

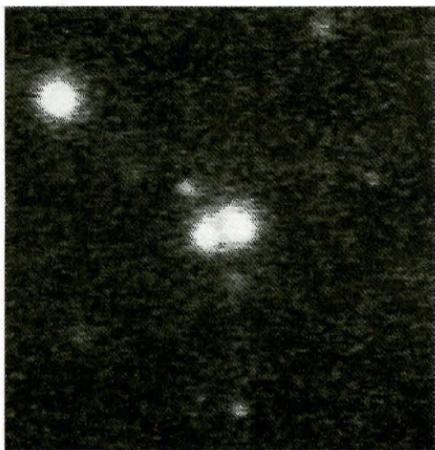
Volume 27, No. 3  
June 1993



The most luminous known object in the cosmos is captured in this picture, taken in March with Caltech's Near-Infrared Telescope. The center shows what astronomers believe to be a group of colliding galaxies that will eventually merge into a single galaxy. The "wings" on the largest object are thought to be stars and interstellar material being drawn off one galaxy through its gravitational interaction with the others. This photo was taken at a wavelength roughly four times that of visible light.

---

## *The Keck has its first picture show*



Also taken with Caltech's Near-Infrared Camera at the Keck Observatory, this photo shows an outstanding example of gravitational lensing. The pair of star-like objects in the center are images of a single quasar, whose light has been bent by the intervening galaxy. The object in the left upper corner is an unrelated star.

When you go off to Hawaii with a new camera, it's always a treat to come back and show off the results. A team of Caltech and Berkeley scientists did better than that—they called a press conference to parade their pictures and to hail the superb performance of their state-of-the-art optics, better known as the Keck Telescope. In its first real test as a scientific instrument, said the astronomers, the \$90 million 10-meter instrument on Mauna Kea, Hawaii, has more than lived up to its billing as the world's most powerful optical and infrared telescope.

Keck took the pictures this spring with the Near-Infrared Camera (NIRC), designed and built by Keith Matthews '62, a member of Caltech's professional staff in physics. Matthews led the research team that obtained the images during a two-week stay at the Keck Observatory in late March and reported on the results at a June meeting of the American Astronomical Society (AAS).

"This observing run was the first attempt to make full use of the Keck telescope's capabilities," said Caltech Professor of Physics Tom Soifer '68, who headed up the observing team

with Matthews and is copincipal investigator on the NIRC project. "We showed that the Keck is as good as we hoped. No, even better."

A centerpiece of the AAS picture show was an unprecedented image of the most distant known galaxy in the universe, designated 4C41.17. Located in the constellation Auriga, not far from the Big Dipper, 4C41.17 has a redshift of about 3.8, the largest of any known cosmic objects except for the most remote quasars. Astronomers estimate that the light captured by the NIRC left its source when the cosmos was no more than 10 to 25 percent of its present age.

During the same run, the NIRC also photographed the most luminous known object in the universe, a system of colliding galaxies that emits nearly all of its energy as infrared radiation and was initially discovered in 1991 by scientists analyzing data from the 1983 IRAS survey of the infrared sky. It also took pictures of both a quasar discovered at Palomar in 1990 that currently holds the title of most distant object in the universe, and of a famous gravitational-lens system with the

memorable name of MG1131+ 0456. Gravitational lensing, a phenomenon predicted by Einstein's general theory of relativity, occurs when light emitted from an extremely bright and distant object (usually a quasar) is bent, or warped, by the mass of a galaxy it's passing through. The effect is to create a multiple image of the quasar.

From an Institute standpoint, the Keck's triumphant debut was a family affair. Joining Matthews and Soifer on Mauna Kea were UC Berkeley astronomer and Caltech alumnus Jerry Nelson '65, who invented the Keck's revolutionary segmented mirror, and Howard Hughes Professor and Professor of Physics Gerry Neugebauer, PhD '60, the chairman of Caltech's Division of Physics, Mathematics and Astronomy, and a pioneer in the field of infrared astronomy.

Soifer said the researchers were also pleased with the performance of the NIRC. "Considering how complicated the camera and telescope are, to achieve this the first time the camera is on the telescope is extremely impressive."

*Continued on page 5*

## CAMPUS UPDATE

### June honors bustin' out all over

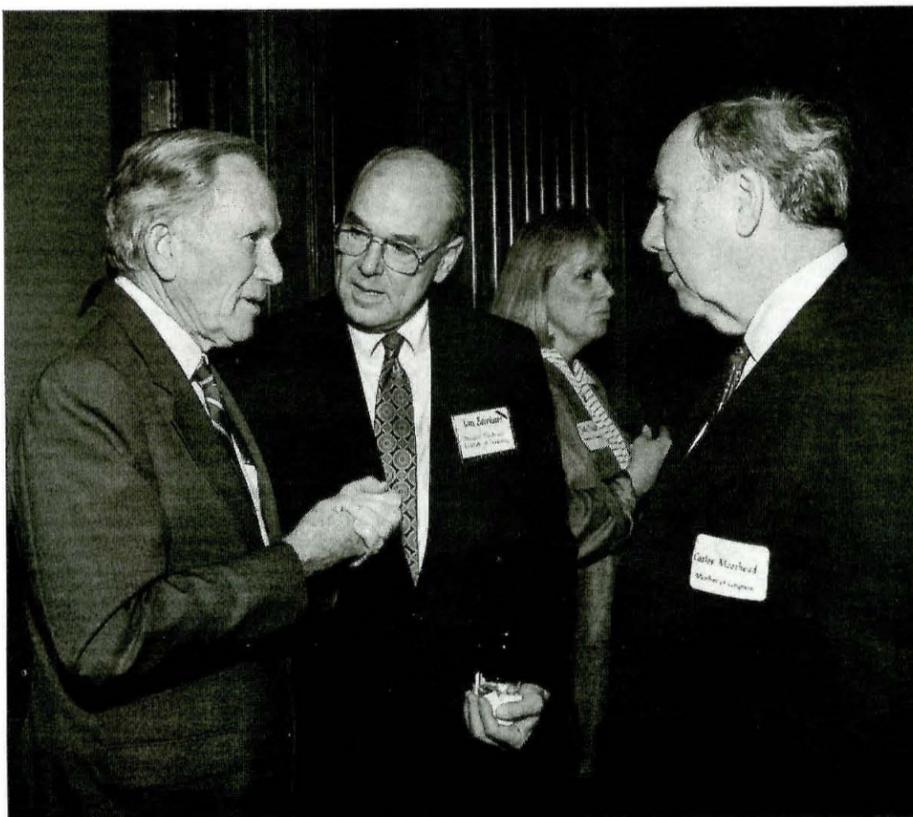
Roger Blandford, Richard Chace Tolman Professor of Theoretical Astrophysics, has been elected to the American Academy of Arts and Sciences. He has done research on the properties of black holes, which may power the extraordinarily bright, active nuclei of some galaxies; and on the behavior of pulsars, the small, rapidly spinning remnants of exploded supernovas.

John Brady, professor of chemical engineering, received the Curtis W. McGraw Research Award at the June meeting of the American Society for Engineering Education. The award of \$1,000 and a certificate recognizes outstanding early achievements by a young researcher at an engineering college and encourages continued productivity. Brady specializes in fluid mechanics and transport processes.

Peter Dervan, Bren Professor of Chemistry, has been selected to receive two awards from the American Chemical Society. Dervan will receive the Arthur C. Cope Award in honor of his advances in the field of DNA recognition. He has also been selected as the 1993 Willard Gibbs medalist. In his research, Dervan engineers molecules that can identify and bind to specific DNA sites—a technology that may be applicable to the study of human genetic diseases.

Samuel Epstein, the William E. Leonhard Professor of Geology, Emeritus, has been chosen as the recipient of the Wollaston Medal, the top honor awarded annually to a distinguished scientist by the Geological Society of London. Epstein traveled to the society's headquarters in London's Burlington House this June to receive the distinctive medal, which is cast in palladium to recognize Wollaston's success in extracting platinum and other precious metals from minerals.

Caltech President Thomas Everhart has been selected by the UCLA Alumni Association to receive its Professional Achievement Award, presented in Royce Hall this June. Everhart received his MSc from UCLA in 1955.



President Everhart (center) confers with Congressman Don Edwards (left), the senior Democrat on California's congressional delegation, and Congressman Carlos Moorhead (right), the delegation's senior Republican, at a California research universities' reception honoring the state's congressional representatives in Washington, D.C., this past April. The gathering was hosted by Caltech, the University of California, Stanford, and USC to promote discussion and exchange of ideas on critical research and education issues facing California, and to enhance collaborative relations with Congress.

Murray Gell-Mann, the Robert Andrews Millikan Professor of Theoretical Physics, received an honorary doctor of science degree in May from Southern Illinois University at Carbondale for his Nobel Prize-winning work on the taxonomy of the elementary particles and for the discovery of quarks, the fundamental building blocks of matter.

Peter Goldreich, the Lee A. DuBridge Professor of Astrophysics and Planetary Physics, has been awarded the Gold Medal of the Royal Astronomical Society for his "outstanding achievements, especially in planetary sciences." He and his colleagues are noted for explaining how tiny moons orbiting Saturn and Uranus "shepherd" planetary-ring debris and maintain the rings' sharp edges.

Barbara Imperiali, assistant professor of chemistry, and Tomasz Mrowka, associate professor of mathematics, have been selected by the Alfred P. Sloan Foundation to receive Sloan Research Fellowships "for their exceptional promise to contribute to the advancement of knowledge." Each will receive grants of \$30,000 for two years. Imperiali and Mrowka are among this year's 88 fellows who are "engaged in research at the frontiers of physics, chemistry, mathematics, neuroscience, and economics."

Hiroo Kanamori, the John E. and Hazel S. Smits Professor of Geophysics and director of the Seismological Laboratory, has been named the recipient of the Arthur L. Day Prize and Lectureship by the National Academy of Sciences. The prize of \$20,000 and an illuminated scroll carries with it an invitation to deliver a series of scientific lectures at an institution of Kanamori's choosing.

Julia Kornfield, assistant professor of chemical engineering, received the 1993 Recognition Award for Emerging Scholars from the American Association of University Women at a June ceremony in Minneapolis. The award, which includes a \$3500 stipend, is given in recognition of Kornfield's exceptional achievements in chemical engineering to date, and of her promise for future accomplishments. The AAUW is a nationwide grassroots organization of 130,000 college graduates dedicated to promoting equity and education for women and girls.

Richard Leske, research fellow in physics, has been named one of three 1993 Outstanding Recent Alumni Award winners by the University of Wisconsin at Whitewater. Leske, who received his BS from UW Whitewater and his PhD from the University of Chicago, specializes in data analysis for SAMPEX (the Solar, Anomalous, and Magnetospheric Particle Explorer) and in instrument design for the ACE (Advanced Composition Explorer), set for launch in 1997.

John Roberts, Institute Professor of Chemistry, Emeritus, has received two honorary doctorates—one from the University of Wales, and the other from the University of Notre Dame. Roberts, who was recognized for his distinction as an organic chemist, was among twelve awardees, including newsman Tom Brokaw and former Secretary of Housing and Urban Development Carla Hills, to be honored by Notre Dame.

Eleanor Searle, the Edie and Lew Wasserman Professor of History, Emeritus, has received an honorary Doctor of Letters degree from the Pontifical Institute of Mediaeval Studies in Toronto for having "notably advanced mediaeval scholarship." This honor has been granted on only two previous occasions.

David Stevenson, professor of planetary science and chair of the Division of Geological and Planetary Sciences, has been elected to fellowship in Britain's Royal Society for his studies of the chemistry and physics of planetary interiors. His discoveries concerning brown dwarf stars have forged a link between stellar and planetary physics.

Hugh Taylor, the Robert P. Sharp Professor of Geology, has been named the 1993 recipient of the Arthur L. Day Medal, for his "outstanding contribution to geologic knowledge through the application of physics and chemistry to the solution of geologic problems." The honor, which is granted by the Geological Society of America, includes life fellowship in the society.

Ahmed Zewail, the Linus Pauling Professor of Chemical Physics, has been awarded the 1993 Plyler Prize by the American Physical Society for his "pioneering and seminal contributions in the area of femtosecond spectroscopy," making it possible to view chemical reactions at the moment when molecules react. In a separate honor, he was recently elected to the American Academy of Arts and Sciences.

### Beltway buddies?

Caltech's Office of Government Relations and Community Affairs is always interested in hearing from alumni with close friends or associates who have either joined the new presidential administration or who are members of California's congressional delegation or the congressional staff. Alumni contacts are helpful in dealing with administrative and legislative issues relating to Caltech in national, state, and local government. Please contact Government Relations and Community Affairs Director Hall Daily at 818/356-6256; or by electronic mail, at hall@starbase1.caltech.edu.

## NAS elects a Caltech political scientist

Professor of Political Science Richard McKelvey was elected in May to the National Academy of Sciences, becoming the first member of Caltech's social science faculty to receive what has long been considered one of the highest honors that can befall a U.S. scientist or engineer. His election brings to 65 the number of Institute professors who are NAS members.

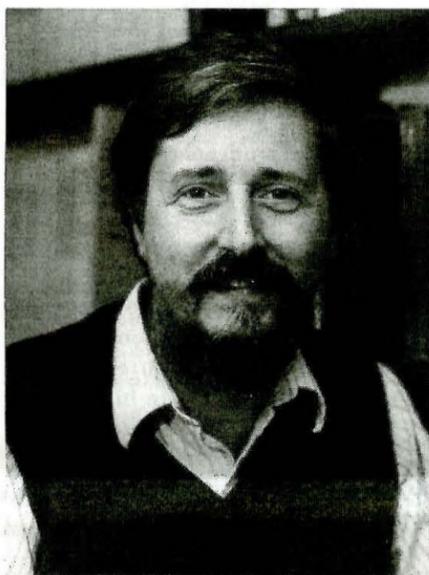
How does a student of society and politics win election to the NAS? It probably helps to have a blackboard that looks more like Albert Einstein's than Albert Gore's. McKelvey's does, the legacy of his undergraduate and graduate training in mathematics, and a reflection of his rigorously quantitative approach to his field. He received his BA degree from Oberlin in 1966 and was partway through graduate studies at Washington University when he decided "I would rather do something I could talk to people about, and that they could understand." He transferred to the University of Rochester, which at the time had one of the few research groups in the country working on mathematical approaches to political science, and received his PhD in political science there in 1972. He held teaching appointments at both Rochester and Carnegie Mellon before joining Caltech's faculty in 1979.

The Caltech professor of political science studies group decision making, voting behavior and elections, game theory, and the theory of political decisions. In one key paper, written shortly before he joined Caltech, he challenged the notion that decisions made under the one-person, one-vote system of majority rule will almost inevitably cluster around a narrow range of "middle-ground" policy outcomes. Using mathematical models, McKelvey showed that in a "pure" majority-rule situation, policy outcomes can range all over the map, depending on how much knowledge is concentrated in the hands of those controlling the issue's agenda.

"Majority rule in its pure form places an enormous amount of power in the hands of such individuals," says McKelvey, adding, "under such a system, an agenda-setter who knows individual preferences can get whatever outcome he or she wishes."

More recently, McKelvey and Caltech colleague Peter Ordeshook have been using laboratory simulations with college students to investigate the extent to which an election's outcome is affected by how well voters inform themselves about the issues. Their rather surprising conclusion is that it doesn't make much difference whether all the voters or only a given fraction of them pay close attention to what the candidates are saying. Electoral decisions made by a largely uninformed electorate that includes a small percentage of informed voters—that is those who base their vote on the substance of

the issues, and not just on advertisements or endorsements—are substantially similar to those that are made when the entire electorate is well-informed. While he cautions against extrapolating from "these very simple experiments" to the real world, McKelvey notes that such results seem to suggest that electoral systems may



Richard McKelvey

function quite successfully even when many voters have very little interest in, or access to, information.

McKelvey is also working with Caltech colleague John Ledyard and Washington University's Richard Boylan to study how theoretical models of economic growth change when decisions are assumed to be made by the political process instead of by economic planners. They have found that stable economic policies are more vulnerable to defeat than are cyclical policies; given the choice, a larger majority of voters will support cyclical policies.

McKelvey, who received word that he had become an NAS member on his birthday, said he was "proud and delighted." "It's great," he said, "that the academy is now recognizing the contributions of social scientists."

Joining McKelvey as new NAS members are six Institute alumni: Mark Davis, PhD '81, professor of microbiology and immunology at Stanford; John Huchra, PhD '77, professor of astronomy at Harvard; Sharon Long '73, professor of biological sciences at Stanford; Robert Merton, MS '67, the George F. Baker Professor of Business Administration at Harvard; Peter Schultz '79, PhD '84, professor of chemistry at UC Berkeley; and Charles Stone '58, professor of statistics at UC Berkeley.

The NAS is a private organization of scientists and engineers dedicated to the furtherance of science and its use for the general welfare. It was established in 1863 by a congressional act of incorporation, signed by Abraham Lincoln; his emotions had he known that politics would one day be considered a science can only be imagined.

## Earthquake Programs Office established

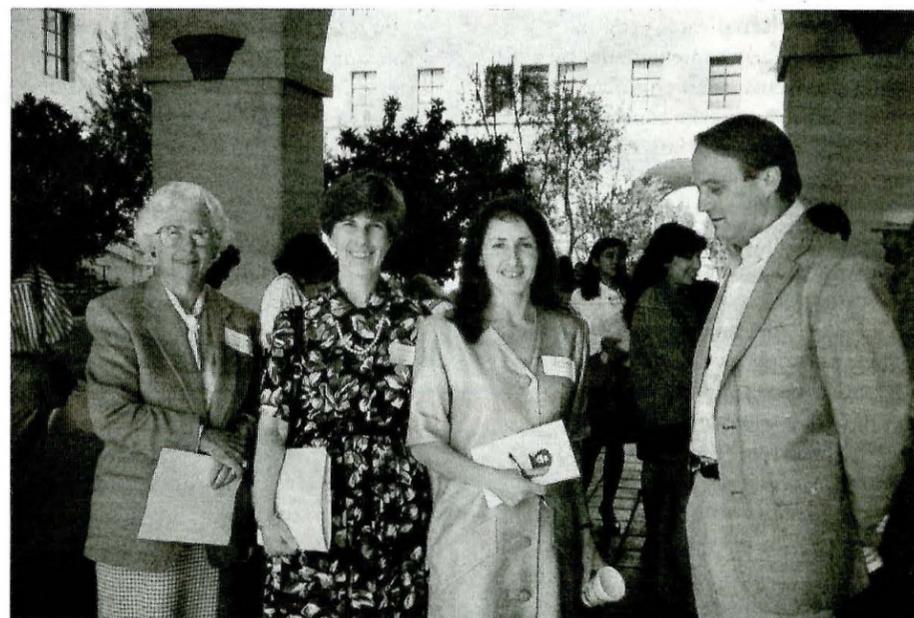
Caltech has established the office of Earthquake Programs to oversee and coordinate fundraising efforts for the Earthquake Research Affiliates (ERA) and Caltech/USGS Broadcast of Earthquakes (CUBE), and to offer programs and support to Caltech's seismology and geology faculty and staff through field trips, conferences, and seminars.

Founded in 1951 by geologist Robert Sharp (now the Robert P. Sharp Professor of Geology, Emeritus), ERA has for the last 42 years brought faculty from Caltech and scientists from the United States Geological Survey (USGS) together to participate in collaborative research projects and program activities. ERA also schedules conferences, field trips, and special seminars for supporting members, as well as for the general public and the Caltech community.

The CUBE system was established in 1990 as a collaborative research project between ERA faculty, USGS,

and a number of private companies and state agencies concerned with earthquake response and disaster relief. The aims of CUBE include providing near-real-time locations and magnitudes of Southern California earthquakes to participating agencies; automatically providing estimates of the distribution of ground shaking following significant temblors; and developing a system to warn of imminent ground shaking in the seconds after a quake has begun, but before seismic waves actually reach sites that may be damaged.

Caltech's new Earthquake Programs office is located in the Southern California Earthquake Center House at 535 South Wilson, in Pasadena. For information regarding participation by individuals and groups, or to receive the Earthquake Programs newsletter and announcements of activities, contact Director Jill Hockwald Andrews (818/356-3298) or Assistant to the Director Jonathan Schwartz (818/356-6318).



The first "Women in Economics Symposium" to be held at Caltech was hosted by Joni Hersch (third from left), visiting associate professor of economics from the University of Wyoming. With her are John Ledyard, chairman of the Division of the Humanities and Social Sciences, and participants Betty Coats (left) and Robin Walther. Sharing the podium with Walther and seven other presenters were Elizabeth Hoffman, PhD '79, and Linda Cohen, PhD '79.

## Background on Bateman sought

Joseph Zund, professor of mathematics at New Mexico State University, is writing a scientific biography of Caltech mathematician, aeronauticist, and theoretical physicist Harry Bateman, and would like to hear from colleagues and students who knew Bateman and are willing to share anecdotes, reminiscences, and class notes they may have taken while attending his courses. Please write to Zund at this address: Professor Joseph Zund  
Dept. of Mathematical Sciences  
New Mexico State University  
Las Cruces, NM 88003

## CAMPUS UPDATE

**A good mechanic may be hard to find—but then, these Caltech students didn't need to know how to put the car back together, just how to dismantle it into as many pieces as possible. This heroic exercise in hands-on reductionism was one of the many Ditch Day stacks that the campus awoke to when the annual event was held May 15. The task for these undergraduates was to find the car's heaviest piece, divide its weight by the weight of the car, and punch that number into a computer to access more clues. Those concerned with the U.S. balance of trade will duly note that the car was a Honda.**



## Class of '97: intellectually gifted, socially concerned

"It's been my life-long ambition to attend Caltech," said one high-school student to the Institute's admissions staff. His dream came true in April when he was notified that he was one of Caltech's 215 incoming freshmen. The citizens of his small town were also thrilled with the decision, and they threw him a townwide celebration.

"We have a group of brilliant, multitalented students this year," says Carole Snow, director of admissions. The class includes three Westinghouse Award winners, whose projects were on improving soldering on circuit boards, using radioactive isotopes to treat cancer, and devising a complex math game. Another incoming student received a genetic engineering internship at NIH.

The class of '97 is 30 percent women—an increase of 5 percent over last year. The numbers of minority students are similar to last year—9 Hispanics and 2 African Americans—and added this year are 2 Native Americans.

Ten of the students come from the northeastern United States, 24 from the Middle States, 97 from the West, 30 from the Midwest, 17 from the Southwest, 13 from the South, and 1 from Puerto Rico. There are 3 U.S. citizens who were living abroad, and 13 international students.

The new freshmen, whose ages range from 15 to 21 years old, have average SAT scores of 1410.

"We also looked at the students' nonacademic activities," Snow says. "We wanted students who increased the quality of life for their fellow students while still maintaining top grades. Members of the class of '97 participated in Students Against Drunk Driving, Amnesty International, Meals on Wheels, and projects for the homeless and feeding the hungry. Many students were volunteer tutors, including one who taught gymnastics to physically challenged kids."

Some of the new frosh took out-of-the-ordinary paths to get to Caltech. Several were home-schooled. One taught himself physics and calculus, since his high school didn't offer those subjects. One student is a pig farmer, and another is an experienced animal tracker from Alaska.

In order to elicit more personal responses from the prospective students, the admissions forms contained several new questions this year. One consisted of two-thirds of a blank page that the students were asked to fill with whatever they deemed important. "We got a wide range of responses," says Snow, "including some very humorous ones, such as hand-drawn cartoons. Another applicant taped play money to the paper." Other responses were more serious—artwork, poetry, origami, math

equations, and quotes that were important to the student. One individual, obviously an avid fisherman, tied flies and taped them to the application.

This year, also for the first time, students were notified via a phone call of their admission to Caltech. "It was a lot of work for the admissions staff and the students on the committee," says Snow. "But the students and their parents were very touched by the personal contact. No other school that these students applied to made phone calls upon admission." Snow says the phoning is the start of a new tradition.

Another new element in the Caltech admission process was a wait list. "It has been a wonderful tool to get us to the target number of admissions," says Snow.

The field that most freshmen said they planned to major in was engineering, with 61 students. The next four most popular options were: physics, 52; chemistry, 31; biology, 21; and electrical engineering, 13.

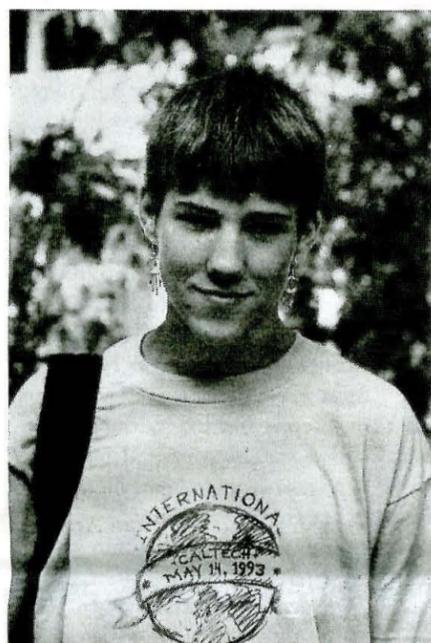
Also new to campus this fall will be 189 graduate students. The group includes 36 women, 3 African Americans, and 4 Hispanics. Eighty-four individuals are from foreign countries. Sixteen students are pursuing their degrees in biology, 38 in chemistry and chemical engineering, and 83 in engineering and applied science. Geological and planetary sciences has 12 new students, humanities and social sciences has 8, and physics, mathematics and astronomy will host 32 advanced-degree candidates.

## Ferguson prizes presented in biology

Longtime friends of Caltech's Division of Biology, Lawrence Ferguson '31, and his wife, Audrey, have endowed a number of prizes for outstanding achievement within the division that are awarded at the end of each academic year. Six such honors were presented this year. Graduate student Dali Ding received the \$2,000 prize for outstanding PhD thesis, for his dissertation entitled "Localization of Maternal RNAs in the Early Embryo of *Drosophila*." The winners of the \$1000 prizes for undergraduate teaching were Assistant Professor of Biology and Computational and Neural Systems Gilles Laurent, and graduating senior Mark Mazurek, for his work as a teaching assistant. Both recipients were selected by a committee of undergraduate biology students. Prizes for graduate teaching, in the amount of \$750 each, were presented to Research Fellow in Biology Georg Striedter, and to Professor of Biology Henry Lester.

## A study of women in physics will take new alumna worldwide

As graduating seniors go their separate ways—whether pursuing their careers or seeing the world—Aimée Smith will do a combination of the two as winner of a 1993–94 Watson Fellowship. She'll go to Hungary, Ger-



Aimée Smith

many, Sweden, and India in search of something she'd like to see in the United States: more encouragement of women in science.

Smith, who just received a BS with honors in engineering and applied science with an option in applied physics, is one of this year's 65 Thomas J. Watson Fellows. She was chosen from among 184 finalists from 52 private colleges and universities nationwide. Named for IBM founder Thomas J. Watson, Sr., the fellowships allow seniors to pursue independent travel and study in any area of interest. Fellows receive stipends of \$15,000, or \$21,000 when accompanied by a dependent. Of the most recent Caltech awardees, Cameron Campbell '89 studied life in the Chinese village of Daoyi, and Jennifer Low '90 studied the epidemiology and sociology of AIDS in Singapore, Rwanda, and Switzerland.

Smith will embark on her year-long expedition this August. Her idea to study women in physics began with a statistic. In a journal article distributed by her Caltech adviser, Professor Harry Atwater, Smith was shocked to read that in Hungary, 47 percent of the physicists at the faculty level are women, compared to 3 percent in the U.S. It made Smith feel less isolated "to know that women were doing this in large numbers elsewhere." And it piqued her curiosity. "I wanted to find out if the difference for women in Hungary versus the United States was qualitative as well as quantitative," says Smith.

So she's going to Hungary to see what it's like when such a high percentage of physicists are women.

"What factors influenced the women to become scientists? How comfortable do they feel? Is there still a glass ceiling? Is the field undervalued?" These are questions that Smith plans to ask the Hungarians, while she asks herself, "If a country can have such a high percentage of women physicists, why can't we have that here?"

She'll be looking for clues in the economic and political foundations of the countries she's studying. Her search will bring her to both sides of the reunited Germany. Smith notes that the former East Germany saw a marked increase in the percentage of female scientists after World War II. And she hypothesizes that 50 years of communism, tied to strict control of the media, may account for the increase. For example, Smith has heard that, "for every East German ad that showed a woman cooking, there was supposed to be an ad with a man cooking"—perhaps a nod toward the equality of the sexes. "I'm not suggesting that we impose this kind of control here," adds Smith. "I just want people to see that there are social influences" behind people's professional choices. "There's not something inherent about women that makes them not cut out for science, or not as smart"—an attitude that some Americans still hold, says Smith.

Smith will go to places as geographically and culturally disparate as Sweden and India to find fresh perspectives and ask more questions. Does Sweden's blend of capitalism and social responsibility—of "opportunity and obligation"—distinguish it from the other countries with regard to women in science? And does the Indian state, Kerala, provide a positive environment for female scientists as a result of its matrilineal history and its progressive reputation?

Smith will record her observations in an article for the Watson Foundation and discuss them with the group of fellows and others. She'd like to publish a journal article as well.

Being selected for the fellowship provided a welcome answer to Smith's question, "What do I do after graduation?" She has been considering a career in women's studies and says her upcoming research should bring her a step closer to that goal.

While Smith hasn't met many female scientists in her life, she has met some very encouraging ones, including Nai-Chang Yeh, assistant professor of physics at Caltech, and a handful of graduate students here. Then there's Shouleh Nikzad, a JPL employee who was a postdoctoral fellow in Atwater's research group. "She was really interested in us [women] as people and really valued our experiences," says Smith, who remains a good friend of Nikzad's.

Outside her field, Smith found men-

tors in Thayer Scudder, professor of anthropology; Joni Hersch, a visiting associate professor of economics, who ran with Smith on Caltech's track team; and Jim O'Brien, their coach. Not only did Smith feel she could "always talk" to O'Brien, she also applied his encouragement on the track to her studies. "To be good at running," she learned, "you need to do more than work hard. When you get to the race, you also need to be relaxed, confident in your abilities, and let it happen. That applies to everything, including tests."

She learned the lesson well. As a junior, Smith received the Mabel Beckman Prize, which recognizes "demonstrated academic and personal excellence, contributions to the Institute community, and outstanding qualities of character and leadership." She has taken the lead as president of Lloyd House and as a member of the ASCIT (Associated Students of Caltech) board of directors. This past year, Smith was an assistant instructor for the IMPACT women's self-defense classes that were offered to any interested students, staff, or faculty, including men, at Caltech's athletic center.

Smith's interest in politics and power structures can be traced back to her mother, a secretary active in the school board and party politics in New York. Likewise, her interest in science comes from her father, a mechanical engineer for a steel plant. The 22-year-old Smith is now forging her own path, which will lead through Europe and Asia beginning in just two months.



Having crossed the Caltech finish line, Smith looks forward to the year ahead. Her selection as a 1993–94 Watson Fellow adds to her already impressive track record in applied physics and student government.

## Keck

Continued from page 1

While the Keck was at work photographing far corners of the cosmos, work was continuing a few hundred feet away on its sibling, Keck II, an identical 10-meter telescope also funded in large part by the W. M. Keck Foundation. Once Keck II is completed in 1996, astronomers plan to link the two instruments electronically through optical interferometry, a technique that will enable the telescopes to function as a single mirror whose diameter is equal to the 85 meters that separate them.

The NIRC is one of several newly designed and built instruments that are slated for upcoming use on the Keck, indeed on both Kecks. But getting there first wasn't easy. About a week before their camera was scheduled to be shipped to Hawaii, Matthews and his colleagues discovered that the tank that holds the liquid helium for cooling the instrument's infrared detector had sprung a leak into the insulating vacuum space. As a quick fix, they patched the leak for shipment to Mauna Kea, but they knew that once they arrived there themselves, they would have to do more than that to keep the instrument up and running properly.

"To keep the vacuum inside the instrument intact and the liquid helium from quickly boiling off, we pumped the vacuum in the instrument every day for the entire run," said Matthews. The strategy worked, but Matthews is looking forward to not having to employ it again. The liquid-helium tank is now back on the Caltech campus, undergoing what everyone hopes will be a permanent repair. The NIRC team's next observing run is scheduled for July.

"We wanted to show the scientific community that the Keck really works as a telescope and especially as a superb infrared telescope," said Matthews. "We're very pleased with how everything turned out."

In addition to demonstrating the Keck's power and potential, the NIRC photo of 4C41.17, the most distant galaxy, has given the astronomical community something new to mull over. Although the galaxy was first spotted with radio telescopes some years ago, the infrared image that the Keck produced is the most detailed yet obtained—clear enough to show for the first time that a number of fuzzy objects surround the galaxy. Astronomers are currently studying these phenomena—one speculation is that they may be less luminous galaxies that are interacting with 4C41.17. More data to resolve or further complicate the issue should be forthcoming later this summer, when the NIRC team returns to the mountaintop.

## FRIENDS

### *Feynman Prize for teaching established*

Caltech has established the Richard P. Feynman Prize for Excellence in Teaching, with the support of a fund endowed by Ione and Robert Paradise, members of the President's Circle of the Caltech Associates. The \$3,000 award will be presented annually to a faculty member who demonstrates

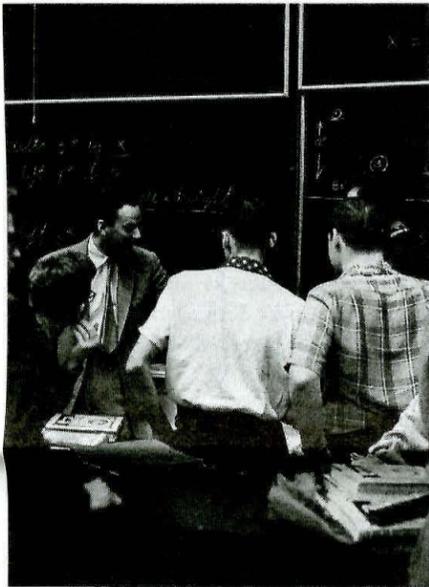


Photo by Tom Harvey

**Feynman in the classroom, in 1956.**

unusual ability, creativity, and innovation in teaching. The prize will be augmented by a corresponding immediate raise in the recipient's salary, as well as by a plaque commemorating his or her teaching achievements.

Feynman, who taught at Caltech from 1950 until his death in 1988, was renowned as a committed, inspirational and original teacher. The award that bears his name is intended to honor his contributions to teaching, and to underline Caltech's own commitment to teaching excellence. In creating the endowment, the Paradises expressed hope that others will be encouraged to honor Feynman and advance excellence in teaching by adding to the fund.

Robert and Ione Paradise joined the Associates in 1989. She is a graduate of UCLA and a past president of the California division of the American Association of University Women. He holds an AB and JD from Stanford and has specialized in oil and gas law. He practiced law in Los Angeles with Gibson, Dunn & Crutcher from 1929 to 1937, served as assistant general counsel of Richfield Oil Corporation from 1937 to 1944, and, after many years in private practice, was general counsel of the Ralph M. Parsons Company from 1966 to 1974, when he retired. He has been involved in the acquisition and development of oil and gas properties and was half-owner of and counsel to Anacapa Oil Corporation.

### *Baxter Foundation grants to support research in medical robotics, bioimaging*

The Baxter Foundation has awarded \$279,000 to two Caltech scientists: Scott Fraser, in support of his research into new techniques for biological imaging; and Joel Burdick in support of his exploration of new directions in medical robotics.

Fraser, the Anna L. Rosen Professor of Biology, is the director of Caltech's Biological Imaging Center, where scientists from biology, chemistry, physics, computer science, and other fields collaborate to develop innovative methods of looking inside living organisms. He will use the Baxter Foundation's award to develop greatly refined magnetic resonance imaging (MRI) microscope techniques, and to develop harmless indicator dyes—dyes that highlight certain features of the body in MRI pictures—to a point where they can be clinically tested.

Burdick, assistant professor of mechanical engineering, works on robots and on the creation of the computer instructions that allow them to operate quickly and smoothly. His research group has developed a prototype 30-jointed "snake robot" and the computer software to make it move side-to-side, stretch out and contract, or even curl up on itself. The flexible design has many potential applications, including exploring collapsed buildings, inspecting complicated structures, or even looking around inside the human body.

Burdick will use the award to develop the prototype of a minimally invasive medical robot, which he envisions would be small enough to be swallowed, and which could make its way through the entire length of a person's gastrointestinal (GI) tract. Endoscopes now in use can see only about 30 percent of the GI tract. Using such a robot, doctors could explore the GI tract for damage, make a diagnosis, and possibly even treat the ailment, all without surgery.

The Baxter Foundation was established by Delia Baxter in 1959 in honor of her late husband, Donald Baxter, a physician, scientist, and engineer. The foundation provides funds to institutions of higher learning for educational research in the field of medicine, including related fields such as biomedical engineering, molecular biology, and gene therapy. For many years it has provided funds for basic research at Caltech. Caltech's Donald E. Baxter, M.D., Hall of the Humanities and Social Sciences was a personal gift from Delia Baxter in honor of her husband.

### *Colvin Centennial Challenge reaches goal*

The Caltech Centennial Challenge has been successfully completed one year ahead of schedule, raising more than \$4.5 million for the Campaign for Caltech. Started in January 1991 by Caltech alumnus Hugh Colvin and his wife, Audy Lou Colvin, the matching grant challenge raised \$1.55 million from alumni and \$3 million from the Colvins.

Hugh Colvin, former president of Unitek Corporation, the world's largest manufacturer of orthodontic supplies, received his BS in chemical engineering from Caltech in 1936 and an MBA from Harvard Business School in 1939. In June 1990, Colvin was one of four



**Hugh and Audy Lou Colvin during a trip to Santa Fe, New Mexico, one of many places they visited, and an area they were particularly fond of.**

Caltech alumni to receive the Distinguished Alumni Award, the Institute's highest honor.

He and his wife died in 1991.

"Throughout his life, Hugh Colvin was a dedicated supporter of Caltech," said President Thomas Everhart. "It is a testament to both him and to the Institute he loved that the Caltech alumni community responded to his challenge with such enthusiasm."

The majority of the money raised from the challenge will go toward the Annual Fund, providing unrestricted support for the Institute. The contribution to the campaign is significant, considering that Caltech would have to raise \$90 million in endowment to yield \$4.5 million in current funds.

Before they established the matching grant challenge, the Colvins had

contributed almost \$1 million to Caltech. They were particularly interested in students, with most of their gifts supporting student-related projects.

The Sierra Madre residents gave nearly \$300,000 to the Beckman Institute Challenge, established an endowed scholarship fund for undergraduates majoring in biology or biochemistry, funded a postdoctoral fellow in biology, and funded several fellowships for the Summer Undergraduate Research Fellowship program. To encourage gifts to SURF endowment, they also provided seed money for five more SURF fellowships, each named after a distinguished Caltech professor—Donald Sherman Clark, William Noble Lacey, Thomas Hunt Morgan, Arthur Amos Noyes, and Ernest Haywood Swift. These were later completely funded by the Centennial Challenge. The couple also provided funds for libraries and medical research at other institutions.

As an alumnus, Hugh Colvin was involved in numerous Caltech organizations. He joined the Associates in 1977 and was its 25th president. He was a member of the President's Circle, was appointed to the board of directors in 1985, serving as its president in 1988. He joined the SURF board in 1983 and was its chairman in 1987 and 1988.

In accepting the Distinguished Alumni Award in 1990, Colvin expressed his gratitude for the education he had received at the Institute and the lifelong friendships that he had formed during his undergraduate years and after his graduation. He said that he was able to attend Caltech because of a scholarship and was happy that he had been able to return something to the Institute to provide scholarships for future generations.

Colvin hoped that the \$3 million challenge would inspire all Caltech alumni, but especially young alumni, to give to Caltech. He designed the challenge so that he would match new gifts from alumni or the increase in their gift amounts in successive years at a two-to-one ratio. However, for young alumni—those who had received a BS degree in the past nine years—the match would be at a three-to-one ratio. Colvin felt that most young alumni had little money to give to the Institute because they were starting families and careers. He felt that they should be rewarded for giving during these more difficult years, and hoped that this would encourage them to give to the Institute and stimulate more gifts in the future.



**A Caltech Associates odyssey took 38 members of the Caltech Associates on a three-week trip to Greece and Turkey this past spring, led by Professor of Geology Kerry Sieh. Top: As day breaks over the Aegean Sea, Sieh and fellow passengers get their first look at the caldera on the volcanic Greek island of Santorini. Left: President's Circle member Jurg Wasser, PhD '44, and wife, Pludie, survey the ruins of a 2nd-century Roman theater in the Turkish city of Myra.**



**Marking the end of her tenure as an Intel graduate fellow, Caltech graduate student in electrical engineering Hayit Greenspan received a plaque last spring from Intel staff scientist Don Sellson, as her adviser, Associate Professor of Electrical Engineering Rod Goodman, looked on. Awarded on the basis of academic merit, the fellowships provide a year of support to Institute students.**



**With a gift from the De Prima family, Caltech has established the Charles De Prima Memorial Mathematics Lecture, to commemorate the late Caltech professor, a faculty member from 1946 to 1992. Those present at the first lecture this past May included (from left) Caltech Professors of Mathematics Emeritus John and Olga Taussky Todd (seated), De Prima's wife, Margaret, Peter Lax of the Courant Institute, who delivered the first De Prima lecture, on the topic of "Witty Mathematics," and Annel Lax, editor of the *New Mathematical Library*.**

## Gifts by Will

*Trusts and bequests provide welcome support to Caltech's Operating and Endowed Funds. Recent gifts received by the Institute include:*

A trust, created by Mr. and Mrs. Finkelstein for the benefit of their daughter, Constance Grippo, has terminated, leaving \$73,444 to establish the Lester M. and Irene C. Finkelstein Endowment Fund for medical research. Irene Finkelstein is an Associate and longtime friend of the Institute.

Raymond F. Labory '31 made a bequest of \$363,919 to the Institute to support the Gnome Club Scholarship Fund. Labory, who died in 1992, had supported the fund for many years.

Caroline M. Kelley McNeice made a bequest of \$155,204 to the Institute's Jon Mathews Class of '57 Memorial Fund, which is a student-loan fund. Mathews, who taught on Caltech's theoretical physics faculty for 23 years after receiving his PhD in 1957, was lost at sea with his wife in 1980 during an attempt to sail around the world.

For information about wording for bequests to the Institute, call the Office of Gift and Estate Planning, (818) 356-2927.

## More Annual Fund thank-yous

The names of the following Annual Fund volunteers for 1992-93 and the areas they represent were inadvertently omitted from the list published in the February 1993 *Caltech News*. These individuals played an invaluable role in the success of the Annual Fund, which is happy to take this opportunity to thank them for their hard work and commitment to the Institute. Each volunteer participated in the Regional Campaign and achieved 100% participation from his assigned prospects.

*C. Croxall LeGrand, Area 315; Dennis C. Evans, Area 495; Keats A. Pullen, Jr., Area 495; John M. Klineberg, Area 500; James L. Liverman, Area 500; Maury I. Marks, Area 505; Edgar W. Gregory II, Area 507; William G. Hwang, Area 510; David A. Hammond, Area 510; Robert D. Christian, Area 515; Rodger W. Baier, Area 518; M. Grant Gross, Jr., Area 518; David L. Randall, Area 518; S. Joseph Poon, Area 520; John C. Waugh, Area 560.*



**Keeping Associates membership all in the family at the Caltech support group's New Members Dinner were longtime Associates and President's Circle members Georgina and William Gimbel. They sponsored their four children's Life Memberships, as well as memberships in the President's Circle. Flanking their parents, daughters Susan Gimbel (left) and Janet Gimbel Rogers (right), and her husband, Stephen Rogers, are part of the growing circle of 2nd-generation Associates.**

## Peter Green's summer of high adventure

By Betsy Woodford

As far as the eye can see there's only snow and ice, mountains and clouds. The temperature is below freezing. Overhead, the sky, when it is visible through the clouds, is a darker blue than most people ever see, due to the very thin atmosphere here. This inhospitable locale, on K2, the second highest mountain in the world, is where Caltech's Peter Green spent eight weeks last summer. Green, a senior scientist in environmental engineering, and his brother, Robert, a JPL scientist, through serendipity had the opportunity to join a Russian, British, and American expedition whose goal was to climb K2.

"It all happened on very short notice," says Green, who is in charge of the instruments in the Environmental Analysis Center. "A climbing friend of

mine ran into the Russian expedition leader in Kathmandu. He was looking for Americans, with cash to spend, to join a Russian expedition with a mountain-climbing permit for K2. Neither my brother nor I had ever been to that part of the world before, and I thought, 'When will I ever get such an opportunity again?'

"I knew the basics about the expedition—it was an underfunded effort, with the Russians providing most of the equipment, and the Americans and the British providing the cash to buy food and pay the porters and various fees. They would use fixed ropes and bottled oxygen—which are necessities for a successful climb. I decided to go. But because I didn't know how expert the expedition's organizers were, I decided to keep my expectations low."



Caltech's Peter Green (left) and his brother, Robert, get a spectacular view of the surroundings on K2, the second highest mountain in the world. After seven weeks of effort, they are on

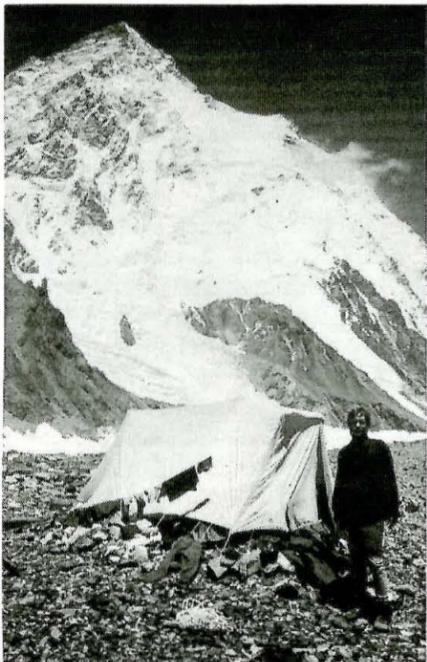
At 28,267 feet, K2 is 761 feet shorter than Mt. Everest, but it's considered the harder mountain to climb. "The easiest route up K2 is along the Abruzzi Ridge," says Green. "It is a much more difficult climb than the usual route up Everest." The success rate of past expeditions clearly shows the difficulty of the endeavor. Ten expeditions have attempted this route up K2 in the last six years. None has put a climber on the summit.

K2 is part of the 300-mile-long Karakoram Range, which lies on the border of China and Pakistan. Located a thousand miles northwest of Everest, the Karakoram Range contains more of the world's tallest peaks than any other mountain range. K2 lies in an area so remote that it takes six days to walk from its base to the nearest village.

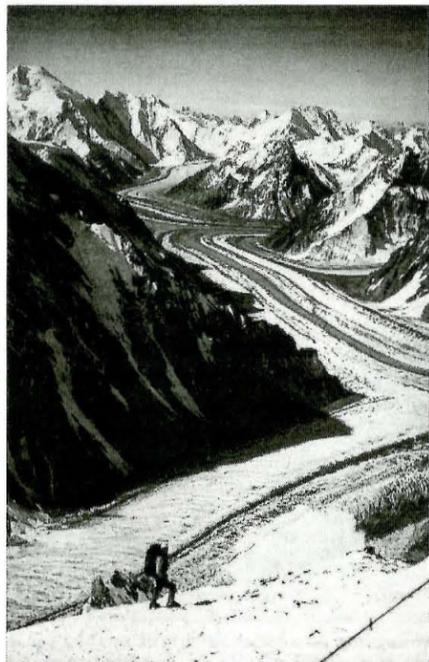
The mountain is so isolated that the local people have no name for it, and the peak was given its unremarkable name in 1856 during a British topographical survey.

In order to travel to K2, the Green brothers each spent \$5,000; some of which they raised, with the help of their mother, by selling special K2 t-shirts. They arrived in Islamabad, Pakistan, on June 8 of last year to await their climbing companions, who were traveling overland from Russia.

Their trip did not get off to a comforting start. The airline lost all but one piece of their luggage. The Russians were a week overdue. "It took another week to finally overcome the necessary bureaucratic obstacles, and to locate the luggage," says Green. "Then everyone boarded the bus to travel to



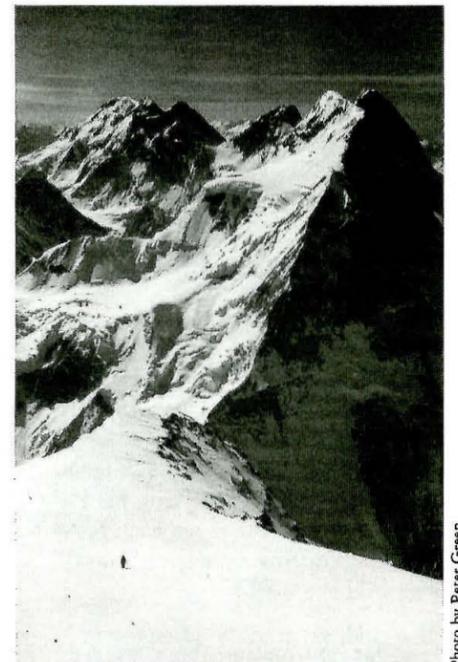
Robert Green does the laundry in base camp, with K2 in the background.



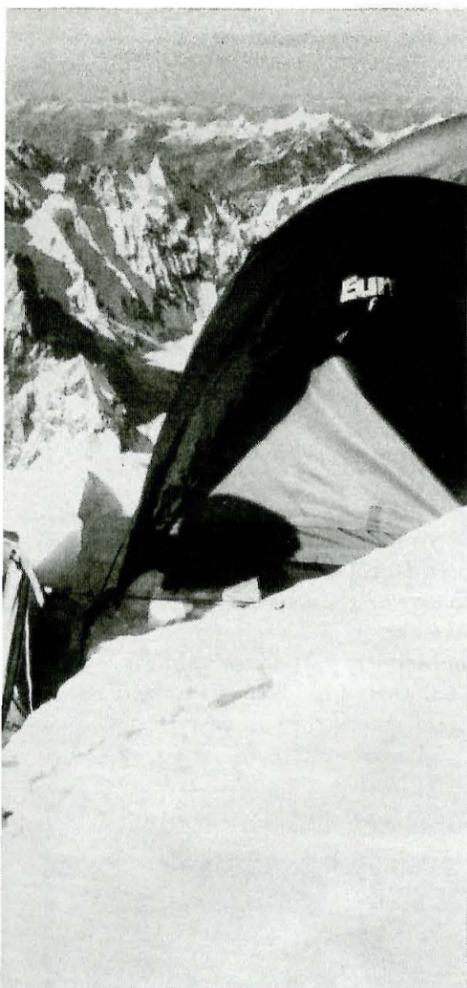
As Peter Green hikes toward camp 2, he looks back at one of the area's many glaciers.



Peter Green completes the mountain's most difficult chimney section, located at 22,000 feet.



Robert Green descending from camp 4. The summit of K2 is on the far right. The five mountains on the horizon are among the world's 20 highest.



mountains from the 26,500-foot level  
67 feet from the summit.

the end of the road."

The journey was 36 hot, bumpy hours through "immense gorges, high desert valleys, across the Indus River, and up to monsoon-drenched foothills." At the end of the road, the climbers assembled their tons of gear—climbing equipment, food, and other necessities for the two-month endeavor—and hired the 180 porters needed to transport the equipment to base camp, located at an elevation of 16,500 feet on the flank of K2. After the eight-day trek, the porters, who were paid \$10 per day to carry 55-pound packs, were let go. The climbers were going to tackle the mountain alone.

Green is no stranger to high altitudes. Growing up in the San Francisco Bay area, he has been hiking since he was two years old, and has climbed extensively in the Sierra Nevada. While earning his PhD at MIT in physical chemistry and doing a postdoc at Caltech, he climbed peaks of 22,000 feet in Peru and Argentina. To train for this trip, he returned to the Sierra Nevada and climbed several of the highest peaks—which at 14,000 feet are half the height of K2.

During the trek to base camp, Green became acquainted with his fellow climbers. There were five Russians—four men and a woman. Two were professional climbing-expedition organizers. The others were a cameraman, a computer scientist, and a doctor. Among the 13 American and British climbers, three were professional mountain guides and three were semi-pros. Other climbers included a lawyer, an insurance salesman, a carpenter, and a couple of scientist/engineers.

Personality conflicts among climbers fill up as much space in mountaineering books as tales of the climbs themselves, but Green entered the situation with realistic expectations:

"I knew it would take an infinite amount of patience to get along with my fellow climbers. As it turned out, that was just the right amount.

"The 44-year-old Russian leader of the expedition, Vladimir, was fearless," says Green. "He would take any risk at any time. He once went up the mountain during a blizzard and wandered around lost for most of a day before finding his way back."

Such risk was not part of Green's plans. "I went on the trip to see the scenery and try to do the best I could," he says. "My philosophy was to give all I had for as long as it was safe. I considered reaching the summit to be beyond my wildest dreams. Setting a new personal altitude record of 23,000 feet was my goal."

From base camp, the climbers started the long process of shuttling supplies—tents, food, and fuel—up the mountain. The route started with an easy walk to the end of the Godwin Austen glacier that flows down from K2. The group then climbed an icefall at the glacier's base. Next came the climb on the Abruzzi Ridge itself, and fastening ropes to the rocks along their intended route. "Without the fixed ropes," says Green, "our many trips up and down would have been far more time-consuming and dangerous."

Climbing the Abruzzi Ridge, the team members walked over snow, ice, and crumbly rocks inclined at a 45 to 50 degree angle. They traversed several stretches of sheer cliffs, usually with mountaineering equipment, but on one cliff they used metal ladders left over from a previous expedition. Working their way up the mountain, the climbers were mummy-like in cold-weather clothing, wearing heavy boots with crampons, and carrying up to 40-pound packs.

Avalanches roared by occasionally, so Green and his fellow climbers planned their route carefully to avoid avalanche chutes. At times, the mountaineers followed the crest of the ridge on a path that was only three or four feet wide with sheer drop-offs on either side. "We accidentally dropped a sleeping bag from camp 2," Green says. "It fell 4,000 feet before stopping."

Green and his brother made a total of seven trips up K2, helping to set up camps at 20,000, 22,000, and 24,500 feet. The team was establishing the progressively higher camps in order to be as near to the summit as possible to wait for a break in the weather. Storms arrive quickly, with strong winds bringing clouds from the south. The storms often last several days, and then there are only one or two clear days until the next storm arrives. "You have to be as high up on the mountain as you can get (or physically tolerate) when the weather clears," says Green, "in order to try for the summit."

But staying high on the mountain often meant waiting out storms. "Robert and I were trapped for four days in camp 2 during a snow storm," says Green. "We were lucky that it didn't deposit too much snow, and that the

wind didn't blow too hard. We were able to continue climbing up after the storm."

The weather was not the only obstacle that the climbers faced. The other was their own bodies. At elevations of more than 20,000 feet, even experienced climbers often lose their appetite, get dehydrated, and have headaches and trouble sleeping. Blood clots, lung troubles, and frostbite have also debilitated high-altitude climbers. "Your body wears down day by day," says Green, "because of the lack of oxygen and the effects of dehydration." In order to keep his appetite in top form, Green took along 40 pounds of his favorite foods—cookies and Pop-Tarts. His wise planning provided a welcome break from the rather bland provisions the Russians had brought along, he says. But in spite of his cookie feasting, Green still

Luck and good weather were not on their side. Although the morning of August 3 dawned clear, the wind was blowing strongly from the south, and storm clouds were approaching. "Robert and I decided to bail out for home," Green says. "The others decided to go on to the top."

By afternoon the sky was overcast. By evening the storm had become "a raging blizzard," Green says.

"Two of the three climbers made the summit, but they had a hell of a time getting back to camp 4," he says. "It took them all day and all night. They suffered frostbite and snow blindness, and had to be rescued by the third climber who had turned back from the summit.

"I have no regrets about turning back," says Green. "Robert and I left all our equipment in camp 4 for the other climbers to use, and went down



A piece of Caltech went to K2—a bag from the bookstore. "It made a great lunch sack," says Green.

lost five pounds on the trip.

Going up at 24,000 feet is not a speedy process by normal standards. Green would take four breaths and then step forward, four breaths, and another step. That is a very fast pace by mountain-climbing standards, and he was complimented on his speed by his fellow climbers. Green was not using bottled oxygen because he considered it too heavy to carry.

On August 2, after almost five weeks of shuttling supplies up the mountain, Green, his brother, and three other climbers reached camp 4, located at 26,500 feet, and were ready for their summit attempt. Under ideal conditions, they could climb the 1,767 feet to the summit in 12 to 18 hours. If darkness fell before the climbers were able to return to camp 4, they would have to find shelter in the snow and spend the night—without tents or sleeping bags, which are considered too heavy to carry during the summit attempt.

"Robert and I felt great and were ready to go to the summit," Green says. "But we had an agreement to head down at the first sign of bad weather."

through camps 3 and 2 picking up trash to take back to the base camp. By descending 10,000 feet in 10 hours, we escaped the storm, and were able to call our mom to tell her we were safe and coming home."

Green did accomplish his goal for the trip, and more. He bested his previous high-altitude record by 3,500 feet.

In all, six of Green's fellow climbers stood on the summit of K2—the first climbers in six years to do so. "They made it through sheer persistence and by taking risks," says Green. Would he go back to try again? "I might go back for the scenery, but would probably try a less dangerous mountain."

Approximately one year after his K2 experience, Green has another mountaineering expedition planned—to the fourth tallest peak in the U.S., Mount Blackburn in the Wrangell Range of Alaska. The high adventure continues.

## ALUMNI

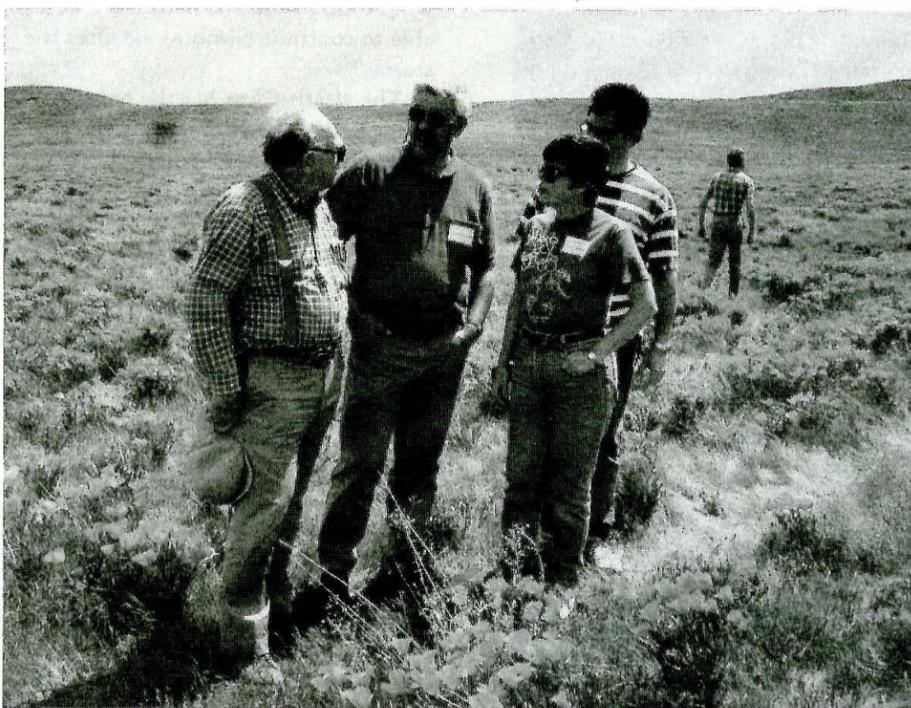
### Chapter Activities

#### Tri-State hears from alumni duo

Noted Stanford biologist Sharon Long '73 and her husband, fellow Caltech alum and well-known food writer Hal McGee '73, spoke this past April in New York City at a meeting of the Tri-State Chapter. Although Long was one of the first women to receive a Caltech BS degree, her talk, "Life in the Underground," dealt not with her undergraduate experiences but with her research into novel ways to improve agricultural crop yields—work for which she received a "genius" fellowship from the MacArthur Foundation last year. McGee, the author of the *New York Times* bestseller *On Food and Cooking*, and a frequent contributor to such publications as *Nature* and *Bon Appetit*, spoke on the chemistry of cuisine in a talk entitled "Playing with Food (Science in the Kitchen)."

#### Neural nets and starry nights on the roster in San Francisco

San Francisco alumni who enjoy learning about progress on many scientific fronts had several opportunities to do so in recent months. On May 25, Frederico Fagin, the president and CEO of Synaptics, Inc., spoke to the San Francisco Chapter on "Neural Nets: A New Paradigm of Information Processing." Fagin concluded his "very stimulating presentation" with the provocative speculation that neural nets—computers whose style of information processing is modeled on biological systems—may one day redefine the nature of human uniqueness, and his talk prompted a round of questions that lasted far into the evening. On two subsequent evenings, May 29 and June 5, the chapter reprised its highly popular "Evening at Lick Observatory." The private tour of the UC facility near San Jose included a viewing of its premier instrument—the 120-inch reflector telescope—and an update on research in astronomy and astrophysics.



An unusually rainy winter created an especially spectacular spring at the Antelope Valley California Poppy Reserve, as a large contingent of alumni and friends discovered when they took part in an all-day field trip centering on Antelope Valley's geology and colorful wildflowers. From left, Keck Foundation Professor for Resource Geology Lee Silver, Doug Josephson '65, Linda Josephson, and Dave Ritchie '80 find themselves surrounded by the state flower.



After speaking to the Washington, D.C., Chapter on how cells in the immune system "talk" to one another, Associate Professor of Biology Ellen Rothenberg did some conversing of her own. Here she's talking to Cliff Cummings '44 and his grandson Scott Driggs, who will be starting Caltech this fall.



From left, Rusty Schweickart '83, Judy Smythe, Rod Smythe '51, PhD '57, Mary Lind, and David Lind, PhD '48, were among the 25 alumni and friends who heard Koepfl Professor of the Humanities Dan Kevies speak on "The Social Challenges of the Human Genome Project" at a meeting of the Colorado Chapter in April.

### Caltech's phone prefix to change

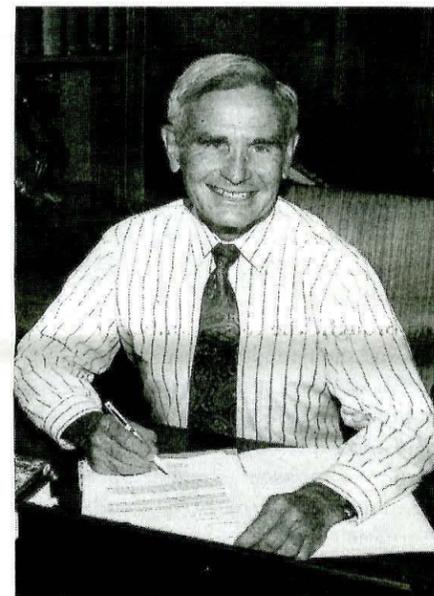
As of July 1, the prefix for all Caltech campus phone numbers will change from 356 or 397 to 395. Callers who use the old prefixes on or after that date will reach the campus operator, who will inform (or

remind) them of the change and connect them to the person or office they're trying to reach. For a helpful mnemonic in making the switch to 395, think DYL. Or if DYL's too mundane, try EXL.

### Le Val Lund looks back on his presidential year

To round out my year as Association president, I would like to bring you up to date on the activities of your Alumni Association in developing programs and services for Caltech's almost 18,000 alumni. Here are some of the highlights of the past year.

The Committee on Long-range Planning has completed its report, which it submitted to the Association



Le Val Lund

Board of Directors on June 3. Since late 1991, the committee of eight members—representing each decade from the '20s through the '80s—has held nine meetings, during which they have reviewed the Association's operations, goals, and directions. Among the committee's specific recommendations are that the Board review the Association's financial policies, examining carefully the role of membership dues income, and revisit the Trilateral Agreement, which sets out the relationship between and the responsibilities of the Association, the Annual Fund, and the Institute. (Association bylaws call for a review of this document once every decade.) The 1993–94 Board will consider the Long-range Planning Committee's report and its recommendations in the upcoming year.

In 1990, the Association Board made an initial effort to have alumni representation on Caltech's Board of Trustees (BOT). The first meeting of the newly formed BOT Committee on Institute Relations was held in January of this year. Making up the committee are seven trustees, including the BOT chair; Caltech's president; the presidents of the Alumni Association and the Caltech Associates; the chair of the Annual Fund; and a Caltech faculty representative. The vice president for Institute Relations and the provost serve as advisory members. The committee will meet four times a year to

develop and foster communication between the trustees and volunteer groups that carry out programs for the benefit of Caltech.

Electronic communications on the Caltech alumni network got into full swing this year, with close to 1,300 alumni requesting accounts. Network bulletin boards have been initiated, including news, jobs, and the Alumni Association calendar.

In a new service started this year, all alumni seeking employment or wishing to change positions now have the opportunity to participate in Caltech Pronet, which provides cross-matching of alumni with national firms and companies seeking experienced science and engineering professionals.

The Association can take great pride in the highly successful 56th Annual Alumni Seminar Day it held on May 15. More than 1,400 alumni registered for the event, which featured a keynote address by 1992 Nobel Laureate Rudy Marcus, and the presentation of seven Distinguished Alumni Awards. Reunions for the classes of 1943, 1948, 1953, 1958, 1963, 1968, and 1983 were held that same weekend and brought the total number of alumni and friends returning to campus to 1,715.

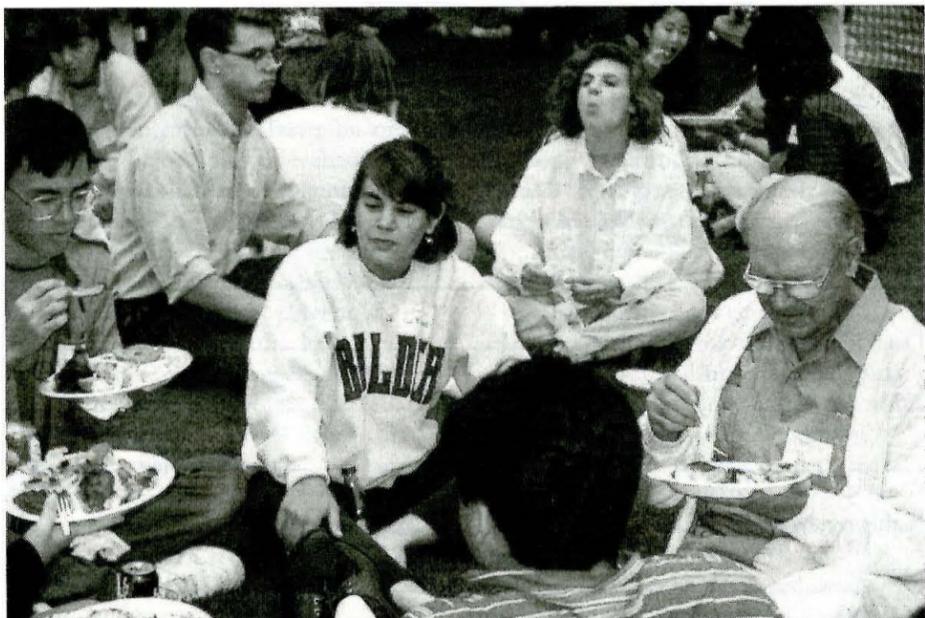
During the year, the Alumni Association conducted three travel/study programs—in Iceland; Ashland, Oregon; and Hawaii. The Association also sponsored local field trips to Mt. Wilson Observatory, the Merle Norman San Sylmar Classic Beauty Collection, the San Gabriel Mountains, the Santa Ana River Mainstem Project, the Big Bear Solar Observatory, and Antelope Valley.

Earlier this year the Association welcomed a new East Bay chapter into its national network, bringing the total number of Caltech alumni chapters to fourteen. In addition to sponsoring a wide variety of chapter events, many of which featured presentations by Caltech faculty, the Association sponsored the annual Holiday Open House

for students, faculty, and staff last winter, the Graduate Underground Social Hour (GUSH) on April 30, and the Senior Barbecue on May 23.

As my year as Association president comes to a close, I'd like to take this opportunity to thank the staff of the Alumni Association and the many Association members with whom it has been my pleasure and privilege to work during the past year. I'd also like to welcome my successor, Bill Whitney '51, whose job it will be to keep this column filled for the next twelve months. And finally, I should remind you that even though the torch has passed, your comments about the Association are always welcome. Please send your ideas and thoughts to Mail Code 1-97, Pasadena, CA 91125, 818/356-6592, or transmit them by electronic mail to the Association President c/o judyamis@pcmail.caltech.edu

**Up in the sky, it's a bird, it's a plane! Or, is it Eaton Canyon and Santa Ana's Seven Oaks Dam? Well, whatever it is, there sure are lots of Institute alumni looking at it. Top Right: More than 40 alumni, including (from left) Dick Knudsen, MS '45, Mary Anne Forrest, Bob Morrison, MS '53, and Judy Dawson joined geologist Bruce Carter, '68, PhD '80, for the Association's second field trip on the geology of the San Gabriels. Right: Seven Oaks Dam Project Manager Art Jung indicates points of interest to Caltech alumni (from left) Bob Wayman '40 and Vic Veysey '36, on the Association's April trip to the Santa Ana River Mainstem project.**



Food and fraternization proved to be big draws, as alums and alums-to-be met and mingled at an Alumni Association Senior Barbecue honoring the class of '93.



From left, grad student in chemical engineering Rob Johnson, Bob Bunker '69, new Association president Bill Whitney '51, and grad student in chemical engineering Phil Lovalenti were among the 140 students and alumni who got together last spring at an Association-sponsored Graduate Underground Social Hour.

## ALUMNI ACTIVITIES

June 10, *Santa Cruz Area Monthly Luncheon*, Peachwood's at Pasatiempo Inn, noon. For reservations, call Bob Shacklett at 408/722-6021. The July lunch will be on July 8, and the August lunch on August 12.

June 17, *San Francisco Peninsula Monthly Luncheon*, Ming's Restaurant in Palo Alto, noon. For reservations, call Hugh Dubb at 415/362-3800 or 408/773-9100. The July lunch will be on July 15, and the August lunch on August 19.

June 8, *Orange County Chapter Dinner/Meeting*, with Caltech President Thomas Everhart.

June 24, *Caltech Big Bear Solar Observatory Tour*.

July 12-21, *Iceland Travel/Study Program*, with Robert Sharp '34, Robert P. Sharp Professor of Geology, Emeritus, and Susan Kieffer, PhD '71, Regents Professor of Geology, Arizona State University.

August 7, *Mount Wilson Observatory Tour*.

August 17-23, *Ashland Shakespeare Festival*, with Jenijoy La Belle, professor of literature.

October 23-24, *Mitchell Caverns/Kelso Dunes Campout*, with Robert Sharp '34, Sharp Professor of Geology, Emeritus.

January 1, 1994, *Tournament of Roses Parade Event*.

February 13-27, 1994, *Guatemala Travel/Study Program*, led by William Schaefer, senior research associate in chemistry.

For more information, please contact Arlana Bostrom for chapter events (818/356-8363), Patsy Gougeon for Seminar Day/reunions (818/356-8366), and Helen Shafran for travel/study and local programs (818/356-8364).

## Association to explore Guatemala

If the study of ancient temples, Caribbean jungles, remote Indian villages, and modern Central American communities appeals to you, mark your calendar for February 13-27, 1994. During those two weeks, William Schaefer, senior research associate in chemistry at Caltech, will accompany 25 adventure-some Caltech travelers through Guatemala's "Heartland of the Maya."

The custom-designed itinerary includes visits to Guatemala's most spectacular archaeological sites, particularly the ceremonial centers of Tikal, and the Mayan world's largest zoomorphic monuments in Quiriguá. Schaefer, who has done extensive studies of the pre-Columbian civilizations of the Mayas, Incas, Aztecs, and their precursors, reports that "our ideas of Mayan culture are undergoing major shifts as we decipher newly uncovered Maya glyphs; it is an exciting time to study the Maya."

Other highlights include the colorful Indian market of Chichicastenango;

the sumptuous colonial churches and residences of Antigua, Guatemala's colonial capital; and two nights on the peaceful shores of Atitlán, one of the most picturesque mountain lakes in the world. The rain forest is also a wonderful natural-history study, offering the opportunity to observe colorful and exotic flowers, trees, birds, and mammals such as parrots, tanagers, toucans, and howler monkeys.

February is an excellent month to visit Guatemala, the "land of eternal spring." The cost for the program is \$3,300 per person, double occupancy, and \$3,750 per person, single occupancy, including airfare from Los Angeles. If you are interested in participating, please fill out the form below and return it to the Alumni Association, in order to receive more complete details of the program. If you have any questions, please call Helen Shafran, assistant director for programs, at (818) 356-8364.

### CALTECH ALUMNI ASSOCIATION

Guatemala Travel/Study Program, February 13-27, 1994

#### INTEREST FORM

I/We wish to participate in the Alumni Association's travel/study program in Guatemala.

Name: \_\_\_\_\_

Phone: (home) \_\_\_\_\_ (business) \_\_\_\_\_

Please mail this form to:

Caltech Alumni Association, Mail Code 1-97, Pasadena, California 91125



#### KEEP US INFORMED!

Keep us informed so we can keep your fellow alums informed. Send us news about you and your family, about a new job, promotion, awards—anything you'd like to see printed in the Personals section of *Caltech News*. Return this coupon and any additional materials to: *Caltech News*, Caltech Mail Stop 1-71, Pasadena, CA 91125.

Name \_\_\_\_\_

Degree(s) and Year(s) Granted \_\_\_\_\_

Address \_\_\_\_\_

Is this a new address? \_\_\_\_\_ Day phone \_\_\_\_\_ Occupation \_\_\_\_\_

News \_\_\_\_\_

## Are they looking for you?



Don't miss the opportunity of a lifetime because a company doesn't know you are there.

From venture capital firms seeking senior management for start-ups to Fortune 500 companies searching for experienced professionals, companies of all types and sizes are always looking for top talent.

Content as you may be with your current position, there are opportunities out there that might entice you to make a change. And, if you're actively looking for a new position, ProNet can help you, too.

Registering with ProNet assures that a profile of your experience and abilities is available to employers seeking to fill challenging positions you wouldn't hear about otherwise.

#### HOW DOES CALTECH PRONET WORK?

A company calls ProNet and requests a search for the individual they need. This request is cross-matched against the profiles of participating alumni. If you're the one they're looking for, you'll be notified. *Complete confidentiality* is maintained throughout this process and you can restrict the release of your profile.

#### HOW DO YOU JOIN?

If you would like an information package, please write to Caltech ProNet Registration Department, Caltech Alumni Association, Mail Code 1-97, Pasadena, CA 91125; or call (818) 356-0654.

**CALTECH**  
**PRONET**

A career service for people not looking for a job... and those who are.

Venture Capital

High-tech

Fortune 500

Start-ups

Bio-tech

Management

Engineering

Pharmaceuticals

Chemicals

Manufacturing

# PERSONALS

1929

T. H. (TOM) EVANS, MS '30, of Lake San Marcos, California, writes that he and his wife have enjoyed retirement for many years with golf, extensive travel, and visits to their children's families. He was a member of the American Society for Engineering Education (ASEE) for almost 60 years, and for services rendered during his tenure he received a "Centennial Certificate" of appreciation from the society as part of its centennial celebration. During his active professional years he was dean at three state universities and one foreign school. From 1952 to 1955 he served on an ASEE national committee to evaluate engineering education. The recommendations of that committee for many years served as a guide for accrediting university engineering programs. Evans was a member of many accrediting teams during the '50s and '60s. In 1959, on a special two-year leave from Colorado State University, he led a group of engineering professors in the establishment of a regional engineering college in Southeast Asia and served as its first dean; the school has since evolved into the Asian Institute of Technology, a major university in Bangkok, Thailand. He has published technical papers on photoelasticity, engineering mechanics, and rainmaking, which a team led by him evaluated in Colorado. He has been listed in *Who's Who in America* since 1955.

1937

SHAO W. YUAN, MS, PhD '42, of San Francisco, California, received an honorary university professorship from Zhejiang University during his recent visit to China. The award was given in recognition of his significant contributions to diverse fields in engineering and the applied sciences. Among previous recipients of this award are two Nobel laureates, Tsung Dao Lee and Chen Ning Yang. Yuan occupied the chair of Canadian Professor of Fluid Mechanics at Université Laval in 1957-58 and was named professor emeritus of engineering and applied sciences by George Washington University in 1984.

1938

STAN WOLFBERG, of Capitola, California, writes that he and his wife "are enjoying the environs of Capitola by the Sea," where they participate in play readings—just in case, he says, Shirley Marneus "calls on us in desperation the next time she needs extra bodies." He also practices what he calls his stand-up routines "as Flotilla Commander of the local Coast Guard Auxiliary, President of the Lifelong Learners at UCSC and the Retired Professional and Businessmen's Club of Santa Cruz, and the monthly meetings of our local Caltech Alumni—a small, but active and interesting group that continues to meet for lunch and exchange words of wisdom, etc."

1948

BENOIT B. MANDELBROT, MS, Eng '49, IBM Fellow at Yorktown Heights and Abraham Robinson Professor of Mathematics Sciences, Yale University, has received the 1993 Wolf Prize for Physics. "He is cited for 'having changed our view of nature.' He is best known as the author of the book *The Fractal Geometry of Nature* (1982). As hinted in the citation, his work has reached beyond physics to mathematics and engineering, but the citation could not hint at the extraordinary appeal that fractals, such as the Mandelbrot Set, have for young people, and of the role they are beginning to assume in education." The Wolf Prize was awarded on May 16 by the President of Israel in the Chagall Hall of the Knesset Building of Israel's parliament, in Jerusalem.

1951

HARDEN M. MCCONNELL, PhD, turned 65 last year and has had a series of events held in his honor, including a symposium last year at Stanford, where he is Robert Eckles Swain Professor of Chemistry. Among the honors are the informally published "McConnell Book," which contains personal information as well as anecdotes from former students and postdoctoral fellows; the March 1993 issue of *Biophysical Journal*, with papers dedicated to McConnell and a brief description of his work; and a festschrift in the March 25, 1993, issue of the *Journal of Physical Chemistry*, which includes a more complete description of McConnell's work and his full publications list. The latter represents the first time a festschrift issue of *Physical Chemistry* has featured a cover photograph of the person being honored. After earning his PhD from Caltech, McConnell served for two years as a National Research Fellow in physics at the University of Chicago and then held a position as research chemist at Shell Development Co. In 1956 he was recruited by Norman Davidson, Jack Roberts, and Linus Pauling and returned to Caltech as an assistant professor of chemistry. He became professor of chemistry and physics in 1963 and moved to Stanford as a professor in 1964. He was named Swain Professor in 1979, and from September 1989 to September 1992 he served as head of Stanford's department of chemistry. He is the recipient of numerous honors and awards, including election as a fellow of the American Association for the Advancement of Science (1982), the Wolf Prize (1984), the Pauling Medal (Puget Sound and Oregon ACS Sections, 1987), the Wheland Medal (University of Chicago, 1988), and the National Medal of Science (1989). In 1982 he received Caltech's Distinguished Alumni Award, and he was a Sherman Fairchild Distinguished Scholar in 1988. He has been on the editorial board of several journals and has acted as a consultant for corporations. He is the founder of Molecular Devices Corporation, in Palo Alto, California, and is also the founder of the nonprofit Foundation for Basic Research in Chemistry. He and his wife, Sophia, have raised three children—Hunter, Trevor, and Jane.

1958

PETER SMITH, MS '59, of Scottsdale, Arizona, writes, "After 29 years with Honeywell I accumulated enough 'points' to make retirement possible—so I did. I find I'm busier now than when I was 'working.' Honeywell transferred me from Minnesota to Florida back to Minnesota and finally to Arizona. Fortunately we ended up in the Valley of the Sun and love it. Marcia (aka Marcia Jones, Scripps '60) and all are fine. The two oldest boys are late bloomers academically and are living at home attending Arizona State—odd to be retired and still have kids at home—but glad they value education as much as I did the Caltech experience."

1962

BRUCE A. LOVELL, MS, of Niwot, Colorado, has retired from IBM after 30 years of service. He now has his own computer consulting and custom programming business in Boulder.

1965

JOHN C. SIMPSON, JR., of Marshall, Virginia, has been elected vice president of Mobil Oil Corporation, with responsibility for the company's worldwide supply and trading division. He began serving March 1.

1967

JAMES F. BEALL, of Houston, Texas, in January was appointed a vice president of the ARCO Oil & Gas Company, a subsidiary of Atlantic Richfield. His areas of responsibility include external affairs and safety, health, and environmental conservation.

ARTHUR T. HUBBARD, PhD, Rieveschl

Eminent Scholar of Surface Chemistry and director of the Surface Center at the University of Cincinnati, has received the David C. Grahame Award of the Physical Electrochemistry Division of the Electrochemical Society, for excellence in physical electrochemistry research. After graduating from Caltech, he served on the faculty of the University of Hawaii for nine years, and on the faculty of the University of California at Santa Barbara from 1976 to 1986. In 1986, he was appointed by Ohio Governor Richard F. Celeste as the first Ohio Eminent Scholar at the University of Cincinnati. His research focus is the surface chemistry of solid electrodes, particularly electrochemical methods of investigation combined with surface diffraction and spectroscopy. He has authored more than 180 papers and won numerous awards. A member of the Electrochemical Society since 1968, he is currently vice chairman of its Cincinnati Local Section. He is also associated with the American Chemical Society, the American Association for the Advancement of Science, and the Society for Electroanalytical Chemistry.

1970

RAHUL BASU, of Bangalore, India, returned to his position as a scientist at DRDO in 1991, after five and a half years at North Carolina State University at Raleigh. While in the United States he visited the Blue Mountains, New York, Washington, Los Angeles, Florida, and Mississippi. He asks old classmates to get in touch with him when visiting India.

1971

JAMES KOSMICKI, MS, Eng '73, of Pasadena, California, successfully completed the defense of his doctoral dissertation on December 9, 1992, in the school of education at the University of Southern California. His PhD in instructional technology was awarded at graduation ceremonies on May 7. His research was conducted at Pasadena City College, where he has been teaching in the mathematics department for the past 12 years. He will be promoted to full professor this fall. He has been active in Caltech's Annual Fund for several years and has been recognized as the area chair inside California to achieve the highest percent of donors for three of the past four years. "Keep up the good work, Arroyo Seco Area volunteers and donors," he writes. He and his wife, Joan, have been living in Pasadena since 1974.

FRANÇOIS WILDENBERG, MS, of

Contrexeville, France, is pleased to announce the birth of his second daughter, Julia. The first, Laura, is now two years old. "That is happiness!" he writes. As a subcontractor in the machine tooling of spare parts and dies, he has just earned his ISO9002 certification and is in the market for new customers.

1972

ROBERT C. DULLIEN, of Boulder, Colorado, writes that, as a technology management consultant, he is "building a growing practice in the exciting area of technology transfer, market assessment for new ideas and decision making under uncertainty."

1974

JESSICA TUCHMAN MATHEWS, PhD, has been named to the U.S. House of Representatives' new Advisory Group on Renewing U.S. Science Policy, which will assist the House Committee on Science, Space, and Technology's Subcommittee on Science as it attempts to ensure that federally financed research and development address the challenges facing the nation. Mathews is vice president of the World Resources Institute, a columnist for the *Washington Post*, and a former Congressional Science Fellow. She has served on numerous scientific panels and advisory committees.

1976

DAYNA J. SALTER writes, "I am now in the Houston area, with Mobil Oil, as a senior staff geophysicist in the Producing Department. My husband, Tony Smith, and I live in The Woodlands. Our hobbies include our Koi/Goldfish water garden, golf, and our cats, and Tony makes an excellent home-brewed lager. Those alumni who were in Blacker house during 1974-75 will remember the two House cats, Cliffie Mae and Arthur. They passed away peacefully this past fall, Arthur in September and Cliffie in November. They were almost 19 years old and lived happy, pampered lives. They are survived by their feline siblings Midnight, Twilight, and Molly."

1977

MADELINE A. SHEA and MARC S. WOLD, BS '79, write that they are pleased to announce the birth of a son, Michael Alexander Wold, on June 24, 1992. He was 22.5 inches and 11 pounds 5 ounces at birth, and 30 inches and 24 pounds at six months. The couple are on the faculty of the Department of Biochemistry at the University of Iowa College of Medicine. Madeline's lab studies cooperative mechanisms of protein interactions, focusing on calmodulin; Marc's studies human proteins involved in cellular DNA replication.

1984

MARCUS CHOWN, MS, writes from London, where he is a journalist, that his first popular-science book, *Afterglow of Creation*, will be published by Arrow (Random House) in July. The book is about the cosmic background radiation and the COBE "cosmic ripples" discovery.

LARRY MEIXNER writes, "I finished my PhD in physical chemistry at Stanford last year.

After an unexpected but enjoyable nine-month detour to Boulder, Colorado, I have joined the research staff at Air Products in Allentown, Pennsylvania. The countryside is beautiful, and I'm having a good time exploring the East Coast."

1985

MICHELE WALTERS COSTA, of Germantown, Maryland, has been on leave of absence from IBM since the birth of her son, Michael Thomas Costa, on March 30, 1992. Her husband, Tom, is still employed by IBM.

CINSY MCCALLEY KREHBIEL and JOHN KREHBIEL, BS '84, of Satellite Beach, Florida, have "great news. We had a wonderful baby boy, Karl Edward Krehbiel, on September 25, 1992." Both are working for Harris Corporation, on the Florida Space Coast.

1987

EMILY A. CARTER, PhD, an associate professor of chemistry at UCLA, has been named an Alfred P. Sloan Research Fellow for 1993-1995, and has received the Glenn T. Seaborg Award (UCLA) for 1993.

# OBITUARIES

1920

ALFIO BISSIRI, on July 20, 1992; he was 94. He was an electrical engineer for the Los Angeles Department of Water and Power until his retirement at age 65. He is survived by his nephew PAUL BISSIRI, BS '46.

1921

ROBERT W. CRAIG, of Los Angeles, on March 7. He is survived by his wife, Jane.

1922

LESTER O. WARNER, of San Marino, California, on March 3. He is survived by two daughters and three grandchildren.

1927

HALLAM E. MENDENHALL, of Ocean City, New Jersey, on April 7. He is survived by his wife, Frances, and his stepdaughter, Jan Van Gilder.

ENGLE F. RANDOLPH, of Laguna Hills, California, on February 14. He is survived by his wife, Irma.

1928

EDWIN W. TEMPLIN, of Newport Beach, California, on January 30, 1992.

1929

WALTER B. GRIMES, of Chico, California, on March 4; he was 85. His first job was with the Army Corps of Engineers in Mississippi. After nine months he was transferred to Sacramento and for the next decade worked in Northern California on river improvements. In 1940 he entered the Corps as a captain. After two years of service in Virginia he began a 32-month tour in the South Pacific, later earning the rank of colonel. He began his private practice as a civil engineer in Chico in 1948, and he retired in 1975. He was very active in civic organizations and served on the boards of many, including the Greater Chico Chamber of Commerce and the United Way. He was elected to the Butte County Republican Central Committee and served as chairman for one year. He also served on the Butte County grand jury and was appointed to the draft board during the Vietnam War. In addition, he was the commanding officer of several Army Reserve units in Butte County. He is survived by a son, Walt; a daughter, Marilyn Hill; a brother, Fred; and four grandchildren and one great-grandchild. His wife died in 1990.

1931

JOHN S. DETWEILER, of San Anselmo, California, on April 11; he was 83. A chemical engineer, he worked for Chevron for many years. He was a life member of the American Chemical Society and a member of the World Affairs Council and Sons In Retirement. An avid traveler, he had visited Europe and Africa. He is survived by his wife, Alice; two daughters, Catherine Gubman and Susan Patterson; a son, John; and three grandchildren.

HENRY W. SCHULTZ, JR., Ex, of San Marino, California, on August 10, 1992.

GEORGE G. WATSON, of Palm Desert, California, on March 7; he was 84. He was an engineer with the Anzon Company for 35 years. After retiring from Anzon, he joined the Casablanca Fan Company—a worldwide supplier of ceiling fans—as production manager. He retired from Casablanca after six years. He was an outstanding athlete at Caltech, lettering in football, track, and basketball, and was named an honorable-mention football all-American; he was also captain of the 1931 conference-champion football team, and a recipient of the Wheaton Trophy. He is survived by his wife, Barbara; three daughters, Bobbette

Hamilton, GiGi Spinazze, and Ginnie Lotchfeld; two sisters, Barbara Vernon and Virginia Kratt; and 10 grandchildren and two great-grandchildren.

1933

ARTHUR N. PRATER, MS, PhD '35, of Encino, California, on February 23; he was 83. After earning his doctorate, he worked for Continental Oil Company as a research chemist (1935–1936) and Shell Oil Company as a refinery technologist (1936–1938), and then returned to Caltech as a postdoctoral fellow (1938–1941). He worked for the U.S. Department of Agriculture as a research scientist from 1941 to 1945, and then joined Gentry, Inc., which later became a division of Consolidated Foods Corporation. He held a number of positions at Gentry, including president of the company and vice president of Consolidated Foods. In 1964 he went into private practice as a chemical engineer. He was a member of many organizations, including the American Chemical Society, the Institute of Food Technologists, and the American Association of Cereal Chemists. He was the holder of various patents and published articles in *Analytical Chemistry*, *Journal of the American Chemical Society*, *Science*, *Food Technology*, and *Chemical & Engineering News*. He was a fellow of the American Association for the Advancement of Science and the American Institute of Chemists, and was listed in *Who's Who in America*, *Who's Who in Industry and Commerce*, and *American Men of Science*, among other publications. He was a member of the Associates of Caltech. He is survived by his son, Nowland; his wife, Thelma, died in 1983. A memorial fund has been established at Caltech. Those wishing to contribute should write to the Arthur N. Prater Memorial Fund, Caltech, 1201 East California Boulevard, 105-40, Pasadena CA 91125.

1934

FRANKLIN J. MCCLAIN, of Mill Valley, California, on September 29, 1992; he was 82. During his 47-year career, he specialized in fire-protection engineering and fire-risk assessment, and he advocated installing automatic sprinkler systems in buildings. He was employed by the Factory Insurance Association, Underwriters Services, and the Fire Protection Engineering Group. He retired in 1987. He moved to Mill Valley in 1948, where he was very active in civic affairs. In 1961, he headed a recall committee that helped elect a new county supervisor, and he took an active role in the "Save Horse Hill" movement when a developer wanted to build 1,200 apartment units there. Over the years he served on the Alto Sanitary District, the Alto-Richardson Bay Fire Protection District, the Southern Marin Subregional Sewage District, and the county's Flood Control District. He was a member of the San Francisco Commercial Club, the Society of Fire Protection Engineers, the National Fire Protection Association, and the Institute of Electrical and Electronics Engineers. He is survived by Aline, his wife of 44 years; a daughter, Nancy Blue; a son, Tim; and a sister, Elizabeth Glenn.

ROBERT G. PITTS, MS, on February 17, 1992. He is survived by his wife, Ruby.

1936

CHARLES O. HEATH, of La Jolla, California, on January 31. He is survived by his wife, Jessie.

CLYDE B. JONES, Ex, of Palm Springs, California, on March 9; he was 79. He worked for 23 years as an engineer, including eight as director of engineering for the aircraft division of the Hughes Tool Company. He also held nine patents on hydrofoils and control surfaces for sailing boats. He is survived by his wife,

Virginia; his son, Thomas; his daughter, Gloria Griffen; and his brother, Charles.

1937

THOMAS R. BELZER, of Vista, California, on January 30. He was a retired colonel, United States Marine Corps. He is survived by his wife.

JAMES A. HURST, Ex, of Whittier, California, on August 14, 1986. He is survived by his brother, Stephen.

1938

JOHN R. "JACK" BAKER, of Dana Point, California, on March 21; he was 76. He served in the U.S. Navy during World War II and worked for Baker Oil Tools for 43 years, during which he earned 33 patents and established a subsidiary in Mexico City. He is survived by his wife, Dood; two sons, John and David; three grandchildren, Michael, Ryan, and Adrienne; and a sister, Katharine Podlech. A memorial fund has been established at Caltech. Those wishing to contribute should write to the John Baker Memorial Fund, Caltech, 1201 East California Boulevard, 105-40, Pasadena CA 91125.

MARVIN H. GREENWOOD, MS, of Houston, Texas, on March 30; he was 78. He worked for Southern Aircraft, in Houston, and in 1941 was hired by the Boeing Aircraft Company, in Seattle. There he rose to assistant chief of preliminary design before he was 30. He returned to Houston in 1945 and cofounded Anderson, Greenwood and Company with his brother-in-law, Ben Anderson; and Lomis Slaughter. He served on the board of directors of Tech-Sym. He is survived by his wife, Barbara; two daughters, Mimi Ellis and Pamela; three sons, Nelson, Benjamin, and John; two stepdaughters, Ann Joyce and Louise Cody; a stepson, Melville Cody; five grandchildren; two stepgrandchildren; a sister, Mary Anderson; and a brother, James. His first wife, Anna, and a daughter, Elizabeth, are deceased.

1941

PAUL LIEBER, MS, PhD '51, of Orinda, California, on December 12, 1992. He is survived by his wife.

1942

PAUL N. A. VEENHUYZEN, of Sun City West, Arizona, on February 8. He is survived by his wife, Audrey; three sons, Peter, Mark, and Carel; a stepdaughter, Diane Storey; a stepson, Kenneth Harris; two grandchildren; four stepgrandchildren; a sister, Judy Klindt; and a brother, Carel.

1943

WILLIAM J. BURLINGTON, MS, of Hanford, California, on March 9; he was 76. He was an optometrist. He joined the U.S. Navy in 1942 and served in the Pacific after studying meteorology at Caltech; after the war, he remained in the Naval Reserve for 20 years and retired with the rank of lieutenant commander. He was a past president of the Hanford Kiwanis Club, the Kings-Tulare Optometric Association, and the California Optometric Association. He is survived by his wife, Maxine; a son, William; a daughter, Gwen Zimmerman; and four grandchildren.

RICHARD N. LEWIS, PhD, on February 8, 1992. He is survived by a son, Gilbert.

1947

ARTHUR S. BOLLES, of Bradenton, Florida, on December 13, 1992; he was 72. He is survived by his wife, Marjorie; a daughter, Elizabeth Blakely; two grandchildren; and a brother, Ralph.

1949

EDWARD L. ALEXANDER, of Torrance, California, on February 18. He is survived by his wife, Pat; a daughter, Sharon; and two sons, Mark and Eric.

1950

ROBERT L. GOTTLIER, MS '51, of Alhambra, California, on April 20. He is survived by his wife, Mildred, and two sons, Robert and James.

EDWARD A. REVAY, of Rolling Hills Estates, California, on December 13, 1992. He is survived by his wife, Wendy, and a daughter, Linda.

HARRY VAN AKIN, of Ventura, California, on December 11, 1992; he was 70. He had retired in 1977 after a 27-year career as an electrical engineer in the United States Bureau of Ships. He was a World War II Navy veteran. He is survived by his wife, Elaine; a daughter, Linda; a sister, Elizabeth Wolfe; and two brothers, Daniel and George.

1952

PHILIP S. THAYER, PhD, of Hull, Massachusetts, on February 2; he was 69. A biochemist, he taught chemistry at the University of California at Berkeley before joining the Arthur D. Little Company, where he worked in the Life Sciences Division and was named a vice president. He lived for many years in Arlington, Massachusetts, where he was a member of the town meeting and served as the first chairman of the Arlington Conservation Commission. He moved to Hull six years ago. A history and genealogy expert, he wrote columns for the local newspaper and served as its "ultimate source for word usage, grammar, syntax and all things historical or nautical. There was seemingly no subject that didn't arouse his curiosity and gentle wit." He was an avid bird-watcher and naturalist and, as a member of the Hull Lifesaving Museum, participated in many museum events, sometimes narrating historical tours in period costume. He is survived by his ex-wife, Virginia; a son, Philip, Jr.; two daughters, Margaret and Elizabeth; a brother, Robert; a sister, Esther Hendrickson; and a granddaughter, Chelsea.

1954

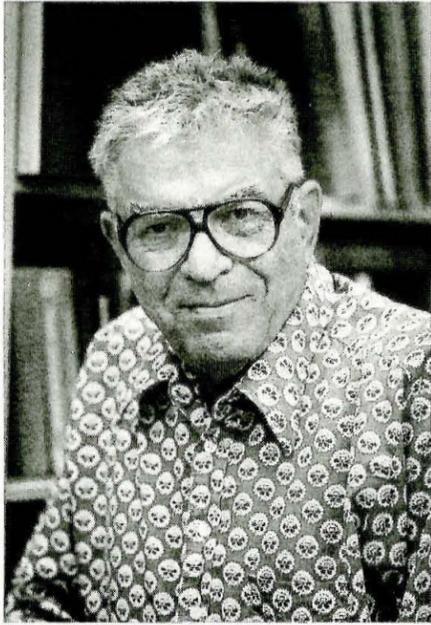
STANLEY P. HUGHART, PhD, of Carmichael, California, on January 1. He is survived by his wife.

1957

FREDERICK C. HALL, MS, of Bellevue, Washington, on November 1, 1992. He is survived by his wife, LaVerne.

1964

KEITH J. VICTORIA, MS, PhD '69, of Del Mar, California, on April 9; he was 53. An aeronautical engineer, he worked at Aerospace Corporation in El Segundo, California, for six years before moving to Science Applications International Corporation in San Diego, where he spent 18 years and rose to corporate vice president. He was head of the company's hydrodynamics research operation, both in San Diego and in Annapolis, Maryland, where he was involved in innovative ship and submarine designs. In recent years he contributed to the design of the America's Cup yacht *Stars & Stripes*, which won the cup back from Australia in 1987. He is survived by his wife, Sherry; a daughter, Karin; a son, Jonathan; a stepdaughter, Kara Rosetto; his mother, Winifred; and a sister, Katha.



Robert Langmuir

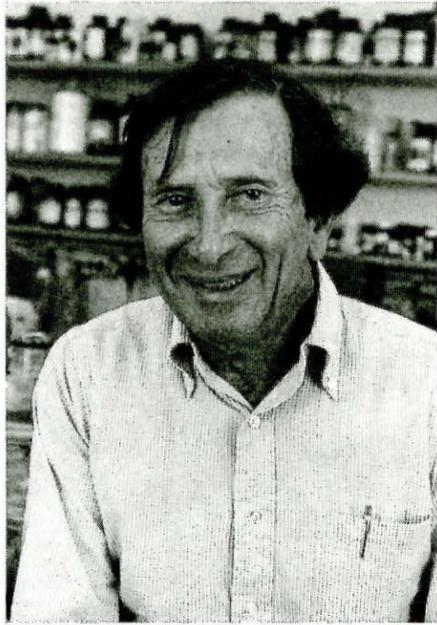
## Robert Langmuir 1912–1993

Robert Langmuir, professor of electrical engineering, emeritus, and the codiscoverer of synchrotron radiation, died May 1, at the age of 80. He had been a Caltech faculty member for 45 years.

A 1935 graduate of Harvard, Langmuir worked in Pasadena from 1939 to 1942 at the Consolidated Engineering Corporation, and then returned to the east to work at the General Electric Company research laboratory in Schenectady, New York, from 1942 to 1948. He was awarded his PhD from Caltech in 1943, for work on improving the performance of electron microscopes. At GE, he worked on radar countermeasures until the end of World War II, and was then a member of the small group that designed and constructed a 70 MeV electron synchrotron; several copies of this accelerator were manufactured by GE over the next few years for nuclear physics research in the U.S. and abroad.

In 1947, Langmuir reported the discovery, with F. R. Elder, A. M. Gurewitsch, and H. C. Pollock, of visible radiation emitted tangentially from the circular orbits of the electrons in the synchrotron. It was recognized almost immediately that this radiation, now called synchrotron radiation, arose from the acceleration of highly relativistic electrons in the the synchrotron's magnetic field. Synchrotron radiation has now been observed in many astrophysical situations, such as radio galaxies. In 1948, Langmuir reported the discovery of a new, radioactive isotope of potassium, K-37.

In 1948, Langmuir returned to Caltech. For the next 12 years, he played an important role with then-Caltech faculty members R. F. Bacher, M. L. Sands, A. V. Tollestrup, and R. L. Walker, in designing and constructing a much higher energy syn-



Heinz Lowenstam

chrotron—for many years, the highest-energy electron accelerator in the world. In the first phase of its operation, the maximum energy was 550 MeV and, in the second phase, the energy was pushed up to 1500 MeV. Langmuir was mainly responsible for the radio-frequency power systems. Former Caltech professor Matthew Sands, now professor of physics, emeritus, at UC Santa Cruz, recalls that "Joe" Langmuir's contributions to the synchrotron were of critical importance to its success as an electron accelerator, because such enormous levels of radio-frequency power had to be developed to overcome the prodigious rate at which energy was being radiated away by the very-high-energy electrons.

Langmuir became associate professor of electrical engineering in 1951, and professor in 1957. Beginning in 1950, he taught, among others, courses in electricity and magnetism, and in electronics. For the former, he authored the textbook *Electromagnetic Fields and Waves* in 1960, based on the course he had designed. Until his retirement in 1980, he continued research on various topics in applied physics and engineering. He served as head of electrical engineering from 1960 to 1970.

During his years at Caltech, Langmuir consulted for Consolidated Engineering Corporation from 1953 to 1955, and for TRW Inc. from 1956 to 1964, as well as for other organizations for shorter periods. He was a fellow of both the American Physical Society and the Institute of Electrical and Electronic Engineers.

His family has suggested that contributions to Caltech in Langmuir's memory may be sent to the Development Office, Mail Code 105-40, Caltech, Pasadena, CA 91125.

## Heinz Lowenstam 1912–1993

Heinz Lowenstam, Caltech professor of paleoecology, emeritus, and the scientist whose discovery that animals can biologically generate their own magnets laid the foundations for the field of biogeomagnetism, died of cancer on June 7. He was 80 years old.

It was in the 1960s that Lowenstam startled biologists and geologists alike with the finding that living organisms can do what conventional science had considered impossible: they manufacture substances such as the iron-containing mineral magnetite within their bodies. Lowenstam first uncovered this phenomenon in a chiton, a sea creature that he discovered had "iron teeth." Magnetite has since been found in organisms ranging from bees to birds to fish, and is strongly suspected to exist in cetaceans. Initially, however, Lowenstam's findings were greeted with great skepticism.

"Most of my colleagues thought I had gone crazy," he once recalled wryly. But in 1975, when a group of biologists independently uncovered a class of magnetic-sensing bacteria, it was Lowenstam who suggested that these organisms were also biosynthesizing magnetite, a prediction that turned out to be correct. Out of this finding came the discovery that many migratory animals generate magnetite and may owe their uncanny homing instincts to the presence of this "internal compass" that allows them to navigate by means of Earth's magnetic field. Just last year, Caltech Professor of Geobiology Joseph Kirschvink '75, a student of Lowenstam's as an undergraduate, announced that he had found magnetite crystals in human brains.

A scientist of wide-ranging interests, Lowenstam conducted research in fields ranging from geology to paleontology, to prehistoric ecology. Some of his most important work was in biomineralization, investigating the chemistry and biology of the teeth, shells, and other preserved parts of both extinct and living marine animals. Asked on occasion to explain what it was he actually did, Lowenstam liked to say he was a "professional beachcomber."

For his research achievements, Lowenstam was elected in 1984 to the National Academy of Sciences, one of the American scientific community's highest honors. Along with his landmark work on magnetite and biomineralization, he is credited with discovering that coral reefs can be major sources of oil deposits and with spearheading the first research effort to analyze intact protein samples in ancient fossils.

"Trained as an orthodox paleontologist," says his Caltech colleague of 30 years Leon Silver (the Keck Foundation Professor for Resource Geology), "Heinz Lowenstam was an original, creative scientist who recognized before most of

his colleagues that the chemical interplay of ancient organisms and their environments led to important evolutionary influences on the organism, and, at the same time, left important environmental information recorded in the fossils of such organisms. A most telling indication of his remarkable talents is the list of his research collaborators and students. They (and I) were all fascinated, charmed, and persuaded by this great and gentle scientific free spirit."

A Jewish native of Germany, Lowenstam was born in Upper Silesia, today part of Poland. He was educated at the University of Munich, where the onset of his graduate studies coincided with Hitler's rise to power. In 1935, he infuriated his department chairman, a man of pronounced Nazi sympathies, by announcing his intention to carry out his PhD geology field research in Palestine. He spent the next 18 months in the Middle East and returned to Germany just in time to feel the full impact of a new law that prohibited the awarding of doctoral degrees to Jews. Carrying letters of recommendation from his two advisers—who wrote them, Lowenstam later said, at some personal risk to themselves—he immigrated to the U.S. in 1937, where he was accepted for graduate study at the University of Chicago.

After receiving his PhD from Chicago in 1939, Lowenstam went to work first as a paleontologist for the Illinois State Museum, and then as a geologist for the Illinois State Geological Survey. In 1948, he joined the geochemistry faculty of the University of Chicago, working with Nobel Laureate Harold Urey and isotope geochemist Sam Epstein (now Caltech's William E. Leonhard Professor of Geology, Emeritus) on the temperatures of the ancient oceans. He joined Caltech's faculty in 1952, and retired from active teaching, as professor emeritus, in 1984. Up until a few weeks before his death, he continued to carry out active research.

In pursuit of his research, Lowenstam traveled all over the world, but for more than 40 years he steadfastly refused to go back to Germany because of the painful memories. In 1981, however, impressed by many of the young Germans he had met, and to honor the two professors who had put their careers on the line for him in 1937, he returned to the country of his birth to accept an honorary degree from the University of Munich, the same institution that had denied him his doctorate in 1937. And in 1990, he finally revisited Upper Silesia, with his granddaughter, Rabbi Lisa Goldstein.

As *Caltech News* went to press, the Caltech community was greatly saddened to learn of the death of Edward Posner, visiting professor of electrical engineering since 1978 and chief technologist at JPL. Posner, 59, was struck and killed by a truck as he bicycled from Caltech to JPL on the morning of June 15. An obituary will appear in the August *Caltech News*.

# Caltech *News*

California Institute of Technology  
Pasadena, California 91125

ADDRESS CORRECTION REQUESTED

---

Issued six times a year (Feb., April, June, Aug., Oct., and Dec.) and published by the California Institute of Technology and the Alumni Association, 1201 East California Blvd., Pasadena, California 91125. Third class postage paid at Pasadena, California. Postmaster: Send address changes to: *Caltech News*, Caltech 1-71, Pasadena, CA 91125.

Le Val Lund  
*President of the Alumni Association*  
Thomas W. Anderson  
*Vice President for Institute Relations*  
Robert L. O'Rourke  
*Assistant Vice President for Public Relations*  
Jane S. Dietrich  
*Director of Periodicals*

*Executive Editor* – Heidi Aspaturian  
*Production Artist* – Barbara Wirick  
*Copy Editors* – Danielle Gladding, Julie Hakewill  
*Photographer* – Robert Paz  
*Contributors* – Jay Aller, Hillary Bhaskaran, Michael Rogers, Betsy Woodford  
*Circulation Manager* – Susan Lee

California  
Institute of  
Technology

# Caltech *News*

Volume 27, No. 3  
June 1993



---

In this issue

*Seeing infrared from blue Hawaii, the Keck Telescope makes a bright debut.*

**Page 1**

*It stands to reason that a student of politics would get elected to something. But to the National Academy of Sciences?*

**Page 3**

*Graduating senior Aimée Smith wanted to know how other nations treat women in science. So she applied for a Watson Fellowship to find out.*

**Page 5**

*Looking for a way to spend your summer vacation? A Caltech scientist spent his scaling the world's second-highest mountain.*

**Page 8**