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Christine Shirley welcomes visitors to the Hale Observatory—a historical landmark in her own back yard.

Hale Observatory owners share their treasure

By Winifred Veronda

Not everyone would want to buy a home with a solar observatory in the backyard — and one slated to become a national historic landmark, at that. But William and Christine Shirley have found their ownership of the Hale Solar Observatory to be a fascinating experience, and the environment one they're happy to share with community groups interested in the history of science.

The Shirleys were living in Bradbury in 1984, and were looking for a home closer to William Shirley's construction business in Pasadena. They saw the observatory property at 740 Holladay Road listed in the newspaper, and were immediately fascinated with the idea of owning it. Christine Shirley, a former teacher at Los Angeles High School, is keenly interested in the history of the area and would soon become a fan of 20th-century science. William Shirley's profession would make it easier to perform needed restoration on the building. Its previous owner was the Carnegie Institution of Washington, whose personnel had considered demolishing the observatory, doubting that anyone would buy it.

So the Shirleys, members of the President's Circle of The Associates, became the new owners of a 21-by-49-foot building with a south-facing dome that isn't much higher than the homes and white oaks near it. Set among hedges and trees on the back of a deep lot on a quiet residential street, it is easy to miss. Near the property on the southeast are the grounds of the Huntington Library. Hale purchased the land for the observatory from his friend, Henry Huntington. The Carnegie Institution of Washington provided the funds.

The year was 1924, and Hale was becoming director emeritus of Mount Wilson, where he had led the work for two decades — from 1904 to 1923. During his lifetime, Hale built the world's largest telescope four times: the 40-inch at Yerkes Observatory, the 60-inch and then the 100-inch telescopes at Mount Wilson, and finally the 200-inch telescope at Palomar Observatory.

In the new solar observatory, Hale could continue his research on the nature of the sun. But the building reveals more about Hale the man than his role as a scientist. A man of broad cultural, humanitarian, and architectural interests, Hale was not only interested in the sun from a scientific perspective, but also in how different cultures perceived it. He was particularly interested in Egyptology. At the University of Chicago, Hale had known James H. Breasted, the great Orientalist. He had visited Egypt, where he noted that the Egyptian calendar was based upon the solar cycle. Hale had even been present at the opening of King Tut's tomb.

Evidence of his fascination with the sun — and with things Egyptian — is evident today in the observatory library, where a bas-relief of the Egyptian pharoah Ikhnaton appears above the fireplace, the pharoah rising in his chariot toward the sun. Above the entry door, a motif depicts the sun with each of its rays grasping symbols, among them the ankh, which represents eternal life.

The library was the intellectual center of the structure, the place where Hale met with such luminaries as Albert Einstein, the astronomer Edwin P. Hubble, and Harold and Horace Babcock, the father and son who, in their turn, succeeded Hale (after Walter Adams) as director of the Mount Wilson Observatory. The woodwork, ceiling beams, and carved corbels of this room are original and untouched, according to Shirley. The library shelves once contained Hale's

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FRIENDS

The Mauna Kea golf course created an ideal setting for members of The Associates to view the eclipse.

Grant supports Benzer research

Seymour Benzer has received a three-year grant of $150,000 from the McKnight Endowment Fund for Neuroscience, to support his research into the neurogenetics of degeneration in the drosophila brain. Benzer, who is the James G. Boswell Professor of Neuroscience at Caltech, will use the funding to investigate the genetic and physiological factors involved in the premature degeneration of nerve cells and related tissues in the brain of the drosophila, popularly known as the fruit fly. In addition to illuminating the fundamental relationship between genes, brain dysfunction, and early senility in a highly regarded animal model—the fruit fly—this work may, over the long term, lead to a better understanding of the specific mechanisms involved in such human disorders as Alzheimer's disease.

The McKnight Awards in Neuroscience were established 14 years ago by the McKnight Foundation of Minneapolis, to stimulate innovative research that may improve understanding of the basic mechanisms of memory and the disorders that affect it. Benzer is one of ten researchers to receive a grant this year under the McKnight Awards for Research Projects program, which is "intended to support investigative programs of outstanding quality involving established neuroscientists." Collaborating with Benzer on the project is Robert Buchanan, Caltech research fellow in biology.

Benzer is widely known for his pioneering studies in neurogenetics—how information in the genes controls the development and function of the nervous system to produce behavior. He has carried out a great deal of this research on the drosophila—an insect that despite its apparent simplicity displays a fairly complicated repertoire of behaviors, including distinctive courtship, eating, learning, and circadian-rhythm patterns. Many of the drosophila genes that Benzer and colleagues have uncovered in fruit flies appear to have similar counterparts in humans, which has opened the way for applying some of the knowledge obtained from the drosophila to studies of how the human brain and nervous system develop, function, and malfunction.

Associates group in Hawaii thrilled by eclipse

The site was carefully scouted ahead of time, and everyone agreed that the location was wonderful. The weather was perfect, the hotel was the Mauna Kea Beach, and 82 members of The Associates had a splendid view of the eclipse from the Mauna Kea golf course on the island of Hawaii.

The trip was booked to capacity. Providing expert insight into the dramatic event were Marcia Neugebauer, senior research scientist at JPL, and Edward Stone, vice president of Caltech, director of JPL, and professor of physics. Both gave guidance as to what to look for when the eclipse occurred, what visual precautions to take, and even what sort of film to use. The team presented a lecture afterward. Joining the group as participants were Caltech President Thomas E. Everhart and Mrs. Everhart, and William M. Keck II and Mrs. Keck.

Two days after the eclipse, the 82 visitors made the long drive up the Mauna Kea volcano to visit the W. M. Keck Observatory and the Caltech Submillimeter Observatory. The facilities had been reserved for scientists during the day of the eclipse and for several days prior to it. The Caltech visitors, members of the first group allowed to visit after the reserved period, toured the observatory and looked at the instruments. "This was the high point of the trip," said one visitor, "the opportunity to be in an environment where people are viewing the universe."

One member recorded the experience with a video camera, and requests for copies were prolific. Clearly, this was a trip that members of the President's Circle of The Associates wanted to remember.

Mellon grant supports EQL research

Caltech has received a grant of $323,000 from the Andrew W. Mellon Foundation, to support research into the distribution and dynamics of groundwater pollutants. The work will be carried out at the Environmental Quality Laboratory (EQL), under the direction of Norman Brooks, the James Irvine Professor of Environmental and Civil Engineering, EQL director, and Caltech's executive officer for environmental engineering science.

The gift from the Mellon Foundation follows an initial $300,000 grant that the foundation made to the EQL in 1988. According to Brooks, the funding will enable the laboratory to follow up promising avenues of study initiated under the first grant, and to expand research under way into new areas.

The goal of the EQL project is to deal with the behavior of water pollutants in natural systems, through an integrated consideration of physical, chemical, and biological processes. The researchers' focus will be on investigating fundamental processes in well-controlled laboratory experiments, supplemented by conceptual simulations and computer modeling. Their overall aim will be to contribute to the storehouse of knowledge needed to establish effective procedures for prevention, risk assessment, and remedial actions for control of groundwater pollution.

In addition to continuing the work that was initiated with the support of the first Mellon Foundation grant, Brooks and his collaborators plan to expand their research into two related areas: the contamination of stream beds, and the behavior of metals in bodies of water.

Working with Brooks on this EQL project are three Caltech professors: James J. Morgan, the Marvin L. Goldberger Professor of Environmental Engineering Science; Mary E. Lidstrom, associate professor of applied microbiology; and E. John List, professor of environmental engineering science.

Gifts by will

Trusts and bequests provide welcome support to Caltech's operating and endowed funds. Recent gifts received by the Institute include:

Jane C. Fitzpatrick—A portion of Jane Fitzpatrick's estate, amounting to $344,368, has been directed to the Institute to establish the Anna Mangan Fitzpatrick Fund for Student Loans. The donor was a friend of the Institute.

Clyde L. Blohm—A distribution of $89,397 from Mr. Blohm's estate has come to the Institute as unrestricted funds. He was a 1930 graduate in chemistry.

Vera G. Hargrove—The Hargrove estate has distributed to Caltech $241,465, which has been designated to provide scholarships. Mrs. Hargrove was a friend of the Institute.

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

Whittier Foundation boosts geophysical observatory

Caltech has received a grant of $990,820 from the L. K. Whittier Foundation of South Pasadena to expand the Whittier Advanced Geophysical Observatory, a network of seismic stations designed to speed and enhance the collection, analysis, and interpretation of seismic data from earthquakes throughout southern California.

The grant is the second major gift for the TERRAscopa. In 1989, the Whittier Foundation gave Caltech a similar gift to support the upgrading of the observatory's prototype station in Pasadena, and the construction of four stations in Goldstone, Pinon Flats (jointly operated with the University of San Diego), Lake Isabella, and Santa Barbara. The new grant allows for the construction of three additional stations. They will be located in carefully selected sites that, when electronically linked to the existing stations, will greatly increase the observatory's ability to provide regional coverage of earthquakes.

Each station in the Whittier Advanced Geophysical Observatory consists of a broadband, high-dynamic-range digital seismometer, serviced by high-speed computers. Ultimately all the stations will be linked to one another via satellite telemetry. (Some of the stations will be equipped with receivers for the Global Positioning Satellite network.) Collectively, the observatory's existing five stations, and the three new ones, will constitute a significant portion of Caltech's 12-element TERRAscope—a terrestrial telescope that will peer downward, providing data and images of the tectonics, crust, and mantle beneath southern California. The TERRAscope was conceived and designed by Caltech's Seismological Laboratory, which also oversees its operation.

The Whittier Advanced Geophysical Observatory and the TERRAscope, of which it will be a part, operates on principles similar to those of a telescope, but instead of collecting light rays, it collects seismic waves produced by earthquakes. Using sophisticated methods of extracting information from seismograms, the observatory stations— operating in tandem—will routinely provide a wealth of information that now requires months of specialized study. They will supply seismic data of exceptional quality during earthquakes of all magnitudes and locations, and will provide almost instantaneous information on earthquake locations and orientation, the stress of faults, and the extent of ground breakage. Caltech's library of seismograms, which spans the past 60 years, will be digitized and made part of TERRAscope's data base, allowing scientists to compare the shaking patterns of previous quakes with those of a new event while it is happening.

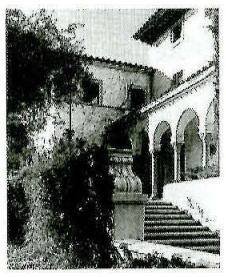
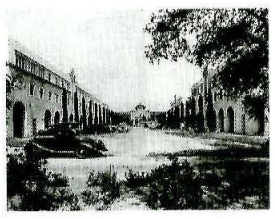
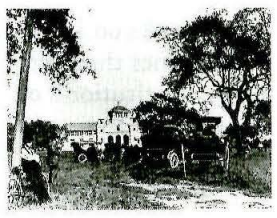
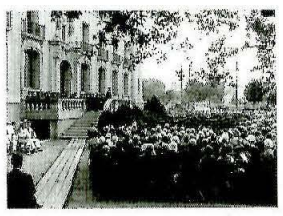
Robert Schultz joins Caltech Board of Trustees

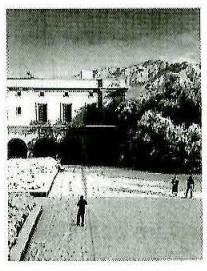
Robert J. Schultz, vice chairman of General Motors Corporation, has joined the Board of Trustees of Caltech. Schultz, who assumed his current position with GM and joined its board of directors and its finance committee in August 1990, is a graduate of Michigan State University, where he earned his undergraduate degree in mechanical engineering and his master's degree in business administration. A native of Lansing, Michigan, he started at GM in 1955, after serving in the U.S. Air Force.

Prior to becoming vice chairman of GM, he had served as an executive vice president since February 1989. His present responsibilities include management of GM Hughes Electronics Corporation (GMHE), Electronic Data Systems Corporation (EDS), GM's Technical Staffs, and Corporate Information Management. In addition, he serves as GMHE's chairman, president, and chief executive officer.

At 61, Schultz is a member of the Society of Automotive Engineers, the national administration honor society Beta Gamma Sigma, and the Michigan State University Fund Board of Directors.

Centennial Notecards



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Pfeiffer grant backs molecular biology research

Caltech has received a grant of $120,000 from the Gustavus and Louise Pfeiffer Research Foundation, for the support of four research groups in molecular biology.

Cell biology is the study of the cell, the fundamental unit of all living plants and animals. To understand how cells specialize and cooperate in multicellular plants and animals, both the internal working of the individual cells and also the interactions of cells in complex systems must be understood. Increasing knowledge in this area is leading to a new understanding of the causes and potential treatments of previously incurable diseases, one of which is cancer. Caltech has long been a leader in basic biomedical research in this area.

The first group to receive funding from the foundation will be headed by Judith L. Campbell, professor of chemistry and biology, whose work concerns the molecular mechanisms that regulate chromosome replication and cell proliferation. William G. Dunphy, assistant professor of biology, will head the second group, which will focus on the other major regulatory event in cellular division, mitosis, during which replicated chromosomes are transmitted to the two cells that have divided from the original one during the division process.

Scott D. Emr, associate professor of biology, will concentrate on the basic molecular mechanisms in complex cells, mechanisms that segregate distinct and often competing biochemical reactions into distinct subcellular compartments, called organelles. Jean-Paul Revel, Albert Billings Ruddock Professor of Biology, will head the fourth project. His work is involved with cell-cell interactions rather than individual cell function. He focuses on specialized membrane structures, called gap junctions, that function in cell-cell communication by forming continuous aqueous channels between neighboring cells.

Hale Observatory

Continued from page 1

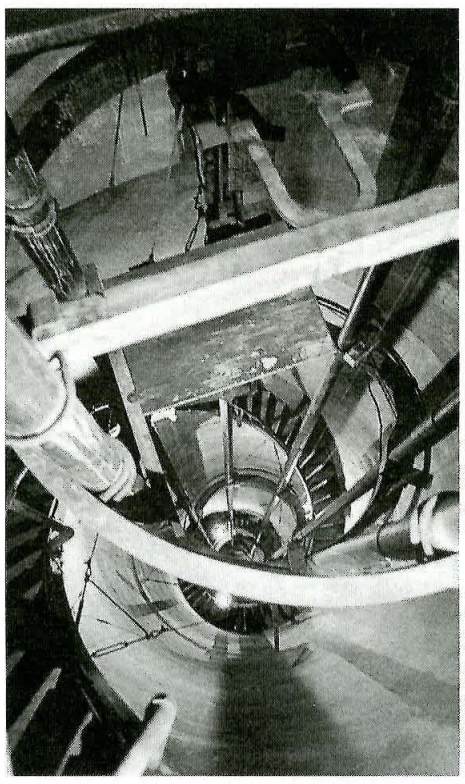
collection of books on the history of science— volumes that were housed at the Carnegie Institution's office in Pasadena and now are in the Huntington Library.

It was in this room that Hale worked on the design for the 200-inch Palomar reflector, usually called the Hale Telescope, at Palomar Mountain. The telescope was designed in 1928 and completed in 1948, ten years after Hale's death.

But as the years went by, the solar observatory, once a distinguished center of scientific activity, fell on hard times. The Carnegie Institution, to whom Hale had left it, ran out of funds to maintain the now outmoded facility. Carnegie officials instead wanted to put money into new scientific facilities at Las Campanas in Chile.

One alternative considered was to level the lot and fill in Hale's specially designed, concrete-lined, 76-foot-deep pit under the lab that was used to reflect images of the sun from the dome back up to the equipment in the basement. Taking the place of this scientific environment would have been recreation facilities for the staff of Carnegie's Pasadena branch. But instead, the property was put on the market and acquired by its eager buyers, the Shirleys.

William Shirley's abilities to mastermind restoration projects were much in need. Years earlier, an article in the *Los Angeles Times* had described a thick layer of dust, along with cobwebs, rust, and mustiness. By the time the Shirleys purchased the property, conditions had gone further downhill. For more than ten years, the building had been empty, unused, and vandalized. The windows and window frames were broken. The pit had been used by high-school students for initiations,



Nearly 100 steps spiral down the concrete walls of the 76-foot pit beneath the observatory.

and some scientific equipment had been removed by intruders.

The Shirleys' first project was to plan their own home. They considered converting the observatory for this purpose, but such a step was clearly impractical. The structure contained no kitchen and only a half bathroom. And besides, they wanted to preserve it for future use as a possible museum.

In a parklike area northwest of the observatory on what had been lawn, they constructed a 2,000-square-foot classical-style home, a structure that faced the driveway and allowed for a clear line-of-sight from the street to the historic building. Preserved were the sycamore trees that flank the observatory entrance, and the loquat trees and arbutuses that surround it, as well as citrus trees in the parking court behind dwarf myrtis hedges, and toyon by the parkway.

Even while constructing their own home, the Shirleys sandblasted and painted the outside of the observatory, and rebuilt and reglazed the windows. They retained the original mahogany doors, and the cast-stone bas-relief from a Theban tomb that is set above them. Then they removed the original red roof tiles, repaired the roof, and replaced the tiles. Next, they cleaned and painted the library and restored and waxed its wood, including massive bookshelves set into shallow depressions in the walls. They also cleaned the workshop and began repairs on the generators and other equipment in the basement that was used to rotate the dome when experiments were conducted.

In the foyer, they placed a removable counter over the opening where the sun's image — reflected by special highly refined mirrors in the dome — passed through to mirrors and recorders in the basement. The Shirleys, who are continuously involved in restoring the observatory, intend to restore all the scientific equipment from dome to pit so that the scientific history of this unique facility can be retained intact for interpretation to guests.

A proud hostess, Christine Shirley shows a guest the dome room, up the staircase on the east side of the entry, and beyond that, up a ladder to the original equipment that guided the rotation of the dome. The dome's movements made it possible to follow the movement of the sun, and to make accurate measurements. Shirley points out two big mirrors that need restoration. Helping with the restoration of the dome's mirror system and of the motors necessary to run it has been David Thompson, a retired member of Harold Zirin's team of solar observers at Caltech. The Shirleys' goal is to complete restoration of the system of mirrors so that it can once more be used to obtain an image of the sun. The dome is a popular napping place for the Shirleys' cat, Archie.

At the opposite pole of the observatory is the basement well room, containing the spectroheliograph that Hale invented. Work in spectral analysis at the observatory and at Mount Wilson resulted in the identification of more than 70 elements in the sun. Many glass plates, used in photographing solar spectra, still remain in the observatory. Other remnants of the structure's proud heritage are Hale's journal collection and lantern slides.

Thanks to the Shirleys' pleasure in sharing their scientific treasure, community groups frequently use the observatory for meetings. A group of 150 members of The Associates met there, as did members of the Associates of the Los Angeles County Museum of Natural History, members of the Mount Wilson Observatory Association, and board members of the Pasadena Hall of Science and the Pasadena Playhouse. Groups of teachers also have visited the observatory, and Shirley hopes to develop programs that will attract school children.

Are there any drawbacks to owning a historic landmark? None that Christine Shirley can think of. "All the aspects that I can think of are enhancing," she says. "We love the building. Everything fits together so well — the library, the laboratory equipment, the total environment. It's all challenging and stimulating. The elements all pull together and give the place a power and a purpose. Hale was an unusually well-rounded individual. He wanted a person to be enriched by his surroundings, and he succeeded remarkably here. But then, I'm a fan of George Ellery Hale."

Mrs. Shirley displays an off-axis paraboloid mirror, the beginning of a focusing system that will make it possible to project an image of the sun that visitors can view.

Pasadena Symphony salutes Caltech

The Pasadena Symphony Orchestra will salute Caltech in a special concert at 8 p.m. on Saturday, October 26, commemorating the Institute's Centennial year. The concert will be held in the Pasadena Civic Auditorium, 300 East Green Street, and will feature *The Planets,* an orchestral suite by Gustav Holst. The composition contains six sections, each focusing on a specific planetary body. Richard J. Terrile, an astronomer in the earth and space science division at JPL, and group supervisor for the planetary astronomy group, will give a modern perspective on the planets in a presymphony lecture at 7:30. Sunney Chan, Centennial Committee chairman and professor of chemical physics and biophysical chemistry, will represent Caltech.

Director Jorge Mester will open the evening with Beethoven's Leonore Overture No. 3. Mezzo-soprano Kimball Wheeler (Mrs. George Mester) returns to her native Pasadena for the concert to perform songs by Richard Strauss.

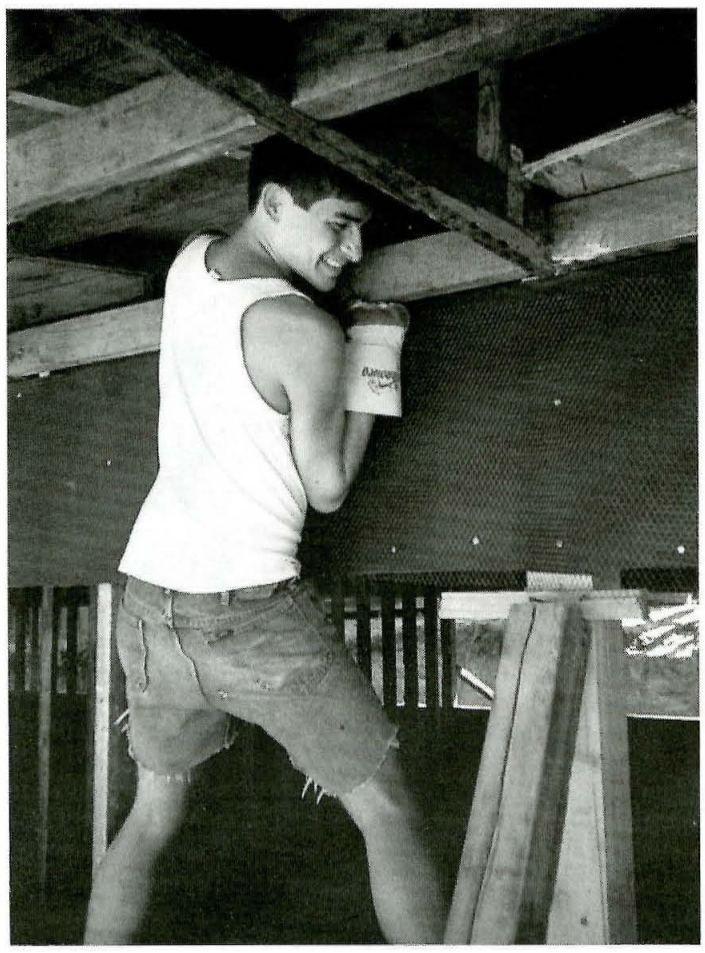
Tickets for the event will go on sale in early October; for information, call 818/449-7360. Those with student identifications will be admitted for $7. Prices for others are $12.50, $22.50, $25.00, and $32.50.

An all-campus noontime birthday party along the Olive Walk, in honor of Caltech's Centennial, is scheduled for November 1. The Caltech Jazz Band will perform.

Edward Stone receives National Medal of Science

At a ceremony in the White House Rose Garden, Edward C. Stone, Caltech vice president, director of JPL and professor of physics, was among 20 U.S. scientists to receive the National Medal of Science from President Bush on September 16. Stone's award was for his leadership as a project scientist for the Voyager mission and its experiments in the outer solar system.

Four other Caltech people received medals at the ceremony—Folke K. Skoog (BS '32, PhD '36) and H. Guyford Stever (PhD '41), the Medal of Science; James Duderstadt (MS '65, PhD '68) and trustee Stephen D. Bechtel, Jr., the National Medal of Technology.



Daron Standley installs tar paper as part of a Caltech Y project to help build a community center in Tijuana.

Students build—and grow—in Tijuana

By Winifred Veronda

A barren, steeply sloping hillside in southeastern Tijuana is home to 80,000 squatters who are part of that city's burgeoning population. The hillside community, with little electricity and scant water supplies, is called Mariano Matamoros, and, at a YMCA project located in the midst of it, Caltech students are learning valuable lessons not available to them at the Institute.

The students are participants in a project conceived by Caltech Y executive director Lucy Guernsey to help them discover another culture, as well as contribute to an important work. On a United Way field trip to Tijuana in 1990, Guernsey met Oscar Oscalada from Tijuana, who had fashioned an ambitious program to help residents of Mariano Matamoros through the YMCA he directed.

The first group of students went down during spring break, and groups returned twice during the summer. The Y plans to make the work in Tijuana an ongoing project, and to return with small groups at regular intervals. Each group will contain some repeating workers and some new participants—giving as many people as possible the chance to share in the experience.

Riki Moilanen organized the first trip and got her father interested in what Oscar Oscalada and his coworkers were doing in Mariano Matamoros. Her father, who is in construction work, and his brothers donated a station wagon, and took down a truck heaped with building supplies, appliances, and other commodities, to be used or sold.

In the Caltech Y offices, several participants in the project described their experiences and what they had gained from them.

In Mariano Matamoros, they had slept in a home for migrant children, young people from Mexico and Central America who had become separated from their families while attempting to enter the United States illegally, and found themselves on the streets of Tijuana with no resources. The staff of the migrant home makes attempts to reunite them with their families, and succeeds in 75 percent of the cases, said Daron Standley. One 15-year-old left to join his family while the group was staying there.

The students' initial contribution to the Y project consisted of manual labor —construction work on a community center being erected on a muddy, slippery slice of precarious hillside. "We were relieved that we could delve right in, go to work, and get our hands dirty," says Mike Clemens. "We didn't want to wait around a day getting oriented."

"No one asked, 'What effect will this work have on my grade curve?' " Dan Sandoval interjects, "and this was nice for a change. Caltech students tend to ask, 'What's going to be my contribution to science,' not, 'What can I do to help humanity?'"

"We didn't see how a community center could ever be constructed on that site," adds Mike Clemens. "But it's up now, and filled with people coming to programs."

"The work was extremely rewarding," says David Liney. "Knowing that we were doing something immediately beneficial gave us a kind of satisfaction that one doesn't get from classes."

"The differences in culture were evident right away," contributes Daron. "The people live with much less than we do, and they don't have any luxuries. They're also much more religious than we are. They're thankful for everything good that happens to them, thankful for every meal."

"A lot of them lead rich lives, in spite of being so poor," Daron continues. "They laugh and have a lot of fun together. They enjoy their families. Some of them have happier lives than we do. That made me wonder about my priorities.

"We learned something from these people that we couldn't have learned in books, something we couldn't have learned in an ethics course. In two days there, I learned more about values and about how it's possible for people to make a difference, than I would have learned in all my time at Caltech. After watching the YMCA staff dig in and go to work, I'll never again say that there's no hope for a situation. My attitude's going to be, 'Give it a try.' If you try, you can always do a lot to help."

Daron Standley helps lay the foundation for the Tijuana YMCA.

"It was great to see these people at the Y doing good things as if it were second nature," adds Dan. "They were a real inspiration to us. The experience changed me pretty drastically. It raised a lot of questions about what I want to do with my life. I know now that I want to dedicate it to a project like this."

"I'll definitely want to do more of this kind of thing," says Mike. "I believe the other people who went down feel the same way."

"At Caltech," Daron adds, "there's a lot of concern among students that they might not ever have an impact, because their work is going to be so specialized. The great thing about this project is that it goes right to the heart of the matter in terms of meeting serious needs.

"We were impressed because everyone who went down feels pretty much the same way we did about the experience," he continues. "We believe that

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YMCA project

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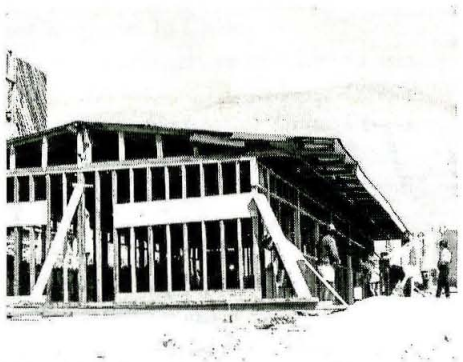
anybody who goes will react the same way. Caltech tends to be pretty narrow in the perspective it gives. This project helps to broaden that experience, and to provide a look at another kind of life."

The community center, which the Caltech students helped make a reality, will offer preschool and partial day care, with educational services for children. These services will enable single mothers to hold jobs. The center will also provide family counseling, literacy classes for adults, and health and hygiene classes (with instructions in boiling drinking water, washing and disinfecting fruits and vegetables, and personal cleanliness). Cooking classes, which teach the use of inexpensive and



The structure for a community center in Tijuana that Caltech Y students helped to erect.

nutritious foods, also are a part of the program.

In addition, the Y offers camp programs for orphans and children from lower economic classes, and a recreation center.

"One of the most helpful things we did," Mike believes, "was to give the people there a look at a different kind of person from the United States than the ones they usually encounter. They tend to either idealize the U.S., or to have negative stereotypes, based on the border patrol and the students who come down to party."

Conversely, points out Daron, the trip revealed a different side of Tijuana to the students. "Tijuana downtown is a nasty place, not representative of the real city. What most people see who go there are the discos, the beach, the cheap blankets. We met people who live in a different world, the real Tijuana that most tourists never see."

"I was so enthusiastic about the project, and about the people like Oscar who are involved in it, when I first encountered it," says Guernsey. "It's really been gratifying to see the students become as enthusiastic as I was, and to have the opportunity to share this with them."

So the Caltech Y continues to broaden the perspectives of the students who become involved there, introducing them to lessons not available in classrooms or textbooks.

Momentum strong in admissions program, says Snow

Carole Snow, Caltech's new director of admissions, feels fortunate that she has inherited a program with a lot of built-in momentum. "There's no undoing and rebuilding to do," she says. "I can just have a great time expanding on what's already here."

Snow comes to the Institute from USC, where she was special assistant to the dean of the college of letters, arts and sciences.

While earning her PhD there, she taught sociology and then went on to hold a variety of administrative posts—along with establishing a private practice in marriage and family therapy.

She currently is completing a second master's degree, this one in professional writing, with an emphasis on fiction. She did research and counseling at the first hospice in the state, and is writing a novel based on her experiences there.

The new director of admissions lives with her family in South Pasadena, and had walked on campus many times, assimilating a feeling for the Institute. "I was very excited when I heard that an opportunity here was a possibility for me," she says. "I knew about the Caltech spirit, and I was eager to learn the content."

Snow views Caltech as a place where appropriate students finally get to be in a place where "barriers to fulfilling themselves have been removed—a place where they can finally reach for their limits and be stimulated by other students who are just as bright as they are."

These students are among the best spokespeople for what Caltech has to offer young people who are considering coming here, she feels, and she wants to involve them more broadly in admissions work than they have been in the past. She hopes to use continuing students as part-time staff in the admissions office, and to involve them in a variety of ways in the recruitment process. Public speaking and involvement in special events are among the roles she envisions for them.

Snow plans 29 off-campus visits this fall, to schools "where Caltech has gotten really good applicants, and where the counselors and teachers know Caltech and are supportive of it." Most of these locations also have a strong core of alumni who are very helpful in the admissions process. ("I'm thrilled about the strong alumni support out in the field," she says. "The alumni are well informed, and very helpful to us.") Half of the locations are east of the Mississippi, and half are west of it—a balance that Snow finds pleasing. Faculty have not been involved in recruitment interviewing recently, and Snow hopes to reinstitute this tradition.

"I knew about the Caltech spirit, and I was eager to learn about the content," says Snow.

More attention to younger high-school students is important for the admissions office, Snow believes—particularly to those who single Caltech out for early contact. "Some students write us when they're freshmen in high school, telling us how they're counting the time until they come here," she says. "I'd like to keep the contact with them going, to continue reinforcing their interest in us." Snow would also like to reach prospective students early in the recruitment process, perhaps through a special event on campus, "before they're overwhelmed by all the colleges that rush in to make overtures. If we reach them first, we'll make a lasting impression."

One of Caltech's greatest problems, Snow believes, is southern California's "image problem."

"People who are coming to campus contact us and ask us what routes are safe to take, and where they can park safely," she says.

"They hear about gangs, about earthquakes, and it's hard to convince them that one can live safely in southern California."

Snow hopes to use the Centennial video as one means to counteract this fear. "I hope the serene image of the campus that it presents will help to convince parents that this is a good place for their young person to be," she remarks.

"Once they get here," adds Snow, "Caltech sells itself. We just have to get the barriers out of the way."

During the summer, Snow attended a Bridge Program reception for students participating in a preenrollment program to boost their skills in science and mathematics. She was impressed by the number who told her they chose the Institute because of the personal attention they received from people here—people who made them feel important and special. "Some of the other top institutions made them feel they would be lucky to be admitted, that they didn't really count as individuals," says Snow. "They said the attitudes of the people they met here made the difference in their decision.

"We're working with 17-year-olds who are making life decisions. We have to attend to that. At the same time, we need to give them a realistic view of what Caltech is like. This way, those who are right for us will come, and those who aren't will make another decision. And that's appropriate."

Getting the right match between students and Caltech is always a challenge, but for Carole Snow, who has a strong foundation to build on, meeting that challenge is one she enjoys.

Edward Lewis a winner of Lasker Award

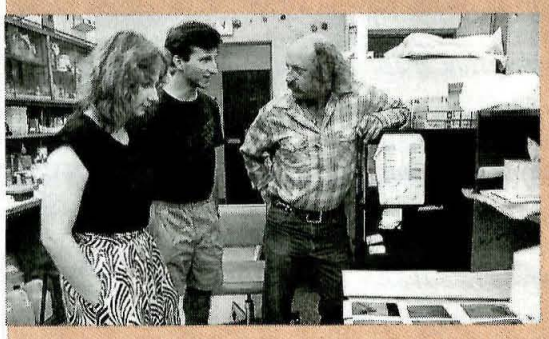
Edward B. Lewis, the Thomas Hunt Morgan Professor of Biology, Emeritus, is one of the 1991 winners of the Albert Lasker Basic Medical Research Award, specifically for the discovery of the Bithorax Complex, a cluster of genes in the fruit fly *(Drosophila)*. The cluster controls how the body segments develop.

Lewis first became fascinated with the *Drosophila* when he was in high school and has been using it in professional research for more than 40 years. He is recognized as a pioneer in the field of modern genetics.

The CAMPAIGN *for* CALTECH

A SECOND CENTURY OF DISCOVERY

Campaign *Report*



Eric Davidson, the Norman Chandler Professor of Cell Biology (right), examines photographs of sea urchin embryos with graduate students Kellie Whittaker and Robert Zeller.

Alumnus Warren Schlinger believes Caltech can play a major role in the development of alternate energy. The Schlinger professorship is aimed at stimulating more research, development, and teaching in this area.

TRUSTEES FROST, CHANDLER PLEDGE $1,000,000

Caltech trustee Camilla Frost and her mother, Dorothy Chandler, who is an honorary life trustee, have pledged $1,000,000 to The Campaign for Caltech. "The Chandler family has had a longtime association with Caltech," Camilla Frost told Caltech President Thomas E. Everhart. "My mother and I are happy to continue that tradition by participating in this historic campaign."

Harry Chandler began the family's long relationship with Caltech in 1920, when he was elected trustee. He was instrumental in bringing Robert Millikan to Caltech from the University of Chicago, and remained on the board until his death in 1944. His son, Norman Chandler, was elected trustee that same year, and served on the board and on a number of its committees until 1973.

Dorothy Chandler has held the title of honorary life trustee since 1974. Camilla Frost has been an active board member since 1977, currently serving on the board's buildings and grounds and nominating committees, and on the visiting committee for the Division of the Humanities and Social Sciences.

The Chandler family's generosity over the years has benefited the entire campus community. In addition to various other gifts in support of science and the humanities, family members and the Times Mirror Company have given the Institute the Harry Chandler Dining Hall, and have furthered Caltech's research in biology and biochemistry by establishing the Norman Chandler Memorial Laboratory and the Norman Chandler Professorship of Cell Biology, held by Eric H. Davidson. Norman R. Davidson is Caltech's Norman Chandler Professor of Chemical Biology, Emeritus.

SCHLINGERS MAKE LEADERSHIP GIFT

Warren Schlinger's interest in chemistry began when he was experimenting with a Gilbert chemistry set in grammar school. This fascination led Schlinger (BS '44, MS '46, PhD '49) to come to Caltech to study chemistry and chemical engineering.

Caltech was not far from Schlinger's Glendale home, and he and friends from high school often attended Friday evening science lectures on the campus, his interest in the institution deepening all the while. "Caltech was the only school I ever wanted to come to," says the alumnus who, with Mrs. Schlinger, has made a leadership gift to The Campaign for Caltech.

The Schlingers' pledge of $1.5 million will endow a professorship whose holder will specialize in energy research, an area in which Dr. Schlinger has had extensive experience throughout his career. To be named the Warren and Katharine Schlinger Professorship in Chemistry and Chemical Engineering, the chair will be awarded to a professor whose research may involve developing energy concepts that are environmentally safe, including new sources of energy and more efficient utilization of existing energy resources.

When the young man from Glendale arrived at Caltech in the fall of 1941, the United States was not actually involved in World War II and campus life was relatively normal. But wartime quickly changed Caltech, and Schlinger took part in an accelerated academic program, earning a BS degree in applied chemistry two years and nine months after he entered.

Upon graduation, he went to work for Earnest H. Swift, professor of applied chemistry, for whom he had great respect. In 1945 Schlinger enrolled in graduate school and became part of the research team of William N. Lacey and Bruce H. Sage, both professors of chemical engineering, who were doing groundbreaking work involving thermodynamics of petroleum hydrocarbons. His efforts centered in the chemical engineering laboratories above the old Caltech steam plant.

Meanwhile, an attractive young woman named Katharine Stewart, secretary to the chemical engineering department, had come to Schlinger's attention. "Unfortunately, I was more interested in her than she was in me," says the alumnus. "In those days, she was someone of 'importance' and I was just a lowly student where men outnumbered women 20 to 1."

By 1946, Schlinger was nearing the completion of his M.S. thesis, and he asked the object of his interest to type it for him. As a gesture of thanks, he invited Katharine Stewart to dinner at Eaton's Restaurant, at Michillinda and Colorado. Friendship quickly grew into romance, and the couple were married in 1947, returning to Eaton's on their wedding night.

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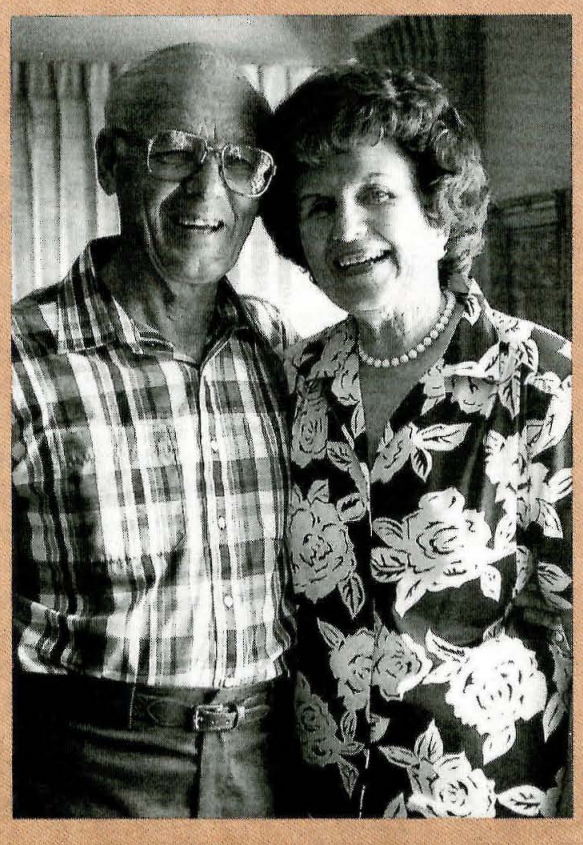
Warren and Katherine Schlinger's $1.5 million commitment to The Campaign for Caltech will establish an endowed chair in energy research.



A MESSAGE FROM THE CHAIRMAN

In the first issue of the Caltech Report, I mentioned the March 11 public announcement of The Campaign for Caltech with $120 million in gifts and pledges already committed. I am pleased to announce the total has now reached $229 million.

Our success to date would not have been possible without enthusiastic support from every Caltech constituency - alumni, faculty, staff, Trustees, and friends. We deeply appreciate the vote of confidence in Caltech.

Important academic priorities are already being funded as a result of The Campaign. That is gratifying. However, the hardest part is still ahead. With continued support from all parts of the Caltech family, I am confident we will meet our goal.

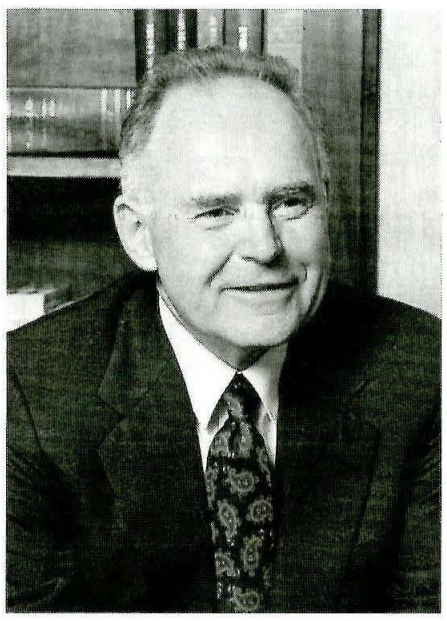
James W. Glanville

GORDON MOORE: A QUIET MAN WITH VISION THAT CHANGED THE WORLD

Gordon Moore (PhD '54), chairman of the board of Intel Corp., was one of a handful of pioneering young scientists who helped launch the international semiconductor industry. Co-founder of Fairchild Semiconductor Corp. in 1957 and Intel Corporation in 1968, Moore has demonstrated throughout his career an uncanny talent for foreseeing the flow of technology and developing ways to speed its progress. Under Moore's direction, electronic innovations, including the integrated circuit, microprocessor, and semiconductor memory have entered the commercial marketplace, revolutionizing the way humankind lives and works in virtually all walks of life.

Moore and his wife, Betty, have encouraged the continuation of that revolution with a $16.8 million pledge to The Campaign for Caltech for a new electronic materials and structures laboratory. The new facility will house classrooms, offices, and laboratories where new generations of pioneers in materials science, applied physics, electrical engineering, and other disciplines will collaborate to advance information systems technology in ways we can't even imagine today.

When he was only 10 or 11, Gordon Moore's mind was made up. He wanted to be a chemist, a decision that coincided with his first exposure to a chemistry set. Today, this quiet man with graying hair and smiling eyes still exudes boyish excitement at possibilities for scientific innovation. Moore may not look like a revolutionary, but the products of his career have changed forever the way women and men live and work throughout the world.



Carver Mead, Gordon and Betty Moore Professor of Computer Science at Caltech, says, "Gordon is just like an old shoe, so comfortable and unassuming. You would never guess that his surefire vision helped found and influence the development of the nation's multi-billion-dollar semiconductor industry."

It all began back in 1956 when Moore, two years after receiving his doctorate in chemistry from Caltech, took a call in his office at the Applied Physics Laboratory at Johns Hopkins University. On the other end of the line was William L. Shockley, co-inventor of the transistor and future Nobel prize winner. He was just forming the Shockley Semiconductor Laboratory and asked Moore to join him to work out chemical problems standing in the way of producing low-cost transistors for commercial use. Moore accepted the offer.

"I had gotten kind of tired of pure research," Moore says. "So getting closer to work leading to real products made sense for me. Shockley was proposing a challenging idea, which also would take me back to where I wanted to be – in California."

Moore's decision to join Shockley eventually lead to the creation of two multi-million dollar corporations and electronic innovations responsible for a large portion of the product and profits that drive the semiconductor industry today.

After only a year and a half at the Shockley Laboratory, Moore and seven other Shockley recruits, including Robert N. Noyce, co-founded Fairchild Semiconductor Corporation in Mountain View, California.

Moore at first managed the engineering department, then assumed the title of director of research and development, a post he held until 1968. Under his direction, Fairchild Laboratory developed the first planar integrated circuit, the first stable MOS transistor, the first complementary MOS circuit, the first dielectrically isolated integrated circuit, and the first practical two-layer metal integrated circuit.

"The integrated circuit had just been invented by Bob Noyce when I took over the R&D job," Moore recalls. "One of our first tasks was to implement his invention. I got to watch that develop and have lived with integrated circuits ever since."

In 1968 Fairchild was going through some disruptive management changes. The Board had fired two chief executives in a six-month period and was looking outside for new leadership. Dissatisfied with the situation at Fairchild, Moore and Noyce founded a new corporation – Intel, now an international manufacturer of microcomputer components with 25,000 employees worldwide and expected revenue this year of nearly $5 billion.

"We saw a chance to change the leverage in the semiconductor business," Moore says. "In 1968, companies with large, low-cost assembly plants in Southeast Asia had a major advantage. We envisioned products in semiconductor memory that could bring the advantage back home through clever processing of silicon. Frankly, we were successful beyond anything we could have reasonably expected."

Moore and Noyce looked for a complex product with the potential for selling in huge quantities. Moore says Intel took a "Goldilocks" approach to finding just the right technology to establish Intel's edge.

Continued on page 8

FELLOWSHIPS SUPPORT CALTECH'S RESEARCH MISSION

Talented graduate students and postdoctoral fellows contribute enormously to Caltech's achievements as a research institution. To assure continued success in attracting the best and brightest young scientists, the Institute has made funding for graduate and postdoctoral fellowships a high priority in its drive to raise $350 million by the end of 1993. The Campaign for Caltech seeks $15 million in endowment for graduate fellowships and $10 million for postdoctoral fellowships.

According to Vice Provost David Goodstein, most Caltech faculty members would agree that "Caltech's primary purposes are to create new knowledge and transmit that knowledge to the next generation of scientists. And the presence of bright graduate students and postdoctoral fellows is absolutely central to those ends."

Provost Paul Jennings couldn't agree more.

"Scientists often do their most productive, breakthrough research during their postdoctoral fellowships," he says. "They have the youth and energy to pursue fresh ideas and the time to focus on difficult questions without the distractions of teaching and administrative duties, which come with professorial appointments. And graduate students are the next generation of scientists. One of the main reasons Caltech exists is to educate them."

John Schwarz, Caltech's Harold Brown Professor of Theoretical Physics, is passionate about the need for fellowships, especially in areas of theoretical research where public and other funding sources are particularly scarce.

"The best work in any field of science is done by a handful of people with the most fertile, best-educated minds," Schwarz says. "If Caltech wants to maintain its pioneering role in science and engineering, it must continue to attract exceptionally talented graduate students and postdoctoral fellows, and providing fellowships is one way to do that."

Graduate Students: Getting the Best – Graduate students are drawn by Caltech's fine reputation, but their ultimate choice of institution often is influenced by economic factors, such as fellowship opportunities.

According to Arden Albee, dean of graduate studies at Caltech, the Institute was able to offer full or partial fellowships to only 141 of its 260 new graduate students in 1990. He says new gifts for graduate fellowships, particularly gifts of endowment, are needed to strengthen Caltech's ability to compete with other leading institutions for top graduate students.

The Institute uses fellowships to support first-year graduate students so they can concentrate on coursework and take time to explore many study options before devoting themselves to a research or teaching assistantship with a particular professor. Fellowships also help graduate students beyond the first year who have special needs or who are working in areas that are important, but underfunded.

"Graduate students are the postdoctoral fellows and professors of the future," Schwarz says. "We must support them if scientific research and discovery are to continue."

Postdocs: A Vital Source of Fresh Ideas – Postdoctoral training has become nearly as universal in the sciences as graduate education. As Goodstein points out, "The subject matter and research techniques have become so complex that four to six years of graduate study simply is no longer enough to learn your trade as a working scientist."

Postdoctoral fellowships permit young scientists to continue learning in close association with experienced professors. The fellowship period also permits young scientists a few years to focus on research and establish the record and reputation required to win a tenure-track faculty position and funding for ongoing research. While postdocs gain a great deal from their sojourn at Caltech, they also contribute to the Institute in many crucial ways:

♦ **They serve as mentors for graduate students.** Graduate students learn the ins and outs of scientific research under the tutelage of Caltech professors, but when they need more detailed, day-to-day guidance than professors have time to give, they turn to postdoctoral fellows. Postdocs have the maturity and experience to help graduate students through problems and mental blocks that impede progress.

♦ **They are a source of fresh ideas and new research directions.** Because of their youth, postdocs may be freer than professors of biases and established viewpoints and more open to new, sometimes radically new, directions and approaches. The freshness of their viewpoints along with the new ideas and research techniques they bring from other institutions spur fruitful interactions in which professors supply the wisdom of experience while the postdocs provide the challenge of new perspectives. This cross pollination frequently results in deeper insights and faster progress than either postdoc or professor could achieve alone.

"The introduction of new ideas from postdocs is especially important at a small institution like Caltech," Goodstein says. "We try very hard to keep our faculty at about 275 professors, so it is difficult to bring in new ideas at the professorial level. Our principal source of fresh ideas and vitality comes from the flow of very bright postdoctoral fellows who come to the Institute."

♦ **Postdocs increase the productivity of Caltech faculty.** Professors often have many more ideas and research directions than they can possibly pursue alone. By suggesting research problems to postdocs and providing modest guidance, these faculty members can have far greater impact on the sciences than they could without postdoctoral fellows.

Again, this dynamic is especially important in a small institution like Caltech. While Caltech may have one professor doing research in a particular area, a larger institution, such as Harvard or MIT, might have 10. The only way to keep the competition reasonably even is if the Caltech professor has a corps of very bright postdocs.

The Financial Picture – One of the most difficult hurdles experimental and theoretical scientists face today is raising money for scientific research amid rapidly increasing competition for limited resources.

"It is no secret," Goodstein says, "that competition for federal funding is more intense now than ever before. Remarkably, Caltech's success rate has not decreased in the face of increased competition. Eighty percent of all proposals are funded and two-thirds of all new proposals are funded. This has been true for many years, but now we are getting less of what we ask for.

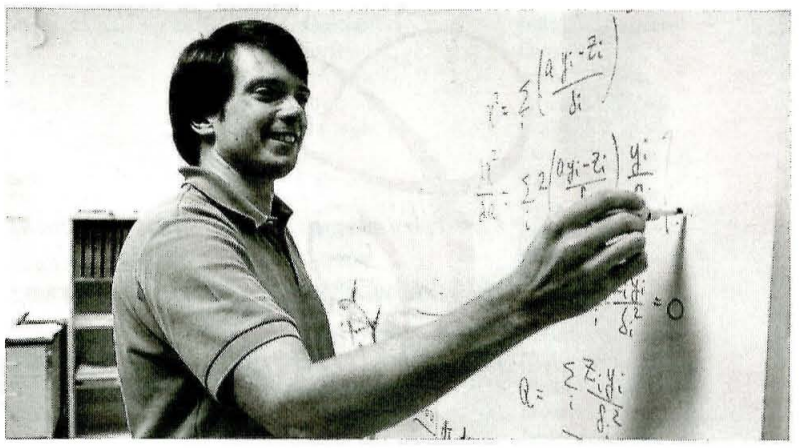
"In the past, for instance, if a professor requested $200,000 to pursue a promising idea, Caltech would get $200,000. Now the funding agency might say, 'Yes, we want to support you, but we can only afford to give you $150,000.'"

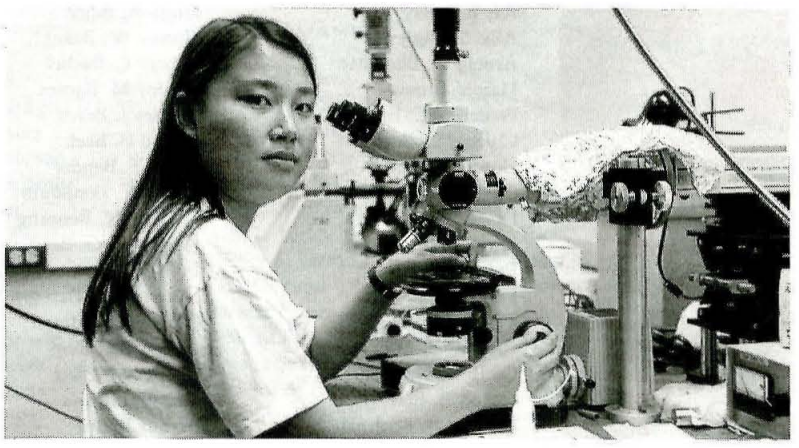
Because one of the most expensive items in a research project is salary and benefits for graduate students and postdoctoral fellows, reductions in funding put these positions at risk. Significant reductions put people out of work and slow the progress of scientific discovery.

Naturally, Goodstein says, concern for the security of individual members of the research team can distort a professor's scientific priorities. He or she might be influenced to pursue research directions where funding is available rather than directions that are most scientifically interesting.

"That is just one more reason," he says, "why fellowships, especially endowed fellowships, help Caltech be more effective at what it does – pioneering research aimed at pushing forward the frontiers of our knowledge."

Contributions for endowment are invested. The income from the endowment fund then provides fellowships for graduate students and postdoctoral fellows year after year. With a reliable source of fellowship support, the Institute can continue to work effectively – with a stimulating mix of age and experience, of graduate and undergraduate students, postdoctoral fellows and professors – regardless of changes in the economy and political environment that affect other sources of financial aid and research funding.





Top: **Erich Ormand (*pictured*), DuBridge Postdoctoral Fellow in nuclear physics, and Calvin Johnson, a Prize Fellow in nuclear physics, are developing a new approach to the Nuclear Shell Theory. Both are honing research techniques, and enjoying interaction with faculty and graduate students. "This three-year fellowship is giving me a chance to learn how to be a professor," Ormand says. "I see how the professors interact with others and have time to get my research organized and underway. That would be harder to do if I had the added responsibilities of a professor."**

Middle: **Matthew Bonner, James Boswell Postdoctoral Fellow in chemistry, is devoting his energies to solving problems of tissue damage and electrode corrosion that occur with neuroprostheses, such as pacemakers or intramuscular implants. His fellowship was endowed at Caltech by the James Boswell Foundation to promote cooperative research, especially with the Huntington Medical Research Institute in Pasadena. With a new Ph.D. in biomedical engineering from Case Western Reserve University, Bonner is the vehicle for stimulating exchange of information and ideas between disciplines and between institutions.**

Below: **Katharine Liu, a graduate student in biology has held the Lawrence Hansen Graduate Fellowship for the past three years. Although not an endowed fellowship, Lawrence Hansen (BS '42) has renewed the fellowship each year since 1961 and has helped dozens of students pursue research related to the nervous systems of animals. Liu is identifying neurons linked to mating behaviors in *C. elegans*, a type of nematode.**

In Caltech's Centennial year, unrestricted gifts of $2,409,000 were received by the Annual Fund and total gifts of all types from alumni reached $19,855,257. Contributions at these levels exhibit an extraordinary commitment to Caltech and emphasize the importance of alumni support.

1990-91 HONOR ROLL

Caltech takes this opportunity to thank all those individuals and organizations who have supported its programs in the past year, and to particularly recognize the following groups of individual donors who have made contributions during the period July 1, 1990, through June 30, 1991, or who have provided for a gift to Caltech through their estate plans.

The Institute would like to thank the many alumni who made special gifts to the Amos G. Throop Society ($5,000 or more), the George Ellery Hale Society ($1,000 - $4,999), the Arthur A. Noyes Society ($500 - $999), and the Robert A. Millikan Society ($250 - $499) for 1990-91.

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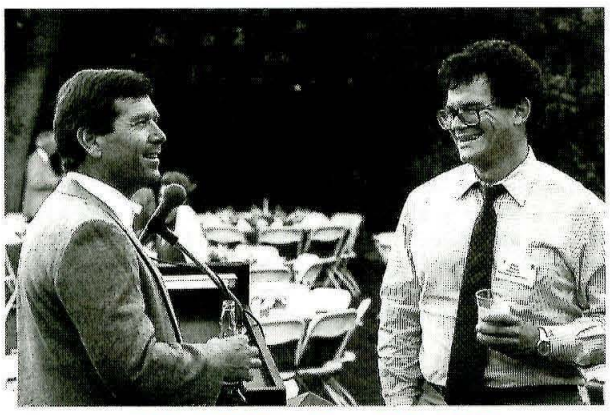

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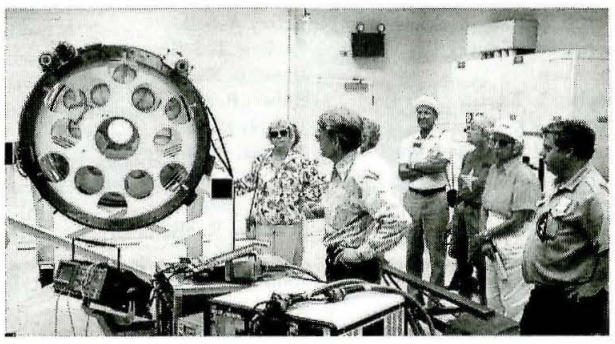

Members of the President's Circle of the Caltech Associates toured the Keck Telescope facilities on Mauna Kea, Hawaii, in July. The tour was part of the group's trip to view the recent eclipse of the sun. President and Mrs. Everhart and several Caltech and JPL scientists accompanied the group.

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SCHLINGERS KEEP STRONG CALTECH CONNECTION

Continued from page 1

Katharine Schlinger continued to work for a several years after the marriage, while her husband earned a PhD in chemical engineering that was awarded in 1949. Typing that PhD thesis was a task that Mrs. Schlinger gladly undertook.

Schlinger spent four more years at the Institute, conducting postdoctoral research and teaching chemical engineering classes.

Describing the excitement and rewards of that period, he says: "I was young, and hungry to learn new things, and I saw a whole body of research growing before my eyes. I realized that I could contribute to it. All of the faculty members were world renowned, and something new happened every day "

The chemical engineer loved teaching at the Institute, but, he says, "I decided I wanted to get out in the world and see what was going on there. I joined Texaco in 1953 at its Montebello Research Laboratory, and I never came back to Caltech, although I had several opportunities." Schlinger has kept in touch with many of his former students, and one came to work for him at Texaco.

Schlinger spent almost 35 years at the Texaco laboratory. He went on to become manager and associate director of gasification, developing processes to produce clean energy from coal, tar sands, oil shale, and other organic sources. He holds more than 60 U.S. patents in the energy field. He retired in 1987.

"At the Texaco lab, I found myself right in the midst of all kinds of development work," he says. "I couldn't have created a scenario that would have been more exciting. I was never bored, and I always looked forward to going to work, because I knew something new would come up that day. I was tempted, from time to time, to come back to Caltech, but at Texaco I was always involved in something that absorbed my interest.

"I've derived a lot of satisfaction from being involved with an alternate energy technology like coal gasification that has moved out of the research laboratory and into commercial usage," Schlinger continues. "Today, plants all over the world are converting heavy tar, coke, and coal to useful products such as methanol ammonia, and other chemicals."

Schlinger sees a bright future for alternate energy – in part, because its use is going to become mandatory. "We're going to have to develop it," he says. "Alternate energy will play a major role in the future for all of us. But we have a long way to go in developing the best alternative sources. So far, the possibilities have barely been scratched. But in the development process, we continually have to be concerned about the effects of what we're doing on the environment, and about the productivity of the energy source we're working to develop."

Schlinger believes Caltech can play a major role in the development of alternate energy, and he hopes the new professorship will stimulate more research, development, and teaching in this area.

The Schlingers, who met in Pasadena, have made it their home throughout their 45 years of marriage. They are the parents of two sons and a daughter, Michael, Norman, and Sarah Lynne, and have five grandchildren. One son lives in Yorba Linda and a second in Lafayette, and their daughter lives in Tiburon.

Mrs. Schlinger, active in many community affairs, has served on the boards of the Pasadena Youth Council, the Coleman Chamber Music Association, and the PTA. Both used to sing in the choir at the Oneonta Congregational Church in South Pasadena.

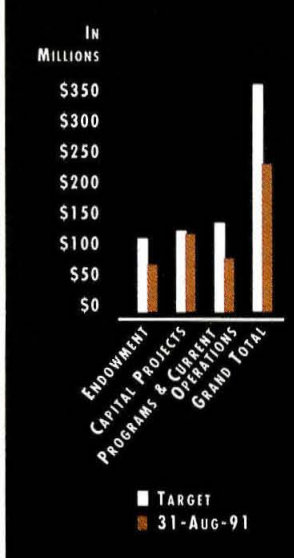
In 1973, the couple joined The Associates, and now are life members as well as members of the President's Circle. Schlinger was recently elected to The Associates board of directors. A life member of the Alumni Association, Schlinger has also served on its board of directors. "We've kept in touch with Caltech all along," he says. "This connection is very important to us."

The Schlingers were at a Coleman Chamber Music concert in 1987 when they received a major shock. Their second home in Pebble Beach, along with 33 others, had burned to the ground, leaving only the chimney and parts of the foundation. A replacement home gives them a 180-degree view of the ocean. The couple divides their time between Pasadena and Pebble Beach, where golf games are a frequent activity.

Life continues to be busy and exciting for the Schlingers, good friends of the Institute, and they want their gift to create exciting times for young people for years to come. "I look back on my 12 years on the Caltech campus as one of the most rewarding periods in my life," says Schlinger. "My wife and I hope that this professorship will help provide similar experiences for future students."

CAMPAIGN TOTAL EXCEEDS $220 MILLION

Recent gifts, including a $1 million commitment from Caltech trustee Camillia Frost and her mother, honorary life trustee Dorothy Chandler (see front-page story), have brought the total of gifts and pledges to The Campaign for Caltech: A Second Century of Discovery to $229 million as of August 31. Progress toward achieving the campaign's three main subgoals – endowment, capital projects, and programs and current operations – is depicted in the chart below.



Caltech alumni have founded companies and invented new technologies in industries ranging from Aerosospace to Xerography. Like Gordon Moore, they bring a winning combination of technical insight and entrepreneurial spirit to American enterprise.

MOORE'S SCIENTIFIC GRASP HONED AT CALTECH

Continued from page 2

"We chose three technologies," he says. "One was too difficult, and we couldn't do it. In fact, we are still working on it. One was too easy. Everything worked right, but our competitors were able to copy it pretty easily. The third was just right. By focussing all our energy on developing silicon-gate MOS, we were able to solve the two or three really tough problems that came along, but it took our competition several years to really come around and compete with us effectively."

In 1971, Intel introduced the tiny silicon chip called a microprocessor. This minuscule device, which within a few years would become the brains of the personal computer, put computing power at the fingertips of millions of users, from grade school students to airline pilots to top executives.

Intel's 286 and 386 chips have dominated the office computing marketplace. And, with more than a million transistors loaded onto a silicon chip the size of a thumbtack, Intel's new 486 packs the power of a mainframe into a PC-sized box. Although Intel uses the same basic technology it developed two decades ago, improvements and embellishments have permitted the rapid evolution of smaller circuits and increasingly complex products, including the Touchstone Delta System, the world's fastest and most powerful computer, which was built by Intel and installed at Caltech this spring.

"By the end of the century," Moore says, "we will be building computer functions on a chip with 100 million transistors compared to maybe 2 million today at the leading edge. A hundred million transistors will allow us to bring into the chip a lot of functions that people are just beginning to work with – compressed and decompressed video images, probably speech recognition, certainly a wide variety of very high-performance computing applications. But those are the easy things to see. The interesting things will be those things I can't predict at all."

As Moore points out, IBM introduced its first personal computer only a decade ago, and no one then was predicting the impact it would have. Ten years before that the microprocessor didn't exist.

As early as the 1960s, Moore predicted technology's relentless march toward the infinitesimal – tinier being faster and more powerful in the world of microchips. The complexity and speed of integrated circuits would double each year, he said, while at the same time the size of chips would shrink by half. Moore's Law, like so many other of Gordon Moore's predictions, turned out to be true.

Andrew S. Grove, Intel's president and chief executive officer, once said in an interview with *Electronics* magazine: "I'll implicitly trust (Gordon's) judgment because time after time his understanding of how some basic technological discovery can be utilized to attack some market segment, and how we can approach it, and the ultimate capability of that technology, turns out to be far better than anyone else's."

Moore's longtime colleague, the late Robert N. Noyce, former vice chairman of Intel's Board of Directors, described Moore as an excellent planner and organizer who has the ability to recognize good people and good ideas. Moore is quick to give credit to others and admits that in a high-tech field like the semiconductor industry top managers quickly become technologically obsolete. Many key decisions are pushed down to the engineers and scientists who have knowledge of the product and the processes it requires.

"Intel is a pretty democratic organization," says Moore, who served as Intel's chief executive officer from 1975 to 1987. "No one is afraid to speak his or her mind at a meeting, and people who speak generally get heard."

Moore, however, earned a reputation for being a stickler for defining and tracking objectives. According to Noyce, "Product planning is done on the basis of economic impact analysis after technical analysis."

Moore's intuitive grasp of science, his ability to pick the most productive directions for research, was honed, he says, at Caltech. He took classes from Linus Pauling, then the head of the chemistry department.

"Pauling was really rather intimidating," Moore recalls, "but he had a very intuitive way of looking at things that I found appealing. Professor Richard Badger was my thesis advisor, and he was a marvelous person to work with. He left me alone as much as I wanted to be left alone, yet was always there if anything important came along that I wanted to discuss."

"Caltech is a very special place," Moore says. "It is small enough so the disciplines don't get isolated from one another. Most of the really interesting things in science seem to happen at the interface between classic disciplines. It is very important that this unique institution maintain the wherewithall to work the way it has in the past, doing the unexpected things that lead to the kind of really new ideas and directions in science and engineering that you can't predict – just as you can't completely predict the impact of revolutionary products."

Betty Moore has had a long partnership with Caltech, too. She married Dr. Moore in Northern California on a Saturday, took a honeymoon drive south on Sunday, and was with her husband in Pasadena on Monday, the day he appeared at Caltech for his qualifying exams.

Life members of the Caltech Associates and of the President's Circle, Dr. and Mrs. Moore endowed the Gordon and Betty Moore Professorship in 1975 and the Gordon and Betty Moore Scholarship in 1985.

As a pioneer in the computer age, Moore has received many honors and awards, including the National Medal of Technology in 1990 and the Founders Award of the National Academy of Engineering. A recipient of Caltech's Distinguished Alumnus Award, he has been a member of the Institute's Board of Trustees since 1983.

Senior computing analyst Heidemarie Lorenz-Wirzba (left) and Tom Metzger, an Intel systems manager on loan to Caltech, work with Intel Touchstone Delta in Booth Computing Center.

This alumnus used his Caltech training to develop a modern, high-tech ranch.

High-tech farming yields top award

By Winifred Veronda

Eugene Nebeker (MS '60, PhD '65) knew the 680-acre family ranch west of Lancaster was "there," but he wasn't really expecting to become a farmer when he earned his doctorate in chemical engineering from Caltech. His father's death changed his career direction, however, and Nebeker put his Caltech training to work in developing the ranch into a profitable, modern, high-tech operation. He made water conservation a major goal, solved a problem for the city of Lancaster by doing so, and succeeded so well in his efforts that this year he was recognized as California's 1990 Conservation Farmer of the Year, an award sponsored by the National Endowment for Soil and Water Conservation.

"I was really surprised that I was selected," he says. "After all, there are 85,000 farmers and ranchers in the state."

Nebeker raises alfalfa, oat hay, barley hay, and Sudan grass on 480 acres of the farm, which he says was "run down" when he began to develop it in the mid 1970s. He also raises sheep; at present, there are approximately 2,000 on the ranch. Blood from the animals is used as a tool in hospitals, where platelets from the blood hold saliva or tissue awaiting diagnosis.

Through his conservation efforts, Nebeker has cut his farm's water consumption by about 30 percent, and now uses between 4 and 7 million gallons a day. That water is pumped from wastewater oxidation ponds five miles away. The water had created a problem for Edwards Air Force Base, where it flooded Piute Ponds, which borders Rosamond Dry Lake, a landmark used for aircraft tests, training, and emergency landings. The water attracted birds, which interfered with aircraft activity.

The problem was solved when the Environmental Protection Agency, the state, and the county sanitation district installed a $6 million pipeline to carry treated wastewater from the oxidation ponds to Nebeker's ranch. According to the Caltech alumnus, the process is a way to dispose of pollutants, particularly nitrogen, in an environmentally safe manner. When wastewater sits for a period of time, there is a danger that nitrogen will seep into the groundwater, he said. Nitrogen-thirsty crops such as alfalfa and Sudan grass absorb the nitrogen and solve a potential contamination problem. By using the wastewater, Nebeker saves enough water for 4,000 homes. He also is saved the cost of fertilizer, and he doesn't have to use as much electrical energy as if the irrigation water were pumped from the ground.

With a grant from the Department of Energy several years ago, Nebeker developed a hydraulic system to utilize wind energy to pump wastewater from the ponds to his ranch. Irrigation efficiency has also been enhanced by using lasers to help level the fields. The laser system allows Nebeker to slope his fields at the rate of five inches every 100 feet, a slight grade that allows the water to irrigate as it flows downhill.

Nebeker also utilizes deep tillage as he endeavors to change the soil profile. The soil is desert alluvial, which does not absorb water well. He and his employees are endeavoring to change the mix to a depth of three to four feet, using manure and composting. Involved with Nebeker in an experiment to eliminate a weed problem caused by the composting is David Cudney, a professor at UC Riverside.

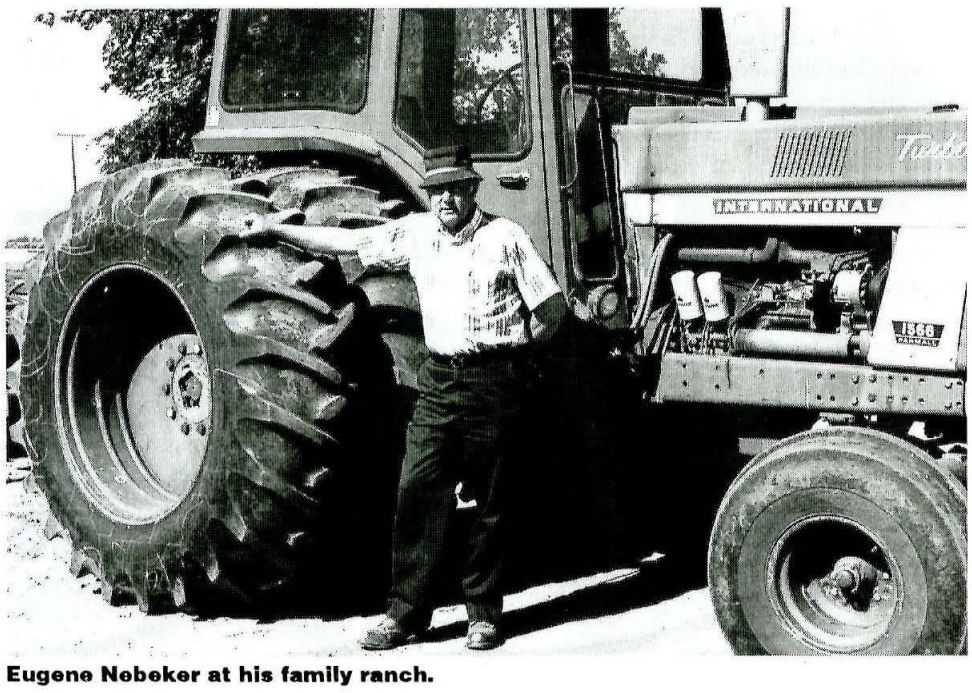
A new project involves collaboration with a professor at UC Berkeley who is developing beneficial insects. After initial work at Berkeley, the next step will be to see whether the insects will breed at the ranch.

How does Nebeker like his complex farming role? "Sometimes I enjoy it, but most of the time I don't," he says frankly. "But I like it much more than I would like working for a big company. That would be so impersonal, and one's contributions would be difficult to see. Here, the benefits are obvious. When I took this over, it was an old, run-down ranch. Now we're doing as well as anybody in the state. I've never been sorry for the choice I've made because I'm building something that will have a lasting basis. It will support me and my family for decades."

Although Nebeker didn't anticipate using his Caltech education as a farmer, he has found it immensely helpful to him in that role. "The brain training, the self-confidence it gave me to tackle a problem no one had solved before — I got all that from Caltech," he says. "What I learned has also helped me confront legal issues. At the time, getting my Caltech education was an extremely unpleasant process because it was so tough. But over the years, it's been the most useful feature of my whole life."

Nebeker spreads his time between his farming operation and Scientific Associates, Inc., a company in Santa Monica, California. The company is involved in fluid-mechanics projects—water jets for cutting concrete and rock, oil skimmers for skimming oil on the high seas after an oil spill, and wind-energy projects.

The Caltech alumnus lives with his wife in West Los Angeles. They have no children—"just 2,000 sheep." Nebeker works seven days a week and takes a vacation about every two years. Given the intensity of his involvement, he says it is fortunate that Mrs. Nebeker is also involved in the business. She works in the company offices and runs the sheep operation.



Eugene Nebeker at his family ranch.

ALUMNI

Chapter news

New Mexico Chapter Hears SURF Students

Members of the New Mexico chapter in Albuquerque welcomed SURF students Alfredo Morales and S. Lan Smith at a dinner meeting in August. Alfredo, a senior whose research supervisor is John E. Bercaw, professor of chemistry, spoke on his work involving the architecture of polymers. Lan described his efforts to understand the effects of different solvent-solute interactions on the relaxation times of protons. A senior majoring in chemical engineering, Lan works under the direction of John D. Roberts, the Institute Professor of Chemistry, Emeritus.

Charles R. Trimble speaks to San Francisco chapter

Charles R. Trimble (BS '63, MS '64), president and one of four founders of Trimble Navigation, Ltd., spoke to members of the San Francisco chapter in September. His topic was "Entrepreneurship and GPS," which focused on entrepreneurial management of innovation in high technology.

Stupian to focus on long-range planning

What's a nuclear physicist? As a ten-year-old, Gary Stupian didn't know, but he kept telling people this was what he wanted to be. As a boy growing up in Alhambra, the 1991–92 Alumni Association president also knew from an early age that he wanted to come to Caltech, and he focused his energies in that direction.

Stupian entered Caltech in 1957. His was the last pre-Sputnik class to enroll at the Institute, and, within his first year here, science would become very fashionable as the nation geared itself to meet the challenge triggered by Soviet success in space.

Tuition was $750 a year when Stupian enrolled as a freshman. He still remembers the talk President Lee A. DuBridge gave at Freshman Camp on "your $750 bargain." Stupian also remembers lectures under Jon Mathews, professor of theoretical physics, who later was lost at sea on a sailing trip around the world. "He was one of my most articulate teachers," says Stupian, "and his lectures seemed crystal clear—at least, until you left the lecture room." Mathews was one of many fine teachers that Stupian says he encountered at the Institute. "The teaching here was consistently good," he reminisces.

Stupian never became a nuclear physicist, but did become a solid-state physicist. He earned a BS degree in physics in 1961.

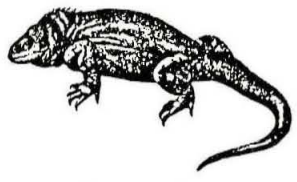
After leaving the Institute, Stupian went on to the University of Illinois in Urbana, where he earned a PhD in physics. From there, he spent two years at Cornell doing postdoctoral research in the materials science department. "Graduate school was definitely easier after what I went through at Caltech," he remarks wryly.

After completing his graduate studies, Stupian went to work for the Aerospace Corporation in El Segundo, where he is a research scientist and a member of the technical staff, involved in solid-state and surface physics. What if he had chosen a field other than physics? Well . . . perhaps electrical engineering (he has continued an interest in amateur radio developed as a boy), Stupian says, but he can't really imagine being anything other than a physicist.

Stupian innocently entered the road to involvement in alumni activities when he came to Seminar Day one year, and checked on the back of the form that he would like to get involved. No such offer is ever ignored, and, by 1986, Stupian was chairman of Seminar Day. After this, he was elected to the Alumni Association Board of Directors, and thus began his climb up the ladder to the presidency.

Given the Association's intensive involvement in Centennial activities during the past year, Stupian feels it is time for the organization to pause and take stock of where it is, do some five-year planning, and set goals for the future. "A president can at best accomplish one major task," he says. "I feel that my job is to take the lead in doing some planning for the future."

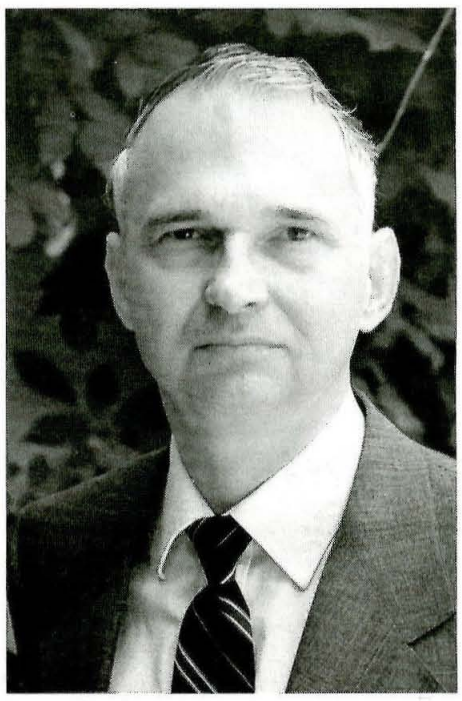
Limited space available on Ecuador/Galapagos Islands trip



There is still space for a few lucky alumni to go with the Alumni Association on an exciting travel/study program to Ecuador and the Galapagos Islands. Beginning March 29, 1992, William P. Schaefer, senior research associate in chemistry and director of the X-ray Diffraction Laboratory in the Beckman Institute, will lead alumni on a one-week excursion through Quito, Riobama, and Cueneca, Ecuador. The second week of this adventure will be aboard the *Isabela II*, a 34-passenger ship that will cruise the Galapagos Islands. Please call Helen Shafran, 818/356-8364, before October 15, to take advantage of this once-in-a-life-time program.

Committees plan exciting program year, Alumni President Stupian reports

By the time this article appears in *Caltech News*, the Alumni Association's 1991-92 activities will be well under way. Board members are elected for three-year terms, and therefore about one-third of the membership changes each year. The entire Board meets once a month, but, as I mentioned in my last column, much of the work is carried out by smaller committees. Even without bothering to grapple with national or global concerns such as the general state of science and engineering or the changes taking place in Eastern Europe



Gary Stupian

and the USSR, there are many issues important to alumni and to Caltech which deserve attention.

The first Board meeting under the new President (in this case, me) was in September. At this meeting, members were asked to indicate their preferences for committee assignments for the coming year. The committee chairs were appointed by the President in a timely manner in advance of the September meeting. Several committees are responsible for general membership activities. The Program Committee (Warren Goda, BS '86, Chair) plans many events, including the very popular travel/study programs. The Association now has chapters in twelve cities. The Chapter Affairs Committee (Vic Veysey, BS '36, and Leo Baggerly BS '51, co-Chairs) acts as a liaison between the chapters and the Association, and assists in the formation of new chapters. The largely autonomous Seminar Day Committee (Greg Simay, BS '75, Chair) organizes the single largest alumni event of the year.

Two committees are directly concerned with Caltech's undergraduate and graduate students. The Student/Faculty/Alumni Relations Committee (Le Val Lund, BS '47, Chair) organizes events which bring together students (both undergraduate and graduate), faculty, and alumni. Some events are primarily social. Other events (such as meetings between grad students and local alumni from a particular academic department) are intended at least in part to help new graduates leave our cloister and enter the outside world.

The Undergraduate Admissions Support Committee (Ed Lambert, BS '82, Chair) coordinates a growing network of volunteers throughout the United States which assists Caltech in the undergraduate admissions process.

Finally, some committees deal with issues that are administrative and organizational (but essential!). The Publications Committee (Pete Mason, BS '51, MS '52, PhD '62, Chair) is responsible for, among other things, the "free" directory of Caltech alumni provided to members. This free directory costs a lot to produce. The Publications Committee is also involved with both *Engineering & Science* and *Caltech News* and has administrative responsibility for publications such as the two volumes of the *Legends of Caltech*. Other publications are being planned. The Membership Committee (Frank Dryden, BS '54, MS '57, Chair) deals with that age-old question "How do we get more of our alumni involved with the Association?" The Reunion Committee (David Holtz, BS '64, Chair) is responsible for setting the schedule for class reunions and for ensuring that class reunions take place smoothly. The Executive Committee, chaired by the President and consisting of the officers of the Association (President, Vice President, Treasurer, Secretary, and Immediate Past President), attempts to direct traffic as efficiently as possible.

I hope that I have provided a bit more insight into the workings of the Association. As much of our limited funding as possible is made available for direct support of student activities. As a general rule, however, the Alumni Association contributes the time of its members, not money. I should therefore mention that membership on Board committees is not limited to members of the Board of Directors. If YOU want to become more actively involved and lend us some of your time and talent either in Pasadena or in some other area of the country, your wishes can quite possibly be accommodated. Your comments are always welcome, and you can contact us at: Caltech Alumni Association, mail code 1-97, Pasadena, Calif. 91125, (818) 356-6592. You can also send your remarks to me via electronic mail at STUPIAN@JULIET.CALTECH.EDU or GSTUPIAN@CALTECH.BITNET.

We're sorry

Caltech News regrets an error in the June issue, which featured Edwin B. Seidman, Chicago chapter president, in the Chapter News column. The article erroneously stated that Mr. Seidman has twin daughters when he actually has four sons, the oldest two being twins. We apologize to Mr. Seidman for the error.

Reunion chairman describes farm background

Growing up on an Antelope Valley alfalfa farm, where he raised and judged show cattle, turned Kirk Dawson's interests in the direction of agriculture, rather than science. He loved to ride horses, and he enrolled in agriculture courses as a freshman in high school.

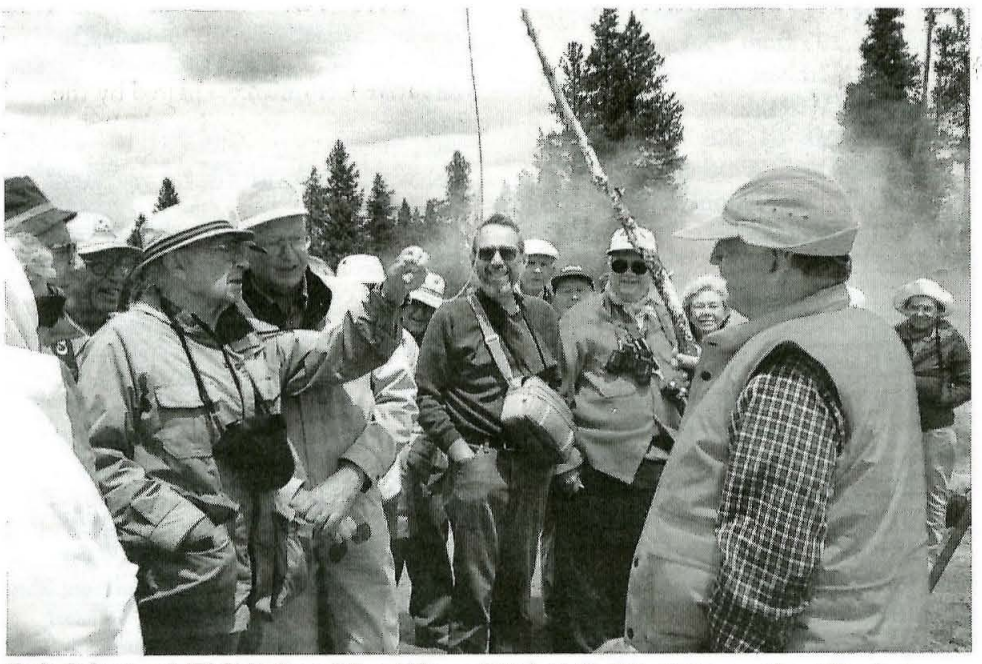
But a motivating teacher from whom he took general science and physics changed the life course, not only of Dawson, but of many of his classmates. "A lot of us went into science and engineering because of his inspiration," says Dawson (BS '61, MS '62), who is chairman of the Annual Fund reunion campaign.

Dawson's father had worked at

Kirk Dawson

Lockheed in Burbank before buying the 160-acre farm in the Antelope Valley, and he encouraged the teenager in his new career interest. Dawson enrolled at Occidental College as part of the 3-2 program, majoring in physics there for three years and coming to Caltech for an additional two years. After earning his BS in 1961, he stayed on at the Institute for an MS degree in electrical engineering.

Coming back to his room in Ruddock House on Ditch Day and finding it totally bare was a shock to Dawson—a vivid memory from his Caltech years.



Bob Grinstead (PhD '50) and Fred Eisen (BS '51) find that the pools at Pocket Basin in Yellowstone National Park register almost 200 degrees. Leon T. Silver (PhD '55), the W. M. Keck Foundation Professor for Resource Geology, holds the thermometer, as Paul McHorney (BS '56, MS '57) and Charles Bates (BS '51) look on. Alumni traveled to Yellowstone on a travel/study program in June.

Incoming freshmen Lucy Chen and Jacob Holland meet Seattle chapter president Ernest Janzen (BS '61) and Jenijoy La Belle, professor of literature, at the July 25 Seattle chapter dinner meeting.

The mystery was soon solved through a call from construction workers at the site of new graduate houses. There Dawson found all of his furniture, arranged as it had been in his room. With the help of friends, he retrieved it.

Horace Gilbert, who awakened many budding scientists and engineers to the intrigues of economics, was a favorite among Dawson's teachers. Dawson remembers that, upon request from students, Gilbert organized a late-afternoon investment group, which he supervised on his own time. Gilbert circulated some of his own stock certificates, some of them worth more than $20,000, to inspire the students, indicating that he wanted to be sure to retrieve them before class was over. Carver Mead, in his first year on the Caltech faculty, was another favorite instructor.

As an Occidental student, Dawson had met a pretty education major, Marjory Burk, who eventually became Mrs. Dawson. She taught before the Dawson children began to arrive, and more recently has taught special education in La Cañada -Flintridge. The couple have two children, a son, 25, who graduated from UCLA in aerospace engineering, and a daughter, 23, who earned a degree in psychology at Azusa Pacific.

"A large lot" in La Cañada is the site of the Dawson home. There Dawson spends a great deal of time gardening and getting involved in landscape architecture. He still likes to go horseback riding, utilizing a style called western pleasure riding. He also likes to hike in the Sierra Nevada.

JPL was Dawson's destination after graduate school, and it has been his professional home ever since. He was technical manager for the spacecraft power system for the Mariner IV spacecraft, the first to go to Mars. "To be 24 and to have this role was really exciting," says Dawson. "I really respect JPL for its commitment to giving young professionals the opportunity to grow."

Dawson went on to become supervisor of the power systems group, and then manager of the control and energy conversion division. In 1982 he took on the role of deputy assistant laboratory director for technical divisions, and is now assistant laboratory director for technical divisions.

Dawson first became active with the Alumni Fund in 1979, working as area chairman among Caltech graduates at JPL. "We increased participation my first year from 50 to 75 percent," he says proudly.

He was reunion chairman for the 25th anniversary of his class, and has been reunion year chairman for the last four years.

Reunions arouse strong feelings of loyalty in alumni, Dawson feels, and many of them want to get involved. Contributing to the Institute is one way of expressing that loyalty, and everyone derives satisfaction as a consequence.

Alumni Activities

October 19–25, 1991, *Hawaii travel/study program* with Robert P. Sharp, Robert P. Sharp Professor of Geology, Emeritus.

January 1, 1992, *Rose Parade event,* breakfast and lunch at the Athenaeum. Reserved seating for the 103rd Tournament of Roses Parade at Hill and Colorado.

March 29–April 15, 1992, *Galapagos travel/study program* with William P. Schaefer, senior research associate in chemistry.

May 14, 1992, *class of 1942, 50th reunion dinner,* the Athenaeum.

May 15, 1992, *Half Century Club reception and luncheon,* the Athenaeum.

May 15, 1992, *class of 1947, 45th reunion dinner,* the Athenaeum.

May 15, 1992, *class of 1952, 40th reunion dinner,* the Athenaeum.

May 15, 1992, *class of 1967, 25th reunion dinner,* the Athenaeum.

May 16, 1992, *55th annual Alumni Seminar Day and dinner,* the Caltech campus.

May 16, 1992, *class of 1957, 35th reunion dinner,* the Athenaeum.

May 16, 1992, *class of 1962, 30th reunion dinner,* the Athenaeum.

May 16, 1992, *class of 1982, 10th reunion dinner,* the Athenaeum.

June 18, 1992, *Alumni Association annual meeting and honorary alumni dinner,* the Athenaeum.

June 21–28, 1992, *Yellowstone travel/ study program* with Robert P. Sharp, Robert P. Sharp Professor of Geology, Emeritus, and Leon T. Silver, W. M. Keck Foundation Professor for Resource Geology, Geology and Planetary Sciences.

July 13–21, 1992, *Iceland travel/ study program* with Robert P. Sharp, Robert P. Sharp Professor of Geology, Emeritus.

August, 1992, *Ashland/Crater Lake travel/study program* with Jenijoy La Belle, professor of literature, and Charles Bacon, United States Geological Survey.

Unless otherwise indicated, for information, please contact Helen Shafran for travel/study programs at 818/356-8364, and Patsy Gougeon for Seminar Day/reunions at 818/356-8366.

PERSONALS

Alumni directory in process

Locating fellow alumni will be much easier with the new Caltech Alumni Association directory now being prepared.

This comprehensive volume, scheduled for release in the fall of 1992, will be the most up-to-date and complete reference on more than 16,000 Caltech alumni ever compiled. The information listed will include the name, maiden name where applicable, Caltech class year(s), degree(s) and option(s), undergraduate student house, current occupation, business address and telephone number, and residential address and telephone.

The Caltech Alumni Association has again contracted the Bernard C. Harris Publishing Company, Inc., to produce the new directory. Harris will soon begin researching and compiling the data to be printed in the directory, by mailing a questionnaire to each alumnus. Alumni who prefer not to be listed in the directory should contact the Alumni Association in writing as soon as possible.

Class of '41 raises record reunion gift

The class of 1941 raised the largest 50th reunion class gift on record, reporting a total of $114,392 in unrestricted funds from 57.8 percent of the class. Frederick Thiele (BS '41) was chairman of the reunion committee. His members included Robert Bowlus (BS '41), George Bramhall (BS '41), William Chapin (BS '41), Donald Dawson (BS '41), Quentin Elliott (BS '41, MS '42), Paul Faust (BS '41), Sidney Gally (BS '41), George Harr (BS '41), Gilbert Jones (BS '41), Emerson La Bombard (BS '41), Bruce Lawrence (BS '41), Joseph Lewis (BS '41), James McIntosh (ENG '49), Robert Myers (BS '41), Alfred Schaff (BS '41), and Joseph Weiss (BS '41).

Marion Gillihan (MS '46), was reunion committee chairman for the class of 1946, with members including Kenneth Cartwright (MS '46), James Evans (BS '46), Yoshiyuki Fujimura (MS '46), Calvin Kempton (BS '46), Richard Montgomery (MS '46, PhD '48), James Parker (MS '46, ENG '46), and Harry Wolbers (BS '46). A total of $47,456 was raised from 41.4 percent of the class.

Chair of the class of 1951 reunion committee, which raised $56,120 from 46.3 percent of the class, was Robert Covey (BS '51, MS '52). His committee members were Leo Baggerly (BS '51, MS '52, PhD '56), Joseph Bookee (BS '51), Dean Daily (BS '51), William Eilau (BS '51), David Elliott (BS '51, MS '52), James Enslow (BS '51), Raymond Greutert (BS '51, BS '53), Earl Hefner (BS '51, MS '52), Albert Jackson (BS '51, MS '52), Hiroshi Kamei (BS '51, MS '52), Thomas Layton (BS '51, PhD '57), Peter Price (BS '51), and William Whitney (BS '51).

Ralph Kehle (BS '56, MS '57) was chairman of the 1956 committee, which raised $48,229 from 44 percent of the class. Working with him were Harold Almond (BS '56, PhD '61), George Louis Fletcher (BS '56, MS '57), Alan Poisner (BS '56), William Purves (BS '56), and Curt Schulze (BS '56, MS '57).

The class of 1961 committee was chaired by Kent Frewing (BS '61); it raised $24,295 from 35.5 percent of the class. Members included Henry Abrash (PhD '61), Constantine Ananiades (MS '61, MS '78), Richard Balsam (MS '61), Ward Calaway (BS '61, MS '62), Joel Donnelly (BS '61), Ronald Draper (MS '61), Douglas Fenwick (BS '61).

Other members of the committee were John Hribar (BS '61, MS '62), Jerome Kasper (BS '61), David Kendle (BS '61, MS '62), John Kennedy (BS '61, MS '62), Hayden Macurda (BS '61, BS '63), Miles McLennan (BS '61), David Morse (MS '61), Neil Richardson (BS '61, MS '62), Michael Ruecker (BS '61, MS '62), Oliver Seely (BS '61), Charles Siegel (BS '61), and Samuel Suitt (BS '61).

Alan Harris (BS '66) was chairman of the committee for the class of 1966, which raised $14,517 from 30.9 percent of the class. Members included James Austin (BS '66, MS '67), David McCarroll (BS '66), Gordon Myers (BS '66), Richard Nielsen (BS '66, MS '67, PhD '71), Howard Powell (BS '66), and John Rouse (BS '66).

The class of 1981 committee, with Christopher Finch (BS '81) as chair, raised $8,393 from 16.2 percent of the class. Members included William Fong (BS '81), William Ledeboer (BS '81), Ronald Merkord (BS '81), and Ira Simon (BS '81).

Volunteers needed for "Sustainable World"

Volunteers are needed to help with registration for the four-day Centennial symposium, "Visions of a Sustainable World," on campus October 27-30. Those interested should contact 356-2189.

1944
CLIFFORD W. OLIVER, JR., MS, is a senior partner with Oliver Berninger Public Accountants and is lieutenant governor of Division 6 of the Ohio District of Kiwanis International for the year 1990–1991.

1962
NORMAN D. MALMUTH, PhD, received the University of Cincinnati's Distinguished Alumnus Award in October 1990, in recognition of meritorious achievement that reflects unusually large credit on the university; Cincinnati was Malmuth's undergraduate alma mater. In November 1991, Malmuth will receive the AIAA Aerodynamics Award, "for notable contributions in the development and application of combined asymptotics and numerics in the solution of transonic and hypersonic problems."

1963
PAUL J. NAHIN, MS, is currently an associate professor of electrical engineering at the University of New Hampshire. On sabbatical this fall, he will be a visiting professor of engineering at Harvey Mudd College, where he was on the faculty 1971–1973 as an assistant professor. "While there," he writes, "I'll be correcting the proofs of my new book, *Time Machines*, which will be published by the American Institute of Physics in 1992. The book discusses time travel in science fiction, and in fact (including, in particular, the recent work of Caltech's theoretical astrophysics group)."

1964
ANDREW DE MARI, MS, PhD '68, has received the Entrepreneur of the Year award for the Los Angeles area, in recognition of his having taken the Retix Corporation from a 1985 start-up to a company earning $50 million a year in 1991. The award was presented at a June 26 black-tie dinner held at the Century Plaza Hotel. As a recipient, de Mari will be inducted into the Institute of American Entrepreneurs at its National Conference in Boca Raton, Florida, in November, and will be eligible to be chosen national Entrepreneur of the Year in the fall. The recipient of the national award will be featured in the cover story of *Inc.* magazine's January issue, and regional recipients will appear in that and later issues. De Mari was nominated for the regional award by R. D. Middlebrook, professor of electrical engineering at Caltech.

1966
DOUGLAS W. GAGE has recently returned to the Naval Ocean Systems Center in San Diego, after a 15-month assignment with the Office of Naval Technology in Washington, D.C., as assistant to the chief scientist.

1968
ERIC WICKSTROM writes that he "is currently a professor of chemistry at the University of South Florida, developing gene-targeted DNA therapeutics. Lois is a microcomputer liaison specialist in the Institute for Instructional Research and Practice at USF. Erica graduated last year from MIT, and is now an NSF Fellow in developmental biology at Stanford. Eileen is studying political science and Soviet studies at Emory University, and working this summer in Moscow to improve her Russian."

1969
MURRAY K. HILL, MS, PhD '73, has taken a two-year assignment with IBM in Japan as technology manager for a new line of disk-drive products. His wife, Lee, and daughter, Jennifer, are looking forward to an exciting time. Jennifer will attend ASIJ in Tokyo for the 10th and 11th grades.

OBITUARIES

1975
MARK PARISI and MARY JOHNSON, BS '76, write that they were married on May 18, 1991, at the home of WESLEY CHALFANT, BS '76, and CYNTHIA KOJIMA, BS '76. Parisi is an engineer with the Deep Space Network, at JPL. Johnson, who received her PhD from Harvard in 1982, is currently employed as a research scientist in Caltech's Division of Geological and Planetary Sciences.

1976
RICHARD L. ANDERTON, MS, writes, "Bonnie and I celebrated our 20th wedding anniversary on a 747 airplane on our way to Kuwait last year. Little did we know! Bonnie, Jennifer, my 11-year-old daughter, and I are all safe and sound back together again after being held hostage in Kuwait by the Iraqi army. We took refuge at the U.S. Embassy on August 2nd when we found ourselves in the middle of the Iraqi invasion. Bonnie and Jennifer left Kuwait in September with Jesse Jackson; however, I didn't get out until right before Christmas." Since then, Anderton adds, he has completed his overseas assignment in Bangkok, Thailand, and Kaohsiung, Taiwan, and has returned to Denver, Colorado, where he has been promoted to technical manager for design with Engineering-Science, Inc. "'There is no place like home!' (click heels, and repeat three times)."

1977
BEN S. FREISER, PhD, has been named winner of the 1991 ANACHEM award, of the Association of Analytical Chemists. The award, which is given annually to recognize an individual for outstanding research achievements and service to the field, will be presented to Freiser at the organization's annual meeting in October. Best-known for his pioneering research in the field of Fourier transform mass spectrometry, Freiser is the second member of his family to receive the award; his father, Henry Freiser, a professor of chemistry at the University of Arizona, was winner of the award in 1986. While at Caltech, Ben Freiser won the Herbert Newby McCoy Award in 1976, for "most outstanding graduate student in chemistry." He is a professor of chemistry at Purdue University.

MELODY A. (HOWE) MCLAREN, in "a special message to the Blacker House cycling jocks in the class of '75," writes, "I finally discovered where my gear shift levers are and, along with my husband (Ian) and 450 other British cyclists . . . completed a sponsored 3-day Bikethon from London to Paris on behalf of the National Society for Prevention of Cruelty to Children." Her volleyball team, she continues, "finally won its National League Division title with the benefit of our maniac Polish coach and several bottles of vodka. Workwise, I am now corporate writer for Business in the Community (promoting business support of community projects) and write publications and speeches for British business leaders as well as HRH The Prince of Wales."

1982
JACK A. KAYE, PhD, writes, "This has been an eventful spring for me and my family. First, my wife, Dawn Bressler-Kaye, daughter Becky, and I welcomed our newest family member, Hannah Jeanne, born March 31, 1991. Second, I have transferred within NASA, moving from the Goddard Space Flight Center to NASA Headquarters. I now manage NASA's Atmospheric Chemistry Modeling and Analysis Program, which supports research in computational modeling and data analysis of stratospheric and tropospheric chemistry."

1922
MAYNARD S. REYNOLDS, of Anaheim, California, on March 29, after a lengthy illness. He served in the U.S. Army in World War I, and he served again in World War II, on loan from the Union Oil Company. He retired from Union Oil in 1962, after 35 years of service as a chemical engineer. He is survived by his wife, Cecyle, and her children, C. Annette Harvey and James F. Murfield.

1925
CARL H. HEILBRON, of Sunnyvale, California, on December 17, 1990. He is survived by his wife.

1930
PHILIP JANSSEN, of Los Angeles, on April 29. He is survived by his wife, Ailleen, and daughter, Joan Janssen Takemoto.

JOHN S. MURRAY, of San Marino, California, on July 23. He was for many years president of the Standard Felt Company, in Alhambra, California. He was active in Caltech affairs as an Athenaeum member and an Associate, and he assisted with the Friends of the Caltech Libraries. He is survived by his wife June, who for many years assisted at Caltech's Well Baby Clinic; a sister, Anna Raitt; two sons, JOHN (MS '66) and Cameron; and three grandchildren.

1931
ROSS ELLIOTT MORRIS, MS '32, of Vallejo, California, on June 22, following a lengthy illness. After graduating from Caltech, Morris studied rubber chemistry at Akron University, in Akron, Ohio, and went to work for Goodyear Tire and Rubber Company, in Akron, and Cumberland, Maryland. Then he moved to the Mare Island Rubber Laboratory, where he was a rubber technologist for 34 years, managing the facility from 1939 to 1974, when he retired. He provided technical assistance to the rubber industry in the design, manufacture, and testing of rubber items, and he owned several patents. He is survived by his wife, Helen; a daughter, Marilyn Ormand; and a brother, Lee.

1937
JAY R. BAILEY, of Sun City West, Arizona, on May 31. He is survived by his wife, Winifred.

1939
JAMES SCOTT GASSAWAY, of Camarillo, California, on June 18. After graduating from Caltech, he worked at North American Aviation from 1939 to 1946, serving in management positions in the P-51, B-25, and AT-6 aircraft programs. A prominent inventor, he over the years created more than 30 different products, ranging from coin changers to memory discs, most of which are patented. In 1972, he invented the Anchor Pad security device and founded Anchor Pad International, Incorporated, which manufactures desktop security systems for office equipment and computers. He served as president and board chairman until 1988. His beloved first wife, Merilyn, is deceased. He is survived by his wife, Arloa; four sons, Paul, Gary, Mark and his wife (Victoria), and Lee and his wife (Linda); a sister, Anna Bruckman; a brother, Steve; five grandchildren; and his lifetime friend and business associate, J. CALVIN MUELLER (EX '38).

1943
JOSEPH K. KEELAGHAN, MS, of Playa del Rey, California, on June 13. He was a retired aeronautical engineer, and had worked for Douglas Aircraft, North American Rockwell, and the FAA. He is survived by his wife, Peggy; six children, Joseph, Therese, Eithne, Patrick, Colum, and Moira; and four grandchildren.

1944
LEWIS L. GRIMM, of Upland, California, on June 16. After leaving Caltech, Grimm received his master's degree from Claremont Graduate School in 1954. He served in both World War II and the Korean War, and retired as a lieutenant commander in the Naval Reserve after 20 years' service. He had retired from his position of professor at Chaffey Community College, but had continued to teach part time at Pomona College. He is survived by his wife, Edith; two sons, Randal and Steven; a daughter, Joyce Greatbanks; and six grandchildren.

WILLIAM G. JACKSON, MS, ENG, of Encino, California, on May 1. He is survived by his wife.

1946
JOHN F. LANCE, MS, PhD '49, on May 27. He is survived by his wife, Catherine.

1951
WALTER F. PFEIFFER, of Del Mar, California, on March 7. He received his MS in nuclear engineering from the Air Force Institute of Technology in 1959, and retired from the U.S. Air Force with the rank of lieutenant colonel in 1969. He enjoyed flying radio-controlled airplanes. He is survived by his wife, Irene; a daughter, Jo Griffith; a son, Stephen; and a granddaughter, Mindy Griffith.

1953
SWAROOP C. BHANJDEO, of Calcutta, India, on March 21. He was founder and managing director of M.G. Commercial Private Ltd., a firm specializing in the design, manufacture, and erection of high-security fencing, including part of the international fence along the Punjab border between India and Pakistan. A holder of degrees in geology, physics, and metallurgy (the latter two from other universities), BhanjDeo was a prolific inventor; at the time of his death, he was researching a project to make composite wood from waste materials. He was known for his infectious zest for life, his insatiable curiosity, and the knack for making deep and inspirational friendships. He is survived by his wife, Asha, who writes that "he was truly an original thinker, a man for all seasons"; and by a son from a previous marriage, Michael Chandra.

1954
ROBERT KATZ, MS, PhD '58, of San Diego, California, on March 12. An Air Force veteran and a mechanical engineer, he spent many years with General Atomics. After his retirement, he devoted himself to music, which he considered his true love. An accomplished violinist, he played duets, quartets, sonatas, and with local orchestras. He also made violins and other stringed instruments, as well as the tools to make such instruments, and was treasurer of the Southern California Association of Violin Makers, of which he was one of the first members when it was founded in 1964. He is survived by his wife, Temme; two daughters, Lisa and Corinne; four stepdaughters, Laurel Jo Simon, Lynn Alderete, Jody Weinberg, and Marcy Simmons; a brother, Nathan; and two grandchildren.

1956
JOHN D. ROGERS, MS '58, PhD '61, of Campinas, Brazil, on December 27, 1984.

1957
ROBERT H. NORTON, MS '58, PhD '64, of La Cañada Flintridge, California, on March 21. He is survived by his wife, Joanne; a son, Robert; and a daughter, Tory.

Legendary filmmaker Frank Capra dies at 94

"You have to make films that you like, not what others tell you the audiences will like. Great films have to hit people where their emotions are." Frank Capra, the Academy-Award-winning director who died in September at 94, expressed this philosophy in an interview in *Caltech News* in 1972, and throughout his life, he had relied upon it to build a career that has become a legend in the entertainment industry. Capra is best known for his classic films, such as *It's a Wonderful Life*—films that express the theme that a small man, with the courage of his convictions, can triumph over the most unwieldy bureaucracies.

But more than 70 years ago, the future filmmaker was aiming for a career of a different sort. Having landed in Los Angeles at the age of six with his penniless Sicilian family, Capra made his way to Manual Arts High School and, after that, to what was then Throop Polytechnic Institute. He not only had to earn his own tuition, but also to help support his family. He did this by holding down three jobs while he went to school, including a four-hour stint with the Pasadena Power Plant that began at 3:30 a.m. Every day, he drove a second-hand motorcycle to Pasadena from his family's small lemon grove in Sierra Madre. He still found time to edit the *California Tech.*

Capra had to win the freshman scholarship prize of $250 in order to pay his tuition for the next year. He finished at the top of his class. When his father died during his sophomore year, school officials loaned him enough money to pay his tuition until graduation in 1918. His senior thesis was on "Conductivity of Picric Acid and its Salts."

After a stint in the Army, Capra found no work waiting for young chemical engineers. He did odd jobs for three years, eventually stumbling into spots as cameraman, gag writer, and director of a small movie studio. These launched his career in the film industry. But Capra continued to maintain close ties with Caltech, joining The Associates, serving on the visiting committee for the Division of the Humanities and Social Sciences, and supporting a program for student filmmaking.

In 1972, Capra gave the school his 14-acre ranch in Fallbrook. The San Diego County site, with its formal gardens, citrus groves, and wooded paths, has been widely used as a retreat by research groups, trustees, and others connected with the Institute.

Back in 1966, when Capra received Caltech's Distinguished Alumni Award, Lee A. DuBridge, who was then president of Caltech, paid tribute to him in a unique way. "His accomplishments," said DuBridge, "demonstrate that a Caltech education is not a fatal handicap to a distinguished career in the arts."

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Production Artist — Barbara Wirick
Copy Editors — Julie Hakewill, Betsy Woodford
Photographer — Robert Paz
Contributors — Heidi Aspaturian, Phyllis Brewster, Betsy Woodford

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