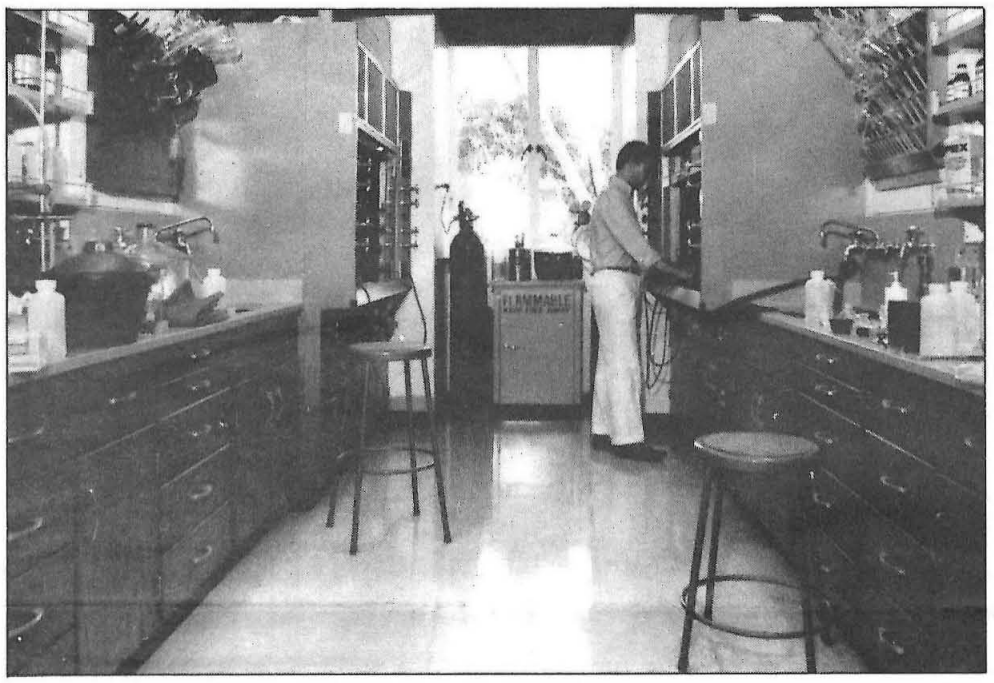
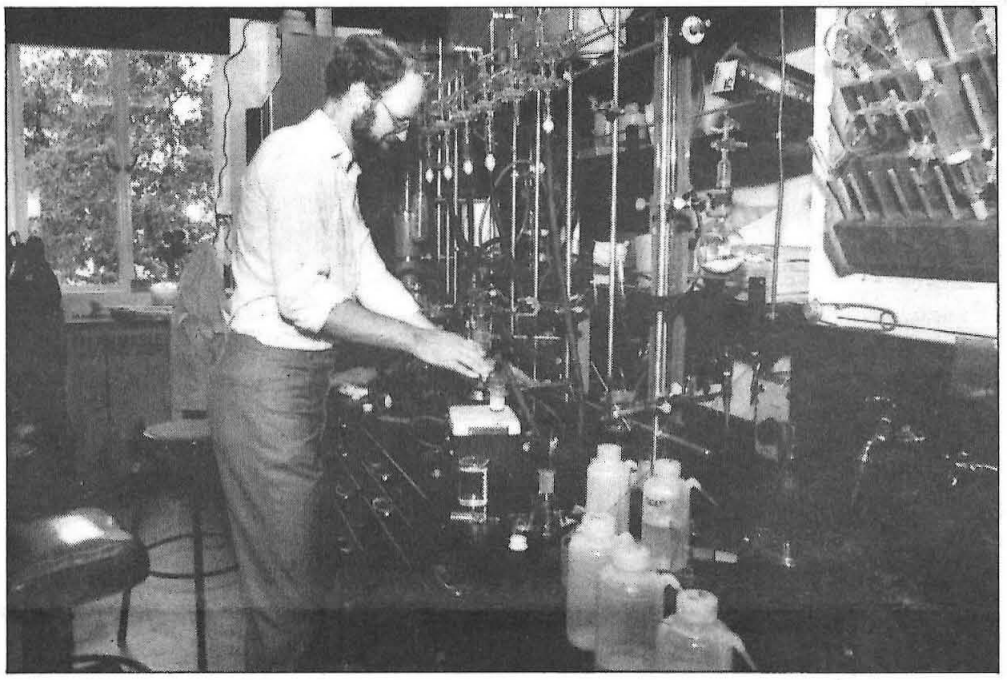
CALTECH NEWS

December 1985

Beckman Laboratory of Chemical Synthesis:



Peter Dervan in his laboratory in the Arnold and Mabel Beckman Laboratory of Chemical Synthesis. Existing labs did not meet modern synthetic chemistry needs.



Robert Grubbs checks instrumentation in his laboratory. All labs in the building are designed by the professors who occupy them.

Transformation under way

By Winifred Veronda

The initial phase of the Arnold and Mabel Beckman Laboratory of Chemical Synthesis is finished, and "it's as beautiful as we dreamed it would be," says Peter B. Dervan (professor of chemistry), whose laboratory occupies part of the new facility.

Work on the laboratory began in July 1984, made possible by a gift of $6.5 million from the Arnold and Mabel Beckman Foundation. This gift has enabled the Institute to completely renovate Crellin Laboratory of Chemistry and Church Laboratory of Chemical Biology, creating a new facility.

The first phase has involved renovation of the second and third floors of the west wing (16,000 square feet) and creation of an instrument room on the third floor of the east wing. Laboratories for Dervan and John D. Roberts (Institute Professor of Chemistry) are on the third floor of the west wing; Robert H. Grubbs (professor of chemistry) and his group occupy a new lab on the second floor.

Creation of the laboratory involves combining Crellin and Church into a single structure with an all-new interior and the most modern instrumentation possible for research in bio-organic chemistry, polymers, natural product synthesis, and catalysis.

A knowledge explosion in synthetic chemistry is under way, says Dervan, giving scientists increasing power to tailor-make complex chemical structures with great precision. Their work can lead to advances in microelectronics; new catalysts, drugs, and transport systems; and new chemical compounds for the food, drug, and chemical industries, and for use in research laboratories.

Many of the breakthroughs are taking place at the interdisciplinary boundaries within chemistry, and research laboratories need to be equipped to accommodate this process.

But Caltech, early in the decade, was not ready to play a leading role in this work. "By 1983, Caltech's synthetic chemists—both organic and inorganic—realized that we needed new facilities if we were going to be at the leading edge in this renaissance," says Dervan.

"The labs were almost 40 years old, and chemistry isn't done today as it was done when they were built. We needed clean instrument rooms, analytical facilities, dark rooms; we needed new state-of-the-art instruments; we needed air conditioning and better safety features; and we needed computers to keep track of the hundreds of atoms in the molecules that we model. The importance and the potential of synthetic chemistry is expanding and so are its costs; to do first-rate work in this field in 1985 is very expensive."

The inorganic chemists—Fred C. Anson, John E. Bercaw, Terrence J. Collins, and Harry B. Gray—occupy adequate labs in the Noyes Laboratories, but the organic chemists—Dervan, Dennis A. Dougherty, Grubbs, Robert E. Ireland, and Roberts—needed new labs, and all of these chemists needed new instrumentation. The Beckmans' gift was the answer.

"Arnold Beckman has incredible wisdom," says Dervan. "His love of Caltech, and his wanting to see it stay at the forefront, made him realize the need for an infusion of funds. This was an essential turning point for our future."

Through their initial gift, the Beckmans created a special five-year fund of $460,000 a year to equip the

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Transformation under way

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research groups with the most modern research instruments possible. The faculty members, through their grants, are expected to match this sum each year with an equal amount. The equipment will also be used by synthesis-oriented researchers in chemical engineering.

With phase one of the renovation complete, work is under way on phase two—a suite of offices for the organic chemists on the third floor of the west wing where they can easily meet and share information (particularly important at a time when much is happening at the interface between disciplines), and new laboratories on the second floor of the east wing for two research groups. All the labs are designed by the professors who occupy them—"a once-in-a-lifetime opportunity and a real privilege," says Dervan.

The second and third floor of the west wing, plus installation of the Calder arches and creation of instrument rooms with 1,600 square feet in the structure that they span, as well as landscaping and paving, will be complete by April 14, and all of phase two will be complete by the end of June.

A third phase, involving the first floor of the west wing, will include a laboratory for a new faculty member to be appointed, and new office space for the division. This phase will be finished in approximately two years. The total cost of the laboratory (incorporating 46,100 square feet) will be an estimated $16.5 million, to which the Institute and other sources expect to contribute approximately $10 million.

"When the work is complete, we'll have one of the best synthetic chemistry facilities in the world," says Dervan. "Already we're being sought out by synthetic chemists at other universities who want to see what we've done.

"We'll be able to attract the brightest young minds in the country. We can tackle more ambitious projects than we could have taken on before. Our productivity will increase tremendously.

"We had been working in a restricted mode. Now we won't have to curtail our dreams."

Charles Richter dies at 85

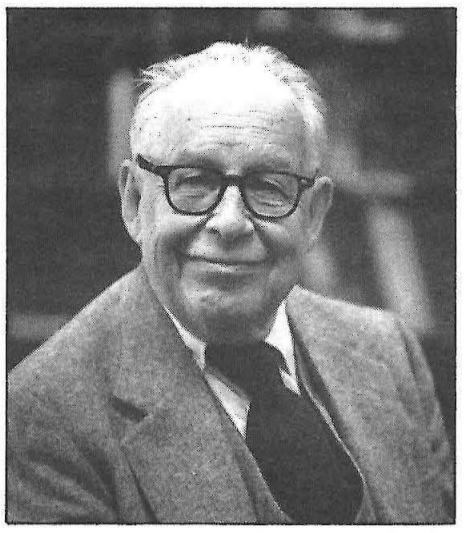
Charles F. Richter, whose name became known worldwide for the earthquake scale he helped to develop, died September 30 in Altadena of coronary artery disease. He was 85.

Richter was born in 1900 on a farm outside of Hamilton, Ohio, and moved with his family to Los Angeles in 1909. He earned his AB degree from Stanford in 1920 and entered Caltech that year to work on a PhD in theoretical physics.

But a year before he was to get his degree, the late Robert A. Millikan, then head of Caltech, asked Richter if he would be interested in an opening for a physicist at the newly established Seismological Laboratory, then managed by the Carnegie Institution of Washington.

Richter accepted the job, and soon discovered the fascination of seismology. His work in 1932, in collaboration with Beno Gutenberg, would make his name a household word for co-creating the Richter scale, the original scale for determining the magnitude of energy released by an earthquake.

Later, several other magnitude scales were designed, and are used today depending on the type of data available, but Richter's name has been popularly applied to all of them.



Richter was probably the only person to keep a seismograph in his living room.

Richter was probably the only person to keep a seismograph in his living room and to drape its records over the backs of armchairs. He maintained that his wife, Lillian, considered the device a good conversation piece. He never minded receiving midnight calls from reporters, providing they were calling for information about a southern California tremor.

Richter was well known to scientists for his book *Elementary Seismology,* used as a text in many countries. He also wrote, with Gutenberg, *The Seismicity of the Earth.*

He played a key role in establishing the Southern California Seismic Array, a seismological reporting network at Caltech that has proven invaluable in the study of earthquakes around the world.

Richter retired in 1970 and remained active with his consulting firm, Lindvall, Richter, and Associates, in Los Angeles. He had been a president of the Seismological Society of America, and was a Fellow of the American Academy of Arts and Sciences and a member of Sigma Xi.

Richter married Lillian Brand of Los Angeles in 1928. She preceded him in death. The couple had no children.

Caltech: Number 1 in producing science PhDs

Caltech placed at the top in a study of the percentage of graduates from colleges and universities who go on to get PhDs in the sciences. In a ranking for students going on for PhDs in all fields, Caltech placed second, 0.7 percent behind Harvey Mudd College.

The study is by the Great Lakes Colleges Association, and is based on a comparison of the number of bachelor's degree recipients who earned PhDs between 1951 and 1980 with the total number of bachelor's degrees awarded between 1946 and 1976 at each of 1,500 institutions.

Caltech sent 39.2 percent of its graduates (1,781) on to get PhDs in sciences, the study showed. It was followed by Harvey Mudd, sending 39.1 percent (247 graduates), by Reed College, sending 20 percent (766 graduates), and by MIT, sending 19.8 percent (5,141 graduates). Princeton, in 23rd place, ranked highest among Ivy League universities with 7.6 percent continuing for PhDs (1,765 graduates).

In an "all fields" category, Caltech sent 40 percent of its graduates (1,818) on for PhDs, compared with front-runner Harvey Mudd with 40.7 percent (257) of its students going on to get PhDs in some field.

Other top-ranking schools in the "all fields" category were Reed College with 25.3 percent (966) going on for PhDs; and MIT and Swarthmore, tied with 20.9 percent (968 and 5,438 students, respectively). Princeton, the top Ivy League performer, finished 21st in the rankings, with 11.7 percent (2,713 students).

The report is available free of charge from the Great Lakes Colleges Association, 220 Collingwood, Suite 240, Ann Arbor, Michigan 48103.

Pamela Pesenti: new Caltech Trustee

Pamela Pesenti of Santa Barbara has been elected a member of the Caltech Board of Trustees. She represents the third generation of the Braun family to serve on the Board. Her father, John G Braun, became a Life Trustee early this year, and her grandfather, Carl F Braun, preceded her on the Board.

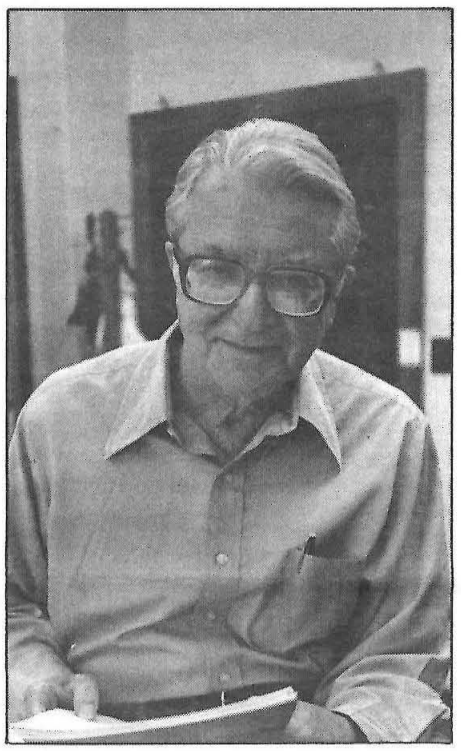
Pesenti, 41, served with the Red Cross in Vietnam after graduating from Briarcliff. She is on the boards of the Hospice Auxiliary of Santa Barbara and the Laguna Blanca School. A private pilot, she is editor of the Santa Barbara Pilots Association publication.

She and her husband, Francis V. Pesenti, have three children, Kimberly, Diana, and Christopher.

"Origin of Life" symposium honors Horowitz

In 1956, Norman H. Horowitz, writing in *Engineering and Science* magazine on the origin of life, noted that a well-known physician and chemist of the 17th century claimed he had "proven" by laboratory experiment a much-respected theory of the time, e.g. that living things can originate spontaneously from nonliving material.

The chemist's experiment demonstrated that if perspiration from a



"Viking cost $1 billion and it only succeeded in answering the question of life on Mars because of Norm."

dirty undergarment is squeezed into a vessel containing wheat, fully formed mice can be produced from the resulting ferment within 21 days.

Horowitz went on to quote Pasteur, who 100 years later noted of this test, "What this proves is that to do experiments is easy; but to do them well is not easy."

In October the Caltech community paid tribute to Horowitz—a man who did his experiments well, and whose results sometimes challenged popular thinking of his colleagues. A two-day Division of Biology symposium on the origin of life on earth featured eight presentations by scientists from research institutions nationwide.

Lee Hood, who succeeded Horowitz as division chairman in 1980, paid tribute in his opening remarks to Horowitz's "achievements both in formulating fundamental theories of evolution and in participating in the search for life on Mars."

Horowitz, whose career spanned nearly 50 years—45 of them at Caltech—earned his PhD at the Institute in 1939. During World War II he joined Nobel laureate George Beadle's research group at Stanford for four years on research on the biochemical role of genes in the red bread mold *Neurospora crassa*.

He returned to Caltech in 1947 as an associate professor with Beadle (who had been appointed chairman of the division) and his research group. Chairman of the division from 1977 to 1980, and executive officer from 1971 through 1976, Horowitz retired as professor of biology, emeritus, in 1982. In 1965, his interest in biochemical evolution took him to JPL for an important phase of his career. There he spent five years as chief of the bioscience section. As a member of the scientific teams for both the Mariner and Viking missions to Mars and on the Viking mission, he and two collaborators designed an experiment capable of detecting any biochemical evidence of life. This test proved highly instructive in its results.

At a banquet at the Athenaeum, two former colleagues-geneticist David Stadler and planetary scientist Bruce Murray-paid tribute to Horowitz for contributions in two phases of his research: his pioneering work on the genetics and evolution of biochemical synthesis, and his role in the search for life on Mars.

Stadler, a geneticist at the University of Washington who worked with Horowitz as a research fellow, hailed the biologist as "a rational man with passion" who believes that if there is a simple explanation for a biochemical phenomenon, that explanation is probably correct.

This attitude, he observed, underlay Horowitz's contributions to the one gene-one enzyme theory (which states that each gene produces one enzyme). Horowitz was responsible for developing critical tests of this theory at a time when many biologists believed that genetic mechanisms were too complex to yield so basic an answer.

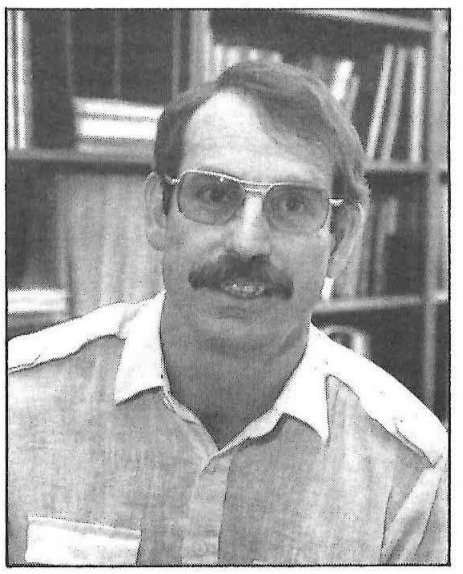
Bruce Murray, professor of planetary science and former director of JPL, noted that Horowitz began the design of an experiment for the Viking-Mars lander at a time when early observations gave much reason to expect the presence of water-based life. Mars's rotation cycle was close to that of the earth, there were light and dark markings that appeared to change seasonally, and the white substance at its poles was suspected of being water.

But early Mariner photos showed huge, very old craters, and geologists concluded that Mars had had no oceans or rivers for billions of years. And the white substance proved to be carbon dioxide frost, not water ice. Horowitz assimilated all this information, Murray noted, and he designed an experiment that relied on biological interaction with carbon dioxide. The other experiments relied on interaction with water and thus they failed to work.

"He came up with the right kind of biochemical test," said Murray. "His experiment has proven essential in establishing that there is no life on Mars. Viking cost $1 billion, and it only succeeded in answering the question of life on the planet because of Norm."

And with that, the audience gave a round of applause for "the rational man" and his contributions to science over 50 years.

Bercaw appointed to Shell Distinguished Chair in Chemistry



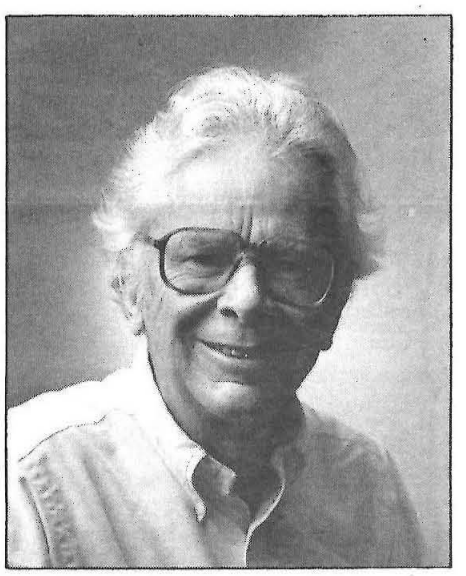
John Bercaw, professor of chemistry, has been appointed to the newly established Shell Distinguished Chair in Chemistry.

The Shell Companies Foundation, Inc. established the Shell Distinguished Chairs program in 1980 to support "promising young scientists with established reputations as outstanding, creative, productive performers with potential for continuing brilliant careers."

Bercaw has concentrated his research in the area of organometallic chemistry, developing ways to synthesize and structurally characterize transition metal compounds containing molecular nitrogen, carbon monoxide, and hydrocarbons. His work with compounds containing molecular nitrogen is relevant to the synthesis of fertilizers both industrially and biologically by nitrogen-fixing bacteria.

Bercaw, who has been a member of Caltech's faculty since 1972, is known as an outstanding educator. He received the Camille and Henry Dreyfus Teacher-Scholar Award in 1977 and a 1980 student-sponsored award for excellence in teaching undergraduates.

Boehm named Valentine Professor of Physics

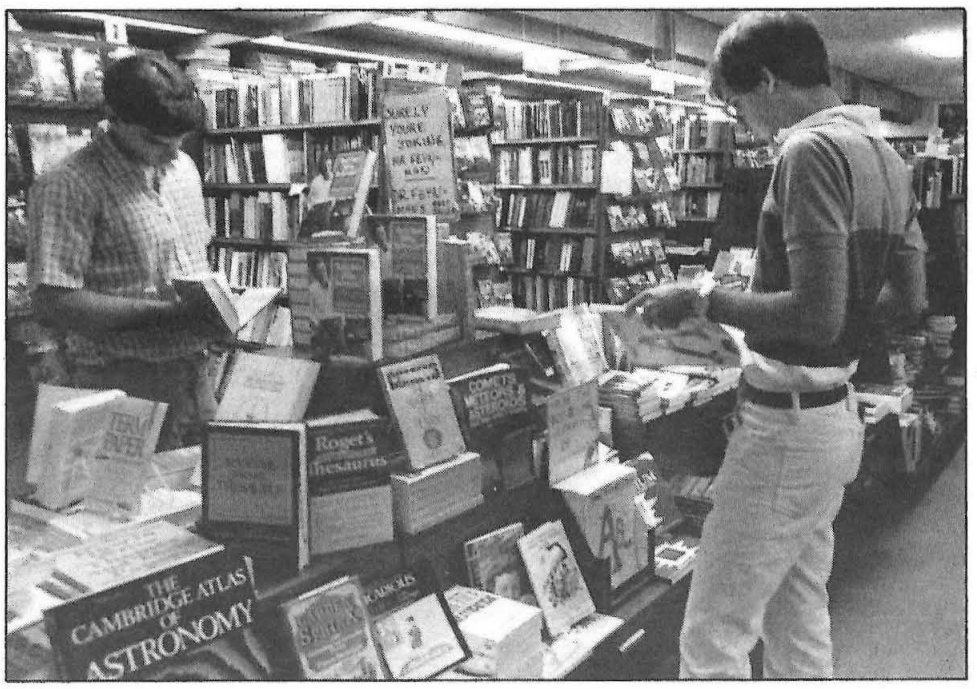


Felix Boehm, professor of physics, has been named the William L. Valentine Professor of Physics. He succeeds Robert Leighton, who retired as Valentine Professor, Emeritus, earlier this year.

Boehm's research has focused on nuclear structure and the nature and behavior of subatomic particles. He is known for his pioneering investigations of symmetries—properties of nature that physicists hold to be unchanging—in nuclear reactions. His experimental studies of parity breakdowns have contributed significantly to major breakthroughs in theoretical physics.

He is currently investigating whether neutrinos have mass and change from one form to another as they fly through space. These questions have major implications for such problems as the evolution of the universe.

Boehm, a native of Switzerland, joined the Caltech faculty in 1953 and was appointed professor of physics in 1961.



Richard Feynman's memoir, Surely You're Joking, Mr. Feynman, *was certain to be a hot seller in the Caltech bookstore. But it could not compete with the most popular item: physics reference books. During the last calendar year, 6,109 of these volumes were sold, followed in popularity by computer science texts, with 3,000 sales.*

Challenge for bookstore: anticipating the Tech taste

By Winifred Veronda

Registration week is in full swing, and freshmen are swarming through the Caltech bookstore, purchasing necessities for the coming term. There is much low-key socializing in the long lines and among the first-time college book buyers, some of it deals with amazement over the cost of a text.

"With these prices, do you drive a Mercedes?" one of the students asks the clerk who is totaling up his bill, missing the point that the bookstore operates on a non-profit basis.

Legends of Caltech draws much attention from the newcomers (43 copies were sold during the first week of classes) and *Surely You're Joking, Mr. Feynman,* is a favorite. But the bulk of the purchases are of textbooks and references.

"Some of the freshmen buy every book in sight if it looks like one they might use," says bookstore manager Lee Foster. "The veteran students are more circumspect."

All of the students are loyal customers. Of the 67-member Western Collegiate Bookstore Association, only Stanford sells a larger volume per student than does Caltech.

Once the rush is over, a few students settle in to become bookstore "groupies." "Every year," says Foster, "four or five of them get to know the staff and find mother or grandmother figures in some of them. They come in almost every day. They browse and they talk to sympathetic listeners. They feel lonely, and the bookstore gives them a place to roost."

Jupiter-Mariner prints, note cards bearing Dalton's atomic elements, and numerous posters of Einstein offer visual testimony that Caltech's is not an average bookstore. So does its sales sheet for the year.

Physics reference books top the list, with 6,109 volumes sold, followed by computer science texts (approximately 3,000 sold). Next comes science fiction, the darling of the Tech student, with 2,400 titles moving out and onto campus over the year. (However, a book on astrology, introduced a few years ago under previous management, generated a backlash in the astronomy department and was soon dropped.)

Students who wish to do so may pick books that broaden their reading interests, Foster points out. "We feel we have a responsibility to offer good reading on subjects the students don't *have* to read about," he says. "We'd like to entice them to explore new areas."

To serve the non-academic tastes of Caltech students—and to predict what will catch their fancy—can be a bit of a challenge. It took no magical insight to discern that a best-seller on campus would be Richard Feynman's whimsical memoir, *Surely You're Joking, Mr. Feynman.* Some 2,000 copies had sold even before the new students arrived this fall to make their own purchases.

But other choices can be more obscure. "Every year, something catches the students' fancy that wouldn't sell well on other campuses," says Foster. One year it was a poster of a nerd with labels pointing out his calculators, slide rules, and pocket pen protectors. A few years ago, a poster showing the empty cockpit of a spacecraft, with all of its dials and switches in magnificent display, was a fast mover. Surrealistic posters by M. C. Escher featuring never-ending waterfalls and staircases continue to be favorites.

Isaac Asimov's *Robots of the Dawn* sold wildly two years ago, and *Godel, Escher, Bach,* by Hofstadter, a non-fiction work that gave an eclectic look at science, art, and music once topped the bookstore best seller list. Dover books—reprints of original works in the sciences that are now out of print—are popular with faculty as well as with students. Technical reference books are purchased throughout the year, as personal and professional libraries are created.

The bookstore sells a lot of candy, gum, and cookies, and—in certain seasons—a significant amount of No-Doz. Sweat shirts and T-shirts with Caltech emblems are purchased in substantial numbers, along with tennis balls, toothpaste and vitamins, stuffed animals, birthday cards, and wrapping paper. A steady stream of Caltech mugs, key rings, license plate frames, and other crested items flow forth to the campus. However, slide rules, once a staple item, have been virtually replaced by mathematics software for personal computers.

But books are at the core of Caltech student purchases—and of the others who frequent the store. In addition to serving students, the bookstore of course meets the needs of faculty and staff, and it does a brisk business with technical staff members at JPL—mainly in science and technological reference books. About five percent of its wares go to other off-campus customers.

Once the books have been purchased, they seldom return.

"Most schools buy back books at least once a year," says Foster. We bring in a wholesaler and do this in June. But if the wholesaler walks out with ten cartons of books, that's a lot. And most of those are fiction."

Six new ACS research grants go to faculty

Six new research grants totaling $324,555 have been awarded to Caltech faculty members and postdoctoral research fellows by the American Cancer Society (ACS). The grants bring the amount of money currently granted to scientists at Caltech by ACS to $557,782.

Faculty members to receive new ACS grants are: John N. Abelson, professor of biology, $110,000 for studies on the mechanism of the action of an RNA splicing enzyme; and Peter B. Dervan, professor of chemistry, $48,870 for research into binding sites of anti-tumor drugs on native DNA.

Recipients of postdoctoral research fellowships are: Nancy Costlow, $41,425; Nalini Narasimhan, $41,500; Stephanie Ruby, $41,260; and John Termini, $41,500.

The grant checks were presented to the recipients at a reception in the Athenaeum by J. Ben Earl (BS '44), a member of the Board of Directors of the ACS Northeast County Unit, and by Kenneth Hanna, president of the unit.

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IRC takes on a new role:

educating executives for spiraling technological change

Caltech's Industrial Relations Center has been undergoing a transformation.

Founded in 1939 with an emphasis on labor and management relations, the Center continued for many years to focus on what had been a critical issue when it was endowed. But as times have changed, a new need became apparent: offering increased educational opportunities to executive leadership and management in a time of rapid technological change.

With this objective, the center, under the guidance of acting director Gaylord E. (Nick) Nichols, Jr., and associate director Valerie Hood, two years ago began developing new programs for technical managers in such areas as the management of technical innovation, production operations, and research and development, as well as engineering management. The center also began to explore additional ways to work with higher level managers and to involve more faculty members in its programs.

"Our overall direction," Nichols explains, "has been to integrate the center more closely with Caltech's central purposes and with the kind of intellectual resources that the Institute has to offer."

"In making the shift," says Hood, "we also believe we've become of greater service to Caltech alumni—many of whom have moved into management positions in major organizations."

As the IRC began to emphasize programs for leaders in technological management, Nichols says that "we quickly learned that not many good programs on the management of technology are being offered. Business schools are involved in teaching their own students, and besides that, the topics we're focusing on are relatively new to academic circles. We've been overwhelmed with the response, and with how far people are willing to come for these new programs. It has become evident that this is an area where Caltech can make a unique contribution to the ongoing education of managers."

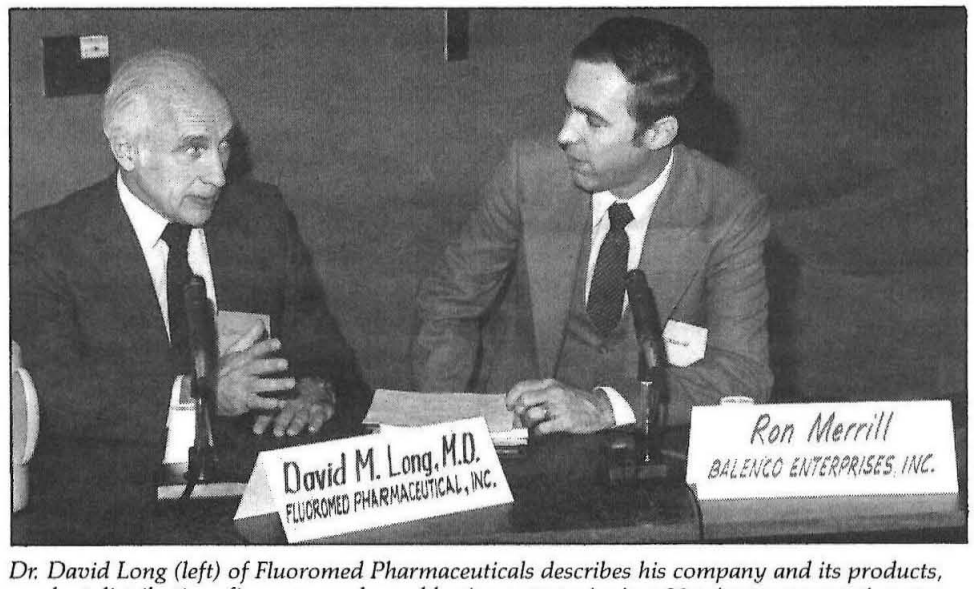
A favorite among the new IRC offerings has been the Caltech/MIT Enterprise Forum, given in collaboration with the MIT Alumni Association. This series brings the head of a technology-based company to present his firm's business plan to a panel of experts who respond with suggestions and criticisms. Each meeting draws about 200 attendees, and a discussion open to everyone concludes each program. The forums have been particularly popular with young alumni who have recently gone into business, and have attracted numerous Caltech students.

Under the guidance of Gaylord E. (Nick) Nichols, Jr., and Valerie Hood (above), the IRC two years ago began developing new programs for technical managers, and exploring ways to work with higher level managers and to involve more faculty members in IRC programs.

Other new programs have ranged from one-day "Executive Briefings" to week-long intensive residential seminars. Briefings have dealt with the management issues in such topics as "Artificial Intelligence and Expert Systems," and "Just-In-Time Manufacturing."

One of the week-long seminar programs, to be offered February 10-14, 1986, will admit 50 executives and will focus on the management of technology and innovation. Faculty members, chosen for their expertise, are drawn from universities throughout the country. A second residential seminar, also offered annually, deals with the effective management of production operations. This program will be given March 16-22, 1986.

Another popular program has been the Executive Forum, which attracts top executives in general corporate management who meet quarterly to discuss important issues related to technology, management, and government. The meetings include a featured speaker, and a technical research report by a Caltech faculty member. Fred Hartley, chairman of Union Oil, and James Hodgson, former ambassador to Japan, were two typical speakers, and one recent program featured three Caltech faculty members who described their involvement in cooperative research relationships between academia and industry.



Dr. David Long (left) of Fluoromed Pharmaceuticals describes his company and its products, product distribution, finances, goals, and business strategies in a 20-minute presentation at a monthly meeting of the Caltech/MIT Enterprise Forum. Ron Merrill moderates. Long's business plan will now become the basis for a session during which a panel discusses the presentation content and offers suggestions. Later, all members of the audience may join in with comments. Forums attract audiences ranging between 200 and 300 persons.

Also of continuing high interest has been the IRC Engineering Management Program, an interrelated set of eight short courses offered to engineers and scientists who want to develop their management skills. The courses focus on the theory and practice of management in a technical setting. Participants who complete approximately 120 class hours over a one-year period receive certification. The IRC has also given programs "on location" at Northrop, TRW, and Rockwell International.

Another offering of the IRC is the Productivity Improvement Group, consisting of representatives of major southern California firms who hold half-day meetings five times a year, generally studying case histories of programs and projects that have been effective in improving productivity, quality, and ultimately, profitability.

Meanwhile, the center continues to offer two- or three-day management seminars—some of them featuring traditional IRC subject matter—on topics ranging from managing technical organizations to successful project management to negotiating, managing time, and building successful work teams.

JPL managers have been frequent participants in programs at the Center; many of them are alumni of the Engineering Management certificate program. Representatives of Industrial Associates member firms have also been frequent participants in IRC programs—particularly those on technology and innovation.

On the average, two events a week are in progress at the IRC, (100 were scheduled during 1985), and 4,000 people enrolled in its programs last

Continued on page 9

Faculty committee recommends changes in admissions, recruitment

Caltech needs to adopt a "more aggressive and innovative approach to admissions recruitment," concludes an 88-page report, the result of a four-month study by a five-member faculty Ad Hoc Committee on Admissions Policies and Procedures.

The committee members—Chairman Bruce Cain, John Bercaw, Glen Cass, Steven Koonin, and David Van Essen—were appointed in February 1985 to make a "comprehensive and critical review of present admissions policies and procedures."

The study was inspired in substantial measure by a decline during 1982-84 in the percent of those admitted to Caltech who actually came (the acceptance rate) and because of comparisons of those rates with those of the major competition—MIT, Harvard, and Stanford. And although the mathematics SAT scores of students admitted to the Institute have remained consistently high, there has been concern among some faculty members and administrators about the intellectual breadth of students accepting Caltech when compared to those accepting its major competitors.

During the 1970s, the report notes, Caltech received acceptances from about 55 percent of the students it admitted, and in 1981 the "yield" rose to 60 percent. But it dropped to 48 percent in 1982 and remained below 50 percent in 1983 (46 percent) and 1984 (45 percent). This year, the yield rose to 52 percent as the Institute admitted 441 students and received 232 acceptances.

Meanwhile, the 1985 Harvard yield was about 70 percent (the highest in the country), Stanford 63, MIT 55, and Occidental 35. In the 1970s, Caltech was chosen by 60 percent of those who were admitted at both the Institute and MIT or Stanford, it was noted, but in the 1980s the Institute only got 40 percent of this group.

The belief on the part of the committee is that the drop in Caltech acceptances from 1982 to 1984 was primarily caused by a sharp increase, during a recession, in tuition and in self help (the amount of money a student must provide through earnings or loans before receiving financial aid) and by a nationwide drop in the size of the college applicant pool. But the occasion seemed right to take an overall look at the Institute's admissions procedures.

In preparing their report, the committee members obtained written and oral "testimony" from faculty members and students at Caltech, and from staff members in admissions, financial aid, and public relations. The committee also visited seven schools (MIT, Stanford, Princeton, Harvard, the University of Michigan, Harvey Mudd, and Occidental) to interview admissions staffs and make comparative studies of admissions procedures, and they reviewed earlier studies of Caltech's own admissions process.

The committee noted that, across the country, there has been a marked decline in the number of high school students scoring above 650 on the verbal SAT (from approximately 54,000 in 1972 to 30,000 in 1982). Meanwhile, there has been very little drop in the number scoring over 750 in mathematics on the SAT.

At Caltech, mathematics SAT scores have remained consistent since 1971, while verbal SAT and English achievement test scores have declined, in line with the national pattern. This means that Caltech is attracting students more narrowly focused on mathematics and the sciences than in the past.

The committee concentrated its recommendations in two areas: procedures for recruiting and admitting, and undergraduate life as it may relate to acceptances.

Recommendations concerning recruiting and admitting included developing a strong fall recruitment program, with visits to college nights and science fairs and to guidance counselors and science teachers at selected high schools, and perhaps special meetings with parents, students, and teachers involving slide shows, talks, and alumni participation. (In the past, recruitment activity had been limited to spring but was expanded to include an additional 11 weeks this fall.)

The committee concentrated its recommendations in two areas: procedures for recruiting and admitting, and undergraduate life as it may relate to acceptances.

Other recommendations involved targeting major high schools throughout the country that are strong in science and mathematics and strengthening the Institute's year-long interaction with those schools; increasing involvement with local high schools—possibly through expanding the Summer Secondary School Science Project and utilizing it more intensively for recruiting; targeting students with specific scientific interests and mailing them brochures on the opportunities for study and research in those options at Caltech (especially important in fields with strong departments but few undergraduate majors); offering prize fellowships to outstanding prospective freshmen and advertising these in science magazines; raising more funds to make possible non-need fellowships, reduced tuition, or reduced self-help levels; and continuing to recruit applicants after they have been accepted, with personal contacts from faculty and alumni.

The committee noted that, according to a survey by the admissions office, both students who accepted Caltech and those who went elsewhere perceived the Division of the Humanities and Social Sciences as being limited in its offerings and the Institute as being small and "lacking diversity."

Of those who enrolled at the Institute, 32 percent mentioned these areas; 51 percent of those who did not enroll mentioned them.

To help deal with these perceptions, the committee recommended a special brochure on the humanities division, its offerings, and the distinction of its faculty; and more emphasis in recruitment literature on the potentials of the Summer Undergraduate Research Fellowships (SURF) program, the intimacy and flexibility at the Institute, the level of cooperation among students, and the honor system.

The committee also recommended considering a shuttle bus service to schools with "cultural and humanistic offerings that Caltech cannot provide" and expanding the 3-2 program as well as exploring whether the program can be extended to include areas other than engineering.

(The 3-2 program enables students to take a prescribed study course at certain liberal arts colleges for three years and then transfer into the third year of an engineering option at the Institute.)

The committee additionally recommended encouraging the newly created faculty ad hoc curriculum committee to explore ways to reduce student pressure and enhance curriculum flexibility. This committee has been appointed to review the content and appropriateness of academic requirements for undergraduates and to make recommendations. Its findings and recommendations are due in February 1986.

Among the procedural recommendations by the committee were: developing a written set of admissions criteria to be revised yearly and to include a personal rating for each applicant's nonacademic interests (with an effort to introduce greater diversity into the entering class without sacrificing academic excellence); creating a new position—dean of admissions and financial aid—who would be responsible for admissions procedures; and giving members of the faculty committee on freshman admissions one term of teaching credit to enhance participation.

Future stories in *Caltech News* will report on how the committee recommendations are implemented through efforts of the faculty and administration.

CARA settles into a new home

The California Association for Research in Astronomy (CARA) has found a new home at 535 South Wilson in a handsome light brown house renovated with funds provided through the generosity of Mr. and Mrs. Gilbert W. Fitzhugh. Mr. Fitzhugh is a Caltech Trustee; Mr. and Mrs. Fitzhugh are Life Members of The Associates and members of the President's Circle. CARA is a non-profit corporation established to oversee construction and operation of the W. M. Keck Observatory. It has a project office at Caltech and a scientific office at the UC Lawrence Berkeley Laboratory.

Richard L. Hayman with Mrs. Robert Henigson (Phyllis), at left. Center: Marvin L. Goldberger with Mrs. Samuel P. Krown (Frances) and Mrs. Lester M. Finkelstein (Irene). Right: George Page, Mr. and Mrs. Francis Ravel (Liliane), Merle Kingsley, and Richard L. Hayman.

Smith predicts dynamic future for U.S. automobile industry

Under a huge canopy beside the Athenaeum patio, 350 members of The Associates of Caltech and their guests gathered in mid-October to hear a talk by Roger B. Smith, chief executive officer and chairman of the board of General Motors Corporation.

The occasion was The Associates' annual black-tie dinner at the Athenaeum, and Smith, who is a Caltech Trustee, spoke on "The Future of the Automobile Industry." Richard L. Hayman, president of The Associates, welcomed the group, and President Marvin L. Goldberger introduced the speaker. (Members of the President's Circle met with Smith earlier in the evening at a private reception, followed by a second reception for all those who attended.) Dancing to the music of the Caltech Jazz Band concluded the evening.

The automobile industry is the driving force in the U.S. economy, and must remain strong if other economic sectors are to thrive, Smith told his audience. He noted that in former days, GM could advertise that it offered "a car for every price and purpose," and could meet its claim with five selections.

But today the market is much more complex, and the industry itself must evolve and make substantial changes to meet the challenges that confront it, Smith stressed. At GM this means integrating the work of three General Motors corporations—GM, GM-Hughes Electronic Corporation, and Electronic Data Systems Corporation—and bringing their efforts together at the beginning of the automotive design process in a fully automated and intensively coordinated way.

The results, said Smith, will "take two years out of the product cycle," and will enable the company to manufacture a more creative and efficient automobile—one in which electronics and computerization play a dramatically expanded role.

The corporation is taking a "whole new look" at the car, and at ways that electronic innovations and computerization can bring about better performance, Smith noted, and he predicted that in the future, virtually all automotive functions will come under computer control.

The same technologies will have a profound effect on the corporation itself. Smith predicted that "our twenty-first century corporation will be computerized, integrated, and paperless."

GM is also taking a new look at its employees as resources. A major goal within the corporation is to "free up the spirit of entrepreneurship within the work force," Smith told his audience. This means looking at people in a new way in terms of their capacity to think creatively and to exercise sound judgment, and giving them the freedom to take more risks and even to fail—in short, allowing them free rein in a process where "only the final results count."

Smith said he feels optimistic about the outcome of the process taking place, noting that an optimist has been characterized as "someone who was chased up a tree by a lion but who enjoys the view."

"We've been tested and we're coming out tougher than ever," he said. "Today's ideas are rapidly becoming tomorrow's prototypes."

Dr. and Mrs. Lew Allen (Barbara), Roger Smith, and Mr. and Mrs. Robert J. Banning (Joan), in the top photograph. Center: Robert Henigson, Mrs. Richard L. Hayman (Dotty), Roger Smith, and Mildred Goldberger. Bottom: Mr. and Mrs. William Mosteller (Valda), Mrs. Ulric Bray (Evelyn), Marvin L. Goldberger, and Mrs. Downie D. Muir III (Joanna).

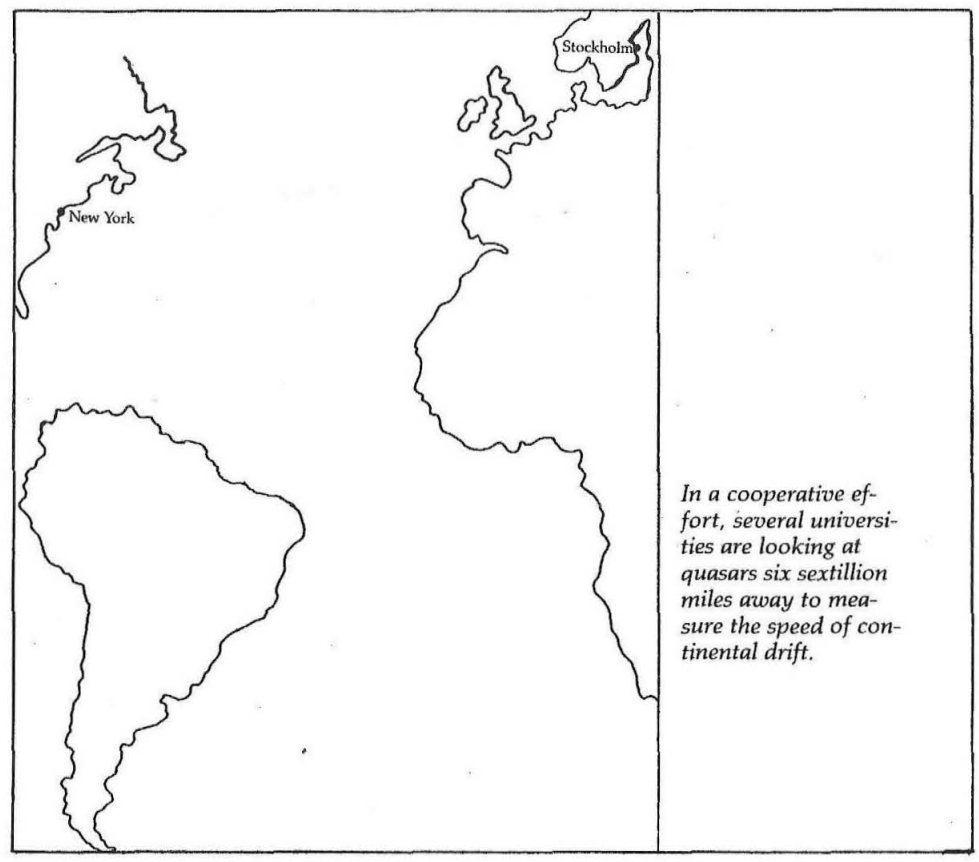
How fast do continents drift? Scientists check with quasars

How rapidly is New York moving away from Stockholm?

In a cooperative project involving Caltech and several other institutions, scientists are looking at quasars 60,000,000,000,000,000,000 (six sextillion) miles away in an attempt to learn the answer.

Their work is making it possible to measure the speed of continental drift —a phenomenon caused by the shifting of vast rigid plates that move slowly on the molten rock beneath them. If scientists can determine whether these plates move smoothly or in spurts, it will help them gain deeper insight into the forces within the earth that propell them.

The project is coordinated by scientists at the Harvard-Smithsonian Center for Astrophysics in Cambridge. There, astrophysicists record how long it takes for radio waves from space to reach antennas in Sweden and the United States. If this distance changes, it means the antennas are no longer the same distance apart. If the measurements are made for a sufficiently long period of time, it becomes possible to know how rapidly the continents are moving apart.



In a cooperative effort, several universities are looking at quasars six sextillion miles away to measure the speed of continental drift.

The arrival of radio waves in the United States is recorded at Caltech's Owens Valley Radio Observatory, at the Haystack Observatory in Westford, Massachusetts, and at Harvard's radio antenna at Fort Davis, Texas.

To ensure that the different telescopes are making their observations at precisely the same time, the recording scientists use hydrogen maser clocks. These are accurate to within a millionth of a second a day, and are adjusted, through a computer calculation, to within a small fraction of a billionth of a second, according to Caltech's Marshall H. Cohen, professor of radio astronomy. Observations at Owens Valley are made several times a year.

Measuring the width of the Atlantic Ocean when both shores are presumably creeping away from each other is not easy—particularly when everything on the earth is probably moving. First of all, it is necessary to find a stationary benchmark to use for the measurements. This is where quasars sextillions of miles away come in handy. They are so far away that their motion is undetectable and thus they can serve as fixed markers.

Radio waves from the quasars are collected by radio telescopes using VLBI (Very Long Baseline Interferometry). This technique involves combining observations from radio telescopes separated by thousands of miles to produce high resolution pictures of a celestial body. The image produced is many times sharper than that gleaned from a single telescope.

Launching a project to study continental drift represents a confidence in the theory that is a far cry from when it was first introduced in 1912. Ridiculed at that time, the theory became respectable in the 1960s and now is scientific doctrine.

Convincing evidence for continental drift was found on the floor of the Atlantic in studies of the magnetism of ancient rocks. As molten rock cools, its magnetic particles point toward the Earth's magnetic poles. When the planet's poles switch places, as they do every few hundred thousand years, a record is left behind in the newly formed rocks.

Evidence of this was discovered by scientists who were studying the magnetic record on the ocean floor on both sides of a mountainous ridge that runs down the middle of the Atlantic. The investigators made a surprising find. Parallel bands of rock were imprinted with magnetic fields pointing first one way and then the other. The scientists deduced that as new sea floor is formed and cools, it preserves the magnetic alignment of the era when it was born. Most geologists believe that the newly formed rock pushes the rest of the ocean floor and the continents away from the ridge.

Over the eons, the continents separate at the rate of an inch or two a year. But whether they creep steadily or jump in spurts is a question that scientists would like to understand. Until now, they have been able to tell how far, and how fast, the continents separate in 1,000 centuries. But anything more precise than that has been just a guess.

Wood from Kenya juniper yields insight into weather history

Wood from a 145-year-old juniper tree from Kenya, near Lake Victoria, is yielding insight into the climate of that region during the tree's life. Lake Victoria, with an area of 70,000 square kilometers, is the lake most often used as an indicator of east African climate. Much of the water feeding the lake comes from rain that falls within its catchment area.

Evidence derived from the wood indicates that, since early in the century, the region around Lake Victoria has become increasingly desert-like—a pattern broken only by several wet years in the early 1960s.

The method used to analyze the wood holds potential for increasing our understanding of weather history in regions for which there are few conventional records, according to Samuel Epstein (the William E. Leonhard Professor of Geology at Caltech) and Caltech research fellow R. V. Krishnamurthy. Their findings appeared in the September issue of *Nature*.

Epstein and Krishnamurthy analyzed wood cellulose from the tree, which grew at an altitude of 2,700 meters in the Mau Narok Forest adjoining Lake Victoria, using a method developed by Epstein in 1977. His research has revealed that tree wood cellulose can be used to determine where a tree gets its water, the prevailing humidity during its growth, and even cycles of drought and rain during its lifetime.

For example, Epstein's studies of trees dating back to the last ice age showed that the climate over ice-free sections of the U. S. at that time appeared to be, on a yearly average, not much colder than today.

The use of trees as recorders of weather conditions is based on the fact that the water taken up by a tree and incorporated into its wood at any point during its lifetime has a unique isotopic "fingerprint" that depends on the temperature in the region at that time.

In their analysis of the Kenyan juniper, Epstein and Krishnamurthy measured the ratio of two isotopes—deuterium and hydrogen—in the cellulose of the wood. This ratio is directly related to the ratio of deuterium and hydrogen in the water used by the tree to build its cellulose molecules. And, in turn, the isotope ratio in the water depends on the temperature at the time the water fell as precipitation.

Water consists not only of hydrogen and oxygen (H_2O) but of a mixture of other types of water molecules. Two of these contain deuterium, a heavier isotope of hydrogen.

(An isotope is an atom that differs from its brethren only in the number of neutrons in its nucleus. For example, hydrogen has only one proton in its nucleus, while deuterium has both a proton and a neutron, making it twice as heavy as the more abundant form of hydrogen.)

Water molecules that contain deuterium usually comprise about 3/100 of one percent of "normal" water and have slightly different physical characteristics than H_2O.

Continued on page 9

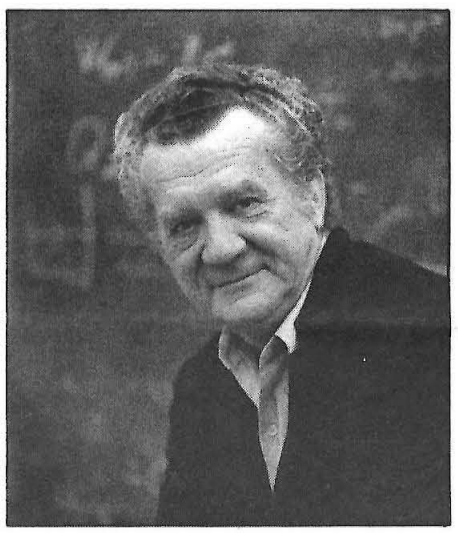
Kenya juniper: its wood holds early climate history

Continued from page 8

The cooler the climate, the less deuterium exists in that region's rainfall.

Epstein explains that this occurs because water molecules that contain deuterium are less volatile than "regular" water. Thus, they are more likely to condense out of a moisture-containing air mass as it is progressively cooled to form rain while traveling from warmer to cooler regions. As a result of this process, the air mass contains a smaller fraction of deuterium-containing water to fall as rain in cooler regions than in warmer regions.

Thus far, wood analyzed by this method has come primarily from



Samuel Epstein

North America and to a lesser degree from Europe—from higher latitudes and cooler climates than the Kenya juniper tree analyzed by Krishnamurthy and Epstein.

The scientists speculate that the beginning of this century may have marked the onset of increasing desert-like conditions in the region around Lake Victoria, but they add that more research will be necessary to verify this.

Results of the Kenya tree analysis correlated reasonably well with what weather data for the area was available through other sources, Epstein said. For instance, the geochemists' data indicated that, during the 1920s, the area was particularly dry, and that around 1961 there was heavy rainfall.

Both of these events are a matter of historical record. Oral history verifies the dry time during the 1920s and independent meteorological data confirms the tree-wood evidence that there were unusually heavy rains in Kenya in 1961—almost three times the average for the earlier corresponding period.

Beginning in 1899, gauge readings from Lake Victoria are available, and the geologists were able to compare these records with weather records from the tree's wood cellulose. Meteorological records have existed for several decades. Before 1899, however, there are no weather records other than those left behind in tree wood.

Readings from the tree indicate that, prior to 1899, wet and dry interludes fluctuated much more dramatically than during recent history.

The study by Krishnamurthy and Epstein demonstrates the potential for using isotope records in trees as sensitive indicators of ancient weather history in equatorial regions—parts of the world for which few conventional records exist and for which virtually no wood isotopic analysis has been done.

Analyses of dendrochronologically- and carbon 14-dated wood from these regions should reveal long and short weather cycles in local climates, and also allow important tropical phenomena that are associated with equatorial belts—monsoon systems, for example—to be better understood.

IRC takes on new role

Continued from page 5

year. Most of these met for course work and meetings at the center headquarters, but week-long forum participants utilize campus lecture rooms, take their meals at the Athenaeum, and stay at a local hotel.

The center's transformation has extended to the colonial structure on Hill Avenue that it has occupied for 23 years. The house has been repainted, its air conditioning rehabilitated, and its interior redecorated in keeping with the integrity of the original design.

"We wanted to create a comfortable, attractive environment that would still be practical for seminars," says Hood, "one that would promote interaction among participants. Many of the people who have come for programs tell us how much they enjoy it."

Also looking new is the center's management library, a part of Millikan Library, which now provides extensive literature on management, economics, technology, and human resources—with new materials stressing the management of technology. Reference services through computer data banks are provided by the staff.

All of this makes for an exciting environment as the IRC helps managers keep pace with the complex changes that increasingly confront them in their professional lives.

FACULTY HONORS

German society honors Anderson for research

Don L. Anderson (professor of geophysics and director of the Caltech Seismological Laboratory) has been awarded the Emil Weichert Medal, the highest honor of the German Geophysical Society, for his research and theories on the structure and formation of the earth, moon, and planets.

Among Anderson's recent research projects have been contributions to the development of seismic tomography—or the production of three-dimensional pictures of the earth's interior by computer synthesis of seismic waves. He has also used seismic waves to understand the nature and circulation of the earth's mantle.

Liepmann awarded honorary doctorate

Hans W. Liepmann, Theodore von Karman Professor of Aeronautics, Emeritus, has been awarded an honorary Doctor of Engineering degree from the Rhine-Westphalia Technical University at Aachen, West Germany. He received the doctorate in a formal presentation ceremony on November 15.

Stone given NASA Distinguished Service Medal

Edward Stone, professor of physics and chairman of the Division of Physics, Mathematics and Astronomy, has been awarded NASA's Distinguished Public Service Medal for 1985, in recognition of his "extraordinary record of service to NASA and, in particular, his ability to convey the excitement of space science to both the public and the scientific community."

He received the medal on October 8 at the 1985 NASA Headquarters Annual Honor Awards Ceremony in Washington, D. C.

Stone has worked with NASA as a consultant, principal investigator for instruments on NASA missions, and project scientist for the Voyager missions to Jupiter, Saturn, Uranus, and Neptune. He has received two previous NASA awards—the Medal for Exceptional Scientific Achievement in 1980 and the Distinguished Service Medal in 1981.

Sternberg receives prestigious applied mechanics honor

Eli Sternberg, professor of mechanics, has received the nation's most prestigious award in applied mechanics—the 1985 Timoshenko Medal of the American Society of Mechanical Engineers—at the ASME winter annual meeting in Miami Beach. He was selected this year's recipient "in recognition of the significance of his contributions to the foundations and applications of the theory of elasticity."

Elasticity theory is concerned with the analysis of stresses and deformations in elastic materials. It is an essential tool for the safe design of buildings, bridges, airplanes, and machines.

Wasserburg recipient of AGU medal

Gerald J. Wasserburg (the John D. MacArthur Professor of Geology and Geophysics) has been awarded the first Harry H. Hess Medal of the American Geophysical Union for his "outstanding achievements in research in the constitution and evolution of the earth and sister planets."

The AGU is a scientific society with a worldwide membership of 17,000 researchers, teachers, and administrators. The medal is named in honor of the late Princeton geophysicist Harry H. Hess.

Wasserburg has specialized in analyses of interplanetary dust, meteorites, moon rocks, and terrestrial materials to study the evolution of the earth, the moon, and the solar system.

Caltech to honor Linus Pauling on 85th birthday

"A Salute to Linus Pauling," a one-day program on the 85th birthday of Linus Pauling, Caltech professor of chemistry, emeritus, and two-time recipient of the Nobel Prize, will be held on February 28, 1986. Reception and dinner in the Athenaeum will conclude the day. Registration may be made through Caltech, mail code 1-36, Pasadena, California 91125, Attention: Linda McManus.

[THE WAY IT WAS]

1925

Caltech students present their annual "leg show" at the Raymond Theater —a benefit for injured athletes of the institution. "The beauty chorus, attired in gay as well as scanty costumes, was received with a storm of applause," reports the *Los Angeles Times* on February 25. "Each was wearing his mother's underskirt and a pair of 'ice man' shoes."

Caltech announces plans to construct dormitories and dining halls (to be known as the student union), a campanile, and a faculty club house (to be called the Athenaeum)—all to cost $4 million. (Pasadena *Star News*, March 30).

A seismological laboratory in the San Rafael Hills, west of the Arroyo Seco and north of Colorado, will be constructed on the three-acre Mason estate for the joint use of Caltech and the Mount Wilson Observatory. (*Star News*, June 2).

Robert Millikan announces that Dean John P. Buwalda has accepted the chair of geology at Caltech and will direct programs of the new department of geology to get underway the next year. (*Star News*, June 13).

Occidental defeats Tech 10-0 in the "big game of the year" in the Rose Bowl. (*Star-News*, November 9).

Millikan announces the discovery of rays "100 times more intense than X-rays and capable of penetrating a wall of lead six feet thick . . . ." The cosmic rays were discovered at a research site at Muir Lake near the peak of Mount Whitney. (Pasadena *Post*, November 25).

1935

A "foolproof" fence has been erected around the water in front of the Bridge physics laboratory, the traditional disciplining pool for freshmen. According to a "semi-official explanation," the fence was put up to keep out "foreign matter such as leaves, dirt, sand, and rocks"—but unofficially, say the seniors, it's another faculty move against hazing. (*Star News*, April 19).

Caltech and Mount Wilson astronomer Edwin Hubble are awarded the Barnard Gold Medal of the National Academy of Science, given every five years for the most outstanding work in physics or astrophysics in any country. (*Star News*, June 13).

In an article in the *California Tech*, Coach W. L. "Fox" Stanton urges the United States to withdraw from the 1936 Olympic games in Germany because of the Hitler regime's persecution of Jews. ". . . 35,000 Jewish athletes in Germany . . . and only four admitted to special training groups sponsored by the government," Stanton laments.

A solar telescope designed to be the most powerful in the world is under construction at Caltech and will be installed in the astrophysics laboratory on campus. (*Los Angeles Times*, February 11).

1975

James D. Gunn (PhD '66), professor of astronomy, is one of a team of astronomers who conclude that the universe has no more than a tenth of the mass needed to close it, and that it will expand forever. (February *Caltech News*).

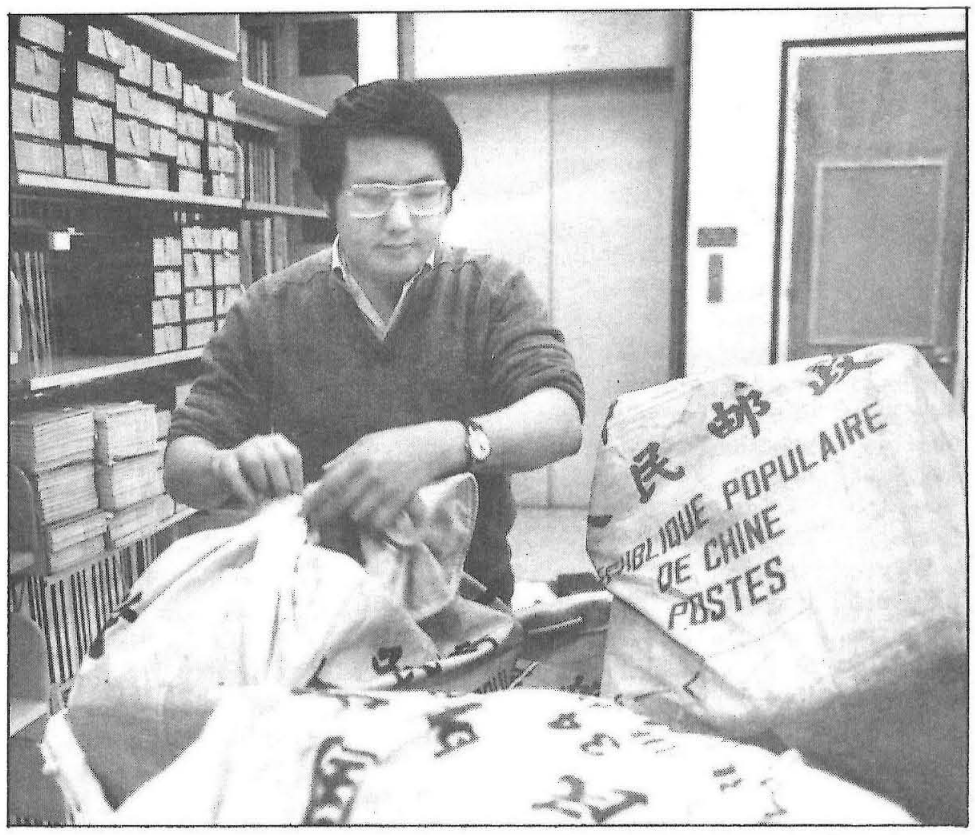
A powerful X-ray source in Cygnus X-1, a double star system in the Milky Way Galaxy, is a black hole, according to Caltech professor of theoretical physics Kip Thorne and his research colleagues. Thus far, black holes have existed only as a theoretical concept. (April *Caltech News*).

Driving a modified Datsun 610 sedan, a Caltech team takes first place in Class 1 in the Gasoline-Powered Reduced Emissions Devices Rally, popularly called the clean-air car rally. The car was driven (for three hours through San Francisco) by senior David P. Beatty, junior Edward J. O'Rourke, and sophomore Paul D. Shubert. (June *Caltech News*).

Philip Engelauf and his pet 210-pound lioness, Duchess, make the cover of the *Los Angeles Times* when Duchess visits Ricardo Gomez's freshman physics class . . . and David Smith, associate professor of English and director of galleries, dons Middle Eastern garb to ride a camel provided by students for his retirement party as master of student houses. (July *Caltech News*).

Harry B. Gray, professor of chemistry, gives the commencement address, admonishing students, "If you haven't yet found what you want to do, then keep on seeking it. And when you find it, don't let anyone talk you out of it." Ceremonies unofficially end with an off-stage recording of Wagner's "Ride of the Valkyries." (July *Caltech News*).

Continued in column 3



The core of Caltech's Chinese collection arrived from Peking University in 1982 through an arrangement made between Caltech and that institution. The collection currently includes about 6,000 volumes and is on the third floor of Millikan Library. Here the books are inspected by James Lee, now assistant professor of history.

Chinese-language book collection: users sample 6,000 volumes

During the past three years the Institute has made an unusual acquisition of 6,000 Chinese language books on Chinese history, philosophy, literature, and social science.

Known as the Chinese Collection, the acquisition contains a large number of important Chinese classics in several large sets—some with as many as 120 volumes—as well as many individual books.

The initial acquisition arrived from Peking University in 1982 under an arrangement made by Caltech and that institution. Caltech received more than 2,000 selected titles—many of them out of print—in exchange for library equipment and English language books.

Since that time, the collection has been supplemented by additional exchanges from Peking University and by substantial donations from individuals in this country and from China and Hong Kong. Other materials (less than half the total) have also been purchased. Thus the library has been able to build a core Chinese collection for very low cost. The entire collection will form part of the Caltech libraries data base and will be available by author and title entries and by standard Library of Congress subject headings.

According to Janet Jenks, head of the Humanities and Social Sciences library where the collection is shelved, the books are being used regularly by members of the Caltech Chinese community. An astronomy professor frequently dips into the history books, a history professor uses volumes for research, and students frequently read fiction works, as well as academic titles. The collection is especially popular among students of Asian origin, who now comprise about one-fifth of the Caltech graduate and undergraduate population, according to Jenks.

[The Way It Was]

Continued from column 2

Two alumni and one former faculty member receive Nobel Prizes from the Swedish Royal Academy of Science: James Rainwater (BS '39), Howard Temin (PhD '60), and Renato Dulbecco, a Caltech faculty member from 1949 to 1963. (December *Caltech News*).

Cambridge Astrophysicist Stephen Hawking, internationally recognized for his research concerning Einstein's general theory of relativity, and severely crippled by a rare degenerative motor disease, spends a year at the Institute as a Fairchild Scholar and shares his philosophies in *Caltech News*: "I would be sorry if we were to find the ultimate answers to the universe. As human beings, we need the quest." (December *Caltech News*).

Alumni Fund area chairmen announced

Alumni Fund area chairmen for 1985-86 are listed below, in order of their geographic regions—Region 1: George E. Mann, BS '37, MS '38, Alhambra/South Pasadena; Michael Burnett, MS '72, PhD '80, San Marino; Robert Brydolf, BS '44, East Pasadena; David B. Ritchie, BS '80, Arroyo; Raymond L. Heacock, BS '52, MS '53, JPL.

John H. Keyser, Jr., BS '40, La Canada-Crescenta Valley; Thomas V. Davis, BS '38, MS '47, Eng '48, Altadena; Charles M. Finley, BS '57, Arcadia-Sierra Madre.

Region 2: Calvin E. Kempton, BS '46, Laguna Beach; Robert W. Wayman, BS '40, South Laguna Beach; Sanford S. Sweet, BS '51, Huntington Beach; Dwight L. Carey, BS '72, Fullerton; Terry Simpson, BS '65, Anaheim-Orange; Mark M. Morrisset, BS '81, Newport Beach; Jerry F. L. Aldrich, MS '47, Irvine-El Toro; Paul W. Tuinenga, BS '77, MS '78, Santa Ana; George B. Harr, BS '41, Long Beach; John E. Pollet, BS '56, Artesia-Westminster; William H. Bond, BS '44, Downey-Whittier; David B. McCarroll, BS '66, Covina; Donald Stewart, Jr., BS '47, Pomona-Claremont; Joseph Sheffet, BS '32, MS '33, Desert; Charles E. White, BS '34, Riverside-San Bernardino.

Region 3: Reinaldo V. Gutierrez, BS '54, Palos Verdes; Paul Dergarabedian, PhD '52, Aerospace Corporation; Patricia J. Stoddard, BS '82, Torrance; Peter Gottlieb, BS '56, TRW; Gene H. Beisman, BS '58, Santa Monica; Jon K. Evans, BS '65, Los Angeles-Brentwood; Kiet A. Mai, MS '84, Los Angeles-Hollywood; Arthur L. Rubin, PhD '78, Los Angeles-Downtown.

Region 4: Raymond G. Richards, BS '40, East San Fernando Valley; David A. Resnik, BS '60, South San Fernando Valley; G. Richard Morgan, BS '49, West San Fernando Valley; George A. Watts, Eng '62, North San Fernando Valley; Leslie A. Paxton-Rousseau, BS '79, Ventura-Thousand Oaks; Tad E. Reynales, BS '72, Santa Barbara; Pierre St. Amand, MS '51, PhD '53, Bakersfield; Hampton E. Mulligan, Eng '54, San Luis Obispo.

Region 5: Donald L. Cleveland, BS '34, Monterey-Santa Cruz; Robert Talbot, BS '57, San Jose; Howard Oringer, MS '63, Santa Clara; Boyd P. Israelsen, BS '52, MS '53, Los Altos; Charles H. Ng, BS '82, MS '83, Sunnyvale; Donal B. Duncan, BS '45, PhD '51, Palo Alto; J. David Kinkade, BS '67, Menlo Park; E. E. Gullekson, MS '39, San Mateo; Robert A. Bell, BS '72, MS '72, San Francisco.

Region 6: Robert M. Sherwin, BS '43, MS '50, PhD '52, Marin County; Perry H. Brown, BS '39, Napa-North Coast; Ben G. Burke, BS '61, MS '62, North East Bay; Harold Forsen, BS '58, MS '59, Contra Costa; David C. Oakley, BS '50, MS '52, PhD '55, Livermore; James T. Kenney, Jr., BS '49, MS '50, Sacramento, Clinton L. West, BS '57, Sierra.

Region 7: Dwain Bowen, BS '42, MS '46, Rancho Santa Fe; Hector A. Schetne, BS '48, North San Diego County; Philip J. Lowry, Ex '71, San Diego; Mabry Van Reed, BS '35, La Jolla; Dwain Bowen, BS '42, MS '46, South Bay-San Diego; Douglas E. Brandt, BS '78, Hawaii; Charles W. Pearson, BS '42, Phoenix; Edward A. Hayes, BS '33, Tucson; Clay T. Smith, BS '38, MS '40, PhD '43, Albuquerque; Adam F. Schuch, PhD '50, Los Alamos.

Region 8: John J. Deniston, BS '47, Corvallis-Eugene; Gilbert B. Peppin, BS '53, East Seattle; Frederick W. Thiele, BS '41, West Seattle; Craig Zumbrunnen, MS '68, University of Washington; Tak Sing Lo, BS '83, North Sound-Alaska; John R. Thomas, BS '57, Boeing; Frederick M. Mann, PhD '75, East Washington-Oregon; Donald M. Lilienthal, BS '48, "Big Sky"; John C. Alleman, BS '63, Utah; Harold Leinbach, MS '50, Boulder; Timothy C. Groat, BS '79, Denver; J. Greg Bourque, BS '68, South Colorado.

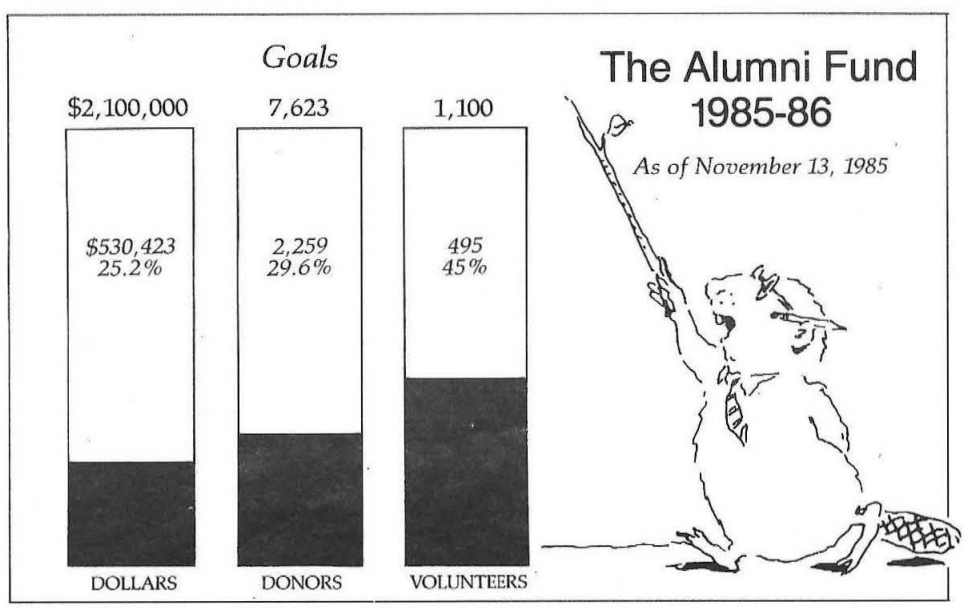
Region 9: David B. Atkinson, BS '75, Oklahoma-Arkansas; Richard W. Forester, MS '71, PhD '75, Dallas-Fort Worth; James R. Lloyd, BS '56, MS '57, PhD '61, Houston; Alvin L. Fehrman, MS '55, Eng '55, North Florida; Arthur S. Bolles, BS '47, South Florida; Henry A. Corriher, Jr., MS '50, Georgia; William V. Wright, BS '51, PhD '55, North Carolina.

Region 10: Raymond R. Cosner, PhD '76, Missouri-South Illinois; George R. Dubes, PhD '53, Central Plains States; Benjamin G. Cooper, BS '67, Minnesota; Erik W. Gunderson, BS '81, Wisconsin; Roger Brandt, BS '42, Northeast Chicago; Robert D. Levin, BS '65, Southwest Chicago; Robert E. Johnson, MS '74, Champaign-Urbana; James H. Koontz, BS '56, Indiana; Michael J. Otto, MS '80, West Michigan; Dale J. Meier, BS '47, MS '48, East Michigan; David B. Peisner, BS '74, Cleveland; John S. Jackson, Jr., BS '45, MS '54, Cincinnati; J. L. Swedlow, BS '57, PhD '65, West Pennsylvania.

Region 11: Frederick C. Brunner, BS '40, MS '41, Baltimore; Scott W. Jennings, BS '69, Washington, D.C.-West Maryland; Philip D. Harriman, BS '59, Washington, D.C.-East Maryland; Lawrence C. Baldwin, Eng '55, Northwest Virginia; Raymond Cromley, BS '33, Northeast Virginia; Capt. Paul W. Utterback, Eng '60, South Virginia; William M. Hardam, PhD '65, Wilmington-Philadelphia; A. Frederick Thompson, MS '65, PhD '68, East Pennsylvania; John Walden, MS '59, Princeton; Alfred B. Brown, Jr., MS '47, PhD '50, Northern New Jersey; Kenneth F. Drake, Jr., BS '71, Central New Jersey.

Region 12: Andrew H. Lo, BS '72, Manhattan; K. Norman Easley, MS '60, Long Island; Donald P. Clausing, MS '62, PhD '66, West New York; Patrick M. Frantz, MS '80, Central New York; Robert N. Hall, BS '42, PhD '48, East New York; Bernard M. Malofsky, BS '59, Connecticut; Norma J. Ofsthun, BS '81, Southeast Massachusetts; Norton Starr, Ex '58, Massachusetts-Rhode Island; Walter R. Larson, BS '40, Upper New England; Donald L. Strange, PhD '72, East Canada.

Region 13: Everett W. Van Ness, BS '42, Europe; Shaukvat Feroz, MS '66, Middle East and Africa.



Glee Clubs to present holiday festival

The Caltech Glee Clubs will present a program of festive holiday music at 8 p.m. in Dabney Lounge on December 6 and at 3 and 8 p.m. on December 7. Traditional Christmas and Hanukkah selections will be featured. Tickets are $5.

Alumni invited to join March trip to Russia

Alumni and other friends of Caltech are invited to become participants in a trip to Russia and Copenhagen March 21-31 with George Cheron, second-year Russian teacher at the Institute.

Cost is $1,349 (including hotels, three meals a day, city tours with English-speaking guides, and transfers between cities) plus $25 for a Soviet visa.

Included on the itinerary will be four days in Moscow, with an excursion to the Monastery of Zagorsk, and visits to the Bolshoi Theater, the Tretyakov Art Gallery, Moscow University, the GUM department store, and other sites; three days in Leningrad, with visits to the Hermitage, St. Isaac Cathedral and the House of Peter the Great, and other attractions; and a day in Copenhagen.

More information is available from George Cheron, Division of the Humanities and Social Sciences, 101-40, Caltech, Pasadena, California 91125. Deadline for payment is January 2, 1986.

Homecoming Sports Day

Alumni are invited to join students and faculty for Homecoming Sports Day on the campus, Sunday, February 16. Individual sports events during the morning, a buffet luncheon under tents in front of the gymnasium, and a challenge softball game and challenge triathlon during the afternoon are planned. More details will be in the February *Caltech News*.

Alumni Activities

For more information about any event listed below, please call Janet Davis, executive director of the Alumni Association, at (818) 356-6594.

JANUARY 1, 1986. *Rose Parade program*, including breakfast, parade seats, luncheon buffet in the Athenaeum, and box lunches with bus transportation for those with tickets to the Rose Bowl game. Open to Association members and their guests. Call the Alumni Association for reservations.

JANUARY 30—FEBRUARY 2, 1986. *Death Valley trip* led by Robert P. Sharp (the Sharp Professor of Geology, emeritus). The trip is full. A waiting list is being maintained for a second trip to Death Valley planned for April 9-12, 1986.

MARCH 8, 1986. *Houston chapter meeting* including luncheon and speaker. Information will be mailed to Houston area alumni in January.

MARCH 14 and MARCH 21, 1986. Wine tastings at 7 p.m. in the Athenaeum featuring a selection of more than 16 vintage wines from four major wine-producing regions of California—including Napa, Sonoma, Santa Barbara, and Monterey. Open to Alumni Association members and their guests. Cost: $20 per person. Reservations required.

MAY 17, 1986. *Seminar Day* on the Caltech campus, featuring faculty research seminars and exhibits. Open to all alumni, their families, and guests.

JUNE 13, 1986. *Commencement* on the Caltech campus.

JUNE 19, 1986. *Alumni Association annual meeting and dinner* honoring new honorary alumni and officers, at the Athenaeum.

Class Reunions

These dates have been selected for 1986 class reunions:

APRIL 19, 1986—Classes of 1951 and 1956.

APRIL 26, 1986—Classes of 1941 and 1946.

MAY 2, 1986—Class of 1971.

MAY 9, 1986—Class of 1966.

MAY 16 and 17, 1986—Class of 1961, a 25th reunion that traditionally is held on Seminar Day weekend.

MAY 30, 1986—Class of 1976.

JUNE 7, 1986—Half-Century Club luncheon in the Athenaeum. Additional activities will be announced for the class of 1936 and its 50th reunion celebration.

JUNE 13, 1986—Class of 1981.

ALUMNI ASSOCIATION FINANCIAL STATEMENTS

ALUMNI ASSOCIATION
CALIFORNIA INSTITUTE OF TECHNOLOGY
Pasadena, California

BALANCE SHEET

June 30, 1985

ASSETS

Cash on Hand and in Bank	$ 11,582
Investments:	
C.I.T. Consolidated Portfolio	837,854
Money Market Funds	127,237
Investment Income Receivable	15,000
Other Receivables	8,935
Advance for Landscaping Costs	4,818
Postage Deposit and Other Deferred Expenses	1,184
TOTAL ASSETS	$1,006,610

LIABILITIES, RESERVES AND SURPLUS

Accounts Payable	$ 38,490
Deferred Income:	
Annual Membership Dues Paid in Advance	5,615
Investment Income from C.I.T. Consolidated Portfolio	41,000
Life Membership Reserve	842,339
Reserve for Directory	23,242
Reserve for Student Support and Educational Programs	22,762
Surplus	33,162
TOTAL LIABILITIES, RESERVES AND SURPLUS	$1,006,610

STATEMENT OF INCOME, EXPENSES AND SURPLUS
For the Year Ended June 30, 1985

INCOME

Dues of Annual Members	$ 66,897
Investment Income:	
C.I.T. Consolidated Portfolio	56,082
Money Market Funds	11,738
Net Income from Publication of *Legends of Caltech*	8,978
TOTAL INCOME	$143,695

EXPENSES

Publications	$ 15,934
Net Expenses of Annual Seminar and Other Programs	14,155
Net Expenses of Class Reunions	8,692
Net Expenses of Chapter Meetings	3,589
Student Support	20,381
Undergraduate Admissions Support	1,285
Administration	50,823
Membership	10,788
Allocation for Reserve for Directory	22,000
Allocation for Reserve for Student Support and Educational Programs	8,335
TOTAL EXPENSES	$155,982
EXCESS OF INCOME (EXPENSES)	$ (12,287)
Surplus, June 30, 1984	45,449
Surplus, June 30, 1985	$ 33,162

AUDITOR'S REPORT

Board of Directors
Alumni Association
California Institute of Technology

I have examined the balance sheet of the Alumni Association, California Institute of Technology as of June 30, 1985, and the related statement of income, expenses and surplus for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as I considered necessary in the circumstances.

In my opinion, the financial statements referred to above present fairly the financial position of the Alumni Association, California Institute of Technology at June 30, 1985, and the results of its operations for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Calvin A. Ames
Certified Public Accountant

October 24, 1985

Area Luncheons

Santa Cruz area meetings. Second Thursday of each month, 12 noon, Hollins House on the Pasatiempo Golf Course. Contact Don Cleveland (408) 429-9322 for reservations.

San Francisco Peninsula meetings. Third Thursday of each month, 12 noon, Ming's Restaurant in Palo Alto. Contact Hugh Dubb (415) 362-3800 or (408) 287-8278 for reservations.

Caltech campus wins national honor for beauty

The Caltech campus has won the highest honor given in the national competition of the Grounds Maintenance Awards Program sponsored by the Professional Grounds Management Society. Caltech won the Grand Award over all other entries in the college, university, and school category. This was the first time the Institute entered the competition.

For some years, Caltech has boasted a well-kept, park-like campus that has been widely admired. But what gave the crucial boost that brought the Grand Award home were brilliant flowers that appeared last March in beds and planters all over campus.

Efforts toward eventually winning the award had been under way for several years as the grounds operations system was restructured for greater speed and efficiency and conscious efforts were made to bring the grounds to their peak in attractiveness. Ken Schmitz, former superintendent of grounds who left Caltech for Berkeley just before the award came through, and George Mecado, the current grounds supervisor, led in the beautification operation.

Meanwhile, Clarence Mendelson, a horticulturist with many years of experience, joined the grounds crew, and when the decision was made to plant flowers at strategic locations on campus, his expertise was called on. Plans were created for flower beds in 17 locations, and the coloring of campus began with commencement as the immediate goal.

Creating a campus filled with blossoms was not without its problems, such as off-campus passersby who helped themselved to bedding plants already in the ground. For instance, the gardners twice spotted a gray-haired lady running away from the Athenaeum beds clutching a bouquet of just-uprooted flowers.

But by May and June, the plants were well-entrenched, and the campus was bursting with beds of ageratums, lobelias, impatiens, alyssum, begonias, marigolds, dusty millers, petunias, daisies, and snapdragons. Gardeners reported that a number of people of all ages stopped to say how much they like the flowers.

After the success of the trial spring program have come plans for year-round plantings. Planning for fall was under way as this article was written, and the number of flower beds is being expanded to 36. The gardeners promise some surprises for the Christmas season.

Help us find these lost alumni

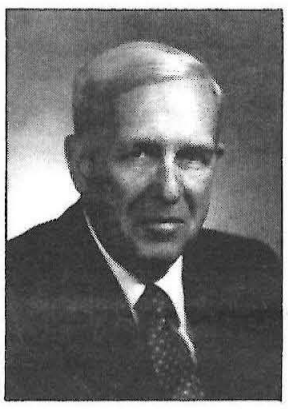
Caltech has no record of the addresses of these alumni. If you know the current locations of any of them, please relay the information to the Alumni Office.

Blake Beatty BS '22
Robert J. Hammond BS '23
Hubert Woods BS '23
Warren B. Leavitt BS '24
Mitchell C. Lukens BS '24
Willard H. Tracy BS '24
Carrol M. Wakeman EX '24
William H. Allen BS '25
Wilfred G. Thompson BS '25
Conrad J. Waller BS '25
Hung Y. Chang BS '26
Riley L. Gilbert EX '26
Nathan F. Scudder BS '26
Frank F. Peterson BS '27
Francis C. Martin MS '28
John D. Elder PH '29
Reymond J. Kircher BS '29
Kam H. Lau BS '29
Julius Nelson BS '29
True W. Robinson BS '29
Willem Uyterhoeven PH '29
Donald K. Allison BS '30
William Kelley BS '30
Frank N. Moyers BS '30
Jack D. Pritchett BS '30
Jack H. Amann BS '31
William T. West BS '31
Carl K. Yoshioka BS '31
William A. Adams BS '32
Thomas C. Burk EX '33
Luis E. Kemnitzer MS '33
William A. Larsen MS '33
Edwin B. Michal MS '33
Winston H. Rice BS '33
Maple D. Shappell PH '33
Warren H. Smith BS '33
Edward A. Bertram MS '35
Seibert Q. Duntley MS '35
M. Harrison Evans BS '35
Paul F. Genachte PH '35
Fun-Chang Huang MS '35
Harry M. Koons, Jr. BS '35
Russel L. Maycock EX '35
Dagoberto Rivas BS '35
Neil W. Snow EX '35
Howard F. Hamacher BS '36
Larry L. Young MS '36
Thomas R. Burnight BS '37
Ju-Yung Cheng MS '37
Roderic C. Davis MS '37
Anthony Easton MS '37
Paul F. Jones MS '37
Thomas N. Shaw BS '37
Ellis W. Shuler MS '37
Meyer J. Test BS '37
Clark H. Wiget BS '37
Hyman D. Goodman MS '38
Arthur G. Gross BS '38
Arnulfo G. Gutierrez MS '38
Frank C. Lowe BS '38
Noble R. Maines EX '38
William Rhett BS '38
Chi-Cheng Tsao BS '38
James W. Watson BS '38
Andrew Frejer BS '39
Winthrop G. Jones MS '39
Spencer W. Oakley BS '39
Lester G. Zukerman BS '39
George A. Brettell, Jr. MS '40
Arthur M. Compton BS '40
Rear Adm. William E. Gentner MS '40
Arville C. Gibson MS '40
William J. Green MS '40
William J. Howell MS '40
Ruhollah Y. Karubian MS '40
Adolph Lovoff MS '40
Luigi Menis BS '40
Norman L. Peterson MS '40
Robert A. Phillips BS '40
Sabin A. Ustel MS '40
Tsung-Su Wang MS '40
James M. Watkins, Jr. BS '40
Norman Z. Alcock MS '41
Glenn W. Billman BS '41
Hugh Bradner PH '41
Morris R. Clark BS '41
Samuel J. Easley MS '41
John M. Feeley BS '41
Glyn Frank-Jones BS '41
Robert C. Geitz BS '41
Donald L. Harvey BS '41
George I. Reimers BS '41
Frederick G. Robinson BS '41
William Schubert BS '41
Stanley E. Sohler BS '41
C. B. Stadum BS '41
Clyde T. Standridge MS '41
Robert L. Weaver MS '41
Colman Zola MS '41
Mehmet F. Bebe EN '42
Orhan M. Emre EN '42
Frank I. Given BS '42
Chong-Hu Go MS '42
Victor H. Martinez MS '42
Russell Rhyne BS '42
John Spizizen PH '42
Kenneth E. Anspach BS '43
James M. Brown MS '43
Wayne H. Brown BS '43
Ted L. Crosthwait MS '43
Benjamin A. Daleon MS '43
Warren V. Eaton, Jr. MS '43
Oleg C. Enikeieff BS '43
Leon Katz PH '43
Edward G. King MS '43
Robert H. Koch MS '43
William L. Leeds MS '43
Roland E. Lundquist MS '43
Klaus Mampell PH '43
Robert A. Moore BS '43
Fred D. Roberts MS '43
Dan R. Scholz MS '43
Leslie A. Shannon MS '43
Thomas B. Smitherman MS '43
Peter A. Tileston EX '43
Ernesto Vicente MS '43
Courtland L. Washburn MS '43
Frank A. Alonso BS '44
Warren H. Amster BS '44
William O. Ballard, Jr. BS '44
Francisco Barriga MS '44
William E. Bell MS '44
Donald G. Benjamin MS '44
Mehmet N. Berkant MS '44
Ertugrul Birlik BS '44
Joseph E. Burch MS '44
William G. Burke MS '44
Ahmed Cebeci MS '44
Carlos A. de Medeiros MS '44
E. J. Goehring EX '44
Charles P. Harrison MS '44
Ning Hu PH '44
Robert F. Laabs BS '44
Paul J. Labanauskas MS '44
Carl O. Mattinson BS '44
Kenneth L. McBreen MS '44
Merrill E. Onstad MS '44
Ethem Ozkaragoz MS '44
Te-Hsien Pi PH '44
Jim M. Ridlehuber MS '44
Mayo G. Shults MS '44
Enrique F. Silgado MS '44
Roberto L. Stein MS '44
R. S. Tanyildiz BS '44
Garland S. Taylor BS '44
William M. Trimble BS '44
D. R. Wight MS '44
John J. Writt MS '44
Victor A. Ari MS '45
Walter B. Dandliker PH '45
F. Miles Day BS '45
Chung-Pen Ho MS '45
Roy G. Killian BS '45
Jonathan F. Rice BS '45
Robert G. Trout BS '45
Necat Turkbas MS '45
Bruce R. Vernier BS '45
Charles W. Allison, Jr. BS '46
Khosrow Behroon MS '46
Harvey H. Brinkhaus BS '46
Ke-Yuan Chen MS '46
Robert H. Conradt BS '46
Jerome P. Dyson BS '46
David R. Esner BS '46
Hassan F. Fateh MS '46
Robert W. Foote BS '46
R. Bruce Foster MS '46
Luis E. Freire BS '46
George S. Gill BS '46
Benjamin S. Hayne III BS '46
H. T. Huang BS '46
Frederick J. Lewis MS '46
Norman J. Macdonald BS '46
Stanley R. Nixon BS '46
K. V. Prasad MS '46
Carl K. Salbach MS '46
Elmer R. Shepard BS '46
Lt. Col. Harvey F. Smith MS '46
Yu-Sin Tung MS '46
Thomas F. Weldon MS '46
Rolland S. Asher BS '47
Adolfo J. Atencio MS '47
Paul K. Charlu MS '47
Ta-San Chung MS '47
Fredric B. Clarke EN '47
Hugh H. Collins EN '47
Brian D. Dagnall MS '47
Subodh C. Das MS '47
Byrne Eggenberger BS '47
Eric Gillam MS '47
Walter Harrington MS '47
George R. Vanden Heuvel MS '47
Ea-Qua Huang MS '47
Felix A. Kalinski MS '47
Leo Fiorello MS '47
James S. Lesko MS '47
John Manoukian MS '47
Michael K. Molloy MS '47
Basil E. Moorehead BS '47
Raymond L. Olson BS '47
John L. Orr MS '47
Francis D. Sullivan BS '47
Russell A. Thompson, Jr. EN '47
Pao K. Wan MS '47
Alonzo H. Wellman, Jr. EN '47
Clifford M. Wimberly MS '47
Edward B. Winters, Jr. BS '47
Eugene F. Wyszpolski MS '47
Lai-Chao Ying MS '47
Ying-Ching Au BS '48
Capt. James A. Bunce MS '48
Tao-Hung Chu MS '48
Albert R. Clark MS '48
Burgess F. Collins BS '48
Perry H. Eubank MS '48
Patrick N. Glover BS '48
Robert J. MacNeill MS '48
Herman A. Mason BS '48
John T. Slusher MS '48
John S. Swain BS '48
Robert K. Swank MS '48
William H. Voelker MS '48
James E. Whitney MS '48
Robert S. Winniford MS '48
Thomas E. Allen EN '49
Thomas J. Andrews MS '49
Laurence I. Baumann BS '49
Cdr. Arthur R. Benton, Jr. BS '49
John R. Brown EN '49
Joseph F. Burkholder BS '49
Harold D. Cooper MS '49
Harold W. Davidson MS '49
Francis C. Foster EN '49
Lloyd P. Geldart EN '49
Jarvin R. Heiman BS '49
Col. George M. Hrebec BS '49
Frank G. Hylton BS '49
Fred E. Krasin BS '49
Max Krauss PH '49
William E. Lamb EN '49
Pierre J. Leroux MS '49
Dan M. Parker MS '49
Thomas G. Petrulas BS '49
Charles C. Petty MS '49
William C. Roesch PH '49
Ltc. Dale D. Ryder BS '49
Salim Solomon MS '49
John W. Wilkening EX '49
Jean F. Wiren BS '49
Joseph B. Alexander MS '50
Weldon O. Bergreen BS '50
Julian Brody BS '50
Kenneth J. Hammond BS '50
Robert McMillan MS '50
Robert W. Paulson MS '50
H. Edwin Reinecke BS '50
Marco A. Romero BS '50
Charles A. Savant BS '50
Howard R. Schmidt MS '50
Robert S. Welte BS '50
Norris D. Whitehill BS '50
Ricardo M. Arosemena MS '51
Edward B. Crichton BS '51
Robert J. Diamond PH '51
John R. Doe BS '51
Howard C. Goodell MS '51
Jacob P. Lafdjian MS '51
Wilfred C. Mosier MS '51
Joseph E. Padgett, Jr. MS '51
Raymond A. Sjodin BS '51
Allan J. Summers MS '51
Paul E. Arbo EN '52
Smith V. Bucy MS '52
Wesley Caspers MS '52
Frank C. Lang, Jr. BS '52
Basil R. Parnes BS '52
William C. Robison MS '52
Yung-Chung Shen MS '52
Donald E. Sutton BS '52
Richard W. Weeks BS '52
Howard E. Wilson MS '52
Charles A. Davies BS '53
Stuart G. Lennox MS '53
Norman M. Schroeder BS '53
Fred P. Storrer MS '53
Nobuyoshi Takahashi BS '53
Ltc. David S. Twining BS '53
Ltc. John T. Coughlin II MS '54
Christian P. Dambrine MS '54
Jassim M. El-Hussaini MS '54
Wesley R. Guebert MS '54
Irvin G. Henry MS '54
Herberto Jimenez MS '54
Berdine H. Rogers MS '54
Francis F. Scott BS '54
Herbert H. Winters MS '54
Alain Brethes MS '55
John D. Britton PH '55
Lewis F. Ellmore BS '55
Jean Garcin MS '55
William E. Huber MS '55
Oreste W. Lombardi BS '55
James Meacham BS '55
Ltc. William T. Moore MS '55
Norman W. Albright BS '56
Robert W. Edwards MS '56
Jacques Feige MS '56
Lee R. Gallegher MS '56
E. Mark Gold BS '56
Thomas P. Gordon MS '56
Maurice Granier MS '56
David W. Hill MS '56
Ltc. W. Hugh Jenkins, Jr. MS '56
James L. Kelly MS '56
Duncan E. MacDuffie BS '56
William N. Spence BS '56
T. Neil Davis MS '57
John F. Edsforth MS '57
Alan E. Farley BS '57
Jon W. Harford BS '57
Douglas B. Holdridge MS '57
Robert T. Moore BS '57
Joseph E. Stuteville BS '57
Andre A. Treyer MS '57
John C. Uhthoff MS '57
Cpt. Eugene M. Wisenbaker EN '57
Chi-Hsiang Wong PH '57
David G. Byles BS '58
John L. Gardner, Jr. MS '58
Lawrence I. Kittiver MS '58
Jean P. Lacrouts MS '58
Rene E. Maurice MS '58
Hugh D. Palmiter EX '58
Gerald M. Pjerrou BS '58
Gunnar E. Stenberg MS '58
Victor Baekelandt MS '59
Samuel M. Berman PH '59
Chai B. Byun BS '59
Clark E. Carroll BS '59
Ronald A. Christiensen MS '59
Charles K. Daniels BS '59
Thomas E. Dawson EN '59
Andre J. Fossard MS '59
Michel P. Guillemet MS '59
Jay H. Harris MS '59
Richard E. Hemmingway EN '59
Thomas N. Irvine PH '59
Ronald B. Leonard BS '59
Stanley Roth BS '59
Thomas K. Boehme PH '60
Joseph M. Cauley BS '60
Jacques J. de Barbeyrac MS '60
Alain N. Genko MS '60
Gary C. Goodman BS '60
Ernest A. Isaacs BS '60
Pierre E. Joffres MS '60
Peter D. Noerdlinger PH '60
William A. Sinoff BS '60
Robert C. Thompson PH '60
Paul R. Widess BS '60
Rear Adm. Allen D. Williams EN '60
Lewis W. Hemphill BS '61
Roland Kitten MS '61
Etienne Macke MS '61
Ann R. Massar PH '61
Lawrence W. McCombs BS '61
Demetrius Philippou MS '61
Dwain J. Reed BS '61
Lewis L. Smith MS '61
Furman Y. Sorrell, Jr. MS '61
Nazeer Ahmed MS '62
Clement C. Audet MS '62
James T. Chang PH '62
Michel M. Cousin MS '62
Michel d'Arbaumont MS '62
Jean C. Dubois MS '62
Larry D. Fitzgerald MS '62
Barry A. Gordon BS '62
Peter W. Hammond BS '62
Paul Y. Hu MS '62
Marlyn T. Jakub MS '62
Barry N. Pines BS '62
Robert C. Ruddick BS '62
Henry D. Abarbanel BS '63
John E. Baldwin PH '63
Michael F. Behrens BS '63
David C. Cartwright MS '63
Pierre J. Facon MS '63
Anthony S. Lau BS '63
Alan Lippert MS '63
Lee W. Samuelson EX '63
David S. Siegel BS '63
Will G. Spiegelman BS '63
Janis Vasilevskis PH '63
John Y. Wu BS '63
Eudoxia Aliferis MS '64
Tzeu-Ching Chang MS '64
Duygu M. Demirlioglu BS '64
Jean-Marie F. Grange MS '64
Takehiko Ikeda MS '64
Karl H. Kanus MS '64
Chung-Mo Kwok BS '64
Jacques A. Parisot MS '64
Barry W. Peterson BS '64
Geroge E. Radke, Jr. BS '64
Harold P. Waits PH '64
Raymond P. Cej MS '65
Philippe R. Chalier MS '65
Inder Cheema MS '65
Allyn M. Davis MS '65
Richard S. Frenk BS '65
Ronald E. Hutton BS '65
Michel A. Lagorce MS '65
William P. O'Neill BS '65
Roger L. Peterson PH '65
Major George A. Repasy BS '65
Samir D. Sayegh MS '65
Robert B. Scott BS '65
Bernard C. Solelhac MS '65
Melvin M. Stephens II BS '65
Matias J. Turteltaub MS '65
Philippe Vidal MS '65
Arden B. Walters BS '65
Anthony B. Williams BS '65
Robert O. Winkler MS '65
Felix S. Wong MS '65
Robert T. Barron MS '66
Harold T. Couch PH '66
Altan K. Eris MS '66
Dario Iacuelli BS '66
Larry R. Miller BS '66
Robert E. Serafin BS '66
Joseph J. Stupak, Jr. BS '66
Donald H. Valentine, Jr. PH '66
Surendra N. Adodra MS '67
Philippe J. Blondy MS '67
Cpt. James R. Boyd MS '67
John B. Davies MS '67
Terrall M. de Jonckheere MS '67
Payton D. Fuller MS '67
Robert E. Goldwasser MS '67
Eitan Gonen MS '67
G. Laurie Hatch PH '67
Michel J. Henry MS '67
Louis Kircos MS '67
Duane P. McClure BS '67
Jean M. Moysan MS '67
Robert C. Neveln BS '67
John C. Perrin MS '67
Nagendra Singh MS '67
Vivian L. Steadman MS '67
Duke A. Sun BS '67
Alain A. Artaud MS '68
Gerald M. Cotreau MS '68
William M. Denny MS '68
William J. Driskell MS '68
Jacques P. Fleuret MS '68
Jay R. Freeman BS '68
Ender M. Kaya MS '68
John M. Lehman BS '68
David M. Mackenzie BS '68
Brian M. Schaefer MS '68
James B. Andrew BS '69
Jean-Henry Barth MS '69
Thomas D. Baze BS '69
Capt. J. Neal Brantner MS '69
James P. Cerne MS '69
Ted W. Dillingham BS '69
Michael B. Farber BS '69
Michel H. Flandrin MS '69
Mark P. Goldstein MS '69
Luis N. Ikwueke MS '69
Barry R. Keller BS '69
Stephen S. Pomeroy BS '69
Donald D. Rintala BS '69
George J. Siltanen MS '69
Richard L. Sweet III MS '69
William E. Wright MS '69
Thomas J. Bicknell BS '70
David Boss MS '70
Richard F. Doyle BS '70
George P. Drake BS '70
Helio Fagundes MS '70
Atef I. Girguis MS '70
Edwin J. Hamilton, Jr. PH '70
James D. Hutchinson MS '70
Nicole H. Imbert MS '70
Juan E. Leon MS '70
Alexander C. Livanos BS '70
Pierce A. Lynne MS '70
Isaac A. Majerovicz BS '70
Jovka Michova MS '70
Vivek C. Monteiro MS '70
John E. Newbold PH '70
Richard W. Noren MS '70
Arthur Ogawa BS '70
Denis R. Rydjeski MS '70
Juan L. Steimle MS '70
Howard H. Stover BS '70
George Z. Voyiadjis MS '70
Peter M. Wilzbach BS '70
Theodor S. Colbert MS '71
David A. Dixon BS '71
Ralph B. Graham BS '71
Lcdr. Kirk A. Mathews BS '71
Lt. David C. Muchmore PH '71
Ahmet Ozkul BS '71
Jean-Marie Quitin MS '71
Richard J. Schwall BS '71
William M. Weigel BS '71
Robert M. Westervelt BS '71
Carl R. Anderson BS '72
Richard J. Blint PH '72
Eric R. Boissaye MS '72
Emmy T. Chan MS '72
Robert L. Derham MS '72
Robert C. Langill EX '72
Robert N. Miller MS '72
Robert J. Panek BS '72
Keikichi Yagii PH '72
Frederick H. Auld, Jr. MS '73
Bruce W. Bennett BS '73
Raymond E. Carhart PH '73
Vijay Chatoorgoon MS '73
Bruce S. Eisenhart BS '73
Donald A. Herron MS '73
Xavier F. Lagarde MS '73
Michael A. Piliavin PH '73
Richard A. Shaw BS '73
Wayne K. Warzecha MS '73
Neil S. Berkey BS '74
Charles R. Birdwell PH '74
John E. Gelotsky PH '74
Eric K. Gustafson BS '74
Joseph F. Karnicky PH '74
Kar-Shing S. Lee BS '74
Thanh Luu BS '74
Michael J. Mariani BS '74
William R. Molzon BS '74
Howard C. Morris PH '74
Stanley K. Nakamoto BS '74
Vinod Shekher MS '74
Lt. Donald J. Sullivan MS '74
Erik J. Brune BS '75
James C. Conwell MS '75
Christopher L. Cooper BS '75
James W. Demmel II BS '75
Russell A. Desiderio BS '75
Alexander C. Egwuatu BS '75
Sylvan A. Jacques, Jr. MS '75
Melvin J. Knight II PH '75
Vincent K. Leung MS '75
Robert W. Lim BS '75
Victoria A. Roberts BS '75
Michael D. Rourke MS '75
Jeffrey B. Smith PH '75
Gregory K. Taylor BS '75
Bruce D. Westermo MS '75
Eric D. Williams BS '75
William G. Bagnuolo PH '76
Rhett G. Butler MS '76
James W. Deutsch PH '76
Mohammad A. Hamzavi-Abedi MS '76
Robert H. Higley BS '76
Andrew J. Jankevics BS '76
Thomas J. Lawler BS '76
Chiu-Yuen J. Ng BS '76
Lewis S. Proudfoot BS '76
Stephen R. Roe BS '76
Karl H. Rudnick PH '76
Alan B. Saul BS '76
Alan J. Shusterman BS '76
Gregory R. Baker PH '77
Andrew Bewsher MS '77
John M. Epperson BS '77
Shrikant A. Garde BS '77
Glenn J. Greene MS '77
Bruce G. Herring BS '77
Pui K. Lam BS '77
Rebecca Winter Lewis BS '77
Ibrahim M. Rashed MS '77
Larry J. Ruff MS '77
Michael J. Savage MS '77
Margaret Y. Scott PH '77
Michael A. Surkes MS '77
Maurice S. Zwass BS '77
Nain H. Al-Adhadh PH '78
William I. Behen BS '78
Welcome Bender PH '78
Yuk-Sun Chan BS '78
Reazuddin A. Chaudhuri MS '78
Teryl K. Frey PH '78
Edward N. Keller BS '78
Moses L. Ma BS '78
Arthur I. Metz MS '78
James H. Mullany BS '78
Stephen P. Pope BS '78
Jack Powell MS '78
Kenji Shintani MS '78
Barton Zwiebach MS '78
Douglas A. Breisky BS '79
Stanley S. Chen BS '79
Ping Y. Chiu BS '79
Bo H. Cho BS '79
Steven W. Cordray MS '79
Fred J. Crimi BS '79
Steven T. Eckmann BS '79
Kenneth P. Fecteau MS '79
Leila M. Gonzalez BS '79
Frederick S. Grennan BS '79
Ahmad F. Khorrami MS '79
Deborah A. Levin PH '79
Brian T. Lew BS '79
Mark G. Mcharg BS '79
Charles E. Novitski PH '79
Richard C. Parker PH '79
Tim X. Rentsch BS '79
Jose A. Rial PH '79
Augusto Sagnotti MS '79
Matthew L. Spitzer PH '79
Jebril A. Swedan MS '79
David R. Van Alstine PH '79
Tak-Yiu Wong MS '79
Peter B. Armentrout PH '80
Meir Bartur MS '80
Michael S. Becker MS '80
Robert J. Bensoussan MS '80
Thomas A. Boldt BS '80
Roland L. Bouchard MS '80
Eugene D. Brooks III MS '80
Alain Delsupexhe MS '80
Reda E. El Damak MS '80
James R. Ellison MS '80
Jeffrey L. Fordon MS '80
Dhrumil J. Gandhi MS '80
Patrick W. Goalwin MS '80
Peter M. Goodwin BS '80
Jeffrey B. Johnson MS '80
David M. Joseph BS '80
Herman S. Li MS '80
Mark A. Ludwig MS '80
Christian Mailhiot MS '80
Kevin S. Mcloughlin BS '80
Bruce B. Pedersen BS '80
Charles S. Reynolds BS '80
Napapon S. Scott PH '80
Eric J. Swanson MS '80
Harold S. Wilson PH '80
Stephen Wolfram PH '80
Michael R. Woolley BS '80
Howard K. Yee MS '80
John R. Bell PH '81
Benjamin P. Dolgin MS '81
Horace R. Drew III PH '81
Luen-Hin Kwok MS '81
Louis Lamarche MS '81
James P. Landon BS '81
Charles R. Nichols BS '81
Ka-Yiu San MS '81
Paul N. Spathis BS '81
James M. Takacs PH '81
Daniel H. Turnbull MS '81
Marc J. Berman BS '82
John T. Bongiovanni BS '82
Ilnur Erbas MS '82
Graeme F. Fowler PH '82
Karl W. Heuer BS '82
Linda B. McAllister BS '82
Samin A. Mithani BS '82
John Y. Ngai BS '82
Hisup Park BS '82
Michael L. Pearson BS '82
Michael A. Ravine BS '82
Liem T. Tran BS '82
Russell E. Walker MS '82
A.V. Anilkumar MS '83
Philip S. Beran MS '83
David P. Brady MS '83
Arthur E. Chiou PH '83
Walter A. Coole BS '83
Kent F. Evans BS '83
Robert G. Helbing BS '83
Jeremy Leader BS '83
David A. Muraki BS '83
Wendy A. Olson MS '83
Jonathan E. Parker BS '83
Ilene M. Reinitz BS '83
David C. Sams MS '83
Kenneth J. Stern MS '83
Walter S. Tsuha MS '83
Korawit Wacharasindhu MS '83
Glyn H. Anderson BS '84
Damir I. Barudi PH '84
Anne-Marie Brest MS '84
Carol J. Bryan BS '84
Haris Christodoulou MS '84
Loucas N. Christodoulides MS '84
Brian J. Fitzsimmons PH '84
Terry J. Ligocki BS '84
William K. Moonan PH '84
Phu T. Nugyen BS '84
Jeffrey P. Rhinesmith MS '84
John J. Schaeck BS '84
Barry A. Swartz PH '84
Emre Toker BS '84
Nadeem Tufail BS '84

Personals

1924
WILLIAM L. HOLLADAY and his wife, Louise Helen, recently celebrated their sixtieth wedding anniversary at their Altadena home. He began his career with General Electric Co., and later served as product manager for the George Belsey Co. He co-founded Holladay and Westcott (now Holladay, Eggett and Helin) in 1952 and has been vice president, president, board chairman, and senior consultant of the firm. He is now a consulting engineer. He is past president of the Pasadena Lung Association, the Caltech Alumni Association, and the American Society of Heating, Refrigerating and Air Conditioning Engineers.

1934
NICK van WINGEN was awarded the Society of Petroleum Engineers' Anthony F. Lucas Gold Medal "for a long and distinguished career as author, petroleum engineer, educator, and consultant; and as a



Nick van Wingen

leader in the advancement of petroleum production technology, particularly in secondary oil recovery." The award recognizes distinguished achievement in improving the technique and practice of finding and producing petroleum. Currently, a consulting petroleum engineer, he has played major roles in the development of the oil production technology in the US, Austria, Canada, West Germany, Iran, Turkey, and Venezuela. His vast petroleum experience ranges from roustabout to chief evaluation engineer with the Richfield Oil Corporation. He was professor of petroleum engineering at the University of Oklahoma for two years (1947-49) and taught at USC for 26 years. An SPE member since 1943, he has served on several committees. He has also been active in the American Petroleum Institute and AIME. A licensed professional petroleum engineer in California, he has been listed in *Who's Who in America, Who's Who in Engineering,* and *American Men of Science*. He is a member of Tau Beta Pi, Sigma Xi, and Pi Epsilon Tau. He lives in South Pasadena.

1936
APOLLO M. SMITH, MS '37 and '38, received the Fluids Engineering Award of the ASME during its winter annual meeting for "his pioneering and lasting contributions to a wide range of areas in the field of fluid mechanics; and for his leadership in solving many of the design problems encountered in early supersonic aircraft and liquid rocket engines." Established by the ASME Fluids Engineering Division in 1968, the award is given for contributions to the engineering profession and particularly to fluids engineering through research, practice, or teaching. He started his career at Douglas Aircraft, where he worked on aerodynamic and preliminary design problems of the DC-5; the SBD dive bomber; and the A-20, DB-7, and B-26 attack bombers. He had the prime responsibility for detailed aerodynamic design of the B-26. He left Douglas for two years in 1942 to organize the engineering department of Aerojet; when he returned to Douglas in 1944, he moved into the research side of aerodynamics. Smith is retired but continues to do consulting and is an adjunct professor at UCLA and a part-time professor at CSU, Long Beach.

1938
CARL FRIEND recently spent six months teaching advanced aircraft design at the Institute of Aeronautics and Astronautics, the graduate school of the National Cheng Kung University in Taiwan, Republic of China. During that time, Carl and his wife, Jane, were guests of the ROC and "experienced traditional Chinese hospitality with many parties and short travels. The Chinese faculty of IAA was augmented by five full-time 'foreign devils'—including WALLACE D. HAYES (BS' 41, Eng '43, PhD '47) . . . and KRISHNAMURTY KARAMCHETI (MS '52, PhD '56)."

1940
W. BERTRAM SCARBOROUGH, MS '41, has been retired for more than a year from Standard Oil Co. of California (now Chevron Company) where he worked for 42 years. He retired as project manager in the engineering department in San Francisco and Richmond.

ROBERT WAYMAN has received the Borg-Warner Technical Innovations Award, the first of its kind, in recognition of his continuing contributions to automatic transmission technology. The holder of 13 US patents, Wayman has been with Borg-Warner since 1940 and has just retired from full-time activities. He was recently sent to Australia to assist with Borg-Warner Australia's production development of automatic transmissions. He and his wife live in Mission Viejo, California.

1947
ALBERT H. J. MUELLER, MS '49, retired from Hughes Aircraft after almost 34 years. At the time of his retirement, he was group vice president, administration, for the Hughes Ground Systems Group in Fullerton. Previously, he had been manager of the Missile Systems Group Manufacturing Division in Tucson for 12 years. He and his wife plan to live in Vienna for the next year "to enjoy the European scene and be near the Austrian skiing." He encourages any classmates coming through Vienna to give them a call at 31-84-50.

1949
VICTOR LAWFORD, MS, has been granted one of the first ITT Special Corporate Patent Awards. He is a senior member of the technical staff of ITT's Barton Instruments Co. in the City of Industry, California, where he has worked for more than 26 years in various engineering positions. He has filed numerous patents for developments dealing with process instrumentation. A member of the Instrument Society of America and the ASME, his most recent development includes safety-related instrumentation for nuclear power plants.

1953
THOMAS H. APPLEWHITE, PhD '57, has been appointed editor of the *Journal of the American Oil Chemists' Society (JAOCS).* A past president of the AOCS, he has been a member since 1959 and has served as an associate editor for *JAOCS* for 18 years. Currently director of research services for Kraft Inc. Research and Development in Glenview, Illinois, he has been involved with fats, oils, and their end-products since 1959 when he joined the staff of the USDA Western Regional Research Center. He served as general chairman for the 1976 World Conference on Oilseed and Vegetable Oil Processing Technology in Amsterdam. Author of numerous technical papers and chapters and patent-holder in the fatty acid and amino acid fields, he is a member of the American Chemical Society, Institute of Food Technologies, and Sigma Xi.

1955
ROBERT N. CLAYTON, PhD, received the Elliott Cresson Medal from the Franklin Institute in April for "the major role he has played in the application of mass spectroscopy to a wide variety of geoscience researches and, in particular, for his far-reaching contributions to the knowledge of the early solar system." Professor of chemistry at the University of Chicago, Clayton pioneered in the mid-1960s in the use of bromine pentafluoride in mass spectrometry as a solvent for determining the total oxygen content of a material in the mid-1960s; it is still a standard analytical technique. Clayton was on the faculty at Pennsylvania State University before going to the University of Chicago in 1958. He is currently the Enrico Fermi Distinguished Professor of Chemistry.

1957
PETER P. GASPAR has won the 1986 American Chemical Society's Frederic Stanley Kipping Award in Organosilicon Chemistry. Professor of chemistry at Washington University, Gaspar is being honored for his investigation of chemical reactions of short-lived, silicon-containing species. His research has led to the discovery of new kinds of molecules and new ways to make organosilicon compounds. He will receive the certificate and $3,000 award, sponsored by Dow Corning Corporation, in April at the society's 191st national meeting in New York City. He has written or been co-author of more than 70 scientific articles and is a Fellow of the Royal Society of Chemistry.

MARK F. MEIER, PhD, received the Seligman Crystal, the highest award of the International Glaciological Society at the group's Symposium on Glacier Mapping and Surveying, which was held in Reykjavik, Iceland. Meier, the top glacier expert in the USGS, has been chief of the USGS glacier studies office in Tacoma, Washington, since 1956. He was honored for his "pioneering work on the flow of Saskatchewan Glacier; on the understanding of heat, ice and water balances; on glacier surges; on the remote sensing of snow and ice; and on the stability and dynamics of glaciers." His current research involves work on Columbia Glacier near the terminus of the Trans-Alaska oil pipeline at Valdez, Alaska. An adjunct professor of geophysics at the University of Washington since 1964, Meier has received many honors and awards, including the U.S. Antarctica Service Medal (1970), and three medals from the Academy of Sciences in the Soviet Union.

1961
OLIVER SEELY, JR., is in Paris on sabbatical leave from the department of chemistry at CSU, Dominguez Hills. He is "finding immense pleasure in this opportunity to develop fluency in another language . . . . I'm also getting a little work done at the Ecole Normale Superieure de Saint-Cloud on a project involving the application of computers to education." He is "sold on the lifestyle" and recommends it "highly to all you folks out there leading drab, dull lives and driving the freeways every day."

1963
WAYNE HUBER has received the Florida Engineering Society's 1984-85 Outstanding Technical Achievement Award for his accomplishments in the field of water resources and hydraulics. Professor of environmental engineering sciences at the University of Florida in Gainesville, Huber has been a faculty member since 1968. He has received numerous awards, including the 1984 Technical Achievement Award for EPA Storm Water Management Model from the North Central Chapter of the Florida Engineering Society. During the last five years, he has been awarded almost $900,000 in grants to direct projects for the US EPA, the South Florida Water Management District, the Florida Department of Environmental Regulation, the Southwest Florida Water Management District, and the US Air Force. He has also been an officer of the American Society for Civil Engineers, Gainesville branch.

D. JAMES MORRE, PhD, has been granted an honorary doctor of science degree by the University of Geneva for "his originality and accomplishments and for his dedication to the biological sciences (in Switzerland and in the University of Geneva)." Morre, who is director of the Purdue University Cancer Center and a professor in Purdue's pharmacy and science schools, was the only American honored at the commencement in Switzerland. His research focuses on cell growth and the biogenesis of membranes toward the understanding of tumor development. Morre is co-editor of the *European Journal of Cell Biology* and editor of the journal *Protoplasma*.

YING-CHU L. (SUSAN) WU, PhD, recently received The Society of Women Engineers (SWE) Achievement Award, the group's highest honor, for "fundamental research in electrofluid dynamics of MHD and outstanding service as educator and administrator." Professor of aerospace engineering and administrator of the Energy Conversion Research and Development programs at the University of Tennessee Space Institute, she has been the recipient of many awards, including the university's Chancellor's Research Award (1978), Outstanding Educators of America Award (1973 and 1975), and the Amelia Earhart Fellowship (1958, 1959, and 1962), of which she is the first three-time recipient. She is an associate fellow of the AIAA, a member of ASME and the Society of Sigma Xi, and is now an honorary member of SWE.

1964
JOHN M. MADEY, MS '65, has received a $1,500 prize for achievement in accelerator physics and technology "for the invention and demonstration of the free electron laser." Madey, who is research professor of physics at Stanford, was given the award at the history symposium of the US Summer School on Particle Accelerators held at the Stanford Linear Accelerator. The prize was made possible by donations from the Universities Research Association, Varian Associates, and Westinghouse Electric. His research involves using a bunched electron

beam passing through a periodic magnetic structure to stimulate the emission of light; it has the prospect of being developed into a light source of very high power and excellent efficiency. Madey has been at the High Energy Physics Laboratory (HEPL) at Stanford since 1972 and was named research professor in 1982.

1966
TOM R. MILLER has been promoted to associate professor of radiology at Washington University in St. Louis.

1967
EDWARD G. TRACHMAN, MS, has been named director of applied research at Rockwell International Corporation's automotive operations in Troy, Michigan. Before joining Rockwell in 1981 as chief engineer for applied research, he was head of engineering analysis for Vadatec Corporation and a technical staff member of RCA Laboratories.

1968
PETER S. BLOOMFIELD has been named vice president of sales and marketing for TIENET, Inc., a local area network and communications consulting company in Boulder, Colorado.

1969
MARTIN H. ISRAEL, PhD, has accepted a three-year appointment on NASA's Space and Earth Sciences Advisory Committee, a group of the country's senior space scientists who make recommendations on NASA's overall policy for space sciences. The committee also reviews proposed scientific missions and recommends which ones should be submitted for congressional appropriation in addition to advising NASA on basic scientific research areas it should fund. Israel is professor of physics and associate director of Washington University's McDonnell Center in St. Louis. He has also been selected co-chairman of NASA's Magnetic Spectrometer Definition Study. The team will define instrument requirements and scientific goals of a space station facility that is expected to play a key role in cosmic ray research.

1971
STEPHEN KURTIN, PhD, is president of Protype Corporation, the developer of the Display Typewriter, which integrates a video screen with a standard electronic-typewriter keyboard. Kurtin has 12 patents, including one he earned at age 14 for his three-dimensional TV design.

1973
ROBERT J. GELLER, MS '75, PhD '77, is currently teaching seismology at Tokyo National University, the first foreigner to hold a professorship at a Japanese university. His appointment marks the end of a 100-year-old law that prevented noncitizens from teaching in Japanese schools. Geller, previously assistant professor at Stanford, became interested in Tokyo University in 1973 after talking to Hiroo Kanamori, his mentor at Caltech and a former faculty member at the university. Geller still finds time after 13-hour days at the university to play contract bridge, a hobby that made him one of the top 200 players in the US. He has already won the Tokyo bridge championship.

1974
JEFF HARROW married Jae Brainard, a psychotherapist, in October of 1984. He finished his PhD in bioengineering at the University of Utah in March of this year "after six years of work plus trips to Germany, Czechoslovakia, Turkey, France, Denmark, Hong Kong, and Japan to exotic medical conferences." He has started his internship at LDS Hospital in Salt Lake. He will go to Boston for a residency in anesthesiology at Massachusetts General Hospital next July. "Skiing. . ., river-running, and Hobie Cat sailing have been my principal hobbies, until this internship started."

1976
JONATHAN G. KAYE has been awarded the John Spangler Nicholas Prize for the outstanding doctoral candidate in experimental zoology by Yale University.

1977
WING KAM LIU, MS, PhD '81, received the Pi Tau Sigma Gold Medal—"for outstanding achievement in mechanical engineering within ten years after graduation"—from the ASME during its winter annual meeting. He is associate professor of mechanical and nuclear engineering at Northwestern University in Evanston, Illinois.

1979
WILLIAM B. McKINNON, MS, has been named to the National Research Council's Committee on Planetary and Lunar Exploration. The panel advises NASA on policy and missions affecting the exploration of planets, the moon, and solid objects in space, including the proposed space station and its impact on planetary science. He is assistant professor of earth and planetary sciences at Washington University in St. Louis.

1980
PATRICIA F. SCOTT, MS, was married in September to DAVID M. COLE, PhD '80. She is a geophysicist with ARCO Exploration in Dallas, and he is a scientist at TRW in Redondo Beach.

Obituaries

1919
CLAYTON C. LAVENE, Ex, of Santa Monica, on August 3. He began his career in Mexico as a civil engineer and then as an engineer before working for Union Oil and Julian Oil in California. He joined Douglas Aircraft in 1939 where he was involved with company recruiting. Since his retirement from Douglas in 1961, he had traveled extensively. An aerial gunnery instructor in World War I, he was one of the founding members of the Order of Daedalians, a national fraternity of military pilots. He is survived by his wife, Hilda; a son, Norval; and three grandchildren. The family has established a memorial fund in his name at Caltech (Office of Memorial Funds, 1-36, Pasadena 91125).

1920
PAUL N. CROSBY, of Seal Beach, after a sudden illness. He was retired.

1924
MAX W. MOODY, of Honolulu, on July 6. He had been president of Walker-Moody Const. Co., Ltd., in Honolulu.

1925
EDWARD W. HART, of Alamo, California, on August 25. He had retired in 1974 and had continued to do occasional consulting with manufacturers in the development of their drawback programs and their subsequent preparation of claims for the refund of import duties.

1926
HENRY CARTER AUSTIN on July 23. He was a resident of Laguna Hills.

ALEX A. KRONEBERG of Laguna Hills. He was retired.

1927
GEORGE F. COLLINS of Playa Del Rey in August. He was retired.

HARRY K. FARRAR of Portola Valley on March 14. He began his career at Bell Telephone Laboratories in New York in 1927 where he worked until transferring to Pacific Telephone in Los Angeles in 1941. He moved in 1950 to Pacific Telephone in San Francisco and retired in 1969. He was a member of Tau Beta Pi and was a registered professional electrical engineer. He is survived by his wife, Elizabeth, a daughter, and three grandchildren.

1928
CARL F. RENZ, MS, of Vista, California, on August 24. He had retired in 1965 as chief, structural branch, Ohio River Division Laboratories, U.S. Army Corps of Engineers, Cincinnati, Ohio. He is survived by his wife, Clara.

1929
V. L. HOLDAWAY, MS '30, of Scotch Plains, New Jersey, on July 4. He was retired.

MILTON H. SPERLING on September 1 of a heart attack. A resident of South Pasadena, Sperling was retired from ARCO where he had been manager of product development and technical services. He is survived by his wife, Elizabeth, a daughter, a son, and two grandchildren.

1930
G. WILBUR READ, MS '31, of Camarillo, California, on June 30. He was retired.

1932
MAURICE ANTOIN BIOT, PhD, at his home in Brussels, Belgium, on September 12. He had been affiliated with many universities as professor, instructor, or research scholar, including Caltech, Columbia, Michigan, Harvard, Brown, Technological University of Delft, University of Zurich, and Catholic University of Louvain. He was consultant to the Shell Development Corporation, the Aeronautical Laboratory at Cornell University, the Mobil Research and Development Company, and the Office of Scientific Research of the US Air Force. A member of the NAS, the NAE, the Belgian Royal Academy of Science, and the American Academy of Arts and Sciences, he was given an honorary doctor's degree by the University of Liege in 1967. He received many other awards, including the Timoshenko Medal of the ASME, the von Karman Medal of the ASCE, and honorary membership in the Acoustical Society of America.

MILLS S. HODGE, MS '33, of Long Beach, on August 17 after a long illness. He was retired and is survived by his wife, Nina.

WILLIAM L. KENT, of Fullerton, on July 16. He was retired from Union Oil Company where he did engine testing of fuels and lubricants. A 35-year member of SAE, he had kept up his interest in engines by serving as a reader for SAE. He is survived by his wife of 50 years, Barbara, a son, a daughter, and two grandchildren.

1934
WARREN L. PATTON, of Rancho Palos Verdes, California, on September 29. He was an attorney with Fulwider, Patton, Rieber, Lee, and Utecht in Los Angeles. He is survived by his wife, Mildred, two daughters, and two granddaughters.

1936
PAUL J. SCHNEIDER of Oakland on August 19 after a long illness. He was a retired physician.

1939
THOMAS W. MOUAT, JR., MS, of Ganges, British Columbia, Canada. He had retired in 1982 as a consulting engineer.

1940
EDWARD V. GANT, MS, of Storrs, Connecticut, on July 4. Professor of civil engineering and former provost of the University of Connecticut, he had served three times as acting president of the university. He joined the faculty in 1942 as assistant professor of civil engineering and eventually held every academic rank except instructor. He was named an honorary alumnus of the university in 1973 and received special awards bestowed by the board of trustees in 1969, 1973, and 1974. A past president of the Connecticut section of the American Society of Civil Engineers and former director of the Connecticut Society of Civil Engineering, he was a member of many professional societies. He is survived by his wife, Margaret, a daughter, a son, and four grandchildren.

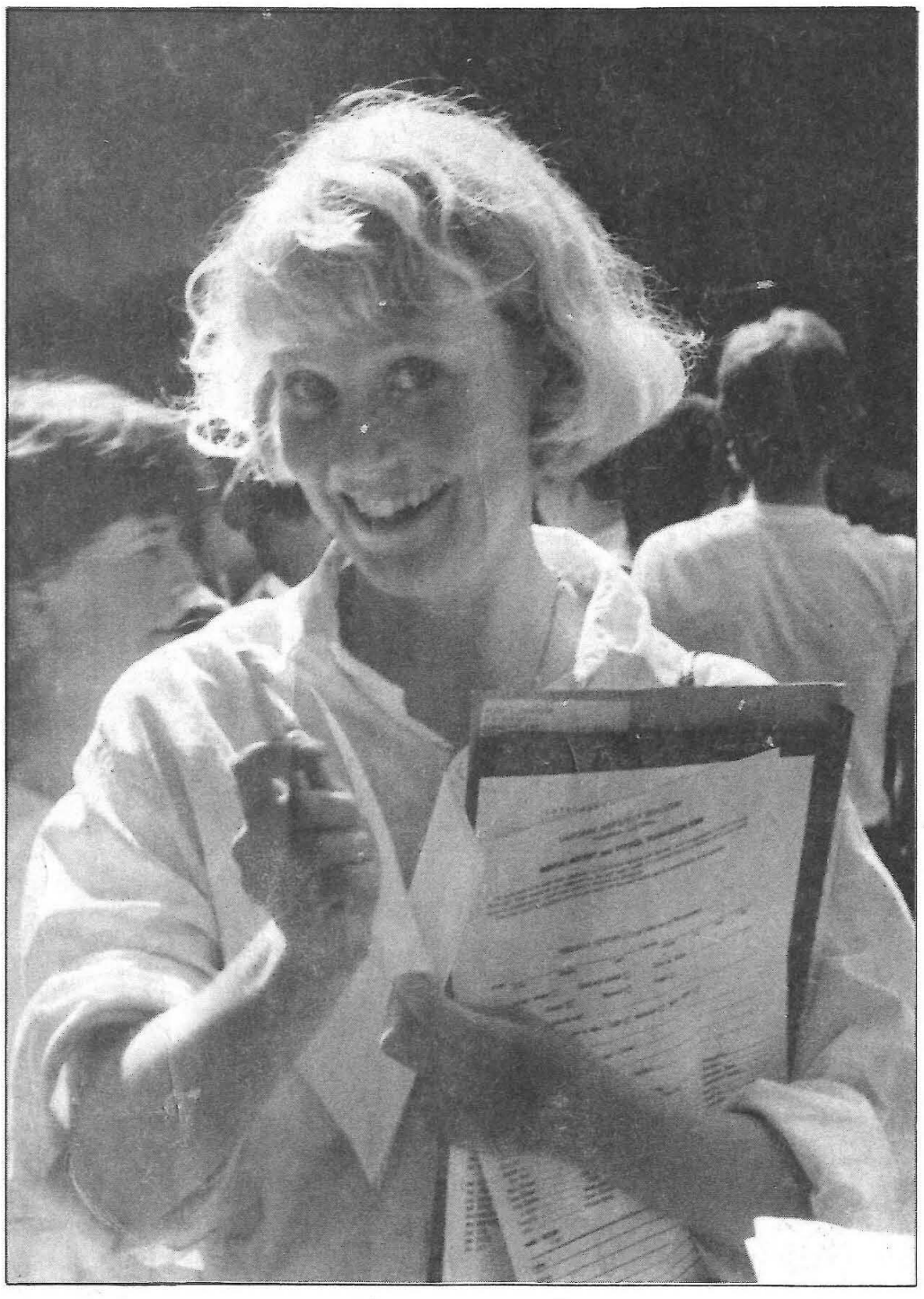
1945
MERRITT A. WILLIAMSON, MS, of Nashville, Tennessee, on July 19, following a short illness. He was professor emeritus at Vanderbilt University and Director of Engineering Management Program Development at the University of Tennessee Space Institute in Tullahoma. He became Vanderbilt's first Orrin Henry Ingram Distinguished Professor of Engineering Management and Director of Studies in Engineering Management in 1966. In 1983, he was appointed the first chairman of the faculty executive committee of the Engineering Management Program in the National Technological University. He belonged to The Institute of Industrial Engineers, The Order of the Engineer, the American Society for Engineering Education, Tau Beta Pi, Sigma Xi, and Gamma Sigma. He was a registered professional engineer and served as consultant in technical management. He is survived by his wife, Jean, six daughters, three grandchildren, and one sister.

1946
L. WAYNE MULLANE, MS, Eng '47, of La Jolla, California. He had most recently been a consultant for Aerojet General Corp., which he joined in 1959. He had served as group vice president and was promoted to executive vice president in 1967 with responsibility for all of the plants and operating divisions of the company.

1950
CALVIN WONG, MS, PhD '53, of Livermore, California, in 1984. He was a research radiation physicist at UC's Lawrence Livermore Laboratory.

1959
JOHN M. STEVENS, of New Orleans. He had been program manager, data systems, at Litton Data Systems in New Orleans.

1966
RICHARD RAY UNDERWOOD, of St. Louis, on January 2, of cancer. He had been a specialist in scientific applications at McDonnell Douglas.



Heidi Anderson registers as a Caltech freshman.

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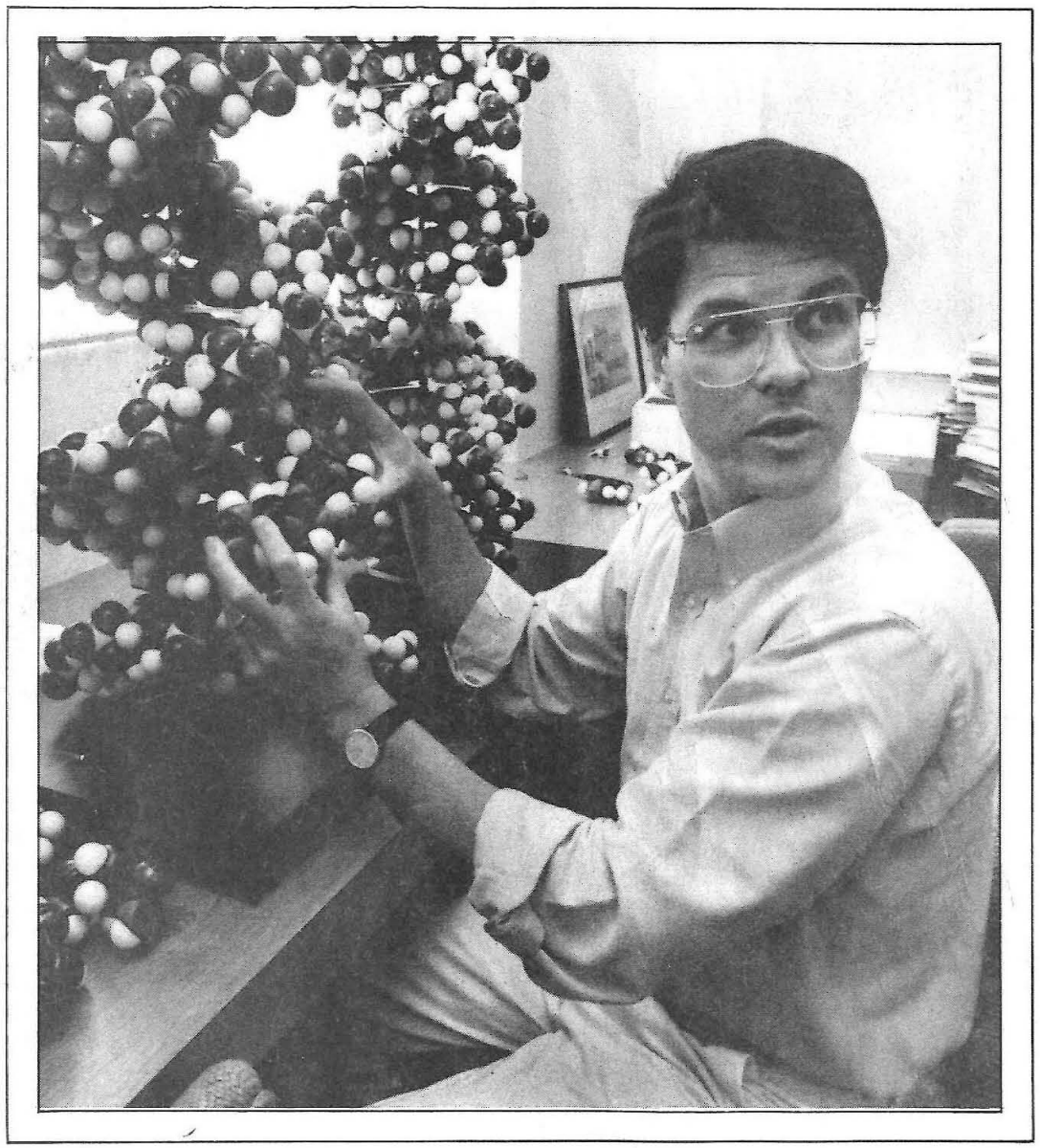

A knowledge explosion in synthetic chemistry is under way and the new Arnold and Mabel Beckman Laboratory of Chemical Synthesis will enable Caltech to play a major role. Peter Dervan (above) is one of the Caltech chemists to occupy a lab in the building. See page 1.

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