A PILGRIMAGE TO PRÍNCIPE

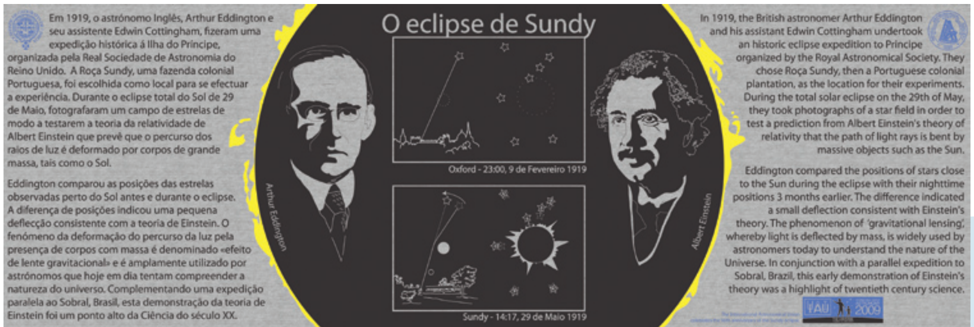
Albert Einstein became a worldwide celebrity in 1919 when his outlandish claim that gravity could bend light was proven to be true. Doing so took the efforts of a team of Englishmen led by Arthur Eddington, the Plumian Professor of Astronomy at Cambridge University, and a happy confluence of the stars—literally, in that the sun went into a total eclipse in the midst of the Hyades, a cluster of bright stars in the constellation Taurus; and figuratively, in that World War I had ended just months earlier, making it politically possible for a British astronomer to prove a German physicist's theory.

Eddington and E. T. Cottingham sailed to the remote equatorial island of Príncipe off the west coast of Africa, at the time a Portuguese colony. As part of the same expedition, Charles Davidson and A. C. D. Crommelin went to Sobral, Brazil. Both groups took photographs of the Hyades before and during the eclipse, looking for slight changes in the apparent positions of stars near the sun's limb that would indicate that their light had been influenced by the sun's mass. The British astronomers successfully measured the small deflection, 1.75 seconds of arc, predicted by Einstein's theory of general relativity.

Today this phenomenon, called gravitational lensing, is an important astronomical technique. Caltech researchers have exploited it with the W. M. Keck, Hubble, and Spitzer observatories to study some of the most distant galaxies known, make the first 3-D map of the distribution of dark matter in the universe, and trace the mysterious dark energy that pervades the cosmos.

Richard Ellis, the Steele Family Professor of Astronomy, has participated in several of these studies, and was also once the Plumian Professor at Cambridge before moving to Caltech. In September 2008, Ellis undertook what he describes as a "personal pilgrimage" to Príncipe, now part of the democratic republic of São Tomé and Príncipe. (São Tomé is the bigger and by far the more populous island.) Ellis's mission was to find the spot where Eddington took his photographs, and to line up government support to install a commemorative plaque this May—the eclipse's 90th anniversary—as part of the International Year of Astronomy's program of global events marking the 400th year of Galileo's first use of the telescope. The plaque, in Portuguese and English, was designed by Richard Massey of the University of Edinburgh, a collaborator of Ellis's and former Caltech postdoc.

Ellis recounted some of his adventures at a recent lecture in the Hameetman Auditorium in the brand-new Cahill Center for Astronomy and Astrophysics. Eddington arrived with his equipment following a monthlong sea voyage via Lisbon and Madeira; Ellis took a small plane from São Tomé, landing on the tiny Príncipe air-



The plaque.

strip in poor weather—to be greeted by the rusting hulk of an abandoned aircraft in the tall grass just off the runway. Equipped with transcripts of Eddington's letters to his mother, Ellis was able to retrace Eddington's visits to possible observing sites that ultimately led him to Roça Sundy, the now-derelict plantation where the famous photographs were taken.

The arrival of a professional astronomer on this tiny island did not go unnoticed. Ellis was interviewed on national television at the eclipse site—an appearance enlivened by a very aggressive cockerel snapping at his heels—and was subsequently invited to meet the president of the republic, Fradique de Menezes, who graciously offered his support. For meetings at the presidential palace, a dark suit, tie, and black shoes are mandatory. This was a serious problem for an academic who had only packed "Sports Chalet attire," until an obliging former foreign minister loaned him the necessary clothes. The shoes proved to be two sizes too small, but fortunately for Ellis's feet, the meeting was relocated to the president's mountain residence—a more relaxed setting.

Now sponsored by the San Tomean government as well as the International Astronomical Union, the Royal Astronomical Society, and a sympathetic Dutch hotelier and eco-tourist developer Rombout Swanborn (who Ellis also met), the plaque's installation will be accompanied by lectures in Portuguese and a poster display. Gisa Weszkalnys, a social anthropologist who studies the islands' economic future, and Pedro Ferreira, a Portuguese cosmologist at Oxford University, are assisting with the project. For further details, see http://www.1919eclipse.org. e&s

Opposite: The Roça Sundy plantation's central square seen from a point close to where Eddington made his observations.
Top right: Ellis and o Presidente.
Right: Remote Parking Lot A at the Príncipe airport.

AIDS VACCINES: Y SO HARD?

It's 25 years and counting after the AIDS epidemic began, yet we still don't have a good vaccine against HIV, the virus responsible. A Caltech team thinks that part of the reason may be that our body's natural HIV antibodies simply don't have a long enough reach.

Antibodies, which are Y-shaped, work best when both arms of the Y bind to their target proteins on the virus at more or less the same time. This can increase the antibody's grip strength a hundred- or even a thousandfold. But double-armed binding can be easier said than done. Pamela Bjorkman, the Delbrück Professor of Biology and a Howard Hughes Medical Institute investigator, and grad student Joshua Klein looked at two antibodies that bind to proteins that stick out like spikes from HIV's viral membrane.

"The story really starts to get interesting when we think about what the HIV virus actually looks like," says Klein, the lead author of a paper published April 16 in the online early edition of the *Proceedings of the National Academy of Sciences*. Whereas a flu virus's surface is studded with approximately 450 spikes, he explains, the similarly sized HIV may have fewer than 15. With spikes so few and far between, locating two that both fall within an antibody's reach—generally between 12 and 15 nanometers, or billionths of a meter—becomes much more of a challenge. "HIV may have evolved a way to escape one of our immune system's main strategies," he says.

"I consider this a very important paper because it changes the focus of the discussion about why anti-HIV antibodies are so poor," adds virologist David Baltimore, the Millikan Professor of Biology and a Nobel Prize winner. "It brings attention to a long-recognized but often forgotten aspect of antibody attack—that they attack with two hands. What this paper shows is that anti-HIV antibodies are restricted to using one hand at a time and that makes them bind much less well. Responding to this newly recognized challenge will be difficult because it identifies an intrinsic limitation on the effectiveness of almost any natural anti-HIV antibodies."

As well as Bjorkman and Klein, the paper's authors are research technicians Priyanthi Gnanapragasam, Rachel Galimidi, and Christopher Foglesong, and Member of the Professional Staff Anthony West, Jr. (PhD '98). The work was supported by a Bill and Melinda Gates Foundation grant through the Grand Challenges in Global Health Initiative and the Collaboration for AIDS Vaccine Discovery. *—LO* e&s

DR. KOONIN GOES TO WASHINGTON

President Barack Obama has nominated Steven E. Koonin (BS '72), former Caltech provost and professor of theoretical physics, as Under Secretary for Science in the Department of Energy. If confirmed by the Senate, Koonin would oversee the Department of Energy's basic-science portfolio, which includes many of the national laboratories, as well as provide technical advice and coordination across the Department's energy and national-security activities.

Koonin took a leave of absence from Caltech in 2004 to serve as chief scientist for the British energy giant BP, where he guided the company's long-range technology strategy, particularly in alternative and renewable energy sources. He is also a longtime member and past chair of JASON, a semisecret group of advisors to the U.S. government on technical issues associated with national security. He is a member of the Council for Foreign Relations and the Trilateral Commission, and has served on advisory committees for the National Science Foundation, the Department of Energy, and the Department of Defense and its various national laboratories.

Koonin's research interests include theoretical and computational physics, nuclear astrophysics, and global environmental science. He currently holds a position as a visiting associate in physics. *—DW-H* e&s

. . . AND DR. ZEWAIL GIVES ADVICE

Obama has also named Nobel Laureate Ahmed Zewail, the Pauling Professor of Chemistry and professor of physics, to the President's Council of Advisors on Science and Technology (PCAST). PCAST, which will meet every two months, includes three Nobel laureates, two university presidents, four MacArthur "genius" fellows, and 14 members of the National Academy of Sciences or its Institute of Medicine, the National Academy of Engineering, and the American Academy of Arts and Sciences. In the speech announcing the appointments, Obama said, "I will charge PCAST with advising me about national strategies to nurture and sustain a culture of scientific innovation . . . I intend to work with them closely." PCAST's bailiwick includes energy, education, health, climate change, the environment, security, and the economy.

Zewail won the 1999 Nobel Prize in Chemistry for creating the new field of femtochemistry. A femtosecond is 10^{-15} seconds—one quadrillionth of a second, the timescale on which atomic bonds break and form. His lab is now developing a technique called four-dimensional microscopy to track atoms in time and space simultaneously to try to understand complex biological reactions.

Zewail serves on many national and international boards, and is involved in promoting science and education in the developing world. *—AB* e&s

FLUID DYNAMICS—FROM MILLIKAN POND TO FORMULA ONE

As amphibious robots engaged in a desperate struggle, hundreds of people—including reporters from NBC, CBS, the *Los Angeles Times* and the *Pasadena Star News*—jostled for a better view from behind yellow caution tape strung around Caltech's Millikan Pond. Eighteen students in a course innocuously titled "ME 72 ab: Engineering Design Laboratory" had been working toward this moment, the final round of their March 10 tournament, for 20 weeks.

Teams of two or three undergrads worked with identical kits of materials to design and build radio-controlled 'bots that could survive a 14-inch fall into the pond, scoop up floating balls, and deposit them into the red or blue team bin on the opposite bank, all within three minutes. (A sandpaper-covered ramp allowed the machines to crawl up out of the pond.) Most teams opted to build two boats: a small, nimble attack vehicle and a larger craft to gather as many balls as possible. The class was taught by Joe Shepherd (PhD '81), the Johnson Professor of Aeronautics and professor of mechanical engineering; and Joel Burdick, professor of mechanical engineering and bioengineering.

During this, ME 72's 25th annual double-elimination tournament and its first aquatic challenge, casualties mounted from the moment the vehicles leapt from the bank. One craft plunged into the water upside down—twice. One got stuck on the edge with two wheels hanging. But the strategic crux was the ramp. Sumo-style shoving matches broke out in the water at the ramp's foot as teams tried to prevent their opponents from climbing out; whoever gained the high ground usually won.

In the end, team Ramen and Cheesesteaks—named for dietary staples of members Marshall Grinstead and Edmond Wong—faced off in a shoving match with Newt N' Salamander, Marc Sells and Kevin Noertker's team. Nimble Newt raced to the top of the ramp and spun to block its opponent, which was scrabbling tenaciously up the slope. Salamander, the transport craft, attacked from the water. Motors whined, wheels spun, batteries drained—and time ran out.

Sells and Noertker's victory leap into the pond clinched the story for the evening news. But history tells us that their triumph isn't just a geeky human-interest story; it's a portent. However humble the materials, however whimsical the challenge, ME 72 teaches the design process—from concept through building, testing, and refining—that governs engineering everywhere. Many alumni have drawn on similar Caltech preparation to revolutionize entire industries.

Consider Distinguished Alumnus Jim Hall, who, with his wife, just pledged $2 million to create the Jim and Sandy Hall Fund for Mechanical Engineering.

Armed with the 1957 model of the same BS in mechanical engineering that the ME 72 champions will earn this June, Hall started his own race-car company, Chaparral Racing Cars,

Kevin Noertker (left) and Marc Sells do a victory dance in Millikan Pond after winning the final round of the ME72 contest.

and took on the titans of Formula One racing—Ferrari, Alfa Romeo, Porsche, and Maserati—while still in his twenties. Chaparral drove design innovations on the circuit for two decades, culminating in 1980 when a Chaparral 2K driven by Johnny Rutherford took the pole position at the Indy 500 and then cruised to victory, leading the pack for 118 of the 200 laps. Hall has been on the covers of *Sports Illustrated* and *Newsweek* and is in three motor sports halls of fame.

Hall's Caltech education taught him to see racing as a challenge in aerodynamics. He realized that pressing the car down into the track would improve its cornering speed, and he stunned the racing industry with innovations designed to create such a downforce: spoilers, air dams, movable wings, shaped undersides, skirts, and ducted fans that created a partial vacuum under the car.

The Halls' gift helped kick off a $20 million ME fund-raising initiative last winter. Their names will grace a conference room planned for the soon-to-be-renovated Thomas Laboratory of Engineering; his name will also adorn the upgraded design and prototyping lab used by students in ME 72 and similar hands-on courses.

The first prototyping lab was built in Hall's senior year. He missed being able to use its mills and lathes by months, and thus had to learn how to apply theory to practice on his own. "When I realized what was happening in the ME 72 course and what those guys were learning, I got excited about it," he says. "When you get to do those things and see how things work and how they're made, it really helps your thought process."

Tom Tombrello, the Kenan Professor and professor of physics, often likens Caltech students to Formula One race cars, hand-crafted through close interactions with faculty. In that sense, Hall is back on the front lines building race cars again. As history repeats itself, perhaps Sells and Noertker will return to Caltech many years hence and dedicate the Newt N' Salamander Laboratory. —*AW* e&s

While Newt makes a dash for the ramp, Salamander goes bow-to-bow with one of Colin Ely and Kevin Tjho's Professional Ball Handlers, which featured an Archimedes screw to lift balls into the scoring bin without leaving the pond. White balls were worth one point each; orange, three; and blue, minus two.

OTHER SUNS, OTHER EARTHS

The quest to discover Earth-sized planets orbiting stars at distances such that water could pool on the planet's surface—another step in the search for life on other worlds—kicked into high gear when NASA's Kepler spacecraft roared off the pad at Cape Canaveral aboard a Delta II rocket at 10:49 p.m. EST on Friday, March 6.

The spacecraft has entered a sun-centered orbit, and is drifting away from Earth at about one kilometer per second. (The Spitzer Space Telescope, which was launched into the same orbit more than five years ago, is now some 100 million kilometers away.)

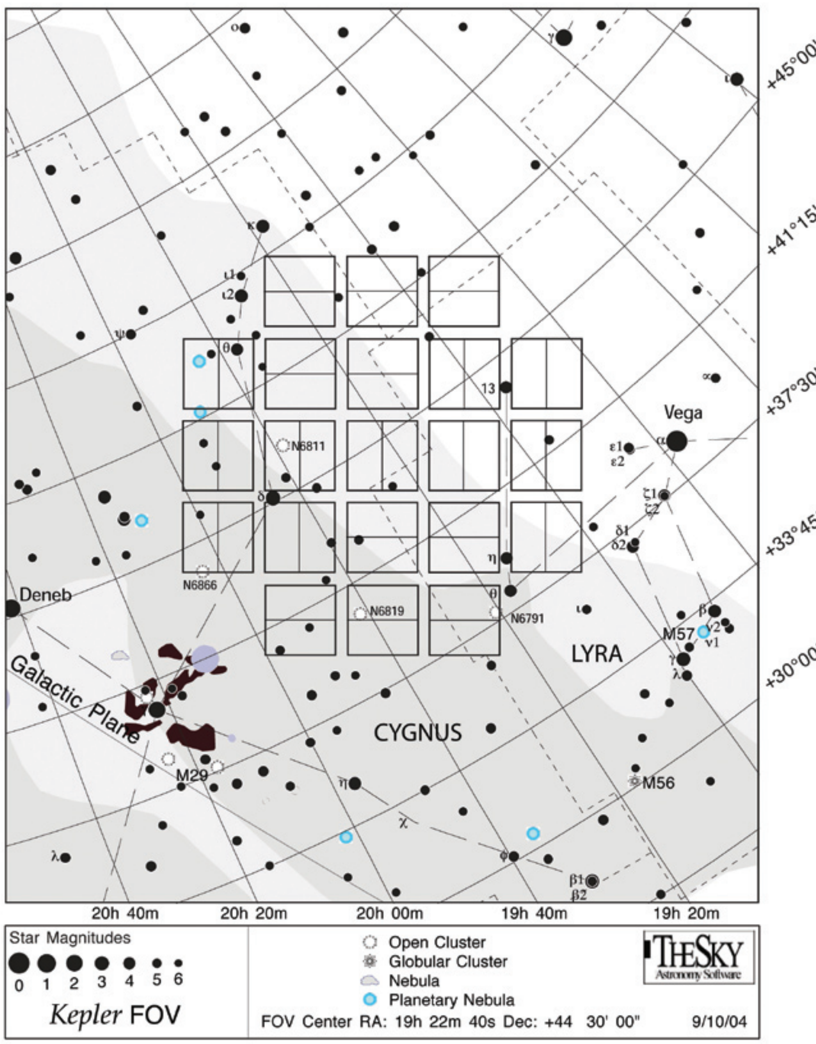
From this vantage point, Kepler will watch upwards of 100,000 stars simultaneously, 24/7, for at least three and a half years, looking for a periodic dimming of their light that would be caused by a planet passing between them and Earth.

Engineers have now turned on and focused Kepler's single instrument, an 0.95-meter-diameter telescope with a wide-field CCD camera. This 95-megapixel camera, the largest ever launched into space, can detect a change in a star's brightness of 20 parts in a million. As soon as the camera is properly calibrated, the search will begin in earnest.

The first planets to catch Kepler's eye are expected to be portly "hot Jupiters"—gas giants that circle close and fast around their stars. Neptune-sized planets will most likely be found next, followed by rocky ones as small as Earth. The true Earth analogs—ones orbiting stars like our sun at distances where surface water, and possibly life, could exist—will take at least three years to discover, as such planets will have orbital periods similar to Earth. Each planet will have to pass in front of its star at least three times to be discovered—if the time interval between successive pairs of dimmings repeats with high precision, then we can conclude that a planet is responsible. Observations by the Hubble and Spitzer space telescopes will be used to confirm some of Kepler's discoveries and analyze the planets' atmospheres. Ground-based telescopes will verify some of the finds as well.

In the end, Kepler will give us our first look at the frequency of Earth-sized planets in our corner of the Milky Way galaxy, and an idea of the fraction of them that could theoretically be habitable. "Everything about Kepler has been optimized to find Earth-size planets," says James Fanson (MS '82, PhD '87), Kepler's project manager at the Jet Propulsion Lab. "Our images are road maps that will allow us, in a few years, to point to a star and say a world like ours is there."

Kepler is a NASA Discovery mission. The science principal investigator is William Borucki of NASA's Ames Research Center at Moffett Field, California, which is responsible for the ground-system development, mission operations, and science data analysis. JPL manages the Kepler mission development. Ball Aerospace & Technologies of Boulder, Colorado, built the spacecraft. For more information, visit http://www.nasa.gov/kepler.
—*WC* e&s



Kepler's field of view (the rectangles) is aimed along the length of the star-rich Orion Spur, covers 100 square degrees, and includes an estimated 4.5 million stars. Clever pointing maximizes the number of the brightest stars that fall into the gaps between the 42 CCD blocks. The bright starlight would saturate the nearby pixels, blinding the telescope to potential faint flickerings from planets circling dimmer stars nearby.

MOLECULAR MISSILES

A search-and-destroy molecular machine that selectively locks on to cancer cells could make radiation treatments a thing of the past, at least for breast cancers. A team of researchers from Caltech; Technion, the Israel Institute of Technology, in Haifa; and the Cedars-Sinai Medical Center in Los Angeles have joined forces to develop a potentially much less traumatic treatment.

The corrole was simply injected into the bloodstream, where it circulated freely and could hunt down nascent metastatic tumors too small to be seen.

The method uses a chemical payload called a gallium corrole, mated to a protein carrier that seeks out a cancer-cell marker. Once it binds to the cell, the protein triggers endocytosis, a process in which the cell engulfs the corrole-carrier combo.

Corroles are very similar to the porphyrin molecules used in a cancer treatment called photodynamic therapy, in which they are injected into the body and activated by a laser. This prompts the porphyrins to produce highly reactive, tumor-killing oxygen radicals. But some corroles don't require a laser boost to turn lethal, says Harry Gray, the Beckman Professor of Chemistry. "The striking thing about gallium corroles is that they apparently kill cancer cells in the dark," says Gray. "We don't yet know exactly how this works, but what we've seen so far tells us that it *does* work."

The team paired the gallium corrole with a carrier protein that binds to human epidermal growth factor receptor 2, or HER2, which is found on about 25 percent of breast-cancer tumor cells and marks them as particularly aggressive and difficult to treat. Preparing this cancer fighter is a breeze—the corrole-carrier pairs spontaneously self-assemble in the test tube.

In trials in mice, the corrole was able to shrink tumors at doses five times lower than doxorubicin, the standard chemotherapeutic agent for HER2-positive tumors. Doxorubicin has to be injected directly into the tumor, because at high doses the drug can cause heart damage. This, of course, also means that you need to be able to actually *see* the tumor. By contrast, the corrole was simply injected into the bloodstream, where it circulated freely and could hunt down nascent metastatic tumors too small to be seen.

Gallium corroles fluoresce intensely when zapped with a laser, and Gray's lab has been using them for many years to study electron transfer mechanisms. The new application resulted from trying to use the corroles as tracers to track the carrier protein's journey through the body. "We were amazed to see that the tracer itself was killing the tumors," says Gray.

The difficulty in getting to this point, notes Gray, is that corroles were tough to synthesize—until coauthor and Caltech visitor in chemistry Zeev Gross of Technion figured out how to make them in what passes for bulk in a biochemistry lab. "We went from being able to make a couple of milligrams in two years to being able to make two grams in less than a week. It really puts corroles on the map."

The work appeared in the April 14 online edition of the *Proceedings of the National Academy of Sciences*. The paper's lead author is Hasmik Agadjanian of Cedars-Sinai; the other authors are Jun Ma, Altan Rentsendorj, Vinod Valluripalli, Jae Youn Hwang of Cedars-Sinai; Atif Mahammed from Technion; Daniel Farkas, director of Cedar-Sinai's Minimally Invasive Surgical Technologies Institute; Gray; Gross; and Lali Medina-Kauwe, who holds a joint appointment at the David Geffen School of Medicine at UCLA and Cedars-Sinai.

The work was supported by grants from the National Science Foundation, the National Institutes of Health, the U.S. Department of Defense, Susan G. Komen for the Cure, the Donna and Jesse Garber Award, the Gurwin Foundation, the United States–Israel Binational Science Foundation, and by the U.S. Navy Bureau of Medicine and Surgery. *—LO* e&s

PCC students Selma Cuya and Russell Lund remove vials of cryopreserved mouse stem cells from a liquid nitrogen tank.

CALTECH, PCC'S BIOTECH BRIDGE

This fall, up to 10 Pasadena City College students will work with stem cells at Caltech, thanks to a $1.7 million grant and the leadership of a former Caltech postdoc. Others will follow in 2010 and 2011. Upon completing the program, they will be fully prepped to work on the frontiers of biomedicine as stem-cell lab techs. PCC is the only two-year college among 11 institutions statewide to win one of these "Bridges to Stem Cell Research" grants from the California Institute for Regenerative Medicine, established in 2005 after the passage of Proposition 71, the California Stem Cell Research and Cures Initiative.

"It's such an incredible opportunity for PCC to partner with Caltech," says professor Pamela Eversole-Cire, director of the biotechnology program at PCC. "We're very excited." It's a homecoming of sorts, as Eversole will once again be working with Shirley Pease, director of Genetically Engineered Mouse services (GEMs) at Caltech, with whom she'd collaborated while a postdoc of Mel Simon, Biaggini Professor of Biological Sciences, Emeritus, and former chair of Caltech's biology department.

Eversole's lab at PCC was once a stockroom. With support from division dean Dave Douglass, equipment donations from private industry, and technical advice from Pease, she turned it into a cell-culture facility. The students grow mouse embryonic stem cells under industry-standard conditions, in incubators heated to body temperature and containing a 5 percent carbon-dioxide atmosphere with 90 percent humidity. The cell cultures are processed in three laminar-flow hoods, and a few strides away are a centrifuge, water baths, and a hemocytometer for counting cells. The genetically altered cells are studied under a microscope, and students share their results on an electronic "smart board" contributed by the LA/OC Biotechnology Center. Most of the equipment was donated by biotech companies such as Amgen, Invitrogen, Biogen-Idec, Cell Biolabs, and Biocatalytics. "Without donations," said Eversole, "this probably would not be possible. The infrastructure is expensive."

Students design their own experimental protocols, prepare solutions, maintain lab equipment, plan research schedules, adapt to schedule changes, and give presentations. They keep meticulous daily notebooks that meet industry standards. When students ask how much detail to include, Eversole replies, "If I can give that notebook to a new student and they can reproduce the experiments in it, then it's properly recorded. If they have questions, it's not." Students even negotiate for their final grades—an exercise intended to prepare them for real-world negotiations, for instance, during annual performance reviews.

At Caltech, interns can work in any of several stem-cell labs, including the GEMs core facility, where Pease has designed a curriculum in advanced stem-cell manipulation techniques for them. The internships are being coordinated by Paul Patterson, the Biaggini Professor of Biological Sciences, who also helped Eversole write the grant proposal. PCC's other "Bridges" partners include USC and Children's Hospital of Los Angeles.

Intern Mark Starbird, 28, earned a biotechnology certificate at PCC four years ago, then got his BS at Cal State Long Beach. Now he's back at PCC taking courses that weren't available then. He hopes to pursue a career in biomedical research. "I'm intrigued and enthusiastic about this," he says, "because you can't find this anywhere else. With my earlier training in cell culture at PCC, I'm already ahead of the curve. Now PCC has a stem-cell culture program to go along with it." The biotechnology program was established by Wendie Johnston, Eversole's predecessor, 10 years ago in response to industry requests.

Eversole enjoys the diversity of her students. Many are career professionals seeking to upgrade their skills. Some are mothers returning to the workforce. One is a 17-year-old high-school student whose mother drives him to night classes from South Pasadena. Another is a 30-year-old electrical engineer changing careers.

And the biotech graduates do well. One is employed by Pease and another is working at USC. One is doing graduate work at Cal State Los Angeles. Two have transferred to Berkeley, where both landed undergrad research positions in their first term. Says Eversole, "We tell students, 'You can do more than you think.' And they do it." *—LD* e&s

MAYNE'S CAHILL: LIGHT DESCENDING A STAIRCASE

Caltech's newest building, the Cahill Center for Astronomy and Astrophysics, was dedicated on January 26. Situated across California Boulevard from the Robinson Laboratory of Astrophysics, the Cahill Center unites the Robinson Lab's former occupants with astronomers and cosmologists who had previously been scattered among several campus buildings.

Designed by Pritzker Prize-winning architect Thom Mayne of Morphosis in Santa Monica, the Cahill's twisted and fractured facade of terra-cotta-colored cement-board panels is intented to harmonize with the Spanish style of the older buildings across the street, while at the same time giving dramatic physical expression to the powerful forces that shape our universe. The Pritzker is sometimes called the Nobel Prize of architecture, and thus Mayne's latest work has attracted considerable attention. Architects and architecture students from across the country have stopped by to have a look—as, apparently, has most of Pasadena.

Ever-changing astronomical images projected on a wall in the lobby can be seen from the street, inviting visitors in. There, once they finish gawking at spacecraft models on display, their eyes will be drawn to the foot of the staircase (left) that is the building's centerpiece. Designed as a medi-

Above, from left: Freshman Jennifer Greco, senior Daniel Walter Rowlands, freshman Samson Chen, sophomore Aliza Malz, and sophomore Jasmine Sears, all members of Blacker House, showed up in *Star Wars* costumes for the Cahill Center dedication.

tation on the optical telescope, the stairwell is all about light. The massive, oddly angled pillars on the ground-floor landing remind one of the piers and supporting trusses of a major telescope like the Hale or the Keck, while the irregularly shaped interior windows and fragments of walls in the upper reaches (right)—a triumph of computer-aided design and fabrication techniques—create a constantly changing interplay of light and shadow as the photons gathered by the skylight at the top of the shaft make their way down the tube to the observer.

On the upper floors, the space warp makes its way indoors. Long hallways are broken into skewed segments, meeting in nooks that encourage people to hang out and chat. And the transverse corridors could have come from a Federation starship.

But another galaxy far, far away was in evidence at the dedication, held beneath the Cahill's overhanging prow. A small procession of Moles dressed as Jawas, plus a silver C-3PO, joined the back of the throng waiting for the ceremony to start. "We're here for the dedication of the giant sand-crawler," they explained.

The Cahill Center is named for Charles Cahill and his late wife, Anikó Dér Cahill. Other benefactors include Trustee Fred Hameetman (BS '62) and his wife, Joyce; the Sherman Fairchild, Ahmanson, and Kenneth T. and Eileen L. Norris Foundations; PIN USA, Inc.; and Michael Scott (BS '65). For complete coverage of the dedication ceremony, see *Caltech News*, No. 1, 2009. —*DS* e&s

Right: If our eyes could see a slice of the near-infrared spectrum beloved of astronomers, the Cahill Center's south side would look like this. Tom Prince, professor of physics, JPL senior research scientist, and director of the W. M. Keck Institute for Space Studies, shot the photo with an 830-nanometer filter.