California Institute of Technology
Pasadena, California 91125

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Caltech News

Volume 35, Number 2/3
2001

In This Issue

A multitude of voices are heard when alumni, students, and faculty discuss diversity, nonconventional research, airline safety, philanthropy, and Caltech past and present

California Institute
of Technology

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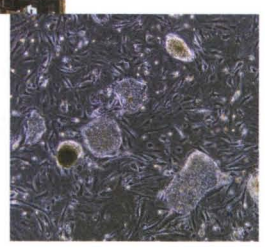

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Caltech receives $600 million from Gordon and Betty Moore and Moore Foundation

As *Caltech News* went to press, the campus learned that Caltech has received two gifts totaling $600 million—half from Intel cofounder Gordon Moore, PhD '54, and his wife, Betty, and half from the Gordon and Betty Moore Foundation. Together the two are the largest donation ever made to an institution of higher learning. Moore said that the gifts are intended to allow Caltech to continue to do what it does best—collaborative work between disciplines—and to keep the Institute on the forefront of science and technology.

Moore, 72, has been a Caltech trustee for 18 years, serving as chairman of the board from 1993 to 2000.

"Caltech has a unique ability to do multidisciplinary work—partly because of its size and partly because of its history," said Moore. "It is described as being a national treasure and it certainly is. The education I received there has served me well. We are hoping this gift will position the Institute well as it moves forward."

More information is available at the Caltech Web site—www.caltech.edu

Up Front

A word about this double issue

It all started with letters from *Caltech News* readers. So many have arrived in recent months that we knew they would be a key component of the upcoming issue. With that in mind we took a fresh look at the stories we were working on and noticed how, like the letters, they represented a lively spectrum of the Caltech community. We decided to combine all these views and voices into a single issue. When the single issue began to look more and more like a double issue, we got our printer's assurance that the bindery could fold 32 pages and kept on going.

Having heard from a cross section of the community, we'll give you a preview of who these people are and what they are saying. They are students, hard at work in the labs and in the field. They speak about weights and balances, physical and social. They are faculty members charged with educating the students and forging ahead into new areas of research. They are friends of the Institute, supporting Caltech's research and teaching efforts. They are administrators concerned with the Institute's role in science and society and with the evolution of national science policy.

They are alumni. Whether remembering their student days or considering current events, they are weighing in in record numbers, bursting the seams of the new Tech Talk section and the *Caltech News* issue at hand. Read what they have to say in feature stories and in their letters, Class Notes, and Personals. And, should you feel similarly inspired to join in the conversation, please do.

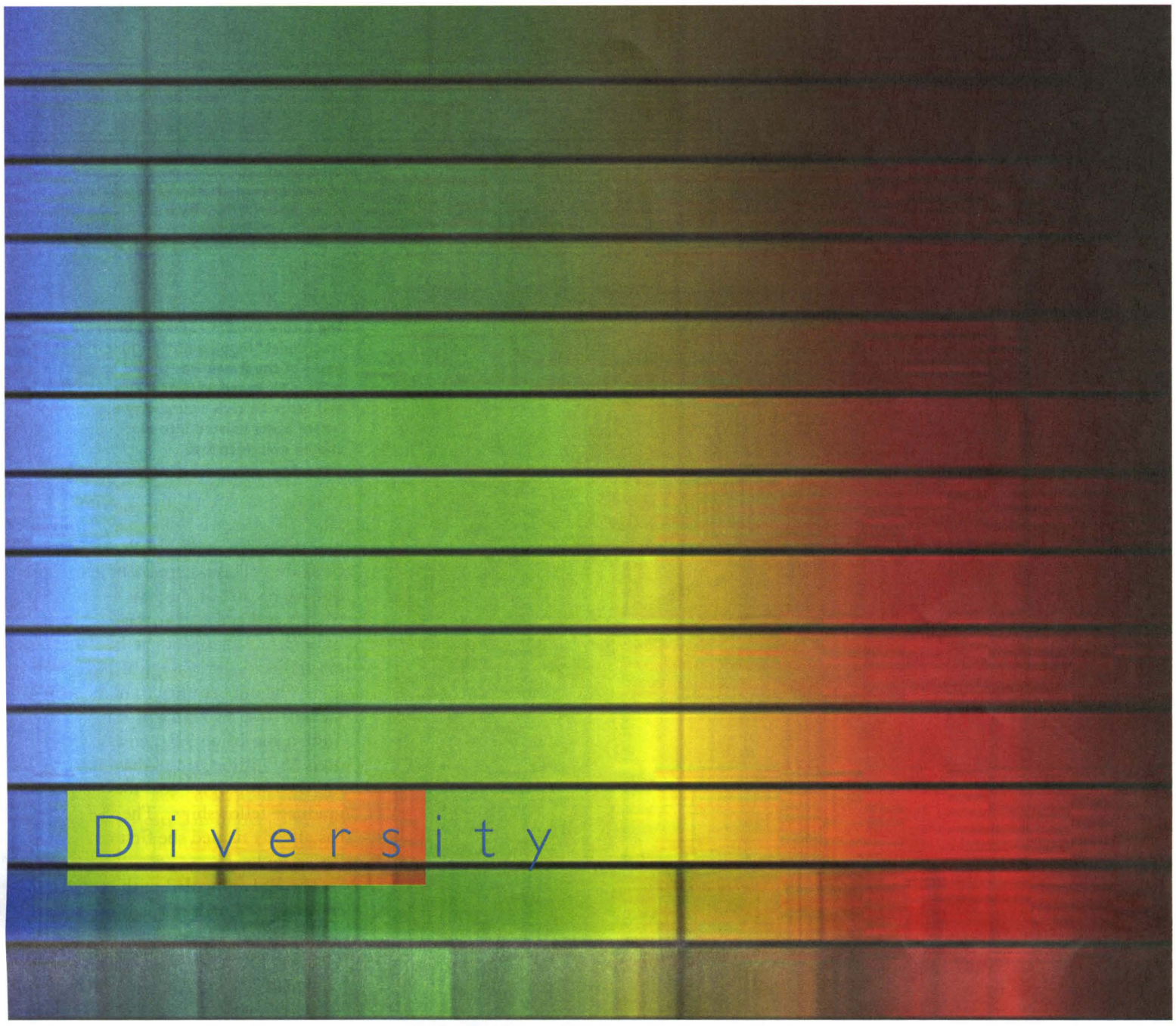
Caltech News was headed for the printer when the events of September 11 took place, and we found the space for a few additional voices.

Jesse Beauchamp graduated from the Institute in 1964 and has been a member of Caltech's chemistry faculty since 1967. During the 1990s, as an expert in explosives detection, he served on two federal commissions set up to review airline safety and security in the United States. In the interview that begins on page 10, Beauchamp talks about that experience and about the challenges of keeping airlines safe from future terrorism.

The Caltech community lost an alumnus on September 11: Bryan Jack was on American Airlines flight 77 when it crashed into the Pentagon. He is remembered by friends and colleagues on page 31.

In these times, we turn naturally to our community, our family, our friends. We may be at a loss for words. We may be comforted by the words of others. We may need to speak out. Thank you all for sharing your thoughts and for keeping in touch.

—The editors



Seeking Diversity

By Rhonda Hillbery

Twice as many black, Latino, and other underrepresented minority students are entering graduate school at Caltech this fall compared to last year, thanks in part to better outreach efforts and new use of an online application service.

That's the good news, tempered by the small numbers involved. We're talking about 20 new students, compared to last year's total of just 10. But this year does mark a new Caltech high, boosting underrepresented students in the graduate school population to 64, up from 46 in 2000. It also signals that a range of initiatives designed to improve grad student diversity on campus may be starting to pay off.

Increasing diversity is a key mission for Rod Kiewiet, dean of graduate studies, who confirmed the numbers in his Parsons-Gates office. "We did work real hard," he said, adding that administrative diligence tells only part of the story.

Working hard means sending representatives to national academic conferences and handing out interest cards for prospective students to fill out. It means contacting students who declined to come as undergraduates, when the time comes for them to choose a graduate school; encouraging students who have started the application process to complete it; and deploying emissaries on special outreach trips to Historically Black Colleges and Universities (HBCUs) and other institutions.

Kiewiet also gives much of the credit to the strength of the 22 graduate options and their faculty, and to the success of their "visiting weekends" for prospective students.

He also singles out better fellowship and assistantship offers, which Caltech strives to make competitive with the benchmark $18,000 offered by the National Science Foundation. "We really want to make sure that if it makes sense for a grad student to come here to Caltech that money is not an issue; so that they don't turn us down because our offer was not competitive."

Despite signs of progress, Caltech isn't claiming bragging rights in an elusive and complex effort to bring more African Americans, Hispanics, Native Americans, Puerto Ricans, and Pacific Islanders to campus. The still-low numbers reflect the challenges facing higher education in general, especially in the math, science, and engineering schools. The Institute picture is similar at the undergraduate level, with 28 underrepresented minorities enrolling this fall, a good jump over last year's 18, but still not a large number.

Some of the factors leading to Caltech's modest improvement remain unknown. "Even though we engaged in a lot of outreach efforts, a large majority of underrepresented minority applications came in from people we had never contacted," Kiewiet acknowledges. "They just sent in applications."

Keen Competition

"We knew nothing would happen without more applications," Kiewiet says. "That's been the largest bottleneck so far."

This year more than half of the Institute's grad school applications came in through Embark, an online application service used by Caltech for the first time. Overall, the firm reports receiving sharply higher numbers of online applications processed for hundreds of colleges and universities. According to one of its surveys, some 92 percent of prospective graduate students reported using the Internet to research or apply to graduate programs.

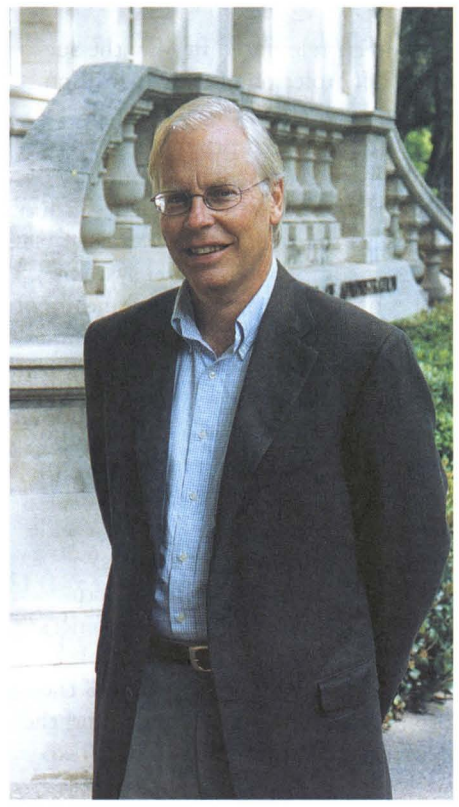
"It may have opened up a new pool of applicants," Kiewiet says, adding that the online process also saves money and avoids the hassle of mailing bulky application packages.

The rise in online applications is encouraging, especially since overall Caltech graduate school applications dropped to 3,728 this year from 3,886 in 2000.

Once applicants are evaluated, Caltech finds itself competing for the same pool of underrepresented minority students sought by the nation's other top schools. All possess the exemplary test scores, grades, and glowing letters of recommendation required for admis-

Continued on page 18 . . .

Caltech's dean of graduate studies, Rod Kiewiet, has made increasing the number of underrepresented minority graduate students on campus a key mission of his office.



The future Broad Center celebrated a traditional "topping off" on June 13. The top beam of the frame was signed by Institute trustee Eli Broad, President David Baltimore, and other Caltech community members before being hoisted into place with a flag and an evergreen tree.

Biological Sciences Initiative concludes

Three-year campaign tops $100 million goal

Caltech celebrated in May the successful completion of a $111 million fund-raising effort to advance the Institute's research programs in the biological sciences. The resources raised will give Caltech's scientists and engineers the tools to uncover the mysteries of complex biological systems and contribute to our understanding of intractable diseases. The goal of the three-year effort—dubbed "Beyond the Genome: The Biological Sciences Initiative at Caltech"—was $100 million. Funds were raised for a new building, new professorships and fellowships, new faculty appointments, and a wide range of new research programs.

"We can be proud of the accomplishments of the Biological Sciences Initiative. All were made possible by the dedication of the members of the Biological Sciences committee and the generosity of our donors," said President David Baltimore. "The Initiative not only exceeded its monetary goal, it is already enabling Caltech to realize the goal of interdisciplinary approaches to biology."

The campaign was planned and led by the Committee for the Biological Sciences Initiative, a group that included trustees, alumni, faculty, and other friends of the Institute. It was cochaired by Benjamin Rosen '54, chairman of the board of trustees, and Senior Trustee Camilla Frost. "Speaking for the committee, we are extremely pleased with the results of the campaign, and we want to thank all of Caltech's friends for supporting this great effort," said Frost, who contributed $5 million toward the construction of the Broad Center. The Camilla Chandler Frost Laboratories on the second floor of the Broad Center will be named in her honor.

Added Rosen, "Caltech supporters have always been extremely generous, but in the case of the BSI, I think our friends realized that it was particularly important to support the Institute's programs in the biological sciences, given the opportunity to make important discoveries that will improve the human condition." Rosen also contributed $5 million, single-handedly meeting the campaign's goal for endowed graduate fellowships. The Institute has already named the first of many Rosen Fellows.

The BSI coincided with the race to complete the map of the human genome, which was sequenced last year. The task for many investigators now is to use this information as a springboard for understanding in greater detail the processes that drive both healthy and unhealthy biological functioning. As a result of this new research, there is enormous potential for developing new drugs and therapies to address diseases like cancer and AIDS. BSI-supported work at the Institute over the next few years will tackle these problems and others, including research aimed at gaining a deeper understanding of how organisms develop and what causes anomalies in their development, and investigations into higher-level brain functions, such as consciousness and cognition.

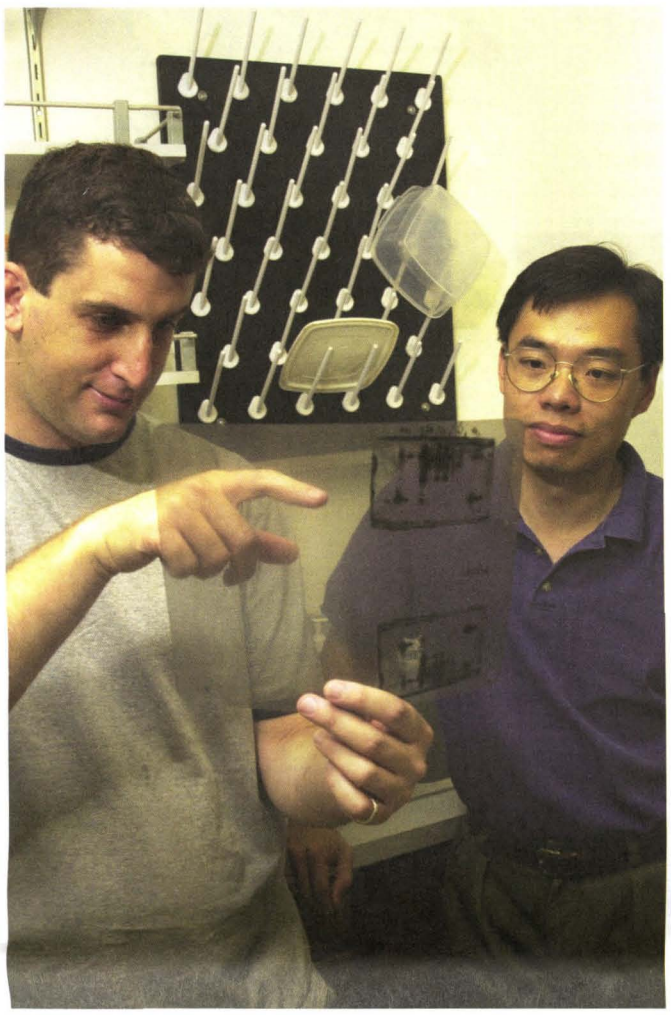
The centerpiece of the new research efforts funded by the BSI is the Broad Center for the Biological Sciences, named for Caltech trustee and Los Angeles business and civic leader Eli Broad and his wife, Edythe, who provided $23 million—the lead gift—for the building. Ground was broken for the Broad Center last September, construction is well under way, and occupancy is expected in summer 2002 for this state-of-the-art facility designed by world-renowned architect James Freed.

The Broad Center will house about a dozen research groups working in such areas as structural, behavioral, and computational biology, and will also contain shared facilities for electron microscopy and magnetic resonance imaging. Additional funding for the building's construction and equipment came from the estate of William Hacker '31, which provided $8 million in capital funds as well as $1.4 million in discretionary funds for the chair of the Division of Biology, and the Ralph M. Parsons Foundation, which provided $2 million in equipment funds for the Biomolecular Structures Laboratory. Other contributors to the Broad Center include Warren Schlinger '44, PhD '49, and his wife, Katharine, who donated $500,000 to the facility and an additional $1 million gift that will name the Schlinger Seminar Room; Life Trustee Arthur Rock and his wife, Toni, whose $1.5 million gift will name the Rock Lecture Hall; and Trustee Ronald Linde MS '62, PhD '64, and his wife, Maxine, who contributed $1.25 million, matching an equal amount donated by alumni to name the Ronald and Maxine Linde/Caltech Alumni Laboratories.

Eight new professorships were endowed through the campaign. Trustee Donald Bren contributed $10 million through the Donald L. Bren Foundation to support new faculty as Bren Scholars and eventually endow five Bren Professorships, and Trustee Philip Neches '73, PhD '83, contributed $2 million to endow the Bernard A. Neches Professorship in honor of his father. Amgen Inc. also contributed $2 million to endow a professorship in honor of former CEO and Caltech trustee Gordon Binder. In addition, Caltech trustees contributed $2 million to fund a professorship honoring Caltech president emeritus and trustee Thomas Everhart and his wife, Doris.

The campaign raised more than $12 million for discovery funds, which provide support for innovative research. The W. M. Keck Foundation contributed $5 million for discovery funds, while the family and friends of the late Bill and Georgina Gimbel, and the Reliance Steel and Aluminum Company (where Bill had served as chairman and CEO), contributed more than $6 million to create the William T. Gimbel Discovery Fund in Neuroscience.

Other gifts to the campaign included $3 million from the Carl F Braun Trust for laboratory renovation and startup funds for new faculty; $2.5 million from Burroughs Wellcome Company for postdoctoral fellowships and research funds; $1.44 million from the L. K. Whittier Foundation to support the L. K. Whittier Gene Expression Center; $1.25 million from the Colvin Foundation for innovative research; $1 million from Cecil



Above: David Chan, shown here with graduate student Toby Rosen, and (below) Dianne Newman are among the new Caltech faculty whose interdisciplinary research will be supported by the BSI.

Drinkward '50 to endow a postdoctoral fellowship; and $1 million from the David and Lucile Packard Foundation for research funds for geobiology.

Professor Mel Simon, who as the former chair of the Division of Biology played a pivotal role in the BSI, said that Caltech will now have the tools to tackle some of the most difficult problems in the biological sciences.

"In any great endeavor you require three things: vision, money for resources and materials, and bright young people to carry out the work," said Simon, Caltech's Anne P. and Benjamin F. Biaggini Professor of Biological Sciences. "We have the vision to create greater understanding of biological systems by integrating the data emerging from the genome projects with our growing insight into molecular and cellular functions. We have the new Broad Center and remarkable new tools, such as cryo-electron microscopy and computational methods that provide new ways of doing biological research. And our hiring process is going full bore, so that we will soon have the biologists, chemists, engineers, physicists, and others to focus on biological complexity."

Through the BSI, Caltech has already made several new appointments of young faculty members whose interests are indicative of the interdisciplinary nature of the initiative. For example, David Chan, assistant professor of biology, uses cell biological, biophysical, and genetic approaches to study how membrane-bound systems like organelles and viruses fuse under certain circumstances. In particular, he is interested in understanding the fusion mechanism of mitochondria, organelles important for energy production and cell death. In addition, he studies how the human immunodeficiency virus (HIV), the agent of the disease AIDS, enters human cells. Dianne Newman, the Clare Boothe Luce Assistant Professor of Geobiology and Environmental Science and Engineering, is leading a project to investigate how micro- organisms and Earth's near-surface environments have interacted over billions of years. Her project integrates molecular microbiology with geochemistry and field geology to try

to identify chemical signatures of early life in the geologic record.

"The biological sciences today present an intellectual challenge that is changing the environment at Caltech," said Simon. "So the resources are here, the vision is here, and some of the people are here. Now all we have to do is great science."

Recognition

John Abelson, Beadle Professor of Biology, and *Alexander Varshavsky*, Smits Professor of Cell Biology, have been elected to the American Philosophical Society, as members of its biological sciences class. Founded by Benjamin Franklin in 1743, it is the oldest learned society in the United States devoted to the advancement of scientific and scholarly inquiry, and promotes the sciences and humanities through scholarly research, professional meetings, publications, library resources, and community outreach.

John Baldeschwieler, Johnson Professor and professor of chemistry, emeritus, received the American Chemical Society's 2001 Award for Creative Invention at the society's spring meeting in San Diego. He was honored for his role in creating new methods for "seeing" the structure and action of molecules.

Paul Bellan, professor of applied physics, has received one of two 2001 SPD Popular Writing Awards. Given each year to a professional scientist and to a science writer or journalist by the Solar Physics Division of the American Astronomical Society, the awards include $500 cash and a certificate, and recognize the winning articles' relevance to solar physics, educational value, accuracy, and clarity of presentation, among other criteria. Bellan's article, "Simulating Solar Prominences in the Laboratory," appeared in *American Scientist*, volume 88, March/April 2000.

Morteza Gharib, PhD '83, professor of aeronautics and bioengineering, gave the Honored Speaker address to the 81st annual American Association for Thoracic Surgery conference this past spring in San Diego. Speaking at the San Diego Convention Center to an international gathering of 3,000 thoracic surgeons, he discussed the challenges and rewards of applying bioengineering principles to space exploration.

Alan Hajek, associate professor of philosophy, has received a $10,000 grant from the Center for Theology and

Continued on page 9 . . .

Alumni Rise to Linde Challenge

While there were many success stories in the recently completed Biological Sciences Initiative, none involved more members of the Caltech community than the Linde Alumni Challenge. Through the Challenge, thousands of alumni were able to leverage their BSI-designated gifts to yield a greater impact on research at Caltech than they would have been able to do on their own.

In early 1999, as part of the campaign, Trustee Ronald Linde, MS '62, PhD '64, and his wife, Maxine, created the Linde Alumni Challenge, which matched contributions from alumni to raise more than $2.5 million for laboratories on the ground floor of the Broad Center. Through the Challenge, the Lindes contributed $1.25 million to Caltech, matching donations made by 3,795 alumni. The laboratories in the building, which is expected to be completed by summer 2002, will be named the Ronald and Maxine Linde/Caltech Alumni Laboratories.

To qualify their contributions for the matching funds, alumni had to give a larger amount of money to Caltech than they had in the year before the Challenge started. Of alumni who participated in the Linde Alumni Challenge, more than 1,000 had not contributed any funds to Caltech within the prior five years.

"We are extremely happy with the results," said Ron Linde, who earned the Institute's first PhD in materials science in 1964. "Alumni giving exceeded the financial goal of the Challenge, and the Challenge achieved a very important additional goal: to increase the number of alumni who support Caltech. Alumni from all disciplines and from class years ranging from 1928 to 1999 joined together to create very tangible support for the Institute to fulfill a vital objective.

"There was no higher priority for Caltech than to get the BSI under way on sure footing. Maxine and I are glad we were able to play a role in making that happen," said Linde, who, as a member of Caltech's Biological Sciences Advisory Council and the BSI Gift Committee, played an active role in the campaign.

A SUMMER OF POLITICAL BIOLOGY

CALTECH'S PRESIDENT LOOKS AT THE STEM CELL CONTROVERSY

BY DAVID BALTIMORE

This was the summer when politics hit biology. In earlier years, the research community successfully countered such attempts, but this summer the politicians were determined to have their say. The scientific issues at stake were two: stem cells and cloning. They entail quite separate processes but they do interact. Let's start with stem cells.

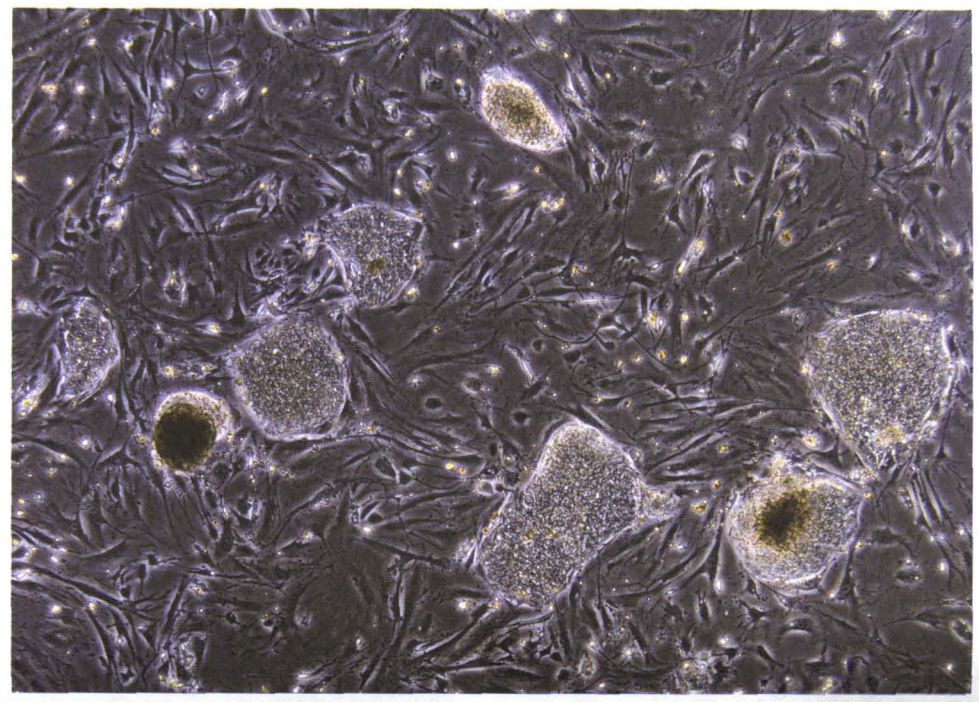
The phrase *stem cells* was coined long ago for cells that both renew themselves and give rise to a variety of progeny cells. The first were ones that can develop into blood cells. Then stem cells of skin and nerve and other tissues were found. These are "adult stem cells," and in each case the specialized cells that can be derived from them are limited to one organ.

However, certain cells derived from early embryos have the potential to make all the different cells of the embryo—they are known as *embryonic stem cells*. These cells have excited the politicians because of the need to derive them from embryos. Their potential value is that it might be possible to control their development so that they become a source of cells to be used therapeutically anywhere in the body, say for treating Parkinson's disease or diabetes.

Only a few years ago, scientists learned how to derive human embryonic stem cells. As a source, they mainly used embryos derived in vitro, made by mixing sperm and egg in the laboratory and allowing fertilization to occur. Thus, these embryos have never been inside a person and can only grow into a tiny ball of cells.

If implanted into a woman, however, they can grow into a human being, and couples use this form of reproductive assistance for some types of infertility. Thus many embryos are made and stored frozen, and many of these are ultimately discarded after the couple has the children they want. This provides a ready source of starting material for making embryonic stem cell lines.

Cloning is shorthand for deriving a fertilized egg by killing the egg's own nucleus and then implanting into the egg the nucleus from an adult cell. An embryo derived from such a union is genetically identical to the adult who donated the nucleus and thus a clone of that adult. The idea of human clones has produced outrage among politicians and the public, even though no one has ever made such a clone and in actuality identical twins are clones in just this sense. If the method was safe, and it isn't, it might be valuable to couples with certain types of infertility or inherited-genetic-disease issues.



This image shows a colony of undifferentiated human embryonic stem cells under investigation in the research lab of University of Wisconsin developmental biologist James Thomson. The embryonic stem cell colonies are the rounded, dense masses of cells. The flat, elongated cells in between the embryonic stem cell colonies are fibroblasts that are used as a "feeder layer" on which the embryonic stem cells are grown.

Where cloning and embryonic stem cells interact is when embryos derived by cloning are used for making stem cells. There is good reason to want to do this—the stem cells would be the perfect source of organs for the adult who donated the original nucleus, because there would be no danger of immune rejection of the cells by the recipient. This is called therapeutic cloning to differentiate it from reproductive cloning, which might be used to make a whole person by cloning.

I am not aware of any work today at Caltech involving human embryonic stem cells, or of any attempts at human cloning. However, the issues are ones that concern all biologists because of a common interest in seeing that new capabilities reach the public as new therapies.

With that background, we can describe the events of the summer. Congress first got into the cloning issue. The public seemed so incensed by the idea of cloning that the House passed a bill banning it. However, the bill was drafted by absolutists who lumped therapeutic cloning and reproductive cloning together in the ban. The Senate has not acted and the slim Democratic majority may be reluctant to act, so possibly no bill will come to the president for signature. If it comes, he seems sure to sign it. Losing the opportunity to make embryos to order is no problem at the moment, but putting a ban into law would make reversing it in the future very difficult.

The president—who was responding to calls, mainly from religious groups and conservative anti-abortionists, to ban the research—took on the stem cell issue. He agonized publicly over his decision for weeks, listened to many opinions, including that of the Pope, and announced his decision in prime time on television. He gave a surprisingly learned discourse on the issues before making a Solomonic decision to allow the government to fund work on cells that already exist, but not the derivation or study of new stem cell lines. He did not listen to those in opposition who argued that adult stem cells might be able to replace embryonic ones.

Predictably, the conservatives argued that his decision was immoral, and the liberals argued that it was insufficient. Although I think that limiting research in this way is bad, I believe that Bush's decision was realistic and is not the last word. If the research community can show that there is actual—as opposed to theoretical—benefit to be derived from human stem cells, but that the limiting factor is the need for new cell lines, I would think that Bush—or the next president—and Congress would be under enormous pressure from patients and their advocates to relax the prohibitions.

I believe that Bush's decision was realistic and is not the last word.

So this has been a momentous summer for biomedical research. In the 1970s, when recombinant DNA research was first invented, there was a push for legislation to limit the purview of the work or even to ban it. The research community fought these efforts successfully and argued that it could police itself. The issues were mainly about safety, so the moral considerations in the debates were muted. This summer morality has been the key issue. Even in the cloning discussions, where safety is a huge concern (in animals, cloning produces mainly poorly formed offspring), the moral issues have been the main ones. We still don't have signed legislation, and maybe we can avoid it, but there is no question that the research community has now developed capabilities that many people consider inappropriate human activities. People's moral decisions change over time, and practical considerations often outweigh moral ones when a new technology provides proven benefits. So I expect this to be a changing landscape. But as physicists discovered years ago, powerful sciences develop controversial capabilities. Now, the biological research community—never mind university administrators—is going to have to take an ever-more-public role to explain and defend its proposed activities.

Caltech's president, David Baltimore, shared the 1975 Nobel prize for physiology or medicine for his role in the discovery of reverse transcriptase—an enzyme that permits viruses such as HIV to replicate. He has been active in a variety of national science policy issues, including the development of research standards governing recombinant DNA research.

"Stay low, and be confident"

At Caltech's 107th Annual Commencement, keynote speaker Gordon Moore had some advice for snowboarders and for the sun-drenched graduates. "Stay low, and be confident."

Moore, a Caltech alumnus and the chairman emeritus of the Institute's board of trustees and of Intel, offered those words to encourage the degree candidates to stay "close to the data" and to be confident and "proactive" as they advance their opinions throughout their careers.

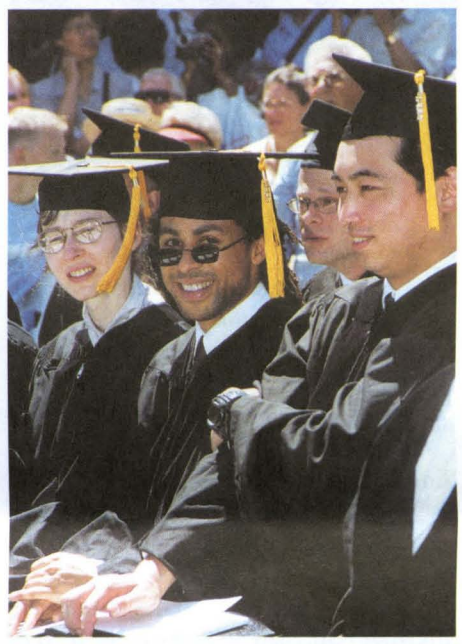
"Spread the gospel of the scientific method," said Moore. For instance, even California's "whole-language approach to reading" should be scrutinized, he noted. "It sounded good but, implemented on a large scale, didn't work very well."

As you go forward, he told the newly minted graduates, it is likely "you will see your career change several times." But "the basics of what you've learned here," including learning how to learn, "will carry you a long way."

Moore has followed his own advice: He received a 1954 Caltech PhD in chemistry; cofounded Fairchild Semiconductor Corporation, producers of the integrated circuit; predicted the annual-to-biannual doubling of the number of transistors that can be placed on a computer chip, known widely as Moore's Law; and cofounded Intel, makers of the microprocessor. In introducing Moore to the crowd, fellow alum Ben Rosen, the new chairman of Caltech's board of trustees, noted that history counts the microprocessor as "one of the top inventions," right up there with the lightbulb, telephone, and airplane.

In his remarks, Moore stayed "close to the data," putting the odds of a wet commencement ceremony at about 1 in 360—a calculation not in tune with recent history (two squalls in the last six years) but quite believable under this year's cloudless skies. The veteran Techer and Caltech commencement speaker likewise spoke comfortably and confidently, mixing nostalgia and prediction as he marveled over some of the great advancements in knowledge that have occurred in his lifetime.

The data: 204 BS degrees; 120 MS degrees; 1 Engineer degree; 159 PhD degrees.



Chairman Emeritus Gordon Moore, Chairman Ben Rosen, and President David Baltimore (top right) join well-shaded well-wishers and newly minted graduates at Commencement 2001.

US News once more rates Caltech high, as critics yet again berate US News

Do ratings matter? The new academic year has brought with it an updated list of the nation's best colleges, faithfully compiled by *U.S. News & World Report*. No sooner were the rankings made public than they were met with sharp criticism, with college and university presidents across the country saying they consider the controversial list to be nothing short of baloney.

The debate stems from skepticism regarding the list's basic validity, changes in the methodology, and accusations that the formulas used to determine a school's position are largely arbitrary.

In this year's rankings, Caltech dropped one notch down to 4th place in the category of Best National Universities that offer doctoral degrees. In the past few years it has hovered among the top spots, clinching the top spot in 1999 and slipping in last year's list to a 3rd-place tie.

The data that the magazine gathers to compile its lists has also come under fire, especially such information as the amount of alumni donations, students' SAT scores, and the school's overall reputation. The most damaging criticism may have come in an article from a former *U.S. News* data analyst, who wrote in the *Washington Monthly* that the magazine's editors ignore "measures of learning and good educational practices."

Caltech's administrators have remained publicly silent on the issue, but those from other schools have not been as reticent. Steven Sample, the president of USC, has reportedly called the list "silly" and "bordering on fraud." USC placed 34th on the list of best national universities. UC Berkeley chancellor Robert Berdahl expressed a similar sentiment, calling the rankings "highly questionable." Berkeley ranked 20th among national universities, but came in first among public colleges.

Among its other findings, the magazine determined that Caltech was the top national university in terms of best value. The Institute was listed at an overall no. 4 in the category of Best Undergraduate Engineering Programs.

A number of Caltech's engineering specialties received the magazine's stamp of approval: aerospace/aeronautical/astronautical (no. 6), chemical (no. 10), civil (no. 15), computer (tied at no. 10), electrical/electronic/communications (no. 6), environmental/environmental health (no. 9), and mechanical (no. 9).

To view the 2002 *U.S. News & World Report* college rankings in more detail, log on to www.usnews.com/usnews/edu/college/rankings/rankindex.htm.

Faculty board elects new officers

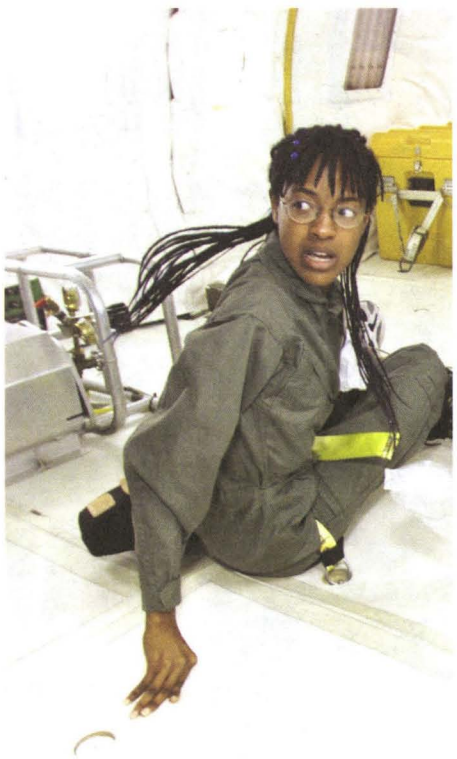
Caltech's Officers of the Faculty have announced that Marianne Bronner-Fraser, Billings Ruddock Professor of Biology, has been voted in as the newest faculty chair, and Melany Hunt, professor of mechanical engineering, has been selected as vice chair. Professor of Geography, Emeritus, Ned Munger was named as secretary, taking over from Professor of Physics, Emeritus, Ward Whaling, who stepped down after 16 years.

This year's election was noteworthy in two ways: Bronner-Fraser is the Institute's first female faculty chair, and the voting process was conducted online for the first time. The electronic ballot was set up by Michael Alvarez, associate professor of political science—who is currently working on the joint Caltech-MIT Voting Technology Project—and Marionne Epalle, communications specialist in engineering and applied science.

Beckman Scholars Program supports undergrad research

The Arnold and Mabel Beckman Foundation awarded Caltech $105,600 to support and encourage research among exceptional undergraduates in biology, chemistry, and chemical engineering. Caltech was one of 14 institutions selected from hundreds of applicants to receive the Beckman Scholars Program award, which will support six students over a three-year period.

The program offers an outstanding opportunity for gifted undergraduate students to obtain in-depth laboratory research experience, collaborating closely with faculty mentors. Each Beckman Scholar will perform research part-time during one academic year and full-time over two summers, and will receive an award of $17,600.



Dirk Englund (below) and Serena Eley (above) experience weightlessness aboard NASA's "Vomit Comet." Eley teams up with Englund, John Ferguson, and Joseph Jewell for the research flight (above right) and disembarks (right).

UNDERGRADS GIVE ZERO-G RESEARCH A WHIRL

In the name of science, four Caltech students cut their summer break short in order to fly aboard NASA's KC-135 airplane, otherwise known as the "Vomit Comet."

Twice a year students from universities across the country are encouraged by NASA's Johnson Space Center in Houston to submit research proposals as part of its Reduced Gravity Student Flight Opportunities Program (RGSFOP). The teams that are selected are allowed two flights on the KC-135, at which time they conduct their experiments. The research plane flies through 30 parabolic trajectories, producing about 30 seconds of weightlessness each time.

For the summer 2001 session a Caltech team consisting of senior physics majors Serena Eley, Dirk Englund, and John Ferguson, and sophomore aeronautics major Joseph Jewell, were selected as one of 35 teams that participated in the program. The team's fiber optic experiment is sponsored by Caltech physics professor Hideo Mabuchi, PhD '98, as well as Lute Maleki and Vladimir Iltchenko from the Jet Propulsion Laboratory.

The team's experiment focused on a new type of glass called ZBLAN (an acronym based on the metals present in the glass: zirconium, barium, lanthanum, aluminum, and sodium), which could be the fiber optic material of the future because of its wider band of wavelength transmittance. This glass is fabricated from the heavy metal fluoride family as opposed to the current silica-based fiber optic glass. "The advantage of ZBLAN over silica-based fiber is that it is many times less absorptive, over a much larger optical window—from the near-ultraviolet to the near infrared regions of the spectrum. In fact, the attenuation of a perfect ZBLAN glass should approach the theoretically lowest levels allowed by matter," said Englund.

The benefits of ZBLAN could be applied to a wide range of fields, besides telecommunications. For instance, ZBLAN can be used to create a small and inexpensive laser that has applications in electrodynamics, communications, and medicine. At present, making such a laser is very costly.

The difficulty with the production of ZBLAN is that, if it is created under the presence of gravity, it crystallizes, destroying its unique optical properties. The mission of the Caltech team is to manufacture microspheres under the different gravity conditions provided by the KC-135's parabolic trajectory.

The team's experiment was split into three parts. First, before leaving for Johnson Space Center the team made microspheres at the Caltech and JPL labs. On the plane, these three sets of microspheres were produced again under the differing gravitational conditions. Finally, the microspheres created on the KC-135 were brought back to the labs at Caltech and JPL for tests and analysis.

Each team in the program must participate in a community project. The four Caltech students have chosen to present their experiments at several elementary and high schools in various districts around Southern California.

Eley, Englund, Ferguson, and Jewell were at Johnson Space Center from August 22 to September 1. The first few days were devoted to training for the flight. Though the program pays for the training and the cost of the flight on the KC-135, the team had to raise the money for equipment, transportation to and from Houston, and accommodations. Caltech and JPL covered most of the costs.

Neda Afsarmanesh '04

Afsarmanesh spent this past summer as an intern with the Caltech office of media relations.

Pamela Bjorkman elected to NAS

Caltech's Pamela Bjorkman, professor of and executive officer for biology, was one of 72 American scientists elected this year to membership in the National Academy of Sciences (NAS). Bjorkman, who has been at Caltech since 1988, is the Institute's first female faculty member to be elected.

Bjorkman focuses much of her research on molecules involved in cell-surface recognition, particularly molecules of the immune system. Investigators in her lab use a combined approach, including X-ray crystallography to determine three-dimensional structures; molecular biological techniques to produce proteins and to modify them; and biochemistry to study the proteins' properties.

Much of the Bjorkman lab's efforts have involved proteins known as class I MHC, as well as very similar proteins that have a number of functions aside from an immunological role. In a 1999 study, for example, Bjorkman and her colleagues determined the three-dimensional structure of a protein that causes cachexia, a wasting syndrome in cancer and AIDS patients. The discovery provided the scientific basis for possible future strategies for controlling cachexia and/or for the treatment of obesity.

A native of Portland, Oregon, Bjorkman earned her bachelor's degree from the University of Oregon in 1978 and her PhD from Harvard in 1984, and has held postdoctoral positions at Harvard and the Stanford University School of Medicine. She is an investigator with the Howard Hughes Medical Institute and has been a Pew Scholar in the biomedical sciences, an American Cancer Society Postdoctoral Fellow, and an American Society of Histocompatibility and Immunogenetics Young Investigator. She has also received the William B. Coley Award for Distinguished Research in Fundamental Immunology, the Gairdner Foundation International Award for achievements in medical science, and the Paul Ehrlich and Ludwig Darmstaedter Award.

Bjorkman's election brings to 67 the number of living Caltech faculty who are NAS members. Established in 1863 by President Lincoln, the academy acts as an advisory body for the federal government on scientific matters.

O'Rourke named VP for public relations

Robert O'Rourke has been named vice president for public relations at Caltech. The newly created position reports to President David Baltimore and oversees all of the Institute's public relations operations.

O'Rourke has served as head of public relations at the Institute since 1986, most recently as associate vice president for Institute relations, a title he has held since 1996. As vice president, he will be in charge of electronic media publications, government and community relations, media relations, periodicals, publications, public events, and the Caltech visitor's center.

Since coming to Caltech, O'Rourke has placed special emphasis on strengthening ties between Caltech and the Southern California community. He has established programs that involve the Institute in community activities and that bring the public to campus. He created the Caltech visitors' center and inaugurated a monthly radio talk show—*AirTalk: The Caltech Edition*—on the Pasadena NPR affiliate, KPCC. He is also responsible for the DuBridge Distinguished Lecture Series, which has brought to campus such notables as Walter Cronkite and Warren Buffett, and which will host Nobel Peace Prize laureate John Hume this November (see story, page 11). He has also established the Institute's first department for Web publishing, and worked to expand community awareness of Caltech research through the introduction of such well-received programs as the annual Biology Forum.

Caltech President David Baltimore made the announcement to the campus October 1. "Since before I had even arrived at Caltech, Bob has been an advisor to me on all questions about public relations. He has been thoughtful in his approach to handling complicated issues and has gone out of his way to make friends for Caltech. It is clear that he loves the place and is able to send its message widely and effectively. Promoting him to vice president will give him greater visibility and authority as Caltech moves forward," he said.

During O'Rourke's tenure, Caltech Public Relations has received multiple awards, including nearly 20 medals from the Council for the Advancement and Support of Education (CASE) for publications, periodicals, media relations programs, and *AirTalk: The Caltech Edition*.

Caltech, public TV join forces

Caltech and the multimedia production endeavor *Closer to Truth* have entered into an agreement to create and distribute science-oriented materials in a variety of electronic media.

Closer to Truth explores fundamental issues in science and human understanding and encourages high-quality discourse in "new knowledge" through television programming, videos, books, and two Web sites (www.closertotruth.com and www.scitechdaily.com).

The *Closer to Truth* television program airs on public television stations nationally. It brings together leading scientists, scholars, and artists to focus on topics that fall within five categories: brain and mind, life and health, technology and culture, earth and universe, and thinking and meaning. Topics explore new ideas and the frontiers of creative thinking, and feature lively discussions among experts, tailored for general audiences.

Bruce Murray, Caltech professor of planetary science and geology, emeritus, and provost Steve Koonin '72 have appeared on several episodes, and vice provost David Goodstein moderates an online discussion on the *Closer to Truth* Web site. The new agreement will expand the number of Caltech faculty appearing in future television episodes.

Murray oversees the development of the *Closer to Truth* Web site, which is maintained by KCET. It includes streaming video and transcripts of all the TV panel discussions, links to the guest experts, TV schedules, and other related links and resources. It also has a hyperforum chat feature, which is a moderated, online discussion among professionals and others who wish to participate. The *Closer to Truth* (www.closertotruth.com) and Caltech (www.caltech.edu) Web sites will be linked.

The enterprise *Closer to Truth* was created by Robert Lawrence Kuhn, who is also the host of the *Closer to Truth* television program. Kuhn, who holds a doctorate in anatomy/brain research from UCLA, is president of the Geneva Companies, a mergers and acquisitions firm, and is chairman of the Kuhn Foundation, which funds and operates *Closer to Truth*. He also created and produced the PBS special *In Search of China* and edited the *Closer to Truth* book, published by McGraw-Hill.

During the coming year, the Institute and *Closer to Truth* will jointly tape and produce a number of Caltech events for distribution to cable and broadcast stations throughout the United States. These programs will also be made available as streaming video on both Web sites. Some *Closer to Truth* shows will also originate on the Caltech campus.

"This partnership expands the

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Recognition . . . from page 5

the Natural Sciences. He will develop a new course entitled Probability, the Philosophy of Religion, and the Philosophy of Science.

Philip Hoffman, professor of history and social science, has been named a Fellow of the John Simon Guggenheim Memorial Foundation. His project for the fellowship period will be "The Role of Crises in Economic and Financial Development," on which he will collaborate with UCLA professor of economics Jean-Laurent Rosenthal. Together with Gilles Postel-Vinay, Hoffman and Rosenthal coauthored *Priceless Markets: The Political Economy of Credit in Paris, 1660–1870* (University of Chicago Press, 2000).

Recipients of Caltech's 2000–01 Graduate Student Council Teaching and Mentoring Awards are, for classroom teaching, *Hans Hornung*, Johnson Professor of Aeronautics and director of the Graduate Aeronautical Laboratories; *Julia Kornfield* '83, MS '84, associate professor of chemical engineering and director of the Center for the Science and Engineering of Materials; and *Brian Stoltz*, assistant professor of chemistry; and, for mentoring, *Agustin Colussi*, senior research fellow in environmental science and engineering, and *Brian Stoltz*. The teaching-assistant award has gone to *John Morgan*, graduate student in chemistry.

Linda Hsieh-Wilson, assistant professor of chemistry, has been selected to receive a 2001 Beckman Young Investigators award. The award program "helps provide research support to the most promising young faculty members in the early stages of their academic careers in the chemical and life sciences." This year marks the 10-year anniversary of the program, which is funded by the Arnold and Mabel Beckman Foundation, an independent, nonprofit foundation established in 1977.

Shrinivas Kulkarni, MacArthur Professor of Astronomy and Planetary Science, and Nobel Laureate in Chemistry *Ahmed Zewail* have been elected Fellows of the United Kingdom's Royal Society, one of the world's oldest and most prestigious scientific organizations. Kulkarni was cited for fundamental astronomical discoveries that include the fastest known radio pulsar, which has a spin rate of 1.5 milliseconds, and the first example of a brown dwarf star. Zewail, Pauling Professor of Chemical Physics and professor of physics, was cited for pioneering development of laser techniques and their application to the study of the ultrafast dynamics of molecular systems. Established in England in 1660, with Isaac Newton as

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COUNTERING AIRLINE TERRORISM

Jesse (Jack) Beauchamp '64 is a longtime private pilot and chemist who has worked with some of his graduate students on new ways to detect the chemical signatures of concealed explosives. During the 1990s he put this combined expertise to use as a member of two federal commissions charged with investigating ways to enhance safety and security on the nation's airlines. In the wake of the September 11 terrorist attacks on New York City and Washington, Caltech News *editor Heidi Aspaturian asked Beauchamp, Caltech's Ferkel Professor of Chemistry, for his perspective.*

What can you tell us about your involvement in the two airline security commissions?

I've been involved in two different efforts. The first was the National Research Council (NRC) Committee on Aviation Security, which I chaired from 1993 to 1997. John Baldeschwieler [Johnson Professor and professor of chemistry emeritus] had been the previous chair, and I took over from him. That committee, which is still active, is actually run by the National Materials Advisory Board. Its mandate is to review the R&D programs at the FAA Technical Center in New Jersey, which is where all the basic research that relates to aviation safety and security is coordinated. The center does a lot of work in the area of developing, deploying, and testing new technology for passenger screening and explosives detection. These are two very different problems because you can subject luggage and carry-on items to all kinds of high-tech scrutiny that you can't use on a person. You can check for weapons or explosives carried by people too, but that requires dealing with a lot of other issues in terms of what you can and can't do. So I served on that committee for four years.

Then in 1996 when TWA 800 blew up over the Atlantic on its way from New York City to Paris, the Clinton administration formed a commission on aviation safety and security that was chaired by Vice President Al Gore. How I became a member is an interesting story. I had sent Gore an e-mail, basically outlining my background in the area. First I got a response thanking me, and then a couple of weeks later Gore invited me to join the commission because of my technical expertise in the area.

Initially we focused most closely on security because it was thought that TWA 800 had been destroyed by a terrorist bomb, like Pan Am 103, which exploded over Lockerbie, Scotland. Later, of course, investigators determined that it had been an accident, caused by a freak explosion in a fuel tank. But the report that we delivered to the president in 1996 described the potential for terrorist attacks as a "national security issue," and made numerous proposals for security improvements.

Hindsight is always 20/20, but I think it's safe to say that if those recommendations had been in place and operating on September 11, at least some of the hijackers might have been stopped before they got on the planes.

What were these key recommendations?

The most important to my mind was recommendation 3.19. [The full text of the report can be found on the Web at http://www.fas.org/irp/threat/212fin~1.html]

Essentially it advocates complementing technology with a system of computer-automated passenger screening (CAPS), which was then being developed by Northwest Airlines. We suggested that this system be further developed to maximize its potential and be adopted by all the major carriers. Basically it involves using information from readily available computerized databases—the type that are already available to airlines and, say, credit card companies—to separate passengers into two security-risk categories—a large low-risk group, and a small high-risk group.

The premise behind this approach is that 98 percent or more of airline passengers rarely pose any cause for concern. They're frequent travelers—business travelers or people on vacation. They have purchased their tickets with credit card, not cash. They can be found in several databases. Chances are that somebody using a false ID and planning to inflict harm on an aircraft is not going to appear to an automated profiling system in the same way that a business traveler or a tourist would.

We also recommended that the FBI, CIA, and ATF [Bureau of Alcohol, Tobacco and Firearms], all of whose directors were on the commission, refine and expand their ongoing research into known and potential terrorists, hijackers, and bombers so as to develop a database to be used in conjunction with passenger screening. Although the agencies would certainly have notified the airlines of certain risks, I don't think that the intent of the recommendation was carried out.

We now know that some of the September 11 hijackers had previously been under surveillance, and that some had been identified as having connections with known terrorist organizations. If the profiling system had been in place and if that intelligence had been available to the people who checked these individuals in, I think the airlines would have been alerted along the way to at least part of what was happening.

Why wasn't it widely implemented? What happened?

Bureaucratic inertia was certainly a factor. The *Los Angeles Times* recently published an article on the commission. It reported that while the FAA and the airlines didn't oppose the CAPS recommendation and related measures, for the most part their guidelines for implementing them were still "in development" four years later, on September 11.

It's also the case that many older airports, both here and overseas, are not designed with a high level of security in mind. For example, in many airports it is difficult to isolate or separate passengers who have been screened and cleared to board aircraft from other individuals. If you're building a new facility, you can incorporate many security-enhancing features into the design, and that is now being done in some places.

Did the projected cost of the profiling system also slow down implementation?

All of this costs money. The cost of a CAPS system, though, is probably a fraction of the cost of equipment for explosives and weapon detection, in which the government has made a substantial investment. One of the commission's other recommendations was that the government optimize the use of existing technology by purchasing large quantities of high-end X-ray equipment and computer topography equipment that can scrutinize luggage specifically for explosives-type materials. And in fact, the government has since spent hundreds of millions of dollars buying this equipment and making it available to the airlines to use in airports.

But does it get used?

Up to now it's been used mostly on international flights, where it's required that both checked luggage and carry-ons be X-rayed. There's been no similar requirement for domestic flights, and a bomb in a suitcase could conceivably go undetected on a domestic flight.

In any case, the focus here has been mostly on trying to keep explosives and weapons off planes, and it's now become clear that the challenge is much

I think it's safe to say that if those recommendations had been in place and operating on September 11, at least some of the hijackers might have been stopped before they got on the planes.

broader than that. People taking control of an aircraft with nothing more than a few knives and then using the aircraft itself as a weapon represents a major escalation of the game, which is going to require more security measures than being questioned about whether anyone else has handled your luggage.

There's a a debate under way in Congress about whether to federalize aspects of airline security that in the past have mostly been subcontracted out by the airlines to private companies. Did the Gore Commission take any particular stand on oversight?

The prevailing view, and it's mine as well, was that it probably doesn't matter so much who's handling airline security—the government, the airlines, or companies they subcontract to—as long as they're doing a good job. Clearly this has not generally been the case. The people who are hired by these security firms get minimal training, minimal wages, and minimal benefits. You get paid as much as you would to work at McDonalds, with the difference that McDonald's offers more chance for advancement. It's a real dead-end job, and the turnover is just enormous. This is a huge problem that needs to be addressed.

Part of our work on the commission involved looking at how security procedures are handled outside the United States. In particular we took a close look at Israel, where passengers traveling on the national airline, El Al, are routinely scrutinized much more closely than they are anywhere else. Highly trained, experienced professionals do these jobs, and not much gets by them. I wouldn't want to play cards with these people because they could probably tell what kind of hand I had. They will often question travelers extensively about why they've been visiting Israel, where they've been, and what they've been doing. They are very good at picking up on small inconsistencies in someone's story, and from there they will probe further.

Anyone who seems suspect has their baggage examined with sophisticated scanning equipment on the spot. They will use chemical assays to test for several families of explosives materials, and if they're still not satisfied, they will take items away and disassemble them. I've seen a computer come back as a box full of parts and screws. I once watched them work on a very expensive-looking pair of in-line skates that had custom molded liners. They shoved a big horse syringe through the side of the skate and took out a sample of the gel inside because of the possibility that it could have been a plastic explosive.

But of course Israel has only a couple of major airports, and they handle only a fraction of the air traffic that we have in the United States. Providing that kind of hands-on scrutiny at every check point in this country would be impossible. That again is why computerized profiling was suggested as a means by which we could move toward enhanced security. You can't possibly question everyone in America's airports, but you can go some way toward identifying a small handful of people who do need to be closely looked at.

There's another element to the Israeli equation, which is that they have air marshals on all El Al flights. We certainly don't do that routinely in this country, although there is more talk about doing it now. Whether we should is another question.

I had an opportunity to visit the air-marshal training school just outside Tel Aviv and to attend the graduation of one of the candidates. They have a commencement exercise in which each graduate goes through a simulated hijacking in the mock cabin of a 747. And they actually use live ammunition in these simulations. They told us that in advance and said, "Are you sure you still want to watch?" I said sure, I'd love to. I figured, what are they going to do—shoot the spectators? And it was very interesting. The scenario involved a terrorist who had grabbed a passenger and was holding a knife or gun on him and trying to get into the flight-deck area. It was not unlike what actually happened in September. The graduate's role was to kill the terrorist.

Was he successful?

He passed, but not without criticism. When he jumped up to thwart the hijacking, he failed to look over his shoulder. So he was criticized because there might have been another party sneaking up on him from behind. He didn't cover his rear.

It was all pretty authentic. After the "terrorist" seizes a hostage, the two disappear into another room, but continue to be projected on a video screen. And the air marshal candidate fires his gun at the screen, which has some kind of laser marking system that denotes exactly where his bullets hit. He got off a lethal shot. We took a closer look at the screen afterward, and it was literally in patches, with little white stick-ons covering dozens of bullet holes.

Whether or not we'll see such things implemented here, I don't know. They're talking about it, but think about the expense that would be required in terms of trained personnel. Personally, I don't believe it will happen, and I hope it won't. We don't want to see this country become more like a police state, and the more individuals you have running around carrying arms in an official capacity, the more it begins to resemble one. Do we really want to put people carrying live ammunition on aircraft? Doing that on the scale we'd need to in this country seems to me to create more potential problems than it solves.

Given your own work in flight security, did the September 11 attacks take you by surprise?

Yes. I personally consider it a massive failure of intelligence. The relevant intelligence agencies knew about some of these people, and the fact that they didn't give the airlines a heads-up points to a real breakdown in the system. I don't want to finger-point here—I worked with FBI and the CIA people on these commissions, and they have a tough job. It's doubly hard in this country because of the personal freedoms we all enjoy, whether we're citizens or not. But I do think that from now on, people who are regarded as security risks will be much more closely monitored and that information will be passed on to those who need to know. I certainly hope so.

Caltech News invites letters from readers whose work relates to antiterrorism efforts. Please send your comments to hja@caltech.edu.

Nobel Peace Prize winner John Hume to visit campus for 2001 DuBridge Lecture

Nobel Peace Prize winner and Northern Irish political leader John Hume will be the featured guest at Caltech's Lee A. DuBridge Distinguished Lecture for 2001. "A Conversation with John Hume" will take place November 20 at 8 p.m. in Beckman Auditorium on the Caltech campus. *Boston Globe* reporter Kevin Cullen, who served as the newspaper's bureau chief in Dublin and London, will interview Hume.

Hume shared the 1998 Nobel Peace Prize with David Trimble, leader of Ireland's Ulster Unionist party. Until recently, Hume led that country's Social Democratic and Labour Party (SDLP). The two were political rivals who set aside their differences to work toward their common goal of ending decades of religious violence in Northern Ireland. Hume is Catholic, Trimble, a Protestant.

Hume has been involved in the politics of Northern Ireland for more than 30 years as a tireless advocate for radical but peaceful change. One British newspaper described him as "regularly seen in the heart of [action], striding through the tear gas or dodging rubber bullets; never afraid to confront the security forces, but always urging peaceful protest."

In 1970, he helped found the SDLP, bringing together the various strands of nonmilitant activists in Northern Ireland. In the 1980s, he approached Sinn Fein, the political party that represents the Provisional Irish Republican Army (IRA), the violent faction in Northern Ireland, to include them in the political process. He negotiated in secret with Gerry Adams, the Provisional IRA leader, and weathered the storm of protests that followed when his talks with terrorists became public in 1993. His negotiations with Adams, however, led to an IRA cease-fire the following year.

In 1998 Hume helped negotiate the so-called Good Friday agreement, which remains the basis for negotiations in Northern Ireland. It would allow for power sharing between the various factions, and disarmament of the IRA. Hume, 64, led the SDLP from 1979 until his resignation in September 2001. He remains a member of both the British Parliament and the European Parliament.

The DuBridge Lecture is free and open to the public. No tickets are necessary; at least 500 seats will be available on a first-come, first-served basis. Doors open at 7:30 p.m.

The Lee A. DuBridge Distinguished Lecture series brings prominent speakers of national and international importance to campus. The series was inaugurated in 1996 in honor of Lee A. DuBridge, who served as the Institute's president from 1946 to 1969. For more information, call 626/395-4652 or, toll free, 888/222-5832.

John Hume, who shared the 1998 Nobel Peace Prize for his tireless efforts to bring an end to the conflict in Northern Ireland, will be the featured guest at the Institute's 2001 DuBridge Lecture, "A Conversation with John Hume," on November 20.

Trustee Earle Jorgensen's scholarship program is enduring legacy

Mention the name Earle Jorgensen on the Caltech campus and chances are people will think of the Earle M. Jorgensen Laboratory of Information Science. In 1971, he provided the seed gift of $625,000 for this building, which has gone on to become a center of pioneering work in computational research and computer science. They may think of the Mosher-Jorgensen graduate student residence, for which Jorgensen gave major funding in 1961, and which now forms a wing of the new student activities center. They may be aware that Jorgensen served on Caltech's board of trustees for more than four decades, and they may recall the role he is said to have played in altering the nation's political landscape—the California industrialist, who made his fortune in steel, reportedly launched his friend Ronald Reagan's political career by convincing him to run for governor of California.

What is not well known—and Jorgensen himself never publicized it—is that five years after he joined the Caltech Associates, and a year before he was elected to the Institute's board of trustees, he made a long-term commitment to help the Institute fulfill one of its ongoing, prized objectives—to make a Caltech education available to every qualified student, regardless of ability to pay.

When Jorgensen died in 1999, he was 101 years old, a rare and venerable age. So it seems appropriate that the Jorgensen Scholarship program that he established at Caltech in 1956 to support outstanding undergraduates is also notably long-lived. The program marks its 45th anniversary this year, having assisted more than a hundred students in the course of nearly five decades.

"Earle Jorgensen recognized an opportunity when he saw it—in the business world and in academia," said Caltech president David Baltimore.

"His commitment to Caltech, and his far-sighted generosity in providing higher education funding to those who could not afford it, spanned a good part of his life and the life of the Institute, and has made an enormous difference in the lives of many gifted young men and women. We are truly grateful to Earle and to his wife, Marion, for their many years of friendship and support."

Jorgensen's desire to help guarantee an education to the best and the brightest grew out of personal experience. The son of a Danish sea captain, he spent much of his youth aboard ship and had sailed to Alaska, Polynesia, New Zealand, and Australia by the time he was six. But the seafaring life and army service during World War I left him little time or opportunity to get the type of formal schooling he would have liked. According to his longtime friend Ruben Mettler '44, PhD '49, he was determined to give others the chance he had not had to receive a college education.

"Earle was always ready to assist young people," says Mettler, Caltech's trustee chair emeritus, who served on the board with Jorgensen for many years. "In particular he was tremendously supportive of helping students and saw Caltech students as especially meritorious."

For the students themselves, such aid, coming at a pivotal time in their lives, was indispensable.

"It was an honor for me to attend Caltech with this scholarship. I couldn't have come to campus without it," says Maclen Marvit '83, who credits his Caltech education with "developing my ability to shift between different worlds."

The much-traveled son of a sea captain, Caltech trustee and steel magnate Earle Jorgensen (top) established an undergraduate scholarship program that has helped numerous Caltech students set a course for their futures. Past Jorgensen Scholars include (bottom left, from top) Louise Kirkbride, Bharathi Jagadeesh, and Maclen Marvit, as he appeared in the 1983 *Big T.*

These days, Marvit, who was supported at Caltech for three years by a Jorgensen Scholarship, puts that ability to use as an entrepreneur. Since leaving the Institute with his physics degree, he has successfully launched several start-up companies with fellow Caltech alums, including his brother, David Marvit '84.

The brothers' most recent venture is Disappearing, Inc., a San Francisco company whose flagship product is a software application that permanently obliterates old e-mails, including the innumerable "ghost" copies that lurk in other computers and have the potential to surface as legal evidence in court cases. The Marvits are currently contemplating another start-up.

Another Jorgensen Scholar who has turned successful entrepreneur is Louise Kirkbride '75, MS '76, now the CEO of the Santa Clara–based company Broad Daylight. The firm, which designs and markets software to enhance knowledge-based, Web-enabled customer service, is the third that Kirkbride has founded; her first venture, Answers Inc., was purchased for $40 million in 1995.

Kirkbride's Caltech days were less flush; she ran away from her Philadelphia home to enroll against her parents' wishes, and was supported the entire time by scholarship aid and work-study jobs.

"I couldn't have made it without scholarship support," says Kirkbride, who was a member of Caltech's first four-year class of female graduates. "It made all the difference." Kirkbride went on to become one of 80 finalists for the position of first civilian astronaut in the U.S. Space Shuttle program, one of the first female engineers and first female CEOs in Silicon Valley, and, like Jorgensen, a Caltech trustee. She was elected one of the Institute's first Young Alumni Trustees in 1996.

For his part, Jorgensen, who was named California Industrialist of the Year in 1976 by the California Museum of Science and Industry, considered Caltech a major player in Southern California's emergence as a leader in technological development and innovation. He let it be known that he felt "honored" by his association with the Institute, which he regarded as a unique regional and national resource. His enthusiasm for Caltech was contagious.

"Earle had a genuine and deep interest in and respect for science and technology," says Mettler, the retired chairman and CEO of TRW. "He regarded Caltech as one of a kind in that sphere." According to Mettler, this affinity for science and technology came naturally to his friend. "He had what I would call an engineer's outlook, although he had not had the formal training."

In 1981, Caltech presented Jorgensen with its first Millikan Medal, "in recognition of distinguished service to the Institute for the preservation and enhancement of its goals."

Earle married Marion Newbert in 1953 and credited his wife with sparking his interest in philanthropy. They met while doing volunteer work for the

Continued on page 15 . . .

THE NATURAL WORLD WILL SOON BE THEIR LAB

Caltech students with an interest in marine science will soon be conducting research aboard the rolling deck of a Boston whaler at sea, or while kneeling in the wet sand of a Southern California estuary. Such real-world learning will be part of a new Environmental Science and Engineering program funded by a five-year, $700,000 grant from the Henry Luce Foundation.

Intended for both graduate and undergraduate students, the ESE program will be interdisciplinary in its approach, spanning the fields of geology, engineering, and chemistry. For the graduate students, the goal is to unify and enlarge environmental teaching and research at Caltech.Undergraduates will have the opportunity to take a lab class in environmental analysis.

"The students here have a ton of skills in mathematics, biology, chemistry, and physics," says Jess Adkins, assistant professor of geochemistry and global environmental science, "and a number are interested in the environment, but don't quite know what direction to go in with that interest." The ESE program will help provide that direction, he says.

The laboratory class will immerse undergraduates in field-based research. In many classes, Adkins says, the lab experience is typically limited to textbook problems and off-the-shelf samples that are manipulated at a lab bench. Now, students will leave campus and head out into the field, where they'll learn how to properly take scientifically clean samples under varying environmental conditions. Back in the lab, they'll be taught the current methodologies in metal, organic, and isotopic analysis.

Besides teaching, the Luce grant has two other equally important components. One is the establishment of a high-quality research platform for Caltech environmental scientists. Home for this part of the program will be the Kerckhoff Marine Biological Laboratory in Corona del Mar, at the mouth of Newport Bay. The lab has been maintained by the Division of Biology since 1930 and provides access to Southern California's estuarine, coastal, and open-ocean waters. It will be modernized and upgraded for environmental science research with the latest standard and specialized analytical tools.

The other component of the program is research. Given its location, the Kerckhoff lab is ideally located to study a variety of research questions that pertain to the transformation from freshwater to ocean, to so-called "blue water" conditions further offshore, or to the specific differences between polluted and natural waters. Each undergraduate class will also take samples of local water conditions that will, over time, establish a permanent, baseline measurement for evaluating subtle changes in the Southern California marine environment. Various research projects will also be conducted at Kerckhoff with the help of students.

The Luce Foundation was established in 1936 by Henry R. Luce, the late cofounder and editor-in-chief of Time, Inc. With assets of about $1.1 billion, the foundation focuses heavily on innovation and scholarship in higher education. Luce's son, Henry Luce III, is the foundation's chairman and CEO.

Gifts by Will

The James Michelin Distinguished Visitors Lecture Fund was recently endowed through a generous gift of $600,000 from the estate of Bonnie Cashin, a longtime friend of the Institute.

Caltech received approximately $388,000 from the estate of alumnus Edward R. Bate, Jr. '59, MS '60. The funds were directed to the Edward R. Bate, Jr., Undergraduate Scholarship Fund.

Marcella R. Bonsall, a charter member of the SURF Board, established two scholarship funds through a distribution of $688,000 from her estate: the Marcella R. Bonsall Endowed SURF Fund, and the Marcella and Joel Bonsall Undergraduate Scholarship Fund.

Hall L. Hibbard, a friend of the Institute, provided for Caltech with an unrestricted bequest of $1,185,000.

Arthur Miller '54, MS '55, gave Caltech a bequest of $5,000 and a special gift of his treasured stamp collection.

Caltech has received a preliminary distribution of approximately $1.5 million from the estate of Evelyn Bray, a close friend of the Institute. These funds will support the Ulric B. and Evelyn L. Bray Endowment Fund for the fields of chemistry and chemical engineering.

These are just a few of the many individuals who have contributed to Caltech over the years. For more information regarding bequests, please contact the Office of Gift and Estate Planning, Mail Code 105-40, Pasadena, CA 91125; 626/395-2927; planned_gifts@dar.caltech.edu; www.gep.caltech.edu.

"IT ALL STARTS WITH GOOD PROFESSORS," SAYS DONOR OF NEW TOMIYASU CHAIR

Kiyo Tomiyasu '40 and his wife, Eiko, have endowed a new professorship in the field of electrical engineering. David Rutledge, executive officer for electrical engineering, has been named the first Kiyo and Eiko Tomiyasu Professor of Electrical Engineering. Rutledge, a faculty member at the Institute since 1980, said that the professorship is especially meaningful to him, since Tomiyasu also works in microwave engineering.

"Kiyo Tomiyasu is one of my heroes," said Rutledge. "He's the second oldest member of the Microwave Theory and Techniques Society, through which I met him about ten years ago. The fact that he is still active and is well respected in the field, makes the professorship all the more important to me."

Rutledge, who directs Caltech's Lee Center for Advanced Networking, is a leader in the theory, development, and application of circuits and integrated antennas in the millimeter-wave and submillimeter-wave regimes. His research has direct application to wireless communications, radar, remote sensing, and satellite broadcasting.

Kiyo Tomiyasu '40 (center), wife Eiko, and sister Uwamie are joined by Caltech students who have received support from the Tomiyasu scholarship fund. Tomiyasu, his wife, and sister have now also endowed the Kiyo and Eiko Tomiyasu Chair in Electrical Engineering.

Kiyo Tomiyasu said he decided to create the professorship after meeting a few years ago with John Seinfeld, the Louis E. Nohl Professor and professor of chemical engineering, and, at the time, the chair of the Division of Engineering and Applied Science.

"Students get their knowledge through professors," said Tomiyasu, Management and Data Systems Fellow with Lockheed Martin Corporation in Philadelphia. "You can't have good classes without good professors. It all starts with them."

Other gifts from the Tomiyasus to Caltech include two undergraduate scholarship funds, as well as a charitable trust, whose proceeds will eventually endow one of the scholarships.

Kiyo Tomiyasu grew up in Las Vegas, Nevada, where his father pioneered growing techniques in the harsh conditions of the desert for a wide variety of fruits and vegetables. Tomiyasu excelled in science and mathematics in high school and was encouraged to apply to Caltech by a high school teacher. It was the only college to which he applied, and he was accepted.

Tomiyasu had been interested in electricity as a youth, and this interest continued at Caltech, where he majored in electrical engineering. The faculty members who had the greatest influence on him, he said, were Charles Townes, PhD '39, who would go on to win a Nobel Prize in physics, and William Pickering '32, PhD '36, who would become director of the Jet Propulsion Laboratory. "They were wonderful," Tomiyasu said. "If I had any questions, they'd stick with me, whether it took 15 minutes, a half hour, or an hour."

After graduating from Caltech, Tomiyasu received a master's degree in communication engineering in 1941 from Columbia University. During World War II, he returned home to help his father run his ranch, and then went to Harvard, earning his PhD in engineering science and applied physics in 1948. He then worked for one year as an instructor at Harvard. In the course of his career, Tomiyasu has worked for three companies: first with Sperry Gyroscope, then with General Electric, and lastly with Martin Marietta, which merged with Lockheed in 1995 to become Lockheed Martin Corporation. His areas of expertise are in the fields of communication, propagation, remote sensing, radar, and synthetic aperture radar involving microwaves and lasers.

Tomiyasu's sister, Uwamie, a neuropathologist with the Veterans Administration in Los Angeles, has also provided support for the scholarships and professorship established by her brother and sister-in-law. "Like Kiyo, I feel like we have to educate the young people," she said. "They are the ones who have to carry on."

The Associates mark a diamond anniversary

It's been in existence for nearly as many years as Caltech and has been among the Institute's most constant supporters throughout its history. The Associates of the California Institute of Technology marked the 75th anniversary of its founding in May with a celebration that brought together Caltech's current president, David Baltimore, and two former presidents, Tom Everhart and Harold Brown.

Caltech, the Associates, and their interdependent histories were the focal points of the evening. While the Institute has certainly changed dramatically over the past 75 years, the Associates has remained steadfast in its support of Caltech's research and education mission.

The Associates was created at a time when astronomer George Ellery Hale, chemist Arthur Amos Noyes, and Caltech's "chief," (he refused the title of president) Robert Andrews Millikan, were transforming the Institute into a world-renowned institution for research and education in engineering and science. Back then, in the mid-1920s, Caltech was still just a collection of five buildings surrounded by dusty lots and orange groves.

The Institute had major expansion plans, but Millikan, a Nobel laureate in physics, realized that Caltech would never reach its potential without involving prominent members of the local community. He envisioned creating an organization of 100 wealthy individuals who would be willing to donate $10,000 apiece over a period of 10 years. Millikan's idea was warmly received by a core group of prominent local businessmen, most notably, Henry Robinson, a local banker and a member of Caltech's board of trustees.

The first 100 members were recruited, and 75 years ago, on March 9, 1926, the Associates held its first formal meeting at railroad magnate Henry Huntington's home in San Marino, now the site of the Huntington Library and Gardens. The founders' group included many of the civic and business leaders of Pasadena and Los Angeles, among them Harry Chandler, Arthur Fleming, Charles Gates, and William Kerckhoff. They and other Associates would provide the funds to help build many of the laboratories, student houses, and other buildings on campus, as Caltech continued to grow.

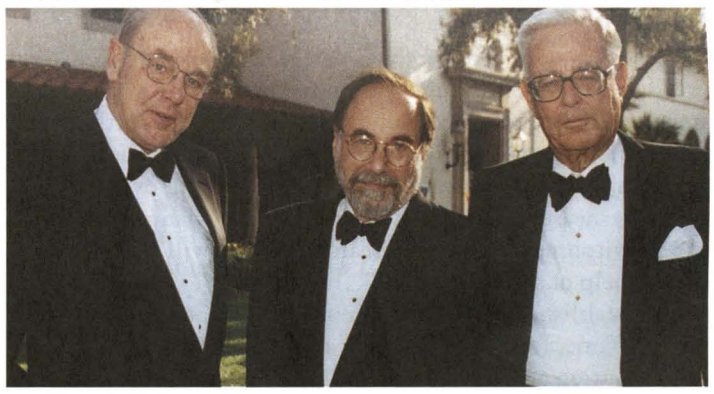
The Institute was evolving rapidly. In the summer of 1926, the Daniel Guggenheim Graduate School of Aeronautics took shape on campus. And in 1928, Kerckhoff and his wife, Louise, provided a laboratory for biology. That same year, Associates Joseph and Louise Dabney funded a new building for the humanities.

As Caltech grew, so did the Associates. More members were recruited as the Institute continued to branch into new disciplines, hire more faculty, and enroll more students.

In 1945, Millikan retired, and Caltech entered the postwar era under a new president—Lee DuBridge, who came to the Institute in 1946 after five years as director of the MIT Radiation Laboratory. During his 23 years as president, the professorial faculty of 140 nearly doubled, and the research faculty grew from 124 to 344. The 30-acre campus expanded to 80 acres and the $17 million endowment grew to more than $100 million, thanks, in part, to the continuing support of the Associates. During the DuBridge presidency, 44 buildings were added to the Caltech campus. Of these, 26 had ties to the Associates.

In 1976, Caltech celebrated the 50th anniversary of the Associates. By that date, the Associates had grown to 527 members; still a select and indispensable group. As then-president Harold Brown said in 1975, "Yours is more than simply an organization attached to Caltech. The Associates have become an integral part of this institution. Your support has been a major factor in maintaining the vitality and strength of Caltech."

Today the Associates membership numbers more than 1,400 people. And the organization continues to fill a critical role, providing funds for professorships, fellowships, and scholarships, and helping the Institute meet many of its essential needs. The group also serves educational and social functions, through the many trips and lectures that it holds each year. Associates members represent a diverse cross section of the Caltech community, including alumni, faculty, and friends of the Institute.



Top, left: Associates president, Tom Tyson, PhD '67, emceed an evening of celebration and reminiscences, highlighted by a panel discussion among Caltech presidents past and present. Above, from left, are Tom Everhart, David Baltimore, and Harold Brown. Beckman Professor of Chemistry Harry Gray acted as moderator.

Jack Roberts, Institute Professor of Chemistry, Emeritus, and his wife, Edith, a member of the Associates emeriti board, joined the Associates as life members in 1981. Roberts said that one of the most important aspects of the Associates is encouraging influential people who are not connected with Caltech to become involved with the Institute.

"I've always been impressed with the program," said Roberts, who first became involved with the Associates when he was provost from 1980 to 1983. "It brings in people who may not know a lot about Caltech, and they then become interested and contribute enormously to the campus. For one thing, I don't think we'd have the Athenaeum without the Associates. Associates also contribute to the general purposes of the Institute and also to specific programs like the Caltech Y and the Summer Undergraduate Research Fellowships (SURF) program. It's also a good way of getting the faculty and alumni to get acquainted with lay people. Other schools have tried to imitate the Associates, but the small size of Caltech makes it work."

Joseph Yang '86, PhD '91, joined the Associates three years ago with his wife, Roxana. "I felt very good about my Caltech experience and I wanted to give something back," said Yang, who is head of the Bay Area chapter of the Alumni Association. While Yang participates in many Alumni Association events, he wanted his wife, who did not

Guests enjoying the gala evening included (photo left, from left) John Baldeschwieler, Caltech's Johnson Professor and professor of chemistry, emeritus; Malcolm Cloyd, a venture capitalist and retired industrialist whose keen interest in science led him to involvement in Caltech; Peter Dervan, Bren Professor of Chemistry; and Louise Wannier '75. Also on hand to celebrate 75 years of outstanding support for the Institute were (from left) Associates Gordon (Rusty) and Kathleen McDonnell, Caroline Heinz-Youness, and Amre Youness.

Associates Activities

All events will be held at the Athenaeum unless otherwise noted. Individual invitations for each event are sent monthly. Contact the Associates at 626/395-3919.

OCTOBER 5–23
Associates' Trip to China—"Exploring China and the Ancient Silk Road," with James Lee, professor of history.

OCTOBER 23–28
Optional China Trip Extension—Five-Day Yangtze River Cruise.

OCTOBER 18
Associates Dinner and Program—"Climate Change and the Ozone Hole," with Paul Wennberg, professor of atmospheric chemistry and environmental engineering science.

OCTOBER 29
President's Circle Dinner and Program—"Fuel Cells: Powering Progress in the 21st Century," with Sossina Haile, assistant professor of materials science.

NOVEMBER 8
Associates Dinner and Program—"The Wind and Beyond: Raising the Obelisk," with Morteza Gharib, PhD '83, professor of aeronautics and bioengineering; and Maureen Clemmons, president, Transformations Company.

DECEMBER 4
Associates Tour, Luncheon, and Program—"Color in Gemstones," with George Rossman, PhD '71, professor of mineralogy and divisional academic officer.

JANUARY 17, 2002
Associates Dinner and Program—"Understanding Cosmic History with Present and Future Ground-Based Telescopes," with Richard Ellis, professor of astronomy and director, Palomar Observatory.

FEBRUARY 7
New Member/Provost's Circle Dinner, with Caltech Provost and Professor of Theoretical Physics Steve Koonin '72.

attend Caltech, to have a close relationship with Institute, and the Associates offered that. Although they can't attend most of the Associates events held in Southern California, Yang said they are able to attend the lectures and talks organized by the group in the Bay Area.

Malcolm Cloyd is neither a Caltech faculty member nor an alumnus, but as someone who has a keen interest in science, he has always admired the Institute and wanted to get involved. Cloyd, a venture capitalist and retired industrialist whose business is based in Pasadena, and his wife, Mary Ann, a senior tax partner with PricewaterhouseCoopers, joined the Associates in 1996, and have become active in the group. On an Associates trip to Washington State in 1997, Cloyd met and became friends with the Associates' immediate past-president John Glanville and with Associate John Baldeschwieler, Caltech's Johnson Professor and professor of chemistry, emeritus.

An active entrepreneur, Baldeschwieler has started up several companies. A year and a half after that first meeting, Baldeschwieler, Glanville, and Cloyd started a venture capital fund called the Athenaeum Fund. The fund has backed numerous commercial enterprises that have originated in Caltech labs.

"I think that the Associates program is a great outreach for Caltech, because it informs the community about what Caltech is doing, which creates an opportunity for charitable donations to the Institute," said Cloyd, who joined the Associates board last year. He and his wife also recently set up a trust, and a portion of the proceeds will eventually go to Caltech.

"My interest is in economics and geology and geophysics. Through the Associates, I now know the people at Caltech who are involved in those disciplines and what they're doing. To make our democracy work well, we must start with education. Caltech is one of the best educational institutions in the country, and that's why it's important to support Caltech."

A video of portions of the Associates' 75th anniversary celebration may be viewed on the Caltech Associates' web page at http://associates.caltech.edu/ or on the @Caltech Theatre web page at http://atcaltech.caltech.edu/theater/.

Jorgensen . . . from page 12

Red Cross, and were active in many civic, cultural, and charitable causes, including the Boy Scouts, the YMCA, several hospitals, and the Los Angeles Music Center. In 1982 Jorgensen received the American Red Cross Humanitarian Award, Los Angeles Chapter, in recognition of his contributions to the organization.

Marion, who continues to live in the couple's Bel Air home, has shared her husband's commitment to Caltech, particularly to student support. In 1993, as part of the Campaign for Caltech, the Jorgensens established a second scholarship program, giving $1 million to endow the Marion and Earle Jorgensen Scholarship Fund. Together, their scholarship fund and scholarship program continue to extend financial aid to numerous Institute undergraduates.

Bharathi Jagadeesh '87 was one of those students. Today she is an assistant professor of neuroscience at Northwestern University, investigating, as she puts it, "the last unknown frontier—the brain." Her research focuses on how complex visual scenes and images are represented in the brain, and how the brain's response to them changes with experience and memory. In 1983, she was a high school senior, thrilled to have been accepted by her "dream school," but concerned about the cost. Paying all her own way at Caltech wasn't an option, "but the Caltech brochures said that Caltech would find a way to help everyone who got in. I pinned my hopes on that, and was pleasantly surprised when it turned out to be true."

"I cannot overstate the importance of Caltech's scholarship program," says Jagadeesh. "Caltech launched me into biology. I learned how to work with—not compete against—really bright people, to think quantitatively, to see how science is done by the great ones, and to be unafraid of any scientific problem."

Jagadeesh believes that such aid not only has a positive impact on the lives of individual Caltech students, but on the quality and caliber of the Institute as a whole. "At Caltech," she says, "I joined a group of students chosen without regard to their ability to pay, but instead for their aptitude for and interest in science. This created a community that continues to consist of the smartest, most able people I have met."

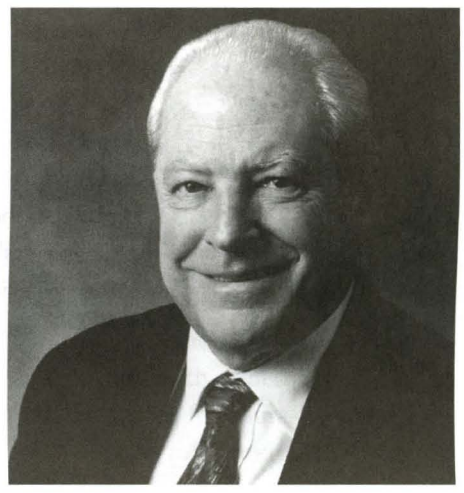
Jorgensen was proud to play a role in that community. Throughout his years as a trustee, he asked for and enjoyed receiving yearly reports about the Jorgensen Scholars and their progress.

"It gives me so much pleasure," he once remarked, "to assist in the education of such bright and talented, hardworking students."

For a view of recent happenings in the Jorgensen lab, check out the back-page poster.

AVERY DENNISON CHAIRMAN NAMED TO CALTECH BOARD

Philip Neal, chairman and chief executive officer of Avery Dennison Corporation, has been elected to the Caltech board of trustees.



Philip Neal is Caltech's newest trustee.

At Avery Dennison, Neal's career has spanned over two decades in corporate finance and senior management. He has been instrumental in the growth and development of the multi-billion-dollar Fortune 500 company, which is the global leader in pressure-sensitive technology.

Neal joined Avery Dennison in 1974 as controller and moved up the ranks, being appointed CEO in May 1998 and chairman in May 2000. Prior to joining Avery Dennison, he was associated with McKinsey and Company in Los Angeles.

Born in 1940, in San Diego, Neal graduated from Pomona College in 1964 with a degree in economics, and received his MBA from Stanford in 1966.

Neal's affiliations include membership on the board of trustees of Pomona College, and he has served on the boards of directors of the Independent Colleges of Southern California, Edwards Lifesciences Corporation, the Los Angeles Area Chamber of Commerce, and the Los Angeles World Affairs Council. He is also a member of the California Business Roundtable, the Los Angeles Business Advisors, and the Board of Governors of Town Hall, Los Angeles.

How many Techers does it take to raise an Egyptian obelisk?

The world may soon find out.

One could argue that there aren't enough Techers on Earth to raise a modest-sized obelisk without power equipment. After all, didn't it require thousands of workers to put the obelisks and pyramids of ancient Egypt into place? Maybe not.

The task may have been accomplished by a dozen or so people flying the stones into position with a kite. A business consultant from Reseda has proposed this theory, and a few Techers are helping to demonstrate that it's a possibility.

This summer the team of Techers and friends raised a three-and-a-half-ton obelisk in 25 seconds, with reporters and cameramen documenting the feat. Now they plan to build larger obelisks to demonstrate that even the mammoth 300-ton monuments of ancient Egypt—not to mention the far less massive building blocks of Egypt's 90-odd pyramids—could have been raised with a fraction of the effort that modern Egyptologists have assumed.

It's an engineering challenge, says aeronautics professor Mory Gharib, PhD '83. The idea of accomplishing heavy tasks with limited manpower is appealing, he adds, because it makes logistical sense.

The challenge was posed to Gharib and his colleagues two years ago by business consultant Maureen Clemmons. In 1997 she had seen a picture in *Smithsonian* magazine of a 340-ton obelisk being raised in St. Peter's Square in 1586. This feat had required 74 horses and 900 men using ropes and pulleys. Clemmons came up with the idea that ancient Egyptian builders could have used kites to accomplish the task more easily.

She needed an aeronautics expert with the proper credentials to field-test her theory. Gharib was interested. He, in turn, needed a willing undergrad who would devote himself to the problem.

Willing undergrad Emilio Castaño Graff '02 tells the story from his perspective.

The ups and downs of raising obelisks

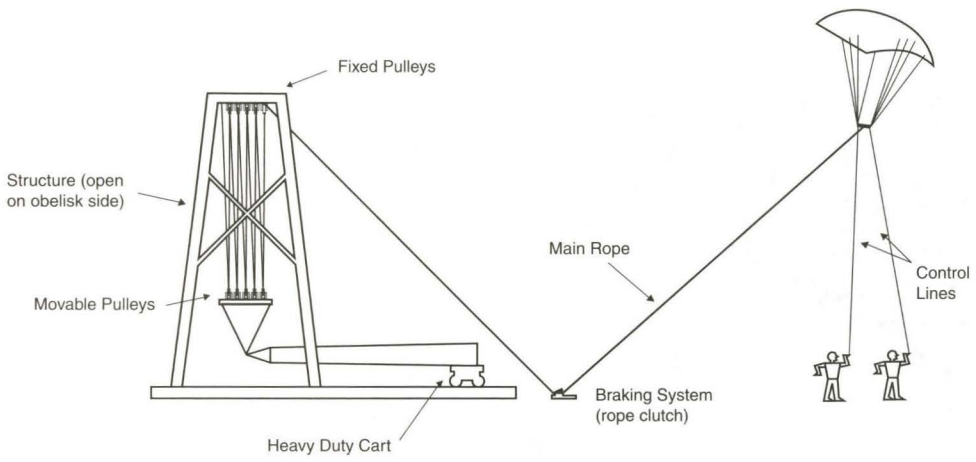
We're not Egyptologists, says Mory Gharib, PhD '83. But we want to determine if the Egyptians could have used wind power to accomplish such feats.

"I came to Caltech as a Millikan Scholar and did my prefrosh SURF (Summer Undergraduate Research Fellowship) with Gharib in the summer of 1998," Graff recounts. "The next summer, I decided that I wanted to do another SURF with Mory, and it was in the spring of 1999 that Maureen Clemmons had contacted Mory about her ideas. He suggested I work on that as a project, and I agreed.

"The first summer was all about checking the feasibility of the whole idea and designing a basic system." Graff and Gharib decided they would need to build a simple structure around an obelisk with a pulley system mounted in front of the stone. That way, the base of the obelisk would move across the ground for a few feet as the kite lifted the stone, and the stone would then be quite stable once it had been pulled up to a vertical position. The top of the obelisk would be tied with ropes threaded through the pulleys, through a braking system, and attached to the kite.

"The next summer I worked on the project again," says Graff, "and the task was to get ready for a two-ton obelisk and get more specific on the design of the system to the point where we could put one together and try the ideas.

"By then, two more people had joined the team. Daniel Correa, from Inca-Block of San Diego, read about the idea in a newspaper and contacted Maureen, offering his construction expertise. Using my drawings, he manufactured two concrete obelisks for us that were made with rebar, or iron rods, to strengthen the massive objects. He also helped in the setup of our structure, and it was his workers who built the first version of it. Maureen had also found our kite expert, Eric May, a kite surfer from Santa Barbara. He taught me how to fly the things so that I could take one control line and he could take the other of our large kite, which is impossible to fly with just one person."



The team raises obelisks with the help of a system designed by Emilio Castaño Graff '02. As the kite pulls on the rope, the pulleys rise up. As the tip of the obelisk is lifted, its base slides into place.

Graff continued working on the project as a part-time staff member throughout the 2000–01 school year, conducting tests every few months. "Our first field test was in October 2000, in Tecate, Mexico, where the obelisk was built. There was no wind, and it was a bit discouraging." On a Web site dedicated to the project—www.pyramidiots.org—Graff writes that, in lieu of wind, the kite was replaced with a truck to test the structure and the pulley system. "Very slowly, the obelisk reached about 75 degrees, after which one of the pulleys seized and was ripped out of the structure by the truck's pull. The rip in the metal caused the whole beam to break, and the obelisk came dramatically crashing down." The obelisk was essentially destroyed, and "the initial idea to save money on the pulleys and the structure was abandoned." The team bought larger, more rugged pulleys, reinforced the brake, and redesigned the structure, or scaffolding, to make it stronger and safer.

In the meantime, the team conducted a February kite test at a new site in the Guadalupe Sand Dunes north of Santa Barbara, California, where a steady breeze was assured. It didn't go perfectly, but it did yield "an actual measurement that the kite could pull at least 500 pounds in 7-mile-per-hour winds," says Graff. "This gave us a boost in confidence that it would work." Subsequent rains and the impending arrival of the snowy plovers (birds that have priority to nest in the area) sent the team packing. The setup was moved to Quartz Hill, near Palmdale.

"Our first field test there was also plagued by a lack of wind," says Graff. "But suspecting that the obelisk did not weigh 4,000 pounds, we did some tests and found that in fact it weighed nearly 7,000. The rebar had added weight that I did not factor into the size calculations.

"The next time we went we finally had wind, but Eric May was not able to make it. With another inexperienced flier at the other end of the kite, we lifted the obelisk after wrestling with the kite for an hour and a half or so. The second successful field test, with Eric May and slightly stronger winds, resulted in the obelisk being raised in just 45 seconds.

"Then on June 23, 2001, we had our first public field test," which was well attended by members of the national press. "Although the winds were not as smooth as we would have liked, we managed to bring the obelisk up in two tries, requiring a total of about 25 seconds of kite airtime." The force generated by the wind actually lifted the obelisk off the ground, where it swung for a few seconds before the team lowered it into an upright position.

Will the idea fly?

One reporter, who covered the event for *The Chronicle of Higher Education*, posed the question, "Does Ms. Clemmons's theory hold air?" Egyptologist Barbara Lesko answered no. "Even if it is technically possible to do this, the Egyptians left us no documentation that shows they knew of kites or used kites," said Lesko, a research associate at Brown University.

Graff considers the historical question from an engineer's perspective. "I think that the whole kite idea is great," he says. "First, it gives more credit to the creativeness of the Egyptians. If they were smart enough to design buildings like the pyramids so perfectly, then it just seems wrong that they would not devote any of this intelligence to construction methods, and that they would have everything done with human power. Aside from that, the kite method would be much faster and less strenuous. And it would require fewer people.

"Although there are some difficulties that we have not yet experienced with our smaller obelisks, imagine how difficult it must be to coordinate thousands of workers. To move their larger obelisks, weighing up to 300 tons, they would have required at least 2,000 workers pulling on one or more parallel ropes, and all 2,000 would have had to pull at the exact same time with all their strength. And somehow, between pulls, they would have had to prop the obelisk up with something so it wouldn't fall back down. And they would have had to do this for hours or even days.

"Meanwhile, with the kite method, they would have had to fly a kite or a stack of kites, with at the most a couple of people for each control line and a minimal support crew to operate the brake, lubricate the pedestal as it slid, and guide the obelisk into place. With steady winds it would not take nearly as long and it would be much more graceful than a bunch of Egyptian men with hernias at the end of the day.

"A lot of people say that we are wrong and that this doesn't prove the Egyptians did it this way," Graff continues. "Part of that feeling I think is honestly not believing in our idea, while part of it is simply not being open enough to accept the first serious theory that does not involve thousands of workers in heavy labor for hours if not days. They are right about the fact that we have not proved the Egyptians did it this way—not with our obelisk one-tenth the size of the smallest Egyptian variety; not with our nylon parafoil for a kite; not with our steel pulleys and steel structure and braided yachting rope. But what we did is the first step in trying to prove the Egyptians may have used this method."

On to bigger, more ancient things

"Now that we have seen the tremendous forces that the wind can develop when its power is properly harnessed, we will get ready to gradually downgrade our technology to the level that the ancient Egyptians may have used," says Graff. "And we will eventually increase the size of the obelisk until it reaches Egyptian size."

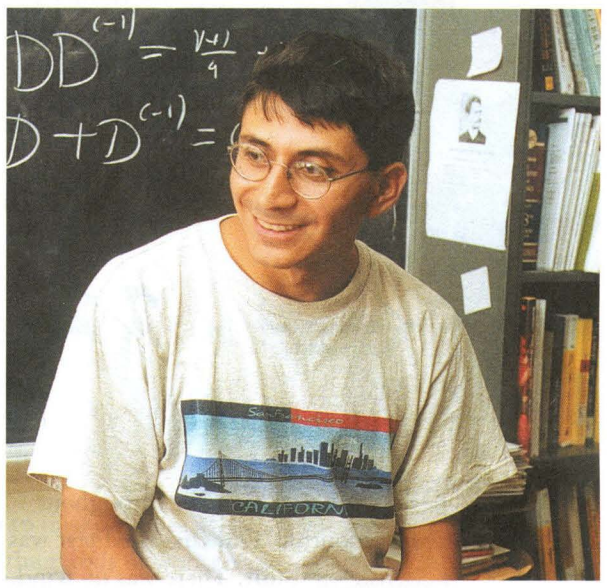
Graff himself may be off designing race cars by that point. He plans to graduate in a year (in engineering and applied science, with a concentration in aeronautics) and pursue this long-held goal.

Future SURF students take note. Gharib says the team is "preparing to replace the steel scaffolding with wooden poles and the steel pulleys with wooden pulleys like the ones they may have used on Egyptian ships." Now that he, Graff, and cohorts have shown that a kite can raise a huge weight, they plan to progess to a 10-ton and then perhaps a 20-ton stone. Eventually they hope to receive permission to raise one of the 40-ton obelisks that still lie in an Egyptian quarry. "We may not even need a kite," Gharib suggests. "It could be we can get along with just a drag chute."

What do you think? What nonconventional research projects have you worked on at Caltech or elsewhere? Send your letters to hillary@caltech.edu.

The team that successfully raised a nearly 7,000-pound obelisk with a kite includes (front row, from left) volunteers Eunice Wu and Tamara Sheffey, Caltech senior Emilio Castaño Graff, kite expert Eric May, volunteer Vic Rechtman, Daniel Correa of Inca-Block, Caltech Professor Mory Gharib, PhD '83, (back row) volunteer Keith Nash, Caltech senior Christophe Maquestiaux, business consultant Maureen Clemmons, and volunteers Charles Wilhelm and Ruth Reid.

"I THOUGHT I'D PROBABLY MEET EVERYONE"



The issue of diversity doesn't exactly preoccupy Carlos Salazar-Lazaro, a math doctoral candidate who is studying difference sets, a topic of algebraic combinatorics. "I do think that Caltech has a lot of diversity when it comes to international students, but this diversity is not very well reflected among American students."

Perhaps reflecting the world-diverse atmosphere on campus, he knows many more international graduate students than American grad students. When it comes to other students' work here at Caltech, he is less interested in their cultural background than in their accomplishments. "What's more important is that they're good at the work they do."

Born in Peru, Salazar-Lazaro lived in Venezuela in early childhood before his family settled in Oregon, where he spent his teen years. Living a few blocks from the institution now known as Southern Oregon University, he attended college-level math and physics courses while in high school.

He attended Rensselaer Polytechnic Institute in Troy, New York, as an undergraduate, and while doing a summer internship at JPL, became acquainted with Caltech. He also applied to UC Santa Barbara, University of Washington, and Carnegie Mellon and was accepted by all.

"I chose Caltech because it's a small school. I thought it might be a friendlier environment. I thought I'd probably meet everyone here."

He has not been disappointed. And he feels comfortable here, while maintaining a life outside of Caltech. Salazar-Lazaro lives off campus with several roommates, with whom he enjoys visiting nightclubs on weekends in Old Town Pasadena and Los Angeles.

It's not hard, he says, to connect on campus through groups like MSA, which does a good job of getting the word out about activities. "I get e-mails from them but I never have been able to attend, because something always comes up. I would be interested in attending some of their things." He recently spent four weeks as an MSA summer research mentor, introducing two pre-frosh underrepresented minority students to lab work in math and genetic algorithms.

Diversity . . . from page 3

sion, so they can often pick and choose among colleges. "Competition for domestic students is quite severe. The ball game you're in is a very tough one," Kiewiet believes.

This year the school received 105 applications from underrepresented minority students compared to 84 in 2000. Many of them undoubtedly received multiple offers, Kiewiet says. "I'm sure a lot of them got accepted everywhere they applied, with rare exceptions. I just have a strong sense that the number of minority students that do have Caltech credentials is definitely going up."

More than half of the 31 underrepresented students who were offered admission accepted. Among the 20, 14 identify themselves as Hispanic, four as African American, and two as Native American.

Why weren't higher numbers of minority students offered admission? Kiewiet says the graduate program is in line with overall Institute numbers. In Caltech's tough academic waters, only one of seven or so applicants makes the cut. And its small size sometimes makes a match difficult between students and graduate options. "Each student needs to be picked up by a research group," Kiewiet says, adding that the Institute's limited range of options in certain fields may encourage some students to look elsewhere.

The familiar refrain that too few minorities enter engineering and science college programs is underscored by the world of work. National statistics show that underrepresented minorities account for 23 percent of the total U.S. population but add up to only six percent of the engineering and technology workforce.

No one seems to expect rapid gains. The hope is that diversity will come to mirror the steady incremental rise in female students since Caltech went coed in 1970.

MIRRORING THE OUTSIDE WORLD

In plain terms, Caltech needs to look a lot more like the outside world, says President David Baltimore.

"This is a great challenge because it involves surmounting historical barriers and requires moving forward in sometimes difficult and often innovative ways," the president said in a recent statement.

"I have emphasized diversity as a goal both because its realization will increase the pool of talent from which Caltech can draw and because it will make the atmosphere on the campus a more realistic model of the world outside. Moreover, I personally feel that achieving diversity is the moral responsibility of a university in contemporary America."

Attending a summer closing banquet at the Athenaeum for Caltech YESS (Young Engineering and Science Scholars), are (left to right) Sue Borrego, director and associate dean of MSA; Miriam Feldblum, special assistant to the president; Brandi Jones, MSA assistant director; and Tracy Johnson, postdoctoral scholar, biology.

Backing up the good intentions with action are administrators and faculty alike. Among them is Miriam Feldblum, special assistant to the president, who has visited HBCUs including Atlanta's Morehouse College, and hosted its representatives on campus last spring.

Caltech also is building ties with other colleges and universities. As a founding university partner of EMERGE, Empowering Minority Engineers to Reach for Graduate Education, the Institute is helping forge a national partnership committed to increasing minority graduate rates in science, engineering, and mathematics.

EMERGE plans to forge cooperation among universities and to work toward building "a true national pipeline for producing minority graduates," especially at the advanced-degree level.

Through these and other alliances, such as Quality Education for Minorities (QEM), Caltech hopes to improve its institutional outreach by collaborating with other institutions to achieve representation in the math, science, and engineering fields on a par with the general population.

"This is the first time we have endeavored to achieve our goals more at an Institute-wide level," Feldblum says. "One of the things we learned is that there have been good efforts at recruiting minorities, but the whole follow-through hasn't been there."

Perceptions can be tough to change, among them that Caltech is insular, Kiewiet says. "Here in the middle of L.A., an amalgam of different groups, we have a little institution that seems impervious to the rest of the goings-on in the world."

This is the case despite the fact that Caltech is very diverse in a global sense. As evidenced by the multitude of languages spoken around campus, there's no doubt that Caltech has achieved an international diversity impressive for

its size—900 undergraduates and 1,000 graduate students. Out of 252 graduate students starting Caltech this fall, about half are international, while U.S. citizens total 131.

Efforts also have been marked by a new consistency and cohesion since Baltimore became president in 1998. "In the past there were some really strong individual efforts," says Sue Borrego, director and associate dean of the office for minority student affairs (MSA). "But they were piecemeal."

Echoing Feldblum's sentiments, she says, "Now there is really an effort to throw a net around what we're doing. We really are working as an institution to collaborate more and to build more crossover between graduate and undergraduate affairs."

That melding is critical at an institution like Caltech, where the small student population and often-solitary nature of hitting the books and conducting laboratory research can breed isolation.

The office of minority student affairs can play an important role by providing day-to-day support to students, and helping them build educational and leadership skills. It also weaves support for and awareness of diversity throughout the Institute.

Underrepresented graduate and undergraduate students get together at informal MSA monthly luncheons, where conversations can range from PlayStation II Street Fighter to the difficulty of a quantum mechanics course.

One afternoon last spring, as 25 or so students broke up after devouring a spread of spare ribs, coleslaw, and baked beans, MSA assistant director Brandi Jones reminded them to attend an upcoming career-night program. "I want to expose you to the world!" proclaimed Jones over the protests of a few students who claimed they were too busy to attend.

She describes how MSA reaches students by offering them social, academic, and other support services and by supporting campus groups like the Caltech National Society of Black Engineers, Club Latino and CLASES (the Caltech Latino Association of Students in Engineering and Science). "We're trying to reach out and let grad students know we're here. The key is fostering communication."

In comfortable surroundings in the Student Services Center, MSA shares common space with other groups such as International Student Programs, which is headquartered right across the hall.

A collection of other efforts is intended to enhance programs that have become indispensable.

A newly formed president's office Diversity Initiative Fund will seek proposals for program or single-event

Continued on page 20 . . .

"Race is not something I focus on"

Steve Mayo heard a clear message from his undergraduate chemistry advisor at Penn State: "There's only one graduate school in the world where you will survive–that's Caltech."

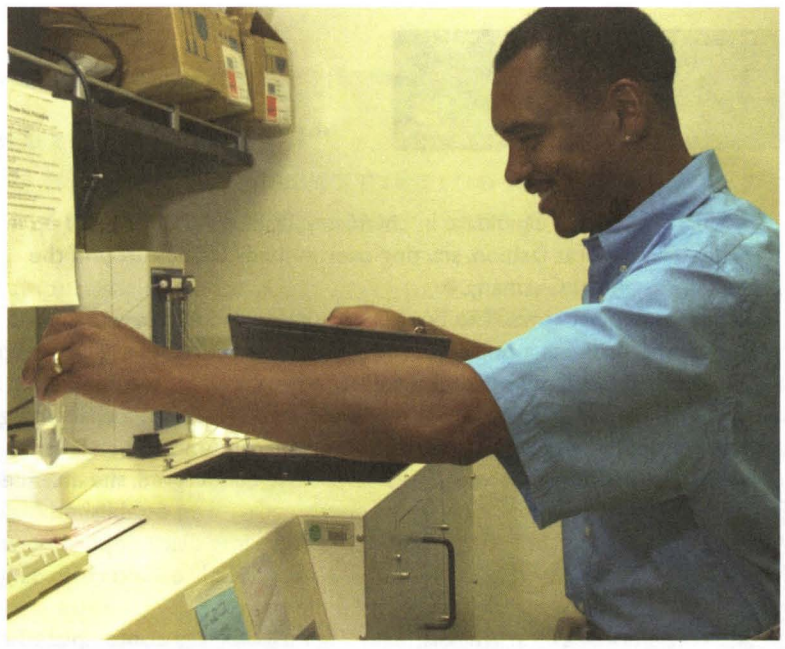
Why? Because Caltech had a reputation for allowing people to be very independent and creative, recalls Mayo, associate professor of biology and chemistry. He finished his PhD at Caltech in 1987 after four years. "I had a great time, a phenomenal time while I was here."

When the time came to apply for faculty positions, Caltech and MIT were among the universities Mayo considered. There was no doubt about MIT's excellence, but in a strange way he felt that officials there were almost too eager to hire him. They were "thrilled to death that I was African American," which had the unintended effect of making him feel uncomfortable. "I felt that they thought they could put a little check in a box."

Caltech was different, and his graduate school experience had given him insight into the Institute and how it worked. "Things were less bureaucratic at Caltech" than at other institutions, he reasoned. Interdisciplinary efforts would be easier to pursue here.

"I felt very comfortable at Caltech. I knew I could do the kind of work I wanted." When he joined the faculty nine years ago, he also knew the financial resources were available to pull together the type of laboratory he had in mind. After joining the biology division, Mayo became Caltech's first black tenured faculty member in 1998.

At Mayo's Braun lab, he supervises 15 students and postdocs trying to decipher the intimate details of proteins' three-dimensional structure and to use this knowledge to



design, build, and test proteins with novel biochemical properties. Also an associate investigator for Howard Hughes Medical Institute, Mayo explores the interface of computational and experimental chemistry and biology.

Lest someone make the mistake of viewing him through the prism of race, Mayo makes his position clear. "I certainly don't want to be identified as a black faculty member," he says. He wants to be identified as a faculty member, a scientist. Period. Race is "not something I focus on.

"You have a passion for science. That's why you're here." The same sensibility applies to what he looks for in students. "What I want to focus on are good students who can hit the ground running and make a contribution."

Growing up set the tone for feeling comfortable in an environment where he is one of few African Americans. He lived in upper-middle-class neighborhoods, where his family's comfortable lifestyle was supported by his father's career as a civilian in the Army. "I was typically the only African American in class and in my neighborhood," Mayo recalls. "That's about as extreme in terms of nondiversity as you can get."

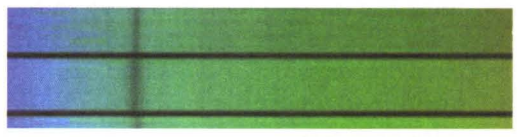
So here at Caltech he doesn't feel culturally isolated. Having said that, Mayo is quick to add that the goal of creating a better mirror of society is laudable and that the Institute would benefit from having greater diversity among faculty and students.

"No matter how you slice and dice it, the numbers are pretty bad," he concedes. "I have no doubt that having a critical mass would be beneficial."

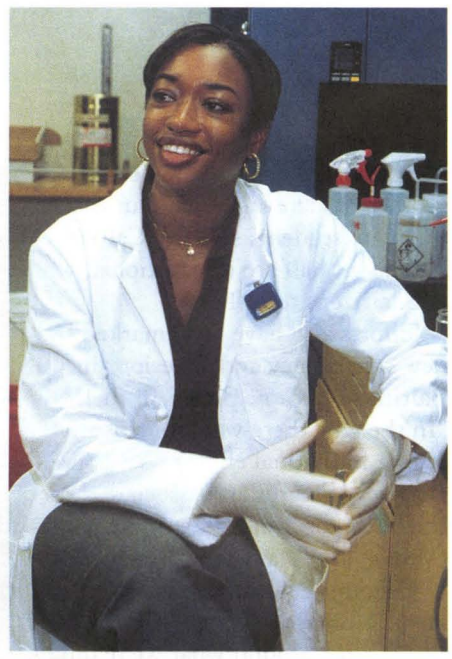
He sees this as mirroring societal disparities and too-low standards in some of our nation's schools, not a reflection of Caltech. Fixing the problem in part calls for reform of a society and educational system that somehow lets gifted students slip away, he says. By the time higher education rolls around, it's too late.

Sitting on graduate admissions committees in biology and biochemistry, Mayo sees firsthand just how few underrepresented minority applications are received.

"The numbers are vanishingly small," he says. "Too much energy is spent looking at it from the end point. We lose people because we're not providing adequate opportunities at the front end of our educational system."



"I FEEL A PERSONAL RESPONSIBILITY"



A fourth-year PhD candidate in chemistry, Tashica Williams grew up in nomadic military-brat fashion, starting over in many locales around the United States and in Germany.

"It made me force myself to be more outgoing and extroverted," says Williams, who projects a poised confidence as she talks about growing up in a goal-oriented family that encouraged her to work hard to reach her dreams. That upbringing has served her well as she navigates a challenging graduate school in which she sees few other African Americans.

To her mind, diversity is very important. As an undergrad, she attended Baylor University in Waco, Texas, an environment with an established African American presence. "I am used to having a really large black population and having that community around me. It's hard at a place like Caltech, finding people who share your similar interests and struggles."

She considered several schools, including MIT. "I really contemplated MIT, both because of the higher number of black students enrolled there, and I was really interested in their polymer science program," she recalls. However, in the end, she chose Caltech. "I came to Caltech because it was small. The intimacy of the atmosphere was important to me."

Working in the research group of Professor Jackie Barton in Noyes Laboratory, Williams explores the mechanism of DNA charge transport.

When she is not immersed in test tubes, she makes a habit of seeking out African American students on campus. "One of my first duties coming here was finding other graduate students I could relate to and talk to."

Despite her concerns, Williams feels a sense of camaraderie in the grad school, a sense of shared experience. "Everybody has had to travel the same road to get here." That helps. "I've met a lot of interesting people and am doing work I find challenging."

A member of the National Society of Black Engineers, Williams gets involved on campus and enjoys activities at the Minority Student Affairs Office, but has been troubled by turnover at the organization in recent years. A welcome change is the hiring of Brandi Jones as assistant director. "She's very dynamic. She has a lot of ideas."

This summer was her second working as an assistant with the MURF program, which places minority students in eight-to-10 weeks of professor-guided research on campus. "We also try to give them a hint of what L.A. is like," through trips to the Getty Museum and the Museum of Contemporary Art and outings to hear jazz.

In the future, pursuing a career that may begin with her working as a scientific advisor in the patent law field, she hopes to fill the role of a mentor and role model.

"I feel a personal responsibility to encourage more African Americans to pursue the sciences. I want to get out there and say, 'You can make it in the sciences.' People paved the way for me. Many African American scientists and leaders were the beacons and inspiration for all of us in science and beyond."

She welcomes the institutional push toward diversity at Caltech. "In most cases you've been the token black all your life," she says. "It's very frustrating. It's good that Caltech is starting to openly attack these issues. I'm glad to see that and I hope to be able to see some result from it. I'd like to give something back."

Diversity . . . from page 19

funding, in part supported by the Irvine Foundation Grant.

The current three-year $2.2 million Irvine commitment helps fund 11 budgeted areas, including nine two-year graduate fellowships totaling $725,000. Another $45,000 goes to outreach programs, with $75,000 earmarked for multicultural activities on campus, including lectures and cultural celebrations. The grant doubles the $1.1 million awarded during a previous three-year period.

Caltech's Minority Undergraduate Research Fellowships (MURFs), which bring talented undergraduates to campus to work for a summer in a research laboratory, also can help students determine choices for graduate school, planting the seed for a future return to campus. Like participants in the SURF program on which it's modeled, students work under the guidance of faculty members.

As the Institute moves forward, the graduate school office intends to assess each year to see which recruitment methods have succeeded and which have not. "I'm not going to choose to believe our goal is insurmountable," Kiewiet says. "That leads to defeatism."

In the end, he suggests, the institution's reputation as a hotbed of science and engineering knowledge must be the most compelling draw of all. "This is a science and engineering school first and foremost, and the defining culture of Caltech is science and engineering in a foremost and fundamental way. What a great thing to pursue."

"YOU CAN MEET PEOPLE HERE, BUT YOU HAVE TO WORK AT IT"

Gabriel Acevedo-Bolton projects a serene air that probably serves him well in his graduate bioengineering option, studying how blood flow affects development of the embryonic heart.

With his fair skin and blue-gray eyes, and a mass of hair often contained by a crocheted tam or a bandana, his looks and his life as a Latino differ from that of most living in Southern California. His parents emigrated from Chile, and he grew up around the UC Davis campus, where his mother and father worked.

After weighing offers from the University of Washington, a joint MIT/Harvard program, and a combined UCSF/UC Berkeley program, the highly sought applicant chose Caltech because of his standout advisor, Mory Gharib, and the research Gharib was doing.

Acevedo-Bolton said he loves Caltech, even though he enjoyed the boisterousness of the UC Berkeley campus where he spent his undergraduate years. There it was impossible to walk across campus and not run into friends.

Caltech is different. "It's not really a social environment, so it's always kind of hard to get a sense of who's around outside of your research group. It stunned me when I first got here." But, he adds, "There's an opportunity here to meet people. You just have to really work at it." Acevedo-Bolton felt ready for the advantages found at small, well-funded Caltech. After completing his PhD and postdoctoral work, he would like to go into academia. "I like research and teaching. It's a nice mix."

He partly attributes his well-adjusted demeanor to the fact that he has a life outside Caltech. Living off-campus with his girlfriend, a first grade teacher, Acevedo-Bolton stays in touch with former Berkeley friends who live in Southern California. Over the years he has also gotten involved in campus activities, including jazz band, the surf club. and Club Latino.

Getting involved with the Office of Minority Student Affairs has helped round out his Caltech experience. As a math and physics workshop leader and tutor during Freshman Summer Institute, Acevedo-Bolton helps students prepare for their first year of rigorous studies at Caltech, by leading workshops and helping with homework, contact that continues during the school year.

His recruiting for the Caltech grad office at his alma mater, Berkeley, has helped underscore student concerns. He thinks prospective students need to know that support exists here to combat potential isolation and cultural loneliness. "I talk to a lot of students. The main thing is, they need to know that they can come in knowing other minority students and knowing there's a place to get help if they need it."

To attract more minority students, Caltech should recruit more actively, better promote the college, and attract a more diverse faculty, he says, calling the low numbers of underrepresented students "a real vicious circle."

Alumni Update

Caltech Alumni Association sponsors range of regional programs

From the Caltech Alumni Association

Caltech alumni from Massachusetts to Menlo Park have enjoyed a banner year for educational events sponsored by their Alumni Association.

Close to home base, in Los Angeles, the Association hosted almost 200 alumni who watched Alan Alda perform in *QED*, an entertaining and—according to those who knew him—eerily convincing portrayal of Richard Feynman. (See Tech Talk, p. 23.) Local alumni also enjoyed an event at the Magic Castle and an all-day tour of the Metropolitan Water District.

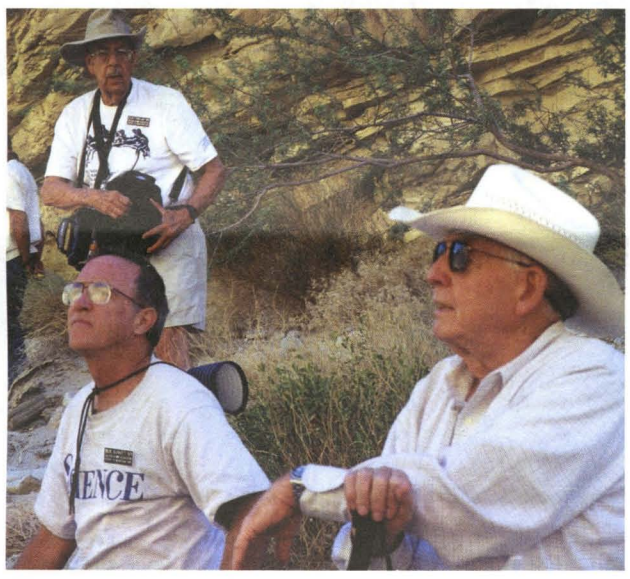
Right here on campus, the Association was the proud host to gatherings in honor of two anniversaries. Caltech's computer science program celebrated 25 years this spring, and the Association hosted an opening cocktail gathering at Alumni House. The Division of Geology and Planetary Sciences held a 75th birthday bash, and again Alumni House was the site of a festive opening event.

A bit farther afield, Caltech friends and family in Seattle welcomed David Baltimore on his first official visit there since becoming president of Caltech. Co-sponsored with the Associates, the program gave participants a chance to hear firsthand from the president about a wide range of exciting projects under way at the Institute.

In Northern California, the Bay Area Caltech Alumni organization hosted yet another successful Happy Hour at a Palo Alto watering hole, where Stephen Hsu '82 was the raffle winner of a copy of *Caltech's Architectural Heritage: From Spanish Tile to Modern Stone*, signed by author Romy Wyllie. Later in the year, the Stanford Linear Accelerator Center (SLAC) was the site of an alumni-led, behind the scenes guided tour, with approximately 200 Techers and friends participating (many of whom stayed for a picnic lunch under perfect picnic conditions).

The West Coast wasn't the only location where Techers gathered. On a gray day on Cape Cod, an opportunity to tour numerous laboratories at the Woods Hole Oceanographic Institution drew a capacity crowd. Lucky participants were treated to a "bridge to keel" tour of the research vessel *Atlantic* and its famed submersible, *Alvin* (in which Dr. Robert Ballard discovered the wreck of the *Titanic*). To the south, alumni got a geologist's view of the Great Falls National Park area outside Washington, D.C.

The spring's educational programming was capped off by one of the largest-ever turnouts for Alumni Seminar Day followed in June by the fourth annual Alumni College program, focusing on *Computing and the Future of Communications*, and showcasing Caltech's expertise in computer science and engineering and applied science.



This summer, on the Alumni Association's 3rd annual and perennially popular Desert to the Mountains travel/study trip, Clay Englar '49 (in back) and (from left) Bob Burket '65 and trip leader Lee Silver, PhD '55, take in the Split Mountain Gorge in Anza Borrego State Park.

Among upcoming events, the Association plans to host gatherings in Chicago, New York, Baltimore, and San Francisco as well in as other areas around the country. Keep an eye on the Association's event calendar at www.its.caltech.edu/~alumni for up-to-the-minute schedules or call the Association at 626/395-6592 for updates.

Better yet, if you have an idea for a behind-the-scenes tour of an interesting facility, or can help to facilitate such an event, contactarlana@alumni.caltech.edu, or call Arlana Silver at 626/395-8363.

Newly nonprofit association will always profit from active alumni involvement

The Alumni Association was successful in its bid this year to convert its corporate structure from a mutual-benefit corporation to a public-benefit corporation. The primary implication of this change is increased flexibility to do what we have always done, in addition to the acceptance of tax-exempt gifts. No, the Association is not preparing a fund drive; that is the province of the Alumni Fund, and there are no plans to reorganize this. The whole exercise did prompt the Association board of directors to review and modify our charter as well as to reconsider the consistency of our programs with that charter. Our current mission, or charter, follows:

1. Contributing to, promoting, and enhancing the educational environment of Caltech.

2. Promoting educational contacts between and among students, faculty, and alumni of the Institute.

3. Supporting the educational purposes and activities of the Institute.

4. Providing educational opportunities to students, faculty, and alumni of the Institute.

5. Supporting the educational activities of students, faculty, and alumni of the Institute.

6. Engaging in any lawful educational activities that do not contemplate the distribution of gains, profits, or dividends to the members thereof.

This is perhaps a long-winded way of saying that our focus is on maintaining alumni contact with Caltech and one another in the most positive ways possible, often in an educational context.

Recent and continuing priorities include the following:

1. Electronic communications, with emphasis on enhancing the efficiency, speed, and effectiveness with which we use this medium. The development of the Association Web site and the inauguration of an electronic *Alumni Directory* (which can now be accessed at http://www.search.caltech.edu/alumnidirectory) are the most recent examples of what we would like to offer. While we intend to increasingly use this medium, we will maintain postal mail capability for those of you who prefer it. We had expected to have more functionality in our site, but we had to abort a dotcom collaboration due to a change in our prospective partner's direction.

2. Educational meetings around the country in a variety of venues, including the Stanford Linear Accelerator (SLAC), Woods Hole Oceanographic Institute in Massachusetts, a Potomac River outing near Washington, D.C., and a couple of well-attended social mixers in the Bay Area.

New Alumni Association President Ted Jenkins (left) is joined by fellow members of the 2001–02 Association Board (clockwise) Blair Folsom, PhD '74, past president; Thomas Tisch '61, treasurer; Stephanie Charles '73, secretary; and Debra Dison Hall '74, vice president.

3. Alumni College, covering computer science this year and economics last year.

4. Travel programs to interesting regions with Caltech faculty. Recent trips include Antarctica (with the Associates), the Anza-Borrego Desert, and Sicily (September), all places where Caltech faculty can offer a unique travel experience.

5. Volunteer opportunities in the undergraduate admissions process, as well as in mentoring and developmental programs with graduate and undergraduate students.

6. Seminar Day, the granddaddy of them all.

We feel we have a diversity of activities tuned as well as we can to your interests. Your participation increases the fun for all. If you haven't been to an event in a while, get together with some of your alumni friends and attend the next one that piques your interest.

If you have ideas for activities we aren't addressing, please send us an e-mail (see the Alumni Association home page) or a note. Let us hear from you.

Ted Jenkins

Three longtime members of the campus community who have contributed significantly to the quality of campus life for Caltech students have been inducted into the Alumni Association as honorary members. Pictured from left: Warren Emery, who headed Caltech's athletic program for 25 years before retiring in 1989; Suzette Cummings, assistant to the dean of students, and Tom Apostol, professor of mathematics, emeritus. The new electees were honored in June at the Association's annual dinner.

Apostol's twelve

In June, when Tom Apostol was named an honorary member of the Caltech Alumni Association, the emeritus professor of mathematics looked back on more than 50 years of teaching at the Institute. Along the way, students have expressed appreciation and other sentiments via letters, e-mail, and, in at least one case, song. One of Apostol's favorite examples appeared in his campus mailbox in December 1963, shortly after the first term ended. What follows is an abridged version of "The Twelve Weeks of Math 1A," which Apostol shared with an appreciative audience at the Alumni Association's annual dinner.

The piece was written, to the tune of "The Twelve Days of Christmas," by Dan Erickson '67, PhD '74, who now works at JPL; and G. Kurata, who left Caltech before he graduated.

The Twelve Weeks of Math 1A

On the first week of first term, Apostol gave to me: the Triangle Inequality.

On the second week of first term, Apostol gave to me: Two Step Functions, and the Triangle Inequality.

On the third week of first term, Apostol gave to me: Three Upper Limits, Two Step Functions, and the Triangle Inequality. . . .

On the tenth week of first term, Apostol gave to me: Ten Exponentials, Nine Logarithms, Eight Parts to Integrate, Seven Substitutions, Six Links of Chain, Five Sines and Cosines, Four Differentials, Three Upper Limits, Two Step Functions, and the Triangle Inequality.

On the eleventh week of first term, Apostol gave to me: Eleven Partial Fractions, Ten Exponentials, Nine Logarithms, Eight Parts to Integrate, Seven Substitutions, Six Links of Chain, Five Sines and Cosines, Four Differentials, Three Upper Limits, Two Step Functions, and the Triangle Inequality.

On the twelfth week of first term, Apostol gave to me: an F.

Please join the Alumni Association for *"Good Times"*
at the 113th Tournament of Roses Parade

Our schedule for Tuesday, January 1, 2002—

- *7 a.m.–8:15 a.m.* Parade ticket distribution and optional breakfast
- *9 a.m. (approx.)* 113th Tournament of Roses Parade (reserved seating at the southwest corner of Colorado Blvd. and Hill Ave.)
- *11:45 a.m.* Buffet lunch at the Athenaeum

Each package includes parking, reserved parade seating, and lunch at the Athenaeum. Optional continental breakfast at the Ath is available at an additional cost. We will send confirmation of reservations and hold your tickets for pickup at the Athenaeum on New Year's Day. Cost is $75.00 per person, $70 for children 11 and under. Optional breakfast is an additional $9.

To reserve space now, fill out and mail in the form below or register online at http://www.its.caltech.edu/~alumni/ Just click on Events!

113th Tournament of Roses Parade

I/We will attend the Tournament of Roses Parade and luncheon on January 1, 2002, New Year's Day.

Please make ____ reservations at $75 per person

____$70 for children 11 years and under

Enclosed is an additional $9 per person for ___ optional Athenaeum breakfast(s)

Enclosed is my check made out to the Caltech Alumni Association for the amount of _____

I would like to pay with my Visa__ Mastercard__

Card Number _____Expiration Date____

Signature _____

Name _____Class Year_____

Address _____

_____

City _____State_____

Day Phone_____Email _____

Please mail to Caltech Alumni Association, 1-97, Pasadena CA 91125

President Baltimore (center) finds himself in the distinguished company of (from left) Sandra Tsing Loh, Edwin Furshpan, Michael Rosbash, Robert Bower, and James Hall. Below: Seminar Day Speaker Kip Thorne chats with Eli Chernow '61.

Alumni honored on Seminar Day

Six Caltech alumni took center stage at the Institute's 64th annual Seminar Day: the day's general session speaker Kip Thorne '62, who regaled the audience with "Space-Time Warps and the Quantum: A Glimpse of the Future," and five of the six recipients of Caltech's 2001 Distinguished Alumni Award.

Robert Bower, MS '63, PhD '73, president and CEO of Device Concept Inc. and professor emeritus at UC Davis, is internationally known for his work in integrated circuit development, most notably for inventing the major device structure in nearly all integrated circuit chips—the Self-Aligned Gate MOSFET.

James Hall '57, president of Chaparral Cars, Inc., has compiled an extraordinary record in the race car world, as both a designer and constructor, including his leadershup of the only team ever to have won auto racing's triple crown in a single season.

Sandra Tsing Loh '83, writer, performer, composer, and all-round So-Cal cultural gadfly, is an NPR commentator, author of two plays, including the critically acclaimed *Aliens in America* and four books, the most recent of which—*A Year in Van Nuys*—spent many weeks on the *Los Angeles Times'* Southern California bestsellers' list.

Edwin Furshpan '55, Research Professor of Neurobiology at Harvard Medical School, has carried out pioneering research into the propogation of signals across the nervous system and is known (with David Potter and Bernard Katz) for the key discovery that signals conveyed across certain transmitters are not spread by the release of a chemical but by the direct electrical spread of the nerve impulse.

Michael Robash '65, professor of

Continued in next column . . .

biology at Brandeis, has carried out fundamental research in the areas of both RNA processing and the molecular basis of circadian rythmns—the biological clocks that all organisms possess.

Peter Schultz '79, PhD '84, who was absent from the ceremony due to illness, is principal investigator at Lawrence Berkeley National Laboratory, a professor at La Jolla's Scripps Research Institute, and founding scientist and chairman of the scientific advisory board for Affymax Research Institute, which focuses on developing and utilizing state-of-the-art techniques for the discovery of new drugs. He has also founded or cofounded several other biotech companies.

Recognition . . . from page 9

its first president, the Royal Society is the world's oldest scientific academy in continuous existence.

Elliot Meyerowitz, professor of biology and chair of the biology division, has been named a Wilbur Lucius Cross Medal winner for 2001. In announcing the award, Yale University cited Meyerowitz's contributions to *Drosophila* (fruit fly) genetics and developmental biology early in his career, and his more recent discovery that *Arabidopsis thaliana* has the smallest genome of any of the known higher plants, which "spurred a revolution in the plant biology community." The medal was awarded at Yale's commencement convocation in May.

John Preskill, professor of theoretical physics, has been invited to be the 2002 Lorentz Chair at the University of Leiden. Described as "the most prestigious visiting professorship in the Netherlands," the chair since its founding in 1955 has been held by 10 Nobel Prize winners.

George Rossman, professor of mineralogy, has been selected to receive the Mineralogical Society of America's Dana Medal. Established in 1998 and named in 2000 in honor of the contributions by James Dwight Dana and Edward Salisbury Dana to the science of mineralogy, the Dana Medal recognizes "continued outstanding scientific contributions through original research in the mineralogical sciences" by an individual in the midst of his or her career.

Anneila Sargent, PhD '77, professor of astronomy and director of the Owens Valley Radio Observatory and of the Interferometry Science Center, has been elected a foreign associate of the Royal Astronomical Society "in recognition of her inspiring leadership and outstanding service to the promotion of astronomy."

Wallace Sargent, Bowen Professor of Astronomy, has been named the fourth Icko Iben, Jr., Distinguished Astronomy Lecturer, which will involve his going to the University of Illinois at Urbana-Champaign in October to deliver a public lecture, give a joint colloquium to the astronomy and physics departments, and interact with faculty, staff, and students. The lectureship brings world-renowned astronomers and astrophysicists to the university.

Nohl Professor and Professor of Chemical Engineering *John Seinfeld* has been awarded the 2001 Nevada Medal of the Desert Research Institute, which is an autonomous research division of the University of Nevada and Community College System. The minted silver Nevada medallion and $10,000 prize recognize outstanding achievements that have led to a better understanding of the global environment. Seinfeld developed the first mathematical models of air pollution, which are both stipulated in the Federal Clean Air Act and remain the basic tool for simulating urban and regional air quality.

Edward Stone, Morrisroe Professor of Physics, has received NASA's Distinguished Service Medal. Director of the Jet Propulsion Laboratory from December 1990 to May 2001, he remains the Voyager project scientist and is the principal investigator for NASA's Advanced Composition Explorer science mission. Also receiving Distinguished Service Medals are *Larry Dumas*, who retired from JPL in July after having served as deputy director for nine years, and *Edward Caro*, who retired from JPL in September 2000 as chief engineer for the Shuttle Radar Topography Mission, after 43 years at the Laboratory.

Keith Taylor, a member of the professional staff in astronomy, has received the 2001 Maria and Eric Muhlmann Award, presented by the Astronomical Society of the Pacific, for his "unique contributions to astronomical instrumentation at various observatories."

Mark Wise, McCone Professor of High Energy Physics, has been awarded the American Physical Society's J. J. Sakurai Prize for Theoretical Particle Physics. Both a memorial to and recognition of the accomplishments of the late theoretical physicist J. J. Sakurai, the prize "demonstrates that the recipient's accomplishments and contributions to physics are judged exceptional by his colleagues." Wise's research has allowed physicists to understand the behavior of particular subatomic particles without having to solve the equations of quantum chromodynamics.

Tech Talk

As Doug Christman mentions in his letter, Fortune magazine provides an in-depth view of Caltech through the eyes of Depression-era reporters. One moving passage reads, "If the boom of 1927, 1928, and 1929 ripped the American economic structure to pieces—as many intelligently argue—and built many palaces for which there were no foundations, it also created this Institute in whose annals the depression of 1930, 1931, and 1932 will be recorded as a mere incident; as one might say that in 1665, the year that Newton made his first important discoveries, England suffered from the plague." A copy of the magazine is housed in the Caltech Archives.

Caltech made *Fortune* in 1932

I found the website featuring the March 17, 1941, *Life* magazine article quite interesting. [An online version can be seen at archives.caltech.edu/life_article, as reported in *Caltech News*, no. 1, 2001.] For an earlier view of Caltech, you might want to look at the July 1932 issue of *Fortune* magazine, which had Caltech as the subject of its lead article, "Seat of Science." I came across the article in my collection of *Fortune* from the '30s.

—Doug Christman '59

1941 mystery man lights the way down memory lane

Regarding the previous *Caltech News* (no. 1 of 2001), I would swear that the cover illustration was of a much younger Linus Pauling lecturing to the freshman chemistry class. [As I recall the scene in question,] the subject is the weight gain of potassium chromate when it burns. Professor Pauling had emptied a one-pound jar of the chemical on a pan balance, placing suitable weights on the other pan to balance it, and igniting it with the flame of a Bunsen burner. He had previously tried to ignite it with a match that he had borrowed from a student.

The chemical had burned as expected (it was more like an explosion) scattering ashes and soot over the front rows. Professor Pauling tried to scoop up the debris and place it back on the pan. This was followed by a hand-waving argument in which everyone would agree that the reaction products obviously weighed more than the original material.

Unfortunately, the drawing does not resemble the mental image that I have of Professor Pauling. The time frame for my recollection was in the 1947–1948 time frame, but I am sure that the same demonstration was performed for many freshman classes.

Thank you for a bit of nostalgia.

—Al Thiele '51

The Feynman beat goes on

QED, the play about Richard Feynman that was featured in Caltech News, *no.1, 2001, is now enjoying a Broadway run. It will play on Sunday and Monday nights through December 17 at the Vivian Beaumont Theatre in New York City. Call 212/239-6200 for tickets.*

I also am a Feynman Fan! Class of '53, remember the Feynman Physics Lectures always crammed full! Can almost hear the explanation of the Uncertainty Theory based on soldiers shooting at each other on a battlefield. I also remember one of his close friends who was a house brother (Blacker), who

Continued on page 24 . . .

Tech Talk . . . from page 23

I said to myself, "I certainly won't register with this monkey. He is obviously nuts!"

used to spend time with Feynman going to bars, etc. Swaroop was a fascinating person in himself, reportedly the son of an Indian Maharajah. I knew Swaroop well as we played on the Caltech soccer team (So. Calif. Champions!) together. Later ran across him one day walking down a street in London. Have no idea where Swaroop is today, but if you found him I'm sure he'd tell you much about Feynman.

—Perry Vartanian '53

Great *Caltech News* story on Alan Alda playing Feynman in the new play *QED*. I did notice that the caption under the photo credited Shirley Marneus with recruiting Feynman to play the bongos for the ASCIT musical *Guys and Dolls*. Actually, it wasn't Shirley. It was me. I suggested it to Shirley, who thought it was a great idea, so I approached Feynman in his fourth-floor office of Downs-Lauritsen.

Feynman, despite his natural showmanship, was reluctant. He was afraid it would take too much time for rehearsals, and I said we had it all worked out so he wouldn't have to attend any but a few of the final rehearsals. He'd play the bongos for the Havana scene, and we assumed this would be easy for him because of his reputation as a bongo player. (We were wrong, as Feynman explains in *Surely You're Joking, Mr. Feynman.* Feynman was arrhythmic and had to have another guy behind him providing him with the beat!) Finally, he agreed.

(About the same time, I recruited Harry "The Horse" Gray to play the *Guys and Dolls* character of, remarkably, the same name. He was a lot easier to persuade than Feynman.)

We brought Feynman in on one of the earlier rehearsals, and it occurred to me that this was perhaps the only guy in the entire cast capable of a thick, authentic New York accent. So I suggested that he provide the voice of Joey Biltmore, who the audience hears as the off-stage voice in a phone call. At this, Feynman was *perfect*. And about then, Feynman got the bug. He was there for just as many rehearsals as the rest of us, and had a great time. Harry Gray got the bug even worse; once we got him on the stage, there was no getting him off. He was hooked.

Since I also was playing keyboard in the orchestra for that show, I had a perfect view of the audience reaction when the curtain went up for the second act and the spotlight hit Feynman, with his purple sequined shirt knotted at the chest. Every pair of heads in the audience turned to each other, fingers pointed, and the whispers were in almost perfect unison: "That's *Feynman*!"

That was the beginning of the Caltech tradition of giving cameo (or larger) roles to some of the world-class scientists on the faculty. The same qualities that make people great teachers often make them great for theater roles!

—John Gustafson '77 (Ruddock)
Producer, *Guys & Dolls*

Responding to your request for memories about Richard Feynman, here are some of mine.

In the period 1952–56, Feynman would come over to the student houses for dinner and a chat afterward. He loved to talk about himself and his adventures: making patterns with tiles in his high chair as a child; the incident with the draft board that left him 4-F (unfit for military service); working on the BOMB; decoding (and finding errors in) a Mayan tablet at the foot of pyramids in Mexico while his second wife, Mary Lou, climbed up; exchanging letters in secret codes in and out of Los Alamos with his first wife, Arline; learning to pick locks from the ex-con who was the locksmith at Los Alamos; getting into trouble with the secretaries at Oak Ridge after he had broken into their safes. And on and on . . .

That was in undergraduate school. When I came back to graduate school (1959–62), some of us who had met Feynman as undergrads thought it would be fun to have a "Feynman Party" at my house. I reached him on the phone and he agreed to come. Then, about a week before the party he called me and asked, "Do I have to bring my wife?" "Not at all," I replied. "I don't think I'll come," said he. The point of all this is that in the play *QED* his interplay with the young college student . . . never letting her into his office . . . reflected just this part of his personality. I was glad to see this as part of the play.

—Chuck Bodeen '56 (Blacker),
MS '59, Eng '61

I gladly follow your invitation in *Caltech News* to share memories of Richard Feynman.

I arrived at Caltech in 1952 as a very naive and inexperienced foreign student. Faced with the need of choosing among five instructors in the Math Physics course (which was required of all graduate students), I asked a fellow student for advice. The guy said, "Take Feynman. He always starts out with five minutes of playing the bongo drums." I said to myself, "I certainly won't register with this monkey. He is obviously nuts!" So I didn't, and this stupid mistake remains one of the perennial stains on my career. The only physicists I knew at this stage were Nobel Prize winners—and Feynman had not yet garnered his.

Many years later, I finally met Feynman at the home of a colleague in Mexico City. By then I knew who Feynman was, and I was too intimidated to talk to him. I am trying to make up for it by reading all I can about him. In *Surely You're Joking, Mr Feynman,* there is a hilarious story about his being rejected for military service because he failed the psychology test. This made me feel better. I had not been the only one to think he was crazy!

—Cinna Lomnitz, PhD '55

I was a graduate student at Caltech in 1966–68. During the advanced quantum mechanics class, Professor Feynman told us many stories, most of which have since been in print, thanks to Ralph Leighton. Here are a couple that I don't recall having seen, however.

The first was about Feynman having seen a movie where German prisoners of war without watches synchronize their actions by counting in a regular rhythm to themselves. Feynman became interested in whether this technique would work. He found that it did work and that he could accurately time events by counting. Then he began to test what physiological changes might upset the timing. He tried running up stairs and found that his timing was still accurate. He found that he could read a book and maintain accuracy but that he could not concentrate on music and be accurate.

When he discussed the matter with his MIT roommate, the roommate said that he could count while concentrating on music but not when he was reading. It turned out the roommate visualized the numbers when he counted, while Feynman said them to himself. Feynman suggested this could be a test for determining whether a person vocalized while reading.

The second story was of a more humorous nature and was about a time when Feynman was living in a fraternity (I presume) and was perhaps an upperclassman. Around the dinner table, a freshman was talking about Taylor series expansions that he had learned about that day and that he felt were pretty much useless as no one could calculate them fast enough to be of much use. Feynman objected, to humor the freshman, and boasted that he could easily do the math mentally.

So the freshman challenged Feynman to calculate the log to the base ten of 5. Since Feynman knew the log of ten and the log of two all he need to do was to subtract one from the other, which he did, slowly of course to show he was working on the series. This amazed everyone and someone asked him to do another, which I think was log to the base e of 5. Another easy one since Feynman knew the natural logs of both ten and two.

Then Feynamn finished his meal and as he was walking away from the dinner table the amazed freshman tagged along and pleaded with Feynman to do one more. Feynman didn't want to since his luck might run out, but the freshman persisted so he agreed. Fortunately, the freshman asked him to do log base e of 20. So he did it and quickly departed.

I'm not sure of the exact examples in the above story, but the gist is correct. Of course to get the humor, one probably has to be a physics or math major.

—Ed Bernard, MS '68

I don't have a lot to add, as far as the articles on Feynman and *QED* go, but I do recall a Feynman drumming performance at Caltech from even earlier than *Guys and Dolls*.

During my freshman year, I was in an ASCIT talent show entitled "I didn't know Caltech had any . . ." in Beckman Auditorium, in which Feynman did a drum solo. During the solo, he did a little riff in which he leaned his elbow on the drumhead to change the tuning of the drum while he played it. One of the little things that really impressed me about Alan Alda's performance was that he apparently knew about that elbow-on-the-drumhead riff and did the same thing in his performance in *QED*. (My contribution to the talent show, incidentally, was a Caltechisized version of the Allan Sherman song "Hello Muddah, Hello Faddah.")

I arrived in 1965, one year too late to hear Feynman lecture in person in Physics I or II, but I do remember a well-attended talk on "Color Vision" that he gave in Beckman. I also recall the electric motor in Bridge, built in a 1/64-inch cube, which he sponsored. I think of that motor every time I read a new article on nanotechnology. Is it still around somewhere?

—Dan Villani '69

The micromotor mentioned above is on permanent display in an alcove in East Bridge Laboratory, pictured at right. Its architect, Bill McLellan '50, met Feynman's $1,000 challenge. He continues his association with the Institute today as a consultant with Palomar Observatory.

ALUMS OFFER THEIR TAKE ON ELECTION REFORM

Caltech News first reported on the Caltech–MIT Voting Technology Project in issue number 4, 2000. For the latest project news, see www.vote.caltech.edu.

I'd like to add a comment on the discussion of Caltech and MIT's efforts to improve voting systems in the United States. One important aspect is to make sure that whatever system is implemented allows for preference, or Instant Runoff Voting (IVR). In this system voters vote for their first, second, third and additional choices for each office. The voting equipment tabulates the preference orders of the voters. These preference orders are processed through a clever algorithm that has many valuable advantages over the current plurality-voting algorithm. More information is available at www.instantrunoff.com/.

Unfortunately, the current punch-card voting machines in common use in California don't allow voters to cast preference orders, and thereby prevent the use of IVR and other superior vote counting algorithms. We need to be sure that whatever replaces punch cards does not force us into keeping the same vote counting algorithm.

—Dirk Runge '93

I read with great interest the letters on improving voting machines and methods. There are many good suggestions, but I do not quite agree with all of them.

I suggest equipment modeled on both ATM machines and the ancient mechanical voting machines that are still in use here in New York. However obsolete, the mechanical machines have two important features: (1) The voter can review his vote and, if he has made a mistake, cancel and change any selection, as long as he has not completed his vote by opening the curtain. (2) The machine accumulates votes for each office and issue in a series of counters; it does not retain individual votes. At the end of the day the totals can, on many mechanical machines, be printed out and remain available for any recounts.

These aspects of mechanical machines should be retained in any electronic system. Some may consider keeping only totals to be a step backward. But it does ensure an important principle, ballot secrecy. Printing and retaining an individual voter's choice endangers this principle, because the voter cannot be certain that others might not later access such a printed record improperly.

Security from tampering is not enough reason to keep individual voting records. Totals kept in numerous individual machines can be made reasonably secure by proper auditing of each machine before election and police guarding the machines before and after. This works well enough with today's mechanical machines and will be sufficient also with properly designed electronic methods. The totals are sent to election central at the end of the day, but retaining totals for each machine allows for recounts. Recounting machine totals within a few hours is doable, even by hand, which is hardly the case for individual votes recounted statewide.

However, for the actual vote, I am all in favor of electronic machines with ATM-like displays, which can be made far superior to mechanical voting machines.

—Werner Buchholz, PhD '50

I continue to be amazed by the outpouring of opinions on how to fix the current voting system, without any apparent consideration of whether there really is a problem. In particular, the sentiment that we should have 6-sigma reliability is patently absurd. The recent election for president is, of course, responsible for most of this discussion. However, no one has ever actually suggested that a more accurate count would have made a discernible difference. Oh, it is possible that Gore would have been elected instead of Bush, but in an election this close, would it really matter? The nation as a whole made one thing abundantly clear on election day: "We don't think that there is a significant difference between Al Gore and George Bush." While this may not have been the sentiment of a single individual voter, it was the sentiment of the nation as a whole.

"If it ain't broke, don't fix it." If, and when, it is demonstrated that there is a real problem with the vote counting system, then we can spend time worrying about it. Until then, it is just the musings of those of us who are hypertechnical and like to get everything "exactly right." As Frank Weigert has correctly pointed out [in the last issue as well as below], there is far more wrong in the process than the vote counting. Issues such as gerrymandering and campaign finance are far more significant. Let's put our energy into the real problems, rather than attacking a very small problem like the counting and then, if successful (a big if), patting ourselves on the back; that approach just makes it easier to avoid attacking the real problems.

—John Manley, '77 and '79

Continuing with the dialogue on how best to improve voting methods in this country, an article in the May 29 issue of *The Wall Street Journal* (page A24) proposed a patch type of fix. They suggest counting each ballot locally before officially submitting it. The idea is like the extra scanner in the supermarket, where shoppers can verify an item's price before checkout. The article claims errors go down to better than a 3-sigma level.

The more I think about the issue, it is not enough to have world-class counting technology unless we also address the issue of eligibility. I grew up in Chicago during the Daley times. The mantra was "vote early, vote often." How can technology insure that each eligible voter gets to cast a ballot no more than once while rejecting all ineligible ones?

My parents moved in 1956 and could not vote in their new state. They unsuccessfully tried to argue that presidential elections were national and they were U.S. citizens. In our system, we vote for local electors rather than for the president. Residency requirements are another issue that needs consideration in a transparent voting system.

—Frank Weigert, PhD '68

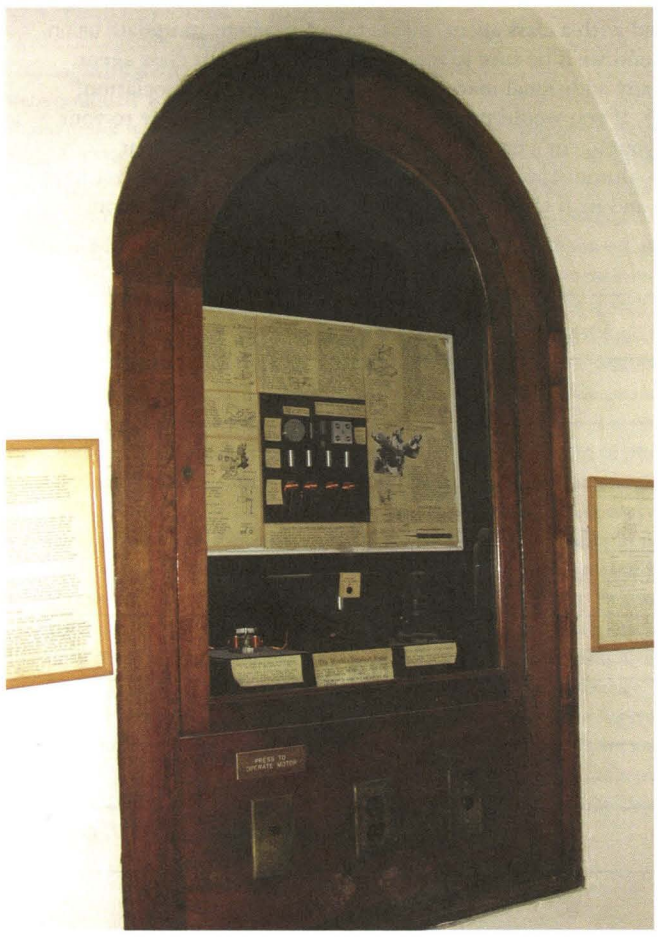
Give us your take on topics presented in Caltech News, and present new topics, by sending e-mail to hillary@caltech.edu. Caltech News reserves the right to select and edit letters.

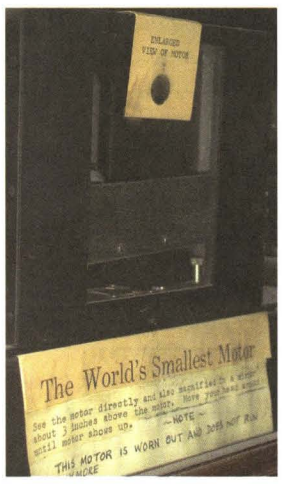
Truth . . . from page 9

Institute's presence in electronic media to better share our groundbreaking research with the public," said Koonin.

"*Closer to Truth*'s objectives are to raise scientific awareness, enhance scientific literacy, increase appreciation of the human condition, and improve critical thinking," commented Kuhn.

"This new agreement with Caltech is a perfect way to accelerate our achieving these goals."





I think of that motor every time I read a new article on nanotechnology. Is it still around somewhere?

Class Notes

1960
Peter Rony
peter@rony.com
www.rony.com

"WHAT are you doing?" Initially, I thought that this Super Bowl, Budweiser-commercial, punch line was stupid and not up to par with the previous Budweiser frog commercials. However, it is a good line for initiating e-mail communications with my class of '60 colleagues. This line, possibly my e-mail message, plus the e-mail addresses provided by the Alumni Association, have produced a bumper crop of responses, which are summarized below, in this, the third installment of the 1960 class notes. It is a joy to be the class of '60 scribe and to receive responses from class colleagues whom I have not heard from since my 1959–60 senior year. **Brad Efron**? Phone home, please.

Bill Arveson (arveson@mail.math.berkeley.edu) reports: "I've been hanging out since 1968 in Berkeley, where I am a professor of math. After finishing Tech, I did graduate work at UCLA (PhD 1964), spent three pleasant years at Harvard as a math instructor, and then came back to California. It's been a fairly predictable academic life, with occasional disruptions like the great fire of 1991 that burned our house to the ground. I learned more about the insurance business than I want to know. I don't see many from the class of '60 anymore. I overlapped with **Al Hales** for a couple of years when we were both instructors in the late '60s in Cambridge. I also ran into **Brad Efron** there; **Fletcher Gross** in Salt Lake City a bit later; and **Don Anderson** in the mid-'70s when I visited UC San Diego. I used to see Al Hales occasionally at UCLA, but not since he retired a few years ago. These are all math people; haven't run into anyone else, except for **Chuck Antoniak.** who metamorphosed from a Caltech physics major into a statistician—he was in the Berkeley statistics department for a while some years back.

I go back to campus every couple of years for Barry Simon's annual math–physics conference. At one of these meetings recently, I crossed paths with Tom Apostol, who had taught me calculus and linear algebra when I was a sophomore (and especially, how to *think* about mathematics), which was nice! He is now retired, but is still very active in mathematics and education. Probably, nobody else in my class will remember me since I was married and living off campus."

Bill Benisek (wfbenisek@calwest.net) communicates the following: "After 30 years as a faculty member in the biological chemistry department at UC Davis, the last four as department chair, I have retired from academia. I still think about protein chemistry (mostly in my dreams), but my waking hours are now happily spent on my other long time interests—cycling, landscape photography, and programming. Marie and I are approaching our 41st wedding anniversary. We've produced two children, Lisa and Eric. Lisa is the mother of our only grandchild so far, and Eric is a lawyer."

After retiring in 1994, **Tom Bjorkland** (tbjorklund@uh.edu) is still working on getting his next career started. "I hope to finish my PhD at the University of Houston this year and then travel the globe studying earthquakes or looking for oil and gas or running with the Hash House Harriers or attending conventions at exotic locations or all of the above. However, I first must deal with the old-boys network of journal-manuscript reviewers, who I have so far found to be provincial and resistant to new ideas. I have been traveling from Houston to Southern California quite frequently to look for earthquakes, to visit my psychologist ('significant other') and shoot a few baskets with **Fred Newman**."

Graeme Blake (GBlake2935@aol.com) sent the following e-mail on 28/06/99: "I have been hoping something interesting enough to report would happen to me. I suppose I could count my 25th anniversary of working at the same company (though under two company names: Sundstrand Data Control and Allied Signal—soon to be changed again to Honeywell. Also, in July Cathy and I are going to Costa Rica, fulfilling a long-held wish."

John Campbell (johnhcampbell@hotmail.com) is professor of neurobiology at UCLA. "As much time as possible, I live in Australia—Perth or Canberra. My main hobbies are collecting skulls, insects, shells, and especially seedpods. Heather is my wife of 39 years. We have two kids with PhDs in genetics, and one grandchild. My science program focuses on the feasibility of and methodology for human germ line genetic engineering. Strangely enough, my favorite activity is: thinking. I have a scientific proof that the future can act causally on the present. My primary scientific breakthrough: one drop of Tabasco sauce can turn a three-dollar rotgut wine into a Penfolds. My retrospective view of Caltech: A great place for educating a person twice as smart as I."

John Cooper (jcooper@bucknell.edu) reports that he is teaching and doing research in chemistry at Bucknell University, "as I have for, lo, these past 34 years."

Ken Dinwiddie (kend@daise.com) writes, "For the last 19 years, I have been practicing software engineering as Dinwiddie Associates, Inc., a usually one-man shop for custom software development involving digital image processing, exotic hardware, or object-oriented designs. Sue and I enjoy travel, both domestically and abroad, as much as our schedules permit. Sue took early retirement from a head teacher position at Bing Nursery School at Stanford several years ago and then commenced her own consulting practice, training teachers and parents. Activities at our health club and brisk walks with our 90-pound German shepherd, George, keep us reasonably fit."

Jim Farmer (jamesfarmer@earthlink.net) is now retired and living in Natick, Massachusetts. "Our daughter adopted a little Romany girl from Bulgaria, who is a bit behind her age group in development. We are caring for her a few hours each day; it is sometimes as challenging as anything I ever did at Caltech. Once she no longer needs us on a daily basis, we hope to do some traveling to some of the places I never got to see in my younger days. I occasionally think about going back to work, but I lie down until the thought passes. I am curious about our class gift. The last time I heard about it, back in the '60s, the money had still not been spent. Did we ever give a gift? If so, what was it? My favorite proposal was a 24-hour digital clock on Throop that would display '1960' at 8 p.m."

Lee Hood (lhood@systemsbiology.org) states, "I am director of the Institute for Systems Biology in Seattle. The institute is a nonprofit research facility that I started a little more than one year ago. We have grown from a staff of two to more than 160 (and seven faculty members). It has been a wonderful challenge with terrific colleagues."

Earl Johnson (earl.johnson@verizonmail.com) reports, "Currently I am a Web master for Verizon Communications, Enterprise Solutions Group, where I am responsible for a site that provides information to a sales force and supporting staff of approximately 18,000. Sorry, you can't see our site; it is Intranet-only. My children are grown and out of the nest. I am happily married for the second time to the love of my life, Gail, a midwife here in the Dallas–Fort Worth area, who delivers 40–60 babies at home, each year. She also assists other midwives in this area, so with my Web work and her deliveries, we often don't see each other for extended periods. Ballroom dancing and travel are our major forms of recreation. This past summer we went to Greece, where we walked and walked— seemingly all uphill. That was lucky, because we ate lots of Greek food!"

Tom Jovin (becky@mpc186.mpibpc.gwdg.de) writes that since 1969 he has been both chairman of the department of molecular biology and a director of the Max Planck Institute for Biophysical Chemistry in Goettingen, Germany. His scientific interests include DNA structure and function, molecular mechanisms of cell signal transduction, and microscopy. He received his medical degree in 1964 from Johns Hopkins, and, taking a road less traveled by Caltech grads, became an Established Investigator of the American Heart Association, working with Nobelist Manfred Eigen on fast reaction kinetics at the Max Planck Institute for Physical Chemistry in Goettingen from 1967 to 1969. He was named a scientific member of the Max Planck Society in 1969. Tom is married to fellow scientist Donna Arndt-Jovin and has three children from this and a previous marriage: Ellen, Diana, and Rebecca. A second daughter of Tom and Donna, Suzanne, was murdered in 1998, during her last year at Yale University.

Ron Kunzelman (ronkunz@onemain.com) sends word that "after getting my MSEE from Caltech in 1961, I spent four years at Secode, a San Francisco startup telecommunications company. Then I spent 17 really fun years at Stanford Research Institute in Menlo Park; a year at another start-up, Packetcable; and then 12 interesting years with ROLM/IBM/Siemens, a job that involved travel throughout the U.S. and Europe. I took early retirement from Siemens in 1994. I was married for 20 years to Carol. We have two great kids, Dave, 31, and Kevin, 29. During my working years, for recreation, I spent a great deal of time with my family and friends camping, skiing, sailboat racing, and windsurfing. Sylvia Paul, my fiancée of 14 years, died of lung cancer in January 2000. After that I moved from Cupertino, California, to a house on the water in Discovery Bay, midway between San Jose and Mammoth. I bought a powerboat, which is docked in my backyard. I am still pretty much an outdoors-activity junkie. My current recreational activities include tubing and wakeboarding in the Delta, driving in the sand and dirt at pretty high speeds in my off-road buggy, acting as pit crew for my motorcycle road-racing-addicted son Dave, and racing my go-kart. Guess I'll never grow up."

"Growing older has its spiritual and mental ups and its physically deteriorating downs—and I've had more than my fair share of both of those. Aging has come to mean appreciating life and the healthy moments available to me," says **Meredith Mitchell** (m-b-m@ix.netcom.com). "As a Jungian analyst and psychologist, I have allowed my practice to shrink so that I continue to see only a few select clients. Meanwhile, I have been writing essays, which I have been constantly posting on my Web site at http://members.tripod.com/~meredithbm. In addition, I have developed a resurgence of interest in trying to sell my book, *Hero or Victim?* and am setting up another Web site

CLASS NOTES CUTOUT COUPON

If you're a Caltech undergrad with a class agent, please take a moment to update us on what you've been doing, and we'll be sure to send that info on to your class agent. Return this coupon and any additional materials to Caltech Alumni Association, 1-97, Pasadena, CA 91125. If you would prefer to e-mail your news directly to your agent, you can find your agent's name and e-mail address on the Web at http://www.its.caltech.edu/~alumni/class_notes.htm. And if your class doesn't yet have an agent, please fill out and mail the Personals Coupon in the *Personals* section.

Name_____

Option and Degree Year_____New address?_____

Address_____

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NEWS_____

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(http://www.herovictim.com), dedicated solely to promoting the book and arousing more interest in it. I have a fairly new hobby, too: I joined the baritones in the Burbank Chorale and have enjoyed that experience very much."

John Price (JohnP67544@aol.com), of Granada Hills, reports: "I retired in 1994 when Litton Data Systems offered a 'Golden Handshake' (although they did not refer to it by that name). As you know, if you do not accept an offered Golden Handshake, you *will* receive a Bronze Shaft; so I took it. In 1999, Mary Kaye, my wife of 33 years, passed away from a combination of heart and kidney problems. Since then I have occupied myself with bowling twice a week, directing a chess club in the West San Fernando Valley, and clock repair (as a hobby—not for profit). My son is a particle physicist at UCLA, while my daughter is a sales representative for Warner Records. They both live in the Valley, so I've got family nearby. That's about it."

Bob Norton (rlnorton@pacbell.net) states: "I recently retired from JPL and am enjoying life in our South Pasadena condo. It's nice to be close to campus and to drop up from time to time for a lecture."

Peter Rony (your class agent) reports that **Bob Bump** '62 wrote me the following: "Would you have been involved in the Old Piano Prank (I think it would have been near Christmas of your junior year), where **Clint Frasier** '59 played the to-be-discarded pastel light-green piano at Hollywood and Las Palmas? That was my introduction to the marvelous sense of humor at Caltech. One of my vivid recollections was my fascination with the 1940 black Cadillac that you had—with its three ranks of seating, a straight-8 engine, and that neat whine in the lower gears."

Bob, I confess that both my 1940 Cadillac and I participated in the Green Piano Prank. My Cadillac brought the piano to Hollywood Blvd., carried the demolished piano back to Ricketts House, and then transported it to Oxy, where it made its way, ceremoniously, into the Occidental College swimming pool [*Scientific Note*: The piano floated]. Also, the Cadillac transported the Ricketts House rowdies to and from Hollywood Blvd. I still have one of the piano keys, which may ultimately wind up in a "Caltech Legends" museum on campus. The Oxy logistics were made possible by the superb undergraduate lock-pickers at CIT. The Green Piano prank is briefly reported in *Legends of Caltech*. (The story describes my Cadillac as "an old hearse." Actually, it was a car originally owned by the actor Don Ameche.)

James Sorensen (SORENSJC@apci.com) states: "Speaking of the recent Bud commercial, believe it or not, on a flight a couple years ago I sat next to and shot the breeze with 'Cedric,' who then went on to his starring role in the Bud bit. At the time I met him, he was flight-delayed and late for a personal appearance in Philly, and so was interested in talking about local pathways re his sprint to the stage. (Sadly, I can't claim that the idea for the commercial was mine.) I continue to have a pretty heavy travel schedule for Air Products; I'm now responsible for our liquid-phase technologies and government systems departments. Lately, I've been more of a carpenter than a fisherman as Sandy and I continue to fix up our weekend place near Penn State. And we're really enjoying our first grandchild, who was born last summer."

Keith Taylor (Keith.A.Taylor@tex.com) contributes the following information: "Still building trigger IC's at Tektronix and raising a couple of boys. Plan to retire in a couple of years unless #1 goes to an expensive college. Worried about where to get my nerd fix if I *do* retire."

Former Caltech diver extraordinare **RC Thompson** (rctbone@worldnet.att.net) states that he is still active at work and play. He is engaged full-time in orthopedic surgery, with a special interest in spine problems. He is also national database manager and 2000–01 president of the Flying Physicians Association—a listing of physicians who are pilots; is doing research on eye physiology and flying, specifically "see and avoid" problems, and vision anomalies in poor visual conditions; and is participating in an a cappella quartet. On top of all this, RC, formerly known as Robert, is a new grandad, and has started swimming again after years away from this sport.

Laurence Trafton (lmt@astro.as.utexas.edu), an "optimal procrastinator," communicates, "I am still at the University of Texas at Austin, as a senior research scientist in the astronomy department and at McDonald Observatory. My research is mainly on planetary atmospheres, especially in the outer solar system. I am involved in both ground-based telescope and Hubble Space Telescope observations. When not working, I might be flying a Cessna Skylane or ice-skating. I recently competed in an ice-dancing event (like ballroom dancing on ice) in the Texas Bluebonnet Figure Skating Competition.

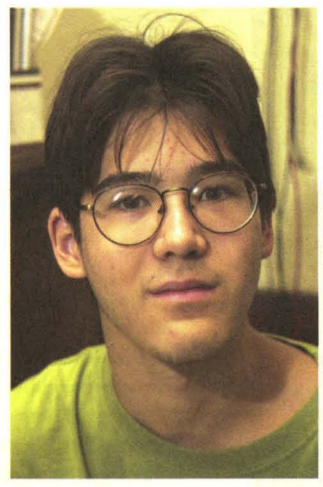
Gerald Wilhelmy (ggwii@ix.netcom.com) reports: "After seven years in aerospace I went back to school and got my DDS from UCLA in 1972. I had my own dental practice for 25 years, and, after I retired in June 2000, I enrolled at Concordia University in Irvine to get my California teaching certificate. I decided that I would like to teach high school mathematics. It is better than watching the afternoon soaps and Jerry Springer."

In the *oops* department, **Joe Woodward** (joe.woodward@aspentech.com) responded: "My name must be on the wrong list, I got my MS in '61 and a PhD in '65. I was still at Texas A&M in '60." In the spirit of interclass camaraderie, we communicate the following from Joe: "Still working full time for a company named Aspen Technology in their Houston office." Joe is a chemical engineer who spent 26 years at DuPont and is now going on nine years at Setpoint (purchased by Aspen). "**Pedro Bolsaitis** and **Jarold Meyer** stayed on after getting their 1960 undergrad degrees and were in my MS class."

And now, for a sample of the responses from classmates who didn't respond: Two returned e-mail messages state: "The following—arrenid.smith@lmco.com, rgerbracht@mgfairfax.com, heyl_dominique@lilly.com, bobyjo@swbell.net, rjhquevirginia.edu, someone@harborside.com—had permanent fatal errors."

My question: *what kind of e-mail address is someone@harborside.com??* And there was this. "Hi. This is the qmail-send program at mx10.rmci.net. I'm afraid I wasn't able to deliver your message to the following addresses, rmelville@sunvalley.net. This is a permanent error; I've given up. Sorry it didn't work out." I'm sorry too.

They keep getting younger



Caltech's youngest graduate in 2001 would certainly give any adult pause. It's not that he looks any younger than the rest. It's the fact that, at 18 years of age, Chris Hirata is a standout among a student body of standouts.

Hirata enters Princeton's graduate physics program this fall as the recipient of a cornucopia of Caltech awards—among them the 2001 Feynman Prize in Theoretical Physics; a 2000 Ryser Memorial Scholarship "for academic excellence, preferably in mathematics"; and the 2000 Froehlich Memorial Award "for a junior in the upper five percent of his or her class who shows outstanding promise for a creative professional career."

When he arrived at Caltech at the age of 14, he earned one of the highest scores ever achieved on the Institute's mathematics diagnostic tests, thereby foregoing freshman calculus and sophomore differential equations. Later, on the Graduate Record Exam advanced subject test in physics, he scored a perfect 990.

Unlike other mathematics prodigies, who are often stereotyped as loners with no real peers, Hirata was active socially and athletically from the time he arrived on campus. He took particular pride in having been accepted as a peer by fellow students, despite his age.

"I can think of myself as being 18, or as a college senior," said Hirata shortly before graduation day. "I prefer the latter." Though he admits to feeling his years (or the lack of them) when he began college, he thinks he had pretty much overcome the stigma of being a young student by the time he was 16. If his age had any significant impact, he thinks it was probably on his performance on the varsity swimming team. But he says he became more competitive as time went on.

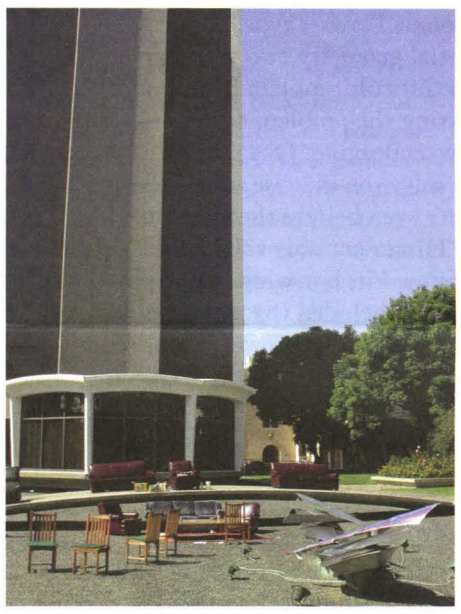
Also active with the campus Mars Society, Hirata impressed peers such as Derek Shannon with his commitment to Martian exploration. As team leader on one of the Society's projects, Hirata "has been a teacher when it comes to getting people up to a level where they can contribute to plans to send humans to Mars," says Shannon. "He has redesigned NASA's own human Mars exploration plans three times, and hopes to complete a fourth version soon. He really has a selfless motivation to make space exploration happen."

Markus Keel, Caltech's Taussky–Todd Instructor in Mathematics, said that Hirata "does not come across as a pain-in-the-ass Doogie Howser type." Keel taught Hirata differential geometry two years ago and tells this story about a difficult problem he put on the final exam. Before putting the problem on the test, Keel had consulted two colleagues. One said he didn't see right away how to solve the exercise, while the other said that he didn't even believe the solution Keel had worked out. Hirata not only solved the problem as Keel had framed it, but wrote that he knew of an easier way, and included that solution too.

Peter Goldreich, DuBridge Professor of Astrophysics and Planetary Physics, described Hirata as the best student in his planetary dynamics class, "even though it was a graduate course and he was the only undergraduate."

According to President David Baltimore, "we rarely encounter a scholar so young who is able to take advantage of Caltech. It is a credit both to Chris's brilliance and to his parents' commitment that he could be so successful."

In early October, Rudds and Flems put freshman initiates to work redecorating and refurbishing Millikan pond. Rudds added extra sparkle and an "R" to the rotating sculpture, while Flems provided the water-free comfort zone (below).



According to the class of '60 records, we have 12 "lost" graduates: Ronald B. Arps, Samuel Bergman, Neville A. Black, Paul R. Calaway, Joseph M. Cauley, Herman G. Hartung, Richard A. Newcomer, Jan Rampacek, William A. Sinoff, Stephen V. Stephens, Paul R. Widess, and ex-CIT-water-polo-player David L. Tucker, Jr.

And we have a class of '60 poet laureate. Consider "Ode to Diffusion Length," **John Shier** MCMLXLIX.

"I sing you of minority carriers
Those that climb potential barriers
As anyone can plainly see
They soon decay to 1/e
'Diffusion length' is what we say
For the average distance that they stray
Yes, they recombine as they bump along
That is the burden of my song"

That's all, folks. Stay tuned for class of '60 notes, part IV—sometime in this decade. Keep your e-mails coming, please.

1962
Bruce Abell
bruce@santafe-strategy.com

Hal Wyman and his wife, Linda, continue the ocean adventure they began in November 2000 aboard the 55-foot trawler *Que Linda*. By the end of January 2001, they had reached the Honduran island of Roatan after a transit of the Panama Canal. In the interim they made ports of call along the Mexican, Guatemalan, and Nicaraguan coasts. They took a break to go home to Seattle in February and March, then headed back to contemplate the continuing voyage to Florida in April/May, Bermuda in June, and an Atlantic crossing to Gibraltar in July. Hal sent out one e-mail newsletter in November, and his shorebound friends eagerly await the next one. The boat is described at his Web site, http://ourworld.compuserve.com/homepages/halwyman/QueLinda.htm

Larry Altman retired from Mobil Technology in New Jersey on September 2000 and is trying (and we hope succeeding) a new career as a consultant in Sarasota, Florida.

I had a mini reunion with **John Golden** in Pasadena at a meeting for undergraduate admissions support alumni volunteers. John reports that he has recently been promoted to Grandfather. And for those who are not aware of it, the Caltech Alumni Association has a network of alumni who provide assistance—school visits, award presentations, college fairs, and whatever else is appropriate—to high school students around the country. If you would like to become part of this network, please contact Karen Carlson in the alumni association office at Caltech. (Karen@alumni.edu)

Dave Rogstad, of Monrovia, California, has retired from JPL after 31 years to join Reasons to Believe as executive vice president. RTB is a Christian organization founded in 1986, one of whose aims is to demonstrate that science and the bible complement one another. Dave invites you to visit the RTB site at www.reasons.org.

Ken Larson retired last year from Kimberly-Clark Corporation after a career that can be described as dedicated to paper. After Caltech he got his PhD from the Institute of Paper Chemistry, then spent 29 years at Scott Paper in Philadelphia. When Kimberly-Clark bought Scott in 1995, he and his wife moved to Wisconsin, where he remains after retirement. He and his wife travel to Delaware and Maryland to visit their two sons and one granddaughter, and Ken plays volleyball and golf to stay in shape. They also try to make one big trip each year, and the last three have taken them to Europe, the British Isles, and China. He adds that "I remember classmates **Doug Smith** and **Ron Gebhardt**, and I was sorry to hear about **Bob Bump**. I wonder about classmates like **John Curtis** and **Kerry Donovan** and other former Ricketts House people like **Chuck Minichiello** '63, and **Truman Seely**. How about an update, guys?"

Well, Ken, coincidentally, **Ron Gebhardt** sends his greetings from Slatington, Pennsylvania. Ron went to Princeton after Caltech, and, as reported before, he's spent his career as an expert in cement science and technology. Since 1992 he's been president of Kiln Technology, Inc. Before that he was vice president of Regulatory Affairs and Compliance for Cemtech LP in Middlesex, New Jersey, and before that with Lehigh Portland Cement and Martin Marietta Cement. He adds that he and Ginny, whom he met at Pomona when we were all undergraduates, have a son who also graduated from Pomona, like his mother, and with a degree in geology, like his father.

1973
Stephanie Charles
sjcharles@juno.com

There's lots of news this quarter about everything from appointments to upcoming books to weddings and adoptions. The women in the class are especially well represented. Out of four women, two have news. (I could make it three by telling you about my recent success in my first venture as a community activist, but I'll save that for a quarter when no one else has much news). If you didn't get an e-mail from me in early April when I asked for input for this column, that means I don't have a current e-mail address for you. You can write me at my e-mail address (above) and I'd love to hear from you. So would your other classmates.

Sharon Long reports that she has been appointed dean of humanities and sciences at Stanford, starting September 1 of this year. Although Sharon was too modest to write more, Stanford's press release said, "Noted plant biologist Sharon R. Long, also an award-winning teacher, was named dean of the school of humanities and sciences." Long, who succeeds Malcolm Beasley, wants to increase support for students to pursue the fine and performing arts and encourage collaboration between the mathematical and experimental sciences. For more about Sharon's appointment, see http://www.stanford.edu/news/report/news/april11/long-411-a.html.

Deborah Chung writes to say that her new book *Applied Materials Science* is being published by CRC Press in June 2001. In addition, she has just been named a fellow of the American Carbon Society for her 25 years of sustained contribution to carbon science (for more information, see http://www.mae.buffalo.edu/people/faculty/chung/research1.txt). Deborah has also been active giving concerts and sermons in various cities. She plays the piano and the organ, and performs as a soprano as well. In the year 2000, these concerts and sermons brought about 60 people to receive Christ and another 60 people or so to dedicate their lives to Christ.

Doug Duncan says that in addition to doing astronomy, he has served for six years as science commentator on public radio station WBEZ in Chicago. He recently led an educational trip to the Arctic to study and photograph the aurora during the solar maximum. He reports that "In addition to getting some excellent photographs (http://astro.uchicago.edu/duncan/~lights.html) we ended up learning to drive a dogsled, eating caribou stew (good!), and tracking wolf, moose, and cougar."

Rich Short writes to say that he plans to climb Mount Whitney for the 12th time in 12 years. But he says that this is a small accomplishment compared to **Dale Dalrymple** '74, who will be making it to the summit of Mount Whitney for the 31st time. Dale has climbed the mountain at least once in each of the last 25 years, even in years when he's suffered a fractured leg, separated shoulder, or cracked clavicle. Rich's son, Nathan (age 21) will be making the trek with them for the 5th time. They do it in a single day. Rich says it's exhilarating, and it feels so good when they finish and can rest!

Kelly Beatty reports that he has a book in the works—*Other Worlds: Exploring the Solar System*. It's being produced by National Geographic and should be out by the end of the summer. Aside from that he continues to edit and write for *Sky & Telescope* magazine, where he is the executive editor. They now have three Techers among their staff of 12 editors.

John Fraser says that he has plans to get together with **Russ McDuff** and **Paul Yancey**. Russ is at the University of Washington, where he administers a research ship that Paul, who is chairman of the science department at Whitman College, will be taking his students out on. Since Paul will be in town, they decided to all get together.

Dan Reichel writes to say that this past January he married a woman from Saint Petersburg, Russia, whom he first met via the Internet. He says that "she is an industrial designer, by formal education, with an 'artistic' temperament that makes her rather accepting of some of my more outlandish suggestions (such as sentient beings now living on Mars, or that the 'visitors' now arriving in flying saucers are perhaps connected to the 'gods who live in our cities' of Egyptian religious history)." Dan supposes that his marriage to a Russian means he now has even less chance of ever getting a government security clearance, but, he says, "who wants to live a life of having to keep such secrets—as scientists we are supposed to be sharing information, not helping to hide it!"

Robert McNamara writes that he and his wife, Evelyne, are planning their next trip to China to pick up their most recent adoptive daughter, Grace Helene McNamara. They are waiting on their referral for the specifics, but they believe that she will be about four years old. That will bring their total to nine children—the last five adopted. Mac thinks that this will be about it for kids, at least for now.

Alum named assistant secretary of defense

John Stenbit '61, MS '62 was recently sworn in as assistant secretary of defense (command, control, communications and intelligence),

Stenbit has served in key positions involving electronic, aerospace, and information systems. He has held a number of positions with TRW, retiring as executive vice president in May 2001. In earlier assignments with the firm, he was executive vice president and general manager of TRW Systems Integration Group, performing systems engineering and the integration of complex systems such as strategic and tactical command and control, information processing, and security systems. He has also worked for the Aerospace Corp., focusing on command and control systems for missiles and satellites. During that time he studied and taught for two years as a Fulbright Fellow at the Technische Hogeschool in the Netherlands.

A member of the National Academy of Engineering, Stenbit served as chairman of the Science and Technology Advisory Panel to the CIA director, and was a member of the Science Advisory Group to the directors of the Naval Intelligence and Defense Communications Agency. He also chaired the Research, Engineering and Development Advisory Committee for the administrator of the Federal Aviation Administration.

Stenbit's position is that of advisor to the secretary of Defense on information superiority, communications, and intelligence policy issues. More information on the office can be found at http://www.c3i.osd.mil.

Personals

1941
H. GUYFORD STEVER, PhD, chairman of the Policy Division of the National Research Council, has been elected to the American Philosophical Society as a member of its arts, professions, and public affairs class. Founded by Benjamin Franklin over 250 years ago, the society promotes the sciences and humanities through scholarly research, professional meetings, publications, library resources, and community outreach.

1943
ARTHUR BECK PARDEE, MS, PhD '47, professor emeritus at Harvard Medical School, has been elected to the American Philosophical Society as a member of its biological sciences class. Founded by Benjamin Franklin in 1743, the society is the oldest learned society in the United States devoted to the advancement of scientific and scholarly inquiry.

1948
KEITH W. HENDERSON, of Mountain View, California, writes that he was recognized by SRI International as one of the team of engineers that, in the early 1950s, "contrived and constructed the world's first electronic check sorting and bookkeeping machine." The occasion of the recognition was SRI's Weldon B. Gibson Achievement Award, established in 1996 and named after SRI's director emeritus, who in 1946 was one of the cofounders of the institute, then known as the Stanford Research Institute. The machine "was a fundamental accomplishment," Henderson writes, "because transistors had not yet been perfected, most logic was performed with diodes and relays, data storage was limited largely to magnetic drums and tapes, and there were very few computers anywhere."

1953
ALLAN R. SANDAGE, PhD, astronomer emeritus with the Carnegie Observatories, has been elected a Foreign Member by the Royal Society, which cited his contributions to the determination of the size of the universe through the Hubble constant. His work on stellar evolution, globular clusters, variable stars, galaxies, and quasars, the society goes on to say, has "shown penetrating insights and thereby extended theory into his observational domain."

1955
JOHN ANDELIN, PhD '67, writes: "I graduated in 1955 with my 6-week-old twin sons, Daniel and David, present in their strollers. This past February we celebrated the first birthday of Daniel's twin girls, Abigail and Rebekah. A simple case of 'Grandpa's Revenge'. This past January little Isaiah came on the scene as grandchild number 11. My wife, Judie, is down to 30 hours a week as she winds down to retirement next January. I am too old to retire so I am continuing at Abbott Labs reviewing software for compliance with new FDA regulations."

1961
JAMES M. KALLIS, MS, of Los Angeles, has received the 2001 IEST Reliability Test and Evaluation Award for "his significant contributions to the integration of physics of failure and analytical methods into reliability test programs, the development of accelerated test strategies, and environmental stress screening optimization." He received the award in April at ESTECH 2001, the Institute of Environmental Sciences and Technology (IEST) annual technical meeting in Phoenix. A multidisciplinary, international society, IEST presents the award for a body of work rather than a single project, and generally not to a person more than once. Kallis is an Engineering Fellow at Raytheon Company.

1966
ARTHUR RIGGS, PhD, has been named chief executive officer of City of Hope's Beckman Research Institute. Credited with creating the gene for manufacturing human insulin in bacteria, Riggs and his colleagues have also developed a process for bacteria to produce human growth hormone. He joined City of Hope in 1969 and has held various leadership positions, including chair of the Division of Biology. Director of the Beckman Research Institute since September 2000, he is a member of its clinical and scientific executive team. He has published more than 120 articles in peer-reviewed journals.

1972
MARK S. WRIGHTON, PhD, chancellor and professor, inorganic materials chemistry, Washington University in St. Louis, has been elected to the American Philosophical Society as a member of its arts, professions, and public affairs class. Founded by Benjamin Franklin over 250 years ago, the society promotes the sciences and humanities through scholarly research, professional meetings, publications, library resources, and community outreach.

1974
GREGORY L. GEOFFROY, PhD, has been appointed the 14th president of Iowa State University, effective July 1, after being named on a unanimous vote of the board of regents. He had been senior vice president for academic affairs and provost at the University of Maryland, College Park, since 1997, serving as interim president in 1998. Prior to that he served in several positions at Pennsylvania State University, University Park, including dean of the Eberley College of Science and professor and chair of chemistry.

1986
LAURA R. GILLIOM, PhD, an organic chemist and manager at Sandia National Laboratories, has been named director of the Lawrence Livermore National Laboratory's university relations program, effective June 11. She was manager of the advanced design and production technology program at Sandia Albuquerque, a position she had held since 1997; she had been at Sandia since 1985, working in materials science. She is married and has two children.

1989
SCOTT PHELPS, MS, reports that he recently received his 10-year pin from the Pasadena Unified School District, as well as one of five 2001 Pasadena Rotary Teachers of Excellence Awards. He has recently become involved with the Caltech Alumni Association as a member of its undergraduate admissions support committee. He has also been active for the past seven years with the Institute's Precollege Science Initiative, developing curricula and researching science education. Scott was married on July 2.

1992
ARI D. KAPLAN writes that, along with TAL SCHWARTZ '92, he has started PocketDBA Systems. "We have innovated the wireless database monitoring and management industry—freeing database professionals from their desktops and enabling them to manage databases with wireless PDAs." He adds that he is still living in Chicago and helping baseball teams with scouting and player-development systems.

1997
WILLIAM B. CONNICK, PhD, and JUSTIN DU BOIS, PhD, have both been named recipients of 2001 Beckman Young Investigators (BYI) awards. "The BYI program helps provide research support to the most promising young faculty members in the early stages of their academic careers in the chemical and life sciences." Connick is an assistant professor, inorganic chemistry, at the University of Cincinnati, and served his postdoctoral fellowship at the University of Rochester, 1997–98. Du Bois is an assistant professor, organic and inorganic chemistry, at Stanford; he was an NIH postdoctoral fellow at MIT, 1997–99.

1998
KATHERINE E. (POMYKAL) AYERS, PhD, writes that she married Alan Ayers on October 7, 2000. She currently is team leader in anode fundamentals and is electrochemistry platform steward ("platforms" being groups of scientists in a single area organized and led by the stewards to enhance collaboration and communication) at Energizer, in Westlake, Ohio. Westlake is located near Cleveland.

2001
DAN PROVENZANO, PhD, reports that he and Traci Gargaro "rang the wedding bells on February 24, 2001, at St. Philip the Apostle in Pasadena." He is now working at Orbits Lightwave, Inc., in Pasadena, and Traci is working in the office of undergraduate admissions at Caltech.

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Return this coupon and any additional materials to *Caltech News*, 1-71, Pasadena, CA 91125.

Name_____

Degree(s) and year(s) _____

Address_____

_____New address?_____

Day phone _____ E-mail_____

NEWS_____

Obituaries

1928
JOHN W. THATCHER, MS '30, of Laguna Beach, California, on December 5, 2000. A fellow of the IEEE and the Institute for Advancement of Engineering, he was the recipient of many honors, including membership in Tau Beta Pi and Sigma Xi. He is survived by many children, grandchildren, and great-grandchildren.

1932
FOLKE K. SKOOG, PhD '36, of Madison, Wisconsin, on February 15; he was 92. A professor emeritus at the University of Wisconsin, he was a biochemist who helped identify the hormonal forces that prompt plants to sprout and flourish. His research group collaborated with Nelson Leonard, then of the University of Illinois and now a faculty associate in chemistry at Caltech, in the synthesis and testing of hundreds of possible cytokinins—compounds involved in cell division—and cytokinin blockers. After receiving his doctorate from Caltech, he worked at Harvard and Johns Hopkins before serving in the U.S. Army as a biochemist and technical representative in Europe toward the end of World War II.

1933
WILLIAM T. WHEELER, of Pasadena, California, on October 7, 2000; he was 89. In 1946 he founded the business that became Wheeler & Gray, Consulting Engineers, a civil- and structural-engineering company whose high-profile projects included Disneyland and Disney World. Predeceased by his wife, Evelyn, he is survived by two sons, Richard and Robert, and by five grandchildren and five great-grandchildren.

1934
ROBERT C. FELT, of Rancho Palos Verdes, California, on September 30, 2000; he was 88. He had retired from Chevron in 1971 after 37 years.

RICHARD E. SLAUGHTER, MS, MS '35, on October 30, 1999, in Huntsville, Alabama. An accomplished pilot, he had worked as a flight superintendent at Berry Field in Nashville, Tennessee, before retiring from American Airlines. Predeceased by his wife, Cathryn, and his son, Richard, he is survived by his daughter-in-law, Patricia Slaughter, and by two step-grandchildren.

NICK T. UGRIN, on January 27; he was 91. He lived for many years in San Marino, California, before retiring to Leisure World. After graduating from Caltech he went to work for Union Oil. He served as chairman of the American Petroleum Institute and was very active in civic affairs, serving as vice president of the Medical Advisory Council—City of Los Angeles, as president of the San Marino School Board, and as president of the Boy Scouts of America and the Campfire Girls, among many other social, civic, and church positions. Predeceased by his wife, Edna, on December 29, 2000, he is survived by his daughters, Tanya Larsen and Nikki Finke, and by three grandchildren and five great-grandchildren.

1938
WILLIAM F. NASH JR., MS '39, PhD '42, of Morgantown, West Virginia, on December 3, 2000. He served as vice president of C F Braun Company for 25 years, and as director of student placement at Caltech for 10. He was a member of the Caltech Associates. Predeceased by his wife, Helen, he is survived by a daughter, Jan Reger-Nash; a granddaughter, Emily Jewson; and a number of nieces and nephews.

1939
DONALD G. LAWRIE, of Garden Grove, California, on November 8, 2000; he was 83. He began his career in engineering and management, and he served in the U.S. Army during World War II. He retired as contracts and pricing chief for Rockwell International. He is survived by Anne, his wife of 56 years; two daughters, Carol and Bonnie; and a brother, James.

KEATS A. PULLEN, on December 8, 2000; he was 84. He received his PhD in engineering from the Johns Hopkins University in 1946 and became a licensed professional engineer in Maryland in 1948. He started working at the Ballistics Research Laboratory, Aberdeen Proving Ground, Maryland, in 1946, remaining there until 1978, when he transferred to the U.S. Army Material Systems Analysis Activity. He retired in 1990. He designed and evaluated designs for a wide range of electronic systems for military use, and he also taught classes in engineering at several universities, including the Pratt Institute, the University of Delaware, and Drexel University. A life fellow of the IEEE, he was a member of the American Defense Preparedness Association, the Association of the United States Army, the Association of Old Crows, and Sigma Xi. He served as president of the Aberdeen Chapter of Armed Forces Communications and Electronics, and in 1982 he received the Marconi Memorial Medal from the Veteran Wireless Operators Association. During his life he published nine books, more than 25 reports, and many more papers and letters, and was the holder of six patents. He is survived by his wife, Phyllis; four sons, Peter, Paul, Kap, and Andy; a daughter, Vickie; and seven grandchildren.

DAVID H. SCOTT, of Arizona, on August 9, 2000; he was 84. He spent his career as a geologist/geophysicist. He is survived by his wife, Lilia; four sons, Dennis, Greg, Dana, and Rick; three daughters, Pallas Hansen, Julia Burke, and Carmela Scott-Brant; and ten grandchildren and two great-grandchildren.

1942
JOHN R. ALLAN, of Medford, Oregon, on October 3, 2000; he was 81. He served in the U.S. Navy during World War II, and he worked as a naval architect at Todd Shipyards Corporation in San Pedro, California. A member of the International Wood Collectors Association, he taught wood carving and made more than 2,500 dragons from samples of exotic woods he had collected. He also participated in the Children's Festival and enjoyed reading Western novels. He was a member of the Caltech Alumni Association. Predeceased by his wife, Bobbie, he is survived by two sons, Rick and Bob, and by two grandchildren.

1944
HARRY J. HEIMER, Eng, PhD '58, of Newport Beach, California, on February 26. During World War II he served as an officer in the Aero Branch Aircraft Lab at Wright Field, where he was also a professor and head of the department of aeronautics in the air force's Institute of Technology. He was employed by Douglas Aircraft, Hughes, TRW, Northrup, and Rockwell, where he was instrumental in the development of the S2 stage for Project Apollo. He is survived by his wife, Margaret; a son, Robert; and three grandchildren.

FRED W. MORRIS, of Pebble Beach, California, on October 3, 2000; he was 78. A technology management consultant, he served as an officer in the U.S. Army during World War II, from 1944 to 1947, and was named Officier de l'Ordre Grand-ducal de la Couronne de Chêne, Luxembourg. In 1960 he worked as telecommunications consultant to the Kennedy White House executive office, and in 1964 he became deputy assistant to the director of the Office of Telecommunications Management. He was also former president and CEO of TRT Telecommunications Corporation, a former director of COMSAT Corporation, and the founding president of Fred W. Morris & Associates. The author of numerous publications, he was a fellow of the AIAA and the IEEE, as well as a member of the Caltech Associates' President's Circle and the alumni associations of Caltech and Stanford. He is survived by Nancy, his wife of 51 years.

LEONARD E. POPP, of Cambria, California, on December 15, 2000; he was 77. He studied at the Naval School of Oriental Languages as a lieutenant during World War II. He spent his career in Southern California, first with the Southern California Gas Company, then later as vice president of the James Jones Company and as engineering manager for the Rainbird Sprinkler Company and for the Sierra Engineering Company. Before retiring, he worked for his last 20 years as a consulting engineer with Truesdail Laboratories. His enthusiasms included skiing, hiking, and camping, as well as cooking, gardening, and woodworking, and he was an active supporter of the Boy and Girl Scouts. He is survived by Dorothy, his wife of 48 years; a daughter, Gretchen Poe; a son, Walter; and four grandchildren.

ADAM A. RULA, MS, of Mississippi, on December 28, 1999; he was 76. One of a group of students during World War II who received certification after completing an accelerated training program in meteorology—and who referred to their group as Ceiling and Visibility Unlimited, or CAVU—he received a retroactive MS in meteorology. As chief of the Mobility Systems Division, Geotechnical Laboratory, U.S. Army Corps of Engineers Waterway Experiment Station (WES), he conducted research into technology related to the design, evaluation, and employment of military vehicles in a variety of missions and environments, which resulted in a comprehensive computer model accepted by the NATO community as a reference model. He also served as test director for the MX Transporter/Road Proof Tests conducted by the USAF Ballistic Systems Division at the Nevada Test Site. After retiring from WES he spent 10 years as a consultant to automobile companies, defense contractors, and government agencies. Predeceased by his first wife, Anna, he is survived by his second wife, Margaret.

1945
ALBERT SENEKER, MS, of Anaheim, California, on December 22, 2000; he was 79. While at Caltech he worked on a project to develop an antimalarial drug to replace quinine, which had been difficult to obtain during World War II; his master's thesis was based on this work, which ended with the war. Afterward he went to work in the coatings industry, in which he remained until retiring in 1983. He worked for PPG, Sherwin Williams, General Electric, Chevron, and Ameron, among others. He is survived by his wife, Ida Jane; a daughter, Mary; and two sons, Stephen and Carl.

RALPH S. WHITE JR., of Los Altos, California, on January 13; he was 75. After receiving his MBA from Stanford, he became a marketing consultant for and president of White Associates. He was also a licensed engineer. Active in the Palo Alto Kiwanis Club, he became its president in the 1970s, then received the Kiwanis International President's Award in 1987 and was named George F. Hixon Fellow in 1999. A member of Neighbors Abroad, he served as its president from 1981 to 1983—he was an enthusiastic traveler as well as an avid fisherman and photographer. He is survived by a son, Ralph; a sister, Lois Williams; a brother, Charles; a granddaughter; and his longtime companion, Gabriele Loosen.

1946
BENJAMIN L. AUSTIN, of Utah, on July 16, 2000; he was 73. Predeceased by his first wife, Shirley, he is survived by his second wife, Marilyn; a son, Doug; a daughter, Shanna Hendrickson; a stepdaughter, Marsha Stanton; and nine grandchildren.

JOHN W. SEASE, PhD, of Portland, Connecticut, on November 12, 2000; he was 80. He joined Wesleyan University's chemistry department in 1946 and retired in 1988, but continued to teach as a professor emeritus, especially in environmental chemistry, for the next 10 years. He served as department chair and as head of the building committee for the Hall-Atwater Laboratory. A model railroader, he had a lifelong interest in railroads and steam locomotives, and he and his wife enjoyed traveling, and particularly sailing. He is survived by Mary, his wife of 57 years; three daughters, Margaret Skiles, Catherine Sease, and Ann Monoyis; a son, John; and five grandchildren.

1948
LUTHER F. FISHER, MS, of Austin, Texas, on October 11, 2000; he was 78. He is survived by his wife.

1953
JACK N. LINDSLEY, Eng, of Surprise, Arizona, on January 8. Following 20 years as a U.S. Navy aviator and engineer, he became a staff engineer at JPL. He is survived by his wife, Norma.

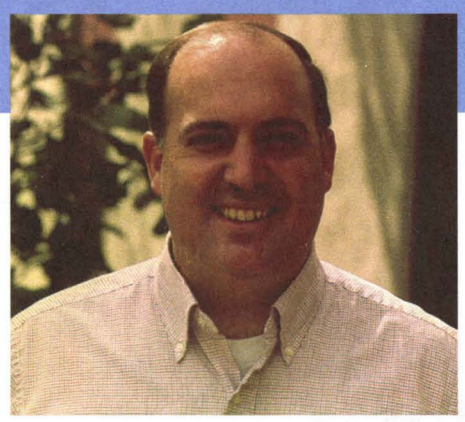
1956
ROBERT L. SHACKLETT, PhD, on November 16, 2000; he was 74. A professor of physics at Cal State Fresno, he served as dean of graduate studies, retiring in 1979. In pursuing his interest in the relationship between matter, mind, and consciousness, he became executive director, vice president, and board member of the Foundation for Mind-Being Research as well as an active member of Noetic Sciences and a scientific advisor to the HeartMath Institute. He was a fund-raiser for Caltech's Alumni Fund for the past 16 years. His varied interests included traveling, civic affairs, working with his hands, and classical music: he spent six months setting up a physics course at Ganado Junior College on the Navajo reservation, built a 4,000-square-foot home that included a 35-foot geodesic dome, and constructed a full-pedal electronic organ. He is survived by Edie Fischer, his wife of 21 years; two sons, Richard and David; a stepdaughter, Eva Coffin; a stepson, Paul Fischer; a brother, Gordon; and four grandchildren.

1966
GARY L. NEIL, PhD, of Menlo Park, California, on February 9; he was 60. He was president and CEO of Crescendo Pharmaceuticals, a publicly held company formed by ALZA Corporation in 1997 to develop and commercialize human pharmaceutical products. He came to Crescendo from Therapeutic Discovery Corporation, where he had served as president and CEO.

HOWARD T. POWELL, of Livermore, California, on November 15, 2000; he was 56. After receiving his PhD from Cornell and spending two years at McDonnell Douglas Research Lab in St. Louis, Missouri, he joined Lawrence Livermore National Laboratory. Besides holding a number of technical positions in the field of laser science and technology, he was a public speaker and a mentor to other scientists and to graduate students. He was a corecipient of three R&D 100 awards for scientific and technological innovation, in 1988, 1994, and 1997. A lover of art and American history, he collected early-American furniture and glassware. He also produced his own wines from homegrown grapes, coached soccer, and was active in the Livermore Valley Tennis Club. He is survived by Mary, his wife of 33 years; a son, Thomas; a daughter, Diana; and his mother, sister, and brother.

1971
RON BOHL, Ex, of Thousand Oaks, California, on January 8. Known in Dabney House in the early '70s as the originator of the Ron Bohl Heavy High Award, which launched his term as house comptroller, he became an expert device driver programmer after leaving Caltech. He worked for several young companies, including Data/Ware, Opcode, EMS, and BioMorphic VLSI. An early supporter of the skeptical inquiries of James Randi, he maintained lifelong interests in secular humanism, underground comics, science fiction, computer graphics, and private-pilot aviation. He is survived by his fiancée, Judy Greengard '77; his parents, Liz and Pete Bohl; and a sister, Betty.

1979
WALTER C. HESS, on November 3, 2000. A lieutenant colonel in the Air Force, he was in charge of several space programs and had served at Air Force Space Command headquarters. The recipient of a master's degree in management and space system management from Webster University in Colorado Springs in 1987, he was serving at Los Angeles Air Force Base at the time of his death. He is survived by his wife, Virginia; his parents; and a sister, Alison Williams.



Glen Cass 1947–2001

Glen Cass, PhD '78, professor of environmental engineering and mechanical engineering, died of cancer July 30 at Duke University Hospital in North Carolina. He was 54.

Cass, whose research focused on air pollution, taught at the Institute for 24 years. In January 2000 he joined the faculty of the Georgia Institute of Technology as chair and professor of the earth and atmospheric sciences, while maintaining a joint appointment with Caltech.

In 1999, Cass initiated a global ozone study at 500 sites around the world, which continues today. His research group takes airborne particle measurements in many parts of the world, including four sites in India and the Maldives. Seven sites in mainland China were monitored for "Operation Blue Sky," which identified pollution sources in Beijing and other cities, and whose results factored into China's 2008 Olympic bid.

A prolific scientist with more than 200 published articles, conference proceedings, book chapters, and technical reports to his credit, Cass carried out air pollution studies that placed particular emphasis on the control of airborne particles, photochemical oxidants, and improved visibility.

He was instrumental in identifying the complex mix of airborne chemicals that pollute urban areas like Los Angeles and the Northeastern United States. Of special concern were very fine particles that can be inhaled and stay in the lungs, and that contribute to haze and poor visibility. He once described haze as a "problem of worldwide note and local disgust."

Cass was equally interested in the protection of museum collections and archaeological sites from air-pollution damage. He did long-term research projects for the Getty Conservation Institute, which included studies to determine which artist colorants are subject to fading by gaseous pollutants like ozone, as well as many studies to measure air pollutant intrusion into museums and other facilities that house artwork, such as the new Getty Center in Los Angeles.

Similar work by Cass in China contributed to the design of particle filtration systems and appropriate ventilation rates for reducing air pollution within the Yungang Grottoes, a collection of man-made cave temples dating from the 5th century A.D. that hold more than 50,000 stone carvings. The grottoes are located in one of China's largest coal-mining regions.

Cass was also involved in preservation efforts at Poland's immense Wieliczka mine, whose interior is filled with freestanding statues, bas-relief carvings, and immense chandeliers that miners have carved out of salt over the centuries. His work contributed to the finding that lowering the relative humidity in the mine would protect these artistic folk treasures from the deterioration that has set in over time.

Cass, who held a patent for systems reducing the deposition of fluid-borne particles. was a member of the U.S. Environmental Protection Agency's advisory committee on Ozone and served on advisory panels for the National Research Council, the Lovelace Respiratory Research Institute, the Center on Environmental Health Sciences at MIT, the Universities Corporation for Atmospheric Research, and the Los Angeles South Coast Air Quality Management District.He served on several editorial boards and was a member of the research advisory committee of the Health Effects Institute.

His sponsored research included work for the California Air Resources Board, NASA, the Department of Defense, Exxon, and the Ford Foundation.

Cass's wife, Jeanie, and son, Rob, were with him at the time of his death.

Dear friends,

We lost a very special member of our alumni community on September 11. Bryan Jack '74 was traveling on American Airlines flight 77, the hijacked airliner that crashed into the Pentagon.

Bryan was originally from Texas. At Caltech, he started out in Blacker House, and later lived off campus with several other Blacker students in a house on Palmview Place in Pasadena. Bryan was vice president of ASCIT and chairman of the board of control. He was a good friend to many students, both during and after his years at Caltech. Bryan later earned an MBA from Stanford Business School, and received a PhD in Economics from the University of Maryland.

A profile of Bryan from the *Washington Post* described his work [see below]. Earlier this summer, Bryan married his longtime friend, Barbara Rachko, and they established a second home in Greenwich Village in New York City, where Barbara has pursued her career as an artist.

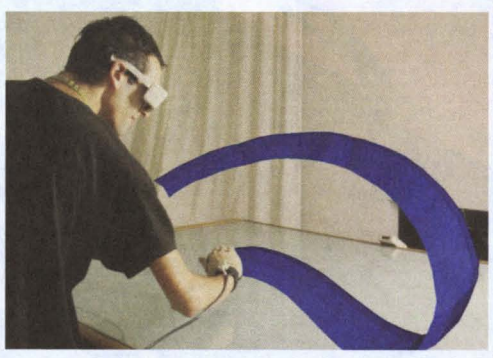
We extend our deepest sympathy to Barbara, and to Bryan's parents and family. All who knew Bryan will miss him and mourn him.

—Sharon Long '73
—Peter Smith, PhD '72

The September 13 *Washington Post* article cited Bryan Jack's reputation as "a brilliant mathematician and top budget analyst who translated policy decisions by the defense department into hard numbers." He headed the department's programming and fiscal economics division.

Caltech's Charlie Plott recalls how Jack, an undergraduate economics major, had a strong interest in the details of committee procedures. "He worked to understand Robert's Rules of Order from a game-theoretic point of view—how the rules function in shaping the decisions of large groups and how they can be used strategically." Says the Harkness Professor of Economics and Political Science, "Bryan was really a very clever and nice guy."

Friends are welcome to e-mail sharon.long@stanford.edu or Peter Smith at plsmith@cfa.harvard.edu for family contact information.



Art in Cyberspace

In the depths of Jorgensen Laboratory, Steven Schkolne sculpts air. His sweeping hand motions create three-dimensional patterns that, with the help of special 3-D glasses, hang in space before his very eyes. He can stretch, move, and touch up these patterns to create human figures in midstride, flowers in bloom, and mobiles that turn. A computer records the final image for posterity. Schkolne, a graduate student in computer science, has taken a number of courses at Art Center College of Design. As a member of the Caltech Multi-Res Modeling Group, he collaborates with Peter Schröder, professor of computer science and applied and computational mathematics. Schkolne calls his technology surface drawing.

Armed with Schkolne's computer software and special interface hardware, anyone can take a swing at this science-meets-art activity. Take the artist who introduced himself as Tabalip when he happened upon Schkolne's exhibit at last year's Mostra da Realidade Virtual, in Rio de Janeiro, Brazil. With his hand wired to function as a human mouse, he donned 3-D glasses and sculpted the space above a special table, a setup that Schkolne describes as "the head-tracked stereoscopic display environment of the responsive workbench." The outcome of Tabalip's handiwork, "Spun Tubule," is pictured on the back-page poster in this issue of *Caltech News*. A few of Schkolne's quickly sketched figures admire the abstract art.

Schkolne has also demonstrated surface drawing at the 1999 Siggraph Emerging Technologies forum in Los Angeles. See and read more at www.cs.caltech.edu/~ss/sdraw/ and www.multires.caltech.edu.

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