California Institute of Technology Pasadena, California 91125

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CaltechNe

Volume 39, Number 2

2005

In This Issue

Combatting Hunger

Veep with a Vocation

Sir Isaac Haunts the Huntington











and

Commencement with

a Punch (Line)



California Institute of Technology Volume 39, Number 2 2005

Caltech N e w s

ON THE COVER

All Dressed Up and Somewhere to Go. As Caltech faculty robe up in the Garden of the Associates outside Dabney Lounge for the June 10 commencement procession, the Institute's first six-legged commencement speaker (center photo) arrives in Millikan Library, accompanied by husband Mike Miller (right) and Susi Martin (left) of the Caltech president's office. Pictured clockwise from top left are (photo I, from left) environmental scientist Tapio Schneider and planetary scientist Geoff Blake; (2, from left) biologist Alice Huang, computation & neural systems' Christoph Adami, biologists Marianne Bronner Fraser and David Anderson, JPL chief technologist Erik Antonsson, and biologist Scott Fraser; (3) biologist Henry Lester; (4) chemist Harry Gray; (5, second from left) physicist David Politzer, geologist Lee Silver, and historian Warren Brown; (6) JPL director Charles Elachi and Mary Webster of the President's Office (in Millikan); (7) Linwood Tabata of the Caltech Bookstore and mystery marcher No. I; (8) mystery marcher No. 2 and geobiologist Dianne Newman. Exhaustive research having failed to yield the identities of these two individuals, Caltech News welcomes input from readers, who may have an idea or two.

IO Son of a Preacher Man

A Putter with a Purpose

A new VP for business and finance takes stock of Caltech's flock.

Thanks to golf, a geology grad helps bring Caltech inventions to market.

I 2 Out of Manzanar

Interned six decades ago in a Japanese American relocation camp, biologist Gordon Sato has devoted the past 20 years to promoting freedom from hunger.

Also in this issue:

New NAS faculty, a new dean of students, Alumni Association volunteerism, Seminar Day highlights, and Sir Isaac's iterations (on the back-page poster).

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Issued four times a year and published by the California Institute of Technology and the Alumni Association, 1200 East California Blvd., Pasadena, California 91125. All rights reserved. Third class postage paid at Pasadena, California. Postmaster: Send address changes to: *Caltech News*, Caltech 1-71, Pasadena, CA 91125.

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Front

There is an anecdote about Sir Isaac Newton—a true one—about the time he stuck a knife in his eye. Naturally it was all in the interest of science: Newton was studying the properties of light, and as he later wrote, "I took a bodkin [a type of dagger] and put it between my eye and the bone as near THE NEWTONIAN MOMENT ARRIVES FOR CALTECH HISTORIAN

to the backside of my eye as I could, & pressing my eye with the end of it (so as to make the curvature in my eye) there appeared several white, dark and coloured circles..."

The bizarre description goes on, and when considered in the context of his other peculiarities—his written confession about "Threatening my father and mother Smith to burne them and the house over them," his reputation for aloof arrogance, his lifelong interest in alchemy (a popular medieval pursuit that, among other things, sought to transmute base metals into gold)—it's led some to argue that Newton, in addition to being a brilliant scientist, was mad as a hatter.

distorted picture of the remarkable man that Newton actually was. Some people would indeed like to think that Newton was not a man of reason, but of madness and alchemy," says the professor of history. "And there are indeed some anecdotes about him not eating, not sleeping, his hair staying unkempt." Most of those examples, he says, stem from a single 18-month period when the protean scientist was writing his most important work, the Principia Mathematica. "Eighteen months," says Feingold, "does not reflect his whole life. "Certainly Newton had his eccentricities," he adds, "and he was a complex person. It's difficult for us to conceive of someone with that kind of mind, a mind that thinks in different terms than you and I.



was mad as a matter.

Of course this is the man who discovered the law of universal gravitation and planetary motion, invented calculus, and proved that white light is composed of a spectrum of colors. What does it matter if people think he was crazy?

It matters, says Caltech's Mordechai Feingold, because it "presents a

Caltech historian Mordechai Feingold, a specialist in the history of 17th- and 18thcentury science, is curator of the Newton exhibit currently on display at the Huntington Library in San Marino. The show, which brings together a treasure trove of rare documents and artifacts relating to the life and legacy of the great scientist, debuted earlier this year in New York City, and will remain at the Huntington through December 2005. "So he wasn't like us, but he wasn't a dejected, solitary, raving lunatic. He was like many professors at Caltech!" he laughs.

Feingold should know. Besides being a Caltech professor himself, he is one of the world's foremost Newton

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SANDRA TSING LOH HITS THE HIGH NOTES AT COMMENCEMENT

"I believe I'm on the short list of candidates for patron saint of those lost at Caltech," declared Sandra Tsing Loh '83, who holds the distinction of being Caltech's first alum commencement speaker equipped with two X chromosomes.

Speaking at the Institute's 111th annual commencement on a pleasantly cool, mildly overcast June morning, Loh set the tone of her talk early, preferring to dwell on her shaky undergraduate record rather than on her status as a 2001 recipient of Caltech's Distinguished Alumni Award. "Junior year, I was assigned as physics lab partner classmate Sekhar Chivukula; widely regarded a genius, he's still in physics today. Of our pairing it was said: 'Sekhar will do the calculations, Sandra will handle the radioactive samples.'"

An author and humorist whose monologues air locally and nationally on National Public Radio, Loh described herself as a mediocre student during her campus days, suggesting that she felt like something of an academic poseur.

By senior year, this predicament had inspired her to develop her own law of quantum mechanics. "Sandra's Theory was this: 'On any Phys 106 exam involving the spin of an atom, the answer is at least 63 percent likely to be 1/2.' I don't know why but you'd be amazed how often it worked: To skip the calculations and just boldly put down 1/2 and then write next to it an illegible honeycomb snarl of curlicues that vaguely resembled any of the Greek symbols-lambda. iota, zeta, tau, ampersand." Yes, she confided to her audience on the Beckman Mall, her undergraduate degree was built entirely out of "partial credit."

Sharing the stage with such luminaries as Nobel Laureate David Baltimore, National Medal of Science winner Harry Gray, and JPL director Charles Elachi, PhD '71, along with many other distinguished faculty, Loh took the opportunity to poke some fun at her alma mater.

"Consider that beloved academic





1991, then-president George Bush, Sr. But, with her long dark hair cascading down her shoulders and her expressive hands punctuating every tongue-incheek line, she clearly wasn't about to let precedent cramp her style. Meanwhile, friends and family members crowded into the designated photography area and waited for the moment when their grads bounded down the stairs after receiving a diploma and a handshake from President Baltimore.

The class of 2005 included nearly as many PhD graduates (182) as undergraduate degree recipients (217). Of the BS candidates, 103 graduated with honors and 34 percent were female. Among PhD graduates, 25 percent were women. The Institute also awarded 120 MS degrees and conferred two engineer degrees.

Loh filled her speech with Institute lore and mythology. "Caltech—look around you-has always felt like a land of kings—its heroes the fathers of modern chemistry, biology, physics, neuroscience. . ." She invoked the patriarchal presence of Caltech's "holy trinity," depicted most famously in the Athenaeum dining room: "Not Father, Son, and Holy Ghost, but Noyes, Hale, and the virtual George Washington of Caltech-in full academic regalia-Robert Millikan." Caltech's "fathers" notwithstanding, she added, women continue to gain prominence on the Pasadena campus. The speaker congratulated her former classmate Julia Kornfield '83, MS '84, now professor of chemical engineering, and saluted the Institute's 2005 first allfemale chemical engineering graduating class.

freedom begins now! Diploma in hand, start today veering wildly off course. And you Asian students? That goes double for you. You know who you are . . . don't make me come and get you. Don't be shy. Look at me—I went into the liberal arts, which, for a Chinese father, is like pole-dancing."

This rakish message apparently was not what Loh's father, Eugene, PhD '54, had in mind for the day. The younger Loh explained that her dad's initial thrill over learning that

his daughter would deliver Caltech's commencement address was quickly succeeded by fear that she would miss the big day by oversleeping or, even worse, that she would try to be "funny." The retired aerospace engineer had even outlined acceptable topics on a paper napkin: that father and brother (Eugene Ying Loh '80) are Caltech alumni; that Sandra's parents met at the Caltech swimming pool; that Mom worked in biologist and Nobel Laureate Renato Dulbecco's lab. As far as her father was concerned, that about covered it. Sandra Loh closed with what she called the "obligatory" Richard Feynman story. Back in 1979 when she was a freshman, he dropped by Page House after dinner to shoot the breeze about electromagnetic induction. "And thento our shock, he utters a non-FCC-approved word for which, on public radio last year, I got fired."



The irrepressible commencement speaker urged the class of 2005 to boldly pursue the unexpected— "skiing, snorkeling, belly-dancing, sleeping. Maybe try out for *American Idol*. Why not?" As the festivities concluded, President Baltimore congratulated the graduates, confetti rained down on the crowd, and Caltech's newest alumni celebrated.



tradition—the take-home, open book, infinite-time exam. That's right! Take all the time you want! Won't really help you because p.s., Problem Number Two? It's actually impossible. That's right! It's a famous impossible conundrum! Even Descartes couldn't solve it, after working on it for 37 years. Then he went insane. Had a fight with Foucault, bar in Lyons, few drinks, argument, duel. Funny story, we thought it would be amusing to give this unsolvable drove-Descartes-mad paradox to you freshmen in Math 1 your very first week at Caltech!"

Loh confided that as commencement speaker, she felt the historical weight of past speakers, including Nobel laureates, Fortune 500 CEOs, network anchormen, *Time* magazine Men of the Year, and, in

Noting that all commencement addresses should feature sage words of wisdom, Loh dispensed hers: "Dare to disappoint . . . your father.

"That's right, Caltech graduates,

She was referring, of course, to her highly publicized dismissal from the

Continued on page 7 . . .



Campus Update

CALTECHERS NAMED TO NATIONAL ACADEMY



Three Caltech professors, one former faculty member who is now a visiting associate, and six Institute alumni were elected on May 3 to the National Academy of Sciences, one of the most important honors that can be accorded an American scientist or engineer. The recent election brings to 70 the number of Caltech faculty who are NAS members.

Caltech's newest NAS members are Richard Andersen, the Boswell Professor of Neuroscience; James Eisenstein, the Roshek Professor of Physics; and Wallace Sargent, the Bowen Professor of Astronomy. Roger Blandford, formerly on the faculty and now a visiting associate in physics, is also among the electees.

Andersen is a neuroscientist who has garnered considerable attention in recent years for his progress in using brain signals to control prosthetic devices. Much of his current work focuses on severely paralyzed human patients who can think about making movements, but whose brain damage from trauma, stroke, or peripheral neuropathies, prevents them from actually engaging in movement. Andersen is working on brain-implant technology that will act as an interface between a patient's desire to move and artificial limbs, computers, or other devices, and "read out," or implement, the patient's desires. Eisenstein is a specialist in condensed-matter physics, which involves investigating the fundamental laws of nature as they apply to atoms and molecules that make up solid matter. His most significant research accomplishment in the last year has been to demonstrate that unusual particles known as "excitons" can inhabit solid semiconductor materials in such a way that each exciton loses its individual identity, and, in certain ways, a large collection of excitons becomes a single quantum entity.

Clockwise, from top left, Caltech's new NAS members are Richard Andersen, Roger Blandford, James Eisenstein, and Wallace Sargent.

Sargent is particularly well known in the astrophysical community for his work in spectroscopy. His research in extragalactic spectroscopy provided the first evidence for a black hole in galaxy M87, and his work on intergalactic gas has led to new insights into the primeval materials of the early universe. His work in the stellar spectroscopy of A-type stars led to the discovery of the helium-3 isotope in the star 3 Centauri.

Blandford, a former faculty member in Caltech's physics, math, and astronomy division, is currently a visiting associate in physics at Caltech, as well as being the Pehong and Adele Chen Professor of Physics at the Stanford Linear Accelerator Center at Stanford, where he is also director of the Kavli Institute for Particle Astrophysics and Cosmology.

Six Caltech alumni were also elected to the NAS this year. They are Gary Cox '78, PhD '83, professor of political science at UC San Diego; David Jewitt,

Continued on page 15 . . .

ENGINEERS EN ROUTE TO DEVELOPING MORE EFFICIENT FUEL CELL

Caltech engineers have created a propane-burning fuel cell that's almost as small as a watch battery, yet many times higher in power density. Led by the Institute's Sossina Haile, the team reported in the June 9 issue of *Nature* that two of the cells have sufficient power to drive an MP3 player. Commercialized versions of these fuel cells would be able to drive the player for far longer than the best lithium batteries available.

According to Haile, who is an associate professor of materials science and chemical engineering, a couple of breakthroughs in fuel-cell technology led to this new development. A key innovation was a novel method of getting the fuel cell to generate enough internal heat to keep itself hot, a requirement for producing power.

"Fuel cells have been done on larger scales with hydrocarbon fuels, but small fuel cells are challenging because it's hard to keep them at the high temperatures required to get the hydrocarbon fuels to react," Haile says. "In a small device, the surface-tovolume ratio is large, and because heat is lost through the surface that is generated in the volume, you have to use a lot of insulation to keep the cell hot. Adding insulation takes away the size advantage."

The new technology tackles this problem by burning just a bit of the fuel to maintain the fuel cell at the needed temperature. The device could probably use a variety of hydrocarbon fuels, but propane is just about perfect because it is easily compressible into a liquid and because it instantly becomes a vapor when it is released. That's exactly what makes it ideal for your backyard barbecue grill.

"Actually, there are three advances that make the technology possible," Haile says. "The first is to make the fuel cells operate with high power outputs at lower temperatures than conventional hydrocarbon-burning fuel cells. The second is to use a single-chamber fuel cell that has only one inlet for premixed oxygen and fuel and a single outlet for exhaust, which makes for a very simple and compact fuel cell

Continued on page II . . .





At left, Elliot Meyerowitz (right), Beadle Professor of Biology and chair of the Institute's biology division, presented the "Golden

Anemometer," a device for measuring wind speed and liquid flow, to Pamela Lewis, the widow of Caltech's late Nobel laureate in physiology or medicine Ed Lewis, PhD '42, and their son Keith Lewis (seated, left), as the Ed Lewis Memorial Weather Station (pictured above) was dedicated on campus in April. Also participating in the ceremony were Lewis's longtime colleague Seymour Benzer, Boswell Professor of Neuroscience, Emeritus (standing, left), and Fritz Coleman, weathercaster for Los Angeles NBC affiliate KNBC-TV. The station honors Lewis both for his remarkable contributions to genetics and for his four years as a U.S. Army meteorologist in Hawaii and Okinawa during World War II. Housed in Caltech's Physical Plant, it provides real-time weather information as part of the Weather-Net network of schools. Some of the network sites are featured on KNBC-TV's weather broadcasts, bringing viewers meteorological conditions and forecasts in specific neighborhoods.



All shook up in the Dean of Students Office? Civil and seismic engineering expert John Hall took on the job of overseeing the Institute's undergraduates in June.

THE HALL OF ACADEME

Despite his new formal-sounding title, Dean of Students John Hall prefers not to think of himself as an administrator. "I don't really think of it as administration so much as performing a needed function," says the professor of civil engineering and applied mechanics, who began his additional job on June 20. "Dealing with students is something I feel comfortable doing."

Working closely with Associate Dean of Students Barbara Green, Hall's job officially consists of counseling undergraduates on academic and personal matters, and supporting student activities from house parties to Mudeo mud fests.

In practice, his multifaceted job will feature lots more of the sort of kibitzing the professor has enjoyed for more than two decades, brainstorming with students about their academic goals and how best to reach them. Then there are the less enjoyable but equally important aspects: overseeing academic matters such as cheating, and helping students who are in trouble academically get back on track. (Under Caltech's Honor Code, incidents of cheating are first investigated by other students who serve on the Board of Control, which makes recommendations to the dean of students.) Other duties include welcoming students to many official events, such as Frosh Weekend, the annual Senior Banquet, and New Student Orientation. Interestingly, Hall never officially applied for the position. He had been appointed to head the campus committee whose job it was to find a successor to longtime dean of students Jean-Paul Revel, Ruddock Professor of Biology. After initially deciding to leave the deanship a year ago, Revel agreed to serve through commencement 2005, while a search committee set out to find

his successor. Along the way, the committee quietly sent an emissary to report to Margo Marshak, vice president for student affairs, that the best candidate was in fact Hall, the committee's chair. Hall had a suspicion what was going on behind-the-scenes, so he wasn't entirely surprised by his own selection.

Hall first came to Caltech as a postdoc in 1980, after earning his BS at West Virginia University, MS at the University of Illinois, and PhD at UC Berkeley. At Caltech, he steadily rose through the ranks, becoming an assistant professor in 1983, associate professor in 1989, and full professor in 1997. Until a few months ago, he served as executive officer for civil engineering and applied mechanics. Through the years, he has developed an international reputation as an expert in earthquake engineering (particularly the structural dynamics of dams and steel- and woodframe buildings), and he also investigates how science and technology can be harnessed to improve construction standards and public education. In 1998 Hall managed a multi-university research project to improve the earthquake resistance of wood-frame homes, which in Southern California had suffered about \$20 billion in damage from the 1994 Northridge earthquake. The project, funded by the Federal Emergency Management Agency (FEMA), concluded that modest structural enhancements in such housing could potentially save homeowners and the state tens of billions of dollars in reduced damage from future earthquakes.

Earthquake engineering aside, Hall is also intrigued by the variables of student life. One of his chief concerns is spotty class attendance, which he thinks may reflect student apathy, overwork, or a combination of factors. "It's pretty widely known that many students regularly don't come to class. In my experience, in a class of 30 to 35, it wouldn't be unusual to see 15 or more not attend." He thinks the absentee rate is too high, and hopes to probe its cause. "You might say that if students can learn the material by reading the book, then the question is, why should they come to class? On the other hand, I think that if the system is working properly, the students should want to come to class, because there is teaching going on in the classroom that they can't get out of a book." Under consideration, he adds, is the creation of a student classroom ombudsperson who would channel student issues and complaints to professors. "Some students feel that going through the ombudsperson would be more comfortable for them than having to approach the professor themselves." At the same time, Hall wants to ask professors to consider brushing up on their own teaching skills. "Most professors really don't get trained in teaching and it's not their specialty. Some of us are real good at it, and some of us aren't,

For a few hours on May 4, the Hollywood Walk of Fame was transformed into the "Scientists' Walk of Fame," thanks to a group of enterprising Caltech students and some very low-tech special effects. In the gloom of night, around 3 a.m., about 100 students representing all classes arrived in Hollywood, armed with 600 strips of adhesive paper the size of bumper stickers, each bearing the name of a different scientist. They included giants such as Newton and Einstein and a handful of Caltech Nobelists, among them Richard Feynman; Charles Townes, PhD '39; and the Institute's latest laureate, theoretical physicist David Politzer. The students' mission: to paste the tags over the names of Hollywood types gracing



the sidewalks along Hollywood Boulevard and surrounding streets. A streetcleaning patrol armed with power washown forward the

ers forced the Techers to cool their heels for half an hour, but at 3:30 a.m. they got to work. All went well until about 4 a.m.,

when a police



officer in an unmarked car spotted a group of students putting stickers on the stars. He called for backup, and soon four police officers at the corner of Hollywood and Highland were arresting four Caltech students. As it turned out, only one of the students was charged—he was 17 and was booked and cited for being out and about after the city's 10 p.m. curfew. (By 6 a.m., his mom had retrieved him at the station house.) The senior who thought up the scheme, Galen Loram, said that he was inspired by the 1987 prank in which students altered the famous Hollywood sign to spell out CALTECH on the occasion of Hollywood's 100th anniversary. This year's prank was also timed to coincide with the May 4 release of the "American Scientists" stamp series honoring four scientists, including Feynman.

Loram says that while Grauman's Chinese Theatre removed the stickers by that afternoon, the El Capitan Theatre let them stay. But he figures that by the following night all the stickers had been washed away by the sidewalk cleaners. "Overall, I think that we all had a great time, and that it was a fun way to showcase the ingenuity and quirkiness of Caltech students," Loram says. "I got e-mails from as far away as Canada congratulating us on the prank, so I think we ended up doing a pretty good job of raising awareness of scientists. Also, I thought it was wonderful how it brought together people from across houses, years, and majors."

RECOGNITION

Five Caltech faculty members are among this year's newly elected fellows of the American Academy of Arts and Sciences. They join 191 other Americans and 17 foreign honorees as the 225th class of fellows of the prestigious institution that was founded in 1780 by John Adams and other prominent Americans.

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This year's new Caltech inductees are **Barry Barish**, the Linde Professor of Physics and director of the Laser Interferometer Gravitational-Wave Observatory (LIGO); **William Bridges**, the Braun Professor of Engineering, Emeritus; **Andrew Lange**, the Goldberger Professor of Physics; **Barry Simon**, the IBM Professor of Mathematics and Theoretical Physics; and **David Tirrell**, chair of the Division of Chemistry and Chemical Engineering and McCollum–Corcoran Professor and professor of chemistry and chemical engineering.

The five from Caltech join an illustrious list of fellows, both past and present. Other inductees in the 225th class include Supreme Court Chief Justice William Rehnquist, Angels in America author Tony Kushner, actor Sidney Poitier, former NBC Nightly News anchor Tom Brokaw, Washington Post CEO Donald Graham, and Pulitzer Prize-winning cartoonist Art Spiegelman.

The AAAS is an independent policy research center that focuses on complex and emerging problems such as scientific issues, global security, social policy, the humanities and culture, and education. The fellows were chosen "through a highly competitive process that recognizes individuals who have made preeminent contribu-

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A Putter with a Purpose

CALTECH'S DIRECTOR OF TECHNOLOGY TRANSFER TURNED HIS LOVE OF GOLF INTO A CAREER HELPING CALTECH SCIENTISTS AND ENGINEERS MARKET THEIR INVENTIONS

BY MICHAEL ROGERS

Thanks to his love of tree-lined fairways, immaculate putting greens, and all other things related to golf, Rich Wolf, PhD '97, is sequestered in a nondescript office above a machine shop in Caltech's Central Engineering Services building, helping other people on campus realize their dreams.

Wolf is director of Caltech's Office of Technology Transfer (OTT), which fosters and promotes start-up companies and licensing activity at Caltech. But it was his own idea for a product that steered him to the job of guiding other would-be inventors and entrepreneurs on campus.

Wolf became actively involved with technology transfer as a Caltech grad student. After getting his bachelor's degree from Princeton, he came to Caltech in 1992 to study earthquake geology. An avid golfer, Wolf found time to visit local links when he wasn't in classes or the lab. On one golf outing, he stood on the side of the practice putting green, studying golfers' techniques. He noticed that the better players raised the blade of their putter just before striking the ball to increase the ball's spin and improve the accuracy of their putting. "I wondered if there was a way to do that artificially," he says.

"I thought, 'If you can raise the center of mass in the putter itself, you will increase torsional forces.' That's simple Newtonian physics."

So Wolf designed a putter with a raised center of mass. At about the same time he discovered Bill Johnson, PhD '75, across campus in the Keck Lab. The Mettler Professor of Engineering and Applied Science had started a company called Liquidmetal Technologies, which was also developing hightech golf clubs. Liquidmetal helped Wolf develop his putter while he assisted the company with some of its projects. With Caltech's help, Wolf got two patents for his putter design, and a company in Utah began manufacturing it. (While Wolf says that the club worked well and improved his game, the company eventually went out of business.)

After receiving his PhD for developing a tool for measuring the thermal history in rocks and sediment, which is useful for understanding hydrocarbon maturation, Wolf turned down geology jobs in industry, opting instead to take a position with the Institute's recently established Office of Technology Transfer, reviewing new technologies at JPL. "In science, you make a commitment to one thing," Wolf says. "The JPL job taught me a lot of different things, from physics to microbiology. I got excited with the opportunity in industry to capitalize on these diverse scientific and engineering projects.

"It turns out that at JPL there are licensing opportunities in areas that are not noticed," Wolf says. "The lab is great at developing sensors and microdevices, but they haven't exploited those technologies. What is important to NASA and the mission of JPL is not in parallel with what industry is interested in."

"We are done with the high-flying days of 1999 and 2000, and we seem to be done with the low-flying times of the last two years," Wolf says.

Strengthening the connections of Caltech and JPL with industry is exactly why the Institute formed the OTT in 1995. It was also a direct response to the growing interest in entrepreneurism among Caltech faculty, staff, and students, fueled, in part, by the hightechnology boom that began in the 1980s and the decline in government funding for science that started in the early 1990s.

Wolf says that OTT has five functions: "To act as an advocate for much of the faculty and students to see the technology that they develop commercialized; to legally protect the intellectual capital of the Institute; to benefit the taxpayers who fund research projects so that they might develop into



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It might not have a Nike swoosh engraved on it, but the putter that Rich Wolf invented and patented while he was a Caltech graduate student not only improved his golf game, it also launched his career in technology transfer.

useful new products that improve the way we live; to generate money for the Institute; and to promote entrepreneurism, so that we can help Caltech's next generation of entrepreneurs instead of discourage them."

The Office of Technology Transfer celebrates its tenth anniversary this year, and while many companies have come and gone in that time, the Institute's scientists and engineers have kept OTT staff busy filing patents, working out licensing deals, and assisting in start-ups.

In 2004, for the second year in a row, Caltech ranked second in the number of patents issued to academic institutions in the United States (behind the entire University of California system), even though its total was down slightly from 147 in 2003 to 140 in 2004. Invention disclosures for 2004 totaled 196 for Caltech, up from 135 in 2003. And license agreements and options totaled 52 last year, compared with 41 the year before. Over time, Caltech start-ups have averaged out to about 10 each year since the inception of the office, with the highest number of start-ups occurring in 1999 and 2000. In recent years it has tapered off,

deals with larger companies or renegotiating deals. So we actually have been busier than usual."

Wolf, named OTT director in 2003, figures that the worst is now over. "We are done with the high-flying days of 1999 and 2000, and we seem to be done with the low-flying times of the last two years," he says. He predicts that the Institute will be back on track soon, doing eight to 10 start-up company deals each year on average for the near future.

The OTT staff definitely has a better than average understanding of the technologies coming out of Caltech labs, since half of its staff members are Caltech alums. They include Fred Farina, MS '92, the associate director, Scott Carter, PhD '99, the assistant director, and licensing associates Karina Edmonds, PhD '98, and Michael Slessor, PhD '98. "We have a bias toward hiring people with a technology background," Wolf says, adding that Institute alumni have valuable insider information when it comes to the job of developing a rapport with Caltech faculty.

Working closely with Caltech scientists and engineers is one of the favorite parts of his job, Wolf says. Especially in the case of spin-offs, he has to learn the nuts and bolts of a diverse array of Caltech technologies before he can help their developers create a strategy for commercializing the enterprises. Some of the new Caltech devices that he's particularly excited about include a miniature, bladeless heart pump developed by Mory Gharib, PhD '83, Caltech's Liepmann Professor of Aeronautics and Bioengineering, and a new suture developed by Mark Davis, the Schlinger Professor of Chemical Engineering, which includes a feature for time-releasing drugs into a wound.

Working every day with Caltech inventors, Wolf finds it hard to resist the entrepreneurial bug that got him started with OTT in the first place. "I am really into it," he says. "At some point, it would be fun to take a short leave and run a company and get involved in the technology. Will that happen soon? You never know."



Santa Monica–based NPR station KCRW for her unintended airing of the "F" word. After a few days, the station manager offered to take her back, but by then Loh had decided to migrate to Pasadena-based KPCC—a homecoming of sorts for this Caltech graduate. Aside from this passing reference, Loh said nothing of her own growing reputation in the distinctly Caltech-atypical realm of arts and entertainment.

Taking a divergent path from most of her classmates, Loh, who graduated from the Institute with a double major in physics and literature, entered USC's graduate program in English. Before long, she was tackling performance art, hiring a local orchestra to help serenade spawning fish on the beach at Malibu and playing classical piano for commuters on L.A.'s Harbor Freeway. A prolific writer, her sardonic take on life in Southern California has been revealed in solo theatrical shows, plays, essays, a 1997 novel, If You Lived Here, You'd Be Home by Now (1997), and radio commentaries. The author also of Depth Takes a Holiday: Essays from Lesser Los Angeles (1996), and A Year in Provence Van Nuys (2001), Loh has been published widely in national magazines and newspapers, and is a regular contributor to The Atlantic magazine.

After Loh's address and the presentation of degrees, President Baltimore wrapped up the commencement ceremony with awards and concluding remarks.

Caltech's president criticized current White House energy policy and spending priorities. "While you have been preparing to take on the world," he told the Institute's graduating class, "the world has changed in many dramatic ways." He reminded the departing undergraduates that they had begun their Caltech careers in the wake of 9/11, and that their higher education had occurred in an environment dominated by the Bush administration's insistence that the bulk of public funding be directed to national security priorities.

Said Baltimore, "We need to educate more scientists and engineers while we catalyze massive basic science education programs to fuel innovation, but rather, we seem to be doing less.

"Security is critical, but *as* critical is support for innovation, the need for science education, and the need for alternative energy resources."

with only four new start-up deals in 2004.

"The downturn in the economy over the past couple of years hurt us," says Wolf, who became the OTT's associate director in 2001, assisting then-director Larry Gilbert, who is today the senior director. "Companies in which Caltech has a financial interest lost value, and that, of course, diminished our equity positions. We have had to refocus our efforts on doing licensing



Caltech grad student Wolf ducks for cover during a sample collecting expedition in the Spring Mountains of Nevada in 1993.

Whatever roads the class of 2005 chooses, said Caltech's president, "You are well-equipped to make great contributions to the future. You have the skills and the mindset to be lifelong learners and lifelong contributors. So we send you out into the world confident that we have prepared you to play a role in shaping its future. The rest is up to you."

Sandra Loh's commencement address and the Institute's graduation ceremony can be viewed online at http://pr.caltech. edu/commencement/index.html. For a 2000 *Caltech News* feature on Loh, go to http://pr.caltech.edu/periodicals/Caltech-News/articles/v34/loh.html.

Newton . . . from page 2

scholars, "engrossed" with the man (as he puts it) for some 15 years. It was not, however, his original intent to become expert in all things Newton. Feingold's area of expertise is 17th- and 18th-century science, and, as he quickly discovered, "you can't read anything about the science revolution of that time without Newton's influence being evident."

The key fact to appreciate about Newton, says Feingold, is that his influence extended far beyond his seminal work in physics to permeate all aspects of modern culture. It is this Newtonian diffusion that has interested Feingold, who has spent the last two years of his life researching, designing, and curating two exhibits about Newton's sci-

ence and its impact on our world. The first went on display for several months last year at the New York Public Library before moving, in a two-part format, to San Marino's Huntington Library this past spring. Part I, entitled All Was Light, ended in June and showcased Newton's science revolutions. Part II, The Newtonian Moment, opened July 23 and highlights the enormous impact that Newton has had on modern culture. The show runs through December 2005. Feingold also wrote a book, The Newtonian Moment: Isaac Newton and the Making of Modern Culture, to accompany the exhibits, and has published several papers about one of the most famous scientists in the world.

The Israeli-born Feingold's original interest wasn't science but political his-

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tory. He grew up in Yeruham, a small town located in the desert of Israel's "deep south," as he puts it, during the 1960s, when Israel fought the Six Days' War with its Arab neighbors and subsequently annexed the Sinai, the West Bank, and the Golan Heights. It was a tumultuous time, and Feingold developed an early passion for history, wanting to understand the context of the events swirling around him. The first person in his family to attend college, he did his undergraduate work at the Hebrew University of Jerusalem, before earning his doctorate in modern history at Oxford.

It wasn't until he attended a lecture on science history in the 1970s that he became interested in that topic. "It turned out that the past in science was much more interesting to me than the history of politics," he says. And that, in turn, led him to Newton.

Isaac Newton was born on Christmas Day in 1642. His father had died before he was born, and the sickly, scrawny child was raised by his mother, but only until the age of three, when she remarried and left him in the care of his grandparents. Mother and son were not reunited until Newton was eight, after the death of her second husband. No doubt this had an effect on Newton. "I presume he was bitter," says Feingold. "Wouldn't you be?"

Whatever Newton's dysfunctional family relationships, they certainly did not interfere with his rise to prominence as a scientist. He burst onto the scene toward the end of the scientific revolution, which historians roughly peg as taking place in the years between 1500 and 1700. "When Newton

"He wasn't like us, but he wasn't a dejected, solitary, raving lunatic. He was like many pro-



The 18th century brought experimental confirmation of Newton's theory that the earth was an oblate spheroid, flattened at the poles. The finding led to a new round of tributes to Newton, including this engraving, which depicts the "flattening" of an ornamental globe.

one of Newton's greatest contributions was the "establishment of the physical sciences on the secured foundation of mathematics."

Newton changed science forever, Feingold says, transforming the realm of scientific thought and inquiry from one based largely on hypothesis and faith to one grounded in empirical evidence. He reinvented science as the kind of knowledge people wanted to bring to other disciplines. The Newtonian search for rational, universal principles shaped the development of ideas in virtually all fields, including history, psychology, metaphysics, and literature. "Everyone wanted to be the Newton of their field," says Feingold. "Adam Smith wanted to be the Newton of economics; David Hume wanted to be the Newton of moral philosophy."

In 1704, 17 years after the Principia. came Newton's second seminal work, The Opticks, which contained Newton's revolutionary theories regarding light and colors. In it he described how passing a beam of white light through a prism dispersed it into the many colors of what is known today as the visible portion of the electromagnetic spectrum. It was in pursuit of these insights that Newton stuck that bodkin in his eye, and repeatedly stared at the sun through a telescope until he injured his eyes so badly that he had to stay in a dark room for several days before regaining his vision. Even if people didn't understand Newton's science-and most didn't ("Newton boasted he'd made the Principia purposely difficult in order to stave off 'smatterers' in mathematics,' says Feingold), by early in the 18th century Newton had achieved almost iconic status in Europe. This kind of intellectual hero worship-the scientist as popular idol-was, Feingold says, unprecedented in human history. People quickly realized Newton was something quite unique. "By the beginning of the 18th century, he had become Einstein-like in how people saw him, some sort of legend."

With a bare bodkin? This page from one of the young Newton's notebooks describes and illustrates the manner in which he inserted a small knife between his eye and his skull bone in the course of an optical experiment.

fessors at Caltech!"

came to the scene the scientific revolution was well under way," says Feingold. "He came after Galileo, Kepler, Descartes—a time when there was already a new conception of the world in the making."

Newton was 45 when he rocked the scientific circles of his day with the 1687 publication of the *Principia Mathematica*. "It is the monumental treatise that unified celestial and terrestrial mechanics under a single law—universal gravitation—and charted the course of physics for some two centuries," says Feingold. As he writes in his book,

As Newton's insights began to percolate through all levels of Western European society via lectures, plays, written materials, the design and development of new scientific instruments, and even art, "his ideas took on many different forms, sometimes vulgarized in popular culture," notes Feingold. Busts of Newton began to appear everywhere, from public places to people's parlors.

Newton's laws of gravitation were particularly prone to popularization, says Feingold. "People played with these ideas," he says. The protagonist in Francesco Algarotti's Newtonianism for Ladies reasons on one occasion that when lovers are first together their attraction is infinite; but after "eight Days Absence Love becomes sixty four Times less than it was the first Day, and according to this Proportion it must soon be entirely obliterated." Says Feingold, "That's what I call the vulgarization; it doesn't make any sense if you understand what his principle was about. But that's how his ideas were often conveyed.'

Another Newton-inspired invention that became popular by the mid-1700s was that of wonderful, mechanical models of the solar system. Called orreries, they were turned by a crank and depicted the relative size and motion of heavenly bodies. "It was science that could be visualized and made intelligible to much broader audiences," says Feingold.

One of Newton's biggest fans was the 18th-century French writer and philosopher Voltaire, who popularized the physicist and his work. Voltaire spread the story of how Newton's legendary eureka moment in an apple orchard led him to propose the law of universal gravitation. Feingold doubts the tale is true, and suspects that it is more along the lines of the yarn about



George Washington and another fruit tree. Newton, he says, was known more for perseverance and sheer hard work than he was for flashes of inspiration.

Not everyone was enamored of the new Newtonian universe. The Romantic poets, for one, preferred "mysteries and emotions to laws and reason," says Feingold. The poet Shelley excoriated Newton as the chief culprit who had "decomposed the rainbow," while the mystic poet and artist William Blake lamented that "single vision that had deadened nature."

Feingold admits that Newton did not possess the world's most attractive personality. He had a running conflict with another eminent British scientist, Robert Hooke, who had proposed his own theory of light, formulated a theory of planetary motion, and proposed the inverse square law of gravitational attraction (and introduced the term "cell" into biology). After one debate about optics, says Feingold, Hooke wanted to make peace. Newton responded to this overture with a letter, in which he credited Descartes's contribution to optics, acknowledged Hooke's own, valuable contribution, and confessed that if he, Newton, saw further than others into Nature's mysteries, "it is by standing on the shoulders of giants.

For centuries, people have interpreted this as evidence of Newton's humility, says Feingold. "Only problem is," he says, "Hooke was somewhat deformed. So if you tell a hunchback you stood on the shoulders of giants, it's not a compliment. It's a dig.

"Newton was arrogant," says Feingold, "but it was because he knew he was the purveyor of the truth in so many domains that he was unwilling or unable to listen to any objections or criticism. And he was willing to defend

> his ideas nearly to the end. He lived a long time and was basically able to bury his opposition.

"So yes, he was a difficult person, but we make exceptions



Since that time, some historians have played up this side of Newton, placing as much emphasis on his eccentricities as his science. Feingold, however, is not among them. "For Newton, alchemy was the precursor to chemistry. What he wanted to understand were the principles, maybe even a unified principle of matter. To him it wasn't mystical or religious, it was an empirical science. He applied to it the same kind of rigorous, methodical understanding of fact, and what constituted evidence, as he did to physics and optics."

The debate rages on, and, as the curator of a bicoastal, widely publicized Newton exhibit, Feingold has placed himself squarely in the center of it. But the controversies swirling around Sir Isaac haven't swayed Feingold from his love of science. In particular he is fascinated by how much science has permeated our lives and our culture, and how little most of us understand about how it works, "not unlike people in Newton's day." As an example, he points out that cars and computers have completely changed our lives, yet most of us don't have a clue what's under the hood of either. He perceives danger in this, worrying that citizens and politicians will make crucial decisions concerning science and technology with no factual basis or understanding, "leading to lunacies like what's going on in Kansas," where the board of education will decide later this year whether to include the teaching of so-called Intelligent Design (a variant on creationism) as part of the science curriculum. Feingold retains his fascination with Newton. "It is humbling to be in the presence of a genius," he says. He is now collaborating with his Caltech colleague Ied Buchwald, the Drevfuss Professor of History, on a book about

The orrery, a mechanical model of the solar system, was a popular 18thcentury device for illustrating Newtonian theories to the public at large.

Newton's interest in chronology; that is, the science of ordering historical events.

"In Newton's day," he says, "chronology was a pivotal battleground upon which theologians and scholars waged heated debates. Newton argued

that it was common among ancient nations to inflate their antiquity." Because Newton thought the Hebrews were the first to acquire the attributes of a civilized society and of a political nation, says Feingold, he believed it necessary to revise the chronologies of the ancient kingdoms so that their advent toward civilization would follow that of the Hebrews-and thereby conform to the narrative of holy scripture, which seemed to offer the most authentic account of world history. Newton was certain that his revisionist dating would "make chronology suit with the course of Nature, with Astronomy, with Sacred History, with Herodotus . . . and with itself.'

"Jed and I are the first to do this," says Feingold. "And I'm sure our research will lead to many other important discoveries. Newton is constantly enriching, and his scholarship is a never-ending story."

for difficult people with a talent." Another side of

Newton came to light in 1936, when a metal trunk of his previously undiscovered notebooks was purchased at an auction by the economist John Maynard Keynes. The papers revealed Newton's lifelong interest in alchemy and theology.

American statesman and founding father Ben Franklin, an eminent scientist in his own right, chose to have himself painted in 1766 with a bust of Newton prominently displayed (at left) on his desk.





Son of a Preacher Man

BY MICHAEL ROGERS

Growing up in Texas the son of a Presbyterian minister, Dean Currie, Caltech's new vice president for business and finance, heard a lot of one particular Bible story. Educated at the elite Choate prep school in Connecticut and then at Harvard, Currie says that whenever he returned to his hometown of Texas City and sat in on one of his father's sermons, the day's lesson somehow always seemed to concern the New Testament tale of the prodigal son.

In that parable, a son who had deserted the family farm and squandered his wealth returns impoverished, desperate, and penitent, and is welcomed back like a hero by the father whom he had abandoned. When the other son, who had remained dutifully behind with dad, complains bitterly about his father's reaction, the father explains, in a famous passage, that the time to rejoice has come "because this brother of yours was dead and is alive again; he was lost and is found."

Currie's family didn't own a farm, and he never pursued a career as a ne'er-do-well. But, as his father's only son in a family full of preachers (his grandfather, uncles, and many of his cousins were Presbyterian ministers), it might be said that he strayed a bit from the fold. After earning his bachelor's degree from Harvard in 1969 and then returning there to get his MBA in 1973, Currie became a career administrator in academia. And his fondness for a certain parable notwithstanding, Currie's father was never disappointed in his son's choice of profession.

"My dad never put pressure on me," says Currie, who resembles a somewhat less beefy version of the actor John Goodman. "He wanted me to do what made me happy

"Every preacher's kid goes through the process of deciding whether he has the vocation or not," Currie says. After finishing college and before entering graduate school, he got a job running a settlement house in Cambridge, opening up satellite community centers in the area. "I found out I had more of a gift for organizing things than for working one on one with people."

But some of that early parental influence must have rubbed off: Currie decided to devote his organizational talents to the not-for-profit sector. He went to business school, figuring that management skills would be just as important in the nonprofit arena as in the corporate world. His opportunity came shortly before he got his MBA degree, when the head of Harvard's business school offered him a role on the school's admission's board and a chance to become director of admissions and financial aid. "It was a powerful position and I knew it would be intellectually interesting," says Currie. "That was the draw."

"Every preacher's kid goes through the process of deciding whether he has the vocation or not. I found out I had more of a gift for organizing things than for working one on one with people."



Six months into his new job, Caltech's vice president for business and finance Dean Currie has settled into his office and has started holding meetings to acquaint the campus community with the intricacies of the Institute's budget priorities.

> Currie stayed at Harvard for 15 years, because, he says, "They kept offering me new jobs." In 1977 he became assistant dean for educational affairs at the business school, and in 1980 he was named its associate dean for administration and policy planning. In the latter post, he oversaw 300 employees and was responsible for a \$70 million operating budget.

- setting the setting of the production of

But ultimately he decided it was time for a change. "It was hard leaving Harvard after all those years, but I had made the bulk of the contributions I had set out to make and it's good to be reported every once in a while," he says. Currie decided to return to the familiar soil of the Lone Star State in 1988, accepting the job of vice president for finance and administration at Rice University in Houston.

Currie held the post for more than 16 years and is quick to credit his staff at Rice for the many developments he oversaw during that time. These included the creation of a budget office; converting Rice to new software for finance, payroll, and human resources; creating a cogeneration operation providing 80 percent of the university's electrical, heating, and cooling needs; and participating in the university's first bond financing, which attained a coveted AAA rating.

The bond issue helped solve a growing problem at Rice, Currie says. The university needed to raise money for new buildings as it expanded over the years, but the Rice charter specifically prohibited the school from assuming any debt. "We needed graduate housing badly," Currie says. "First, I put together a company that was able to raise money for it."



The company, called Graduate Housing, Inc., was formed in 1998, with Currie as president and chairman of the board. A separate entity from Rice, it had no assets or collateral, making it difficult to convince a bank to lend it the \$5 million it needed to build the housing complex. Currie says he was eventually able to get a bank loan, because Rice said it would encourage first-time graduate students to rent there, guaranteeing a revenue stream.

"A few years later, we changed the charter so that Rice could borrow for construction. There was a lot of pent-up demand for labs, housing, classrooms, and administrative buildings, and we added 50 percent to the square footage of the campus while I was there.

Currie says that while he and his wife, Carol, enjoyed life in Houston, where they raised two children-David, soon to start law school, and Sarah, about to begin her senior year at Harvard-they decided last year that they might be ready for something new. Rice had hired a new president and Carol had just received her PhD in public health from the University of Texas when Currie heard that Caltech was looking for a new vice president for business and finance and applied for the job. After a series of interviews late last year, he was hired in December. He arrived on campus and started work in February.

The interview process convinced me that this would be an interesting place to come to," Currie says. "The first person I met wasn't the president or provost. It was a faculty member-Preston McAfee," the Johnson Professor of Business Economics and Management. McAfee had come to Caltech from the University of Texas, so the two men were able to connect. They easily fell into a discussion about McAfee's research, which concerns auctions and bidding, and industrial organization. "It was fun that he was willing to engage with a bureaucrat."

Of course Currie did eventually hook up with Caltech president David Baltimore, who says he is looking forward to working with him. "Dean is immensely talented, has a wealth of experience in finance and business administration at two great academic institutions, has boundless energy, and is an extremely thoughtful person. He will be a great asset to the Institute and will help us meet the challenges that lie ahead.

Although Rice, like Caltech, emphasizes education in science and engineering, it also has a large humanities component, as well as schools of music and architecture, and a graduate school of management. It also plays Division I sports, including football, and is a larger institution than Caltech, with 2,850 undergraduates and 1,950 graduate students, compared to the Institute's approximately 900 undergraduates and 1,200 graduate students. Rice had net assets of \$3.9 billion as of June 30, 2004, compared with Caltech's net assets of \$2.1 billion for the year ending September 30, 2004.

But Currie has plenty on his plate at Caltech. He oversees a wide variety of departments, including human resources, facilities management, security, and the financial services, controller, and accounting offices, among other operations. He says that he has been spending his first few months on the job talking to as many people in the Caltech community as he can and combing through the Institute's Archives to get a better sense of the institution.

NEW FUND GRANT WILL AUTISM STUDY

Caltech neuroscientist Ralph Adolphs has been awarded a \$120,000 grant from the Cure Autism Now foundation to study the way that autistic patients process information about other people's facial expressions.

The funding will support Adolphs's ongoing work to understand the role of a brain structure, known as the amygdala, in certain disorders that make it difficult for sufferers to interpret other people's emotions. Adolphs is a professor of psychology and neuroscience at the Institute and holds a joint appointment at the University of Iowa College of Medicine.

According to Adolphs, the grant will lead to progress in understanding how the amygdala may be involved in autism, and to possible ways for people with autism to improve their social functioning.

Earlier studies have shown that persons with autism have a hard time looking with sufficient attention at the faces of others to read emotions. Yet there is tantalizing evidence that the problem may not be entirely an inability to read facial expressions, but rather the lack of ability to focus attention on faces long enough to properly process and interpret expressions. Better knowledge of how people with autism look at faces could result in intervention strategies where they could be coached to focus their attention on facial expressions, even though they have no natural inclination to do so.

The pilot research award will be earmarked for a two-year period. Adolphs says that the first year of funding will involve a close study of how subjects view faces, followed in the second year by fMRI studies using Caltech's new scanners.

"If our hypotheses are supported, the implications might be dramatic for rehabilitation," Adolphs says. "In a sense, we could be helping people with autism to see the world socially by telling them specifically how to look at the world with their eye movements."

Founded in 1995, the Cure Autism Now foundation is an organization of parents, clinicians, and leading sci-

Hall . . . from page 5

but I'm sure there are experts somewhere who have studied the best methods of teaching today's students. Professors could attend seminars, and we could go and learn and get excited and go back to the classroom and be invigorated.'

Hall also wants to help tweak Caltech's legendary core-curriculum workload, and examine whether students are able to learn subjects holistically, as opposed to tackling only what is required to complete a particular problem set. "We throw all this material at them and don't always get a sense of how well they digest it. We might be better off throwing a little less material at them and having it understood better." At the same time, Hall notes that the "core" is a key distinguishing characteristic of Caltech and a requirement that fosters excellence in students.

Above all, Hall says that he considers open communication with students absolutely essential to the job. "Attending college is an interesting time in a person's life. Young people are away from home and trying to figure out what they are going to do with their careers. There is a potential for interaction that's very meaningful and it's a positive thing."

Fuel cells . . . from page 4

system. These advances were achieved here at Caltech.

"The third involves catalysts developed at Northwestern University that cause sufficient heat release to sustain the temperature of the fuel cell." In addition, a linear counterflow heat exchanger makes sure that the hot gases exiting the fuel cell transfer their heat to the incoming cold inlet gases.

Although the technology is still experimental, Haile says that future collaborations with design experts should tremendously improve the fuel efficiency. In particular, she and her colleagues are working with David Goodwin, a professor of mechanical engineering and applied physics at Caltech, on design improvements. One such improvement will be to incorporate compact "Swiss roll" heat exchangers, produced by collaborator[®]Paul Ronney at USC

"There is a special organizational genius about this place that is still a mystery to me," he says. "How Caltech can replicate itself at the scale of excellence with the number of faculty it has is amazing. If you gave me \$4 billion, I don't think I could re-create Caltech. There's something about the positive genius for identifying, recruiting, and supporting faculty that makes extraordinary results happen."

Most institutions direct their research into areas for which ample funding already exists, Currie says. "At Caltech, the faculty asks, 'What are the interesting questions?' and then they find the funding to pursue the answers. This place is so different. It has a powerful but not obvious capacity to sustain itself at an extraordinary level."

Currie says that he knew before coming to Caltech that the Institute had recently gone through a period of belt-tightening, including a salary freeze in 2003. Although Caltech's endowment has recently bounced back to \$1.32 billion, after falling from \$1.57 billion to \$1.09 billion three years ago, Currie predicts that there are still tough times ahead.

"It appears to me that there is a structural deficit here that goes back a long way," he says. "We inherited a situation where our predecessors probably spent more of

Continued on page 20 . . .

entists committed to accelerating the pace of biomedical research in autism through research, education, and outreach.

Since its founding, the organization has committed over \$23 million to research, to the establishment of and ongoing support for the Autism Genetic Resource Exchange, and to numerous outreach and awareness activities aimed at families, physicians, governmental officials, and the general public.

ROBERT TINDOL

As for applications, Haile says that the sky is literally the limit. Potential applications could include the tiny flying robots in which the defense funding agency DARPA has shown so much interest in recent years. For everyday uses, the fuel cells could also provide longer-lasting sources of power for laptop computers, television cameras, and pretty much any other device in which batteries are too heavy or too short-lived.

In addition to Haile, the other Nature authors are Zongping Shao, a postdoctoral scholar in Haile's lab; Jeongmin Ahn and Paul D. Ronney, both of USC; and Zhongliang Zhan and Scott A. Barnett, both of Northwestern.

ROBERT TINDOL

Out of Manzanar



"I thought, 'If they can build an atomic bomb and call it the Manhattan Project, maybe I can help stop famine and call it the Manzanar Project. Maybe it's my romantic nature," says Gordon Sato, PhD '56, who has devoted much of the last 20 years of his life to alleviating hunger in the Horn of Africa nation of Eritrea. He was on his way there for the first time when he decided to name his antihunger project after the Manzanar relocation camp in the California desert, where he and his family, along with thousands of other Japanese Americans, had been interned during World War II. Arriving in Eritrea, he found the country locked in a brutal struggle for independence from Ethiopia, whose attempts to starve the rebel nation into submission had unleashed widespread famine in the region. The intense, soft-spoken American biologist won the trust of the rebel leadership, and with the support of the Eritrean military established an ocean-based fish-farming operation in a village on the country's northern coast, which produced high-protein food for the wounded.



800,000 mangrove trees along the Eritrean coast. Many more are on the way.

Gordon Sato was 14, living in Southern California, when the forced resettlement of the state's Japanese Americans turned his life ubside down and left him with an intense desire to see some good come out of his Manzanar experience. In 1950 an unlikely chain of events led him to Caltech, where he did his graduate work with Max Delbrück. In 1958, he joined Brandeis University as a professor of biochemistry, and in 1969 moved to UC San Diego, where he was a professor of biology until 1983. From 1983 to 1992, he was a director of the W. Alton Jones Cell Science Center in Lake Placid, New York. Elected to the National Academy of Sciences in 1984, Sato, now 78, spent much of his research career investigating how tissue culture cells could be transformed

Biologist Gordon Sato stands before one of the many mangrove forests that his Manzanar Project has planted in the Red Sea waters off Eritrea (see map, left). In June, Sato was honored with the Blue Planet Prize for his two decades of pioneering work to alleviate hunger in the East African nation. The \$500,000 international environmental award recognized him "for achievements that ... are demonstrating to the world the importance of a way of living which regularly uses the technology of environmental conservation and humanity."

into cells representative of those in living organisms. This work has led to a new understanding of the complexity of hormonal

By the time Eritrea won its independence in 1991, Sato had committed himself and the Manzanar Project to creating new and permanent opportunities for sustainable development in the East African nation. When fish-farming proved to be too laborintensive for the country's fragile infrastructure to support on the scale he had envisioned, he turned to mangrove cultivation, which, as he explains in the following interview, has the potential to spur food production all the way up the Eritrean food chain and provide a thriving, low-tech means of enhancing economic well-being. To date, the Manzanar Project has planted some requirements in the body's cells and holds tremendous promise for the development of new cancer therapies.

In the mid-1970s he began a series of experiments in the California desert near the Salton Sea to develop a form of algae that could grow successfully in salt water. "Many of the faculty members at UCSD thought I had gone bonkers," recalls Sato, who nevertheless kept at his efforts, inspired by his memories of Manzanar where the "food was so awful we began looking for ways to grow our own in that harsh desert environment." Blue-green bacteria are extremely high in protein, and Sato felt that they had exceptional promise as a food source in agriculturally barren regions of

"We're working very hard to perfect a lowtech sustainabledevelopment program that can be readily exported to many regions of the world where hunger has been an enduring problem."

the world. In 1986, he brought his expertise and convictions with him to Eritrea. "From one who experienced the camp," says the website for the Manzanar Project, "comes an effort to create a proud though bittersweet remembrance, to further memorialize the Japanese Americans and their hardships in a way that is appropriate to their character."

Over the last 20 years Sato estimates that he has poured at least half a million dollars of his own money into the Manzanar Project, but his financial prospects have recently taken an upward turn. In 2002, he received a \$100,000 Rolex Award, presented every two years by the Swiss watchmaker in recognition of innovative and pioneering projects intended to foster "a spirit of enterprise around the world." And the recent FDA approval of the drug Erbitux for treatment of colon cancer could bring Sato additional revenues of up to several hundred thousand dollars a year, according to some estimates. The drug owes its genesis to work carried on in Sato's UC San Diego lab in the 1970s; he and his son, J. Denry Sato, are two of the four inventors credited on the patent.

This past May, Sato returned to his alma mater to receive the Institute's highest



In 1942, at age 14, Gordon Sato and his family were sent to the "Manzanar War Relocation Center" in California's Owens Valley. This Library of Congress photo is one of many taken by famed photographer and human rights activist Ansel Adams to document the grave injustices meted out to the nation's Japanese Americans after the December 1941 attack on Pearl Harbor.

honor, the Distinguished Alumni Award (see related story, page 17). In late June came word that he had been awarded the \$500,000 Blue Planet Prize for 2005 by the Tokyo-based Asahi Glass Foundation. Established in 1992, the international environmental award, which has been called the Nobel Prize of ecology, is presented every two years "to individuals and organizations that make outstanding achievements in scientific research and its application, and in so doing help to solve global environmental problems." Sato was recognized "for developing a new mangrove planting technology in Eritrea. . . . His achievements, which have proved a practical measure to enable economic self-sustainability in the poorest area of the world . . . are demonstrating to the world the importance of a way of living which regularly uses the technology of environmental conservation and humanity."

In this interview, Sato discusses the Manzanar Project, his memories of the Manzanar internment camp, and his experiences at Caltech. He was interviewed on separate occasions for Caltech News by Heidi Aspaturian, editor of Caltech News, and Daryn Kobata, editor of the campus community biweekly Caltech 336.

What inspired you to begin the Manzanar Project? Had you known much about the area or the Eritrean struggle for independence before that?

I had met a scientist at a National Research Council meeting who had told me a lot about Eritrea, and I had talked to Eritreans in Washington, D.C., but essentially I just went. I didn't really know much about the area or its language or culture. I just wanted to do something to help.

Now when you first started it, the hunger project was more of an aquaculture initiative?

Yes, with a focus on fish farming. We had to produce food quickly to ease the suffering from famine, and so we put the emphasis on that. We kept that project going for about two years, while the war was still being fought. After the Eritreans achieved independence, the situation became more complicated. Fish farming is sustainable in the long term, but it takes a lot of labor and money to get it organized and to keep it going. During the war, I had all the help of the army for this type of intensive labor effort, but after the war, they had other priorities.

So how did you then decide to transition to mangrove cultivation?

els eat them, and that was about the extent of it. It had never occurred to them these trees might provide food for sheep and goats-that the seeds could be dried and fed to their livestock. They also didn't realize that the seaweed that washes up on shore in great amounts could be dried and processed and used as animal food. This is something that had been done for centuries in Ireland, but it was a new concept in Eritrea, where sheep and goats have traditionally grazed freely on grass and other vegetation. They would eat the trees-the acacia thorn bush, for instance-but each year the supply dries up within a few months, which means that the farmers and herders have to repeatedly move farther into the mountains with their animals in hopes of finding more food. It's a very unreliable form of subsistence.

So it sounds like growing mangroves is actually addressing several sustainable resource issues. It's providing food and preventing deforestation at the same time.

Yes, And the mangrove forests that we've planted are quite beautiful. The thing about mangroves is that they can grow in seawater, and we're planting thousands of them in the intertidal zones along the Eritrean coast. We wanted to optimize growing conditions, so we experimented to identify the mangroves' pH tolerance range, and we also developed an ammonium phosphate and iron solution that provides the trees with essential minerals that they cannot get in sufficient amounts from the seawater. We grow the trees from small plants, and these new plants have thrived.

There has been some criticism to the effect that the amount of fertilizer used in mangrove cultivation might destroy local coral reefs. Can you comment on that?

I'm familiar with that viewpoint. My own view is that there are people who are pursuing their own selfish agendas and have no interest in getting a firsthand look at what we're actually accomplishing. We have measured the fertilizer from our planting, and there is none polluting the sea. We have developed ways of releasing fertilizer so that it goes slowly to the trees in just the needed amounts. These people who claim that we cause damage are awful—and you can quote me on that. There's one critic in particular who claims to be an expert on biodiversity, who could have come out and measured the amounts of fertilizer we're generating. He hasn't done that in two years. He could have come to see for himself if coral reefs are in fact, as he claims, dying, and he hasn't done that either. If



Sato is joined by members of the local population who are working with him on the Manzanar project.

I was in an area with mangrove trees, and I noticed the camels eating them. I got the idea that the trees could also supply food for sheep and goats. There was lots of available space for growing mangroves, so it seemed like an obvious solution. Initially, I had to figure out how best to grow them and how to make the mangroves good food. We found that mangroves would be adequate food for livestock, as long as they were supplemented by a small amount of fish meal prepared from fish waste. It's been a lot of work.

Had the Eritreans been using mangroves before that?

Not really. They had let the cam-

Continued on page 21 . . .

Friends

there's only **one.caltech**

CAMPAIGN HIGHLIGHTS

Following closely on the heels of the Institute's 2005 commencement festivities, construction crews began the 14-month renovation and restoration of Caltech's south undergraduate houses. The \$36.4 million project will vastly improve the facilities' infrastructure, renovate living and gathering spaces, and restore historic architectural details. In the meantime, Blacker, Dabney, Fleming, and Ricketts residents will move into temporary housing that has been constructed in the northeast area of campus. The South Houses complex is scheduled to reopen in September 2006, in time for the start of the 2006-2007 academic year.

Leadership commitments to the renovation of the South Houses already include \$2 million from Caltech Trustee and Fleming House alumnus Alex Lidow '75; \$1.5 million from an anonymous donor; and \$1.5 million from the estate of Fred V. Maloney '35, MS '36.

Progress is also being made on several other campaign priorities. With the design-programming phase completed, the Cahill Center for Astronomy and Astrophysics' architect Thom Mayne (2005 winner of the prestigious Pritzker Architectural Prize) and his architectural firm, Morphosis, have begun the schematic design. The center's formal design phase will follow sometime in the fall. In addition, Caltech's Architecture and Engineering Services will begin reviewing potential contractors.

The Institute selected another Pritzker Prize-winning architect, Rem Koolhaas, for the new Walter and Leonore Annenberg Center for Information Science and Technology. Koolhaas's firm, the Office for Metropolitan Architecture (OMA), and Gruen Associates will design the facility. Both firms are credited with numerous well-known and critically acclaimed buildings. The Annenberg Center for Information Science and Technology will serve as the interdisciplinary home for Caltech's IST initiative, which is bringing together people from different academic specialties to redefine the ways we approach, understand, and implement information science and technology-the first activity of its kind in the nation organized at an institutional level.

Recent funding is helping to focus the spotlight on innovative research projects. The Bill and Melinda Gates Foundation, for example, announced the award of a \$13.9 million grant to Caltech in support of the Engineering Immunity project led by Caltech president David Baltimore and Pamela

Bjorkman, biology professor and Howard Hughes Medical Institute investigator. Baltimore and Bjorkman aim to attack the problem of creating immunity against HIV, using adult stem cells for gene therapy that would facilitate the production of special antibodies capable of binding to and neutralizing the virus. Engineering Immunity is among 43 projects receiving funds through the Grand Challenges in Global Health Initiative-a competition announced by Bill Gates two years ago to find new ways to attack the greatest health challenges facing people in poor countries.

The Gordon and Betty Moore Foundation has awarded a \$17.5 million grant to Caltech in support of Ultrafast Science and Technology (UST). Under the direction of Ahmed Zewail, UST will focus on fundamental studies of molecular complexity, the development of technology for ultrafast imaging with atomic-scale resolution, and applications to real physical, chemical, and biological systems.

Other gifts include a \$3 million pledge from Trustee Mia Frost to support activities in the Division of Biology. The commitment will fund the Camilla Chandler Frost Endowed Fund for Biology to provide resources for such activities as space renovation, equipment purchases, and launching the research activities of new faculty within the division.

Moreover, the Caltech Associates have set their sights on raising the final \$1 million of Caltech's funding commitment for the Combined Array for Research in Millimeter-Wave Astronomy (CARMA). The \$15 million CARMA initiative relocates the Owens Valley Radio Observatory (OVRO) and the Berkeley-Illinois-Maryland telescope array (BIMA) to a site in California's Inyo Mountains with improved atmospheric transparency. The project will create a frontline instrument for future studies of the formation of planets, stars, galaxies, and of the large-scale structure of the universe. The Associates hope to complete the funding in time for CARMA's first light in fall 2005.

As of June 30, 2005, gifts and pledges to the campaign totaled \$1,048,409,081. Want to learn more? Visit the now-expanded campaign website at http://one.caltech.edu for more information about these and other exciting campaign projects!

VANNESSA DODSON



Around 50 Caltech Associates and Torchbearers gathered for a special tea in April in Caltech's Athenaeum to hear Faculty Associate in Biology Alice Huang speak "On Women: Smarts and Power," a look at the advances that women have made in science over the past 35 years. Those attending included Associates presidentelect Cathleen Godzik (right),

Recognition . . . from page 5

tions to their disciplines and to society at large."

Jacqueline Barton, Hanisch Memorial Professor and professor of chemistry, has received an honorary doctor of science degree from Yale University. Public Service Medal, in recognition of "exceptional scientific achievement in ultraviolet astrophysics and contributions to the success of the Galaxy Evolution Explorer." Martin is principal investigator for JPL's Galaxy Evolution Explorer, an orbiting space telescope that, working in the ultraviolet range of the electromagnetic spectrum, is mapping the history and evolution of galaxies and star formation in the universe. John Preskill, MacArthur Professor of Theoretical Physics, has been chosen as the 2005 Lawrence C. Biedenharn Lecturer at the University of Texas at Austin. He will give a series of lectures on quantum mechanics during the fall. The Biedenharn Lectureship in Physics was established by Sarah Biedenharn in honor of her late husband's contributions to the field. A former adjunct professor in UT Austin's physics department, Biedenharn was noted for having carried out important research in quantum physics.

shown here with Huang.

Charles Elachi, PhD '71, Caltech vice president, director of JPL, and professor of electrical engineering and planetary science, has been honored with a Laureates Hall of Fame Award at Aviation Week and Space Technology's 48th Annual Aerospace Laurels Awards. Honorees are nominated by the editors of the aerospace magazine for "extraordinary individual and team accomplishments in the global aviation, aerospace and defense industries." The award recognizes Elachi's leadership of the Mars Exploration Rover program, whose team is searching for signs of life on Mars, and of the Cassini mission team, which is investigating the mysteries of Saturn's moon Titan.

Chris Martin, professor of physics, has received his second NASA

Associates Activities

All events will be held at the Athenaeum unless otherwise noted. Individual invitations for each event will be sent monthly. For more information about the Associates, contact Carrie Stubstad at 626/395-3919, or at associates@dar.caltech.edu.Visit the group's website at http://giving. caltech.edu/CA.

September 10–25, 2005, President's Circle Trip—"A Journey through the Habsburg Empire," with Warren Brown, associate professor of history.

October 1, 2005, President's Circle Garden Party, President's Residence.

October 16, 2005, President's Circle Event at the Huntington Library—"All Was Light: Isaac Newton's Revolutions, Part II," with Mordechai Feingold, professor of history.

November 3, 2005, Associates Reception, Dinner, and Program— "The Science of Investing," with Brad Cornell, visiting professor of finance.

November 14, 2005, President's Circle Reception, Dinner, and Program—"The Environmental Impact of Microbes," with Dianne Newman, Luce Assistant Professor of Geobiology and Environmental Science and Engineering.

December 1, 2005, *Associates Luncheon*—"Planets Past Pluto," with Michael Brown, professor of planetary astronomy.

January 2, 2006, Associates Rose Parade Event.



ALUMNUS OFFERS SURF MATCHING OPPORTUNITY TO FELLOW GRADUATES

As a hands-on research experience for very young scholars, Caltech's Summer Undergraduate Research Fellowships (SURF) program can't be beat, but one Institute alumnus has made a definite commitment to matching it. As part of the "There's only one. Caltech." campaign, the alumnus (who wishes to remain anonymous) and his wife will donate a matching gift of up to \$50,000 to complement any SURF gift or pledge of \$75,000 or more from an alumnus or group of alumni. The full cost of a SURF scholarship endowment is \$125,000, so that an alumni gift of, for instance, \$100,000, would be matched by a \$25,000 donation.

A SURF endowment, which may be named as the donor or group of donors designates, creates a stipend in perpetuity for one student each summer. Students are listed with their named endowments in all SURF materials, and donors are acknowledged in student presentations and publications. Endowment contributors are invited to attend SURF events, including the annual Donor-Student Dinner and SURF Seminar Day.

For the past 27 years, the SURF program has offered Caltech undergraduates the opportunity to experience firsthand the rewards and challenges of conducting university-level research in a collegial and stimulating environment. Students collaborate with mentors to define and develop a project and then write research proposals that are reviewed by a faculty committee. Students whose proposals are approved carry out the work over a 10-week period in the summer before submitting the results in the form of both a technical paper and an oral presentation at SURF Seminar Day, a symposium modeled on professional meetings. Each participant receives a \$5,000 stipend for the 10-week period.

The relationship that develops between mentors

and students is the essence of SURF. Collaborating with their faculty mentors and other members of a research group, SURFers take on intellectual ownership of their projects as they learn new research skills and techniques and begin to discover what kinds of careers they want—or don't want—to pursue. Sometimes the collegial partnerships between mentors and students last long after graduation, developing into professional collaborations.

"Students don't learn to love science from taking courses," says Harry Gray, the Beckman Professor of Chemistry and mentor to 60 SURF students since 1981. "They discover what they want to do by being in the lab. SURF gets students into research labs and gets them talking with people about what is going on. Students find out what they are good at and what they like best."

Students, for their part, find unique value in SURF. Electrical engineering major Haomiao Huang '05, who worked with Richard Murray '85, chair of Caltech's Division of Engineering and Applied Science, sums up the views of many, saying, "It's a really great chance to learn something and actually apply it, as opposed to just doing problem sets or writing up a paper and never touching the subject again."



For their SURF project last summer, Caltech undergrads Lyle Chamberlain (left) and Haomiao Huang spent 10 weeks working on "Bob," the autonomously controlled vehicle that Institute students designed and built to compete in the 2004 DARPA Grand Challenge race organized by the Defense Advanced Research Projects Agency of the U.S. Department of Defense. "I've probably learned more from working on the Challenge than doing anything else at Caltech," says Huang. "It was immensely satisfying to see Bob driving off on its own the first time. Now we're going on to the second generation, and I'm very excited about what we're doing."

NAS . . . from page 4

PhD '83, professor of physics and astronomy, the Institute for Astronomy, University of Hawaii; Joseph Polchinski '75, professor of physics and permanent member of the Kavli Institute for Theoretical Physics, UC Santa Barbara; Charles Rice, PhD '81, the Greenberg Professor and head, Laboratory of Virology and Infectious Diseases, Rockefeller University; George Schatz, PhD '76, the Morrison Professor of Chemistry, Northwestern University; and Ellen Williams, PhD '82, Distin-

In April nearly 150 Caltech Associates, their children, and grandchildren took part in a special tour of JPL's Von Kármán museum as part of the Associates Family Saturday at JPL. The outing included a welcome by the lab's deputy director, Eugene Tattini, as well as tours, lunch, and a program, "JPL Looks at Earth from Space," presented by Randall Friedl, chief scientist of JPL's earth science and technology directorate. Alumni Karen Roberts '74 and James Sagawa '63 have already taken advantage of the opportunity to match their gift to SURF. "This grant made it possible for us to fund an endowment in memory of my father, Dr. Ernest R. Roberts," says Roberts. "He and my mother donated to SURF for many years, and we feel setting up this fellowship in his name is a wonderful way to honor his memory, but we could not have done it without the match."

SURF offers many members of the Caltech community—mentors, alumni, and friends and supporters—a range of ways to invest in the Institute's multitalented undergraduates. The SURF Matching Gift offer provides a remarkable opportunity for alumni to contribute to the future of the Institute, the SURF program, and Caltech students.

(a) provide the latter of the providence of the second se Second seco guished University Professor, department of physics, University of Maryland, College Park.

The National Academy of Sciences is a private organization of scientists and engineers dedicated to the advancement of science and its use for the general welfare. It was established in 1863 by a congressional act of incorporation signed by Abraham Lincoln, which calls on the academy to act as an official adviser to the federal government, upon request, regarding any matter of science or technology. Alumni **Update**

THE ALUMNI ASSOCIATION WANTS YOU-VOLUNTEER EFFORTS STRENGTHEN THE CALTECH CONNECTION

I was down on campus at the Alumni House last winter and idly asked, "How many volunteers does the Alumni Association have?" I was staggered when the answer came back—"750 to 1000."

"What," I asked, "do all those volunteers do?" Actually, I knew that most of them had to be admissions volunteers. Karen Carlson, who is responsible for Association activities related to admissions, tells me that there are 660 volunteers who speak at information sessions, visit high schools, attend college fairs, socialize with high-school students at receptions, and talk individually with potential applicants who want to know more about Caltech.

Karen was actually the start of my own volunteer involvement with the Institute. It has been 20 years since she called me to say that she needed an alumna to visit an all-girls' high school in the Bay Area, where I live.

As I think about it, Karen is ultimately responsible for the very busy year as president that I'm just wrapping up. I agreed to do that one



Speaking of volunteers—The 2005–06 executive officers of the Caltech Alumni Association are (from left) Kelly Beatty '73, secretary; Angie Bealko '96, vice president; Ponzy Lu '64, president; Stephanie Charles '73, past president; and Bob Kieckhefer '74, treasurer.

high-school visit, and one thing led to another. Someday, after I've forgotten how much work this year has been, I'll probably thank her.

As an admissions volunteer, I've gotten to know the counselors at local high schools, and I enjoy talking each year with fresh groups of eager (and



Above: The Caltech unveiling of the Feynman stamp, one of four in the "American series issued in the spring by the United States Postal Service, took place on May 20 in Beckman Auditorium before a large and enthusiastic crowd of campus community members and Institute alumni returning to their alma mater for Seminar Day/Reunion Weekend. Among those participating in the tribute to the late Caltech professor of theoretical physics and 1965 Nobel laureate were (from left) Tom Tombrello, chair of Caltech's physics, math, and astronomy division; Feynman's sister, JPL scientist Joan Feynman; his daughter, Michelle; and Kip Thorne '62, who studied with Feynman as an undergraduate and is now the Feynman Professor of Theoretical Physics. Left: Outside Beckman Auditorium, the return of the Feynman van, still covered with the Feynman diagrams that Feynman invented in the 1940s to help him understand and illustrate subatomic particle interactions, reminded attendees of the physicist's power to move his audiences.

ever younger-looking) students. Karen tells me that some admissions volunteers, such as Mike Boughton '55, have cultivated such close relationships with high-school counselors that the counselors call them when a particularly promising student turns up.

Like many admissions volunteers, I have also gotten involved in information sessions and receptions. My most memorable moment? Perhaps it was when a mother walked up to me and said that she had opposed her daughter's going to Caltech until, seeing me, she realized that a woman could graduate from Caltech and still wear skirts and speak in whole sentences. Or it could have been the young man who asked me a whole lot of questions, wandered off, then came back later, and asked me very similar questions all over again. It turned out he was actually twins. Both of them had been admitted and wanted to pick my brains about Caltech.

I asked Karen where she gets so many volunteers, and she told me that mostly, as she did with me, she just asks. If she needs a volunteer in a particular region, she finds alumni living in that area and starts calling. I can personally attest to how effective she is at this. Of course, sometimes a graduating student or an alum hears about admissions volunteer activities and contacts Karen, which makes it that much easier for her to maintain a strong network of volunteers. But back to my conversation last winter. "If admissions volunteers account for 660 of our volunteers, what do the others do, and why don't we know how many there are?" I asked. Karen told me that we have quite a number of alumni who participate in career conferences, meet with students over lunch to talk about career paths, mentor students, and even critique student résumés at the ever-popular Resumania. There is a lot of overlap

among different groups of volunteers, which explains why it is so hard to pin down the total number.

Most of us are involved in these activities because we enjoy it, but there can be more tangible benefits. Steve Wurst '78 has participated in several small lunches with students over the years, talking about his career in the aerospace industry. Although these were just supposed to be informational lunches, he wound up hiring one of the students who attended his last lunch. His company was so happy with the new recruit that they've encouraged Steve to do more informational lunches at Caltech.

Alumni Association volunteers do much more than just support students. One of Karen's colleagues, Patsy Gougeon, works with nearly 110 volunteers on the Seminar Day committee and 15 reunion committees. These committees organize and run the many festivities on campus during the third weekend of May each year. Yet another Association staffer, Mary Said, works with perhaps 50 volunteers around the country who organize regional events.

Although the Alumni Fund is a separate organization from the Alumni Association, I would be remiss if I failed to mention that they also rely on volunteers, even more than we do. Fund volunteers tell me that they enjoy the opportunity to talk to classmates and other alumni while soliciting support for the Institute.

Most of us lead very busy lives and may not have the time to volunteer while we pursue careers and raise families. Until recently I had focused on events and publications as ways of building and maintaining alumni relationships with the Institute. However, for those alumni who have some time and would enjoy a closer connection to Caltech than they get from reading *Caltech News* and attending an occasional event, becoming a volunteer is a



great way to do that.

On that thought, I end my last letter for *Caltech News*. Ponzy Lu '64 will have become president of the Alumni Association by the time you read this. Although I'll no longer be president, I expect to continue volunteering for Caltech for many years to come.

Stephanie Charles

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From left, Jane Dietrich, Larry Gilbert, and John Baldeschwieler were welcomed into the Caltech Alumni Association as honorary members at the CAA Annual Dinner on June 10. Dietrich, who retired from the Institute earlier this year, was recognized for her 20 years as editor of Caltech's award-winning research magazine, *Engineering & Science* and also as the Institute's director of periodicals from 1987 to 2005. Gilbert was honored as the founding director of Caltech's Office of Technology Transfer, and for shepherding the Institute into its current position as an acknowledged leader in technology transfer. Baldeschwieler (who was not able to attend the meeting and is pictured here in his Caltech office) was recognized for his academic, research, and administrative achievements, including election to the National Academy of Sciences, receiving the National Medal of Science, serving for five years as chair of the chemistry and chemical engineering division, and contributing in numerous ways to Caltech's technology transfer and entrepreneurship ventures.

RESEARCH, RECOGNITION HIGHLIGHT SEMINAR DAY

On May 21 more than 1,250 alumni and their guests enjoyed hearing about pioneering research under way at the Institute at the Alumni Association's 68th Annual Seminar Day. For many, the highlight of the day was the awarding of five 2005 Distinguished Alumni Awards. Recipients received framed certificates and engraved Tiffany pewter bowls.

Caltech president David Baltimore presented the Institute's highest honor to five Caltech graduates. The new Distinguished Alumni are Mark Davis, bilities to overcome barriers to various kinds of experimentation.

Raymond Orbach '56 is the director of the Office of Science at the Department of Energy, the third-largest federal sponsor of basic research in the United States, and the former chancellor—for 10 years—of UC Riverside.

Gordon Sato, PhD '56, made key contributions to identifying the multiple factors required to culture and cultivate mammalian cells outside the body, work that led him to codevelop the new cancer drug Erbitux. In the

LINK UP WITH LINKEDIN

One benefit of being an Institute grad is belonging to a lifelong network of successful professionals with whom you share the Caltech experience. Alumni can easily activate this network by completing an updated profile on the Alumni Association website at http://alumni.caltech.edu/network.

Now Caltech alumni can further expand their set of contacts and strengthen Caltech connections by joining LinkedIn, a free, private, commercial website that helps participants find inside connections to jobs, industry experts, and business partners worldwide. The "trusted network" model of online business networking allows users to integrate their existing professional network with the Caltech alumni network in a variety of ways.

Within the LinkedIn service is an exclusive Caltech Alumni group, screened by the Alumni Association and limited to members of the Caltech community. This allows alumni to search for contacts and resources who are affiliated with the Caltech community. Visit the Association website to learn more, then visit LinkedIn, at http://alumni.caltech.edu/careers/ linkedin, to sign up.

HELP US LOCATE LOST ALUMNI!

Several of your Caltech classmates are lost! The Alumni Association is always working to ensure that we have the most current and accurate information for each of our graduates. Unfortunately, many former Techers have no current contact information on file. You can help by visiting our Lost Alumni page at http:// alumni.caltech.edu/network/ lost_alumni. If you recognize names on the list, please e-mail us with their contact information at information@alumni.caltech.edu. You can also ask them to contact us directly.

And if you would like to update or confirm your own contact information, log in to the Alumni Network with your 10-digit ID number, which can be found on the mailing label of Caltech News. Log in at http://alumni. caltech.edu/network.

TRAVEL WITH TECHERS IN 2005-06

Many alumni have traveled the world with fellow grads and Caltech faculty leaders. The Alumni Association is offering two new educational travel programs in 2006. Additional information is available on the Association website at http://alumni.caltech.edu/learning/travel. You can also contact the Alumni Association at 626/395-6592, or send an e-mail to travel@alumni.caltech.edu.

March 22-April 1, 2006

Total Solar Eclipse in the Aegean Sea Aboard SV Panorama

This seaborne educational tour, led by the Anthony Professor of Planetary Science Andrew Ingersoll, is specifically designed for viewing the total eclipse of the sun that will take place in the eastern Mediterranean on March 29, 2006. Our exclusively chartered 44-passenger vessel will take up its position on the center-line of totality, so we will be ideally situated to enjoy the maximum duration of this rare event. Throughout the tour, Ingersoll's talks will touch on the science of eclipses;



Caltech president David Baltimore (third from left) presented the Distinguished Alumni Award to (from left) Wilton Webster, Gordon Sato, Leonard Herzenberg, Mark Davis, and Raymond Orbach.

Continued on page 20 . . .

Leonard Herzenberg, Raymond Orbach, Gordon Sato, and Wilton Webster.

Mark Davis, PhD '81, is the Avery Professor of Immunology at Stanford and a Howard Hughes Medical Institute investigator whose studies of T lymphocytes, a major component of the body's immune system, have yielded new insights into how these molecules recognize foreign invaders. Leonard Herzenberg, PhD '56, conceived and oversaw the development of the fluorescence activated cell sorter (FACS), the first of a series of flow cytometry instruments that have become essential tools in biology and medicine, and he has continued to develop new FACS capalast two decades he has won acclaim for the Manzanar Project, a sustainable development initiative that he pioneered in the late 1980s to help alleviate famine in the Horn of Africa nation of Eritrea. (An article on Sato begins on page 12 of this issue.)

Wilton Webster '49, the founder and current senior science advisor at Biosense Webster, a cardiovascular catheter company, was inspired to start his business after a cardiologist showed him how to modify existing catheters by adding thermistors, and he has since adapted these catheters for use with radio-frequency ablation to cure

Continued on page 20 . . .





Caltech alumni will have an opportunity to view next March's total solar eclipse (illustrated in the NASA schematic at left) from a prime location in the eastern Mediterranean, aboard the sailing ship *Panorama* (above).

Notes

1939

Charles Townes, PhD '39, a physics professor at UC Berkeley and winner of the 1964 Nobel Prize in Physics, is the recipient of this year's Templeton Prize for Progress Toward Research or Discoveries about Spiritual Realities. Reputed to be the world's richest annual prize—more than \$1.5 million—the award has this year gone to Townes "for talks and writings about the importance of relating science and religion." A member of the National Academy of Sciences, Townes shared the Nobel with two Russians for research into the principles underlying masers and lasers.

1944

Alfred G. Knudson Jr., PhD '56, a Fox Chase Cancer Center Distinguished Scientist and senior advisor to the president of Fox Chase in Philadelphia, Pennsylvania, has been selected to receive the 28th annual Bristol-Myers Squibb "Freedom to Discover" Award for Distinguished Achievement in Cancer Research. He is being recognized for his groundbreaking "two-hit model," which explains how cancer develops when tumor-suppressor genes are damaged (a "second hit" when the "first hit" of a germline mutation is already present), and which has enhanced understanding of the role of heredity and other factors in causing cancer. The award, a \$50,000 cash prize and a silver commemorative medallion, will be officially presented at the annual Bristol-Myers Squibb Distinguished Achievement Awards dinner, to be held in New York City on October 19. Knudson, who received his MD in 1947 from Columbia, is a member of the National Academy of Sciences, the American Philosophical Society, and the American Academy of Arts and Sciences. He joined Fox Chase Cancer Center in 1976, after a distinguished medical and academic career at City of Hope Medical Center, the State University of New York at Stony Brook, and the University of Texas at Houston.

1951

Richard K. Smyth writes that he and Emilie, his wife of 54 years whom he met at a Ricketts exchange dance in October 1950, have returned to California from Malaga, Spain, and are now living in Lompoc, near Vandenberg Air Force Base. They moved to Malaga after Smyth retired as chief engineer for avionics at

the Autonetics Division of Rockwell International, where he obtained a patent on a special automatic flight-control system for the F-111 fighter-bomber. Besides receiving his PhD in electrical engineering and mathematics from USC in 1963, he earned certificates from the U.S. Air Force as a member of the Scientific Advisory Board and from NASA as a member of the Shuttle Flight Readiness Assessment team. In Spain, Smyth's oldest son took up catamaran racing off the coast of France, and Smyth learned a mathematical method for options trading from a New York trader who sponsored his son. Under the name of Dr. Jon Schiller, Smyth wrote two books on option trading, and he has also developed software for trading index and stock options. His newest book, published by PublishAmerica this year, is titled Self Adaptive Options and Currency Trading for the Volatile Markets of the 21st Century. For readers of his new book, he has also developed Excel-based software packages called SelfAdapStkOp, SelfAdapFutOp, SelfAdapCur, and SelfAdapSigIndicOEX, which use a five-input, three-layer neural network to predict market directional trends. He adds that he learned about the concept of neural networks from the 2004 Caltech Alumni Seminar lecture series on the same subject. In Lompoc Emilie substitute teaches, and they both "attend weekly dances remembering the way they met at a Ricketts House dance almost 55 years ago."

1955

Richard Nielsen, MS '57, a consulting geologist with over 45 years of experience exploring for uranium and precious/base metals, has agreed to direct the efforts of the Canadian firm Vena Resources Inc. to confirm the historical uranium exploration data that has been collected by the Peruvian Institute of Nuclear Energy (IPEN) over the past three decades. A specialist in geologic field evaluation, ore target and model definition, exploration planning, geochemical surveys, and drilling programs, Nielsen earned his PhD at UC Berkeley and has published over 15 technical articles. His clients have included Hecla, Billiton, Homestake, Noranda, Queenstake Resources, Anglogold, Newmont Mining, and Teck.

1957

C. Gordon Fullerton, MS '58, a former astronaut and currently chief research pilot at

Feynman professor of Physics Kip

NASA's Dryden Flight Research Center at Edwards Air Force Base, was inducted into the U.S. Astronaut Hall of Fame at the Kennedy Space Center Visitor Complex in Florida on April 30. Fullerton logged more than 382 hours in spaceflight as a NASA astronaut from September 1969 until November 1986, when he retired from the astronaut corps and joined the research-pilot staff at Dryden. As an astronaut, Fullerton served on the Apollo 14, 15, 16, and 17 lunar-mission support crews at NASA's Johnson Space Center. In 1977, he was assigned to one of the two two-man flight crews that piloted the Space Shuttle prototype Enterprise during the approach and landing test program at Dryden, and in 1982 he piloted the eight-day orbital flight-test mission that exposed the Columbia to extremes in thermal stress and tested the 50-foot Remote Manipulator System used to grapple and maneuver payloads to orbit. In 1985 he commanded the Spacelab 2 mission flown on the Challenger, which carried 13 major experiments in the fields of astronomy, solar physics, ionospheric science, and the life sciences. After graduating from Caltech, Fullerton joined the U.S. Air Force, where he flew both fighters and bombers. In 1966, he was selected to serve as a member of the flight crew for the Air Force Manned Orbiting Laboratory program, which was terminated in 1969. He completed a 30year career with the U.S. Air Force in 1988. retiring as colonel, and at Dryden he continues as a civilian research pilot. He is currently chief of the flight-crew branch.

1958

Eugene Cordes has been elected to the board of directors of Vertex Pharmaceuticals as a nonexecutive member. A member of the company's scientific advisory board from 1995 to the present, Cordes has been a member of the faculty of the University of Michigan at Ann Arbor since 1995, and is the chair of Vitae Pharmaceuticals, a privately held pharmaceutical company. He received his PhD in biochemistry from Brandeis University. Vertex Pharmaceuticals seeks to discover and develop small-molecule drugs for treating viral diseases, inflammation, autoimmune diseases, and cancer.

1963

John E. Baldwin, PhD, distinguished professor and chair of the chemistry department in the College of Arts and Sciences of Syracuse University, has been named to the William R. Kenan Jr. Professorship. Nationwide, only about 120 academics share this honor. A physical organic chemist whose primary field of study involves in-depth experimental examinations of the thermal rearrangements and fragmentations of relatively simple hydrocarbon molecules, Baldwin has been a faculty member at Syracuse since 1984. He is a former Sloan Fellow, Guggenheim Fellow, and Alexander von Humboldt Award winner.

Akihiro Kanamori, a professor in the department of mathematics and statistics at Boston University, has been chosen from nearly 3,500 faculty members at Boston University to receive the Metcalf Award for Teaching Excellence. He and his fellow Metcalf recipient, chemistry professor John E. Straub, were honored at the school's commencement, on May 22, with each winner receiving a prize of \$5,000. "With his knowledge, patience, passion, and wit," according to the university, Kanamori is able to make higher mathematics "enchanting. A brilliant mathematician and an authority on the history of set theory, the science of the infinite numbers, he elegantly conveys to students both the array of complex mathematical concepts on which science is built and the personalities of the scientists who formulated them." The author of numerous journal articles and the book The Higher Infinite: Large Cardinals in Set Theory from Their Beginnings, Kanamori joined the Boston University faculty in 1982 after holding positions at UC Berkeley, Harvard University, and Baruch College of the City University of New York. He received his doctorate from the University of Cambridge, King's College, in 1975.

1971

Clifford M. Will, PhD, has been named the James S. McDonnell Professor of Physics at Washington University in St. Louis. Considered a leading expert in the use of experimental and observational data to explain Einstein's general theory of relativity, Will's research interests encompass the observational and astrophysical implications of general relativity, including gravitational radiation, black holes, cosmology, and the physics of curved space-time. His Was Einstein Right? (1986) was reviewed in The New York Times and also made the newspaper's Christmas Books list that year. The book, which focuses on general relativity and the experiments designed to test it, won the American Institute of Physics Science Writing Award, given annually to the best popular science book. A second edition was published in 1993. His Theory and Experiment in Gravitational Physics (1981, revised 1993) is widely considered that field's bible. A fellow of the American Academy of Arts and Sciences and the American Physical Society, Will came to Washington University in 1981 as an associate professor of physics after seven years at Stanford University and two years as an Enrico Fermi Postdoctoral Fellow at the University of Chicago. He became a full professor in 1985 and has served two terms as department chair (1991-96 and 1997-2002).

1973

J. Kelly Beatty, editor of Night Sky-Sky Pub-



Thorne '62 joined (clockwise, from Thorne's right) former secretary of state Colin Powell, playwright David Mamet, novelist Amy Tan, and World Wide Web inventor Tim Berners-Lee in Wilmington, Delaware, this past April, where the quintet was honored with 2005 Common Wealth Awards of Distinguished Service by the Common Wealth Trust. Thorne and his cowinners were each awarded a medal and \$50,000 "in recognition of their exceptional contributions to the world community." Established by the late businessman and philanthropist Ralph Hayes, the awards "reward and encourage the best of human performance worldwide." Thorne, the "foremost American researcher of black holes and gravitational waves," was honored for his accomplishments in science and invention.

1970

Alexis Livanos, MS '73, PhD '75, corporate vice president and president, Space Technology Sector, Northrop Grumman, has been appointed to the Space Foundation board of directors following the resignation of Wes Bush, who was recently named chief financial officer of Northrop Grumman. At Northrop Grumman, Livanos is responsible for the operations of the Space Technology Sector, which develops a broad range of space, defense, and electronics systems. Founded in 1983 and headquartered in Colorado Springs, the Space Foundation is a national nonprofit organization that works for the advancement of civil, commercial, and nationalsecurity space endeavors and education.

lishing's magazine for beginning stargazers-and executive editor of Sky & Telescope magazine, has been awarded the 2005 Harold Masursky Award for meritorious service to planetary science by the Division for Planetary Sciences of the American Astronomical Society. The highest honor the division bestows on nonscientists, the Masursky Award recognizes "individuals who have rendered outstanding service to planetary science and exploration through engineering, managerial, programmatic, or public service activities." The recipient of a master's degree in science journalism from Boston University, Beatty has reported on planetary science for Sky & Telescope for more than three decades, plus his work has appeared in newspapers such as The New York Times and Boston Globe, on National Public Radio, and as numerous book chapters. He frequently speaks about science in classrooms and at planetary-science conferences, and he is the author of The New Solar System, which is currently in its 4th edition and is used as an introductory textbook at universities

nationwide. He also serves as a mentor in Sky & Telescope's internship program. He will receive the award at the AAS's annual meeting, in September, at Cambridge University, England.

1976

Howard Bubb has been named CEO and chairman of the board of Ambric Inc. He comes to Ambric from Intel Corporation, where he was a vice president and the general manager of Intel's Communications Infrastructure Group, having joined Intel when it acquired Dialogic Corporation, where he was president and CEO. Prior to that he had been senior vice president and general manager at Lexar's Telenova subsidiary. Bubb has also held top management positions at United Technologies, Memorex, and Telex. Founded in 2003 and headquartered in Beaverton, Oregon, Ambric is a "fabless" semiconductor company, designing and developing semiconductor chips while contracting out the manufacturing-fabrication-process to others.

1978

Gary Cox, PhD '83, professor and chair of political science at UC San Diego, has been elected to the National Academy of Sciences. The author of numerous articles in the areas of legislative and electoral politics, as well as several awardwinning books, he has most recently coauthored *Elbridge Gerry's Salamander*, which analyzes the political consequences of the reapportionment revolution in the United States. His most recent honors include the 2004 Chancellor's Associates Award for Excellence in Research and the 2004 Riker Prize. A former Guggenheim Fellow, Cox was elected to the American Academy of Arts and Sciences in 1996.

1979

Ann R. Karagozian, MS, PhD '82, has been appointed by General John Jumper, chief of staff of the Air Force, and Michael Dominguez, acting secretary of the Air Force, to be the next vice chair of the Air Force Scientific Advisory Board. The three-year term commences in October. She has also recently been elected a fellow of both the American Physical Society and the American Institute of Aeronautics and Astronautics. A professor in UCLA's department of mechanical and aerospace engineering since graduating from Caltech, she specializes in fluid mechanics, combustion, and propulsion systems.

1980

John M. Cimbala, MS, PhD '84, professor of mechanical engineering at Penn State, is coauthor of a new undergraduate fluid-mechanics textbook: Cengel, Y. A., and Cimbala, J. M., Fluid Mechanics: Fundamentals and Applications New York: McGraw-Hill, 2006). Intended for junior or senior undergraduate engineering students, the book's objectives are to cover the basic principles and equations of fluid mechanics; to present numerous and diverse real-world engineering examples to give students a feel for how fluid mechanics is applied in engineering practice; and to develop an intuitive understanding of fluid mechanics by emphasizing the physics, and by supplying attractive figures and visual aids to reinforce the physics.

director, Chiu will be responsible for managing the research portfolio of the Institute and for organizing and directing the review of research grant applications. A developmental neurobiologist, Chiu is currently associate director of the Office of Research Administration of the National Institute of Biomedical Imaging and Bioengineering-one of the National Institutes of Health-where she oversees grants management and extramural review and policy programs, and serves as the executive secretary of the National Advisory Council for Biomedical Imaging and Bioengineering. Previously she was program director of stem cell research and of spinal cord injury at the National Institute of Neurological Disorders and Stroke. In 2004, she received the NIH Director's Award for "outstanding contributions to the development of stem cell research." Before coming to the NIH, Chiu was a tenured associate professor at the Beckman Research Institute of the City of Hope, in Duarte, California.

1990

Mark Adler, PhD, has been named Engineer of the Year by Drexel University as part of its celebration of National Engineer's Week. The honor is in recognition of "his vital role in the development of the Mars Exploration Rovers." Adler presented two talks. The first was an overview of Mars exploration given to undergraduate and graduate students from the school of engineering. The second, given during the awards banquet held at the historic Union League in Philadelphia, Pennsylvania, was a keynote address highlighting the *Spirit* mission.

1991

(Charles) Glenn Boyd, PhD, has joined Barclays Capital, the investment banking division of Barclays PLC, as a director and head of mortgage strategy. Based in New York, he will be responsible for building the mortgage research team that will support the residential mortgagebacked securities (MBS) business. He joins the firm after five years at UBS (as the merger of Union Bank of Switzerland and Swiss Bank Corporation is known), where he was a director in their mortgage strategy group, specializing in prepayment. At UBS, he was part of the team that achieved top ranking in MBS prepayment from Institutional Investor magazine. Prior to that, Boyd was in the mortgage strategy group at CSFB (Credit Suisse First Boston).

David J. Park, a major in the U.S. Marine Corps, writes, "Lisa and I are moving to Iwakuni, Japan, in June 2005. I completed my tour as an instructor for the United States Naval Test Pilot School. I am being assigned to an operational Marine Corps Aviation Group (MAG-12) in Marine Corps Air Station Iwakuni. Lisa and I will be there for three years. Our mailing address is updated and my personal e-mail address will stay the same. Contact us, if you ever come down to the Hiroshima area." also spent several years at Bell Laboratories, Lucent Technologies, where he played a key role in developing Lucent's optical networking products, and received the prestigious Bell Labs President's Gold Award.

1994

Milan Mrksich, PhD, a professor in the University of Chicago's department of chemistry, has been selected as an investigator by the Howard Hughes Medical Institute. With a focus on engineering the interface between cells and surfaces, Mrksich as a postdoctoral fellow helped transform an inexpensive process for making computer microchips into a method for controlling the shape, position, and function of living cells, which provided insight into how mammalian cells decide to grow, differentiate, move, or die. As an HHMI investigator, Mrksich will continue to work in his university laboratory as an employee of HHMI, which will also pay for his laboratory space at the university. His five-year appointment will provide long-term funding with no annual-report or grant-renewal requirements.

Richmond Wolf, MS, PhD '97, director of Caltech's Office of Technology Transfer (OTT), has agreed to join the nanotechnology company Arrowhead Research Corporation as chair of its advisory board. He will in addition serve as a key consultant, assisting Arrowhead and its subsidiaries with technology development and with identifying strategic opportunities. As OTT director, Wolf is responsible for the management and licensing of intellectual property developed at Caltech and JPL, which includes over 2,000 issued and pending patents. While at Caltech he has worked with technology start-up companies from Caltech and JPL in areas of business and product development, and he is cofounder of two companies. A member of the board of directors of Alexandria Real Estate Equities, he is or has been a member of the advisory board of ITU Ventures, Oak Grove Systems, the Los Angeles Regional Technology Alliance, and the Egg Factory, and an observer on the boards of several other start-ups.

1999

Shana Kelley, PhD, assistant professor of chemistry at Boston College, was presented an award for distinguished research at the college's annual Faculty Day luncheon, held on May 9. Kelley, who joined the faculty five years ago, is known for her work on understanding and detecting DNA damage. "Shana Kelley, from my perspective, ranks among the brightest young chemists exploring problems in chemical biology," said Jacqueline Barton, Hanisch Memorial Professor and professor of chemistry at Caltech. Kelley's honors include the Research Corporation Innovation and National Science Foundation Career awards, and selection as an Alfred P. Sloan Fellow. MIT's Technology Review magazine named her a "Top 100 Innovator" last year.

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Name	

1981

Arlene Chiu, PhD, has been appointed director of scientific programs and review at the California Institute for Regenerative Medicine, which was established in 2004 with the passage of Proposition 71, the California Stem Cell Research and Cures Initiative, and which will be responsible for disbursing \$3 billion for stem cell research to California universities and research institutions over 10 years or more. As

1992

Jianhui Zhou, MS, PhD '95, has joined Com-Ventures, a venture-capital firm focused on early-stage communications investments, as entrepreneur in residence. A native of China with 18 years' experience in the communications industry as a senior engineer and general manager, and extensive management experience in both China and the United States, he previously had been vice president and general manager for Ciena Corporation's China operation. Prior to that, Zhou was vice president of product management at ONI Systems, a communications technology company in Silicon Valley that was acquired by Ciena in 2002. He



Caltech News

2001

Christopher Anderson, PhD, an assistant professor in the University of Rhode Island's department of environmental and natural resource economics, has been named teacher of the year and researcher of the year in URI's College of the Environment and Life Sciences. He says that teaching an introductory class in natural resource economics to undergraduate students, as well as several graduate-level classes, provides a nice balance to his research. The economist, who joined URI's faculty in 2000, has recently started several major research projects, published five research papers in the past year, and traveled the world to discuss his research findings. Applying experimental economics, game theory, and behavioral economics to understanding the decisions people make under different regulations, he is currently focusing on tradable fishing allowances, which create a market where fishermen can buy and sell the "right" to catch fish. He is also designing a mechanism for accurately eliciting public preferences for spending money on land conservation and habitat preservation.

2002

Ben Kulick writes that he "has designed and partnered in Biodiesel of Las Vegas, Inc.," a biodiesel facility that supplies 1,300 school buses and 400 support vehicles belonging to Clark County; the University of Nevada, Las Vegas; and the U.S. Air Force with renewable and cost-effective biodiesel, a diesel alternative. BLV Inc., he says, "is one of the only facilities in the country that can and does produce biodiesel from used cooking oil." The process operates without a waste stream, with complete consumption and the use of all materials, products, and by-products, and no sewer, solid, or hazardous waste.

Seminar Day . . . from page 17

patients with heart arrhythmias.

Following the award ceremony, President Baltimore sat down for a 50-minute conversation with Stanford biologist Irving Weissman, director of the Institute for Cancer and Stem Cell Biology and Medicine, and the Beehuis Professor of Cancer Biology at Stanford. Their topic was the promise, potential, and challenges of stem-cell research, and the wide-ranging discussion included questions submitted by the audience.

The two biologists discussed the science of stem cells, explained why they are important to researchers, and addressed the ethical and public-policy questions that the research engenders. Although California voters approved a \$3 billion bond issue to jump-start statewide research in the field, advocacy groups have delayed distribution of the funds with a variety of court challenges. The interactive discussion format was new to the Seminar Day program, which traditionally features a lecture during the General Session. The Association will consider incorporating the conversational format again in future Seminar Days.





Eddie's has left the building. A **Caltech institution located three** blocks from campus, Eddie's Market closed its doors this spring after more than two decades of catering to the hungry hordes of Institute faculty, students, and staff who flocked to it daily at lunchtimeand often at dinnertime, too-to order deli fare, pick up grocery supplies, and shoot the breeze with one another and with store owners Lynn and Chris Stanton and their indefatigable sandwich-making crew. The Stantons said that since their lease was about to expire and they were unable to agree with their

landlord on renewal terms, they decided to pull up stakes. In recent years, Eddie's had also been losing market share to local restaurants, and "we are not motivated to move with the times and embrace the frapuccino machines and smoothie fruit-blend-ing machines," Chris Stanton told a *Pasadena Star-News* reporter. The Stantons said that they plan to travel before deciding on their next move. What the future holds for Eddie's—another deli? a time-share? a frapuccino bar?— is anybody's guess.

Currie... from page II

our endowment than was healthy. You can't do a one-time salary freeze and bring it all back into balance. I'm trying to understand how we can feel poor if we're so successful with our research and capital campaign.

"The research engine generates money, but large amounts of money are also spent on research," he says. "The financial markets haven't been as kind to us as they were in the 1990s." Improving the Institute's investment portfolio will help strengthen the Institute's finances, and Currie says that the Institute is moving in that direction. Caltech has to deal with an increase in benefit expenses and capital costs from building projects, but unlike other universities, it can't generate much additional revenue from tuition since the student population is small and fairly static. "It may take several years to address the structural deficit. Whatever we do, we

cannot jeopardize the core genius.

"This is a wonderful place to be and my job is to support the work that the Institute does," Currie says. "No one grows up thinking, 'I want to be in academic administration when I grow up.' But I enjoy working with smart people whose goal is academic excel-

Travel . . . from page 17

ancient astronomy; celestial navigation; Caltech's involvement in planetary exploration; and climate change and global environmental science.

August 15-25, 2006

Iceland's Natural Wonders Iceland is an island of dramatic

and contrasting beauties, with brightgreen grasslands juxtaposed against mountains of black volcanic sand, vast glaciers, snow-capped peaks, dramatic waterfalls, bubbling hot pools, and stark fields of lava. Warmed in the summer by Gulf Stream currents and 20 hours of sunlight each day, the island provides a spectacular backdrop for exploring active geological features, Viking history and culture, and island fauna, including many thousands of nesting migratory birds. In addition, Iceland is uniquely positioned as a leader in biopharmaceutical research. To learn more about this unique nation (and Caltech's connections with it), we will be accompanied by Scott Fraser, the Anna L. Rosen Professor of Biology, and Marianne Bronner-Fraser, the Ruddock Professor of Biology and professor of bioengineering, who have previously led extremely popular alumni tours to Ecuador's Galapagos Islands and to Costa Rica. (This program will also feature an optional excursion to Greenland at additional cost.)



lence. Harvard, Rice, and Caltech have that in common."

When he's not on campus, Currie enjoys reading, playing a bit of tennis, and hiking. The proximity of so many trails in the San Gabriel and Santa Monica mountains was one of the attractions of the Caltech job, Currie says. "There are not many parts of my job where you can see immediate, tangible results. But once you've climbed a mountain and reached the top, you can look down and say, 'Hey. I'm here.'"

Second States (Second States) (Second State

Dramatically different Iceland is the destination for an alumni trip slated for 2006. Manzanar . . . from page 13

he had, he would have found out firsthand that there are no coral reefs right in the vicinity of where we are planting. I have to question the motives of these people. Their criticisms are completely unfounded.

Since the early '90s, you've been spending at least six months out of every year in Eritrea. Where are you based?

Our center of operations is in Massawa, which is located on the Red Sea. I had a mild stroke recently, so the amount of time I can spend there is now somewhat restricted. However, my staff in Eritrea is super. I have four Eritrean colleagues, who graduated from the nation's Asmara University, whom I work with directly. We have about 50 other Eritreans, who make up our test group in the local village of Hargigo. We are having them bring in their livestock and we train them in how to feed the animals mangroves and seaweed. It takes time to get people accustomed to doing this, but I think we are about a year away from having enough food for all the livestock in the village. That should in turn mean more food for the villagers to eat, and should lead to greater self-sufficiency and economic independence over the longer term.

Do the villagers seem to be buying into this? Do they feel like they have a sense of ownership over the project?

Yes. We're trying to get that in place. The important thing over the longer term is that the villagers are able to realize a profit from the work they do themselves.

What would you say is a typical day for you when you're in Eritrea?

I don't know because I'm a pretty disorganized person. But I'm always working. One thing we need to do, and haven't done yet, is put together a coordinated educational program. Most of our workers have never gone to school. I think that getting some of the scientific ideas across to people who have no education whatsoever is kind of difficult. But I believe we can do it. The main objective of the Manzanar Project is to train people to have the confidence to think independently, and try new things to build their country. It is important that they have a handson knowledge of the work.



A growing program of sustainable development. To provide a stable food supply for Eritrean villages such as Hargigo (top), the Manzanar Project trains villagers in the cultivation and use of mangroves, which the project has planted in abundance in areas such as the seawater off the port city of Massawa. The thriving plants rapidly mature into trees, whose foliage is then harvested to provide food for local livestock.

It looks like you'll soon be receiving royalties from the marketing of Erbitux and that you intend to apply nearly all of those to the Manzanar project.

That's correct. I'd also like to add that the project has implications come here as a very young boy, worked as a fisherman there. Terminal Island had a large Issei and Nisei [first- and second-generation Japanese American] population, but it was also the center for the Pacific Fleet, and shortly after the bombing of Pearl Harbor, all Japanese Americans were exiled from it. We went first to Los Angeles, and then a couple of months after that we were sent to Manzanar. I remember it vividly to this day. My whole family and many others were put on trains guarded by soldiers and sent to the resettlement camp, where we lived behind barbed wire.

Do you feel that that experience has influenced your life?

Probably. A very great influence on me there was a Professor Emerson from Caltech, who used to come visit a graduate student of his, Shimpei Nishimura, who was also interned at Manzanar. Shimpei was working on a project that involved making rubber from a desert plant, and I remember how inspiring it was for us to see an actual Nisei scientist. Professor Emerson would drive up in a 1928 Studebaker filled with presents. He was always extremely kind and helpful. Through Professor Emerson I learned about Caltech for the first time.

Years later, Emerson's son was looking for a summer job. He asked me if I had space in my lab to take on a student. I said I'd take him no matter what if his name was Emerson, and he worked for a couple of summers in my lab.

How did you end up coming to Caltech for grad school?

After the war ended and all the interned Japanese were freed, I worked as a gardener and then went into the Army. It was a horrible experience for me; I felt like I was just constantly battling racism there. Afterward I came back to Los Angeles and enrolled at USC as an undergraduate in biology but continued working almost full time, both as a gardener, and at my uncle's fruit stand. It was a hard balancing act for me. I remember that I got the highest grade on my final exam in mathematics on differential equations. but only a B in the course because I never showed up for class. In the meantime-this was 1950-I used to drive by Caltech on my gardening route and think, "Gee I'd like to be a student here." Then one day it was raining, and I fell off my gardening truck. It was kind of a dumb thing to do—I sprained my ankle. The next day, I limped into a Caltech office and told the first person I met there that I wanted to be a student. He turned out to be a physicist, and when he heard that I was interested in biology he sent me to George Beadle.

ed in, and I told him "transport across cell membranes." He said, "That's really biophysics—not my topic. We only take the best here. What kind of student are you?" I said I was a terrible student, so he said, "Go see Delbrück."

So, I went and knocked on Max Delbrück's office door. I found him sitting deep in thought, probably annoyed to be interrupted. He said, "What do you want?" I said, "I want to be a student," and he said, "Tell me the story of your life." So I did. For an hour. And he said, "Okay. Come back next week, and we'll give you an oral exam."

I came back the next week to find that he had put together this committee: Beadle was on it, Dulbecco too, I think. All these future Nobel Prize winners. I remember a few of the questions they asked me. One had to do with the most abundant species on Earth. Another, on radioactive compounds, happened to be a differential equations problem. I must have been inspired that day—I was pulling answers out of thin air.

At the end of it all, they accepted me at Caltech as a special student—I wasn't prepared enough to be a regular student, but I got regular Caltech graduate student status later on. Delbrück was my adviser: I wrote my thesis on an aspect of bacteriophage. In the beginning, it was very tough because I had never worked very hard at being a student before, and now here I was, confronted with the Institute's math and physics curriculum. I had to study very hard. Working with Max profoundly changed the course of my life, for which I will be forever grateful.

Overall, I have very good memories of Caltech. I formed bonds there and found people who I felt thought like I did. I'd always been in an atmosphere where I was an oddball, and that wasn't true at Caltech. I felt like I'd found a home. My family, however, was a bit baffled. I don't think they had ever been quite sure what to make of me.

More information on the Manzanar Project can be found at www.manzanarproject.com. that go beyond what we're hoping to achieve in Eritrea. We're working very hard to perfect a low-tech sustainable-development program that can be readily exported to many regions of the world where hunger has been an enduring problem. In that sense, this work has the possibility of being really revolutionary.

You named the Manzanar Project after the Manzanar camp, where you were interned during World War II. Can you elaborate on that?

It's complicated, but it definitely left its mark on me. I was raised on Terminal Island, in east San Pedro. My father, who was born in Japan but had

Beadle asked me what I was interest-



Gordon Sato (kneeling right) and Eritrean colleagues administer to a growing mangrove plant a special nutritional mixture that they created to supplement the plants' saltwaterbased diet.

Obituaries

1925

Keith M. Wilson, MS '31, of South Pasadena, California, on December 17, 1988.

1926

Harold Wilbur Lord, of Rohnert Park, California, on June 7, 2004; he was 98. After graduating from Caltech he went to work for General Electric, in Schenectady, New York. By the end of his life he had been credited with 97 patents; his innovations included fluorescent lamp ballast and the timing circuit used in line (as opposed to spot) welders. During World War II he worked in the areas of radar and IFF (identificationfriend or foe) systems. After the war his interest in photography led him to develop photoflash tube exciters and controls. During his years with GE his own household enjoyed several firsts: the first dual-control electric blanket, the first turkey cooked by microwaves, and the first fluorescent light. After his retirement in 1966, he and his family moved to Mill Valley, California, where he continued to work as a private consultant. He was a life fellow of the IEEE and a recipient of its Centennial Medal and Third Millennium Medal, as well as the Magnetics Society's 1984 Achievement Award. Predeceased in 2000 by Doris, his wife of nearly 72 years, he is survived by four children, 13 grandchildren, 23 great-grandchildren, and one great-great-grandchild.

1930

Edward Koehm, on May 11, 1993.

Frank N. Moyers, MS '31, on July 11, 1986.

Jack D. Pritchett, on December 20, 1990.

1931

Robert P. Coleman, of Bala Cynwyd, Pennsylvania, on July 26, 2003. Predeceased by his wife, Katherine, he is survived by his daughter, Gail.

Stephen C. Dorman, on November 10, 2000.

Sam C. Eastman, on May 21, 2004.

Calvin B. Frye, of San Diego, California, on July 10, 1993.

Marvin W. Hall, on February 1, 1993.

Charles K. Lewis, MS '32, on August 17, 1992.

1934

David P. Bushnell, Ex, of Laguna Beach, California, on March 24, 2005; he was 91. The founder of the Bushnell Optical Corporation, he played a leading role in providing affordable binoculars and other optics to the U.S. and world markets. Realizing that few jobs were available even for engineering graduates during the Depression era, he left Caltech, and, armed with letters from Robert Millikan-"Any favors that are shown him [Bushnell] will be appreciated by me personally"-and Secretary of State Cordell Hull, he set out on a trip around the world. Seeing the availability of inexpensive merchandise abroad, he returned to California to earn a business degree at USC and become involved in the import-export business, trading in commodities such as asbestos, turquoise, and cement. In 1938 he married Frances Elizabeth King, with whom he had two children, David Alan and Jean Frances. After her death in 1947, he married Nina Gmirkin. It was during their honeymoon that Bushnell purchased and sent back to California two cases of binoculars, and began his business of marketing Japanese-made binoculars and other optics at half the price of U.S. and German products. He sold his company to Bausch & Lomb in 1971. and retired in 1974 as a vice president of that

company. He and Nina had two children, Steven Ensign and Natasha, and divorced in 1977. Bushnell married Nancy Rose in 1977. Active in his church and the community, he among other things served on a draft board during the Vietnam War ("though not the board responsible for his draft-age son"). He is survived by Nancy, his wife of 27 years; his sons, David and Steven; his daughters, Jean Salfen and Natasha Suter; eight grandchildren; and two great-grandchildren.

Willis R. Donahue Jr., on February 16, 2002.

1937

Herbert R. Sheppard, in Pasadena, California, on March 19, 1998.

1939

J. Louis Fredrick, MS '40, of Laguna Hills, California, on October 2, 2002.

1940

on April 16, 1999.

George A. Brettell Jr., MS, in South Pasadena, California, on December 10, 1982.

William D. Lewis, MS, in Yountville, California,

Sabin A. Ustel, MS, on April 12, 1988.

1941

Lloyd A. Lewis, MS, in Midland, Texas, on January 1, 1987.

1946

Dan N. Hendricks Jr., MS, of Mercer Island, Washington, on October 24, 2004.

Charles R. Russell, MS, in Walnut Creek, California, on July 2, 2003.

John C. Siltanen, MS, on July 10, 2000.

Basil G. Stergis, MS, on February 24, 1989.

Thomas F. Weldon, MS, Eng '47, on January 31, 1999.

1947

Norman C. Appold, MS, of Niceville, Florida, on March 17, 2004; he was 86. A retired vice president of Lockheed Martin and former program director for the C-5 aircraft, he had been a bomber pilot during World War II. He is survived by his wife, Edie; his daughters, Linda Appold Anderson, Kaaren Appold Peterschmidt, Jennifer Taylor Neilson, and Shannon Taylor Musgrave; his son, Rocky Taylor; and two granddaughters.

Raymond A. Brown, MS, PhD '49, on November 1, 2002.

daughters, Bharati Dutta, Banani Sarkar, Shibani Das, and Archana Das; and eight grandchildren.

William H. Eisele, MS, on December 29, 2000.

Robert B. Harris, MS, of Chelsea, Michigan, on April 27, 2003; he was 84. A professor of civil engineering, emeritus, at the University of Michigan, he had been a faculty member there from 1947 to 1987. Considered a pioneer in construction engineering and management research and education, he had a prominent international role in the development and advancement of those fields. In 1954 he helped establish the University of Michigan's graduate program in construction engineering and management-the first to offer a separate graduate degree, the master of science in engineering (MSE) in construction engineering and management. A registered professional engineer, he frequently served as a consultant to construction organizations. A fellow of the American Society of Civil Engineers (ASCE) and a member and past president of Chi Epsilon, the national civil engineering honor society, he served as editor of ASCE's Journal of Construction Engineering and Management for more than 16 years. His awards include ASCE's Construction Management Award (1983), Peurifoy Construction Research Award (1991), and Richard R. Torrens Award (1996). He is survived by Jean, his wife of 53 years; five sons, William, James, David, Peter, and Richard; and nine grandchildren.

Sidney T. Martin, MS, of Gilmer, Texas, on May 17, 2003; he was 89.

Clayton A. Rust, MS, on December 7, 1991.

Jarvis L. Schwennesen, MS, on November 11, 1997.

Frank A. Swatta, MS, on September 11, 2000.

George R. Vanden Heuvel, MS, on February 15, 1996.

Clifford M. Wimberly, MS, on January 8, 2001.

1948

Matthew J. Altenhofen, MS, of Los Altos, California, on February 29, 2000. He was a retired lieutenant colonel, U.S. Army.

James R. Dale Jr., MS, on August 27, 2003.

Frank Morton Emerson, of Lakewood, California, on July 18, 2004; he was 79. An aeronautical engineer, he contributed to the space program and the B-2 stealth bomber. He is survived by Marjorie Bess, his wife of 56 years; a son, David; a daughter, Sharon; and four grandchildren.

Samuel R. Hoffman, MS, on July 27, 2004. With his late wife, Rochelle, he founded Camp

1951

Cornelius (Neil) John Pings, MS '52, PhD '55, of Pasadena, California, on December 6, 2004; he was 75. A former vice provost, dean of graduate studies, and professor of chemical engineering and chemical physics at Caltech, Pings later served as provost at USC and as president of the Association of American Universities. After receiving his PhD from Caltech, he joined the faculty at Stanford, then returned to Caltech in 1959 as an associate professor of chemical engineering. Promoted to full professor in 1964, he served as executive officer for chemical engineering from 1969 to 1973, and as vice provost and dean from 1971 to 1981. He then joined USC as provost and senior vice president for academic affairs, remaining in those positions from 1981 to 1993 and overseeing the university's academic and research programs, the libraries, student affairs, and community and governmental relations. In 1993, Pings became president of the Association of American Universities, which represents the nation's 60 major research universities, serving in that position until 1998. During his career, he chaired several national committees that addressed education and research issues, and he served on numerous institutional and corporate boards. His own research activities focused on the areas of applied chemical thermodynamics, statistical mechanics, and liquid-state physics. A member of the National Academy of Engineering, the American Academy of Arts and Sciences, the American Institute of Chemical Engineers, and the American Chemical Society, his many honors included Caltech's Distinguished Alumni Award, the Institute's highest honor, and the Presidential Medallion, USC's highest honor. He was active in civic affairs, serving on L.A. city committees and as chair of the Pasadena Redevelopment Agency, receiving that city's Arthur Noble Medal. He was also a member of the Caltech Associates President's Circle. Pings is survived by Marjorie, his wife of more than 40

Kinneret in 1954, in Agoura, California, for children 4 to 14. Noted as "a profoundly effective pedagogue, role model and inspiration among colleagues within the fields of informal, formal and Jewish education," he also directed the camp for many years. He is survived by his sons, Stuart and David, and by a sister, Ida Sachs.

Charles W. Suman, MS, on June 21, 1991.

Jack L. Shoenhair, MS, on July 19, 2002.

Tom H. Stauffer, on April 27, 2004.

Raymond M. Clock, MS, of Orlando, Florida, on February 24, 2004; he was 86. A 1940 West Point graduate, he retired from the Army in 1965 with the rank of colonel. His degrees included a PhD from the University of Florida, and he was a professor of engineering at the Citadel, in Charleston, South Carolina. He was also an accomplished equestrian and an enthusiastic golfer. He is survived by his wife, Jeanne; two daughters, Deborah and Heather; and four grandchildren.

Subodh C. Das, MS, of Worcester, Massachusetts, on June 5, 2003; he was 86. A professor at the School of Leather Technology in India, he was a scientist in the industry and published articles in publications about leather technology. He retired in 1982. He is survived by Anita, his wife of 71 years; two sons, Gautam and Uttam; four

Omer I. Inonu, Eng, on March 1, 2004.

Robert S. Winniford, MS, of Sweet Home, Oregon, on July 9, 2003; he was 81. He received his PhD from the University of Tennessee, worked as an industrial research chemist for 10 years, then taught chemistry at Whitworth College in Spokane, Washington. Retiring in 1981, he built a log house and managed a tree farm in Holley, Oregon, and remained active in the United Presbyterian Church of Brownsville. Predeceased by his son, David, he is survived by Georgene, his wife of 58 years; his daughters, Nancy Ashley, Gail Bergeleen, and Mary Anne Winniford; five grandchildren; and a sister, Betty Udell.

1949

David Cutsforth, MS, of Albany, Oregon, on October 19, 2002; he was 81.

years; his son, John; and his daughters, Anne and Mary.

Ludwig Rupert Vreugde, of Ridgefield, Connecticut, on December 11, 2004; he was 76. The son of a Dutch father and an American mother, he spent most of his childhood overseas, including in German-occupied Holland, where as a youth he reported troop movements to the Dutch underground and on several occasions had to be hidden from soldiers who were rounding up Dutch boys for the labor camps. With the end of World War II his family returned to the United States, and after graduating from Caltech Vreugde received his master's degree from Stanford. He went to work for Lockheed Missiles and Space Company, where he was involved in the management of spacecraft systems development, and in 1979 for PerkinElmer, where he was an associate director of space station programs. In the early 1990s, he began working with Hoffmann & Feige, a consulting metallurgical firm. Active in

St. Stephen's Church in Ridgefield, Vreugde was an avid gardener whose other hobbies included photography, stamp collecting, skiing, electronics, and carpentry. He is survived by Nancy, his wife of 52 years; three sons, Robert, William, and John; a daughter, Mary McCracken; seven grandchildren; and a brother, John.

1953

Bruce R. Weinert, MS, on June 23, 2003.

1955

Harry A. Griffith, MS, of McLean, Virginia, on July 16, 2003; he was 78. A lieutenant general in the U.S. Army who retired as director of the Defense Nuclear Agency, he began his military career as an enlisted man during World War II and graduated from West Point after the war. He served in the Army Corps of Engineers, commanding an engineering group in Vietnam. He was district engineer in Mobile, Alabama, and oversaw construction of the Tennessee-Tombigbee Waterway, and later was chief of the Joint U.S. Military Assistance Group in Korea. Retiring in 1983, he became senior vice president of Brown & Root International, directing the company's Washington office; this included providing logistical support to U.S. forces in Bosnia, Haiti, Rwanda, and Somalia. President of the West Point Society of the District of Columbia from 1983 to 1986, he was a member of the Cosmos Club in Washington and of St. John's Catholic Church in McLean, and a volunteer with So Others Might Eat. He is survived by Ann, his wife of 47 years, and by six children and 17 grandchildren.

1957

Alfred Francis Lawrence Jr., MS, of Elkton, Virginia, on June 10, 2004; he was 73. A West Point graduate and Korean War veteran who was an officer in the Army Corps of Engineers, he served in both combat and staff positions, including as commanding officer of the 69th Engineer Construction Battalion in Vietnam, and on the faculty of the engineer school at Fort Belvoir. His decorations included two Bronze Stars, two Legions of Merit, one Air Medal, and two Meritorious Service Awards. After retiring in 1979 with the rank of colonel, he worked for the Engineer Division of the Fairfax County Public Schools until 1995. He is survived by Nancy, his wife of more than 49 years; a son, Dale; two daughters, Wendy Eastham and Suzanne Wulff; three granddaughters; and a brother, William.

Muhip A. Yeneriz, MS, of Mission Viejo, California, on April 3, 2000.

1960

Theodore Alan Jacobs, PhD, of Annandale

A member and past president of the American Institute of Chemical Engineers, he was also a member of the American Chemical Society and served on the founding committee of the Design Institute for Physical Property Data and as its chair during 1977-78. He produced over 150 technical papers, seminars, and presentations. He served in the U.S. Army Reserve, and he was an active member of the Church of Jesus Christ of Latter-day Saints. An accomplished organist and pianist, he contributed to the production of the City of Joseph pageant (the second-largest outdoor musical in America) in Nauvoo, Illinois. He is survived by Sharon, his wife of 37 years; four sons, Reed, Adrian, E. Kimball, and Cameron; two daughters, Cherry Ann Redd and Katrina Larsen; 11 grandchildren; and his mother, Marie.

1972

David Jackson McGinty, PhD, of Midlothian, Virginia, on July 3, 2004; he was 59. He spent 30 years in research and development at DuPont, during which he was awarded eight consequential patents. Well read in history and literature, he enjoyed theater in Washington, D.C., and opera in Richmond. He was also an accomplished cabinetmaker, and he was a member of Salisbury Presbyterian Church and the Salisbury Country Club, where his handicap was four. He is survived by Sally, his wife of 37 years, and by two sons, Andrew and Luther.

1974

Richard E. Weinberger, of Los Angeles, on March 22, 2004; he was 52. He spent most of his working life as a community activist for groups like Public Citizen, advancing the cause of civil justice and fighting for economic equality for all citizens. He was also a poet, writing and performing at open readings in the greater Los Angeles area. He is survived by his mother, Esther, and by a brother, Marc (Lee).

1979

Ross Kay Anderson, MS, of Rancho Palos Verdes, California, on July 7, 2004; he was 62. A former U.S. Navy fighter pilot and "Top Gun" instructor, he had left Torrance Municipal Airport for his daily commute to Chino Airport when his homebuilt airplane-on which he had logged 125 flight hours without problems-crashed in Seal Beach. After his naval service, Anderson received a master's in business from Stanford University as well as his master's in aeronautical engineering from Caltech. He worked for various engineering and manufacturing companies and also became a principal in Janes Capital Partners, a private investment group in Newport Beach. He had bought Square One Aviation, a vintageaircraft restoration firm located at Chino Airport, ember 2003, and was in the pro-



NORMAN HOROWITZ 1915-2005

Norman Horowitz, PhD '39, a Caltech geneticist best known for his work on the "one-gene, one-enzyme" hypothesis and a series of pioneering Viking lander experiments to search for life on Mars, died on June 1 at his home in Pasadena. He was 90.

A pioneer of the study of evolution through biochemical synthesis, Horowitz was a Caltech professor of biology for many years. After a distinguished career studying the genetics of the red bread-mold *Neurospora crassa*, he began collaborating with JPL in 1965 after becoming interested in the biochemical evolution of life and its possible applications to the search for life beyond Earth. He spent five years as chief of JPL's bioscience section.

A native of Pittsburgh, Horowitz earned his bachelor's degree at the University of Pittsburgh before coming to Caltech, where he earned his PhD with embryologist Albert Tyler. He then moved to Stanford to work as a postdoc in the laboratory of future Nobel laureate George Beadle.

When Beadle became chair of the Institute's biology division in 1946, Horowitz returned to his alma mater as a faculty member, and stayed for the remainder of his career. He was the biology division chair from 1977 to 1980, and became a professor emeritus in 1982. His contributions to the division also included the endowment of the Horowitz Lecture Series. He was a member of the scientific teams for both the Mariner and Viking missions to Mars. On the Viking mission, he and two collaborators designed an instrument capable of detecting any speculative interpretation of how life carries on its chemistry. Horowitz and a colleague used mutations to disprove an alternative view that was gaining credence at the time, thereby indirectly strengthening the one-gene, one-enzyme hypothesis.

The author of a 1986 book titled *To Utopia and Back: The Search for Life in the Solar System*, the late Caltech professor was a member of the National Academy of Sciences and the American Academy of Arts and Sciences, and a recipient of a 1998 medal from the Genetics Society of America.

Horowitz is survived by a daughter, Elizabeth Horowitz of Berkeley; a son, Joel Horowitz of Iowa City, Iowa and Evanston, Illinois; and two grandchildren. He was married to Pearl (née Shykin) Horowitz, who died in 1985. Horowitz funded the Pearl S. Horowitz Book Fund at Caltech in her honor.

A NEWTONIAN MOMENT

Most Caltech alumni become extremely familiar with logarithms at some point in their education, yet the back-page poster, with its obsessive detail, might engender more feelings of unease than nostalgia. The image is one of several pages from Isaac Newton's student notebooks. They were part of a recent exhibition on the pioneering 17th-century British scientist, which opened at the New York Public Library and is now at the Huntington Library in Pasadena. (Part II of the show, "The Newtonian Moment," will run at the Huntington from July 23 through January 1.) In the worksheet, which almost resembles folk art, Newton calculated several logarithms out to 55 places as part of his research into binomial expansion. The Newton exhibition is curated by Mordechai Feingold, Caltech professor of history. His book The Newtonian Moment was published last year as a companion to the show, which includes many of Newton's original notes and books and artists' interpretations of his theories, on loan from institutions around the world. While Newton is renowned for his extraordinary scientific discoveries, including the law of universal gravitation and planetary motion, and the invention of the calculus, the exhibit also explores Newtonian pursuits that are not so well known such as his strong interest in alchemy and mysticism. Despite some of Newton's far-out ideas, the show makes the case that he might not have been as weird as some people seem to think. For more on the Newton exhibition and his influence on the West, see the article on page 2.

Virginia, on February 23, 2004. He is survived by his wife, Joan, and his son, Steven.

1962

William Kozicki, PhD, on July 29, 2003; he was 72. A professor of chemical engineering, emeritus, at the University of Ottawa, his career there had spanned 34 years of teaching, research, and administration, including as vice dean for engineering. He is survived by his wife, Denyse; a daughter, Sharon; his mother, Mary; and a brother, Alex.

1969

Alvin Henry Larsen, PhD, of St. Louis, Missouri, on June 23, 2004; he was 65. He worked for Monsanto Chemical Company, and its subsidiary Solutia Inc., at Monsanto's world headquarters in St. Louis. Retiring in 2002 after 35 years, he served as adjunct professor of chemical engineering at Washington University in St. Louis.

refurbishing three P-51 Mustang fighter planes at the time of his death.

1981

Maritza Crabtree, née Stapanian, PhD, in Cincinnati, Ohio, on October 18, 2001; she was 51. She had worked on the Peacekeeper missile and the Milstar communications satellite projects, two key parts of Ronald Reagan's "Star Wars" program. After receiving her doctorate, she joined the Air Force, and during her career there was awarded the Air Force Commendation Medal with an oak leaf cluster and the Meritorious Service Medal with two oak leaf clusters. After leaving the Air Force as a major in 1996, she returned to Greater Cincinnati, where she worked as an engineering management consultant until cancer forced her to retire in 1997. She is survived by William, her husband of 10 years; her mother, Mary; two sisters, Juliette Apkarian and Marylis Rigdon; and a brother, Martin.

biochemical evidence of life at two preselected sites on the planet. The results were negative, but the data gathered in the experiment continues to inform current research in astrobiology.

Horowitz is most renowned in the field of biochemistry for a 1945 paper on biochemical evolution, published in the *Proceedings of the National Academy of Sciences*, and today considered the founding study for the investigation of evolution at the molecular level. Horowitz also performed a key experiment that led to the widespread acceptance of the one-gene, one-enzyme hypothesis, a theory that until the early 1950s was considered to be a wildly

