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New Horizons for Science


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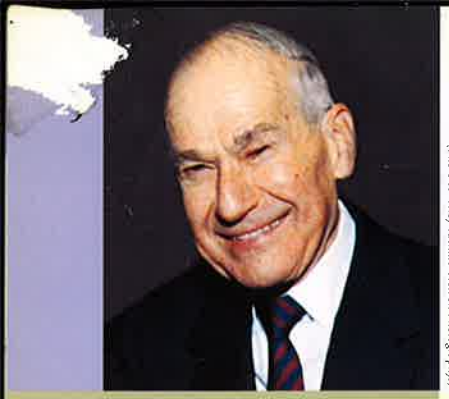

(Photo courtesy Richard Holden Photography.)

Global Ecology Is Making its Mark

On April 12 we celebrated an important day for the institution—the dedication of the new building for the Department of Global Ecology, Carnegie's first new department in over 80 years. Global ecology is an emerging discipline. It integrates information from the physical and biological sciences and makes connections among processes that occur at the molecular scale up to the scale of the entire planet. In existence for less than two years, the department is already home to an array of some truly remarkable achievements.

Currently, a handful of research staff members—Greg Asner, Joe Berry, and department director Chris Field—are making a very large impact. With their postdocs, predocs, technicians, and collaborators, this small group has published some four dozen papers in year one. And they have been important papers, too, according to the Institute for Scientific Information. That body ranked the department in the top 1% of institutions for the number of citations in the ecology/environment area—a solid endorsement for the novel approaches that these researchers have developed.

Greg Asner has been making enormous progress in relating information from satellite and aircraft remote sensing to biological phenomena on the ground. His array of tools has taken him from the American Southwest to the Amazon Basin. Among his many studies, he has been analyzing selective logging in Brazil. This stealth form of logging is difficult to detect because the forest canopy covers the evidence of single-tree removal. Asner's remote methods penetrate this veil. It is now known that selective logging is the major human impact over large regions in the Amazon Basin. This important result will help toward understanding the impact on biological diversity there.

Formerly a staff member at Plant Biology, Joe Berry, with collaborators, has recently been investigating how to quantify the carbon balance—the sum of carbon taken in and locked up by plants during photosynthesis and the amount released to the atmosphere by plant respiration and human activities such as fossil-fuel burning. To accomplish this goal, he is using tracers to determine how carbon flows through the atmosphere. His group has for the first time measured the annual carbon balance at a scale the size of an American state. This new procedure will become very valuable to understanding how this greenhouse gas works its way through specific regions and thus how it can be better managed.

In addition to fulfilling his administrative functions as director and his role supervising the construction of the new building, Chris Field continues to be heavily involved in his research. Field was coauthor of two notable papers from the Jasper Ridge Global Change Experiment. One, written with graduate student Erika Zavaleta and others, had an unexpected result: warmer temperatures lead to wetter soil conditions rather than the drier conditions predicted by many environmental models. The other study, with colleagues including former postdoc Rebecca Shaw, defies the conventional belief that elevated levels of atmospheric carbon dioxide (CO_2) prompt faster plant growth. Instead, their work indicates that elevated CO_2 levels do not always make plants grow faster, especially when other environmental changes are considered. The conclusions from both projects are especially important to help decipher how the environment can, *or cannot*, compensate for some human activities.

These few examples illustrate the pioneering work undertaken by our researchers and how the department is building its reputation. The philosophy upon which Global Ecology was founded—to integrate information from diverse disciplines and scales that range from the molecular to the global—is creating a new lens through which we can view our planet. And this new perspective is allowing us to better grasp the environmental changes the Earth is undergoing. It is clear from this impressive beginning that the department's approach is gaining momentum in the scientific world, and I foresee a future where new discoveries will influence a much broader community.

—Michael E. Gellert, *Chairman*

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Going Strong:
The Carnegie Campaign for Science

It has been a productive and promising time for *The Carnegie Campaign for Science,* an ambitious $75 million fundraising effort to provide two new buildings, a major renovation of a third building, state-of-the-art research instrumentation, and postdoctoral fellowships that will benefit all of Carnegie's departments. As of the end of March, the campaign has raised $48.8 million, or about 65% of its goal, since its launch in spring 2002.

The most dramatic progress is visible at construction sites on the West and East coasts. The new $5 million "green" home for the Department of Global Ecology is complete, and staff are moving into it from the adjacent Department of Plant Biology. A dedication ceremony and festivities took place on April 12. The *Global Ecology Initiative Fund* of the campaign also includes a $20 million endowment for this newest Carnegie department.

In Baltimore, at another construction site, the Maxine F. Singer Building for the Department of Embryology is rising near the west entrance of the Johns Hopkins University Homewood Campus. The building—a 79,000 gross sq. ft. biomedical research facility—will have an open layout that encourages collaboration. Core spaces include a computing facility, a vivarium, a biotechnology lab, a library, and common meeting rooms. Clad in brick, metal panels, copper shingles, and with large, attractive windows, the three-level structure is being built into an existing hill. Extensive landscaping and hill restoration will follow by planting trees and native plants. Completion is expected in early 2005.

The *Embryology Facility Fund* goal is $5 million to supplement a $30 million construction bond for the Singer building and $15 million to support operations and maintenance.

In Washington, D.C., the Broad Branch Road Campus, which houses both the Department of Terrestrial Magnetism and the Geophysical Laboratory, will gain new and larger meeting rooms and a modern kitchen and dining facility when renovations are made to a historic "experiment building" at the center of the campus. The building will be named for former trustee David Greenewalt.

In addition to the building projects, the *Earth and Planetary Sciences Instrumentation Fund* of the campaign will provide $8.6 million for eagerly awaited scientific instrumentation. "The current revolution in geochemistry is driven by a newly acquired ability to analyze smaller and smaller samples," explained Carnegie staff scientist Douglas Rumble. "Each new advance in instrumentation brings a previously inaccessible scale of observation."

Two other funds are also part of the campaign. The *Observatories Enhancement Fund* will provide $15 million for new instrumentation and for additional scientific staff. The *Postdoctoral Fellowship Fund* seeks to raise an additional $4 million to endow named fellowships.

TRUSTEE News

The board of trustees met at the Department of Embryology in Baltimore on Thursday, December 4, and Friday, December 5, 2003. In addition to the full board, the Audit, Finance, Development, Research, and Nominating committees met.

After lunch on Thursday, the trustees toured the construction site for the new Maxine F. Singer Building and visited labs in the existing Embryology building, where the scientific staff explained their work. That evening the director of Embryology, Allan Spradling, gave a talk on stem cells.

On Friday, the board passed a resolution to memorialize David Greenewalt, board secretary and longtime friend of the Carnegie Institution, who died in October 2003. After the full session of the board, Alycia Weinberger, staff member at the Department of Terrestrial Magnetism, presented a talk on the birthplaces of planets. A buffet luncheon at Embryology concluded the meetings.

Top: Carnegie trustee Jaylee Mead (left) listens as Embryology staff member Joe Gall discusses his work on Cajal bodies—structures in the cell nucleus that contain factors believed to be needed for transcription and processing messenger RNA. **Bottom:** Embryology staff associate Alex Schreiber (right) describes his work on flatfish asymmetry to trustee Robert Goelet.

The Carnegie Medal of Philanthropy

"On behalf of the 18 family members whose philanthropy over three generations is acknowledged today in the award of the medal, I thank you very much all for the honor."

—Lord David Sainsbury

"I am sincerely grateful to everyone from the Carnegie Family of Institutions for recognizing my humble activities."

—Dr. Kazuo Inamori

The Sainsbury family of Great Britain and Dr. Kazuo Inamori of Japan, Carnegie trustee emeritus, received the 2003 Andrew Carnegie Medals of Philanthropy on December 8, 2003, at the Carnegie Institution of Washington, which hosted the ceremony. These world-renowned philanthropists were recognized for their decades of work using their personal wealth for the benefit of humankind. The Carnegie Medal, instituted in 2001 and first awarded at a ceremony hosted by the Carnegie Corporation of New York, is awarded every other year by the 22 worldwide Carnegie institutions to commemorate their founder's philanthropic legacy.

Richard Meserve, president of the Carnegie Institution, introduced the day's first event, a symposium titled "The Road Ahead: Challenges for [illegible]s in the 21st Century." David Swensen, chief investment officer of Yale University and a Carnegie trustee, and Lester Salamon, founding director of the Institute for [illegible]dies at The Johns Hopkins University, spoke. Swensen outlined the successes and failures of past investment strategies for nonprofit institutions and the lessons for the future, while Salamon addressed the reasons for the recent growth in the nonprofit sector in the world economy and what lies ahead.

The awards ceremony followed. Meserve introduced the master of ceremonies, Robert MacNeil, author and former co-anchor of the PBS *MacNeil/Lehrer NewsHour*. MacNeil began with a vivid account of Andrew Carnegie's life covering his youth, his rise to fortune and fame, his philosophy of giving, and his philanthropy. MacNeil then introduced the first medal presenter, David Rockefeller, who in 2001 accepted the Carnegie Medal of Philanthropy on behalf of the Rockefeller family.

On presenting the 2003 medal to the Sainsbury family, Rockefeller remarked, "Over the span of three generations, 18 family members have created 19 separate trusts, which have become the benchmark for British philanthropy over the past three decades." Lord David Sainsbury accepted the award on behalf of the Sainsbury family, saying that it was a "great privilege to accept this international award given...in the name of one of the greatest philanthropists ever, Andrew Carnegie..."

MacNeil then introduced the next medal presenter, former Speaker of the U.S. House of Representatives and former ambassador to Japan the Honorable Thomas Foley. Foley took to the podium to present the medal to Inamori, saying, "With each step in his business, Dr. Inamori has advanced his core belief to give back to humanity." He quoted a statement from Inamori's book *A Passion for Success* that embodies his philosophy: "If you happen to have leadership talents, you should use them for the world, for society, and for the group, never just for yourself." On accepting the award, Dr. Inamori expressed his deep appreciation for the honor. A luncheon for participants and guests followed.

David Rockefeller (right) presents the 2003 Andrew Carnegie Medal of Philanthropy to David Sainsbury, representing the Sainsbury family of Great Britain.

(Image courtesy Jim Johnson.)

The Honorable Thomas Foley (left) presents the Andrew Carnegie Medal of Philanthropy to Dr. Kazuo Inamori.

(Image courtesy Jim Johnson.)

The recipients and presenters of the 2003 medal are shown with Carnegie president Richard Meserve. From left: Thomas Foley, Kazuo Inamori, Richard Meserve, David Sainsbury, David Rockefeller.

(Image courtesy Jim Johnson.)

Trustees and officers of the 22 Carnegie organizations gather for the 2003 Andrew Carnegie Medal of Philanthropy awards on December 8, 2003.

(Image courtesy Jim Johnson.)

Will **Climate Change** *Speed Up?*

"We should not count on carbon storage by land ecosystems to make a massive contribution to slowing climate change," said Chris Field, director of Carnegie's Department of Global Ecology. "And lower storage of carbon in these ecosystems results in a faster increase in atmospheric carbon dioxide, leading to more rapid global warming."

Future atmospheric levels of the notorious heat-trapping gas, carbon dioxide, remain a controversial topic among environmental scientists. Many researchers believe that increasing amounts of CO_2, belched into the atmosphere by human fossil-fuel use, will be captured through nature's ability to lock up the carbon in soil organic matter and faster-growing trees. But it's not so simple. A report published in the November 28 *Science* showed that the availability of nitrogen, in forms usable by plants, will probably be too low for large increases in carbon storage.

Ecosystems on land could store more carbon, through bigger trees and more organic matter in soils, but shortages of mineral nutrients, especially nitrogen, curb potential future carbon storage. Several approaches to calculating ecosystem carbon storage, including those featured in the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) assume that nitrogen available to plants is abundant, even though current nitrogen limitation is widespread. "Realistic scenarios for future changes in nitrogen availability limit ecosystem carbon storage to the low end of the range presented in the recent IPCC report," said Field.

"In a garden limited in water, a gardener would not expect a big increase in growth from adding potassium. Similarly, plants in natural ecosystems limited in nitrogen may not grow much faster when they are exposed to increased levels of carbon dioxide," explained coauthor Jeffrey Dukes. "Plants will need more nitrogen if they're going to lock up more carbon. The models used by the IPCC just didn't acknowledge that to a sufficient extent." Human activities tend to add biologically available nitrogen to ecosystems, but the additions are patchy and the added nitrogen can be rapidly lost. According to Field, "Even with generous assumptions about future increases in biologically available nitrogen, we still couldn't find enough nitrogen to support the range of carbon storage discussed in the IPCC report." These new findings highlight the challenge of limiting global warming.

IN The News

The Department of Terrestrial Magnetism's (DTM) **Alan Boss** was quoted in the Oct. *Sky & Telescope* about a planetary system found in globular cluster M4. Boss's instability theory of planetary formation was described in the Nov. 22 issue of *Science News* and the Nov./Dec. issue of *Mercury* magazine. Boss and DTM's **Sara Seager** were also mentioned in the Oct. 17 *Washington Post* "Sky Watch" for their talks on extrasolar planets at an NSF-sponsored symposium.

Director of the Geophysical Laboratory and president of the Planetary Society **Wesley Huntress, Jr.**, wrote a feature article, "An Exciting Future for Human Spaceflight," in the Nov./Dec. issue of *Space Times.* He was also quoted in the Dec. 5 *Boston Globe* on the topic.

The Dec. 18 *Baltimore Business Journal* reported on the $1.5 million Kresge Foundation challenge grant awarded to Carnegie for the construction of Embryology's new Maxine F. Singer Building.

The study by David Lobell and Global Ecology's **Greg Asner** indicating that climate change can depress corn and soybean productivity in the U.S. was mentioned in the "Breakthroughs of the Year" published Dec. 19 in *Science*. Both the *Stanford Report* (Dec. 10, 2003) and the *Stanford Daily* (Jan. 27, 2004) carried stories about Asner's work using tools, including satellites, to study the impact of illegal logging in the Amazon.

The lead article in the Dec. 30 "Science Times" section of the *New York Times* was about the contemplated new generation of giant telescopes, including the 20-meter Giant Magellan Telescope (GMT) proposed by the Magellan Consortium. A schematic of the GMT was pictured next to a photo of the existing Magellan telescopes. **Wendy Freedman**, director of the Observatories, and staff astronomer **Patrick McCarthy** were quoted in the article.

Observatories' **Pat McCarthy** is a coprincipal investigator on the Gemini Deep Deep Survey, which uncovered a surprising find—that old galaxies existed in a young universe. The story was reported in widely different publications here and abroad, from *USA Today* (Jan. 6) to the *Innovations Report* in Germany. McCarthy himself was mentioned or quoted in the *Innovations Report, The Australian,* and the *Honolulu Star* [illegible] among other news outlets.

The discovery made by the Geophysical Laboratory's Dave Ma[illegible] and [illegible]dy Mao that hydrogen can be stored in small "ice cages" was featured in the Jan. 6 *New York Times* and carried by UPI on Jan. 9.

[illegible] Schweizer was quoted in *SPACE.com* (Ja[illegible] 9) as coauthor of a study revealing the potential of the pair of colliding galaxies, the Antennae, as a source of materials to produce life-bearing planets.

The Jan. 20 *San Francisco Chronicle* article about the Intel Science Talent Search winners discussed 17-year-old **Catherine Qing Sun's** research at Plant Biology that led to her prize.

Carnegie president **Richard Meserve** wrote an editorial for the Jan. 23 issue of *Science,* "Global Warming and Nuclear Power," suggesting that "nuclear power should be considered as part of the solution [to global warming]."

The Feb. 3 issue of *NewScientist.com* quoted **Sara Seager** of DTM on the find by others of carbon and oxygen "streaming" from an extrasolar planet.

Allan Sandage, Observatories staff member emeritus, was quoted in a Feb. 8 *New York Times* article about the proposal to decommission the Hubble Space Telescope.

Chris Field, director of Global Ecology, was among the 60 scientists, including 20 Nobel laureates, who signed a statement accompanying a report by the Union of Concerned Scientists charging the Bush administration with misrepresenting scientific findings. The story received wide coverage, and Field was quoted in the Mar. 17 *Stanford Report* on this issue.

Three Geophysical Lab scientists, **Chih-shiue Yan, Dave Mao,** and **Russell Hemley,** recently created from gas the hardest diamonds yet. The achievement had extensive media coverage in such diverse outlets as the *Washington Times, Trade Arabia,* and Reuters (Feb. 25); *Science News* and the *Los Angeles Times* (Feb. 28); the Mar. 11 *New York Times.com*; and the Mar. 15 *Business Week.*

Sean Solomon, director of the Department of Terrestrial Magnetism, was quoted in the Mar. 4 *Christian Science Monitor* on what the recent discoveries from Mars mean for our understanding of the other inner planets. He was also quoted in the cover story of the Apr. issue of *Discover* magazine on the upcoming mission to Mercury, for which he is principal investigator.

A Mar. 11 *Nature* "News and Views" article by Embryology director **Allan Spradling** commented on a recent finding by researchers at Massachusetts General Hospital that upends the generally held belief that mammals are born with all their eggs. Instead, it appears that stem cells are at work. Spradling was interviewed for his perspective on *Morning Edition* by National Public Radio on Mar. 11. He was also quoted by the BBC, *ABC News Online,* and in the Mar. 13 "News of the Week" in *Science News.* Spradling was also featured in the Mar. 15 *Baltimore Sun* about his finding, published in the online *Nature* on Mar. 14, that tissue cells can revert to stem cells.

Countdown to Mercury:
MESSENGER
Gets Ready for Blastoff

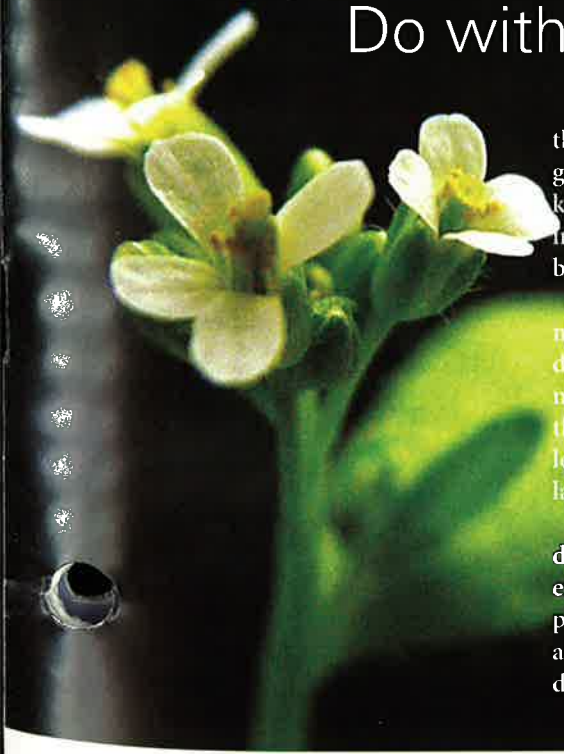
Almost five years in the making, the Mercury-bound MESSENGER spacecraft has been built, tested, and vetted, and is now undergoing its final processing at Cape Canaveral, Florida, for a scheduled launch beginning July 30. The MESSENGER mission is led by Carnegie's director of the Department of Terrestrial Magnetism, Dr. Sean C. Solomon. The Applied Physics Laboratory (APL) at Johns Hopkins University in Laurel, Maryland, built the craft and will preside over its operation for NASA during the time that it will take to get to Mercury orbit and the 12 months that the craft will circle the planet gathering data.

A suite of seven instruments on the composite craft will collect data to help answer scientific questions in six areas: the planet's composition, its geology, the structure of its core, its magnetic field, the nature of the material at its poles, and the volatiles present in its thin atmosphere. This information will help toward understanding how all the terrestrial planets evolved.

Getting to Mercury is highly complex. The craft has to use the gravitational pull by both Venus and Mercury to slow down enough to enter Mercury orbit with a single burn of its main thruster. Once in orbit the craft then has to withstand extreme temperatures. The planet's surface has a daytime high of over 400°C (752°F) and a nighttime low of -200°C (-328°F). Two solar panels on the craft are designed to withstand temperatures up to 250°C (482°F). MESSENGER is the first orbital mission to the closest planet to the Sun. *Mariner 10* in the 1970s was a flyby that mapped less than half the globe. •

Sean Solomon, director of Carnegie's Department of Terrestrial Magnetism, is the principal investigator of the MESSENGER mission. He stands in front of the packaged craft at the Goddard Space Flight Center, where the craft underwent testing just before its departure for Cape Canaveral on March 9, 2004. The craft arrived safely in Florida March 10.

Flowering Plants:
What's LOV Got to Do with It?



Like many plants, the model plant *Arabidopsis* flowers more quickly when it senses that the days are getting longer. Figuring out what goes on behind the scenes to trigger this response has recently received a big boost from the work of postdoctoral fellow Trevor Swartz and Director Emeritus Winslow Briggs at the Department of Plant Biology and their colleagues at the Scripps Research Institute. The scientists' work was the cover story in the November 20 issue of *Nature*.

It has been known for some time that for *Arabidopsis* to flower, light has to regulate the expression of a protein called CONSTANS, or CO, which in turn induces a flowering gene (*FLOWERING LOCUS T* or *FT*) to turn on and begin the process. Scientists have not known until this study, however, what light-sensing mechanism is at work that prompts CO into action. "It appears that the plant's flowering response may begin with a nudge from blue light that is absorbed by a previously unknown photoreceptor," said Briggs.

Through a series of experiments, the scientists discovered that a protein called FKF1 may start this sequence of events. They determined that the protein has a special region, or domain, to which light-absorbing molecules called flavins bind. These domains are found in many organisms—from bacteria to humans. Because they sense light, oxygen, or voltage, they have been dubbed LOV domains. They were originally identified by Briggs and colleagues as the light-sensing modules in the phototropins—photoreceptors that the Briggs lab first described and characterized.

The researchers found that when illuminated with wavelengths of blue light, LOV domains of FKF1 undergo a photochemical reaction that somehow then stimulates the expression of CO. Since levels of this FKF1 protein are only high late in the day, this believed photoreceptor will only be active on long days. Because of the oscillating availability of light as the seasons change, the scientists suspect that FKF1 may be the real player behind sensing differing day length and stimulating the downstream genes into action. •

Carnegie Goes to THE MOVIES

Audrey M. Huang

To image cells under the microscope, scientists in days past were restricted to still photographs. Filming living cells in action was simply out of the question. Now researchers record real-time movies showing the intricacies of life at the cellular level with a technique called confocal fluorescent microscopy. "It's like a whole new world out there," says Plant Biology staff member David Ehrhardt—a pioneer in the technology for plant research. Although they are 3,000 miles apart, the departments of Plant Biology and Embryology have both embraced this technology to study a variety of problems in plants and animals.

(Images courtesy Yixun Zhong.)

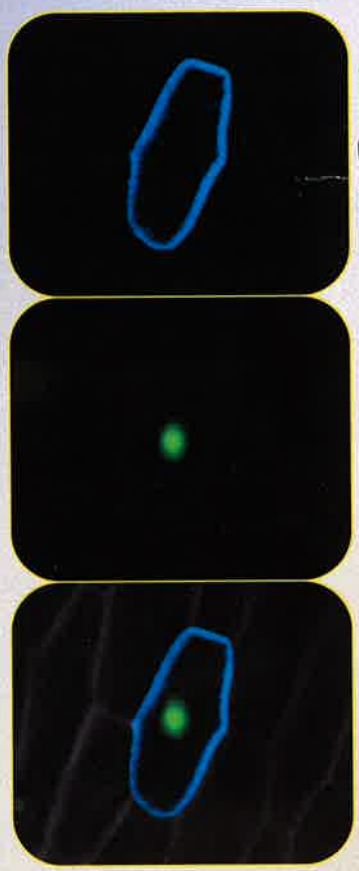
Fig. 1 Microtubule Cytoskeleton: Microtubules from frogs change from long, wavy strands in nondividing cells (top panel) to short, fat bundles in the mitotic spindle when cells divide (bottom panel).

(Image courtesy David Ehrhardt.)

Fig. 2 3-D Reconstruction: This three-dimensional reconstruction of a plant root tip is made by stacking layers of confocal images. The plant is making a fluorescently tagged protein that outlines the cell surface.

(Image courtesy Jim Wilhelm.)

Fig. 3 Fly Ovary: This fruit fly egg chamber is making a red-tagged cytoskeletal protein, which outlines the egg, and a green-tagged protein involved in protein synthesis that localizes to the posterior end of the egg in addition to the cytoplasm of other cells in the egg chamber.



(Images courtesy Ehrhardt.)

Fig. 4 Multicolor Tagging: Onion-skin cells are making a blue-tagged protein that outlines the cell surface (top panel) and a yellow-tagged protein (green in the figure; middle panel) that marks the cell nucleus. The bottom panel shows the two images merged together.

Behind the Scenes

Confocal fluorescent microscopy first requires tagging proteins with fluorescent molecules. One of these is the protein that makes jellyfish glow, green fluorescent protein, known as GFP. The gene for GFP and its relatives—CFP, YFP, and RFP, which glow blue, yellow, and red, respectively—can be tacked onto the end of any gene of interest. The resulting fused gene then makes a fluorescently tagged protein when injected into embryos of model animals, such as fruit flies and worms. To tag proteins in plants, researchers shoot the plant with tiny pellets coated with the fused gene or they insert the fused gene into bacteria, which are then sprayed onto the plant. When the bacteria infect the plant they transfer the fused gene into plant cells, which then make the fluorescent protein.

In movies made of these cells, glowing strands and particles weave around, sometimes in a slow dance, other times zipping across the screen. To accomplish this fluorescent floor show, researchers zap the cells with high-energy lasers. It's a painstaking process since these lasers can bleach out the tags, making them invisible. To combat this problem, both Plant Biology and Embryology recently acquired spinning-disc confocal microscopes, which expose cells to much less laser energy, avoiding bleaching and allowing longer viewing and movie-recording times.

In addition to recording moving images, confocal fluorescent microscopy eliminates what used to be a problem with viewing live tissue—contending with a blurry foreground of out-of-focus cells within a whole organism. Using lasers aimed at a single focal plane, this microscopy effectively eliminates the forest from the trees by fixing on specific cells of interest.

The Preview

Wolf Frommer, the newest staff member to join Plant Biology, uses a fluorescent imaging technique called FRET (fluorescence resonance energy transfer) to study proteins that bind metabolites, such as sugars, to understand metabolite transport within a plant. In this technique he arms proteins with two differently colored tags—one at each end of the molecule—to make "biosensors." When bound to a metabolite, the biosensor changes shape and brings the two tags closer together. Zapping the biosensor with a laser of one color makes one of the tags glow. If the two tags are close enough, that glowing tag will emit enough energy to make the second tag glow. Unbound biosensors, therefore, glow one color, while the metabolite-bound biosensors glow a second color. Currently working in isolated cells, Frommer hopes to put these biosensors into whole plants soon.

The Feature Show

One common interest at Plant Biology and Embryology using this technology is the study of the behaviors of microtubule cytoskeletons. These components are networks in a cell's cytoplasm that are responsible for maintaining cell shape, transporting molecules throughout the cell, and controlling cell division.

Microtubules are long, thin, wavy ropes made of chains of the protein tubulin. During cell division, they turn into short, fat bundles to form a mitotic spindle—the structure that coordinates cell division, ensuring that each daughter cell gets a complete set of parts. After the cell divides, the mitotic spindle disassembles and the fat bundles of microtubules become long and thin again.

Staff member Yixian Zheng studies this disassembly process at Embryology. She and her colleagues recorded movies of mitotic spindles from frog's eggs, then reviewed the movie frame by frame to measure the length of each individual microtubule and calculate the rates of growth and shrinkage. The group discovered that microtubules returning to long and thin shapes after cell division require critical signals; without them they stay fat and bundled. Using this approach to study spindle disassembly was not possible prior to fluorescent confocal movies, Zheng says.

The Ehrhardt lab at Plant Biology also studies the microtubule cytoskeleton, but in plant cells. Plant and animal cytoskeletons differ in one notable respect: plants lack microtubule-organizing centers. As their name suggests, microtubule-organizing centers organize and anchor microtubules from a point near the center of the cell. Via movies, Ehrhardt recently showed that plant cells organize microtubules at the cortex, just inside the cell membrane. To better understand how plant cells function without microtubule-organizing centers, Ehrhardt, in collaboration with Plant Biology director Chris Somerville and colleagues, is studying how a mutant plant with hypersensitive microtubules organizes its cytoskeleton.

Ehrhardt has just finished putting together the spinning-disc microscope at Plant Biology, and every lab there uses the technology. The microscope at Embryology was set up by staff associate Terence Murphy, who has also generated a large set of fluorescent tags for fruit fly proteins, which are used by the Murphy, Jim Wilhelm, and Allan Spradling labs to make multicolored movies of fly cells in action. Other researchers at Embryology also use the equipment for still images of different model organisms.

"This technology has completely revolutionized cell biology," says Zheng. Staff associate Jim Wilhelm echoes the sentiment: "We are so lucky to have a spinning disc at Carnegie—I think it's the future of cell biology."

To further explore this technology at both departments, go to the following Web sites:

Plant Biology cell imaging: http://deepgreen.Stanford.edu

Biosensor movie: http://www-ciwdpb.stanford.edu/research/frommer/research_frommer_movies.php

Embryology's fruit fly tags: http://www.ciwemb.edu/labs/murphy/Gateway%20vectors.html

Major Grant Backs **Carnegie Legacy Project**

Efforts to preserve the records of 100 years of scientific discovery at the Carnegie Institution have received a major boost in the form of a $240,741 grant from the National Historical Publications and Records Commission (NHPRC). The institution, one of the nation's first privately funded basic research organizations, houses an irreplaceable archive documenting the progress of American science in the 20th century. The NHPRC is a statutory body affiliated with the National Archives and Records Administration and supports a wide range of activities to preserve and encourage use of historic documents relating to the history of the United States.

Funding for the two-year initiative, dubbed the Carnegie Legacy Project, will set the institution's archives on a firm footing. Professional archivists are combing through 1,700 feet of records and more than 37,000 historic photographs at Carnegie's administrative headquarters and the Broad Branch Road campus of the Department of Terrestrial Magnetism (DTM) and the Geophysical Laboratory (GL). Valuable materials that have languished in dusty, poorly accessible locations will be transferred to state-of-the-art storage facilities. Records will be organized and finding aids posted on a project Web site for researchers to access worldwide.

Legacy team members pose in the Broad Branch Road library. Left to right standing are John Strom and Shaun Hardy. Sitting left to right are Jennifer Snyder, Rachel Ban, and Charles Hargrove.

The archives' holdings include documents that chronicle the institution's pioneering work in atomic physics in the 1930s; experimental studies of rocks and minerals that probed the deep interior of the Earth; and geophysical expeditions from the high Arctic to the tropics. Noted scientists whose correspondence is in the collection include astronomer George Ellery Hale; geneticist Barbara McClintock; and Vannevar Bush, Carnegie president, science advisor to President Franklin D. Roosevelt, and the architect of U.S. defense research during World War II.

The genesis of the Legacy Project emerged during preparations for the institution's centennial exhibition. It is taking place in conjunction with preservation efforts at the Observatories where the historic photographic plate collection—including the plates depicting the discovery of the expanding universe by Edwin Hubble—is being inventoried and rehoused.

John Strom, Carnegie's Web manager, directs the Carnegie Legacy Project. Shaun Hardy, librarian at the Broad Branch Road campus, administers the DTM and GL archives. Two archivists are working under the grant: Charles Hargrove, who previously worked at the Smithsonian Institution Archives; and Jennifer Snyder, formerly with the Archives Center of the National Museum of American History. Rachel Ban of History Associates is providing project oversight and management. Other Carnegie staff provide additional part-time support.

The Mystery of High-Temperature SUPERCONDUCTORS

Imagine the day when magnetic-levitation trains whisk passengers around the country at 300 miles per hour and the nation's electrical grid carries 100 times more power than it currently can. That day may not be that far off, thanks to the research on superconducting materials by scientists such as Xiao-Jia Chen, a postdoctoral fellow at Carnegie's Geophysical Laboratory (GL).

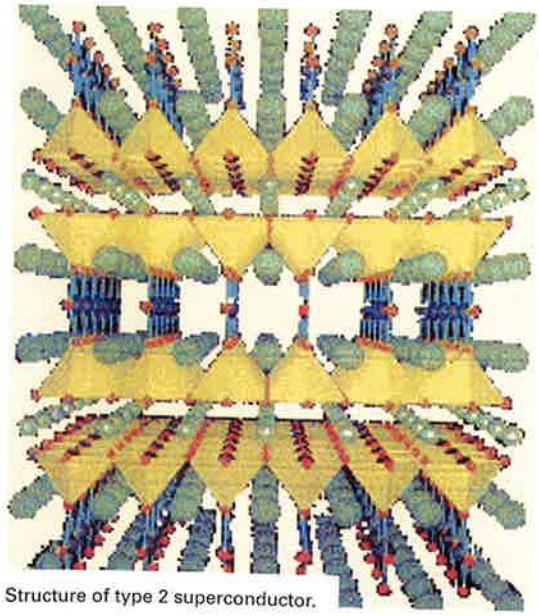
Superconductors are materials that conduct electricity—the flow of electrons—without any resistance. The absence of resistance allows these materials to convey far more electricity than copper or aluminum wires used today. Superconductivity was discovered almost 100 years ago, but the early superconductors had to be cooled to extremely low (below 20 K or –253°C) "transition temperatures" for electrical resistance to disappear. This low-temperature requirement impeded widespread practical use of the technology. However, in 1986 researchers discovered a class of high-temperature superconductors, copper oxides. At present, these types of mercury-based superconductors hold the record with a transition temperature, or Tc, as high as 135 K or -138°C—a feature that enhances the possibility of many practical applications because they can be cooled with liquid nitrogen.

High-temperature superconductors are ceramics that contain copper and oxygen atoms arranged in planes (see image). It is believed that the layering structure of the planes may be what determines the behavior of the electrons when a material is subjected to its specific transition temperature. However, despite the decades of work in this field, researchers still do not know exactly what subatomic mechanisms operate that allow the electrons to flow so freely. Understanding what controls higher Tc is a central

problem in the field and one that GL's Xiao-Jia Chen and his colleague Hai Qing Lin from the Chinese University of Hong Kong are tackling.

Each superconducting material can have its maximum transition temperature at a specific amount of "doping," which is the addition of electrons or positively charged particles. Below the optimum level of doping, the material tends to be insulating. Above the optimum level, the material will be a superconductor, but at a colder transition temperature. Achieving just the right amount of doping is the big challenge.

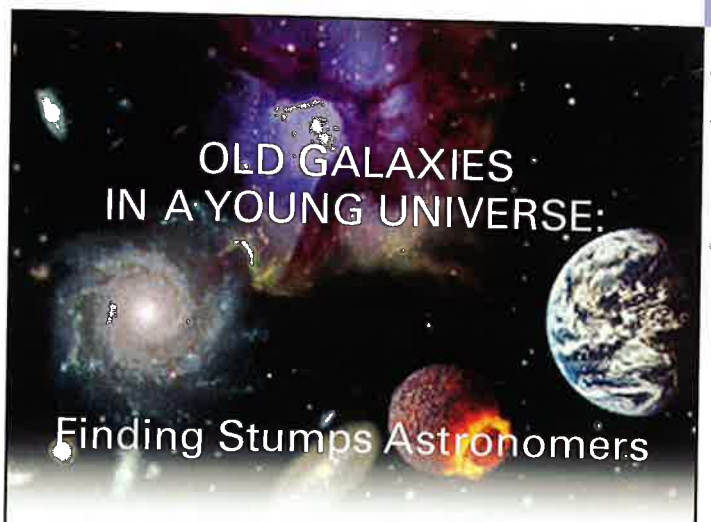
Chen and Lin recently calculated the temperature at which different copper-oxide families become superconductors. They proposed a model to simulate hole-doped copper oxides, in which an electron has been taken away, resulting in a positively charged opening in the lattice. They found that the higher transition temperatures among different families of copper oxides were the result of the way the positive charge traveled in the layers. The highest temperature is achieved when a positive charge travels to the copper atom next-nearest to it with a "hopping magnitude," or energy level, of 0.02 electron volts. They also found that materials from the same family had the highest transition temperature when adjacent layers were tightly coupled. The fact that these physical differences were clearly linked to different transition temperatures is very important to understanding how to synthesize new materials in the future and is a significant step toward unraveling the basic physics of high-temperature superconductors—something that is surprisingly hard to nail down.



(Image courtesy Superconductors.org)

Structure of type 2 superconductor.

This Carnegie work was published in the March issue of *Physical Review B* and was supported in part by the U.S. Department of Energy and the Hong Kong Earmarked Grant for Research.



(Image courtesy Gemini Observatories.)

"We expected to see small, young galaxies colliding and growing in the adolescent universe when it was about 20% to 40% of its present age," said Patrick McCarthy, staff astronomer of the Carnegie Observatories and coprincipal investigator of the multinational Gemini Deep Deep Survey (GDDS). "It turns out, however, that the young universe was home to much older and more massive galaxies than we thought possible. I can't wait to see what the theoreticians will come up with to explain our observations." The findings were announced at the 203rd meeting of the American Astronomical Society held on January 5, 2004.

Distant galaxies live far back in time and have been notoriously difficult to study. Not only are they dim because of their distance, but the motion of the expanding universe makes it additionally problematic to capture their light and read the secrets of their spectra. A sophisticated technique called "Nod and Shuffle" has allowed scientists to break through this obstacle for the first time. It was developed by the coprincipal investigator of the survey, Dr. Karl Glazebrook of Johns Hopkins, and was used on the Gemini Multiobject Spectrograph on the 8-meter Gemini North telescope in Mauna Kea, Hawaii.

"We were able to collect spectra from over 300 galaxies initially identified in the Carnegie Las Campanas Infrared Survey completed in the late 1990s," explained McCarthy. "That survey collected infrared and optical colors of more than 100,000 galaxies to find the handful of massive, old galaxies in the early universe that we subsequently surveyed with Gemini." The Gemini group homed in on these faraway objects from the part of time called the Redshift Desert—an era between 8 and 11 billion years ago that has been very difficult to observe. This survey is the most comprehensive study of galaxies in the early universe to date. It required over 120 total hours of telescope time and exposures that are about 10 times longer than is typical. "The results have been simply startling," McCarthy concluded.

IN Brief

❶ From left: Bill and Cynthia Gayden, Miguel Roth, Susanne Garvey, Marty and Richard Meserve, Nancy Davis, Pamela Wyatt, Ian Thompson, Eric Persson, and Frank Perez.

Trustees

❶ Trustee Bill Gayden with wife, Cynthia, joined **Richard Meserve** and wife, Marty, **Wendy Freedman**, and **Susanne Garvey** for a visit to Las Campanas on Nov. 4-6.

Administration

President **Richard Meserve** was asked by the National Academies of Sciences and Engineering to chair the Board on Radioactive Waste Management in Jan. The board advises the government on radioactive waste issues, including those relating to the proposed spent-fuel repository at Yucca Mountain. He was also asked by Mohamed El Baradei, the director general of the International Atomic Energy Agency (IAEA), to serve as the chairman of the International Nuclear Safety Group, an international group newly formed to assist the IAEA, the nuclear community, and the public on nuclear safety. He attended the meeting in Vienna, Austria, on Nov. 13-14 and a second on Nov. 24-26.

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Meserve also chaired a National Academies committee on peer review standards for regulatory science and technical information. The committee sponsored a workshop on the subject on Nov. 18. Additionally, Meserve has joined the board of directors of the Foundation for Nuclear Studies, a non-profit organization that informs the public on issues relating to nuclear power, science, and technology.

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Rosa Smith's son, Michael, died after a long battle with cancer. For the past 10 years Rosa has provided lunches to students and teachers at First Light and CASE. Cards or a donation may be sent to 815 Webster Steet, NW, Washington, DC 20011.

Embryology

Staff member **Andy Fire** joined the Stanford U. School of Medicine as professor in the Dept. of Pathology, where he studies the mechanisms by which cells and organisms respond to genetic change. Postdoctoral fellow **Julia Pak**, graduate students **Rosa Alcazar**, **Daniel Blanchard**, **Ky Sha**, and **Fred Tan** will continue their studies under Fire's supervision.

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Reiko Nakajima of Zheng's lab is now an assistant professor at Kyoto University School of Medicine.

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Jinzhe Mao (Ph.D., Georgia State U.) has joined the Brown lab.

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Joining the Halpern lab is **Yung-Shu** (Ph.D., U. North Carolina) and **Mike** illey, animal care technician zebrafish facility manager.

—

aduate student **Dongli Huang** ently received her Ph.D. from The ns Hopkins U. She will continue r studies in the Koshland lab.

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Laura Buttitta of the Fan lab received her Ph.D. in Jan. and started postdoctoral work with Bruce Edgar at the Fred Hutchinson Cancer Research Center. A new addition to the lab is **Cheng Xu** (Ph.D., Institute of Oceanology, Chinese Academy of Sciences).

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Aja Campbell is the Schreiber lab fish technician.

Geophysical Laboratory

Wes Huntress participated in a National Research Council workshop on the future of human spaceflight in Nov. Huntress also participated in an event on the same topic associated with the centennial of flight on Dec. 17 in Washington.

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Ronald Cohen organized the workshop "Fundamental Physics of Ferroelectrics: 2004" in Williamsburg, VA, Feb. 8-11. It was sponsored by Carnegie, the Office

Francis R. (Joe) Boyd, 1926-2004

Francis R. (Joe) Boyd, 77, a geologist who contributed to the understanding of the formation of the Earth, died of sepsis Jan. 12 at Sibley Memorial Hospital in Washington. Boyd was born in Boston and held degrees from Harvard and Stanford. He joined the Geophysical Lab as a staff assistant and became a staff member in 1956. Although he retired officially in 1996, he continued his research at GL until shortly before his death.

Boyd conducted research in two areas: high-pressure experimental studies and petrologic investigations of mantle rocks erupted as inclusions in kimberlites and basaltic volcanics. One of his earliest and most important contributions to experimental petrology was the Boyd-England piston-cylinder, high-pressure apparatus, which he developed with GL researcher Joe England. This device enabled him and his collaborators to determine pyroxene-garnet phase relations to 50 kbar, data that provided a basis for estimating the origin depths of mantle rocks quenched by rapid eruption. A major collaboration between Carnegie and petrologists and geochemists at the Institute of Mineralogy and Petrography at Novosibirsk, Russia, was the investigation of Siberian xenoliths to determine similarities and differences between the lithospheres beneath the Siberian Platform and the Kaapvaal Craton in southern Africa. Major element, trace element, and isotopic studies revealed that the Siberian peridotites are as ancient as counterparts from southern Africa and are equivalently depleted in magmaphile elements.

Among other significant achievements was Boyd's examination and documentation of an extensive collection of ultramafic nodules from kimberlite pipes. In the 1990s, with support from the Center for High Pressure Research (CHiPR), he was also involved in the design and development of a cubic-anvil apparatus permitting phase studies with substantial volumes of sample in the range 5-25 GPa. This apparatus and a similar, newer one are major components in GL's high-pressure research supervised by Yingwei Fei.

A longtime member of the Cosmos Club, Boyd was a past president of the Geochemical Society and the Geological Society of Washington, a fellow of the Geological Society of America and the American Geophysical Union, and a member of the National Academy of Sciences. This year the Mineralogical Society of America awarded him its highest award, the Roebling Medal.

Joe Boyd was not only a distinguished scientist but also a wonderful friend and colleague. He will be missed by all who knew him.

Geophysical Laboratory Greats Honored

Gary Ernst, Don Lindsley, and **Charles Prewitt** were honored with a dedicated symposium and a special reception at the joint annual meeting of the Mineralogical Society of America and the Geological Society of America held in Nov. in Seattle. Ernst, a Carnegie trustee and former GL postdoctoral fellow, was honored on his retirement from Stanford. Lindsley, a former GL staff member, retired this year from research and teaching at SUNY-Stony Brook. Prewitt, former director of GL, received the 2003 Roebling Medal of the Mineralogical Society of America. He was recognized for his outstanding original contributions to understanding the crystalline structures of high-pressure minerals and joins some 15 other GL staff members and alumni who have received this honor.

GL's Doug Rumble (left), past president of the Mineralogical Society of America, presents the Roebling Medal to Charles Prewitt (right). Prewitt's citationist, Alexandra Navrotsky (U. California-Davis) is also present.

Gary Ernst, Don Lindsley, and Charlie Prewitt (left to right) respond to their colleagues' toasts at the MSA-GSA reception in Seattle.

of Naval Research, and the *Journal of Physics: Condensed Matter*. About 100 participants attended. Cohen has run this meeting every other year since 1990. Proceedings can be found at http://www.gl.ciw.edu/~cohen/meetings/ferro2004/ferro2004.htm/.

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At the request of the National Science Foundation, Cohen ran a town meeting at the fall American Geophysical Union meeting in San Francisco, and is organizing a workshop on computational geoinformatics in Washington, DC, May 2-4. Working groups have been formed to write a white paper on the computation needs of the Earth sciences for the next 5 to 10 years. More information is available at http://www.gl.ciw.edu/~cohen/meetings/geoinf2004/.

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Andrey Bekker (Harvard U.) is now a Carnegie fellow. Bekker is interested in the evolution of the atmosphere and the surface environment of the Earth. He will be working with Doug Rumble and others at GL.

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Steven D. Jacobsen (U. Colorado) has been appointed postdoctoral research associate and will be working on structure and elasticity of Earth-forming minerals; hydrogen in the mantle; gigahertz ultrasonic interferometry; and high-pressure X-ray and neutron diffraction.

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Pei-Ling Wang, former postdoc working with Doug Rumble, is a new assistant professor in the National Oceanographic Institute, National Taiwan U., Taipei City.

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Xianwei Sha (U. Massachusetts) was appointed postdoctoral research associate and will be working with Ron Cohen on iron at high pressures and temperatures, and on iron alloys.

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Takuo Okuchi (Ph.D., Tokyo Institute of Technology) is a visiting investigator in high-pressure material sciences, using nuclear magnetic resonance spectroscopy in the diamond-anvil cell to understand the property of Earth and planetary materials at high pressure and temperature. He will work with Russell Hemley, George Cody, Viktor Struzhkin, Dave Mao, and others.

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Rachel Schelble (U. Southern California) was appointed a predoctoral fellow and will be working with Andrew Steele and others on the fossilization of microorganisms.

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Kevin Wheeler (Lamont-Doherty Earth Observatory) has been appointed a predoctoral associate and will be working with Yingwei Fei.

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Li Zhang (Southwest Jiaotong U., China) is a new predoctoral research associate interested in shock wave and static compression techniques to establish thermal equations of state for mantle minerals over a wide pressure and temperature range.

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The Winter 2003 *Spectra* reported that **Valentina Degtyareva** visited GL to work on a project in the high-pressure lab. Unfortunately, she was unable to get a visa.

Global Ecology

Staff member **Greg Asner** completed filming of a National Geographic special on high-tech remote sensing of ecosystems in Hawaii. He traveled to Buenos Aires in a NASA delegation to brief the Argentine Space Agency on desertification-monitoring possibilities using new aircraft and satellite remote sensing approaches. This breakthrough will change the way that global desertification studies are executed. Asner also started a new study on desertification and climate change in southern Patagonia, and completed the first mapping of forest canopy gaps for the entire Amazon Basin. The breakthrough in satellite measurement of forest canopy water content will now be used to sense the effects of El Niño and drought on Amazon forest condition and productivity.

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Postdoctoral research associate **Jeff Dukes** left the Field lab to accept a position at U. Massachusetts. **David Kroodsma** and **Molly Palmer** joined the Field lab as technicians, and **Jessica Guh** joined as a lab assistant. Other additions are **Kim Nicholas Cahill** and **Jon Benner**, doctoral students.

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Guanghui Lin, associate research scientist from Columbia U. and the Biosphere 2 Center and Lamont-Doherty Earth Observatory, is currently a visiting professor in Joe Berry's lab.

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Amanda Warner left the Asner lab on Feb. 27 for a position with Hyperspectives in Bozeman, Montana, to work on hyperspectral and radar fusion in the greater Yellowstone area.

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On Saturday, Feb. 14, over 60 people helped plant more than 5,000 plants around the new Global Ecology department building.

Observatories

On Jan. 17 Carnegie and Caltech jointly held the first Zwicky Supernovae Workshop including dark-energy and gamma-ray bursts at the Observatories' William Golden Auditorium. The workshop was organized by Derek Fox, Avishay Gal-Yam, Shrinivas Kulkarni, and **Wendy Freedman**. Forty-five astronomers, mainly from the Pasadena community but also from Berkeley, Lawrence Livermore, Harvard, Very Long Baseline Array (VLBA), U. Hawaii, and Yale, attended. The meeting brought together radio, gamma-ray, and optical astronomers as well as theorists and instrumentalists, and provided a unique forum for the exchange of ideas and progress reports on a huge range of ongoing and new initiatives. Wendy Freedman gave an overview of the new Carnegie Supernova Project, and **Mark Phillips** gave a talk on the infrared properties of supernovae. The meeting led to several new collaborations.

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John Mulchaey was awarded a NASA Long-Term Space Astrophysics (LTSA) grant.

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Staff member **François Schweizer** gave an invited talk at the Nov. Workshop on the Formation and Evolution of Massive Young Star Clusters in Cancún, Mexico.

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❷ DTM Director Emeritus George Wetherill was awarded the Henry Russell Lectureship from the American Astronomical Society, acknowledging lifetime achievement in the field of astronomy.

❸ Vera Rubin (right), with husband Bob, poses after receiving the James Craig Watson Medal and prize.

Carnegie fellow **Kurt Adelberger** gave invited talks on galaxy formation during the first half of the universe's history at UC-Berkeley on Oct. 30 and at Lawrence Livermore National Laboratory on Oct. 31.

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Mario Hamuy gave an invited talk on supernovae at the third annual meeting of the Chilean Astronomical Society (SOCHIAS) in Santiago on Jan. 12-14.

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Scientific visitor **Karl Gebhard** (U. Texas) presented a colloquium on massive black holes during Oct.-Nov.

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Matthew Malkan (UCLA) began his six-month sabbatical at the Observatories in late Dec.

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Christopher Sneden (U. Texas) visited in Feb. and taught astronomers the use of his stellar abundance analysis software. He also presented a colloquium, "Comparing Chemical Histories of Halo Field Stars and Globular Clusters: the Struggle Continues."

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Sylvain Veilleux ended his sabbatical year at the Observatories and Caltech in Jan. He returned to U. Maryland, where he will supervise the building of the Maryland-Magellan Tunable Filter for the IMACS spectrograph at Las Campanas.

Plant Biology

Chris Somerville gave a seminar, "Genetic Dissection of Cell Wall Synthesis and Function in *Arabidopsis*," on Jan. 14 at the Complex Carbohydrate Research Center at U. Georgia.

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Winslow Briggs was invited to give a seminar, "Phototropins: A New Family of Plant Blue Light Receptors," on Dec. 15 at Washington U. in St. Louis. He also was an invited speaker on Jan. 26 at the Gordon Research Conference on Photosensory Receptors and Signal Transduction.

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Staff member **Shauna Somerville** gave seminars on microarray analysis in Sept. at UC-Berkeley and at NSF-RCN in Mohonk, NY. In Oct. she gave seminars at Mendel Biotechnology, Hayward, CA; the Noble Foundation, Ardmore, OK; and Oklahoma State U., Stillwater. She also presented seminars in Nov. at Plant Genomics, Academia Sinica, Taipei; and in Dec. at the Disease Susceptibility Conference in Giessen, Germany. In Jan. Shauna was appointed a member of the Science and Industry Advisory Committee for Genome Canada for a three-year period. In Mar. she began a term with the Genetics Study Section, Center for Scientific Review, at the NIH, which will end in June 2007.

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Arthur Grossman and **Devaki Bhaya**, along with Richard Zare of the Stanford chemistry dept., are teaching a new freshman laboratory-seminar course called "Light, Pigments, and Organisms." The course coordinator is **Dafna Elrad**, a former graduate student of Grossman. Bhaya also lectured in the BIOSCI 2 course at Stanford, which introduces students to current research topics in biology.

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Dominique Bergmann of Chris Somerville's lab gave seminars at the Plant Research Lab, Michigan State U., in Dec.; the Dept. of Biology, Indiana U., also in Dec.; and the Dept. of Biological Sciences, Stanford U., and the Dept. of Plant Biology, Cornell U., in Jan.

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Postdoctoral research associate **Trevor Swartz** presented an invited talk, "Phototropin Structure and Function," at the Gordon Research Conference on Photosensory Receptors and Signal Transduction.

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Stefan Bauer joined Chris Somerville's lab as a postdoctoral research associate.

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Marta Berrocal-Lobo received a postdoctoral fellowship from the Spanish government and is working in Shauna Somerville's lab.

—

Stephan Eberhard was welcomed as a postdoctoral research associate in the Grossman lab.

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Woojun Park (Harvard U.) joined the Bhaya lab as a postdoctoral research associate.

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Anja Schmidt received the Reinhold and Maria Teufel Stiftung Fellowship and will join the Frommer lab as a predoctoral visiting investigator from Feb. 23 to May 21. Also new to the lab is **Loren Looger**, a postdoctoral fellow from Duke U.

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Catherine Qing Sun, an intern in Zhi-yong Wang's lab last summer, is a semifinalist in the Intel Science Talent Search, the country's oldest and most prestigious youth science competition. Catherine examined the growth of plants and their sensitivity to hormones and proteins.

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Timothy Chang joined the Wang laboratory as a lab assistant.

Terrestrial Magnetism

❷ On Feb. 4 **George W. Wetherill**, DTM director emeritus, was awarded the Henry Russell Lectureship from the American Astronomical Society, a prize acknowledging lifetime achievement in the field of astronomy. Past recipients have included Nobel Laureates Subrahmanyan Chandrasekhar, Enrico Fermi, and Riccardo Giacconi, as well as **Allan Sandage** of the Carnegie Observatories and **Vera Rubin** of DTM.

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❸ **Vera Rubin** was awarded the James Craig Watson Medal and prize from the National Academy of Sciences (NAS) "for her seminal observations of dark matter in galaxies, large-scale relative motions of galaxies, and for generous mentoring of young astronomers, men and women." Among the others who have received this prize is **W. Kent Ford, Jr.**, a former DTM staff member who worked very closely with Rubin. This award, which is given every three years, was presented to Rubin in a ceremony at the NAS annual meeting on Apr. 19. In addition, Rubin was chosen as one of the 2004 recipients of the Wings Trust's Woman of Discovery Awards. The Wings Trust is a nonprofit organization "dedicated to researching, promoting, and celebrating contributions of extraordinary women explorers around the world." This award was presented at the National Arts Club on Mar. 3. Rubin also spoke at Hine Junior High School in Washington, DC, and gave a public lecture at Princeton U.

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David James was elected a fellow of the American Geophysical Union and will be honored at the 2004 spring meeting. James was also selected as an Incorporated Research Institutions for Seismology /Seismological Society of America Distinguished Lecturer for 2004.

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Staff scientist **Rick Carlson** was made a fellow of the American Geophysical Union (AGU) in Dec. at the organization's fall meeting in San Francisco. In addition, Carlson was featured in an article in the Jan. 2004 issue of *Geotimes* magazine on using inductively coupled plasma mass spectrometry (ICP-MS) to identify the origins and source regions of diamonds.

—

Paul Butler was presented with U. Maryland's 2004 International Alumnus Award in mid-April. In addition, in Dec. Butler gave the Carl Sagan Lecture at the American Geophysical Union's fall meeting in San Francisco. His talk focused on his work studying and searching for extrasolar planets.

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In Mar. **Sara Seager** was awarded the Bok Prize, given annually to a Ph.D. graduate of the Harvard astronomy department. During the winter/spring season Seager gave colloquia at Harvard U., MIT, Fermilab, U. Pennsylvania, and Ohio State U.

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Sean Solomon delivered seminars on the MESSENGER mission to Mercury at The Johns Hopkins U. and the Space Telescope Science Institute in Mar., as well as at U. Maryland in Apr. He was interviewed for a radio feature on MESSENGER that aired Feb. 19 in the UK on the BBC science program *Leading Edge*.

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Alan Boss presented his theories on giant planet formation at the Terrestrial Planet Finder Science, Technology, and Design Expo, held in Pasadena, CA, in Oct. Also in Oct., he attended the NASA Kepler Mission Science Team's annual meeting at Ball Aerospace, Boulder, CO, and spoke at the NASA Astrobiology Institute's Executive Council Retreat at

Jackson Hole, WY. In Nov. Boss was a featured speaker at the Symposium on Life in a Planetary Context, a part of the American Society for Gravitational and Space Biology's annual meeting, held in Huntsville, AL. Boss spoke on the formation of giant planets at U. Delaware in Nov. and at the Space Telescope Science Institute, Baltimore, in Dec. In Jan. he presented the Origins Public Lecture on the search for new solar systems at McMaster U., in Hamilton, Ontario, as well as giving a seminar on giant planet formation to their Dept. of Physics and Astronomy.

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In Oct. **Sara Seager** and **Alan Boss** gave invited talks at the NSF symposium "The Universe from the Ground Up: Ground-Based Astronomy in the 21st Century," intended for the public and widely distributed on the Web. Also in Oct., **Seager** and **Alycia Weinberger** gave invited talks at the 14th Annual Maryland Astrophysics Conference, "The Search for Other Worlds," held at U. Maryland, where postdoctoral fellows **Nader Haghighipour** and **Kaspar von Braun**, along with former summer intern **Jared Crossley**, also presented their work.

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Staff members **Larry Nittler** and **Conel Alexander**, along with postdoctoral fellows **Nader Haghighipour** and **Michael Smoliar**, delivered talks at the Lunar and Planetary Science Conference in Houston in Mar. Additionally, **Andrea Young**, one of DTM's former undergraduate interns, presented a paper based on the work that he did during his term at BBR.

—

Alycia Weinberger presented a talk at the American Astronomical Society's Jan. meeting, along with postdoctoral fellows **Kathleen Flint** and **Aki Roberge** and 2003 summer intern **Martha Buckley**. Weinberger also gave a colloquium at the National Radio Astronomy Observatory in Charlottesville, VA, in Nov. In Feb. she gave an invited talk at the Very Large Space Telescope Workshop at the Space Telescope Science Institute in Baltimore, and in Mar. she gave a colloquium at the New York Center for Studies on the Origins of Life (RPI), where she was interviewed on WAMC public radio. In Apr. she gave a colloquium at U. Maryland, Baltimore County.

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Presenters at the American Geophysical Union (AGU) fall meeting in San Francisco included **Mark Behn, Rick Carlson, Lucy Flesch, David James, Katie Kelley, Petrus le Roux, Alan Linde, Ambre Luguet, William Minarik, Selwyn Sacks, Mark Schmitz, Alison Shaw, Steve Shirey, Paul Silver, Sean Solomon,** and **Linda Warren.**

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At the 2003 DTM Visiting Committee meeting, held in mid-Nov., staff scientist **Larry Nittler** was the keynote speaker for the meeting's evening reception, giving a talk titled "Hunting Antarctic Meteorites." Chaired by trustee **William K. Gayden**, the committee consisted of the following members: **Philip H. Abelson**, Neta A. Bahcall, **Tom Cori, Bruce W. Ferguson**, Donald W. Forsyth, J. Freeman Gilbert, Alex N. Halliday, Albrecht W. Hofmann, and Anneila I. Sargent, as well as ex officio members **Michael E. Gellert** and **Richard A. Meserve.**

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Kathleen Flint, a Carnegie fellow who was working in the Astronomy Group at DTM, left in Mar. to begin a postdoctoral position at the Gemini Observatory in Hilo, HI.

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In Oct. postdoctoral fellow **Aki Roberge** began a three-year term as a member of the Multimission Archive at Space Telescope (MAST) Users Group, an advisory committee for the space-based astronomy data archive that includes all Hubble data.

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Carnegie Fellow **Mark Schmitz**, who finished his term as a postdoctoral associate in Dec., has joined the faculty of Boise State U. In addition to continuing his research on the isotope geochemistry, geochronology, and thermochronology of the deep continental lithosphere, Mark joins a scientific team in the Dept. of Geosciences working to calibrate precisely the geologic timescale.

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In Nov. **Eiichiro Araki** ended his term as a visiting fellow from the Japan Marine Science and Technology Center. Araki worked with Selwyn Sacks and Alan Linde.

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Myung Gyoon Lee, a visiting investigator from the astronomy department at Seoul National U., returned to the BBR campus for a two-month visit in Jan. and Feb. to continue work on extragalactic astronomy and observational cosmology.

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Oksana Skass joined DTM as an administrative assistant in early Feb. Oksana has degrees in English from Odessa State U. of I. I. Mechnikov in Ukraine and Web design from Montgomery College.

—

Brooke Hunter, former project and publications coordinator for DTM, departed in Dec. to pursue a graduate degree in creative writing at Antioch College.

DTM/GL

Presenters at the Mar. Astrobiology Science Conference, held at NASA's Ames Research Center in Moffett Field, CA, included **Andrey Bekker, Alan Boss, James Cho, Nader Haghighipour, Jake Maule, Eugenio Rivera, Aki Roberge, Sara Seager, Andrew Steele,** and **Jan Toporski.**

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DTM-GL visiting investigator **Kevin Burke** has returned to U. Houston for the semester. A professor emeritus in the Dept. of Geosciences, he divides his time between Washington, DC, and Houston.

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Bruce Jakosky, a DTM-GL visiting investigator from U. Colorado-Boulder, is visiting the campus through the spring to continue his work on the physical properties of the Martian surface in support of the Mars Exploration Rover traverses. In addition, Jakosky is collaborating with GL staff member **Andrew Steele** and others to promote technology development for astrobiology spacecraft missions.

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CIW Legacy Project archivist **Jennifer Snyder** has joined the BBR campus on a part-time basis. Jennifer has spent the past year working exclusively at CIW's P Street offices. Both Jennifer and **Charles Hargrove**, the Legacy Project's second archivist, will be splitting their time between BBR and P Street.

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Librarian **Shaun Hardy** participated in the Geoscience Information Society's annual meeting in Seattle in Nov.

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Nearly 1,200 books and scientific reports from the personal library of **Hatten S. Yoder, Jr.**, late director emeritus of GL, were donated to the campus library by Yoder's daughter, Karen M. Wallace. The extensive collection contains many valuable works in igneous petrology, mineralogy, volcanology, and the history of science.

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The library also received a gift of over 400 publications from DTM Director Emeritus **George Wetherill**, reflecting his long-term studies on the origin and evolution of the solar system.

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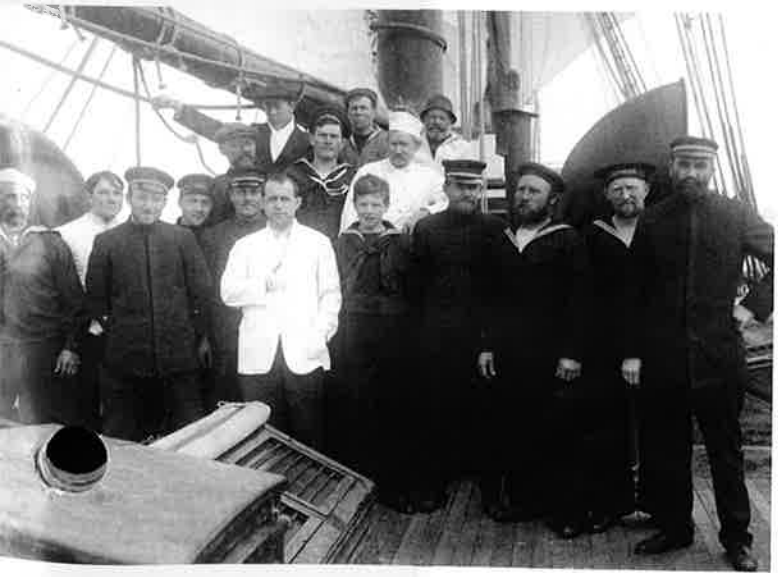
❹ Copies of the unpublished memoirs and letters of **Jasper Sewell**, a 15–year–old cabin boy on the research vessel *Carnegie*, were donated to the DTM archives by his daughter, Andrea Weymouth of Queensland, Australia. ◐



❹ Jasper Sewell (middle) appears with the crew of the *Carnegie* during its circumnavigation of Antarctica, 1915-1916.

Department of Embryology
Faces a New Kind of Challenge

The Carnegie Institution is facing a new challenge at its Department of Embryology. But this time the challenge does not arise from a question in developmental biology. The Kresge Foundation has awarded Carnegie a $1.5 million challenge grant, which requires that the institution raise an additional $7.2 million by July 1, 2005, toward the construction of a modern, well-equipped research building on the campus of The Johns Hopkins University. The building is located on the Homewood Campus and is named for former Carnegie president Maxine F. Singer.

"To meet this challenge we also have to introduce ourselves to philanthropists in Baltimore and beyond."

"This building is a fitting tribute to Maxine Singer," said Michael E. Gellert, [illegible] of Carnegie's board of trustees. "She is a remarkable scientist and an even more remarkable leader. The department's geneticists are picking up where she and her colleagues of researchers left off. Biomedical science will be able to save lives and prevent disabilities because of the work that goes on here. This kind of progress is priceless."

"To meet this challenge we also have to introduce ourselves to philanthropists in Baltimore and beyond," said Carnegie president Richard A. Meserve. "Our scientists have been doing world-class research for 40 years, but few in the general public know anything about it. We have taken many steps toward solving the unknown questions in genetics and developmental biology, and these facilities will let us sustain that effort on into the future."

The brick, copper, and glass facility, which will cost a total of $31.2 million, is being built into a sunny hillside on San Martin Drive and will have 13 laboratories for staff members and researchers, a library, and meeting rooms. The Department of Embryology operates as a molecular biology think tank, with scientists seeking to understand the effect of hormones on development, the ways in which cells send targeted signals to other cells during development, and the exquisitely choreographed sequence of gene activation that shapes the growth of each individual organism. Their investigations are central to biology—indeed, to all of society—since a solid understanding of these processes can help yield therapies for such diseases as cancer, for birth defects, and for other developmental disorders.

Spring Lectures at the Observatories

The Observatories hosts its second spring lecture series at the Huntington Library in San Marino, California. The lectures begin at 8:00 p.m. Carnegie astronomers and the titles of their lectures are as follows:

Tuesday, March 30, 2004
"Building Big Telescopes"
›› Stephen Shectman

Tuesday, April 13, 2004
"The Birth of Galaxies"
›› Patrick J. McCarthy

Tuesday, April 27, 2004
"Stardust: Its Biological Legacy"
›› George Preston

Tuesday, May 11, 2004
"Cosmology: Looking through Time"
›› Michael Gladders

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