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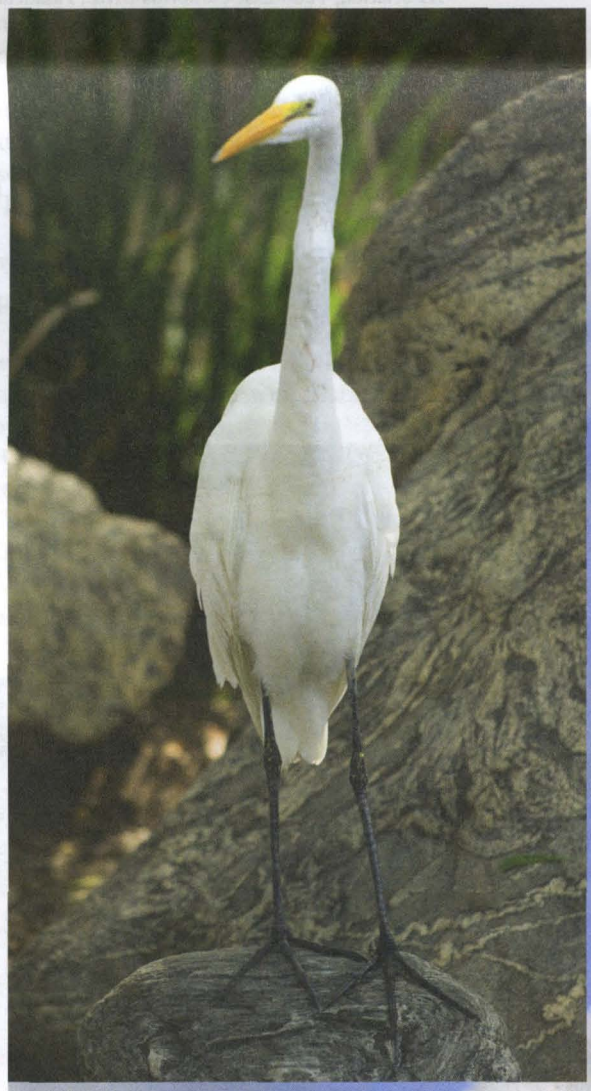
# Caltech News

Volume 43, Number 1
2009



## In This Issue

California Institute of Technology

Volume 43, Number 1
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# Caltech News

**ON THE COVER**
**Astronomers of a feather flocked together in January for the dedication of the Institute's Cahill Center for Astronomy and Astrophysics (see page 6), just as another veteran of the skies arrived back on campus for its annual visit. As *Caltech News* went to press, astronomers were moving into their new digs, while the great white egret had flown off to its next destination, hopefully to return next year.**



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## Up Front

### WAY DOWN UNDER, COLD CORAL SEARCH YIELDS HOT FINDS

Take a look at this issue's back-page poster. Can you guess which object had never seen the light of day—or ever been seen at all—until last January? That would be the bulbous, nubby sea anemone at the bottom left of the collage of photographs taken by the undersea robot *Jason II* in a marine reserve near Tasmania, Australia.

While it's always a thrill to discover a new species, it wasn't the primary aim of the investigation headed by Caltech's Jess Adkins, associate professor of geochemistry and global environmental science. Along with an international team of collaborators, Adkins headed down under to gather thousands of fossilized coral samples, which he hopes will provide insight into the impact of climate change on the world's oceans.

The monthlong voyage on the research vessel *Thompson* explored the Tasman Fracture Commonwealth Marine Reserve, and included scientists from Caltech, Australia's Commonwealth Scientific and Industrial Research Organization, and the Woods Hole Oceanographic Institution in Massachusetts—which owns and operates the *Jason* submersible.

**Aboard the RV *Thompson* off the coast of Tasmania, Caltech professor Jess Adkins sorts through a trove of deep-sea treasures brought to the surface by *Jason II*, an undersea robot capable of working to a largely unexplored depth of 4,000 meters.**

The main goal of the cruise was to try to use deep-sea corals to reconstruct the paleoclimate—with an emphasis on the changes in climate over the last 100,000 years—and to understand the fluctuations in $CO_2$ found in ice-core records that have been taken from polar ice caps in Antarctica. "Rapid climate changes show up clearly in the ice core," Adkins says. "We want to know if the ocean changes in the same timescale as shown in the reliable $CO_2$ histories from Antarctica. The deep ocean is part and parcel of these rapid climate changes."

Investigators also wanted to look at changes in the ocean over a much smaller slice of time—the past few hundred to one thousand or so years. "We want to see what's happened to the corals over the Industrial Revolution timescale," says Adkins. "And we want to see if we can document those changes."

The 10,000-plus coral samples that the researchers have collected will help them begin the task of deciphering just what has been happening to the ocean throughout the centuries of climate change, and during and between glacial cycles. "They're like a tape recorder

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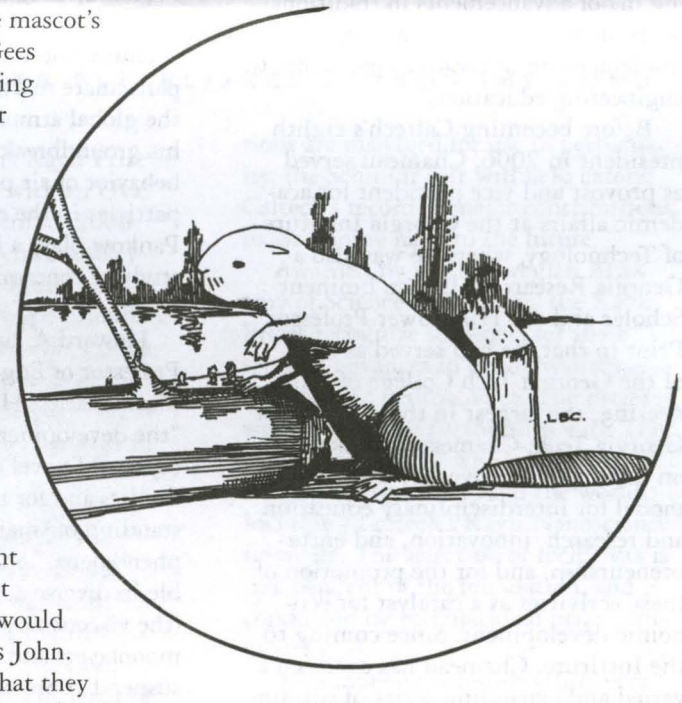
# "Nature's Engineer" Gets a Retrofit

By Michael Rogers

Fans who turned out to cheer for Caltech's athletes at sporting events in recent years may have noticed that despite the Institute's sterling academic reputation, its commitment to mascot maintenance cried out for an extreme makeover. The furry, oversized costume of Caltech's venerable mascot, the beaver, had apparently been lost in the student houses for months, if not longer, and by the time it resurfaced in 2007, it was starting to resemble road kill.

"It was kind of ratty by that point," says Wendell Jack, Caltech's director of athletics and physical education. "The tail was pinned on with safety pins. And you had to hold onto its head to keep it on."

Enter John Gee '53, a Pasadena resident who has been enthusiastically attending Caltech sporting events since he was a student athlete, and his wife, Barbara, who used to cheer for him when she was a South Pasadena–San Marino High School student. The Gees have been active in many Caltech support groups, including the Alumni Association, the Associates, the Caltech Y, and the SURF program. John Gee was Alumni Association president in 1976–77, served as president of the Gnome Club Board in 1984–85, twice chaired the Caltech Y Board, and most recently was chair of the SURF Board from 2004 to 2007. The Gees were watching a women's basketball game in January 2007 when the old, run-down beaver made a surprise appearance. Despite the mascot's spirited cheering, the Gees realized that the rollicking rodent was not ready for prime time.




"At the game I noticed that the tail was falling off and it looked like moths were coming out of it," says Barbara. "I told John, 'We need to get a new beaver.'" The men's and women's teams were coming off rare victories that season. "Possibly there was a thought that with the recent first victories, a new beaver would lead to more wins," says John.

The Gees told Jack that they wanted to underwrite a new beaver costume, the offer was enthusiastically accepted, and at Gee's 55th Caltech reunion last year, the new beaver—a state-of-the-art costume manufactured by a professional mascot maker—made its debut. It's been showing up at numerous Caltech events since then, entertaining the Caltech community.

"I think it's great," says Barbara. "The students need it. It's given them more spirit." Adds John, "From the comments we have heard from the students and alumni, the response is very positive."

Unlike many of the Institute's scientific achievements, the tale of the Caltech beaver has not been systematically recorded. In fact, the Institute Archives has only one document pertaining to the Institute's liaison with the industrious, semiaquatic dam builder: a clipping of an article from the February 10, 1922 *Pasadena Star-News* announcing the advent of the beaver mascot.

"The beaver has become the mascot for California Tech—a symbol of engineering and fight around which the student body spirit of the engineer can act with it as a nucleus," the newspaper reported, somewhat awkwardly. "Yesterday morning, the sophomore class of California Tech presented to the student body a very appropriate stand for the beaver, which shall act as a means of displaying the mascot, and lend more dignity to the animal as symbolic of engineering and student body spirit."

The paper did not explain what exactly was "appropriate" about the stand, adding only that "a full-sized stuffed beaver was presented to the student body for con-

*Continued on page 12 . . .*


**The new Caltech beaver mascot made a surprise appearance at a campus event last year, posing for a photo, above, with John and Barbara Gee. The top photo shows the Institute's recently upgraded mascot cavorting next to one of its early predecessors, which used to be borne aloft shoulders to Caltech sporting events. The drawing above right appeared in the 1923 Caltech yearbook *Big T*.**

## President Chameau, six alumni elected to NAE

Jean-Lou Chameau, who, when he's not leading the Institute, is also a Caltech professor of civil engineering, environmental science and engineering, and mechanical engineering, is one of 65 new members, including six alumni, elected to the National Academy of Engineering (NAE). Chameau was cited by the academy for his "national and international leadership and contributions in engineering education, geotechnical engineering, and public policy."

NAE membership, which is among the highest professional distinctions accorded to an engineer, honors those who have made important contributions to engineering research, practice, and education, and those who have demonstrated unusual accomplishments in the "pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering, or developing/implementing innovative approaches to engineering education."

Before becoming Caltech's eighth president in 2006, Chameau served as provost and vice president for academic affairs at the Georgia Institute of Technology, where he was also a Georgia Research Alliance Eminent Scholar and the Hightower Professor. Prior to that, he had served as dean of the Georgia Tech College of Engineering, the largest in the country. At Georgia Tech, Chameau had focused on making the university a worldwide model for interdisciplinary education and research, innovation, and entrepreneurship, and for the promotion of these activities as a catalyst for economic development. Since coming to the Institute, Chameau has overseen a varied and expanding series of sustainability initiatives at Caltech. On his watch, two solar-energy facilities have been installed atop campus facilities, the first of several such projects, while new buildings such as the Cahill Center for Astronomy and Astrophysics, the Annenberg Center for Information Science and Technology, and the Schlinger Laboratory for Chemistry and Chemical Engineering will attain gold LEED (Leadership in Energy and Environmental Design) levels for sustainable building design. In addition to Chameau, six Caltech alumni were elected to the NAE.

Robert Leon Cook, EX '86, the vice president of advanced technology at Pixar Animation Studios, was named "for building the motion picture industry's standard rendering tool." This software has made computer-drawn animated movies look much more realistic, and earned Cook the first-ever Oscar awarded for software in 2001.

William J. Dally, PhD '86, was elected to the NAE for his "contributions to the design of high-performance interconnect networks and parallel computer architectures." Dally is the Bell Professor of Computer Science and Electrical Engineering at Stanford, as well as chief scientist and vice president at NVIDIA Corporation, a visual computing technologies company.

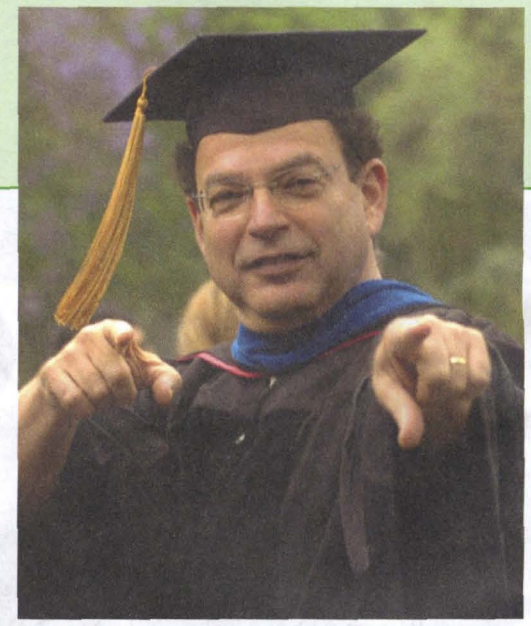
Chaitan Khosla, PhD '90, the Rauser and Petiprin Professor at Stanford, was cited for "engineering molecular assembly lines, developing metabolic engineering technologies, and advancing biopharmaceutical discovery." His research includes the engineering of new antibiotics and a therapy for celiac sprue, an autoimmune disease in which people react adversely to grains. Khosla received Caltech's Distinguished Alumni Award in 2000.

James F. Pankow, PhD '79, a professor at Portland State University, Portland, Oregon, was elected for his "contributions to understanding the chemical thermodynamics of organic particulate matter in urban air and the global atmosphere." As well as his groundbreaking research into the behavior of air pollutants and aerosol particles in the earth's atmosphere, Pankow plays a leading role in the study of contaminants in drinking water.

Howard A. Stone, PhD '88, Joseph Professor of Engineering and Applied Mathematics, Harvard, was named for "the development of fundamental concepts and novel applications in microfluidics and for improving the understanding of small-scale, viscous-flow phenomena." Such research is applicable in diverse areas, including biology (the viscous flows of lipid bilayers and monolayers and the motions of particles suspended between them), and geology (sedimentation and the flow of fluids in the earth's mantle).

In addition to these alumni, Sébastien Candel, PhD '72, professor and head, Ecole Centrale Paris and Institut Universitaire de France, Chatenay-Malabry, was one of nine individuals elected to the NAE as a foreign associate. Candel, who participated in the commission of inquiry into the partial failure of the second flight of the European satellite launcher Ariane 5 in 1997, and the fatal failure of the space shuttle *Columbia* in 2003, was cited for "significant contributions to solving multidisciplinary problems in the fields of combustion, fluid mechanics, aeroacoustics, and propulsion."

Founded in 1964, the NAE is an independent, nonprofit institution that advises the federal government on issues of science and technology policy while conducting studies to articulate the societal implications of rapid technological change. The NAE also initiates programs designed to encourage international cooperation between engineering societies, to improve the public's technological awareness and understanding, and to enhance the dialogue between scientists, engineers, and policy makers.



## Shuki Bruck awarded Feynman Teaching Prize

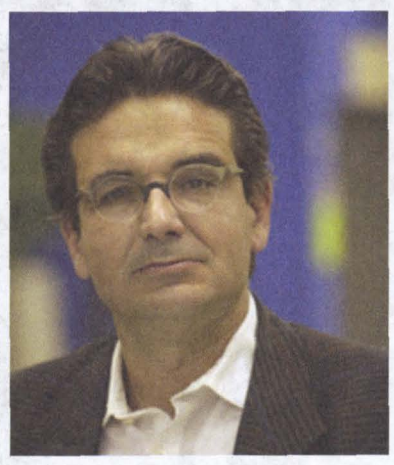
Jehoshua "Shuki" Bruck, Caltech's Moore Professor of Computation and Neural Systems and Electrical Engineering, has been awarded the Richard P. Feynman Prize for Excellence in Teaching. Caltech's most prestigious teaching honor, the award comes with a $3,500 cash prize plus an equivalent raise in annual salary.

The Feynman Prize was established in 1993 "to honor annually a professor who demonstrates, in the broadest sense, unusual ability, creativity, and innovation in undergraduate and graduate classroom or laboratory teaching." Any member of the Caltech community, including faculty, students, postdoctoral scholars, alumni, and staff, may nominate a faculty member for the award, and the winner is selected by a committee appointed by the provost.

A member of the Caltech faculty since 1994, Bruck was the founding director of the Information Science and Technology program from 2003 to 2005. His research combines work on the design of distributed information systems and the theoretical study of biological circuits and systems.

## Rosakis named to head EAS Division

Ares Rosakis, Caltech's von Kármán Professor of Aeronautics and Mechanical Engineering, has been named to succeed David Rutledge, the Tomiyasu Professor of Electrical Engineering, as the new Chair of the Division of Engineering and Applied Science. He will



take over from interim chair Richard Murray '85, the Everhart Professor of Control and Dynamical Systems, in May.

Rosakis, whose research into solid mechanics, ballistic impact and the dynamic failure of metals, composites and interfaces covers diverse areas such as the mechanics of earthquake ruptures, ways of shielding spacecraft from high-speed micrometeoroid impacts, the reliability of thin films, the mechanics of metallic glasses, optical interferometry, and the restoration of ancient stone monuments, has been the director of GALCIT since 2004. Under his leadership, GALCIT celebrated its 80-year anniversary last year, changed its name from the Graduate Aeronautical Laboratories at the California Institute of Technology to the forward-looking Graduate Aerospace Laboratories (at CIT), and moved into the newly renovated Guggenheim building.

Rosakis has also led the renewal of GALCIT's research program by building on its strengths in the mechanics of solids, fluids, and propulsion, and emphasizing, with the faculty, new research directions in space structures and bioinspired design. Working closely with JPL, he has introduced a new MS and PhD program in space engineering which has drawn top graduate students from across the nation.

Born in Athens, Greece, Rosakis earned his bachelor's and master's degrees in engineering science at Oxford, then moved to Brown for ScM and PhD degrees in solid mechanics before joining Caltech as an assistant professor of astronautics and applied physics in 1982. He became an associate professor in 1988, professor of aeronautics and applied mechanics in 1993, and professor of aeronautics and mechanical engineering in 2000. He was named the von Kármán professor in 2004.

His honors include the Society

*Continued on page 7 . . .*

## Mars rover scientist to keynote Alumni Seminar Day General Session in May

Marking the fifth anniversary of *Spirit* and *Opportunity*'s arrival on Mars, Steven Squyres, the science-payload principal investigator for JPL's Mars Exploration Rovers, will present the general session address at the Caltech Alumni Association's 72nd annual Seminar Day on May 16. In his talk, "Roving Mars: *Spirit*, *Opportunity*, and the Exploration of the Red Planet," Squyres will discuss how these intrepid robotic rockhounds, which began exploring the Martian surface in early 2004, have more than lived up to their names. Today, long past their projected 90-day lifespans, they continue to pursue their mission of sniffing out signs of past water on Mars and investigating whether Mars has ever had conditions suitable for life.

*Opportunity* landed on Meridiani Planum, a smooth plateau near the Martian equator, and within a few weeks it found compelling evidence for the past existence of water. The rover later drove nearly eight miles across the planet's surface and explored Victoria Crater, an impact crater half a mile in diameter.

*Spirit* landed in Gusev Crater, a large impact crater in the southern highlands of Mars, then trundled about a mile and a half to the Columbia Hills, where it found strong indications that rocks had been modified by water and that ancient hot springs had once existed on Mars.

Best known for his studies of the history and distribution of water on Mars and of the possible existence and habitability of a liquid water ocean on Jupiter's moon Europa, Squyres received his PhD in 1981 from Cornell University, spent five years as a postdoctoral associate and research scientist at NASA's Ames Research Center, then returned to Cornell, where he is the Goldwin Smith Professor of Astronomy.

He has participated in many of NASA's planetary missions, including the Voyager missions to Jupiter and Saturn, the Magellan mission to

Venus, and the Near Earth Asteroid Rendezvous mission. He is also a coinvestigator with the 2003 Mars Express and 2005 Mars Reconnaissance Orbiter missions and a member of the imaging team for the Cassini mission to Saturn. Squyres has also served as chair of the NASA Space Science Advisory Committee and a member of the NASA Advisory Council.

A fellow of the American Academy of Arts and Sciences, Squyres has received numerous awards, including the American Astronomical Society's Harold C. Urey Prize, the Space Science Award of the American Institute of Aeronautics and Astronautics, and the American Astronautical Society's Carl Sagan Award.

**Campus photographer Bob Paz captured this moody image of the skies above campus in February.**

**From left, young inventors Ophir Vermesh and William Chueh, along with Rob Lemelson and his wife, Susan Morse, celebrate the awarding of the first Lemelson-Caltech Student Prize on campus.**

On March 5, Caltech honored two of its most promising young inventors, as graduate student Ophir Vermesh was named the winner of the first-ever $30,000 Lemelson-Caltech Student Prize, which seeks to "recognize and inspire burgeoning innovators and inventors." Vermesh, a graduate student in Gilloon Professor and Professor of Chemistry Jim Heath's group, was honored for his key role in the invention of the Integrated Blood Barcode Chip, which has the capacity to analyze a single pinprick of blood for a wide range of diseases. The runner-up, and recipient of $10,000, was William Chueh, a graduate student in Professor of Materials Science and Chemical Engineering Sossina Haile's group, who invented a cerium dioxide–based system of producing fuels such as methane directly from any form of heat (including solar energy). The Lemelson Prize is named for the late Jerome Lemelson, prolific inventor and holder of one of the largest number of patents ever awarded in the United States. The prize, which can be awarded to graduate or undergraduate students for outstanding innovation, is funded by the Lemelson Foundation, through the Lemelson-MIT Program, and by Michael W. Hunkapiller, PhD '74, a recipient of Caltech's Distinguished Alumni Award, himself the holder of some two dozen patents, and originator of the automated fluorescent DNA sequencer.

## Kavli Laureate establishes astronomy fund

After festivities for his Kavli Prize in Astrophysics concluded with an Oval Office reception in November 2008, Maarten Schmidt, Caltech's Moseley Professor of Astronomy, Emeritus, got right back to work making a difference in astronomy. He and his wife, Corrie, gave half of Schmidt's $500,000 prize money to Caltech, establishing an endowed fund for innovative projects in astronomy.

Like many other gifts invested in Caltech's general endowment, the Maarten and Cornelia Schmidt Endowed Fund in Physics, Mathematics and Astronomy is designated to support a particular field: in this case, observational astronomy. The chair of the PMA Division will select projects for funding, with the provost reviewing each choice.

This October will mark the 50th anniversary of Schmidt's arrival at Caltech. Just four years later, in 1963, Schmidt discovered the redshift of quasars, a breakthrough that "dramatically expanded the scale of the observable Universe and led to our present view of the violent Universe in which massive black holes play a key role," in the words of the Kavli Astrophysics Prize Committee, which awarded its inaugural prize to Schmidt and Cambridge astronomer Donald Lynden-Bell (a Caltech postdoc from 1960 to 1962). Schmidt's continuing investigation of quasars' distribution and evolution has helped usher out the steady-state theory in cosmology and advance Big Bang and inflationary models.

Now, because endowment contributions are managed for use in perpetuity, the Schmidt gift will help extend Caltech's record of major contributions to astronomy far into the future.

Awarded by the Norwegian Academy of Science and Letters, the Kavli Prizes recognize scientists for their seminal advances in astrophysics, nanoscience, and neuroscience. The prizes were founded in partnership with The Kavli Foundation, which supports 15 research institutes around the world, including Caltech's Kavli Nanoscience Institute. The selection of recipients is independent of the foundation, and is conducted by international prize committees.

(For more on Schmidt's discovery and the Kavli Prize, check out the recent *Caltech News* article "Redshift Turns Gold for Maarten Schmidt," at http://pr.caltech.edu/periodicals/CaltechNews/articles/v42/schmidt.html. For more on the Kavli Foundation, visit www.kavlifoundation.org.)

### Recognition

*For an up-to-date list of awards and honors bestowed recently upon Caltech faculty and staff, go to http://today.caltech.edu/today/oncampus.tcl and scroll down to Honors and Awards in the right-hand column, as well as to the Archives link in that section.*

## Cahill Center—All It's Cracked Up to Be

"It looks like it's coming apart," architect Thom Mayne happily remarked, as he surveyed the newly completed Cahill Center for Astronomy and Astrophysics, its fractured skin of terra-cotta-colored panels slashed to reveal powder-blue recesses and glossy black windows. "Or it's coming together, or emerging. You're seeing something literally in the process of becoming."

At the building's dedication and ribbon-cutting ceremony on January 26, the Pritzker Prize–winning architect credited Caltech's astrophysics community with helping to inspire the design of this striking addition to Caltech architecture. According to Mayne, his design incorporates the forces, warps, and wrinkles that astronomers frequently encounter in the course of their research—or perhaps, as Harvard professor and author Robert Kirshner, PhD '75, quipped at the all-day astrophysics symposium held in honor of the new building, the collisions common in their faculty meetings.

Speaking at the dedication, Physics, Mathematics and Astronomy Division Chair Andrew Lange pointed out that nearly 10 percent of Caltech's faculty—26 professors—will occupy the Cahill Center and that he looked forward to seeing it "catalyze a new era of Caltech astrophysics.

"We are very pleased," said Lange, who is also the Institute's Goldberger Professor of Physics, "that after 60 years of waiting we have this magnificent facility to which our faculty will bring their extraordinary vision and a cadre of the most talented graduate students, postdocs, and research scientists in the world. Though our small campus has had a profound impact on astrophysics worldwide, we have done so while dispersed among several buildings across campus. We will now be brought together in a setting that has been artfully designed to help us bump into each other on the way to the coffee machine and pause for extended conversation in the wonderful spaces that are distributed throughout the building. Intellectually, this will be the equivalent of stoking up a stove, and we will all soon be burning hotter and brighter. I am confident that there will be new discoveries made in the coming years as a result of these interactions."

Ultimately, between 200 and 300 researchers will occupy the new building, where they will work, says Lange "to unravel some of the most profound scientific mysteries of our age," probing such questions as the origin and ultimate fate of the universe; the forces that have shaped the formation and evolution of galaxies, stars, and planetary systems; the nature of the dark matter and dark energy that seem to permeate the cosmos; the behavior of spacetime and matter and energy under extreme conditions, such as those involving black holes; and of course, the perennially fascinating question of whether life exists elsewhere in the universe.

The building's distinctive purpose begins with its address at 1216 California Boulevard—1216 being the wavelength, in Angstroms, of a far-ultraviolet line in the spectrum of hydrogen, known as the Lyman alpha line, that for decades has provided observational astronomers with a goldmine of information about a wide range of cosmic phenomena. Inside the lobby, a glowing, ever-shifting panorama of astronomical images is projected across a furrowed white wall. Behind this wall is the 148-seat Hameetman Auditorium, decorated with a mural of the 200-inch Hale Telescope at Palomar Observatory, and a library that looks out on a terrace running along the back of the building.


The focal point of the first floor is its stairwell, an Escher-like construct of eccentrically angled white beams, open spaces, and irregularly shaped windows (the drywallers also completed the famously curvy Walt Disney Concert Hall in downtown Los Angeles). The view up the staircase narrows toward the third floor, converging on a skylight and suggesting the passage of light through a telescope.

One floor below the lobby, an array of labs with exposed utilities, and windows that look out on slopes of ferns and bunchgrasses, could double as contemporary lofts—if you overlook the grappling hooks on chains, pipes labeled *helium*, *nitrogen*, *dry nitrogen*, and *compressed air*, and the many other accoutrements essential to the design and construction of the state-of-the-art instrumentation that has long been a hallmark of Caltech astrophysics.

The striking architectural features continue on the upper floors, where angled and offset corridors open onto a mix of office spaces, meeting rooms, and a variety of gathering spots designed to promote impromptu discussions and informal group meetings. Windows frame views of the main campus and mountains to the north, and of the Caltech athletic fields to the south.

In his welcoming remarks, Caltech president Jean-Lou Chameau noted that the campus has anticipated this building for more than five decades, a period in which the Institute has become a world leader not only in astrophysics and astronomy research but in the development of leading-edge instrumentation covering every portion of the electromagnetic spectrum. Plans for just such a facility date back to the postwar era and continued, as Chameau noted, to remain "high on the Institute's wish list" until a committed group of donors brought the dream to fruition.

In particular, said Chameau, the new facility owes its existence to "the extraordinary generosity and foresight" of Charles Cahill, a retired producer of educational films who has followed Caltech astronomy and JPL planetary exploration since the late 1950s and early 1960s, when he filmed several of the earliest space-science docu-

**Above, from left, Cahill architect Thom Mayne, President Jean-Lou Chameau, and PMA division chair Andrew Lange look on as (left to right) Sharon Cahill, her father, Charles Cahill, and Joyce and Fred Hameetman '62 officially cut the ribbon to mark the opening of the new Cahill Center for Astronomy and Astrophysics, shown, top right, at night. Left, the facility's stairwell boasts a distinctive design.**

**Charles Cahill funded the Cahill Center in honor of his late wife, Anikó, pictured here in a portrait with her husband.**

mentaries made in conjunction with JPL. The building has been named for both Cahill and his late wife, Anikó Dér Cahill, in whose honor Cahill made the gift. Other benefactors include Trustee Fred Hameetman '62 and his wife, Joyce, the Sherman Fairchild Foundation, the Ahmanson Foundation, the Kenneth T. and Eileen L. Norris Foundation, PIN USA, Inc, and Michael Scott '65.

Among its other notable attributes, the Cahill Center is Caltech's first building to achieve gold-level certification in the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system, conforming to a rigorous set of conservation and energy-efficiency standards that include reducing water use by 30 percent and providing access to daylight in no fewer than 75 percent of its spaces. (For more information on the LEED program and rating system, go to http://www.usgbc.org/.)

Toward the end of his remarks, architect Mayne described the bemusement that he felt when he first encountered Caltech's astrophysics faculty and their unfamiliar research terrain, and described his firm's attempts to capture that dynamic in the Cahill's interior and exterior design. "Architecture," he said, "is about making real who we think we are. Astrophysicists deal with a very different reality, but it is a real reality." With the dedication of the Cahill Center, Caltech's astronomy and astrophysics community is set to open a new and exciting chapter in that very different reality.


**An all-day symposium on "The Future of Astrophysics," held to mark the dedication of the Cahill Center, drew many former Techers back to campus, including former postdoc and University of Colorado professer Jason Glenn (above), who discussed research currently under way at the Caltech Submillimeter Observatory on Mauna Kea, and (inset) Harvard astronomer, Caltech Distingiushed Alumnus, and award-winning author Robert Kirshner, PhD '75, who spoke on "The Exhilarating Universe."**

## *Associates Activities*

*All events will be held at the Caltech Athenaeum unless otherwise noted. For more information about the Associates, please visit http://associates.caltech.edu, or contact the Associates at 626/395-3919.*

***April 2, 2009,*** *Associates Dinner and Program*—"The Future of Solar Energy," with Harry Atwater, Hughes Professor and professor of applied physics and materials science.

***April 25–26,*** *President's Circle Travel Program to Palomar Observatory,* led by Mike Brown, Rosenberg Professor and professor of planetary astronomy.

***May 2,*** *Northern California Associates Dinner and Program*—"More Sustainable Developments at Caltech," with Carol Carmichael, faculty associate in engineering and applied science. The Carnelian Room, San Francisco.

***May 6,*** *East Coast Associates Dinner and Program*—"Energy," with Steve Koonin '72, chief scientist for BP and former provost of Caltech. The Lotos Club, New York.

***May 22,*** *Associates Luncheon and Program*—"Developing Products for Third World Countries," with Ken Pickar, visiting professor of mechanical engineering.

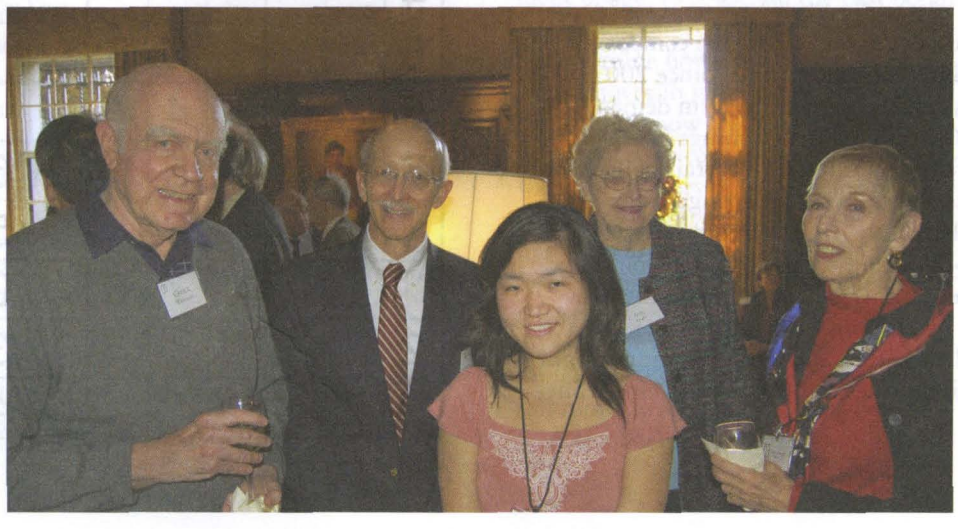
**Perched high on a cliff overlooking England's northeast coast, the brooding ruins of 7th-century Whitby Abbey in Yorkshire will be one of many stops on the Associates Norman Conquest tour. Spaces are still available; contact the Associates for more information.**

***June 19–28,*** *Associates Travel Program on the Norman Conquest of England*, led by Warren Brown, associate professor of history. Optional pre-trip to London, June 16–19.

***September 26,*** *President's Circle Garden Party*, hosted by Caltech President Jean-Lou Chameau and Carol Carmichael. The President's Residence, Caltech.

*Rosakis . . . from page 4*

for Experimental Mechanics Harting award in 2007 and their highest honor, the Murray Medal, in 2005; the IBM Faculty Development Award; the Kingslake Medal and Prize from the International Society of Optical Engineering (SPIE); an NSF Presidential Young Investigator award; and an Excellence in Teaching Award from the Caltech Graduate Student Council. He is also a fellow of the American Society of Mechanical Engineers and the New York Academy of Sciences.



**From left, Associate Chuck Waterman enjoys the reception prior to the Associates Hoffman Luncheon, with Rosenberg Professor of History and Social Science Philip Hoffman, Caltech student Lili Yang, Associate Ann Hight, and Pamela Waterman.**


# GRIDS of GLORY

**ONE TECHER'S VICTORY MAY MEAN ANOTHER'S DEFEAT. BUT IN THE WORLD OF SUDOKU, WHO'S COUNTING?**

BY HILLARY BHASKARAN

For Caltech alumnus Wei-Hwa Huang '98, life is practically all fun and games these days. This 33-year-old techie "retired" from his job as a Google software engineer in July 2008. He seems content to sleep late and work on puzzles and pet projects until he runs out of money.

Or until he finds himself in a "reverse midlife crisis," yearning for an existence that is less carefree, more serious. It's a possibility that Huang has considered. "Maybe when I'm in my forties, I'll think, 'Oh my gosh, I've just been having fun. Maybe I should do something to establish a legacy.'" That leaves Huang about 10 years to decide whether to make a respectable name for himself beyond World Puzzle Champion of the late 1990s, occasional national champ of the '00s, and coauthor, with fellow alum Thomas Snyder '02, of a new puzzle book, *Mutant Sudoku*, slated for publication by Sterling Publishing in the fall of 2009.

It's possible that even among the Caltech cognoscenti, there are one or two individuals who have never heard of Sudoku (as distinct from those who have heard of Sudoku, but can never remember how to spell it or pronounce it, or both). The puzzle consists of a grid of cells in which the numbers 1 through 9 must be placed vertically, horizontally, and sometimes diagonally in such a way that each row or column contains only one of each number. Although Wikipedia traces its evolution back to the magic squares published in late-19th-century French newspapers, Huang, Snyder, and others argue that Howard Garns most likely produced the first modern "Number Place" puzzle for a 1979 Dell Magazines publication without necessarily knowing about similar European puzzles. In 1984 a Japanese variant called "*suuji wa dokushin ni kagiru*," meaning "digits must remain single," was published by Nikoli Co., Ltd., and soon came to be known as Sudoku.

*At the nationals, where the two competed on 20 puzzles, Huang says that Snyder "soundly kicked my butt on all but one." But that one puzzle cost Snyder the championship.*

The puzzle can be enjoyed at one's leisure, or with a stopwatch, or even with competitors egging one another on to solve the grid at warp speed. In recent years the, uh, sport has become so outrageously popular that the World Puzzle Federation decided to give Sudoku its own competition, distinct from the more generic world and national puzzle contests that feature an ever-expanding cornucopia of logical, visual, and numeric brainteasers.

Which brings us to Huang's fellow alum, coauthor, and sometime competitor Thomas Snyder, for whom life has become a different sort of game. Since 2007, when he earned a PhD in chemistry at Harvard, Snyder has juggled the twin demands of being a Stanford postdoc and World Sudoku Champion. His mornings begin early with a puzzle or two—instead of a cup of coffee—to jumpstart his brain. His record is 52 seconds "for an easy Sudoku," and four to five minutes for a zinger from the newspaper. Then he's off to a bioengineering lab on the Palo Alto campus, where he works on the design and fabrication of lab-on-a-chip technology that could lead to life-saving medical diagnostics and tiny fuel cells. (He has also found the time to write *Battleship Sudoku*, published last year by Sterling.) Downtime, or whatever passes for it, might be spent pulling puzzle all-nighters, and while vacations might feature exotic locales, they're dominated by high-stakes competitions at which Snyder defends his title as the two-time World Sudoku Champion and three-time U.S. Puzzle Champion.

And now Snyder has to contend with Huang, who beat him at his signature game in October, when Huang "upended the reigning world Sudoku champ and snared the 2008 national Sudoku championship," in the words of the *Philadelphia Inquirer*, which began hosting the national contest in 2007. That was the year Snyder defeated 856 competitors to claim the title and its $10,000 prize *and* to secure an all-expenses-paid trip to India, where he successfully defended the world Sudoku title that he had won in 2007 in the Czech Republic. (If you can keep all these Sudoku and non-Sudoku contests straight, you may well be on your way to a puzzle championship yourself.)

Having lost to Huang at the 2008 nationals, Snyder might have to pay his own way to Slovakia later this spring to "meet" the Sudoku upstart face to face, along with 100-plus contenders from 20-some countries. As Snyder prepares for the showdown, he assures fans, first, that his expenses will probably be covered by U.S.-team sponsors and, second, that puzzle face-offs do not stir up bad blood between competitors. (Participants have better things to do with their brain cells.) As sworn nonrivals, Snyder and Huang have competed so many times in so many venues while remaining friends and coauthors that even these two Sudoku savants may have lost count. They've also represented the United States as teammates at the team portion of World Puzzle Championships and shared team victories for the past three years. (Huang has helped the U.S. team to nine victories in addition to winning four individual puzzle championships in the '90s, but Snyder has been gaining ground on the non-Sudoku front while Huang gains on the Sudoku front.)

As Snyder recounts, the two met in 2005 in the Munich airport on the way to a puzzle championship in Eger, Hungary. "Wei-Hwa was solving a huge numberlink puzzle, and I was fascinated to watch this famous puzzle solver tackle a tough challenge."

As Huang looks ahead toward this April's international showdown, he is neither stressing nor expecting to win. As he sees it, "If Thomas and I were to go head-to-head on 20 Sudoku puzzles, he'd beat me 19 out of 20 times. He's that good. He practices more than I do." At the nationals, where the two competed on 20 puzzles, Huang says that Snyder "soundly kicked my butt on all but one." But that one puzzle cost Snyder the championship, since it was the final winner-takes-all playoff game.

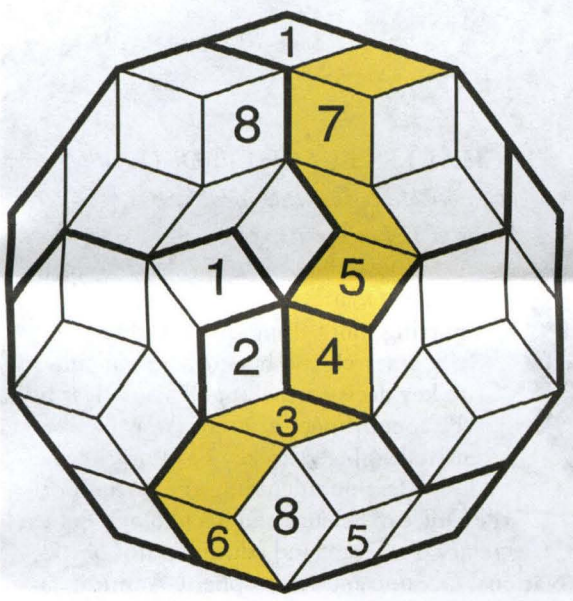
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3 | 2 | 1 | | | | | 8 | |
| 4 | | | | | | | | 6 |
| 5 | | | 1 | 3 | 8 | | | |
| 6 | | | | 4 | | | | |
| 7 | 8 | 9 | | 5 | | 2 | 6 | 4 |
| | | | | 6 | | | 5 | |
| | | | 2 | 7 | 6 | | 9 | |
| 2 | | | | | | | 3 | |
| | 7 | | | | | | 4 | |

**Teaming up in Belarus in 2008 (above, at left), Thomas Snyder and Wei-Hwa Huang piece together the third-straight victory for the U.S. team at the World Puzzle Championship. In their spare time, they create puzzles including Snyder's Tech-centric "CIT" Sudoku, at left. Readers may fill in each cell with a digit from 1 through 9 such that each row, column, and outlined area contains each digit only once. Snyder rates the puzzle "fairly average in difficulty." If you do it in 102 seconds, you'll have something in common with "Dr. Sudoku" '02. Answers will be posted on the *Caltech News* website.**

"I still think my win in the nationals was a fluke," says Huang, who maintains that one weakness generally in the design of competitions is that "the best player or team doesn't always win." But Huang doesn't care so much about being the best or the winner. "I'm kind of competitive, but in some cases I'm not."

That laid-back vibe is on display each winter when Huang competes in the popular MIT Mystery Hunt with more than a dozen teammates who call themselves "Team Left Out." Rather than fly from the Bay Area to Boston, he and half of the team are happy to solve puzzles online "from a sunny California house, while the other half is in chilly Cambridge," running around MIT working on the puzzles that can't be solved online. "Team Left Out" competes against three dozen teams whose members, according to Huang, tend to "have a much stronger drive for victory" and therefore are more diligent about showing up at the actual hunt. For instance, Snyder flies across the country to join "The Evil Midnight Bombers," which has won the hunt both times it competed. The "prize" for winning is being invited to organize the next hunt.

But Huang, whose team is about a third of the way back in the pack, says, "We don't want the prize. We want to see the 150 or so puzzles—the most in any competition that I know of." When one of Huang's friends did want to win, he joined Snyder's team.




**In this variant called Penrose Sudoku, which is named "Torch" by creator Huang, only numbers 1 through 8 are used, and the rows and columns have been distorted by the irregular tile pattern. A row is a series of quadrilaterals that share parallel edges. For example, the highlighted set of eight cells (covering the givens 7, 5, 4, 3, and 6) are all in the same row. There are exactly 10 rows, each with eight cells, beginning and ending at opposite edges of the decagon, and each cell is in exactly two rows. If you do it in 9 minutes 43 seconds or less, let us know. Snyder rates this creation of Huang's as really difficult and says it should come with a warning. Good luck.**

As international puzzle champs, Snyder and Huang have the option of foregoing a number of competitions in order to design the puzzles for them, as Huang did for the 2007 nationals and as both have done on occasion for events sponsored by Google, Microsoft, and Gen Con. In 2010, the World Sudoku Championship will be held in Philadelphia, which might give Snyder, Huang, and a dozen or so other U.S. puzzlers a chance to create rather than compete in the international arena. Although tempted by the chance to have his creations judged for quality and dispersed to "friends from other nations," Snyder doesn't think he'll be allowed to step back from the fray this time. "If I'm successful at the U.S. championship this fall, I likely will have to compete."

Ditto for Huang and the other "good solvers," who need to represent the country unless "we can find five hitherto-unknown American solvers who are at my level or better within the next two years," says Huang. "But chances don't seem to be too high for that."

Snyder has hinted that there might come a time when he'd be ready to rest on his laurels. He told an interviewer last year, "The world's getting quicker. I might have to retire pretty soon and just start writing puzzles for the competition." But so far he's keeping his day job, and he clearly still has that competitive streak. "While I have accomplished a lot in puzzles, I have yet to win a World Puzzle Championship—my highest finish is second in 2007 in Rio de Janeiro—and that is a goal I still strive for." Snyder scrupulously keeps track of all the competitions he's in, analyzing his performance on his online blog, motris.livejournal.com. He also shares his puzzle creations there, as well as in *Games* magazine and elsewhere. When does this guy get any sleep?

And where does that leave Huang, who's seemingly content to spend hours on end designing puzzle-solving software, attending puzzle conventions, and playtesting and designing games and puzzles for friends and the occasional client? His own moldering website includes the announcement that it was last modified in 2002, along with the comment, "Gasp. Wei-Hwa actually updated his home page?" (You'll find it at ofb.net/~whuang/ugcs/.) Could it be that the beach bum of puzzledom is actually headed for a reverse midlife crisis (or that anyone besides his girlfriend will ever find out about it if it happens)? Huang revisits the possibility, as he reflects on Snyder's lofty pursuits: "Thomas is doing research and stuff. If he's successful, he may be remembered later on. But it's unclear how much my name will be remembered."

Huang freely credits the Institute with helping to shape his work ethic. "Some of my Caltech experience showed me that things don't completely fall apart if I give up. The first time I got a C, I thought 'Oh my gosh, the world didn't collapse.' And I thought, 'Well, if it doesn't collapse when I get a C . . .'

"I'm not sure the experience taught me the right life lessons." For instance, after two years of enrolling in, then dropping Physics 2B, which he had to pass to graduate, Huang finally got around to passing the course during his senior year. Besides, he says, that last time around, he clicked with the new professor and the text.

Searching for a word to define his post-semiretired, pre-midlife-crisis status, Huang says, "I suppose you could call me self-employed. But that would imply that I'm making money." Well, he did just pocket $10,000 in Philadelphia. And, if times get tough, Huang can always costar with Snyder or, if Snyder's too busy, Will Ferrell, in *Grids of Glory*. ◆

*Adkins . . . from page 2*

of climate conditions," Adkins says. He and his group will spend the summer screening the age distribution of the fossils using the Accelerator Mass Spectrometer at Woods Hole to measure their carbon-14 content. That will enable him to determine how old they are.

Adkins will then try to determine how climate change has impacted the oceans over time. "We measure the carbon and oxygen isotopic composition of the skeletons as a proxy for past temperatures, and we use the carbon-14 content of the skeletons, coupled with a uranium-thorium radiometric measurement of age, to constrain the past ocean circulation rate." This will enable him to determine how the population of corals moves in space and time.

"I don't know if the coral populations will have responded over time to warm/cold intervals, or to something else," Adkins says. "The answer is not likely to be directly related to temperature because we are only talking about a few degrees. However, these temperature shifts might be correlated with something else that the populations feel more directly."

A secondary part of the mission, Adkins says, was "simply to document what's down there. In one sense, the deep ocean is less explored than Mars. So every time you go to look down there, you see new things; magical things."

Until Adkins's expedition, the reef he was exploring—the Tasman Fracture Zone—had only been explored to a depth of 1,800 meters. Using *Jason*, the researchers were able to reach down to 4,000 meters, uncovering a world that was remarkably rich in life.

Besides the new anemone, he also discovered a new species of carnivorous sea squirt that "looks and behaves like a Venus fly trap" and a new species of barnacle. The discovery of the sea anemone was both a thrill and a bit of a letdown, Adkins admits. "I was excited for the new species, but disappointed" because it resembles the flower-like coral, *Desmophyllum dianthus*, that he was trying to collect, a living version of which can be spotted just to the right of the anemone on the back cover. At the deepest depths, where he had thought to encounter fields of coral, the specimens turned out to be the anemone. But there were sufficient numbers of coral above 2,400 meters.

"These corals will be our window into the impact of climate change," Adkins says. "The info is there; now we just have to unpack it."

—L.O./M.R


# A New Day in D.C.

## What It Might Mean for Science

*Ever since the 2008 presidential election, people around the world have been speculating about what the change in U.S. leadership may mean for them. The Institute is no exception, and many Caltech faculty and administrators have been trying to gauge how the Obama administration will influence the ways in which the Institute carries out teaching and research. With Obama taking swift action in many areas just weeks into his presidency,* Caltech News *asked several members of the Caltech community whose agendas are likely to be directly affected by changes in government policy to share their thoughts about how science and engineering research and education may change over the next four years.*

**JEAN-LOU CHAMEAU** *became Caltech's president in 2006.*

President Obama's vision for science and technology and the role they play in society is exhilarating. He shares our belief in the importance of science in policy making and of scientific research to the health of the economy and general welfare of the country. The president's closest advisors are talented and experienced, reflecting a breadth of knowledge across a wide range of science, engineering, and social science disciplines. It should be a good time to be a scientist or an engineer in Washington!

While the economy, of course, is an urgent concern, I expect we are going to see sustained, long-term investments in science and technology during his presidency. As an early positive indicator, the stimulus package recently passed by Congress includes significant investments in federal agencies supporting research, such as DOE, NSF, NIH, NASA, and others. I'm glad we have momentum in our efforts at Caltech to focus on science and technology that will have a disproportionate impact on society in areas such as energy, the environment, earth science, and medicine. While we have budget concerns of our own, I believe our strategy for maintaining our investments in research and education, combined with our vision for enhancing our research in these areas, will put us in the right place at the right time to make the difference that the new administration is looking for.

Finally, I'm hoping President Obama, his cabinet and advisors, and our leaders in Congress will take actions that will inspire generations young and old to engage in science and engineering as a form of service to our nation.

**CHARLES ELACHI** PhD '71, *a longtime member of the Institute faculty, has been director of JPL since 2001.*

The Obama administration is clearly putting more emphasis on funding scientific research and having scientific inputs to key decision making. This is clear by the appointment of highly respected scientists/engineers to key positions in the administration, including the director of the Office of Science and Technology Policy; secretary of energy; and administrator of the National Oceanic and Atmospheric Administration (NOAA). In addition, the Recovery and Stimulus Initiative, independent of how it is perceived economically or politically, includes significant funds for scientific and technological investments, reflecting the philosophy of the administration.

Specifically, in the space program there is renewed emphasis on Earth observation from space to help better understand and to quantify the changes in our environment. A recent decadal plan for Earth science and observation, which was developed under the aegis of the National Academies, is getting renewed interest and stronger financial support. This will enable NASA and NOAA to field a number of space programs to continue long-term observations and put in place more observational capabilities to better inform policy makers about how to address issues of global change.

**On inauguration day, many members of the Caltech community turned out to watch the parade and presidential swearing-in ceremony on TV monitors while enjoying breakfast in the Chandler cafeteria.**

**FRED FARINA**, MS '92, *is assistant vice president for Caltech's Office of Technology Transfer, which protects and manages the intellectual property developed on campus and at JPL and is responsible for the licensing and transfer of technologies from Caltech and JPL to the commercial sector.*

Our hope is that the Obama administration's emphasis on creating jobs and putting more money into research, at least in the energy and green fields, will affect technology transfer at Caltech in a lot of good ways.

First, there will be more research dollars that can generate inventions. But most likely it is going to take several years in these areas to figure out how to do this, and how to match the funding to the appropriate researchers who can then create inventions. So we hope that, as part of this process, there will also be more funding available for new companies in these areas—in the energy area, in particular—and that therefore we'll be able to transfer our intellectual property (IP) into new companies.


**Inauguration-day crowds in Washington, D.C., filled out posters expressing their hopes and ideas for the new administration.**

In the health-care area, we are hoping that the reform will create a strong demand for innovation and that we can participate in modernizing the system by transferring our inventions to the public through technology commercialization. In the last few years, there have been a large number of inventions and new start-ups in the biomedical area, an area that will likely remain strong in the next few years, particularly if the administration follows through with comprehensive health-care reform. These infusions will not impact us as directly as the investment in energy. The new administration has publicly stated that we will need to invent ourselves out of the energy issues we are facing, and that will likely translate into research dollars being put to work in renewable energies to achieve energy independence. Hopefully, additional funds will be dedicated to commercializing research results so that inventions made in academia can be turned into technologies available to the public.

Concerning the effects of the new economic stimulus package, the part of the stimulus that basically puts an extra $400 into individuals' pockets isn't really going to affect Caltech. However, the package also includes incentives and other initiatives related to clean energy research, and that may help us.

One of the key aspects of all the technology-transfer activities is the Bayh-Dole Act, which was passed in 1980 by Congress and signed into law by President Jimmy Carter on his last day in office. The act said that universities that receive federal funding have the option to own the IP developed with this funding. Before that, the government owned these inventions. And because the government is not in the business of licensing and commercializing, most of these inventions sat on a shelf.

Because of Bayh-Dole, universities have begun to protect their IP and create new companies, and, supported by federally funded research, develop products that then benefit the public. There are now drugs out there, as well as various other devices and inventions in the public domain that did not exist before this act became law. The act has had a very good impact on the public and also a very deep economic impact globally.

There are some detractors who believe that because the public essentially pays for these inventions, the rights should be available to anyone to use. But when people have experience in this field, they understand that university research is very early-stage and that it takes lots of funding to get from idea to invention to product. And if you are not able to give exclusivity to someone through a patent and license for a period of time, nobody is going to invest the money required to actually bring their concept to market as a product—people have to have some incentive to do it and reward for the great risk taken.

We have some concerns that Bayh-Dole may be under threat. There have been rumors that people close to the Obama team—at least one person who is an advisor—may not have such a favorable view of this vital act, and may want to change and adapt it after almost 30 years. I believe it has been working—maybe not perfectly, but very well—and that modifying it may open the door for the detractors to make deep changes.

Overall, I think the impact of the Obama administration will be felt sooner on the research side, where there will be money available that scientists can apply for. But from our side, in the start-up area, a great deal will depend on the financial markets. The market for initial public offerings is almost nonexistent right now. And large companies are not as active as they were a few years ago in looking to license technologies from universities, because the funds are not there.

Still, you always have to look at things in a positive light. These times are an opportunity to rethink the technology-transfer business, to make it more efficient and more robust, and hopefully at the end of the process you come out stronger, ready for a bull market, with some lessons learned to be ready for the next downturn. It will require everyone to be on their toes as far as efficiency and cutting waste are concerned.

**DAVID BALTIMORE**, *Caltech's president from 1997 to 2006, is currently the Institute's Millikan Professor of Biology, and past president (2007) of the American Association for the Advancement of Science.*

The Obama administration has a full plate. With the economy in tatters, the involvements abroad, and the promises he made for a domestic reinvigoration, there is simply not enough money to do everything he wants, at least not all at the same time. Meanwhile, he has put together quite a wonderful team, with outstanding people in so many jobs. Each will want to find the funds to optimally carry out his or her function. Some will be frustrated.

Looked at from a Caltech-centric viewpoint, we care about being able to move forward the frontiers of science and technology. The previous administration squeezed science, often funding short-term investments rather than building the base of knowledge and innovation. In the all-important area of energy research, the administration simply underfunded it and did not support the types of programs that would lead to breakthroughs in generating or storing energy.

Obama has promised a huge program in energy research. He has appointed a Science Advisor and a Secretary of Energy who, in the past, have both encouraged major efforts toward harnessing energy sources that will make us independent of fossil fuels. Will they be able to realize their dreams? I think this is one area where Obama will deliver. If he funnels the bulk of the funds through the Department of Energy, its new head, Dr. Steven Chu, will have to reorganize the whole research effort of the department to make it more innovative in its thinking and more flexible and nimble in its procedures. This is a tall order for a mere physicist, but Steve is an impressive guy and I would bet on him. For Caltech this should be positive but we should, perhaps, more aggressively position ourselves to play an important role in energy research.

Obama appears to understand the importance of basic research and did promise increased funding for NSF and other science agencies. Had he chosen a Science Advisor who had a wider perspective on science, I would be a little more sanguine about the ability to follow through on this promise. While global competitiveness is a driving force for maintaining U.S. dominance of basic science, I suspect that this investment will not be the first one he chooses to make.

As to my field, biomedical research, the NIH budget was doubled over five years, finishing in the first two Bush Jr. years. However, the budget then went flat to slightly down, leading to a 13 percent real decline in purchasing power. The doubling led many universities, especially medical schools, to expand greatly, bringing many new labs on line. Thus, while the doubling made new money available, the competition for it rapidly heated up and the declining funds available have made the funding situation intolerable. We need either more money or fewer investigators,

*Continued on page 14 . . .*

**Former president Tom Everhart (at left) palled around with the previous beaver mascot at Caltech's 1991 centennial celebration. The new beaver was created with the input of (below) recent Caltech graduates Katherine Breeden (left) and René Davis. The photo to their left shows the previous beaver, sporting distinctively human hands and feet.**

*Mascot . . . from page 3*

sideration at one of the big football rallies and bonfires." It also appeared at football games, where it "resided on the side-lines among a group of men acting as its bodyguard."

Caltech first acknowledged its formal association with "nature's engineer" in 1923, when a drawing of a beaver appeared in the Caltech yearbook, the *Big T*, although no mention was made of its role as an official mascot. At some point, following the lead of bigger, more mascot-oriented universities, someone decided that Caltech needed a human-sized beaver costume into which people could zip themselves and parade around during Caltech events.

Images of these primordial beaver mascots are hard to come by. A diligent search through the Caltech Public Relations photo files uncovered a single picture, dating back to 1991, featuring then-president (now president emeritus) Tom Everhart standing alongside the beaver (and grinning almost as widely) at Caltech's centennial celebration. Although the furry critter looked reasonably presentable, it did sport a nasty gouge on its massive right cheek.

"That beaver costume was from the 1980s," Jack says. "When I came here in 1988, I was told there had also been earlier iterations. Back then, the students kept it, but it's anyone's guess where they kept it. Around the time of David Baltimore's inauguration as Caltech's president in 1998 it came out again."

Unlike more sports-oriented institutions, whose mascots regularly strut their stuff on the sidelines at big athletic events, the Caltech beaver's appearances were somewhat ad hoc. "Every now and again it would randomly show up at games," Jack says. "If a student found the costume, they probably thought, 'This is cool,' and they'd wear the beaver to a game."

In recent years, however, the beaver began making more frequent appearances. Caltech's men's and women's basketball teams started getting more attention when they began winning games during the 2006–07 season. As students turned out in larger numbers to cheer on their teams, undergrads Katherine Breeden '08 and René Davis '08 took on the mission of reviving the mascot tradition. Breeden, a cross-country and track athlete, and Davis, a point guard on the women's basketball team and a member of the track and volleyball teams, thought that school spirit would be enhanced if Caltech had a spruced-up mascot.

"Caltech athletics had been on an upswing over my four years," says Breeden, who will start graduate school in computer science at Stanford next fall. "The community was becoming more involved in our athletic teams, which gave our student athletes a greater sense of pride in what they did. I heard a rumor that a mascot existed. No one knew where it was. It took six months of spreading the word around before we actually found it in a student house sometime in 2007."

After the mascot turned up, various students, including Breeden and Davis, took it in turn to don the furry suit and rally beaver-fever fervor at games. "People thought it was fun, but it didn't reflect our hopes for the program," Breeden says. One problem was that the fabric clung to the performer's body, turning it into a sauna. "You'd be drenched." Since the head didn't turn, the wearer found it difficult if not impossible to see well enough to frolic before the fans in appropriate mascot fashion. The sight of hands and feet standing in for the quadruped's paws, which for some reason had never been part of the original costume, also detracted from that magical mascot experience.

Once the Gees donated the money for a new outfit, that should have been the end of the story. But to get through costume procurement, the beaver first had to navigate the maze of costume design. Jack says the project was initially set back a few months by a mascot maker who was either indifferent, incompetent, or overwhelmed by the challenge of fabricating an iconic Caltech beaver.

"I got in touch with a mascot maker in the fall of 2007," Jack says. "He was supposed to do a conceptual drawing. I gave him up to the holidays and he never came through."

Jack then turned for advice to some of his colleagues at Division I universities where mascots are a big part of the campus culture. "They said Street Characters, up in Canada, was the way to go, and that they've made hundreds of mascot outfits. When I spoke to their marketing director, I could tell I was dealing with a high-end operator. I learned more than I ever wanted to know about mascot costumes."

With input from the Student Athlete Advisory Committee (SAAC), a group of Caltech students, and one department advisor—tennis coach Mandy Gamble—Street Characters got started on a mascot design. Both Breeden and Davis were members of the committee, and they naturally had a vested interest in the new design.

While recent designs in the sports mascot universe have trended, according to Jack, toward mean and macho, the Caltech students were more interested in reasonably cute and cuddly. "We wanted something kids would come up to and hug; something that would get the crowd going." Breeden says. "We went through a couple of iterations." An early design featuring small teeth and beady eyes was quickly rejected. "We thought it looked too much like a chipmunk," Breeden recalls. "We wanted teeth that were long and large. And we made the eyes bigger. We wanted it cartoony."

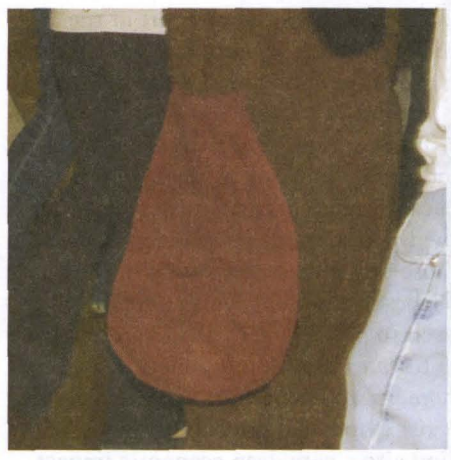
At one point, the SAAC suggested to the designer that the beaver should be outfitted in either a letterman's jacket or a sweater with elbow patches, for that scholarly touch. Back came a mock-up of a beaver wearing a letterman's sweater and patches on the elbows. The committee passed on that option, noting that letterman's sweaters generally don't have elbow patches. "It was a weird hybrid," Breeden says. "Patches on the elbows wouldn't work. This is Caltech. You've got to have a clear idea here."

Jack says that while the costume was being concocted in Canada, some members of the Caltech community began discussing whether the beaver should have a name, which led to conversations about whether the beaver was supposed to be male or female. "People started talking about the message we are sending," Jack says. "I said, 'Let's keep it fun.' Part of the debate came from referring to it as he. They wanted to know why it is a he. I called the company and they said most mascots are male. Just like most people refer to cars as female. This is just how it is."

But Breeden says that the gender of the mascot is not a fait accompli. "I always refer to the mascot as 'she' and have heard others refer to it as 'he' and 'she.' The costume is gender neutral. We have been trying to come up with a name of the beaver, and suggestions would be much appreciated. We are open to male, female, or gender-neutral names, and the correct pronoun would be decided on based on the name." (Suggestions can be sent to the SAAC, whose members can be found at http://www.gocaltech.com/SAAC/index).

The designer incorporated the students' ideas, and the mascot costume arrived last May sporting a white Caltech sweater, sans elbow patches. "When we pulled the head out of the box, we said, 'Yep. This is it,'" Breeden says. Some of the user-friendly features include an interior vest designed to keep performers cool (it's stored in a freezer between games) and a type of football pad that also reduces the internal temperature by maintaining a layer of air between the performer and the suit. And the new beaver cranium has a hockey helmet inside, so that it moves in tune with the performer's head. "I love the new mascot," says Davis. "I think it looks great and is way more comfortable to wear than the old one."

Fans too have greeted Caltech's new improved beaver with enthusiasm. Because it looks more like a beaver than a person in a suit, "it helps people suspend their disbelief a little bit more," Breeden says. Adds Davis, "When people see an awesome-looking beaver getting excited for our teams, they get excited too." Athletes also seem jazzed by the mascot's new look. "Earlier this year, I surprised the cross-country team at a meet with the mascot," says Davis, who is applying for graduate school in biology between beaver gigs. "I have never seen so many people smile while running a cross-country race. And it wasn't just our runners. The beaver made everyone's race a little better, no matter what uniform they were wearing." ◆



## A King For One Season

By Dwight Berg '90, MS '90

I was working at my day job at David Taussig & Associates in Irvine as an assessment engineer—it must have been around August 10, 1990—just months after graduating from Caltech. I was listening to the radio—probably KROQ—when an advertisement announced that tryouts for "Kings' mascot" were being held the following Sunday at the ice rink at the Rancho Palos Verdes mall. I was excited because the Kings' mascot was brand new, and there was only one other National Hockey League (NHL) mascot at the time, Calgary's Harvey the Hound. Ice hockey is my favorite sport. I started playing in the seventh grade in Greenbelt, Maryland. I even played at the college level at Caltech, where I led in penalty minutes each season. So I knew I would be a shoe-in for the mascot position.

On Sunday morning I arrived at the ice rink expecting a massive crowd. It turns out that in 1990, Los Angeles was still rather devoid of ice skaters and hockey fans. The turnout was underwhelming, about five skaters, all of whom were figure skaters, not hockey players. This might have been due to the poor preparation by the Kings' staff, which proceeded to have us all skate in a Smurf costume—because the costume of the Kings' mascot—a snow leopard named Kingston—was still being made.

I stuffed myself into the Smurf costume and proceeded to move about the ice to the beat of "Stray Cat Strut"—which turned out to be Kingston's theme song—and went beyond the call of duty by jumping onto the boards, exiting the ice, and kissing someone in the stands. I was convincing enough to get a job offer the next day.

The job offer was great: free parking pass to the Inglewood Forum, free before-game meals in the press room, free after-game snacks and drinks in the team lounge, plus $100 per game. I was not a savvy negotiator, and am glad they didn't ask me to work for the perks alone. This was well before the NHL Mascot Union could have given me advice. And in return, I only had to don the Kingston outfit and skate around the ice two times per game, plus one trip by foot around the concourse level in the second period of each game. What a job!

*The Kingston costume was amazing in its own right. The head was very large, about 36 inches wide, so I had to turn slightly sideways to go through the door of the dressing room—an old closet—and get out to the ice surface. Within the cavernous head was a battery-operated fan to help keep me cool. But even with the ice and fan, it got very hot.*

Despite my checkered past, I never got any penalties while working as Kingston. But I was sucker punched by defenseman Marty McSorley just before the national anthem of my debut game. And I did have a running feud with the nose-bleed fans in Section 32. Every time I walked by, they would yell, "Hey, Kingston, get a real job!" and I would yell back, "Get real tickets!" And best of all, I got to watch almost every home game during the 1990–91 season, standing with my face pressed to the glass at ice level in the corner behind the Kings' goal. (I like to think that it was not by coincidence that the Kings won their only divisional championship to date that year. Wayne Gretzky may have helped, too.) It was a hockey lover's dream on a negative budget.

Despite my stellar performance, I was released as a free agent at the end of the season, and I never returned to play Kingston again. I haven't even gotten any invitations to reunion games.

Fresh off my stint as Kingston, I unsuccessfully tried out for roller hockey the following year, and then lost all hope of a return to the ice when I was deemed "too tall" for the Wild Wing costume when the Mighty Ducks were formed in Anaheim. I did return to action to help score a Mighty Ducks game and still have hopes to be called up as a goal judge in the future.

Or maybe the battling beaver mascot position at Caltech will open up . . . but for now, back to my desk job.

*Dwight Berg is still trying to live down the stigma of being placed in remedial English at Caltech. He currently structures federal tax credit financing transactions to benefit charter schools and other nonprofit entities. The Kings retired Kingston and replaced him with a new mascot named Bailey in 2007.*


**Dwight Berg spent a year entertaining fans of the L.A. Kings NHL hockey team as the mascot known as Kingston the Snow Leopard.**

# Tech Talk

### Specially Effective Techers

Dear Editor,

I just wanted to say that I enjoyed reading your article about Scott Townsend working in the film-effects business [Vol. 42, No. 4, 2008]. I've been doing very much the same thing myself since 1997, and have wondered from time to time if I was the only Techer to make the jump to special-effects work.

I came from Traverse City, Michigan, to Caltech in 1985, spent four years in Ruddock House, and graduated June '89 in applied physics. I attended graduate school at USC for 2.5 years and then worked in the greater L.A. area until spring '98 when I moved to the Bay Area to work for George Lucas's Industrial Light & Magic (ILM) as a particle/effects technical director. After eight years there I left in June of 2006 at the end of *Pirates of the Caribbean II* to be a stay-home dad and take care of my two young sons, which I've been doing for a little over two years now.

Amusingly I found out Scott presented a talk on his Daemon Death Effect not too long ago at Siggraph with three of his coworkers, one of whom was my mentor 10–12 years ago. While I haven't quite been lucky enough to work on an Oscar winner, I've enjoyed working on several box-office successes (*Star Wars II & III*, *War of The Worlds*, *Perfect Storm*, *Mummy I & II*, *Terminator 3*).

—Erik Krumrey '85

### Porter Sundial Trail Goes "Cold"

I noticed in the sundial article in your latest issue Russell Porter's famous drawings of what the 200-inch telescope at Palomar would look like. In 1968 I noticed in *Sky and Telescope* that Porter's daughter, Caroline Kier, was selling some of his paintings of Arctic scenes, so I paid her two visits and purchased four of them. She took me to the Peary Museum in Portland, Oregon, and as we emerged I asked her if she knew whether or not [the renowned American explorer] Robert Peary had reached the North Pole. She shook her head, so I asked her how she knew that he had not made it. Peary told his wife, who told her hairdresser, who told Porter's wife (Caroline's mother) who in turn told Caroline. So it depends on how reliable hairdressers are. I am not an expert in that field but my advisers tell me that they are indeed very reliable.

My conversation with Caroline Kier has never before appeared in print, although I have told it to a few people both verbally and in letters. After Peary returned and claimed to have reached the pole there arose a controversy between him and Cook, who also claimed the same thing at about the same time, and that debate split the exploration community much as the Dreyfus Case split France. Peary's attacks on Cook (who almost certainly did not reach the pole) were about as polite as Senator Joe McCarthy's against his enemies. One might even go back to Cicero's tirades against his enemies for a parallel.

—George Wallerstein, PhD '58

*Arctic explorer Peary claimed to have been the first person to reach the geographic North Pole (in April 1909). He returned from his expedition only to find that fellow American explorer Frederick Cook said that he had gotten there first—in 1908. Both claims are still debated today. Ed.*

### Revenge of the Son of the Sundial

Dear Professor Asimow et al.,

Once again, I must offer my mea culpa and beg forgiveness, for I am the person to blame for the sundial . . . not the original (missing) sundial, but the one pointing south!

It was a dark and stormy night, and Ditch Day was tomorrow (Frosh!). Okay, it wasn't all that stormy, and come to think of it, it wasn't all that dark either, given Pasadena at night. You can't fault me for trying, I hope. Ditch Day REALLY was tomorrow, though! Like many other frantic seniors, I was running around, leaving clues and tasks and the like. One clue was at the top of Millikan Library—nearly South of the sundial (mark II)—so I sent them to the Iris Garden to look for a sign. (Or something like that.) Noticing where the sundial was pointing—completely out of character for most self-respecting sundials—they were to then go to Millikan, and then to—hmmm—probably the tunnels (except they went off in a direction I hadn't expected at that point, and spent a lot of time shifting the clay around in the pottery area at Poly! Which meant they were behind, and grabbed lunch on campus; so missed the lunch with the custom fortune cookies with the

*Continued on page 15. . .*

*Caltech News welcomes letters from readers while reserving the right to select and edit them for content. Please send yours to hja@caltech.edu or to Editor, Caltech News, Caltech 1-71, Pasadena CA 91125.*

*New Day . . . from page 11*

along with more effective review processes.

Do I expect more money? Yes I do, but not on the scale that is needed to keep up with the increased demand. I also believe that the biomedical research community has to do a better job of selling itself—the budget was doubled but Congress finds it hard to see that much was changed. Meanwhile, we have actually seen remarkable advances in the field, led by the newly acquired power of genomics. We have a lot to sell. Also, biotechnology has been a huge American success, fueled by biomedical research. Funding biomedical research therefore has a competitiveness rationale, along with the promise of better, and cheaper health care.

Although John Holdren, the new Science Advisor, is a very smart and effective person, he is a physicist by training and an energy guru by adoption. Thus his choice for co-directors of PCAST (President's Council of Advisors on Science and Technology) is a very hopeful sign for biomedical scientists. Harold Varmus and Eric Lander, premier biomedical scientists, are two of the best leaders we could wish to have in these positions. They will see to it that the needs of biomedical research are not forgotten. At this writing a new head of NIH has not been named but we can hope that it is a person who can work closely with the others and rejuvenate that agency.

One place where we have now seen a clear-cut change in policy is in the area of human stem cell research. Obama has just lifted the Bush administration's restrictions to allow research on a wider range of cells than previously. Whether he will completely free the community from the shackles of ideology remains to be seen. There are still strong forces of opposition to research on human embyros—including derivation of new embryonic stem cell lines—and on using somatic cell nuclear transfer into human eggs to produce cell lines (not today demonstrated). To pursue these two activities would require a change in law, bringing Congress into the equation.

In summary, I believe that Obama understands that science is at the heart of American competitiveness and wants to see large increases in funding for basic science (and also for science education). However, finding the money needed to support the various initiatives will be difficult until the economic stimulus takes effect and our overseas commitments stop taking such huge allotments. Of course, then we will have to pay back the money we borrowed for the stimulus and we will have to rebuild our over-stretched military forces, so the good old days are not likely to return

**MARJORY GOODING**, *director of International Offices, oversees the process that enables foreign students and scholars to come to Caltech. For more on her role and the impact of 9/11 on these Caltech programs, go to http://pr.caltech.edu/periodicals/CaltechNews/articles/v37/caltech911.html.*

Caltech has always been devoted to international cooperation and collaboration in scientific research. Of note is the fact that our student body (about 35 percent), postdoctoral researchers (about 55 percent), and faculty are highly international. Caltech attracts the best and the brightest in the world. The past eight years have seen dramatic fluctuations in the bureaucratic environment in which we operate. Following the events of September 11, 2001, the Bush administration reformatted the old Immigration and Naturalization Service (INS) and renamed it the Department of Homeland Security (DHS). While many of the functions remained the same, the tenor of our interactions with the bureaucracy changed. There were layers of added security checks and considerable time delays for people seeking visas to come to Caltech. Research was interrupted, and prospective students and researchers were discouraged in their attempts to work their way through the red tape. Current international students and scholars stayed away from international conferences because they feared visa delays. With the help of time, the Institute's administration, Congressman Adam Schiff (D-California), whose 29th district includes Caltech, and considerable advocacy efforts, the tension has eased somewhat, and international applications have returned to near normal.

What might an Obama administration bring? We are hopeful that the policy level discussions on the power and efficacy of "public diplomacy" will translate into less red tape and a healthier approach to working with our international partners. The Department of State sets the tone for this kind of diplomacy and administers one of the visa programs utilized by Caltech. But bureaucracy always lags behind policy and, even as the Bush administration left office, we saw last-minute regulatory moves to restrict access. It will take some time to recalibrate and change course. In the meantime, members of the Caltech community will work hard to keep partnerships operational, international students and scholars coming to campus, and to keep the ideas flowing. Caltech is, of course, a full partner in security concerns and efforts. The key for policy makers and regulation writers is to strike the right balance.

**NATE LEWIS** '77, MS '77, *Caltech's Argyros Professor of Chemistry, has been a faculty member since 1988, and has a long-standing interest and research program in alternative energy technologies and initiatives, particularly solar energy.*

Energy is the most important scientific and technological challenge facing our planet in the 21st century. There is now widespread consensus that our traditional approaches to addressing energy needs—fossil-fuel consumption coupled with energy conservation—will not be sufficient to meet future energy demands. Energy security and environmental security have come to the forefront as both global and national priorities.

Although the world is in an economic slump now, that is almost certainly temporary, and with populations still growing, we can expect a tripling of energy demand by 2050. That will lead to more $CO_2$ pumped into the atmosphere, leading to even more profound climate changes than we are experiencing now. Without immediate action, the world is headed for the biggest uncontrolled experiment in human history. The environmental effects created by the $CO_2$ we produce over the next 40 years will last for thousands of years—a timescale comparable to that of recorded human history. Within the next 20 years, we either solve these problems or the world will never be the same.

Finding those solutions within that narrow window hinges upon our ability to make fundamental advances in science and technology. The Obama administration seems to be aware of the dimensions of the problem and committed to addressing it, but I hope that the President will do more than talk. We should be pouring just as much R&D money into energy as we currently expend on biomedicine and health. We're currently spending about $1 billion a year on total energy R&D, but this is a multitrillion-dollar-a-year business. We have to see real funding support and real action.

That doesn't mean we shouldn't be doing things now. In fact, we should be doing everything we know how to do now. We should be increasing both our investments in and our reliance on wind energy and solar thermal energy. We should be providing subsidies and incentives for all sorts of renewables and testing whether or not clean coal works. But at the same time that we're developing these cheaper technologies, we need to be working on the next generation of solar cells. If we can't figure out how to store sunlight, it doesn't matter how many solar cells are out there because we're never going to get energy at night from them. We can't just take existing technologies and get to where we need to be—we need to commit to supporting the kind of research that will lead to large-scale deployable energy-storage breakthroughs. So we have to be both working on bringing a "faster, better, cheaper" approach to the things that we already know how to do now, and we have to invest in the R&D that will really make it possible to develop a robust and comprehensive new system centered on next-generation clean-energy technology.

*"Am I hopeful?" says Lewis. "I'm guarded. I think the gap between intention and action is pretty clear, but I also think that the president and the public seem to understand this. It's a question of whether or not Congress is going to authorize the funding to start closing the gap."*

Now, President Obama has said that he wants an 80 percent cut in greenhouse gas emissions by 2050, but to reach a goal like that is not a party, to quote my friend [*New York Times* columnist and Pulitzer Prize–winning author] Tom Friedman. That's a revolution.

In fact, if we really intend to reduce greenhouse-gas emissions by 80 or 90 percent from 1990 levels, we might as well go the whole way and cut them by as close to 100 percent as possible. Until somebody works out how to build an electrically powered airplane, or some other alternative, we will continue to rely on fossil fuel to power our jets—which includes our air force—and our ships, unless we turn to nuclear power for every seafaring vessel in the world. But nearly everything else is going to have to run on systems that are completely different from anything that we rely on today. Obviously, this calls for an R&D revolution on a truly unprecedented scale.

Our new energy secretary, Steve Chu, understands this, and I believe that in appointing Chu, President Obama is also signaling that his intentions are very serious. Chu is a Nobel laureate in physics, who probably wouldn't have gone to DOE without at least some assurance that there would be backing for more science and technology and R&D in energy. But while even the previous administration had proposed, in the past several years, modest increases—on the order of a few hundred million dollars—in the DOE's Office of Science R&D budgets, in the end they were

zeroed by Congress. So even modest budget increases proposed by the Bush administration haven't made it through to the light of day. And we just see now in the recent stimulus bill that the DOE's amount for R&D for basic energy sciences is not very large. This is not having your money go where your intentions are, and so part of the challenge facing Secretary Chu and the administration will be to convince Congress to actually fund these things. Otherwise it's just talk.

We can look at what's happened nationally in biomedical research as a model. Over the last few decades, the growth of the NIH has completely changed the landscape of what research universities, including Caltech, are doing in the biological sciences. You can argue that if this country really intends to get serious about energy and sustainability, it needs to make the same commitment to R&D there, significantly changing the footprint and emphasis of all research universities. Now we are seeing some of that starting to happen. Stanford has received a quarter of a billion dollars from an industrial consortium for energy research. Berkeley has a $50 million-a-year project under way just on biofuels. It's not unreasonable to extrapolate from that and say that if our government really wanted to get serious about energy R&D, you would have significant chunks of faculty research programs nationwide focusing in a cohesive way around clean and sustainable energy technology. These would include very basic research programs aimed at better understanding the interactions of light with matter, intermediate things like building better solar cells, as well as more applied, short-term projects like using JPL expertise in robotics to build solar thermal towers that will self-assemble in the desert. The whole spectrum of activities would be fostered if we had a serious effort in energy R&D.

Am I hopeful? I'm guarded. I think the gap between intention and action is pretty clear, but I also think that the president and the public seem to understand this. It's a question of whether or not Congress is going to authorize the funding to start closing the gap.

As for the impact that all of this could have on Caltech, I think that as a campus, we have yet to embrace our potential in this type of energy R&D. We're doing some things, but as they say in the movie *Jerry Maguire*, "Show me the money!" Princeton has just received a $100 million gift to establish a sustainability institute; Stanford another $100 million from a single individual to add to the quarter billion they already have in industrial funding. So when you have places building institutes and explicitly emphasizing this as an area for their research efforts and competing to attract the faculty, graduate students, and undergraduates who want to be part of those fields and really have something to bring to the table, you need to decide if you're going to play in this arena too. If you're going to play, you have to play with the same face cards as everybody else.

I know there are significant numbers of faculty here—at least a dozen—who are interested in working in this area and would come together to work on it. And a collaboration of this type involving a dozen Caltech faculty would be a stupendous undertaking with the potential to make extraordinary contributions. In many respects I think we are ready to move ahead. ◆

*Tech Talk . . . from page 13*

fortunes written in code. . . . Sigh) and then on to—you get the picture. But I am digressing.

In the aftermath of Ditch Day, the poor sundial, its purpose served, was callously forgotten. I graduated, and worked on campus for Palomar Observatory during the fall of '94 and the winter of '95, until a graduate student (was that you, Professor?) wrote an article in the *California Tech* (could it have been an open letter to President Everhart?) that held up the sundial pointing the wrong way as a symbol of the decline of the scientific standards at Caltech. Upon reading this, I guiltily recalled the task to which I had put the long-suffering sundial, which I had never corrected. Once again, in the dead of night, I crept out and reversed the sundial to its intended position. I then wrote a short letter to the *Tech*, apologizing for the error of my ways, and promised never to be seen reversing sundials on campus again!

But, alas, while I have repented, the consequences of my actions dog me to this day.

—Matthew P. Johnson '94

## George Housner Remembered

I am surprised that in your appreciation of Professor Housner in the last issue, you didn't mention that he was the senior author [with Donald E. Hudson] of *Applied Mechanics Dynamics*. This text was used by junior-year engineers and was our first exposure to practical applications of F = ma! Most of my reminiscences in this connection are strictly of trying to pass the course. The junior year for engineers was (and still may be) a sharp turn away from the pure sciences to engineering courses: strength of materials, electron tube circuits, dynamics, etc. As you can tell from the number after my name, I passed!

—Jon Valbert '58, MS '59

*The sundial trail leads to a new solar saga in the next Caltech News.*

# Alumni Notes

1939

**Charles H. Townes**, PhD, and his wife, Frances, recently unveiled the sign for the Charles H. Townes Laboratories for Optical Science and Engineering, located at the Advanced Materials Research Laboratory in the Clemson University Advanced Materials Center. The naming of Clemson's state-of-the-art optical-science laboratories in his honor celebrates the university's long-time connection with Townes, winner of the 1964 Nobel Prize in Physics for his research on the maser (microwave amplification by stimulated emission of radiation), which led to the development of the laser. The dedication follows the 2005 creation of the Townes Fellows program, which bring Furman undergraduates to Clemson to conduct optics research with the COMSET (Center for Optical Materials Science and Engineering Technologies) program. A native of Greenville, South Carolina, Townes received his undergraduate degrees in literature and physics from Furman, and Clemson was among the first to acknowledge Townes's achievements with an honorary degree in 1963. Townes returned to Clemson in February 2000 to deliver the Godfrey Distinguished Lectures in Astrophysics, and two Clemson faculty members, Chris Przirembel, the university's vice president for research and economic development, and Caron St. John, director of the Arthur M. Spiro Institute for Entrepreneurial Leadership, have received the Charles H. Townes Individual Achievement Award from InnoVision, which promotes excellence and leadership in technology. In addition to being a Nobel laureate, Townes is a Templeton Prize recipient for contributions to the understanding of religion. He has been a professor of physics at UC Berkeley since 1967.

1956

**Leon M. Keer**, MS '58, Walter P. Murphy Professor of Mechanical and Civil Engineering at Northwestern University, has received the Mayo D. Hersey Award from ASME (which was founded in 1880 as the American Society of Mechanical Engineers and today is a "not-for-profit professional organization promoting the art, science and practice of mechanical and multidisciplinary engineering and allied sciences"). The honor, presented during the International Joint Tribology Conference, held in Miami October 20 through 22, recognizes Keer's "pioneering research and distinguished contributions in contact mechanics, particularly the modeling of surface interaction, friction, adhesion, wear and fraction of bodies under concentrated contacts, and crack initiation and rolling contact fatigue." Widely known as an expert in contact mechanics, Keer was at one time a member of the technical staff at Hughes Aircraft, then joined Northwestern's faculty in 1964. During his career he has developed novel solutions to difficult and crucial engineering and mechanical problems, most recently developing innovative semi-analytical techniques in contact mechanics, including fundamental contributions in the design of gears and bearings. An ASME fellow, Keer is a member of the Publications Committee and has served as chair of the ASME

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Chicago Section, technical editor of the *Journal of Applied Mechanics*, chair of the Transactions Board of Editors, and member-at-large on the Board of Communications. He has received the Tribology Division's Innovative Research Award and ASME's Daniel C. Drucker Medal. A former president of the American Academy of Mechanics, Keer's memberships include election to the National Academy of Engineering. He has to his credit over 300 journal publications.

1965

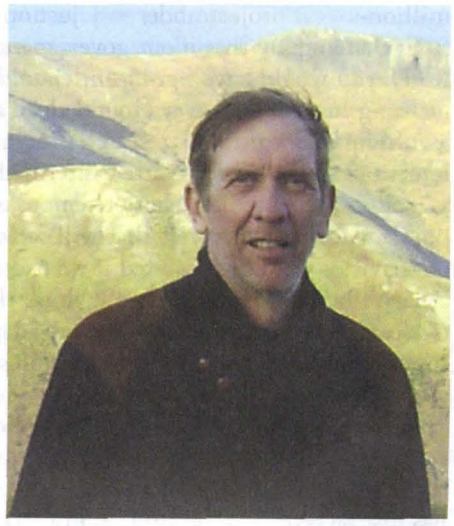
**Gerald Ash**, MS, PhD '69, retired in May 2007 after almost 35 years at AT&T and moved from West Long Branch, New Jersey, to North Clarendon, Vermont. At AT&T he was a network designer and wrote two books based on his work, *Traffic Engineering and QoS Optimization of Integrated Voice* and *Data Networks and Dynamic Routing in Telecommunications Networks*. Both are available from Amazon.com. During his career he was named a Bell Labs fellow, an AT&T fellow, and an IEEE fellow, and in 1989 he received the IEEE Alexander Graham Bell Medal "for contributions to the conception and implementation of Dynamic Nonhierarchical Routing (DNHR) in telecommunications networks"—his IEEE biography can be found at http://www.ieee.org/web/aboutus/history_center/biography/ash.html. He was also the 1997 recipient of the Rutgers Distinguished Engineer Award, and he was inducted in 2001 into the New Jersey Inventors Hall of Fame, whose write-up at http://www.njinvent.org/2001/inductees_2001/ash.html briefly captures some of his work. He and his wife, Lyn, are "enjoying much that Vermont has to offer in the way of hiking, biking, kayaking, swimming, skiing, snowshoeing, and all the multitudinous craft fairs, pancake breakfasts, and 'local-color' events that happen constantly in the Green Mountain vacation-land." They plan more travel in retirement, including frequent visits with their three children and four grandchildren. Ash has taken up ham radio again (WA2BLK) after a 25-year hiatus and has completed the first draft of a children's book based on bedtime stories told to his children as they grew up ("the stories include some Caltech folklore and adventures based in Pasadena"). He hopes to return to Caltech for his 40th reunion this year and to reunite with many classmates he hasn't seen since leaving Caltech in September 1968.

1966

**Jerry Yudelson**, of Tucson, Arizona, writes that his eighth book, *Green Building Through Integrated Design*, was published last September by McGraw-Hill. His ninth book, *Green Building Trends: Europe*, will be published in May by Island Press.

1968

**Kermit "Kit" Kubitz** has received the Carnegie Medal, awarded throughout the United States and Canada by the Carnegie Hero Fund Commission "to those who risk their lives to an extraordinary degree while saving or attempting to save the lives of others." Of the 19 recipients in the final announcement of 2008, three "lost their lives in the performance of their rescue acts." A total of 92 awards were made in 2008, which brings the number to 9,243 since the fund's establishment by Andrew Carnegie in 1904. Throughout the 104 years since, the fund has given $31.1 million in one-time grants, scholarship aid, death benefits, and continuing assistance. Kubitz—an attorney and a Vietnam veteran—on May 19, 2007, saved the life of a 15-year-old girl when she was attacked by a knife-wielding assailant in a San Francisco bakery. The attacker, a high-security inmate apparently released by mistake from San Quentin State Prison, was pulled from the girl by Kubitz, who received multiple stab wounds before finally removing the knife from his side and throwing it to the sidewalk. He spent several days in a hospital and several months recuperating from a collapsed lung and other wounds. In addition to the Carnegie Medal, Kubitz received a commendation from the San Francisco Police Commission, along with the doctor who treated both the girl and Kubitz until the ambulances arrived, and a third man who pursued the fleeing attacker on foot and aided in his capture by police. (The girl has dubbed her trio of rescuers "the Three Musketeers.") A longtime Marine Mammal Center volunteer, Kubitz has visited the Brooks Range in Alaska perhaps 12 times over the past 30 years and has twice traveled down the Noatak, a river that starts above the Arctic Circle and flows 425 miles to Kotzebue Sound, draining the largest river basin in North America that remains virtually unaffected by human activities. He has also provided to Fleming House, on a semipermanent loan basis, a drawing by Richard Feynman.



**Kermit Kubitz, shown here by the Noatak River in Alaska, has been awarded a 2008 Carnegie Medal for intervening to save the life of a teenage girl during a knife attack in 2007.**

1972

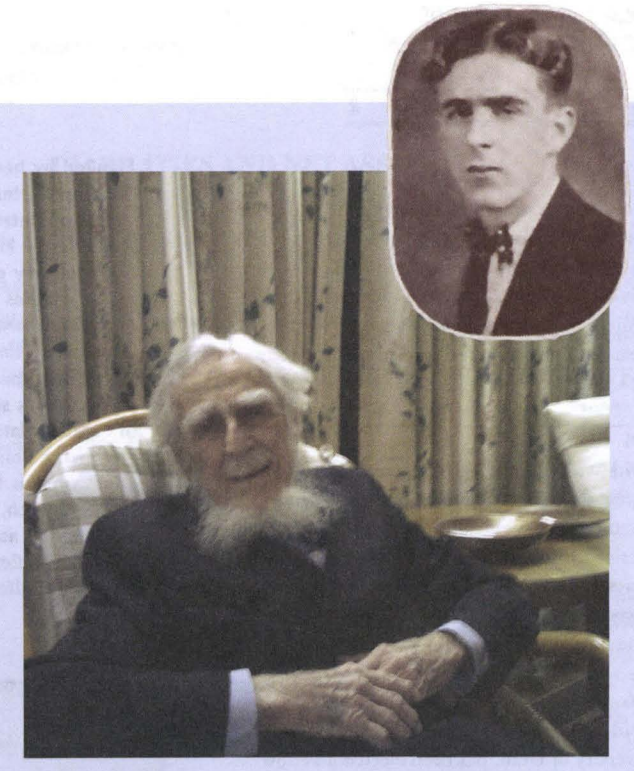
**Philip Jeffrey Hay**, PhD, has been elected a 2008 Fellow of the American Association for the Advancement of Science. The publisher of the journal *Science*, the AAAS is the world's largest general scientific society. Hay, who has retired after 33 years at the Los Alamos National Laboratory, was recognized for "distinguished contributions in the field of computational and theoretical chemistry, particularly in the area of inorganic chemistry." His research has included

Caltech Trustee Chair Emeritus **Gordon Moore**, PhD '54, and **Carver Mead** '56, MS '57, PhD '60, Caltech's Moore Professor of Engineering and Applied Science, Emeritus, are among the innovators selected for induction this year into the National Inventors Hall of Fame, which "honors the women and men responsible for the great technological advances that make human, social and economic progress possible." The inductees were chosen by the selection committee of the National Inventors Hall of Fame Foundation from a field nominated by peers and the public. The committee includes representatives from the leading national scientific and technical organizations.

A recipient of the National Medal of Technology and the National Academy of Engineering's Founders Award, and a member of the National Academies of Science and of Engineering, Mead is renowned as an inventor, a chip designer, an entrepreneur, and a university scientist. His induction honors the key role he played in the development of very large-scale integration (VLSI), which permits tens of thousands of transistors to be packaged on a single silicon chip, and he coauthored with Lynn Conway the 1980 textbook *Introduction to VLSI Design*, which paved the way for what came to be known as the Mead and Conway Revolution. The holder of more than 50 U.S. patents, and the author of or a contributor to more than 100 publications, Mead has founded more than 20 companies, including Synaptics and Impinj, and he has been a faculty member at Caltech since 1958.

Gordon Moore's induction honors his work in the area of semiconductor production. A cofounder of both Fairchild Semiconductor and Intel, Moore "set the pace and standards for Silicon Valley's chip manufacturing methods . . . devising strategies that successfully transformed painstaking scientific experimentation into cost-effective products [that] would establish the model of the computer industry researcher-entrepreneur and help make Intel a world-leading chip maker." He is also known as the author of "Moore's Law," which states that the number of transistors that can be mass-manufactured on an integrated circuit will double every two years. In 1968, Moore became a cofounder of Intel, eventually serving as president and CEO, and then chairman until his retirement as chairman emeritus in 1997. A member of the National Academy of Engineering and a recipient of the National Medal of Technology and the U.S. Medal of Freedom, Moore is today principal sponsor of the Gordon and Betty Moore Foundation, "dedicated to global environmental conservation and scientific research, and quality of life in the San Francisco Bay Area."

Moore credits Mead with coining the term "Moore's Law," and, according to the Inventors Hall of Fame citation for Mead, he "performed the physics calculations to prove it."



**Above, John Marsland, shown in his Maryland home, and in his 1927 Caltech yearbook photo (inset) celebrated his 102nd birthday with family and friends on January 19. Is the retired petroleum engineer Caltech's oldest living alumnus? Readers who have information on this question are invited to write to hja@caltech.edu.**

John Marsland '27 turned 102 years old on January 19. If there's an alumnus out there older than he, *Caltech News* would like to know. As readers might guess, Marsland is often asked his secret for staying alive so long.

"Just keep living," he answers. And so he has, earning a degree in chemistry while deciding he'd rather be an engineer, finding his footing during the Great Depression, and designing oil refinery equipment that helped fuel World War II airplanes.

After working from 1933 to 1962 for the Shell Oil Company, Marsland began enjoying an early retirement. "I retired 46-and-a-half years ago," he points out, "which is longer than I worked for them." Since then, "I've done a lot of things," he says of his 25,000 miles of sailing, his design of a colonial-style home in which he still lives, and his design and construction of a 38-foot schooner, which he sailed until 1999. He named his boat *Anitra's Dance* in honor of his first wife, whom he had met "a bit before graduating from Caltech."

In the carefree years before the Depression, Marsland tried his hand at working in a chemistry lab at the Los Angeles Soap Company. After a summer of that, he says, "I decided I didn't want to be a chemist." He changed his major to "engineering," but his courses still added up , to a degree in chemistry.

Marsland didn't realize the economic slowdown was about to torpedo the job market when he quit a job at Union Oil in 1930. "I was young and not very mature," he recalls. "I didn't really fit in there. Prior to that time, oil refining had been an art, not a science, and they had a bunch of older people who'd grown up in the way it was then. In those days, oil was put in a big round still or kettle and the gasoline was boiled off. It was very primitive. They didn't like me and I didn't like them," says Marsland, who nevertheless waited to leave until the day after his raise came through. "I had made my point," he says, but he soon found that "there weren't any jobs."

Well, there were a few that he tried, the worst of which was running a service station—"a miserable job, absolutely miserable."

"However," he adds regarding such experiences, "I won't dwell on those things." Perhaps this is part of his secret. "Don't dwell on the bad things, anyway."

Without much employment to speak of, Marsland thought, "What better thing to do than go back to school?" So he got his master's degree in chemical engineering from MIT in 1932. Then he took a job that lasted five months. He married Anitra, and they lived on a farm in Michigan for a summer before they decided to head to San Francisco in search of "gainful work."

Asked if he has any advice for graduates looking for work in today's tough job market, Marsland says he doesn't. "It might be difficult to look for a job right now, but I would think a good person could get a job. I was lucky in one way. After Shell cut back and let many technical people go, the company eventually started to build up again, and quite a few technical people joined when I did." At Shell, Marsland was able to draw on his Caltech and MIT education as he designed equipment to make the aviation gasoline "that was of tremendous importance during the war." Looking back, Marsland says, "In many respects, I think I was a good chemical engineer."

Marsland was fortunate in another way, he says, in that he didn't have to deal with modern computers. "Computers are the most frustrating thing that ever came along."

His wife Anitra passed away in 1980 after the couple's 47 years of marriage. Some 14 years later, Marsland married Faith. Together they celebrated his 102nd birthday with 16 friends and relatives, exchanging presents as part of a "Yankee Swap." When Marsland wrote *Caltech News* about his birthday, he noted that, "Except for quite poor eye-sight, I'm in fairly good health both in mind and body." And speaking by phone from his home in Easton, Maryland, he adds, "I can't complain about anything."

theoretical studies of the electronic properties and reactions of actinide and transition-metal complexes. A Laboratory Fellow as well, Hay helped develop relativistic effective core potential techniques widely used in theoretical studies of inorganic chemistry, metal catalysis of hydrogen and hydrocarbons, and the role of metals in biological processes. He was also group leader of the lab's theoretical chemistry and molecular physics group, and participated in various collaborative research activities with industrial partners. He is a 20-year member of AAAS.

**Russell Pinizzotto** has been appointed vice president for academic affairs and provost by the Wentworth Institute of Technology, effective March 2. As chief academic officer for the institute and a member of the president's advisory council, he will report directly to the president and be responsible for all academic affairs related to undergraduate, graduate, and continuing-education programs. With over 22 years of experience in academia as an administrator, educator, and innovator, he had previously served as the dean of the faculty of science and engineering at Merrimack College in North Andover, Massachusetts. Prior to Merrimack, he spent four years as the dean of the Missouri Academy of Science, Mathematics and Computing, and for 13 years he was a professor of materials science and physics at the University of North Texas. Before starting his career in higher education, Pinizzotto worked in industry as an entrepreneur, founding a technical consulting services firm, and he was also employed by Texas Instruments as a senior member of the technical staff. He received an engineer's degree and a PhD in materials science from UCLA in 1977 and 1978, respectively, and has had over 80 peer-reviewed articles published in professional science and education journals.

1973

**Stefan K. Lai** has received IEEE's 2008 Andrew S. Grove Award, in recognition of his contributions to the development of flash memory technology, vital to a number of contemporary consumer electronic devices. IEEE—originally the Institute of Electrical and Electronics Engineers—is the world's leading professional association for the advancement of technology, and the Grove Award—sponsored by the IEEE Electron Devices Society—was presented on December 16 at the 2008 IEEE International Electron Devices Meeting, in San Francisco. Lai led the Intel team that developed the EPROM Tunnel Oxide (ETOX) flash memory cell, which represented the first simple-to-build, highly manufacturable nonvolatile memory (NVM) technology, introduced commercially in 1988. Since its introduction, Lai and his team have put it through 10 generations of innovation. Initially developed as an embedded technology for applications requiring cost-effective reprogramming, flash memory began to see commercial success in the early 1990s in cellular phones. Flash memory storage has also contributed to growth in the digital-camera and memory-storage categories—since 2000, the USB flash drive has largely displaced floppy and other removable storage technologies. An IEEE Fellow, Lai has served as a panelist, lecturer, and presenter at numerous semiconductor industry events. A holder of seven patents, he has published 34 papers on flash and other NVM technologies, and he is a 2003 winner of Intel's Patent of the Year award and has received the 2006 Intel Achievement Award. He is currently vice president of

business development at Ovonyx Inc., and prior to that he held executive positions within Intel's flash memory business unit from 1982 to 2006. From 1979 to 1982, he was a member of the technical staff at the IBM Thomas J. Watson Research Center. He received his doctorate from Yale University.

1978

**David W. Thompson**, MS, chairman and CEO of Orbital Sciences Corporation, was recently elected to a one-year term as president of the American Institute of Aeronautics and Astronautics. The leading professional society for aerospace engineers, AIAA has 36,000 members in the United States and overseas.

1986

**David Blair**, PhD, a professor of biology at the University of Utah, has been elected a Fellow of the American Academy of Microbiology. Fellows of the academy "are elected annually through a highly selective, peer-review process, based on their records of scientific achievement and original contribution that have advanced microbiology. There are now over 2,000 Fellows representing all subspecialties of microbiology, including basic and applied research, teaching, public health, industry, and government service." Blair's research focuses on understanding the structure and molecular mechanism of the bacterial flagellar motor. Bacterial flagella—thin helical propellers driven by rotary motors in the cell membrane—enable many species of bacteria to swim, and play a role in the virulence of some bacterial pathogens.

1987

**Joel York** has joined Xignite Inc., a leading cloud computing provider of on-demand financial Web services, as chief marketing officer. With more than 15 years of experience marketing business-to-business software and software-as-a-service products, York will play a key role in developing Xignite's business strategy and marketing programs at a time when the company is in a period of rapid growth and introducing a series of new products. York comes to Xignite from the software-as-a-service strategy and marketing consulting firm Affinitos, where he worked with clients such as Conduit and Zendesk. At Conduit, York served as interim vice president of marketing and led the establishment of U.S. operations for the global company, including worldwide product marketing, social media marketing, and public relations. Prior to that, York served in senior management positions at Navis, SPSS, and Passlogix. He holds an MBA from the University of Chicago and has managed global sales and marketing organizations serving over 50 countries, including local operations in the United States, the United Kingdom, Germany, Israel, and India. He blogs at www.chaotic-flow.com.

1999

**Matt Gregori** has accepted the position of vice president–general manager with Renewable Energy Products LLC, in Norwalk, California. He will oversee the commission, operation, and future expansion of the company's 10-million-gallon-per-year biodiesel facility.


**Flanked by her colleagues Dr. Mandhir Gupta (left) and Dr. Harold Henry, Dr. Karen Maples '76, chief of service for obstetrics and gynecology at Kaiser Permanente Bellflower Medical Center, briefed the press after the delivery of the hospital's octuplets on January 26. Maples led the delivery team for the births and oversaw prenatal care for the babies' mother, Nadya Suleman, following Suleman's treatment by non-Kaiser fertility specialists. At the briefing, Maples described the team's surprise at the unexpected appearance of an eighth infant, adding that both mother and children were doing well. Maples, who was among the first women to receive an undergraduate degree from Caltech, went on to earn her MD from UCLA. She has been an assistant clinical professor at Harbor-UCLA Medical Center since 1987 and joined the Southern California Permanente Medical Group in 1983.**

# Obituaries

1935
**Albert O. Dekker**, PhD '40, on November 21.

1936
**Peter V. H. Serrell**, MS '39, on November 26.

1939
**Herman S. Englander**, on January 26; **Tyler R. Matthew**, MS, on October 2.

1941
**George C. Sakai**, MS '42, on May 11.

1942
**Jack H. Irving**, on November 11; **Everett W. Van Ness**, on July 17.

1943
**Warren A. Culbertson**, MS, on September 21; **Edgar W. Flavell**, on August 9; **David E. Shonerd**, MS '48, Eng '49, on October 23, 2004.

1944
**Kenneth G. Brown Jr.**, on June 1; **Keith S. Ellis**, CAVU, MS '52, on October 19, 2006.

1946
**Joseph B. Deodati**, MS, Eng '47, on November 14, 2004; **Charles B. Dougherty**, MS, on November 28; **Yoshiyuki J. Fujimura**, MS, on November 4; **Prasad Krishna Kadaba**, MS, on November 27; **William C. Stookey**, on September 19.

1947
**Carl P. Spaulding**, MS, on February 11; **Warren S. Wooster**, MS, October 29.

1948
**Ralph F. Costa**, Ex, on April 1; **Arnold Feldman**, MS, on January 23; **Douglas C. Strain**, on November 15.

1949
**Ralph E. Lind Jr.**, MS, on June 25.

1950
**Harvey J. Amster**, on August 23; **Peter Grosz Jr.**, MS, on November 17.

1951
**Don Schmid**, on January 23.

1952
**Frank Capra Jr.**, Ex, on December 19, 2007.

1954
**Calvin L. R. Barker**, MS, PhD '58, on December 31.

1957
**Robert S. Slizeski**, MS, on October 8.

1961
**George A. Sellers**, MS, PhD '66, on September 23.

1962
**Robert L. Rosenfeld**, PhD, on November 13.

1964
**Horacio A. Mendez**, MS, PhD '74, on October 14; **Stanley N. Nathanson**, MS, on December 11, 2007; **Myles A. Walsh III**, MS, PhD '67, on February 7, 2008.

1970
**Ronald L. Smith**, PhD, on October 4.

1972
**Edward "Ted" Gates**, MS, PhD '77, on December 20.

1981
**Maqsood Mahmud**, on October 15.

READ COMPLETE *CALTECH NEWS* OBITUARIES ONLINE

*The full* Caltech News *obituaries may be found at http://alumni.caltech.edu/network/obituaries, where readers can browse expanded content and additional biographical information about the alumni listed here.*

## UNDER THE SEA

**The deep-water collage on the back page poster is a composite of images taken recently in a marine reserve off Tasmania by Jess Adkins, associate professor of geochemistry and global environmental science. Sailing aboard the RV *Thompson*, Adkins dispatched a submersible known as *Jason II*, which trolled the ocean floor hunting for the coral that Adkins is studying as part of his investigations into the impact of climate change on the world's oceans. *Jason* did indeed locate the coral, along with three previously unknown species of marine life. For more on the expedition and Adkins's research, see page 2.**

## ALUMNI ASSOCIATION
## CALIFORNIA INSTITUTE OF TECHNOLOGY
## STATEMENTS OF FINANCIAL POSITION
## SEPTEMBER 30, 2008 AND 2007

### ASSETS

| | 2008 | 2007 |
|---|---|---|
| **Assets** | | |
| Cash and cash equivalents | $ 153,932 | $ 160,433 |
| Accounts receivable | 2,869 | 17,617 |
| Prepaid expenses | 20,155 | 4,538 |
| Caltech pooled investment accounts | 6,915,080 | 8,529,327 |
| Computer equipment | - | - |
| **Total Assets** | $ 7,092,036 | $ 8,711,915 |

### LIABILITIES AND NET ASSETS

| | | |
|---|---|---|
| **Liabilities** | | |
| Accounts payable | $ 47,706 | $ 73,513 |
| **Unrestricted Net Assets** | 7,044,330 | 8,638,402 |
| **Total Liabilities and Net Assets** | $ 7,092,036 | $ 8,711,915 |

### STATEMENTS OF ACTIVITIES AND CHANGES IN NET ASSETS

| | 2008 | 2007 |
|---|---|---|
| **Support, Revenues and Other Income** | | |
| Membership dues | $ 69,810 | $ 76,913 |
| Life membership dues | 80,985 | 108,785 |
| Seminar day | 64,040 | 67,855 |
| Alumni college (continuing education) | 17,950 | 21,465 |
| Class reunions | 17,816 | 23,611 |
| House reunions | - | 3,440 |
| Regional programs | 20,154 | 29,651 |
| Travel study programs | 8,229 | 7,595 |
| Net investment returns - pooled accounts | (1,210,315) | 1,498,730 |
| Interest income | 3,946 | 7,956 |
| Miscellaneous income | 2,764 | 1,410 |
| **Total Support, Revenues and Other Income** | (924,621) | 1,847,411 |
| **Expenses** | | |
| **Program Expenses** | | |
| Regional programs | 124,473 | 160,666 |
| Seminar day | 93,322 | 87,394 |
| Class reunions | 84,423 | 80,865 |
| Communications - print | 48,395 | 63,026 |
| Communications - electronic | 3,925 | 42,674 |
| Alumni college (continuing education) | 41,157 | 41,616 |
| Leadership conference | 36,920 | 37,544 |
| Career services | 32,476 | 26,525 |
| Membership | 2,972 | 15,717 |
| Undergraduate admissions support | 8,045 | 13,960 |
| House reunions | - | 12,099 |
| Sponsorships | 10,100 | 7,500 |
| New opportunities | 75,008 | 4,822 |
| Student club | 5,000 | - |
| Travel study programs | 3,417 | 4,505 |
| **Total Program Expenses** | 569,633 | 598,913 |
| **Administration Expenses** | 99,818 | 90,765 |
| **Total Expenses** | 669,451 | 689,678 |
| **Change in Net Assets** | (1,594,072) | 1,157,733 |
| **Net Assets, Beginning of Year** | 8,638,402 | 7,480,669 |
| **Net Assets, End of Year** | $ 7,044,330 | $ 8,638,402 |

### STATEMENTS OF CASH FLOWS

| | 2008 | 2007 |
|---|---|---|
| **Cash Flows from Operating Activities** | | |
| Cash received from service recipients | $ 296,496 | $ 337,197 |
| Cash paid to suppliers | (710,875) | (636,522) |
| Interest received - pooled accounts | 40,211 | 66,770 |
| Interest and dividends received - other | 3,947 | 7,956 |
| **Net Cash Used in Operating Activities** | (370,221) | (224,599) |
| **Cash Flows from Investing Activities** | | |
| Additions to Caltech pooled investments | 363,720 | 214,316 |
| **Net Decrease in Cash** | (6,501) | (10,283) |
| **Cash and Cash Equivalents, Beginning** | 160,433 | 170,716 |
| **Cash and Cash Equivalents, Ending** | $ 153,932 | $ 160,433 |
| **Reconciliation of the Change in Net Assets To Net Cash Used in Operating Activities** | | |
| Change in Net Assets | $ (1,594,072) | $ 1,157,733 |
| Adjustments to reconcile the change in net assets to net cash used in operating activities | | |
| Realized and unrealized gains/(losses) on investments | 1,250,527 | (1,431,960) |
| (Increase) Decrease in: | | |
| Accounts receivable | 14,748 | 9,062 |
| Prepaid expenses | (15,617) | 2,799 |
| Increase (Decrease) in: | | |
| Accounts payable | (25,807) | 37,767 |
| **Net Cash Used in Operating Activities** | $ (370,221) | $ (224,599) |

# Caltech News