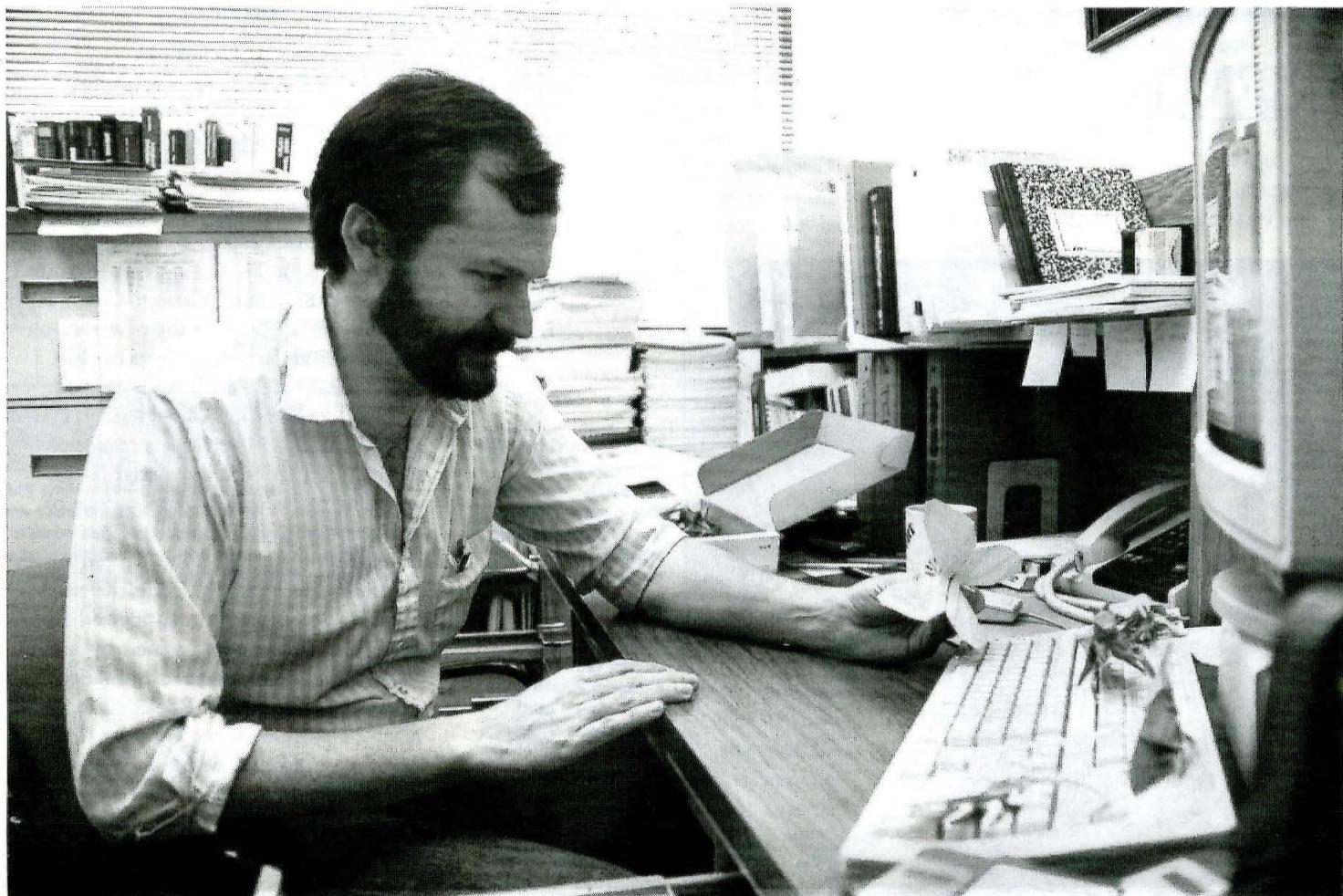


Caltech *News*

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In his office at JPL, Robert Lang displays some of his origami creations.

Japanese folk art attracts JPL engineer

By Winifred Veronda

Robert Lang (BS '82, PhD '86) was in the first grade when his teacher gave him a book on the ancient Japanese folk art of origami, the folding of paper into abstract and natural shapes. She had no idea that she was launching a love affair that would bring this Caltech alumnus to the top ranks of origami artists in the world. In recent years he has achieved the ultimate mark of distinction among this group of artists. Three of his own books have been published: *The Complete Book of Origami*, *Origami Zoo*, and *Origami Sea Life*. He is also the author of magazine articles for *New Scientist* and *Engineering & Science* about his avocation.

The folk art that so captured Lang's attention dates back to about A.D. 500 or 600, when its techniques began to be handed down from Japanese mother to daughter. Many of the early objects were abstract, but many others represented natural objects—the crane, for example, which symbolized long life, and the frog, for good luck. New and more complex designs began to show up

some 50 years ago, and informal rules evolved, requiring that the traditional design should be formed from a single piece of uncut paper, preferably a square.

In the early 1900s, a renowned Japanese artist and other origami craftsmen began to write books about the folk art; these were translated into many languages, including English. It was one of these books that fell into the hands of Robert Lang. As more books appeared, spreading knowledge of the paper-folding techniques, origami enthusiasts increased until today there are thousands of avid fans around the world.

After his initial exposure to origami, Lang continued to fold paper into the shapes that fascinated him. "There was something about taking pieces of paper and making all these creatures that seemed wonderful to me," he says.

The book his teacher gave him included only four designs—a dragon, a bird, a spider, and a frog. "Even to a little kid, doing these same designs over

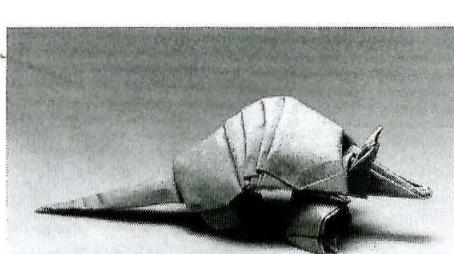
and over got boring, so I started to play around with them a little bit," he says. "Then I found another book that had quite a few new folds in it, and I reasoned that if there were two books, there were probably more. So I started watching for others. Eventually I started to come up with some ideas of my own, and I began creating my own designs." He first made records of his designs when he was 13.

Lang had no need for G.I. Joe dolls as a boy. He created all the toy soldiers anyone could want, by folding origami.

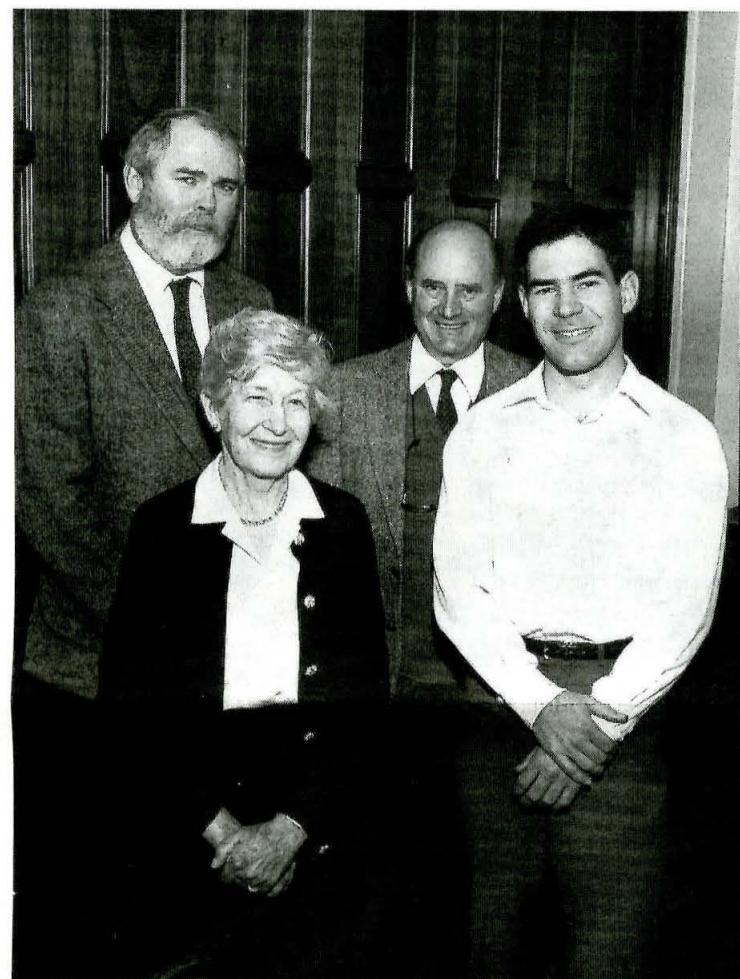
As he grew up, he continued to fold origami and to create increasingly complex forms. "I get the same satisfaction from it as from solving a mathematics problem, or a problem in my work," he says. "The pleasure lies in coming up with not just a solution, but an elegant solution—one that's intellectually interesting as well as nice to look at."

The community had the chance to view some of Lang's elegant solutions in

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FRIENDS



Elizabeth (Mrs. S.) Gordon Ross recently visited the campus to meet the current Ross Fellow, graduate student Greg Huyer. Also present were John Abelson (left rear), George Beadle Professor of Biology and chairman of the Division of Biology, and Seymour Benzer, James G. Boswell Professor of Neuroscience and longtime friend of the Rosses. Benzer's research has benefitted from Ross Foundation grants.

Ross endowment for biology established

Caltech has received a bequest of \$1 million from the estate of S. Gordon Ross to establish the Gordon and Elizabeth Ross Endowment for Biology. Through the years, Dr. Ross, a Pasadena physician for more than half a century, took a personal interest in the division's research and its students, and also provided support through annual gifts from the Gordon Ross Medical Foundation.

Dr. Ross received his medical degree from the University of Toronto in 1923, at the time Sir Frederick Banting and Dr. Charles Best discovered insulin. That pioneering research influenced Ross's subsequent specialization in the treatment of diabetes.

Income from the new Ross Endowment will be used to provide financial assistance to promising graduate students and postdoctoral research fellows within the division, extending in perpetuity the memory of Dr. Ross's influence on biological research at Caltech.

Intel grant funds graduate fellowship

The Intel Foundation has selected Tak Kwan (Tony) Lee, a graduate student majoring in computer science, to receive the Intel Foundation Graduate Fellowship Award at Caltech for the 1991-92 academic year. The grant to Lee will be considered for renewal for the 1992-93 academic year.

Lee, whose advisor is Alain Martin, professor of computer science, is working on the design of very large scale integrated circuits. He is developing digital circuits that don't require a clock to organize their activity, as do those now in existence. Lee is also trying to create more automatic methods to develop such chips. A talented mathematician, Lee has distinguished himself in the national William Lowell Putnam Mathematics Competition. A native of Hong Kong, he came to the United States in 1975.

Anderson delivers Bray Lecture

Robert Anderson, the immediate past chairman and CEO of Rockwell International Corporation and a Caltech trustee, delivered the annual Caltech Ulrich B. and Evelyn L. Bray Visiting Lecture on the American Economic System. His topic was "America's Space Program: Where Do We Go From Here?" The Bray Visiting Lectureship is conferred annually on an entrepreneurial leader who has made major contributions to education and public affairs.

Anderson discussed the United States' future in space, emphasizing the need for a balanced program supported by long-term funding and joined by members of the international community.

The speaker joined Rockwell in 1968 after 22 years with the Chrysler Corporation, where he was vice president and general manager of the Chrysler-Plymouth Division. During his 14 years as CEO, Anderson completed the organization's evolution from a collection of unrelated companies into a strategically guided, high-technology enterprise.

Bray, who received a National Research Council Fellowship from Caltech, went on to a distinguished career as a scientist, engineer, inventor, and technologist. His pioneering work in chemical additives led to substantial improvements in lubricants, hydraulic fluids, and corrosive preventives. He is listed as the inventor or coinventor on 130 patents. Evelyn Bray has shown a strong commitment to Caltech and to education in general, one indication of which is her establishment of the Bray Lectureship.

Caltech receives major equipment gift from Intel

Ten microcomputers that are the most advanced currently available are a gift to Caltech from the Intel Corporation. Valued at \$106,740, they will be the fastest personal computers at Caltech.

The machines are being placed in the central campus workstation in Jorgenson Laboratory, a general-purpose facility available to Caltech faculty, staff, and undergraduate students. There the computers will be used both in conjunction with a number of ongoing Caltech courses as well as for general-purpose computing, mathematical problem solving, and mathematical text processing. The microcomputers will replace older, slower equipment that cannot meet all the needs of the Caltech curriculum and will compose a special section in the laboratory.

Luce Foundation funds two women's fellowships

Two two-year fellowships for female graduate students at Caltech have been funded through a \$100,000 grant from the Clare Boothe Luce Fund. The two grants will support female students beginning graduate studies at Caltech in the fall of 1991 and pursuing PhD degrees in the Divisions of Physics, Mathematics and Astronomy; Chemistry and Chemical Engineering; Engineering and Applied Science; or Geological and Planetary Sciences.

The Clare Booth Luce Fund is administered by the Henry Luce Foundation, which was established in 1936 by Mrs. Luce's husband, Henry R. Luce, the late cofounder and editor-in-chief of *Time*. Under the terms of Mrs. Luce's will, the fund was created to encourage women to enter, study, graduate, and teach in certain scientific and technological fields in which they are underrepresented.

This is the second grant that Caltech has received for this purpose. In 1990, the foundation funded three Clare Boothe Luce Fellowships for women at Caltech.

Gifts by will

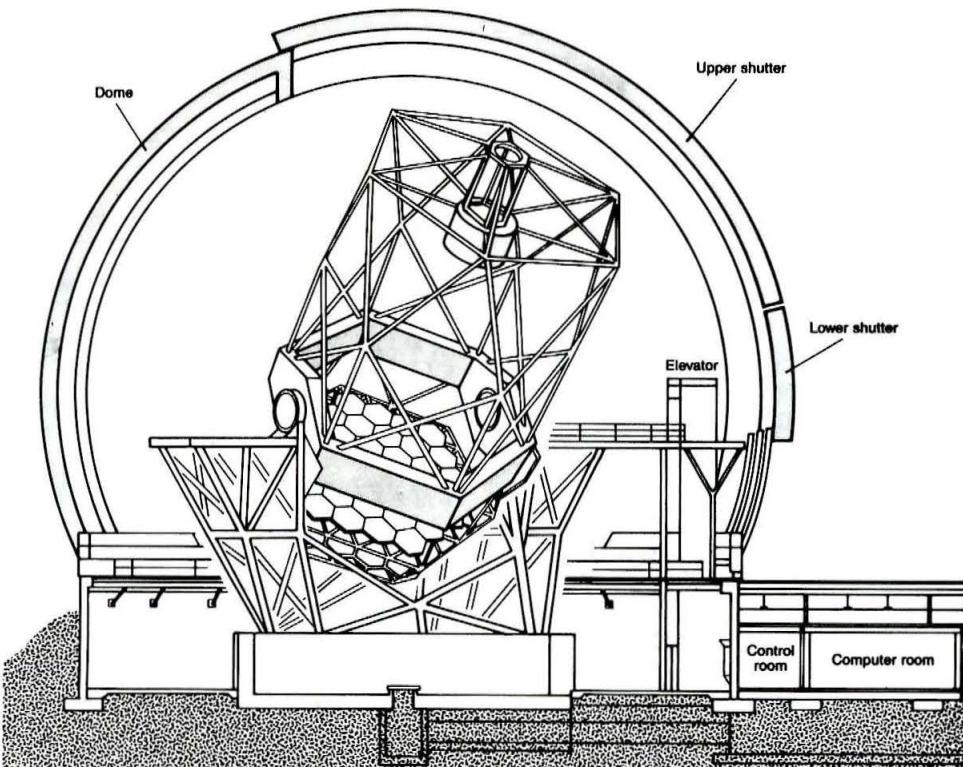
Gladys I. Gardiner—The Institute has received the sum of \$371,733 from the estate of Mrs. Gardiner for basic research. She was the wife of Everett Southworth Gardiner, who graduated from Throop College of Technology in 1914.

Paco Axel Lagerstrom—A bequest of a portion of the residue of Dr. Lagerstrom's estate amounting to \$151,313 came to the Institute in unrestricted funds. Dr Lagerstrom was a Caltech faculty member for many years.

Bruce A. Nevelli—Nevelli, a 1957 Caltech graduate, made a specific bequest for the use of the annual fund in the amount of \$27,000.

Ivadelle Johnson—\$203,051 has been distributed to Caltech from Mrs. Johnson's estate to set up a life income plan for a family member. Upon termination, the remainder will be distributed to the Institute for the Chester A. Boggs Scholarship Fund in Engineering. Mrs. Johnson was the sister of Mr. Boggs, a Caltech graduate.

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



The extremely short focus length of its primary mirror allows the dome of the Keck 10-meter telescope to actually be smaller than that of the Palomar 5-meter, leading to significant cost and materials savings. Because individual mirror segments are so much thinner than a monolithic mirror, the telescope also requires only a third as much glass as its nearest rival, the Soviet 6-meter reflector, and its total weight is less than half the Soviet instrument.

Caltech receives \$74.6 million for second Keck telescope

The W. M. Keck Foundation has announced a grant to Caltech to fund up to \$74.6 million, or 80 percent of the cost of building a twin telescope adjacent to the world's largest telescope, the 10-meter Keck I, now nearing completion on the island of Hawaii.

As with Keck I, the new telescope will be built and operated by the California Association for Research in Astronomy (CARA), a partnership between the University of California and Caltech. The two institutions will share the majority of the observing time on the two telescopes, and the University of California will contribute to the telescope's operating costs.

Keck II will be built adjacent to its sister telescope at the 13,600-foot level, atop the extinct Mauna Kea volcano. The site, operated by the University of Hawaii as a scientific preserve for several observatories, is widely considered to be

the best in the world for astronomical research because of its clear, still skies. The University of Hawaii shares a fraction of Keck I observing time and will also have time on Keck II. Total cost of the second telescope is estimated at \$93.3 million.

Among the benefits of a sister telescope are doubling of the light collecting power and the ability to perform optical and infrared interferometry, according to Edward C. Stone, chairman of the CARA board of directors, Caltech vice president, and director of JPL.

Interferometry, which examines the differences in the times in which the light waves from the same source reach two telescopes, greatly improves the ability to distinguish detail at vast distances. It has been used successfully at radio wavelengths, and is just now beginning to be explored for optical and infrared astronomy.

Centennial outreach program

Caltech graduate student Laurie Watson was nervous. She was facing her first high school classroom lecture, to be given before 30 black and Hispanic students at Pasadena High School. "I wasn't sure if all their heads would go down on the desk, or what," she says, "but they were really terrific. Of course, I had come prepared with lots of great visual aids. They had read the material, they asked good questions, they were very attentive. They were really great."

Watson, a geochemistry student, was one of three Caltech graduate students who ventured into the Pasadena public schools as participants in a Centennial science education outreach program. The Caltech students each gave lectures on earth science and vulcanism as part of a program aimed at combating science illiteracy and at encouraging students not to shun science as a college major or career possibility. The participating public schools were Blair, Muir, and Pasadena High Schools and Eliot Middle School; the lectures were on three separate days during a one-week program. Before the lessons were prepared, the Caltech scholars met with the participating high school and middle school science teachers. Their meeting focused on making the Caltech lessons as strongly connected to the existing school curriculum as possible.

"I had a fantastic experience," says Phillip Ihinger, a geology graduate student who lectured before three separate classes at Blair High School—a junior-level chemistry class of motivated achievers, an enthusiastic class of biology sophomores, and an earth sciences class of ninth through twelfth graders whose attitude, according to Ihinger, was "I challenge you to teach me something."

"A lot of heads went down on the desks," says Ihinger, "but fortunately I brought a lot of rocks with me. The rocks were very effective in getting their attention."

"Young people here are very interested in earthquakes," Ihinger remarks. "They've all experienced them. I showed them why we have quakes and what we're learning about

them, and what more we need to learn. We talked about why they might like to get involved in studying about earthquakes in college."

As the final portion of the outreach program, the participating public school students—some 200 of them—visited the Caltech campus for a lecture by Peter Wyllie, professor of geology. Wyllie touched on several areas of geological science: volcanoes, earthquakes, plate tectonics, and the devastating environmental effects caused by humans. Lots of slides of erupting volcanoes punctuated the lecture. In his address, Wyllie emphasized that scientists are ordinary people.

"I came from a family where no one went to college," Wyllie told the students, adding that he didn't know what a university was until he was 16 or 17, when his teachers encouraged him to apply for scholarships.

Afterward, the students were taken on a campus tour. For many of them, this was their first exposure to a Caltech

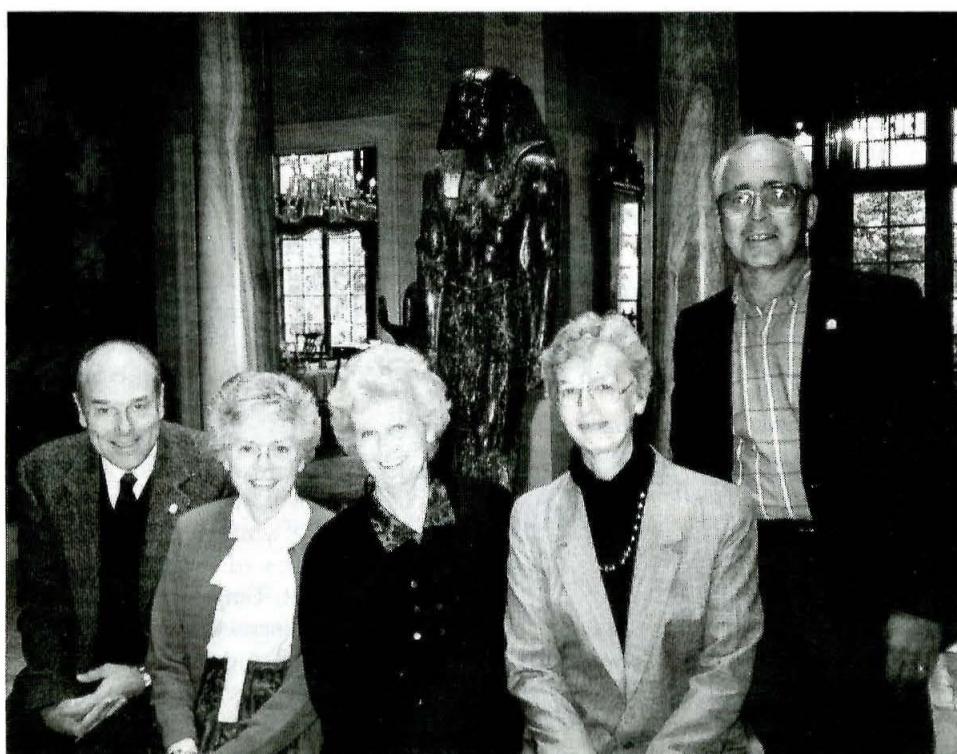


professor or to the campus. "The students generally pass by the campus and don't know what's there," said James Hsu, chairman of the science department at Blair High School. "Having an insider give them a tour was very interesting to them."

Eliot science teacher Judy Hartman said the experience was a valuable one for all the students. She added that many of them are from minority groups and have had little incentive to consider science as a career.

"The goal of this Centennial science outreach was simple and important," concluded Hall Daily, director of media, community, and government relations, who conceived the plan. "It was to expose hundreds of young Pasadenans to Caltech, and to the lessons of science and engineering that—for the past century—Caltech has presented to more gifted or more fortunate young people."

Certainly for the 200 enthusiastic youngsters who visited the campus, that goal was abundantly achieved.



President Thomas E. Everhart, Shirley Larson, Doris Pankow (president of The Associates), Doris Everhart, and Carl Larson at The Associates' San Francisco dinner at the home of Charles and Doris Pankow. Larson (BS '52) is chairman of the Northern California Membership Committee. Dr. Everhart was the speaker at the dinner, attended by 90 members of the organization.

Associates plan trip to Japan, Korea

The Caltech Associates have planned a trip to Japan and Korea for October 2-18. Accompanying them will be Amnon Yariv, the Thomas G. Myers Professor of Electrical Engineering and professor of applied physics, and Robert A. Rosenstone, professor of history. Call 818-356-3919 for information.

Robert Lang

Continued from page 1

1985 when he presented a one-man show at a gallery in Torrance. Visitors could view the largest piece of origami Lang has created—a life-size violin player—as well as a kangaroo, a five-foot-long dragon, a full-size Galapagos turtle, and a biplane. He displayed a set of faces made from the same design but with different expressions created by varying the paper creases. And a collection of insects, scaled to life, looked like an entomological display. There were lots of other pieces too, and the exhibit was one of the most popular to be shown at the gallery.

Lang also exhibits his work at origami conferences, and publishes his designs in origami magazines, newsletters, and convention programs. Through this exposure, his creations have developed a reputation for unequalled sophistication and complexity of design technique. One of his designs holds the distinction of being the model with the most folds ever to be printed in the British Origami Society magazine. The model is of a cuckoo clock with hands, face, and pendulum, and a door that opens as a cuckoo pops out at the tug of a lever. The model required 90 steps to complete and consumed 12 pages in the magazine.

The artist has taught classes in origami, "all over, generally for kids, and for beginners." His most interesting classes, he says, were at the women's prison in Frontera.

"They were really sharp," he says of these students, "and one of my best audiences. They picked up the knack of folding very quickly. I taught a couple of three-hour sessions, and by the end of the time they had folded a peacock. That's no mean feat."

Lang's initial book takes the reader completely through the process of mastering origami. "I designed the beginning for a novice, and the last models in the book are among the most challenging that have ever been published," he says. "But if people want to fold the models at the end of the book, they have to actually work through it from the beginning in order to learn all the techniques. They can't jump to the end and say, 'This is what I'm going to make.'"

The last chapter in the book is devoted to models that move—including the cuckoo clock. There are also models for a monkey that claps its hands, and three mobile musicians—a violinist, a bass player, and a pianist whose hands roam over the keyboard.

Lang says his favorite design is usually his most recent creation. But "one that's been up there now for two or three years" is a Black Forest cuckoo clock—a much more complex model than the one in the book, and one

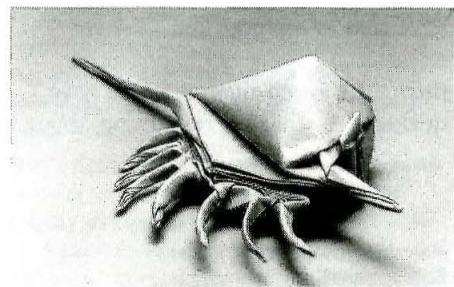
designed only for beauty. This creation features a clock face and hands, leaves around the outside, a deer's head on the top, and pinecone weights hanging down on either side of the pendulum. A cuckoo is fixed in the "out" position.

"It took me a couple of months of evenings just to design it," he says, "and six hours to fold. I really tried to push it in terms of being very efficient, and getting every little bit I could out of the paper."

Although he seldom keeps models very long because they crush easily, Lang has about 100 favorites at his home, most of them small—including a collection of seashells, one of his current interests. "Seashells have very irregular shapes, some with points, and all the basic folds are geometric," he says. "Yet they have a lot of smoothness. Creating a smooth irregular shape that has a lot of points represents quite a challenge to origami design techniques—and that makes a seashell interesting to fold."

Seashells are also interesting to work with because they present another one of origami's greatest challenges—how to craft an object that is complex and sophisticated in its folding requirements so that it looks natural, smooth, and neat to the eye.

Another recent challenge for Lang to fold was an angler fish, a creature with many long, sharp teeth. "A lot of design problems revolve around making the appendages of a subject," Lang explains. "For a four-legged animal, you need to make five appendages, six



if it has a tail. An insect has even more legs. An angler fish has 10 to 12 sharp teeth, all in one area of the body, and they're very difficult to achieve. Probably that's the reason no one had tried to fold an angler fish before I took it on."

Lang's most recent challenge has been to push the limits of what can be made from standard 10-inch origami paper. The paper rips rather easily, he explains, and must be handled carefully; otherwise, it breaks down at stress points. One of his most complex creations with standard paper is a praying mantis. Other insects present a similar challenge. So enthusiastic about these creations is Lang that he is now plan-

ning a fourth book, which probably will be called *Origami Insects*.

Lang keeps up an active correspondence with several people throughout the world who make models that are at his level of sophistication. "We learn from each other," he says. "And we exchange designs. I think that, even when you're devising new designs yourself, you enjoy folding someone else's work."

Although he keeps relatively few of his creations, Lang does keep diagrams of the folds required for all his designs. Recently he has begun to use a computer to draft these drawings. "I've actually gotten to the point where I can draw on the computer much faster than I could draw with ink, and the quality of the work is much better. The drawings are also much easier to edit," he says.

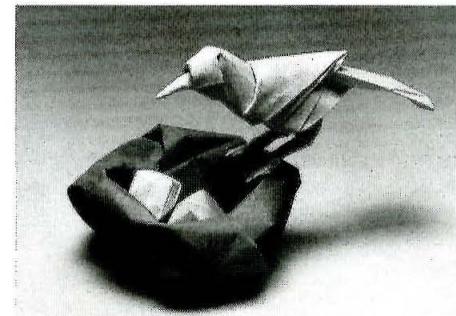
Lang is a master at creating fine folk art, but so far he has not sold any of his works. "If someone offered me enough money for one of the pieces, I probably would sell it," he says, "but I haven't really made any efforts in that direction. The reason is that I have the luxury of not having to fold origami for a living. Origami folding is a hobby, and my spare time is a lot more valuable to me than if I had to use it to earn money. If I spent time churning out models for sale, that would take away from doing them just for fun."

In his professional life, Lang is at JPL as group leader of the photonics sub-group, part of the Sensor Technology Group. He works in the Microdevices Laboratory, which has been in operation since September of 1989.

In addition to his two degrees from Caltech, Lang holds a master's degree in electrical engineering from Stanford. His BS degree from Caltech is in electrical engineering; his PhD is in applied physics. He spent several months in Germany as a member of the technical staff at Standard Electric Lorenz Research Center.

Lang grew up "a little bit all over but mostly in Atlanta, Georgia." He learned about Caltech from a backpacking buddy who had earned his PhD at the Institute. He is married to the former Diane Davis, who was for several years a member of the Caltech public relations staff. They live in Altadena with their son, Peter, where those hundred or so pieces of origami that Lang decided to keep are on display.

Evenings in Altadena, one is likely to find Lang at the computer, drafting origami designs, or folding yet another piece of paper into a shape that pleases the eye and defies the imagination with its complexity.



Minority enrollment increases

For the third straight year, the number of African-American and Hispanic students applying to and admitted to Caltech has increased. "We're seeing a trend in progress that indicates success for the Institute's efforts to enroll more minority students," says Daniel T. Langdale, director of admissions.

The number of African Americans applying to the Institute increased from 19 in 1989 to 35 in 1990 to 40 in 1991, according to Langdale. The number admitted rose from 9 in 1989 to 18 in 1990 to 20 in 1991. The number of Hispanic applicants rose from 54 in 1989 to 98 in 1991. Admissions for this group rose during the same period from 23 in 1989 to 32 in 1990 to 39 in 1991.

The number of women applying to Caltech has also shown substantial growth, as the Institute has worked intensively to increase female enrollment. In 1989, 272 women applied to the Institute and 140 were admitted. In 1990, 386 women applied and 129 were admitted. In 1991, there were 376 female applicants and 184 were admitted.

Meanwhile, the size of the freshman class has remained the same at about 200-220 students.

Geographic distribution of class members remains substantially the same. Of the new students, 29 percent will be from California, compared with 33 percent in 1990 and 29 percent in 1989. Ten percent of the class will come from the Far West, compared with 14 percent in 1990 and 16 percent in 1989. From the Midwest come 15 percent of the students, compared with 14 percent in 1990 and 14 percent in 1989.

Twenty-four percent of the freshman class is from the South, while in 1990 19 percent came from this geographic region, and 17 percent in 1989. Statistics show 18 percent are from the Northeast, compared with 16 percent in 1990 and 15 percent in 1989. Four percent of the class will be from foreign countries, compared with 5 percent in 1990 and 7 percent in 1989.

In assessing candidates from the class, Langdale said the Institute uses a tiered system of selection. The first tier is based on academic qualifications and the second on personal qualities that should have a bearing on the young person's academic performance and contributions.

Langdale will be leaving Caltech at the end of the academic year, President Everhart announced. "During his three years here, Dan Langdale has done a superb job of increasing the enrollment of categories of students that have been underrepresented at the Institute," he said. "We are very proud of his contributions."



Eddie Grado wants to stamp out the word "exclude"

Eduardo Grado is proud of the new organizations on campus that he advises—the Society of Hispanic Professional Engineers, and the National Society of Black Engineers. Their formation this year is one indication of the growth in the number of underrepresented minority students at Caltech—a growth that Grado views with pride. He is much in evidence at barbecues and dinners of the organizations, which draw up to 40 students each month.

"The freshman class includes 23 African-American, Native-American, and Latino and Hispanic students," he said. "That's more than all three other classes put together. And the prospects for the incoming class look equally good."

Grado joined the Institute staff in the fall as director of student affirmative action programs and secondary school relations, coming from MIT, where he was the associate director of admissions and the coordinator of minority admissions. His responsibilities lie in the areas of affirmative action, recruitment and retention of underrepresented minorities, and making Caltech better known among minority young people.

He spends a great deal of time with the minority students at the Institute, meeting individually with each one about three times a month, counseling them about any problems of adjustment to the Caltech student body, and keeping up with their academic progress. "I talk with students who may be brilliant, but weaker than the average student at Caltech in science or math," he says.

"Perhaps their parents didn't go to college, and the mere idea of being here is intimidating."

Grado notes with pride that several minority students have volunteered to be science or math tutors in the Pasadena public schools, where they serve as role models for a substantial minority enrollment.

One of Grado's responsibilities is to help create the new Young Engineers and Science Scholars Program, a summer program that will replace Caltech's traditional summer school for high school students. (See separate story in this issue.) Through the new effort, which will enroll 40 students who have completed their junior year in high school, the Institute hopes to attract a substantial number of underrepresented

minorities to the campus.

In creating the new program, he is working with the reorganized Relations with Schools Committee, under the chairmanship of James M. Bower, associate professor of biology, and with the staff of the Office of Student Affairs.

Another of Grado's responsibilities is the Bridge Program, which enables students who need the boost to spend six weeks in class on the Caltech campus before the regular session begins. In the past, Grado explains, all minority students were expected to attend. This year, students will be asked to apply, including a few nonminorities.

Still another of Grado's projects will be a mathematics and science camp on the campus this summer for 30 Native-American students. Caltech is one of four universities hosting a camp. This year, the Institute will be responsible for the computer science and engineering program. Based on this year's experience, a decision will be made about whether to host it in the future.

Grado also keeps busy attending high school and college fairs—"just letting people know we're here," he says.

All in all, a busy schedule for a young man who, in speaking of Caltech programs, says emphatically, "We want to stamp out the word 'exclude.'"

40 top high school students to study here in new summer program

A new summer program designed to give high school students with exceptional talent and ability an introduction to an engineering and science career will be offered on the Caltech campus this summer. The program, called Young Engineering and Science Scholars (YESS), will admit 40 students, most of them juniors. The participants will be given free room and board as well as tuition.

Other goals of the program will be to give participants a sense of self-confidence and self-reliance by challenging their creativity and intellectual capa-

city, to provide a preview of the social life commonly found on an engineering and science campus, and to give Caltech an opportunity to attract, meet, and recruit outstanding underrepresented minority students, according to Gary Lorden, vice president for student affairs.

The Faculty/Student Committee on Relations with Secondary Schools has been working with Eduardo Grado, director of student affirmative action programs, to design the program. "In choosing students, we'll be looking at PSAT scores, grades, parents' education, and whether the person is disadvantaged," Grado said.

"The format of this program as it evolves over the next several years is likely to include innovative 'hands-on' teaching methods that Caltech faculty members want to develop to attract junior high and high school students to the study of science and engineering," said Lorden.

Lorden said that several professors have been helping to develop courses, and will participate in the program as instructors. Among those involved will be David J. Anderson, assistant professor of biology, and Howard D. Lipshitz, assistant professor of biology, who, along with graduate students and undergraduates, are creating a program in developmental biology and genetics.

Michael C. Cross, professor of theoretical physics, and Jerome Pine, professor of physics, are designing the physics course, planned as a "hands-on" course similar to the one offered to freshmen at Caltech. James M. Bower, associate professor of biology, and J. Morgan Kousser, professor of history and social science, are creating a humanities program, including a class in art and art history, incorporating computer graphics, and a course placing special emphasis on the diversity of culture in this country.

Peter J. Wyllie, professor of geology, is in charge of an earth science program. The mathematics courses will involve two levels of instruction, a regular calculus course and an accelerated one.

"We want to give the kids something they won't get in high school or college," said Bower, chairman of the Faculty/Student Committee on Relations with Secondary Schools, "something unique." He emphasized that the courses will heavily emphasize laboratory work, and that the faculty members involved in designing the courses have reputations as outstanding teachers. High school teachers will participate in the program, doing some teaching, and learning lab-based techniques that they can take back to the classroom.

"The curriculum will be demanding and rigorous and will require a lot of work in and out of class," said Bower. "Students will need to develop time-management skills."

Complementing the academic curriculum will be a variety of activities and events designed to create a sense of community among the participants, Bower said—field trips to Palomar Observatory and JPL, beach parties, and a college-admission and financial-aid

orientation. Also offered to students will be the opportunity to take tennis or other athletic classes.

Bower said that, after the 40-student YESS program is successfully launched, the Faculty/Student Committee on Secondary Schools plans to work with Grado in initiating a summer program on campus for seventh, eighth, and ninth graders.

MURF program opens minority research slots

A new program is being launched at Caltech that will provide talented undergraduates from underrepresented minority groups with the opportunity to spend the summer conducting research on campus.

Called Minority Undergraduate Research Fellowships (MURFs), the program is aimed at improving the representation of African Americans, Hispanics, Native Americans, Puerto Ricans, and Pacific Islanders in the biological and chemical sciences. According to David C. Van Essen, professor of biology and MURF director, participants will be selected on the basis of their academic record and their desire to work in a modern research laboratory under the guidance of an experienced scientist.

Van Essen said that more than 100 students have applied to the program, many of them exceptionally well qualified. Fourteen students were admitted, and nine of them have elected to join the MURF Program. This is an impressively high percentage of acceptances, because most students were also accepted into other programs as well, according to Van Essen.

"We received earnest warnings that generating interest in the program might be tough," he said. "There are a number of similar programs across the country designed for minority students. We set out to make ours small but exceptional, in the Caltech tradition."

"We promoted it carefully, and I visited several historically black universities, meeting with key personnel and letting them know we're really serious in our intent to create opportunities for minority students. We're very pleased with the response to our efforts."

Van Essen said the program is inspired by Caltech's SURF (Summer Undergraduate Research Fellowship) program. About 150 Caltech undergraduates participate in SURF every summer, conducting independent research in campus laboratories under the guidance of faculty members. The two programs will be closely integrated.

Weekly seminars and roundtable discussions led by Caltech faculty will be a part of MURF, as will oral presentations by individual students on their research.

around the new graduate-student houses, the off-campus houses on Wilson and Holliston, the new parking structure, Tournament Park, and Beckman Institute. Meanwhile, the crew itself has grown from 24 to only 27.

Among the multitude of problems Mecado's crew must deal with is the weather. Although usually mild, it can produce extremes such as 60-mph-plus windstorms, tropical storms, 95-degree temperatures in the middle of January—with frost a few days later—and smoggy days with temperatures well above 100 degrees.

Variations in temperature and humidity encourage pests, like the white fly and a canker that is killing the eugenia bushes. And, because of the dangers of toxic substances, the grounds crew is limited in what it can use to eradicate such hazards. "We try to use nontoxic substances," says Mecado. "For example, Safer soap is especially made for killing insects. When it's sprayed, a soapy film gets on the bugs and kills them. We also use a lot of

When the Institute won a national award in 1985 for the best university grounds in the nation, Caltech community members took special note of the beauty that surrounds them. Those who take a look today find that beauty undiminished, thanks to the tireless efforts of the 27 members of the grounds crew, who work consistently to keep 104 landscaped acres in peak condition.

Heading this monumental maintenance job is George Mecado, supervisor of grounds services for physical plant. Mecado's effort involves tasks as diverse as deep-watering hundreds of trees, coordinating the landscaping of neighboring structures as architecturally diverse as Ramo Auditorium and Dabney Hall, and choosing the best turf mix to thrive in southern California's unpredictable weather. Mecado has been with Caltech for 17 years, and he is a man enthusiastic about his work.

"Our philosophy is to set high standards and maintain them," says Mecado. "We can't let down or we may lose something precious."

A lot of their success depends on the high morale of the workers, Mecado says. "We have to like what we're doing because we get dirty, sweaty, and wet," he explains. "And I can say with conviction that we all take pride in our work. And we are the busiest people on campus. The plants won't wait."

When Caltech won its award from Professional Grounds Maintenance in 1985, the grounds crew had 70 acres to maintain. Since then, another 34 acres have been added, including lawns

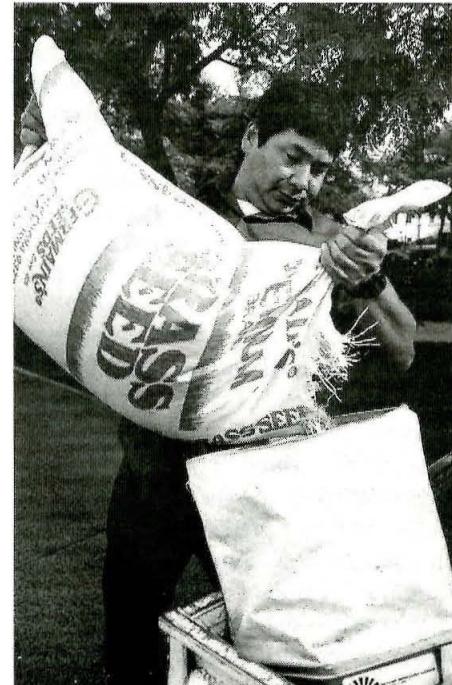
Fred Maldonado is ready to plant annuals.



systemics—materials that will go in through the roots and therefore won't pollute the air."

Several years ago Mecado planned to spray for the white-fly infestation on Bechtel Mall. He circulated his intent, and quickly dropped his plan when he learned researchers in adjacent buildings were doing experiments on fruit flies and were afraid the spray would creep

Rene Rebollo pours seeds into a spreader which measures how much seed is distributed.



Beautiful campus a Caltech

by Winifred Veronda

in through the vent system and kill the experimental subjects.

The campus has nearly 1,000 trees, many of them ornamental and some 400 of them olives; rolling expanses of lawn area; mounds of ground cover; hosts of shrubs and flowering bushes; and 15 sites where 3,500 annuals are transplanted from 4-inch pots twice a year. Numerous pedestrian malls are graced by this profusion of plant life.

To insure a harmony of appearance within its 104 acres, Caltech engages a landscape architecture firm that has worked with the Institute for the past 16 years. "Together, we try to make sure that everything ties in," says Mecado. "A lot of thought goes into choosing the shades of green that we combine, into how the shrubbery ties in, and into selecting the colors of the flowers. We also select plants that will harmonize with the buildings they complement. For example, a lot of the older buildings have wisteria growing around them, and the Athenaeum has plants that go with Mediterranean-style architecture." Mecado searched a year and a half to find just the right palms for potting by the Athenaeum entrance.

"When we do a landscape plan for a new building, we make sure it ties in with the older buildings nearby," Mecado emphasizes. "We try to maintain a theme for the whole campus that

underlies all the different elements."

All this takes a lot of dedication. "The people out there at Caltech are wonderful," says Tom Lockett, of Land Images, the landscape architectural firm that Caltech engages. "There's a totally different work ethic, a totally different attitude among the grounds crew there than on any other campus we've worked with—which includes Loyola Marymount, Dominguez Hills, Colorado State, UC San Diego, and UCLA."

Several years ago Mecado made a major organizational change. He switched to a crew system. And that, he believes, is responsible for a great improvement in the appearance of the campus. Before that reorganization, each gardener was responsible for the total maintenance of a specific section of the campus. "But it became too much for one person to handle," Mecado says. "Now special crews take care of the heavy trimming and other major projects such as preparations for overseeding the lawns. And the gardeners continue to do the daily routine maintenance of their assigned areas—weed, cultivate, pick up trash, and general cleanup."

In addition to nine gardeners, the grounds crew has a group of gardener-specialists, and a group of grounds-specialists. The gardener-specialists include four equipment operators and



**Fred Maldonado,
George Mecado,
Tony Guzman,
Milton Olander,
and Tony Soria
plant annuals.**

between Parsons-Gates and Millikan Library—require special care. "They are very delicate," says Mecado, as if speaking of somewhat fragile children. "We don't deep-water them—in fact we have to be careful that there are no leaks in the irrigation system that would give them excessive water, because they might develop armillaria, a fungus fatal to oaks; we can't let soil accumulate at their bases, because their roots need to be exposed; and the only safe time to trim and remove the deadwood is between June and August. Otherwise the rapid new growth develops a mildew condition."

Oak trees are vulnerable to all sorts of other plagues. There's a deadly slime flux that has to be dug out, and the problem area treated with chemicals. And the surrounding trees must be carefully watched to be sure the flux hasn't spread to them.

To help preserve the older trees, Caltech brings in consultants for an inspection at least once a year. "If a tree doesn't look right, I'll get one or two consultants before I do anything on my own," Mecado says, pulling out a thick folder. "This is how many consultants we've had in the last two years." The assorted pages of detailed instructions for trees in trouble contain such recommendations as: Clean out all rot. Spray for wood borers. Paint interior with Bordeaux oil mix. Fill with cement to callus line. Cover cement with Tree Seal.

"About two years ago, when we were having really serious problems with our oaks, the specialist we brought in made several recommendations. We stayed right with what he told us to do, and very few of the problems have come back. And the Engelmann oak, which was in trouble several years ago because it lost a branch in the October 1987 earthquake, was recabled and given new supports. Now it has a lot of new growth."

The job of trimming the 400-plus olive trees on campus is contracted out, as is the regular spraying of growth hormones to discourage the production of olives that would litter the sidewalks.

Along city streets, Caltech must plant the kinds of trees specified by the City of Pasadena. In other locations, however, the grounds crew has stressed the purple-blooming jacaranda and Tinuana tipu, which produces yellow blooms. "We give them special food, which encourages flowering, and when they bloom, they harmonize very nicely," says Mecado.

The grounds crew has planted numerous redwoods on campus during the last ten years, and despite their susceptibility to smog, they have done well.

Campanula is a good ground cover for shady areas, and vinca minor also works well. Gazania is used at the Throop site, where a taller cover is appropriate. Armeria and sea pink are also used fairly extensively, and California ivy is another favorite. "Ground covers are difficult to select, because often one that will grow well in a particular location doesn't match what's

treasure

five landscape gardeners. The equipment operators mow, edge, aerate, and crosscut. They also sweep the streets, parking lots, walkways, and patios. The landscape gardeners are responsible for landscape renovation and installation, for pruning shrubs, and for major cleanup. The grounds-specialists are in charge of tree maintenance, chemical control (including fertilization), irrigation installation and repair, and grounds equipment maintenance for the whole campus.

Another responsibility of the regular gardeners is to deep-water all the trees, except the oaks. This they do tree-by-tree. At successive locations near the base of the tree, they insert a three-foot metal tube that has four outlets in one end and is attached to a hose at the other end, above ground. When the water is turned on, it trickles out of the holes in four directions. The process is repeated every two or three feet around the base of the tree.

"If trees get only as much water as is put on the lawn, they don't develop strong root systems, and there's danger they'll fall over in a windstorm," Mecado says. "By deep-watering, we encourage the roots to go down. We get strong taproots, and that makes the trees healthy."

The live oaks on campus—including the 400-year-old Engelmann oak



Tony Guzman prepares ground to receive new spring plants.

already there," Mecado says.

By sticking with low-growing ground covers and staying away from certain species of ivy that grow higher as they mature, Caltech has been able to avoid rats turning up in the area.

For perennial plantings, Mecado looks for low-maintenance shrubs and covers, and uses growth retardants. "We've cut our trimming time by more than half by using growth retardants," he says.

For its turf, Caltech uses a mixture of rye and creeping red fescue. "The fescue is drought-tolerant and handles the heat well," says Mecado. "So if we have an irrigation problem, the rye-grass may go, but the fescue will keep on growing."

Several years ago, beds of annuals were added in more than a dozen locations on campus, a move that turned out to be very popular with the campus community. Mecado selects seeds for the annuals from a catalog, and gives the list to his off-campus grower who starts the growing process by planting the seeds in four-inch pots. Mecado visits the grower every few weeks to inspect the plants and "make sure there aren't going to be any surprises." Then, after three months, the plants are transplanted on campus. Annuals are usually set out twice a year, but during the



Centennial year, it will be four times.

"We're limited in our choices," Mecado says, "by what will grow in the area, by what will require minimum care, and by what will give good color for a maximum length of time. We dropped ranunculuses and mums because their color season was too short."

After some experimenting, Mecado and his crew have settled on a mix of pansies, snapdragons, and velland poppies for the winters; and salvia, marigolds, petunias, dianthus, verbenas, and dahlias for the summers.

Mecado's advice to the home gardener for keeping plants healthy is to water them properly, trim out deadwood, and adhere to feeding instructions. "Pests go for a plant that's sick, and they go out and tell their friends about it," he says. "So solve problems before they start by keeping your plants healthy. If you notice bugs, mix up Tide into a soapy solution. It will kill most chewers."

Several years ago, Caltech was the beneficiary of a major gift from an anonymous donor that has helped substantially in the landscape maintenance of the campus. Some smaller gifts have been specified for use in renovating older lawn areas on campus.

Mecado plans to enter the competition for the Professional Grounds Maintenance Best Campus award again. With the pride, effort, and attention that go into Caltech's grounds, there just may be another award coming this way.



**Milton Olander
and Juan Sanchez
prepare the soil
for planting
annuals, above.
Below: Lorenzo
Mesa trims
ground cover.**

ALUMNI

Chapter news

Ed Seidman, Chicago chapter president, heads growing alumni group

Involvement in the community is a major commitment for Ed Seidman, president of the Chicago alumni chapter. Seidman was reelected in April for his fifth term as city councilman in Deerfield, Illinois. He has also served for four years on the county's solid-waste planning agency, and has held just about every possible office in the local Optimist Club. He recently was elected president of the Chicago alumni chapter, which reorganized last year. He is also regional chair for the Annual Fund. For 17 years, Seidman has worked for Abbott Laboratories, a large pharmaceutical firm, where he is a senior systems analyst and project leader. Seidman's daytime telephone number is 708/937-3519.

Already married and with twin girls, Seidman graduated from Caltech in 1955 with a BS degree in chemistry. He and his family lived in southern California before moving to Chicago 20 years ago. The Seidmans like to collect art. They are the parents of two sons and two daughters, and have two grandchildren.

As Chicago chapter president, Seidman sees his role as providing an opportunity for alumni to keep in touch with one another and with the school, and to encourage more interest in the Institute among graduates. Two meetings, attended by approximately 25 members, have been held since the chapter became active a year ago; the speakers were Michael R. Hoffmann, professor of environmental chemistry; and Robert McEliece, professor of electrical engineering. Seidman points out that there are more than 200 alumni in the Chicago area. He would like to continue holding two meetings a year, and hopes chapter attendance will grow from the 20 to 30 who now attend to 50 or more.

MIT invites Caltech alumni to participate in a club event

The MIT Alumni Association extended an invitation to Caltech alumni to attend a club event in the Tucson area in April. One of the major topics for discussion during the evening was the growing concern over scientific illiteracy in the United States. Christian J. Matthew, president of the MIT Alumni/ae Association, reported on an outreach program that MIT has developed, and that Caltech is very enthusiastic about. The Alumni Associa-

tion is exploring possibilities for an outreach program of its own that will offer opportunities for alumni participation.

Tri-State chapter hears Charles Plott at April meeting

The Tri-State Chapter of the Caltech Alumni Association heard a presentation by Charles R. Plott, the Edward S. Harkness Professor of Economics and Political Science, at its April meeting in New York. Plott spoke on *Outbid or Outfoxed: The Nature of Rationality in Markets*. Plott discussed newly developed laboratory technologies and techniques that are transforming economics into an experimental laboratory science that permits new glimpses of human behavior in economic situations.

Washington, D.C., chapter hears Jeffrey Dubin on the income tax lottery

Jeffrey A. Dubin, associate professor of economics at Caltech, spoke to the Washington, D.C., chapter on *Playing the Income Tax Lottery: What are the Odds?* at the April meeting. Today, Dubin said, the odds of winning in the income tax lottery are good. The IRS audits roughly one percent of all individual tax returns filed. So the chances of getting away with a few omissions on a tax return are 99 out of 100. But although the probability of getting caught cheating is much lower now than it was ten years ago, Dubin said, if one is caught cheating today, the consequences are much more severe. Several young alumni attended the meeting, many of them former students of Dubin.

San Diego chapter holds joint meeting with MIT Club of San Diego

In a joint April meeting, members of the San Diego chapter and the MIT Club of San Diego heard a presentation by the Four Pi Systems Corporation, a high-technology firm founded in 1986 by a team of executives and scientists to address the electronics industry's state-of-the-art solder connection requirements. Bruce Baker (BS '78), senior vice president of product development and a company founder, was the featured speaker. He reviewed the company's technology, applications, and business development from an entrepreneurial standpoint.

Colorado chapter members hear Jean-Paul Revel at their May meeting

The Greenbriar Restaurant was the setting for the May meeting of the Colorado chapter of the Caltech Alumni Association. Jean-Paul Revel, the Albert Billings Ruddock Professor of Biology, spoke on "May the Force Be with You." He discussed research in his laboratory that focuses on efforts to visualize cellular structures, emphasizing the

channels that traverse the rather impermeable membrane that surrounds our cells.

Forecasting Large Earthquakes is topic for Boston alumni chapter

Kerry E. Sieh, professor of geology, spoke to members of the Boston chapter of the Caltech Alumni Association at the May meeting. MIT alumni were invited to attend. Within just the past several years, said Sieh, geologists and seismologists have begun to make specific forecasts of destructive earthquakes in California. He discussed the scientific principles and data behind these forecasts, including the accuracy of the forecast for the segment of the fault that produced the San Francisco earthquake of 1989.

San Francisco chapter organizes informal hike

The San Francisco Chapter organized an informal hike at Rancho San Antonio Park on the Peninsula on Saturday, May 4. Nine alumni and guests, led by Tad Hogg (BS '79) took an easy walk along the Wildcat Loop Trail. They also stopped by Deer Hollow Farm to look at the animals. Everyone agreed it was an enjoyable day.

Boston chapter organizes visit to ITEK

Caltech's role in the building and operation of the Keck Telescope was the motivation for a visit by members of the Boston chapter to ITEK in Lexington, Massachusetts, where the mirror segments are being designed, fabricated, and tested. Alumni interest in the telescope and its advanced technology was high; 20 alumni and guests were present at the meeting. Frank Morse (MS '40) told the group that he had seen the 200-inch Palomar reflector being ground and polished some 50 years ago. Twelve of the party met before the tour for lunch at the Hartwell House in Lexington. More gatherings such as this one are planned for the future.

Alumni Activities

June 6—Chicago chapter event at the Fireside Restaurant. David Middlebrook, professor of electrical engineering, guest speaker.

June 20—Alumni Association annual meeting and honorary alumni dinner, the Athenaeum. The annual meeting will be held in the Athenaeum Library at 6:30 p.m.

June 23-30—Yellowstone Travel/Study Program, with Robert P. Sharp, Robert P. Sharp Professor of Geology, Emeritus, and Leon T. Silver, W. M. Keck Foundation Professor for Resource Geology.

June 25—Tri-State chapter evening at the Comedy Club, Catch a Rising Star, in Manhattan. For information, call Andrew Weigel, 212/480-3360 (day), or 212/727-1136 (evening).

June 27—Boston chapter event, David Middlebrook, professor of electrical engineering, guest speaker.

July 11—Solar eclipse viewing, Big Bear Solar Observatory.

July 25—Seattle chapter event. Jenijoy La Belle, professor of literature, guest speaker.

September 27-30—Owens Valley and Yosemite travel/study program, with Le Val Lund (BS '47), civil engineer in water resources and earthquake engineering, and Suzanne Granger, associate curator, Los Angeles Arboretum and Botanic Gardens.

October 17—Japan chapter event, Amnon Yariv, Thomas G. Myers Professor of Electrical Engineering and professor of applied physics, guest speaker.

October 19-25—Hawaii travel/study program, with Robert P. Sharp, Robert P. Sharp Professor of Geology, Emeritus.

Unless otherwise indicated, please contact Helen Shafran at 818/356-8364, for travel/study programs, or Arlana Bostrom at 818/356-8363, for chapter events.

APRIL 10

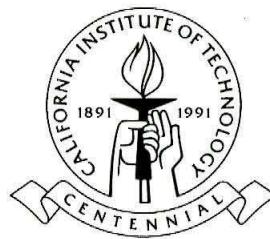
Abelson named new Beadle Professor

John Abelson, chairman of the Division of Biology, has been named the new George Beadle Professor of Biology. The professorship is named for the late Nobel Laureate George Beadle, who headed Caltech's biology division from 1946 to 1961, when he became president of the University of Chicago.

Abelson joined the faculty in 1982. His research centers on the mechanisms of gene expression in yeast. He has received the American Cancer Society Faculty Award and a John Simon Gug-

genheim Memorial Foundation Fellowship. In addition, he is editor-in-chief of *Methods in Entomology*, associate editor of the *Annual Review of Biochemistry*, and a member of the board of reviewing editors of *Science* magazine. He is also a founding member of the board of the Agouron Institute in La Jolla, California.

Donations for the professorship came from Beadle's friends and former students at Caltech and the University of Chicago.



Symposium to explore world resources

"Visions of a Sustainable World," a four-day symposium beginning Sunday, October 27, will be the culminating event in a year of Centennial activities highlighting a century of achievement for the Institute.

The objective of the symposium is to stimulate thinking about how the earth's rapidly growing and changing human population, including many diverse cultures, can reach an equilibrium with the earth's finite environment and resources, while maintaining a comparatively peaceful world order.

To set the stage for the symposium, Murray Gell-Mann, Millikan Professor of Theoretical Physics and Nobel Laureate, will introduce the main themes in a public lecture Sunday evening. After his presentation, a panel of

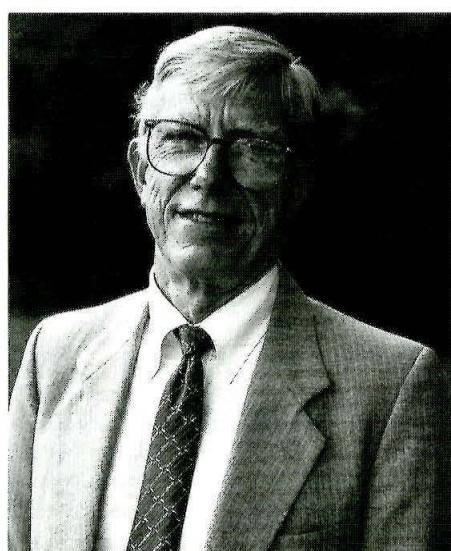
distinguished experts will elaborate and expand on these themes.

On Monday and Tuesday, October 28 and 29, sessions and panel discussions will be held on such topics as the development of a sustainable future; demographic, technological, economic, and cultural transitions; speculations and challenges from the unexpected; and global governance. The final day on Wednesday, October 30, will focus on California, where both new challenges and opportunities often have been encountered first.

The symposium is open free to Caltech faculty, students, and staff, and to JPL employees. For others, there is a registration fee. More information is available by calling 818/356-2188.

From the alumni president

By E. Micheal Boughton



It has been an honor and a pleasure to serve as alumni president as Caltech enters its second century. The Centennial celebration has brought with it many exciting events, with many more still ahead. This year has also seen a tremendous expansion in each of our alumni programs, and I hope you have taken the opportunity to participate in some, and will do so again.

An enduring project in which the Alumni Association is participating, through the Chapter Affairs Committee, is a science literacy outreach program. This is an area of great concern to the nation as a whole, and we can help make a difference.

The Institute is currently involved in several science outreach programs, most of which have been within the Pasadena Unified School District in both the primary and secondary grade levels. President Tom Everhart recognizes the need for these programs, and is an enthusiastic supporter. Caltech students and faculty working in the programs are making a tremendous impact in the Pasadena neighborhood schools. What

they see is exciting, and the programs continue to be expanded.

One such program is Project SEED (Science for Early Educational Development), an example of Caltech's commitment to primary school science education. The project provides intensive teacher training, and stresses hands-on classroom experience. This three-year-old project, founded by two Caltech professors, physicist Jerome Pine and biologist James Bower, began as a pilot program in one Pasadena elementary school. It proved to be so successful that the Pasadena Unified School District allocated funds to expand to five schools. Last fall, Project SEED was awarded a four-year, \$653,197 National Science Foundation grant to support its expansion to all 21 schools within the district. The grant was matched 2 to 1 by the Pasadena Unified School District.

The expansion from a single school to the entire district is a clear statement that this is not an event, but a process. Jim Bower and Jerry Pine hope the program will become a model for school districts nationwide.

This summer several area alums are volunteering their time to assist with teacher training for Project SEED. This is just the beginning for Association participation in a community outreach program. The Chapter Affairs Committee is committed to supporting this movement, which is of such great national interest.

I will continue to be involved in this project next year as a special assignment to the Association, working with Vic Veysey, chairman of the Chapter Affairs Committee. I would be very interested in getting your input on this project. Please address your comments to the Alumni Association, Mail Code 1-97, Pasadena, 91125.

Input needed for travel/study programs

The Alumni Association is looking ahead to 1993 and beyond, and would appreciate your input on our travel/study options. Please review the list below and rate (1, 2 . . . with 1 being your favorite) your choices in the spaces to the left. Trips will be planned based on the interest expressed by alumni.

Copper Canyon, Northwest Mexico: A train trip through seven canyons, which make up an area deeper and larger than the Grand Canyon, would offer lectures in geology, engineering, and Indian lore.

England, Town and Country: The town portion of the trip would include visits to London's theaters, museums, cathedrals, and possibly the Old Bailey, while the country portion would highlight the historic cities of York, Stratford, Warwick, Oxford, and Windsor. Lodging would be in country houses and manors, with an afternoon treat of a teatime cruise down the Thames.

Great Barrier Reef/East Coast of Australia: The reef, stretching more than 1,200 miles along the northern half of Australia's east coast, is studded with some 600 islands supporting a host of native animals and bird life, while the fascinating coral formation itself provides a backdrop for nearly 900 species of fish. Island stops would include Whitsunday and Fraser, and a special tour of the Iluka Rain Forest and Yuraygir National Park, home to kangaroos, wombats, and wedge-tailed eagles.

Mediterranean Cruise: We have been offered a chance to participate in a joint cruise with alumni from several small California and Washington colleges—Pomona, Scripps, Mills, University of Redlands, University of the Pacific, and Whitman. Professors from each of the participating schools will offer lectures in their areas of expertise. The cruise will be aboard either the *Sun* or the *Queen*, both luxury liners from the Royal Viking line, and the countries visited will probably be Italy, Greece, and Turkey.

The Mississippi River and the Campaign of the Civil War: A cruise aboard the *Mississippi Queen* paddle-wheeler, this trip would start in New Orleans and include stops at antebellum homes, sugar and cotton plantations, and Civil War battlefields, before ending at Memphis.

The Sea of Cortez: This cruise would offer the opportunity to study a great variety of water birds and tropical land birds, as well as marine life ranging from whales to sea urchins. The trip would also include many occasions for swimming and snorkeling.

Sedona/Monument Valley, Arizona: A spectacular geology tour beginning with the red sandstone and rugged topography of Sedona, continuing through Oak Creek Canyon, along the edge of the Grand Canyon to the Navajo and Hopi reservations, through the painted desert, and, finally, to the splendor of Monument Valley.

Thank you for your assistance. Please return this form to:

Caltech Alumni Association, 1-97, Pasadena, California 91125

Name _____ Class _____

Address _____

Phone (home) _____ (business) _____

PERSONALS

1940

FRANCIS MORSE, MS, writes, "Carmen and I are looking for a cruise ship which will take us into the path of totality (off the coast of Baja) of the solar eclipse on July 11, 1991."

1942

HARRISON PRICE writes, "Old consultants never die—they just recycle. I am 70 on 5-17-91 and will drink a bottle of Margaux bottled in the year of my birth (probably for breakfast)." His consulting business, HPC, which specializes in leisure attractions, "is active worldwide—especially in Japan, so we resist the urge to hang it up."

LEROY A. WELLER, whose wife of over 42 years, Eloise, died suddenly in September 1989, was married to Sylvia Brickley in November 1990, in a ceremony at the Cate School Chapel, in Carpinteria, California.

1945

DUANE T. MCRUER, MS '48, was presented with the Distinguished Public Service Medal at a NASA Headquarters awards ceremony on March 12. He was cited for an "exemplary record of personal service and leadership that has contributed materially to the space and aeronautical missions of NASA."

1947

PAUL C. YANKAUSKAS, ENG, retired in 1990. "I am so busy traveling, fishing, reading, etc.," he writes, "that I don't know how I found time to work." His latest news is that he has 14 grandchildren.

1948

JULIUS S. BENDAT, MS, reports that his sixth book for John Wiley & Sons has recently been published. The title of the book is *Nonlinear System Analysis and Identification from Random Data*. His previous books have been translated into Russian, Polish, Japanese, and Chinese, and more than 120,000 copies have been printed.

1951

PETER F. ORCHARD, MS, retired from Rolls Royce in 1979, after which he bought a country-house hotel. He operated the hotel until 1989, and is now fully retired.

1953

THOMAS H. APPLEWHITE, PhD '57, has received the A. Richard Baldwin Distinguished Service Award, presented by the American Oil Chemists' Society on the occasion of its 82nd annual meeting. Since being instituted in 1981, the award has been presented only once before; it is given in recognition of "long-term distinguished service to the AOCS at positions of high responsibility." Applewhite was director of research for Kraft, in northwestern suburban Chicago, for nearly all the last two decades of his career. He is now retired and a part-time resident of Austin, Texas, and of Bailey's Harbor, Wisconsin.

1954

ROLAND S. MILLER, MS '55, has embarked on a new venture after spending five years building prisons for the state of California. As senior vice president with Jaykim Engineers, he is busy establishing their northern California regional office, in Sacramento.

1957

KIRK S. IRWIN has retired after a 34-year aviation career that included the US Air Force, NASA, and Tracor Aviation. He has started an aviation management consulting business and has clients in the United States and Europe. "In addition," he writes, "I have converted a serious hobby into a business by forming I & I Images, a photography company primarily involved in the publication of photography books."

1958

WAYNE NELSON, of Niskayuna, New York, has been selected as a senior research fellow of the National Institute of Standards and Technology (NIST), formerly the National Bureau of Standards. He will do statistical research on product and material reliability in collaboration with NIST staff members. A former employee in General Electric's research and development statistics program, he still consults there and throughout industry. He is an expert in the engineering applications of statistics and has authored two books and nearly 100 articles. He has been elected a Fellow of the American Society for Quality Control, and is a member of the American Statistical Association and the Institute of Electrical and Electronics Engineers.

1959

BARRY G. CLARK, PhD '64, of the National Radio Astronomy Observatory in Socorro, New Mexico, has received the 1991 Van Biesbroeck Award for unselfish service to astronomy. The award, given on January 25 at the Flandrau Planetarium and Science Center in Tucson, Arizona, recognizes his role in the development of radio-astronomy instrumentation, particularly in the area of radio interferometry, and in the construction of the Very Large Array.

1960

THOMAS K. BJORKLUND writes, "After two years in Port of Spain, Trinidad, W.I., with Amoco Trinidad, I was appointed Chief Geologist, Amoco Orient Petroleum Company, Shekou, People's Republic of China. I am learning Mandarin and am involved with exploratory drilling operations in the South China Sea. I hope to return to Caltech for the 1991 Centennial."

1962

JOHN M. KLINEBERG, MS, PhD '68, director of NASA's Goddard Space Flight Center, in Greenbelt, Maryland, has received the Distinguished Executive Presidential Rank Award from President Bush at a recently held White House ceremony. When nominated for the award, Klineberg was director of NASA's Lewis Research Center, in Cleveland, Ohio. "Your integrity and professionalism have helped make our Federal Government a model for the rest of the world," the president said. Each year, only one percent of Senior Executive Service employees may receive the rank of Distinguished Executive.

1966

JERRY M. YUDELSON, vice president, sales and marketing, Pacific Coast Environmental, Inc., of Portland, Oregon, is a member of the board of directors for the three-year-old environmental contracting firm. He is responsible for all corporate sales and marketing activities, corporate communications, government relations, and public relations.

1967

USO WALTER, ENG, joined the European Transonic Windtunnel project in January, 1989, after 15 years handling a variety of assignments for DLR, the German aerospace research establishment. He writes that he enjoys working in the four-nation project.

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Name _____

Degree(s) and Year(s) Granted _____

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News _____

1969

ELTON N. KAUFMANN, PhD, has been appointed associate director of Argonne National Laboratory's strategic planning group, which develops programs that match Argonne's capabilities with national needs. Kaufmann will initially concentrate on advanced materials and on the Advanced Photon Source, which will provide the world's brightest X-ray beams, for use in materials research. Kaufmann came to Argonne in 1989 as director of the laboratory's Superconductivity Pilot Center, an experimental program designed to foster cooperative research between Argonne and industry. He is a former president and a current councilor of the Materials Research Society and a fellow of the American Physical Society.

1970

ALLAN B. ELKOWITZ is currently the director of operations for the information systems department at Children's Hospital, in Boston, Massachusetts. He is married to Peggy Wingard, MD.

1971

JACK E. LEONARD, PhD, last October formed and became president of Environmental Management Institute, Inc., an Indianapolis-based nonprofit environmental/occupational training and information company. "With a staff of six," he writes, "we have already trained over 1000 people, provided assistance to a dozen government and industry groups, and filed a US Patent on a method for cleaning certain Superfund sites."

1973

DAVID BRIN and CHERYL ANN BRIGHAM (PhD '90) were married on March 24. Brigham is doing postdoctoral research in cosmochemistry at the University of Paris. Brin obtained a PhD in space physics from UC San Diego, but now spends most of his time writing novels. He has won three Hugo Awards for works of science fiction. One novel, *The Postman*, is scheduled to become a film from Warner Brothers. His latest novel, an ecological techno-

thriller titled *Earth*, is an American Library Association First Selection. "We have been living in Paris for more than a year," writes Brin. "During the past year and a half, we have visited much of Europe, as well as Japan, Malaysia, Thailand, New Zealand, Easter Island, India, and gone hiking in Nepal." By the end of summer they should be back in southern California, where they intend to build a house and set down roots.

PETER P. BROOKS is CEO and president of MicroMind, Inc., a software organization based in New York. In his spare time he helps peace and community groups and develops software for the handicapped. "Despite numerous entreaties," he writes, "I have declined all invitations to pose for PlayGirl's annual Middle-Aged Men of Programming issue. Sorry."

DEBORAH D. L. CHUNG, BS, MS, professor of mechanical and aerospace engineering and director of the Composite Materials Research Laboratory in the University at Buffalo School of Engineering and Applied Sciences, has been selected as the holder of the Niagara Mohawk Power Corporation endowed chair in materials research. The professorship was established at UB by Niagara Mohawk in 1989 to attract and retain a nationally recognized teacher and scholar in the field of energy-related materials. She has been the recipient of many honors, and she currently serves as chair of the 21st Biennial Conference on Carbon, sponsored by the American Carbon Society, to be held at UB in 1993. Chung resides in Amherst, New York, and also has a home in Churchill, Pennsylvania, with her husband, Lan K. Wong, a professor of pharmacy at the University of Pittsburgh.

1974

RICHARD L. BAKER made the leap from academics to industry in January 1990. "I had spent five memorable years on the faculty at UCLA," he writes, "having a great time teaching electrical engineering and researching image and video compression techniques. Now, as Director of Research at a hot little east coast videoconferencing manufacturer (PictureTel), I have the

chance to help the world 'teach out and see' one another." His wife, Robin, whom he met 11 years ago at Stanford, has a PhD from UCLA in organizational behavior. They live in Belmont, Massachusetts, and have two children, "blond and blue-eyed Shannon (3½) and red-headed Scott (2)."

1975

JON E. AHLQUIST, MS, writes that he is currently an associate professor of meteorology at Florida State University. He and Linda Munsinger were married in June 1987, and in March 1990 they became the parents of a daughter, Sigrun Carol.

1976

WOLFGANG O. FRANZEN was awarded his PhD in computer science by USC, in May. His area of specialization is computer vision.

1977

MICHAEL J. K. CRAIG, MS, former alien and now a bona fide citizen of the United States, is currently a civil-engineering consultant with Unocal. He lives in Bakersfield, California, with his wife, Vicki, and their children, Peter (five years old), Trevor (three), and Caroline (three months).

JOHN H. LOO married the former Carolyn Pineda on January 5, and has settled down in Encinitas, California. He is currently working for Fluor Daniel, Inc., in Irvine, where he is manager of technology development in the company's information systems group. Even though he majored in chemical engineering, he hasn't done much in that field since 1980, "having decided," he writes, "that a career in information systems is a lot more fun!"

STEPHEN M. TRIMBERGER, PhD '83, writes, "Laura and I are pleased to announce the birth of our second daughter, Pamela, just before Christmas."

1978

PHILIP L. ENGELAUF writes that, after being selected last year as a flight director in the Space Shuttle program, "I completed my year of training and served my first flight in that capacity during the recent STS-37 mission. I have been assigned to two more flights this year, and several in 1992."

KOCHAN JU, PhD, has been named senior manager of IBM's research division.

1979

JOHN S. CHEN, MS, has been promoted to vice president and general manager of the Unix Systems Group, of Unisys Computer Systems Group, and will be responsible for the development, manufacturing, and marketing of all Unix products and programs. Before his latest promotion, he was vice president and general manager of Motorola's platform division, as well as acting general manager of Unix Systems. He joined the Santa Clara-based Unisys Corp. in July 1979 as an electrical-design engineer for Burroughs Computer Systems Group.

1984

DAVID W. HAWLEY writes that he and his wife, Lynn, are pleased to announce the birth of their first child, Sarah Elizabeth, on March 13. Starting in June, the family will be spending six months in Swindon, England, as well as the rest of Europe, where Hawley will be working as an applications engineer for National Semiconductor. His wife will be on extended leave from her job with the Sierra Club.

NED S. WINGREEN writes, "I'll be finishing a postdoc in physics at MIT in September and moving to Princeton to do basic research at NEC's new lab."

1985

JAMES F. GARVEY, PhD, in February received tenure in the department of chemistry at the State University of New York at Buffalo. A review of his research at SUNY over the past three and a half years has been published in the February 1991 *Accounts of Chemical Research*.

MARGARET C. OLICH writes, "I have recently retired from my instructor position with General Electric to become a Quality Assurance Engineer with Northern States Power at their Monticello Nuclear Generating Plant in Minnesota . . . and am discovering the great white(!) north."

1986

DANIEL E. LOEB of Bordeaux, France, writes, "Hélène and I are expecting our first child this April."

1987

BRETT C. BUSH, who is currently at UC Berkeley working on his PhD in astrophysics, is taking part in an extended tryout for the United States Men's Olympic Volleyball Team. Bush led Caltech to two National Club Volleyball Championships.

OBITUARIES

1920

ROBERT CARSON SMITH, of El Toro, California, on February 21, 1990. He was a manager of the Reliance Title Insurance Co., formerly Security Title Insurance Co., and was deeply involved in community affairs. He was a founder of the Santa Ana Lions Club, president of the Santa Ana YMCA board of directors 1935–1936, and president of the Bowers Museum board of trustees 1954–1958; he served on the board of directors as well. He was also president of the Santa Ana Board of Realtors in 1956, and a board member for 24 years. He was mayor of Santa Ana 1947–1949. His wife, Dorothy, died on February 26. He is survived by his brother, Harold Smith; daughters, Peggy Evans and Grace Thomas; eight grandchildren; and four great-grandchildren.

1923

FOREST L. LYNN, of Bakersfield, California, on June 12, 1990. A schoolteacher, he taught mathematics; he was also a tennis coach. He is survived by two sons, Richard and Robert.

1925

WILLIAM DOUGLAS SELLERS, of Pasadena, California, on March 13. He graduated from George Washington Law School and became a partner in Sellers and Brace, a Pasadena law firm. He was a member of the Athenaeum, the Jonathan Club, and numerous local business clubs. He is survived by his son, Stephen; daughter, Margaret Cartwright; grandson, Steven; granddaughter, Susan; and great-granddaughters, Brittany and Alexis.

1927

BENJAMIN RHEES LOXLEY, of Pasadena, California, on February 21. He spent 38 years with Southern California Edison, and he received awards for 25 years of outstanding service to Linda Vista youth and 65 years of service to the Boy Scouts, with whom he was an assistant scout master, and later a scout master, in Linda Vista. He is survived by his wife, Ruth Ann; daughter, Margaret Ann Rosenberg; and two grandchildren, Thomas Loxley Rosenberg and Kariana Rosenberg.

1930

REA E. HOPPER, of Los Angeles, on April 19, of pneumonia. After 10 years at Douglas Aircraft Co., where he helped design the DC-3, Hopper joined Hughes Aircraft in 1939. There he was selected by Howard Hughes to be chief designer for the Spruce Goose, the mammoth prototype transport plane that made its only flight on November 2, 1947, in Long Beach Harbor, with Hughes at the controls and Hopper at his shoulder giving instructions. In 1951, Hopper was named chief engineer at Hughes Aircraft; he was responsible for the development of such aircraft as the D-2 and XF-11, and the Apache helicopter. In 1954, he became general manager of the Hughes Tool Co. Aircraft Division. When he retired, in 1983, he was senior vice president of Summa Corp., the Hughes holding company. He is said to have been one of the few individuals who had direct access to Hughes, enjoying his confidence even after the billionaire became reclusive. Hopper is survived by his wife, Mary; two daughters, Polly and Paige; two sons, Christopher and Randolph; two sisters, Esther Hopper and Evelyn Cozzolino; and four grandchildren.

1933

YGNACIO BONILLAS, MS '35, of San Francisco, on April 30, of cardiac arrest and kidney failure. He worked for the Chevron Corporation from 1935 until his retirement in 1973, and was a member of the Provost's Circle of The Associates. He married the late Jean Stone in 1938, and he is survived by a niece, Mrs. Steven Oaks.

1934

GERARD J. ("BUCK") FORNEY, EX, of San Francisco, on January 17, after a long illness. After leaving Caltech, Forney graduated from West Point, served in the Army Corps of Engineers during World War II, and after the war took charge of the Oak Ridge nuclear facility. After retiring from the Army, he managed large international projects for American Cyanamid and for Bechtel Corp.; later, he became a vice president of Bechtel. He is survived by his wife, Enid; one son; two daughters; and several grandchildren.

1936

MERAL W. HINSHAW, on January 14. A mechanical engineer, he had his own manufacturing business, Diamond Tool Associates, located in Gardena, California. He is survived by his wife, Grace; two daughters, Victoria Steele and Diane Halasz; and a son, Gordon.

1939

CARROLL M. BEESON, PhD, of Laguna Niguel, California, on February 22. Beeson was a professor at the University of Southern California, and chairman of its petroleum engineering department; he later received the title of professor emeritus. When he retired, he was chairman of the engineering department at California State University, Los Angeles. He is survived by his wife, Alice; daughters, Barbara Mersini and Virginia Ruffalo; granddaughters, Liria Mersini and Diane Ware; and a great-granddaughter, Lani Ware.

1940

JAMES W. JONGENEEL, MS '41, of Marina del Rey, California, on March 1, after a long illness. He went to work for Douglas Aircraft in 1941 as a power-plant engineer and retired from McDonnell Douglas in 1982. He was for many years the main Douglas technical representative to companies manufacturing aircraft engines. He is survived by his wife, Jean; her children, Heide and Holland Simmons; his son, Alan; his daughter, Linda Moreland; and four grandchildren.

1941

CECIL G. YOUNG, of La Cañada Flintridge, California, on March 10, 1990, of lymphoma, following a two-year illness. He began his engineering career with the General Electric Company in the East and the Midwest, then returned to California in 1946 as chief engineer for the A. O. Smith Corporation, where he stayed until the company relocated in 1954. Specializing in product-design applications, he was responsible for many patents. He retired in 1982 as lead engineer for Keck-Craig, Inc., in South Pasadena, but worked as a consultant until 1987. He is survived by his wife, Virginia; two daughters, Linda, married to James V. McArdle, PhD '76, and Carol Verheyen; and three granddaughters.

1942

NOVA B. KIERGAN, ENG, of Pensacola, Florida, on October 13, 1989. He is survived by his wife.

1943

ALBERT T. ELLIS, MS '47, PhD '53, of La Jolla, California, on April 11; he was a senior research fellow at Caltech 1954–1958, and associate professor of applied mechanics 1958–1967. During World War II, Ellis served in the Army Signal Corps. In 1967, he left Caltech for UC San Diego, where he became professor emeritus of applied mechanics in 1986. He was active in the San Diego–Edinburgh Sister City Society and the English Speaking Union. He held a number of fellowships over the years, the last as a visiting fellow at Wolfson College, Oxford University, 1985–1988. He is survived by his wife, Helen; a son, James; a daughter, Kathryn Gauder; and three grandchildren.

1948

JAMES K. TAYLOR, MS, of El Paso, Texas, on January 9. Taylor graduated from West Point in 1940 and retired from the military with the rank of colonel. Proficient in mathematics, he taught the subject after retiring, both in private schools and as a tutor. He is survived by his wife.

1950

WILLIAM T. STAATS, JR., of San Diego, California, on February 24, 1990, of a heart attack. Formerly a staff engineer with Lockheed, he had retired in 1984. He is survived by his wife, Harriett.

1959

CEDRIC I. DAVERN, PhD, of Salt Lake City, Utah, on October 18, 1988. He is survived by his wife and son.

1966

GEORGE W. DICKINSON, JR., of Golden, Colorado, on April 17, of acute asthma. After graduating from Caltech, Dickinson went to work for TRW Systems Group, in Redondo Beach, and participated in the development of technologies for the Apollo, Pioneer, and Skylab projects. He also developed new computer-aided methods for structural analysis that became company and industry standards. He returned to Colorado in 1972 to join the consulting engineering firm of Dickinson-Associates, Inc., where he became president in 1978. He is survived by his wife, Suzonne, and his sister, Rita D. DeLollis.

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In this issue

What started as a first-grade hobby has brought alumnus Robert Lang to the top ranks of origami artists in the world.

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In a Centennial outreach program, Caltech graduate students carry programs on vulcanism and earth science to students in the Pasadena public schools.

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For the third straight year, the number of African-American and Hispanic students admitted to Caltech has increased, thanks to a concerted effort on the part of the university grounds in the nation.

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