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Caltech News

In This Issue

Revisiting Mid-Century
Caltech

Reinterpreting Feynman

Building for
Biomedicine's Future

and
Redefining the Desktop



Caltech News



ON THE COVER
A few things have changed since 1941, including the colors in the image on this Caltech News cover. The original Big T illustration appears below.

Up Front

A SCROLL DOWN MEMORY LANE

The school that Ben Rosen attended was all male, he recalls. Coats and ties were de rigueur at dinner. The campus ended at San Pasqual. Faculty focused on doing “a few things well, rather than trying to do everything in science and technology.” That was in the early 1950s.

Fast forward to 2001. Rosen '54 recently came across an old issue of *Life* magazine featuring his alma mater in a photographic essay. The March 17, 1941, issue provides a snapshot of Caltech that reveals, to Rosen and others, how much the Institute has changed in appearance and how little it has changed in purpose in the course of 60 years. How will the next wave of readers perceive the piece?

“When I happened upon the article,” says Rosen, who now chairs Caltech’s board of trustees, “I immediately felt that I should share it with the broadest Caltech community.” He donated the issue to the Caltech Archives,

whose staff put the photo essay on the Web in a modern-day format with commentary. Archivists Judith Goodstein and Shelley Erwin, historian Kevin Knox, and Web designer Glenn Smith '96 produced the site, accessible at http://archives.caltech.edu/life_article/.

The magazine essay points out the links between basic research and its practical applications. It highlights the opportunities for Caltech students, including undergraduates, to participate in all aspects of this research. It extols the virtues of poker.

“The importance of investigations into the architecture of molecules, into the properties of sinusoidal curves, into the dynamics of electrons may seem at first remote,” it states. But “these forays on the frontiers of knowledge play their part in the fight against virus diseases, in the design of airplane

Caltech News invites readers to share their reminiscences, including their perspectives on how things have changed or remained the same throughout their association with the Institute. Please send e-mail to billary@caltech.edu.

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Scientists peer at the dark of the moon; alumni go out of their way (and uphill) to write in; Blair Folsom hits pay dirt in his “own backyard”; and technicians take on a job of astronomical proportions, on the back-page poster.

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In 1941, Techers were hard at work in the lab, as depicted in this illustration from the Big T. And when they weren't in the lab? Read on.

wings, in the more efficient production and transmission of electric power.”

Considering Caltech's ratio of “about two graduate scientists to every three undergraduates,” the essay continues, “it is not long before the undergraduate catches the fever of aspiration to deeds of brain and hands.” Students then as now conducted research in laboratories; their resources included “a 2,000,000-volt atom smasher, millions of fruit

flies that have been pedigreed through 280 generations, [and] a 200-in. telescope mirror which next year will extend man's sight millions of light years beyond its present horizons.” (The Hale telescope is featured on page 19 and on the back-page poster of this *Caltech News*.)

When Provost Steve Koonin '72 saw the piece on the Web, he was “amazed” to see how much of the 60-year-old description of the Institute's philosophy and character was still applicable. “Either we're sticks-in-the-mud, or Millikan et al. really did put together the right formulation for a great research university.”

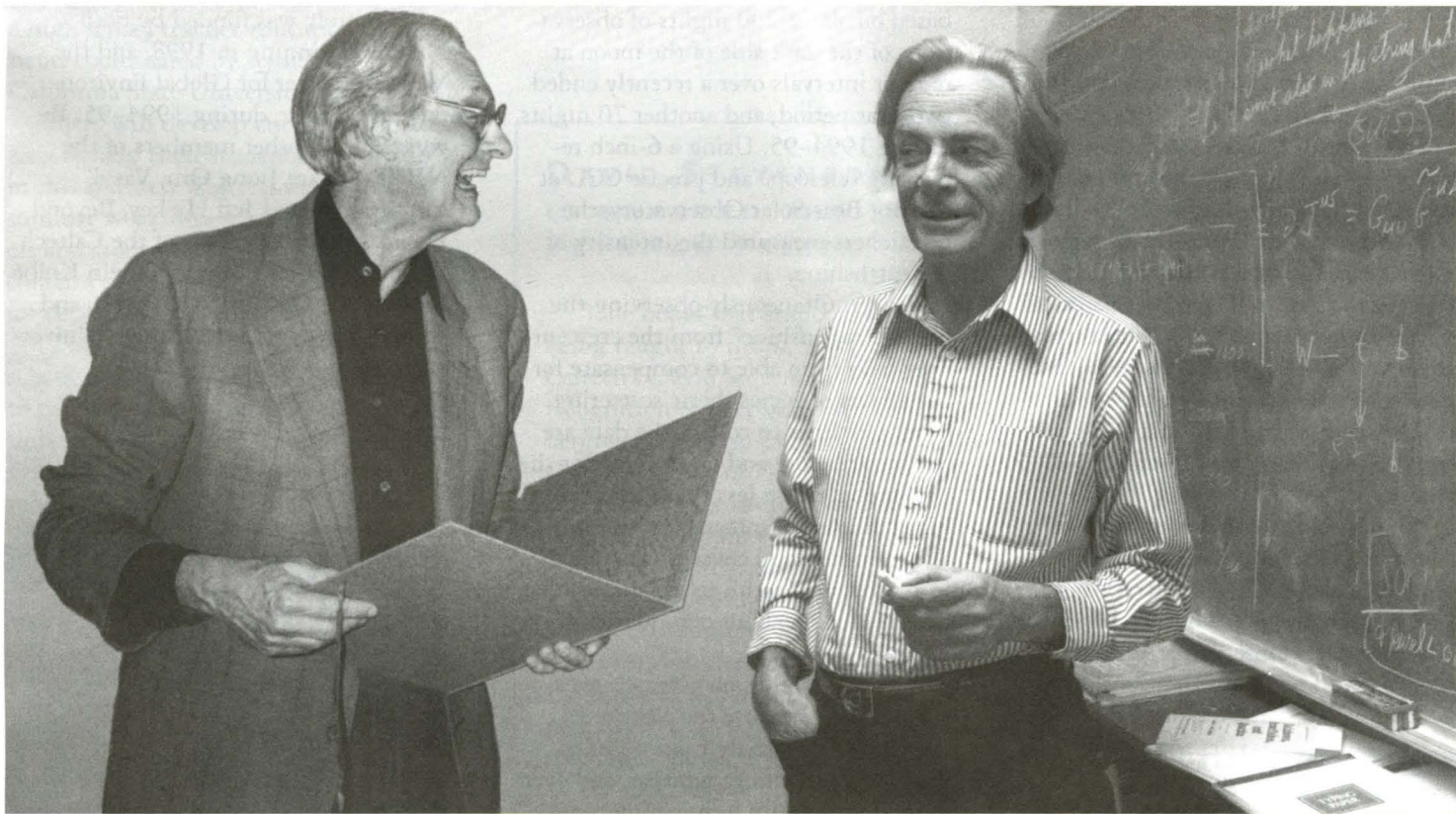
The 1941 magazine is one of 600-some issues of *Life* and *Time* magazines from the 1930s, '40s, and '50s that Rosen has located and purchased. He says that browsing through the collection is “like reading history as it happens, unfiltered by time.”

Photographs from 1941 show Techers taking exams, sleeping on the Athenaeum's open-air balcony, and playing three-dimensional ricktacktoe and poker. Poker, it is said, “provides

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Q E D

ALAN ALDA PLAYS RICHARD FEYNMAN ON STAGE: A CALTECH PHYSICIST AND A STAGE DIRECTOR WEIGH IN



David Goodstein, Caltech's vice provost and professor of physics and applied physics, was a friend and colleague of Richard Feynman's for nearly a quarter-century, so it was natural that Caltech News would ask him to share his views on *QED*, a play about Feynman, starring Alan Alda, that premiered in April at the Mark Taper Forum in Los Angeles. Goodstein has written frequently about Feynman's life and work, and he shares with Feynman the distinction of being the only Caltech professor besides Robert Millikan to receive the American Society of Physics Teachers' Oersted Medal for important contributions to the teaching of physics. In 1995 he was named Caltech's Frank J. Gilloon Distinguished Teaching and Service Professor. The following commentary by Goodstein originally appeared in the May 2001 issue of *Physics World*.

Richard Feynman was the star of his own life. Feynman played Feynman, and he played it to the hilt. He was always on stage whenever he had an audience, no matter how small. Although I don't know him at all, I

suspect that, like Feynman, Alan Alda plays Alan Alda. And so now, at the Mark Taper Forum in Los Angeles, before a house that was sold out for its entire run before it even opened, we have Alan Alda playing Alan Alda playing Richard Feynman playing Richard Feynman, in a play by Peter Parnell called *QED*.

And it works! Alda doesn't look like Feynman and, in spite of what must have been valiant efforts, he doesn't sound much like him either. I came to the play fearing that Alda would talk the talk and walk the walk, but like one of those south Pacific cargo cults Feynman used to like to talk about, it would be all outward appearance, lacking the inner guts that made Feynman who he was. Miraculously, almost the exact opposite happens. Alda puts the Dick Feynman I knew back up there, on the stage, where he always belonged.

The play takes place in Feynman's office at Caltech. Like Alda himself, the set doesn't look like the real thing, but captures its spirit. It is a Saturday morning, near the end of his life. That

night, Feynman is to appear beating his bongo drums as the chief of Bali Hai in the Caltech student production of the Rodgers and Hammerstein musical *South Pacific*. In the course of the day, Feynman learns by phone from his doctors that his cancer has returned and new, even more perilous surgery is needed. He debates his treatment with his doctors, and he debates the form of the final report on the space shuttle *Challenger* disaster, again by phone, with the chairman of the investigating commission, former Secretary of State William Rogers. He works on a public lecture he had forgotten he was supposed to give in a couple of days. Some Russians arrive at the airport and show up off-stage, part of a scheme to help Feynman gain entry to the mysterious Soviet Central Asian land of Tuva.

All the while, he talks to his audience, in the Feynman idiom, about things big and small—physics, sketching nude women, his father, his first wife, himself. There are lots of good

Continued on page 13 . . .

Pursuant to the pleasure of finding things out, Alan Alda paid a visit to the Caltech campus this spring to find out all he could about RPF for his role in *QED*. Alda talked to Richard Feynman's friends and colleagues, peeked into physics lecture halls and Ramo Auditorium, and spent a few moments in Feynman's old office, soaking up the ambience. At times, it must almost have seemed like Dick himself was there.

see where Dick had performed, and we went over there and talked. I told a few stories about Feynman's time in the theater, and they used some of that in the play.

QED scrambles the chronology like eggs, of course—it's dramatic license, and you accept that. In the play, which takes place toward the end of his life, Dick is performing as chief of Bali Hai in the Caltech show *South Pacific*, which he had actually done after a previous surgery six years earlier. But his appearance in *South Pacific* is what people are familiar with, because of the photographs of him drumming and wearing that marvelous headdress.

I laughed in *QED* when he comes back to his office after the show saying that he could have played Bloody Mary if only they'd given him a wig. That line was made up. It's conceivable that he might have asked to play Bloody Mary, but he didn't. He just wanted to play the tweti—a Tahitian drum. It makes this ricky-ticky-tick-tick sound, and he got really excited about that. He went to a lot of trouble to find Tahitians in Los Angeles who could teach him about it.

I thought Alda gave a wonderful performance. Obviously he has

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Shirley Marneus, the director of the Caltech Theater Arts (TACIT) program, first met Richard Feynman after she had recruited him sight unseen to play the bongos for a Havana nightclub scene in TACIT's 1977 production of *Guys and Dolls* (a story she tells in "What's a Director Like Me Doing in a Place Like This?" which appeared in the February 1993 Caltech News). Shortly afterward, she found out "who" he was, while Feynman, who had never acted in a play before, had discovered how much he enjoyed being a thespian. The two became friends, and the physicist continued to perform in Caltech productions right up to the end of his life, an avocation that

found its way into the *QED* script. Here Marneus offers her unique perspective on the topic of Feynman on stage.

About two years ago, Alan Alda and Gordon Davidson, artistic director of the Mark Taper Forum in Los Angeles, got together to produce a play about Richard Feynman at the Taper. While they were working on it, Davidson and Peter Parnell, the playwright, came to campus to talk to me about Dick's involvement in Caltech theater, which they had heard about from Ralph Leighton. They asked to see Ramo Auditorium, because they wanted to

DARK OF THE MOON SHEDS NEW LIGHT ON EARTH'S CLIMATE



From Earth to the Moon. Observations of "earthshine" (the shiny region immediately to the left) of the dark part of the lunar disk provide new insights into changing climate conditions back on Earth, including global warming. This image is one of many taken with a refracting telescope and CCD detector at Big Bear Solar Observatory. Caltech provost Steve Koonin '72, a pioneer in earthshine studies, led the investigation for the Caltech team.

Scientists have revived and modernized a nearly forgotten technique for monitoring Earth's climate by carefully observing "earthshine," the ghostly glow of the dark side of the moon.

Earthshine measurements are a useful complement to satellite observations for determining Earth's reflectance of sunlight (its albedo), an important climate parameter. Long-term observations of earthshine thus monitor variations in cloud cover and atmospheric aerosols that play a role in climate change.

Earthshine is readily visible to the naked eye, most easily during a crescent moon. Leonardo da Vinci first explained the phenomenon, in which the moon acts like a giant mirror showing the sunlight reflected from Earth. The brightness of the earthshine thus measures the reflectance of Earth.

In the current issue of the refereed

journal *Geophysical Research Letters*, a team of scientists from the New Jersey Institute of Technology and Caltech reports on earthshine observations showing that Earth's albedo is currently 0.297, give or take 0.005.

In the early 20th century, the French astronomer André-Louis Danjon undertook the first quantitative observations of earthshine. But the method lay dormant for nearly 50 years, until Caltech team leader and professor of theoretical physics Steve Koonin '72 coauthored a paper in 1991 describing its modern potential. The present data are the first that are precise and systematic enough to infer the relative health of Earth's climate.

"Earth's climate is driven by the net sunlight that it absorbs," says Philip Goode, leader of the New Jersey Institute of Technology team, director of the Big Bear Solar Observatory, and a Dis-

tinguished Professor of Physics at NJIT. "We have found surprisingly large—up to 20 percent—seasonal variations in Earth's reflectance.

"Further, we have found a hint of a 2.5-percent decrease in Earth's albedo over the past five years."

A 2.5-percent change in reflectance may not seem like much, but if Earth reflected even 1 percent less light, the effect would be significant enough to be a concern when studying global warming.

Koonin notes that "studies of climate change require well-calibrated, long-term measurements of large regions of the globe. Earthshine observations are ideally suited to this, because, in contrast to satellite determinations of the albedo, they are self-calibrating, easily and inexpensively performed from the ground, and instantaneously cover a significant fraction of the globe."

The new albedo measurements are based on about 200 nights of observations of the dark side of the moon at regular intervals over a recently ended two-year period, and another 70 nights during 1994–95. Using a 6-inch refracting telescope and precise CCD at the Big Bear Solar Observatory, the researchers measured the intensity of the earthshine.

By simultaneously observing the bright "moonshine" from the crescent, they have been able to compensate for the effects of atmospheric scattering. The best times to collect the data are one week before and one week after the new moon, when less than half of the lunar disk is illuminated by the sun. When local cloud cover is also taken into account, Earth's reflectance can be determined on about one-quarter of the nights.

The study relies on averages over long periods because the albedo changes substantially from night to night with changing weather, and even more dramatically from season to season with changing snow and ice cover. The locations of the land masses also affect the albedo as Earth rotates on its axis. For example, the observations from California easily detect a brightening of the earthshine during the night as the sun rises over Asia, because the huge continental land mass reflects more light than the Pacific Ocean.

"Thus, the averaging of lots of data is necessary for an accurate indication of a changing albedo," Goode says.

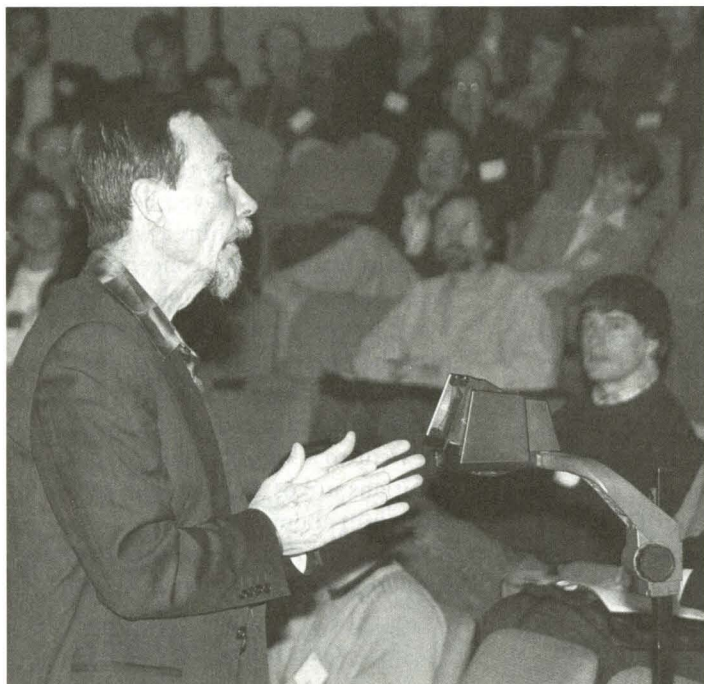
It is significant that the earthshine data suggest that the albedo has decreased slightly during the past five years, since the sun's magnetic activity has climbed from minimum to maxi-

mum during that time. This supports the hypothesis that the sun's magnetic field plays an indirect role in Earth's climate. If supported by further observations, it would explain why there seem to be so many signatures of the sun's 11-year activity cycle in Earth's climate record, but the associated variations in the sun's brightness are too weak to have an effect.

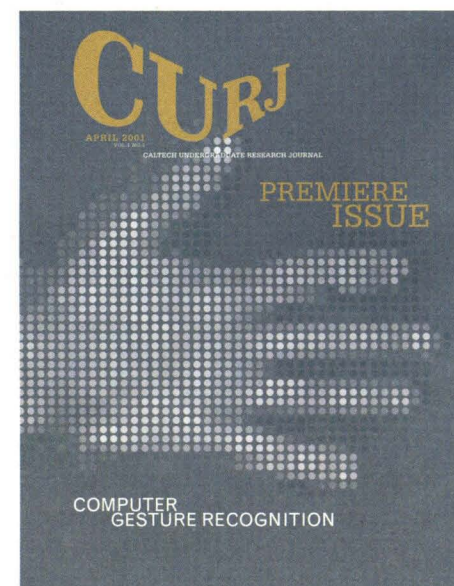
The researchers plan to continue observing from Big Bear. "These observations, supplemented with additional ones from a planned worldwide network, will allow even more precise, round-the-clock monitoring of the earth's reflectance," Goode says. "That precision will also make it possible to test connections between solar activity and Earth's climate."

"It's really amazing, if you think about it," Koonin says, "that you can look at this ghostly reflection on the moon and measure what Earth's climate is doing."

The study was funded by both NASA, beginning in 1998, and the Western Center for Global Environmental Change, during 1994–95. Beyond Goode, other members of the NJIT team are Jiong Qiu, Vasyly Yurchyshyn, and Jeff Hickey. Beyond Koonin, other members of the Caltech team are C. Titus Brown, Edwin Kolbe (now at the University of Basel), and Ming Chu (now at the Chinese University of Hong Kong).



An April symposium celebrated the 25th anniversary of Caltech's computer science option. Speaking to the multiple interests of the participants was Carver Mead '56, PhD '60, one of the CS founders and a noted pioneer in the field.



Caltech undergraduates have launched a research journal, collaborating with students from Art Center College of Design to meld substance with style. Would-be readers can let their fingers do the surfing through an online version, accessible at <http://www.curj.caltech.edu/>.

HIGH SCHOOL STUDENTS TO PARTICIPATE IN COSMIC-RAY RESEARCH

Los Angeles-area high school students will team up with Caltech researchers to study ultrahigh-energy cosmic rays on their own campuses, thanks to a recent grant from the Weingart Foundation.

The Los Angeles-based foundation has donated \$100,000 to Caltech to establish the California High School Cosmic-Ray Observatory (CHICOS) on four campuses in the Northridge area initially, expanding to 50 and possibly hundreds more sites in the future.

Of the four initial schools, three have a high number of students who are underrepresented in the sciences, which means the program may assist in increasing the number of future scientists in the United States. The schools are Sylmar, Van Nuys, and Harvard Westlake high schools and Sherman Oaks Continuing Education School.

The research will be coordinated by professor of physics Robert McKeown of Caltech's Kellogg Radiation Laboratory. The program will also incorporate a high school teacher education component, coordinated by Ryoichi Seki at California State University, Northridge. Teachers will develop curriculum materials to help their students participate in this research. Caltech will host a summer workshop where physics teachers and students can participate in the construction of new detector stations for deployment at additional sites.

"This grant will give many high school students a unique opportunity to participate in research science at the university level," said Caltech president David Baltimore. "It will serve as a model for future collaborations in other subjects between world-class research universities and high schools."

The project will involve the development and construction of detector hardware, associated electronics, and computer equipment to form a networked system among the high schools. A large array of this type will enable the study of ultrahigh-energy cosmic rays through the detection of "showers," several kilometers in radius, of secondary particles the rays create in Earth's atmosphere. These are the highest-energy particles ever observed in nature and thus of great current interest in the astrophysics and particle-physics community. When a majority of the 50 sites are operating, it is expected that the project will yield significant scientific results that will be reported in the scientific literature.

RECOGNITION

Clarence Allen, PhD '54, professor of geology and geophysics, emeritus, received the 2001 George W. Housner Medal at the annual Earthquake Engineering Research Institute meeting in February. The award recognizes his "sustained and significant contributions to earthquake safety."

Tom Apostol, professor of mathematics, emeritus, has been elected a corresponding member of the Academy of Athens, the most prestigious scientific organization in Greece.

Frances Arnold, the Dick and Barbara Dickinson Professor of Chemical Engineering and Biochemistry, has been elected a fellow of the American Institute for Medical and Biological Engineering.

Caltech president David Baltimore has been awarded the 2000 Warren Alpert Foundation Prize for his work "in the development of Abl kinase inhibitors for use in the treatment of chronic myelogenous leukemia." The prize is awarded each year "to a scientist (or group of scientists) who has made a significant discovery leading to

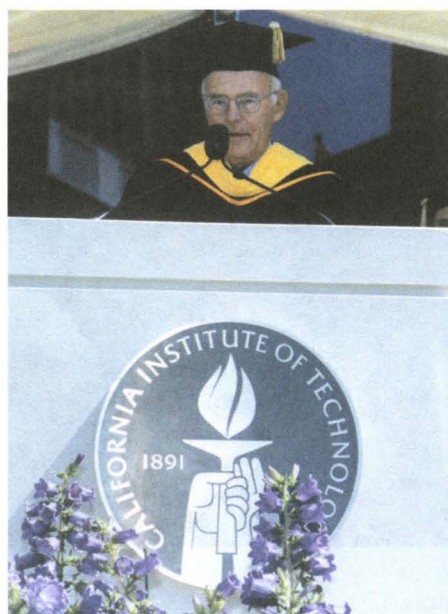
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DAVID STEVENSON IS AWARDED THE FEYNMAN PRIZE

"One hopes that students are being taught to think," says Caltech's David Stevenson. In recognition of his passion for undergraduate education, the Van Osdol Professor of Planetary Sciences has been awarded this year's Richard P. Feynman Prize for Excellence in Teaching.

Stevenson was honored by a selection committee composed of faculty and students for modifying the existing Geology 1 class into a new elective course within the core curriculum. "I was challenged by the difficulty of constructing a course that would be attractive to a wide range of students, without being too conventional," he says. "The problems in the exams, homework, and projects should not be merely routine applications of standard book work." The selection committee noted the increase in the class's enrollment, from 20 students at its start to 165 this year.

The Feynman Prize is made possible by an endowment from Ione and Robert E. Paradise and is given each year to a Caltech professor who demonstrates exceptional ability, creativity, and innovation in both laboratory and classroom instruction.



Gordon Moore at commencement 2000.

YES, IT'S MOORE

Fittingly enough, the man who helped to spearhead the computer revolution will deliver Caltech's commencement address for the year 2001. While the sinister Hal may not be in the audience, more than 400 of Gordon Moore's fellow Caltech grads will be on hand. The cofounder and now chairman emeritus of Intel, Moore, PhD '54, served as chair of the Institute's board of trustees for seven years, before stepping down last year as chairman emeritus. As chairman, he's acted as master of ceremonies for seven Caltech graduations and while he's now turned that job over to successor Ben Rosen '54, come June 15 he'll be up on the podium one Moore . . . er . . . more time.

TO HUNT PREY, OWLS COUNT ON MULTIPLICATION

Owls have long been known for their stunning ability to swoop down in total darkness and grab unsuspecting prey for a midnight snack. Recently, in the April 13 issue of the journal *Science*, Caltech neuroscientists reported that the largely nocturnal birds locate their prey in the dark by processing two auditory signal cues to "compute" the position of their midnight snacks.

This computation takes place in the midbrain and involves about a thousand specialized neurons. "An owl can catch stuff in the dark because its brain determines the location of sound sources by using differences in arrival time and intensity between its two ears," says Mark Konishi, Caltech's Bing Professor of Behavioral Biology and the paper's coauthor.

For example, if a mouse on the ground is slightly to the right of a flying owl, the owl first hears the sound the mouse makes in its right ear, and, a fraction of a second later, in its left ear. This information is transmitted to the specialized neurons in the midbrain. Simultaneously, the owl's ears also pick up slight differences in the intensity of the sound. This information is transmitted to the same neurons of the midbrain, where the two cues are multiplied to provide a precise two-dimensional location of the prey.

"What we did not know was how the neural signals for time and intensity differences were combined in single neurons in the map of auditory space in the midbrain," Konishi says. "These neurons respond to a specific combination of time and intensity differences. The question our paper answers is how this combination sensitivity is established."

"The answer is that these neurons multiply the time and intensity signals," he says. Thus, the neurons act like switches. The neurons do not respond to time or intensity alone, but to particular combinations of them.

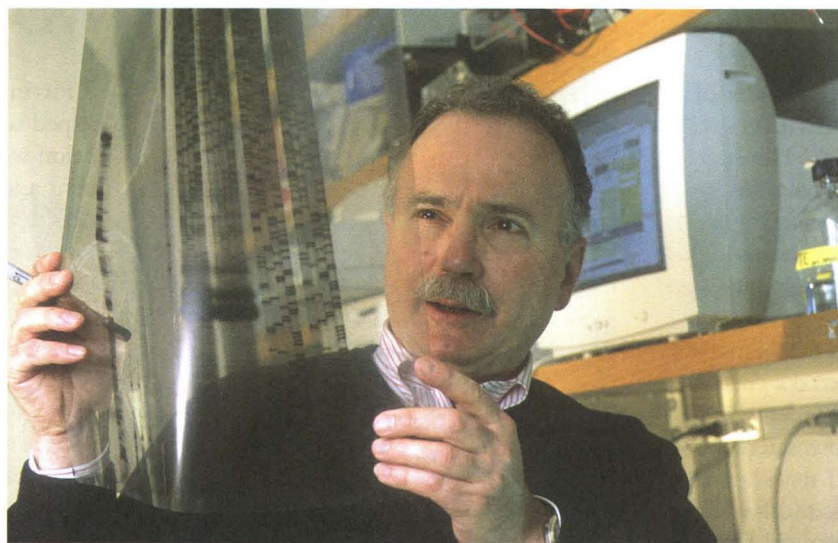
The reason the neural signals are multiplied rather than added is that, in an addition, a big input from the time pathway alone might drive the neuron to the firing level. In a multiplication, however, this possibility is less likely because a multiplication reduces the effects of a big input on one side.

It's not clear how the owl perceives the location of the mouse in the third dimension, Konishi says, but it could be that the owl simply remembers how far it is from the ground or how much noise a mouse generally makes, and somehow adds this information into the computation.

The lead author of the *Science* paper is José Luis Peña, a senior research fellow in biology at Caltech.

On the cover of
the magazine:
Check out the
April 13 cover
story in *Science*.





David Clayton builds biomedical bridges

BY RHONDA HILLBERY



Imagine that you've been handed the chance to help design a new biomedical research incubator from scratch, one that will help determine the future of biotechnology.

David Clayton, PhD '70, finds himself in just that role, holding a scientist-administrator's dream job. As vice president for science development at Howard Hughes Medical Institute, he will help lead a \$500 million plan to build a new biomedical science center.

Scheduled to open in 2005 on the grounds of a recently purchased 281-acre farm outside Washington, D.C., the campus is slated to exploit today's rapid advances in science and technology.

"A major theme is to provide the physical resources and intellectual environment to support the latest technologies in biomedical research as they emerge to active use by trained scientists," Clayton said in a phone interview from the medical institute's headquarters in Chevy Chase, Maryland.

The Janelia Farm campus, as it is now called, will feature up-to-the-minute technology and laboratories, as well as smart people from cross-disciplinary fields.

The stakes couldn't be higher. "Breakthroughs in computer science, chemistry, physics, and engineering can be critical for developing research tools used in the study of biology and medicine," said Thomas Cech, Nobel laureate and the institute's president, in a recent statement.

When completed, the new campus will house a substantial, permanent research-and-development program. "At the same time, its large financial resources and space capacity will enable rapid shifts into new areas that show unusual scientific promise," Cech added.

Clayton, along with Gerald Rubin, Hughes vice president for biomedical research, will comanage the program during design and construction. He will also help identify and recruit the scientists who will work there.

Named for its creator, aviator-industrialist Howard Hughes, the institute is supported by an endowment of about \$13 billion. The nonprofit medical research organization employs hundreds of biomedical scientists at more than 70 locations around the country. Eight Hughes investigators work at Caltech.

Clayton talks about a campus where visiting scientists will work at the biomedical frontiers in an interdisciplinary environment that will foster collaboration among researchers with diverse backgrounds and varying perspectives. To that end, the institute will be on the lookout for creative, even risky proposals that could lead to new discoveries but may be considered too unconventional to receive research funding from more traditional sources.

Despite the institute's nonprofit status, the campus will also reflect the growing mutual interest between science and industry to develop, adapt, and improve new technology before it gets to the market.

Clayton offered a few examples of the type of research that will take place at the campus. Scientists will leverage the vast quantities of data pouring in from the Human Genome Project to carry out wide-ranging biogenetics research, to probe the fundamental roots of diseases, and to develop better methods of diagnosis as well as new drugs and other forms of treatment.

Research will also focus on bioinformatics—the integration of technology research and the biological

David Clayton (top) studies a gel electrophoresis film in the lab he maintains at Stanford. Now in the Washington, D.C. area, the biologist will help lead a Howard Hughes Medical Institute project to build a new biomedical science center at Janelia farm (above), whose old world-style manor and carriage house will lend an historic air to a decidedly forward-looking endeavor.

sciences—and computational biology—the discovery and application of mathematical models to biological systems.

"Things we once only imagined are upon us, and the pace of new developments in biomedical research has accelerated tremendously," Clayton said.

"When I started my own laboratory in 1970 there was no good reason to think we would be able to sequence even modest portions of genes by the year 2000.

"The obvious challenges ahead are how to assimilate and use this wealth of information," he added.

The campus will differ from traditional research settings at universities in important ways. Unlike the long-term employment often found at universities, many scientists will work there only until their projects end. "This will be augmented by confer-

ences and perhaps focused training courses to reach every level in the conduct of cutting-edge biomedical research,” said Clayton.

And an open lab architecture will afford researchers space and lab facilities as needed. The enriched environment is designed to offer the chance for exciting cross-disciplinary work, not unlike what Clayton has witnessed at professional conferences that pull people together from far-flung settings. “Most of us have had a terrific idea for a joint effort—usually conceived during the wee hours of a scientific meeting—only to have the passion fade on the way home to our regular busy environment.”

Just as important, he says, are projects devoted to perfecting an instrument or technique. Maybe it’s something as mundane as the discovery that an apparatus needs clips to secure it to a table and keep it from crashing to the floor. If the time frame for such findings could be shortened, the practical implications could be enormous.

Clayton compares such trial-and-error scenarios to the product evolution of a new car. “You don’t really know if the bugs are out until it’s taken on the road.

“The new campus would bring together the people and lab capabilities to expose the bugs in considerably less time. We want to shorten the whole segue from young and brash and promising to mature, reliable, and productive.”

At Caltech, Clayton was a student of Jerome Vinograd, a biochemist who made pioneering contributions to DNA research. Clayton credits those years with helping him understand what science was all about. “I remember that the business of Caltech was excellent science, and that was the yardstick by which things were measured.”

That credo stuck with him after he graduated from Caltech with his PhD in biophysics and chemistry. At the time, career opportunities in molecular biology were flourishing, and Clayton was able to become a faculty member at Stanford in 1970, at the tender age of 26.

Clayton became a pathology professor in 1982 and was appointed professor of developmental biology in 1989. He also served as associate director of Stanford’s Beckman Center for Molecular and Genetic Medicine.

His research on mitochondrial DNA in humans and mice at Stanford, where he continues to maintain a lab, has helped show how depressed or mutated mitochondria are implicated in serious diseases, including cancer, diabetes, and Alzheimer’s.

He also headed Stanford’s Medical

Scientist Training Program for nearly 20 years. The program educates MD–PhD candidates who want to work as physician-scientists, helping to unify laboratory research and the clinical practice of medicine.

“What we saw there was a comingling of getting a medical degree and doing serious science,” says Clayton, whose personal interest in medicine can be traced back to his youth. As a kid growing up in an Illinois farming community, he was certain that he wanted to become a medical doctor. “I thought the person with the most interesting job was without a doubt the family doctor. I thought that was really interesting compared to working in the cornfield, so to speak.”

The Stanford program attracted the likes of Peter Kim, who became an MIT biology professor and Howard Hughes investigator known for groundbreaking research on AIDS at the Whitehead Institute. Kim, who was associate head of MIT’s biology department, discovered how HIV fuses with and invades human cells.

Kim recently was named executive vice president for research and development at Merck Research Laboratories, where he will head efforts to discover and develop new drugs.

“His work has been influenced by the fact that he was in a PhD program and in medical school,” Clayton says, adding that many program graduates go on to take faculty positions at top university research and medical centers.

Another physician-scientist graduate is Richard Lifton, professor of genetics and medicine at Yale University School of Medicine. Also a Howard Hughes investigator, Lifton has conducted pivotal research on the genetic and molecular underpinnings of hypertension.

Despite the standout success of the program’s graduates, Clayton at times felt obliged to defend it. Skeptics on all sides failed to see the point of investing so much training, time, and expense in turning out joint PhD–medical doctor grads.

Clayton thought it was clear that the interdisciplinary study helps bridge two worlds—that of human health and its underlying biological mysteries. “I would say today that the point is that if you go through medical school and have some clinical exposure after you earn your degree, it can’t help but bring to your attention the nature of disease—what it means physiologically. And that can only push your thinking about what you might want to work on compared to someone lacking that experience.”

The professor was lured away from academia to the Hughes Institute in 1996. “I had no interest in a typical

administrative role, but I had been very impressed with the goals and quality of the institute by virtue of serving on their scientific advisory board. HHMI gets things done with no compromise in scientific quality, and has the resources to move forward without fundraising.”

When Clayton moved to the East Coast, his interest in classic American “muscle cars” moved with him. Prize possessions include his flagship vehicle, a 1967 Pontiac GTO, which he bought new and is having restored in Illinois. He also owns a 1977 Corvette and a 1979 Pontiac Trans Am, which Clayton notes is the last model year of its type to feature the 400-cubic-inch V-8 engine.

Given his fondness for vintage artifacts, Clayton should feel right at home at the new facility. Maybe on opening day he can drive one of his historic cars onto the Janelia Farm campus, which features a Normandy-style manor house and carriage house, both listed on the National Register of Historic Places.

Recognition . . . from page 5

the prevention, cure, or treatment of a disease or disorder that afflicts humankind.” Baltimore will share the \$150,000 prize with four other scientists.

Seymour Benzer, the James G. Boswell Professor of Neuroscience, Emeritus, has received the International Prize for Biology. Awarded annually since 1985 by the Committee on the International Prize for Biology “in commemoration of the sixty-year reign of Emperor Showa and his longtime devotion to biological research,” the prize was presented to Benzer on November 26 at the Japan Academy, in the presence of the emperor and empress. Past Caltech winners are professors Mark Konishi and Elliot Meyerowitz.

Assistant Professor of Planetary Astronomy *Michael Brown* has been selected by the American Astronomical Society’s Division for Planetary Sciences to receive the Harold C. Urey Prize in Planetary Science. The award is for his “outstanding achievement in planetary research.”

Richard Ellis, professor of astronomy and director of the Palomar Observatory, has been appointed the Lansdowne Lecturer at the University of Victoria, in British Columbia. The university awards this premier appointment in the physical sciences once every two years.

William Goddard, PhD ’64, the Charles and Mary Ferkel Professor of

Chemistry and Applied Physics, received the Richard C. Tolman Medal, presented by the Southern California Section of the American Chemical Society on April 19.

Sunil Golwala, Millikan postdoctoral scholar, has received the American Physical Society’s Mitsuyoshi Tanaka Dissertation Award in Experimental Particle Physics “for his versatile and extensive contributions to the detectors, hardware, electronics, software, and analysis of the results of the Cryogenic Dark Matter Search (CDMS) experiment.”

Sossina Haile, assistant professor of materials science, has been selected to receive the American Ceramic Society’s 2001 Robert L. Coble Award for Young Scholars. “This award recognizes an outstanding scientist who is conducting research in academia, industry or a government-funded laboratory.”

Alice Huang, senior councilor for external relations and faculty associate in biology, has been selected to receive the 2001 Alice C. Evans Award, which is sponsored by the ASM (American Society for Microbiology) Committee on the Status of Women in Microbiology. She is being honored for “contributions toward the full participation and advancement of women within the science and profession of microbiology and in ASM.”

The Alice C. Tyler Perpetual Trust has awarded a Caltech research group a grant of \$100,000, which will fund the group’s project, “Environmental Quality Near Large Urban Areas.” The project, which will examine the effects of a growing population and the impact of human interaction on land and aquatic ecosystems in the San Gabriel Valley and San Gabriel River watershed, will be jointly supervised by *Janet Hering*, associate professor of environmental engineering science; *Michael Hoffmann*, the James Irvine Professor of Environmental Science and executive officer for environmental engineering science; *James Randerson*, assistant professor of global environmental science; and *Paul Wennberg*, professor of atmospheric science and environmental engineering science.

Benjamin Johnson, instructor in history, has received the Forest History Society’s Ralph W. Hidy Award, which is presented each year for the best article in the field of environmental history. Johnson’s article, “Conservation, Class, and Subsistence at the Birth of Superior National Forest,” examines the effects of early conservation measures on the economy, politics, and ecology of communities near the Superior National Forest.

Tracy Johnson, postdoctoral scholar in

Continued on page 9 . . .

Friends

SLOAN FOUNDATION GRANT WILL ADVANCE BRAIN RESEARCH

Continuing its support of Caltech's efforts to unravel the workings of the most complex structure in our world—the human brain—the Alfred P. Sloan Foundation has awarded an additional grant of \$400,000 to support the Institute's Sloan-Swartz Center for Theoretical Neurobiology.

The center was established in 1994 with a \$1.4 million grant from Sloan. Its goal was twofold: to develop a new field of study called theoretical neurobiology, and to train the next generation of neuroscientists. Given the brain's complexity, with its hundred-billion-plus nerve cells, each capable of forming connections with literally thousands of other cells, it was recognized that understanding how the brain functions required an increasingly sophisticated research approach.

Neurobiology is the study of the brain and nervous system in humans and other animals. Theoretical neurobiology allows Caltech scientists and students to share ideas from two research perspectives, the theoretical and the experimental. Theorists use data from actual experiments to create detailed computer models of brain function or behavior. From this modeling, hypotheses are developed to make predictions. Then, a researcher can design an experiment to physically test the theory.

At Caltech, the cross-pollination of these two approaches has led to greater understanding of such processes as temporal coding, the firing rate of neurons over time; neural representations, how the brain combines information from the various senses; and the neural mechanisms that underlie the human visual system.

The center has also successfully trained, or is in the process of training, 36 postdoctoral and predoctoral students. These young scientists, who

come from an array of fields that includes physics, mathematics, and engineering, are working with senior neurobiologists, conducting research and learning experimental methods. Currently, 70 percent of postdoctoral graduates have obtained faculty positions at various universities around the world.

The Sloan-Swartz Center for Theoretical Neurobiology is led by Richard Andersen, Caltech's Boswell Professor of Neuroscience. The center is one of five that were established in 1994, with the others at Brandeis University, New York University, the Salk Institute, and UC San Francisco. The Sloan Foundation was founded in 1934 by Alfred P. Sloan, Jr., who was chief executive officer of General Motors for 23 years. The foundation makes grants available for higher education and research in the fields of science, technology, economics, and public policy.

POSTDOCTORAL RESEARCH ENDOWED BY FAIRCHILD GRANT

Caltech has been awarded a \$10 million grant from the Sherman Fairchild Foundation to establish an endowment for the existing Sherman Fairchild Postdoctoral Scholars Program in theoretical physics, theoretical astrophysics, and mathematics.

The endowment will provide the best young scholars in these areas with three- to six-year postdoctoral appointments, along with infrastructure support. Its goal is to furnish scholars with a supportive, unencumbered research environment, and to allow for collaboration with an international network of premier scientists.

The endowment will facilitate advanced research in areas such as particle, nuclear, and string theory; theoretical astrophysics and relativity; condensed-matter physics; atomic physics and quantum computation; and mathematical physics.

Gifts by Will

The generosity and foresight of Caltech alumni and friends benefits the Institute.

Caltech received approximately \$31,000 from the estate of Edward J. Horkey '37, MS '38. These funds were designated to equally support the Donald S. Clark Alumni Awards Fund and the Theodore von Kármán Memorial Fund.

Fred B. Stitt, PhD '36, provided for Caltech with an unrestricted bequest of \$151,000.

Walter S. Spuhler, MS '42, provided for Caltech to receive an unrestricted bequest of \$20,000 from his estate.

As one of several charitable remainder beneficiaries, Caltech received \$100,000 from the estate of Arnold M. Kuethe, PhD '33.

Grace Logie Mathews, mother of Caltech alum and former Caltech physics professor Jon Mathews, PhD '57, provided for Caltech to receive \$10,000 to support the Class of 1957 Jon Mathews Memorial Student Loan Fund.

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 & Estate Planning, Mail Code 105-40, Pasadena, CA 91125; 626/395-2927; planned_gifts@caltech.edu; www.gep.caltech.edu

ASSOCIATES MAKE NEW ASSOCIATIONS

New Associates board members welcomed at a recent meeting of the Institute support group included (in the upper lefthand photo, from left to right) Olin Barrett; Bob Perpall '52, MS '56; Amy Lee PhD '75; Gerrie Kilburn; Kim Caldwell; and Ted Jenkins '65, MS '66. They were joined by Thomas Tyson '54, PhD '67, who is board president. Pictured at right, the 2001 executive committee of the Associates was also ushered in, including John Glanville, past president; Peter Cross '68, secretary; Margaret Richards, treasurer; Thomas Tyson '54, PhD '67, president; and Gordon McClure '47, vice president.

In the lower righthand photo, new members of the Provost's Circle honored this winter at an Associates dinner included Nicholas and Amanda Stonnington (left), with sponsors Alice and Joseph Coulombe. Also attending (lower lefthand photo) were new members Darrell and Nancy Kerckhoff.





Earthquake engineer Donald Hudson (shown here in 1966) and his love for chamber music have been commemorated in a gift to Caltech.

NEW CHAMBER MUSIC FUND MAKES NOTE OF DONALD HUDSON

For most of his life, Donald Hudson '38, PhD '42, who died in 1999, studied earthquakes at Caltech as a professor of mechanical engineering and applied mechanics. But he also had a special love of chamber music, and, in honor of that interest, his brother, Richard '44, gave \$100,000 to Caltech in February to create the Donald E. Hudson Chamber Music Fund.

"It is the largest gift ever made to Caltech's student chamber music program and is surely one of the largest gifts ever given to any college chamber music program," said Delores Bing, director of the Caltech Student Chamber Music Program and lecturer in chamber music at the Institute.

"This is just an extraordinary gift," said Bing. "In the world of chamber music, it is a very large gift, made especially meaningful because it was given to a scientific institution."

Bing said that the Institute should be able to start using money from the gift in the fall, but that the specific projects that the endowment will fund are still being discussed. "This will make a tremendous difference in the chamber music experience for Caltech students for generations to come," she said.

Donald Hudson spent nearly his entire career at Caltech, becoming an assistant professor in 1943 and a full professor in 1955. Elected to the National Academy of Engineering in 1973, Hudson was a pioneer in the field of earthquake engineering. He helped develop instruments that record ground motions during earthquakes and that have provided information vital in designing quake-resistant buildings, bridges, and dams. After retiring from Caltech in 1981, Hudson went to USC that same year, where he

SWITZER GIFT TO BENEFIT STUDENTS AND OTHER WILDLIFE

In one fell swoop, alumnus Al Switzer '34 has advanced the causes of conservation and education, helping to create an ecological preserve on California's central coast and endowing a fellowship program for Caltech graduate students.

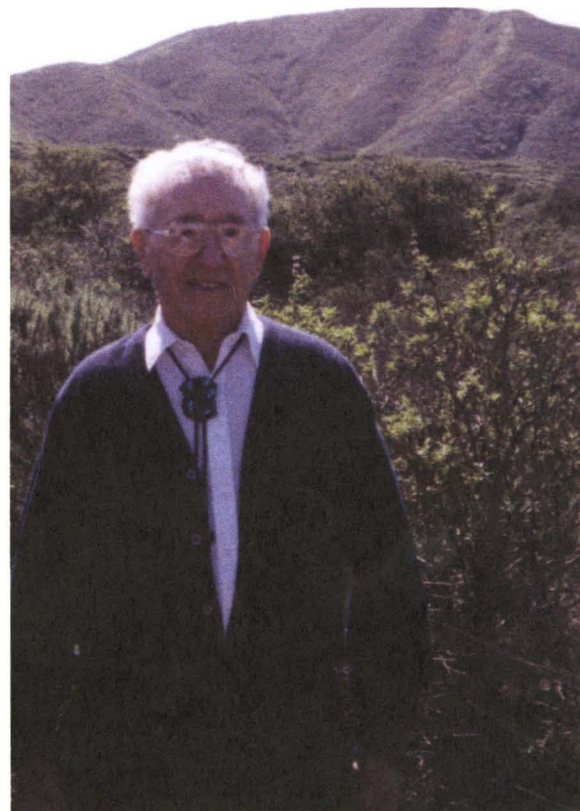
Last November, Switzer gave Caltech an interest in a stretch of undeveloped coastal land in San Luis Obispo County, just south of Morro Bay. He had invested in this property through a partnership in 1969, paying around \$37,000 for his share. Over time, the partnership considered developing the acreage for residential use, but new environmental standards and local zoning concerns—including the discovery that the land was one of the few remaining habitats of the endangered Morro Bay kangaroo rat—prevented this from happening. Meanwhile Al had become inspired by the news that his classmate, George Van Osdol '34, had endowed a professorship (the Van Osdol Chair is currently held by planetary scientist David Stevenson). So last summer, after contacting Caltech, Switzer arranged to transfer his interest in the central coast property to the Institute.

In January, Caltech sold its interest to the state of California so that the state's Department of Fish and Game's Wildlife Conservation Board could establish an ecological reserve on the property. The more than \$800,000 that Caltech received from this sale will be used to endow the Alfred I., Catharine J., and Eleanor G. Switzer Graduate Fellowship Fund. The new Switzer Fellowship is unrestricted, allowing the dean of graduate studies to direct it wherever the need is greatest. Al recalls that he worked many long, difficult hours to pay for his Caltech education, and he is very pleased that this gift will help others avoid that hardship.

The fund's name reflects Switzer's desire to honor the memory of his late wives, Catharine and Eleanor, linked in perpetuity with his own name. His first wife, Catharine, died in 1978 after 39 years of marriage. In 1983, Switzer married Catharine's good friend, Eleanor; she died in 1997.

Al has previously made generous donations of land for environmental and civic use. In 1976, he and his friend and financial partner John Curci gave San Luis Obispo County six acres for the establishment of a community park, and later he donated a site for a local Catholic church, dedicated to the memory of his wife Catharine. In 1989, Switzer and Curci presented an additional 25 acres to the state, which then granted the property to the Audobon Society for the creation of the Los Osos bird sanctuary.

After graduating from Caltech, Al served in the U.S. Army Corp of Engineers for many years, attaining the rank of lieutenant colonel. In 1954, he went into business for himself designing and constructing mobile home parks throughout the United States and Canada. He retired in 1974 and now lives in a mobile home park—of his own design—in Los Osos. He continues to be active in civic affairs and enjoys golfing, fishing, and hunting.



Al Switzer '34 stands on San Luis Obispo County's newest ecological preserve, created on land that he donated to Caltech last year. The property was dedicated on March 10, in a ceremony that hailed Switzer and his financial partner John Curci for their contributions to California's conservation efforts.

chaired the School of Civil Engineering and held the Fred Champion Professorship in Civil Engineering. He retired again in 1985.

After leaving Caltech, Richard Hudson studied music, got a PhD in musicology from UCLA, and became a professor of music at UCLA, retiring in 1991. But Hudson says that his brother's interest in music was equally strong. "He did not play an instrument, but he was one of the world's best listeners. For me, just bringing chamber music, my brother, and Caltech together seemed like a logical thing to do. I hope this fund will encourage more Caltech students to appreciate and perform chamber music."

Recognition . . . from page 7

biology, was honored at the Roy Campanella Humanitarian Award Dinner in March. The award honors "outstanding leaders who have distinguished themselves in their fields."

Associate Professor of Applied Physics *Stephen Quake* has been named one of the "Technology Review Ten" by MIT's *Technology Review* magazine for his innovative work in the branch of biotechnology known as microfluidics, which involves manipulating amounts of liquid thousands of times smaller than a drop of water, and which may make possible the automation of genomic and pharmaceutical experiments, the performance of diagnostic tests, or the building of drug-delivery devices, all on mass-produced chips.

Steven Quartz, assistant professor of philosophy, has been selected by the National Science Foundation for a Faculty Early Career Development (CA-REER) award, the NSF's most presti-

gious award for outstanding faculty early in their independent professional careers. Quartz will be funded for five years for his research into the mechanisms of cognitive development, enabling him to construct a computational/robotics framework for exploring how the mind emerges from a developing brain's interaction with environmental complexity.

Richard Roberts, assistant professor of chemistry, has received a Presidential Early Career Award for Scientists and Engineers, "for his innovative combinatorial method of selecting and designing protein motifs that specifically recognize biologically important RNA structures." The award recognizes outstanding young professionals at the outset of their independent research careers, providing up to five years of grant support. He has also been selected as an Alfred P. Sloan Research Fellow.

Professor of Astronomy *Anneila Sargent*, PhD '77, who is also director of

Continued on page 12 . . .

Organization Woman

Simplicity sells, says Louise Saffman Wannier

BY RHONDA HILLBERY

The “new” economy may be mired in a market meltdown, but that hasn’t stopped Enfish Technology, Inc., from unveiling its newest product, Onespace. It’s billed as computer software that will quickly and easily organize information on a user’s PC.

Nor is the economic slowdown evident in predictions issued by Enfish’s CEO, Louise Wannier ’78. The head and founder of the 40-employee privately held company isn’t shy about predicting that Enfish will grow to become a multi-hundred-million-dollar enterprise.

“Our target market is business professionals and their companies; it spans all industries,” she said in a recent interview from her sixth-floor office on Pasadena’s Los Robles Avenue. “Our potential target market is anyone who is using documents and e-mail in their computer as their primary information platform, because everybody needs a better way of using their computer.”

Of course, projecting confidence is key to the job of a company leader. Yet Wannier contends that unlike new technology gizmos with plenty of shine but no substance, Onespace fills a unique niche.

The personal desktop portal combines installed software with an Internet connection that automatically delivers related information and services.

It’s marketed as an easy way for busy computer-dependent professionals to whip computer chaos into shape. According to the company, Enfish users can immediately access and manage the contents of e-mail and information from all applications in their systems. As new information arrives, they can track it by subject.

In a thumbnail sketch of how Onespace works, suppose that a business order’s delivery date advances by a week. The person in charge of the order isn’t sure if the original date is documented in an e-mail or memo, but can quickly find out by clicking a find button on the tool bar. Without having

to switch applications, the user can also change related budget figures contained in spreadsheets and send the product vendor an e-mail regarding the date change. Onespace also creates individual “people pages” that pull together contact information, related documents, and e-mail.

“I wanted to be able to dump lots of information into the computer and have the computer do some of the organizing for me,” said Wannier, who comes off as a straightforward businesswoman who either can’t or won’t be bothered with high-maintenance cosmetics and hairstyles. “That was the germ of the idea.”

“When human beings think, we think in terms of people or project or whatever we are working on. We don’t think according to whether the information is e-mail or Web-based or a document. What Enfish does is break down the barriers between all the content in your computer so you no longer have to remember where things are.

“Our competitive edge is that we automatically organize information according to what is important to each individual user.”

That’s a lofty claim, but it’s clear that Onespace has fans. A *Wall Street Journal* reporter recently praised it as one of three software programs he would choose to take with him if stranded on a deserted island.

Steve Barth, editor-at-large of the San Francisco-based business magazine *Knowledge Management*, calls Onespace a standout among hundreds of “personal knowledge-management tools.”

Barth says he relies on it to mitigate his disorganized nature. “Speaking for myself, I am a very disorganized person. I am looking for products to make me more productive, not more organized. Nothing can do *that* for me.” He especially likes the idea that he can customize the product.

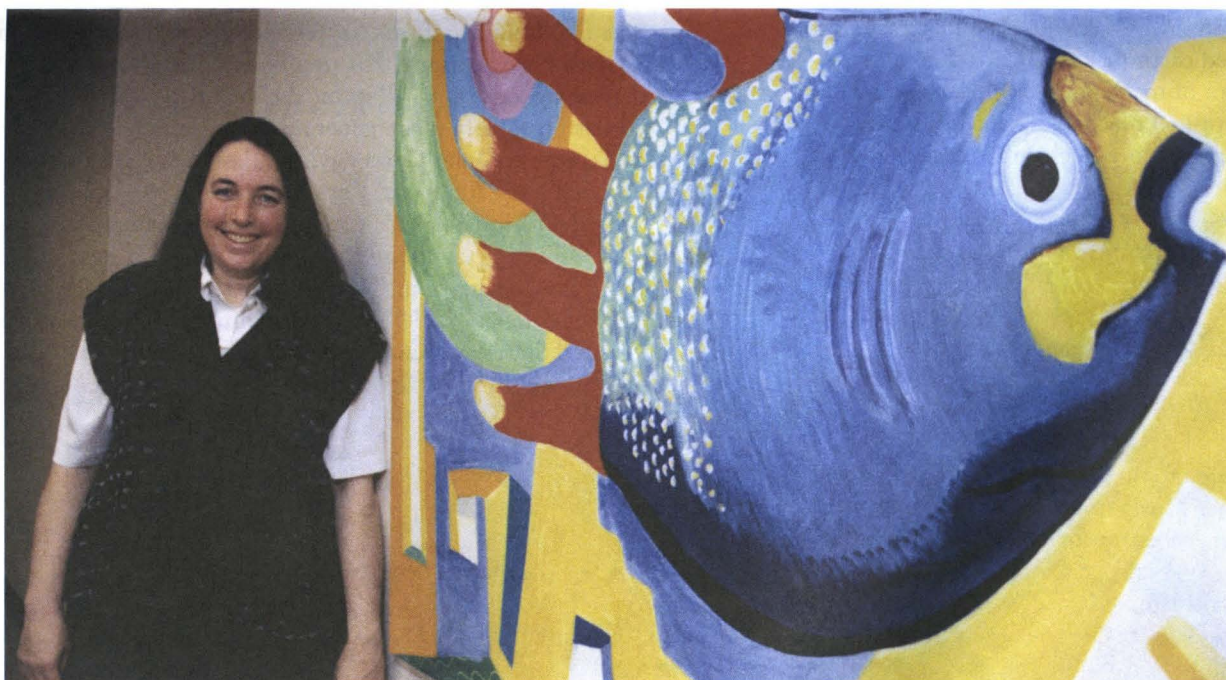
Since Enfish unveiled Onespace in April 2000, more than 85,000 PC users have tried a free download. New customers pay \$69.95 for the latest version, which offers a free 30-day trial from the company Web site.

Enfish’s business strategy calls for building revenue the old-fashioned way, by getting people to pay for its product. “I actually think we’re going to be able to grow this company through expanding the revenue base,” said Wannier, expressing classic old-economy logic.

But it’s clear that Enfish, which has attracted funding from Intel Corpora-

Southern California technology industry by BridgeGate, a technology search firm, for standing out as a great cultivator and motivator of people. “Her position as a mentor has clearly defined her as a ‘difference maker,’” said Dudley Brown, BridgeGate’s managing partner. “Louise has helped a number of people establish successful careers in each company she’s worked for, as well as those who have moved on to build their own companies.”

Wannier has enjoyed a steady rise in an orbit far from the astronomy studies that she majored in at Caltech. A self-described faculty brat, she is the daughter of Philip Saffman, Theodore von Kármán Professor Emeritus of Applied Mathematics and Aeronautics. The family moved from England to the United States when Louise was eight. She grew up steeped in campus life and even audited a few Caltech courses during high school before being admitted as a freshman.



Enfish CEO Louise Wannier (standing next to a large wall painting of her corporate logo) says she isn’t too concerned about launching a new product in economically turbulent waters.

tion, among other investors, is now at a critical phase. Will companies and individuals shell out for new efficiency software at a time when economic uncertainty is prompting layoffs and belt-tightening?

THE ACCIDENTAL ENTREPRENEUR

“I often say I was an accidental entrepreneur,” said Wannier. “It wasn’t what I exactly set out to do. But once I did it, I found that I loved it, so I stuck with it.” Her personality and product align closely, since she describes herself as someone who loves to organize things. “I’ve always been interested my whole life in making things more efficient.”

Last year she was named one of the 20 most influential people in the

At first she pursued an independent study course spanning chemistry, biology, and planetary science, which sprang from an interest in exobiology—the possibility of discovering life on other planets. But after spending a summer holed up in the basement of Steele Laboratory studying the isotopic variations of the element samarium for a research project, she felt a jolt of recognition that would send her in another direction.

“I wanted to understand what it would be like to have a career as a

scientist. And after doing that I realized it was not the career for me. You have to find something you're passionate about. I'm not passionate about science. I'm passionate about people and about the world."

Looking back, Wannier has no regrets. She focused on graduating with an astronomy major, and believes she was well served by her rigorous undergrad studies. "The thing Caltech taught me really well was how to do problem solving; how to think. I really credit my Caltech education for that."

Even then it wasn't clear where her interests would lead her, but she decided to attend business school at UCLA. "It seemed to me that was the fastest way to get into the real world. I was intrigued by people and problems."

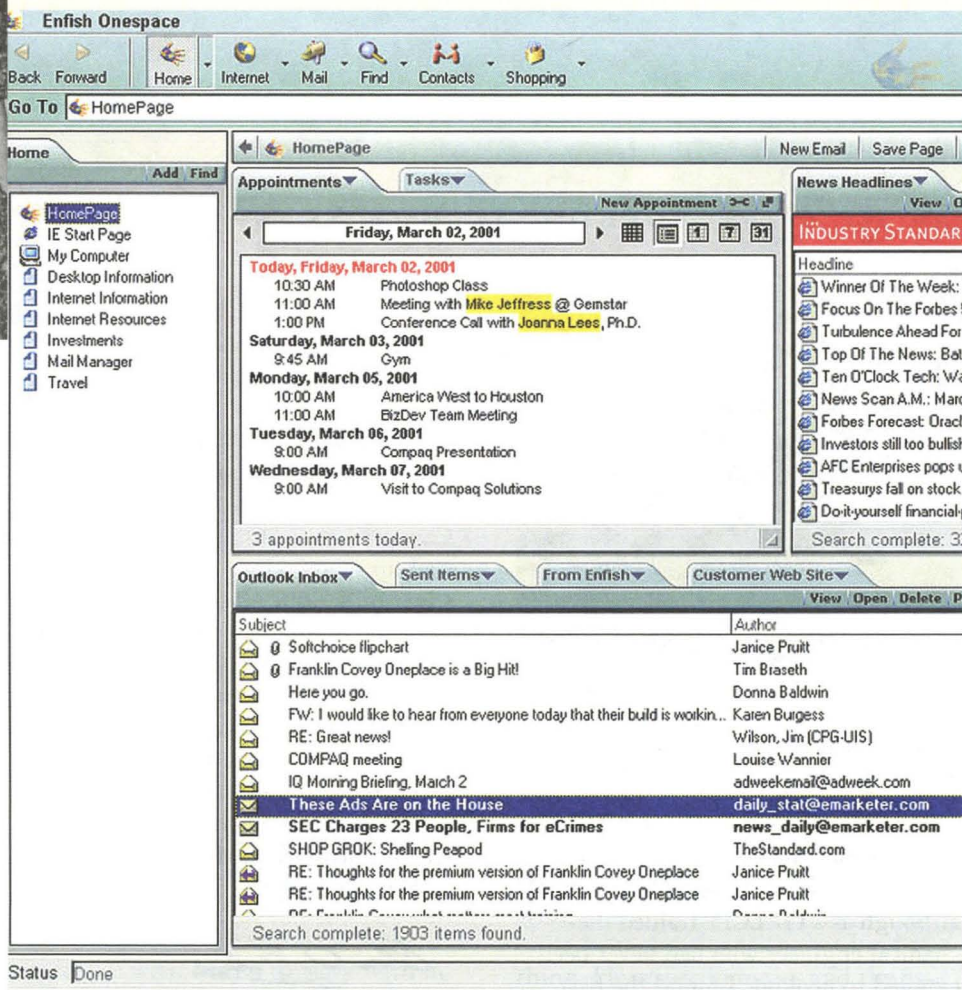
After obtaining her MBA, she consulted for the accounting firm of Ernst & Young, and then was hired to help start an educational software company in Sweden. She had moved there in 1986 with her then-husband, Peter Wannier, a JPL scientist who had landed an astrophysics post at the University of Gothenburg.

Returning to the United States, Wannier began exploring new business opportunities. Around the same time, she began attending the Caltech/MIT Enterprise Forum, where Southern California-based entrepreneurial ventures grappling with growth and other business issues present their cases to a panel of experts.

Contacts made there became important in two future business ventures—Gemstar and Enfish.

Wannier got involved with Gemstar after becoming reacquainted with Henry Yuen, PhD '73, who had been her father's graduate student. He invited her to help form the company now known as Gemstar-TV Guide International along with fellow alums Daniel Kwok MS '72, PhD '79, and Wilson Cho '73. The company's VCR Plus product became, as they say, a household name. By plugging in sets of numbers, users could record TV shows without needing to program their VCRs.

Wannier persuaded key executives to buy in to the concept; its success depended on alliances with newspaper publishers, retailers, VCR, videotape, and TV manufacturers, as well as cable TV operators. To be viable, the system had to include control of cable boxes so that the newspapers could publish one number that would work with various channel lineups among cable TV operators in their areas.



A major breakthrough came when newspapers agreed to publish the VCR Plus codes in their television listings.

Wannier recalls how she tried repeatedly to talk to the *New York Times* by going through recommended circulation department channels. No luck. So she contacted senior management directly and got her phone calls returned. "That's one of the other things I've learned. You have to go to the top sometimes to get things done. Don't be afraid to go to the top."

VCR Plus proved to be a hit domestically and overseas. Wannier established VCR Plus in the United States and then became chief executive of Gemstar Europe, overseeing product rollout in 15 countries within two years.

Her share in the company's phenomenal success helped fund what would become her next project.

ENTER ENFISH

By the early '90s, Wannier was ready for her own challenge, one that didn't involve commuting to Europe and spending weeks at a time away from her family.

During one of the Enterprise Forums she had begun attending years earlier, she met one of the people with whom she would in 1993 form Enfish, an acronym of the words enter, find, and share.

Enfish's first product was Tracker, a computer file organizer that has now been superseded by Onespace.

As CEO and chairman, Wannier spends much of her time on strategic direction, planning, and working with investors. "I see my role as to set the vision and strategically direct the com-

pany." As for her management strategy, she says, "I think of myself as a catalyst. Someone who can look at a problem, look around at things, pull people together—not necessarily solve the problem myself or drive the solution myself, but more to create an environment where I can catalyze the solution."

As part of her business plan, Wannier is forging strategic partnerships with other companies. And this past February, Enfish announced an alliance with Franklin Covey Company, whose Franklin Planners have become as common as Post-it notes in the workplace, to begin marketing a special version of Onespace through retail stores, catalog and other sales channels. Last September, Enfish became a founding member of Intel's Peer-to-Peer Working group, an industry working group designed to advance the direct exchange of services or data between computers.

Later this year, the firm will release other new products, all based on the same idea of helping people work more effectively with their computers. To date, Enfish has raised \$30 million from Wannier and investors including Intel Capital, Black Diamond Ventures, and Women's Growth Capital Fund. The Washington, D.C.-based fund's mission is to improve access to equity capital for female entrepreneurs.

Enfish's top executive says that as a woman in a high-tech area, she hasn't faced prejudice in the workplace. At the pace this business moves, she adds, people are very quickly sized up according to the quality of their work and judged accordingly.

"The only place I feel women don't have a strong enough network is when

Wannier's interest in "making things more efficient" dates back to her student days at Caltech (above left). The Onespace application (left), designed by her company Enfish, reflects this interest, allowing users to customize their desktops to easily organize and access information from many sources.

it comes to financing. When you look at the numbers, there are very few women-led companies that are getting substantial financing."

She believes the climate is changing, however, with the advent of venture funds aimed at female-led enterprises and networks of entrepreneurs.

As a female CEO, Wannier is often asked to comment on the challenges of balancing family and career, as if she were official spokesperson for her gender.

"I hate those questions, and I don't answer them very well either, do I?" jokes Wannier, who has four teenaged children. She does allow that the pressing demands of travel abroad fed into her decision to leave Gemstar. But she thinks men as well as women nowadays speak up about wanting balanced lives, and maintains that Enfish's corporate culture tries to accommodate them.

She describes her own life as one consumed by work and family, and little else, except maybe her new "salon." In her Pasadena home, Wannier hosts what she calls L.A. Conversation, where business folks and technology entrepreneurs talk about issues and ideas.

Her get-togethers deliberately avoid the business-meeting model and members don't even talk about their jobs or professions, according to Scott Alderton, a Los Angeles technology attorney who has attended twice.

"How I would differentiate it from the usual business meeting is that people are not brought together for the purpose of networking," he said. "We are all truly interested in talking about emerging technology, as opposed to finding the next business deal or making new business contacts. We get together to visit."

For her part, Wannier says she loves the salon. "I hope I keep doing it forever."

As for other future plans, she's not talking about what lies beyond Enfish. "I will stay however long Enfish needs me to be CEO. I want to see Onespace realized in the marketplace. This is a really important product and service."

"If we end up being a really large company, it's not clear if I would be the right person to run it. We'll just have to see."

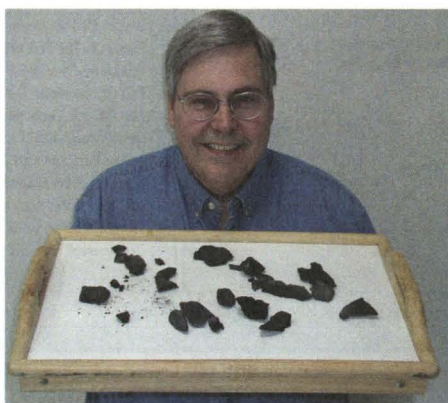
THERE'S COAL IN THEM THAR HILLS (ACCORDING TO BOB SHARP)

I left the Institute with my PhD in 1974, and, as with many other new Caltech grads, the pressures of a new career and family didn't leave me much time for Caltech or the Alumni Association. I moved to Irvine in Orange County, about 50 miles from Tech, and went to work for Ultrasystems in Newport Beach, working on environmental problems. At first I focused on controlling oil spills with a high-speed skimmer, and later I moved into control of air pollution produced by coal combustion. This involved fluid mechanics, chemical kinetics, and radiative/convective heat transfer, using both analytical and empirical techniques.

The work was technically challenging and improved the environment, and it was a lot of fun. We built the world's largest coal-combustion test facility and used it to develop a broad range of low-emission equipment. We made *really big flames* (on the order of 15 feet in diameter and 30 feet long). We even blew giant smoke rings out the stack (anyone from Ricketts would love this)! We learned that coal characteristics had significant effects on combustion performance and emissions, and we brought coal from all over the United States (or so I thought) and from several other nations to Orange County.

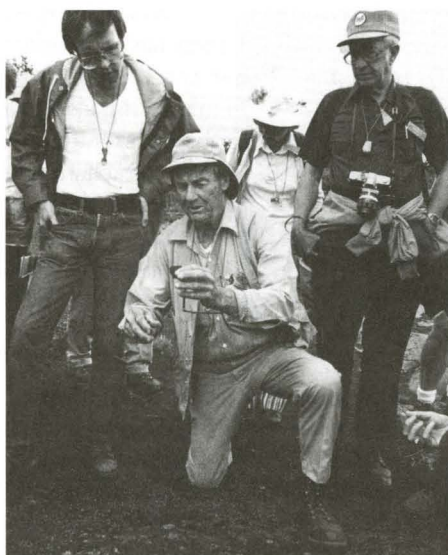
It wasn't until 1991, 17 years after leaving Tech (and after burning a lot of coal), that I became involved again with the campus. Judy Amis (who was then director of the Association) and Arlana Silver (currently the deputy director) asked Tom Tyson '54, PhD '67, and me to jump-start an alumni chapter in Orange County. We roped in Dave Wooten, PhD '67, and the three of us began to plan events. It was great to get back in touch with Techers and to be back on campus again. Among the events we held over the next several years, one of the most popular turned out to be a bus tour of the geological features of Orange County, led by Bob Sharp '34, MS '35. The tour traced a large circle around the county, and at each stop Bob would hold forth on the local geology. One highlight was a stop near the San Onofre nuclear power plant, where we inspected an exposed fault. This fault had been discovered during the planning phase for the plant and had just about done it in before Bob convinced the authorities that the fault hadn't moved in a *really* long time.

The tour generated so much enthusiasm among alumni that we held it a



Coal Man. Mining Caltech connections has unexpected rewards as Alumni Association President Blair Folsom, displaying several chunks of genuine California carbon, explains.

second time. Since I was the chapter president, I went along on both tours, although as a GALCIT-trained mechanical engineer who had never been exposed to geology, I found the first go-round a bit like drinking from a fire hose. But by the second tour, I was able to focus more on some of the finer details in Bob's commentary. One remark that immediately captured my attention was a seemingly minor comment about coal. As we passed the Coal Canyon turnoff on the 91 freeway, Bob mentioned that the county's actual coal deposits could be found a few miles south in Silverado Canyon. He added that coal had been mined there



Professor Bob Sharp leads one of his many geology field trips for members of the Alumni Association, this one in the 1970s.

in the 1800s for the railroads, but that it wasn't economical and the mine had been abandoned.

What? Coal in Orange County?! Here I was, the coal-quality expert, and I didn't even know that there was coal

in my own backyard. Of course I was skeptical; I had lived in Orange County for decades and had never heard of Orange County coal. I had to check it out.

How does one find an abandoned coal mine? Frank Coen, a colleague in our lab, stabled a horse in Silverado Canyon. I asked him if he had ever seen coal up there. He had seen the old silver mines but no coal. After some pleading on my part, he agreed to look around the next weekend. When I arrived at work the next Monday, he greeted me with a five-gallon bucket of Orange County coal! Bob, you were right; there is coal in Orange County.

It is amazing what you can learn by staying involved with Caltech.

Keep in touch.

Blair A. Folsom

Recognition . . . from page 9

both the Owens Valley Radio Observatory and the Interferometry Science Center, has been honored with two invitations, one to be the University of Edinburgh Science Festival Lecturer for 2001, the other to be the Philips Visitor at Haverford College for spring 2001.

Wallace Sargent, the Ira S. Bowen Professor of Astronomy, was awarded the Henry Norris Russell Lectureship for 2001 by the American Astronomical Society, in recognition of his contributions to astronomical spectroscopy. The lectureship is the society's "most prestigious prize and is awarded annually to recognize a lifetime of preeminence in astronomical research."

John Seinfeld, the Louis E. Nohl Professor and professor of chemical engineering, will receive an honorary doctorate this year from the University of Patras, Greece.

Professor of Biology Paul Sternberg, who is also an investigator for the Howard Hughes Medical Institute, has been elected a fellow of the American Academy of Arts and Sciences.

Ersan Üstündağ, assistant professor of materials science, has been selected by the National Science Foundation for a Faculty Early Career Development (CAREER) award, the NSF's most prestigious award for outstanding faculty early in their independent professional careers. The award supports his research into solid-state reactions and phase transformations in materials, particularly ceramics, and the mechanical behavior of materials,

Alumni Activities

June 22-23, *Alumni College*
featuring *Computer Science*.

September 5-16, *Sicily*
Travel/Study Program, with
Warren Brown, assistant
professor of history.

especially composites.

Alexander Varshavsky, the Howard and Gwen Laurie Smits Professor of Cell Biology, has received the Albert and Mary Lasker Foundation's 2000 Albert Lasker Award in Basic Medical Research. He shares the award, for critical research into the ubiquitin system, with Avram Hershko and Aaron Ciechanover of the Technion-Israel Institute of Technology. Varshavsky is also the corecipient, with Hershko, of the 2001 Wolf Foundation Prize in Medicine for the discovery of "the ubiquitin system of intracellular protein degradation and the crucial functions of this system in cellular regulation." The prize includes an honorarium of \$100,000 that will be split between the two awardees.

Associate Professor of History Alison Winter has received the Northeast Victorian Studies Association (NVSA) Sonya Rudikoff Award for her book, *Mesmerized: Powers of Mind in Victorian Britain*. Given for the best Victorian book by a first-time author, the award was presented in April at the NVSA conference.

Peter Wyllie, professor of geology, emeritus, has been selected by the Mineralogical Society of America as the Roebling Medalist for 2001. The Roebling Medal is the society's highest award "for scientific eminence as represented primarily by scientific publication of outstanding original research in mineralogy." The only other Caltech faculty member to have received this medal was Linus Pauling, in 1967.

Nai-Chang Yeh, professor of physics, has received the 2001 Achievement Award of the Chinese-American Faculty Association of Southern California, which cites "her outstanding contributions to experimental condensed matter physics, particularly in the areas of high-temperature superconductivity and state-of-the-art frequency standards." She has also been elected a fellow of the Institute of Physics and granted the title of chartered physicist.

Goodstein discusses Feynman, QED . . . from page 3

laugh lines, and Alda delivers them impeccably. He prowls around the stage, occasionally writing on the blackboard or beating his drums. There is physics in Alda's long monologue, enough of it, and done right, to tell the audience that it was physics that lit Feynman's fire, and the rest was window dressing. (Well, not all of it. He liked the women too.) Late that night, in the second act, the only other character in the play shows up. She's a very pretty young student, slightly tipsy from the after-the-play party (Feynman would have loved it). Her role in the drama is to help pull him out of the growing depression that his own condition and his memories of the death of his first wife, Arline, have cast him into. And that works too.

There have been important plays written about scientists. Bertolt Brecht's *Galileo* comes to mind as does *In the Matter of J. Robert Oppenheimer* by Heinar Kipphardt. When I saw the Kipphardt play at the Taper years ago, the actor who played Edward Teller looked like Hans Bethe, and the actor who played Bethe looked like Teller. Most of the audience would not have known or cared. More recently, Michael Frayn's *Copenhagen* portrayed various versions of Werner Heisenberg's visit to Niels Bohr during the Second World War.

Feynman's life did not contain the kind of moral dilemma faced by the personages in those plays (although Parnell gets considerable dramatic mileage out of Los Alamos and the making of The Bomb). This is not a play of ideas, but rather a character sketch. Ah, but what a character! Parnell's *QED*, as played by Alan Alda, is a fitting tribute to an old friend of mine who just happened to be one of the most singular characters to roam the earth in the twentieth century.

I purposely skipped Caltech night (which was also press night) at the Taper so I could see the play among an ordinary audience and make up my own mind. At the end of the performance I attended, the audience members came forth with an instantaneous, spontaneous standing ovation. I'm not sure whether they were applauding Alda or Feynman. I guess it doesn't matter.

Caltech News readers who would like to share memories of Richard Feynman, on stage, offstage, behind the scenes, or otherwise, are invited to send their letters to hja@caltech.edu.



Joined by the then-mayor of Pasadena John Crowley (second from left) and two students, physicist David Goodstein brought up the rear in the custodians' kick line in the Institute's 1986 production of *How To Succeed in Business Without Really Trying*. Feynman appeared as a wastebasket-drumming janitor and a quiz show emcee in what was to be his last Caltech performance. Goodstein went on to appear as Merlin in Caltech's 1990 production of *Camelot*.

Marneus discusses Feynman, QED . . . from page 3

studied the films and photos, heard the recordings, and read the stories, but beyond that, he shows an intuitive understanding of the character that transcends what he has to work with in the script. He has the dazzling energy, the focus, and the charm—and with



Two Directors in Search of a Physicist. Shirley Marneus and QED director Gordon Davidson embrace on the eve of opening night.

Feynman that's big-time charm. He's not Feynman and he doesn't try to be—it's an interpretation, not an impersonation—but he does capture the essence of his personality. When he cradles his head in his arms or talks about the death of his first wife, Arline, or his father's death, and his voice trails off into silence, there are depths suggested in these silences. This is very powerful stuff in the theater—the actor on stage is having deep insights, and it's up to us in the audience to internalize them and complete the process. It's a measure of Alda's faith in his audience that he trusts us to fill in the blanks.

There's enough science in the show to intrigue the people who see it and ease them into reading more about Feynman and his work. Dick once told me, "I wrote *QED* [his book for laypeople on the "strange theory of light and matter"] for people like you.

Do you understand it?" I told him that while I was reading it, I had the illusion that I understood it, and that was good enough for me, but that he shouldn't ask me to explain it. "Oh," he said, "then I'm not good enough." Because he took pains with that kind of thing. He wanted physics and the excitement and discipline that goes into it to be accessible. Feynman was incredibly disciplined. He liked to present himself as this rowdy character, but inside there was this hard, clear core. I wish the play brought this out more—at times, Alda, if not the script, does give us a glimpse of this side of the man.

This play is what I call an audience pleaser. The first act works on every level, but when you get to the second act and his encounter with the female physics student from Pasadena City College, it may be that they're trying too hard to please. I found the actress and her role disappointing. I mean, does this man really decide to have do-or-die surgery because a young woman comes into his office a little drunk, takes off her shoes, and dances for him? Maybe that's how some people make decisions. But I'm dubious; I think there was more to it than that.

But the play does seem to be a work in progress; I hear there's some talk of taking it to New York. If there are changes, I hope they will be in the direction of making the play a bit harder and more dry—overall, less comfortable for the audience. There is a hint of this in one lovely short section where Dick is on the phone with his wife, Gweneth. He's talking about the surgery and his prognosis. She tells him that he has to have hope. He replies, "What do you mean, I should have hope? Hope? That's not me." That's the real Feynman—beyond the gestures and the anecdotes.

What was Dick himself like as an actor? We're not talking Paul Scofield here, but I have seen professional actors who were not as good. Above all, he was a wonderful performer, who would have been a delight in any community

theater. He was so flexible and creative—full of ideas about his parts and always eager to hear what others had to say. I'd be in my office and he'd stick his head in the door and say, "Shirley, I got this idea. Let's go have soup and talk."

Dick's first experience in the theater was as a bongo player in Caltech's production of *Guys and Dolls*, and it was then that he said, "How come nobody ever told me about this drama stuff before? It's fun!" He would have liked to do more with TACIT, and I would have loved to have stretched him more as an actor, but his time was usually so limited that most of his appearances were fairly brief. I was able to cast him in a few fairly substantial parts—as Matthew Skips, the town bum, in *The Lady's Not For Burning*, and as the sewer man, a rather mysterious, charismatic character, in *The Madwoman of Chaillot*. Obviously, they played to his strengths, and he was memorable in both. He was always comfortable and confident on stage, but he knew these were good roles and he really worked at them.

Dick's last TACIT appearance was in *How to Succeed in Business Without Really Trying*. We had a custodians' kick line in that show, but he said, "I'm throwing it in, Shirley; I'm not a good kicker anymore." He did go on as one of the custodians, but instead of kicking, he grabbed the wastebasket and drummed. And when next year rolled around—it was late 1987—I called him to do *Oliver* and he said, "No, I don't think so this time, Shirley. And I said, "Okay, next year." And he said, "I don't think so, Shirley." And I said, "Dick?" And he said, "Yeah." And there was a silence.



JPL DIRECTORSHIP REPRESENTS
“GREAT LEAP” FOR ELACHI ET AL.

Dear Editor:

The last issue of *Caltech News* [number 4 of 2000] pleasantly surprised me with the front-page portrait of my old friend Charles Elachi with the background of the nine planets aligned with our sun. Charles hasn’t changed very much since the end of the sixties, with the minor exception of his front hair being somewhat thinner.

For nearly two years—mid 1968 to mid 1970—we had formed a close “social circle.” Him, Sebastian Candel and myself—residents of Braun House—with some associates, such as Finn Ravndal, Chris Hammer, and others.

I have been following Charles’ continuous successes through the years, but I think this is really the great leap forward, and I wish him all the best.

Inside the same issue, the picture of the ancient Greek amphitheater atop the city of Taormina, Sicily, drew my attention. As it happened, one week ago I was there participating in the Steering Committee of the European Union-funded Thematic Network on Intelligent Forecasting Systems for Refineries and Power Systems, with the program Brite-Euram.

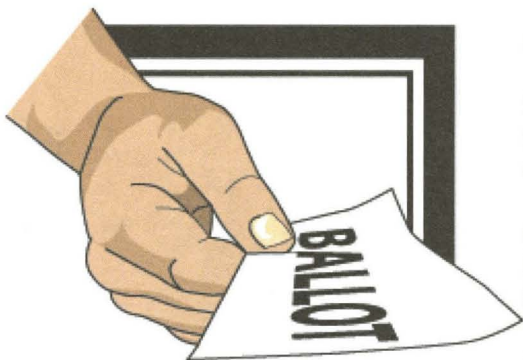
The venue was the Hotel Villa Diodoro, which has a spectacular view of Mount Etna and the region south of Taormina, including the city of Giardini Naxos (Greek in ancient times).

While there, I very much enjoyed the local food. It almost seemed to me as if the activity of Etna had made the food richer than usual.

—Thales Michael Papazoglou,
MS ’70, Crete.

FOR THE RECORD

Charles Elachi, PhD ’71, is the fourth alumnus to direct the Jet Propulsion Laboratory, following in the footsteps of alums Frank Malina, PhD ’40; Louis Dunn ’36, PhD ’40; and William Pickering ’32, PhD ’36. *Caltech News* thanks the two alumni who noted Malina’s tenure (1944–6) and Dunn’s (1946–54). The entire lineup includes Theodore von Kármán, Malina, Dunn, Pickering, Bruce Murray, Lew Allen Jr., Ed Stone, and now Elachi.



READERS OFFER THEIR VIEWS ON
A BETTER WAY TO VOTE

Dear Editor:

I am accepting the invitation in the latest *Caltech News* to comment on voting technology. [See “Out of the box: Caltech and MIT elect to reform voting system” in issue number 4 of 2000.] I have no particular credentials in this area, and may be merely rehashing concepts you have already considered, but perhaps my ideas may be of value. The criteria any optimal voting system should satisfy include the following:

1. It should be impossible for the voter to prepare an invalid ballot.
2. The voter should be able to verify that his ballot has been marked the way he desired.
3. It should be impossible for ballots to be lost by any mechanical malfunction.
4. Ballots should not be susceptible to tampering or hacking, either by insiders or outsiders.
5. Ballots must be retained in a physical form allowing recounts and auditing.
6. Ballots must be marked so as to allow simple unambiguous reading by both human and machine.
7. Equipment used must be that which is mass-produced for a general-purpose market.
8. Equipment must be trivially easy to use, by both voter and staff.

A system that appears to satisfy these criteria is as follows:

1. The voter will make his choices on a programmed touch-screen computer.
2. Every list will have a ‘no vote’ option to avoid ambiguity as to the voter’s intent.
3. The computer will print out an optical sense card ballot. The program will assure that every ballot is valid.
4. The same codes on the ballot will be readable by the voter and the optical sensor. This is to insure that a partisan programmer can’t present different information to the human and to the machine to subvert checking.
5. The voter will read the ballot to verify that it represents his desired vote. This step is critical.
6. The voting machine won’t print out another ballot until reset by staff, to prevent a voter from inserting mul-

multiple ballots into the reader.

7. The voter will insert the ballot into the optical reader, where it will be tallied immediately in a central poll computer.

8. The optical reader computer will display what it reads to the voter, allowing another check of proper machine function.

9. Different groups will program the touch-screen computer and the optical-reader computer. This is to minimize programmer misconduct.

10. The ballots will be retained for recount, in event of any question of machine malfunction, programmer misconduct, or hacking.

11. When the poll closes, the complete count will be sent via direct phone line (not via internet) to the central vote-counting office, using appropriate encryption and verification.

12. This will allow complete vote results to be available within minutes of poll-closing.

While this exercise may be somewhat naive, I hope that any system you do come up with will address the same issues.

—Harvey S. Frey ’55

I applaud Caltech’s effort to apply some science and engineering to the chaotic mess that is the current voting process in the nation. While information theory, database design, and systems analysis were not mentioned in the subject article, I hope your team incorporates expertise in these areas.

The design of a voting system should include among its requirements the following:

- The voter should be presented with a single issue on a page: the candidates for one office or a single proposition.
- Each page should include “Abstain” as a choice. (Abstain may be confused as the name of a candidate, so something like “I do not choose to vote on this issue” might be preferred.)
- Each choice should be presented to the voter in the form “You have voted for *candidate name* for the office of . . .” or “You have voted Yes (or No) on the issue of . . .,” and the voter should be required to confirm his/her choice before the next page is presented. If not confirmed, the same page should be presented again for correction.
- A hard copy of the voter choices should be made for confirmation of the tabulation.

If implemented, these attributes should eliminate confusion, overvoting and undervoting. Implementation seems most straightforward with the DRE-type systems. The ATMs offer a good model. The magnetic strip card could be issued at the voting precinct to registered voters. It could have prewritten a precinct-specific code as well as a unique serial number. This card would enable the voting equip-

ment and would be further encoded with the voter choices. The voting equipment would retain it as a hard copy of the choices.

At the precinct level, the collection of voting data is a very small database problem. One customized desktop computer could easily handle the typical 4 to 10 voting booths. Moving up in the hierarchy, the database gets larger and more computing power is required. But nothing that is not in the current state-of-the-art.

Implementation of these improved voting systems will be costly, but such an essential element of efficient and error-free democracy warrants a high priority assignment of resources.

All of this is probably “carrying coals to Newcastle,” but I am enthused by your engagement in the project and I wish you well.

—Jerry Jacobs ’50, MS ’51

I received my PhD from Caltech in 1952; my wife and I moved on to a job with Dow Chemical in Michigan, a faculty position at UCSF in 1959, and I retired from that position in 1991. During that period I became involved with each of the communities where we lived, running for the town council in Tiburon in 1974; I was elected and served as Mayor one year during the four years I was on the Council. Subsequently, I applied for and was appointed to the position of the County of Marin’s representative on the Metropolitan Transportation Commission, a regional agency responsible for allocation of the

Continued on page 16 . . .

CALLING ALL K–12 EDUCATORS

In preparation for a special feature on K–12 education, *Caltech News* wants to hear more about the involvement of members of the greater Caltech community in the schools.

Are you, or have you ever been, a teacher, an administrator, or a volunteer in a public or private school? How have your experiences shaped your impressions of the public education system and its alternatives? How do you view the state of K–12 math and science education? What are the biggest problems facing our educational systems today, and what would you suggest as solutions to these problems?

Readers are welcome to simply send contact information or, if so inclined, to append their thoughts in a “letter to the editor,” based on the above questions or related topics. Please e-mail these to hillary@caltech.edu.

CLIMBING BOOTT SPUR

BY CHEUK GONG, MS '75

Inspired by alum Paul Lee's account of mountain climbing in China ("Hua Shan Rises," #3, 2000), this Caltech News reader sent us a mountaineering highlight of his own.

New Hampshire's Mount Washington looms large over its southern extensions, which include two major ranges—the Southern Presidential Range and the Montalban Ridge. The Montalban Ridge begins at Boott Spur from the southern end of the Bigelow Lawn, then drops off quickly to the south. Looking from the southeast, the rocky peaks of Boott (pronounced "Bot," after a local naturalist) Spur and Mount Washington dominate the skyline. Boott Spur possesses all the attributes of a big mountain, falling short of that category by only 20 feet, according to regional peak-bagging standards. At 5,504 feet, it stands among its neighbors—Mounts Adams, Jefferson, Madison, and Monroe. All are the highest in the Appalachians' northern tier.

A long and rocky ridge leading up the mountain to Boott Spur affords great hiking. This was the climb my wife, Po, and I set out to accomplish on September 30 last year.

We started out with easy footing and soon diverted onto the Boott Spur Trail, separating us from the crowd. This steep trail goes straight up to the mountain in no time. On a rocky outcrop, the famous Huntington Ravine showed itself in full, with its awesome headwalls extended wide and tall. On other lookouts higher up, a few people caught up with us. Some got scared off by the roughness of the terrain and turned back.

On the Harvard Rock lookout, we had a clear view of the ravine's floor. The Tuckerman Ravine revealed its massive extent and convoluted and formidable rocky precipices in the midmorning light. It's amazing how the ancient glaciers have carved out huge hollows, creating many deep ravines like this. Straight ahead, numerous landslides yielded a 45-degree plane of rocks and stunted trees. The views of Boott Spur and Mount Washington were bright and high. Lion Head at 5,033 feet and a mile away as the crow flies looked challenging. Autumn was earnestly coating the maples, beeches, birches, ashes, and other species with its full spectrum of colors, which, when combined with the intricate rocks and landslides, made the views of the ravine extremely busy and awesome.

We climbed, and climbed still. We didn't seem to gain an inch, as the

Wildcat Range appeared to be forever above our shoulders. As we climbed above the tree line, the trail followed a beautiful ledge, where it was bright and expansive. I knew we were some halfway up to Boott Spur. From here on, the trail was extremely rocky and steep, and I was glad that we had experience climbing such vertical terrain.

The alpine zones were unbelievably beautiful, and arctic plants were common. Large boulders were everywhere, and the going was slow. On a long and steep thin path connecting two levels, I stood to catch a breath. As I turned and looked downward, I spotted a falcon soaring in the air below, over the Gulf of Slides. I could not help wondering whether we were the envies of the falcon. We reached the top of one section, only to discover many more levels to go. It seemed endless. I had lost my sense of distance and heights. Later we reached a narrow ledge; the views looking down into the deep Gulf of Slides revealed its numerous landslide structures.

It had been long since Split Rock—another landmark—and we lost track of time. But finally, we scrambled over the last of the vertical rock fields and reached the top of Boott Spur. From where we stood, all the hills and valleys below—those we recognized and those we didn't—appeared distant and tiny, lined up in endless layers and extending in all directions. Their colors changed from autumn's reddish green to pinkish blue, and yet lighter blues, then sky blue . . . and then became murky. Tens of thousands of square miles stretched out below us.

The view expanded to the horizon, where the sky and the earth became one seamless entity. Here, standing between the rocks and the sky, for a flash of a moment it seemed as though I had become part of the universe, that I was neither a part of the sky nor the earth, but of both. My mind was free and reaching out boundlessly. That was a great feeling indeed, even if it lasted

only for a few seconds . . .

Now I realized that Boott Spur was a standout. Height was not everything.

Boott Spur's panoramic view was incredible. Mount Washington stood tall two miles away. Right below was the Tuckerman Ravine. Oakes Gulf sloped away from here; its immensity was hard to reckon. The Spur's command over the Montalban and the Gulf of Slides was immediate and absolute, making the Gulf look forbidding and deep.

Shortly afterward we followed the Davis Path and the Lawn Cutoff up and down the Bigelow Lawn to the Junction, enjoying the easier walk for a change.

The Junction is a convergence of many great trails. The distant cairns resembled sentries guarding the high peaks. Toward Boott Spur the view was absolutely amazing, as if it were a painting in impressionistic fashion: numerous patches of land features, all showing chalky colors in different shades of red, blue, green, and yellow. Most interestingly, the seemingly rapid recess of the rock structures of the edges of the Lawn made Tuckerman Ravine look as though it was the sinkhole of the earth. The afternoon sun added a swirling effect.

Moments later, we started walking down toward Lion Head—another exciting spur full of rocks and deep cliffs. It dropped relentlessly in order to compensate for the change in height in half the distance. On its peak, from half of a mile away, we could make out and even hear the many ribbon waterfalls on the shaded rock faces of the ravine. Once we had climbed Lion Head, we found ourselves crawling on all fours over a vertical cliff and saw many more rock fields below us. Negotiating over these rocks down steep hills was very



demanding, so our first order of business was to be surefooted. Looking back up toward Lion Head occasionally, we were blinded by the high sun, which hung over the tallest rocks. Now and then, the sun cast long shadows of the ridge onto the forest far below.

Finally, after the last rocky cliff, we were back down in the woods. From the Hermit Shelters, the downhill section of the T. R. Trail was easy. We took a left turn and were moving fast on it. In 90 minutes we closed the loop, completing a great alpine hike of 8.5 miles and a net elevation gain of some 3,800 feet.

A great finale was viewing the Crystal Cascade, which was so pretty that we thought it equaled any waterfalls in the White Mountains. Gradually the Cascade became darker, and we finally realized that daylight was coming to an end. We didn't want to leave and did so with utmost reluctance. One more look upward in the fading light, and I knew how much we had come to love these mountains.

The author lives in Newport, Rhode Island, where he is affiliated with the Naval Undersea Warfare Center (NUWC).



The author (pictured above) takes in the many fall colors of Boott Spur.

considerable state and federal funding that comes to local governments for transportation purposes.

I am still involved with transportation problems, although we now live in Sonoma County, some 50 miles north of Tiburon. I serve with some 15 other people on the Citizens Advisory Committee of the Sonoma County Transportation Authority, the latter being the countywide administrator of the planning and funding for transportation in the County of Sonoma. I mention these items solely to indicate my continuing interest in the voting systems of our nation. Recently the League of Women Voters (LWV) of Sonoma County has undertaken a study of voting systems, having held some four meetings at this time relevant to the variety of approaches to voting.

I am pleased to read that my Alma Mater is concerned about how well these voting systems work. The LWV meetings have all confirmed that whatever happened in the Florida elections last November may not be unusual, and that the technological aspects of the voting methodology need careful scrutiny.

I write at this time to suggest that whatever techniques are used for voting, the voter should receive (perhaps as a "printout") a representation of what votes he or she intends to cast, prior to making the final decision about entering his or her ballot into the system. There should be some interval when the proposed ballot could be reviewed, and changed if desired. But surely, the voter should have a record of what votes on his or her ballot were entered into the system.

As for the costs of operating election systems, I note the comments of the Speaker of the California Assembly: in his inauguration speech he listed priorities for the near future. The item that received much applause from the Assembly members was "and we must be assured that our vote counting is accurate," and he implied that the state would spend whatever is necessary to do that.

It is important, therefore, that in your approach to defining a better system of voting, the technological aspects not become the sole focus of attention. The League mentioned above is considering the many varieties of voting that exist in the world, and Caltech and MIT should do the same.

—George Ellman

Although not an alumna, I worked at Caltech while my husband was in graduate school. I have for many years served on local election boards. I urge you to require persons working on your project to serve on an election board at least once. Voters have problems and questions that are not considered in most discussions of elections. A situa-

tion we faced last fall was registration at the Department of Motor Vehicles. This was supposed to encourage voters to register. And it did. But there wasn't a good system for getting these registrations to the County Clerk. So on election day we had voters who were sure they had registered but were not on the voters list. The cost of an election is more than the latest equipment!

—Phyllis Ellman

As an alumnus of both institutes of technology, I appreciate the opportunity to make my voice heard on this important issue. Americans deserve 6-sigma reliability in vote counts as much as in our manufactured gadgets. The last presidential election certainly pointed out just how unreliable our current methods are.

Any new technology must satisfy a number of conflicting constraints. The technology should force each voter to make exactly one choice on each ballot question. No paper method can prevent a voter from skipping the question or voting more than once. Mechanical voting machines can enforce the prohibition against more than one vote. Requiring one vote for each question is more difficult.

Computer technology can help. A good model as to how to run an election is the corporate voting technology of eproxyvote.com. Each election is a page. The voter must select one option from a menu. One of the choices should always be "no preference." In that way, the total votes over all candidates in all elections is a constant. At the end of the selection process, the voter sees a summary and can make any changes. For computerphobes, an alternative input device is the telephone. Voice mail hell can become a friendly balloting system. "You are now voting for President. Press or say 1 for Gush, press or say 2 for Bore . . . For no preference, press 0. To hear the choices over again, press *. You have chosen Nader. If this is correct, press #. To revote, press *."

Most counties have plenty of personal computers at schools or libraries. Phones are either available or cheap. There is no need for expensive new capital equipment to achieve 6-sigma reliability. However, I do not trust computers. There must be a piece of paper with ink on it as a permanent record of the voting process. Therefore, whichever method the voter has used up to now, the next step is for a small dot matrix or ink-jet printer to print a paper ballot. Thermal printers are unacceptable. It should have an accession number composed of the machine number and a time of day stamp and a string of 6 random characters for a password. Each ballot question should receive one line and should include the names of the office and the chosen candidate. The voter should receive two copies of the ballot. One gets deposited in the ballot box; the other s/he keeps.

The ballots later get run through a scanner coupled with an optical character reader to deconvolute the printed page and add up the votes. This machine should run off a battery and all output should go to a floppy disk or two. Telling Gush from Bore should not tax OCR software. Even though both names have four characters, none of them are the same. The names printed at stage one should make the job of OCR in stage 2 as reliable as possible. Since the pattern matching only has to pick one name from a short list, the method should meet 6-sigma reliability standards.

If there are problems in determining voter intent, the election board can publish the accession numbers of questionable ballots. The voter responds with the password and preserves anonymity. "No choice or preference" is an important modification to current practice. It acts like a check digit so that the total number of votes will be a constant in all elections.

I could write the software for the menu-based system myself in less than a week. The voice-recognition system already exists and could be licensed. The operating system should *not* be Windows. The system must be robust. It should not crash. Ever! The election board should disconnect any hard drive the PC may have. Everything should work off a single, certified, floppy disk. There should be ways for monitors to check the integrity of both the ballot-creating and ballot-counting procedures at all stages of the process. Voters should no more trust election monitors than the hardware they use.

These ideas have much in common with those of Rebecca Mercuri of University of Pennsylvania. She too feels voters should not trust computers. You can read a discussion of her ideas in the 3/19/01 issue of the *Wall Street Journal*, page B1. The article refers to her Web site www.seas.upenn.edu/~mercuri/index.html.

There is far more wrong with our voting process than merely the process of counting the votes. In other forums, the country needs to address gerrymandering, primaries, caucuses, conventions, money, negative campaign ads, and debates. One simple change in the ballot might be appropriate given the new machine capabilities. If the voter prefers one candidate over all the others, fine. However, the current system is not adequate if the voter *dislikes* one candidate and has no particular preference for any of the others (if there are more than two candidates). The new ballot should include the option for "Not Hir" for every candidate in every election. Choosing this option subtracts one vote from that individual.

—Frank Weigert, PhD '68

Keep the conversation going, or start new ones, by sending e-mail to billary@caltech.edu.

exercise for Cal Tech wits and relaxation for brains."

Intense work and play were occurring at a time of international crisis and opportunity, according to the essay. "The promise of the immediate future of science, especially in the field of atomic energy, is so great that the National Defense Research Committee has put Cal Tech laboratories under contract and sworn them to secrecy.

"To hard work both faculty and undergraduates are driven by the realization that this century promises to bring science to some great conclusions that will justify the grubbing, the cataloguing and experimenting of the centuries past. Cal Tech's undergraduates, in particular, find acute inspiration in the thought that a major role in this fruition of science may well be theirs." That was *Life* in 1941.

UNFILTERED HISTORY, CALTECH-STYLE

For an alternate version of history, adventurous readers can browse through back issues of the *Big T*, Caltech's undergraduate yearbook, accessible in hard copy at the Archives. The *T*'s monumental role is elegantly stated in the foreword to the 1941 edition: "The eyes of the camera and the keys of the typewriter translate into permanence the inimitable, colorful array of events experienced by the student of 1941." Colorful illustrations front each section. (The illustration for the section on "classes" has been reproduced on the cover of this *Caltech News*.)

References to the atmosphere of international crisis can be found in much of the text, and a call to arms, or at least to the lab, echoes the sentiments of the *Life* article. The *Big T* notes that the graduates, having "learned from men who have themselves contributed to the advance of science . . . will find that the emergency which confronts the nation demands hard working, well trained men, capable of solving the new and diverse problems which confront a nation in the throes of a struggle for national security, and they will be prepared."

More laid-back Tech talk can be found in the section on student houses, which recounts such news as "Doc's Party" in Blacker, the Hodge-Podge "tunnel of love" in Dabney, and Fleming's superior grade-point average ("surprising the old guard" of that house). Ricketts House made note of its newest members, who had "accomplished the transition from high-school 'big-shots' to insignificant 'frosh.'" The Throop Club reported that it "furnished social life and student activities which non-residents would otherwise lack."

Rosen sums things up. "Today, there is no longer a *Life* magazine," he says, "but there is still a lot of life at Caltech."

C l a s s
N o t e s

1984
Laura Ravine
LRAVINE@graycary.com

Ed Suranyi writes, "I finally finished my PhD at UC Davis in 1996. For the last few years I've been working as a software engineer at Etak, in Menlo Park. I was recently promoted to Staff Scientist there."

Candi McCoy lives in Seattle, Washington with her husband. She is a medical director for Immunex, a medium-sized biotech company. Their first child, Sofia, was born in May.

After a long stay in Austin, Reese Faucette is back in the Bay Area, working for Geocast Network Systems.

1985
Leslie Lippard
llippard@sdg.com

Hi folks! Hope you all are well. Those of us who attended our 15th reunion had a wonderful time, sharing stories and speculating about the whereabouts of those of you who were unable to attend. Joe Cheng, Kurt Lemke, Charlie Miller, Gayle Myers and I had a lovely time catching up. All of us showed up without a date, except Kurt, who had two. Joe is working with a start-up, and he and I spoke at length about the capital markets in L.A. and San Francisco; he had a lot of interesting experiences to share. Charlie is interested in space travel and has worked extensively with foundations dedicated to making it available more broadly. Gayle is doing software development, after several years in the military. Kurt is getting married (maybe he is hitched by the time you all read this), and, yes, one of his dates was his fiancée. The class of 2000 was kind enough to schedule Ditch Day to coincide with the reunion, which brought back lots of memories. As I arrived on campus, I spotted a strange contraption that turned out to be a home-brewed mechanical bull, constructed out of a beer keg, some large springs, and a mattress. Several would-be riders were having a fine time trying to conquer the bronco.

I have a long backlog of updates, sent by snail, and e-mail. I had put together a column for publication last May, but it was suggested that I wait until after the reunion to submit it, with some information about that. Unfortunately, I have been very tardy in terms of catching up with that—my apologies.

Mike Barela writes, "I am currently an attaché at the U.S. Embassy in Helsinki, battling the growing problem of protecting embassies overseas. The recent bombings at our embassies in Africa have shown that we have much to do to protect those advancing our foreign policy overseas. Last May, I was presented with a Department of State Meritorious Honor Award for my efforts in this area. Actually, the Finnish language is as much a challenge as the job, a challenge shared by my wife, Traci, and our daughters—Kate, nine, and Laura, five." (4-22-99)

Michael Chwe writes, "After being on the south side of Chicago (University of Chicago) for eight years (!), we're headed for even greater population density—Greenwich Village (I took a joint job in politics and economics at NYU, starting in the fall)." (5-9-99)

Glen Crawford says, "As for us (that now includes 3 kids), we're moving again—to Maryland. I've taken a job with the DOE and am looking to catch up with old friends in the

Baltimore/D.C. area." (8-5-99)

Faye Flam writes that she is living in Philadelphia and working as a science reporter for the *Philadelphia Inquirer*. (4-20-99)

Anirvan Ghosh writes, "I am an assistant professor in neuroscience at Johns Hopkins and am having a blast. I have a lab full of fun, talented people, and we are busily chipping away at trying to understanding how the brain develops. Lee Anna ('86) and the kids (Rhyen, nine, and Akaina, five) are doing well. I have been trying to convince Rhyen that picking football as a career might not be the best plan, but he is convinced that with Montana and Elway gone, there is a real need for some good young quarterbacks. Oh well . . ." (4-28-99)

Paul Graven writes, "I married Susan Carlston from Virginia Beach in September '95. We're living in Palo Alto. We have a 3.5-month-old son, Andrew (our first). I'm working for RB Webber & Co., a small Palo Alto-based management consulting firm specializing in markets and strategy for technology companies. We see a lot of Aaron Roodman and family now that he is a professor at SLAC [Stanford Linear Accelerator Collider]." (7-2-99)

Jennifer Haase writes, "I've got a soccer team here in France. We've got eight out of the ten women working for the company playing on the team and came in fifth out of seven teams." (7-7-99)

Kurt Lemke writes, "I'm currently serving as the director of operations for the Europe, Middle East, and Africa regional office of SAFCO Technologies, Inc. I've been with the company for ten years and live in Oxford, England, where my office is based. The company designs and sells tools and services in the wireless communications industry. Next month, I'll be changing jobs and moving to Helsingborg, Sweden, to work as technical director in a company called ComOpt that we recently purchased. Not married, no kids, no dogs, but hoping to change all three." (4-26-99)

Phyllis Li Rostyus writes, "The company that John and I worked at in Redmond, Washington, sold our group off to another that then got bought by Xilinx, Inc. So we relocated to Boulder, Colorado, and are living here happily with our dog, Fezzik. The change has been drastic but good on the whole, and we now have Big Sky, mountains, and sunshine instead of Big Trees, mountains, and rain." (4-28-99)

Steve Loyola writes, "After spending about 13 years (in two stints) at JPL, I gave it up in January 1999 to concentrate on my own Internet start-up, BestWebBuys.com, of course). Our first Web site, BestBookBuys.com, started as my hobby back in 1997 and has grown to be one of the most popular places on the Web to compare book prices. It has received some pretty good press, including the March 2000 *Consumer Reports* selecting it as one of nine "Web sites that really deliver" and, at the other end of the spectrum, a mention in the April 2000 *Playboy*! BestWebBuys' strategy to take over the world is to build on the success of BestBookBuys.com and roll out many more Best****Buys.com comparison shopping sites. Our team includes a part-time Dave Werntz '86 and, on our board of advisors, attorney Michael Krieger '63. While I'm working most waking hours (and some sleeping ones, too), I enjoy hearing from fellow Techers at the easy-to-remember steve@loyola.net." (4-12-2000)

Brian Mapes says, "It's time to send my address to the Alumni Association so they will stop sending mail to my mother. All is well."

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_____

Day Phone_____E-mail_____

NEWS_____

(6-7-99)

Sean Moriarty writes, "New job, new house, toddler, etc." (7-25-99)

John Morrison writes, "I finished law school at the University of Houston last May, took the Texas bar exam in July, and was admitted to the bar in November. I think that I will try to do some kind of public service, and perhaps a little patent work for myself. I have already filed one provisional application." (3-31-2000)

Karla Peterson writes, "David Sahnaw '84 and I are still in Baltimore. We've been here ever since Caltech. I've been working for the Hubble Space Telescope for seven years and really enjoy it. We've been organizing some get-togethers for local young alums. If you are in the Philly/Balto/D.C. area and haven't heard from me, send e-mail to Peterson@stsci.edu." (7-15-99)

Ketan Shah writes, "After Caltech, I completed an MBA at William & Mary in Virginia. After graduating in 1987, I spent five years working in London, and five years after that in Kenya. I have been back in London since July last year (intending to stay put for now!). I am researching the snacks business here, with a view to starting an own-label ethnic snacks line, subject to availability of capital and a market niche." (4-23-99)

Bill Sharpe writes, "The executive summary on my life is that I've been happily married for over 11 years and have a son, with another child on the way. Professionally, I left grad school after three years, went to med school in New Haven, then went out to Seattle for residency/fellowship. Radiology and nuclear medicine were pretty much no-brainer medical career choices for a geek from Caltech. Having left the Midwest almost 20 years ago to go out to Pasadena, I never thought I'd find myself back here but that's how it ended up. I work in a private practice radiology group in Springfield, Missouri, which is a nice place to live and raise a family. Perhaps only a Caltech audience would understand when I say that I felt like I was leaving science when I left grad school to go into medicine. My life doesn't fit the success paradigm of pure research that was drilled into our heads at Caltech, but for me it's been a good switch because I can use my scientific background in a way that gives personal satisfaction." (4-21-99)

Chris Tiller graduated from Columbia Theological Seminary and received the James T. and Celeste M. Boyd Book Fund Award. I wish I had more data to share—this came from a press release forwarded to me by the Alumni Association. (6-13-00)

Todd West writes, "For the past three years I have been working at Sandia National Laboratories, Livermore, California, in their system studies group. I have a wonderful 3-year-old daughter, Lauren, and my wife, Mary, is doing postdoctoral work at nearby Lawrence Livermore National Laboratories. Life is full and San Francisco is great!" (4-21-99)

Craig Zupke writes, "Since graduating I received my PhD in chemical engineering from MIT. After a postdoc at the Shriners Burns Institute in Cambridge, Massachusetts, and an unsuccessful search for a faculty position, I got a "real" job in 1995, doing small-scale cell-culture process development at Immunex, a biotechnology company in Seattle. My wife, Karyn (formerly Karyn Betzen '86), and I just celebrated our 12th anniversary and have two happy and healthy kids (Paula, almost four, and Peter, nine months). Last year, I began playing volleyball regularly again, but recently ruptured my Achilles tendon playing ultimate Frisbee, so I'm sidelined for at least a few months. I have also been trying to pursue woodworking as a hobby but have not been too successful making time for it. (I am getting a decent collection of tools though). (5-24-99)

Thanks for keeping the cards and e-mails coming. As for me, my son, Nicolas, is two years old now—what a trip he is. I'm still enjoying working as a consultant. My grandmother was visiting us last November when she had a major stroke; that's been a real challenge on a daily basis. I look forward to seeing a few more of you at our 20th reunion!

1997
Emily Chen
emilyc@alumni.caltech.edu

Jun Cai, aka Mike Cai, is now engaged and plans to have his wedding sometime next year.

ShihChing Chu, aka Jenny Chu, reports that she will be graduating from law school in May. She has decided to stay in New York City, where she will be working at the New York Office of O'Melveny & Myers.

Ann Chen will be graduating from Vanderbilt University law school this year and has decided to work in New York as well.

Lin Jia will graduate from the rain, storm, and sleet of Harvard Medical School in June 2001 and will do her residency in internal medicine at UCLA. Before graduation, she will head to Taipei, Taiwan, for a medical rotation and then travel to Hong Kong and Japan for a vacation. She looks forward to returning to sunny Los Angeles and will be happy to hear from her classmates! (ljia@ugcs.caltech.edu)

Personals

1929
CHARLES MORGAN WOLFE, MS, PhD '32, of Coeur d'Alene, Idaho, reports that he last worked from 1957 to 1966 developing geo-physical instruments for detecting Soviet nuclear explosions. Since then he has taken up art, primarily oil on canvas and watercolors. He says that he'll paint anything, but mostly does portraits of his children and grandchildren, not to sell but to give to family and friends. His wife, he adds, has some 50 around the house.

1939
CHARLES E. PETTINGALL writes that he transferred to Caltech after graduating from Pasadena City College, and commuted daily from Burbank with classmates RALPH RUGGIERO, SPENCER OAKLEY, and HAROLD HANCE, who helped buy the gas for his 1932 Ford V-8 hot rod. After graduating he worked for Lockheed, the Federal Power Commission, Southern California Gas, Douglas Aircraft, Hughes, McDonnell Douglas West, and the Jet Propulsion Laboratory. He is now "happily retired in Tucson, Arizona."

1940
ELLIS E. LAPIN, Eng '41, and FREDERIC C. E. ODER, MS '41, have both been selected by the National Reconnaissance Office (NRO) as Pioneers of National Reconnaissance, in honor of the 40th anniversary of the first reception of pictures from space, which occurred "when a CORONA satellite capsule carrying film was caught in midair by an Air Force C-119 aircraft. With this recovery, space photo reconnaissance became a reality."

Lapin "managed the Aerospace Corporation's system design and engineering efforts for Program A imaging satellites, improving flight operations by nearly doubling functional on-orbit time."

Oder, a colonel in the U.S. Air Force, in the late 1950s "directed the nation's first reconnaissance satellite enterprise, the USAF WS-117L (later SAMOS) Program, continuing his career with Lockheed and Eastman Kodak."

The Pioneers were honored on September 27 by NRO director Keith Hall and CIA director George Tenet in a ceremony at NRO headquarters, in Chantilly, Virginia.

1941
ROBERT H. WEIGHT, MS, of Leeds, Utah, retired in September 1983 from the Bechtel Corporation, after 32 years there. He had served as chief civil engineer, assistant manager of engineering, and engineering manager at the L.A. office. "Retirement includes gardening, hiking, horseback riding, and church service." He is married and has six children and 35 grandchildren.

1943
JOHN R. SPENCER writes, "I reside now in the Plantation Valley retirement community (lots of old folks) in Lake Jackson, Texas. My youngest son resides here, and his twin sister lives in nearby Angleton. If need be, help is close at hand."

1949
EMMETT P. MONROE, MS, of Stow, Ohio, reports that he has retired from medical practice, specifically his family practice in Cuyahoga Falls. He remains active in a teaching program for medical students at a local medical school.

1953
ROBERT J. STANTON, PhD '60, spent eight years as a research geologist with Shell Development Company, Houston, Texas, and then 33 years at Texas A&M University, retiring two years ago as the Ray C. Fish Professor of Geology. "Now I've returned home to California. I will be a research associate in the Department of Invertebrate Paleontology at the Los Angeles County Museum of Natural History."

1958
ALLEN KLINGER, MS, writes that he has been appointed a national director of the Tau Beta Pi engineering honor society and has been a professor emeritus in continuous service at UCLA "since 'retiring,' conducting research, attending conferences and workshops and publishing in journals, involved in community and public service, and teaching courses every quarter." "A Pattern Measure," a paper he coauthored with Professor N. Salingaros, appeared in *Environment and Planning B: Planning and Design*, vol. 27, July 2000, pp. 537-547. He has participated internationally in workshops concerned with computer science and has coauthored an NSF report available at <http://cslu.cse.ogi.edu/nsf/wiccs97/report.html>, as well as two other reports, one sponsored by the National Research Council Computer Science and Telecommunications Board and dealing with information-technology literacy.

EDWIN M. PERRIN, MS, of Toronto, writes that he has retired and expects to visit Southern California in 2001.

1963
WILLIAM J. ANDERSON, PhD, of Ann Arbor, Michigan, has retired from the University of Michigan after 35 years in its aerospace engineering department. He reports that he sold his consulting company, Automated Analysis Corporation, to Belcan Corporation on January 2. He has formed a multimedia start-up corporation, Online Training Inc.

1968
BARRY M. COHEN, MS, of Newton Centre, Massachusetts, writes that he has been working as an independent consultant and engineering-software developer for the past four years.

1969
SÉBASTIEN CANDEL, MS, PhD '72, has been a professor at Ecole Centrale Paris since 1978, where he heads aerospace studies and teaches fluid mechanics. During the year 2000 he chaired a governmental panel on research for future supersonic aircraft and was the cochair of the 28th International Symposium on Combustion (Edinburgh). During that same year, he was made a Chevalier de la Légion d'Honneur; awarded the Marcel Dassault Grand Prize by the French Academy of Sciences, for his contributions to aerospace propulsion; and elected a member of the newly created Academy of Technology (the French equivalent of the U.S. National Academy of Engineering).

1979
JOSEPH NILSEN, MS, PhD '82, was elected a fellow of the American Physical Society at the October 2000 meeting of the Division of

Plasma Physics. His election was "for his outstanding contributions to the understanding and development of X-ray lasers," according to the citation. He adds that his work in designing X-ray lasers has resulted in the demonstration of the world's shortest-wavelength, highest-energy experimentally demonstrated laser. "I also discovered the prepulse technique used today to drive virtually all X-ray laser systems." A staff physicist at Lawrence Livermore National Laboratory—where he has been employed since 1977, when he began graduate school at Caltech—he is currently involved in attempting to develop applications for pico-second-driven X-ray lasers.

1980
JAMES C. HERMANSON, MS, PhD '85, associate professor of mechanical engineering at Worcester Polytechnic Institute (WPI), has been elected a fellow in the American Society of Mechanical Engineers (ASME), in recognition of "exceptional engineering achievements and contributions to the engineering profession." Fellow is the highest elected grade of membership within ASME. The recipient of a National Science Foundation CAREER Program grant to study the vaporization of liquid fuels in supersonic flow, Hermanson holds the George I. Alden Chair in Engineering at WPI. He is also the principal investigator for a NASA microgravity combustion experiment on pulsed diffusion flames and a NASA micro-gravity fluid physics experiment on film condensation and heat transfer. He lives in Paxton, Massachusetts.

1983
DENNIS E. MCGEE, PhD, a research technologist with the ExxonMobil Films Business in Macedon, New York, has published a book entitled *Messages from God*. "It is a detailed study that derives a biblical significance for the letters of the Hebrew alphabet. The book is available from Amazon.com."

1985
PRATIM BISWAS, PhD, recently became the first Stifel and Quinette Jens Professor of Environmental Engineering Science at Washington University in St. Louis. Director of the environmental engineering science program of the Washington University School of Engineering and Applied Science, Biswas's research focuses on aerosol science and engineering, air quality and pollution control, environmentally benign synthesis of benign materials, and nanotechnology.

1987
VINEER BHANSALI, MS '87, after receiving his PhD in theoretical physics from Harvard, worked as a derivatives and bond trader at Citibank, Salomon Brothers, and CSFB. He has recently moved to Newport Beach as executive VP and head of analytics at PIMCO, the largest fixed-income money manager. "Please send me an e-mail if this reaches old friends!" His e-mail is bhansali@pimco.com.

1992
DAVID K. KIM has finished medical school and is working at a medical software start-up in Seattle. He flies airplanes in his spare time.

1999
LU SUN, MS, has been hired by Teradyne, Inc., Agoura Hills, California, as a software engineer.

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Keep us informed so we can keep your fellow alums informed! If you're a Caltech graduate who received your MS or PhD from the Institute, or an undergrad alum who doesn't yet have a Class Notes agent, the *Personals* is the place to let us know what you've been doing. Send us news about you and your family, about a new job, promotion, awards—anything you'd like to see printed in the *Personals* section of *Caltech News*.

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NEWS_____

O b i t u a r i e s

1929

JAMES W. DUNHAM, of Los Alamitos, California, on November 26, 2000; he was 92. After graduating from Caltech he served with the Army Corps of Engineers, and with the outbreak of World War II he was ordered to active duty. He served in Europe for three and a half years in the Engineering Supply Service program. Following the war he continued in the Army Reserve, eventually retiring as a lieutenant colonel. In 1946 he was placed in charge of the L.A. Engineering District's new Beach Erosion Unit, preparing reports on harbor and shore erosion problems from the Mexican border to Santa Barbara. His reports resulted in the construction of several new harbors, and he received the Corps' Meritorious Service Award. He retired from the Corps in 1953 and joined the firm of R. M. Parsons, for whom he worked on projects at home and abroad, and in 1958 he was appointed chief engineer of the state of California's new Division of Small Craft Harbors. In 1960, he joined the firm of Moffat and Nichol Engineers, in Long Beach, California, and while with them authored important manuals on small-craft harbors and low-cost shore protection. A registered professional engineer, he was a fellow of the American Society of Civil Engineers (ASCE), a military member of the American Society of Military Engineers, and a member of the National Society of Professional Engineers and of the American Shore and Beach Preservation Association, serving as Vice President, West, of the latter for a time and organizing that association's California section. A year after retiring he received the ASCE Moffat and Nichol award for outstanding coastal engineering service. He is survived by Barbara, his wife of 63 years; two sons, Douglas '60 and David; and two grandchildren.

1931

RICHARD J. BARNETT, of Ojai, California, on June 18, 2000; he was 91. A third-generation farmer in the Temecula Valley, he had owned a service station in La Cañada, California, and been a past president of the Elsinore School Board and a member of the Temecula School Board in the 1930s and '40s. Built in 1932, the home of Barnett and his wife became the Senior Citizens Center in Temecula; it was finally torn down in 1999. Predeceased in 1977 by his son Robert and in 1999 by his wife, Virginia, he is survived by two sons, Richard and Philip; a daughter, Barbara; and 12 grandchildren and 19 great-grandchildren.

ROBERT G. SMITH, of Friendswood, Texas, on May 11, 2000. He is survived by his wife, Bernice; a son, Gary; two sisters, Martha Thomas and Kathryn Gunter; and five grandchildren and two great-grandchildren.

1936

VICTOR V. VEYSEY, of Hemet, California, on February 13; he was 85. After graduating from Caltech he went on to receive his MBA in industrial management from Harvard Business School in 1938. He taught at Caltech for 11 years, then moved to Brawley, California, in 1949 and began farming on his family ranch site just north of Brawley. In 1961 he was elected to the state assembly, representing the Imperial Valley and other southern regions. He was a U.S. congressman from 1971 to 1977, and remained in Washington an additional year, serving as assistant secretary of the army. Returning to Pasadena in 1978, he became director of the Industrial Relations Center at Caltech, and in 1983 he was appointed director of industrial relations in the cabinet of Governor George Deukmejian. After retiring from his

political career he returned again to Pasadena, this time as director emeritus of the Industrial Relations Center. During his years in the Imperial Valley he served on the board of trustees of the Brawley Elementary School District and, in 1957, started the efforts to establish Imperial Valley College in its present location; with its establishment in 1959, he was elected founding trustee. He served as president of the California Beet Growers Association, District 9, and was active as a Rotarian and in the 4-H and Boy Scouts of America. A lover of music, gardening, and sailing, he was also an accomplished potter. He is survived by Janet, his wife of 60 years; a daughter, Ann; three sons, John, Tom, and Mark; and nine grandchildren and five great-grandchildren.

1940

MARION E. HINES, BS '41, MS '46, of Boston, on August 19, 2000; he was 81. An authority on microwave theory and techniques, he had been chief scientist at M/A-COM. After serving in the Army Air Forces during World War II, he performed research on microwave tubes and solid-state power-generation devices for Bell Labs from 1946 to 1960. He then joined Microwave Associates, later M/A-COM, where as vice president of research and then as chief scientist he developed harmonic-generator microwave sources, high-power signal-control devices, and solid-state microwave oscillators and amplifiers that had applications in radar and wireless communications. Upon his retirement in 2000, M/A-COM established in his name an award for technical innovation. He is survived by his wife, Julie; two sons, Sheldon and Julian; a daughter, Hadley Chianese; two brothers, Laurance and C. Lee; and three grandchildren.

1944

RICHARD BURL SULLIVAN JR., MS, of Shreveport, Louisiana, on January 7, 2000; he was 78. A member of CAVU, a group of students who in 1944 received certification after completing an accelerated training program in meteorology, and who referred to themselves as Ceiling and Visibility Unlimited, he was retroactively awarded a master's degree in meteorology. He served as a meteorologist and an air-traffic controller in the Army Air Forces during World War II. Following the war, he returned to Shreveport and entered the oil business; he also taught geology at Centenary College and was director of its evening school. He worked for Sun Oil Company in Dallas and Houston from 1959 to 1977. He then went back to Shreveport, retiring in 1983 from Sun Exploration and Production Company and becoming an independent geological consultant. He was a member of numerous geological societies, a past president of the Centenary College Alumni Association, and a member of East Ridge Country Club and St. Paul's Episcopal Church. Predeceased by his wife, Clarisse, he is survived by two daughters, Gale Howell and Clare Towerly; a son, Richard Burl III; and two grandsons.

1945

STANLEY D. CLARK, of Claremont, California, on September 12, 2000; he was 75. After graduating from Caltech he received his law degree from Loyola University Law School and practiced in San Marino, where he lived until 1974. A junior tennis champion in his youth, he founded the San Marino Tennis Foundation. He also founded the Claremont Tennis Club. He is survived by his wife, Susan; three children from his first marriage, Stanley, Kevin, and Geoff; and six grandchildren.

First light, endless care



On the back-page poster, viewers get a glimpse of the Hale Telescope as its 200-inch mirror receives its annual-to-biennial realuminization. The aluminum film, scarcely a hundredth the width of a human hair, has degraded due to exposure to the elements and no longer reflects as it did when deposited just a year ago.

Above, Palomar Observatory superintendent Bob Thicksten and his crew bathe the 14-ton mirror—the first step in a process that includes four hours of washing, gently rubbing with an acid bath to remove the aluminum, rewashing, rubbing the surface with potassium hydroxide, rewashing, patting down the surface with 200-proof ethyl alcohol, and then sealing the mirror in a giant “bell jar,” or vacuum chamber, for the actual aluminizing process to begin. Once all the air is pumped out, employees fire off 350 tungsten filaments coated with pure aluminum in the roof of the bell jar one by one. This process, dating to the original design of the telescope in the 1930s, acts something like a perfume atomizer to deposit an extremely smooth coating over the entire surface.

When Palomar Observatory was dedicated in the summer of 1948, the Caltech facility instantly became the preeminent astronomical observatory in the world and its 200-inch Hale Telescope the world's leading astronomical instrument—until the Keck Observatory opened about a decade ago.

Soon after it was commissioned, the Hale Telescope was responsible for revolutionizing the cosmological distance scale and, in later years, was used to better describe the evolution of stars and to establish the optical basis of quasars. It was the first telescope to be used to study infrared sources—still a major emphasis of Palomar research and still a furiously active area in both space- and ground-based research programs—and currently is used to aid in the studies of galactic structure and gamma-ray bursts.

1947

PETER SWERLING, of Pacific Palisades, California, on August 25, 2000; he was 71. A mathematician who became an expert in radar and stealth technology, he was an analyst for 13 years at the RAND Corporation. He later headed his own companies and in 1960 coauthored “A Statistical Theory of Target Detection by Pulsed Radar.” He founded Technical Service Corporation in 1966 and was president for 16 years; he then formed Swerling, Manasse & Smith. He also taught at the University of Illinois and later at USC, and he was a founder and trustee of the Crossroads School, in Santa Monica. He entered Caltech at the age of 15 and may have been inspired to go into mathematics when his father, screenwriter Jo Swerling, arranged for the boy on his 10th birthday to meet Albert Einstein, who advised him to pursue mathematics and remember “important things,” like baseball. The younger Swerling followed that advice not only by excelling at math, but by spending his free time hang gliding, bodysurfing, memorizing Shakespeare, and listening to Wagnerian opera. He is survived by his wife, Judith; three children, Elizabeth, Carole, and Steven; his brother, Jo Swerling Jr.; and six grandchildren.

1950

HARVEY L. PASTAN, MS, of Chestnut Hill, Massachusetts, on September 12, 2000. The holder of 18 patents, he helped found two instrumentation companies and was a project leader in the MIT aerophysics research group. He went on to become a vice president of Arthur D. Little, Inc., the consulting firm, and manager of its electronic systems section. He is survived by his wife, Barbara; two daughters, Jeanne Weber and Nancy Gold; four grandchildren; a sister, Patricia Manuel; and a brother, Robert.

1957

JOHN C. UHTHOFF, MS, of Qualicum, British Columbia, on May 28, 2000; he was 79. After working for Avro Canada on the Arrow aircraft project, he rejoined the Royal Canadian Air Force as a liaison officer to the German air force. In later years he worked at NASA

and also for a time in South America. He was an avid skier, sailor, fisherman, and golfer. He is survived by his wife, Joy, and his sons, John and Michael.

1976

JAMES R. YOUNG, MS, PhD '82, of Altadena, California, on February 13; he was 49. After receiving his doctorate in environmental engineering science, he joined Environmental Research & Technology, Inc., a consulting firm in Newbury Park, California, working as both a senior scientist in the environmental chemistry division and a manager of information technologies. In 1989 he moved to Southern California Edison as a senior research scientist in the environmental research group within Environmental Affairs (EA). Much of his initial work focused on aerosol issues in the L.A. basin, global environmental issues, and air and water quality; he managed several major research efforts related to climate change and provided technical expertise to policy developers at the corporate level and internationally. Beginning in 1996, he assumed the role of EA's manager of research and emerging issues, with responsibility for coordinating responses to strategic environmental research needs and establishing methodologies to screen, assess, prioritize, and manage environmental issues facing the company. A wine connoisseur, he enjoyed traveling and opening his home to colleagues and friends for good food and conversation. He is survived by his wife, Beatrice; his mother, Bernice; and a sister, Jennifer Barnhill. Although a quadriplegic due to an accident, spending the last 28 years of his life in a wheelchair, including his years at Caltech, “Jim's drive and spirit were in no sense diminished by his mobility impairment, indeed he was an inspiration to all who were fortunate enough to know him.” A memorial fund has been established at Caltech to provide extra resources and equipment for handicapped students. Those wishing to contribute should write to the James R. Young Memorial Fund, 105-40, Caltech, 1200 East California Boulevard, Pasadena CA 91125.

