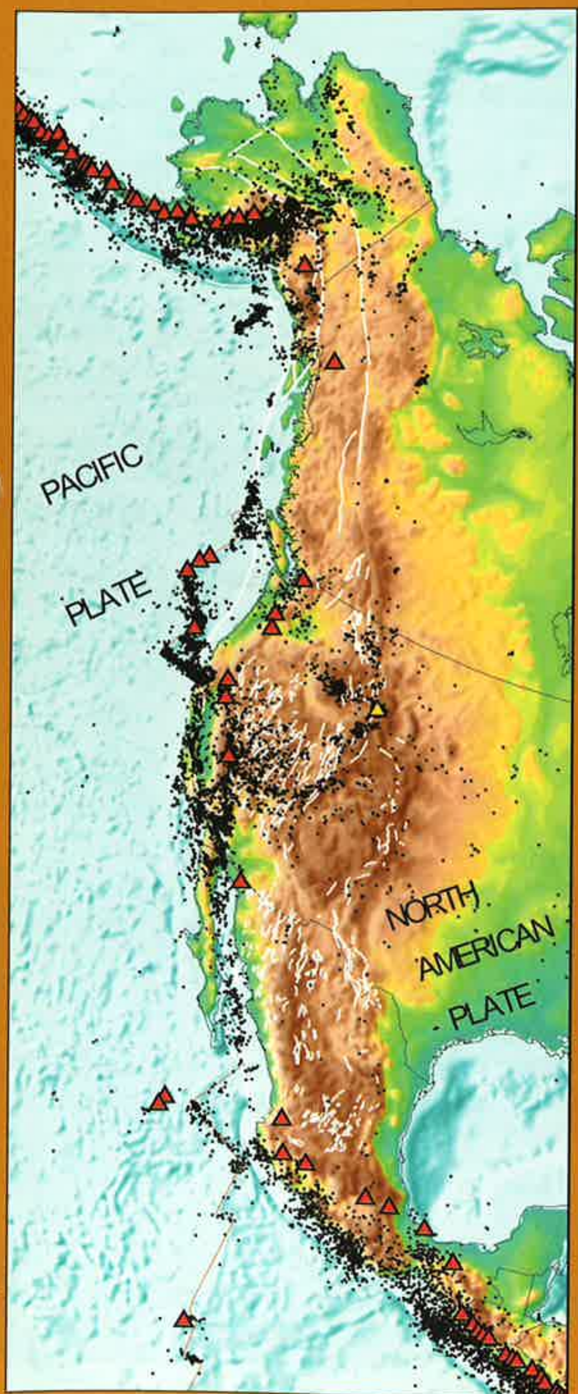
SPECTRA

Fall 2000

THE NEWSLETTER OF THE CARNEGIE INSTITUTION

Extending the Frontiers of Science



INSIDE:

This relief map of western North America shows areas of active tectonics and faults, and recent seismicity. See pages 6 and 10 for stories about this volatile area.

Speaking plainly about science

Tom Urban

Science is not simple. And explaining science to the public can be a difficult task; but it is an important one. Almost every aspect of society is affected by scientific achievement, from the economy and health care, to nutrition, education, and even recreation. To make informed decisions, the public and policymakers need to be familiar with the science behind issues such as the changing environment and genetic engineering. Those of us involved in the sciences are the best equipped to help others understand breakthroughs and show how basic research can help solve problems and make people's lives better.

We are fortunate at Carnegie in that our research is mostly supported by our endowment. However, we also rely on the help of individuals, foundations, and even the taxpayer, through federally funded projects. To enlist new supporters and to keep them interested in our science we must explain what we do, why it's important, and how exciting it is in plain terms.

Many Carnegie scientists work hard at communicating the amazement of discovery to the public. For years, Bob Hazen at the Geophysical Lab has championed science education at all levels. He has put his purpose into practice with his popular books and lectures that have intrigued and informed audiences about the most compelling scientific mysteries that face us. Alan Dressler at the Observatories is another Staff Member who reaches out. NASA recently awarded him its Public Service Medal for his many outstanding efforts.

As environmental concerns remain at the forefront of the news, Plant Biology's Chris Field has become increasingly involved in educating elected officials and the media. He appeared before the U.S. Congress to discuss the rise in atmospheric CO_2 and talked with a host of reporters about a study detailing the changing climate in California. The list goes on. Alan Boss, Vera Rubin, Wes Huntress, and Sean Solomon are some of our scientists who are frequently quoted in the popular press about new findings in their fields. And, of course, Maxine Singer, our president, constantly communicates with the public through her many speeches, her writings, and by hosting the Capital Science Lectures.

The more people understand science, the faster they will come to see how important and relevant basic research is to their own lives. The Carnegie researchers who are able to communicate complicated concepts simply and effectively are performing a vital service for the institution *and* the public. We should applaud their efforts and do what we can to follow their example.

Ta

Tom Urban, Chairman

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Magellan project to be dedicated in December

It all began in 1986, and now the first telescope of the Magellan Project is almost ready for scientific observations. It will be operational in time for the dedication ceremony, which will be held at the Las Campanas Observatory in Chile on December 9, 2000. The entire Magellan Project consists of the Walter Baade and Clay telescopes, also known as Magellan I and II; the Cecil and Ida Green and the Neil and Jane Pappalardo Science Support Facility; the John Stauffer Library; and the Horace Babcock Lodge. About 300 guests, invited from the five consortium institutions, are expected to attend the ceremony and dinner.

In addition to the dedication activities on December 9, there will be lectures and festivities in La Serena earlier in the week. The board of trustees will also hold its December meeting on Friday the eighth at Las Campanas.

Carnegie's Saturday school paves the way for college

Ten years ago, when Daryl Allen was eight years old, his mother decided that he would not be spending Saturday mornings watching cartoons. No mind-numbing TV for Daryl; he would spend his Saturdays at First Light, Carnegie's science school for District of Columbia elementary school children. At first the idea was unappealing to him. Daryl didn't like school, and school on Saturday just didn't seem fair. Furthermore, it was the first year of the program, so he had no idea what to expect. Early on, though, he discovered that First Light was not a normal school; it was fun. "I had stories to tell at the end of the day," he said. Besides stories, he ended up absorbing material that first year that he wouldn't encounter in his regular school until he was 13.

This fall Daryl, who is the grandson of Carnegie's Lloyd Allen, is a freshman at Virginia State University. Just before he left for college, he reflected on his five years at First Light and how the experience affected his life.

One particularly memorable day involved a "chemistry show that Chuck put on for us," he recalled. "He grabbed something blue and then something gray and put them both in a pan. A fire started. It was pretty cool." Eye-catching experiments, playing with microscopes, all kinds of field trips, and interacting with the other kids were pivotal in changing the way Daryl viewed learning. After a while, even his regular school seemed more fun.

By the time Daryl got to Anacostia High School in southeast Washington, D.C., his interests had broadened. He was a member of the photography club and the computer club; he played football and baseball, ran track, and worked on the school paper; and he was a member of the Student Conservation Association (SCA), an organization that is similar to First Light but focuses on the environment. In his senior year, Daryl was on Anacostia's team for *It's Academic,* a TV show in which teams from local high schools compete by answering progressively harder questions in subjects ranging from history and literature to math and science. Daryl was the team's leading scorer in the math category.

Unlike most entering freshmen, Daryl knows exactly what he wants to do in college: major in communications. He is particularly interested in TV, radio, and graphic design–areas that fit well with his interests in photography and computers.

Daryl, two days before he goes off to college, visits the First Light lab.

Daryl Allen is shown here at his graduation from Anacostia High School in Washington, D.C., in June 2000.

It is hard to gauge how much of Daryl's success (or the success of any of the graduates of First Light) can be attributed to the Carnegie school. However, it is interesting to note that Daryl is still in touch with five others who attended the Saturday class with him. Although he wasn't sure who among them definitely intended to go to college, he did know that they all graduated from high school. This is an enormous accomplishment in a city school system where illiteracy, underachievement, and dropping out are far too common.

What the Brain Does in the Dark

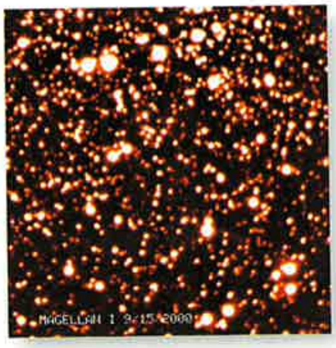
The commercially available hormone melatonin has been hailed as the solution to problems ranging from sleep disorders to inadequate sex drive. It is produced naturally by the body and regulates our internal clocks, or circadian rhythms, in concert with the daily cycle of light and dark. A tiny gland called the pineal gland, which resides in the center of the brain, is solely responsible for the production of melatonin. The amount of light the body perceives determines how much of the hormone is released. Very little is present during the day, but when night falls the pineal gland goes to work synthesizing the hormone and releasing it into the bloodstream.

Jimo Borjigin, at the Department of Embryology, is conducting research on the molecular mechanisms that govern circadian rhythms. As part of this research, she and her collaborators are studying the pineal gland in rats in an effort to understand the genes that are involved in stimulating the pineal gland and what genetic processes regulate the synthesis of melatonin.

To identify genes that function in the pineal, the scientists compared the gene activity of rat pineal glands sampled during the day with those sampled between 2:00 a.m. and 3:00 a.m. Thus far they have found about a half dozen day-specific genes and several dozen night-specific genes that are connected with circadian rhythms. Exposure to light for as little as one minute can inactivate the night genes' production of enzymes and interfere with their normal function. The researchers therefore conduct much of their work when the rest of us are asleep. Currently, they are determining if the genes they have identified are involved in melatonin production or if they have other functions.

Jimo Borjigin in her lab.

First Light on



Globular cluster NGC 6809 is the first object imaged by the Walter Baade telescope. Above, the cluster is shown in full-field, while an enlarged portion is below.

On September 15, 2000, the Walter Baade 6.5-meter telescope saw first light. The Magellan team used the CCD guide camera to take the images, which were of NGC 6809, a globular cluster that is 20,000 light-years away and 81 light-years in diameter. The recorded stellar images averaged 0.54 arc-seconds in diameter (FWHM).

The guide camera is used to locate and track objects with the telescope. It is not designed to take long exposures. A CCD imager will be added in October, permitting longer exposures. However, the success in using the guide camera is an excellent indication of the quality of images to come with other instrumentation.

The thermal control system, which keeps the 6.5-meter primary mirror from deforming due to temperature differences, and the active optics correction system, which also corrects the mirror's shape caused by factors such as wind and gravity, were used in obtaining the first-light images. Adjustments were made manually during these initial tests and both systems will be automated in the coming month.

The two Magellan domes are shown here in September 2000.

Testing of the image quality under different climatic conditions and optimizing the "seeing" will continue through October using the image analyzers built into the guider cameras. The ultimate goal is to capture the sharpest

Before Borjigin came to Carnegie, she and colleagues isolated three night-specific genes. Now at the Department of Embryology, she is determining how these genes function in addition to learning more about the others she and her colleagues have more recently found.

One of the genes Borjigin isolated is serotonin NAT (N-acetyltransferase). Through her functional analysis, she discovered that it is the enzyme limiting the rate at which melatonin is formed. A chief object of study in Borjigin's lab is the mechanism that governs the nightly production of this enzyme. Her recent research also revealed a surprise: that the neurotransmitter serotonin, implicated in a variety of psychiatric disorders, is also produced at much higher levels during the night, and may influence the production of melatonin.

Another gene Borjigin is analyzing is PINA (Pineal Night-specific ATPase). This night-specific gene is detectable in the pineal and the retina, tissues that in lower animals have an independent circadian clock. PINA is also a night-specific form of a gene found in the liver of patients with Wilson's disease, a genetic disorder that affects the body's chemistry by preventing the excretion of excess copper. The copper first builds up in the liver, then the brain, and can cause neurological disorders, eye problems, personality changes, and, if untreated, death. On the basis of her research, Borjigin suspects that PINA may have something to do with the neurologically induced erratic movements characteristic of Wilson's disease. As more is learned about the PINA in the pineal of the rat, more will be understood about the disease in humans.

A third nighttime-only gene the scientists are investigating has to do with tumor suppression. This gene, Patched-1 (Ptc1), is a receptor for the Sonic Hedgehog proteins. These are messenger proteins that send signals in early embryos to activate normal embryonic development. Improper functioning of Ptc1 may result in skin tumors. What Borjigin discovers about the function of this gene in the pineal system

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MAGELLAN I!

images possible. The indications thus far are that the telescope will successfully compete with the finest large telescopes currently in operation.

Science Instrumentation

Plans are under way for bringing the first science instruments to the telescope. The expected initial suite of devices to be operational includes MIT's Magic CCD imager and the LDSS low-dispersion spectrograph. Commissioning of the instruments begins at the end of this year. Initial science operations are due to start in January. Other major Magellan instruments currently under development will come later.

The team will take a break from commissioning science instruments in December when the dedication of the Magellan facility at Las Campanas Observatory takes place.

Magellan II

On the other front, the Clay telescope (Magellan II) enclosure structure is almost complete. The controls that rotate and open up the dome are being installed in final preparation for the telescope's arrival.

The Clay telescope was shipped to Chile in August and September from the Port of Long Beach, CA. In all, fifteen 40-foot truckloads, many of them oversize, were required. The telescope is currently being assembled on site.

The Steward Observatory Mirror Lab, at the University of Arizona in Tucson, is polishing the Magellan II primary mirror. They expect to finish around the end of this year. The supports for the mirror are being installed in the mirror cell. Following successful testing of the supports with a dummy mirror, the actual mirror will be mounted in the cell and tested. The whole process will take about six months. The mirror and cell are expected to arrive on-site around August 1, 2001.

The secondary and tertiary mirrors of the telescope are completed and ready for use when the primary mirror arrives. In short, the Clay telescope is on schedule for completion in 2002.

This interior shot of the Walter Baade telescope shows what it looks like to peer through the open dome.

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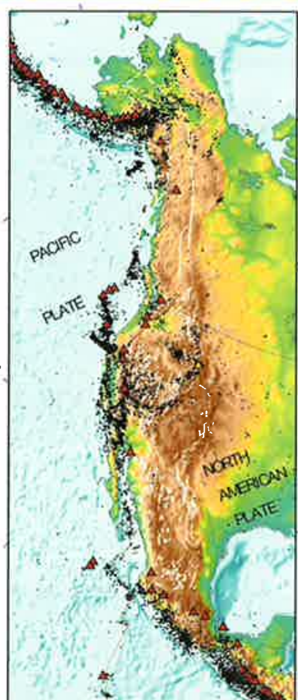
may provide clues to understanding embryo development, pattern formation in the body, and what goes on in the growth of tumors.

The work in Borjigin's lab would be impossible without new procedures for studying gene function. Perhaps the most important such procedure allows the researchers to monitor what goes on in the pineal in real time. Previously, animals had to be sacrificed to study the pineal; the data came from a one-time sample from one gland. Now the scientists use a microdialysis probe implanted in the pineal of the rats to acquire information. Artificial cerebral spinal fluid circulates through the probe and collects samples at specific intervals. A liquid chromatography system then allows the scientists to see the products of the pineal just after they are produced. This "live" sampling procedure is ideal for investigating the secretion of melatonin in one gland over many circadian cycles.

This rat is shown with a microdialysis probe implanted in its pineal.

Another technique Borjigin and her collaborators are using has greatly expanded the number of genes they can analyze. Previously, they used only drugs as a means of suppressing the function of a gene to monitor what happens. Developing these drugs, however, can take a long time. Now, in addition to using drugs, the researchers are using recombinant viral vectors—a delivery system that introduces genes to the pineal by direct injection. By adding this technique to their suite of procedures, they can analyze



This is a relief map of western North America. Red triangles indicate areas with recent eruptions or active tectonics. The white lines are active faults, while black dots show areas of recent seismicity. The western part of the plate boundary zone is home to the San Andreas Fault. (Courtesy Paul Silver.)

AN OBSERVATORY THAT LOOKS

When we hear the word "observatory" at Carnegie, we tend to think of Las Campanas and the night sky. This word may soon call up a different picture as Paul Silver, geophysicist at the Department of Terrestrial Magnetism, firms up plans for the Plate Boundary Observatory (PBO), a new kind of observation facility that would look *into* Earth, not *out* from it. Silver is chairing the steering committee that has developed the initiative for the project and is working with the National Science Foundation, which is considering it for funding. As planned, the PBO consists of a network of devices that would monitor how the Earth's surface deforms as the continuously moving North American and Pacific plates slide against each other.

The PBO is part of a four-part initiative called EarthScope, which has the potential to revolutionize what we know about earthquakes, volcanoes, and fault systems. The PBO would have the capability of observing the slowly deforming Earth in real time over the western one-third of the North American continent. A network of instruments including strainmeters, Global Positioning System (GPS) receivers, and seismometers would constitute the PBO. Strainmeters, such as those produced at DTM, monitor the subtle, short-term strains in the Earth lasting hours to weeks, while the relative motions of the GPS receivers monitor the longer-term deformation related to the continuous drifting of the two plates. The seismometers register seismic activity caused by both earthquakes and volcanic activity. Some 400 GPS receivers are already in place. The program calls for installing 875 more in addition to adding 200 strainmeters to the 45 the functions of more genes faster. Another advantage of the viral technique is that it specifically targets pineal function and thus rules out influences of the virus on other regions of the brain.

Borjigin's continual refinement of her techniques and her use of integrated approaches to analyze the function of pineal genes in rats will contribute to our understanding of human health. Her discovery that the pineal is involved in the dynamic synthesis of serotonin will advance research into mood disorders, and unraveling the details of melatonin regulation may help us understand our daily requirement for sleep. "I hope that one day our research can shed some light on the mysteries of what our brains are doing in the dark," she says.

THE OTHER WAY

already in existence.

The integration of the new technology into the Plate Boundary Observatory would give scientists an unprecedented boost toward understanding the mysteries of our moving planet. The system would allow them to observe the motions that lead to building mountains; to watch how strains accumulate, ultimately to produce earthquakes; and to monitor the way magma moves and volcanoes form. The particular advantage of this system over anything in the past is that it can measure the Earth's activities over minutes to decades and at scales from one meter to thousands of kilometers. This level of temporal and spatial resolution would yield surprising discoveries. Perhaps more important, it would also significantly advance our ability to understand and predict earthquakes and volcanic eruptions, and thus save lives.

Detecting Life Here and There

Some two dozen researchers from Carnegie's Department of Terrestrial Magnetism and the Geophysical Laboratory have joined the ranks of frontier scientists in the new discipline of astrobiology. Astrobiology is a multidisciplinary approach to understanding the origin of life on Earth and determining its potential for existing elsewhere in the universe. The fundamental questions scientists ask are how life begins and evolves, if it has formed in other parts of the cosmos, and what the future holds for life on our planet. Although these questions have long tantalized the human imagination, researchers are only now able to systematically investigate the subject from many perspectives, including those of microbiology, astrochemistry, planetary evolution, high-pressure physics, genomics, atmospheric chemistry, geobiology, and more.

NASA is deeply involved in this broad field and, as one component in the effort, has established an umbrella organization called the Astrobiology Institute, which is headquartered at the NASA Ames Research Center in California's Silicon Valley. The institute exists in cyberspace, too—participating scientists from 11 institutions are linked via the Internet to form a virtual institute.

Astrobiology at Carnegie

Although Carnegie officially began research into astrobiology in 1996, the foundation for this work was laid much earlier. Fifty years ago Philip Abelson, former director of the Geophysical Lab and a current trustee, extracted amino acids from fossil clamshells, thus blending the fields of geology, biology, and chemistry. Work in biophysics was conducted at the Department of Terrestrial Magnetism after World War II. Abelson's work and the work done at DTM are examples of a tradition at Carnegie in which problems are approached from a variety of perspectives. It is this tradition that makes the institution a natural place for studies in astrobiology. Today, a multidisciplinary group at Broad Branch Road is attacking one piece of the astrobiology puzzle—hydrothermal systems.

Expeditions since the late 1970s have shown that areas surrounding deep oceanic hydrothermal vents are rich in life. A variety of organisms live in this environment under extreme pressure and without light or oxygen—conditions that, it was formerly thought, would preclude the existence of life. In addition, hydrothermal activity, in which water is subjected to high temperatures and pressures, has either been identified on or is expected on a variety of objects in our solar system, among them planets, large satellites, and the parent bodies of meteorites.

Carnegie's work on hydrothermal systems complements other studies at the institution that contribute to astrobiology. Understanding the distribution of water and other volatiles in the solar system, determining isotopic signatures that indicate life, and searching for extrasolar planets are examples of such studies.

The institution's role in astrobiology doesn't stop with scientific research. Staff members are now introducing themes from astrobiology to the science education programs at the Carnegie Academy for Science Education (CASE) and the First Light science school. As research in astrobiology progresses, public elementary school teachers in Washington, D.C., across the country, and around the globe will participate in this intriguing and multifaceted subject. The CASE and First Light staff is developing a Web site, educational packets, and other materials that will be available for teachers and students to use to explore this imagination-stirring science. ➤

ORIGINS OF ORGANIC MATERIAL

Unraveling the mystery of life is a complicated task. To understand how life emerged here, scientists are examining where organic material—a prerequisite to life—originated. Earth's early atmosphere, hydrothermal systems, and even material from space such as meteorites are candidates.

THE BEGINNINGS OF COMPLEX SYSTEMS

The process by which chemicals and energy came to interact and form complex living systems is another area of analysis in astrobiology. Investigators are trying to determine what the underlying rules are that allow collections of molecules to interact and form cellular systems in a range of environments. They are exploring different chemical interactions among living systems, as well as those frozen in the fossil record.

These scanning electron microscope images show bacteria called symbionts. They live in tubeworms at deep-sea hydrothermal vents. Instead of relying on the Sun for energy, these bacteria get their energy from hydrogen sulfide, which the worms capture as it flows from the vents. The images are at two levels of magnification. (Image courtesy Dr. Colleen M. Cavanaugh, Harvard University.)

Photosynthesis is an example of chemistry and energy interacting to support complex living systems. Until recently, it was thought that all food ultimately came from this process.

COEVOLUTION OF LIFE AND OUR PLANET

As life adapts to the environment of the planet, the environment changes in response. Researchers are examining this coevolution by studying what motivates change and how evolution proceeds at the molecular scale, within organisms, and in ecosystems. They are looking at the genetic makeup—or genome—of different microorganisms and hope to discover what genetic and environmental factors influence biological diversity.

LIVING AT THE EXTREMES

Until recently, some places on Earth were thought to be too harsh for life to exist. Surprisingly, though, extreme environments, including solid ice lakes in Antarctica, subterranean rocks, boiling springs, and high-pressure, high-temperature hydrothermal vents at the ocean bottom, have all been found to harbor living organisms. Scientists are looking at the adaptations required to live in these areas and will use this information as an analog to find likely locations for life on other worlds such as Mars and the Jovian moon Europa.

AN ASTROBIO

FINGERPRINTING LIFE'S ESSENCE

As the conditions needed for life to emerge are increasingly understood, investigators are able to establish biomarkers—molecular and isotopic signatures that indicate the presence of life. These fundamental fingerprints help piece together the puzzle of life on Earth and provide clues for finding it elsewhere.

Mars is the closest planet to us where scientists think it's possible that life might have existed. Martian

LIFE ON MARS

Researchers are continuing to look for evidence of past and present life on Mars. Future robotic missions will allow scientists to analyze samples, and continued studies of Martian meteorites will help determine if the Martian environment is, or was in the past, hospitable to living organisms.

Planets around other stars

In the last five years about 50 planets have been discovered outside our solar system; all are giants like Jupiter and Saturn. As investigative techniques are refined, scientists hope to find smaller, Earth-like planets orbiting distant stars.

OGY SAMPLER

meteorites found on Earth in such places as Antarctica may provide the evidence scientists are looking for.

Understanding water

Investigators are trying to understand how planets or moons acquire and keep water—an apparently vital resource for life to develop and thrive. Theorists are developing models to determine the components and processes required to form water-bearing bodies. This celestial profiling will help discover why Earth has water, and will help locate worlds similar to our own.

The future of Earth

In addition to cracking the code to the origins of life, astrobiology seeks to find out what the future holds for life on our planet. To do this, researchers are examining how ecosystems respond to a variety of disturbances at the global and local levels. These studies will help identify what might happen if changes to the environment occur faster than life's ability to adapt to them.

Celestial migration

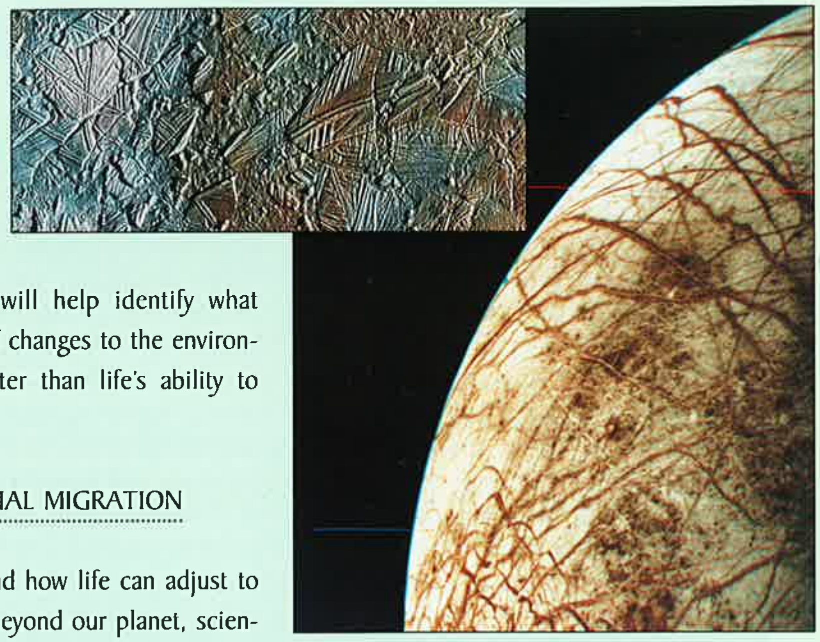
To understand how life can adjust to circumstances beyond our planet, scientists will continue testing the adaptability of Earth-born organisms to low-gravity, high-radiation environments. Future missions, such as those to the space station, will provide the laboratories needed to expand these experiments.

Preventing contamination

Every time we visit an extraterrestrial body there is the potential for contamination. Investigators are now developing guidelines to protect all locations against this possibility. They are also trying to understand the mechanisms that could allow life to migrate naturally from one celestial body to another.

Advancing technology

Because the field is so broad, the problems studied in astrobiology can be solved only with advanced technology and methods. As new tools become available, scientists will make huge strides toward answering these fundamental questions about the role of life in our universe.



The streaks seen across the surface of Europa, one of Jupiter's moons, and the absence of relief suggest the presence of water. This makes this moon another destination scientists hope to be able to sample in the near future.

This *Viking 2* image shows water ice on the surface of Mars. Theorists are developing models to explain how celestial bodies acquire and keep this resource, which is thought to be necessary for life to exist.

Space images courtesy of NASA.

A CONNECTION BETWEEN SEISMIC ACTIVITY AND BAROMETRIC PRESSURE

Scientists at the Department of Terrestrial Magnetism believe that annual variations in seismic activity after the 1992 Landers earthquake in California may be due to barometric pressure changes. Stephen Gao, now at the Department of Geology at Kansas State University, and Paul Silver, Alan Linde, and Selwyn Sacks of DTM, published their results in the August 3, 2000, issue of *Nature*.

The scientists examined data from the Council of the National Seismic Systems for a large area of the western United States during the period January 1988 to January 1997. Their analysis showed annual variations in seismic activity since the June 1992 Landers earthquake, with more seismic activity in the autumn of each year. The researchers ruled out a variety of possible sources for the variation, including differences in the sensitivity of the detecting network, and other environmental influences, such as heavy snowfall, precipitation, and the seasonal variations in water pumping and injection.

The observed activity was characterized by swarms–series of small, localized earthquakes–which occurred most often in hydrothermal or volcanic areas. The scientists compared seismic activity with barometric pressure and found that, on average, low-pressure periods occurred 90 days before seismic highs. The investigators believe that when there is less atmospheric pressure there is less normal stress on vertical faults and they move in response, producing a high seismic reading. The variation in stress under these conditions is about 20 millibars, an amount that is an order of magnitude smaller than the minimum levels previously believed to trigger aftershocks.

In the news...In the news...In the news...In the news...

The discovery of ten more extrasolar planets in August led to a flurry of press coverage. Both **Alan Boss** and **Paul Butler** of the Department of Terrestrial Magnetism were mentioned and quoted concerning the new finds. In an article about the discovery in the August 6, 2000, issue of the *Washington Post,* data collected by Paul Butler and fellow planet hunter Geoffrey Marcy were reported to show that about half the extrasolar planets discovered are likely to be part of multiplanet systems. In the same article, Alan Boss, planetary formation theorist, was quoted about the types of planetary systems thus far found. "These discoveries are all very exciting," he said, "but they are not yet going in the direction of finding habitable planets." The *Los Angeles Times,* the *Chicago Tribune,* and the *New York Times* all covered the news about the most recent planetary finds.

Recent high-pressure experiments conducted by **George Cody** and colleagues at the Geophysical Lab were mentioned in an article in the August 25, 2000, issue of the *New York Times.* The scientists had produced small amounts of pyruvate, which is important to metabolisms of living systems. Their experiments looked at reactions that could occur at high-pressure, high-temperature deep-sea hydrothermal vents where life does not depend on oxygen or light (see page 12). In the article Cody said, "We set out to explore the ability of minerals to catalyze reactions that would be important in a primitive metabolic sense."

The "neglected" planet Mercury was the front-page story in the July 8, 2000, issue of *Science News.* **Sean Solomon**, director of DTM and principal investigator for the MESSENGER mission to Mercury, was quoted extensively. **Alan Boss** was also featured, commenting on theories about why Mercury is so dense.

The mirror shines:

A report from Steve Shectman, project scientist for Magellan, August 22, 2000

On August 7, the Magellan I mirror was successfully aluminized. Matt Johns and Charlie Hull had previously performed a careful mechanical and optical alignment of the primary, secondary, and tertiary mirrors. The systems for supporting all three mirrors, which prevent the force of gravity from distorting the three precise optical surfaces, are now operating reliably. A team from MIT came down to Las Campanas in July to install the first guider assembly and help perform the first optical tests of the complete telescope system.

After completing the tests, the team removed the primary mirror and cell from the telescope and moved it to the mirror washing and aluminizing area in the auxiliary building. The aluminizing chamber was tested a number of times during the past year, but never with the actual primary mirror in place.

To coat the mirror, it must first be washed. It has to be clean at the molecular level. A number of new plumbing fixtures had to be installed to drain water away from the mirror surface without flooding the mirror support system underneath. To access the full surface of the primary mirror a movable bridge, incorporated into the structure of the auxiliary building, is extended over the entire primary mirror cell.

The Walter Baade telescope mirror was coated with aluminum for the first time on August 7, 2000. It has an average reflectivity of 90%—an excellent achievement. The lifting fixture is shown above and reflecting in the mirror.

The aluminum coating is deposited by evaporation from 300 tungsten filaments in a very high-vacuum environment. The area behind the mirror contains all of the mechanisms, plus wiring and plumbing for the mirror support system; it can only be evacuated to a rough vacuum. However, the area in front of the mirror is clean and can be pumped to a high vacuum, but only after the rear volume is sealed off at both the outer and inner edges of the mirror surface. The team ran into a snag when the inner seal did not work. They improvised a quick fix by borrowing an inner tube from the mountain bike used by exercise enthusiasts at the observatory!

Depositing the aluminum takes only about 20 seconds, but the operation requires so much power that it draws most of the electric current available on the mountain. The backup generator has to be used to provide adequate reserve capacity. The team tested the coating the day after it was applied. It has an average reflectivity of 90%, which is excellent even for a small mirror coated under ideal conditions. It is a tribute to Frank Perez and the rest of the aluminizing team at Las Campanas that they found solutions to the problems that arose during the first complete test of the full system.

Following the aluminization, the primary mirror was reinstalled in the telescope. There was some doubt about whether some parts of the mirror support system would require maintenance after being exposed to the vacuum environment, so we were especially pleased to find that the support system worked with essentially no corrective action. At present the team is installing the thermal control system. A new round of tests with the aluminized primary mirror and the full thermal control system should begin in the next few weeks.

JUMP-STARTING THE BIOCHEMISTRY OF LIFE?

Some high-pressure geochemical experiments at the Geophysical Lab produced some unexpected and exciting results–the synthesis of small amounts of pyruvic acid, a three-carbon compound that is crucial to the production of energy in metabolisms of living organisms.

George Cody and colleagues at the Geophysical Lab conducted experiments to mimic conditions at deep-sea hydrothermal vents, environments with extreme pressures and temperatures where there is no light or oxygen. They subjected iron sulfide and mixtures of organic compounds to temperatures of 250°C and pressures of 50, 100, and 200 megapascals, which correspond to conditions at the vents. The iron sulfide promoted reactions that led to the formation of mixed iron-sulfur compounds known as organometallic compounds. Cody and coworkers suggest that the synthesis of pyruvic acid, which also resulted, is a consequence of these reactions. The scientists' work is part of Carnegie's collaboration with NASA's Astrobiology Institute. They reported their findings in the August 25, 2000, issue of *Science.*

According to Cody, "Our results highlight the possibility that naturally occurring organometallic phases may be important to geochemistry and emergent biochemistry. The near ubiquity of iron-sulfur compounds in extant biological energy conversion systems appears to provide a natural bridge from the geological to the biological world." It is possible that this kind of primitive biochemistry jump-started the processes leading to the initial emergence of life on Earth.

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SNIFFING OUT PROTEINS ON OTHER WORLDS

About three years ago, Marilyn Fogel, Staff Member at the Geophysical Lab, took on a challenge when she found out that NASA was thinking of bringing samples back from Mars to analyze for evidence of life. She thought it made more sense, and would certainly be cheaper, if a small, self-contained lab were sent to the planet to "sniff out" proteins–the building blocks of life–on the spot. She started looking around for something that could accomplish what she wanted.

This past summer Fogel, with funding from the Astrobiology Institute and Carnegie, was able to purchase a new protein-recognition instrument used in biomedical research. Called the ProteinChip System, it is manufactured by the California-based company Ciphergen Inc. and debuted about a year and a half ago. The device is the size of a two-drawer file cabinet. It consists of tiny thin strips of metal coated with different chemically active molecules that can bind and retain compounds from complex mixtures according to their different properties. It effectively separates the light molecules from the heavy ones. The detector unit and software analyze and identify a sample by measuring its molecular mass. The heavy molecules of proteins, made up of chains of amino acids, can be readily identified.

Fogel and colleagues will first use the molecular-recognition technology to expand ongoing research into constructing a library of molecules that are involved in living systems in extreme environments, and life-bearing molecules from the fossil record on Earth. This catalog could then be used as the reference for analyzing molecules on Mars or the Jovian moon Europa to determine if fingerprints of life are present there. In addition to looking for life on extraterrestrial bodies, the instrument will advance research into the link between nonbiological synthesis and biochemistry here on Earth.

"This instrument opens up exciting new possibilities for finding signs of ancient life on Earth that have been impossible to detect with standard techniques," says Fogel. "We will be the first to adapt an instrument designed for biomedical research to the search for evidence of life in the solar system," she adds.

Although the equipment is located at the Geophysical Lab in Washington, D.C., it is available to all interested investigators from the 11 lead institutions and related consortia associated with NASA's Astrobiology Institute.

In Brief. . .

ADMINISTRATION

Maxine Singer was one of eight heads of leading international research institutions to speak at the Weizmann Institute during its recent Jubilee celebration in Israel.

John Strom became the administration's new Web manager in June. He will manage the administration Web site at www.CarnegieInstitution.org. **Inés Cifuentes** was appointed director of the Carnegie Academy of Science Education (CASE) and First Light. **Greg Taylor**, a new staff member, will work with Inés as coordinator for CASE and First Light.

OBSERVATORIES

Alan Dressler attended IAU Symposium 201 in Manchester, UK, Aug. 7-11, and gave the presentation "Surface Brightness Fluctuations: Large-Scale Flows and the Hubble Constant."

Luis Ho gave talks on supermassive black holes at the Sixth Taiwan Astrophysics Workshop, held in Taipei in May, and at the Third Joint Meeting of Chinese Physicists Worldwide, held in Hong Kong in Aug. Luis was on the Scientific Organizing Committee for the Taiwan meeting. In addition, at the 196th Meeting of the AAS Rochest in June, he met with the black-hole-search Nuker team.

Patrick McCarthy participated in a critical science review for the Wide Field Camera 3 for the Hubble Space Telescope.

In June, Hubble Fellow **Scott Trager** presented a poster at the "Galaxy Disks-Disk Galaxies" meeting held at the Pontifical Gregorian U. in Rome, Italy, and gave an invited talk at the Padua Observatory.

Carnegie Fellow **Ben Weiner** is taking a postdoctoral position at UC-Santa Cruz, and **Dan Kelson** moved from DTM to the Observatories to work on galaxy clusters.

Jeffrey Willick, an assistant professor at Stanford and a former postdoc at the Observatories (1991-1995), was killed in June by a sports car that crashed into a coffee shop in Englewood, NJ.

EMBRYOLOGY

Marnie Halpern was an invited speaker at a meeting on the molecular analysis of brain development and function sponsored by the Fondation des Treilles, June 14-19, and at the Santa Cruz Conference on Developmental Biology 2000, July 21-25. Postdoctoral fellow **Joshua Gamse**, from MIT, joined the Halpern lab on Aug. 1, 2000. He is studying left-right differences in the zebrafish forebrain.

Haochu Huang is beginning his postdoctoral work in immunology with Dr. Diane Mathis at Harvard Medical School. He was awarded a Damon Runyon postdoctoral fellowship.

Postdoctoral fellow **Laiquan Cai** from the State Laboratory of Reproductive Biology at the Institute of Zoology, Chinese Academy of Sciences, Beijing, PRC has joined the Brown lab.

Catherine Lee received her Ph.D. this spring from Johns Hopkins U. and is now a postdoc at U. Pennsylvania School of Medicine. Johns Hopkins U. graduate student **Gregory Marques** has joined the Fan lab.

This spring **Jenny Hsieh** received her Ph.D. from Johns Hopkins U. She will begin postdoctoral studies on mammalian neuronal stem cells at the Salk Institute in La Jolla, CA, in Oct.

Dr. Kirsten Crossgrove, a faculty member at Loyola Coll., Maryland, will conduct sabbatical research in Dr. Fire's lab for the fall semester. **Hongjuan Gao** will join the lab as a postdoc in early Sept. She recently received her Ph.D. at the State Key Laboratory of Reproductive Biology, Institute of Zoology, Chinese Academy of Sciences, Beijing, PRC.

Hong-Guo Yu, from U. Georgia, joined the Koshland lab to study meiotic centromere structure and function in *S. cerevisisae.* Johns Hopkins U. graduate student **Mark Multinovich** has also joined the lab.

Maggie de Cuevas has taken a position as assistant professor in the Dept. of Cell Biology and Molecular Genetics at U. Maryland. Maggie recently gave birth to daughter Alida Mae Schott.

Dr. Robert Levis joined the department Sept. 1. He will work with Allan Spradling on the *Drosophila* genome project's program to obtain an insertional mutation in all 13,600 *Drosophila* genes.

Jim Wilhelm is the newest staff associate in the department. Jim arrived this summer from UC-San Francisco. He plans to study the mechanism of mRNA localization during *Drosophila* oogenesis.

Postdoctoral fellows **Andrew Wilde** (Zheng lab) and **Bri Lavoie** (Koshland lab) were married Aug. 12 in Shediac, New Brunswick.

Postdoctoral fellows **Shinichi Kawaguchi** (Osaka U., Japan); **Ming-Ying Tsai** (Chinese U. of Hong Kong); and **Li Hoi Yeung** (U. Texas Southwestern Medical Center) will join the Zheng lab in Sept. Johns Hopkins U. graduate student **Kan Cao** joined the Zheng lab in July.

Winslow Briggs and his wife, Anne, were given the DeWitt Award from the California state parks in recognition of more than 20 years of service to the Henry W. Coe State Park. The couple has volunteered thousands of hours of work since 1996.

PLANT BIOLOGY

Dave Ehrhardt gave a talk at the annual meeting of the Society for Developmental Biology held at U. Colorado, Boulder, in June.

On June 12, **Lalitha Subramanian** joined Shauna Somerville's lab as a senior software analyst working on the NSF genome project. The lab also welcomed **Lorne Rose**, lab technician, on July 10. She replaced **Eriko Miura**, who will resume her studies at UC-Davis. On July 25, **Ann Bashyam** joined the lab as an assistant. **Jana Gaebler**, from Germany, also joined Shauna's lab for a three-month stay as a predoctoral research associate.

TAIR welcomed three new members to their group. On June 19, **Lukas Mueller** started his position as a curator; on July 1, **Debika Bhattacharrya** began as a summer lab assistant; and on July 24, **Roxanne Tursi** joined the group to work as a summer assistant in the lab.

Irene Yang, a Stanford student, joined the Grossman lab on June 19 as a lab assistant. **Chiung-Wen Chang** also started in the lab as a technician on July 5. On Aug. 31, **Dr. Hideki Takahashi** (Visiting Scientist in the Grossman lab) and **Akiko Takahashi**, lab technician, left to return to Japan.

Dr. Deepak Khatry, a postdoctoral research associate in Chris Field's lab, left on May 31 to accept a new position. On Aug. 1, **Benjamin Poulter**, a lab technician in the Field lab, left for Duke U.

Dominique Bergmann, from U. Colorado, joined Chris Somerville's lab as a postdoctoral research associate on May 15. **Mark Stitt** left the lab on Aug. 31 to return to U. Heidelberg, Germany, after a summer sabbatical.

Susan Cortinas joined the administrative staff as secretary/receptionist on Aug. 30.

TERRESTRIAL MAGNETISM

The 2000 spring AGU meeting was held in Washington, D.C., May 30-June 3. DTM-GL hosted a spring evening at Broad Branch Road for alumni and friends on May 30, in conjunction with the meeting. Over 400 guests attended the event. Light food and refreshments were served as soft jazz and blues played in the background.

Erik Hauri received the James B. Macelwane Medal at the AGU meeting with a citation delivered by former DTM Staff Member **Stanley Hart**. In addition, **Alan Boss** and **Paul Silver** were elected fellows. **Conel Alexander, Louis Brown, Richard Carlson, Erik Hauri, David James, Alan Linde, Larry Nittler, Selwyn Sacks, Steven Shirey, Paul Silver, Sean Solomon,** and **Fouad Tera** participated in the meeting as did Fellows **Jonathan Aurnou, Laurie Benton, Matthew Fouch, Andrew Freed, Monica Handler, Philip Janney, Fenglin Niu, Chiara Petrone, Aaron Pietruszka**, and **Lianxing Wen**.

The Meteoritical Society announced in Aug. that it will award **Larry Nittler** its Nier Prize next year. The prize is named for Alfred Nier, "the father of mass spectrometry." It is awarded "for significant contribution in the field of meteoritics and closely related fields of research."

Typhoon Lee, at DTM from 1979 to 1984, is the new director of the Institute of Earth Sciences, Academia Sinica, Taiwan, ROC. He was also elected a member of the Academia Sinica last July and visited DTM in Aug.

Caleb Fassett, an intern at DTM during the summer of 1999, is the lead author of an article published in the Aug. 1 issue of the *Astrophysical Journal.* The article, "Age, Evolution and Dispersion of the Loose Groups of Blue Stars in the North East Radio Lobe of Centaurus A," was coauthored with **John Graham**, his DTM advisor. Fassett completed his senior year at Williams Coll. this spring.

Young galaxy gazer with a bright future

As an intern at DTM, Patrick Kelly (at left with his family at the Intel Science Talent Search) studied the properties and ages of galaxies by determining their colors and magnitudes. His research won him the Astronomical League's National Young Astronomer Award and significant coverage in the September 2000 issue of *Sky & Telescope.* He conducted his study under the guidance of postdoc Daniel Kelson, using data from the 1-meter Swope telescope at Las Campanas. Kelly graduated from Sidwell Friends School in Washington, D.C., this past spring and is headed for Harvard this fall, where he will major in astrophysics.

In June, **Vera Rubin** gave the plenary address at the annual meeting of the Danish Physical Society outside Copenhagen. She also addressed the astronomy section and spoke at the daylong meeting, "Women in Physics." Rubin coorganized and spoke at the meeting on disk galaxies and galaxy disks in Rome. In Aug., she attended the IAU General Assembly in Manchester, UK, as chair of the U.S. delegation. She hosted the NAS reception and spoke at the ceremony announcing the recipients of the first annual Peter Gruber Prize for Cosmology: P. J. E. (Jim) Peebles of Princeton U., and **Allan Sandage**, Staff Member Emeritus at the Carnegie Observatories.

Erik Hauri convened the "Plume 3 Conference," held in Kohala, HI, in June. The meeting, cosponsored by Carnegie, brings geochemists, geologists, and geophysicists together to discuss recent findings on mantle plumes. **Sean Solomon** delivered one of the keynote lectures.

Conel Alexander, Larry Nittler, Sean Solomon, George Wetherill, and Fellow **Karl Kehm** attended the 63rd Annual Meteoritical Society Meeting in Chicago, Aug. 28-Sept. 1.

Alan Linde gave an invited talk at the European Science Foundation conference on natural and anthropogenically induced hazards held at Acquafredda di Maratea, Italy, in June. He also met with Italian colleagues at the Dept. of Physics, U. L'Aquila, to discuss installing a number of borehole strainmeters around Vesuvius and Campi Flegri.

Richard Carlson, David James, Steven Shirey, and Fellows **Phillip Janney** and **Matthew Fouch** attended a week-long workshop in Gabarone, Botswana in June to present and discuss results from the Kaapvaal Project, a multinational program to study the formation and evolution of ancient cratons.

Alan Boss spoke about massive planet formation at the Star Formation 2000 workshop, held at Ringberg Castle, Germany, in June, and about terrestrial planet detection at the Ball/TPF Science Team meeting at the Space Telescope Science Institute, Baltimore, in July. His book *Looking for Earths: The Race to Find New Solar Systems* was the subject of "Science Science," Kenneth Fox's cable television show, broadcast in Aug. Boss also reviewed gas giant planet formation at the IAU Symposium 202: Planetary Systems in the Universe, held in Manchester, UK, in Aug.

Steven Desch, a Carnegie Fellow and a NASA Astrobiology Institute Fellow, arrived from Ames Research Center in early July. He received his Ph.D. in Physics from U. Illinois in 1998. The subject of his thesis was the role of magnetic fields during stellar collapse.

Andrew Dombard arrived in July as a NASA postdoctoral associate. A planetary geophysicist, he defended his thesis in May at Washington U. His research involved applying continuum mechanics to models of deformation on planets and icy satellites.

Peter Burkett was appointed seismic field technician at DTM in Aug. He recently completed a master's degree in geophysics at Pennsylvania State U.

Machinist **Jay Bartlett II** was appointed for one year in mid-June to work on borehole strainmeters, which will monitor deformation along the San Andreas and Hayward faults in California.

Visiting Investigator **Julie Morris** arrived in early July from Washington U. in St. Louis. Since leaving the DTM research staff in 1994, she has continued to study modern subduction zones. Currently the chair of the Ocean Drilling Program's Science Steering and Evaluation Panel for Earth's Interior, she has also participated in several drilling legs.

Professor **Robert Tucker**, also of Washington U., arrived in early July as a Visiting Investigator. A geologist and geochronologist, he is spending his six-month sabbatical at DTM.

John Graham has taken a two-year leave of absence to be program director for stellar astronomy and astrophysics in the NSF Division of Astronomical Sciences.

Philip Janney has left to be manager and researcher in the Isotope Geochemistry Laboratory of the Dept. of Geology, Field Museum of Natural History, Chicago.

In Aug., postdoctoral associate **Daniel Kelson** moved to the Observatories. His projects at DTM spanned a broad reach of astronomy, including measurements of light-to-mass ratios for distant cluster galaxies as a function of redshift.

NASA Associate **Harri Vanhala** will join the Dept. of Physics and Astronomy at Arizona State U., Tempe, this fall as a postdoctoral research associate. At DTM he worked on the triggered collapse of molecular cloud cores, incorporating varied cloud and shock properties.

Carnegie Fellow **Lianxing Wen** moved to SUNY at Stony Brook in Aug. as an assistant professor in the Dept. of Geosciences. A seismologist and mantle dynamicist, his research was directed at understanding the seismic structures and dynamics of the interior of Earth.

Visiting Investigator **Cecily Wolfe**, a former DTM postdoctoral fellow, left in Aug. to become assistant professor at the Hawaii Institute of Geophysics and Planetology, U. Hawaii.

Visiting Investigator **Jeffrey Ryan** has returned to his position as associate professor of geology at U. South Florida, Tampa, after spending a six-month sabbatical at DTM.

Other recent short-term visitors to DTM included **Beat Rinderknecht** (Institute for Geophysics, Federal Technical University, Zurich), **Jason Jiun-San Shen** (Institute of Earth Sciences, Academia Sinica, Taiwan, ROC), Visiting Investigators **Elisabeth Widom** (Miami U.) and **Paul Rydelek** (U. Memphis), and graduate student **Kathleen Donnelly** (Lamont-Doherty Earth Observatory).

Ebba Irene Hooft Toomey, a daughter, was born on July 26, 2000, to postdoctoral associate **Emilie Hooft Toomey** and her husband, **Douglas Toomey**, a professor at U. Oregon and a DTM Visiting Investigator.

Shown seated (from left) are DTM research interns Jasmine Foo, Brown U.; Julia Haltiwanger, Grinnell Coll.; Jean Lee, Harvard U.; Lynne Elkins, Smith Coll.; Thomas Doggett, Oberlin Coll.; and advisor Steven Shirey. Shown standing (from left) are advisors Paul Silver, Vera Rubin, Harry Green (Visiting Investigator from UC-Riverside), John Graham, and Matthew Fouch.

DTM/GL

Harry W. Green II delivered the Philip H. Abelson Lecture, "Deep Earthquakes and Deep Rocks: Monitors of Mineral Reactions in Subduction Zones," on June 12 at BBR. Dr. Green, a Visiting Investigator, is vice chancellor for research and Distinguished Professor of Geology and Geophysics, Institute of Geophysics and Physics, UC-Riverside.

DTM-GL postdoctoral associate **Wenjie Jiao** has joined Multimax as a senior geophysicist. While at DTM, he worked on the cause of intermediate- and deep-focus earthquakes.

Professor **Kevin Burke** of the Dept. of Geosciences, U. Houston, arrived in early June as a DTM-GL Visiting Investigator. Prof. Burke is an expert on large-scale tectonics, particularly in the African and the Caribbean regions.

GEOPHYSICAL LABORATORY

Wes Huntress has been elected vice-chairman of the Division of Planetary Sciences of the American Astronomical Society.

Ronald Cohen is on sabbatical at Caltech for a year. He is collaborating on research on the following subjects: shock response of minerals and other materials, defects and optical properties of minerals, and thermodynamic properties of alloys. He will also be teaching a graduate seminar. Research associate **Sonali Mukherjee** will be joining him in Pasadena to work on the high-pressure and temperature phase diagram of iron.

Former Carnegie Fellow and NASA Astrobiology Institute Associate **Timothy R. Filley** has accepted a position in the Dept. of Earth and Atmospheric Sciences at Purdue U.

Henry Fricke, former postdoctoral fellow/Visiting Investigator who collaborated with Doug Rumble and Marilyn Fogel, has taken a position as assistant professor at Colorado Coll.

Former postdoctoral associate **Huaxiang Fu**, who has been working in Ron Cohen's laboratory, will be an assistant professor in the physics department at Rutgers.

Dr. Gudmundur H. Gudfinnsson (U. Texas, Dallas) is a Visiting Investigator at GL. He will conduct research with Yingwei Fei on melting experiments of model systems relevant to magma generation in the upper mantle.

Dr. Quan-zhong Guo has been appointed a CIW-HPCAT Beam Line Technical Associate. Formerly, Dr. Guo worked as a full-time consultant for the GL X17 beam lines at NSLS. Dr. Guo received his Ph.D. in physics from the Institution of Physics, Beijing, PRC.

Robert Hazen was keynote speaker at a meeting of science teachers in West Virginia, where the integrated science course he developed with James Trefil has been adopted for the 10th-grade science curriculum.

Also, during June and July Hazen's 30-hour video course, "Great Principles of Science," was featured in full-page advertisements in the *New York Times Book Review, Scientific American, Science News,* the *New York Review of Books,* and many other periodicals.

Dr. Guixing Hu (Dept. of the Geophysical Sciences, U. Chicago) is a new postdoctoral associate who will be working with Marilyn Fogel, Doug Rumble, and Wes Huntress on the Grand Challenge project to investigate sulfur isotopes in sulfide minerals as evidence for the existence of living organisms on planetary bodies.

Ikuo Kushiro, Professor Emeritus at U. Tokyo, visited the Geophysical Lab June 7-Aug. 6, where he worked with Bjørn Mysen.

Stefanie Japel (Johns Hopkins) has been appointed a predoctoral associate and will work with Charles Prewitt and others on K-Fe sulfides and Fe-Ni phosphides at core pressures and temperatures.

Ho-kwang Mao gave an invited talk at APS, Argonne National Laboratory, in Chicago May 25-27, and another at the Recent Advances in Materials Research Symposium organized by the Institute of Chemistry, Academia Sinica, on July 1. He attended the Chinese Academia Sinica Biannual Meeting, July 3-9, and participated in the Second World Chinese Conference on Geological Sciences at Stanford U., Aug. 2-4, presenting a plenary paper. Mao and **Russell J. Hemley** were conveners of the Mineral Physics and Chemistry: Bassett Symposium at the AGU-GS-MSA spring meeting in Washington, D.C., May 30-June 3.

Michelle E. Minitti has accepted a postdoctoral fellowship and will be working with Yingwei Fei and others in the high-pressure group at GL.

Professor **Zhongyue Shen**, a mineralogist at Zhejiang U., PRC has been appointed a Visiting Investigator and will be working with Fei on the role of ferric iron in high-pressure minerals.

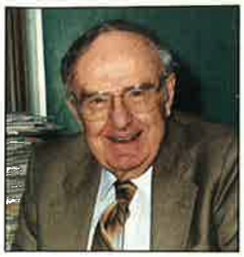
Chrystele Sanloup has been appointed a postdoctoral fellow and proposes to develop a link between high-pressure experimental data on liquid Fe and Fe alloys and planetary applications. She will collaborate with Dave Mao, Rus Hemley, and Yingwei Fei.

Former postdoctoral associate **Sean Shieh** has taken a position at Princeton U.

At its annual meeting at the State Department on May 4, the Public Members Association of the Foreign Service elected **Hatten Yoder** treasurer.

The Summer Intern Program in Geoscience was held from June 5 to Aug. 11. Thirteen college students from around the country and two local high school students worked on research projects with staff from GL and DTM. The interns presented their research at a symposium attended by both departments.

GL's summer 2000 interns pose here. Back row, from left: Amie Lucier, Nick Schmerr, Julie Haltiwanger, Laura Gilpin, Michelle Grosso, Thomas Doggett, Laura Armstrong, and Jennifer Adler. Front row, from left: Lynne Elkins, Amy McAdam, Jean Lee, Jasmine Foo, Anna Bradshaw, and Sarah Strode (not pictured: Achintya Madduri).



Allan Sandage, Staff Astronomer Emeritus of the Carnegie Observatories, will receive the newly established Cosmology Prize of the Peter Gruber Foundation. The prize recognizes individuals who have significantly advanced our understanding of the universe. Sandage earned the award in recognition of his half-century of leadership "in our observational quest to understand the stars, galaxies and the universe." Sandage, Edwin Hubble's protégé, has largely devoted his career to finding the value for the Hubble constant and the age of the universe. The $150,000 award, announced in August, will be officially given to Sandage in November at the Pontifical Academy of Science at the Vatican.

CASE Expands

The Carnegie Academy for Science Education (CASE) is offering free professional education courses this fall in conjunction with the DC ACTS program. DC ACTS is a Washington, D.C.–based teacher-training program in mathematics, science, and computers. The Carnegie component to the program is designed for elementary school teachers who, upon completing four courses, will receive three hours of graduate credit. The curriculum will cover the life and earth sciences, particularly as they relate to the study of astrobiology, and mathematics as the language of science.

Journalists' Seminar on Genetically Modified Organisms Held at Carnegie

Carnegie hosted a public-service seminar for journalists entitled "Straight talk on GMOs" at the administration building on September 19, 2000, to provide unbiased and balanced information on this important and controversial topic. Reporters from the *Washington Post*, the *Boston Globe*, Reuters, *Business Week*, *Scientific American*, *The Scientist*, and other organizations attended the three-hour seminar and question session.

Speaker Sharon Friedman (left) from the White House, is shown here during a break at the GMO seminar. Gordon Conway, another speaker, is on the far right.

Four speakers each gave twenty-minute talks, which were followed by questions from reporters. Professor **Daphne Preuss**, plant geneticist from the University of Chicago, described the science basics of GMOs. **Gordon Conway**, agricultural ecologist and President of the Rockefeller Foundation, talked about GMOs in the context of food and agriculture. A discussion of GMOs and the environment was hosted by **Tom Lovejoy**, ecologist and Chief Biodiversity Advisor at the World Bank. The final session was led by **Sharon Friedman**, from the Office of Science and Technology Policy at the White House, who described the regulatory process surrounding the use of GMOs in food and as pest control. Molecular biologist and President of Carnegie **Maxine Singer** moderated the event. Proceedings from the seminar will be available on the institution's Web site at www.CarnegieInstitution.org.

The National Aeronautics and Space Administration

Presents the

Group Achievement Award

to the

NASA Astrobiology Team

For initiating the new NASA multidisciplinary program in astrobiology, including the definition of the field of astrobiology, the formulation and initial establishment of the NASA Astrobiology Institute, and the development of a Roadmap to guide future NASA investments in astrobiology.

Wesley T. Huntress, Jr.
Carnegie Institution of Washington

Signed and sealed at Washington, D.C. this seventh day of June in the year Two Thousand

In June, NASA administrator Daniel Goldin presented Wes Huntress, Director of the Geophysical Lab, with this group achievement award in recognition of the astrobiology team's contribution to defining and developing the field of astrobiology.

The Carnegie administration Web site has a new address: www.CarnegieInstitution.org

WANTED: Video materials for the Carnegie Centennial exhibit

Margee Hazen is seeking film and video footage relating to Carnegie science for the Centennial exhibition. Imagery of experiments and fieldwork as well as taped interviews that are directed to the nonspecialist are of interest. If you have any such materials and would be willing to have them included in the exhibition, please contact her at mhazen@pst.ciw.edu.

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