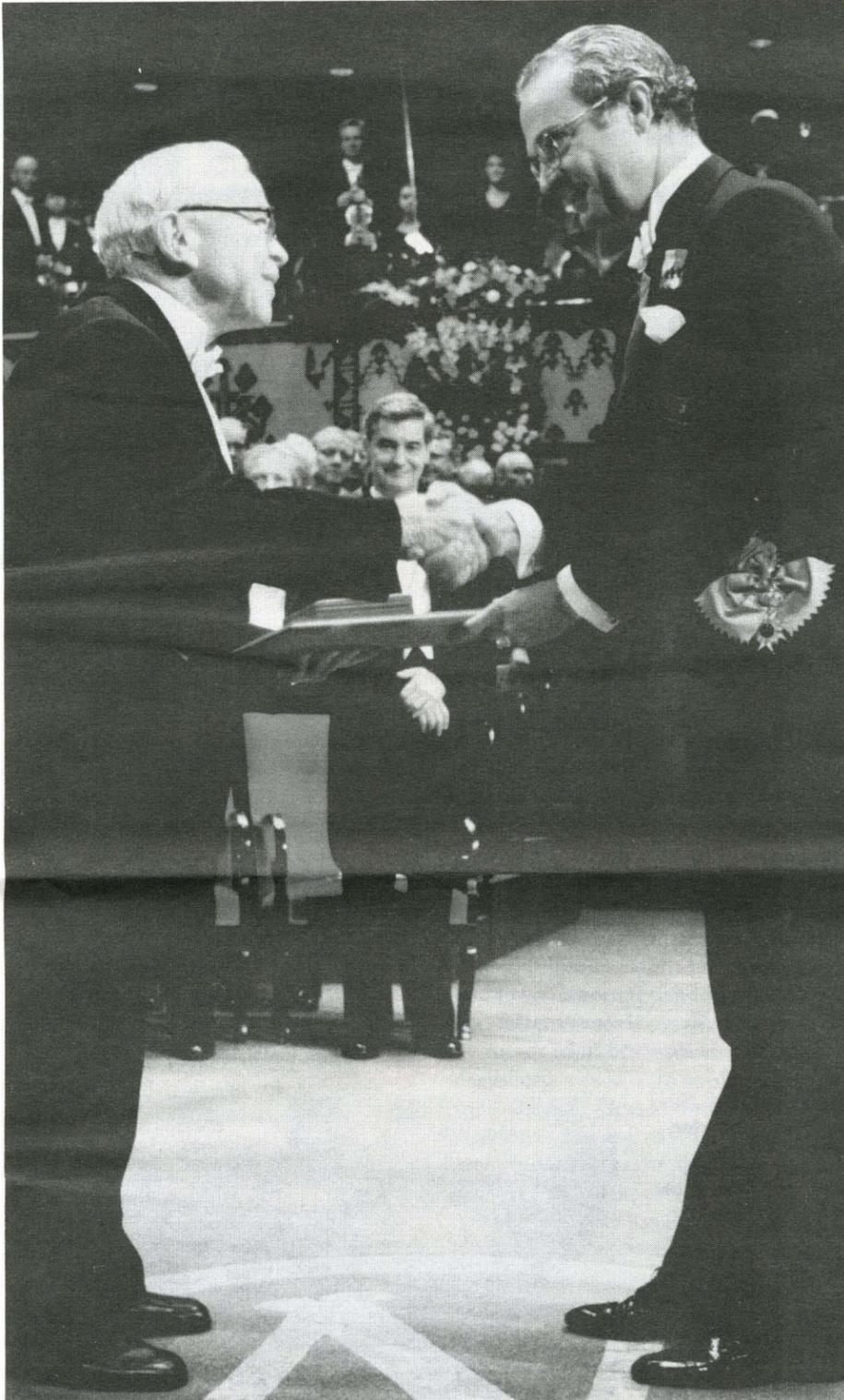


Volume 30, No. 1
Winter 1996

The doyen of *Drosophila*

By Heidi Aspaturian



Northern rites: Edward Lewis, PhD '42, Nobel laureate '95, receives his Nobel medal and the congratulations of King Carl Gustav of Sweden.

Curious bystanders who wandered into a Biology Division party in Caltech's Alles courtyard last October might easily have been forgiven for thinking they had stumbled upon a somewhat unorthodox celebrity roast. Who *was* the individual being commented on from the podium by speaker after speaker in front of hundreds of appreciative listeners, including one gigantic and, thankfully, artificial four-winged fly? "I'm glad he's not here," said one speaker. "Never published much," said another. "He keeps odd hours, but you can always find him at lunchtime in the Athenaeum," added a third. And who was the slight figure seated at the foot of the podium, heckling each speaker to "keep it short," pointing a camera into the crowd like a surveillance man, and sporting a fake beard, something he said he'd acquired after a week in the Alps?

Chocolates and cuckoo clocks are what one usually brings home from Switzerland: Ed Lewis, the Institute's Thomas Hunt Morgan Professor of

Biology, Emeritus, brought home the Nobel Prize in physiology or medicine. An unorthodox keepsake, but, as speaker after speaker implied that day at Lewis's homecoming celebration, what can you expect from someone who began his lifelong infatuation with the tiny, red-eyed *Drosophila* fly while he was still in high school?

Lewis is the 22nd Caltech faculty member or alumnus to win the Nobel Prize (Lewis, PhD '42, falls into both categories) and the fifth member of the Institute's biology faculty to receive the honor. He shared the million-dollar award with Christiane Nüsslein-Volhard, of the Max Planck Institute in Tübingen, Germany, and Eric Wieschaus, of Princeton University "for discoveries concerning the genetic control of early embryonic development." Said the Nobel committee, "Together these three scientists have achieved a breakthrough that will help explain congenital malformations in man."

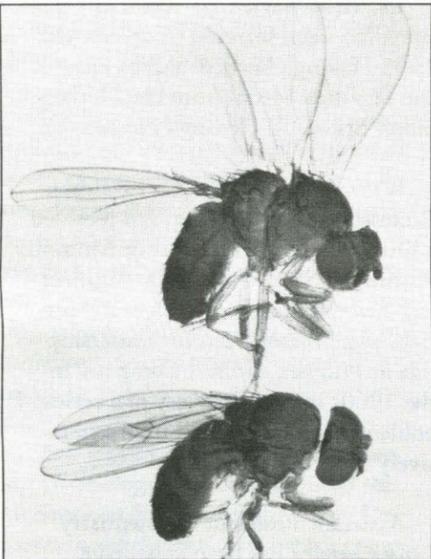
In receiving the Nobel for his work with *Drosophila*, Lewis carries on a tra-

dition inaugurated by Caltech's first Nobel laureate, Thomas Hunt Morgan. Morgan also won the prize for his research with fruit flies, and his disciple, Alfred Sturtevant, was Lewis's thesis adviser when the young biologist arrived on campus from the University of Minnesota in 1939. Lewis also appeared to be keeping faith with a more recent Institute tradition: he was away from campus when word of his selection from the Nobel committee came down, and he was probably one of the last people directly affected by the announcement to find out about it.

"The word had been out," Lewis said later, "but we hadn't heard. They don't really report that sort of thing on Swiss trains." He got the news when he and his wife, Pamela, got off the train in Ascona, Switzerland, near the Italian border, where Lewis was to attend a conference. Alighting from their cab at the Centro Stefano Franscini, where the meeting was being held, they were met by the conference coordinator, Erika Marquardt. "She came out to greet us and I thought, 'how happy and cheerful she looks,' but then Erika—a wonderful person—always does," Lewis said. Then she threw her arms around him and said, "I have to tell you. You have won the Nobel Prize." Then, said Lewis, "Pam and I started to lug our bags out of the cab. All of a sudden people began to show up and we realized we wouldn't have to lug anything."

The Lewises had gone to Ascona to attend a conference on homeotic genes. Homeotic genes, which govern how the body of an organism takes shape during early embryonic development, today constitute one of the most significant areas of research in biology. It is a field that Lewis launched almost single-handedly more than 40 years ago in Caltech's Kerckhoff Laboratories, from

Continued on page 8



The four-winged *Drosophila* perched atop a normal two-winged specimen owes its largesse to three mutations that cause the fly to acquire an entire extra thoracic segment—and with it, a second set of wings. This picture appeared on a 1981 cover of Caltech's *Engineering & Science*, three years after Lewis published the paper on the bithorax complex that ultimately won him the Nobel Prize.

CAMPUS UPDATE

LIGO project moves on to next phase

Construction is moving forward rapidly at the two LIGO sites in Hanford, Washington, and Livingston Parish, Louisiana, bringing scientists that much closer to detecting the gravitational waves whose existence Einstein predicted 80 years ago.

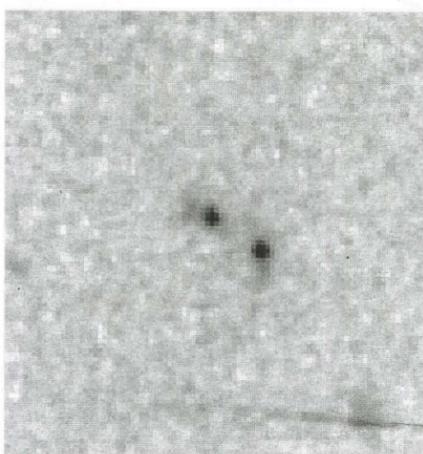
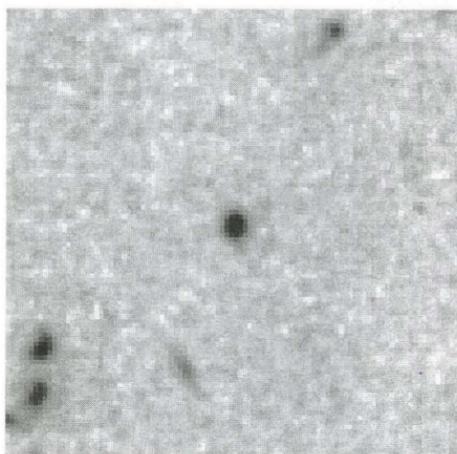
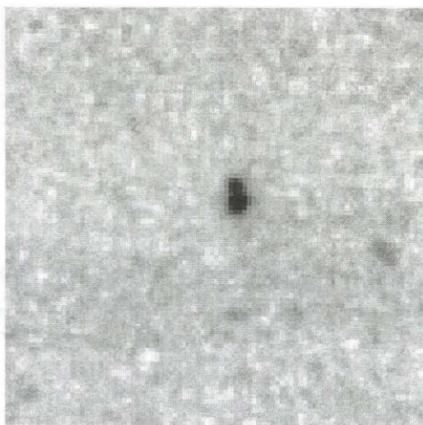
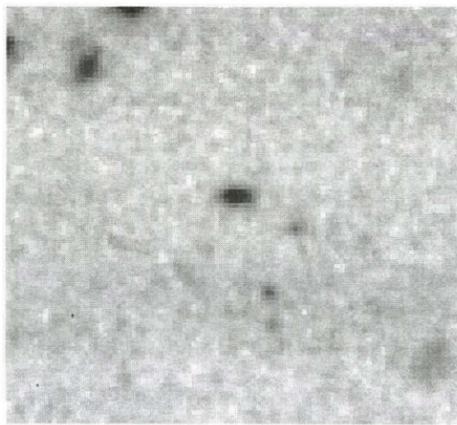
LIGO, the Laser Interferometer Gravitational-Wave Observatory, is a twin facility designed and built by Caltech and MIT, and is funded by the National Science Foundation. A contract has been awarded to begin construction of the eight kilometers of foundations that will support the beam tube in Hanford, which is located on a Department of Energy reservation in south-central Washington. Rough grading activities on the Louisiana site, about 30 miles east of Baton Rouge, are also now under way.

Calling these developments "a major step forward," Stan Whitcomb '73, who leads the LIGO research and development group, says "We are just now finishing the planning and research phase and entering the phase where the work gets done." The project is headed by Barry Barish, principal investigator and Caltech's Ronald and Maxine Linde Professor of Physics and by Gary Sanders, who serves as project manager.

The LIGO project undertakes a new scientific path based on Albert Einstein's 1916 prediction of gravitational waves in his general theory of relativity. The waves are described as ripples in the fabric of space and time, produced by violent events in the distant universe—for example by the collision of two black holes or by the cores of supernova explosions.

Gravitational waves are emitted by accelerating masses, such as light waves, or electromagnetic radiation, are produced by accelerating charges. While astronomers have studied light at optical, radio, and other wavelengths, gravitational waves are likely to yield very different information about phenomena in the distant universe and about the nature of gravity.

"When it comes to understanding the strong sources of gravitational waves, such as black holes," says Whitcomb, "we have very limited knowledge, even regarding how strong the gravitational waves are likely to be. This is because black holes, supernova cores, and such are hidden from direct observation using conventional channels of astronomy—optical, X-ray, ra-



Hubble Space Telescope Photos—M. Giavalisco

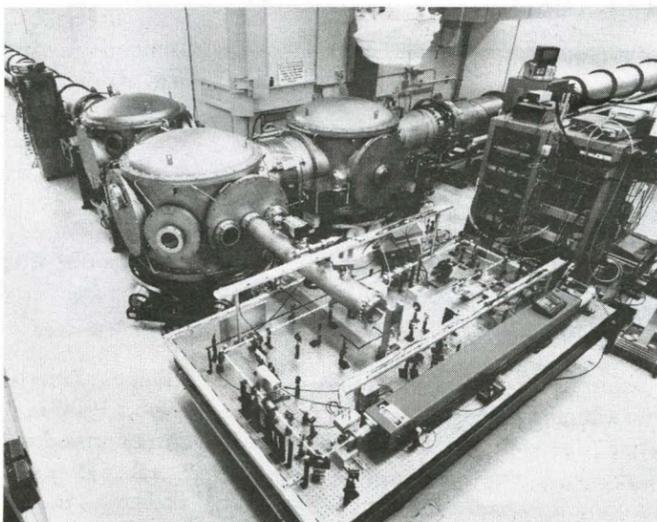
For decades now, the astronomical portrait of the early universe has resembled a celestial freak show: astronomers might spot a fire-breathing quasar here, a powerhouse of a galaxy there, but very little to indicate much continuity between the very young cosmos and the makeup of today's universe. The central blips in the four frames at left, and a dozen more like them, are changing all that: in a paper just published in *Astrophysical Journal Letters*, Caltech Assistant Professor of Astronomy Charles Steidel and his colleagues report that these are images of the most distant, and hence youngest, population of normal galaxies ever discovered—star systems that existed when the cosmos was no more than 10 to 20 percent its current age. To detect these extremely faint objects, Steidel and his collaborators—Mauro Giavalisco of Carnegie Observatories, Max Pettini of the Royal Greenwich Observatory, Mark Dickinson of the Space Telescope Science Institute, and Caltech graduate student Kurt Adelberger—used an innovative technique developed by Steidel to tease out their characteristic light signatures, and then took spectral data at the Keck Telescope to determine their redshifts. The type of light these objects emit, says Steidel, strongly suggests that they are among the earliest ancestors of present-day elliptical galaxies, and progenitors of the cores of spiral galaxies such as the Milky Way.

dio, etc.—and require a new technology to be studied fully."

To detect and study gravitational waves, identical facilities are being built 1,800 miles apart, each one shaped like a giant L with 2.5-mile arms stretching out across a flat plain. The arms will be vacuum pipes four feet in diameter, with test masses and mirrors hanging at each end and at the vertex of the arms. Ultrastable laser beams traversing the pipes will measure the effect of gravitational waves on the distance between the test masses.

This effect is expected to be so

The LIGO 40-meter prototype interferometer on the Caltech campus. While it is too short to have a reasonable expectation of detecting gravitational waves, the prototype serves as a highly reliable testbed for the development of detectors for the full-scale LIGO facilities.



minute—one one-hundred-millionth the diameter of a hydrogen atom over the length of the arm—that the masses must be isolated from all other influences that might alter their motion, including gas molecules in the air. Data from the two facilities will be processed in tandem to help rule out the possibility that disturbances caused by local phenomena such as micro-earthquakes, acoustic noise, and laser fluctuations might produce a misleading reading at one or the other location.

Previous attempts to prove that gravitational waves exist have yielded some promising indications. Although the waves have not yet been detected directly, their influence on a binary pulsar (two neutron stars orbiting each other) has been measured accurately by

Joseph Taylor and colleagues at Princeton and is in good agreement with the predictions.

What are the chances that gravitational waves will be detected soon after the detectors become operational? "That is one of the really hard questions," says Whitcomb. The predicted strengths of the gravitational waves that the LIGO scientists seek "range over several orders of magnitude, depending on the assumptions that are used. If the waves are in the upper range of the estimates, then we should see them. If they are in the lower

Honorable mentions

John Abelson, the George Beadle Professor of Biology, has received the Alumni Achievement Award from Washington State University, his undergraduate alma mater, in honor of his contributions "to the understanding of protein biosynthesis."

Thomas Abrens, professor of geophysics, has been awarded the American Geophysical Union's Harry E. Hess Medal for "outstanding achievements in research in the constitution and evolution of Earth and sister planets."

Fred Anson, the Elizabeth W. Gilloon Professor of Chemistry, has been named a fellow of The Electrochemical Society, Inc., for his work in the field, including his discovery of new electrocatalysts for the electroreduction of dioxygen.

Jacqueline Barton, professor of chemistry, has been selected to deliver the 1995 Havinga Lecture and to receive the Havinga Medal from the Netherlands' Stichting Havinga Foundation.

William Bridges, the Carl F Braun Professor of Engineering, has received a Distinguished Engineering Alumnus Award from UC Berkeley's Engineering Alumni Society. Bridges's three-time alma mater cited his leadership role at Hughes Aircraft Company in the 1960s in the discovery of a series of noble gas ion lasers, still used extensively in airborne systems.

Assistant Professor of Chemistry *Erick Carreira* has been awarded a \$500,000 Packard Fellowship by the David and Lucile Packard Foundation. Carreira studies the use of asymmetric catalysts to produce compounds with the potential to be useful drugs. He

range, then our initial detectors will not be sensitive enough to detect them.

"For that reason," continues Whitcomb, "we have designed the facilities so that the detectors can be improved over many decades. This way, LIGO improves its sensitivity and never becomes obsolete. Scientists, both inside and outside LIGO, are developing techniques for improving the sensitivity of the detectors to the point where we can reasonably expect to detect gravitational waves even in the weak end of the predicted range."

LIGO, heralded as "history in the making" by NSF director Neal Lane, is expected to be operational by the year 2000. The project is headquartered in Bridge Laboratory.



"You see Willy here with another well-known non-administrator at Caltech," said Caltech provost Steve Koonin '72 in recalling his late colleague's disinclination to take on jobs like the one Koonin now holds. Koonin spoke at a memorial observance that formed part of a two-day nuclear astrophysics symposium, "A Celebration of Willy Fowler," held on campus in December to commemorate the late Nobel laureate's life and scientific legacy.

joins 19 of the "most promising" young science and engineering researchers at U.S. universities in receiving the five-year fellowship.

K. Mani Chandy, professor of computer science, has been chosen to receive the 1996 Koji Kobayashi Computers and Communications Award from the Institute of Electrical and Electronics Engineers, Inc., scheduled to be presented in April at the International Parallel Processing Symposium.

Matthias Flach, associate professor of mathematics, was awarded the Heinz-Maier-Leibnitz Prize by the German Ministry for Development, Science, Research, and Technology for his work "A Finiteness Theorem for the Symmetric Square of an Elliptic Curve."

Caroline Foblin, assistant professor of economics, has been awarded the inaugural Gino Luzzato Prize for her dissertation "Financial Intermediation, Investment, and Industrial Development: Universal Banking in Germany and Italy from Unification to World War I." The award is given by the European Association of Historical Economics for "the best PhD dissertation in European economic history."

Kevin Gilmartin, associate professor of literature, has been awarded the Arnold L. and Lois P. Graves Award, which seeks to encourage innovative scholarship in the humanities by young professors at liberal arts institutions on the West Coast.

Harry Gray, the Arnold O. Beckman Professor of Chemistry and director of the Beckman Institute, has been awarded an honorary Doctor of Laws degree from Illinois Wesleyan University and has been inducted into Western Kentucky University's Hall of Distinguished Alumni. Gray received his bachelor's degree from Western Kentucky in 1957.

Tom Heaton, professor of engineering seismology, has been granted the Meritorious Service Award of the Department of the Interior, for his contributions "to technical developments and seismological research for the National Earthquake Hazards Reduction Program of the U.S. Geological Survey."

Michael Hoffmann, professor of environmental chemistry, has received the

1995 E. Gordon Young Award from the Chemical Institute of Canada for his scientific contributions in the area of environmental chemistry. Hoffmann was also named the E. Gordon Young Distinguished Lecturer at three Canadian universities—Alberta, Calgary, and Regina.

Wolfgang Knauss, professor of aeronautics and applied mechanics, has been elected a fellow of the American Society of Mechanical Engineers.

Rudy Marcus, Nobel laureate and the Arthur Amos Noyes Professor of Chemistry, has been selected to receive the Treasure of Los Angeles award from the Central City Association; has been named an honorary fellow of University College, Oxford; and has received an honorary doctorate from the University of Oxford. Most recently, he has been named honorary professor of the Institute of Science of the Chinese Academy of Sciences, and advisor of the Center for Molecular Sciences of the Academy and of the State Key Laboratory for Structural Chemistry of Unstable Species in Beijing.

Gordon Moore, chair of the Caltech Board of Trustees and chairman of the board of the Intel Corp., is one of 10 distinguished Americans to receive the Horatio Alger Award. The award honors individuals who have triumphed over great adversity in their lives to achieve remarkable success. Through their examples of "honesty, hard work, and service to others," recipients serve as role models and heroes to today's youth. Awardees and Horatio Alger Foundation scholarship winners will be honored on April 19 at the Horatio Alger Association's 49th Annual Awards Ceremony, which will be televised in a one hour national PBS special hosted by Dan Rather.

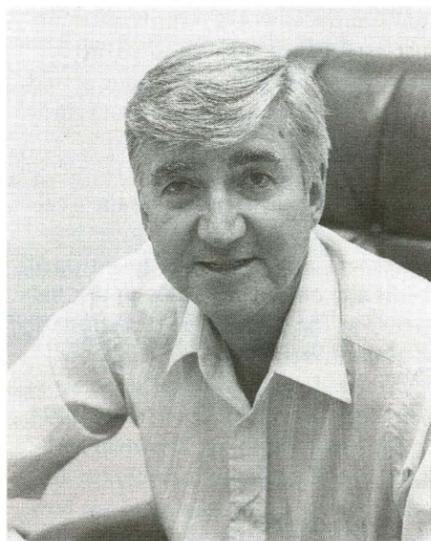
Daniel Pack, graduate student in chemical engineering, has received the Materials Research Society Fall Graduate Students Award for his presentation "Ligand-Induced Reorganization and Protein Assembly in Synthetic Chelating Lipid Membranes." The award is intended to honor and encourage graduate students whose academic achievements and current materials research display a high order of excellence and distinction.

Continued on page 4

Fred Anson appointed to new Gilloon Chair

Professor of Chemistry Fred Anson has been appointed Caltech's first Elizabeth W. Gilloon Professor of Chemistry. Anson, a Caltech alumnus and Institute faculty member since 1957, was chairman of the Institute's Division of Chemistry and Chemical Engineering from 1984 to 1994.

Born in Los Angeles, Anson received his BS from Caltech in 1954 and his PhD from Harvard in 1957.



Fred Anson

He returned to Caltech as an instructor in chemistry that same year and was named assistant professor of chemistry in 1958, associate professor in 1962, and full professor in 1968.

Anson conducts research in electrochemistry, a field with applications in such diverse realms as batteries for automobiles, hearing aids and heart pacemakers, and fuel cells for use in spacecraft and for clean, efficient generation of electricity. He has done pioneering work on the electrochemistry of polymers, on the catalysis of electrode reactions, and on electrochemical reactions that involve ultra-thin coatings of molecules on electrode surfaces.

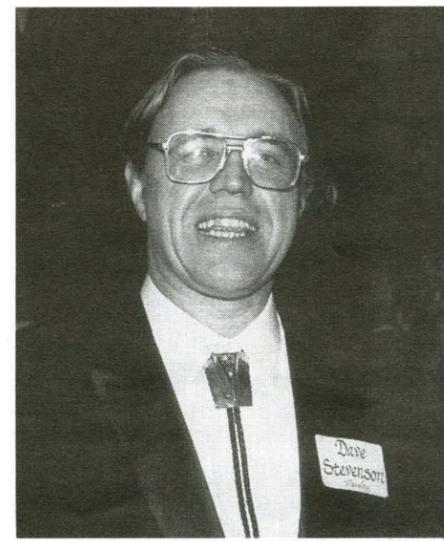
Elected to the National Academy of Sciences in 1988, Anson has received many other honors, including the Electrochemical Society's first David C. Grahame Award (1983), an Alexander von Humboldt Senior Scientist Award (1984, 1986, and 1994), the Society for Electroanalytical Chemistry's C. N. Reilley Award (1986), and the American Chemical Society's Awards in Analytical Chemistry (1989) and Electrochemistry (1994).

Named for the late Elizabeth W. Gilloon, the Gilloon Chair was endowed from the estate of her husband, Frank J. Gilloon, a longtime Caltech supporter who was an instructor in civil engineering at the Institute in 1918–1920. His estate also endowed the Frank J. Gilloon Distinguished Teaching and Service Professorship, currently held by Caltech physicist and vice provost David Goodstein. Before his death in 1994, Gilloon also endowed the Virginia Gilloon Fellowship named for his sister, Virginia, for graduate study at Caltech. The Gilloon family has also given generously to a wide range of environmental causes, including the Sierra Club and the Nature Conservancy.

David Stevenson named first Van Osdol Professor

Professor of Planetary Science David Stevenson has been named the first holder of the recently established George Van Osdol Professorship.

A native of New Zealand, Stevenson earned his bachelor's and master's degrees at Victoria University in Wellington, New Zealand, and his doctorate in theoretical physics at Cornell. He joined the Caltech faculty in 1980 as associate professor and was named pro-



David Stevenson

fessor in 1984. Stevenson served as chairman of the Division of Geological and Planetary Sciences from 1989 to 1994.

A fellow of the American Geophysical Union since 1986, and a fellow of the Royal Society of London since 1993, Stevenson was awarded the AGU's Whipple Award in 1994 for his outstanding contributions to understanding fundamental aspects of the formation and evolution of planets, especially planetary interiors. He has also received the Urey Prize from the American Astronomical Society's Division of Planetary Science in 1984.

Stevenson's research concerns the origin, evolution, and structure of all planets including Earth. He explores areas such as convective processes in the mantle and core, and complexities of two-phase flow, kinetics, and differentiation.

The professorship was established by George Van Osdol, who received his BS in electrical engineering from the Institute in 1934. After graduation, he went to work for U. S. Electric Motors, then returned to Caltech during World War II as a participant in the Naval Reserve program. Van Osdol spent a total of six years in the Navy and Naval Reserve doing radar work and working on the electronics involved in the atom bomb tests. Subsequently, he joined Pacific Bell, designing support equipment that carried telephone systems between buildings. He retired from Pacific Bell in 1977, and has been active in the Alumni Fund and the Friends of Beckman Auditorium.

Caltech's 1996 biology forum to focus on new views of mental illness

The always baffling, often tragic world of mental illness is beginning to yield more of its secrets to science, as biomedical researchers develop increasingly sophisticated and sensitive tech-



Striking images of the brain at work, such as this one obtained from MRI and PET scans, will be displayed and discussed at the Institute's June 12 biology forum.

niques for observing the brain in action. These unprecedented visual images, and what they imply for our understanding, study, and treatment of mental illness, will be the subject of the 1996 Caltech Biology Forum, "Images of Mental Illness: Science Looks Inside the Brain," to be held Wednesday, June 12, at 7:30 p.m. in Beckman Auditorium on the Caltech campus. All interested Caltech alumni are invited to attend. Admission is free, but tickets are required. Please contact the Caltech Ticket Office at 818/395-4652.

Bruce Hensel, MD, chief medical correspondent for KNBC TV in Los Angeles, will moderate a panel made up of Daniel Weinberger, MD, chief of the clinical brain disorders branch of the National Institute of Mental Health; Steven Petersen PhD '82, associate professor and director of the division of neuropsychology within the department of neurology and neurological surgery, Washington University School of Medicine, St. Louis; Scott Fraser, Caltech's Anna L. Rosen Professor of Biology; John Mazziota, MD, professor of neurology, radiological sciences, and medical and molecular pharmacology, and director of the brain mapping division, UCLA; and writer Kathy Cronkite, whose book *On the Edge of Darkness: Conversations About Conquering Depression* chronicles the struggle with depression of some prominent actors, journalists, and politicians. Cosponsors with Caltech are the *Pasadena Star-News* and the Mental Health Association of Los Angeles County.

Campus coach nets a new world record

Stroll past Brown gym and there's a good chance you'll catch Fred Newman shooting some ball. Stop for a moment, and you'll notice he's pretty darn good at sinking those free throws. Linger a while longer, and you'll notice that he almost *never* misses a shot.

That's how Newman managed to net four Guinness world records, plus his just-established first world record for free throws made in a one-hour period.

The Caltech community can join in celebrating Newman's success: he's an alumnus with a 1960 BS in chemistry and a star-studded record on the Tech basketball team. As a computer programmer in the Bay Area, he returned to his alma mater regularly to test his mettle at the Brown free-throw line and in alumni varsity games. And now semiretired, he has worked as an assistant Tech basketball coach since 1994.

This past February, Newman and hundreds of audience members at an NBA charity event wanted to see how many free throws he could make in an hour. Answer: 2,034. He missed 209 additional shots within the time period, but who wouldn't have, when shooting at the rate of 37 shots a minute? (That remains an open question.) Staff at the *Guinness Book of World Records* plan to print Newman's as the first record made in this category. Newman was asked to make the appearance at "jam sessions" sponsored by Fleer, one of the companies participating in the NBA charity event in San Antonio, which made a donation to the city's Child Abuse Prevention Services.

Of the records that Newman has broken in past years, he still holds the one for the most free throws made in a 24-hour period. Since 1975, he has also held records for shooting blindfolded, making 88 baskets in a row; for a 10-minute shooting spree (having two balls passed to him instead of a rack of balls by his side), making 338 baskets; and for making the highest percentage of

shots in a 24-hour period, at just over 98 percent of 13,116 shots.

When it comes to shooting, Newman was not exactly a child prodigy. He did play on teams from age 10 to age 40—at his military primary schools, on a high-school B team ("for little guys"), at Caltech, and on corporate intramural teams like IBM's (where he worked from the mid '60s into the '70s). As a highlight to his longtime hobby, Newman played with the Frankfurt Big Blue while serving overseas in the army in 1962 and '63.

But by 1974, he realized that all his friends had quit playing, and he could relate. "Why run around when you can think of another way to get all those shots (and then some)?" he asked himself. In answer, Newman set a goal of shooting 100 free throws in a row. By his second weekend of practice, he topped that at 139.

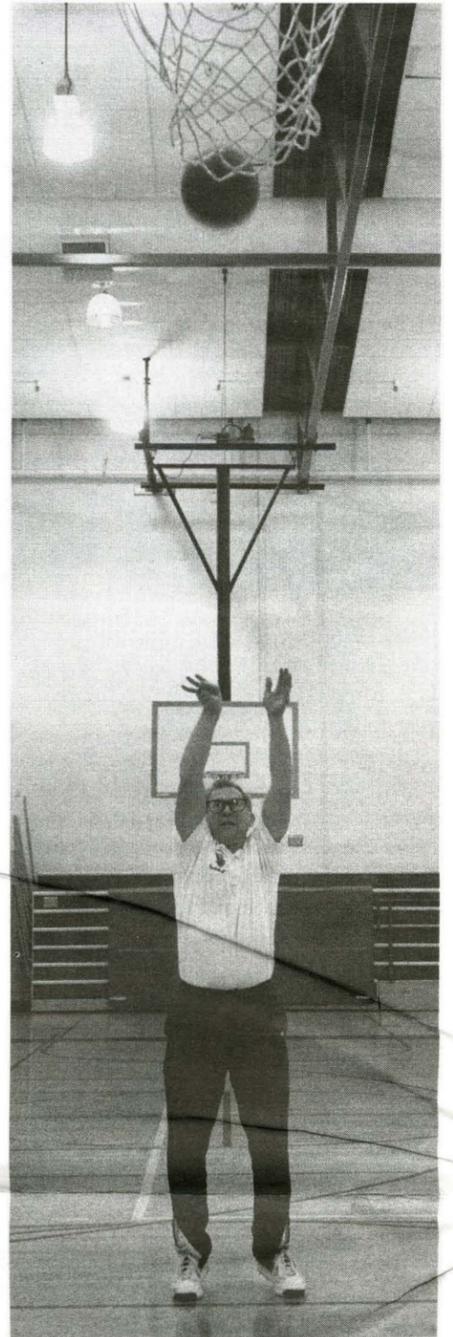
"It gave me a great adrenaline rush to have set a goal and passed it right away," he remembers. Full of pride, he even placed an ad in the *Wall Street Journal* announcing his success. Fellow alumnus Dick Van Kirk '58 saw the ad and broke it to Newman that the record was 145, but by that time Newman's tally was up to 300 and climbing toward 500.

"It's light exercise, but you have to develop endurance. For example, when you build up to shooting for 24 hours, your legs give out on you." Newman practiced for nine months, for 30 to 50 hours a week, before shooting the "most shots in 24 hours" record, witnessed at Caltech in 1990.

Beyond endurance, how does someone who shot 70 percent from the free-throw line as a Tech guard gain the precision to shoot more than 98 percent as a record breaker? "There's a big difference between shooting in games and this," says Newman. "Here you can concentrate on one thing and get into a rhythm, which is really im-

been selected to receive an honorary doctorate in engineering from Glasgow University.

Kip Thorne, the Richard P. Feynman Professor of Theoretical Physics, will be awarded the 1996 Lilienfeld Prize by the American Physical Society at the APS spring meeting on May 4. He joins Val Telegdi, a longtime Caltech visiting associate in physics and presently a faculty associate, who won this prestigious prize in 1995. The prize was established to recognize a most outstanding contribution to physics, and was awarded to Thorne for "contributing significantly to the theoretical understanding of such topics as black holes, gravitational radiation and quantum nondemolition measurements



Fred Newman '60 courts another world record.

portant as far as big numbers go. Plus I never practiced free throws while at Tech."

The next challenge that Newman hopes to take on (and the only one he was practicing for when the latest event came up) is a three-point record. He will see how many three-point shots he can make in an hour, or in the course of 2,500 attempts, or with other specifications that might interest a hosting organization or the *Guinness Book of World Records*. As far as Newman is concerned, why not give it a shot?

... and for conveying lucidly the excitement of these topics to professional and lay audiences alike."

Professor of Geology Peter Wyllie has been elected president of the International Union of Geodesy and Geophysics, and as such, he plans to lead the organization's future projects concerning the coordination of global monitoring and the impact of sprawling metropolitan areas on the earth.

Ahmed Zewail, the Linus Pauling Professor of Chemical Physics and professor of physics, has been selected as the 1996 recipient of the Peter Debye Award in Physical Chemistry, sponsored by E. I. du Pont de Nemours and Company, Inc.

Honors

Continued from page 3

Ares Rosakis, professor of aeronautics and applied mechanics, has been awarded the Society for Experimental Mechanics' B. J. Lazan Award. The award, which is given to "individuals who have made outstanding original technical contributions to experimental mechanics," represents recognition by his peers of significant technical achievements throughout his career.

Ronald Scott, the Dotty and Dick Hayman Professor of Engineering, has

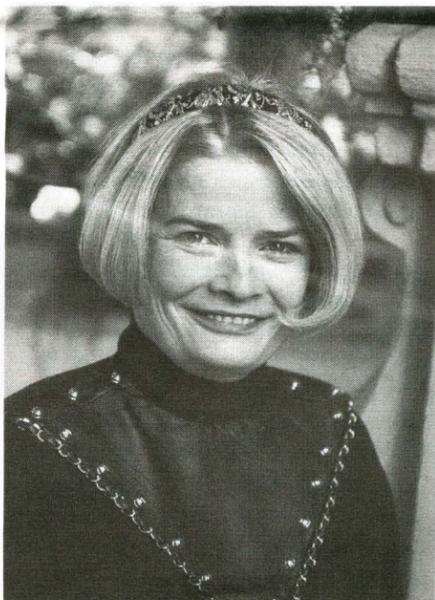
FRIENDS

Kirkbride elected Young Alumni Trustee

Louise Kirkbride '75, MS '76, has been elected to Caltech's Board of Trustees as the Institute's third Young Alumni Trustee. She joined the Board this past September.

Kirkbride, a support specialist with an extensive background in support management, software engineering, and marketing, is the founder and general manager of the San Jose, California-based Answer Systems, Inc. (now a development laboratory of PLATINUM technology, inc.). She focuses on the strategic role that technical support plays in today's open-systems environments, and how companies can use support automation tools to increase productivity and share information throughout the enterprise.

A frequent speaker at help-desk and customer support conferences, Kirk-



Louise Kirkbride

bride was recently recognized by Service News as a "Service 25" innovator who has changed the way companies deliver support. She codeveloped the first and only two patents granted for the support automation market. Under her leadership, Answer Systems won the Harold H. Short, Jr., Innovation in Service Award for "Best New Service Product of 1995."

Prior to founding Answer, Kirkbride was director of marketing at Tektronics CAE Systems Division, and founder of CADRI, a computer-aided-design company. She received her BS in 1975 and her MS in 1976, both in electrical engineering, and was a finalist in the selection of civilian astronauts for the U.S. space shuttle program.

Outstanding alumni under the age of 45 are recruited to serve as Caltech's Young Alumni Trustees.



Sixteen Caltech students—8 undergraduates and 8 graduate students—have been awarded scholarships and fellowships, respectively, by the Los Angeles Founder Chapter and Auxiliary of the Achievement Rewards for College Scientists (ARCS) Foundation Inc. The monetary awards, designed to support outstanding students in their continuing education, are among 62 such awards, totaling more than half a million dollars, that ARCS Los Angeles has granted in the past year. A longtime supporter of Caltech students, the organization honored the Institute's newest ARCS recipients at a recent banquet. Left to right, first row: Jason Kuan (ARCS DuBridge Scholar), Marc Kuchner, Seth Blumberg, Robert Lin, Alexandria Boehm, Dawn Cornelison, Tessa Miller, Nancy Winfree, David Haroldsen. Second row, from left: Caltech Vice President for Student Affairs and Professor of Mathematics Gary Lorden '62, Susan Melnik, Ted Laurence, David Rosenbluth, Jeffrey Miller, David Beam, Kevin Du, Dean of Graduate Studies and Professor of Geology Arden Albee, and Michael Miller.

Mellon Foundation renews SEPP support

The Institute has received a grant of \$425,000 from the Andrew W. Mellon Foundation for support of education and research in science and society through Caltech's Science, Ethics, and Public Policy (SEPP) Program. The grant, which began in the fall of 1995, will support the program for the next three years.

"This program is very popular with our students and helps them to look at science and technology from a different perspective," said Caltech's president, Tom Everhart. "There have been few programs during my tenure here at Caltech that have such broad appeal across campus, and certainly there is no question about the timeliness of such studies, given the changes occurring in the wider community. We are very grateful to the Mellon Foundation for their continued support of this valuable program."

SEPP activities include an undergraduate major and both graduate and undergraduate minors in Science, Ethics, and Society, which were introduced in 1994 and 1995; the training of selected graduate students and postdoctoral fellows; and a regular public seminar to stimulate awareness and discussion of special issues in SEPP within the greater Caltech community. The SEPP Program was initiated in 1987 by science historian and current faculty chair Daniel Kevles, the J. O. and Juliette Koepfli Professor of the Humanities, who continues to direct it.

"We believe it's valuable to expose Caltech students to discussions of policy and ethical problems," Kevles said. "They will have to grapple with these issues in one form or another throughout their careers, for they arise in many areas, including weapons re-

search and arms control, the environment, and biotechnology." During the 1996 winter quarter, SEPP is offering a course on the history of genetics, molecular biology, and biotechnology and how these fields affect society, jointly taught by Kevles and Visiting Professor of History Evelyn Fox Keller, who is on leave from MIT.

Caltech establishes Harris Lectureship

A new addition to Caltech's Science, Ethics, and Public Policy (SEPP) Program has been announced: The William and Myrtle Harris Distinguished Lectureship in Science and Civilization. The lectureship will bring scientists, historians, philosophers, and others to campus "to speak on issues of science in relationship to society," according to SEPP Director and Koepfli Professor Daniel Kevles (see related article, above).

Made possible by a gift from alumnus William Harris '49, MS '50, and his wife, Myrtle, the Harris Lectures will be free and open to the entire community. The first lecture will be held on May 9, when noted virologist Robert Gallo comes to speak on "Epidemic Disease and Basic Research: Lessons from the Case of AIDS." All alumni are welcome to attend the 4 p.m. talk in Baxter Lecture Hall.

For more information on the lectureship, call Ingeborg Sepp at 818/395-4087. Its sponsors, longtime Caltech supporters William and Myrtle Harris, live in Menlo Park, California, and are President's Circle members of the Associates.

Trustee Goldstein elected to NAE

Arthur Goldstein, who joined Caltech's Board of Trustees in 1995, was elected a member of the National Academy of Engineering last month. Election to the NAE is among the highest professional honors that can be given to an engineer. Goldstein, chairman and chief executive officer for Ionics, Inc., a company that purifies and treats water and other liquids, was honored for "inventing and developing membrane separation technology, which resulted in a world-scale desalination industry." Active in community affairs in Massachusetts as well as serving on many boards, Goldstein is the holder of eight patents in areas relating to the purification and processing of liquids.

Institute receives grant to support Alzheimer's research

The Henry L. Guenther Foundation of Los Angeles has awarded the Institute \$120,000 to establish the Henry L. Guenther Postdoctoral Fellowships.

The award will allow Caltech to recognize and support several postdoctoral fellows in the field of neurobiology, where their research in fields related to Alzheimer's disease could lead to a better understanding of the causes of the disease and help to develop treatments to combat its effects.

About 4 million Americans have Alzheimer's disease, which affects memory, judgment, and personality, and eventually causes patients to lose control of bodily functions and speech. Its cause is unknown and there is no effective treatment.

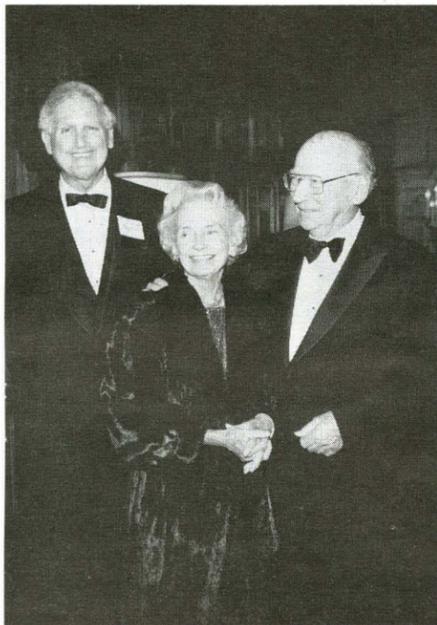
Postdoctoral fellows are critical to the function of every research group at Caltech. Young scientists often do their most creative, productive work during their postdoctoral training period because they are able to devote their full attention to research without the additional responsibilities that accompany a faculty appointment.

The Henry L. Guenther Foundation is a private nonprofit corporation organized to improve social conditions, promote human welfare, and alleviate pain and suffering. The foundation applies its resources mainly to benefit California residents, especially those in Southern California, by means of improved and expanded medical services, opportunities for youth, and other humanitarian or community projects.

"Whose wine I drink"

Fine dining could certainly have been among the topics of conversation late last year, when 274 Caltech Associates, guests, and members of the faculty gathered for the Institute support group's annual Black Tie dinner. But the evening's speaker I. Michael Heyman, secretary of the Smithsonian Institution, wasn't commenting on the cuisine or summoning the sommelier when he quoted the ancient Chinese poet—"Whose bread I eat, whose wine I drink, his song I sing." Rather, he was alluding to the growing role of the private sector in underwriting projects launched by the Smithsonian and other not-for-profit public institutions and to the risks, opportunities, and dilemmas created by this new relationship.

In his talk, "The Private Sector and the Smithsonian: Savior or Seducer?" and the lively discussion that followed, Heyman described the Smithsonian's experience with its recently established corporate membership program and suggested that by exercising care and judgement and hewing to a standard of "enlightened realism," institutions such as the Smithsonian can forge these part-



nerships without impairing their integrity and autonomy. Noting that the museum would shortly launch a corporate-sponsored traveling exhibition in Southern California, Heyman invited his audience to "Judge for yourself."

Photos below, top: The Associates' 1996 board of directors with advisory director, Caltech President Tom Everhart. From left, back row: Everhart, Michael Callaghan '52, Lon Bell '62, PhD '68, Ralph Jones '38, and Associates President Carl Larson '52. Front row, left to right: Adelaide Hixon and Mary Johnson.

Bottom photo: The 1996 Associates' executive committee, from left: Carl Larson '52, president; Milton Mohr, vice president; Roland Smoot '50, secretary; John Glanville, treasurer. Not pictured: Ilene Marshall, vice president.

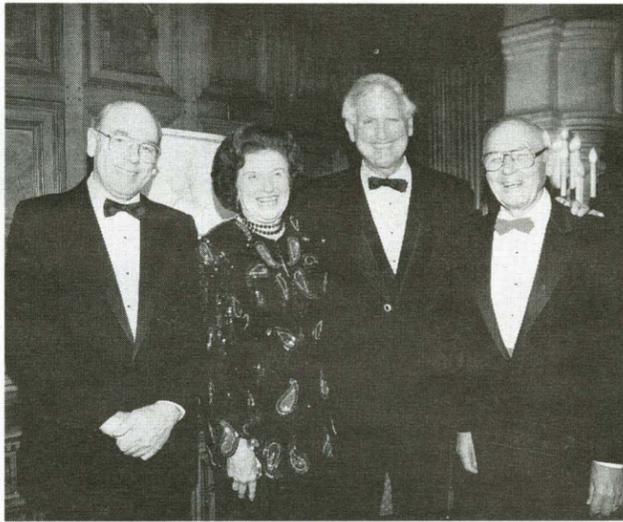


Photo far left: At the Associates' 1995 Black Tie Dinner, the evening's guest speaker, Secretary of the Smithsonian Institution I. Michael Heyman (left) joins Associates Bobbie and Ralph Jones '38; and (photo left) gets together with (from left) President Tom Everhart, and Katie and Warren Schlinger '44, PhD '49. Below: From left, Institute Professor of Chemistry, Emeritus, John Roberts, Gregory Jenkins, Donna Jenkins, and Edith Roberts.



ASSOCIATES' EVENTS

March 5-19, "Lands of Pharaohs and Prophets"—President's Circle Trip to Egypt, Israel, Jordan, and the Red Sea, led by Thayer Scudder, professor of anthropology.

March 26, Associates' 70th Birthday Celebration, with Edward Lewis, 1995 Nobel Laureate and the Thomas Hunt Morgan Professor of Biology, Emeritus.

April 10-11, All Associates' Trip to Hawaii, led by Thomas Soifer, professor of physics. Visits to the W. M. Keck Observatory and the Caltech Submillimeter Observatory.

April 18, Associates/Faculty Dinner, with Christof Koch, professor of computation and neural systems: "Visual Consciousness and Your Brain."

April 22, Event for Associates with Prospective Members.

April 24, Santa Barbara Luncheon at Birnam Wood Golf Club, with Andrew Ingersoll, professor of planetary science: "Galileo Probes Jupiter's Atmosphere."

April 29, President's Circle/Faculty Tour and Dinner—Tour of the Wind Tunnel and the T5 Shock Tunnel, with Hans Hornung, the Kelly Johnson Professor of Aeronautics

and director of Caltech's Graduate Aeronautical Laboratories.

May 7, Associates/Faculty Dinner, with George Rossman, professor of mineralogy: "South American Crystal Quest."

May 13, President's Circle/Faculty Dinner, with Charles Plott, the Edward S. Harkness Professor of Economics and Political Science: "Auctions of the Airwaves."

June 1, President's Circle Garden Party, at the home of President and Mrs. Everhart.

June 13, Jet Propulsion Laboratory Tour, Dinner, and Program, for Associates with children and grandchildren.

September 12-20, President's Circle Trip to Switzerland, led by Brian Wernicke, professor of geology. Followed by optional add-on tour of Burgundy, France, September 20-25.

All events will be held at the Athenaeum unless otherwise noted. Individual invitations for each event will be sent monthly. For more information about the Caltech Associates, call the Associates' office at 818/395-3919.

Armchair astronomer travels to capital to receive top honor

By Jay Aller and Hillary Bhaskaran

"For his profound and lasting contributions to planetary sciences and astrophysics," Peter Goldreich, Caltech's Lee A. DuBridge Professor of Astrophysics and Planetary Physics, has been awarded the National Medal of Science. Goldreich, a member of the Institute faculty for nearly three decades, was among eight scientists who received the medal from President Clinton in a White House ceremony on October 18, 1995.

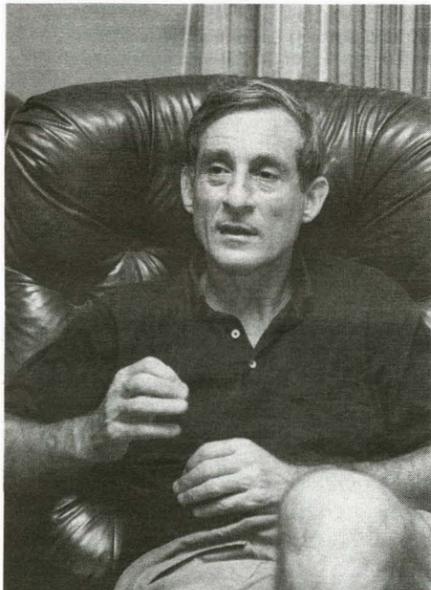
"They certainly made a big fuss over us," says Goldreich of the occasion.

At age 56, Goldreich is the 19th Caltech faculty member to win the nation's highest scientific honor. Theodore von Kármán received the first Medal of Science from President Kennedy in 1962, and JPL Director Edward Stone won it most recently, in 1991. An average of 10 medals are granted annually, based on nominations and committee selections that take into account "the total impact of an individual's work on the present state of physical, biological, mathematical, engineering, behavioral, or social sciences."

In the citation that accompanied the medal, Goldreich was lauded for "providing fundamental theoretical insights for understanding the rotation of planets, the dynamics of planetary rings, pulsars, astrophysical masers, the spiral arms of galaxies, and the oscillations of the sun."

There aren't many areas of the universe where Goldreich hasn't left his intellectual mark. Working almost exclusively from his chair in South Mudd Laboratory, scribbling notes on scraps of paper, Goldreich has applied physics to the study of a myriad of astronomical problems. He typically spends about five years working on a particular problem, writes a few papers about his findings, then moves on to another topic. It is this purposeful rambling among many fields that has enabled him to contribute to a wide variety of problems ranging from why Saturn's rings have sharp edges to how distant stars emit microwave radiation in a coherent form, like a laser.

Goldreich describes himself as a general-purpose theoretician in astrophysics. Even while he is working in one area, he says, he hears about other intriguing ideas. "I always have another set of problems I'd like to solve besides the ones I'm working on," he explains. "I like to work on problems with well-supported observational data and no theoretical explanation of any significance, so that no one has a good idea of what's going on, and I am the first one to explore it in depth. Then



Peter Goldreich in his office in South Mudd.

if you come up with something right, you know it."

Goldreich says he has worked on about a half dozen of these problems where the research fell into place and his explanations turned out to be at least partially right.

But for each respectable result, he examines two or three problems that lead nowhere. "Sometimes I'll learn about something and think about it, but it goes no place. When that happens you need a good sense of when you've gone as far as you can with a problem, when it's time to quit and move on to something else." When he feels he's missing some crucial element, some essential insight that would enable him to solve a problem, says Goldreich, "I can sit in my chair for months quite happily trying to get that one little insight."

When he needs a break from "the obsessive behavior required to get that one little insight," Goldreich often turns to competitive sports. Though both his parents enjoyed intellectual pursuits, the teenaged Goldreich was more interested in sports than in science, a passion he maintains today. He played baseball at the Bronx High School of Science in New York City, and both baseball and soccer in college. It was only as an undergraduate at Cornell University that he developed a strong interest in physics, and to some degree in mathematics, which led him to earn a BS in engineering in 1960 and a PhD in physics three years later. After a year at Cambridge University and a couple of years spent securing tenure at UCLA, he came to Caltech as an associate professor "without tenure" in 1966.

In his first major scientific achievement, the 22-year-old Goldreich provided the theory behind a common yet unexplained occurrence. There are a surprisingly large number of pairs of natural satellites whose orbits have settled into resonances. By resonance one means that the ratio of the two orbital periods is close to the ratio of two small integers.

More such resonances exist than one would have expected if orbits were left up to chance, says Goldreich. He and his former PhD advisor, Thomas Gold, believed that this phenomenon "cried out for an explanation." Goldreich found the explanation in the effects of tidal forces (the distortion of an astronomical body, such as a satellite, produced by the differential attraction of other bodies on parts of the satellite).

Tidal forces cause the satellite orbits to recede from the planet and then settle into a particular resonance.

Three years later, he and colleague Stan Peale showed how tides were also "responsible for trapping the rotation rate of Mercury into a resonance in which it rotates three times about its axis for every two trips it makes around the sun."

Goldreich continued to bring insight and mathematical proof to the dynamics of other systems. In the mid-1970s, he and Caltech postdoctoral fellow Scott Tremaine predicted that there must be undiscovered moons orbiting Saturn and Uranus that "shep-

And in the company of "two burly guys" in the East Room.



herd" planetary debris into the remarkably sculpted rings that encircle those planets. In succeeding years, the Voyager spacecraft confirmed the prediction by photographing two shepherd moons, first around Saturn's F-ring and later around Uranus's epsilon ring.

Venturing out into deep space (still from his chair), Goldreich has sought to understand the mechanisms responsible for pulsars, masers, and the spiral arms of galaxies. In the case of pulsars, he came to the conclusion that a rotating neutron star would generate such enormous electrical fields that the star's electrically charged atmosphere would be forced out of the star as beams of radiation along the poles. This would result in the pulsar emissions, or pulses of radio waves, that radio telescopes detect as the beams sweep past the earth, much like a beam from a lighthouse flashes across the horizon as the light rotates.

Figuring prominently in Goldreich's successes, he says, are his PhD advisor Gold, his graduate students and post-docs, and his colleagues who "come around and say, 'I heard about this neat observation'"—all of which have helped launch the armchair astronomer into his various corners of the universe. He also chooses to teach courses that will push him into new areas of exploration.

Interestingly, Goldreich's sports activities have roughly paralleled his intellectual wanderings, shifting focus every five years or so. In graduate school he took up competitive judo, and over the years he has also competed in wrestling, running, and racquet sports. He now plays a lot of tennis and squash, and is a member of the faculty group that plays the Caltech un-

dergraduate team each year. A different distraction, "an experiment in living," had Goldreich and his wife, Susan, serving as resident associates in Page House with their two sons for "four happy years."

Regarding the most recent distraction from his work—the awards ceremony he attended at the White House with Susan, their youngest son, and their son's girlfriend—Goldreich seems surprised that the occasion wasn't all that bad. "I'm pretty embarrassed at these sorts of things," says the professor who wore a tux for the third time ever (borrowed from a grad student). "But it was a new experience meeting sig-

nificant people and being one of them for a day."

In the East Room, he posed for a photo between "two burly guys"—President Clinton and Vice President Gore (who at least seemed tall in comparison to the scientists in the room)—and he listened to their respective speeches on technology and science and received their acknowledgments. He questioned Gore about what a pain this must be for him and Clinton, "but I got the impression that it was sort of enjoyable and definitely not high stress for them." In addition, he says, "my wife really liked it. This is the only thing I've done where she was really impressed."

Goldreich's numerous honors include election to the National Academy of Sciences at the youthful age of 32. "But one of the things that I'm most proud of," he says, "is that my students have done very well. In part it's because they're good when they come here, but also they become enthusiastic about research and don't get discouraged."

Currently, Goldreich is working on the phenomenon of turbulence in magnetized fluids. He hopes next to have the pleasure of studying cosmology, which he sees as the newest frontier in astronomy. Like most frontiers, this one is crowded with explorers, so it's tough to find a distinctive problem. But he thinks he has a pretty good one picked out, and is excited to get to work on it.

After all, says Goldreich, "When you're ambitious and you do science, you're always behind schedule. The only thing that arrives ahead of time is death."



Camera in hand, "Ed's uncle" makes his entrance at his nephew's welcome-home party on campus.

Lewis

Continued from page 1

the recesses of shelves bulging with bottled flies. Lewis didn't exactly start out trying to create a major new field that would produce extraordinary insights into how genes put organisms together, and that would reveal that flies and humans are more closely related than anyone could have suspected. His original goal was to understand how new *Drosophila* genes arise from old ones. Of course, the Nobel Prize was a great honor—and quite a shock—he told Caltech's Director of Media Relations Max Benavidez, who had reached him by phone shortly after his arrival in Ascona. (The hotel desk had Benavidez on one line and Stockholm on the other; Lewis took the call from Sweden first.) And it was wonderful news for his corecipients, Lewis said, because they were so deserving of the award. But above all, he stressed, it was wonderful that the Medical Nobel Assembly at the Karolinska Institute "had recognized the importance of basic research."

Back at Caltech a few days later, surrounded once more by half-pint bottles full of fluttering flies, he made the same point more emphatically. "It's just so important for people to understand how fundamental research on the fly—something that seems to have no relevance whatsoever to their lives—can lead to discoveries that are going to improve human health. We're on the verge of medical breakthroughs that would have been decades away without this work." He hoped that the public, and especially their elected officials, would not need decades to appreciate that particular message.

Drosophila days

"We always knew that funny flies/ Would someday win the Nobel Prize," ran one of the hundreds of congratulatory messages—many of them adorned with drawings of *Drosophila*—that poured into the Lewis lab in the wake of the announcement from Stockholm. The flies that first drew Lewis's atten-

tion in the 1940s were among the more spectacular freaks in Caltech's fly room, established two decades earlier by Thomas Hunt Morgan. In addition to the specimen known as *Bithorax*, which sported a rudimentary pair of second wings, there was *Antennapedia* (discovered by then-Caltech graduate student Sien-Chiue Yu), which had legs instead of antennae growing out of its head, flies with too many or too few legs, and flies whose deformities were too extreme for the fly to survive past the embryonic stage. Over the next three decades, by selectively mutating and breeding hundreds of thousands of flies and analyzing the results, Lewis traced a large number of such defects to a cluster of genes he named the bithorax complex. Although occupying only a small part of a single fly chromosome, the complex appeared to play a critical role in laying down the basic body plan for the entire posterior half of the fly, making sure that all the organs formed in their correct positions.

When Lewis began this work, the structure of DNA was still a mystery. By the mid-1950s, of course, with the discovery of the double helix, this was no longer the case. To the new generation of researchers flocking into the field of molecular biology, *Drosophila* began to seem old-fashioned. But Lewis kept right on studying the bithorax complex in his flies. In the process, he made the key discovery that what other researchers had assumed were single genes were in fact clusters of linked genes that, Lewis proposed, arose by a process called tandem duplication. The *Drosophila* infrastructure also came in for his careful attention. For example, he developed special chromosomes that have become the tools of modern genetic analysis. And in a community rife with competition, Lewis was renowned for the generosity with which he freely shared his storehouse of both knowledge and flies, supplying strains of *Drosophila* to any lab that requested them. Toward the end of the 1970s, the number of such requests began to rise precipitously, for in 1978 Lewis had published one of his infrequent papers.

"The segmentation pattern of the fly provides a model system for studying

how genes control development." So ran the unassuming first sentence of Lewis's paper, printed in *Nature* and today considered a milestone in the history of modern biogenetics. In it, Lewis reported that the genes of the bithorax complex are lined up along the *Drosophila* chromosome in exactly the same order as the fly's body parts are arranged, and that, furthermore, they appeared to switch on during embryonic development in precisely that same order. Disrupt this process by turning a gene on or off at the wrong time, and major, frequently fatal, malformations resulted. What could account for such an elegant and ruthless genetic hierarchy?

By way of an answer, Lewis harkened back to the theory of tandem duplication that he had first published in 1952, and which had been considered something of a classic of off-the-wall-thinking at the time. All the homeotic genes in *Drosophila*, he proposed, had descended from a lone developmental gene, residing eons ago in a simple,



Lewis, with flies, in the lab in 1956.

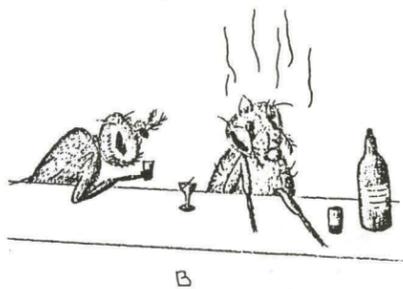
single-segment forerunner of the fly. At some point, this ancestral gene had spontaneously copied itself. Somewhere farther down the line, the identical copy had mutated and wound up performing a different function from its twin. Successive duplications and mutations followed, each ultimately leading to the creation of an additional specialized segment in the fruit fly, and, incidentally, offering evolution an effective way to progress from simpler to more complex forms of life. Once evolution had hit on an invention this good, thought Lewis, it was unlikely to abandon it. He suggested that homeotic genes had originated very early in the history of life and that all such genes in modern organisms should display traces of a common, extremely ancient heritage.

By the 1980s, molecular biology, which had once seemed to be leaving Lewis in the dust, had started to catch up to his work. A team of researchers at Stanford, led by David Hogness '49,

PhD '53 (and a recipient of Caltech's Distinguished Alumni Award in 1982), isolated and cloned the bithorax complex. Researchers elsewhere found a similar complex, dubbed *Antennapedia* after the leggy-headed mutant, governing development in the anterior half of the fly. Over the next decade, homeotic gene clusters, all looking and acting very much like the fruit fly's, and playing the same key role in regulating early embryonic development, were found in a wide range of higher animals, including humans. And in 1983 the second half of Lewis's prediction began to come true. Two research groups, working independently, isolated a small strip of DNA (only 180 base pairs in length) within the *Drosophila* homeotic gene clusters. Nobody knew what it was doing there, but it appeared to be something important, since biologists soon began spotting almost identical DNA strips in animals ranging from sea urchins to frogs to humans. Today scientists believe that this ubiquitous stretch of very ancient DNA, known as the homeobox, plays a key role in governing the hundreds of genes that sculpt organisms. So close is the resemblance between many of the human and *Drosophila* homeobox genes that a normal human homeobox gene inserted into *Drosophila* can partially correct abnormalities caused by defects in the corresponding fly gene.

Celebrating success

In Ascona, where Lewis had looked forward to hearing about the latest findings on homeobox research, he was rather taken aback to find himself now sharing center stage with the science. Led by conference organizer Walter Gehring, whose research lab (along with that of Matt Scott, now at Stanford) had codiscovered the *Drosophila* homeobox in 1983, the meeting's participants treated Lewis to a round of celebrations and festivities. When his chance came, Lewis reciprocated in kind, presenting an evening talk on the history of his research. Conferees also took away a more tangible memento of the occasion. The call for the conference group photo had drawn all 92 participants, and the meeting's coordinator, Erika Marquardt, had the same number of prints made so that Lewis could inscribe "Ed" 92 times across his pictured chest (fortuitously garbed in a white shirt). The autographed prints subsequently appeared beside the dinner plates of each conference participant. Exultant civic leaders presented Lewis with the Medal of Ascona and told him that his presence was giving quite a boost to the city's new conference center. The community's fiscally prudent burghers had apparently needed some persuading to put up the money to build the facility. The events of that week, they agreed, seemed to bear out the wisdom of their decision.



A hitherto unrecorded stage in the life-cycle of the *Bar Drosophila* mutant is depicted at left in this "barfly" drawing by biologist-turned-painter Pamela Lewis. Not pictured here: the double-*Bar* mutant, a tiny-eyed specimen whose condition arises through tandem duplication of the *Bar* gene.

Back at Caltech on October 16, an equally enthusiastic reception awaited Lewis—or at least the bearded personage who showed up in his place to receive the tributes of the biology division. "I'm glad Ed's not here," said Professor of Biology Emeritus Norman Horowitz, one of several longtime Lewis colleagues who addressed the happy throng that gathered that afternoon in Alles courtyard. Introducing the bearded mystery man reclining with a camera on the steps of the speaker's platform as "Ed's uncle," Horowitz said that he "knew for a fact that Ed is off campus taking Swedish lessons," to which the bearded one shouted "massage!" before getting off several photos of the crowd.

With Lewis evidently off-site, those who had known him for years felt freer to say what they really thought. "For many years, we've been sure this announcement would be coming—and we looked forward each October to learning that the Nobel people had caught up with Ed," said former division chair Ray Owen. "Ed's work confirms that Caltech genetics is at the core of modern work in the field." "The mainstay of our division," opined current Biology Chair Mel Simon. For years, he said, he had been buttonholed by colleagues across campus wanting to know, "Why can't the rest of you in biology be more like Ed?" Simon seemed resigned to the fact that now he would be hearing the question more than ever.

Speaking a bit later, Boswell Professor of Neuroscience, Emeritus, Seymour Benzer attempted to put the entire affair in perspective. Explaining, perhaps by now unnecessarily, that "Ed is a maverick who could never survive in a normal institution," Benzer gave it as his view that Pamela Lewis "should really have gotten the prize. She deserves it—if for nothing else putting up all these years with Ed and his utterly unconventional circadian rhythms," reflected most notably perhaps in the new laureate's penchant for staying up all hours with his flies. And although some of his colleagues wondered if Lewis, now 77, hadn't had to wait too long for his research contributions to be appropriately recognized by the Swedes, Benzer didn't think so. Acknowledging that on the basis of the science alone, the award to Lewis was "long overdue," Benzer nevertheless urged his listeners not to lose sight of the bigger picture—namely, that those who receive the Nobel later in life have more opportunities to reap the numerous prizes that generally lead up to it. "Once you get the Nobel," Benzer warned any future laureates who might be in attendance, "that's it; you're finished. Nobody gives you anything after that." (Two years ago Benzer him-



The perks of preeminence: Lewis's longtime biology colleagues line up to pose with him, and the nation's veep asks to be introduced to his wife. Top photo, from left: Professor of Biology, Emeritus, Norman Horowitz; Lewis; James G. Boswell Professor of Neuroscience, Emeritus, Seymour Benzer; Norman Chandler Professor of Chemical Biology, Emeritus, Norman Davidson; Professor of Biology, Emeritus, Herschel Mitchell; and Professor of Biology, Emeritus, Ray Owen. Bottom photo: The man who accompanied Pamela Lewis to the White House looks on as she meets Vice President Al Gore.

self won the Crafoord Prize, awarded by the Royal Swedish Academy for research in fields not covered by the Nobel.) The crowd roared; "Ed's uncle" snapped more pictures.

Life of a laureate

Ed's uncle was nowhere to be found by the time an otherwise sizable contingent of the Lewis family headed for Stockholm in mid-December, but the events of the intervening weeks had certainly provided his nephew with plenty of new opportunities to enrich the family album. In between attempts to get on with his science, Lewis had—by the time he boarded the plane—turned on the Christmas tree lights at Pasadena City Hall, addressed the Pasadena City Council on the virtues of basic research, and traveled with his wife, his brother, James, a retired career diplomat, and James's wife, Betty, to Washington, D.C., where he and his fellow laureates went to the White House to meet with Vice President Al Gore and Hillary Clinton, and to Capitol Hill to meet with members of the House Subcommittee on Science. He had sorted through numerous requests for autographs in an effort to make sure that none of those from children went unanswered, read hundreds of other let-

ters, replied to some, and fretted about those he hadn't yet had the time to respond to. A local news station had filmed him as he plunged, trunks- and goggle-clad, into the Caltech pool—a morning constitutional he's observed for at least the last 15 years—and had followed him back to his lab to capture the sight of his fingers flying over his flute. (Lewis, who took up the flute at the age of 10, went to Bucknell College on a music scholarship before transferring after one year to the University of Minnesota to continue his high school interest in genetics. Today, he still practices as faithfully as he swims, squeezing in

the time for a lesson as often as possible when he and Pamela travel to San Francisco, where they have season's tickets to the opera.)

Off camera, Lewis engaged in intense negotiations over a leg of lamb. It wasn't only the size and heft that had to be correct, he told the butcher; he needed a right leg. Halloween was coming, and he had a reputation to uphold. For years, dressed in a costume that he generally designed and sewed himself, he had been one of the hits of the evening at the Caltech graduate students' annual Halloween party at Prufrock House. ("People are always telling me," Pamela Lewis confided, "that they go to the party mainly to see what Ed's wearing.") This year, he was determined, would be no exception. Decker out in a Tarzanesque leopard skin, his head encased in one end of a barbell, and clutching the lamb leg, which he had spent three days boiling down to the bare bone, he attended as a remarkably faithful likeness of the man in René Magritte's painting *Perpetual Motion*. It was an apt commentary on the direction in which his life had lately evolved.

The pace of things did not slow down much in Stockholm. Of the northern city, dark with Scandinavian winter, but transformed by the Swedes into a glittering combination of Christmas and Nobel village, painter Pamela Lewis observed with her artist's eye, "You feel as if you've landed on a magic carpet." The Lewises' two sons, daughter-in-law, nephew, and grandson were also whirled through the elaborate choreography that characterizes Nobel week. They toured the medieval city, met with dignitaries and well-wishers, attended parties and receptions, and watched as the new laureates went through a Nobel-ceremony dress re-

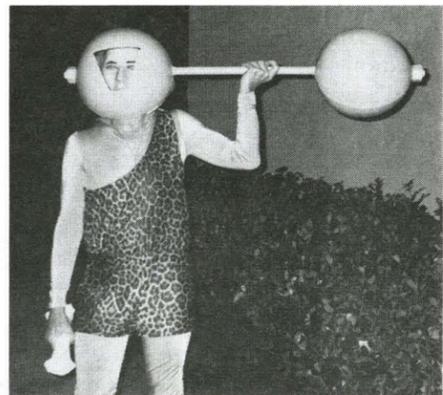
hearsal, in which, among other things, they practiced the trio of bows they would make before Sweden's monarchs, Stockholm's citizenry, and the Nobel officials.

During the actual ceremony, it became clear that this obeisance orientation had its uses. Said Pamela Lewis afterward, "A lot of people told me they thought Ed made the best bows of all."

In his Nobel lecture, Lewis made another graceful bow—to his Caltech predecessors in the field of fly research, whom he has referred to elsewhere as the bearers of the "Drosophila tradition." Speaking from a stage banked with flowers flown in from the Italian city of San Remo (where Alfred Nobel kept a villa), Lewis reviewed some of the seminal contributions of his mentors Morgan, Sturtevant, and Calvin Bridges before returning to the theme that had informed so many of his public statements since receiving the Nobel Prize—the importance of fundamental research.

"We didn't start out trying to find out about the genetics of development," he reminded his audience. "At the time, that was thought to be impossible." He then led his listeners through the details of a scientific investigation that neatly summarized how an unswerving commitment to the most straightforward questions can lead down the most unexpected paths.

Lewis had entitled his talk "Fifty Years of the Bithorax Complex"—a history lesson in the genesis not only of organisms, but of ideas. As for what the next 50 years will bring to the developmental biogenetics field his *Drosophila* research has done so much to create, Lewis had ideas to offer on that as well. "The future," he said, "I leave to you."



The laureate, with lamb bone.



Gordon and Betty Moore's long association with Caltech reached new heights in January. Forty-six years after Gordon became a Caltech PhD student and he and Betty "tied the knot," the couple cut the ribbon to dedicate the Moore Laboratory of Engineering.

Perhaps the most successful of these start-up companies is Intel, founded by Moore and the late Robert Noyce in 1968, and today the world's largest semiconductor manufacturer. Moore chairs Intel's board and has been chair of Caltech's Board of Trustees since 1994.

Through the years, Moore developed

"We must keep moving forward," declared President Tom Everhart at the dedication ceremony for the Gordon and Betty Moore Laboratory of Engineering.

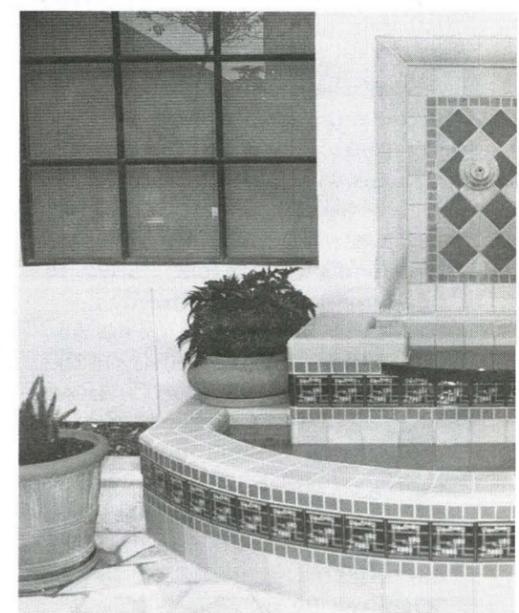
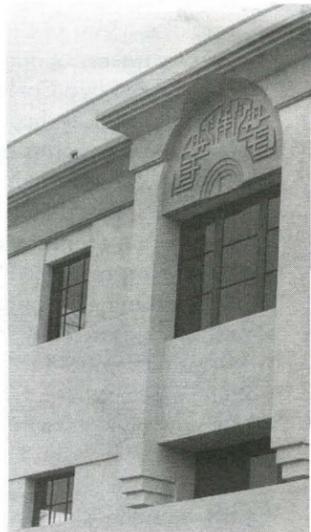
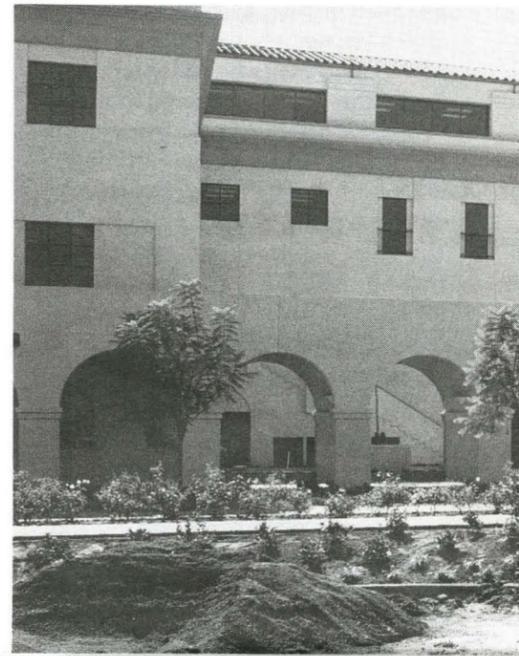
Despite East Coast snowstorms that kept one speaker—Trustee Vice Chair Ben Rosen—from attending the January 9 event (and slight cloud cover over "sunny California"), the ceremony itself moved along smoothly. Members of the Caltech Board of Trustees, students, faculty, staff, and friends gathered hundreds strong in front of the grand Mediterranean-style building that is now home to research efforts at the forefront of electrical engineering, computer science, and neurobiology.

In his welcoming remarks, Everhart praised the new 90,000-square-foot research and teaching facility as one that will help Caltech attract the best people and will serve as "the site of many discoveries in which all of us can take justifiable pride. Every time we dedicate a building," he added, "it really can have an impact on students, on faculty, and—through their actions—on the rest of society."

Basic research conducted at the lab is expected to result in such inventions as machines with sensory perception, micromachines including micromotors and electronic devices, and vastly improved communications and computer systems—the benefits of which will be shared with industry. Housed here will be the Institute's program in computation and neural systems and Caltech's new NSF Engineering Research Center (one of 21 nationwide), called the Center for Neuromorphic Systems Engineering.

To support research efforts in the facility, the Intel Corporation recently donated 110 Pentium personal computers. Several of these are linked to video cameras, allowing users to carry on video conferences from their workstations. Instrumental in facilitating the donation were alumni Gerhard Parker '65, PhD '70, and Ted Jenkins, '65, MS '66, both of Intel, and Peter Cross '67 of Bay Networks. In addition, Bay Networks helped establish the campus's first fiber-optic computer network.

As Everhart spoke of the forward march of technology represented by the Moore Lab, he pointed out an alumnus who, throughout his career, has been steps ahead of the pack: Gordon Moore. With his 1954 Caltech PhD in chemistry, Moore became part of an entrepreneurial team known as the Fairchild Eight. The group went on to lead "a revolution in microelectronics," in Everhart's words, starting with the founding of Fairchild Semiconductor Corporation in 1957. That company doubled in size every year, and many of the technologies developed there, including that of integrated circuits, spawned start-up companies across Silicon Valley.



With the dedication of Moore Laboratory, campus marches on



Two professors address a crowd that stretches along what is becoming the campus's northern east-west corridor (running between, and parallel to, Del Mar and the Moore Lab). Pictured above is David Rutledge of electrical engineering, chair of the building committee. Below is John Seinfeld of chemical engineering, the Louis E. Nohl Professor, and chair of the Division of Engineering and Applied Science.



sound management principles, one of which was summed up by Everhart as "Raise money before you need it." That advice seems to have been followed in the case of the Moore Lab. Caltech's president recalled his talk with Moore and his wife, Betty, back in 1990, when the Institute's fund-raising campaign, the Campaign for Caltech,

had just gotten under way with the inception of its "quiet phase." Everhart told the Moores that he thought "a new engineering building would be terrific." They said, "We do too," and "in a very short period of time" they had donated \$16.8 million to build the facility. Before construction began, the Institute had to build the parking structure on

Holliston Avenue to accommodate the cars that would have to move off the lab site.

Situated on a grassy expanse just northeast of Beckman Auditorium, the lab offers impressive views of the San Gabriel Mountains and much of the campus, including the Beckman Institute, which—like the lab, with its porticoes, red tile roof, and artistic fountains—follows the Mediterranean architectural theme of Caltech's 1920s master plan. In one departure from the master plan, the Moore Lab's two north-facing tympana (inset archlike structures above and to either side of the north entrance) are adorned with unique decorations. The one to the east bears a semiconductor computer-chip design, the one to the west a representation of microwave parabolic antennas.

Everhart pointed out that Gordon and Betty Moore's gift—one of many, including an endowed chair and an endowed scholarship, over a half-century of support for the Institute—not only made the engineering building possible, but also "gave impetus to the Campaign for Caltech and made it come in with resounding success."

When Gordon Moore took to the podium, the soft-spoken chair of Caltech's Board of Trustees acknowledged that the lab would certainly improve research facilities. "Having visited Carver Mead's previous lab," he said by way of an example, "I see that he'll finally have his lab and office in the same building. . . . But it's not the facilities that make the university, it's the people," he added. "And there's no place in the world with a better group than Caltech." Their work, "here and in the rest of the facilities, has a profound impact on what goes on in the future from a technological point of view."

Speaking of the 16 faculty members who will lead research efforts at the lab (in contrast to the large electrical engineering and computer-science faculties at peer universities), John Seinfeld reminded the crowd that "Caltech is all muscle." The chair of the Division of Engineering and Applied Science added, "I'm proud of the accomplishments of the lab's occupants and look forward to greater achievements in the future." He thanked the building committee, chaired by Professor of Electrical Engineering David Rutledge, who also passed along his words of thanks.

In the day's other remarks, leaders of

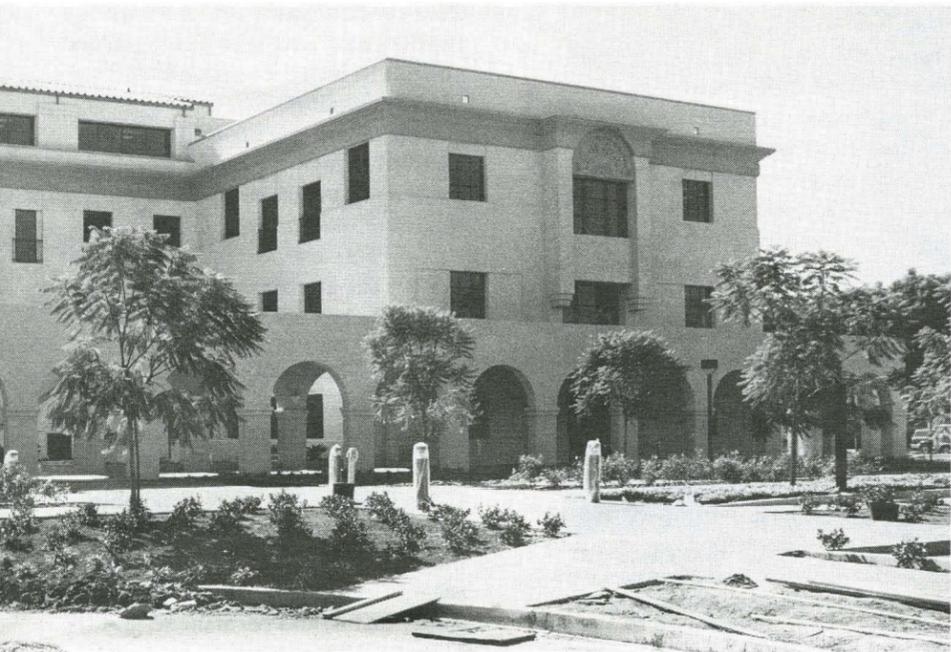
Joining Betty and Gordon Moore are sons Steve (left) and Ken (right), and Ken's wife Kris.



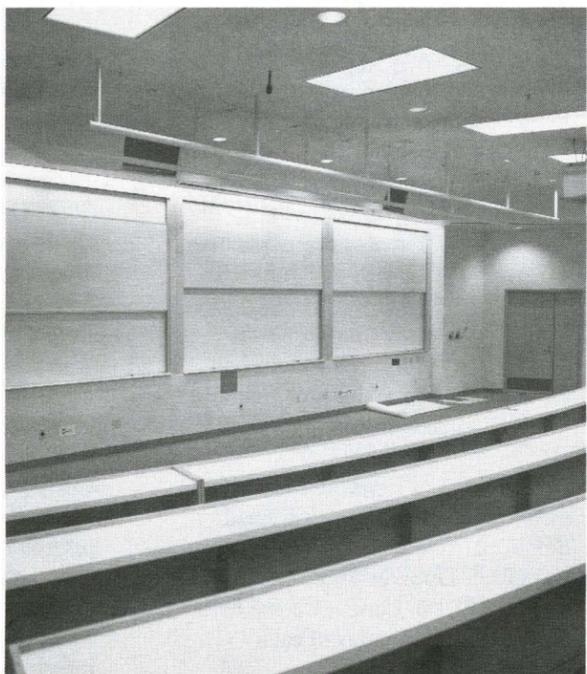
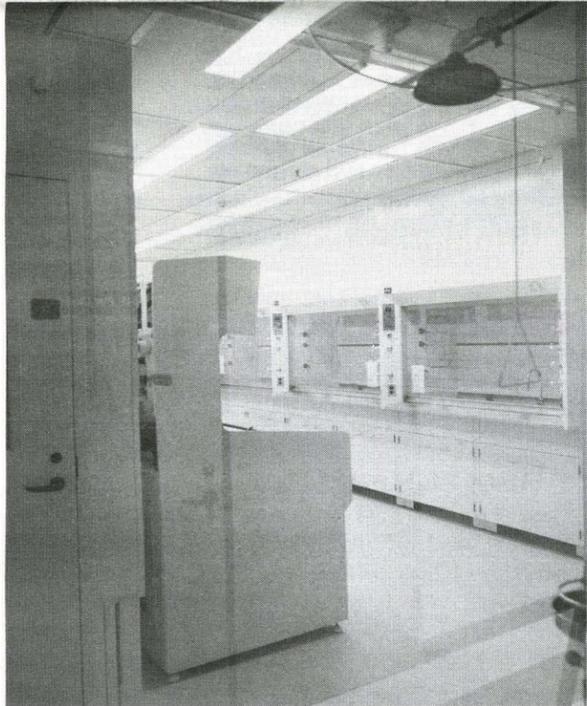
the design and construction teams—from Neptune-Thomas-Davis and Swinerton & Walberg Company, respectively—reminded the crowd of key moments in the construction process, including the time students hung a 25-foot-long stuffed fish from the site's crane as a 1994 graduation prank.

But construction is a risky business, Everhart said toward the end. He asked for a moment of silence to remember Jim Lennox, the construction worker who died while on the job. Lennox worked for GSM Company, a sheet-metal subcontractor.

Everhart then invited the crowd to tour the facility—"but not all at once." As tourists marveled at the state-of-the-art lecture halls, special "clean rooms" (for the fabrication of micromachines), and teaching laboratories, they noticed a message scrolling across the freshly donated Pentium computers in one student lab. It read, "Thank you Gordon Moore."



Clockwise from top: the Moore Lab not long before its unveiling; Associate Professor Yu-Chong Tai's clean room, which dramatically reduces contamination during the building of the smallest of devices; one of its high-tech lecture halls designed for multimedia capability; one of two courtyard fountains, inlaid with colorful tiles of integrated-circuit patterns; the northeast tympanum, styled after a semiconductor computer chip created by students of Carver Mead, the Gordon and Betty Moore Professor of Engineering and Applied Science.



ALUMNI

Association makes board nominations

At its January 1996 meeting, the Alumni Association accepted the proposals of the nominating committees for officers of the Association board of directors and members of the board. The term of office for directors and officers will begin at the close of the annual meeting in June 1996.

Nominations for officers are: president, Edward M. Lambert '82; vice president, Thomas J. Tyson '54, PhD '67; treasurer, Warren G. Goda '86; secretary, Lisa M. Anderson '74, PhD '82. Association President for 1995-96 Franklin D. Dryden '54, MS '57, will become official past president for 1996-97 when the new terms begin this summer.

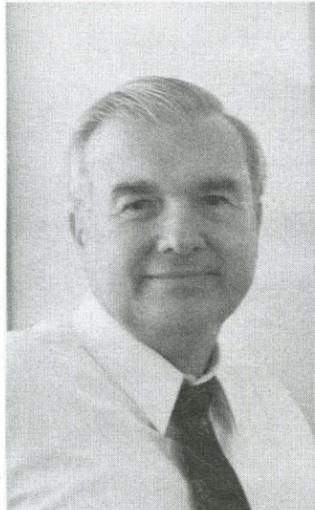
The following were nominated for the board: Roger H. Goodspeed '72; Robert T. Jenkins '65, MS '66; James King, Jr., MS '55, PhD '58; Nancy Krehbiel-Brownell '83; and Madeline A. Shea '77, all for three terms. Named to serve a second one-year term as chapter representative was Blair A. Folsom, MS '68, PhD '74, president of the Orange County Chapter.

Section 5.01 of the Association bylaws provides that members of the Alumni Association may make additional nominations for directors or officers by petition, signed by at least 50 members in good standing, providing the petition is received by the secretary no later than April 15. In accordance with sections 5.02 of the bylaws, if no additional nominations are received by April 15, the secretary casts a unanimous vote of all regular members of the Association for the election of the candidates nominated by the board. Otherwise a letter ballot is required.

Alumni Association inaugurates Caltech Signature Awards

By Frank Dryden '54, MS '57

Caltech is dedicated to training the best and brightest young people our nation has to offer and providing them



Frank Dryden

with the best possible education in major fields of science and engineering. We have done this so successfully that it is often surprising to alumni that some of the high school students that our Admissions Office thinks should be coming here actually choose to attend college elsewhere. In the competition to attract the best young people nationwide, we find that our small size often means that we are not as well known as some of the schools with which we compete. Our smaller alumni base translates into fewer knowledgeable advocates scattered around the country, keeping an eye out for the outstanding high school students.

Over the past 11 years, the Alumni Association's Undergraduate Admissions Support (UAS) Committee has established a network of more than 300 alumni admissions representatives throughout the United States. These alumni visit local high schools to provide information about the Institute to

teachers, guidance counselors, and interested students and parents. Their efforts in support of the Office of Undergraduate Admissions are sustained by 30 area coordinators, who are also alumni. I want to acknowledge and thank all those participating in this effort and wish there were room in this column to list your names.

As an outgrowth of this effort, the Alumni Association, through UAS, is now implementing a three-year pilot program called the Caltech Signature Awards. The specific idea is credited to Ponzy Lu '64, area coordinator for Philadelphia, who saw that other colleges and universities were generally more visible than Caltech, and that some were using awards as part of their recruitment programs. The UAS Committee under the leadership of Jeanine Hoffmann '86 developed the idea into a specific proposal, and Warren Goda '86 has led the committee's efforts to implement it this year.

The Caltech Signature Award will be given annually to juniors at selected high schools who have demonstrated innovative and creative thinking or problem-solving skills; the dedication to go beyond what is required or expected; and curiosity and the joy of discovery in mathematics, the sciences, or in fields with foundations built on these disciplines.

Fifty-six high schools will be included in the award program for 1996. Assuming that the initial effort is well-received, the number of schools will rise to 150 by the end of 1998, with a goal of ultimately having 1,500 schools in the program. This year's 56 schools will include 8 from the Mid-Atlantic Region, 8 from the Midwest, 10 from the West, 7 from the Northeast, 9 from the Southwest, and 14 from the South. They have been selected based on alumni recommendations and on historic contacts with Caltech.

Participating schools for 1996 received their information about the awards in January and will be returning their nominations to Caltech by the end of February. Caltech alumni will present the awards at each high school's award ceremonies in May or June. After extensive discussions on just what to award, the committee members have decided that this year's award will consist of the *CRC Standard Mathematical Table and Formulae*, signed by a Caltech faculty member or notable alum, along with that individual's biography. The desire is to present each recipient with something personal, useful, and permanent; and the UAS welcomes suggestions.

We hope that the Caltech Signature Awards will help to strengthen our competitive position for the recruitment of future Techers. If you have ideas or suggestions for future awards, or are interested in any aspect of UAS, please contact Karen Carlson at the Alumni Association Office, at 818/395-6592; or via e-mail at karen_carlson@starbase1.caltech.edu.

ALUMNI ACTIVITIES

February 24-March 8, Yucatan—Land of the Maya, Travel/Study Program, led by William Schaefer, senior research associate, emeritus, chemistry.

March 8, New Mexico Chapter Dinner/Meeting with guest speaker Ellen Rothenberg, professor of biology.

March 14, Santa Cruz Area Monthly Luncheon, Peachwood's at Pasatiempo Inn, noon. For reservations, call Bob Shacklett at 408/722-6021. Luncheons are held on the second Thursday of each month—the dates of the next three are April 11, May 9, and June 13.

March 18, Seattle Chapter Dinner Meeting with guest speaker Judith Goodstein, University archivist and faculty associate in history.

March 21, 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. Luncheons are held on the third Thursday of each month—the next three are sched-

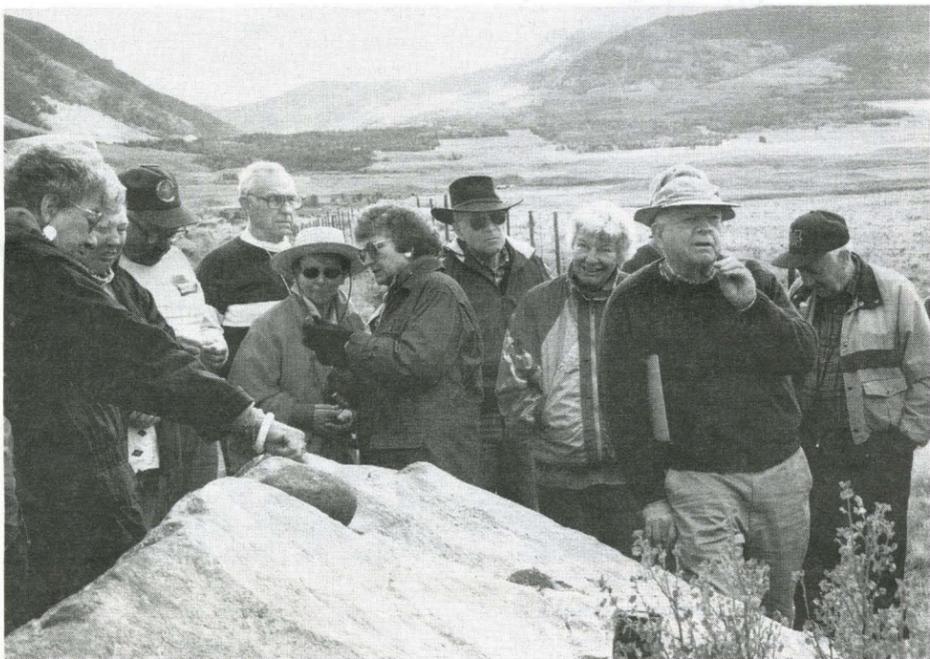
uled for April 18, May 16, and June 20.

March 25-27, Geology, Flora, and Fauna in the Low Desert of Southern California Travel/Study Program, led by Leon Silver, the W. M. Keck Foundation Professor for Resource Geology.

May 16-18, 59th Annual Seminar Day/Reunion Weekend. See Reunion Calendar next page.

June 24-July 3, Alaska Travel/Study Program led by Robert Sharp, the Robert P. Sharp Professor of Geology, Emeritus, and Leon Silver, the W. M. Keck Foundation Professor for Resource Geology.

For information regarding the above, please contact Judy Amis at 818/395-6594 for foreign travel/study programs; Arlana Bostrom at 818/395-8363 for travel/study programs in the United States and chapter programs; and Patsy Gougeon at 818/395-8366 for Seminar Day/Reunion Weekend information.



Keck Foundation Professor for Resource Geology Lee Silver (in hat, with envelope) appears to be scanning the open road for a mailbox, as, from left, Jeanne Senouillet, Carol Wilkinson, Rick Jali '55, MS '58, Barney Flam '47, Evelyn Flam, Nancy Stuart, Milt Andres '49, Patricia Clarke, and Don Clarke '51 examine a formation in Colorado's Creede volcanic caldera. The group, led by Silver, took part in the Association's September '95 Rio Grande del Norte Travel/Study program.

Centennial committee seeks names of alumni "who have made a difference"

The Caltech Alumni Association will celebrate its 100th anniversary in 1997. As part of its recognition of this milestone, the Centennial Committee of the Association's Board of Directors is interested in identifying the many Institute alumni who have made a marked imprint on society and the world. For example, consider how different our world might be had not Institute alumni discovered the nature of the chemical bond, helped to pioneer semiconductor technology, or arrived at key insights into the workings of the gene and heredity. Aeronautics and space technology might not have become what they are today, and we might never have enjoyed the movie classic *It's a Wonderful Life*.

The Association needs your help in nominating alumni to be heralded during the upcoming Centennial. Please take a moment or two to let us know of those alumni who you feel have made an impact on our world, either in the scientific or engineering fields, or through a more nontraditional career.

The committee members are also seeking your ideas for a theme for the centennial year, such as "Celebrating 100 years of Caltech Alumni." If you can help them by identifying alumni to be recognized and/or by suggesting a theme for the centennial year, please fill out the form below and return it to the Centennial Committee, Caltech Alumni Association, 1-97, Pasadena, CA 91125. Or, you may send e-mail to Association Director Judy Amis at judy_amis@starbase1.caltech.edu.

Name of Centennial Nominee:

Class Year:

Description of achievements (please attach a second sheet, if necessary):

Suggestion for Centennial theme:

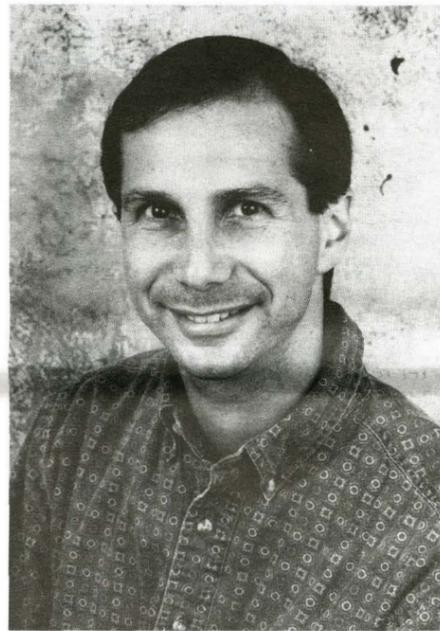
Submitted by:

Seminar Day highlighted by talks, exhibits, and first divisional reunion

What's the lesson plan for the Alumni Association's upcoming Seminar Day? Alumni who return to the classroom and lecture hall on May 18 to learn about the latest research at the Institute should find plenty to pique their interest. The day's offerings range from talks on such topics as image-processing in the brain and observations of Earth-crossing asteroids to guided tours of the Beckman Room Science Museum and screenings of "The Tunnel of Samos," the newest award-winning video from Project MATHEMATICS! A guest lecture, otherwise known as the general session address, will be presented by Young Alumni Trustee Bill Gross '81, who will speak on "Future Education and the Internet." A complete list of the Seminar Day talks, class reunions, and numerous displays and events can be found in the Seminar Day registration

packet, in the mail this month.

In a new addition to Seminar Day's Reunion Weekend, the Alumni Association has also begun a program of divisional reunions that will bring together graduates, postdocs, and former students of each of Caltech's six divisions. The first such gathering will focus on the Institute's Division of Humanities and Social Sciences. The May 17 event will be highlighted by a Humanities Symposium in Judy Library from 8 a.m. to 2 p.m. and an



"Future Education and the Internet" will be the topic when Young Alumni Trustee Bill Gross '81 presents the general session talk at the Alumni Association's 59th Annual Seminar Day on May 18. Gross, 36, is founder, chairman, and CEO of Knowledge Adventure, a Glendale, California-based company that designs interactive computer products for children.

all-day Social Science Symposium in Beckman Auditorium. The two meetings, which will feature talks and panel discussions by former postdocs and graduates of the division, will be followed that evening by a dinner in the Athenaeum.

Topics at the Humanities symposium will include a presentation on "Science and Ethics," and, on an equally contemporary note, a consideration of "Bruce Springsteen and the Ghost of the American Dream." Speakers and discussants at the Social Science Symposium will address such issues as "Money in Congressional Elections: Who Has It and What Is It Worth?" and "Political Bases of Federal Support for R&D." (A complete listing of the symposia talks is printed in the Seminar Day brochure.) All alumni are welcome to attend the symposia.

REUNION CALENDAR

May 16, *Class of 1936, 60th Reunion*

May 16, *Class of 1941, 55th Reunion*

May 16, *Class of 1946, 50th Reunion*

May 17, *Class of 1951, 45th Reunion*

May 17, *Class of 1956, 40th Reunion*

May 17, *Class of 1961, 35th Reunion*

May 17, *Class of 1966, 30th Reunion*

May 17, *Class of 1971, 25th Reunion*

May 17, *Humanities and Social Sciences Divisional Reunion and Reunion Dinner* (See article, this page.)

May 18, *59th Annual Alumni Association Seminar Day and Dinner*, the Caltech campus

May 18, *Class of 1976, 20th Reunion*

May 18, *Class of 1981, 15th Reunion*

May 18, *Class of 1986, 10th Reunion*

May 18, *Class of 1991, 5th Reunion*

All events, unless otherwise noted, will be held in the Athenaeum. Alumni who would like additional information regarding the above, are asked to please contact Patsy Gougeon, assistant director, Seminar Day/Reunions, 818/ 395-8366; e-mail, patsy_gougeon@starbase1.caltech.edu.

Caltech ProNet ...it works.

OVER \$38 MILLION WORTH OF POSITIONS HANDLED THIS YEAR

Whether you're currently job searching or not, keep in mind that offers come along that are too good to refuse. Caltech ProNet keeps you abreast of challenging opportunities in a variety of fields, including high-tech, banking and finance, general management, sales and marketing ... and many more.

It's easy and confidential. For more information, contact Caltech Alumni Association, 345 S. Hill Ave. MC 1-97, Pasadena, CA 91125, Tel. 800-758-1944.

*Matching Experience
With Opportunity*

Alumni, students, and faculty invited to Association-sponsored lunches

The Student/Faculty/Alumni Relations Committee of the Alumni Association is sponsoring small, informal lunches in which an alum, faculty members, and one or two students may participate. These lunches are designed to give students opportunities to hear about careers, to find out what life is like in the "real world," and to interact with alumni and faculty members.

Alumni, students, and faculty members who would like to participate are invited to contact Arlana Bostrom at the Alumni Association (818/395-8363; e-mail, arlana_bostrom@starbase1.caltech.edu). The Association welcomes participation from alumni who live outside the Southern California area and who plan to visit here in the next few months.

ALUMNI ASSOCIATION FINANCIAL STATEMENT

ALUMNI ASSOCIATION
CALIFORNIA INSTITUTE OF TECHNOLOGY
Pasadena, California

BALANCE SHEET
September 30, 1995

ASSETS

Cash on Hand and in Bank	\$ 19,559
Investments:	
C.I.T. Consolidated Portfolio	1,835,206
Charles Schwab	117,060
T. Rowe Price	80,794
University ProNet	5,000
Accounts Receivable	4,018
Investment Income Receivable	67,246
Inventories and Postage Deposit	19,506
Deferred Program Expense	54,590
Computer and Other Equipment	30,349
Accumulated Depreciation	(8,147)
TOTAL ASSETS	\$ 2,225,181

LIABILITIES, RESERVES, and SURPLUS

Accounts Payable	\$ 43,680
Deferred Income:	
Investment Income from C.I.T. Consolidated Portfolio	90,121
Program Income	64,414
Life Membership Reserve	1,835,206
Operating Reserves:	
Directory	59,997
Publications	7,841
Computer Equipment	9,908
Investment in Equipment	22,202
Surplus	91,812
TOTAL LIABILITIES, RESERVES, AND SURPLUS	\$ 2,225,181

STATEMENT OF INCOME, EXPENSES, AND SURPLUS For the Year Ended September 30, 1995

INCOME

Dues of Annual Members	\$ 81,430
Investment Income:	
C.I.T. Consolidated Portfolio	86,773
Other Investments and Checking Account	9,796
Net Income of Alumni Programs	17,434
Sale of Legends and Other	5,161
TOTAL INCOME	\$ 200,594

EXPENSES

Publications	\$ 23,630
Net Expenses of Seminar Day	6,990
Net Expenses of Class Reunions	19,503
Net Expenses of Chapter Programs	14,252
Student/Faculty/Alumni Relations	20,568
Undergraduate Admissions Support	12,604
Administration	63,003
Membership	20,265
Directory	20,000
Electronic Communication	7,140
TOTAL EXPENSES	\$ 207,955

INCOME OVER (UNDER) EXPENSES \$ (7,361)

Surplus, September 30, 1994	99,173
Surplus, September 30, 1995	\$ 91,812

INDEPENDENT AUDITOR'S REPORT

Board of Directors
Alumni Association
California Institute of Technology

I have audited the accompanying balance sheet of the Alumni Association, California Institute of Technology as of September 30, 1995 and the related statement of income, expenses, and surplus for the year then ended. These financial statements are the responsibility of the Association's Board of Directors. My responsibility is to express an opinion on these statements based on my audit.

I conducted my audit in accordance with generally accepted auditing standards. Those standards require that I plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. I believe that my audit provides a reasonable basis for my opinion.

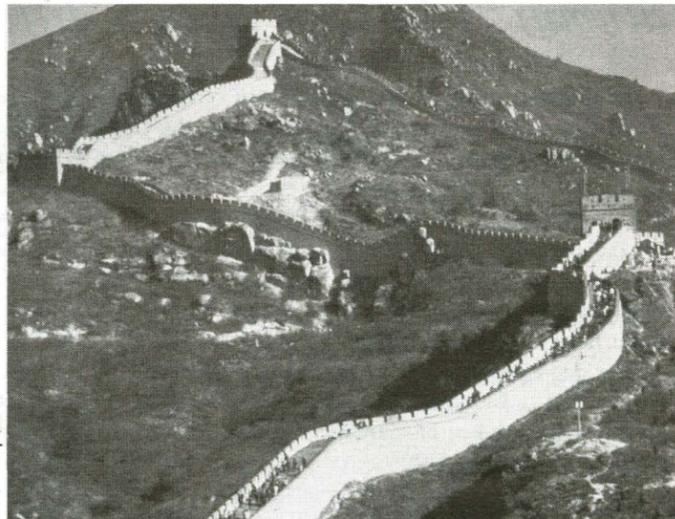
In my opinion, the financial statements referred to above present fairly in all material respects, the financial position of the Alumni Association as of September 30, 1995 and the results of its operations for the year then ended in conformity with generally accepted accounting principles.

Calvin A. Ames
Certified Public Accountant

January 18, 1996

Travel China and the Yangtze River

Experience firsthand, by land and by water, the fascinating People's Republic of China on an Alumni Association travel/study program led by Dr. James Lee, associate professor of history at Caltech. Professor Lee has research interests in the comparative demography of Asia and Africa and in the development of advanced science and technology in modern



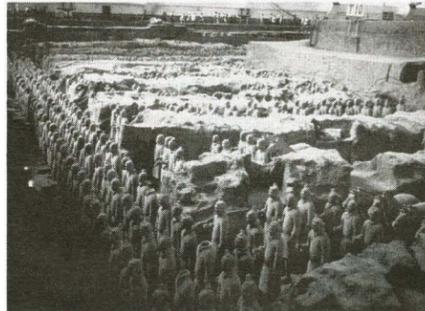
China. He has published extensively in the field of Chinese history, especially on population and family history, and he is the founding editor of *Late Imperial China*, a journal published by the Johns Hopkins University Press.

Scheduled for October 6–21, 1996, our Alumni Association tour will begin in Beijing, where the sweep of China's history and culture is evident in the city's extraordinary landmarks—the opulent Forbidden City, the monumental Great Wall, the colorful Temple of Heaven, and the impressive Tiananmen Square.

From Beijing, we will travel southwest to Xi'an, former gateway to the Silk Road and world-renowned for its wealth of antiquities. Here we will visit the imperial tomb with its army of more than 6,000 terra-cotta warriors, and we will also tour the Shaanxi Provincial Museum and the 1,300-year-old Big Wild Goose Pagoda.

Continuing on to Chongqing, a picturesque hilltop city located at the confluence of the Yangtze and Jialing rivers, we will board the deluxe cruise ship East Queen and begin a five-day/four-night journey through the spectacular Three Gorges of the mighty Yangtze River. This may be one of the

The terra-cotta warriors of Xi'an.



last chances to experience the extraordinary natural beauty of the river landscape: upcoming construction work on the Three Gorges Dam is scheduled to bring river traffic to a halt in the winter of 1997.

Disembarking from our Yangtze cruise at Wuhan, we will fly to Shanghai, the largest city in China and the commercial heart of the nation. Our farewell reception will be here in this city of contrasts, at the family home of Dr. Lee.

For those who wish to visit Hong Kong while it is still under British rule, we are offering an optional two-day extension that will provide ample opportunities to explore and shop at your leisure, as well as time to tour Hong Kong Island with the group. The center of Asia's financial world, Hong Kong is the biggest and busiest duty-free port in the world and has the most expensive concentration of real estate on earth.

The cost of the trip will be \$5,494 per person, double occupancy, from Los Angeles. This price includes round-trip scheduled flights from LAX, overnight in Tokyo, all flights within China, all meals aboard the East Queen, all sightseeing and shore excursions, all breakfasts and many other meals, and lectures by Professor Lee.

Brochures should be in the mail by mid-March, but if you do not receive one and/or would like more information, please contact the Association at 818/395-6592 or return the coupon below to China Travel/Study, Caltech Alumni Association, Mail Code 1-97, Pasadena, CA 91125. Space is limited, and priority will be given to Alumni Association members.

Caltech Alumni Association Travel/Study Program to

China and the Yangtze River

October 6–21, 1996

I am interested in learning more about the travel/study program to China and the Yangtze River. Please send information to:

Name _____

Class Year _____

Address _____

Telephone number _____

Return to China Travel/Study, Caltech Alumni Association, Mail Code 1-97, Pasadena, CA 91125

PERSONALS

1933

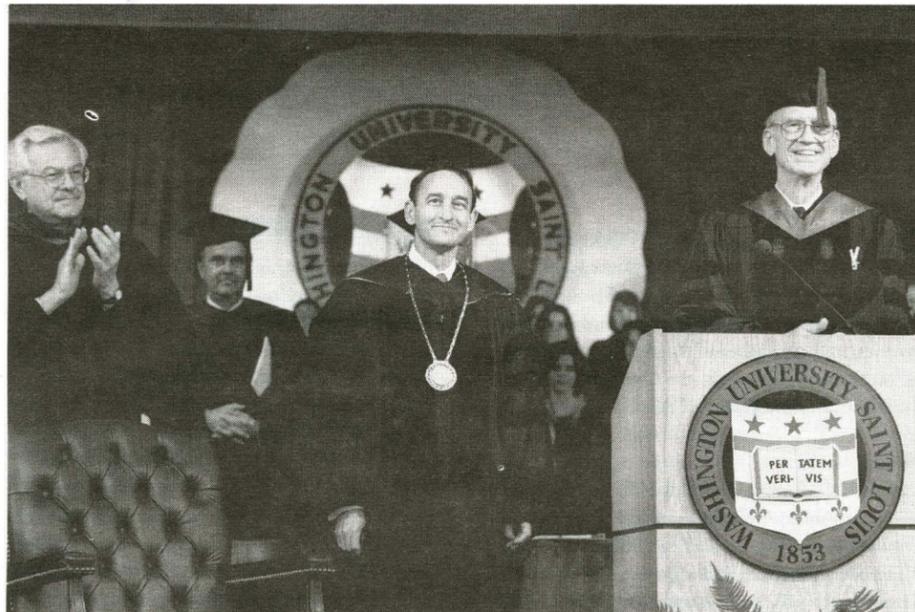
JOHN R. PIERCE, MS '34, PhD '36, and HAROLD A. ROSEN, MS '48, PhD '51, the engineers who developed the technology for communication satellites and ushered in the modern communications era, have received the \$400,000 Charles Stark Draper Prize, the world's largest award exclusively for engineering achievement. The Draper Prize was established by the National Academy of Engineering in 1988 "to recognize individuals whose outstanding engineering achievements have contributed to the well-being and freedom of humanity." While Rosen devised a way to place satellites in geosynchronous orbit around the earth, so that they would be accessible for the continuous transmission of signals by apparently remaining at one fixed location in the sky, Pierce provided the catalyst for that development through his pioneering work designing and launching Telstar 1, the world's first communication satellite that actively received, amplified, and retransmitted signals. Pierce joined Bell Laboratories in 1936 and upon his departure in 1971 held the position of executive director, research, communication sciences division. In 1954, while serving as director of research, he developed the first practical engineering calculations for space communications. In 1960, leading a Bell team, he successfully tested a passive signal reflector—NASA's Echo, an aluminum-coated sphere that acted like a mirror in space. Its success led to Telstar 1, launched in 1962. After leaving Bell Labs, Pierce served as professor of engineering at Caltech (1971–1980) and chief technologist at JPL (1979–1982). In 1983, he became visiting professor of music, emeritus, at Stanford. He was elected to the National Academy of Sciences in 1955 and the National Academy of Engineering in 1965, and his many awards include the National Medal of Science (1963) and the NAE Founder's Award (1977). The recipient of 89 patents, he has published 250 technical and popular technical papers and 17 books. He lives in Palo Alto, California.

1944

GARMAN HARBOTTLE, a senior chemist at the U.S. Department of Energy's Brookhaven National Laboratory, has won the Seaborg Medal, one of the most prestigious awards given by the American Nuclear Society. Presented only nine times since its inception in 1984, the Seaborg Medal honors excellence in research achievements considered especially beneficial to the development of peaceful uses of nuclear research. Harbottle's uses of nuclear-science techniques, according to Brookhaven, "are innovative and diverse. For instance, he has used carbon dating and another technique called neutron activation analysis to identify the origin of works of art. . . . Further, he has extensively measured natural radioactivity in soils." After graduating from Caltech, Harbottle received his PhD from Columbia University in 1949. He lives in Setauket, New York.

1948

HAROLD A. ROSEN, MS, PhD '51, and JOHN R. PIERCE '33, MS '34, PhD '36, the engineers who developed the technology for communication satellites and ushered in the modern communications era, have received the \$400,000 Charles Stark Draper Prize, the world's largest award exclusively for engineering achievement. The Draper Prize was estab-



Mark Wrighton (center), PhD '72, receives the medallion of his office as his predecessor William Danforth (at podium) proclaims him chancellor of Washington University in St. Louis. The former provost of MIT and a recipient of Caltech's Distinguished Alumni Award, Wrighton was formally installed as chancellor in October.

lished by the National Academy of Engineering in 1988 "to recognize individuals whose outstanding engineering achievements have contributed to the well-being and freedom of humanity." While Pierce designed and launched Telstar 1, the world's first active communication satellite, Rosen built on that accomplishment by developing a method for placing the Syncom II satellite in geosynchronous orbit, a step that made communication satellites more commercially viable—because a geosynchronous satellite appears to remain at one fixed location in the sky, it is accessible for the continuous transmission of audiovisual signals. Rosen began his career at Raytheon, then moved to Hughes Aircraft in 1956. It was at Hughes, in the early 1960s, that he led a small team in the development of the Syncom satellite; after an initial failure, Syncom II was launched in July 1963. He recently retired from Hughes, where he had been a vice president since 1975, and is currently the CEO and president of Rosen Motors, which is developing a hybrid electric automobile. Among his numerous awards are the first American Institute of Aeronautics and Astronautics' Aerospace Communications Award, in 1968; the first L. M. Ericsson International Prize in Communications, awarded by the King of Sweden in 1976; and the National Medal of Technology, awarded by President Reagan in 1985. In 1973, he both was elected to the National Academy of Engineering and won the AIAA's spacecraft design of the year award. The holder of 54 patent awards, he is the author of more than 20 technical publications. He lives in Santa Monica, California.

1952

ROBERT CHARLES PERPALL, SR., MS '56, of Rancho Palos Verdes, California, married Antoinette Fowler on September 14, in Roche Harbor, Washington State. Perpall is retired from the Garrett Corporation, where he was vice president and general manager of the turbo-charger division. He and his bride, both widowed, "met at King Harbor Yacht Club and share friends, travel, yachting, church, good wine and bad tennis." She is a graduate of Seattle University and the UCLA Graduate School of Business, and is a sailboat-racing and ballet enthusiast.

1953

THOMAS JANSSENS and fellow teacher Sandy Lofstock, both of California Lutheran University, in Thousand Oaks, California, have shared in a \$1,000 prize awarded by Caltech's Project MATHEMATICS! The project conducted a contest in 1994 open to all teachers who had used its videotape and workbook modules, and entries were judged on the basis of innovative and effective use of those materials in the classroom. Awards were provided through the generosity of Hewlett-Packard and the Intel Foundation, with each first-place award of \$1,000 being accompanied by an additional \$1,000, presented to the awardee's school to be used in a manner determined by the awardee.

Janssens and Lofstock won "for hands-on activities related to the modules on sines and cosines and the story of pi." After graduating from Caltech, Janssens entered the Jesuit Order for six years, then became a National Science Foundation Fellow at Stanford, where he earned his MS and PhD degrees working with Nobel Laureate Robert Hofstadter. He later worked in solar astronomy, until his solar videomagnetograph was destroyed in the Sylmar earthquake of 1971. After teaching at Cal State Long Beach for 20 years he joined the faculty at Cal Lutheran, where he has been teaching mathematics and astronomy for six years.

ROBERT H. WOOD, professor of chemistry and biochemistry at the University of Delaware, has been selected by the Faraday Division of the Royal Society of Chemistry as the R. A. Robinson Memorial Lecturer—an honor, according to the university, never before bestowed on a U.S. scientist. The lectureship, which is awarded every two years and includes a medal and an honorarium of £500, is presented to outstanding scientists working in electrolyte solutions, but in previous years only scientists living in Southeast Asia or the United Kingdom had been eligible. Wood accepted the award and gave the lecture September 6 at the autumn meeting of the Royal Chemical Society, in Sheffield, England. After graduating from Caltech, Wood earned his doctorate from UC Berkeley, and he joined the UD faculty in 1957. He lives in Newark, Delaware.

1959

NORTON MOISE, MS, PhD '63, has taken a position as research professorial fellow at the University of Otago, in Dunedin, New Zealand, where he is continuing his work in laser physics and photonics. He retired from Hughes Aircraft Company a few years ago.

1966

GARY NEIL, PhD, has been appointed to the board of directors of Allergan Ligand Retinoid Therapeutics (ALRT). Neil worked for 23 years at the Upjohn Company in a variety of scientific and management positions, then served as executive vice president of Wyeth-Ayerst Research, and is currently president and CEO of Therapeutic Discovery Corporation. ALRT is a new company dedicated to discovering and developing drugs based on retinoids.

1967

THOMAS BERGER, PhD, has been appointed Carter Professor of Mathematics at Colby College, in Waterville, Maine. He had previously been teaching at the School of Mathematics, University of Minnesota, St. Paul. His work includes a textbook, papers on mathematics education and popular computing, and research papers on group theory and representation theory, and he is a member of the Mathematical Association of America, the American Math-

ematical Society, and the Association of Computing Machinery.

1970

RAHUL BASU, of Bangalore, India, writes that he has recently "been promoted at DRDO, India," and has returned to his research in rotor dynamics. His paper on solutions for "self-freezing," based on his recent research in the United States—done using the computers at Research Triangle Park, North Carolina—was published recently. "Presently I am trying to utilize such effects for energy generation and develop other projects such as solar energy collectors, cookers and biogas."

BOB GRAY, of Framingham, Massachusetts, when last he wrote, in 1984, had just finished a parental leave to care for his new baby, Scott. Next, he writes, came two more babies, Kristen and Jenna, with two more leaves, and then his wife, Robin, and he decided to switch to part-time work. "So here I was, caring for my kids and watching them grow. As they grew older, I became fascinated by how they learned about numbers and shapes. Before I realized it, I had regained my old interest in mathematics (which I had ditched long ago for the world of computers). I became so inspired that I even wrote some math articles! This summer, the Mathematical Association of America gave me their Lester R. Ford award for my article 'Georg Cantor and Transcendental Numbers,' which appeared in last November's *American Mathematical Monthly*." While working on this article, he says, he had the pleasure of reestablishing contact with fellow alum MIKE BROIDDO '70. "Mike did a great job reading and commenting on the many drafts of the article."

1973

TAK SING LO, senior principal research engineer, reservoir research and technical services, ARCO Exploration and Production Technology, has received ARCO's Outstanding Technical Achievement Award for 1995, for his role in "facilitating the development and monetization of the complex, enormous Romeo hydrocarbon asset of the Prudhoe Bay field by successfully uniting low-cost computing technology with advancements in geostatistics." This award "is the highest recognition that ARCO bestows on its technical people. . . . Mr. Lo has elected to designate [a] gift of \$1,000 to be used for the Caltech Alumni Fund."

1974

JAMES L. LATIMER, MS, PhD '78, of Los Angeles-based Hughes Telecommunications and Space Company (HTS), has been selected as the National Information Infrastructure Testbed's technical director by that consortium's Working Group Forum. Latimer is a 21-year veteran of Hughes Electronics Corporation, of which HTS is a part. His past experience includes engineering, technical management, and business development in satellites, communications, and information systems.

JESSICA TUCHMAN MATHEWS, PhD, a senior fellow at the Council on Foreign Relations, was elected to the Brookings Board of Trustees at its annual meeting, held on November 8 and 9 in Washington, D.C. In 1993, Mathews was deputy to the undersecretary of state for global affairs, and from 1982 to 1993 she was vice president of the World Resources

Institute. Mathews had a post in the White House as director of the Office of Global Issues, a part of the National Security Council, from 1977 through 1979, and she has been a Congressional Science Fellow and a member of several committees of the American Association for the Advancement of Science. The author of a column for the *Washington Post* that appears both nationwide and in the *International Herald Tribune*, she has also written for the *New York Times*, *Foreign Affairs*, and other scientific and policy journals. She lives in Washington, D.C.

1978

LESLIE KOHN has joined C-Cube Microsystems as a C-Cube fellow and the chief architect for C-Cube's next-generation digital video encoder chip, this after consulting for the company since December 1994. He comes to C-Cube from Sun Microsystems, where he was the chief architect for Sun's UltraSPARC processor (1992-94). Prior to that he had worked, first, at National Semiconductor as one of two lead architects of the NS32000 product family and as manager of a software development group; then at Intel, where, among other things, he was chief architect on the 860 processor and its successor chip (1982-89); and, finally, at Aquest, a start-up company focused on 860-based graphics products, where he was chief technology officer (1989-92). He has published numerous technical papers.

1979

ROBERT M. HANSON, a chemistry faculty member at St. Olaf College, has published *Molecular Origami: Precision Scale Models from Paper*, which was August's Library of Science Book Club alternate selection. Based on his own use of origami in teaching chemistry, the book shows chemistry students and teachers how to make precision scale-model molecules from paper. *Molecular Origami* is published by University Science Books, of Sausalito, California. After graduating from Caltech, Hanson went on to earn his MS and PhD in chemistry from Columbia University and to undertake postdoctoral study at MIT, where he discovered and patented "catalytic asymmetric epoxidation." He has been teaching chemistry at St. Olaf College since 1986, and he has received a number of awards and research grants, including the NSF's Presidential Young Investigator Award. In his nonacademic life, he pilots sailplanes, plays the violin, and writes computer software under the business name of Integrated Graphics. He lives in Northfield, Minnesota, with his wife, Debbie Hadas, and two sons, Ira and Seth.

LEE W. TUTT, of Webster, New York, writes that he married SHARON LUNT, PhD '92, in 1992. They moved to New York, where they both work in the research division of Kodak, in Rochester. Their first child, Logan William Tutt, was born on August 27, 1995, "and is a delight to his proud parents."

1980

JAMES CARL HERMANSON, MS, PhD '85, of Coventry, Connecticut, has been appointed assistant professor of mechanical engineering at Worcester Polytechnic Institute, in Worcester, Massachusetts; the appointment is a tenure-track position. Prior to joining the WPI faculty on March 13, he was a research scientist at United Technologies' Research Center in East Hartford, Connecticut. His research and teaching interests focus on fluid mechanics, including aerodynamics, turbulent mixing, and compress-

ible and multiphase flow, and on combustion, including flame structure and stability and exhaust emissions. He is a senior member of the American Institute of Aeronautics and Astronautics, and a member of the American Society of Mechanical Engineers, the Combustion Institute, and the National Space Society.

1982

DAYALAN KASILINGAM, MS, PhD '87, assistant professor of electrical and computer engineering at the University of Massachusetts, Dartmouth, has received a Faculty Early Career Development Program Award (CAREER) from the National Science Foundation. Intended to support a balance of research and education on the part of new faculty members within the context of their overall career development, the award totals \$400,000 over a four-year period. After receiving his doctorate from Caltech, Kasilingam worked as a research scientist at Ocean Research and Engineering, in Pasadena, during which period he developed a widely used model for the imaging of ocean surface waves by synthetic-aperture radars. He joined the UMass, Dartmouth, faculty in January 1993. At UMass, he conducts research on the use of radar remote sensing for marine and ocean environments. In September 1994 he was awarded a grant by the Engineering Foundation to investigate the development of techniques to make neural networks learn how to perform nonlinear mapping processes on remotely sensed data. He will utilize the NSF CAREER award to continue this research and to set up a remote sensing laboratory and run a course on environmental remote sensing. In 1994 he received a Navy/American Society for Engineering Education summer Faculty Fellowship, to spend the summer of 1994 working with scientists and engineers from the Naval Research Laboratory in Washington, D.C. He has published many

papers in the fields of radar remote sensing and electromagnetics, and in 1995 he presented papers at the International Geoscience and Remote Sensing Symposium in Florence, Italy, and at the Progress in Electromagnetic Research Symposium in Seattle, Washington. He also chaired a session on "Radar Backscatter from the Ocean" at the latter conference.

1986

JOHANNES SCHMIDT has been promoted to vice president, software development, at Cornerstone Imaging, Inc. Prior to his current position, he was director of engineering for Pixel Translations, a Cornerstone subsidiary acquired in 1994; Schmidt had founded Pixel in 1990, and served as its president and CEO. Prior to that, he had been an engineer and a manager of applications and tools development at Calera Recognition Systems. In his new position, Schmidt will directly manage the overall development of Cornerstone's InputAccel and Pixel Translations PixTools product lines and will provide technical input on software for Cornerstone's other product lines.

KRISTIN L. WOOD, MS, PhD '90, an associate professor of mechanical engineering at the University of Texas at Austin, has received the first AT&T Engineering Education Excellence Award, which "honors tenured engineering faculty of ABET-accredited programs, who are 45 years of age or younger and have made outstanding contributions to engineering education." He was presented the Engineering Educator Medallion and a check for \$10,000 on July 26, at the National Society of Professional Engineers (NSPE) annual meeting, in Louisville, Kentucky. Joining the UT faculty as an assistant professor in 1989, Wood, according to the NSPE, "immediately established a computational and experimental laboratory for research

design and manufacturing. During his six years at UT, Wood has distinguished himself through his pre-college teaching efforts in science and mathematics through Design Technology and Engineering for Americas Children (DTEACH), a program he developed and implemented. He has also made significant contributions to UT's undergraduate and graduate design curricula, including a new course instructing graduate students on ways to develop and fabricate devices to assist the physically and mentally challenged." The winner of two American Society of Mechanical Engineering Best Paper Awards, he has published over 50 papers. He has been a National Science Foundation Young Investigator and a June and Gene Gillis Endowed Faculty Fellow in Manufacturing, and is the recipient of more than 20 other awards. "Wood also finds time to consult for various organizations, serve on several UT committees, and assist with community activities enhancing the lives of children." He lives in Austin.

1989

JAMES BARKER COYKENDALL IV has joined the faculty of Lehigh University as a visiting assistant professor of mathematics. Previously, he was a visiting professor of mathematics at Cornell University, where he received the Russell Award for Distinguished Teaching of Mathematics. Specializing in algebraic number theory and commutative algebra, he has written half a dozen journal articles and is a member of the American Mathematical Society and the Mathematical Association of America. He lives in Bethlehem, Pennsylvania, with his wife, Kathy, and their two-year-old daughter, Ashley.

ANDREW HSU and SAMANTHA SEAWARD '91 have written to announce that they were married on June 10 at Alumni House. "While Samantha is keeping her name legally and professionally, we will be known socially as Mr. and Mrs. Andrew Hsu. We are happy to tell everyone that we will be here in Philadelphia until next July of 1996. Samantha just received her MD from UCLA and is currently a transitional intern at the Presbyterian Medical Center. Meanwhile, I am busy trying to finish my PhD in neuroscience at the University of Pennsylvania. After July, we will move to San Francisco, where Samantha will be a resident in radiation oncology at UCSF. Despite being physically far from Caltech, we still feel very much a part of the Caltech community through the efforts of the Alumni Association." They add that they can be reached through Hsu's e-mail address, ahsu@retina.anatomy.upenn.edu.

RICHARD C. HSU announces that after graduating from Columbia Law School (JD 1994) and passing the California Bar, he has joined the law offices of Lyon & Lyon in Los Angeles, a firm specializing in patent and intellectual-property matters. He reports that he is one of three attorneys at Lyon & Lyon who are Caltech alums. The other two are JEFFREY TEKANIC '88 and ROLAND "BUD" SMOOT '50.

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OBITUARIES

DAVID JUNG has joined the Washington office of Morgan, Lewis & Bockius as an associate in the Intellectual Property Practice Group, concentrating in the area of patent law. He received his JD from the University of Illinois in 1993, and he most recently worked as a patent examiner with the U.S. Patent and Trademark Office. His background also includes experience in the computer industry with IBM and the Oracle Corporation. He has been admitted to practice in Illinois and has passed the examination to practice with the U.S. Patent and Trademark Office. He is also fluent in Korean. He resides in Arlington, Virginia.

CYNTHIA STRONG, PhD, has been awarded tenure and promoted to the rank of associate professor of chemistry at Cornell College. While at Cornell, whose faculty she joined in 1989, she has received two grants for instrumentation and had a paper, "Preparation and Characterization of Cobalt(II)-Substituted Rusticyanin," published in the journal *Inorganic Chemistry*. At Cornell, she teaches Analytical Chemistry, Advanced Inorganic Chemistry, and Chemical Principles II, among other courses, under the school's innovative One-Course-At-A-Time academic calendar, under which students and faculty focus on a single subject during month-long terms from September to May.

PIERCE WETTER III and JOHN DEREK WOOLVERTON '89 "have shed the bounds of California smog, traffic, crime and taxes; and formed Twin Forces Entertainment in the mountains of Arizona. (Arizona has mountains?) Our goal is to create the next generation of interactive experiences for home entertainment and with two projects in the hopper right now we're off to a running start. When we're not programming in our office, we're off camping, fishing, and watching the local demolition derby."

1991
THOMAS KIEFER and his wife, Eve, "proudly announce the birth of their son, Shaun Thomas, born July 7, 1995. He joins his sisters Gillian and Brynn."

1993
ANUP JATIA and his wife, Shruti, were married on December 1 in Calcutta, India.

ANDREAS REISENEGGER, PhD, writes about two new and exciting events in his life: "First, on September 22, 1995, my wife, Ana María Butrón, gave birth to our second child, Thomas. Second, I have recently accepted a tenure-track position at the Department of Astronomy (in formation) of the Catholic University of Chile in Santiago, my hometown. I will start working there on January 1, 1996. It is my intention to initiate a theoretical astrophysics group, which so far does not exist in the country, despite its enormous astronomical potential. Naturally, we and our 3-year-old daughter Renate are happy about the addition to our family and the return to our country."

1925
RICHARD W. PALMER, on February 23, 1995. He is survived by a sister-in-law, two nephews, and a niece.

1927
ALAN E. CAPON, of Burbank, California, on August 10; he was 88. After graduating from Caltech, he spent four years with Westinghouse as an electrical engineer. Through the 1930s, he worked for the Metropolitan Water District; he also designed high-voltage transmission lines for the Colorado River Water Project. In 1941, he joined Burbank's Public Service Department as an electrical engineer. He served as chief engineer and assistant general manager from 1958 to 1970 and as general manager from 1970 to 1973. He also served on the Committee of Southern California Utilities when it was negotiating with the Bonneville Power Authority over bringing more high-voltage power to the L.A. region. In 1973, he received an Award of Merit for an Outstanding Example of Excellence in Utility Design. Also in 1973, he received the Citizen-of-the-Year Award from the Burbank Board of Realtors. He served with numerous organizations and on a variety of boards, including the board of directors for the Burbank Chapter of the American Red Cross, the Burbank YMCA, the Burbank Symphony Association, as well as many other civic and professional associations, and he was a past president of the Kiwanis Club of Burbank. He also continued to be involved with his department after his retirement in 1973. In 1977 he was selected to serve on the Public Service Department's advisory board, remaining a member until his death. He also served as interim general manager in 1987. He is survived by his wife, Emma, and other family members.

J. HENRY GUNNING, Ex, of Pebble Beach, California, on June 21; he was 90. He had served in the Air Force Reserve, and he was an engineer for Douglas Aircraft for 40 years. He was a member of the Gnome Club, the Alumni Association, and the Beta Theta Phi fraternity. He is survived by his wife, Violet; a brother, Frederick; and two sisters, Cynthia Taylor and Virginia Watts.

1928
RALPH W. CUTLER, MS '29, of South Pasadena, California, on July 28; he was 89. A registered civil, structural, and mechanical engineer, his 60-year career in steel fabrication and engineering included work on the Palomar Observatory, Coast Guard ships, pressure vessels, and commercial buildings. He worked for U.S. Steel, Western Pipe and Steel, Kaiser Steel, and Vinnell Steel, and he had been self-employed as a consulting engineer for the past 30 years. He was a 50-year member of the South Pasadena Masonic Lodge #290, serving as Master of the lodge in 1953, and as Inspector of the 534th Masonic District from 1955 to 1963. He is survived by his wife, Ruth; a daughter, Sherilyn Robison; and two granddaughters, Cynthia Haye and Pamela Robison.

JOHN S. GOODWIN, Ex, of Whittier, California, on January 17, 1994. He was a member of Sigma Alpha Pi. He is survived by his wife, Helen.

1929
RUSSELL W. RAITT, MS '32, PhD '35, of San Diego, California, on March 6, 1995; he was 87. A key participant in 1950s and '60s ocean surveys central to developing theories of seafloor spreading and plate tectonics, he was among the first to successfully adapt land oil-exploration seismic techniques to shipboard measurements of the earth's crust beneath the seafloor—a task made difficult by the water's depth and the tendency of ships to bob on the ocean's surface. His observations establishing fundamental properties of the sediment layers and crust below the oceans include the first measurements of the crust's thickness beneath the Pacific Ocean and the discovery of the East Pacific Rise, the largest topographic feature in the oceans. During the 1930s he worked for a geophysical survey company searching for oil in the L.A. basin and the San Joaquin Valley, and during World War II he joined the division of war research at UC San Diego, where he measured seafloor sound reflection and sound propagation and scattering in seawater—studies that were applied by the U.S. Navy to submarine detection. It was during wartime sonar studies that Raitt and others observed the "deep scattering layer," a phantom ocean bottom that scatters sound waves; the layer, which constituted a major oceanographic discovery, was found to be composed of sea life that migrates up and down during daily cycles. After World War II, Raitt joined the newly formed Marine Physical Laboratory at the Scripps Institution of Oceanography, and in 1950 he served as the senior geophysicist on Scripps's first distant expedition to the Central Pacific. His shipboard investigations over 25 years covered large sections of the Pacific and Indian Oceans. He was a Fellow of the American Geophysical Union, and in 1976 he became a professor emeritus. His wife of 40 years, Ruth, participated in one of Scripps's South Pacific expeditions and authored *Exploring the Deep Pacific*, which described the operations, significance, pleasures, and frustrations of doing science on small ships in remote seas. She died in 1976. He is survived by a daughter, Martha Harrison; three stepchildren from his wife's earlier marriage, Alison Gist, Craig Biddle, and Charles Biddle; 12 grandchildren; and nine great-grandchildren.

1931
CARL F. J. OVERHAGE, MS '34, PhD '37, of Santa Fe, New Mexico, on August 7; he was 85. His professional interests included both photography and electronics. His first job after graduating from Caltech was as director of research at the Technicolor Motion Picture Corporation, and in 1944 he was awarded a patent for the design of eyeglasses that made color movies appear three-dimensional. In 1941 he joined the Radiation Laboratory at MIT, where he contributed to the development of radar technology. After the war, he worked for the color-control department of Eastman Kodak Company. He returned to the MIT Radiation Laboratory after it had been renamed the Lincoln Laboratory, and helped develop electronic applications for military operations. He was a laboratory division chief in charge of aircraft control when he was named director in 1957. In 1964 he became a professor of electrical engineering at MIT, where he directed a

program for the application of advanced information-transfer techniques to libraries. He retired in 1973. He served on several advisory boards and federal commissions and was a recipient of the Presidential Certificate of Merit in 1948 and the Air Force's Exceptional Service Award in 1958. He was also a fellow of the American Physical Society, the Optical Society of America, and the American Academy of Arts and Sciences. He is survived by Katya, his wife of 55 years.

1932
LAWRENCE D. SCHRODER, MS, of Salt Lake City, on November 4, 1993; he was 84. After receiving his master's from Caltech, he did graduate work at Stanford and then received his doctor of education degree from the University of Utah. He taught high school physics and math and served as assistant principal and then principal at a number of elementary schools, ultimately becoming assistant superintendent of the Salt Lake City public schools, serving as personnel director and science supervisor. He later worked in the Salt Lake Community Schools. He was president of the Salt Lake Teachers Association and the Salt Lake Community Services Council, and chairman of the Mental Health Advisory Board. He was also a member of the Utah Academy of Sciences, Arts, and Letters, the National Council on School House Construction, and the American Personnel and Guidance Association, among other organizations. He was also a member of the Salt Lake Kiwanis Club and of Phi Kappa Phi, Tau Beta Pi, and Phi Delta Kappa, and he was an associate member of Sigma Xi. He is survived by his wife, Vera, and his daughter, Vera Jean.

1933
BARNARD A. MORSE, Ex, of Altadena, California, on February 12, 1995; he was 83. After completing his sophomore year at Caltech, he transferred to Stanford, where he received his AB in 1933. He joined Southern California Edison in 1940, and he rose to the position of manager of valuation; he retired in 1978. Active in community service, he was involved with the Los Angeles Chamber of Commerce and with the Boy Scouts of America, from which he received the Order of Merit and Silver Beaver for his work. In Altadena, he served as president and chairman of the Las Flores Water Company and was very active in St. Mark's Episcopal Church. He also served in various capacities with Civitan, including as vice president of Civitan International, and was a director of the Scripps Home. He is survived by his wife, Muriel; two sons, Robert and Barnard, Jr.; and nine grandchildren.

1936
MORTON K. FLEMING, MS, of San Diego, California, on March 17, 1995; he was 90. Prior to attending Caltech, he had graduated from the U.S. Naval Academy in 1926, been one of five graduates in the first Naval Aviator class from Pensacola Naval Air Station in 1928, and graduated from the U.S. Naval Academy Post Graduate School in 1935. In his early career he flew wood-and-wire fighters—without radios—off the USS *Langley*, the U.S. Navy's first aircraft carrier, and flew seaplanes launched from battleships by compressed-air catapults. After graduating from Caltech, he was assigned to PBY flying boats, which were flown on long patrols from Panama to Alaska to prove their worth for combat. In 1939 he joined the Bureau of Aeronautics at the Navy Department, in Washington, D.C., where, as a design project officer, he designed or participated in the design of aircraft such as the Curtis Seagull, a single-float scout

plane, and the Grumman Avenger torpedo bomber. In 1943 he took command of the seaplane tender USS *Orca* and its assigned contingent of "Black Cat" PBV night patrol aircraft, and in 1944 his planes sank 84,000 tons and damaged 23,400 tons of Japanese shipping, for which he received the Legion of Merit. In 1945, for his further successes while in command of a task group comprising about 200 Black Cats plus seven support ships, he received the Bronze Star in lieu of a second Legion of Merit, and by war's end planes under his command had destroyed over 250,000 tons of shipping. Upon returning from the Pacific in August 1945, he was assigned as Bureau of Aeronautics representative to the Chance-Vought aircraft plant in Stratford, Connecticut, where he at one point refused a delivery of Corsair fighters when the planes did not meet Navy safety standards. In 1947-48 he became executive officer of the Naval Research Laboratory, near Washington, D.C., where he remained until his retirement in late 1949 with the rank of rear admiral. He did private consulting work until 1958, when he joined the VITCO Corporation of America, becoming president and chairman of the board. He is survived by Isabel, his wife of 67 years; a daughter, Barbara Litt; three sons, Paul, Michael, and Peter; three grandchildren; and six great-grandchildren.

1937

ROBERT S. CAMPBELL, of Medford, Oregon, on July 29; he was 79. After graduating from Caltech he joined Southern California Edison, from which he retired in 1975 after 38 years of service. He served in the Navy during World War II, including at the Boston Navy Yard. He is survived by Barbara, his wife of 53 years; two daughters, Barbara Campbell and Bonnie McGovern; and two grandchildren.

1940

WILLIAM J. HOWELL, MS, of Winnetka, Illinois, on June 13; he was 81. A founding partner of Howell and Sisler Associates, he was a pioneer developer of profit-sharing plans. He also served on the boards of the Community Renewal Society, the Christian Industrial League, the Chicago Council on Urban Renewal, and the Chicago Area Broadcast Ministries. He earned a master's degree from the University of Chicago, and he served for four years with the U.S. Marines during World War II. Survivors include Barbara, his wife of 43 years; a daughter, Priscilla; three sons, Peter, Samuel, and John; a brother; a sister; and two grandchildren.

1941

CAROL K. IKEDA, of Phoenix, Arizona, on November 20, 1994; he was 77. After graduating from Caltech he received his MS in 1944 and his PhD in 1945, both from the University of Nebraska. He worked for Du Pont for 34 years as a chemist and retired in 1980. He is survived by his wife, Ruth; two daughters; a son; and three grandchildren.

1943

ROBERT R. DAVIS, of South Laguna, California, on August 27; he was 82. A long-time resident of Pasadena, he retired to Laguna in the late '70s, after working for Consolidated Engineering, in Pasadena; for Beckman Instruments, in South Pasadena; for Westrex, in Hollywood; and, for many years, as a mechanical design engineer at JPL. He was a member of the YMCA and the Indian Guide Father Program, and he sang in the Pasadena Presbyterian Church Choir as well as for several Southern

California choral groups; he also played guitar in the "Big Band Music." He is survived by his wife, Donna; three sons, Lee Ross, S. Robert, and Scott S.; three grandchildren; four stepchildren; and six stepgrandchildren.

HAROLD S. DEWDNEY, on July 7. After graduating from Caltech, he served in the Canadian army. A structural engineer, his long professional career took him all over the world. He oversaw the construction of major U.S. Navy radio towers at Perth, Australia, and Puerto Madryn, Argentina. While chief engineer for Vinnel Co., he outlined the construction of Dodger Stadium, in Los Angeles. An expert in prestressed concrete construction, he later served with Rockwin as that company's chief engineer. He also worked in the field of structural safety. He is survived by his wife, Lily; two daughters, Anita Owens and Susan Estrada; two sons, Bruce Dewdney and Vincent Martinez; and seven grandchildren.

RAYMOND F. MCNEIL, MS, of Daly City, California, on April 6, 1994. He is survived by his wife, Betty, and by six daughters, Pamela, Lynne, Jennifer, Loretta, Leslie, and Elizabeth.

1944

ALVIN M. GALBREATH, of Arcadia, California, on February 26, 1995. He is survived by his wife.

JOHN G. MCDONALD, Ex, of Calgary, Alberta, on June 10, 1992; he was 69. During World War II he served in the RCAF and USAAF as a pilot in Canada and Europe. He spent over 30 years practicing tax law, in Toronto (as queen's counsel), Vancouver, and Calgary. For many years he was a special lecturer at Osgoode Hall Law School, Toronto, and he was the author of numerous books and pamphlets regarding taxes, as well as of newspaper columns. He was a past president of the Canadian Petroleum Tax Society and a member of the Canadian Petroleum Law Foundation, the International Bar Association, the Canadian Bar Association, and the Law Society of Alberta. He created the first limited partnership in the oil and gas sector, establishing the Canadian Oil & Gas Fund, Ltd., and was cofounder of Ranchmen's Resources Ltd., retiring as chairman of the company in 1990. He is survived by his wife, Eleanor; two sons, David and William; two daughters, Patricia and Katherine; six grandchildren; and two brothers, James and David.

ROBERT POLANSKY, CAVU, in June 1994. He was one of a group of students during World War II who received certification after completing an accelerated training program in meteorology, and who referred to themselves as Ceiling and Visibility Unlimited. He is survived by his wife.

1946

JACK N. MILLER, MS, of Winter Park, Florida, on March 16, 1995. Miller retired from the U.S. Navy with the rank of captain. He is survived by his wife, Hope.

1949

GEORGE M. PETZAR, of Riverside, California, on October 16, 1994; he was 73. During World War II he served in the South Pacific as a U.S. Navy pilot. After graduating from Caltech, he worked in marketing and promotion in the cement and concrete industry. In 1989 he did consulting work in India. He was a member of the American Society of Civil Engineers, and he was active in community service organizations, most recently as the founding chairman of the Riverside County

Private Industry Council of the Job Training Partnership Act, from 1983 to 1987. He is survived by his wife, Mary Jane; two daughters, Christine Petzar-Parrott and Patricia Petzar-Piepenbrink; one son, Michael Petzar; and three grandchildren.

1950

WILLIAM H. PROUD, MS '51, of Los Angeles, on September 16; he was 69. He worked for 38 years as a radar systems engineer at Hughes Aircraft Company, retiring as a senior scientist. He is survived by his wife, Ann; his daughter, Dana Newman; two grandchildren; two sisters, Patricia Tolle and Annemarie Huffor; and two brothers, George and Alfred.

1951

FRANK C. BUMB, JR., MS '52, of Pasadena, California, on September 25; he was 66. He was an executive and entrepreneur in the electronic and data-recording instruments industry, and he was a member of the Gnome Club and the Associates of Caltech. He is survived by Dian, his wife of five years; a son, Stephen; two daughters, Luanne Mitchell and Janice Bumb; and five grandsons. A memorial fund has been established at Caltech. Those wishing to contribute should write to the Frank C. Bumb, Jr., Memorial Fund, Caltech, 1201 East California Boulevard, 105-40, Pasadena CA 91125.

1955

DANIEL J. GRIFFIN, JR., of Newport Beach, California, on January 26, 1995. He worked as chief engineer for seven years at Conrac Corporation, in Covina, California, before moving to Perkin-Elmer Corporation, in nearby Pomona, where he participated in the design of the Hubble Space Telescope. He was a life member of the IEEE. Upon retiring in 1990, he and his wife spent four years cruising the Sea of Cortez and the Mexican mainland. He is survived by Jean, his wife of 43 years; four children; and two grandchildren.

1959

EDWARD R. BATE, JR., MS '60, of Pasadena, California, on September 9; he was 58. He devoted his career to the study and development of advanced technology in hydrodynamics, aerodynamics, and air-quality instrumentation. He worked professionally at the Hydrodynamics Research Laboratory at Caltech and at Aero-Vironment Inc., and he consulted for numerous high-technology corporations in the Los Angeles basin; he also spent a year as an engineering technologist in Saudi Arabia. As an avocation, he painted futuristic and planetary landscapes and designed and crafted high-tech furniture. He is survived by a cousin, Peg Kaplan. He left his entire estate to Caltech to establish the Edward R. Bate, Jr., Scholarship Fund. Anyone wishing to contribute to the fund should write to the Edward R. Bate, Jr., Scholarship Fund, 1201 East California Boulevard, 105-40, Pasadena CA 91125.

1962

ROBERT L. BLINKENBERG, of Arcadia, California, on June 16; he was 54. After graduating from Caltech, he received his master's of business administration from Pepperdine University and his PhD in physics from UCLA. He was a senior program engineer at the Aerospace Corporation, in El Segundo, California. His interests included racquetball, tennis, and swimming, and he was a life master in the American Contract Bridge Association. He is a member of the Alumni Association. He is

survived by his wife, Linda; a daughter, Lisa; two sons, Charles and Travis; and two grandsons. A memorial fund has been established at Caltech. Those wishing to contribute should write to the Robert L. Blinkenberg Memorial Fund, Caltech, 1201 East California Boulevard, 105-40, Pasadena CA 91125.

1964

ALAN O. RAMO, MS, of Dallas, Texas, on May 19; he was 53. An expert in geothermal physics and the author of numerous articles about the subject, he was one of the discoverers of the Dixie Valley geothermal field in Nevada. He had worked for Litton Industries and United Geophysical during the '60s and '70s, before joining Sun Oil Corporation—now Oryx Energy Company—in 1973. He is survived by his wife, Doris, and a son, Richard.

1972

DONALD L. ROBBERSON, PhD, of Galveston, Texas, on July 11; he was 53. A molecular biologist and professor of genetics with the department of molecular genetics at the University of Texas M. D. Anderson Cancer Center, he was an expert in the area of electron microscopy of DNA molecules. His research concerned DNA replication in mitochondria, and the molecular genetics of leukemia. The recipient of many honors and awards, he was listed in *Who's Who in Frontiers of Science and Technology* and *American Men and Women of Science*. He was a member of the American Society of Cell Biology, American Society of Biochemistry and Molecular Biology, American Association for Cancer Research, American Association for the Advancement of Science, and Electron Microscopy Society of America. He is survived by his wife, Jane; four daughters, Kirsten Kreutz, Amy Robberson, Lea Nan Moore, and Elizabeth Wurzlów; two sons, Erik Robberson and Clay Wurzlów; his mother, Merle Brown; his stepfather, Cliff; three grandchildren; a sister, Relleen Firooz; his stepmother, Para Lee Robberson; a half brother, Lewis ("Butch") Robberson; and a niece and two nephews.

1974

DONALD L. MILLER, MS '76, on May 30, due to a severe asthma attack; he was 43. After graduating from Caltech, he received his PhD from the UC Berkeley/UC San Francisco biophysics program, studying retinal electrophysiology. His work focused on researching the interplay between receptors, ion channels, and ion pumps. He is survived by his father, Donald A. Miller.

Arrola DuBridge

1900–1995

Arrola Bush Cole DuBridge, the wife of Caltech's late president, emeritus, Lee DuBridge, and an active and



Arrola DuBridge

committed member of the Caltech community for more than 20 years, died on September 30 in Massachusetts. She was 95.

Mrs. DuBridge had been associated with the Institute since 1974, when she and DuBridge, both widowed at the time, were married. The two had met many years earlier while attending Iowa's Cornell College, where they were classmates and friends. Dr. DuBridge, who served as Caltech's president from 1946 to 1969, died in January 1994.

Born and raised in Iowa, the future Mrs. DuBridge—then Arrola Bush—earned degrees in psychology and English from Cornell College, where she met and married her first husband, Russell Cole. Cole served as president of Cornell College from 1943 to 1960, and, upon his retirement, the couple moved to Massachusetts. After Cole's death, Arrola became a social worker at the state's Correctional Institute for Women in Framingham. Later she spent five years as social director of Chapman College's "World Campus Afloat," a shipboard education program that operates with a full faculty and travels around the world each semester.

For a time, Mrs. DuBridge was a scriptwriter for NBC radio and television. A talented violinist, she also taught violin and played in the symphony orchestra of Cedar Rapids, Iowa.

Arrola DuBridge gave generously of her time and support to a wide range of Institute activities, including the Caltech Women's Club, the Caltech Service League, the Caltech Associates, and the Caltech Alumni Association, which named her an Honorary Alumna in 1992. That same year, the Price Charities in San Diego endowed the Arrola DuBridge Scholarship Fund in her honor at the Institute. The scholarship provides funding for undergraduate women. Arrola and Lee DuBridge were widely known for their interest in and dedication to young people in science, a commitment the ARCS (Achievement Rewards for College Scientists) Foundation recognized in 1992 by establishing the Lee and Arrola

DuBridge Endowed Scholarship Fund to support undergraduates at Caltech.

Mrs. DuBridge is survived by her daughter, Bette Rega; son-in-law, Patrick Rega; four grandchildren; and five great-grandchildren; as well as by the two children from Lee DuBridge's previous marriage, Barbara MacLeod and Richard DuBridge; five grandchildren; and two great-grandchildren.

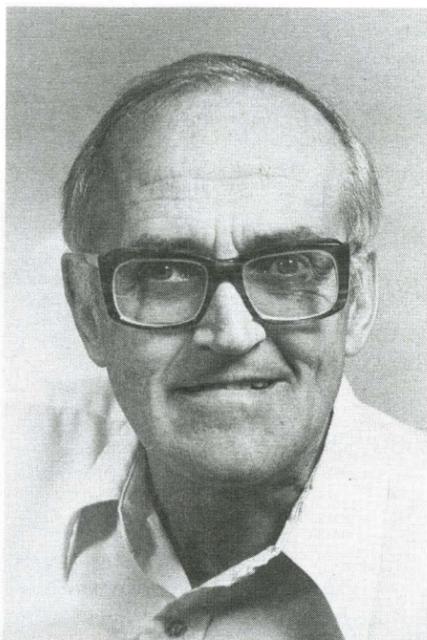
Clair Patterson

1922–1995

Clair C. "Pat" Patterson, the scientist who established the ancient age of the earth and played a key role in alerting the modern world to the dangers of lead pollution, died suddenly on the morning of December 5, at his home in The Sea Ranch, California, northwest of Santa Rosa. The Caltech professor of geochemistry, emeritus, was 73.

Patterson, say his colleagues, had a remarkable talent for finding the most important scientific problems and then solving them. He is best known for his determination of the age of the earth and the solar system, and for his pioneering work on lead pollution. Earlier this year, he was awarded the 1995 Tyler Prize for Environmental Achievement, the premier environmental honor in the world.

The passion that directed Patterson's research was his desire to better under-



Clair Patterson

stand the geochemistry of metals in terrestrial rocks, waters, and atmospheres, in meteorites, and in the solar system. Patterson was a pioneer in the study of lead in the earth's crust. He developed precise analytical techniques that enabled him to establish the true levels of pre-industrial lead in the environment. His analysis of lead isotopes in meteorites and oceanic minerals led him in the early 1950s to conclude that the earth and solar system are 4.6 billion years old. Current theories of stellar birth and evolution, and our very understanding of the history of the universe, are based to some degree on this crucial measurement, considered one of the most important determinations of time ever made.

While studying lead isotopes, Patterson found that human civilization had mined and dispersed an unprecedented amount of the metal around the world. Ice cores from the Greenland ice cap, dating back thousands of years, showed that the amount of lead in modern snow is much higher than in pre-industrial times.

This knowledge led Patterson to wonder whether this abundance of lead might affect humans. His studies of the bones and teeth of prehistoric people confirmed that modern humans contain up to 1000 times more lead than did their ancient ancestors.

His message, that people were being contaminated by lead from water pipes, from leaded gasoline, and from the solder used to seal canned foods, was not a popular idea. But Patterson, a courageous and determined man, fought, against great odds and powerful corporations, to discontinue the use of lead in these materials, and eventually, through his tenacity and his extremely thorough methods, his results and recommendations were accepted.

Born in Des Moines, Iowa, Patterson earned his bachelor's degree in chemistry at Grinnell College in 1943. He continued to study chemistry at the University of Iowa, where he earned his master's degree in 1944, and at the University of Chicago, where he completed his PhD in 1951 with Harrison Brown as his thesis advisor.

He stayed on at the University of Chicago as a postdoctoral fellow for one year, and when Brown came to Caltech to establish the geochemistry program in 1952, Patterson came with him as a research fellow. He became professor of geochemistry, emeritus, in 1993.

In addition to the Tyler Prize, Patterson's many honors included the J. Lawrence Smith Medal from the National Academy of Sciences in 1975 and the Professional Achievement Award of the University of Chicago in 1981. He was elected to the National Academy of Sciences in 1987, and had both a peak in Antarctica and an asteroid named for him.

Patterson is survived by his wife, Lorna Patterson of The Sea Ranch, California; his brother, Paul Patterson; his sister, Patricia Stuart; and four children and three grandchildren. The children are Susan McCleary of Crawfordville, Iowa; Cameron Patterson of San Diego; Charles Patterson of Powell, Ohio; and Claire May Keister of Minneapolis, Minnesota. His nephew, also named Paul Patterson, is a professor of biology at Caltech.

Olga Taussky-Todd

1906–1995

Olga Taussky-Todd, professor of mathematics, emeritus, died at her home in Pasadena on October 7, 1995. She was 89.

Taussky-Todd was born in Olomouc (Olmütz) in the Moravian part of Czechoslovakia. She attended the Koernerschule in Linz and then studied mathematics with the number theorist Philip Furtwängler at the Univer-

sity of Vienna, earning her PhD in 1930. At the University of Göttingen in 1931–32, she served as an assistant to Courant and edited the collected works of David Hilbert. She spent 1934–35 working with Emmy Noether, one of the founders of modern algebra, at Bryn Mawr College in Pennsylvania.

She was appointed to a Yarrow Research Fellowship at Girton College, University of Cambridge, in 1936.

She was awarded, ad eundem, the MA degree by Cambridge in 1937, only after Parliament had changed the university's statutes, which previously had



Olga Taussky-Todd

permitted the degree to be awarded to men only.

In 1937 she took up a position at the University of London, where she met her future husband, fellow mathematician John Todd. They were married in 1938.

The Todds worked for the British Ministry of Aircraft Production during World War II. After the war they came to the United States, working for the National Bureau of Standards (NBS) in Washington for ten years before coming to Caltech in 1957.

Taussky-Todd was named professor of mathematics in 1971, having received tenure in 1963. She became professor emeritus in 1977. In 1963 she was selected as one of the ten Women of the Year by the *Los Angeles Times*.

Taussky-Todd's specialties in mathematics were algebraic number theory and matrix theory, and in both fields she was recognized as one of the world's leading experts. Taussky-Todd was one of the first to point out connections between abstract algebra and topology.

At a 1976 symposium at Caltech, she was honored as one of the foremost living female mathematicians. She was elected to the Council of the American Mathematical Society in 1972 and elected vice president of the society in 1985. She was a fellow of the American Association for the Advancement of Science, a corresponding member of the Austrian Academy of Sciences and the Bavarian Academy of Sciences, and was awarded the Golden Cross of Honor, First Class in Arts and Sciences, by the Austrian Government.

Olga Taussky-Todd is survived by her husband, who is also professor of mathematics, emeritus, at Caltech.

Caltech *News*

California Institute of Technology
Pasadena, California 91125

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PAID
PASADENA, CA
PERMIT NO. 583

Issued four times a year and published by the California Institute of Technology and the Alumni Association, 1201 East California Blvd., Pasadena, California 91125. Third class postage paid at Pasadena, California.
Postmaster: Send address changes to:
Caltech News
Caltech 1-71
Pasadena, CA 91125.

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California
Institute of
Technology

Caltech *News*

Volume 30, No. 1
Winter 1996



In this issue

They "always knew that funny flies" would win this man the Nobel Prize.

Page 1

Since one alum returned to Caltech, you can barely get him off the basketball court—and the world records prove it.

Page 4

A professor proves you don't have to leave your office or own your own tux to win the National Medal of Science.

Page 7

The trustee chair and his wife wanted to give the campus a gift it could really use, so after the holidays they unveiled the Moore Laboratory of Engineering.

Page 10