system.

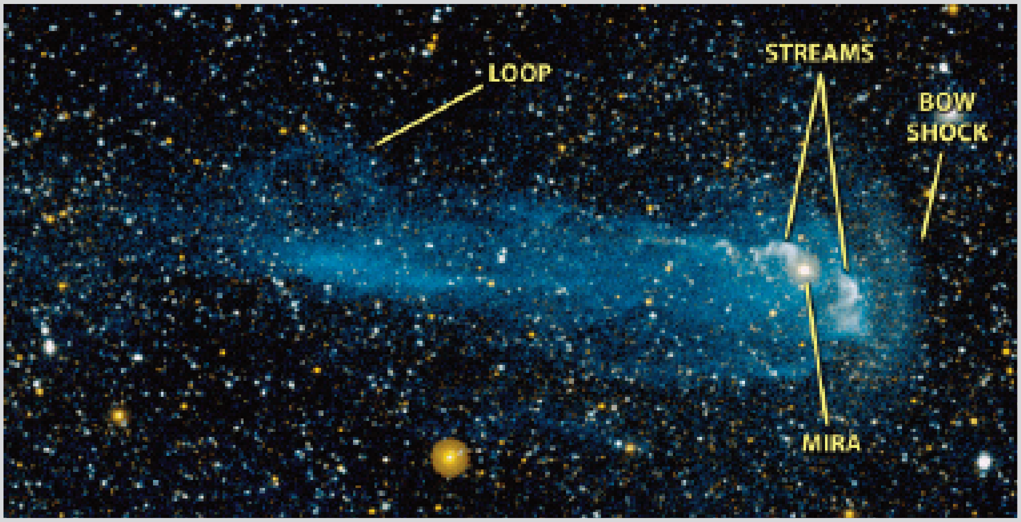
"This is an utterly new phenomenon to us, and we are still in the process of understanding the physics involved," said coauthor Mark Seibert, a postdoctoral associate at the Carnegie Observatories. "We hope to be able to read Mira's tail like a ticker tape to learn about the star's life."

Mira's tail offers a unique opportunity to study how stars like our Sun die and ultimately seed new solar systems. The tail sheds oxygen, carbon, and other elements that build new stars, planets, and possibly even life.

In addition to Mira's tail, GALEX discovered a bow shock, a buildup of hot gas in front of the star, and two thin streams of material coming out of the star's front and back. Astronomers think hot gas in the bow shock is heating up the gas blowing off the star, causing it to fluoresce with ultraviolet light. This glowing material then swirls around behind the star, creating a turbulent, tail-like wake. The process is similar to a speeding boat leaving a choppy wake.

"GALEX is so exquisitely sensitive to ultraviolet light and it has such a wide field of view that it is uniquely poised to scan the sky for previously undiscovered ultraviolet activity," said coauthor Barry Madore, Senior Research Associate at the Observatories. The fact that Mira's tail glows only with ultraviolet light might explain why other telescopes have missed it.

"We never would have predicted a turbulent wake behind a star that glows only with ultraviolet light," said Seibert. "Survey missions like the Galaxy Evolution Explorer can provide many surprises."



The red giant star Mira travels 291,000 miles per hour (468,000 kilometers per hour). Material sloughed off as the star hurls through space will be recycled into new stars, planets, and possibly even life.
(Image courtesy NASA/JPL-Caltech.)

This piece is adapted from a press release issued by NASA's Jet Propulsion Laboratory. Caltech, in Pasadena, CA, leads the Galaxy Evolution Explorer mission and is responsible for science operations and data analysis. NASA's Jet Propulsion Laboratory, also in Pasadena, manages the mission and built the science instrument. The mission was developed under NASA's Explorers Program, which is managed by the Goddard Space Flight Center in Greenbelt, MD. Researchers sponsored by Yonsei University in South Korea and the Centre National d'Etudes Spatiales in France collaborated on this mission. Graphics and additional information about the Galaxy Evolution Explorer are online at http://www.nasa.gov/galex/ and http://www.galex.caltech.edu/.

Cavorting with Cohesion

You are probably unaware of it, but your cells are working very hard to keep you alive. They repair wounds, fight infections, and, to keep fit, replenish themselves over and over by copying your genetic material and splitting into two new cells. This cell division is critical for your body to work smoothly. If gene-carrying chromosomes do not segregate properly, the wrong number of chromosomes can be passed on, leaving the body vulnerable to cancer and other diseases.

Recently, Elçin Ünal, Jill Heidinger-Pauli, and Doug Koshland at Carnegie's Department of Embryology discovered that a vital regulator of chromosome segregation does not work as scientists had thought. Their results challenge the current model of a process called cohesion, which is essential to cell division and DNA repair. The work, published in the July 13 issue of *Science*, has the potential to significantly advance our understanding of diseases such as cancer.

The Cellular Do-si-do

A cell's life cycle is an intricate choreography throughout four basic phases. During the G1 phase (the G stands for gap or growth), the cell's machinery hums along, performing its normal function until it begins to prepare for the next step—synthesis. At this S phase, the genetic blueprint—DNA inside the cell's nucleus—is duplicated. The double helix unwinds and a complementary strand is created alongside, making two identical daughters. To ensure the integrity of the genes, these twins, called sister chromatids, must remain connected until the exact moment that they are supposed to separate. And to accomplish this task, a protein called Eco1 triggers a complex of other proteins, dubbed cohesin, to keep the sister chromatids properly attached. This cohesion process operates across species.

In the next step, G2, the cell continues to grow and cohesion keeps the sisters bound. Mitosis follows. It is relatively brief but very dynamic, ending with the cell's dividing. The chromosomes condense, and the envelope encasing the nucleus breaks down. Fibrous structures called spindles form, cohesion is lost, and the sister chromatids detach. With the assistance of the spindles, the sisters move away from each other toward opposite ends of the cell. After they are safely separated, the spindles disappear, the nuclear encasement reappears around each of the chromosome sets, and the gelatinous material around the nucleus reforms into two new cells.

Out with the Old, In with the New

The process of cohesion makes sure that duplicated sister chromatids stay bound together until separation, and it helps tell which copy is which so that the sisters are correctly distributed into the two new cells. Cohesion is also a first responder. It is called to repair breaks in double-stranded DNA so that damaged ends don't randomly combine with other chromosome parts and cause defective cells that lead to disease.

Before the Carnegie study, it was believed that the cohesin proteins could establish connections between sister chromatids only during the synthesis phase of cell division, when DNA replicates, and that cohesin's role in cells with broken chromosomes was limited to binding and fixing the broken ends.

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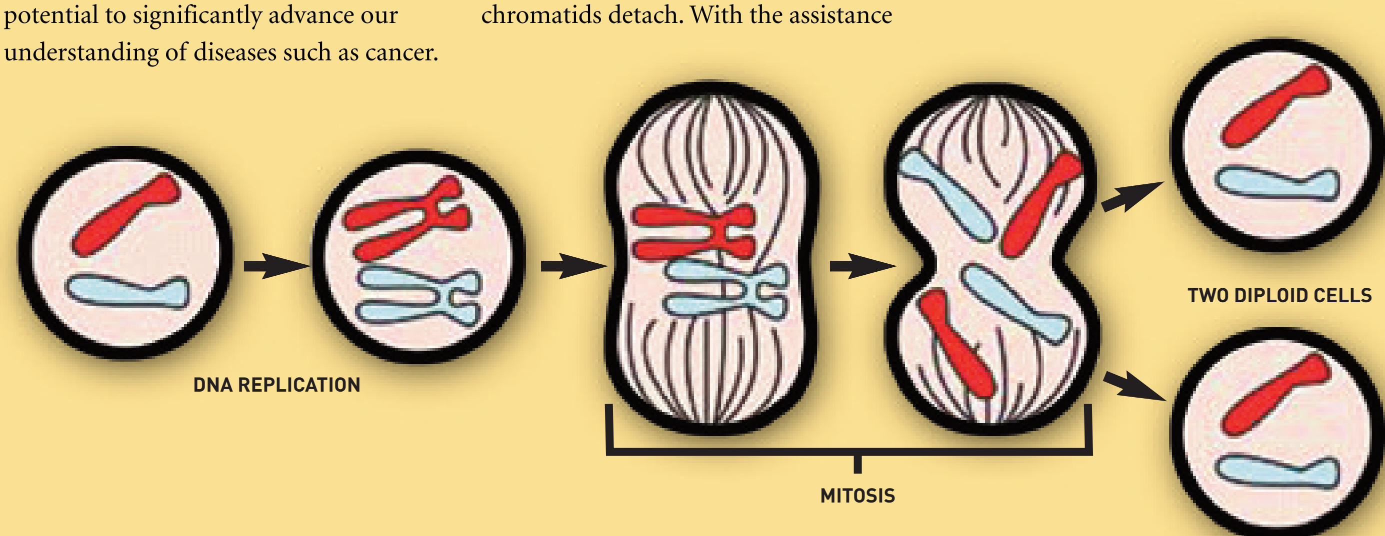


In this simplified schematic of mitosis, the chromosomes (red and blue) inside a cell nucleus duplicate to produce so-called sister chromatids. The sisters separate with the help of rope-like spindles, and the cell divides in two. Each new cell has a complete copy of genetic information.

(Image courtesy National Institutes of Health.)

Earthquakes Get a Break

Department of Terrestrial Magnetism's Paul Silver

The Great Earthquake of 1906 reduced San Francisco to hills of smoldering rubble and proved to be among the worst natural disasters in U.S. history. Similarly, another great quake generated 2004's Indian Ocean tsunami and exacted a death toll in the hundreds of thousands after walls of water inundated the coast. Both events serve as reminders that, underneath its quiet facade, the Earth is dynamic and often violent.

Plate tectonics, the movement of Earth's crust, has wrought the planet's landscape over billions of years. Yet there might be a lull in plate tectonics 350 million years from now, suggests the Department of Terrestrial Magnetism's Paul Silver. His theory of "intermittent plate tectonics," developed in collaboration with former postdoctoral fellow Mark Behn, argues that plate movement might have stopped and started numerous times throughout Earth's history—and might pause again.

"While we have always assumed that plate tectonics has never stopped, or even dramatically slowed down, such an occurrence is completely compatible with plate tectonic theory," said Silver.

The Earth's continents and oceans form the top surface of a mosaic of rigid plates that sit above the hotter and less dense mantle. Because rock becomes less dense when heated, the hotter material rises upwards, replacing cooler, denser material, which then sinks down to be heated again. This cycle, called convection, cools the mantle; the associated motion of plate tectonics is a particularly efficient way of venting heat.

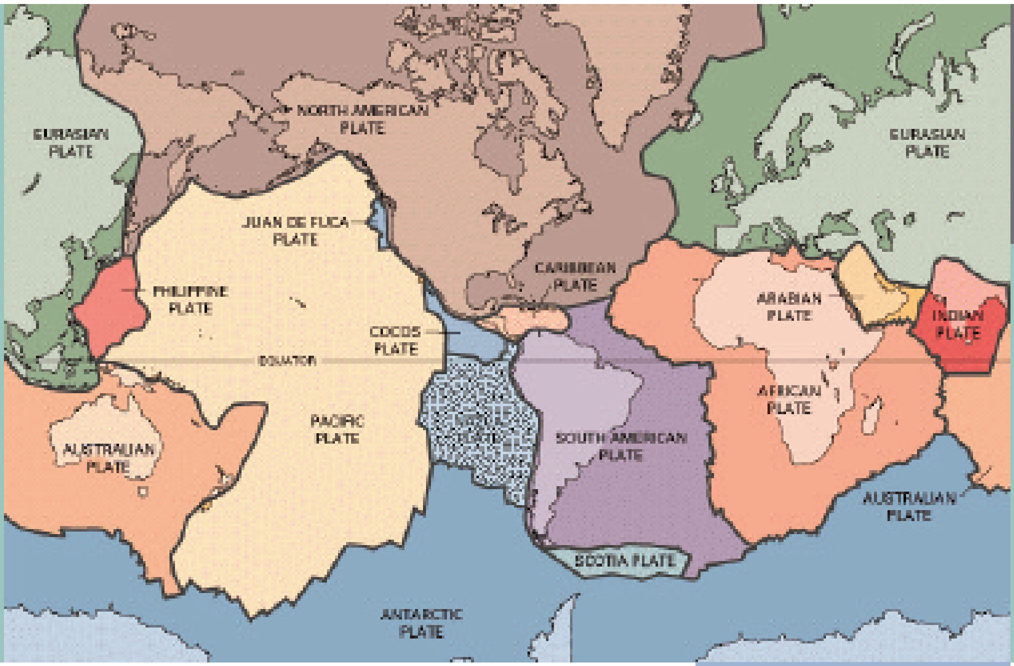
From time to time, the upwelling mantle can actually break apart the continental portions of the plates, resulting in the creation of new ocean floor and the formation of an oceanic basin. This basin widens a few centimeters each year, pushing the rifted continental plates apart from each other. Eventually, this basin may re-close, as did the predecessor of the Atlantic, or it may continue to grow at the expense of another basin; today, for example, the Atlantic Ocean basin is growing at the expense of the Pacific.

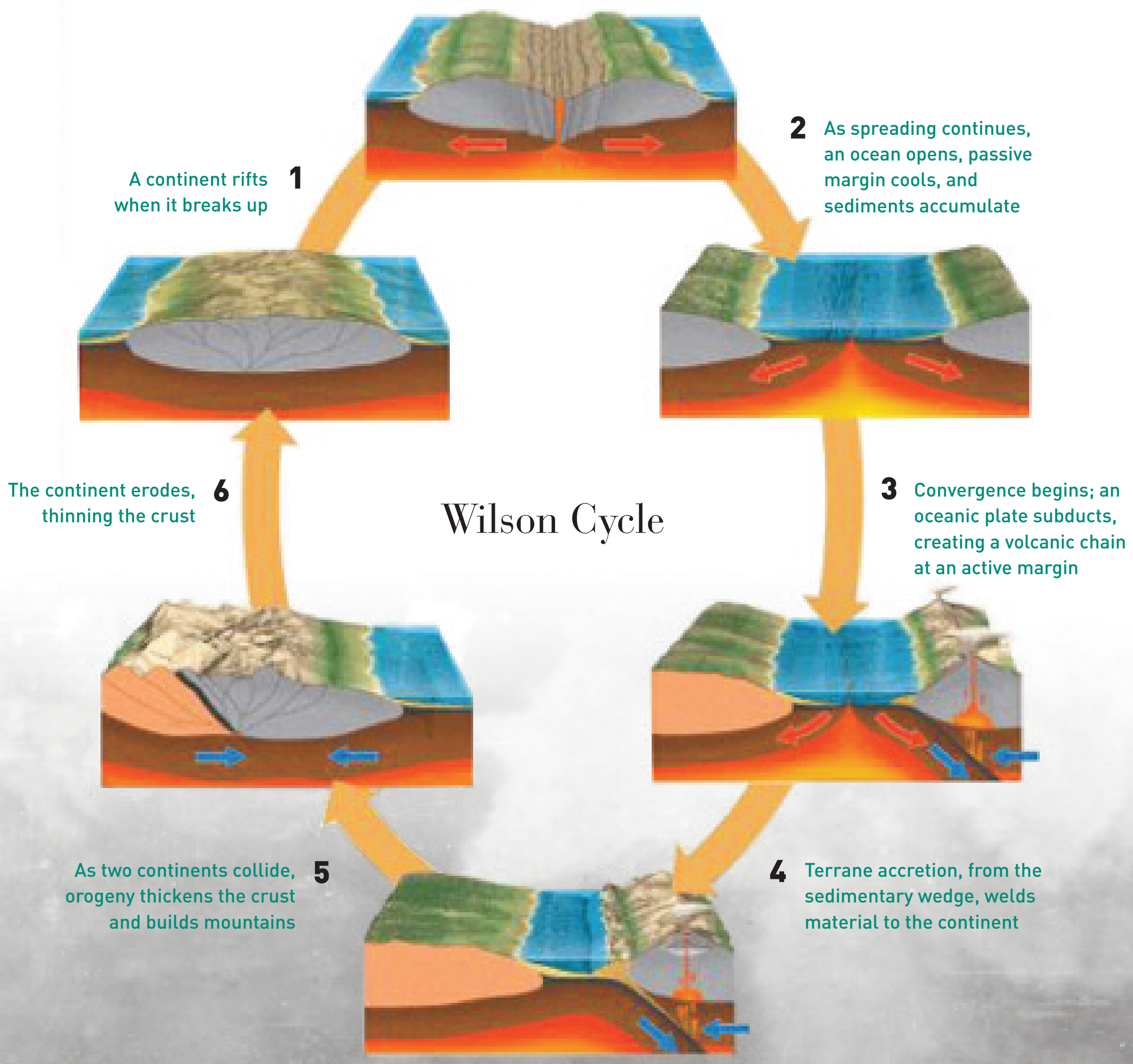
Subduction is the mechanism that returns plate material into the hot mantle. When two plates converge at a subduction zone, the denser oceanic plate slides underneath the edge of the other, forming an oceanic trench. As the plate sinks into the mantle, it generates earthquakes and forms mountain-building volcanoes. Subduction is also the means by which ocean basins eventually close. A new "supercontinent" is formed as the continental portions of the two plates meet. Subduction then ceases along that trench because the buoyant continental crust cannot subduct. Instead, the continents collide, creating mountain ranges such as the Himalayas in Asia. This cycle of ocean opening and ocean closing, continental breakup, and continental collision is called the Wilson Cycle, one of the basic tenets of plate tectonics theory.

Silver believes that the accumulation of these collisions could someday lock up plate movement globally. Closure of the Pacific Ocean basin, presently the site of almost all of Earth's subduction zones, could effectively stop the subduction process in 350 million years. As a result, mid-ocean ridges would shut down, and the oceanic crust would cool and thicken worldwide.

(Left) Flame engulfs the city of San Francisco following the magnitude 7.8 earthquake of April 18, 1906. The cataclysm left over 3,000 dead and almost 300,000 homeless. And the wreckage cost some $350 million. The process of plate tectonics—the movement of Earth's crust—is responsible for geologic events like earthquakes and volcanoes.
(Image courtesy USGS.)

(Right) The Earth's surface is composed of rigid tectonic plates that sit above hot and less dense mantle material. As less dense material rises, it is replaced by cooler, denser material, in a cycle called convection. Convection drives the movement of the surface plates slowly over time. The discipline of plate tectonics helps to explain Earth dynamics such as mountain formation, volcanic eruption, and earthquake distribution.
(Image courtesy USGS.)





One of the basic tenets of plate tectonics theory is a cycle of ocean opening and ocean closing, continental breakup, and continental collision called the Wilson Cycle, illustrated left.
(Image courtesy Vincent J.M. Salters, Florida State University, via Paul Silver.)

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Unable to release heat by plate tectonic convection, the mantle's temperature would rise significantly during a temporary period of less-efficient "stagnant-lid" or single-plate convection. This process is believed to occur on Venus. After such a hiatus in plate tectonics, the temperature increase could eventually result in widespread magmatic activity, restarting the plate tectonic process again.

It is almost universally assumed that when continental plates collide and shut down subduction, other subduction zones will appear elsewhere to conserve the length of subduction zones globally. As a result, it is thought that plate tectonics never stops.

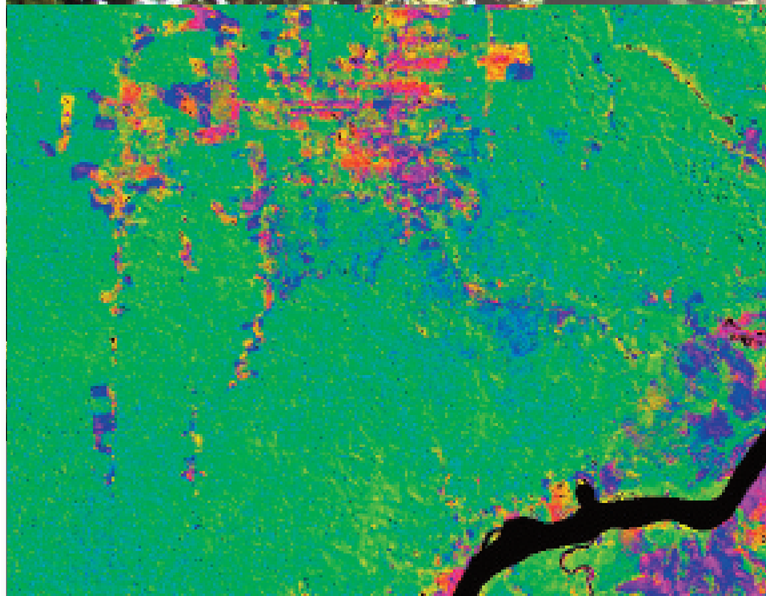
However, Silver points out that recent geologic history suggests otherwise. The Indian and African plates collided with the Eurasian to form the Alpine-Himalayan mountain chain 35-50 million years ago and shut down about 10,000 km of subduction. Yet no new subduction zones have since initiated in the oceans to the south of these two plates. This situation suggests that the re-initiation of subduction may lag behind the subduction-stopping continent-continent collisions by tens to hundreds of millions of years. This time gap would constitute a temporary cessation of plate tectonics.

There is evidence to suggest that a pause in plate tectonics has already played a role in Earth's geologic history. About 1 billion years ago, a supercontinent called Rodinia formed after the closure of a Pacific-type ocean basin. Evidence suggests that there was a corresponding lull in subduction at the time that may have been responsible for creating the unusual belt of granites that stretches from southwestern to northeastern North America, which in turn could indicate stagnant-lid conditions.

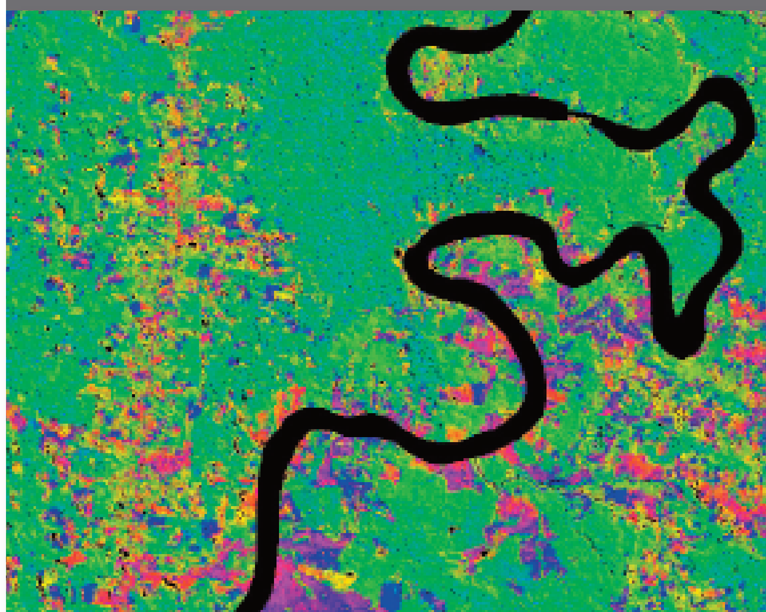
"If plate tectonics indeed starts and stops, then continental evolution must be viewed in an entirely new light, since it dramatically broadens the range of possible evolutionary scenarios," Silver remarked.

Is plate tectonics on Earth actually intermittent? Only deep time will tell. ☐

ANDREW FOSTER MURRAY



These Carnegie Landsat Analysis System images show two regions of the Peruvian rain forest (green). Blue and red indicate areas of deforestation.
(Images courtesy the Asner Lab, Department of Global Ecology, Carnegie Institution.)



"Our approach has improved over the past eight years, but relies on a core set of methods that have consistently worked."

Rain Forest Protection Works in Peru

Land-use policies in Peru have been key to tempering rain forest degradation and destruction in that country, reports an international study led by researchers at Carnegie's Department of Global Ecology. The scientists analyzed seven years of high-resolution satellite data that covered 79% of the Peruvian Amazon. Their work was published in the August 9, 2007, online edition of *Science*.

The scientists found that the government's program of designating specific regions for legal logging, combined with protection of other forests and the establishment of territories for indigenous peoples, helped keep large-scale rain forest damage in check between the years 1999 and 2005. However, the research also showed an increase in forest disturbance over the last couple of years of the study, primarily in two areas of the jungle where the forests are accessible by roads.

"We found that only 1 to 2% of this disturbance in Peru happened in natural protected areas," noted lead author Paulo Oliveira. "However, there was substantial forest disturbance adjacent to areas set aside for legal logging operations. This leakage of human activity outside of logging concessions is a concern."

Peru has about 255,000 square miles of tropical forests—an area a little larger than France. In 2001, the Peruvian government placed 31% of the managed forests into "permanent resource production." By 2005, a region about the size of Honduras (about 40,000 square miles) was put into long-term commercial timber production. In recent years, the rain forests have been experiencing increased human impacts, as they have in neighboring Amazon countries, but the extent of the damage over the region had not been thoroughly assessed using high-spatial-resolution satellite data until this study.

The scientists used the Carnegie Landsat Analysis System (CLAS), formerly used to detect logging activities in Brazil. CLAS is a satellite-based forest-damage detection system, which can penetrate the shielding upper layers of forest leaves to see consequences of logging activities below. The CLAS system can uncover forest changes at a resolution of less than 100 ft. x 100 ft. The core process behind CLAS is an advanced signal processing approach developed by study lead Greg Asner.

"Our approach has improved over the past eight years, but relies on a core set of methods that have consistently worked," Asner said. "We spent years developing them in Brazil, then went to Peru and completed this study in only a year. We are now operating over Borneo. Our approach is proving a good way to monitor rain forest disturbance and deforestation anywhere in the world."

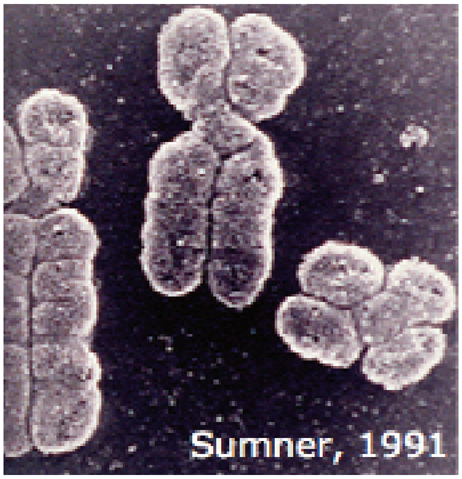
The researchers found that, between 1999 and 2005, disturbance and deforestation rates averaged only 244 square miles and 249 square miles per year, respectively. About 86% of the damaged Peruvian areas were concentrated in two regions—in the Madre de Dios, east of Cuzco, and in the central eastern part of the country near Pucallpa. Most of the rain forest damage (75%) was found within 12.5 miles of the nearest roads. However, even within those limits, forests set aside by the government were more than four times better protected than areas not designated for conservation.

"This is another study from the Carnegie group showing the world how tropical forests can be systematically monitored amazingly quickly and at a reasonable cost," said Michael Wright of the John D. and Catherine T. MacArthur Foundation, which helped support the research. "I foresee that CLAS-like satellite analysis systems will become the standards routinely used by local conservation agencies to track rain forest disturbances and deforestation in the future." □

This work was made possible by grants from the John D. and Catherine T. MacArthur Foundation and the Gordon and Betty Moore Foundation.

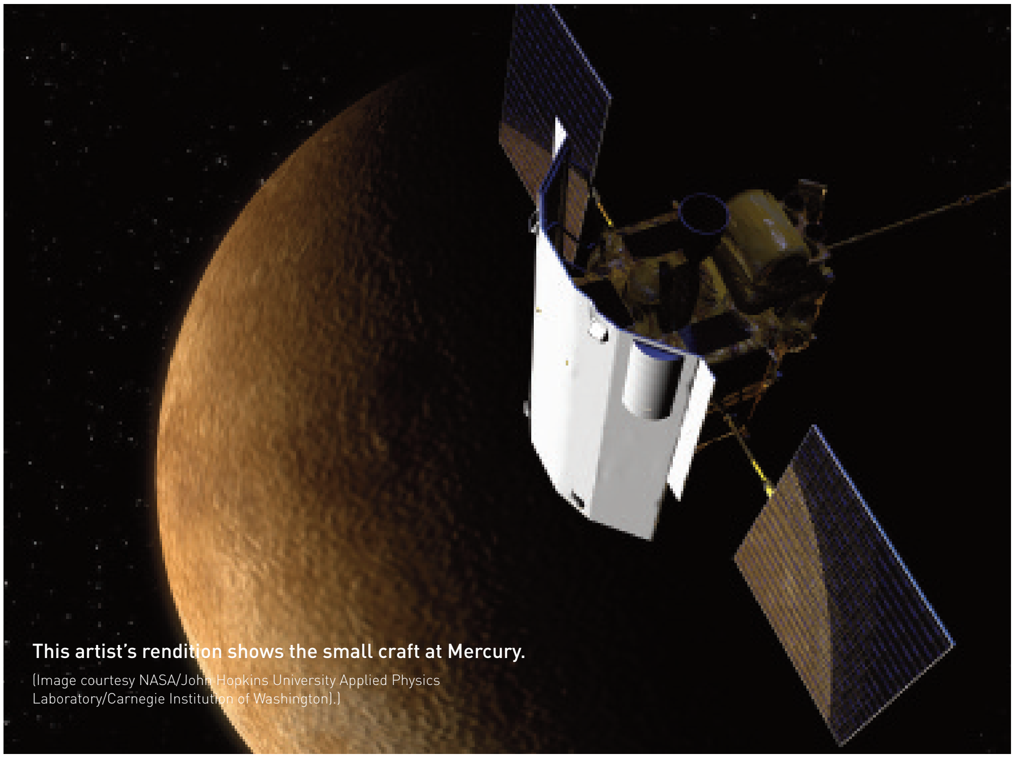
Continued from Page 9

Through a series of experiments on budding yeast, the Carnegie team found that cohesins could establish attachments between sister chromatids independent of DNA replication during the S phase. They also discovered that, when one chromosome breaks, the Eco1 protein generates cohesion-dependent attachments between sister chromatids not only at the site of the broken DNA but throughout the genome on *unbroken* areas of DNA as well. The latter result is the first evidence suggesting that Eco1 and cohesins are involved in guarding chromosomes across the entire genome to make sure that all remains shipshape and big problems don't arise. □



Three pairs of sister chromatids are held together by "invisible" cohesins in this scanning electron microscopy image. The chromatids are joined along their entire length. When the cohesins begin to be removed, the chromosomes look more like an X rather than parallel lines.

(Image from Sumner, A.T., Scanning electron microscopy of mammalian chromosomes from prophase to telophase, *Chromosoma* 100, 410-418, 1991; courtesy Doug Koshland.)



This artist's rendition shows the small craft at Mercury.

(Image courtesy NASA/John Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington).)

Stay Tuned for Mercury Flyby

MESSENGER—the MErcury Surface, Space ENvironment, Geochemistry, and Ranging mission—will have its first close look at the innermost planet on January 14, 2008. It will fly by Mercury along its trajectory to orbit insertion, which is scheduled for March 18, 2011. Mercury is the least studied terrestrial planet. Sean Solomon, director of Carnegie's Department of Terrestrial Magnetism, is the mission's principal investigator. MESSENGER will address six broad scientific questions: Why is the planet so dense? What is its geologic history? What are the structure and state of the planet's core? What is the nature of Mercury's magnetic field? What is the unusual material at the poles? And what volatiles are important? The only other mission to visit the planet was Mariner 10, more than 30 years ago. □

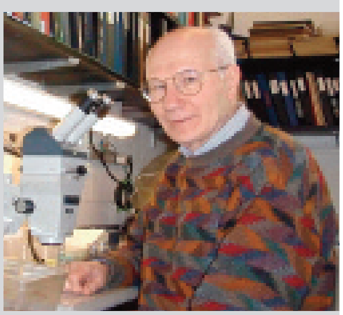
Carrying on the tradition of First Light and the Carnegie Academy for Science Education (CASE), Steve Farber at Embryology received grants from the U. of Maryland, Baltimore County, and the Clark Family Foundation to launch a program that brings a week-long, hands-on zebrafish unit to Baltimore City and County schoolchildren. The unit is designed to excite elementary school students about science while teaching them basic genetics. This outreach program blends aspects of CASE/First Light and Project BioEYES and offers the expanded curriculum to schools in Philadelphia, Baltimore, and Washington, DC. CASE/First Light is the Carnegie science outreach program created by former Carnegie president Maxine Singer, and Project BioEYES is a science outreach program developed at Thomas Jefferson U. by Farber during his tenure there. □

Farber's science outreach program uses zebrafish as a hands-on instructional tool.

InBrief

❶ Carnegie trustee John Crawford

❷ Vice chairman of the Carnegie board, Suzanne Nora Johnson



❸ Joe Gall

Trustees and Administration

❶❷ Carnegie president **Richard A. Meserve** participated in a reception with French scientific leaders at a gathering hosted by Carnegie trustee **John Crawford** in Paris, France, on June 14. He chaired a meeting of the National Academies' Nuclear and Radiation Studies Board July 17 and 18 and made a presentation on the prospects for nuclear power at a reception hosted at the home of Carnegie trustee **Suzanne Nora Johnson** and her husband, David, in Los Angeles on Sept. 6. He then chaired and spoke at a forum on nuclear safety issues at the IAEA's General Conference in Vienna, Austria, on Sept. 17.

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Vickie Tucker, administrative coordinator/accounts payable in the accounting department, retired in Sept. after 16 years of service.

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Science writer and publications coordinator **Matt Wright** left Carnegie for a position as ocean science outreach specialist at SeaWeb/COMPASS, an organization dedicated to advancing and communicating marine conservation issues.

Embryology

Department director **Allan Spradling** lectured at the U. of Oregon student-organized Mini Symposium on Stem Cells.

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❸ On July 27 **Joe Gall** delivered the Distinguished Alumni Lecture at the Marine Biological Laboratory in Woods Hole, MA. He also delivered the opening lecture and received the 2007 Wilhelm Bernhard Medal at the 20th Wilhelm Bernhard Workshop: International Conference on the Cell Nucleus in St Andrews, Scotland, Aug. 27-31.

—

Yixian Zheng was the keynote speaker at the Gordon Research Conference on Motile & Contractile Systems, July 8-13, and an invited speaker at the Institute of Molecular Biology in Taipei, Taiwan, Aug. 27.

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July 12-15, **Marnie Halpern** attended the 5th European Zebrafish Genetics and Development Meeting in Amsterdam, the Netherlands.

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Steve Farber instructed a two-week EMBO course on Animal Models for Development, Physiology, and Disease at the U. of Sheffield in the UK. He was also a session chair and speaker at the FASEB Summer Conference on Lipid Droplets: Metabolic Consequences of Stored Neutral Lipids. Farber also presented lectures at the Veterans Affairs Medical Center, Baltimore, MD; the U. of Maryland, Baltimore County; an Experimental Biology meeting session on Disease Connections, Washington, DC; Lehigh U.; the Mount Sinai School of Medicine; and the U. of Utah.

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In June, **Jeffrey Han** gave an invited lecture at the FASEB Summer Research Conference on Mobile Elements in Mammalian Genomes.

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Postdoctoral fellow **Todd Nystul**, in the Spradling lab, gave a talk in July at the Sixteenth Ovarian Workshop: Ovarian Differentiation, Development, Function and Persistence in San Antonio. The lab's **Benjamin Ohlstein** presented his work on *Drosophila* mid-gut stem cells at the International Notch Meeting in Athens, Greece.

—

Halpern lab postdoctoral fellow **Mary Goll** presented a poster at the Aug. Gordon Research Conference on Epigenetics. In May, **Dan Gorelick** of the lab attended the inaugural meeting of the Organization for the Study of Sex Differences and presented a poster. In June, **Yung-Shu Kuan** presented a poster at the Gordon Research Conference on Developmental Biology.

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Koshland lab postdoctoral fellow **Elçin Ünal** presented her work at the Gordon Research Conference on Chromosome Dynamics in Aug. Graduate students **Jill Heidinger** and **Margaret Hoang** presented their work at the FASEB Summer Research Conference on Genetic Recombination & Genome Rearrangements, July 28-Aug. 2.

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In June, graduate student **David Martinelli** in the Fan lab won 1st prize in the poster competition at the Pan-American SDB Congress meeting in Cancun, Mexico.

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Farber lab's **Rosa Miyares** received a predoctoral National Research Service Award from the NIH for her proposal, "Fatty Acid Metabolism and Signaling during Zebrafish Development." The award provides at least three years of funding. Postdoctoral fellow **James Walters** won an award for his poster at the FASEB Summer Research Conference on Lipid Droplets: Metabolic Consequences of Stored Neutral Lipids.

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Recent Arrivals: Shauna Linn, a student in the Ingenuity Project at Baltimore Polytechnic High School, joined the Halpern lab. Recent Brown U. graduate **Alison Singer** has joined the Gall lab.

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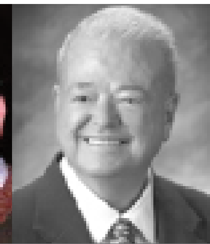


(Left) Fred Kiviat
(Right) Gilbert Mead

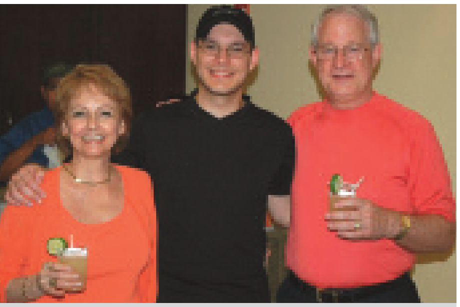
The Carnegie Institution Memorial Fund

The Carnegie Institution accepts gifts in memory of individuals to assure long-term support for the scientific mission of the institution. Since May 1, 2007, the Carnegie Institution Memorial Fund received gifts in memory of Carnegie supporter Fred Kiviat and Gilbert Mead, husband of trustee Jaylee Mead. Jaylee and Gilbert Mead were inducted into the Edwin Hubble Society in May. Hubble members have made lifetime contributions of $1 million or more.

Former Embryology scientist **Nina Fedoroff** has won the 2006 National Medal of Science and has been named science and technology advisor to Secretary of State Condoleezza Rice.

(Above) Former Embryology scientist Nina Fedoroff

Recent Departures: Staff Associate **Alex Schreiber** accepted a position at Notre Dame college in Baltimore, MD, in the Department of Biology. **Michael Buszczak** left the Spradling lab for Dallas, TX, in Aug. to begin work as an assistant professor of molecular biology at the U. of Texas Southwestern Medical Center. Postdoctoral fellow **Liquan Cai** left the Brown lab for a position at the U. of Illinois College of Medicine, Department of Pharmacology. Postdoctoral fellow **Hongjuan Gao** left the Gall lab in Sept. for the U. of Maryland School of Medicine. Technician **Jaya Kuchibhotla** also left that lab. Spradling lab's **Benjamin Ohlstein** accepted the position of assistant professor in the Department of Genetics and Development at Columbia U. Medical Center in Oct.



❹ Outgoing GL director Wes Huntress (right), poses with his son, Garret, and his wife, Roseann, at the party held in his honor.

(Image courtesy Margie Imlay.)

❺ New director of the Geophysical Laboratory, Russell Hemley, and his wife, Amanda, attend Wes Huntress's thank-you party.

(Image courtesy Margie Imlay.)

❻ Doug Rumble is third from left, with Joe Farman, Jon Shanklin, and Brian Gardiner, discoverers of the Antarctic ozone hole (left to right).

(Image courtesy Doug Rumble.)

Geophysical Laboratory

❹ ❺ A party was held this summer for **Wes Huntress**, as he stepped down as director of the Geophysical Laboratory. He led the department from 1998 to 2007. **Russell Hemley** officially began the directorship July 1.

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❻ **Doug Rumble** presented a paper on the ^{17}O geochemistry of Hadean- and Archean-age rocks at the Frontiers in Mineral Sciences 2007 meeting in Cambridge, UK, in June. He also visited the British Antarctic Survey, where he met the discoverers of the Antarctic ozone hole. He gave seminars there and at the Planetary and Space Sciences Research Institute at the Open U.

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Bjørn Mysen gave an invited lecture at the Institute for Study of the Earth's Interior, Okayama U., Misasa, Japan, in Aug., and an eight-lecture series there in Sept.

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Marilyn Fogel celebrated 30 years at the lab. Check out her Web site, http://fogel.gl.ciw.edu/, for a complete story of her life at GL. The lab presented her with a Redskins shirt to commemorate the milestone.

Ho-kwang (Dave) Mao presented a talk at the Chemistry Department of Tsinghua U., Beijing, in June, and the talk "High Pressure—A New Dimension" at Peking U. in July.

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In June, **Robert Hazen** presented the NSF's Directorate for Biological Sciences Distinguished Lecture, "From Geo to Bio: The Emergence of Biochemical Complexity." He also lectured at the Brookings Institution's seminar on Science and Technology: Politics and Issues and was a participant in the first Kavli Futures Symposium, "The Merging of Bio and Nano," held in Greenland, in June. Hazen was also featured on *NOVA scienceNOW's* "Emergence" episode in July.

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George Cody presented invited talks on soft X-ray microanalysis of cometary organics at the annual meeting of the Microscopical Society of Canada in Edmonton in June and the fall meeting of the American Chemical Society in Boston in Aug. He also participated in the origins of life workshop at the Santa Fe Institute.

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Nabil Boctor gave an invited talk on water in Martian meteorites at the Goldschmidt Conference in Cologne, Germany, in Aug.

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Postdoctoral fellow **Jim Cleaves** presented a talk at the American Chemical Society national meeting in Boston in Aug.

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Postdoctoral fellow **Dominic Papineau** presented his stable isotope work at the Goldschmidt Conference in Cologne, Germany, and an invited seminar at the U. of Helsinki. In June, he received a postdoctoral fellowship from the Quebec government.

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Postdoctoral fellow **Matt Schrenk** went on an expedition with various researchers to study microorganisms in hydrothermal sediments off the Aeolian Islands of Sicily in late May and early June.

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Postdoctoral fellow **Hikaru Yabuta** gave an invited talk on Stardust organics from Comet Wild at the Japan Geoscience Union Meeting, Makuhari, Japan, in May. She gave a talk at the annual meeting of the Meteoritical Society in Tucson, AZ, in Aug. as the anchor speaker and received the Best Young Scientist Award from the Japanese Association of Organic Geochemists in July. She received a postdoctoral fellowship from the Japan Society for the Promotion of Science.

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Recent Arrivals: Panchapakesan Ganesh (Carnegie Mellon U.) has been appointed postdoctoral associate to work with Ronald Cohen. Postdoctoral associate **Mihaela Glamoclija** (Indiana U.) arrived Sept. 1, to work with Andrew Steele. Robert Hazen's NASA-sponsored research effort on mineral-molecule interactions was bolstered by the arrival of chemists **Caroline Jonsson** and **Christopher Jonsson** from Sweden and senior geology major **Kim Cone** from George Mason U. Former GL postdoc **Michelle Minitti** (Arizona State U.) returned to GL for one year as a visiting investigator to work with Yingwei Fei. **Fang Peng**, from Sichuan U., has been appointed visiting scholar to the GL and HPCAT to work with Dave Mao and others. **Anurag Sharma**, a former postdoctoral associate, will work with Rus Hemley and others. **Dimitri Sverjensky** (Johns Hopkins U.) has been appointed senior research fellow to work with Robert Hazen.

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Recent Departures: Postdoctoral fellow **Pierre Beck** returned to France in Aug. for a position as Maître de Conférence at the Laboratoire de Planétologie de Grenoble. Postdoctoral fellow **Andrey Bekker** accepted a position as assistant professor at the U. of Manitoba. He was also appointed visiting investigator beginning Sept. 1. Former postdoctoral associate **Tim Benjamin** took a position as beamline scientist at NIST. **Liwei Deng**, a former predoctoral associate, returned to Southwest Jiaotong U., Chengdu, Sichuan, China.

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During the summer the Cody lab hosted research interns **Miriam Hinman** (Harvard U.), **Timothy Peng** (Montgomery Blair Science Magnet), and **Brian Smith** (Salisbury State).

Global Ecology

Department director **Chris Field** participated in the Western Governors' Association conference in Deadwood, SD, in June regarding climate change. He gave the keynote address at a conference in Davis, CA, about climate change and the California wine industry. Field traveled to Kruger National Park in South Africa for a meeting of the Global Carbon Project committee and a conference on Africa's carbon balance.

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Joe Berry participated in the Cloud and Land Surface Interaction Campaign and the Cumulus Humilis Aerosol Processing Study summer field campaigns in the southern Great Plains region in June. He gave a talk at the plenary session at the XIV International Congress of Photosynthesis in Glasgow in July.

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Larry Giles, in the Berry lab, collected data in South Africa and Mali to understand the carbon balance of the African continent. He also maintained the system he installed in Kruger National Park.

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Greg Asner and **Robin Martin** presented findings from the Carnegie Airborne Observatory (CAO) program at the Hawaii Conservation Conference in Honolulu in July. The CAO team spent the summer searching for invasive species in Hawaiian rain forests from the air and ground.

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Molecules, Microbes, and the Interstellar Medium: A Symposium Honoring the Geophysical Laboratory Directorship of Wesley Huntress

To recognize the role that Huntress has had at the lab in forging new scientific directions, the GL is hosting a special two-day symposium October 25 and 26, 2007, at the Greenewalt Building. For more information see www.gl.ciw.edu/

Eben Broadbent and **Angelica Almeyda**, of the Asner lab, worked in Peru and Bolivia during the summer to understand how soils contribute to land-use decision-making regarding tropical forests and clearings.

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In June, **Ken Caldeira** attended a London meeting on the interactions between biodiversity and climate change organized by the Royal Society. He also visited the U. of Bristol regarding work in Earth system modeling. In July, he taught at the Urbino Summer School in Paleoclimatology in Urbino, Italy. Caldeira gave a keynote talk about the geologic context for understanding ocean acidification at the Aug. Goldschmidt Conference in Germany. Also in Aug., he presented work on geoengineering Earth's climate at a meeting organized by the World Federation of Scientists in Italy. The Caldeira lab computer cluster moved to the Stanford Center for Computational Earth & Environmental Science.

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Claudia Tebaldi from the National Center for Atmospheric Research in Boulder, CO, was a visiting researcher during the summer, working with former postdoctoral fellow **David Lobell**.

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In Aug., **Greg Asner**, **Nona Chiariello**, **Chris Field**, **Noel Gurwick**, **Cho-ying Huang**, **Claire Lunch**, **Robin Martin**, and **Paulo Oliveira** participated in the Ecological Society of America's annual meeting in San Jose, CA.

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This year's summer interns for the Jasper Ridge Global Change Experiment were **Michael Alyono**, **Jinyoung Choe**, **Dana Feeny**, **Sarah Tetlitsky**, and **Carol Tran**.

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Recent arrivals: Christian Andreassi joined the Field lab as a technician. Technicians **Matt Colgan**, **John Clark**, and **Tim Varga** joined the Asner Lab. **Rob Genova** is the new IT specialist.

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Recent departures: From the Field lab, **Ben Houlton** left for a faculty position at UC-Davis; **Mark Rogers** left in Apr.; **Miko Tsukimoto**, in June. **Halton Peters** left in Aug. to work with an investment bank. From the Asner lab, **Matt Jones** left for NOAA in Santa Cruz, CA, in Aug. Visiting researcher **Masahiro Negishi** returned to his work at ImageONE in Japan in Aug. **Rebecca Raybin** left in June.

—

Earl Ellis, visiting scholar from the U. of Maryland, Baltimore County completed his sabbatical.

Observatories

In June, Observatories director **Wendy Freedman** gave an invited colloquium at the Aspen Center for Physics. She co-organized an Aspen workshop on Supernovae as Cosmological Distance Indicators and participated in an external advisory review board for the Kavli Institute for Cosmological Physics, where she spoke to science journalists about the future of optical astronomy. In July, Freedman gave a talk at Caltech's Nuclear Astrophysics: Beyond the First 50 Years conference. During Aug., she gave a talk at the A Century of Cosmology: Past, Present and Future conference in Venice, Italy.

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In June, staff astronomer **Steve Shectman** chaired the mid-term review of the Extremely Large Telescope design study, held at European Southern Observatory (ESO) headquarters in Garching, Germany. The study is undertaken by institutes and companies in Europe and Israel and led by ESO.

—

Spitzer Fellow **Jane Rigby** participated in the Obscured AGN Across Cosmic Time workshop in Seeon, Bavaria, in June. She gave an invited talk at the Space Telescope Science Institute in Baltimore and attended an NSF/ADVANCE workshop at U. Maryland, Baltimore County on increasing the participation of women and minorities in science. In Aug., she served on the Infrared Science Archive (IRSA) Users Group at IPAC in Pasadena.

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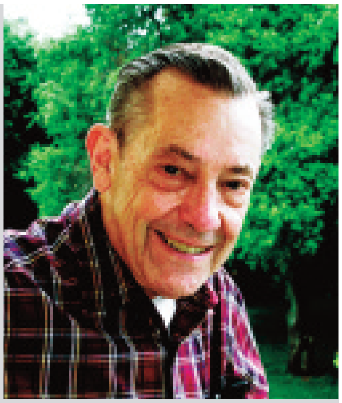
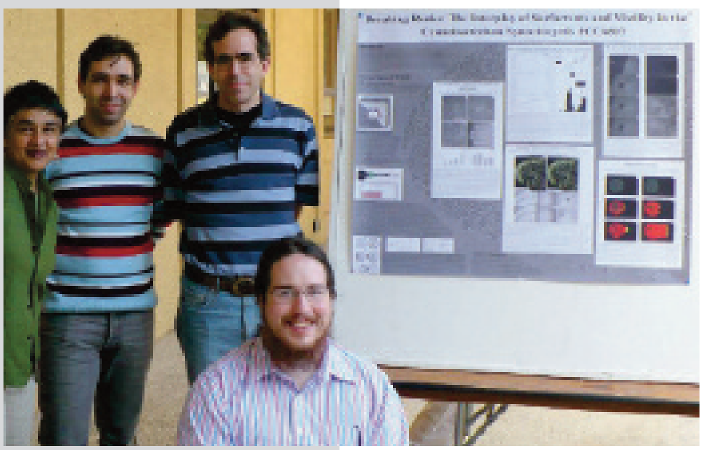
Come to the Observatories Open House!

The Carnegie Observatories welcomes the Southern California community to their open house in November. Explore the past, present, and future of Carnegie's world-class astronomy through exhibits, tours, films, and demonstrations. Enjoy refreshments, music, and fun!

Sunday, November 4, 2007
1:30 p.m. to 4:30 p.m.
RSVP to 626-304-0250 or rsvp@ociw.edu
813 Santa Barbara Street, Pasadena, CA, 91101



❼ Winslow Briggs



❽ Devaki Bhaya poses with Tiago Requeijo and Doron Levy (math department) with Matt Burriesci (kneeling) in front of his poster.

In July, Carnegie-Princeton Fellow **Inese Ivans** participated in the First Stars III meeting in Santa Fe, NM, and the Nuclear Astrophysics meeting in Pasadena, attended by other Carnegie astronomers.

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In June, Carnegie-Princeton Fellow **Juna Kollmeier** lectured at the MIT Kavli Science Journalism Workshop on The Universe, offered by the Knight Science Journalism Fellowships program. In Aug., she spoke at the workshop Dark Matter and Dark Energy in Beijing, and the Legacy of Multi-wavelength Surveys in Xining, China.

—

Francesca Matteucci (U. Trieste) visited the Observatories in June. She collaborated with Andy McWilliam and presented a colloquium, "The Chemical Evolution of the Milky Way and its Satellites." **Stéphane Charlot** (Institut d'Astrophysique de Paris) visited during July and presented a colloquium on the "Extraction of Physical Parameters from the UV, Optical, and IR Spectra of Galaxies." Scientific visitor **Joshua Barnes** (U. Hawaii) arrived in late July to spend Aug. and Sept.

Plant Biology

Department director **Chris Somerville** was awarded an honorary doctorate by the U. of Guelph and was named a fellow of the American Society of Plant Biologists (ASPB). In Oct., Somerville, with Jay Keasling, received BayBio's Visionary Award for bringing bioenergy research institutes to the region.

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❼ Director Emeritus **Winslow Briggs** received the 2007 Adolph E. Gude, Jr. Award from the ASPB for his outstanding service to the plant science community.

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Kathy Barton spoke in the President's Symposium at the ASPB meeting in Chicago in July.

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In June, **Shauna Somerville** gave a talk at the International Conference on Arabidopsis Research in Beijing. In July, she spoke at the American Society of Plant Biologists annual meeting in Chicago and she gave a talk at the Canadian Plant Genomics Workshop, Vancouver.

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Arthur Grossman received a five-year appointment to the graduate faculty of the School of Marine Sciences of the U. of Maine. He presented work on the *Chlamydomonas* genome at the 14th International Congress on Photosynthesis in Glasgow, in July. Grossman taught in the workshop Do Species Matter in Microbial Communities? in Bozeman, MT, in July/Aug.

—

Wolf Frommer was appointed a visiting professor at Lawrence Berkeley National Lab. In Feb., he spoke at Stellenbosch U., South Africa, and, in Mar., at the Max Planck Institute in Golm. He gave a talk at UC-Davis in May and a plenary talk at the International Conference on Plant Vascular Biology in Taipei in July. In Sept., Frommer gave a talk at the Gordon Conference on Metabolic Engineering at San Francisco State U. and a plenary talk on FRET sensing at the ComBIO meeting in Sydney, Australia.

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Zhiyong Wang gave a workshop at the International Conference on Arabidopsis Research in Beijing in June. In July, he spoke at the 19th International Plant Growth Substances Association conference in Mexico; in Aug., he spoke in San Francisco at the 8th International Conference on Mass Spectrometry in the Health & Life Sciences: Molecular & Cellular Proteomics.

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David Ehrhardt gave a talk at the International Conference on Arabidopsis Research in Beijing.

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Sue Rhee gave a talk at Iowa State U. in Mar., and in Apr. she gave talks at the Plant Biotechnology Institute, Saskatoon, Canada. In Sept., she attended the Solanaceae Genome Workshop on Jeju Island, South Korea, and the Korea Genome Organization Conference in Seoul, where she gave invited seminars.

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❽ In May, **Devaki Bhaya** gave a seminar and taught in the Plant and Microbial Development course at Temasek Life Sciences Laboratory, Singapore. She presented a July seminar at Lawrence Berkeley National Lab and taught a course at Hopkins Marine Station, Stanford U.

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Postdoctoral associate **Friederike Hoermann**, of the Frommer lab, gave a plenary talk at the Photosynthesis 2007 July meeting in Scotland. Postdoctoral associate **Dominique Loqué** gave talks at Monsanto and a plenary talk at the International Workshop on Plant Membrane Biology in Spain in June. Postdoctoral associate **Sakiko Okumoto** gave a plenary talk at the Symposium on Plant Cell Biology at the Max Planck Institute in Germany in Sept.

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Eva Huala and **Donghui Li**, members of the Rhee TAIR group, gave a workshop at the International Conference on Arabidopsis Research in Beijing in June.

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Matthew Burriesci, in the Bhaya lab, presented his honors thesis titled "Breaking Ranks: The Interplay of Surfactants and Motility in the Cyanobacterium *Synechocystis* PCC6803," for which he was awarded a Stanford U. 2007 Firestone Medal for Excellence in Undergraduate Research. He joined the graduate school at Stanford this fall.

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Presenting talks at the International Conference on Arabidopsis Research in Beijing were **Joshua Gendron**, a graduate student in the Wang and Somerville labs, and postdoctoral research associate **Stephan Wenkel**, a member of the Barton lab.

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Former postdoctoral fellow **Richard Jorgensen** of the U. of Arizona received the 2007 Martin Gibbs Medal of ASPB for pioneering advances in plant science investigation.

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Recent arrivals: Arriving from Michigan State U., **Clarissa Bejar** joined Chris Somerville's lab in June as a visiting researcher. **Shundai Li**, a new postdoctoral associate, joined Shauna Somerville's lab in Sept. from UCLA. **Dirk Steinhauser** arrived from Max Planck Institute of Molecular Plant Physiology in May to join the Grossman lab as a visiting researcher. **Vivian Lanquar**, U. Orsay, France, joined the Frommer lab in Sept. Three postdoctoral associates joined the Frommer lab in July: **Guillaume Pilot** and **Rejane Pratelli** from the U. of Montpellier, France, and **Yi-Shin Su** from UC-Davis. **Choon Kiat Sim**, a student from the Stanford U. School of Medicine, is doing a rotation in the Frommer lab,

Twenty-seven interns, ranging from high school students to master's degree students, were part of this year's Plant Biology's intern program led by Meghan Sharp (Barton lab). Interns came from area high schools, Stanford U., San Jose State U., and area community colleges. Students attended a weekly research seminar in which faculty from the department and Stanford described ongoing research. The program concluded with a Friday afternoon poster session.

and undergraduate student **Todd Yecies** has joined the lab as an intern. Visiting Ph.D. student **Ruiju Wang** arrived at the Z. Wang lab in Sept. from Nankai U. In Sept. postdoctoral associate **Kun He** arrived from Peking U. to the Rhee group. Postdoctoral associate **Ozgur Ozturk** joined the Rhee group in Aug. from Ohio State U. **Sherri Parr** joined TAIR as a curator in July from Dominican U. of California. Arriving to the Ehrhardt lab as a visiting researcher is **Masayoshi Nakamura** from the Nara Institute of Science and Technology, Japan. The Bhaya lab welcomed graduate students **Adriano Caminho** and **Michelle Davison**. **Payal Joglekar** completed her master's thesis from U. of Pune, India, and joined the lab as a volunteer. Graduate student **Sheila Ingemann Jensen** visited the Bhaya lab this summer and will return in Oct. to work on hot spring microbes, jointly supervised by Arthur Grossman. **Soo-Hwan Kim** (former postdoc in the Wang lab) of Yonsei U. and graduate student **Yuhee Chung** of Seoul National U., Korea, visited the Wang lab for a one-month stay in Aug.

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The late former director of the department, George Wetherill, was presented with numerous awards for his work over the years. Recently, the Wetherill family donated his scientific medals to the institution.

Recent departures: Visiting postdoctoral associate **Miguel Carvalho** left Shauna Somerville's lab to return to Portugal in Aug. Carnegie fellow **Thijs Kaper** left the Frommer lab in Sept. for Genencor in Palo Alto, CA. Postdoctoral associate **Sakiko Okumoto** left the lab to be an assistant professor at Virginia Tech. Lab technician **Kate Chabarek** left in Aug. to be a plant protection officer with the USDA in Southern CA. Postdoctoral fellow **Srinivas Gampala** left the Wang lab for Edenspace Corp. in Kansas, and lab assistant **Nathan Gendron** left for graduate study at San Francisco State U. Curator **Hartmut Foerster** left the Rhee group in Aug. for the U. of New Brunswick, Canada. Curator **Christophe Tissier** left that group in Sept. for a new company in Santa Cruz, CA. Postdoctoral associate **Anne-Soisig Steunou**, of the Bhaya lab, will start her own lab at the Centre de Génétique Moléculaire of the Centre National de la Recherche Scientifique, France.

Terrestrial Magnetism

Sean Solomon gave presentations on the MESSENGER mission and the recent flyby of Venus at a July meeting of the Venus Express Science Working Team in Rome and, in Sept., at the 7th International Conference on Low-Cost Planetary Missions in Pasadena, CA, and at the Discovery at 15 workshop at NASA Marshall Space Flight Center in Huntsville, AL. Also in Sept., he chaired the Advisory Council to the Southern California Earthquake Center and he delivered an Earth and Space Sciences Colloquium at JPL.

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Former Hubble Fellow **Scott Sheppard** joined the Research Staff in July (see page 3). Also in July, he attended the Giant Magellan Telescope Science Working Group meeting in Tucson. In Sept., he served on a review panel for NASA's Origins Program.

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Rick Carlson gave a Sept. invited talk at the Royal Society of London Discussion Meeting on the Origin and Differentiation of the Earth.

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In Sept., **John Chambers** gave a colloquium on planetary migration at the U. of Florida.

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Larry Nittler was selected as a participating scientist for the MESSENGER Mission to Mercury. He gave a July talk at the Nuclear Astrophysics: Beyond the First 50 Years conference at Caltech.

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In June, **Steve Shirey** spoke at the Geological Association of Canada NUNA Conference, The Pulse of the Earth and Planetary Evolution, in Sudbury, Ontario.

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Mass Spectrometry Laboratory Manager **Tim Mock** attended a workshop of the High Precision Isotope Ratio Consortium at the USGS in Denver in June.

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Postdoctoral fellow **Alceste Bonanos** gave a colloquium at the 8th International Conference of the Hellenic Astronomical Society in Thassos, Greece, in Sept.

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In July, postdoctoral fellow **Fred Ciesla** gave a talk at a workshop on solar system mixing at the Theoretical Institute for Advanced Research in Astrophysics in Taiwan.

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Postdoctoral fellow **Hannah Jang-Condell** gave talks in June at the In the Spirit of Bernard Lyot conference in Berkeley and at the Transformational Science with ALMA: Through Disks to Stars and Planets confrence in Charlottesville, VA.

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In June, postdoctoral associate **Maureen Long** presented a poster at the Subduction Zone Geodynamics Conference in Montpellier, France, and spent three weeks in eastern Oregon installing seismometers for the High Lava Plains Project.

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In Aug., visiting investigator **Derek Richardson** concluded his yearlong visit working with **John Chambers** and postdoctoral fellow **Fred Ciesla** on simulations of solar dust dynamics.

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Postdoctoral fellows **Isamu Matsuyama** and **Hannah Jang-Condell** gave talks at the Bioastronomy 2007 meeting in San Juan, PR, in July.

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Summer interns arrived in June. **Sapthala Karalliyadda** of the U. of Peradeniya, Sri Lanka, worked with Paul Silver and postdoctoral fellow Dayanthie Weeraratne; **Amanda Klaus** of Scripps College worked with postdoctoral associate Maureen Long and postdoctoral fellow Lara Wagner; and **Ana Maria Molina** of the Universidad Pontificia Bolivariana, Colombia, worked with postdoctoral fellow Isamu Matsuyama.

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Several gave presentations at the Aug. 2007 Goldschmidt Conference, held in Cologne, Germany, including **Rick Carlson**, **Fouad Tera**, ion microprobe research specialist **Jianhua Wang**, and postdoctoral fellows **Catherine Cooper**, **Julie O'Leary**, and **Ivan Savov**.

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Alan Boss and postdoctoral fellow **Fred Ciesla** gave invited talks and postdoctoral associate **John Debes** and postdoctoral fellow **Hannah Jang-Condell** presented posters at the Gordon Research Conference on the Origins of Solar Systems at Mount Holyoke College in July.

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At the 70th annual Meteoritical Society meeting, held in Tucson in Aug., **Conel Alexander**, **Alan Boss**, **Larry Nittler**, and postdoctoral fellows **Fred Ciesla** and **Ann Nguyen** made presentations.

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Rick Carlson and **Steve Shirey** participated in a workshop in June at the National Institute of Standards and Technology for developing new isotope standards for the geoscience community.

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Recent arrivals: Visiting investigator **Steve Richardson** of the U. of Cape Town, along with student **Karen Smit**, arrived in Aug. for a three-month visit to work with Rick Carlson and Steve Shirey. Postdoctoral fellows **Teh-Ru (Alex) Song**, formerly of Caltech, and **Liping Qin**, formerly of U. of Chicago, arrived in July and Sept., respectively.

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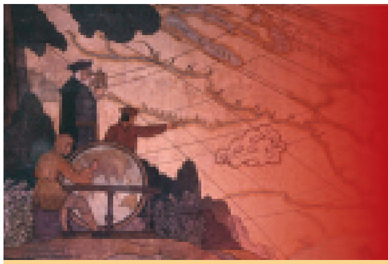
Recent departures: Postdoctoral fellow **Hannah Jang-Condell** left in Sept. for a Michelson Fellowship at the U. of Maryland and Goddard Space Flight Center; **Catherine Cooper** joined NSF in Aug. as a program director for EarthScope; and **Dayanthie Weeraratne** began a faculty position at Cal. State U., Northridge, in Aug.



CAPITAL SCIENCE EVENINGS 2007-2008

All lectures for the Capital Science Evenings are held on Thursdays at 6:45 p.m. at the Carnegie Institution administration building,1530 P Street, NW, Washington, D.C. They are free and open to the public. For more information, call 202-328-6988, send an e-mail to CapitalScienceInfo@ciw.edu, or visit our Web site at www.ciw.edu

October 11, 2007	**Michael Gazzaniga,** University of California, Santa Barbara, Department of Psychology *Brains, Minds, and Social Process*
November 8, 2007	**Richard Alley,** Pennsylvania State University, Department of Geosciences *Get Rich and Save the World . . . Or Else*
January 17, 2008	**Michael Brown,** California Institute of Technology, Division of Geological and Planetary Sciences *Pluto, Eris, and the Dwarf Planets of the Outer Solar System*
February 21, 2008	**Edward "Rocky" Kolb,** University of Chicago, Department of Astronomy and Astrophysics *Mysteries of the Dark Universe*
March 20, 2008	**Lene Hau,** Harvard University, Department of Physics and School of Engineering and Applied Sciences *Wizardry with Light: Freeze, Teleport, and Go!*
April 17, 2008	**Tanya Atwater,** University of California, Santa Barbara, Department of Earth Science *Plate Tectonics Meets the Ice Ages in North American Landscapes*

CARNEGIE INSTITUTION FOR SCIENCE

Carnegie's New Look!

To achieve the public recognition that the institution deserves and to clarify our identity we have changed our look. Our name—the Carnegie Institution of Washington—provides no hint that we are the one Carnegie entity devoted to science. And it erroneously suggests that we exist only in Washington, D.C., when in fact three of our six departments are located in California and one is in Maryland. Our name has hobbled us in achieving recognition, outside of the scientific community, for decades.

Over the past century, science has become a complex and expensive enterprise. The non-profit world has similarly become more crowded and the tasks of differentiating ourselves from other Carnegie organizations and promoting Carnegie as a premier scientific research organization are increasingly difficult. For many reasons, but most importantly to support the growing needs of our researchers now and in the future, we must bring more visibility to our world-class science. To help portray who we are both clearly and concisely, we have adopted a new logo. It closely associates "Carnegie" and "science," revealing our core identity in the blink of an eye.

The use of the new logo does not mean that we have legally changed our name. We will officially and legally remain the Carnegie Institution of Washington. We will be like many organizations that have a public identity that is different from their legal name.

A new logo is a small thing. It is far less important than the quality and influence of the work undertaken by our scientists. But, over time, we hope it will help the Carnegie Institution achieve the public awareness to which our superb scientific work entitles us. ☐

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