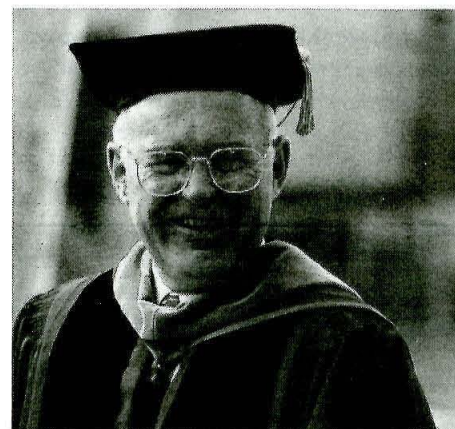
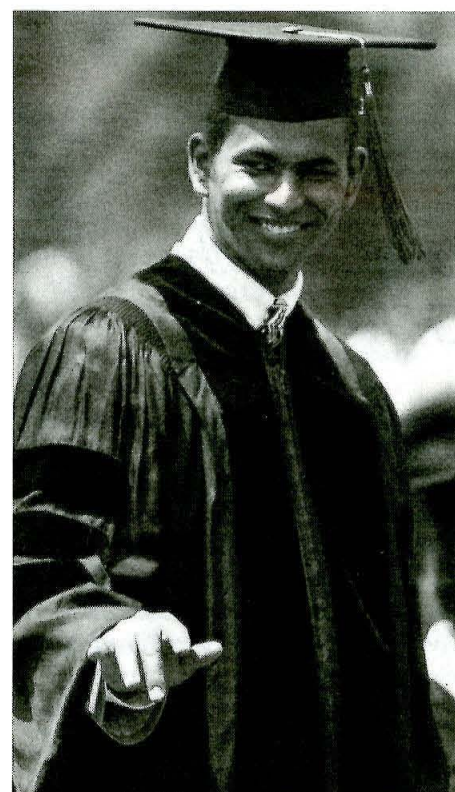


# CaltechNews

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Counting down those final, glorious moments at Caltech, Joan Marie Gimbel '94 is more than happy to accept the Mabel Beckman Prize and Arnold Beckman's applause (top left photo). Gordon Moore (second photo from top) counts this as his first commencement as chair of the Board of Trustees. And the crowd can count on Nobel Laureate Rudy Marcus (bottom photo) to top off the graduation festivities, crowned by his top hat.



## *Flanked by a fish, Caltech's 100th class sets sail for new shores*

Summing up the past and enumerating future possibilities, Caltech's hundredth commencement amounted to one for the books for a number of reasons. Commencement '94 marked the first time that Gordon Moore, the newly elected chair of the Institute's Board of Trustees, presided over a Caltech graduation—almost precisely 40 years to the day that he himself picked up a Caltech PhD in chemistry. It appears to have been the first time that a campus graduation ceremony featured two speakers—in honor of Caltech's centennial class, President Tom Everhart and Board of Trustees Chair Emeritus Ruben Mettler both addressed the graduates. It may mark the only time, so far, that a graduating class has shared the spotlight with a large, artificial, suspended fish (more about this later). And it was the first year, as Mettler noted in his remarks, that Caltech graduates, in receiving their diplomas, were admitted not only to the "rights and privileges" of a degree but also to the "responsibilities."

Speaking from the vantage point of one whose affiliation with Caltech—as he reminded his listeners—spans half the Institute's history, Mettler called the new language that accompanies the awarding of degrees a "significant change" that speaks to the growing and increasingly vital role that Caltech graduates are playing as "leaders in a scientific revolution." Said Mettler, "This revolution is affecting the personal lives of billions of people, the private and public institutions of modern civilization, and the prospects for the

betterment of the human condition."

A three-time alumnus who chaired Caltech's trustees from 1985 through 1993, Mettler suggested to Caltech's newest graduates that "your knowledge and innovative abilities in science, engineering, and yes, your Caltech degree, give each of you significant 'personal power,' in shaping the world of the future." In his address, "Leaders of a Peaceful Revolution," Mettler called on each graduate to exercise his or her personal power "with wisdom as well as imagination, with sensitivity regarding its consequences, and with the highest integrity."

The ways in which previous generations of Caltech graduates have heeded this call was one of the themes of President Everhart's speech, which considered Institute graduates and their "Accomplishments: Past, Present, and Future."

"You are graduating from a remarkable institution—an institution that has dared to be different," said Caltech's president, who then went on to enumerate the contributions of a number of alumni, in areas ranging from making movies to creating the Space Age. (Excerpts from the Mettler and Everhart addresses appear on pages 8 and 9 of this issue.)

As Everhart spoke to the assembled degree candidates, their families, and friends about the ability of Caltech and its graduates to cast a wide net, a possible testimonial to this assertion, in the form of a giant fish—a fish skeleton, really—danced in the breeze a short distance away. In the best tradi-

tion of Caltech's 99 previous classes, an anonymous group of undergraduate pranksters had fashioned the Piscean intruder out of aluminum foil and other useful materials, fastened it to a crane on the construction site of the Moore Engineering Laboratory, and left it there to dangle in decidedly fishy fashion throughout the ceremony. Picked completely clean, the fish might also have been a commentary on how some of the new graduates were feeling as they looked back on their final exams or recalled the countdown to completion of the thesis.

Of these graduates, 197 received the bachelor's degree—94 with honors—116 the MS degree, two the engineer's degree, and 151 the PhD. Among the doctoral candidates, 15 received their degrees in the biology division, 35 in chemistry and chemical engineering, 56 in engineering and applied science, ten in geological and planetary sciences, three in the humanities and social sciences, and 32 in physics, mathematics and astronomy.

The Office of Career Development reports that nearly 60 percent of the Institute's graduating seniors will be pursuing graduate study, while 54 percent of the new PhDs will take up postdoctoral or tenure-track positions. Seventeen percent of the students with BS degrees and 31 percent of those with doctorates have accepted offers from private businesses and industry. Of those with other plans, three undergraduates are joining the Peace Corps. A number of graduates at all degree

*Continued on page 4*





## CAMPUS UPDATE

### *Stolper to chair G&PS division*

Geologist Edward Stolper, featured in the June–July '94 *Caltech News* as the latest Institute researcher to win election to the National Academy of Sciences, has joined a similarly (some might say more) select circle as the newly appointed chair of Caltech's Division of Geological and Planetary Sciences. Stolper, 41, who has been Caltech's William E. Leonhard Professor of Geology since 1990 and a faculty member on campus since 1979, succeeds Professor of Planetary Science David Stevenson, who is stepping down after five years in the position.

Stolper, who received both his BA and PhD (in 1974 and 1979, respectively) from Harvard, and his MPhil in 1976 from the University of Edinburgh, is a specialist on the origin and evolution of igneous rocks. His research interests include the properties of high-temperature magmas, the origin and evolution of igneous meteorites, and the processes by which igneous rocks from the ocean floor are formed. From 1989 to 1994, he served as the division's executive officer for geochemistry.

### *Quake line installed*

Callers seeking information about California quakes can now dial 818/395-3003 to reach the campus's newly established Caltech Earthquake Information Hot Line. The system was created after the January 17 Northridge earthquake in order to deal with and respond to the numerous phone calls that poured in from the public.

The hot line, which is able to answer 240 calls an hour and deal with 8 calls simultaneously, addresses five of the public's most common quake concerns: information on recent seismic activity, agencies providing emergency services, fault lines in California, general information about earthquakes, and requests for earthquake speakers. Hot line callers listen to a menu of options and press the number corresponding to the information that they want to hear. The information, given out by prerecorded voices, is primarily phone numbers of agencies whose main responsibility is handling public inquiries—such as the U. S. Geological Survey, the Red Cross, and the National Earthquake Information Center.

### *Honors by the bushel mark start of academic season*

Yaser Abu-Mostafa, associate professor of electrical engineering, is one of 20 to be honored with the W. M. Keck Foundation Award for Engineering Teaching Excellence. The \$10,000 award recognizes the impact that excellence in teaching has on the future of the engineering profession.

Clarence Allen, professor of geology and geophysics, emeritus, has received the Alfred E. Alquist Award for "achievement in earthquake safety and sustained leadership in the earthquake field," given by the California Earthquake Safety Foundation.

Michael Alvarez, assistant professor of political science, has been selected as a John M. Olin Faculty Fellow for the 1994–95 academic year. The fellowship will provide financial support so that Alvarez can spend the year focusing on research and writing. He has also been awarded a 1994 Haynes Foundation Faculty Fellowship for his proposal entitled "Information in State-Level Political Campaigns: An Examination of the 1994 Senate and Gubernatorial Races in California."

Richard Andersen, the James G. Boswell Professor of Neuroscience, has received the W. Alden Spencer Award, which he shares with Caltech alumnus William Newsome, PhD '80, of Stanford. Presented by the College of Physicians and Surgeons of Columbia University, the \$1,000 award honors each scientist's "highly original contributions to research in neurobiology."

The Associated Students of Caltech have presented their 1994 ASCIT Teaching Awards to Cheryl Anderson, teaching assistant in chemical engineering; Erick Carreira, assistant professor of chemistry; John Elwood, teaching assistant in physics; Steve Frautschi, professor of theoretical physics; Melany Hunt, assistant professor of mechanical engineering; Julie Kornfield, assistant professor of chemical engineering; Tsutomu Ohshima, karate instructor; and P. P. Vaidyanathan, professor of electrical engineering.

Each year, Ferguson prizes of \$1,000 are awarded for teaching excellence in biology, based on polls of undergraduate and graduate students. This year's prize for graduate teaching, which can go to a TA or faculty member, was awarded to David Anderson, associate professor of biology. The teaching-assistant award was shared by Chris Byrd and Michelle Apperson, and the award for undergraduate teaching by a faculty member went to Professor of Biology Charles Brokaw.

Fred Anson, professor of chemistry, has been named the recipient of the American Chemical Society's Award in Electrochemistry, given to a member of the ACS Division of Analytical Chemistry who has "uniquely advanced the field." The award, with its \$4,000 stipend, is sponsored by EG&G Princeton Applied Research.

Three graduate students have been honored with Division of Chemistry and Chemical Engineering's first Outstanding Graduate Teaching Assistant Service Awards. The teaching assistants are Stephen Arvedson, Michael Day, and Susan Kephart. Each was awarded \$100 for their "fine contributions . . . toward the goal of teaching excellence."

Professor of Chemistry Jacqueline Barton has received an honorary doctorate from Ohio's Kenyon College for her research into the chemistry of gene expression.

Seymour Benzer, the James G. Boswell Professor of Neuroscience, Emeritus, has been selected to receive a 1994 McKnight Senior Investigator Award, for continued research into the neurogenetics of brain degeneration in fruit flies. The McKnight Awards programs in neuroscience were established in 1976 to stimulate research in neuroscience, especially that which leads to a greater understanding of diseases affecting memory.

Pamela Bjorkman, assistant professor of biology and assistant investigator for the Howard Hughes Medical Institute, has been chosen to receive a 1994 Gairdner Foundation International Award for her discovery, with Harvard professor Don Wiley, of the structure of a peptide-antigen complex that triggers an immunological response in the body. Bjorkman and Wiley are two of five to be honored with this Canadian award of \$30,000 for achievements in medical science.

The Graduate Student Council bestowed its 1994 GSC Teaching Awards on Norman Brooks, the James Irvine Professor of Environmental and Civil Engineering; Scott Page, assistant professor of economics; Paul Sternberg, associate professor of biology; Barbara Imperiali, assistant professor of chemistry; and Gary Lorden, professor of mathematics.

Lance Davis, the Mary Stillman Harkness Professor of Social Science, has received the third Sanwa Award from the Center for Japan–U.S. Business and Economic Studies at New York University. Davis and Robert Gallman of UNC Chapel Hill will be given a \$35,000 honorarium for their presentation and publication of a study on "International Capital Flows, Domestic Capital Markets, and Economic Growth in Four Frontier Countries."

Two Caltech assistant professors have been chosen as Howard Hughes Medical Institute assistant investigators. William Dunphy and Stephen Mayo of biology will join the 49 new and 225 current investigators nationwide, all of whom are funded by HHMI to continue their research at their home institutions. The organization anticipates that its scientists are "likely to make significant advances in biomedical research and to develop new approaches to overcoming disease." In a separate honor, Mayo has been named a 1994 Searle Scholar and given a three-year grant of \$180,000 to continue his original research in automated protein design. The Searle Scholars Program supports research by outstanding new assistant professors in medicine, chemistry, and biological science.

Roy Gould, Ramo Professor of Engineering, will receive the James Clerk Maxwell Prize in Plasma Physics in November. The award of \$5,000, sponsored by Maxwell Laboratories Incorporated and presented by the American Physical Society, honors "contributions to the advancement and diffusment of the knowledge of properties of highly ionized gases."

Harry Gray has been hailed as a "genius of the classroom and the laboratory" by Columbia University, which granted the Arnold O. Beckman Professor of Chemistry an honorary doctor of science degree.

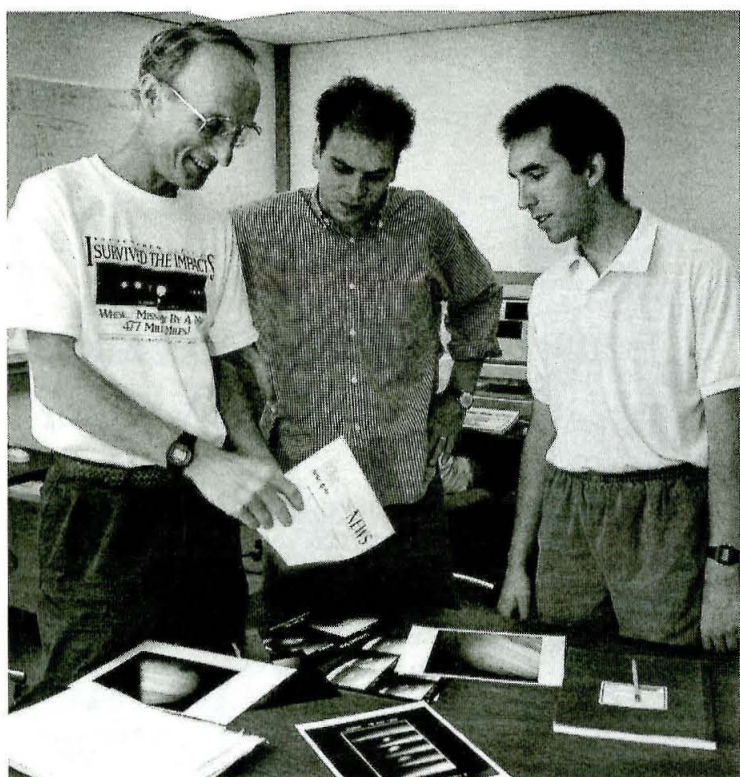
The American Academy of Arts and Sciences has elected Robert Grubbs, the Victor and Elizabeth Atkins Professor of Chemistry, and Shrinivas Kulkarni, professor of astronomy, to join its membership of more than 4,000 distinguished scholars, scientists, artists, and public figures. Grubbs and Kulkarni are among the 210 honorees this year and among the 69 Caltech members of the Academy.

Hiroo Kanamori, the John E. and Hazel S. Smits Professor of Geophysics and director of the Seismological Laboratory, has been awarded the 1993 Asahi Prize by the Asahi newspaper company. The prize, which includes a monetary award, recognizes Kanamori's "studies of the basic physics of the occurrence of earthquakes, and their applications to hazard reduction."

Wolfgang Knauss, professor of aeronautics and applied mechanics, will receive the Murray Medal from the Society for Experimental Mechanics. The honor includes an invitation to give the William M. Murray lecture (named for the society's first president) at the group's spring conference in 1995.

Carver Mead, Moore Professor of Engineering and Applied Science, has received the Robert Dexter Conrad Award—the Navy's highest honor for scientific achievement—for his "enormous impact on very large scale





Baseball's heavy hitters may have been out on strike, but the 20-odd players on "Team Shoemaker-Levy" scored big with scientists and public alike, when they connected, right on schedule, with Jupiter in July. Among the many Caltech scientists watching the play-by-play were planetary science professor Andy Ingersoll, research staffer Christophe Dumas, and grad student Anthony Tolgo (top photo). While Ingersoll's group studied the effect of the collision on the Jovian atmosphere, other teams modeled the impact dynamics, and still others gave the action *The Wave*—infrared and radio-wave studies that is, carried out at Palomar and Owens Valley Observatories. Can Shoemaker-Levy cards bearing some of the striking images produced by the Hubble Space Telescope (bottom photo) be far behind?



integration and neural network technology." As a contractor for the Office of Naval Research, Mead has "helped the Navy maintain its superiority, and the nation excel in solid-state electronics and computer design."

Manfred Morari, Ross McCollum-William H. Corcoran Professor of Chemical Engineering and executive officer for control and dynamical systems, has received the Grössen Ehrenzeichen des Landes Steiermark, which is a major honor awarded by the state of Steiermark in Austria.

John Roberts, Institute Professor of Chemistry, Emeritus, is the recent recipient of two honors. He has received the Arthur C. Cope Award from the American Chemical Society, recognizing his outstanding achievement in organic chemistry with a gold medal, a bronze replica, \$25,000, and an unrestricted research grant of \$50,000. Roberts is also one of four scientists to be named a 1994 Chemical Pioneer of the American Institute of Chemists, Inc., for research that has had "a major impact on advances in chemical science or industry."

Robert Rosenstone, professor of history, has received a Fulbright grant to teach a graduate seminar on "the historical film" at the University of Barcelona next year. He has also been awarded a 1994 National Endowment for the Humanities summer stipend to do a research project on films about the Spanish Civil War.

Philip Saffman, professor of applied mathematics, is the recipient of the 1994 Otto Laporte Award, presented by the American Physical Society. The award recognizes outstanding accomplishments in fluid dynamics research.

Wallace Sargent, the Ira L. Bowen Professor of Astronomy, has been selected to receive the 1994 Catherine Wolfe Bruce Gold Medal from the Astronomical Society of the Pacific for his many achievements in the field of astronomy.

Erin Schuman, assistant professor of biology, is one of 100 "outstanding young scientists and economists" to be awarded a Sloan Research Fellowship. On the basis of Schuman's "exceptional promise to contribute to the advancement of knowledge" in the field of neuroscience, she will receive a \$30,000 grant over a two-year period. In a separate honor, Schuman has been awarded a \$240,000 John Merck Scholarship in the Biology of Developmental Disabilities in Children by the John Merck Fund. Schuman, who is the first Caltech winner of this prize, will receive the award over four years.

David Stevenson, professor of planetary science, has been presented with the 1994 Fred Whipple Award by the American Geophysical Union. Stevenson is the third recipient of the award, given for outstanding contributions in planetology.

Ahmed Zewail, the Linus Pauling Professor of Chemical Physics, has been named the recipient of the Bonner Chemiepreis, presented by the Chemical Institutes in Germany. Zewail is internationally known for his work in developing the field of femtochemistry—chemistry on the time scale of femtoseconds, or millionths of a billionth of a second.

Kai Zinn, assistant professor of biology, is one of 14 scientists to receive a McKnight Neuroscience Investigator Award, which will provide Zinn's lab with \$120,000 over a three-year period, toward research into the development of the central nervous system of insects. The award, given by the McKnight Endowment Fund for Neuroscience, supports studies relating to the basic mechanisms of memory and the disorders affecting it.

## Caltech's excellent adventure continues

A few years ago, a horse named Caltech chalked up a series of fairly impressive victories on the turf. Now, in the latest rankings of America's top graduate schools in *U.S. News and World Report*, Caltech the institution has turned in an equally persuasive performance, with two wins and two places, as well as a number of additional top-ten showings. Based on surveys of department heads and graduate school officials at colleges and universities nationwide, *U.S. News* rated the Institute first in the nation in the quality of its graduate training in physics and geology, and second (behind MIT) in aerospace and chemistry. Caltech was ranked fifth in biology, sixth in its overall engineering program, eighth in mathematics, and tenth in computer science. Ratings reflect such criteria as academic reputation, content of the curriculum, and the quality of faculty and graduate students.

Hard on the heels of the *U.S. News* survey confirming that the Institute caters to some of the best brains comes a report in the journal *Science Watch* that Caltech also carries out some of the best brain studies. "Perhaps forever destroying the stereotype that Californians are wanting when it comes to gray matter, two research institutions in the Golden State—the Salk Institute for Biological Studies and Caltech—have captured the top two spots in *Science Watch's* latest ranking for neuroscience research," reported the journal, adding, "as the natives might say, 'Like totally excellent research, dude!'" The journal, which tracks trends and performance in basic research, based its ratings on a survey of close to 150,000 neuroscience papers published and cited between 1989 and 1992.

## Eyes on the reprise

The last issue of *Caltech News* carried an article about Caltech history professor Morgan Kousser and his role as an expert witness in a number of landmark voting rights cases ("Morgan Kousser Goes Beyond the Classroom to Make His Case for Equal Rights"). In his most recent case, plaintiffs had challenged the constitutionality of the serpentine shape of North Carolina's 12th district, which has sent one of the state's first two African-American representatives to Congress in nearly a century. Kousser, who was serving as an expert witness in defense of the 12th, predicted that the current district boundaries would be upheld at the district court level and that the decision would probably be appealed to the U.S. Supreme Court.

So far, half of Kousser's prediction has come true. On August 1, the majority of a three-judge panel in North Carolina approved of the "racial gerrymander" as a way to help "remedy past discrimination against blacks," according to the *New York Times*. As to the second half of Kousser's prediction, the plaintiffs are indeed expected to appeal the decision to the nation's high court during its 1994-95 term.

## Historians, scientists to talk technology at open conference

The Division of the Humanities and Social Sciences and the Beckman Institute are cosponsoring "a collaborative historical and scientific workshop," which is open to all interested alumni. Registration is required, but there is no fee to attend the many sessions Friday through Sunday, November 11-13.

Entitled "Ideas, Instruments, and Innovation: The Interdisciplinary Migration of Technologies and Concepts," the conference features historians of science from around the world. Each panel of presenters is joined by a respondent from the field of science and by a commentator.

"The workshop centers on the communication of scientific theories, practices, and devices both across fields and among engineers, experimentalists, and theoreticians," says Diana Barkan, Caltech assistant professor of history. "It's meant to encourage dialogue between scientists and historians of science—especially those interested in recent issues in the history of instrumentation."

Some traveling grants are available for graduate students. To register or receive more information, call Helga Galvan at (818) 395-4538.



## JPL Director Stone is Caltech's first Morrisroe Professor

Caltech has established the David Morrisroe Professorship in Physics, and has appointed Edward Stone, professor of physics and director of JPL, the first occupant of the new chair. The professorship, which is named for Caltech's vice president for business and finance and treasurer, David Morrisroe, was made possible through a gift to the Institute from the late Caltech alumnus and trustee James W. Glanville and his wife, Nancy Glanville.

Stone, 58, became director of the Jet Propulsion Laboratory in 1991 following his immensely successful stewardship of the Voyager mission to Jupiter, Saturn, Uranus, and Neptune, for which he served as project scientist. A specialist in cosmic-ray physics, he joined Caltech as a research fellow in



Edward Stone

1964 after earning his PhD from the University of Chicago, and rose through the academic ranks to become professor of physics in 1976. From 1983 to 1988, he chaired Caltech's Division of Physics, Mathematics and Astronomy, and from 1988 to 1990, he was the Institute's vice president for astronomical facilities.

Elected to the National Academy of Sciences in 1984, Stone has received numerous other honors for his research and administrative achievements, including three NASA medals—for Exceptional Scientific Achievement, Distinguished Public Service, and Outstanding Leadership.

David Morrisroe has been associated with Caltech since 1969, when he became the Institute's treasurer and vice president for finance—vice president for business was added to this title in 1978. A graduate of Manhattan College who holds an MA from Columbia and an MBA from Harvard, Morrisroe oversees the business and financial



**Linked by the death of a king, the birth of a town, and the birth of a university, President Tom Everhart and Pasadena businessman George Throop, Jr., pose with the certificate of greeting and congratulations that Caltech, formerly Throop Polytechnic Institute, sent to Throop, Pennsylvania, in September to mark the hundredth anniversary of the east Pennsylvania town. Throop the town was founded by Benjamin Throop, a distant relative of Amos Throop, who founded the university that later became Caltech. No Throops live in Throop now, but acting on information provided by former Throop citizen and Caltech alumna Ann Gretzula Vaeth '85, the town fathers tracked down George Throop in Pasadena and invited him to serve as grand marshal of their centennial parade, an offer that Throop, a distant cousin of both Benjamin and Amos Throop, was happy to accept. And where does the death of a king fit into this family equation? A Throop genealogy shows that George, Amos, and Benjamin Throop can all trace their ancestry back to William Throop, a 17th-century Englishman and a member of the Puritan tribunal that tried and subsequently executed King Charles I.**

operations for both the campus and JPL, as well as the investment of endowment, and is a lecturer in business economics in Caltech's Division of the Humanities and Social Sciences. In establishing a professorship in Morrisroe's name, the Glanvilles have stated that they wished to honor "the high quality and competency of his many years of service to Caltech."

James Glanville first came to Caltech as a graduate student in chemical engineering, earning his MS in 1946 and engineer's degree in 1948. He then pursued a career in oil engineering and finance that led in 1963 to a partnership in Lehman Brothers of New York City, and subsequently to his becoming a general partner of Lazard Freres & Co. in 1978. Elected to Caltech's board of trustees in 1970, Glanville served as board vice chair and as chair of the finance committee, as well as on other board committees. He was serving as chair of the Campaign for Caltech at the time of his death in 1992. Among the many projects he and his wife supported were the Beckman Institute, for which they funded the Beckman Exhibit Room and the Glanville Courtyard, and the Harold Brown Professorship. Last year, the Glanville family made a gift to the Campaign for Caltech of the James W. Glanville Postdoctoral Fellowship.

## Liebau named new admissions director

On August 1, Charlene Liebau joined the staff in Caltech's undergraduate admissions office as director of admissions. She replaces Carole Snow, who accepted the offer of vice president of enrollment at the Illinois Institute of Technology.

Liebau comes to Caltech with 12 years of experience in admissions at Occidental College—the last nine as

dean of admission. During Liebau's tenure as dean, applications increased by 78 percent, and she implemented an alumni admission program.

Her responsibilities at Caltech will include providing leadership and supervision of recruitment, publications, and outreach/orientation programs designed to reach the brightest science and engineering students from across the nation.

The challenges facing Caltech's admissions department are similar to those facing other private colleges, according to Liebau. "We are all trying to recruit a diverse student body, while facing economic challenges and recruitment from the public sector," she says. "In addition, Caltech has the added challenge of bringing to campus students who are focused on mathematics, science, and engineering, as well as being well prepared for the rigorous



Charlene Liebau

course of study offered here."

Liebau was awarded a BA in sociology from Berkeley and an MA in counseling psychology from Stanford. She served in various capacities in student affairs at Stanford and San Jose State University before joining the staff at Occidental College in 1979, part-

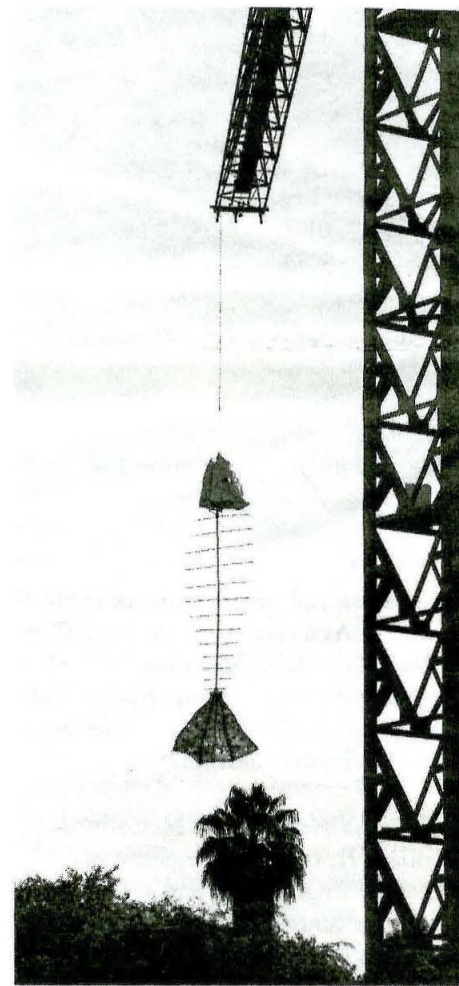
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## Commencement

*Continued from page 1*

levels said that their immediate ambition is to take some time off to travel.

Three prizes were also presented at commencement. The Frederic W. Hinrichs, Jr., Memorial Award, given each year to "the senior who, in the opinion of the undergraduate deans, has made the greatest undergraduate contribution to the welfare of the student body and whose qualities of leadership, character, and responsibility have been outstanding," was awarded to Michael



**On commencement day, the campus awoke to this tribute to all those who had "hung in there." This engineering feat involved a giant crane, aluminum foil, and a fishy sense of humor.**

Lee Brundage, who picked up the prize along with a degree in mathematics.

Joan Marie Gimbel, who graduated with a degree in engineering and applied science, received the Mabel Beckman Prize, awarded to a junior or senior woman "in recognition of demonstrated academic and personal excellence, contributions to the Institute community, and outstanding qualities of character and leadership."

The Milton and Francis Clauser Doctoral Prize, for "research that is judged to exhibit the greatest degree of originality," was awarded to Paul James Tackley for his PhD research into mantle convection—work that has had a tremendous impact on the geophysics community and was the subject of a cover story in the February 25, 1993, issue of the journal *Nature*.



## FRIENDS

### Baxter Foundation endows fellowship

The Donald E. and Delia B. Baxter Foundation has awarded \$800,000 to Caltech for the endowment of a senior postdoctoral fellowship in biomedical research. The Institute will receive the award over a period of five years.

Income from this fund will allow Caltech to recruit the most talented PhDs to conduct basic research in collaboration with the Institute's biology faculty. Caltech's neuroscience research was recently ranked second in the world among colleges, universities, and research institutes for number of citations per research paper, a measure of the papers' impact on the field.

The new fellowship provides a welcome addition to the research program in Caltech's Division of Biology, since it creates an ongoing source of support for an established, senior postdoctoral researcher in the last two years of his or her appointment. Fellowships more typically support a scientist during the first years of a postdoctoral position.

The Baxter Foundation was established by Delia B. Baxter in 1959 in honor of her late husband, Donald E. Baxter, a physician, scientist, and engineer who was a pioneer in the commercial preparation of sterile solutions and associated medical equipment for intravenous therapy. The foundation provides funds to leading postgraduate institutions for research in medicine, biomedical engineering, molecular biology, and gene therapy.

### Liebau

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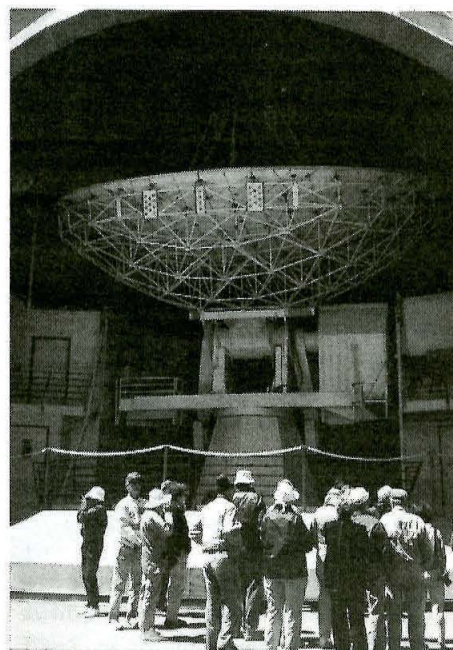
time as assistant director of admission. In 1982 she accepted a full-time position, associate director of admission, and was appointed dean of admission there in 1985.

While at Oxy, Liebau served on the search committees for the college's president and vice president and was a member of the steering committee to develop a long-range strategic plan.

Although the incoming freshmen haven't arrived yet, Liebau says that admissions staff members are already conducting information sessions for students who will apply to Caltech next January for the class of 1999. The staff is planning information receptions this fall in 40 cities nationwide, with the help of local alumni, in order to spread the word about Caltech.

"I welcome the opportunity to continue Caltech's commitment to excellence in research and scholarship," says Liebau. "I am looking forward to working with faculty, students, and alumni in addressing these challenges."

### Caltech Associates make stellar excursion



**Like ancient Polynesian navigators, the Caltech Associates are following the stars to Hawaii. This past spring gave members of the Institute support group two opportunities to view the Hawaiian skies from the pinnacle of Mauna Kea and to learn firsthand from Institute astronomers what modern star-gazers are discovering as they scan the heavens from this unique observing site. About 50 people took part in each trip, visiting Caltech's Keck and Submillimeter Observatories and hearing about the work under way there from Caltech astronomy professors Wallace Sargent and George Djorgovski, here being introduced to the group by Associate and alumnus George Smoot '50 (top photo). The day after the update, it was off to the mountaintop, where tour-leader Djorgovski (above photo, left) elaborated on some of the finer points of both Caltech telescopes and his listeners (above photo, right) got a good look at the technology that has taken the place of the keen-eyed Polynesian voyager. Associates who had hoped but were not able to voyage across the Pacific themselves can thank their lucky stars: both tours were so well-attended and participants so enthusiastic that plans for the next stellar excursion are already well under way.**

### Gifts by will

*Trusts and bequests provide welcome support to Caltech's Operating and Endowed Funds. The following are recent gifts to Caltech:*

Lucille M. Wisegarver has left a portion of her estate to the Institute in the amount of \$238,127 in unrestricted funds. She was the wife of Burnett B. Wisegarver, a 1926 Caltech graduate in chemical engineering.

James T. Reilly has made a bequest to Caltech of the residue of his estate in the amount of \$106,464 in unrestricted

funds. He received his BS in geology from Caltech in 1932.

Dr. James R. Wilts has made a bequest to the Institute of a portion of his estate in the amount of \$67,061 for unrestricted purposes. He received his MS from Caltech in 1949 and his PhD in 1952, both in physics.

For information about wording for bequests to the Institute, call the Office of Gift and Estate Planning (818) 395-2927.

### Caltech Alumni Fund returns to tradition

It's official! This past spring the alumni volunteer leadership agreed to return to its original name of Caltech Alumni Fund, says Fund Chair Kent Frewing '61.

"Our motivation for this," says Frewing, "was to more fully recognize and publicly credit the many loyal and generous Caltech alumni who regularly support Institute fund-raising efforts." He adds, "We had always been known as the Alumni Fund until about four years ago, when we attempted to minimize the confusion between our office and the Alumni Association. I believe the benefits of the name-change will far outweigh any difficulties that may arise as a result of the similarity with the Alumni Association."

In 1993-94, the fund raised close to \$3 million in alumni contributions from approximately 30 percent of Caltech's graduates. Contributions to the Alumni Fund support a wide range of Institute teaching and research areas. These include much-needed student scholarships, the recruiting and retaining of the best faculty, the acquisition of state-of-the-art technology and equipment, and the development of new academic programs. Frewing hopes the fund's retro name-change will encourage more alumni to participate in upcoming fund drives, not only as contributors but also as volunteers seeking donations from fellow alumni.

"Requests for donations take place through a combination of alumni volunteer and Caltech student callers," Frewing says, "and the support of our volunteers has always been a major component of the fund's success."

In keeping with the fund's long history, fund volunteers span several decades of Institute graduates, from Harry Moore '48, who says, "Caltech gave me a great deal as a student, and this is a great way to repay the college," to Daniela Bonafede-Chhabra '84, who echoes Moore's sentiments in stating, "I enjoyed my time at Caltech and got a good education, and I feel like I wanted to give something back."

Each year the fund has more than 700 alumni volunteers. "We're always looking for enthusiastic alums to join our dedicated volunteer family," says Frewing. "It's a worthwhile cause."

Alumni who would like more information about the Caltech Alumni Fund or who are interested in becoming volunteers are invited to call (818) 395-6323 or to write:

Caltech Alumni Fund  
Mail Code 105-40  
Pasadena, California 91125





William Pickering makes his acceptance speech for the Japan Prize before an audience that includes the emperor and empress of Japan (seated in front, at far right). The prize honors outstanding achievement in science and technology, a cause Pickering has furthered by establishing a graduate fellowship at his alma mater, Caltech.



By Michael Rogers

William (Bill) Pickering's life changed dramatically on January 31, 1958. While the now-retired director of the Jet Propulsion Laboratory experienced many anxious days during his long tenure as head of America's unmanned space program, few could equal the tension and anticipation of that day, 36 years ago, when the entire country's expectations were riding on his and JPL's shoulders.

Four months earlier, in October 1957, at the height of the Cold War, the Russians had launched Sputnik, the first man-made object to orbit the earth. Sputnik surprised and shocked the United States, and the Navy was chosen to match the Soviets' success with one of its rockets, called Vanguard. But in early November, when the Russians successfully launched a second satellite, President Eisenhower decided that there should be a backup to Vanguard. In response, the Pentagon turned to Pickering, who ran JPL for the Army. Pickering said he could have a rocket ready in 90 days. He soon had to make good on his promise, for in December, in the full glare of live TV coverage, Vanguard blew up on the launch pad. Now the pressure was on Pickering.

If the launch of Sputnik left much of America feeling frustrated and alarmed,

the opportunity to match the Soviets' achievement in space provided JPL with a new sense of purpose. Best known at the time for making missiles, JPL had already started working on a test rocket for space exploration before Sputnik forced it to speed its tests from lab to launchpad. Beating his self-imposed deadline, Pickering had the satellite, known as Explorer 1, ready for launch within only 83 days. Perhaps fearing further embarrassment, the Pentagon banned TV cameras at the launch site this time. Pickering nervously followed the action by telephone and teletype in a small room at the Pentagon. He was joined by James Van Allen, the scientist who had designed the principal payload, a Geiger counter to measure radiation; Wernher von Braun, the German scientist who went to work for the U.S. building missiles and rockets after World War II; and the secretary of the Army. The late-evening launch was successful, but there would be no sighs of relief until Explorer 1 had completed its first orbit. Scientists had calculated that it would take 105 minutes before it would pass the West Coast, rounding the bend of the first orbit. But when JPL scientists at the tracking station in Borrego Springs, California, heard nothing by the designated time, the

watch at the Pentagon grew tense.

"Eight minutes passed, and it was obviously the longest eight minutes I ever spent," recalls Pickering. "I was on the phone to the command center in Pasadena, and the secretary of the Army was glaring at me saying, 'Where the hell is it?'" A miscalculation of the orbital time had caused the apparent delay, and finally the tracking station picked up the signal.

Before they could celebrate, Pickering, Van Allen, and von Braun were dispatched to a press conference at the National Academy of Sciences. "It was a cold, rainy night," Pickering recalls. "There was nobody around, and as the three of us sat in the car crossing street after empty street, one of us said, 'I wonder if anyone will be there?' When we arrived, we were led through the back door of the academy, and then taken into what they call the great hall. To our astonishment, the place was packed with the media. The reporters kept us there, asking questions right into the early morning." Until that moment, Pickering had been able to work in relative obscurity. But from then on, the space race and the accompanying media attention kept him and JPL in the public eye. "Obviously," he says, "life was different for all of us after that."

This past summer, as JPL celebrated its 50th anniversary, the man who headed the lab for nearly half its life looked back on the path that led him to JPL, and JPL to the solar system. Pickering spent 32 years at the lab, 22 of them as JPL director. Under his guidance, JPL evolved from a facility that basically made missiles for the Army into a NASA-controlled operation whose focus was the unmanned exploration of the moon, the planets, and interplanetary space. When Pickering joined JPL, it had a budget of about \$12 million and a staff of about 1,100 people. When he retired, the lab's budget was roughly \$120 million after adjusting for inflation, and its staff totaled more than 4,000 people. JPL's successes were equally his. So closely was he identified with JPL that at his retirement party most of the 3,000 guests wore green buttons bearing his caricature and the words "Mr. JPL."

A steady stream of achievements highlighted Pickering's career at JPL, including the Ranger missions that provided the first close-up pictures of the moon, the Surveyor spacecraft that first achieved soft landings on the lunar surface, the Mariner missions to Venus and Mars, and the gravity-assisted Mariner mission to Mercury. While Pickering was considered a highly personable director, he also had a reputation for getting the job done. In a 1963 issue of *Time* featuring Pickering on the cover, his "indignant earnestness" over Explorer 1 was described. He reportedly "hollered at Army generals . . . and banged on desks" to get the Pentagon bureaucracy moving. Says Pickering, "That was a slight exaggeration."

Pickering's colleagues say that he had the right ingredients to make a successful director: boundless energy, endless patience, a good sense of humor, and political savvy. "It was a difficult assignment and he handled things very well," says Homer J. Stewart, professor of aeronautics, emeritus, at Caltech, who worked at JPL during the same years as Pickering. "He had good political skills, he listened to people, and he had good help. He's a real char-



acter and a real good man."

While the Explorer 1 mission was only the first of many events that would thrust Pickering into the international spotlight, the most recent occasion was last April, when the 83-year-old scientist was awarded the prestigious Japan Prize by the Science and Technology Foundation of Japan. Along with Swedish neuropsychopharmacologist Arvid Carlsson, who was also presented with the award, Pickering received \$480,000 and was honored at a ceremony and banquet attended by the emperor and empress of Japan. He is the first aerospace scientist to receive the 10-year-old award, which was presented to him for his "inspirational leadership in unmanned lunar and planetary exploration and for pioneering achievements in the development of spacecraft and deep-space communications."

Pickering won the Japan Prize only a few months after he was awarded the University of Michigan's Francois-Xavier Bagnoud Aerospace Prize. It was the first time the prize had been awarded, and Pickering used the \$250,000 to provide the initial funding for a graduate fellowship at Caltech, with which he has been associated since he came to the Institute as an undergraduate in 1929. Pickering, who was born and raised in New Zealand, has stipulated that the award should preferably go to a New Zealander. "There have been a few New Zealanders over here from time to time, but I want to make it a little easier for more of them to come," says Pickering, who believes he was the first Kiwi to come to Caltech. "I believe it's important to support Caltech because of the high-quality education it provides. I believe in giving something back to the Institute and I'd like others to have a similar educational opportunity."

Pickering grew up in a small town called Havelock on New Zealand's South Island. His mother and his only sibling, a brother, died when he was young, and his father was often out of the country, so he was basically raised by his paternal grandparents. His grandfather operated a horse-drawn delivery service, and Pickering occasionally tended the horses. He went to primary school in Havelock and was then sent to a boarding school for boys in Wellington, where his interest in science developed. He and a friend built the school's first short-wave radio and would often talk to fellow radio operators in the U.S. After high school, he spent a year at Canterbury College in Christchurch before he headed across the ocean to Caltech at the encouragement of a great-uncle, a retired civil engineer, who late in life had married a woman from Los Angeles and spent half his time there.

Pickering received his bachelor's degree in physics in 1932. He doesn't mention it in interviews, but a quick look at the 1932 yearbook to determine if he made any impact as an undergraduate shows that he was in fact class president. After this first experience in

a Caltech leadership position, he then continued at the Institute for his graduate studies, receiving his PhD in physics in 1936. Pickering credits Robert Millikan, his graduate advisor, with steering him away from his long-held interest in electrical engineering and into physics. Says Pickering: "I don't remember what he said to convince me, but I made a trip back to New Zealand in 1932 to size up the possibilities of getting a job in the electric power industry. It didn't look too encouraging, so I went back to Caltech."

After receiving his doctorate, Pickering stayed on to become part of a team of scientists that worked with Millikan on cosmic rays, sending Geiger counters up to 100,000 feet in balloons to study the high-energy particles. As part of his work, Pickering developed electronic telemetering techniques, so that data could be transmitted down from the balloons. Millikan and his researchers would occasionally travel cross-country and worldwide, taking radiation measurements at different latitudes, and Pickering recalls that Millikan always put his research first, even in the face of cataclysmic events. On one research trip in 1939, Pickering and Vic Neher, now a Caltech professor of physics, emeritus, who was also working with Millikan, had planned to meet "the chief" in India, but before they could leave Pasadena, World War II started in Europe.

"I sent Millikan a cable asking what to do," Pickering recalls, "and the gist of his answer was: 'Come on. Never mind the war.'" Pickering and Neher got to India, although finding boats willing to take them there under the threat of German submarine attacks wasn't easy. Along with Millikan, they completed their research by March 1940 and then returned to California,



**Along with NASA and JPL officials, Pickering presented a model of Mariner 2 to President Kennedy in early 1963, shortly after the spacecraft flew past Venus. Says Pickering: "It was the first time we had done something in space the Soviets hadn't."**

also by circuitous ocean routes. Later that year, Pickering became an assistant professor in electrical engineering (he would be named associate professor in 1945 and professor in 1947), and in 1944, he went to the newly named Jet Propulsion Laboratory as a section chief developing radio telemetry systems for missiles. JPL had just been transformed from a group studying rocketry at Caltech's Guggenheim Aeronautical Laboratory into a government-spon-



**Pickering (in truck, operating receiving equipment) was in Mexico, conducting cosmic-ray research with Robert Millikan, when word came that the United States had entered World War II. "Keep working," said the highly focused Millikan—and they did.**

sored wartime project for research on long-range rockets and missiles.

Although he was only 33, Pickering says that he didn't feel too young for the responsibilities of the job. On the contrary: "The laboratory was a bunch of youngsters in those days, and I was one of the old ones." Five years after joining JPL, Pickering was chosen to oversee development of the Army's first long-range, liquid-propelled, supersonic missile, called Corporal. In 1950 he stopped teaching at Caltech and moved full time to the lab, where he was soon put in charge of the Sergeant solid-propellant missile project. In 1954, when JPL director Louis Dunn abruptly resigned to take a job at the

much of his time in Washington, representing the lab's interests before Congress and NASA, which took over JPL from the Army on New Year's Day, 1959. But he says he always considered his primary role to be that of a manager organizing groups of engineers. "I always thought of the laboratory work as primarily engineering rather than science, building devices and having them go where they were supposed to go and communicating to Earth the way they were supposed to communicate," he says. "Therefore, I thought of myself as organizing engineering teams to accomplish these engineering objectives."

Of all the missions Pickering oversaw at JPL, his favorite, from the standpoint of its technological achievement, was the Mariner 9 mission to Mars in 1972. The spacecraft's primary job was to map the surface of Mars, and it was already well into its mission when a scientist requested that it detour to take close-up photographs of Phobos, the larger of Mars's two moons. Phobos was circling the Martian equator every eight hours, while Mariner was passing over the poles every 12 hours. The trick was to alter Mariner's speed, direction, and orbital radius by computer control so that it could get close enough to Phobos to take pictures, but not so close that the two would collide.

"We had to modify the trajectory and have sufficient confidence to put that thing close to Phobos, which is about the size of Catalina Island," Pickering says. "We came to within about 20 miles of Phobos and took some photographs as we went whistling by. It absolutely fascinated me that the trajectory analysts and the systems engineers knew enough about the Mariner system to be able to do that. I regarded that as an amazing example of the ability to understand and control these devices at distances of millions of miles and also to communicate with them so well that we knew exactly what was going on."

For all of Pickering's achievements, there were also occasional setbacks. The biggest one almost put JPL out of business. "The most serious trouble we got into was in the early days of the Ranger missions to the moon in the early '60s," Pickering says. "We had five Ranger shots, none of which went as expected. The first five were designed as engineering tests, but as far as Congress and Washington were concerned, we had launched five Rangers and none worked properly. We said we'd spend one year straightening out the problem and then launch Ranger 6. The spacecraft was supposed to photograph the moon in the last ten minutes before it hit the surface, but the camera didn't work. After that fiasco, there was a strong move in Washington to cancel the project. We were able to convince them that it wouldn't happen again. Six months later, we launched Ranger 7 and it was perfect. If it hadn't been, it could have ended the NASA contract."

Today, nearly 20 years after stepping

*Continued on page 9*

Ramo-Wooldridge Corporation (now TRW), Lee DuBridge, then Caltech's president, chose Pickering to take over as JPL director. DuBridge made Pickering promise that he wouldn't use the job to quickly jump to industry. Pickering certainly took his oath to heart. He stayed until 1976, longer than any other JPL director. During his tenure, five U.S. presidents—from Eisenhower to Ford—came and went.

As JPL's director, Pickering spent



## Everhart: "Dream impossible dreams"

Exam time was over for Caltech's commencement crowd, but President Tom Everhart's commencement address, "Accomplishments: Past, Present, and Future," gave graduates the opportunity, if they so desired, to take one last little quiz. In his talk, Caltech's president highlighted the achievements of some of the Institute's earlier graduates, but cagily withheld their identities long enough for his listeners to play a bit of a guessing game.

Which renowned graduate ran the campus laundry in his student days, and which one went broke after only a year at the Institute? Who won a promotion to associate professor by first winning the Nobel Prize? The answers to these questions, and more, are revealed in the following excerpt.

Individuals at Caltech and individuals from Caltech have dared to dream impossible dreams—and then make them come true. When a larger telescope was needed to see farther into the universe, a graduate of Caltech designed it. When better understanding



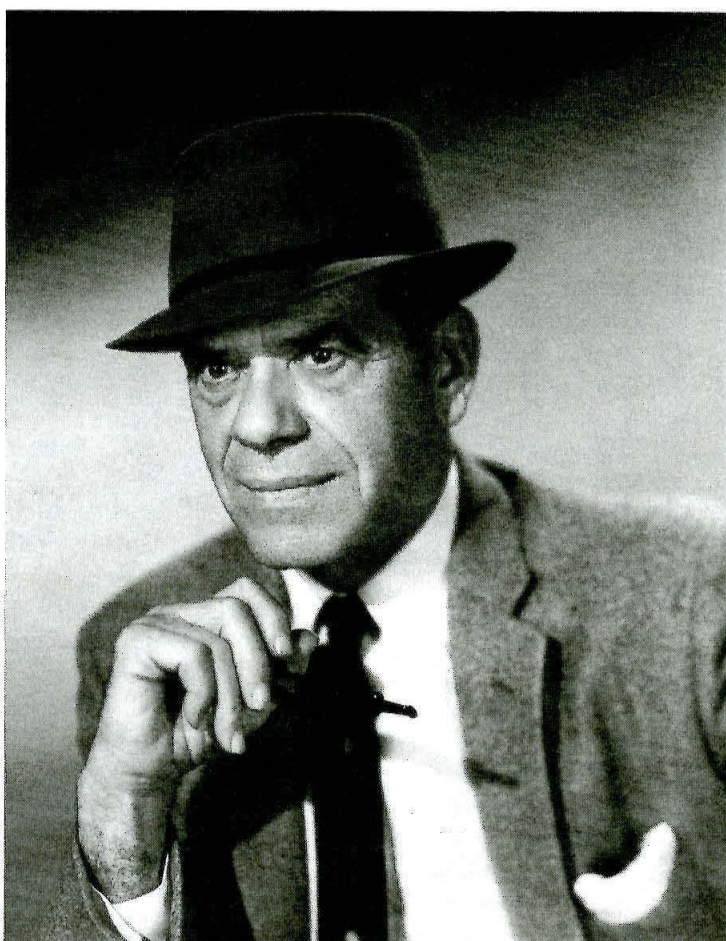
**Linus Pauling**

of aerodynamics was needed to advance aircraft design, Caltech supplied that understanding. If new instruments were needed to measure the shaking of the earth, the sequencing of DNA, or the speed of chemical reactions, people at Caltech dared to invent them, too.

Caltech graduates have achieved in diverse fields and in diverse ways. Consider a few who preceded you to 99 earlier commencements. Frank Baldwin Jewett '98 went on to get a PhD at the University of Chicago, became the first head of Bell Laboratories, and was the first industrial leader to be President of the National Academy of Sciences.

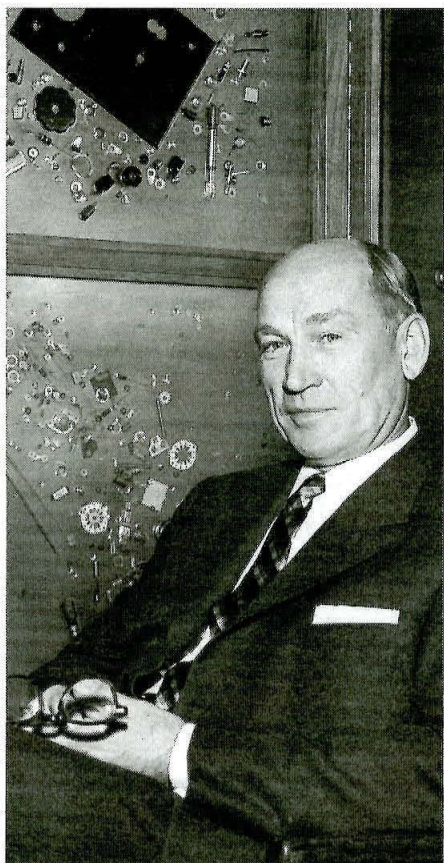
Two decades later, at the end of World War I, the Institute graduated a student who had edited the undergraduate newspaper, *The Tech*, captained his ROTC unit as a senior, worked nights

**Frank Capra**



as a waiter, managed the student laundry, and polished engines at a Pasadena power plant for 25¢ an hour between 3:30 a.m. and 7:30 a.m. After earning his degree in chemistry and completing his army duty, he was unable to find work as a chemist, so he did odd jobs for three years. One of these jobs was as a gag writer, cameraman, and director at a small movie studio. Frank Capra went on to become one of the great movie directors of all time.

In 1922, a young man arrived from Oregon State University to do graduate work at Caltech. In a little over two years, he had material for five papers on the structure of minerals by X-ray diffraction, enough for a PhD in chemistry. After a year or so in Europe, where quantum mechanics was being formulated in the laboratories of Bohr, Born,

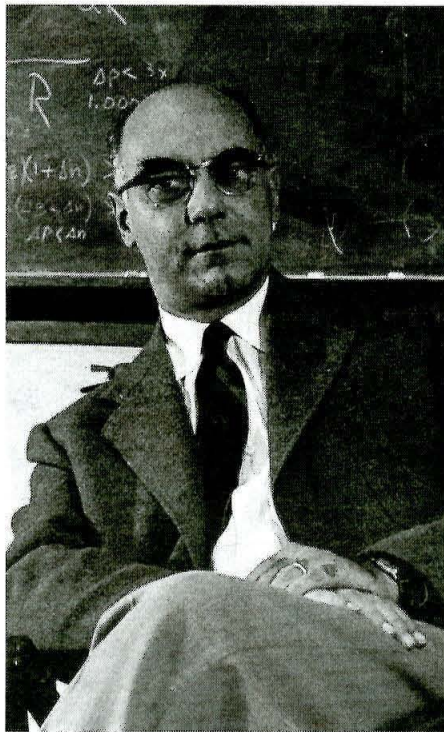


**Arnold Beckman**

and Heisenberg, he returned to Caltech at age 26, the youngest member of the professorial faculty. Linus Pauling revolutionized chemistry during his career. As you know, he received the Nobel

Prize in Chemistry in 1954, and the Nobel Peace Prize in 1962.

Another lad who came from the University of Illinois in 1923, also to study chemistry, has had a rather different impact. After a year at the Institute, he was broke. He joined AT&T Research in 1924 to earn some money and to learn about electronics. After getting married, and no longer broke, he returned to Caltech to get a PhD in photochemistry and then joined the faculty. Shortly thereafter, he combined



**Carl Anderson**

electronics with chemistry, and invented the pH meter. Arnold Beckman commercialized that, and many other inventions, while building a company that carries on his traditions and his name. His exemplary philanthropy has benefited both his alma maters, and many other institutions as well.

When Lee DuBridge came to Caltech as a postdoctoral fellow in 1926, a young undergraduate was assigned to help him with research. That student graduated in 1927, received his PhD in physics in 1930, and stayed on at Caltech as an assistant professor. While working with a cloud chamber in 1932, he discovered a track that could

only have been caused by a positively charged particle with the mass of an electron. In 1936, Carl David Anderson became the first Caltech graduate to win a Nobel Prize for work done at the Institute, the discovery of the positron. The faculty were impressed—the next year he was promoted to associate professor! Two years later, he became a professor. Rarely has success and recognition come so quickly to a scientist.

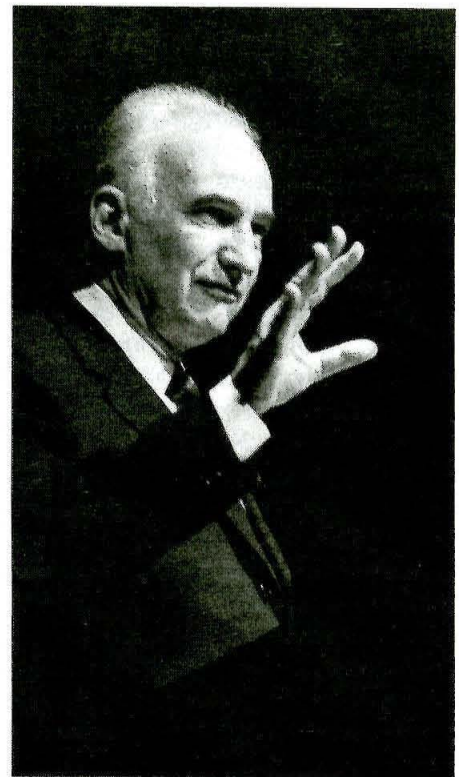
Another young physicist who graduated in 1930 took a different path.



**Chester Carlson**

After a stint of Bell Labs research, and work as a patent attorney, Chester Carlson invented xerography, which eventually changed the way the world reproduces images.

In 1933, a young electrical engineering student who had just graduated from the University of Utah arrived at Caltech. He thought he needed to develop expertise at applying science to the design of real-life electrical equipment and systems. In his own words: "When I began my courses at Caltech, I thought I had made a terrible mistake and come to the wrong place. At this institute, probing the scientific frontiers was the dominant endeavor. There were graduate courses listed under



**Simon Ramo**



electrical engineering, but their main thrust was the science underlying the engineering. It was a year before I realized how lucky I had been to land at Caltech. My eyes were opened to a whole new concept of how to prepare for a career in the application of science. Innovative engineering consists in part of brilliant inventing by creative engineers of new ways to put well-established scientific principles to work. But a large part of what engineering is also about, I came to see, is the exploiting of new scientific knowledge as soon as possible after it is uncovered. It is like the difference between learning how to pump oil ever more efficiently from an existing well and finding new oil deposits. Caltech taught me how to discover oil."

Si Ramo helped transform Hughes Aircraft into a new type of firm that applies science soon after it is discovered. Using that formula, Hughes became the largest corporate employer in California. In 1953 Si Ramo, with his Caltech colleague Dean Wooldridge, formed Ramo Wooldridge Corporation, backed by Thompson Products. This endeavor evolved into Thompson Ramo Wooldridge, later shortened to TRW.

What will you, the Class of 1994, do after commencement? Based on past trends, about half of you receiving your bachelor's degree will go on for an advanced degree, often the PhD. Some of you graduating today may receive honors, such as election to one of the National Academies, or even the Nobel Prize. Many of you will educate others, for many Institute graduates have made teaching and research their career. If you choose to follow in their footsteps, we shall urge you on, for the nation needs excellent teachers and researchers to keep us at the forefront of science, technology, and other areas of knowledge that enrich human life. . . .

## Mettler: "Effects in unexpected directions"

In his commencement address, "Leaders of a Peaceful Revolution," Ruben Mettler spoke about the global impact of science and technology, and about the power of these fields to bring about changes and developments that may far outstrip original goals and expectations. In this excerpt, Mettler elaborates on this theme, drawing on his own experience as an engineer and project manager in the space program.

Science and technology have an enduring and continuing character that acts worldwide and knows no geographical boundaries. Their gradual cumulative effects over long periods of time can be very powerful indeed. These effects may not be really apparent in the short term. A decade or more may pass before the power of long-term effects on advancing science and technology can be clearly and fully

understood.

Often the effects are in unexpected directions. Science and technology not only offer new knowledge and thus new public and private choices, but they also affect the basic framework within which decisions are made. These effects include significant changes in the nature and capacity and power of our most fundamental public and private institutions. The combination of changing individual value judgments, attitudes, and interests, and the gradual transition of our basic institutions, can eventually change the way in which the world works.

Let me illustrate with an example from my own personal experience. I was deeply involved in the earliest days of the space program, as an engineer and project manager, beginning in the mid 1950's. We designed and built the first spacecraft by a private company, and later a spacecraft which became the first object made by human hands to leave the solar system. As young engineers, we often talked about the possible benefits of the space program in scientific and technological and economic terms. And in retrospect there have been such benefits.

But the most pervasive effects of the space effort may eventually come not in those ways, but rather from new perspectives about mankind itself and how we see ourselves and the institutions of which we are a part, and what we expect of them, and of ourselves.

Soaring into space, we discovered planet earth. Think with me for a moment about the pictures of earth from space. From that far perspective, the earth appears as a beautiful blue and white ball. We can see the oceans and continents, partly obscured by clouds. We see no visible boundaries dividing the habitations of mankind.

What a precious place the earth is—how fragile it appears: a spaceship spinning through a hostile void. We, its inhabitants, astronauts all, are totally dependent on earth's life-support systems, and just as utterly dependent on one another.

From that perspective, how small the things that divide us suddenly seem, how immaterial our concerns of national pride, our differences of race or creed! How vital our personal freedom of choice, even as we see our obvious common interests and needs!

The pictures of earth from space have been on worldwide television and have been broadcast and rebroadcast and printed and reprinted in thousands of publications for over three decades. These pictures have been seen by individuals around the world tens of billions of times. The image they convey has now become the common property of all mankind, and it speaks all languages. It is a vision we hold constantly before us as we deal with the great and the small issues by which humanity's fate is being shaped.

What subtle effects has this had on attitudes and perceptions and concerns and public judgment about the earth's natural environment, for humans and

all other creatures? Or on the need for a balanced understanding of the linkages between food and energy supplies, economic development, and environmental issues, if we are to make sustainable long-term progress on these interlocking problems. . . .

## Pickering

*Continued from page 7*

down as lab director, Pickering says that while he sometimes misses the excitement of JPL, he's happy to be out of the spotlight. Asked how he lasted so long at JPL, Pickering replies with his characteristic dry wit, "I guess things were going all right, so they left me there until I got old enough to kick out." Pickering returned to Caltech to resume teaching, but felt somewhat out of touch after a 22-year sabbatical from academia. Shortly thereafter, he received an offer to establish an applied engineering research institute at the University of Petroleum and Minerals in Saudi Arabia and jumped at the opportunity. After he got the institute running, he left in 1978 to start his own consulting firm in Pasadena. Among the studies the firm conducted was a report for the nuclear power industry that examined how the space program went about assuring the reliability of its spacecraft.

Pickering became an entrepreneur in 1984 when he started Lignetics Inc., a company based in La Cañada Flintridge that manufactures pellets out of sawdust. The pellets are burned in special stoves that provide heat for homes. Lignetics has operated a plant in Sandpoint, Idaho, since 1985, and opened a

second factory in Doniphan, Missouri, last December. Although producing wood pellets may seem a comedown from space research, Pickering says he's always been interested in energy, especially in energy efficiency. And even after receiving the numerous awards that take up nearly a full page of his résumé (single spaced), Pickering says he can't imagine the idea of sitting home doing nothing. Although most of his time is spent at his Lignetics office, he has also taken several trips with the Caltech Associates, including an excursion to New Zealand last November, on which he served as the tour guide.

"It was a new experience for me," says Pickering. "I used some of my contacts down there to help arrange some of the things that we saw and did. One thing that I know delighted practically everyone on the tour was that when we were down in Queenstown, on South Island, we were invited by a cousin of mine to come out to his house in the country for morning tea on the lawn. So he had all 40 of us and invited about a dozen of the people from the surrounding area. It was a beautiful day and went off very well."

One experience Pickering has little interest in trying is retirement. "I find myself working as hard at Lignetics as I used to when I was at JPL," he says. "I expect in a few years I may let someone else do the work. The classic thing is to become chairman of the board." But Pickering did take a week off from his work in late July to marry Inez Chapman, his next-door neighbor for the past 20 years. She had also been a close friend to him and his first wife, Muriel, who died in 1992. "Obviously I'm thrilled," says Pickering of this most recent venture. Asked whether marriage might spur his retirement, Pickering replies, "She knows I'm involved in this business and is expecting me to keep on."



**Holding aloft a prototype of Explorer 1, Pickering, James Van Allen, and Wernher von Braun (shown left to right) faced a barrage of reporters on the triumphant morning after the historic launch.**



# ALUMNI

## Chapter News

Even without explosives, alumnus wows Orange County crowd

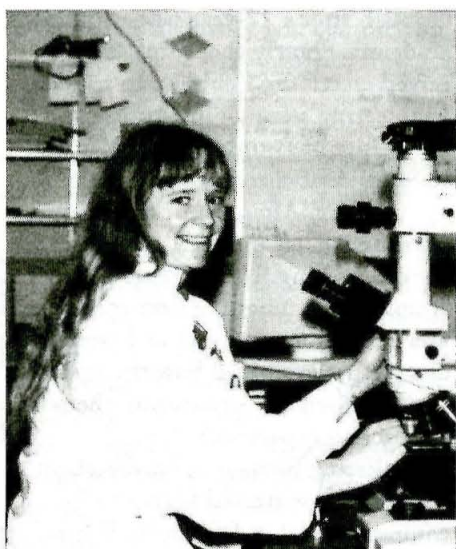
Mark Wrighton, PhD '72, blasted into the annals of academia, getting his Caltech chemistry doctorate at age 22, becoming a full professor at MIT by age 28, and being named provost of MIT by age 41. As if that background and his many patents and publications weren't impressive enough, he also puts on occasional magic shows using his chemistry know-how. But when Wrighton appeared before a Caltech/MIT crowd of about 60 alumni and guests in Orange County just after Independence Day, he relied on verbal fireworks alone as he discussed advances in molecular electronics. "Since the talk was at a private residence, we decided to spare the hosts the possibility of a big explosion," said event organizer Melinda Skaar of MIT (whose husband, David Kirk, MS '90, hails from Caltech and MIT). But according to Skaar, there was no lack of excitement as Wrighton commented on everything from microchips to corporate-sponsored fellowships.



While Bostonians rode out a June heat wave, members of Caltech's Boston Alumni Chapter and their families enjoyed a day of seaside activity at Woods Hole Oceanographic Institution. They toured the facilities and the National Marine Fisheries Service Aquarium—"A type of petting zoo for sea creatures," says Chapter President Kelly Beatty '73 (seen kneeling in adjacent photo). Participants also heard firsthand about the institution from some of the many alumni who work there, including Senior Scientist Carl Bowin '55, who told Beatty and crew about those early days when he was one of the first people to take a computer on an ocean-going vessel. Seeing the research vessels, such as the *Oceanus*, pictured here, was quite a surprise, says Beatty. "You might expect a tug boat, but these are 100 to 150 feet long, and they go out for months at a time."

## For New Mexico chapter president, the emphasis is on communication

As a Caltech student, JeanClare (Jinkle) Seagrave '76 was among the first women to receive a bachelor's degree from the Institute. She came to campus in 1972, two years after Caltech first began admitting undergraduate women. Now Seagrave has become the first woman to head up a Caltech alumni chapter, as president of the Albuquerque-based New Mexico chapter. Although she doesn't expect this role to be nearly the challenge that gender-blending the Caltech campus was all those years ago, she does see it as an opportunity to enhance alumni



JeanClare Seagrave, in the lab.

ties with an institution that she says provided her with a pretty terrific undergraduate experience.

"Between being one of the first undergraduate women on campus and the academic pressures, Caltech was a bit of a culture shock at first," she says, "but once I got used to things here, I found the environment incredibly interesting and supportive."

Seagrave's roots, both in New Mexico and at Caltech, extend for some distance. She grew up in Los Alamos, where her father, John Seagrave, a three-time Institute alumnus, was a research physicist with Los Alamos National Laboratories. After earning her own Caltech BS with honors in biology, Seagrave returned to her home state for a PhD from the University of New Mexico. She now works as a biologist with the Lovelace Institutes, a small, private biomedical research center in Albuquerque that is perhaps best known as the place where America's astronauts showed that they had the "right stuff" as they underwent tests to study the effects of altered

*Continued on page 11*



The Alumni Association officers for 1994-95 are, from left, Tom Tyson '54, PhD '67, secretary; Ed Lambert '82, treasurer; Pete Mason '51, PhD '62, president; Frank Dryden '54, MS '57, vice president; and Bill Whitney '51, past president.

## Letter from the Association president

By Pete Mason '51, PhD '62

As I take the presidency, I offer my thanks to Bill Whitney for the excellent job he did as Alumni Association president for the past year. Bill, the board of directors, and the staff have accomplished a great deal in bringing the affairs of the Association up to date. His will be a hard act to follow.

In this, my first column, I will describe our activities, status, and plans for the year.

### Activities

Association activities may be thought of as falling into three categories. First is service to the Institute. We supply volunteers to the Admissions Office for undergraduate admissions support (i.e., interviews with prospective freshmen) and help recruit Alumni Fund volunteers. Our student/faculty/alumni relations committee also develops activities such as joint lunches to bring the three groups together, and supports one of the gems of Caltech teaching, the Summer Undergraduate Research Fellowships (SURF) program. The Association also assists in the selection of distinguished alumni.

Second is service to alumni in general and to our members in particular. This encompasses our travel/study programs, Seminar Day and reunions, the Alumni computer server, chapter events, and publications, which includes distribution of *Engineering & Science* and the *Alumni Directory* to our members, and special publications such as *Legends of Caltech*. The membership committee seeks to bring both new and old graduates into the Association.

Finally, there are operational activities: the board of directors, the executive committee, and the finance committee. These work closely with our professional staff to assure smooth operation of the Association.

### Status

Where does the Association stand from the viewpoint of the president and board of directors? To begin with, we have an excellent staff under our executive director, Judy Amis. We have close and cooperative relations with the Caltech administration. A number of our members are volunteers with the

Alumni Fund and the undergraduate admissions office. We are proposing new ways of reaching outstanding high-school students, to overcome the disadvantage of limited numbers and name-recognition compared to, say, MIT, Stanford, or the University of California. The student/faculty/alumni relations committee has a vigorous program of interaction among the three groups and provides volunteers and funds to the SURF program.

The travel/study program continues to sell out on nearly every trip. Seminar Day has recently been coupled directly to reunions, and the combined total attendance for these events is growing. The alumni computer server is an on-ramp to the information superhighway for over one thousand of our members and is teaching our members the wonders and pitfalls of UNIX, newsgroups, World Wide Web, and Mosaic. Chapter events are well-attended, and the number and membership of the chapters continues to grow. *Engineering & Science* is widely regarded as one of the best magazines of its kind and has the awards to prove it. *Legends of Caltech* continues to amuse and to evoke reminiscences. *Caltech News*, which has also received awards, provides all Institute graduates with news of the campus, and of alumni and Association activities.

Financially the Association is on sound footing. We have succeeded in maintaining a small surplus even during the past few years of downturn in technical fields. We are generating financial policies and procedures that will give future boards and staff clear guidelines for operations.

This is not to say that we are completely satisfied with our performance. We would like more chapters and better ways of reaching our members who are not near a chapter city. We want our programs to reach members who cannot go on our major trips. Programs involving graduate students need to be strengthened. The obscurity of UNIX vexes many users of the alumni server. Undergraduate admissions can never rest until every potential student knows about Caltech. Our board is not yet representative of the growing number of female and minor-



ity alumni. Finally, Caltech, like every research institution in the nation, has entered a time of reduced federal funding and will need increased contributions from alumni and others to maintain the quality of its research and instruction.

### Relations with Caltech

Our most important focus for the year will be our relationship with Caltech. The Institute has a major stake in the performance of the Association, and backs this by substantial support. All of our staff are paid by Caltech. *E&S* and *Caltech News* are effectively published by Caltech, although the Association is the publisher of record. Naturally, the question arises as to what Caltech is getting for its money. Recently, President Everhart has asked that we review in detail the relations between the Institute and the Association. He is forming an Institute-alumni task force consisting of Institute and Alumni Association representatives, as well as alumni who are not Association members.

Perhaps the committee's most important task will be to find ways in which Caltech and the Association can reach out to all alumni, not just to Association members. For several years, the Association has enrolled about 37 percent of all alumni. As might be expected, the four-year undergraduate percentage is highest at about 50 percent. The PhD-only percentage is about 30 percent, Engineer-only is 25 percent, and MS-only is about 20 percent. These figures evoke considerable admiration when Judy Amis mentions them to other Association executive directors. Nevertheless, the Caltech administration is concerned about reaching and involving many more of the 60 percent of Caltech alumni who are not Association members.

Caltech values our financial contributions, but also values just as much our involvement in its activities and the good will we generate. The Association's job is to satisfy our members' needs and interests and those of Caltech. The Institute-alumni task force and the Association will look at these issues closely. I will report on progress in future columns.



**Viva Haserot O'Haver signs the Gnome Club roster after her induction as member 967 at the club's Summer Party. Reports Club President Bob Perpall '52, MS '56, "Viva, who proudly wore two Gnome pins to the party, has survived two Gnome Club husbands—Clarence Haserot '27 and Mike O'Haver '29." Also joining the Gnomes that day was Al Johnson '53, MS '54, who followed O'Haver as member 968.**

### Seagrave

*Continued from page 10*

gravity on physiological functions. Her research focuses on cellular signal transduction—how cells communicate with one another—using the salivary glands of rats as a model system. Lovelace may have once been famous for astronauts, but Seagrave's nine-year-old niece, she says wryly, calls her a "spitologist."

"Basically I'm investigating the fundamental question of how cellular communication works," says Seagrave. "Malfunctions in this process seem to play a role in the onset of cancer and other diseases. If we can understand

how normal, healthy cells talk to one another, it should lead to a better understanding of why these mechanisms break down and what might be done to prevent the problem or repair it."

Outside the lab, communication continues to be a major preoccupation for Seagrave. She currently oversees Lovelace's weekly seminar series, which provides a forum for speakers within and outside the institute to talk about interesting aspects of their research. And for the past four years, she has directed Lovelace's Minority High School Science Research Apprenticeship Program, which brings talented minority high-school students to Lovelace each summer to do research with the scientists there. The students, says Seagrave, work on projects ranging from DNA-sequencing to studies of the blood viscosity of athletes—and most of them go on to become science majors at top-ranked colleges and universities.

"As a child growing up in a science-oriented community like Los Alamos, I was exposed to science in a way that most kids, especially those from disadvantaged backgrounds, never are," says Seagrave. "I'm eager to create similar kinds of opportunities for young students today to contemplate and pursue careers in science."

Her own career and commitment to science education keep Seagrave busy, but she and her husband, William Rahe, a staff member at Sandia Laboratories, do find the time to enjoy the natural attractions of her native New Mexico. An "avid fisherperson," Seagrave also skis, hikes, practices karate, and trains for dog-obedience competitions with her Siberian husky, Kareetza. Now that she's president of the New Mexico alumni chapter, she'll be devoting some time and energy to planning chapter events as well. The chapter holds two meetings annually, drawing alumni to Albuquerque from both Santa Fe and Los Alamos, an attendance record Seagrave hopes to continue. The next meeting is this fall, when JPL's John Trauger will speak on the Hubble Space Telescope.

Keeping New Mexico alumni current with Caltech is important to Seagrave, who played an active role in founding the chapter about six years ago. Drawing perhaps on the discipline instilled by dog-obedience training, she managed despite her busy schedule to attend every meeting except for one gathering last fall. The alumni who did show up took due note of her absence by electing her chapter president.

## ALUMNI ACTIVITIES

**September 20, Chicago Chapter Dinner/Meeting**, with Judith Goodstein, archivist and faculty associate in history.

**September 30, Boston Chapter Dinner/Meeting**, with Diana Barkan, assistant professor of history.

**October 6, East Bay/Marin and San Francisco Chapters Joint Dinner/Meeting**, with guest speaker Egill Hauksson, senior research associate in geophysics.

**October 13, Santa Cruz Area Monthly Luncheon**, Peachwood's at Pasatiempo Inn, noon. For reservations, call Bob Shacklett at 408/722-6021. Lunches are held the second Thursday of each month—the next ones will be on November 10 and December 8.

**October 17, Houston Chapter Dinner/Meeting**, with Terry Cole, PhD, '58, office of technical divisions, JPL.

**October 20, San Francisco Peninsula Monthly Luncheon**, Ming's Restaurant in Palo Alto, noon. For reservations call Hugh Dubb at 415/362-3800 or 408/773-9100. Lunches are held on the third Thursday of each month—the next dates are November 17 and December 15.

**October 20/21, Phoenix/Tucson Chapter Dinner/Meeting**, with Judith Goodstein, archivist and faculty associate in history.

**October 27, Sacramento Alumni Dinner/Meeting**, with Morgan Kousser, professor of history and social science.

**November 3, Washington, D.C., Chapter Dinner/Meeting**, with Tom Soifer, professor of physics.

**November 7, Tri-State Chapter Dinner/Meeting**, with John Trauger, principal investigator, Hubble Space Telescope Wide-Field and Planetary Camera 2, JPL.

**November 9, Orange County Chapter Dinner/Meeting**, with Joel Burdick, assistant professor of mechanical engineering.

**December 5, Seattle Chapter Dinner/Meeting**, with Gregory Bearman, member of the technical staff, JPL.

For information regarding the above, please contact Arlana Bostrom at 818/395-8363.



**Caltech's newest Honorary Alumni, Student Affairs Administrator Stan Borodinsky and Institute Archivist, Registrar, and Faculty Associate in History Judith Goodstein, received the accolade at the Alumni Association's Annual Dinner in May. The award is presented each year by the Association to individuals who have made significant contributions to the Association itself or its broader purposes.**





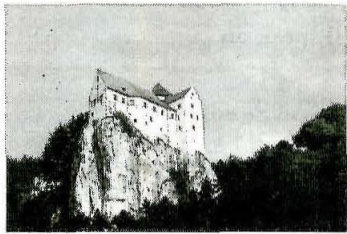
Participants in the Association's recent travel/study program to Glacier National Park came close to being literally blown away by the experience on at least one occasion. Held back by strong winds off Alberta's Lake Waterton are John Peyton '54, Julia Hazard Peyton, and Donna Engleman, wife of Rolf Engleman '59. They were among 42 travelers who joined Bob Sharp '34 and Stan Burket, PhD '50, for a five-day geology trip through the northwestern-Montana park and points north.

Association to travel down the Danube

The Alumni Association is planning a travel/study cruise to explore three great rivers of Europe via the Danube Canal. A superb engineering feat, the canal, which links the Rhine, Main, and Danube rivers, opened in the fall of 1992. The 14-day program through Germany and Austria, scheduled for July 15–28, 1995, will be led by Caltech's Norman Brooks, PhD '54, the James Irvine Professor of Environmental and Civil Engineering. Cosponsored by the alumni associations of Pomona College and the University of Redlands, the trip will also feature lectures by humanities professors from those institutions and will include exclusive guided city tours and walking excursions at ports of call along the river's edge—historic places such as Rudesheim, Heidelberg, Rothenburg, Nurnburg, and Passau, to name a few. Upon arrival

in Frankfurt, participants will go by motorcoach to Koblenz, where they will board the 118-passenger river ship, the *M.S. Swiss Pearl*, for the cruise through the beautiful countryside of Germany and Austria. The program concludes in Vienna, where an optional one-day extension is available. The cost of \$4,350 per person, double occupancy, includes all meals, accommodations, sight-seeing, lectures, supplemental materials, and round-trip airfare from Los Angeles.

Detailed information on this travel/study program will be mailed by early October. If you do not receive our mailing but are interested in participating in this unique trip, complete and return the form below. If you have any specific questions, please call Judy Amis, executive director, (818) 395-6594.



Caltech Alumni Association Danube Canal Cruise, July 15–28, 1995

INTEREST FORM

I/we wish to receive additional information about the Alumni Association's travel/study program on the Danube Canal.

Name \_\_\_\_\_

Address \_\_\_\_\_

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

Please return this form to  
Caltech Alumni Association, Mail Code 1-97, Pasadena, CA 91125



PASADENA TOURNAMENT OF ROSES®

The Caltech Alumni Association

invites all alumni to celebrate

"SPORTS—Quest for Excellence"

at the 106th Tournament of Roses Parade

Monday, January 2, 1995

\$40.00 per person

Package includes: parade ticket, full-color souvenir program, and parking. Tickets, programs, maps, and parking passes will be mailed to all participants in early December.

The Alumni Association is pleased to offer the convenience of parade tickets and souvenir programs by mail, plus complimentary parking on campus. Parade seats are at the southwest corner of Hill Avenue and Colorado Boulevard; parking is in the Tournament Park lot, entrance on the south side of California Boulevard between Arden Road and Wilson Avenue.

This will be the only New Year's program organized for alumni participation this year, and it does not include ANY meals or official access to private campus facilities other than the parking lot.

For reservations, please enclose the form below with your check, made payable to the Caltech Alumni Association, and return to Caltech 1-97, Pasadena, CA 91125. Children under the age of two who will not need separate seats will be admitted free.

Confirmation of your reservation will be mailed upon receipt of payment. Refunds will be made only for those cancellations received by October 28, 1994. Please respond early, as seating is limited. For more information, please call Arlana Bostrom at (818) 395-8363.

.....

Name \_\_\_\_\_ Class Year \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip Code \_\_\_\_\_

Daytime Telephone Number \_\_\_\_\_

Number of tickets \_\_\_\_\_ @ \$40.00 each. TOTAL ENCLOSED \$ \_\_\_\_\_

"Gala" forecast for WW II meteorologists

The following comes to Caltech News from Fred Decker, professor emeritus at Oregon State University and a veteran of the World War II weather officers' program.

Calling all World War II Aviation Cadets in Meteorology!

Celebrate the 50th anniversary of your commissioning! Whether you stayed in the Air Weather Service after the war or went on to pursue a totally different career, you are invited to attend a great gala reunion of World War II cadets in meteorology that will take place October 26–30, 1994, in Tucson, Arizona, as part of the Air Weather Association Reunion. To get on the roster and obtain details of the reunion, please write the AWA at 5301 Reservation Road, Placerville, CA 95667-9745. And please pass the word to classmates and fellow veterans!



## Alumni hold sway at Seminar Day

Caltech alumni like to proclaim each successive Seminar Day "the greatest ever," and quantitatively speaking, the Alumni Association's 57th annual such get-together does seem to fit the bill, attracting a record turnout of close to 2,000 alumni, including nearly 200 who returned to take part in the 50th reunion of the class of 1944. Among those descending on campus for the May 19-21 weekend were keynote speaker and recently elected trustee Mildred Dresselhaus of MIT, the five newest recipients of Caltech's Distinguished Alumnus Award, and the day's 19 speakers, who gave audiences a look at research breakthroughs ranging from new methods for controlling pollution to the latest observations carried out by Wide-Field and Planetary Camera 2 on the triumphantly restored Hubble Space Telescope.



On behalf of the Class of '44, Master of Ceremonies Harrison Sigworth '44 (right) presents a special award at the 50th Reunion Dinner to G. Stan Holditch '48 (left), recognizing his 35 years of leadership of and dedication to the Alumni Fund.



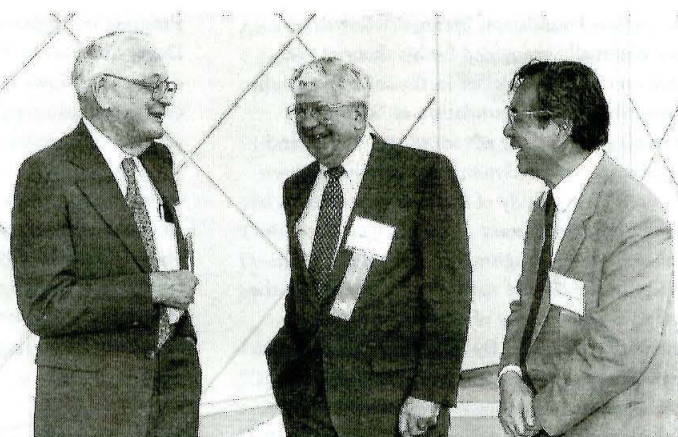
After a morning of talks, presentations, and exhibits, alumni and family members welcome the chance to break for lunch in Dabney Garden.



The Class of '44 is wine and dined.



What better way to kick off a General Session than with Buckey Balls? MIT's Institute Professor of Electrical Engineering and Physics and Caltech Trustee Mildred Dresselhaus, shown here with President Everhart, did just that in her Seminar Day keynote address, "Fullerenes, Tubules, and Their Remarkable Properties."



Their fields may differ, but outstanding achievement in those fields is one quality Caltech's Distinguished Alumni have always had in common. Sporting honorific ribbons, Horace Babcock '34, Glenn Schurman, PhD '50, and Yuan-Cheng Fung, PhD '48 (left) await the start of the 1994 awards ceremony, while Ira Herskowitz '67 and Richard George Brewer '51 (below) appear, perhaps a bit nervously, to be comparing notes on acceptance speeches.



Back on campus for their 50th reunion, members of the Class of '44 feasted together at the Half Century Club luncheon (left), and with fellow alums (right) also found plenty of fare to sample in the Seminar Day program.



## PERSONALS

1944

CHIA-CHIAO LIN, PhD, Institute Professor at MIT, was elected a member of the Academia Sinica, or the China Academy of Sciences, during its Seventh Annual Meeting, held June 1–8 in Beijing. This is the first time foreign members have been elected to the organization—14 were elected in all. Lin is also a winner of Caltech's Distinguished Alumni Award.

1948

YUAN-CHENG FUNG, PhD, professor emeritus of biomechanics and applied mechanics at UC San Diego, was elected a member of the Academia Sinica, or the China Academy of Sciences, during its Seventh Annual Meeting, held June 1–8 in Beijing. This is the first time foreign members have been elected to the organization—14 were elected in all. Fung is also a winner of Caltech's Distinguished Alumni Award.

1949

CHE-MIN CHENG, MS, PhD '52, former director of the Institute of Mechanics, Academia Sinica, was awarded the 1993 Cheng Jia Geng Prize of the Academy. That was the first year the prize was awarded to individual scientists; there were seven, one for each of the major disciplines selected.

1952

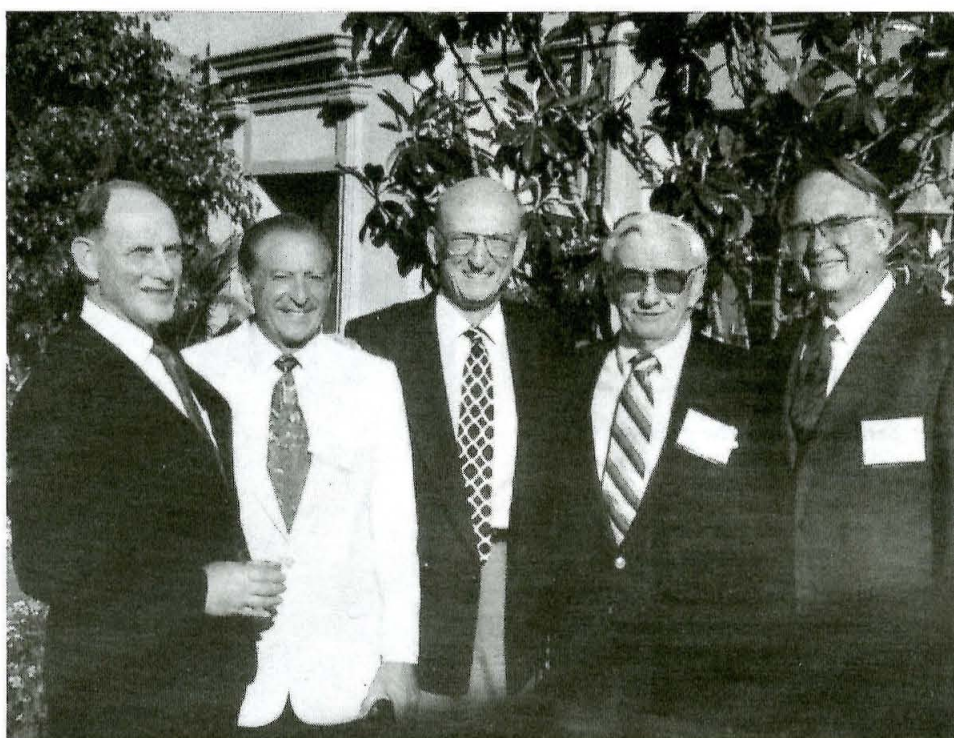
GERALD D. FASMAN, PhD, Rosenfield Professor of Biochemistry at Brandeis University, has been elected to the National Academy of Sciences.

1972

NELSON E. BRESTOFF, MS, of Hidden Hills, California, has become a name partner in the law firm of Radcliff, Brestoff & Frandsen in Los Angeles. He is an adviser to the Caltech SEDS Program, and his partner, Russell M. Frandsen, is a board member of the Caltech-MIT Enterprise Forum. A business and environmental litigation specialist, Brestoff's avocation is the building of a hands-on science center in the San Fernando Valley area of Los Angeles, modeled on San Francisco's Exploratorium.

1973

PAUL H. YANCEY, professor of biology at Whitman College, was presented with the Lange Award for Distinguished Science Teaching, at commencement ceremonies May 22. The award, which includes a cash prize, is given based on demonstrated skill and excellence in teaching, and the ability to inspire students. The recipient of a doctoral degree in marine biology from the Scripps Institution of Oceanography, Yancey joined the Whitman faculty in 1983. He is known for working closely with students, both in the classroom and by including them in his research. His projects have included extensive tests of a drug that could eliminate the severe eye complications from which many diabetics suffer; research on the sage vole that could hold medical significance related to kidney failure and the protection of human tissues; and work on organic osmolytes that has earned him international recognition. The author of numerous publications, one of his papers on the evolution of osmolyte systems has become a science-citation classic, having been cited more than 400 times by other scientists.



**Better late than never, Dave Appel (left) has just received his Caltech master's degree for a program he completed 50 years ago! The story begins in 1943–44, when he participated in a meteorology training course at Caltech with more than 100 fellow air force cadets, including (from Appel's left, to right) Win Kent; Otto Jenista, MS '48; John Riley; and Don Sandison. With certificate in hand, the young Appel took off to get his BS at Purdue without leaving a forwarding address, so he didn't hear the news that his combined education at Caltech and Purdue made him eligible for an MS degree—if he acted quickly to meet a 1952 deadline. It wasn't until a 1991 reunion of the cadets that he found this out and petitioned Caltech for the belated degree, thinking it would be "a pleasant pedigree to add" to his new status as a consultant in metallurgical engineering. Here he shares the good news with his air force buddies during their 50th cadet reunion, which was held on campus this past June.**

1976

CLIFFORD LEONG now works at Science Applications International Corporation in San Diego, where he is a mechanical engineering manager. He writes that he and his wife, Lani Haeyung Chu, live in Encinitas, California, and that "we'd enjoy hearing from old friends." Their address is 3616 Garner Place, Encinitas CA 92024.

1981

JACK L. WISDOM, PhD, professor of planetary sciences in the Department of Earth, Atmospheric, and Planetary Sciences at MIT, is the recipient of a \$260,000 no-strings-attached MacArthur Foundation "genius" fellowship. Internationally renowned for his theories and work on chaotic processes in the solar system, he is described by the foundation as "a physicist who has significantly advanced the understanding of solar system dynamics. Introducing new methods to the study of dynamical problems, he has obtained important and widely cited results that create new insights into order and predictability in the laws of nature." He was one of the first to use the theory of chaotic processes in planetary dynamics. By following the evolution of a large number of asteroid orbits over millions of years, he discovered that the boundaries of the famous Kirkwood gaps—they were discovered more than 100 years ago, but have remained unexplained—coincided with the boundaries of the region of chaotic orbits. He proved that the clearing of the gaps is a consequence of mechanics, and that there is no need to appeal to special phenomena such as collisions between asteroids. Wisdom has won the American Astronomical Society's Harold Urey Prize (1986) and Helen B. Warner Prize (1987), and he was selected as a Presidential Young Investigator in 1988. He is a Fellow of the American Academy of Arts and Sciences. Several years ago an asteroid was named after him—it is now Asteroid Wisdom—in recognition of his achievements in the astronomical world. Following postdoctoral work at UC Santa Barbara and the Observatoire de Nice in France, he joined MIT as a research scientist in 1984, and the faculty in 1985. He and his wife, Cecile, live in Arlington, Massachusetts, and have four children, with "a fifth on the way."

1987

TOM NOLAN, of Palo Alto, California, writes, "The breakup of Botulism City appears complete. Tom A. is off doing the postdoc thing at Hahvahd. Tom N. goes farther east to Hitachi, Japan. Master Castor is looking to show that theoretical physicists can get jobs too, and Scott Mc. moved down the street to windsurf and keep Botulism alive."

1989

JACQUELINE VANNI SHANKS, PhD, associate professor of chemical engineering at Rice University, received the Iowa State University College of Engineering's 1994 Professional Progress in Engineering Award during Alumni Days, June 9–11. She earned her bachelor's degree from Iowa State. "Working with a colleague and several undergraduate students," according to Iowa State, "she helped develop a series of computer programs that is used for a material and energy balance course and is considered to be the most comprehensive available." She received the 1992 National Science Foundation Young Investigator Award, the 1992 Herschel Rich Invention Award, and the 1991 Amoco Outstanding Young Faculty in Engineering Award.

1991

LARRY CHENG and CELIA NG '92 write that they were married June 19 at Dabney Hall. "Lots of alumni were there to kick off the culmination of a relationship that started during Rotation Week 1988. We're both currently working in the Bay Area after getting master's degrees at Stanford (along with half of the class of '91 & '92, it seems)." Also, Meejeen Park, Celia's best friend from high school, married CRIS DAUGBJERG '92 in October 1993. "They've spent the time since then living in Denmark, where they were married."

## OBITUARIES

1925

JAMES H. HAMILTON, MS '27, PhD '28, on September 22, 1993. "He was very proud of his association with Caltech." He is survived by a daughter, Elizabeth Maldonado.

F. MASATO HIRANO, of Tokyo, on April 30;

he was 97. He served the Japanese electric-power industry for 46 years, principally in financing electric-power companies through the introduction of capital from worldwide financial institutions. Since 1960, he had especially helped the development of nuclear-power plants in Japan by introducing technology and facilities from the United States. He is survived by his wife and eight children.

1926

RICHARD D. POMEROY, MS '27, PhD '31, of Twentynine Palms, California, on June 5, 1993. He is survived by his wife.

1927

R. CARTER BLANKENBURG, in December 1993. He is survived by a son, Harry.

1929

HUBERT M. (MIKE) O'HAVER, of Arcadia, California, on May 6; he was 87. He had retired from the Southern California Gas Company in 1969, after 35 years. He served in a variety of organizations, including the Vernon Rotary Club, of which he was a past president; the Rio Hondo Boys' Club, of which he was director for 26 years; and the San Gabriel Council of the Boy Scouts. He was an active member of Caltech's Gnome Club, and had worked as a fund-raiser for the Alumni Association and as a volunteer for the Industrial Task Force. He is survived by his wife, Viva Haserot O'Haver; a daughter, Sharon Wilson; a son, Michael; and four stepsons, Jerry, Richard, Roger, and Douglas Haserot.

1931

THOMAS V. TARBET, MS '32, of San Rafael, California, on August 31, 1993. He is survived by his wife and by a daughter.

1934

MORTON E. MOORE, MS '35, of Los Osos, California, on February 19. He worked for McDonnell Douglas Corporation and NASA before retiring in 1960.

1936

TYLER THOMPSON, of Pasadena, California, on April 22; he was 78. After graduating from Caltech, he received a bachelor's degree in theology from Boston University, went to Singapore as a missionary, and was captured by the Japanese in February 1942. He remained a prisoner until the end of World War II, and later wrote about life in the Japanese prison camp in *Freedom in Internment*, which was published in 1990. After the war, he studied for his doctorate at Boston University while serving as pastor to Weston Methodist Church in Massachusetts. His teaching and philosophy career spanned 35 years and included such institutions as Allegheny College, Garrett-Evangelical Theological Seminary, Northwestern University, and Fuller Theological Seminary. Active in social issues as well, he was imprisoned in Jackson, Mississippi, on Easter 1964 while confronting segregation in the local Methodist churches. He tutored in Pasadena public schools and worked as a volunteer in the Social Service



Center for the homeless at the First United Methodist Church until his death. He is survived by his second wife, Patricia, whom he had met when both were widowed; his children, Francia, Wendy, Heidi, Becky, and Peter; stepchildren Gail, Deborah, Kurt, Lori, Nancy, and Janna; and 12 grandchildren.

1937  
CHARLES F. HADLEY, MS '38, of Tulsa, Oklahoma, on December 25, 1993; he was 79. He received his doctorate in electrical engineering from Stanford in 1944 and did war research at Harvard. In 1946 he moved to Tulsa, where he worked for 34 years in the research laboratory of Amoco Production Co., a subsidiary of Standard Oil of Indiana. A recipient of 12 patents for his company, he also worked on the first experimental heart-lung machine in Tulsa. He is survived by Sadie, his wife of 51 years; a sister, Harriet Johnson; three daughters, Carolyn Hadley, Margaret Hornbostel, and Susie Molder; and six grandchildren.

DALE R. HARRIS, MS, of Tucson, Arizona, on April 16; he was 84. He had been a meteorologist for the U.S. government. He is survived by his second wife and a daughter.

1939  
ELLSWORTH E. GULLEKSON, MS, of Austin, Texas, in March; he was 82. He spent his career in research and development with Standard Oil of California, first as a process-design engineer and then in management, working in various locations in the United States, in Canada, and around the world. After retiring, he formed Gullekson Associates, a consulting corporation, and continued to work in the United States and Canada. He was a member and section chairman of the Commonwealth Club of San Francisco, was a member of the National Association of Corrosion Engineers, and in May 1979 was honored by the University of North Dakota with its highest alumni honor, the Sioux Award, for his outstanding achievements as an alumnus. He is survived by his wife, Beulah-Rom, and by a daughter, Demaris.

EDWARD H. PARKER, of Newport Beach, California, summer 1993. He was a retired structural engineer. He is survived by his wife.

1940  
ROSWELL J. BLACKINTON, of Walled Lake, Michigan, on February 2; he was 83. He is survived by his wife.

BERNARD LOVE, of Santa Monica, California, on October 20, 1993. He is survived by his wife, Lillian.

1941  
EUGENE A. LAKOS, of New York City, on March 21. He had been the Director of Engineering at the Methodist Hospital, Brooklyn, for the past 29 years, and last November he received an award from the American Lung Association of Brooklyn for the invention of an economical portable air-filter unit for use in tuberculosis infection control. He is survived by his wife, Marcille.

LELAND G. SWART, MS, of Beaufort, South Carolina, on December 24, 1993. He is survived by his wife.

CLYDE WAHRHAFTIG, of San Francisco, on April 7; he was 74. An avid hiker and outdoorsman and a member of many environmental organizations, he had been a USGS geologist for over 50 years and was an emeritus professor of geology at UC Berkeley; according to the USGS, he made notable contributions to understanding the coal deposits, geology, and glaciers of Alaska, and the landforms, surficial

deposits, and bedrock geology of the Sierra Nevada and the California Coast Ranges. In San Francisco he was best known as the author of *A Streetcar to Subduction*, a guidebook to the geology of San Francisco that takes the reader on a geological tour of the city by bus and streetcar; he never drove an automobile and devoted much of his time to encouraging people to use public transportation. His career with the USGS began in 1941, and he was among the first U.S. scientists to work in Japan following World War II—his visits to Hiroshima and Nagasaki confirmed his life-long commitment to nonviolence. He received his MS and PhD in geology, both from Harvard, in 1948 and 1953, respectively, and in 1960 he became a professor of geology at UC Berkeley, while continuing his career at the USGS in Menlo Park. He retired from both in 1982, but remained active at each institution until his death. During his career, he was the author or coauthor of 86 maps, professional papers, and articles, coauthored two college-level textbooks, and wrote several popular field guides. A talented artist, he frequently illustrated his nonprofessional papers with his sketches, and in 1993 the USGS library in Menlo Park exhibited selected pen and ink drawings from his sketchbooks. He was also a popular lecturer, and he ran training seminars and field trips for interpretive park rangers. He devoted many volunteer hours to introducing inner-city children to the outdoors. He was a fellow of the Geological Society of America, the American Association for the Advancement of Science, and the California Academy of Sciences; a member of the American Geophysical Union and the National Association of Geology Teachers; and a recipient of the Geological Society of America's Kirk Bryan Award for Geomorphology (1967) and Distinguished Career Award (1989). In accepting the latter award, he made a plea to his fellow scientists to accept homosexual students without bias and to encourage them to enter the field of geoscience. He is survived by his sister, Dorothy Lindheim, and by many nieces and nephews.

1942  
ROBERT T. DEVAULT, MS '52, of Felton, California, in February 1992. He is survived by a daughter, Christine.

ROBERT F. SWANCUTT, MS, of Hermosa Beach, California, on August 29, 1993.

1943  
JOHN GARTH CHATTERLEY, Ex, of Cedar City, Utah, on July 20, 1992; he was 69. After studying meteorology at Caltech, he served as a meteorologist with the Army Air Forces during World War II. He earned his BS and medical degrees at the University of Utah and performed his internship and residency in ophthalmology in Michigan. During his 33-year career in ophthalmology he served a term as president of the Southern Utah Medical Society, was a member of the Utah State Medical Association and the Utah State Ophthalmology Society, and was a diplomate of the American Academy of Ophthalmology. He also served for eight years on the Iron County School Board. A sportsman and outdoorsman, he was a member of the Ski Patrol. He is survived by his wife, Margaret; six children; and 14 grandchildren.

1945  
JOHN V. WERME, of Plymouth, New Hampshire, in December 1993.

1946  
BERTRAM W. DOWNS, JR., of Longmont, Colorado, on May 18; he was 68. He served in the U.S. Navy from 1943 to 1952, and he received his master's degree from the University of Minnesota and his doctorate from Stanford. He held a variety of academic and consulting positions in both the United States and

England, and he was a professor in the physics department at the University of Colorado and was associate dean of the graduate school and acting director of the university's Computing Center, 1965–67. He published a number of scientific papers, and he was a fellow of the American Physical Society and a member of the New York Academy of Sciences. He is survived by his wife, Joanne; three daughters, Cathy Nicholson, Diana Escalante, and Jennifer Downs Man; a sister, Mary Mowry; and two grandchildren.

1947  
CECIL A. CRAFTS, of San Clemente, California, on February 23. He is survived by his wife, Doris.

1948  
WILLIAM A. DREW, of Indianapolis, on March 22; he was 69. A Korean War veteran of the U.S. Army who spent his career in the insurance industry, he retired in 1990 from Indianapolis Life Insurance Co., where he had served since 1967 as senior vice president, chief actuary, and chief financial officer. He had been a reader for the Allen County League for the Blind and a treasurer of the Anthony Wayne Boy Scout Council, Fort Wayne. He is survived by his wife, Fran; three sons, Robert, William, and James; and a grandson.

C. ROBERT LINDEGREN, MS, of Riverside, Connecticut, in September 1992. After graduating from Caltech, he received his PhD in chemistry from UCLA in 1949. He went to work for the research division of the polymer department at Du Pont, in Wilmington, Delaware. Eventually he moved into marketing development and sales technology, working at Mobil Chemical, Witco, and, for his last 10 years, Shell Chemical. Following his retirement in 1987 he did consulting. His interests included tennis, gardening, bridge, and woodworking, and he was a volunteer for the American Red Cross. He is survived by his wife, Ruth; three daughters; and his grandchildren.

PHILIP E. PETERSON, Ex, on February 10.

1949  
THOMAS E. VAIL, of La Veta, Colorado, on December 2, 1993; he was 74. He is survived by his wife, Betty.

1950  
JOHN W. REEDS, MS '53, and his wife, Patsy, both of Sedona, Arizona, on May 12, when their Mooney 231 aircraft crashed shortly after takeoff in Ventura County, California; he was 65, and she was 62. They had moved to Sedona in March 1993, and Reeds had retired from his position as technical supervisor in physics at GM–Hughes Research Labs in Malibu shortly thereafter. Following his years at Caltech, he worked for Beckman Instruments, the 3M Company, and Hughes Research Labs. During his career he obtained a number of patents, playing a role in the development of the first ozone detector used in the Los Angeles area; of pioneering medical equipment for recording angiograms; and of a mechanical design for electron beam lithography. He is survived by two sisters, Peggy McGee and Bonnie Lipscomb, and by a brother, Robert. Patsy Reeds was a teacher and award-winning editor. She is survived by an identical-twin sister, Nancy Lee Stephenson, and by a brother, PAUL A. LINAM '47. The couple is survived by a daughter, EILEEN BRIDGES '77, and her husband, LARRY BRIDGES '77, who have three children; and by a son, JOHN WILLIAM REEDS III '81, and his wife Vicki. Eileen is an assistant professor of marketing at Kent State University, and John is an engineer with Talandic Research in Irwindale.

1951  
MAX H. OSTRANDER, Eng, of Berwyn, Pennsylvania.

1953  
WILMER A. JENKINS II, PhD, of Glen Mills, Pennsylvania, on December 16, 1993; he is survived by his wife, June.

1956  
GORDON L. CANN, MS, PhD '61, on May 30. He was the founder and chairman of Technion, Inc. Prior to beginning his graduate studies at Caltech, he had graduated from the Toronto Conservatory of Music (1941) and had considered a career as a composer-pianist before World War II introduced him to electronics and physics. After receiving his BS in engineering physics from the University of Toronto (1949), he had joined the Canadian Defense Research Board and been a key figure in the development of an antitank rocket. While at Caltech, he worked as a technical consultant for the Giannini Plasmadyne Corporation, and his thesis, on the "Energy Transfer Process in a Partially Ionized Gas," is considered a classic work in the field of high-density plasma physics. Following his graduation in 1961, he joined Electro-Optical Systems, where he pursued the application of plasma physics to space-propulsion devices for NASA and the U.S. Air Force, participating in the successful development of arc-jet, magnetoplasmadynamic, and Hall Current Accelerator designs, first for propulsion, then for applications in chemical processing, energy generation, and thin-film deposition. He continued his work after founding Technion, Inc., in 1969, developing thermal resistojets and plasma arc thrusters. He later focused on the plasma deposition of silicon photovoltaic materials and diamond films, and his equipment innovations and the process he developed are now widely used for the commercial production of CVD diamond film. His estate and technical papers have been bequeathed to Caltech "as a memorial to academic excellence," and a Gordon Cann Research Fellowship Fund is being established at the Neuromuscular Center, University of Southern California School of Medicine. He is survived by three sisters, Enid Wasman, Audrey Cann, and Mary Cramp, and by two brothers, Ted and Jack, all of whom reside in Canada.

1974  
WILLIAM P. FORNACIARI, JR., MS, of Pasadena, California, on May 28; he was 46. Partially paralyzed as a young man, he continued to visit the Caltech campus frequently after he graduated. He earned a PhD from UCLA in 1993. He had been a lecturer in computer science and was considered a gifted musician. He is survived by his parents, Paul W. and Louise F. Fornaciari, who are members of the Associates; a sister, Joan Cathcart; and a brother, Bert.



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*Caltech's  
hundredth  
graduating  
class looks  
toward a  
future rich in  
possibilities  
and responsi-  
bilities.*

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*Long before  
Captains  
Kirk and  
Picard  
came on  
the scene,  
William  
Pickering '32  
turned the  
helm of JPL,  
and the  
imagination  
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toward space.*

**Page 6**

*The first  
female  
president of  
an alumni  
chapter, New  
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JeanClare  
Seagrave '76  
is committed  
to science, to  
education—  
and to  
Caltech.*

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*A record  
number of  
alumni  
return for the  
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57th Seminar  
Day.*

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