

CALTECH NEWS

December 1986

U.S. faces critical scientist, engineer shortage, NSF head tells Associates

Even though our country's research scientists and engineers are the best in the world, too much of our population is unprepared to function productively in an increasingly technological society, Erich Bloch, director of the National Science Foundation, told members of The Associates and their guests when he spoke at the annual dinner at the Athenaeum.

Talking on "The Human Resource Base of Science and Engineering," Bloch focused on the issue of how well the United States is (or is not) doing in training an adequate supply of technologically skilled people in our colleges and universities—and in preparing them in our elementary and secondary schools.

The need for these well-trained young people is critical, he noted, because the employment of scientists and engineers has increased three times faster in the last decade than has total U.S. employment. Scientific and technical employment has grown three times as fast as the real gross national product and twice as fast as total professional employment.

Meanwhile, he said that other countries are rapidly catching up with the United States in the proportion of their labor force devoted to research and development. For example, Japan has doubled its technical workforce in the last two decades and it is annually producing more engineers than the U.S., with half the population.

The shortfall in new scientists and engineers comes at a time when the need for them is acute, he pointed out. For example, the number of individuals engaged in industrial research and development increased by almost 60 percent between 1973 and 1985.

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"The road to scientific progress is paved with good intentions—and a few bricks," says Caltech Archivist Judith Goodstein. The brick commemorating A. A. Noyes is one of several engraved with famous Institute names, originally part of Throop Club's fireplace in the "Old Dorm," and now embedded in the main wall outside the Caltech bookstore.

"Science below the neck:" Mining Caltech history

By Heidi Aspaturian

Picture Caltech during the 1930s. In a laboratory endowed by a cornflakes magnate, a group of physicists, including the youthful Willy Fowler, are on the threshold of determining that thermonuclear fusion powers the sun. Another physicist, Carl Anderson, is about to uncover the ghostly tracks of the positron, the first empirical evidence that antimatter exists. A confederacy of biologists and fruitflies is creating one of biology's more successful and enduring hybrids, the science of genetics.

Lured to southern California by the persuasive and determined Robert A. Millikan, a group of brilliant European theorists are cementing their reputations—and the Institute's—as the world's leading innovators in seismology and aeronautical engineering. The period echoes with the ring of distinguished names: Charles Lauritsen . . . Thomas Hunt Morgan . . . Theodore von Karman

. . . Warren Weaver.

One moment please. Who was Warren Weaver?

He was a representative of the Rockefeller Foundation, and his glowing reports on the Institute's work helped to guarantee Foundation support for Caltech during the 1920s and, even more crucially, the 1930s, when, during the Depression, Caltech was one of the few U.S. institutions to actually flourish.

Weaver's role in promoting Caltech, and his impressions of its scientists, which he recorded in some detail in his diaries, are among the many sidelights of Caltech's story brought to light in the book that Caltech archivist Judith Goodstein is completing on the Institute's history.

"Weaver was the kind of informant historians dream of finding, because he loved to gossip, and he wrote down *everything* he heard," says Goodstein, who required at least two

independent sources to corroborate new or unfamiliar material before she used it.

Occasionally, she adds, Weaver's exuberance created some problems. A long-retired faculty member was so intrigued by Weaver's uninhibited descriptions of his former colleagues that he obtained his own copy of the

"At one point he [Fowler] recalls, he objected to Lauritsen about the long hours he was required to spend in the lab, to which his professor replied: 'Stop complaining; what if you had to work for a living?'"

diaries, only to discover that Caltech's unofficial chronicler also had plenty to say about *him*.

Goodstein, who received her PhD in the history of science from the University of Washington in 1969, began work on her book in 1980 and has continued full-time as head of the archives while researching and writing it.

Now, with several publishers expressing interest in the manuscript (excerpts have appeared in *Science*, *Social Research*, and *Historical Studies in the Physical Sciences*), she plans to have a final draft—and a title—by the end of the year. Her research has been supported by grants from the Haynes Foundation, which sponsors studies on topics related to southern California.

When it is finished, Goodstein's book will trace Caltech's history from its origins in 1891 as part of the Throop facility through the end of World War II and the dawn of the atomic age. Her major emphasis is on the scientific achievements of the inter-war years, when the Institute was headed by Robert A. Millikan.

"Basically, I've tried to move back and forth between the science itself

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Quasar emissions appear to exceed light speed

An international team of astronomers has reported discovering seven new quasars that appear to eject blobs of matter traveling at many times the speed of light.

The scientists used combined arrays of radio telescopes in the U.S. and Europe to make images of the radio emission from the quasars, which lie up to five billion light years from the earth.

Such "superluminal" objects have been known since their discovery in 1969, but until the discoveries of the latest seven, they were thought to be rare. The latest findings bring to 14 the total number of superluminal objects now known.

Of course, the matter ejected from the quasars is not actually traveling faster than light; the blobs are traveling at over 80 percent of the speed of light, or, in the most extreme cases, over 99 percent of light speed.

According to the theory of relativity, the velocity of light is finite, and matter cannot exceed its speed. And although it may seem paradoxical, the objects' appearance of faster-than-light travel is a direct consequence of light's finite velocity.

Their so-called superluminal motion is an optical illusion, and is believed to be caused by the fact that they are traveling toward the earth at close to the speed of light. Their near-light speeds compress the interval between successive observations, just as the motion of an approaching car horn compresses the interval between successive sound waves—thus altering the pitch of the horn.

Thus the change in the time interval causes the material to *appear* to be traveling faster than light, because the apparent velocity is the distance traveled divided by the apparent time interval.

Other members of the Caltech discovery team were Timothy Pearson, a member of the professional staff; Peter Barthel, a research fellow; Anton Zensus, a research fellow; and David Hough (PhD '86), now at JPL. Their collaborators were with the Max Planck Institute for Radio Astronomy in Bonn, West Germany, and with the Naval Research Laboratory in Washington, D.C.

"A central puzzle in astronomy," says Readhead, "is how the central engines in active nuclei produce these powerful jets of material that travel millions of light years into intergalactic space.

"We believe the most likely mechanism for producing the power in these objects may be a spinning, supermassive black hole. This black

hole may contain as much material as a billion suns, at the center of an 'accretion disk,' which lies in the equatorial plane of the spinning black hole.

"Material, including stars, falls toward the black hole under the influence of its enormous gravitational field. As this material approaches the black hole, it is ripped apart by tidal forces and falls into the disk, and eventually into the hole. As the matter falls toward the hole it loses gravitational potential energy, and we believe that this energy is the source of power for the central engine."

Somehow, explains Readhead, the combination of the spinning black hole and the accretion disk manages to convert some of the energy falling toward the black hole into a highly collimated jet of material that moves outward along the black hole's spin axis.

"To escape the enormous gravitational field near the black hole, matter must be traveling at close to the speed of light. So we should not be surprised that any material we see moving away from these objects is traveling very fast," he points out.

DuPont grant will support research in biology

Caltech has received a \$60,000 grant from the Committee on Educational Aid of E.I. Du Pont de Nemours and Company in Wilmington, Delaware. The funding will be used to support research in biology, chemistry, and chemical engineering.

The Du Pont grant was awarded by the company's University Science and Engineering Grants program. Research groups at Du Pont support the specific research of several Caltech faculty members. Du Pont also contributes an additional \$35,000 annually through its subsidiary, Conoco, to assist the Institute's student aid program.

Observatory on Mauna Kea dedicated

Caltech's new submillimeter-wave observatory, located 14,000 feet above sea level on Mauna Kea, Hawaii, was dedicated on November 22. The telescope and observatory dome were constructed on campus. The parts were shipped to Hawaii about a year ago and were assembled on Mauna Kea.

1987 SURF program dedicated to Robert Sharp

The 1987 SURF (Summer Undergraduate Research Fellowship) program has been dedicated to Robert P. Sharp (the Robert P. Sharp Professor of Geology, Emeritus). The dedication honors Sharp because he has long been a "role model for administrators, faculty, and students," according to Fredrick H. Shair, professor of chemical engineering and chairman of the SURF administrative committee.

The 1986 SURF program was dedicated to Lee A. DuBridge, Caltech president emeritus, and the 1985 program, to Ernest H. Swift, professor of analytical chemistry, emeritus.

The SURF program enables undergraduates to conduct independent summer research projects in Caltech laboratories (or at JPL or other off-campus sites) under the guidance of faculty members who provide laboratory space, computer time, and supplies. The students receive stipends for their work.

Industrial Associates plan three conferences

The Industrial Associates will sponsor three two-day conferences on campus during the winter and early spring.

At the first, a research directors' conference on February 10-11, Caltech faculty will describe their research on massively parallel computation, communication/information theory and systems, astrophysical detectors, and the mechanics, synthesis, and design of polymers. Admiral Bobby R. Inman, president and chief executive officer, Microelectronics and Computer Technology Corporation, will deliver the keynote address.

"Electronic Materials and Devices" is the title of a conference on March 3-4 with David B. Rutledge (associate professor of electrical engineering) as chairman. The conference will deal with the many advances in this fast-growing high technology field.

"Chemical Frontiers in Biotechnology," March 31-April 1, with Peter B. Dervan (professor of chemistry) as chairman, will deal with the status and future directions of the underlying basic sciences and of mission-oriented research relevant to the emerging biotechnologies.

Designed for representatives of Industrial Associates member companies, the conferences are also open to alumni and other interested individuals.

Wasserburg twice honored

Gerald J. Wasserberg (the John D. MacArthur Professor of Geology and Geophysics at Caltech) is the recipient of two honors. He has been awarded the Arthur Holmes Medal of the European Union of Geosciences, and he has been selected the Distinguished H. L. Welsh Lecturer in Physics for 1986 by the Departments of Physics and Astronomy, University of Toronto, Canada.

The Holmes Medal is presented every other year in recognition of scientific achievements in terrestrial or extraterrestrial materials sciences. The Welsh Lectures, established in 1975, honor the Late Harry H. L. Welsh, faculty member in physics at the University of Toronto for 40 years.

Wasserburg is director of the Lunatic Asylum, a world-renowned research center for the study of moon rocks, meteorites, and interplanetary dust. He recently received one of the scientific community's most prestigious honors—the Crafoord Prize of the Royal Swedish Academy of Sciences—in recognition of "his major impact on our knowledge of the universe, focusing on the origins and history of the solar system."

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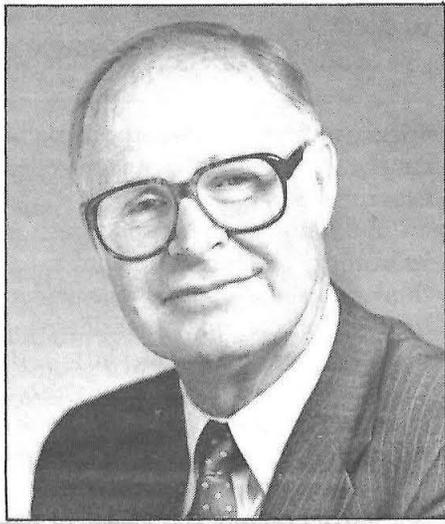
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Donald Guinn elected to Caltech Board of Trustees

Donald E. Guinn has been elected to membership on the Caltech Board of Trustees. Guinn is chairman and chief executive officer of the Pacific Telesis Group (formerly Pacific Telephone and Telegraph), based in San Francisco.

Guinn, who served as chairman of Pacific Telephone during its divestiture from American Telephone and Telegraph in 1981-83, is widely



known in the industrial community for his leadership in guiding the company into its new and more competitive environment as an independent institution. In April 1986 he was named California Industrialist of the Year.

Guinn received his BS degree in engineering from Oregon State University in 1954, and is a registered professional engineer. In 1954 he joined Pacific Telephone and Telegraph in Portland (later Pacific Northwest Bell) as an assistant engineer and held a variety of positions until joining Pacific Bell's parent corporation, AT&T, as assistant vice president of engineering and customer services in 1976.

He was appointed vice president of customer and network services at AT&T in 1978. He became chairman of the board of Pacific Telephone and Telegraph in 1980, and was named chief executive officer designate of the Pacific Regional Operating Company in 1983.

Guinn is a member of the board of directors of Security Pacific National Bank, Di Giorgio Corporation, American Medical International, and Pacific Mutual Life Insurance Company. He is vice chairman of the California Business Roundtable and a trustee of the Committee for Economic Development, as well as a member of the National Business Roundtable and the Conference Board.

Simon named to Biaggini chair

The Anne P. and Benjamin F. Biaggini Professorship of Biological Sciences has been established at Caltech. The first holder of the chair will be Melvin I. Simon, whose research includes the study of molecules that enable organisms, from bacteria to mammals, to respond to changes in their chemical and physical environments.

"We are at an extraordinary period in the history of biology," said President Marvin L. Goldberger. "Fundamental changes, such as those being made by Mel Simon, are not only giving us powerful insights into the mechanisms of life, but also into the nature of disease. This generous gift will significantly enhance this process.

A member of the Caltech Board of Trustees since 1970, and chairman of its investment committee, Biaggini is former president, chairman, and chief executive officer of the Southern Pacific Company. He has served as director of and consultant to the Santa Fe Southern Pacific Corporation since 1983.

Melvin I. Simon received his BS degree in chemistry in 1959 from the City College of New York and his PhD in biochemistry in 1963 from Brandeis University. After a postdoctoral fellowship at Princeton University, he joined the faculty of the University of California at San Diego. He came to Caltech in 1982 as professor of biology.

Kevles: new Koepfli Professor

The J. O. and Juliette Koepfli Professorship of the Humanities has been established at Caltech through a gift from Dr. Joseph B. Koepfli of Santa Barbara. The professorship is named in memory of Dr. Koepfli's father and mother, Joseph Otto and Juliette Blake Koepfli.

The first holder of the professorship will be Daniel J. Kevles, an internationally known authority on the history of science in the 19th and 20th centuries and professor of history at Caltech.

Dr. Koepfli came to Caltech for a year in 1928 as a research fellow in organic chemistry. He returned to Caltech in 1932 after two years as an instructor in pharmacology at the Johns Hopkins University School of Medicine. He remained at Caltech with several periods of governmental service, including three years as science adviser to the Department of State. He became a senior research associate, emeritus, in 1974.

The Koepfli family has also contributed to the Institute through the Koepfli Fund, used to aid research in the Division of Chemistry and Chemical Engineering and to fund visiting scholars and lecturers.

Kevles, professor of history, joined the Caltech faculty in 1964. He is the author of numerous studies of the history of science in the 19th and 20th centuries. Among his works are two award-winning books: *The*

Physicists: The History of a Scientific Community in Modern America (Alfred A. Knopf, 1978), and *In the Name of Eugenics: Genetics and the Uses of Human Heredity* (Alfred A. Knopf, 1985). In 1985 he received a Page One Award for distinguished science reporting in magazines.

Lester Lees dies on November 10

Lester Lees, professor of environmental engineering and aeronautics, emeritus, died Monday evening, November 10, in St. Luke Hospital after a massive heart attack on November 1.

Lees was born November 8, 1920, in New York City. He earned his SB and MS degrees from MIT in aeronautical engineering, and joined Caltech in 1942 as research fellow and instructor in mathematics. He was named professor of aeronautics in 1955. In 1970 he was named professor of environmental engineering and aeronautics and from 1971-74 he was director of the Environmental Quality Laboratory. He became an emeritus professor in December 1985 at age 65.

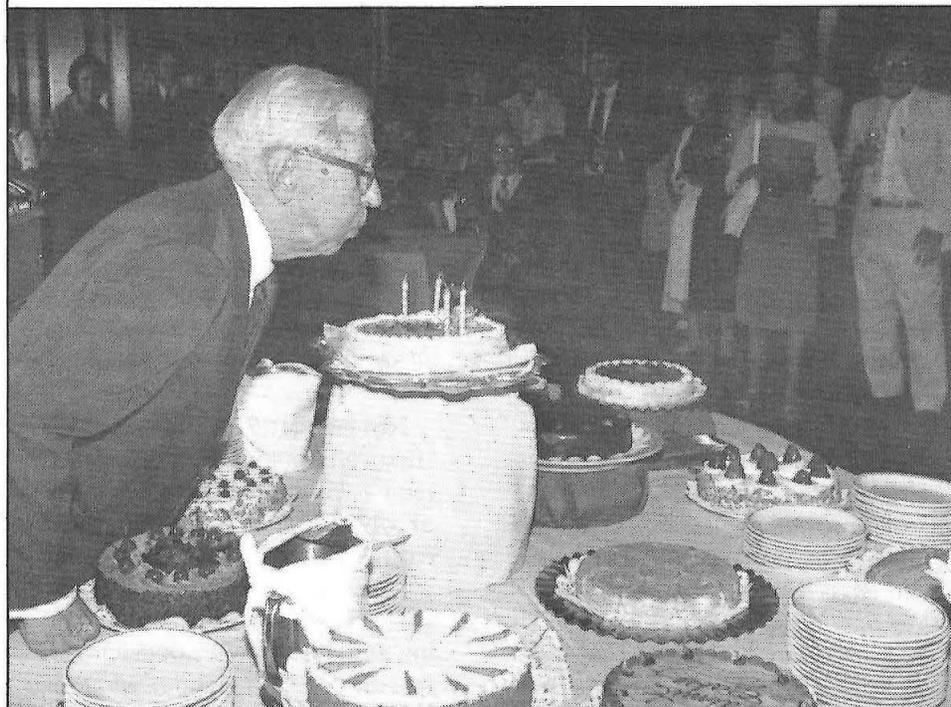
He conducted research on environmental problems related to energy sources, on wakes behind re-entry vehicles, and on problems of high speed flight, including re-entry of missiles and spacecraft into the earth's atmosphere. These studies made a major contribution to the problem of how missiles could be returned to the earth without burning up. Said the Apollo project manager, "Von Braun got the astronauts into space. Lester Lees got them down."

As an educator he inspired a remarkable group of students who continued to pay tribute to his inspirational qualities as a teacher and to his concern for those with whom he worked. Last summer they endowed a SURF fellowship in his name.

Lees was a Fellow of the American Institute for Aeronautics and Astronautics, and a member of the American Academy of Arts and Sciences and the National Academy of Engineering. He is survived by his wife, Constance Louise Lees of Altadena, a son and daughter-in-law, Mr. and Mrs. David Lees, and one grandchild.

Members of his loyal student following are involved in planning a memorial service. A date will be announced. His family asks that, in lieu of flowers, contributions be sent to the Lester Lees SURF Fellowship.

Eighty-five candles for Lee DuBridge



Actually there were only five candles on the cake at the reception celebrating the 85th birthday of Caltech's President Emeritus Lee A. DuBridge. But there was a large selection of complementary cakes, and a gift—a sculptured plexiglass nucleon with a simulated emerald, sapphire, and ruby (each representing a quark) cast into it. The piece was fabricated in the physics laboratory by laboratory specialist William Friedler.

Archivist Judith Goodstein mines Caltech's history

Continued from page 1

and the political and cultural background of the scientists," says Goodstein. "I really don't see the history of Caltech as revealed in budgets, but I don't see it as exclusively a matter of pure scientific currents either. Science is a very human enterprise. You might call my approach 'science below the neck.'"

Logistically speaking, Goodstein has been viewing science at Caltech from the neck down since 1968, the year she descended into the basement of Millikan Library as Caltech's first archivist. (She had arrived on campus two years earlier with her husband David Goodstein, now professor of physics and applied physics).

Eighteen years later, she and her staff are still there, along with the more than 100 collections of faculty papers, and close to 70 oral histories that they have assembled and catalogued.

Seen from below, or at least in the context of these unofficial documents, says Goodstein, some of Caltech's best known scientific accomplishments take on an entirely new dimension.

For example, Beno Gutenberg, the European seismologist and computational theorist who contributed a key concept to the Richter scale, nearly didn't make it to Caltech at all. "We nearly lost Beno," says Goodstein, "because Millikan thought his salary demands were too high. It turned out Mrs. Gutenberg thought she would need to bring two household maids to the United States."

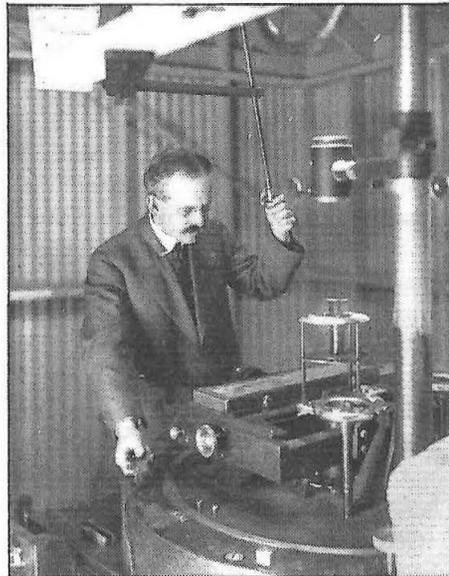
(Without maids, but with plenty of advice from Millikan about the wonders of modern American appliances, Gutenberg arrived in 1930 and, with Richter, launched a revolution in the field of seismology.)

And, several decades before he actually left, Goodstein adds, the Institute almost forfeited Linus Pauling. "Except that A. A. Noyes, who was chairman of the chemistry division, didn't tell Pauling that a Berkeley representative had come to campus to offer him an assistant professorship."

Noyes's action—or lack of it—meant that Pauling was on the faculty in 1929 when geneticist Thomas Hunt Morgan gave a series of seminal

lectures on his research group's work. Morgan and Pauling began a collaboration that grew into the field of molecular biology.

For every Pauling or Morgan, says Goodstein, there are several less well-known figures whose contributions



George Ellery Hale is one of those whose name figures heavily in the early history of Caltech.



Fifty-two high ranking officers of the fleet inspected the laboratories at Caltech in 1934—giving strong indication that the next war would be fought to a finish in the scientific research laboratories of the world. Robert A. Millikan (right) led the tour.

to Caltech have largely gone unnoticed. A major aim of her book is to redress the balance. "A lot of the work around here has been, and continues to be, carried out by people who never get the recognition that they deserve."

One such individual, she says, was Earnest C. Watson, who gave his

name to Caltech's well-known lecture series.

"Everyone on campus knows Watson's name, but almost no one realizes that for two decades he was literally Millikan's right-hand man. He came here to finish his PhD, fell under Millikan's spell, and devoted the years he would otherwise have spent building up his own career to building Caltech. Once Caltech became successful, he was no longer needed. He never got his doctorate, so he had no scientific reputation to fall back on either. If you read his letters, you'll find that Earnest Watson died a sad, disillusioned old man."

Another, much earlier, figure whom Goodstein briefly revives is Hilda Wood Grinnell, who earned a bachelor's degree in biology from Throop Polytechnic College in 1906. In 1910, then-President Scherer decided that Throop's recent change to a primarily engineering curriculum merited a change in admissions policy as well, and closed the Institute's doors to women.

decisions without adequately considering the consequences.

It doesn't bother Goodstein that her book is unlikely to make the best-seller lists—unless it's one that's made up mostly of Caltech alumni. It also doesn't concern her that many of her scientific colleagues undoubtedly view history—and the history of

"I took it upon myself to discourage the women applicants because there were so few, and it wouldn't have been fair to them."

Throop President, A. B. Scherer

science in particular—with the skeptical eye they reserve for uncontrolled experiments.

"In a fundamental way, Caltech is its history," she says. "It's hard to think of a single major challenge facing the Institute today that doesn't have its roots or a parallel in Caltech's past. Caltech's rise is also a unique and remarkable story. Look at Caltech's founder George Ellery Hale. He was an astronomer, but he's also been called a thinking man's P. T. Barnum. He was determined to create a training ground and reservoir of scientific talent for the entire world. And he succeeded."

Talking to Goodstein about the Institute's history, it becomes evident that Hale, who also founded nearby Mount Wilson Observatory, left a legacy of two expanding universes. One was discovered in 1929 by Edwin Hubble, using Mount Wilson's 100-inch telescope. The other was Caltech.

As a historian, of course, Goodstein can only speculate about how Hale's second universe will continue to unfold. But after six years devoted to investigating Caltech's past, she may have arrived

"I have noticed a report in 'Science Service' that Lauritsen has produced neutrons, and the usual Caltech ballyhoo is set forth regarding his being the first in the country, etc., to do it."

Berkeley physicist, Ernest Lawrence, from a letter

at the best view of at least one aspect of the Institute's future:

"The scientists at Caltech will always have the first say," she says. "But in the end, as always, it's the historians who will have the last word."

Not entirely forgotten, Caltech's "first" woman graduate can still be read as co-author (with her husband) of a 1907 *Bulletin of Throop Institute* entitled "Reptiles of L. A. County."

"Scherer made the decision to restrict Throop to men without consulting anybody," says Goodstein. "It's worth speculating about what might have happened if Caltech, like MIT, had remained a coed institution."

Scherer's action, she adds, also raises questions about the wisdom of administrators who make unilateral

They're off to China, to make dreams come true

Durfee Foundation grants enable nine from Caltech to fulfill long-cherished goals.

By Winifred Veronda

The year of the tiger has been one of great good fortune for nine members of the Caltech community—a year when long-cherished dreams found the means of coming true.

These lucky individuals have deep personal interests that involve China and—thanks to the Durfee Foundation's American/Chinese Adventure Capital Program—they have been awarded grants ranging from \$3,000 to \$13,000. Now they can travel to China and pursue their dreams on site.

The Durfee Foundation is the family foundation of R. Stanton Avery, chairman emeritus of the Caltech Board of Trustees and founder of Avery International, N.Y.S.E. The unique grant program owes its existence to an adventure shared by R. Stanton Avery and several of his Pomona College classmates in 1929.

Stan Avery was a sophomore that year, and he and a few others decided to spend 12 months exploring China. Each saved \$1,000—enough to pay for all expenses, including transportation—and together they traveled to the other side of the world to work in famine relief, visit schools and talk with missionaries, and delve deep into this fascinating land.

"My father was profoundly moved by his experience," says Avery's son, Dennis Avery.

"The odyssey was a foundational part of his education; it greatly influenced his life. It involved breaking away from an institution and culture; a true Homeric epic.

"Dad's three children wanted to celebrate his experience, and we came up with the idea of giving other people the chance to embrace their own life-changing adventures in China. We offered to many individuals an opportunity roughly equivalent to my father's. We decided to work through several educational institutions, offering grants to alumni, students, faculty, and staff members.

"Our objective wasn't to reward only top people in their fields, and we set no age limit. We believe each person is a priceless original, and we wanted to nurture their individual qualities. We believe it's important to invest in people, even if they aren't on a specific upper rung in their professions.

"In awarding the grants," adds Avery, "we were looking for people with the interest and ability to fulfill long-held personal goals.

"We found that many people were ready to seize the opportunity. More than 100 submitted applications, and we funded 40 of them. Within the next two years we'll be awarding about \$400,000 in grants. What the results will be in terms of relationships between the countries—and changes in the individuals—is unpredictable. But we do know that experiences like these hold potential for significant personal satisfaction."

Patent agent/folk musician Robert Jamieson will use his Durfee Foundation grant to return to the land of his birth. There he will search for traces of the folk music of his missionary grandfather in the contemporary folk music of the region where his grandfather worked. In China Jamieson also will conduct concerts with Mrs. Jamieson (above), who, like her husband, is a noted folk singer. Jamieson is one of nine Caltech people to receive a grant to travel to China.



The projects that have been funded are almost as diverse as the country itself. They range from a study of the games, puzzles, and recreations of China to a search for endangered gibbons in China's southern rain forests.

A research fellow in biology, William Bleisch is headed for the forests of southern China. There he'll search for populations of endangered gibbons large enough to tempt the Chinese government to establish sanctuaries.

"The gibbons are heavily hunted and they're very wary," says the neurobiologist, who several years ago spent six months studying monkey behavior in India and Thailand. "Their calls carry for several miles, and this is how I hope to find them." His goal, says Bleisch,

"is to get something started that scientists in China can continue."

A few pieces of porcelain brought from China by her grandfather near the turn of the century aroused Barbara Calli's interest in Chinese porcelain, and she became a student of the field. A secretary in the Division of Humanities and Social Sciences, Calli has not yet been to China. With her husband, she plans to use her grant to travel to Hong Kong, Canton, Shanghai, and Beijing, visiting kilns that are still in use after 100 years, and learning about work with porcelains being done in museums.

to share his own musical gifts through a schedule of concerts, some of them with Mrs. Jamieson, also a noted folk singer.

Bill Kros, assistant manager of the Caltech bookstore, has been interested in Buddhist cave art and Chinese monumental art since he was in college. The cave art was discovered at the turn of the century in a group of caves on the edge of the Gobi Desert, and can now be reached by jeep via the old silk route. "Ten years ago," says Kros, "people had to travel by caravan for 500 miles to get to the caves.

Brett Garrett (BS '85), who teaches high school physics in Alhambra, California, plans to spend the summer of 1987 in China, living with a family and taking photographs of the country and its people. He also wants to explore a keen interest in Chinese vegetarian food and, if possible, to work in a restaurant where this type of food is a specialty.

By returning to China, Robert S. (Stu) Jamieson, a patent agent and a respected folk musician, will be going back to the land of his birth. Jamieson's grandfather, a missionary, traveled on foot via the old silk route to a remote Chinese province, Kansu, near Tibet. There he won converts through his singing and banjo picking as well as through his oratory.

His music was adapted by the Chinese, and Jamieson wants to see if any traces of it remain. He also plans

"All of this represents a high point in the culture equal to that of the Gothic cathedrals when—for a time—culture and religion blended," he notes. "I feel as if I'd studied cathedrals for 10 years, and now I'm finally going to be inside one!"

Wheeler North, professor of environmental engineering science, was awarded \$1,400 for airfare to China to assist in a seaweed culturing program with the Yellow Seas Fisheries Research Institute. North was given the airfare award on condition that he take an additional \$1,200 grant to spend three weeks "just to look around." North made one trip to the Chinese research institute this fall. He

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The Tax Reform Act: What to do before year end

To help maximize the benefits and minimize the disadvantages of the new law, four steps are recommended.

This article was written by Tom Gelder, Caltech's director of gift and estate planning.

The Tax Reform Act of 1986 is the most massive revision of the Internal Revenue Code since its first enactment. It will take the IRS a good deal of time to fully explain the new statutes by means of revenue rulings and regulations.

To help maximize the benefits and minimize the disadvantages of the new law, four steps are recommended before the end of the year. Some will obviously be more meaningful than others, depending upon an individual's circumstances.

1. Consult tax and financial advisers. Numerous provisions take effect January 1, 1987, while others are phased in over various time periods; some are too complicated for most of us to understand.

2. Maximize deductions in 1986 while they are still permitted. Many will no longer be available after this year.

3. Delay the receipt of income to 1987 and beyond when tax rates will be lower.

4. If the sale of appreciated assets is contemplated in the near future, make the sale before the end of 1986.

Of the foregoing, the key to surviving the new tax law is to check with your lawyer or accountant now and to act before year-end.

Following are brief descriptions of some of the changes. The list is neither exhaustive nor are the highlighted provisions necessarily true in all cases. As with many tax laws, there are exceptions to the general rules.

- Tax rates will be reduced to a two-rate structure: 15 percent and 28 percent. The highest tax bracket will fall from 50 percent to 38.5 percent in 1987 and to 28 percent in 1988.

- The capital gains tax will be repealed. Appreciation on the sale of capital assets will be taxed the same as other income but no more than 28 percent. The capital gains tax rate for corporations will be 34 percent.

- Deductions from gross income have been reduced or repealed:

- Interest on loans for other than a personal residence or a "second home" will no longer be deductible. (To be phased in over five years.)

- State and local sales taxes will no longer be deductible.

- The charitable income tax deduction for non-itemizers — those who take the standard deduction — will no longer be available. (This will apply to about 80 percent of all taxpayers.)

- The "floor" for claiming the medical expense deduction will be raised from 5 percent to 7.5 percent of adjusted gross income.

- The "standard deduction" for all individuals has been increased. By 1989 the deduction will be \$2,000 per person. The deduction for a married couple in 1986 is \$3,670.

- Gifts of appreciated property from individuals who itemize their deductions will continue to generate a deduction equal to the fair market value of the gift at the time the gift is made. For those taxpayers who are subject to the "alternative minimum tax," gifts of appreciated property must be included as tax preference items. This means that, for some, the appreciated portion of their gifts will be taxed at a 21 percent rate.

- Eligibility and vesting requirements for employee pension plans will be liberalized. Future regulations have to be published before this area is fully understood.

- Scholarship and fellowship aid, over and above tuition and course-required fees, books, etc., will be taxable. In addition, unless the recipient is a degree candidate, the entire scholarship or fellowship is taxable.

- Prizes and awards for such things as scientific or artistic achievement, like the Nobel Prize, will be

fully taxable unless the award is assigned to charity.

- All unemployment compensation is taxable.

- Faculty housing is taxable if the rent charged is less than 5 percent of the property's appraised value.

- It will no longer be possible to shift income to children in a lower income tax bracket by setting up educational trusts to fund children's education. The income will be taxed at the parents' higher tax rate.

- Business meals and entertainment expenses will be only 80 percent deductible.

- The \$100-\$200 dividend exclusion is repealed.

- Income averaging is no longer available.

- Ten-year averaging on lump sum distributions from pension plans is reduced to five years with some exceptions for taxpayers over age 50.

- The penalty for early withdrawals from pension plans has been increased to 10 percent.

The changes made by the Tax Reform Act are substantial and far reaching, but not all the changes are bad. In fact, many taxpayers will actually pay less income tax. The most troublesome aspect of the new act is the uncertainty it causes as we each try to assess its effects on our particular financial situation. Unfortunately, at this point in time, even IRS is unable to provide that information. The best we can do is have patience and maintain close contact with a trusted tax adviser.

They're off to China to make dreams come true

Continued from page 5

will make another trip there next year, and he is postponing use of the grant until then.

Mark Ragins (BS '79) is a resident in psychiatry at the USC School of Medicine. Ragins will use his grant to spend two months exploring the psychiatric care system in China.

Theron Stanford, a Caltech senior, has enjoyed puzzles and games all of his life. He plans to spend most of his time in Beijing, Shanghai, and Heifei, learning from students about the puzzles and recreations popular among young people there.

David Valdez (BS '81), who has been at JPL as an optical engineer, is a self-taught painter who began to work in photorealism and now concentrates on portraits and caricatures. In China now, he is seeking out other self-taught artists who do the same type of work as he, concentrating his efforts in Shanghai and Beijing.

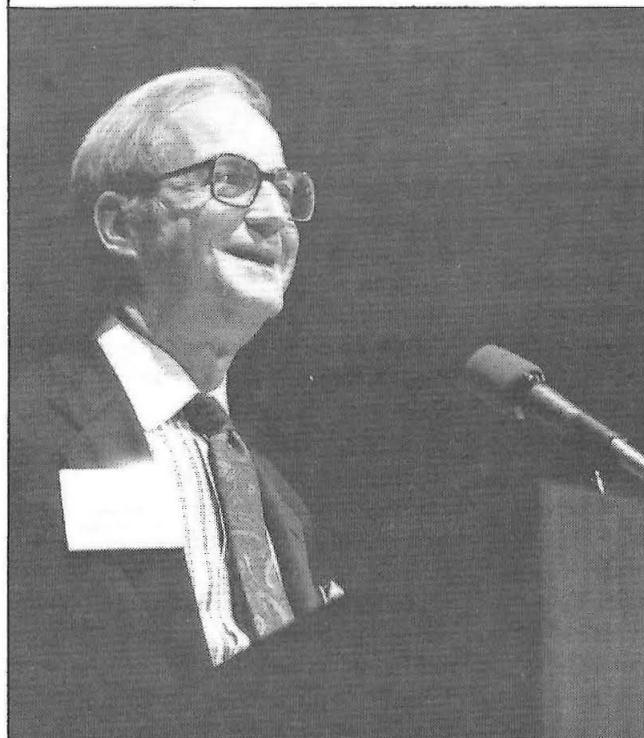
Nine unique individuals; nine adventures. For Stan Avery specifically, and for his children and the trustees of the Durfee Foundation, and for the grant recipients, the next months will be a very special time.

Camilla Frost receives Armand Hammer Award



Camilla Chandler Frost, a member of the Caltech Board of Trustees, is recipient of the seventh annual Armand Hammer Award. This honor is given each year to an individual or organization making an outstanding contribution to the cultural life of Los Angeles. Mrs. Frost is the wife of E. Daniel Frost, senior partner in the firm of Gibson, Dunn and Crutcher. She has served as president and chairman of the board of directors of the Los Angeles County Museum of Art and is chairman of the executive committee of the museum. She is a long-time supporter of the visual arts.

Rosen featured in campus program



Benjamin M. Rosen, a member of the Caltech Board of Trustees and a leading venture capitalist, was the opening speaker at a program on "Getting to Market in High Technology" presented by Caltech, the Industrial Relations Center, and the Caltech/MIT Enterprise Forum. Rosen has been the founding investor and director of 31 high technology companies.

majoring in computer science. But at the University of Toronto, her interests crystallized in another direction and she took a double major in physics and astronomy.

The fact that professional slots in astronomy are scarce doesn't deter Wilson. "I've always wanted to do academic work, and jobs in almost any academic field are hard to find," she says. "And besides, an astronomy PhD can generally find a job in industry if necessary; the de-

that has cross-cultural communication as its goal. There she taught introductory physical science (in French) to students in the seventh and eighth grades. Then she came back to take more undergraduate courses, part-time, at the University of Toronto, and to go on to Kitt Peak Observatory as a summer research assistant.

At the University of Toronto she was president of the student body at one of the university colleges—Innis

the extremes—on both sides of the spectrum—that you find in the United States."

Meanwhile, excitement over Comet Wilson continues as astronomers chart its progress toward the earth. On its discovery, it was about 320 million miles from the sun, and was about 11th magnitude, or roughly 100 times fainter than can be detected with the naked eye.

Based on preliminary observation, astronomers believe it is a long-period comet, one of a class that takes millions of years to circle the sun. It is also unknown whether the comet is on its first close approach to the sun, or whether it has visited the earth before.

If it is on its first journey sunward, it could be an example of the Oort Cloud, a vast collection of trillions of comets that are believed to orbit about a light-year from the sun.

Current calculations indicate that Comet Wilson will reach perihelion,

Numerous comets are discovered every year, but comet Wilson is distinguished by its brightness, and lead time between discovery and perihelion.

or closest approach to the sun, on April 20-21, 1987, when it will be within about 110 million miles from the sun. Later that month, it will make its closest approach to the earth, coming to within 50 to 60 million miles.

During that close approach, it will not be visible from the northern hemisphere, so astronomers will have to use the southern hemisphere telescopes to study it. Brian Marsden of the IAU has estimated the brightness of the comet at about 3.5, which places it in the same range as Halley's Comet.

Numerous comets are discovered each year, but Comet Wilson is distinguished by its size, brightness, and lead time between discovery and perihelion. This lead time will allow astronomers to observe it as it sprouts its coma, or head, and long tail.

Then, as it relinquishes its literal place in the sun, Comet Wilson will head back into the depths of space.

Christine Wilson isn't expecting to achieve scientific immortality through having her name linked with the comet. "It may be a long-period comet," she said. "It could even be a million years before it returns. By the time it comes back, the odds are everyone will have forgotten that it was once named for me."

Astronomy graduate student Christine Wilson has developed a new skill: giving media interviews. She's had a lot of practice since August when she noted a small blotch of light on a photographic plate of a portion of the sky—a plate that she had taken as part of her work with the 48-inch Schmidt Telescope for the Palomar Sky Survey.

The blotch turned out to be a new comet that may rival Halley's Comet in brightness, and right away, members of the media began calling.

The new comet—Comet Wilson—will be visible to the naked eye when it makes its closest approach to the earth in late April and early May next year. Because of comets' unpredictability, astronomers are reluctant to forecast just how bright the new object will become. But they estimate that it will be in the same range as Halley's.

Whether dimmer or brighter, however, Comet Wilson will be scientifically significant. Because of the lead time between discovery of the celestial visitor and its closest approach to

Discovering a comet that may rival Halley's in brightness will have little effect on her career—except that it may give her some recognition among her peers.

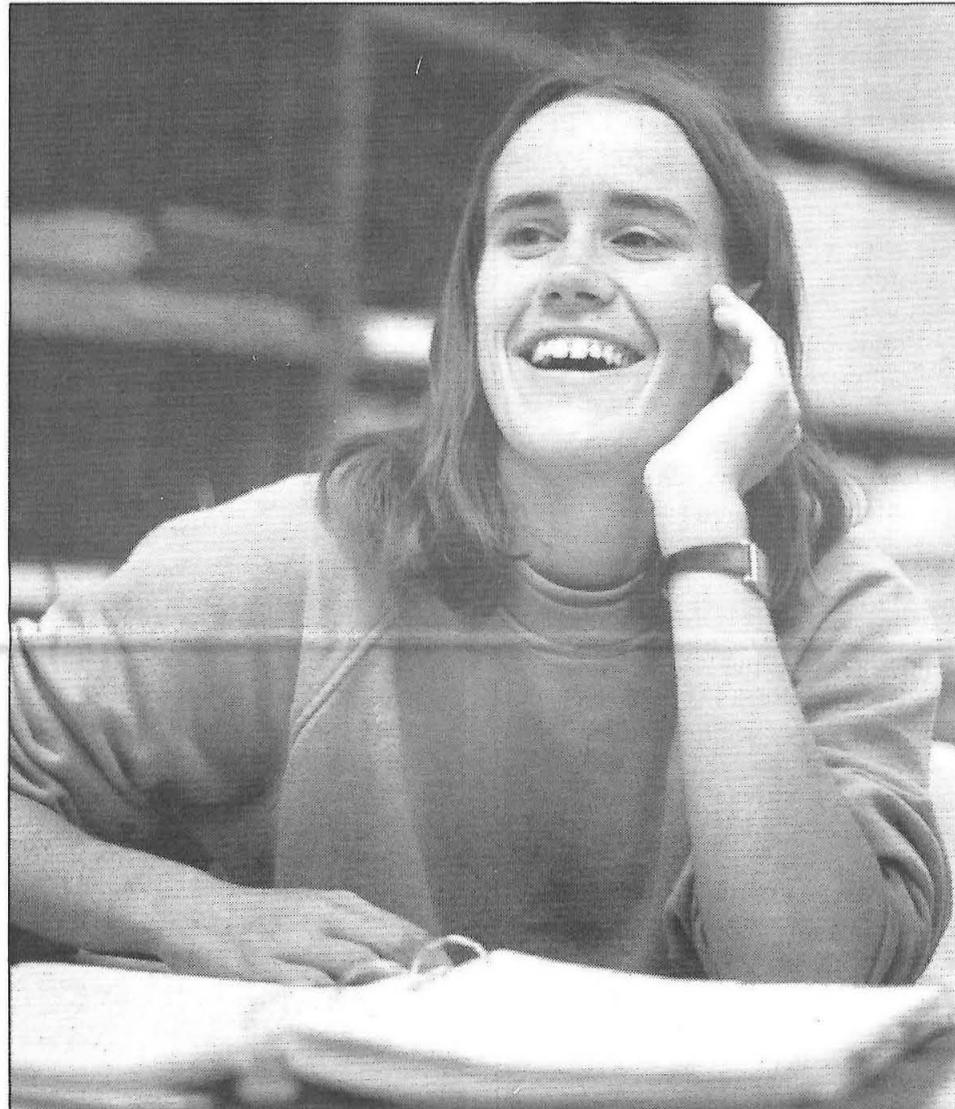
the earth, astronomers will be able to mount a program of observation.

Its discoverer, Christine Wilson, won't be involved in that observation. Her media interviews on the wane, she'll be back at work on her research on galaxies and stars in other galaxies. "I don't mind," she says. "Other people are better equipped to do the observation, and comets aren't my main field of interest."

But she adds that she's hoping to find the opportunity in the spring for a trip to the southern hemisphere, where she can see Comet Wilson at its brightest.

Discovering a comet that may rival Halley's in brightness will have little effect on her career, says Wilson—except that it may give her some name recognition among her peers.

The young astronomer, who is looking toward a career in research and teaching, developed a keen interest in physics and mathematics in high school and briefly considered



Chris Wilson: her namesake may rival Halley's in brightness

gree requires so much background in computer research."

When Wilson applied to graduate school, she surveyed institutions with strong programs in mathematics and astronomy. She had used the Palomar Sky Survey in her University of Toronto work, and was drawn to the Institute.

However, she took a year off after graduation "to get away from science." Actually, she didn't quite succeed in this objective.

She spent three months on the Ivory Coast of west Africa as a participant in Canadian Crossroads International, a volunteer organization

College—and she was active in intramural sports. At Caltech she's taken time from research to sing in the Glee Club and in the Women's Barbershop Quartet, and to play on the women's volleyball team. She's a second-year graduate student, with three or four years to go before completing her PhD.

As a Canadian, she's occasionally found cultural adjustments in southern California a bit difficult—although she lived in Berkeley for a year in junior high school.

"Politics, religion, poverty—all of these issues are more low key in Canada," she says. "You don't find

U.S. faces shortage of well-trained young people, Bloch asserts

Continued from page 1

Meanwhile, there are approximately 1,600 vacant engineering faculty positions (eight percent of the total), and half of these have gone unfilled since 1984, Bloch said.

He added that by 1993, the demand for PhDs in the natural sciences and engineering in academic institutions could be more than double that for 1983.

But meanwhile, colleges and universities are awarding a smaller percentage of degrees in science and engineering than they did during the 1960s. And more than half of new engineering PhDs in recent years have been foreign nationals. Overall, Bloch pointed out, foreign students have accounted for almost 86 percent of the growth of graduate education in the United States.

"One could almost believe that, among U.S. citizens, pursuing the PhD track is considered an unAmerican activity, he quipped.

"These trends are important because the investment (or its absence) in human resources today will be reflected in the achievements of the next generation of scientists and engineers over the next several decades," said Bloch.

Turning the trends around will be made more difficult because of demographic patterns, he noted. For example, the number of 22-year-olds will drop steadily after 1987. This means that unless a larger percentage of undergraduates is attracted to science and engineering, the number earning degrees in these fields will drop.

"The time is gone," said Bloch, "when white male graduates alone can fill all our needs." This means, he continued, that more women and members of minorities are needed in science and engineering to help fill the shortfall.

"We must focus on underrepresented groups not only for reasons of equity," he noted, "but because they are a vital element in our future productivity."

To solve the problem, said Bloch, "it must be attacked at all levels and in all its elements"—beginning with a

reversal of what he termed "the serious underfunding of civilian basic research since the late 1960s." Also crucial is a restructuring of the relationships that have evolved among the federal government, universities, and industries.

These major educational issues must be addressed, he asserted:

- Efforts must be made to improve primary and secondary education in the country, particularly in the sciences and mathematics.

- Everything possible must be done to attract more young people—including women and minorities—into careers in science and engineering.

- The undergraduate curriculum must be improved in terms of effectiveness and productivity. Nationwide, science, math, and engineering education at this level has deteriorated.

- Programs to reduce minority drop-out rates must be given priority.

- The perception must be changed that law and business students will fare better in their future careers than will science and engineering majors.

- More individuals must be attracted to the PhD track through better research opportunities and facilities, and a better reward system.

- Requirements of the PhD track, in some instances, should be reevaluated. For example, eight years may be too long to earn a PhD in engineering after completing a BS degree.

In conclusion, Bloch stressed that "our investment in science and engineering talent—and in research—pays enormous dividends to our society in the long run. It must be handled with foresight and protected from short-term shifts that don't consider ultimate consequences.

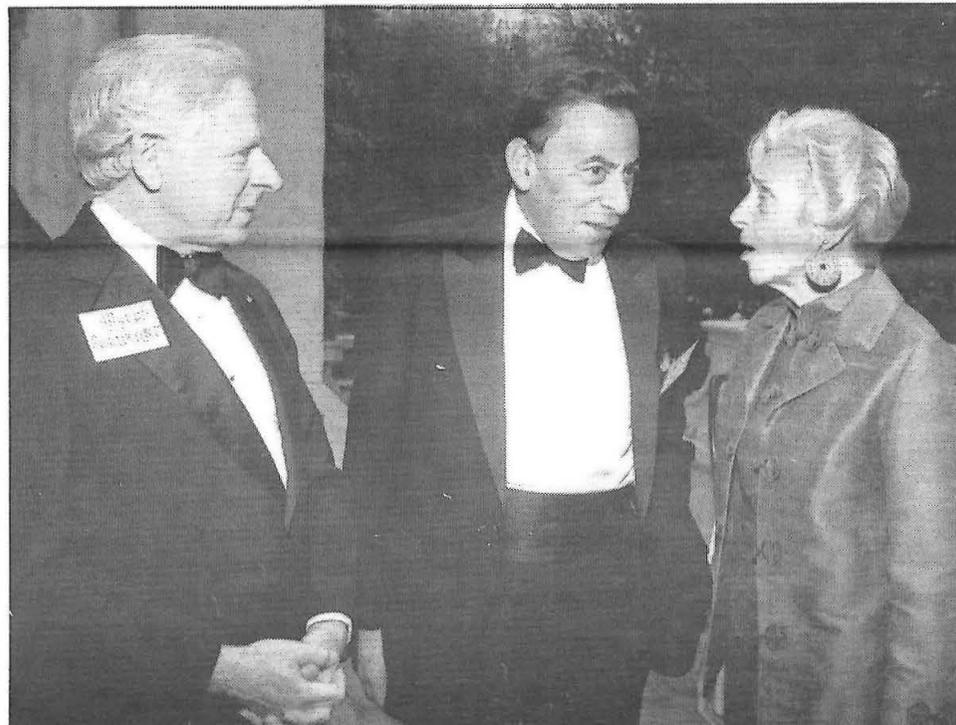
"Current levels of support for research and education are not enough. We must significantly increase the resources available to the institutions that educate our talent and perform our research.

"We must also forge strategies to make more effective use of the resources at our disposal in support of research and education. Industry-university cooperation, for example, creates unique educational opportunities for the next generation of researchers."

In conclusion, Bloch told his audience that "pluralism of institutions, strategies, and views has always been this country's major strength. To make the best possible use of our rich human resource base, we need a new, forceful partnership of those who have a stake in our future: That means all of us."



Mrs. Knox Farrand, whose husband is the son of founder George E. Farrand, Dr. John D. Roberts, Mrs. Andrew D. Farrand, whose husband is the grandson of founder George E. Farrand; Dr. Lee A. DuBridg; and Mrs. John E. Barber, widow of founder John E. Barber.



Dr. Marvin L. Goldberger, Erich Bloch, and Mrs. Vernon Barrett.



Mrs. Reese H. Taylor, widow of Associates founder Reese Hale Taylor, with Mrs. Elise Mudd Marvin, granddaughter of founder Seeley W. Mudd.

Associates recall 1926 founding

Soft platinum tones celebrating 60 years of service set the mood in the Athenaeum for the annual reception and dinner of The Associates on October 9, as the group celebrated its 1926 founding. After dinner, the Art Deco Society Orchestra played music for dancing from the 1920s and 1930s.

Richard L. Hayman, president of The Associates, welcomed the 330 guests. He noted that in 1926, the great literary happenings were publication of *The Sun Also Rises*, *Winnie the Pooh*, and *The Little Engine that Could*. He quoted Robert A. Millikan, who once said that "the founding of The Associates constituted the

most powerful force in the growth of the Institute."

"We have the continuity and support of the founding members," said Hayman. "We are certainly *The Little Engine that Could* because our original 100 members have grown to 1,085, and our annual contributions are well above \$5 million."

President Marvin L. Goldberger greeted the guests and thanked them for their many contributions to the Institute.

Erich Bloch, director of the National Science Foundation, spoke after the reception and before dinner on "The Human Resource Base of Science and Engineering."

Six surviving widows of founding members—along with children and grandchildren of the founders—were honored. A total of 42 children and 58 grandchildren of founders live in the southern California area.

The 100 founding members of The Associates and their guests held their first dinner in 1926 at Henry Huntington's home, now the Huntington Art Gallery. Henry M. Robinson presided.

The group was formed one year after Robert A. Millikan set about to find "one hundred of the most influential people of Southern California, interested in Caltech and interested in helping it grow as fast as possible." These 100 individuals included the civic and business leaders of the region.

At the first meeting, surrounded by Huntington's superb collection of English paintings, The Associates pledged themselves to "aid and advance the welfare of the California Institute of Technology." The Institute, in turn, pledged itself to serve as an intellectual and cultural center for The Associates, where they could gather for private meetings with

scientists and international leaders, and be informed about world affairs and scientific progress.

The pledges were kept. Today, with 1,085 members, The Associates are noted for their contributions to the professions, business, education, and community life, and for their dedication to Caltech's excellence in education and research. Last year, the organization contributed \$1,743,717 in unrestricted funds to the Institute, and the President's Circle contributed \$3,694,315. This represents a total of \$5,438,032 in gifts.

In return for their support, Associates are given opportunities to meet and talk with faculty members and students through special lectures, open houses in campus laboratories, luncheons, dinners, and field trips created especially for members and their guests.

Surviving widows of founders include Mrs. John E. Barber, whose late husband was the organization's first secretary; Mrs. Russell H. Ballard, widow of the first president; Mrs. Henry J. Bauer, widow of the founding third vice president; Mrs. Lawrence B. Brooks; Mrs. R. H. Moulton; and Mrs. Reese H. Taylor.

Caltech Trustees, or wives of Trustees, honored as descendants of founders, include: John Gilbert Braun, son of C F Braun; Mrs. Norman Chandler, widow of Norman Chandler whose father was Associates founder Harry Chandler; Camilla C. (Mrs. F. Daniel) Frost, granddaughter of Harry Chandler; Mrs. Stephen Onderdonk, wife of Trustee Stephen Onderdonk and granddaughter of Frederick S. Albertson; Pamela B. (Mrs. Francis) Pesenti, granddaughter of C. F. Braun; and Mrs. Richard R. Von Hagen, wife of Trustee Richard R. Von Hagen and daughter of R. B. Lloyd.



Dr. Marvin L. Goldberger, Erich Bloch, and Mr. and Mrs. Richard L. Hayman, before Bloch's address to the group.



Mr. and Mrs. Robert Henigson with Mr. and Mrs. Stephen Onderdonk. Onderdonk is a member of the Caltech Board of Trustees; Mrs. Onderdonk is the granddaughter of founder Frederick S. Albertson.



Dr. and Mrs. Millard H. McLain with Mrs. William B. Hicks.



Dr. and Mrs. Horace N. Gilbert and Mr. and Mrs. Samuel D. Hale. Hale is the grandson of Associates founder George E. Hale.



Dr. Michael Millikan, grandson of Robert A. Millikan; Mrs. Francis V. Pesenti, member of the Caltech Board of Trustees and granddaughter of founder Carl F. Braun; Erich Bloch; and Mrs. Reese H. Taylor, widow of founder Reese Hale Taylor.

The Caltech perspective: A life-saving asset?

Extracted from the August 1986 issue of Petroleum Review, the monthly magazine of the Institute of Petroleum, London, United Kingdom.

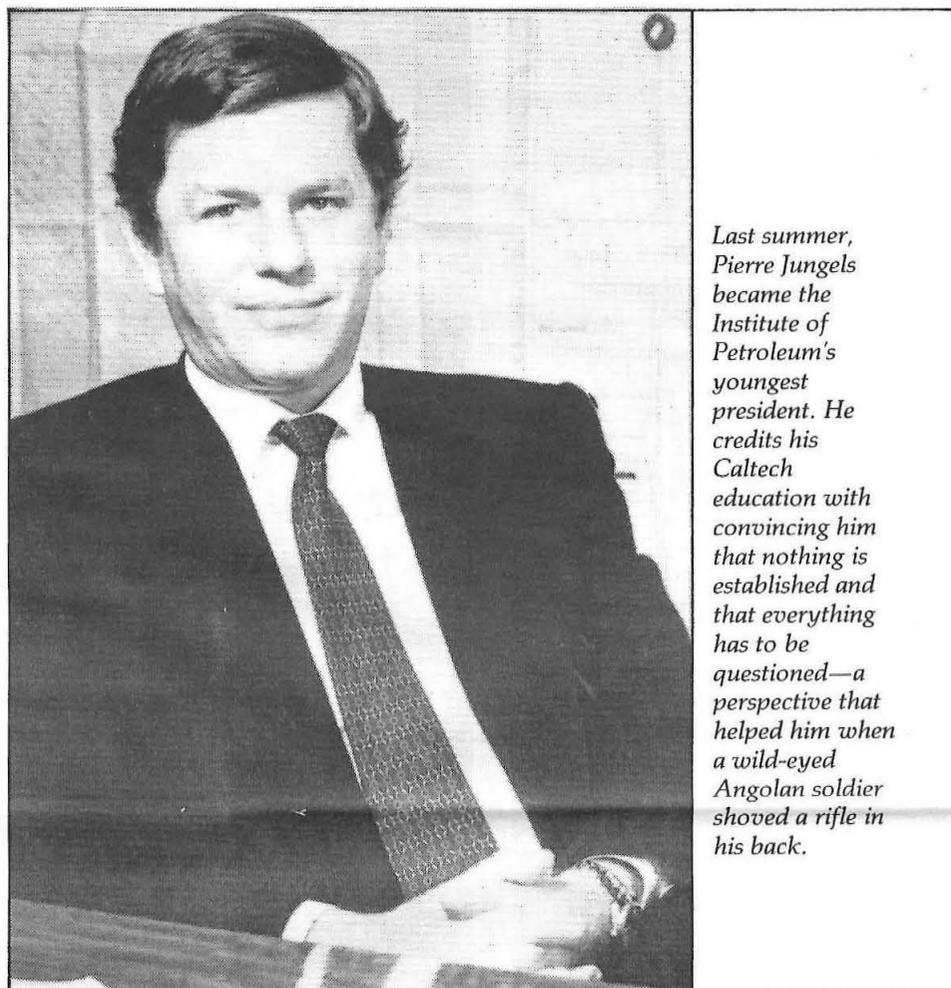
Circumstances have confirmed to Dr. Pierre Jungels time and again that his five years at the California Institute of Technology were among the most fortunate in his life. These include the occasion when a rifle was shoved in his back by a young soldier in a fever of excitement in the aftermath of a battle—in which he was no participant—and the orderly decisions of commercial life.

What they did at Caltech was to show him—convince him forever—that nothing is established and that everything has to be questioned.

The situation when the wild-eyed Angolan soldier burst into his Petrofina house might have been, "Is this the end?" To Pierre the question was: "How can it possibly be the end? There may be three rival armies fighting each other at the same moment in this town—but the commanders know me. They all tell us they want Petrofina here. Ours is the country's only oil production, and it is rising. Surely they must continue to want me here? It is a matter of making the right contacts. This is what this soldier—and his friends who have just joined us—and I must do."

Pierre was the soldier's prisoner as they walked through the streets of the north Angolan town to the headquarters of the movement which had won the night battle on this occasion. Pierre was pleased to see a familiar face or two when they arrived. There were handshakes and goodwill expressed all round. He was soon back to the Petrofina office, next door to his house, where the night had been spent sensibly hugging the floor. The company was open for business as usual.

It was 1975, and his role: district manager for the northern province of Angola for Petrofina. Although the country was torn by a civil war, Petrofina was operating fully. A succession of interesting circumstances, several of which had been set in motion by his questioning of himself and what he was achieving, had brought him to Angola at the moment when the Portuguese were leaving and violence erupted as political tensions escalated. These events went back only a little more than a decade because at the time of the prisoner incident in 1975, Pierre was but 31.



Last summer, Pierre Jungels became the Institute of Petroleum's youngest president. He credits his Caltech education with convincing him that nothing is established and that everything has to be questioned—a perspective that helped him when a wild-eyed Angolan soldier shoved a rifle in his back.

There having been five generations of engineers in the Jungels family, it was not surprising that his father, a highly successful chemical engineer in Liege, wanted Pierre to follow the tradition. But Pierre wished to become a veterinary surgeon. His mother's father had a big farm in the wheatlands of western Belgium, where Pierre spent long holidays. He loved the cattle and horses. When the vet came, the young Jungels watched and helped him at work.

The difference of opinions on the future led to a clash between father and son when the time came for Pierre to go to university. The father's views won. He pointed to the suddenly difficult outlook for vets in Belgium. The Belgian Congo was becoming independent and many veterinary surgeons were returning home. There was not enough work for them all. "They are having to look after canaries, not cattle," declared Mr. Jungels senior.

Pierre, who had not been as questioning as he was later to become, accepted that fact and said he would like to attend mining engineering school in Liege—but with an option in geology—because that would associate him with nature, which he

loved, and with his original intention. This was agreed.

When he graduated with a Belgian mining engineering degree in 1967, the oil industry was in one of its periodical troughs. Geologists were not being recruited. Coal mines were closing all over Belgium.

"I decided to take the soft option of continuing at university," he told me. "I was lucky to get a Fulbright Scholarship for further studies in the United States. Mistakenly thinking it was a middle-of-the-road engineering school, I applied for the California Institute of Technology. It is in fact one of the top research institutions in the world, with 23 Nobel Prize winners among its faculty and alumni. [Ed. note: There are 20] There were some 750 undergraduates, 700 studying for doctorates, and the faculty numbered 650—the highest ratio of faculty to students anywhere. Caltech required a minimum of five years for a PhD in geophysics or geology, simply because they feel a Caltech doctorate must represent a significant advance in research. This research has also to achieve publication, at least in part, in recognized journals. It all takes time."

Earthquakes was his study, in the Richter Laboratory, his thesis being Tectonic Processes Associated with Earthquakes. He was awarded his doctorate in geophysics and hydraulics in 1973, after 11 years at university. It happened that in using one of Caltech's large computers on the tectonic process, he produced models on the Long Beach oilfield where the sea floor of the harbour, due to subsidence, had fallen considerably—but later to rise again following water injection. This study by Pierre much interested Shell America when he began looking for a job. By the scholarship rules, he had to work outside the U.S. for at least two years. Shell International offered him a job as a petroleum engineer and after six months' training at The Hague, he was sent to Borneo as well site petroleum engineer.

He felt conscious of his age.

He was 29 going on 30. Most of the people joining Shell with him then, in 1973, were 21-year-old BAs or Dutch engineers who were 23 or 24. "And having spent five years among all these brilliant people at Caltech, I probably had begun to believe I was just as brilliant myself. I found mud logging and all those things not particularly satisfactory." The questioning process was so severe that after a year he resigned. "The fact that I resigned before finding another job showed I had probably not grown up from university attitudes, especially as my wife—whom I'd met and married in California—was expecting twins."

It was also an illustration to him that taking the right course is more important than being deterred by the risks. He found that the Belgian-based Petrofina company was looking for reservoir engineers. Being a Belgian, having the right sort of degree and a certain amount of experience, won him a job as a staff reservoir engineer in Brussels. He was put to work on the model of a reservoir in Portuguese Angola, where the company had a subsidiary, and next he was asked to go there to assess conditions and to amplify the technical recommendations. It was to be a short assignment.

But events were dictating the situation even as he arrived. The outbreaks of violence as Portugal began to withdraw from the country led to the sudden departure of Portuguese staff. Pierre was given a promotion that startled him. He was asked to stay as district manager of the northern province which held most of Petrofina's oil production. He remained in that post for two years,

but under difficult conditions in which fighting often took place around the oilfield. Nevertheless, Petrofina's production was increased and the first tankers for the export of oil were loaded.

It was a strange existence. Three armies were in the field but the company aeroplane continued to fly, often between Luanda and the province without mishap. Soldiers were wounded by gunfire nearby, but the oil operations were respected by all parties. The question was, "Will this go on forever?" The answer: obviously not. An unexpected aspect that helped to make life a little less difficult for the oilmen was the absence of racism. The Angolan does not notice whether you are black or white, says Pierre.

In January 1977, Pierre was promoted to general manager of Petrofina Angola. His responsibilities included the only oil refinery in the country, production fields in the north and south, and three drilling rigs being used to develop the on-shore fields which were discovered during the civil war. The company was also looking at concessions offshore. Signs of better times were that the appointment was for three years and his family could join him. His twins were the first European children to return to Angola. When Pierre came back to Brussels in 1980 for quick training in refining and supply optimisation, they left behind many friends with whom they remain in contact.

By September 1980 he was transferred to Petrofina (UK) as personal assistant to the chairman. Six months later, at 37, he became managing director and chief executive of Petrofina (UK) Limited, an established, fully integrated UK oil company which, helped by acquisitions, has subsequently improved its UK position. Jungels is also managing director and chief executive of Fina Exploration Limited, which has North Sea interests.

When the Institute of Petroleum further developed its structure in 1984, Dr. Jungels accepted the invitation to become one of the four vice presidents who undertake a specific responsibility. His was manufacturing and marketing. The following year he was invited to accept the nomination of president-elect, the first foreigner—and the youngest person—to have been offered this honour.

"Day on the Job" program yields career insight for students

Caltech alumni can be excellent sources of information and motivation for undergraduates. With that premise as a guide, the Caltech Career Development Center, working with the Caltech Alumni Association, last spring launched the "Day on the Job" program.

The purpose: To match employers of diverse professional interests and backgrounds with students who want to learn more about what the employer's field is actually like. The program was run in conjunction with the new job location and development project, which seeks career-related summer and part-time jobs for students.

Twenty alumni—ranging from actuaries to aerospace engineers to physicians—responded to a query from the Alumni Association asking if they would be interested in hosting students, and over the summer, 14 students went out to visit and explore.

So far, responses on both sides have ranged from favorable to enthusiastic, and an expansion of the program is in the works.

Bassem Mora, a sophomore majoring in biology, was thinking strongly about becoming a physician when he spent parts of two days with James Loddengaard (BS '74), an orthopedic surgeon in private practice in the Pasadena area. "This experience was the straw that broke the camel's back," says Mora. "I decided on medicine as a career."

Mora watched two surgical proce-

dures, both involving the wrists, observing everything from pre-operative preparations to the surgery itself. "Dr. Loddengaard explained everything," he says.

Mora came back to the doctor's office a few days later to observe as Dr. Loddengaard consulted with patients.

"Before he talked with a patient he gave me an overview of what he could and couldn't do in the case," says Mora. "Most of the time he was prescribing exercises for the patients. Afterward we talked for about an hour—about medical school and medical practice. It was all more exciting than I expected."

"He wasn't at all put off by the surgery," remarks Loddengaard. "Of course it was gentle dissection stuff—nothing requiring heavy equipment."

"This was a good experience for a Caltech student. At the Institute, students get to see what they'll be doing if they become scientists, but not necessarily what they'll do if they go into engineering or medicine; those are whole different worlds."

"If other students are interested in coming to visit, I'll be happy to see them."

Toby Shafer, a graduate student in chemical engineering, spent her day on the job in one of the most unusual of all fields—that of the actuary. (An actuary is a statistician who calculates and states risks, premiums, etc., for insurance purposes.) She was one of two students who visited the offices of Milliman and Robertson, an

actuarial firm in Pasadena, where Cary Eklof (BS '66) was her host.

"This is an obscure field," says Eklof. "There are only about 10,000 actuaries in the world. It is an excellent field for Caltech students because it requires a high level of mathematics knowledge and a high intelligence level."

"I feel I owe something to Caltech, and talking to students about what I do is one way to help."

Shafer, who has decided to become an actuary, says that the experience was very helpful—"especially since it involved a field where not much information is available."

John Healy (BS '69) of the Hughes Space and Communication Division coordinated a visit for two students. "Of course, most of our work is done in classified areas and we couldn't take students there," he notes. "We showed the students an unclassified area and had good chats with them. It was a very exploratory experience for them, but it may have helped them decide whether they're interested in software engineering as a profession."

"I'd be more willing to invest time if the students who came had a definite interest in this area, but at least our visitors got some exposure to what we do here."

Other students visited Calreco (formerly Carnation) through the efforts of Joseph Cullen (BS '64), and several students discussed the realities of medical school with Mark Ragins (BS '79), a resident in psychiatry at the Los Angeles County Mental Health Facility.

Lockheed, through Richard Heppel (Eng '47), sponsored a full-day visit for Eric Gaidos, who attended the professional orientation program for new employees, and George Cooke (BS '53) of G. B. Cooke Inc. arranged a visit for Marie Agnes Allard. Cook talked about his construction business, and the two discussed management issues.

Sheryl Mercer, assistant director of the Career Development Center, reports that students have been enthusiastic in their response to the program and that the office is seeking additional employers willing to participate. "We would like to offer a wide variety of Day on the Job experiences to Caltech students," she explains.

Employers in the fields of biology and chemistry are particularly needed, and anyone who is willing to have student visitors through the Day on the Job Program should contact the Career Development Center.

Fox Stanton Track rolls into place



The new six-lane all-weather Fox Stanton Track and Field has been installed—made possible by a \$450,000 grant to the Institute from the Lon V. Smith Foundation. The track does not have to be wet down and dragged every day as the old track did. It can be used in all kinds of weather, including rain, and it does not have to be "striped" before every track event. The running lanes are permanently marked.

Missing: 855 alumni. Please help us find them.

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 Association office, (818) 356-6592, 1-97, Caltech, Pasadena 91125.

Raymond W. Ager	BS	1922	David H. Scott	BS	1922	Thomas D. Baze	BS	Daniel F. Lam	MS
Blake Beatty	BS	1925	Lester G. Zukerman	BS	1925	J. Neal Brantner	MS	Kar-Shing S. Lee	BS
Arthur J. Garfield	BS	1923	George A. Brettell, Jr.	MS	1923	James P. Cerne	MS	David Y. Leung	MS
Robert J. Hammond	BS	1923	Robert C. Brumfield	BS	1923	George K. Chan	MS	Thanh Luu	BS
Hubert Woods	BS	1924	Arthur M. Compton	BS	1924	Ted W. Dillingham	BS	Michael J. Mariani	BS
Warren B. Leavitt	BS	1924	Rear Adm. William E. Gentner	MS	1924	Michael B. Farber	BS	William R. Molzon	BS
Mitchell C. Lukens	BS	1924	Arville C. Gibson	MS	1924	Michel H. Flandrin	MS	Stanley K. Nakamoto	BS
Willard H. Tracy	BS	1925	William J. Green	MS	1925	Mark P. Goldstien	MS	Charles F. Schmidt, Jr.	PHD
William H. Allen	BS	1925	William J. Howell	MS	1925	Luis N. Ikwueke	MS	Vinod Shekher	MS
Wilfred G. Thompson	BS	1925	Ruhollah Y. Karubian	MS	1925	Barry R. Keller	BS	1st Lt. Donald J. Sullivan	MS
Conrad J. Waller	BS	1926	Adolph Lovoff	MS	1926	George J. Siltanen	MS		
Hung Y. Chang	BS	1926	Luigi Menis	BS	1926	Richard L. Sweet, III	MS		
Riley L. Gilbert	EX	1926	Norman L. Peterson	MS	1926	William E. Wright	MS		
Nathan F. Scudder	BS	1927	Robert A. Phillips	BS	1927				
Frank F. Peterson	BS	1927	Shih C. Tao	MS	1927				
Francis C. Martin	MS	1928	Sabin A. Ustel	MS	1928				
John D. Elder	PHD	1929	Tsung-Su Wang	MS	1929				
Raymond J. Kircher	BS	1929	James M. Watkins, Jr.	BS	1929				
Kam H. Lau	BS	1930	John O. Wessale	BS	1930				
Julius Nelson	BS	1931	Norman Z. Alcock	MS	1931				
True W. Robinson	BS	1931	Glenn W. Billman	BS	1931				
Willem Uytendhoeven	PHD	1931	Hugh Bradner	PHD	1931				
Donald K. Allison	BS	1932	Morris R. Clark	BS	1932				
William Kelley	BS	1933	Samuel J. Easley	MS	1933				
Frank N. Moyers	BS	1933	John M. Feeley	BS	1933				
Jack D. Pritchett	BS	1933	Hayne, III	BS	1933				
Katsunoshin Suzuki	BS	1933	H. T. Huang	BS	1933				
Jack H. Amann	BS	1934	Frederick J. Lewis	MS	1934				
Tseng-Loh Ho	MS	1934	Norman J. MacDonald	BS	1934				
James B. Taylor	EX	1934	Stanley R. Nixon	BS	1934				
William T. West	BS	1935	K. V. Prasad	MS	1935				
Carl K. Yoshioka	BS	1935	Carl K. Salbach	MS	1935				
F. B. Phleger, Jr.	MS	1935	Elmer R. Shepard	BS	1935				
Thomas C. Burk	EX	1935	Lt. Col. Harvey F. Smith	MS	1935				
Luis E. Kemnitzner	MS	1935	Yu-Sin Tung	MS	1935				
William A. Larsen	MS	1935	Harry L. Vincent, Jr.	MS	1935				
Edwin B. Michal	MS	1935	Thomas F. Weldon	MS	1935				
Winston H. Rice	BS	1935	Rolland S. Asher	BS	1935				
Maple D. Shappell	PHD	1935	Adolfo J. Atencio	MS	1935				
Warren H. Smith	BS	1935	Paul K. Charlu	MS	1935				
John Read	PHD	1935	Frederic B. Clarke	ENG	1935				
Roland J. White	MS	1935	Hugh H. Collins	ENG	1935				
Edward A. Bertram	MS	1936	Brain D. Dagnall	MS	1936				
M. Harrison Evans	BS	1936	Subodh C. Das	MS	1936				
Paul F. Genachte	PHD	1936	Byrne Eggenberger	BS	1936				
Fun-Chang Huang	MS	1936	Eric Gillam	MS	1936				
Russel L. Maycock	EX	1936	Walter Harrington	MS	1936				
Dagoberto Rivas	BS	1936	Ea-Qua Huang	MS	1936				
Neil W. Snow	EX	1936	Felix A. Kalinski	MS	1936				
Radm Calvin M. Bolster	MS	1936	Leo Fiorello	MS	1936				
Larry L. Young	MS	1937	James S. Lesko	MS	1937				
Thomas R. Burnight	BS	1937	John Manoukian	MS	1937				
Ju-Yung Cheng	MS	1937	Michael K. Molloy	MS	1937				
Roderic C. Davis	MS	1937	Basil E. Moorehead	BS	1937				
Edward J. Horkey	BS	1937	Raymond L. Olson	BS	1937				
Paul F. Jones	MS	1937	John L. Orr	MS	1937				
Thomas N. Shaw	BS	1937	Guruvayur S. Ramaswamy	MS	1937				
Ellis W. Shuler	MS	1937	Loys M. Satterfield	ENG	1937				
Luther P. Spalding	BS	1937	Alexander Smith	PHD	1937				
Meyer J. Test	BS	1937	Loren F. Stringer	MS	1937				
Clark H. Wiget	BS	1937	Francis D. Sullivan	BS	1937				
Kamal Djanab	PHD	1938	Russell A. Russell	MS	1938				
Duane W. Farnham	MS	1938	George R. Vanden Heuvel	MS	1938				
Hyman D. Goodman	MS	1938	Alonzo H. Wellman, Jr.	ENG	1938				
Arthur G. Gross	BS	1938	Clifford M. Wimberly	MS	1938				
Arnulfo G. Gutierrez	MS	1938	Edward B. Winters, Jr.	BS	1938				
Frank C. Lowe	BS	1938	Ying-Ching Au	BS	1938				
Noble R. Maines	EX	1938	Capt. James A. Bunce	MS	1938				
William Rhett	BS	1938	Tao-Hung Chu	MS	1938				
Chi-Cheng Tsao	BS	1938	Albert R. Clark	MS	1938				
Hsih-Heng Wang	MS	1938	Burgess F. Collins	BS	1938				
James W. Watson	BS	1938	Perry H. Eubank	MS	1938				
Andrew Frejer	BS	1939	Patrick N. Glover	BS	1939				
Winthrop G. Jones	MS	1939	James A. Harder	BS	1939				
Spencer W. Oakley	BS	1939	Nelson Jarmie	BS	1939				
Walter B. Powell	BS	1939	Robert J. MacNeill	MS	1939				
			Herman A. Mason	BS	1939				
			Winton G. Roe, Jr.	BS	1939				
			John T. Slusher	MS	1939				
			John S. Swain	BS	1939				
			Robert K. Swank	MS	1939				
			William H. Voelker	MS	1939				
			James E. Whitney	MS	1939				
			Robert S. Winniford	MS	1939				
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ALUMNI ASSOCIATION FINANCIAL STATEMENTS

ALUMNI ASSOCIATION
CALIFORNIA INSTITUTE OF TECHNOLOGY
Pasadena, California

BALANCE SHEET
June 30, 1986

ASSETS	
Cash on Hand and in Bank	\$ 9,469
Investments:	
C.I.T. Consolidated Portfolio	903,832
Money Market Funds	122,530
Investment Income Receivable	14,000
Other Receivables	1,409
Deferred Program Expenses	13,878
Postage Deposit and Other Deferred Expenses	4,318
TOTAL ASSETS	\$1,069,436

LIABILITIES, RESERVES AND SURPLUS	
Accounts Payable	\$ 50,136
Deferred Income:	
Annual Membership Dues Paid in Advance	1,480
Investment Income from C.I.T. Consolidated Portfolio	41,000
Program Income	7,200
Life Membership Reserve	912,059
Reserve for Directory	6,193
Reserve for Student Support and Educational Programs	16,933
Reserve for Equipment Purchases	5,000
Surplus	29,435
TOTAL LIABILITIES, RESERVES AND SURPLUS	\$1,069,436

STATEMENT OF INCOME, EXPENSES AND SURPLUS For the Year Ended June 30, 1986

INCOME	
Dues of Annual Members	\$ 65,868
Investment Income:	
C.I.T. Consolidated Portfolio	59,603
Money Market Funds	10,294
Allocation from Reserve for Student Support and Educational Programs	5,829
Net Income from Annual Seminar and Other Programs	1,390
TOTAL INCOME	\$142,984

EXPENSES	
Publications	\$ 17,783
Net Expenses of Class Reunions	8,547
Net Expenses of Chapter Meetings	6,161
Student Support and Educational Programs	21,800
Undergraduate Admission Support	4,740
Administration	65,899
Membership	8,458
Net Expenses of Publication of <i>Legends of Caltech</i>	2,323
Allocation for Reserve for Directory	11,000
TOTAL EXPENSES	\$146,711
EXCESS OF INCOME (EXPENSES)	\$ (3,727)
Surplus, June 30, 1985	33,162
Surplus, June 30, 1986	\$ 29,435

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, 1986, 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, 1986, 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 23, 1986

Mark G. Mcharg	BS	Lawrence R. McGee	PHD
Charles E. Novitski	PHD	Samin A. Mithani	BS
Patty P. Pang	BS	David A. Myers	MS
Richard C. Parker	PHD	Richard L. Nadler	BS
Tim X. Rentsch	BS	John Y. Ngai	BS
Jose A. Rial	PHD	Hisup Park	BS
Augusto Sagnotti	MS	Pamela J. Phillips	BS
Matthew L. Spitzer	PHD	Steven F. Rice	PHD
Jebril A. Swedan	MS	Edward Schepps	MS
David R.		Anuchit Tiranuchit	BS
Van Alstine	PHD	Liem T. Tran	BS
Tak-Yiu Wong	MS	Russell E. Walker	MS
1980			
Meir Bartur	MS	Jeffrey A. Aguilera	BS
Robert J. Bensoussan	MS	A. V. Anilkumar	MS
Thomas A. Boldt	BS	Philip S. Beran	MS
Roland L. Bouchard	MS	David P. Brady	MS
David M. Cole	PHD	Arthur E. Chiou	PHD
Alain Delsupexhe	MS	Walter A. Coole	BS
Reda E. El Damak	MS	Yongbum P. Cuevas	MS
James R. Ellison	MS	James M. Cummings	BS
Jeffrey L. Fordon	MS	Barry D. Davidson	MS
Dhruvil J. Gandhi	MS	Lisa L. Flitz	BS
Deane A. Gardner	BS	Morteza Gharib	PHD
Patrick W. Goalwin	MS	Robert G. Helbing	BS
Peter M. Goodwin	BS	Baruch D.	
Mohammed F. Helwa	MS	Kupperman	PHD
Jeffrey B. Johnson	MS	Wendy A. Olson	MS
David M. Joseph	BS	Jonathan E. Parker	BS
Herman S. Li	MS	Gabriel M. Rebeiz	MS
Thomas Loughry	EX	Ilene M. Reinitz	BS
Mark A. Ludwig	MS	David C. Sams	MS
Christian Mailhiot	MS	Balachandran	
Kevin S. McLoughlin	BS	Sathiapalan	PHD
Bruce B. Pedersen	BS	Kenneth J. Stern	MS
Charles S. Reynolds	BS	Gregory P. Tollisen	MS
Karen I. Robinson	MS	Walter S. Tsuha	MS
Colleen R. Ruby	BS	Thiti Vejpas	BS
Napapon S. Scott	PHD	Korawit	
Charles S. Slater	MS	Wacharasindhu	MS
Joseph S. Stephens	MS	William H. Wright, III	BS
R. Eric Strong	MS	1984	
Eric J. Swanson	MS	Glyn H. Anderson	BS
Stephen Wolfram	PHD	Damir I. Barudi	PHD
Michael R. Woolley	BS	James H. Bell	BS
1981			
Horace R. Drew, III	PHD	Paul S. Bloch	MS
Singaravelu		Anne-Marie Brest	MS
Elangovan	MS	Carol J. Bryan	BS
Steven L. Gay	MS	Michael P. Casassa	PHD
Ted D. Hesselroth	BS	David N. Chiang	MS
Robert P. Kreh	PHD	Haris Christodoulou	MS
Luen-Hin Kwok	MS	Reese Faucette	MS
Louis Lamarche	MS	Michael A. Fernandez	BS
Christopher		Brian J. Fitzsimmons	PHD
Lamendola	MS	George M. Klapakis	MS
James P. Landon	BS	Terry J. Ligocki	BS
Tuan A. Le	MS	William K. Moonan	PHD
Tzu-Mu Lin	MS	Phu T. Nugyen	BS
Michael O. Newton	BS	Jeffrey P. Rhinesmith	MS
Ka-Yiu San	MS	John J. Schaeck	BS
Paul N. Spathis	BS	Steven G. Schlipf	BS
Peter H. Stahlecker	MS	Barry A. Swartz	PHD
Daniel H. Turnbull	MS	Emre Tokar	BS
Patrick K. Walp	BS	Nadeem Tufail	BS
1982			
John R. Bennett	BS	Hugh H.	
Marc J. Berman	BS	Breneman, III	PHD
John T. Bongiovanni	BS	Ariel Caticha	PHD
Jonathan F. Buss	BS	Keming Chen	MS
Ilnur Erbas	MS	Betty J. M. Hannoun	MS
Graeme F. Fowler	PHD	Larry J. Romans	PHD
Karl W. Heuer	BS	Hidenori Sonoda	PHD
Linda B. McAllister	BS	Seung-Man Yang	PHD

Sacramento alumni meet monthly for lunch

Caltech alumni in the Sacramento area meet for lunch on the second Friday of every month at the Rosemont Grill, 3145 Folsom Boulevard, in Sacramento. A social hour begins at 11 a.m. and lunch is at 12 noon. The next meeting will be December 12, and all alumni are invited. For reservations, phone the luncheon chairman, Paul Wolf (BS '44), at (916) 331-1830.

The Mechanical Universe: loved in Leningrad

A segment of Caltech's video production, *The Mechanical Universe*—a visually sophisticated college-level introduction to classical mechanics—has been honored in Leningrad at the 38th Congress of the International Science Film Association.

The segment chosen, "The Lorentz Transformation," was praised for its outstanding presentation of a complex physics concept. Judges noted its effective use of computer animation, and particularly the clear presentation of the fact that all observers measure the same speed of light.

One of the judges from West Germany said that the segment enabled him to understand the theory of relativity for the first time.

Alumni Activities

Mark your calendar with the dates below and join us for some of the Alumni Association's best programs. For more information about any event, please call Janet Davis, executive director of the Alumni Association at (818) 356-6594.

JANUARY 1, *Annual Rose Parade program* featuring excellent parade seats and brunch at the Athenaeum. Alumni who live outside California and would like specific ordering information should contact the Alumni Office.

FEBRUARY 6, *Special preview of the exhibit, "25 Years of Space Photography,"* for Caltech alumni and guests at the Exploratorium in San Francisco. See article on page 14 for details.

FEBRUARY 21, *Monterey Bay Aquarium event* for Caltech alumni, featuring a private reception and tour of this unique aquatic facility. Details will be sent to alumni in the local area.

MARCH 13 AND 20, *23rd annual winetasting program* in the Athenaeum. An opportunity to taste fine wines and learn about their origins and special characteristics.

MAY 1, *Reunion for the class of 1977* at the Athenaeum.

MAY 2, *Reunions for the class of 1942 and class of 1952* at the Athenaeum.

MAY 2, *Combined reunion event for classes of 1947, 1957, 1967, 1972, and 1982.* Details will be announced soon.

MAY 3, *Sports Day on the campus.* A chance for alumni, faculty and students to compete in a variety of sports activities for fun and fitness.

MAY 15, *Reunion for the class of 1962* in the Athenaeum.

MAY 16, *50th annual Alumni Seminar Day* on the campus. This promises to be an exceptional Seminar Day and we hope you'll join us in celebrating 50 years of learning and achievement.

JUNE 5 AND 6, *Half Century Club luncheon* in the Athenaeum.

JUNE 18, *Alumni Association annual meeting and dinner* in the Athenaeum.

JUNE 19 - JUNE 28, *Alumni trip to Alaska,* guided by Robert P. Sharp, the Robert P. Sharp Professor of Geology, Emeritus.

OCTOBER 5 - 9, *New England alumni trip* through New Hampshire and Vermont, guided by Robert P. Sharp and by Jo Laird (PhD '77) and Wallace Bothner, professors of geology at the University of New Hampshire. Details and sign-up information will be mailed to alumni in the East early in 1987.

Alumni Fund names area chairmen

Area chairmen with responsibility for contacting fellow Caltech graduates in their geographic regions during the 1986-87 Alumni Fund year are announced below. They are:

Region 1: George Mann, BS '37, MS '38, Alhambra/South Pasadena; Norman Fjeldsted, BS '45, San Marino; Dimitri Chamieh, MS '78, PhD '83, south central Pasadena; Robert Brydolf, BS '44, east Pasadena; David Ritchie, BS '80, Arroyo; Raymond Heacock, BS '52, MS '53, JPL; Jack Keyser, BS '40, La Canada-Crescenta Valley; Joseph B. Earl, BS '44, Arcadia/Sierra Madre.

Region 2: Calvin Kempton, BS '46, Laguna Beach; Robert Wayman, BS '40, South Laguna Beach; Sanford Sweet, BS '51, Huntington Beach; Return Moore, BS '47, MS '48, Anaheim; Terry Simpson, BS '65, Anaheim-Orange; Mark Morrisset, BS '81, Newport Beach; William Bonell, MS '39, Irvine-El Toro; Riley Holly, BS '58, Santa Ana; Donald Hyers, PhD '37, Long Beach; Michael Sperry, BS '70, Artesia-Westminster; William Bond, BS '44, Downey-Whittier; Michael Stefanko, BS '70, Covina; Donald Stewart, BS '47, Pomona-C Claremont; Joseph Sheffet, BS '32, MS '33, desert communities; Curtis Lee, BS '39, Riverside-San Bernardino.

Region 3: Reinaldo Gutierrez, BS '54, Palos Verdes; Paul Dergarabedian, PhD '52, aerospace; Mitchell Seidman, BS '58, MS '59, TRW; Fred Blum, MS '64, PhD '68, Santa Monica; Leo Milan, BS '36, Los Angeles/Beverly Hills.

Region 4: Raymond Richards, BS '40, east San Fernando Valley; Richard Morgan, BS '49, west San Fernando Valley; Kyle Catterlin, BS '52, north San Fernando Valley; Leslie Paxton-Rousseau, BS '79, Ventura-Thousand Oaks; Tad Reynales, BS '72, Santa Barbara; Pierre St. Amand, MS '51, PhD '53, Bakersfield; Stanley Parkill, BS '55, San Luis Obispo.

Region 5: Donald Cleveland, BS '34, Monterey-Santa Cruz; Timothy Hight, BS '72, Los Gatos/Saratoga; Robert Talbot, BS '57, San Jose; Boyd Israelsen, BS '52, MS '53, Los Altos; Peter Tong, MS '81, PhD '85, Sunnyvale; Alan Breakstone, BS '72, Mountain View; Donal Duncan, BS '45, PhD '51, Palo Alto; Robert Bell, BS '72, MS '72, Stanford; E. Gullekson, MS '39, San Mateo.

Region 6: Robert Sherwin, BS '43, MS '50, Eng '52, Marin County; Perry Brown, BS '39, Napa-north coast; Maurice Nugent, PhD '65, Northeast Bay; David Sams, MS '80, Oakland-southeast Bay; Norman Bulman,

PhD '52, Contra Costa; David Oakley, BS '50, MS '52, PhD '55, Livermore; Arthur Critchlow, BS '47, Sacramento; Clinton West, BS '57, Sierra.

Region 7: Dwain Bowen, BS '42, MS '46, Rancho Santa Fe; Jack Wireman, MS '60, north San Diego; Philip Lowry, Ex '71, San Diego; Robert Cooley, PhD '42, south bay-San Diego; Douglas Brandt, BS '78, Hawaii; Sy Goodman, PhD '70, Tucson; Clay Smith, BS '38, MS '40, PhD '43, Albuquerque.

Region 8: Russell Halsted, BS '71, Portland; John Deniston, BS '47, Corvallis-Eugene; Gilbert Peppin, BS '53, east Seattle; Frederick Thiele, BS '41, Seattle; Craig Zumbrunnen, MS '68, University of Washington; Tak Sing Lo, BS '73, North Sound-Alaska; John Thomas, BS '57, Boeing; Frederick Mann, PhD '75, east Washington-Oregon; Donald Lilienthal, BS '48, Big Sky; Forrest Allinder, BS '49, MS '50, Utah; George Bramhall, BS '41, Boulder; David Koons, BS '52, MS '55, Denver; Jacques Bourque, BS '68, south Colorado.

Region 9: William Brown, BS '39, Oklahoma-Arkansas; Richard Forester, MS '71, PhD '75, Dallas; Richard Montgomery, BS '59, Austin-Fort Worth; Albert Schweizer, PhD '74, Louisiana; John Wachter, MS '49, Tennessee-Alabama; Alvin Fehrman, MS '55, Eng '55, North Florida; Tsung-Chow Su, MS '70, Eng '73, south Florida; Henry Corriher, MS '50, Georgia; William Wright, BS '51, PhD '55, North Carolina.

Region 10: Edwin Matzner, BS '51, Missouri-south Illinois; George Dubes, PhD '53, central plains; Benjamin Cooper, BS '67, Minnesota; John Firkins, PhD '70, Wisconsin; Roger Brandt, BS '42, northeast Chicago; Robert Levin, BS '65, southwest Chicago; Richard Lindsay, BS '73, Champaign-Urbana; James Koontz, BS '56, Indiana; Ernest Boller, MS '59, west Michigan; Dale Meier, BS '47, MS '48, east Michigan; David

Peisner, BS '74, Cleveland; John Jackson, BS '45, MS '54, Cincinnati.

Region 11: David Shaffer, PhD '74, Baltimore; Robert Jernigan, BS '63, Washington, D.C./west Maryland; Robert Williams, BS '62, Washington, D.C./east Maryland; William Harkins, Eng '54, northwest Virginia; Antanas Dundzila, MS '58, northeast Virginia; Robert von Gerichten, Eng '54, government agencies; Brian Storrie, PhD '73, south Virginia; William Hardam, PhD '65, Wilmington; A. Frederick Thompson, MS '65, PhD '68, Philadelphia; Charles Goebel, BS '57, east Pennsylvania; John Walden, MS '59, Princeton; Bruce Brown, MS '47, PhD '50, northern New Jersey; Kenneth Drake, BS '71, central New Jersey.

Region 12: Lance West, MS '83, Manhattan; Frank Johnson, BS '69, southeastern New York; Robert Hunt, MS '53, west New York; Robert Hall, BS '42, PhD '48, east New York; John Golden, BS '62, central New York; Bernard Malofsky, BS '59, Connecticut; Chang-Chih Chao, PhD '65, northeast Massachusetts; Eric Sinn, BS '83, Massachusetts-Rhode Island; Walter Larson, BS '40, upper New England; Donald Strange, PhD '72, Ontario, Canada; Rex Gibbons, PhD '74, east Canada.

Region 13: Everett Van Ness, BS '42, Europe.

been considered descriptive and theoretical. However, the need for a better understanding of how the procedures used by committees shape decisions has long been recognized, and the literature can provide guidance for the planning of an experimental program.

For example, in a seminal work (Ref. 1) published in 1957, the author states: "The life cycle of the committee is so basic to our knowledge of current affairs that it is surprising more attention has not been paid to the science of committology." He identifies several factors which appear to determine what, if anything, is decided in a committee meeting, but concludes that "—too many vital factors are unknown" and that "—much work remains to do."

A formula for the coefficient of inefficiency of a committee, developed at the Institute of Committology, is given on page 43 of the reference and may be of interest.

Very truly yours,
Ted Fahrner (BS '37)

Ref. 1: Parkinson, C. Northcote, *Parkinson's Law and Other Studies in Administration*. Houghton Mifflin Co., Boston, 1957.

San Francisco alumni to view space exhibit

San Francisco area alumni will have the opportunity to see the exhibit "25 Years of Space Photography" at the Exploratorium (3601 Lyon Street, San Francisco) from February 4 to March 15, 1987. Local alumni will receive an announcement about a special event on February 6 in connection with the exhibit.

The show, which was originally shown at Caltech's Baxter Art Gallery, features 140 images chronicling the unmanned space exploration of JPL—from Ranger and Surveyor missions in the early 1950s through the Mariner, Viking, and recent Voyager missions to Jupiter and Saturn.

The exhibit also includes images of earth as seen by the radar of Seasat, SIR-A, and SIR-B. The Infrared Astronomical Satellite (IRAS) contributes glimpses outside the solar system into our own galaxy and beyond.

The exhibit was organized by Jay Belloli, former director of Baxter Art Gallery, and by Jurrie van der Woude of JPL. The photographs were made by JPL for NASA, and the exhibition was funded by the IBM Corporation. The show has been at New York's IBM Gallery of Science and Art and the Chicago Museum of Contemporary Photography.

LETTERS

Dear Editor:

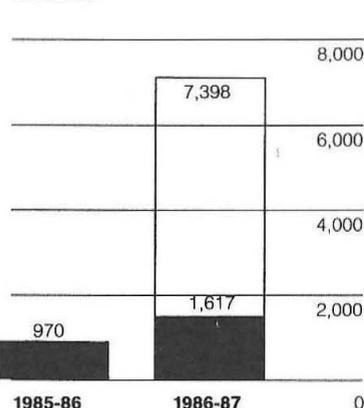
The generous grant to establish a laboratory for experimental economics and political science demonstrates an increasing awareness of the research at CIT in areas outside the physical and biological sciences.

As you state, until recently, economic and political science have

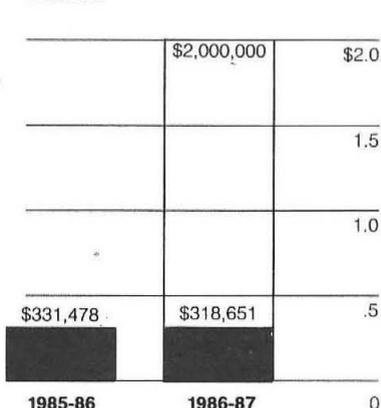
The Alumni Fund 1986-87/Goals and Achievements

□ Goals ■ Achievements as of Nov. 13, 1986

Donors



Dollars



Corporate matching gifts this year are down 50% (\$75,000) in comparison with the same time last year.

Obituaries

1929

KARL A. GANSSLE of Morganfield, Kentucky, on August 2. He is survived by his wife, Dorothy.

1938

PAUL C. HENSHAW, MS, PhD '40, on August 12 in Walnut Creek, California. He was a former chairman of the board of the Homestake Mining Co., which he joined as an exploration geologist in 1953. He is survived by his wife, Betty, three children, and six grandchildren.

FRANK B. JEWETT, JR., on June 28, while on Martha's Vineyard. He lived in New Canaan, Connecticut, and was president of the Technical Audit Association, and former president of New York-based Vitro Corp. of America. He is survived by his wife.

1941

ROBERT E. FISHER, MS '42, of Tarzana, on April 18. He was president of Amercom, Inc. He is survived by his wife. A memorial fund has been established in his name at Caltech, Office of Memorial Funds, Pasadena, 91125.

1944

GEORGE M. HOLSTEIN, of Newport Beach, on July 2. He had been president of Holstein Industries of Irvine.

EDWARD ROSENTHAL, PhD, of Montreal. He had been the Redpath Professor of Pure Mathematics at McGill University.

1946

GLYNN H. LOCKWOOD, of Monterey, on August 19, in a plane crash. He had been on a camping, fishing, and hiking trip to Alaska with two other friends when his light plane went down on a mountain on Hinchinbrook Island. Lockwood, who had always wanted to fly through Alaska, had been planning the four-week trip for 14 years. He was an avid outdoorsman and had climbed the Himalayas last year. Although he retired in 1983 after selling LTI Corp.—a company he founded that pioneered the development of application equipment for hot glue—he owned an antique store in Monterey. He is survived by a son.

1947

ARNOLD H. NEVIS, of Gainesville, Florida, on July 4. He had been a professor of electrical engineering and physics at the University of Florida.

1958

ANDREW GUTTMAN, MS, PhD '62, of Brooklyn. He had been a research engineer with the Space Sciences Lab in Valley Forge, Pennsylvania.

John Boppart, Jr. is very much alive!

We regret an error which appeared in the October '86 issue of Caltech News. John A. Boppart, Jr. (BS '52, MS '53) was listed in the Obituaries. He is currently president of AiResearch Manufacturing Co. in Torrance. He lives in Rancho Palos Verdes.

Personals

1918

FRANK CAPRA was one of twelve prominent artists and patrons who received the National Medal of Arts from President Reagan. A world-renowned film director, Capra won three Academy Awards for best direction of the Hollywood film classics "It Happened One Night," "Mr. Deeds Goes to Town," and "You Can't Take It With You." Two of his other movies are also American favorites, "It's a Wonderful Life" and "Mr. Smith Goes to Washington." He lives in Palm Springs.

1936

ALBERT G. BODINE, president of Bodine Soundrive Co., will receive the silver medal in physics from the American Institute of Physics for work in acoustics. It will be presented on December 10 in Anaheim.

1938

PAUL TILKER, writes from Eugene, Oregon, "Kathryn Whitaker and I were recently married. In addition to becoming a husband, I immediately became a father, father-in-law, and grandfather. I am retired."

1942

WALTER P. MITCHEL was awarded the Lauritsen-Bennett Award at the Naval Ocean Systems Center (NOSC) in San Diego for outstanding technical management contributions to the Center and the Navy, including Ariadne, Tactical Data Information Exchange System Band and command, control, and communications countermeasures (C3CM) programs.

CARL H. SAVIT, MS '43, has retired as senior vice president of Western Geophysical after 38 years of service, during which time he also served as chief mathematician, director of systems research, and vice president of research and development. Most recently, he was responsible for the coordination and direction of the technical activities of Western and its associated companies in the Litton Resources Group. He is the recipient of many awards, including the Litton Advanced Technology Achievement Award for his inventions in marine geophysics. In 1983 he became the first recipient of the International Association of Geophysical Contractors Distinguished Achievement Award.

1950

LEONARD S. LERMAN, PhD, was elected to the National Academy of Sciences this year. He is professor and chairman of biological sciences at the Genetics Institute in Cambridge, Massachusetts.

1951

OLIVER H. GARDNER has joined the investment banking firm of Huston Edmunds Moppel in Carlsbad, as vice president. Prior to his current position, he served as president of Mistral, Inc., a manufacturer of consumer electric fans. He is an avid ocean-going sailor and owns a 47-foot sailboat.

LAUREN A. WRIGHT, PhD, has been named a fellow of the AAAS for his "accomplishments in tectonic-stratigraphic geology, in departmental administration at Penn State and in contributions to national and international geologic organizations." He is professor emeritus of geology at the university. An authority on the geology of

California and Nevada, he is noted for his work in the Death Valley area and the southwestern Great Basin, and for the maps he has produced in association with the USGS and the California Division of Mines and Geology.

1955

F. G. (CHEK) BEUF writes from Sheridan, Wyoming, "After working as an aerospace engineer for Bell Labs and General Electric for 17 years, I returned to school (Temple University) for an MD, then to the Philadelphia Children's Hospital for postdoc training in pediatrics." He is now practicing in Sheridan and has been recently appointed by the governor to a three-year term on the state's Certificate of Need Board. "Spare time is spent in tinkering with (95%) and racing (5%) my Cobra in vintage events, cross-country skiing, backpacking, and trying to keep ahead of the ever-increasing pile of unread journals."

1958

JOHN L. GARDNER, JR., MS, has joined McDonnell Douglas Astronautics in St. Louis as vice president of engineering and operations. He returned to McDonnell—which he originally joined in 1958—after serving as director, systems office, in the Strategic Defense Initiative organization of the Department of Defense.

1960

ELI RESHOTKO, PhD, has been appointed interim dean of Case Institute of Technology in Cleveland, Ohio, the science and engineering school of Case Western Reserve University, where he is professor of mechanical and aerospace engineering. He joined CWRU in 1964 as an associate professor. He was elected to the National Academy of Engineering in 1984 and is a fellow in many organizations, including the AIAA, ASME, and AAAS. He is a U.S. member of the Fluid Dynamics Panel of NATO's Advisory Group for Aeronautical Research and Development and a member of NASA's Aeronautics Advisory Committee. He lives in Cleveland Heights with his wife, Adina, and their three children.

1963

JOHN S. LETCHER, JR., MS '64, PhD '66, has been serving as senior scientist in the San Diego Yacht Club's "Sail America" campaign to win the America's Cup back from Australia in 1987. He had primary responsibility for hydrodynamic and aerodynamic analysis, tank testing, performance testing, performance prediction, and computer-aided design tools used in the development of three new 12-meter yachts named *Stars & Stripes*.

PARK S. NOBEL, MS, is professor of biology at UCLA. He is co-author of *The Cactus Primer*, recently published by Harvard University Press. In addition to introducing cactus biology and providing a summary of the last 40 years' research, it presents the form, physiology, evolution, and ecology of cacti.

1966

AXEL MEISEN, MS, recently received the Canadian Society for Chemical Engineering's ERCO Award, which is "presented annually to a resident of Canada who has made a distinguished contribution in chemical engineering before the age of 40." His research includes the development of working equations for predicting diffusio-phoresis and thermophoresis in real systems for removal of particulates from the gases. He is dean of applied science and professor of chemical engineering at the University of

British Columbia, director of student affairs on the CSChE board of directors, and a member of the Canadian Accreditation Board.

HENRY G. SCHWARTZ, JR., PhD, is president of the Water Pollution Control Federation and recently headed the group's international convention in Los Angeles. He is vice president of the St. Louis-based Sverdrup Corporation.

1969

DAVID C. VIANO, MS, PhD '72, has been named a Fellow of the ASME. He is currently assistant head of the biomedical science department of General Motors Research Laboratories in Warren, Michigan, and adjunct assistant professor at Wayne State University in Detroit. Active in ASME, he is an associate editor of the *Journal of Biomechanical Engineering* and a member of the Transportation Safety Committee. He lives in Bloomfield Hills.

1972

DON N. PAGE, MS, PhD '76, associate professor of physics at Pennsylvania State University, has been awarded a Guggenheim Fellowship for 1986 for unusually distinguished achievement in the past and exceptional promise for future accomplishment. He will use his Guggenheim grant while on sabbatical leave (at Caltech and the University of Texas at Austin) to study theoretical gravitational physics focusing on quantum gravity and its implications for the state of the universe.

1973

G. DAVID BRIN received the John W. Campbell Award for the best science fiction novel of 1985 for *The Postman*. Set in post-nuclear America, a man chances upon a postman's uniform and undelivered mail; this discovery leads to the rebuilding of civilization. He is the 13th winner of the award, presented annually at the University of Kansas Campbell Conference for science fiction buffs. Brin lives in San Diego. He also won the Nebula and Hugo awards for his third novel, *Startide Rising*.

DOUGLAS K. DUNCAN has joined the staff of the Hubble Space Telescope in Baltimore.

1975

DALE R. POWERS, PhD, has been promoted to senior research associate-chemistry, research and development division, of Corning Glass Works in Corning, New York, where he has worked since 1974.

DAVID A. SMALLBERG was one of five recipients of the UCLA Alumni Association's Distinguished Teaching Assistant Awards this year. A teaching assistant in computer science, he is in charge of an intermediate programming course at UCLA. He received a certificate and \$500. He is working on his doctorate in computer science.

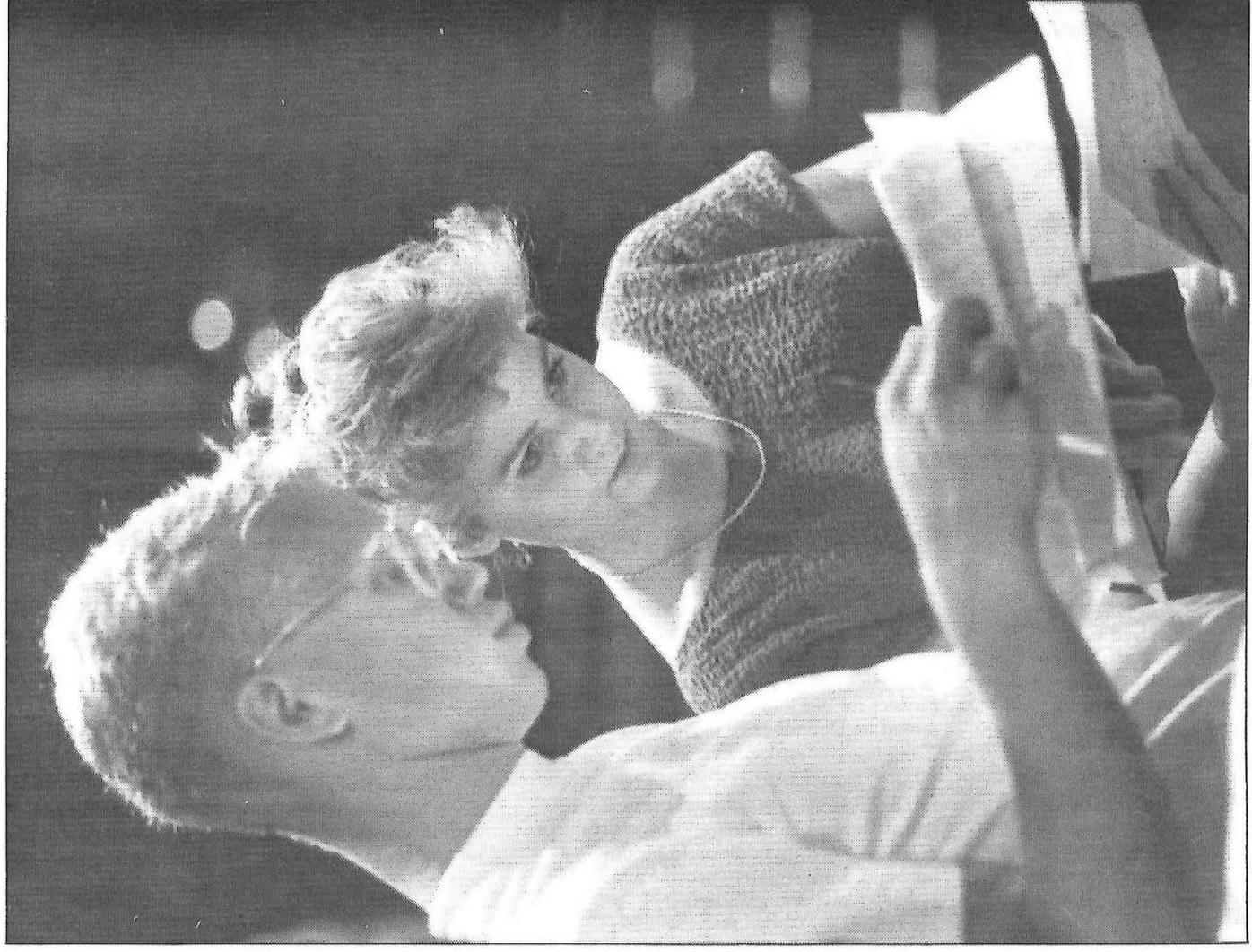
1976

PAUL GAZIS, of Sunnyvale, California, is working at NASA's Ames Research Center as a consultant for the Pioneer project. He received his doctorate in physics from MIT in 1983.

1978

LEE AYDELOTTE, MS '78, lives in Huntington Beach and is in charge of research and development for Codercard Inc., a computer security firm. He and his wife welcomed a son, Paul Charles, on February 17.

CALTECH NEWS



Sophomores Jordan Holt and Rachael Clark register for another year at Caltech.

December 1986



Pam Feldman relaxes on the return voyage from Freshman Camp. Feldman is Board of Control chairman and vice president of ASCIT (Associated Students of California Institute of Technology).

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