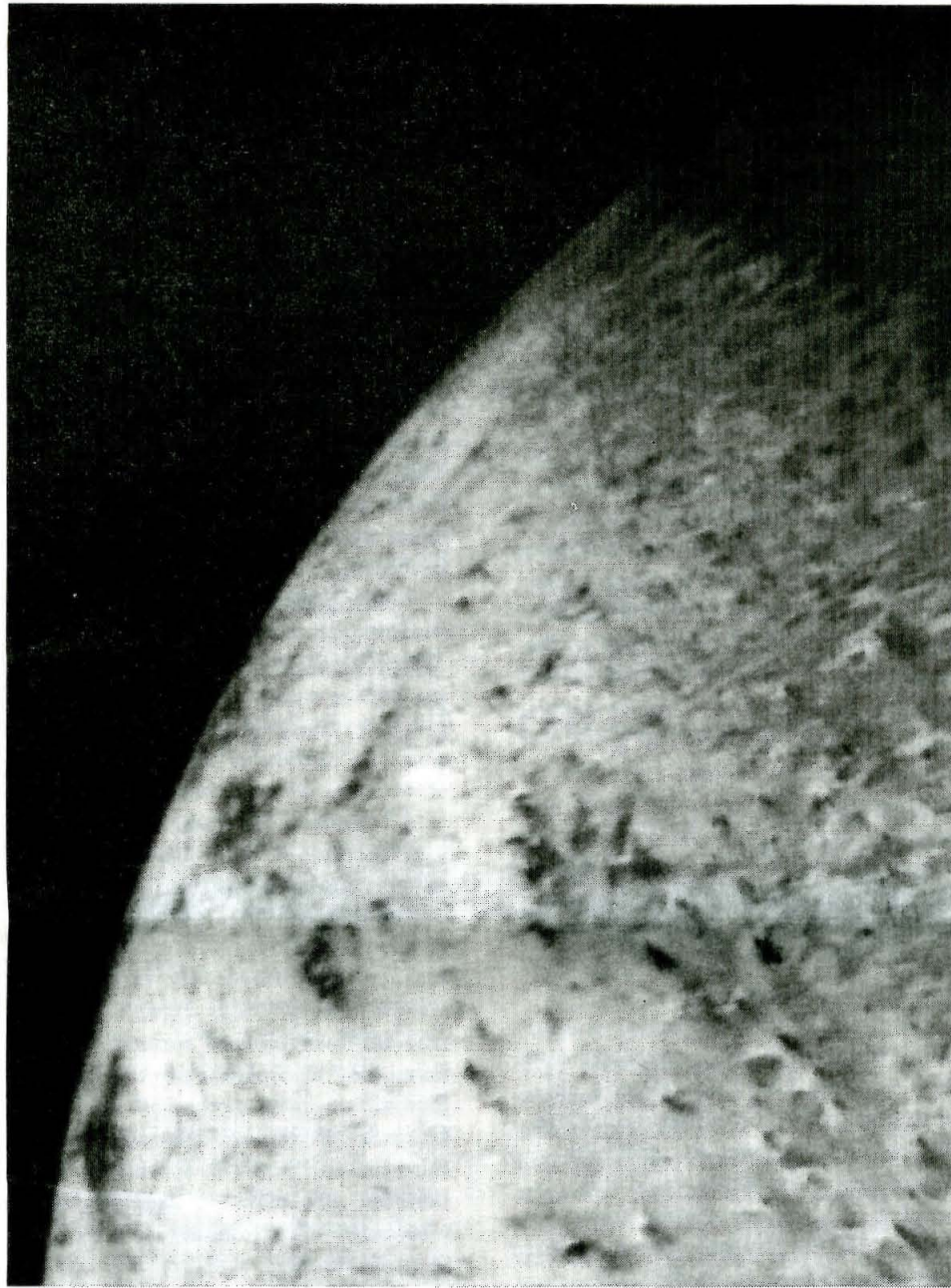


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Voyager captures dramatic images in Neptune flyby

The Voyager 2 spacecraft zoomed past Neptune in late August, sending back spectacular photographs of the planet and its satellites. One of these images is shown here.

This image of the limb of Triton was taken at JPL early in the morning of August 25, when Voyager was at a distance of about 210,000 kilometers (128,000 miles) from the icy satellite. The largest surface features visible are about 3 miles across. The image shows a geologic boundary between a rough pitted surface to the right and a smoother surface to the left. The change between surface types is gradual. Triton is primarily a white object with a pinkish cast in some areas.

A Caltech professor's studies show that infanticide was a commonplace method of fertility control in northeastern China during the 18th and 19th centuries.

When infanticide was practiced in China

Infanticide was practiced systematically as a method of family planning in northeastern China during the 18th and 19th centuries, according to an analysis of Chinese archival records by a California Institute of Technology faculty member and his students.

James Lee, associate professor of history, and two Caltech undergraduates, Cameron Campbell and Christopher Myers, have carefully analyzed 14,000 food-price records as well as 100,000 demographic records from a rural population in Liaoning Province for the period between 1774 and 1873. Liaoning is located northeast of Beijing.

The study establishes that female infanticide was a commonplace method of fertility control. It demonstrates that parents controlled their fertility at least in part as a response to economic conditions as reflected by food prices. It also shows that the families additionally controlled their fertility in response to their position in the local hierarchy. Finally, the study suggests that some peasants killed their sons as well as their daughters, although this was not as common.

Lee's study presents the first systematic study of Chinese historical birth preferences and the practice of infanticide as a method of planning to achieve goals for family size and sex distribution.

In brief, Lee and his colleagues conclude that in rural Liaoning, peasants regarded infanticide as a form of postnatal abortion through which they could choose the number and sex of their children in response to a wide range of short-term and long-term circumstances.

Lee's demographic data comes from local provincial archives in the PRC, in particular, 25 population registers that recorded for each person his or her name, occupation, family and lineage relationships, birth date, recent demographic events, and village of residence. "To the best of our knowledge," says Lee, "no other material records a Chinese peasant population before 1900 with such continuity and detail."

Among the complex network of factors that affected the decision to keep a child was the price of food. The economic data came from the palace archives in Beijing, in particular, from

an empire-wide system to monitor food conditions that began in late imperial China during the 17th century. Lee and his colleagues collected over 1500 monthly price reports for Liaoning. These data provide a systematic measure of food availability in Liaoning, and enable the researchers to identify which grains were most closely tied to specific changes in population and therefore loomed largest in individual decisions about fertility and mortality.

Their results showed that substantially more male births than female births were registered—far above the number that could be accounted for by natural selection, and that a substantially larger percentage of first babies than second or third babies were female.

The ratio of girls to boys decreased with the number of children born to a family. This indicates that families would sometimes allow themselves the "luxury" of an initial girl child when they planned to have other babies whose sex they could determine by keeping only male children. The more children they had, the less likely they were to

Continued on page 2

Infanticide in historic China

Continued from page 1

allow female children to live.

Lee explains that boys were strongly preferred in China because of the practice of ancestor worship, which dates from prehistory in China as a core value. The rites and rituals of ancestor worship were observed by male descendants—thus the preoccupation with having male heirs to propagate these traditions.

As a result of the dearth of girls in the society, bachelorhood was a common condition. Many marriages were to women outside the village. In some other poorer villages, the proportion of males not marrying was as high as 25 percent, Lee reports.

Because of this marriage market, Liaoning could afford to practice family planning through the killing of girl babies; otherwise, the need to provide wives would have been a more significant concern.

Most of the people in rural Liaoning lived in extended families incorporating fathers, sons, uncles, cousins, and female family members in a rigidly structured hierarchical system. The largest family unit recorded included 80 persons.

A decision about whether a child would live was made in a complex household through an intricate negotiating process within the family—a process involving the father of the child and perhaps the mother, the head of the household, and possibly even neighbors.

Records show that those closest to the center of the hierarchy in a complex family—the head of the household and his sons—had more children than those on the periphery—uncles and cousins. Records also reveal that peripheral members of the family were more likely to have girls—apparently because it was less important for those at the periphery to produce male heirs to carry on traditions.

According to Lee, anecdotal information from the time suggests that the child was most likely to be killed by the head of the household, the father, or the midwife. The preferred method was to drown the baby in a bucket of water.

Recent Chinese studies show that cyclic fluctuations in summer temperature were responsible for sharp variations in food prices over the period covered by Lee's data. A comparison with birth registrations shows a decline that correlates with years of poor harvests and high prices. When food prices were high, people had fewer children, especially girls. The correlation between fertility and food prices also reveals that some parents made their family-planning decisions in response to conditions at the time of birth rather than the time of conception.

"The unnatural response of birth rates by sex to immediate economic condi-

tions can only mean that in Liaoning, many peasants limited their fertility through sex-selective infanticide," says Lee. "Virtually all households responded to high prices by reducing fertility and to low prices by increasing fertility."

The preference for male children over females is clearly demonstrated by an analysis of the birth history of almost 1,000 marriages. Lee and his colleagues computed the sex ratios by birth order and completed family size; that is, the total number of births registered to the parents by the time the mother reached age 45. In single-child families there were 576 boys for every 100 girls. For families with two children there were 211 boys per 100 girls at the first birth and 450 boys to 100 girls at the second birth. For families with three children, the ratio was 156 boys to 100 girls at first birth, 194 boys to 100 girls at second birth, and 324 boys for every 100 girls at the last birth.

"This highly unnatural pattern continues through all other completed family sizes," says Lee. "The closer a girl's birth was to the completed family size, the less likely she was to survive to registration. Couples targeted the number of boys they wanted and stopped having children after the desired number had been reached."

Lee explains that the decision to use infanticide was no doubt particularly common in this population because they were members of a state farm population and were not allowed to leave their land. With no safety valve in the form of opportunity to move to regions offering more opportunities, the people of Liaoning were trapped with sharply constrained resources.

Hans Liepmann feted on 75th birthday

Hans W. Liepmann, the Theodore von Kármán Professor of Aeronautics, emeritus, was the guest of honor at a party on July 9 in celebration of his 75th birthday. Some 150 guests attended the party at the home of Dr. and Mrs. Hans G. Hornung. (Hornung is director of GALCIT, and the Clarence L. Johnson Professor of Aeronautics.)

Liepmann received a car cover for his Porsche, signed by the guests; a beanie with propellers and streamers proclaiming his 75th birthday; a pair of silk boxer shorts that he donned and wore over his long pants; and several other gifts.

Record-breaking number of women enroll this fall

A total of 216 freshmen, including 64 women, were expected to enter Caltech this fall. This is the highest number of women ever to enroll. The second highest number was 42 in 1982. This year's class, which includes 2 blacks and 10 Hispanics, is slightly larger than last year's class of 201-freshmen.

Joining the freshmen are 10 transfer students and 15 representatives of the 3-2 program. This program enables students at certain liberal-arts colleges to follow a prescribed course for three years and then to transfer into the third year of an engineering option at the Institute.

A total of 266 graduate students were expected to enter Caltech in September, compared with 255 in 1988.

The new freshman class is described as "well rounded" in terms of interests. Included are students who train horses and write short stories, three women who are involved with Amnesty International, one who played powder-puff football, one who works with the "Clean Calcutta" project, one who was awarded third place in Mexico's fencing competition, one who plays the bagpipes, one who taught an astronomy class for elementary students, a Special Olympics volunteer, a worker for the Dukakis campaign, a member of "Crime-stoppers," a teen hot-line volunteer, and a tour guide for a historic park.

The freshman class is academically as impressive as ever, with SAT scores in the top two percent of the nation. In choosing its students, the Institute continues to look for those who have a commitment to science and technology and whose enthusiasm for these fields transcends good academic performance.

In geographic diversity, the freshman class is similar to that entering last year, but with a smaller percentage from California (last year there were 34 percent). This year, 28 percent are from California, 17 percent from other western states, 17 percent from the Midwest, 15 percent from the South, 14 percent from the Northeast, and 9 percent from foreign countries.

Of the graduate students entering, 132 are in engineering, 134 are in the sciences, and 4 are in the social sciences. A total of 18.9 percent of the students entering in engineering are women, while 17.9 percent of those entering in science are women. Of those students entering in engineering, 48.5 percent are from foreign countries, and of those entering in the sciences, 43.3 percent are from foreign countries.

Renovations in Winnett Center

A number of major changes are under way in Winnett Center that will give the building a new look and a revised floor plan when they are complete. Among the changes—the Red Door Cafe is moving out, secondary school relations is moving in, and the bookstore is gaining badly needed selling space.

First-floor renovations in Winnett include expansion of the international students' desk; the addition of an international students' lounge; new offices for secondary school relations, which is relocating from its current Wilson Avenue office; a new conference room available to all campus organizations; the expansion of the bookstore area; and the refurbishing of Winnett Lounge.

Second-floor renovations include an office for the Organization of Women at Caltech (OWC); an adjacent clubroom that will house the OWC library and can be used as a women's meeting lounge (also available to other campus organizations); and a new women's restroom. Minor modifications will be made to the Caltech Y offices and to clubroom one.

Two major relocations will result from the renovations. The Red Door Cafe will get new quarters at the west end of Chandler Dining Hall. The cafe will be separated from the rest of Chandler and will occupy part of the outdoor eating area, giving it indoor and outdoor seating.

The student shops located in the basement of Winnett will be moved to the Central Engineering Services building on Holliston Avenue. The vacated space will be used for bookstore offices and storage, thus freeing first-floor bookstore space for selling.

The first stage of the renovations, scheduled for completion over the summer, includes the international students' desk, the OWC office, the Red Door Cafe, the secondary school relations offices, and the first-floor conference room.

The second phase will include work on the Y offices, the second-floor restroom, rehabilitation of clubroom one, the creation of clubroom two next to the OWC office, and the overhaul of Winnett Lounge. The lounge walls will be repainted and repaneled, and new lighting, window coverings, and furniture installed. The adjacent bar and kitchen facility will also be renovated.

FRIENDS

DuBridge Prize Fellowships established

The Weingart Foundation has made a gift of \$1 million to Caltech to establish the Dr. Lee A. DuBridge Postdoctoral Prize Fellowship Award Fund. DuBridge is the president emeritus of Caltech, where he served as president from 1946 to 1969.

The fund will be used annually to award three-year Lee A. DuBridge Postdoctoral Prize Fellowships to postdoctoral fellows who are U.S. citizens and who are involved in research in the physical sciences. These prestigious fellowships will bring to the Institute some of the most creative and talented postdoctoral fellows from around the nation. Each award will provide a stipend of \$30,000 per year for a three-year period, representing a total value of \$90,000.



Vice President Dan Quayle greets JPL employees during a morning stopover at the lab during the last leg of the Voyager flyby of Neptune.

Caltech awarded Mellon Foundation grant of \$264,000

Caltech has received a three-year grant of \$264,000 from the Andrew W. Mellon Foundation in support of a program in science, ethics, and public policy (SEPP). The program was initiated at Caltech two years ago by Daniel J. Kevles, a historian of science, who is the J. O. and Juliette Koepfli Professor of the Humanities at the Institute.

"SEPP was started to stimulate thought and discussion among the faculty and students about the interplay of science and technology with the larger society," Kevles says. "It is clearly desirable that Caltech students be exposed to rigorous and informed thinking about policy and ethical issues—religious, social, and otherwise—that have pervaded disputes in areas such as weapons research and arms control, biotechnology, the environment, and military secrecy. Throughout their professional careers, they will have to deal with these issues in one form or another."

SEPP has three major, connected activities—faculty research and writing in relevant topics; education in the field through undergraduate courses and the training of selected graduate students and postdoctoral research fellows; and a regular public seminar series featuring speakers from on and off campus followed by audience-participation discussions of the issues involved.

The SEPP program, which is under the auspices of the Division of the Humanities and Social Sciences, brings together historians, philosophers, and social scientists, as well as natural scientists and engineers. During the 1989 academic year, Kevles says, informal discussions will focus on ethical and policy issues in the human genome project, and will involve several staff members of the new National Science Foundation science and technology center in biotechnology that has recently been established at Caltech.

Advanced Geophysical Observatory funded

Caltech has received the first of two installments of a \$980,000 grant from the L. K. Whittier Foundation of South Pasadena, for the construction of the Whittier Advanced Geophysical Observatory.

The Whittier Advanced Geophysical Observatory will consist of three broadband, high-dynamic-range, digital seismometers, placed at three widely separated locations in southern California, interlinked ultimately by satellite telemetry, and serviced by high-speed computers. Some of the locations will be equipped with receivers for the Global Positioning Satellite (GPS) network. It will be the first stage of a planned 10-element "TERRAscope"—a terrestrial telescope that will peer downward, providing data and images of the tectonics, crust, and mantle beneath southern California. It will be designed and operated by the Seismological Laboratory.

The Whittier Advanced Geophysical Observatory and the TERRAscope of which it will be a part is much like an ordinary telescope, but instead of collecting light rays, it will collect seismic waves produced by earthquakes. Using sophisticated methods of extracting information from seismograms, the Whittier Advanced Geophysical Observatory will routinely provide a wealth of information that now requires months of specialized study. It will supply seismic data of exceptional quality during earthquakes of all magnitudes and locations, and will provide instantaneous information on fault locations, orientation and energy of quakes, and the extent of ground breakage. Caltech's library of seismograms spanning the past 60 years will be digitized and made part of TERRAscope's data base, allowing scientists to assess the patterns of a new event while it is happening.

Community Bank donates \$28,000 to Project SEED

Community Bank has presented Project SEED at Caltech with a gift of \$28,000. Kraig Westra, president and CEO of the Pasadena-based bank, delivered the gift.

Project SEED, which stands for Science for Early Educational Development, is a two-year-old program that explores ways in which the creative use of classroom computers can enhance and reinforce good science teaching in elementary grades K-6. It expands a hands-on elementary science education project founded by two Caltech professors, physicist Jerome Pine and biologist James Bower.

Project SEED is currently in use at four schools—Field Elementary School in Pasadena, the Sequoyah School (private) in Pasadena, the Open School in Los Angeles, and Ambler School in Carson.

Caltech receives biotechnology gift

The Donald E. and Delia B. Baxter Foundation of Pasadena has made Caltech a gift of \$300,000 to support the development of an automated gene mapper and computer processor. The funds will support research conducted by Leroy Hood, the Ethel Wilson Bowles and Robert Bowles Professor of Biology, and a pioneer in the field of biochemical instrumentation. The gift represents the fifth major contribution the Baxter Foundation has made in support of Hood's work since 1983.

"Dr. Hood's research group is conducting fundamental research to create an instrument that may revolutionize our ability to map genes that play important roles in the onset of human diseases," said President Thomas E. Everhart. "The Baxter Foundation's support of this work is central to maintaining the astonishing pace of progress made in this important field."

In addition to supporting development of this technology, the Baxter Foundation grant will provide funding for computer resources. These will be used to analyze the complex arrays of information that will be generated by the effort to map the entire 23 pairs of human chromosomes. This will provide a guide to identifying genes that cause human disease. Over the past ten years, about 20 such genes have been identified, including genes for Huntington's disease, cystic fibrosis, manic-depressive syndrome, and Alzheimer's disease.



Arnold O. Beckman cuts the cake at topping-out ceremonies for the Beckman Institute.

Recently President Thomas E. Everhart completed his second year as president of Caltech. We chose this time to interview him about his goals and challenges, his vision for Caltech in its second century, and a number of other topics.

What surprised you most about Caltech?

Except for the Whittier earthquake, there were no big surprises. I expected the quality of the people to be very high, and it certainly is. I've not been in a place before that has so many research faculty, so that's a difference.

I was pleased by the fact that so many faculty members live close to campus. As a consequence there's much more of a campus community here than you might expect in a big metropolitan area.

I also think the leanness of the administration takes some getting used to. I do a lot more myself than I did in previous situations, and this has both advantages and disadvantages.

What has been your greatest personal challenge here?

I think getting to know and understand the many excellent people here. I feel I would like to spend a day with each one, they're so interesting. That would be very enjoyable, but nothing would get done in the office.

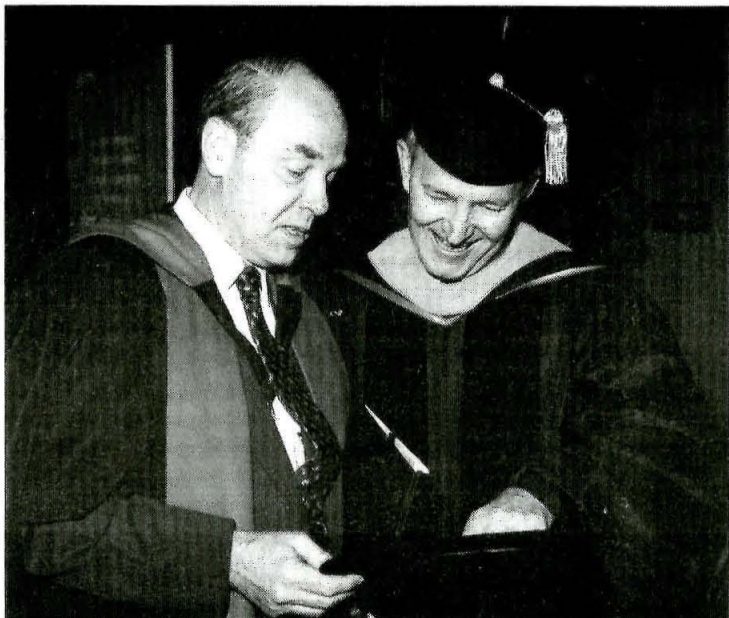
Probably my biggest challenge is to prioritize time. I think that's a challenge in any position like this one.

What have you found to be the differences in the politics of a privately funded institution versus a state-funded one?

I spent five and a half years at Cornell. It is privately funded, so I've had experience on both sides of that equation. I think there is sometimes a tendency for people in private institutions to look at donors as representing money rather than representing ideas, or opportunities to explain science. One should try to get people involved intellectually, and then hope the commitment and support will follow. Unless there's an intellectual commitment to the goals, the project, or the campus being considered, there probably won't be much support—and that's true whether the institution is public or private. Incidentally, public institutions are seeking out private donors very actively these days, so there's not as big a difference between the two as there might have been 20 years ago.

Which of your accomplishments here are you the proudest of?

It's too early in my career here to talk of accomplishments. Besides, it's really the Institute that accomplishes



President Everhart with Board of Trustees chairman Ruben Mettler at commencement.

President Everhart shares his views

things. The president facilitates and helps.

I'm very glad that the relationship between Caltech and NASA is better now than it has been at previous times in the history of the two institutions. I think a lot of people deserve credit for this—Lew Allen, most especially. If I've helped contribute, then I'm glad.

I'm pleased that we're building the largest building on campus right now—the Beckman Institute. It will provide the opportunity for many of our faculty to achieve things that wouldn't have been possible without it.

We're working hard to complete the Keck telescope on time. This was a very courageous endeavor started before I arrived. I think the instrument will set the standard in optical and perhaps infrared astronomy for quite some time, and we can all be proud of that. But again, it's very much a team effort.

I think all of us can be proud of the appearance of the campus. It's a very pleasant place to work. The beauty of the physical campus helps us to do high-quality work in other ways as well. The beauty of the campus is a symbol of the quality, the excellence, of Caltech.

What would you say is the greatest challenge facing Caltech?

Probably the greatest challenge is to remain preeminent as the kind of institution we are. We're very small in relation to almost all the other institutions with which we're compared. Yet we have a reputation that's much, much larger than our size. As the world becomes more complex and other institutions become stronger in research, it's going to become more difficult to maintain this position. But I believe we have both a challenge and a responsibility to maintain that excellence. We probably will need to increase our level of resources to do so. Personally, I'm concerned that we're overly dependent on federal financing right now.

What's your vision for Caltech in its second century?

That we maintain our preeminence in science and become somewhat better known for the applied sciences and engineering. This is a difficult task in the sense that in both cases we have to choose very carefully where we put our resources, choosing fields that will develop for the long term. There are fads, both in science and in engineering, and we have to avoid these.

The 20th century may have been the century of the physical sciences, of phys-

At The Associates' new member dinner, President Everhart is joined by Joanna Muir, president of The Associates (left), and Doris Everhart (right).



ics. I believe that biology will develop in the 21st century in ways that we may suspect but not know in depth because we still have so much to learn.

I think we will have to choose carefully and work hard to be at the cutting edge of science in the next century, and will also have to choose carefully and work equally hard to be at the cutting edge of applied science. It will be a continuing challenge to be the scholarly leader of academia in the next century as we have been in this one.

What outside forces could be the most damaging to Caltech's future?

If the U.S. economy were to falter and we were to become a second-rate nation economically, it would be hard for Caltech to sustain its excellence based just on support from the U.S.

government and private donors. We get about 60 percent of the support for the campus directly or indirectly from the federal government, and a good fraction of the rest comes in private gifts and grants. We are heavily dependent on both these sources of support.

A second issue is the possibility that the federal government would say, "We don't care about supporting research of the greatest quality. We'll do away with merit review," and would proceed to distribute money for research based on equal amounts to all states or equal amounts per unit of population, or any of a number of criteria that are more egalitarian and less based on quality. This would hurt all quality research and educational institutions, and would probably lead to a lowering of standards in the country. It would be very detrimental to the United States.

There are other issues—for example, intolerance or other forces that prevent the creative thought that is needed in a research institution to follow ideas to their logical conclusion. If there were a moratorium on using animals for research, then much of the good biological research that has benefited human life and health would come to an end and that would affect basic research at Caltech.

Of course a calamity such as a large earthquake could be devastating, but we

don't lie awake at night worrying about that.

What is the importance of the Beckman Institute to Caltech?

It provides an opportunity for some of the faculty who will be involved in it to cooperate more broadly, and for their students to learn more broadly, as they work and do research there. But it also presents a challenge to the Institute as a whole to deal with an organization that doesn't fit neatly into one division. Most of the administration of Caltech is done on a division by division basis. Individual faculty cooperate across divisional lines, but that's on a small scale.

Is there a place for strengthened humanities and arts at the Institute?

I believe so. It depends on what you mean by "strengthened." MIT is increasing its number of people in the humanities and arts so much that they may be changing the nature of the institution in a rather fundamental way. Caltech has tried to increase the quality of the humanities and social sciences but hasn't increased the numbers in quite the same way. Those are two different ways of strengthening.

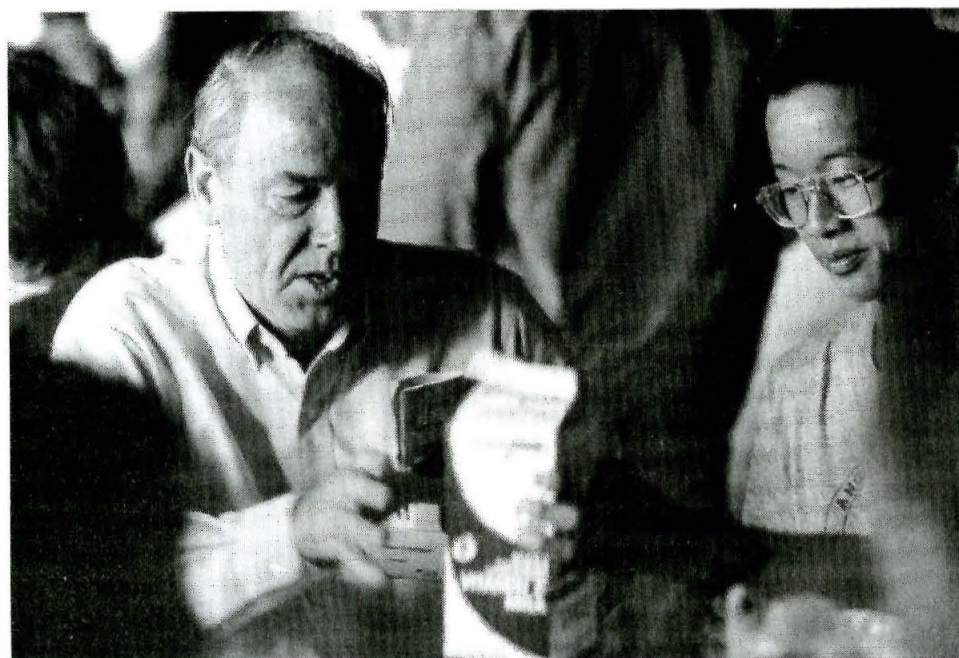
Caltech has a graduate program in the social sciences now that is viewed very positively by the people involved in it. But it may put pressures on the humanities and social sciences to add people who will directly benefit that program rather than benefit the broader teaching mission of the Institute as a whole. So we're trying to understand the ramifications of these sorts of changes, because we depend on the humanities and social sciences to educate our students in areas that the other five divisions don't touch.

I think it's crucial for us to have people of extremely high quality in the humanities and social sciences because we have such capable people in the other divisions. The students won't have the respect for the humanities and social sciences that they should have unless the quality of those faculty members is as good as the quality of our faculty in other areas.

How good are the Caltech students compared with others you've known?

I think they're the best students in the country if you measure them in terms of creativity, of academic ability, and a host of other ways. They are sometimes perceived by the outside world as being rather ingrown. The term, "nerd," is used. I haven't found them to be like that, but there may be some aspects of the living situation which—coupled with the pressures of the Institute—cause them to behave a little differently as a group than they might have as individuals.

As an example, I go to a lot of musical events around here and, during my first year, I was listening to a chamber music concert. There were



Dr. Everhart shares refreshments with a student at Freshman Camp.

several freshmen who seemed to be the star performers. I mentioned this to a senior who had performed quite well, and commented that everyone must be pleased that the freshmen were doing so well in music. He replied, "Oh, it's always that way. The freshmen are the shortest time away from being able to practice a lot. Once you're a student at Caltech, you have less time to practice your music, so after you've been here awhile you play less skillfully." There is a lot of pressure on the students here, and they try to maximize their time in academics.

If you want a short and punchy quote, I think the students here are terrific.

How do you think the increase in female students will affect the environment at Caltech?

I hope it will humanize the environment more. I think an environment with five-sixths men and one-sixth women is rather artificial. The freshman class is a little over two-thirds men and a little under one-third women. I think that may be a healthier ratio.

Perhaps it's time to think about enlarging the student body at Caltech a bit. We could do this if we had more housing for undergraduates, which has been proposed.

I understand there's an increase in female faculty members this year.

We probably have about twice as many tenure-track women in the sciences as we did in 1987-88 when I came. That's because both the provost

and I have emphasized the importance of having role models for female students. We now have at least one or two tenure-track female faculty members in each science division and more in biology.

What is the importance of this trend to Caltech?

If Caltech is to be a leading institution, then we must provide the best possible education for our students. The founders of modern Caltech—Millikan, Hale, and Noyes—emphasize that people learn by example, by following a mentor, as it were. If female students have women as faculty members, they are role models that demonstrate that women can be excellent scientists or engineers, and excellent teachers. The female students can still aspire to such careers if they have no role models but I think it's harder for them.

What do you think of the level of commitment of Caltech alumni?

I think it's very high. Caltech is very impressive in that alumni who were graduate students here have a strong degree of allegiance to the Institute. Undergraduates in many places have a strong allegiance to their alma mater. But somehow when someone comes here as a graduate student, that person develops a strong allegiance to Caltech as well, because of the smallness of the institution and the closeness of the personal relationships that form. So Caltech has a very strong group of alumni and they're very supportive of the institution.

What helps you shake off the tensions of the job?

Well, you don't want to take yourself too seriously. People are pretty intense around here, and sometimes that intensity shines through as perceived ill will or an intense disagreement. I think that I have to shake that off and realize that people are trying to do what's best for the Institute, because they really care for it.

I try to get some exercise every day. I go for long walks in the morning, to clear my head and think things through. I often swim in the evenings. On occasion it's a good way to work off tensions after a hard day.

Is there anything you'd like to add?

I consider it both an honor and a privilege, as well as an opportunity and a challenge, to be president of Caltech. It's a unique institution, and in a world which possesses less and less uniqueness, I think the Institute stands for something that needs to be held up to the country and to the world. And in that sense I, like many other members of the Caltech community, approach my work as more than just a job—but as a way to make a personal statement that will have a considerable, perhaps even a profound, influence on the way we live. Different people make their contributions in different ways. Some discover new knowledge. Some teach students. We are trying to maintain a milieu in which students can develop, and then go out and make important contributions to the world. This is an important challenge. I hope it's one that I and the rest of the people in the administration are successful in meeting.

President Everhart with Robert Bowman (BS '26) (right), and Distinguished Alumnus Cornelius J. Pings (BS '51, MS '52, PhD '55) on Alumni Seminar Day.



Ahmed H. Zewail, professor of chemical physics, with Dr. Everhart at a party in Zewail's honor.



Chris Brennen counsels junior Dave Geraghty.

By Winifred Veronda

Chris Brennen's colleagues describe him as "bright and insightful," "open to adventure," "deeply empathetic and understanding," "full of intellectual and physical courage," "fully giving of himself," "dedicated to the task at hand and to those who need him," and "dedicated to all aspects of education and student life."

All of this is good news for Caltech students, many of whom encounter Brennen through his role, since last summer, as dean of students. Brennen has been a familiar face to Caltech students since 1983, when he was appointed master of student houses. He served in that role until 1987, when he resigned to take a year off from intense involvement in student affairs.

"After four years as master of student houses, I was burned out," he says. "I looked forward to a respite from the daily demands of that job. I was interested to find out how my feelings would evolve during the year that I was no longer in the position, and I confess that I missed the interaction with students. So when I was asked to be dean, I felt that I would welcome the opportunity to play an important role in student affairs at the Institute again."

There is a difference in the level of demand imposed by the two roles, Brennen says. "The master's job is not an easy job. In terms of time and place, its demands are difficult to predict. The dean's job is more prescribed. But I believe I've approached both jobs with the same level of empathy and understanding for what it's like to be a student at Caltech."

The man whom students seek out when they need help with a problem was born in 1941 (four days before the attack on Pearl Harbor) in Belfast, Northern Ireland, at the height of the bombing in World War II. Germany was trying to break the British convoy system, of which Belfast was an important part. Brennen's earliest memories are of being evacuated with his family to the Northern Ireland countryside.

His mother's memories of Brennen's early childhood are even more dramatic. For protection during the German bombing raids, cast-iron tables were issued to members of the local population in Belfast, and she recalls sitting under one of these tables with Brennen on her lap as bombs fell around the house.

Life in the countryside was much more tranquil, and, despite rationing,

the family was never hungry. Brennen recalls being given orange juice on Sundays as a special treat.

In 1945 Brennen's father, who was a doctor, moved the family to Magherafelt, near the geographic center of Northern Ireland, where he went to work at a small country hospital. Brennen grew up in this Irish village, attending kindergarten through twelfth grade at the same institution, the Rainey Endowed School—the only school in Northern Ireland where Catholic and Protestant boys and girls were in the same school together.

It was natural for Brennen to become involved in sports at the school in Magherafelt, because he came from an intensely sports-oriented family. His mother, an ardent golfer and tennis player, was an excellent athlete who had played field hockey for Ireland when she was pregnant with Brennen. His two brothers were athletes, and Brennen found an outlet for his sports interest through participation in the rugby team.

Brennen also enjoyed the theater, and appeared in many productions in high school and college. He spent one vacation working in summer theater at a small Irish seaside resort. His interest in the theater continued at Caltech, where he has appeared in two musicals, *Guys and Dolls* and *Brigadoon*.

Brennen's only sister, Paula, was born with Down syndrome, and Brennen spent many hours during his youth taking care of her and working with other mentally handicapped children. The experience had a profound effect on him, and motivates him to encourage Caltech students to think about community service.

"If I wanted to list the factors that most influenced me in my formative years," he says, "this experience would be number one. Number two would be growing up in a society that was fracturing at the seams through the conflict between Catholics and Protestants. This taught me to have little tolerance for unthinking adherence to a code of

beliefs, and to modes of action that are thoughtlessly passed down from generation to generation. It taught me that hatred begets hatred, and that violence begets violence, and that it's very hard to reverse that process."

At school in Magherafelt, Brennen encountered a teacher who was to change his life. "I was fortunate to be taught mathematics by a rather eccentric individual, a Cambridge PhD, Dr. A. E. Gwilliam," he says. "He found in me a resonance of interest in mathematics and physics. Because of this remarkable man, I was disposed to think about these subjects as a career. During my final year in high school he tutored me for the scholarship entrance exams for Oxford University, and no one was more amazed than I was when I actually won a scholarship." Before he arrived at Oxford, Brennen had switched his major from physics to engineering science.

The travel to Oxford University from Magherafelt was about 400 miles, but it was much farther psychologically for a young man from the Irish countryside. "I was somewhat taken aback in that many of my colleagues couldn't understand a word I said because of the thickness of my Irish accent," says Brennen. "But I overcame that and had an immensely enjoyable time as an undergraduate."

At Oxford, Brennen was a student at Balliol College. He was fortunate in that selection. Knowing nothing about the colleges at Oxford, he had chosen Balliol from a list because it ranked first alphabetically. As it turned out, Balliol also ranked at the top, academically.

At Balliol, Brennen says he didn't have to work as hard as most Caltech undergraduates work, although he probably worked harder in high school than most Caltech students do. He "had a wonderful time," taking part in theatrical productions, playing rugby and soccer, and occasionally playing for a "gentleman's cricket team."

The summer before he went away to college he met his future wife, Doreen,

"I think both the faculty and the students themselves underestimate the quality of young people with whom we're privileged to work," says Brennen.

and the couple were married shortly after he graduated with his bachelor's degree.

"I graduated with a first-class honors degree in engineering science—something that I hadn't anticipated," says Brennen. "I thought I was going on to get a job, but because I was awarded a first-class honors degree I was heavily recruited by the faculty to do graduate work."

Brennen acceded to the pressures. He remained at Oxford for another three years, earning both his MA and DPhil degrees. "Doreen and I had a very tough time making ends meet," he says, "but we had a lot of fun, too."

Brennen's work at Oxford completed, the couple moved to London, where he went to work at the National Physical Laboratory (NPL) as a postdoc. There he met Caltech's Ted Wu, professor of engineering science, who was visiting the NPL. After Wu returned to the Institute he wrote Brennen, asking him if he would be interested in coming to Pasadena as a postdoc for a year.

"I was delighted with that possibility," says Brennen, "so on New Year's Eve, in 1968, Doreen and I left the British Isles, after struggling to find the airfare. We arrived in the United States with two children, two suitcases, and \$200."

The rest is Caltech history. Brennen's one year as a postdoc stretched into two. Then he went on to become a senior research fellow, a research associate, and an associate professor. In 1982 he was appointed professor of mechanical engineering and a year later he found himself deeply involved in student affairs.

Brennen finds no major changes in student life since he became master of student houses, although he says some of the changes enacted a year ago by the faculty have made academic demands a little easier. These include a reduction in the number of units required for graduation from 516 to 486, and a change in the definition of overload. The latter step was taken to encourage students to enroll for fewer units and learn the material in the courses they do take more thoroughly.

"Students' long-term interests are best served if they have a thorough understanding of the fundamentals, rather than if they gloss over a lot of information," Brennen says.

Despite these changes, Caltech continues to be one of the country's most academically rigorous institutions. But Brennen doesn't believe the demands are too tough. "In order to be a first-class institution and to provide a first-class education, you have to be demanding," he says. "But those demands should be

accompanied by empathy and understanding, and by a reasonable approach to the entire college experience. It's very important for our students to have a complete college experience, academically, socially, and governmentally. So many issues in science and engineering today require the individual to make judgments that involve social, environmental, or economic factors. And without a complete education, the scientist or engineer isn't prepared to make those kinds of judgments. So we must always work to provide our students with a balanced education.

"One of the great strengths of our undergraduate program is the freedom we give students to govern themselves, both within the context of the student houses and through the review boards that monitor the honor system. These collaborations encourage another strength in our student life—collaboration in study. I remember, as master of student houses, walking around late in the evenings and seeing study groups hard at work. That's a side of the Caltech experience that few Caltech faculty members see first hand."

Brennen feels the house system is working well, but says that at the same time "we have to provide alternative housing for students who might not feel comfortable in the seven houses." There are already several of these alternatives, he points out—Institute-owned apartments, rooms in Marks and Braun Houses that provide dormitory-style living, and large Institute-owned houses on Holliston—plus all-female housing. Added to these, Brennen would like to see, "at least as an experiment," housing which included undergraduates, graduates, and young faculty members living together in the same quarters. He hopes a proposed eighth house might become the basis for such an experiment.

The late 1970s saw a change in students as they became increasingly job-oriented and less interested in the environment and social service. This trend has continued, says Brennen, but there are some exceptions. He is particularly pleased when he sees students involved in programs to feed the homeless or paint an orphanage in Baja. "I'd like to see more students involved in programs of that kind," he says, "not just because of the good they can do for others, but because of the good they can do for themselves."

The same era saw an increase in entering students who had been involved with computers almost to the exclusion of other scientific activities. This trend has also continued, Brennen says, and he remarks that "unfortunately, during the same period, there's been a decline in the extent and quality of science education in high schools. So the two phenomena are coupled. It's almost as if the interest in computers has increased to fill a void in science education. Perhaps if there were more exciting science education opportunities at the high-school level, we'd see a wider range of science interests in our entering students."

But at Caltech itself, the opportunity for hands-on research experience for undergraduates has improved, thanks to the SURF (Summer Undergraduate Research Fellowships) program. "SURF is a marvelous program that has increased opportunities for students to become involved in research," says Brennen. "And of course, research is one of Caltech's great strengths."

Brennen feels the financial burden for students is probably heavier than it used to be, forcing them to do more part-time and summer work. "It's not at all clear to me that tuition at major colleges needs to be as high as it is," says Brennen. "One of the consequences of students needing to earn so much money to support themselves, is that most of them have to work during their entire vacation period. That excludes one of the aspects of student experience that I think is very valuable—the opportunity to travel and study abroad. Fred Shair and I have been talking about how the SURF program could be expanded to allow students to do research in Europe and Asia. This would achieve the same end as foreign travel, which provides a student with a very useful perspective."

Caltech offers many advantages because of its small size, Brennen feels, but he adds that one of the difficulties is the limits the size places on extracurricular activities, and the activities' need to attract an adequate number of students. "Currently the student newspaper is experiencing hardships because of the small number of students on the staff, and the extra burden this places on the students who do work on the paper. Many activities fall into this category. Theater arts struggles to find sufficient numbers of students to put on a musical, for example. The Glee Clubs are perhaps among the few organizations with a remarkably high percentage of students involved. The Glee Clubs are a real Caltech tradition, and that tradition attracts students to participate."

Like many on the Caltech campus, Brennen would like to see a higher percentage of women students. As a member of the Admissions Committee last year, he suggested a 25-percent ratio of women as a goal to work for. "I think it would make an enormous improvement in the undergraduate experience here at Caltech if we had an equitable number of female students," Brennen says. "It would improve matters substantially for everyone."

"The problem seems to be that women just aren't applying in large enough numbers. We don't know why this is so—whether it has to do with our image, or the image of science and engineering in general, or whether it's a cultural problem that's going to take a long time to overcome. I'm very pleased by the new departures that Dan Langdale [director of admissions] is instituting, and I hope they will prove effective in increasing the number of women at the Institute."

As dean of students, Brennen sees those students who are leaving Caltech—either to transfer to another institution, or to take a leave. Why do

they go? "Some leave because they've lost interest in science and engineering, and want to study the humanities, business, or some other subject," he points out. "Some leave because they're unhappy at Caltech for whatever reason. It can be as simple as a girlfriend who's going to school in Boston. It's not easy to generalize about reasons for transferring."

Brennen finds that leaves are often helpful for students—although leaves are often regarded as failures by students thinking about taking them. "I spend a lot of time persuading students that that's not the case, and they may merely need a break from the Institute to recover their perspective on what they're doing here," says Brennen. "Of the students who take leaves, a very substantial fraction return rejuvenated, and successfully complete their degree."

One of Caltech's most famous features is its students' reputation for pranksterism. Brennen has misgivings about this aspect of the Institute's reputation. "As dean, I don't encourage pranks," he says firmly.

Brennen believes there are many more constructive ways to relieve academic pressure than engaging in pranks, and he also believes pranks "play a larger role in the eyes of public relations than they do in the eyes of Caltech students."

The Caltech student body suffers from a self-imposed image problem, he feels, and pranks contribute to the notion that the students here are a little strange, and given to participating in rather bizarre activities.

"I think both the faculty and the students themselves underestimate the quality of young people with whom we're privileged to work," he says, sternness showing about his eyes. "There's a tendency to say, 'Oh, they're just Caltech students.' And this implies that they're not as worldly, not as articulate, not as broad-minded as students at other universities. I think that's a fallacy. This is a marvelously talented group of young people—tremendously talented, not just in science but in many other ways. I think the students themselves should be less ready to accept the implied criticism in such statements as 'They're just Caltech students.' Unfortunately, perceptions can sometimes become as important as reality—in terms of recruitment, for example."

"This is why I feel the way I do about pranks. Sometimes the idea is put forward that pranks are just something these strange Caltech students do. And I certainly want to avoid that kind of characterization because of the extent and variety of the talents of our students. Pranks just aren't a major part of what Caltech students do. In fact, pranks are somewhat uncharacteristic, at least in terms of the way they're portrayed."

With those firm words, Brennen pauses. Outside, students are beginning to queue up, waiting to talk with their mentor, the man from Magherafelt who made the long journey to Oxford, and the even longer journey to Pasadena.

Gary Lorden appointed vice president

Gary Lorden (BS '62), Caltech professor of mathematics, has been appointed the Institute's vice president for student affairs. As such he will be responsible for the welfare of Caltech students and for all the activities affecting students which supplement the academic program.

Lorden succeeds James J. Morgan, the Marvin L. Goldberger Professor of Environmental Engineering Science, who has held that post since 1980 and is returning to full-time research this fall.

After earning his BS degree from Caltech, Lorden went on to earn a PhD from Cornell University in 1966. After two years on the mathematics faculty of Northwestern University, he returned to Caltech as assistant professor of mathematics. He became an associate professor in 1971 and a full professor in 1977. In addition to teaching, he served as dean of students from 1984 to 1988. He has also been a consultant in probability and statistics at JPL since 1968.

"Professor Lorden is especially qualified for the sensitive and vital position of vice president for student affairs," said President Thomas Everhart in announcing the appointment. "He understands the Institute from the perspectives of both student and faculty member. As dean of students he demonstrated that he understands students, and his decisions concerning their welfare showed wisdom as well as sensitivity. We are fortunate that he is willing to undertake this responsibility for the Institute."

Said Lorden, "There are some intriguing challenges and prospects for student affairs at this point in Caltech's history—opportunities to help not only our current students, but also future generations, and I plan to play an active role in focusing the attention of faculty and administration on problems and solutions."

Lorden's association with Caltech students includes coaching the teams for the William Lowell Putnam national mathematics competition. He has also played bit parts in several Caltech student musicals. As an undergraduate, Lorden was a four-year member of the Caltech Glee Club, and the group's accompanist.

Ed. note: Upon returning from China during the peak of the crisis there, Sara Martin was asked so many questions about her experiences that she prepared a written report. That report is quoted extensively in the article below.

When Caltech senior scientist Sara F. Martin made a two-week trip to China to observe at the Huairou Observing Station, she had no idea she would be in the country for perhaps the biggest story of the decade.

Big Bear Solar Observatory conducts a reciprocal observing arrangement with the Huairou Observing Station, which lies 40 kilometers northeast of Beijing, and Martin arrived in Beijing via the trans-Siberian railway on May 30 after a two-week trip to Russia. Caught up in visiting some tourist attractions, and giving a talk at the Beijing Observatory Offices, Martin scarcely noticed evidence of marshal law.

"The city was alive with bicyclists, and commerce in the side-street shops," she says. "In Tian An Men Square, the density of people was somewhat higher than elsewhere, but nothing in particular was happening at the time I was driven to my hotel. It was a fascinating environment. Everything was new to me, and I might not even have noticed the few soldiers who walked amidst the pedestrians and bicyclists had they not been called to my attention by my hosts.

"I was intrigued by the busy but seemingly calm life in Beijing. Most people now wear colorful western-style dress. The city seemed prosperous and active. In the evenings near the university, many people temporarily paused to listen to the reports of the students that could be heard from loudspeakers. Then they would continue on their way. All of the streets remained busy until late in the evening."

On June 2, Martin flew to Kunming, where she visited the Yunnan Observatory. While being driven by her hosts to the Kunming Airport to return to Beijing and then to the Huairou Observing Station, Martin learned something terrible had happened in Beijing. "I asked what had taken place. Had people been killed?" The answer was "Yes."

"I asked how many. The answer was just 'Many. We don't know how many.' So I supposed that a skirmish had taken place between some students and soldiers. I didn't feel it had been anything very serious. But the Chinese professor who was accompanying me and I did wonder why so very few passengers were going to Beijing."

At the Beijing Airport, several staff members of the Huairou Observing Station were there to meet them. "Once we retrieved our baggage, the news was broken in a hurry. Chills and shivers ran through my body as we were told of



Sara Martin is entertained at a traditional Chinese dinner by Dr. Ding, director of the solar division of Yunnan Observatory.

A China visit during the crisis

a horrible massacre. Everyone was still shocked that the government had turned so viciously against the people. "They turned their machine guns on thousands of students," they told me. "They shot children and old men! The shooting went on and on for three hours!"

"Amidst much talking in Chinese and translating into English, everyone clambered into the vehicle and we headed toward Huairou, avoiding main roads in case of encounters with military vehicles. Everyone was relieved that no military trucks or tanks or soldiers were anywhere in sight. We would all be safe at the observatory at Huairou.

"I was assured that the families of the observatory staff were safe and well except for the director's son, who had been hit on the skull and could not recognize his father. Much later I learned that the younger brother of one of the technicians was missing. One of the many, many missing. . . ."

Martin says it was obvious that the immediate response of the people was one of shock and anger. Most had thought it unlikely that the government would reverse its trend toward tolerance, because such repressive actions had not typically been used by the Chinese government for quite a few years.

"At the observatory at Lake Huairou and in the nearby town of Huairou, the environment was peaceful and calm. The townspeople obviously had no knowledge of what had taken place. At the observatory, we were well informed. In addition to a continuous stream of telephone calls between the staff and their families in Beijing, there were two television channels, CNN coming from the Soviet tracking dish, and Chinese government-run television. The care-

fully controlled scenes of the soldiers on duty shown on the Chinese television contrasted strongly with the reruns of bloody confrontations shown on CNN."

"That afternoon, most of the senior staff drove down to Beijing. About six of the graduate students and younger



Huairou Observing Station of Beijing Astronomical Observatory.

staff stayed at the observatory with me. We half-heartedly made a few magnetograms between cloudy intervals. Eventually the clouds thickened and we decided to close the telescope. The air was filled with uncertainty, anxiousness over each telephone call, and intense interest at what new scenes of Beijing would be shown on CNN. The TV

was on very late that evening. I couldn't get any calls through to the U.S."

The next morning calls came from Big Bear and from Martin's husband, who had finally succeeded in getting through. A message also came from the director of the Huairou Observatory, asking that she leave as soon as possible because of concern for her safety. That evening the American Embassy changed its earlier advice and urged Americans to begin making plans to leave China.

The following morning some of the students accompanied Martin to the airport. It was the seventh of June and everything was in a state of confusion. Martin eventually found a small United Airlines standby window where she signed on as number 138 on standby for Tokyo. She was told that probably 20 people on the list would be able to leave that day.

While Martin discussed with her colleagues whether to remain at the airport for the rest of the day or to go back to the observatory, one of the students who had accompanied her went to check on progress at the United Airlines standby area. He returned quickly, saying with much excitement, "You can go now." A United Airlines plane had come in, many people on the standby list had left in discouragement, and people were being sent to board as rapidly as possible. "The departure was a sudden relief, and we said good-bye with smiles masking a deep undercurrent of sadness," Martin said, concluding her report.

Martin's impression from her time in China was of a broad-based, deep, strongly supported and well-organized student movement for democracy that is not going to disappear. "When a government is strongly lacking in popular support, it either changes or is replaced," she says. Martin is sure the world has not seen the last of the movement for democracy in China. Meanwhile, she has been invited back for an international conference next year. As fascinated as she was with China, she is waiting to see how events develop before she decides whether to go.

Caltech ranks first in PhDs earned per capita

A 1977-86 study of private-university baccalaureate degree recipients found that 32.54 percent of Caltech graduates went on to earn doctorates. This study, published in 1989 by Georgetown University and Franklin & Marshall College, ranked Caltech No. 1 in PhDs earned per capita—far ahead of its nearest rivals, MIT (18.72 percent) and the University of Chicago (16.95 percent).

CALTECH IN THE NEWS

• "Neptune embraced Voyager Thursday night, using its gravity to boost the tiny spacecraft's speed up to 60,000 m.p.h. in the grand climax of a spectacular expedition through the outer solar system.

"After traveling 4.4 billion miles over the past 12 years, Voyager arrived 'within 20 miles of the point we were aiming at,' said Norm Haynes, Voyager project manager.

"That's not bad shooting,' he said, especially considering the fact that Neptune is 2.7 billion miles away. 'The navigation team nailed it right down the middle.' That was good enough for Voyager to discover two more moons Thursday and add a few more chapters to the history of space exploration. That brings the total number of Neptunian moons discovered by the spacecraft to six." *Los Angeles Times*, August 25.

• "Thomas E. Everhart, president of Caltech, has been presented the 1989 Benjamin Garver Lamme Award by the American Society for Engineering Education at its annual conference in Lincoln, Neb.

"The Lamme Award has been presented annually since 1928 to a distinguished engineering educator for contributions to the art of teaching, contributions to research and technical literature, and achievements that contribute to the advancement of the profession of engineering college administration." *Los Angeles Times*, July 29.

• "Five California universities—Stanford, California Institute of Technology, University of Southern California, University of California, Los Angeles, and UC Berkeley—were among the top 20 fundraisers [in the country during the 1987-88 school year], according to the Council for Aid to Education. [Caltech raised \$97.4 for a seventh-place ranking nationally.]" San Jose, California *Mercury-News*, May 3.

• "The Chinese government has throttled the democracy movement in China, but local Chinese students have not given up hope that the movement will resurface, and have kept up their efforts to help its leaders.

"Although sending money to families of those killed during the protests has become impossible in light of the Beijing government's recent crackdown, local students continue to collect money with the hope that they can eventually relay the funds to their homeland. The



SURF student Laura Hernandez spent her summer involved in the development of mathematical models for characterizing virus transport through saturated porous media. This work is essential for predicting sewage dispersal in groundwater aquifers.

students also hope the funds will help the democracy movement remain alive underground.

"Students at Caltech, who formed the Caltech Democratic Reform Promoting Society after the Chinese government's May 20 declaration of martial law, have since collected about \$60,000, said Yun Sun, a Caltech chemistry student." Pasadena *Star-News*, July 24.

• "A tiny 'eye' designed for a missile has given scientists a new way of looking at the sun.

"Hughes Aircraft Company recently provided a missile sensor chip to the California Institute of Technology for a solar observation conducted at Big Bear, California.

"The experiment allowed researchers to observe aspects of sunspots in a very narrow band of the infrared electromagnetic spectrum, 1.65 um. Harold Zirin, Caltech professor of astrophysics and director of the Big Bear mountaintop solar observatory, said this is a 'rather unexplored range of the spectrum. We've never had this good a detector in this range before.'" *OE Reports*, August.

BS graduates' paychecks average \$34,000

Caltech students graduating this year with BS degrees reported salary offers in the \$28,000-\$43,000 range, with the average at about \$34,000. This represents a modest 5-percent increase over last year's salary range. The largest number of offers were made to students in engineering and applied science and in electrical engineering.

Of the 233 students receiving BS degrees, 111 will be attending graduate school and about 20 others have definite plans for graduate study after one or two years. While most will be entering PhD programs in science or engineering, three will attend medical school and one, business school. One student has received a Watson Fellowship for a year of travel and study, and several others plan to travel for about three months to a year before attending graduate school

or working. One is in Belgium with the Air Force ROTC. One student graduating with a BS degree in the social sciences has gone to work for a member of the California State Assembly.

This year, 12 students actively pursued positions in finance and consulting. Two accepted jobs as associates with prestigious management consulting firms and, if they do well, will, after two years, enter top MBA programs at company expense. Their Caltech degrees were in electrical engineering and engineering and applied science.

The highest number of job offers to a BS-degree graduate this year was six. One student, who received five job offers, went on 71 interviews. Says Sally Asmundson, director of the Career Development Center, "He did a lot of preliminary weeding after the initial campus interviews."

Of the 151 students receiving MS degrees, 98 are continuing on for their PhDs, 89 at Caltech and nine at other institutions. Of the 33 accepting employment, 19 are graduates in electrical engineering. Eight MS degree recipients, some of them from foreign countries, are in military service.

Most of the salary offers reported for MS graduates ranged from \$36,000 to \$43,000 per year, but three students reported offers ranging from \$48,000 to \$61,000. The highest offer, for \$61,000, went to a student with an MS in mechanical engineering who took a job with Schlumberger Oil Field Services.

This year, Caltech awarded 134 PhD degrees. So far, 37 of these have accepted industrial positions; 26, academic tenure-track positions; and 55, postdoctoral research positions. Two are continuing their educations, one in medical school and one in law school, and one is pursuing a military career. One had a baby and is taking time off before searching for a job. Seven are still deciding on future plans, and there is no information on five.

Salary offers to PhD recipients varied widely, ranging in electrical engineering, for example, from \$3,800 a month to \$5,400 a month. The highest PhD salary offer, \$85,000, was to a social scientist with an MBA degree who took a job with a "think tank" in Chicago.

This year several PhDs went to work in postdoctoral positions in industry while several accepted jobs with small

entrepreneurial firms with Caltech faculty connections. Several accepted postdoctoral posts overseas.

Salary offers for postdoctoral research positions have not increased appreciably in the last several years and still range from \$17,000 to \$33,000, with most at about \$24,000. Salary offers for tenure-track faculty positions—particularly in engineering—are very competitive with positions in industry, and a job generally comes with money to set up a laboratory, buy equipment, and support research for an incremental period.

Caltech to be in 1991 Rose Parade

On January 1, 1991, viewers of the 102nd Tournament of Roses Parade will see a float sponsored by Caltech rolling down Colorado Boulevard. The float will be the first event in Caltech's year-long centennial celebration; a humorous theme is promised. The Institute was accepted by the Tournament of Roses as a sponsor last June. A committee of Caltech and JPL people met during the summer to make recommendations to the centennial steering committee about how to choose the design of the float.

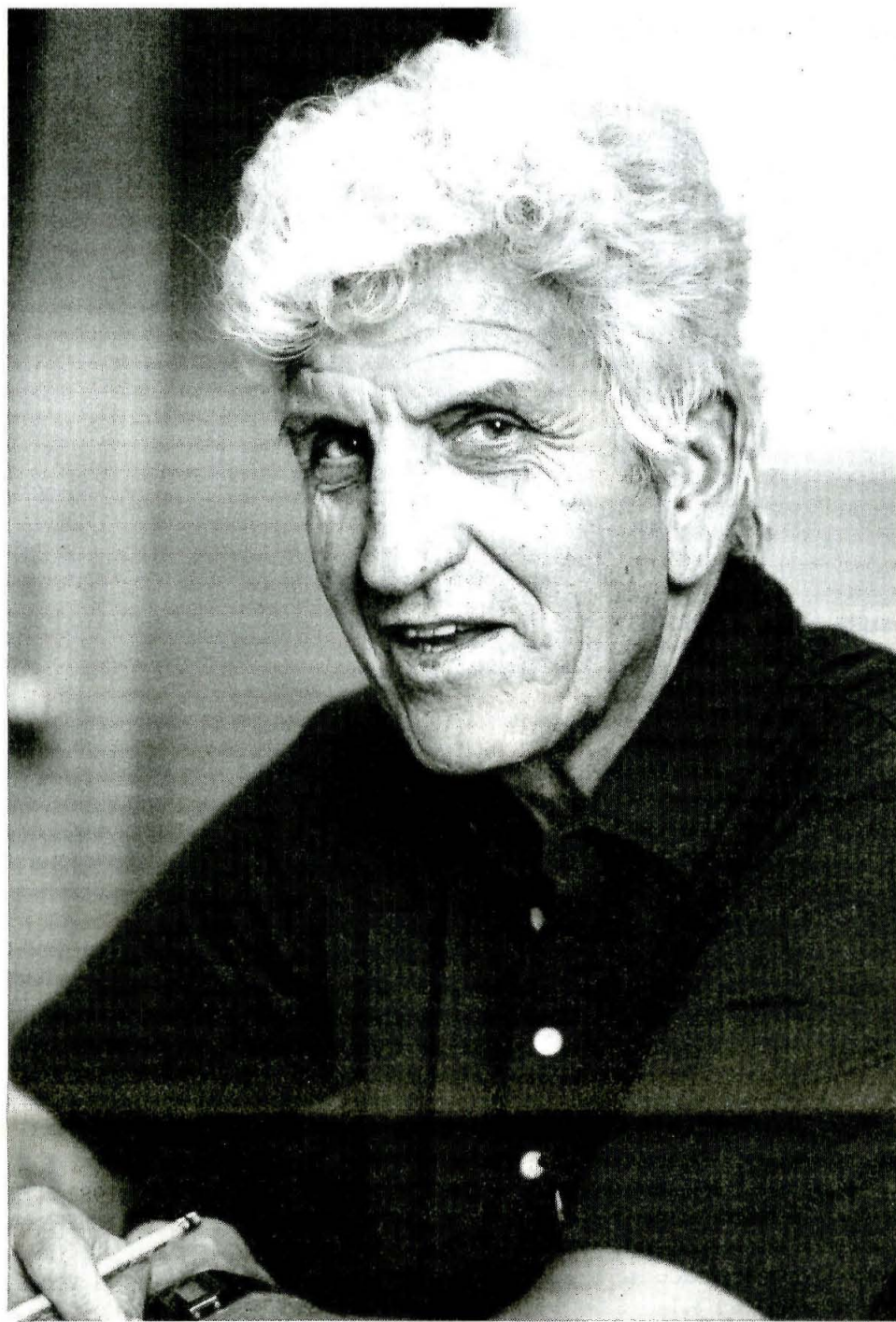
This is not the first time that Caltech (or the Throop Institute) has participated in the Tournament of Roses. Throop sponsored several floats in the early years of the parade. One float, in the 1904 parade, was a rose-covered pagoda pulled by white horses with attendants dressed in Roman togas.

The first float sponsored by Caltech was in the 1950 parade. It depicted the Palomar Observatory (opened in 1948) and included a comet, stars, and a chrysanthemum-covered telescope that moved. The float was built by nine students during the two months before the parade; quite a contrast to the immense amount of planning now required to sponsor a float.

Float your idea!

The committee in charge of Caltech's float in the 1991 Tournament of Roses parade wants your ideas for the float's theme language and design. All entries must be humorous, because humor is the general theme of the parade. To submit an idea, draw a very rough sketch of your float concept. Then write the proposed theme title—a word, phrase, or sentence which acts as a title for the float. If applicable, include two or three sentences describing any moving parts or use of people on the float. Send the completed design to Hall Daily, Caltech 1-71, Pasadena, California, 91125, by December 1.

By Phyllis Brewster



Warren Emery turns over the keys

the team until he was a junior in high school, when his Y swim coach suggested that he "not miss the fun of earning a high school letter."

So Emery earned two letters swimming breaststroke and butterfly for Lincoln High School, and then continued competitive swimming at the University of Nebraska, where he enrolled as a physical education major.

An interruption in his swimming career came in Emery's sophomore year—the year the U.S. entered World War II, when he and a buddy went off to enlist in the Marines. It was then that he was told about his heart arrhythmia. Not only was he turned down for military service, but he was advised to stop competitive swimming. Returning to the university, he completed his BA requirements and began work on a master's degree in school administration. As a grad student, he also began assisting the coach of the university swimming team and taught classes as a TA.

Emery wanted to go right into coaching when he finished his degree work, but "jobs were hard to find in the midwest then," he says. For two years

after he left the university, he trained water-safety and first-aid instructors for the Red Cross—a job that also entailed emergency disaster work. During the Lacota Indian Reservation flood of 1952, Emery managed a disaster shelter in the high school gym. He remembers—painfully—that the gym had a brand new floor, which was ruined.

In 1952, he returned to coaching temporarily—filling in for Nebraska's swimming coach, who had taken a year's leave of absence. But then it was back to the nonathletic world again, this time selling life insurance for Mutual of Omaha.

Determined to return to his profession, Emery decided to follow the advice of his Nebraska mentor, Lou Means, and get a master's degree in physical education.

"The top schools in the country for that program were Iowa and UCLA," Emery says. "I'd never been west of Greeley, Colorado, so I chose California."

In September of 1954, Emery piled his belongings into his '50 Pontiac and drove to Westwood. Although he had never had a response to his letter

Emery brought to the campus not only his swimming and coaching skills, but also a deeply rooted philosophy about teaching physical education.

Warren Emery came to Caltech in the summer of 1955 to take over as swim coach in the newly completed Caltech pool, and was issued two keys—one to the pool and the other to the front door of the building.

A few days ago, when Emery turned over the keys to his successor, the new athletic director, Dan Bridges, he was carrying 48 keys on his key ring—all of which open one lock or another in the Institute's athletic complex. That proliferation is a dramatic commentary on the changes that have taken place during the nearly 35 years that Emery has been associated with physical education and athletics at Caltech.

The year Emery came to campus was a pivotal one for PE and athletics here. Before that time, there was no gym and no pool. Undergrads were required to take four years of PE, but their only choices of classes were tennis and something called "body conditioning."

Emery brought to the campus not only his swimming and coaching skills, but also a deeply rooted philosophy about teaching physical education. "At that time a lot of coaches had a kind of 'throw-out-the-ball' mentality," Emery says. "They were good at coaching, but they didn't have any interest in teaching sports skills to nonathletes."

Emery believed—and still does—that regular physical activity contributes greatly to the well-being of the students, and that properly taught classes in sports skills can go a long way toward capturing the interest of students who might never have participated in athletics.

"Teaching PE is a lot more than just checking attendance," Emery says. "The instructor has to care about the individual student's participation and to encourage the student's pride in improving his skills—even if it's only by a little."

"There's more to learn from sports than how to bounce a ball," he continues. "You learn to play by the rules. You learn that winning is more fun than losing, but that neither are as important as knowing that you played your very best."

Emery's philosophy is rooted in his own sports experience in Lincoln, Nebraska. The oldest of the five children in his family, Emery set the pace by starting to swim competitively for the Lincoln YMCA team when he was 12 years old. He continued swimming for

announcing his intention to enroll, he was not worried.

"In Nebraska," Emery says, "—you just walked in on registration day, and that was it."

Alas, it was not so at UCLA. Emery was sidetracked to Cal State Long Beach for one term, taking community health education and driver education, and working two part-time jobs—loading scrap steel onto dollies at the US Steel plant in Torrance, and delivering laundry to the US Navy ships in Long Beach harbor. He remembers vividly the first time he lugged the canvas bag of clean laundry up the gangplank of a destroyer in port. He came face-to-face with the ship's Officer of the Day—a young man he had taught to swim at the University of Nebraska.

In Long Beach, Emery added water polo to his athletic agenda. It was a new "in" sport and a "must" for swimming coaches, he had been told. He took instruction and began refereeing matches.

Because of Long Beach's superb aquatics facilities, Emery hoped to find a coaching position in that area. But before there was an opening there, he heard that Caltech was looking for its first full-time swimming and water-polo coach. The master's degree would be postponed until years later. Emery had found his career niche on the campus in Pasadena.

"Warren Emery is the all-time Caltech swim coach," says Professor of Aeronautics Brad Sturtevant, whose career on campus parallels Emery's. In his first seven years here his teams won five SCIAC (Southern California Intercollegiate Athletic Conference) championships and were water-polo co-champions for two years. That was before recruiting dominated intercollegiate swimming in the same way it has dominated football and basketball—and, according to Emery's philosophy, changed the nature of the amateur athletic concept he so fervently believes in.

In 1963, Emery became assistant athletic director, and a year later stepped into the director's position from which he has just retired.

"Warren Emery is responsible for building Caltech's athletics program into the excellent, wide-and-varied one it is

today," says Sturtevant, who has been Caltech's representative on the SCIAC for more than 22 years and who chaired the committee to choose Emery's successor. Sturtevant particularly singles out Emery's commitment to the principle that physical education and athletics are for the benefit of the students, not for the rest of the community, and to his longtime commitment to developing in young people sports interests that will last them a lifetime.

Caltech now has 17 instructional courses in a remarkable variety of offerings—e.g., sailing, rock climbing, scuba diving—and 16 intercollegiate or club teams. Emery also has ultimate responsibility for the summer recreation program and for the undergraduate intramural competition.

Sturtevant also gives Emery credit for Caltech's "phenomenal" coaching staff. "He has been able to hire coaches who understand Caltech's unusual philosophy of instruction, or, if they didn't, to help imbue them with the spirit of the importance of education over win-loss records."

One of the members of that coaching staff, Mike McCallan, has been assistant coach in soccer for 17 years. McCallan, whose "other" job at Caltech is that of manager of engineering and estimating for physical plant, was going to retire from the soccer scene this year. Emery, however, persuaded McCallan to end his soccer career with one year of head coaching—filling in for retiring coach Don Cameron.

"Warren and I will go out together," McCallan says, and makes it clear that his respect for Emery's efforts in support of the team is what made him agree to stay. "You can always count on Warren to see that everything is OK. Whether it's Saturday or Sunday, he's there checking the transportation—seeing that the kids get in the right cars. And if we can't get a scorekeeper, he does it."

Over the years Emery has had his critics, to be sure, say his most ardent supporters. One criticism—that he hasn't fought hard enough for funding for the expanded facilities that he feels have been so desperately needed—is "really a left-handed compliment," says one friend, explaining, "When some people at Caltech need more money, to prove it, they just overspend their budgets. Emery has always conscientiously attempted to stay within his budget."

Emery's brusque manner has sometimes put off his colleagues and students. McCallan, for one, appreciates Emery's directness. "What he feels is what he tells you," McCallan says, "And you know he won't be saying anything different behind your back."

One of the graduate students put it this way. "Warren always says 'no' first. The second time he says 'maybe.' And, finally, if you have a good argument, he says 'yes.' But there's no doubt he always has the best interests of the students at heart."

And that's the key to the matter—a key that Emery has always carried—albeit not on his key ring.

Dan Bridges named Caltech athletic director

Caltech's baseball coach, Dan Bridges, is the Institute's choice to succeed Warren Emery in the post of director of athletics and physical education.

Bridges has been on the coaching staff at Caltech since 1984, as assistant football coach as well as head baseball coach. As instructor in physical education, he has taught badminton, golf, and volleyball.

"Dan was our unanimous first choice for the position," says Professor of Aeronautics Bradford Sturtevant, who headed the committee to select the new administrator. "He is a man of principle, sincerity, and commitment." Sturtevant's committee interviewed seven applicants for the position, then narrowed the field to two, who were interviewed by the president.

Emery, who will stay at Caltech in an advisory capacity until May 1990 when he will retire on his 65th birthday, says, "Dan's work here has been characterized by the highest degree of professionalism. He is intelligent, even-tempered, and enthusiastic, and has established excellent relationships with students, faculty, and staff, and with his fellow coaches."

Bridges came to Caltech from seven years of coaching at Brentwood High School, where he was director of athletics and department chair in physical education, as well as head baseball coach and assistant football coach. A graduate of Cal State Long Beach, with both a bachelor's and master's degree, Bridges went on to get a PhD in physical education and athletic administration at USC.

Four new coaches join lineup

As the fall athletic season opens, Caltech welcomes two new full-time coaches and two part-time coaches.

John D'Auria, who has been Caltech's assistant baseball coach since 1982, is the new baseball coach, replacing Dan Bridges, who has been named Caltech's athletic director. Wendell Jack, formerly assistant football coach at the Claremont-Harvey Mudd Colleges, is the Institute's new football coach. Robert Randolph replaces 12-year veteran George Clovis as fencing coach and instructor, and Mike McCallan, who has been assistant soccer coach since 1972, will take over the head coaching position from Don Cameron, who retired this year after 17 years as Caltech's soccer coach.

D'Auria, a graduate of Pasadena City College and Cal State Los Angeles, played two seasons for the Detroit Tigers organization before entering the Army in 1969. Between 1974, when he got out of the Army, and 1982, when he joined the Caltech coaching staff, D'Auria worked in the private sector. In 1988, he received his master's degree in education from Azusa Pacific University.

Jack, an industrial arts and civil engineering graduate of Cal State Long Beach, has nine years of coaching experience at the collegiate and high school levels. He currently is studying for a master's degree in education.

Randolph is a competitive fencer with a number of southern California and Pacific Coast individual championships to his credit. Since 1978 he has run a private fencing academy, Salle Grenadier, in Glendale. He has also coached at the Pasadena Athletic Club.

McCallan comes from an early childhood soccer background in Ireland and has continued playing and coaching in the U.S. McCallan is head of engineering and estimating for Caltech's physical plant department.

Caltech receives NSF grant for video math project

Caltech has received a grant from the National Science Foundation to support *Project MATHEMATICS!*, a series of videotape recordings that use computer animation to help instructors teach basic concepts in mathematics at the high-school and community-college level. *Project MATHEMATICS!* is a nationwide effort involving 32 states together with two professional mathematics organizations.

The project is headed by Tom M. Apostol, Caltech professor of mathematics and an internationally known author of mathematics textbooks. Codirector of the project is James F. Blinn, one of the world's leading computer animators, who is well known for his Voyager planetary flyby simulations. Blinn and Apostol worked together previously as members of the academic team that produced *The Mechanical Universe*, the award-winning physics course for television also developed at Caltech.

The NSF grant has provided *Project MATHEMATICS!* with \$376,453 for the six-month period from July to December, 1989. The grant also provides continuing support of \$698,290 for the year 1990, contingent on the availability of funds and the satisfactory progress of the project. The project had earlier received funding from the Association of Computing Machinery Special Interest Group on Computer Graphics (ACD/Siggraph—\$170,000), the Educational Foundation of America (\$50,000), and the Hewlett-Packard Company (a \$50,000 equipment grant).

Each *Project MATHEMATICS!* module consists of a videotape, 15 to 20 minutes in length, and a workbook to guide students through the video, elaborating on the important ideas. The videotapes make extensive use of computer animation with color, motion, and three-dimensional images to demonstrate concepts in ways that are difficult or impossible to do in a textbook or at the chalkboard. This animation, blended with live action and stills, provides historical perspective and connections to real-world problems. Together with narration, music, and special effects, the videos are intended to motivate students, enhance their intuitions, and stimulate their imaginations.

Caltech 1989-90 Football Schedule

All the games are on Saturdays, and all except the Cal Poly Pomona game (played at Cal Poly Pomona) are on Caltech's home field.

Sept 30	1:30 p.m.	San Fernando Valley Nomads
Oct 7	1:30 p.m.	Australian National Team
Oct 14	1:30 p.m.	Los Angeles Mustangs
Oct 21	1:30 p.m.	Orange County Cowboys
Oct 28	1:30 p.m.	San Fernando Valley Wolves
Nov 4	7:30 p.m.	Cal Poly Pomona
Nov 11	1 p.m.	British Bulldogs
Nov 18	12 noon	Pasadena Police Association

ALUMNI

Rhonda MacDonald: no stranger to challenges

Where Caltech is concerned, Rhonda MacDonald is a veteran at accepting challenges. When she was a freshman, she enrolled at the Institute as one of 25 females in the first class to include freshman women. MacDonald remembers the pioneering venture as one that brought instant popularity to each of the new coeds. "It wasn't like that in high school," she recalls. "I very much enjoyed life in the student houses," she says, "and the opportunities to form good friendships with the male students there." This year, MacDonald has taken up a new challenge for the Institute. She's been elected president of the Alumni Association. And she's filled with plans to make the year an exciting one.

An only child, MacDonald was born in Great Lakes, Illinois, where her parents were stationed in the Navy. She grew up in New Bedford, Massachusetts, where her mother owned and operated a telephone answering service.

Always interested in engineering, MacDonald read in *Seventeen* magazine that Caltech was beginning to admit women as undergraduates, and she decided to apply. A Caltech faculty member contacted her high school guidance counselor to arrange an interview with her. The counselor suggested that MacDonald cancel the interview—that she would be better off going to Smith College. But MacDonald refused to cancel the interview and was soon admitted to Caltech. On campus she quickly carved out a niche for herself, becoming president of the student chapter of the American Society of Mechanical Engineers, and a member of Ricketts House.

MacDonald remembers with special pleasure the interest taken by faculty members in the undergraduates. Her adviser was Rolf Sabersky, professor of mechanical engineering, now emeritus. "When I enrolled at Caltech, I was interested in mechanical engineering," she says, "so he was an ideal choice for an adviser. When I changed my major to civil engineering I asked to keep him as my adviser, because he took such an interest in my personal well-being at Caltech, not just my academic affairs.

"Another professor who was very special to me was George Housner, who is one of the world's authorities on earthquake engineering. He took the time to

teach a class to just two undergraduates. I was very impressed by that. We weren't graduate students, and yet he was willing to spend the whole year teaching just the two of us.

"After I graduated from Caltech I went to MIT for my master's degree. When I completed it I wanted a job in southern California, and I contacted Dr. Housner. He spent a Friday evening with me, giving me suggestions. You just don't find professors like that everywhere. By contrast, at MIT I was a number."

MacDonald found her job in southern California—with C F Braun in Alhambra, working in the petrochemical field. With Braun for 10 years, she was a principal structural engineer. "I really enjoyed my work there," she says. "But I left because the petrochemical industry was declining and it wasn't clear how



Rhonda MacDonald

many opportunities there would be for me to advance. So I decided to go into the aerospace industry."

MacDonald says that at this point she was particularly grateful for the basic problem-solving orientation she had received through her Caltech education. "Having a degree from Caltech really helped me when it came to changing careers 10 years out of school," she says. "I've been at TRW for four years as a project structural engineer."

The career change that MacDonald made led to a more dramatic life change. A few months after coming to TRW, she met her future husband, Steven Lucas, and they were married two years ago. The couple lives in Redondo Beach, "five minutes from the office." MacDonald lived in South Pasadena for several years and both she and her husband love the Pasadena area with its many trees. But they've settled for life near the beach, and that five-minute commute.

Both enjoy the cultural offerings of Los Angeles, and attend events at the Ahmanson Theater and Ambassador Auditorium regularly. They love to travel, especially to the mountains, and

Lucas is an enthusiastic skier. Their favorite mountain destination is the Canadian Rockies, where they spent their honeymoon. MacDonald has also traveled to Alaska, the Alps, Scandinavia, and throughout the Orient.

As she describes her goals for the coming year, MacDonald discusses her plans to increase the participation of young alumni in association activities. "The way to do that," she says, "is to expand our travel programs. We'd like to develop some short weekend trips that would be inexpensive and would appeal to young alumni working in the southern California area.

"We'd also like to increase the services we offer students—for example, the undergraduate admissions support program. This means expanding the network of alumni across the country who help to recruit qualified students for Caltech."

Another goal in services for students is growth in the summer-job and day-on-the-job programs, both of which are becoming very popular with undergraduates. MacDonald would also like to increase the association's financial support for student activities—athletics, ASCIT, and various clubs.

MacDonald is particularly interested in activities that involve students and alumni in joint endeavors. One especially successful example is the student house program, which brings alumni of a house together with the current members for a recreational event. Ricketts, Blacker, and Page have such programs, and plans are under way to start one in Fleming. Thinking of the success of *Legends of Caltech*, MacDonald is interested in the possibility of publishing histories of the individual houses, with alumni and current students collaborating on the contents.

"Of course, one of our major activities this year will be to plan for the centennial in 1991," says MacDonald.

"We're going to have an all-classes reunion that year, in conjunction with Seminar Day. The big advantage of this event will be the opportunity to see friends from neighboring classes. In that respect, it probably offers a once-in-a-lifetime opportunity.

"Caltech is proceeding with a Rose Parade float for the centennial year, and I believe this project will offer an outstanding opportunity for students and alumni to interact in the design and construction of the float.

"To strengthen the Alumni Association, we need to increase the number of active alumni," MacDonald continues. "We want to do this on a nationwide basis through our chapters. This year, we hope to expand our number of chapters from seven to ten. We've found some people in the new areas who are very interested in providing the

leadership to get the chapters going."

The greatest challenge facing the association, MacDonald feels, is to expand the number of alumni involved in activities, and to provide them with the support to keep their enthusiasm going.

MacDonald says that, just since she's been on the board, she's seen the association's vitality increase. "The board members are very active and they're working on some wonderful programs. I inherited a great organization from Chuck Holland," she concludes.

There seems little doubt that, with her own enthusiasm and energy, she'll meet the challenges of her year in office in a vigorous and effective way.

Orange County chapter members dine in Newport

The Balboa Bay Club, overlooking Newport Harbor, was the site of the opening dinner for 62 Caltech alumni who are members of the new Orange County chapter, and their guests, on June 27. Officers elected were Hans Linhardt (BS '60), president; Ray Bowerman (BS '51, MS '52, ENG '55), vice president; Martin Lee (MS '87), secretary/treasurer; and Seymour Lampert (MS '47, ENG '48, PhD '54), program committee chairman.

Charles Barnes, professor of physics, talked on "Cold Fusion: Wish or Reality," giving an overview of the cold-fusion issue.

A trip to Palomar Observatory on Saturday, October 7, has been planned as the second event for the chapter.

Four on faculty receive ASCIT teaching awards

Four members of the Caltech faculty have received awards for excellence in teaching from the Associated Students of the California Institute of Technology (ASCIT). They are Yaser S. Abu-Mostafa, associate professor of electrical engineering and computer science; Clinton D. Dodd, swimming coach; J. Morgan Kousser, professor of history and social science; and Robert J. McEliece, professor of electrical engineering.

The award recipients are chosen for their overall teaching abilities, based on student evaluations in the Course Listing of Undergraduate Education (CLUE). Final decisions are made by ASCIT officers, who also solicit student recommendations through the *California Tech* and the student houses.

Climbing Worthington Glacier: Rosemary Anderson (wife of Kenneth G. Anderson, BS '45), Jason Lombard (son of Walter and Ruth Ann Specht), and David Dorn (MS '72).



Panning for gold at Crow Creek: Walter A. Specht, Jr., (BS '57, MS '61, PhD '65); Ruth Ann Specht; and Robert P. Sharp, the Sharp Professor of Geology, Emeritus (wearing the hat).

Caltech alumni share an Alaska adventure

Soaring eagles, caribou, grizzly bears, and salmon leaping fish ladders in an icy stream were some of the memorable wildlife sights shared by 37 Caltech alumni, spouses, and guests on the Alaska travel/study program, June 23–July 2. Faculty trip leaders Robert P. Sharp, the Robert P. Sharp Professor of Geology, Emeritus, and Leon T. Silver, the W. M. Keck Foundation Professor of Resource Geology, examined road cuts and rocks, glaciers and moraines, as they talked about the forces of nature that shaped the south-central Alaskan landscape.

Majestic mountain peaks dominate much of the Alaskan landscape. The group received a rare treat—the opportunity to see Mt. Denali in full view, unobstructed by clouds. Clear views of Denali occur only occasionally, and usually in winter.

Scrambling up the Worthington Glacier and hopping over crevasses while the ice crunched below their feet invigorated and refreshed many of the group. Gold panning in a stream of mountain runoff near an abandoned gold mine brought the realities of a miner's life into focus. The group was fortunate; plastic gloves helped insulate fingers from the cold, but like so many miners before them, the tour members found that gold nuggets were elusive.

Imagine a tunnel dug deep into the permafrost, where ice crystals tens of thousands of years old can be examined. Hard hats and flashlights were in order as Carl Benson (PhD '60) led the group on an excursion into the Cold Region Research Engineering Laboratory permafrost tunnel.

Oil and the Alaskan pipeline were of great interest to the group, especially when they traveled by ferry through Prince William Sound from Whittier to Valdez. Their route followed the Alaskan pipeline north from Valdez to Fairbanks and included a look at some of the pipeline's special engineering.

These were just a few of the special trip sights and experiences. The trip is over, but the friends and the memories remain.

A message from the alumni president

By Rhonda MacDonald

As the Alumni Association begins a new year, the Membership Committee, chaired by Joseph Dobrowolski (BS '49), is working to increase participation in the association by sharing what association membership does for alumni and for Caltech. Membership in the association helps alumni stay in touch with the Institute and with each other. As a membership organization, dues are the "fuel" for our programs and publications. Programs such as reunions, Seminar Day, chapter activities, special association events, travel/study programs with Caltech faculty leaders, and alumni directories help rekindle the friendships formed at Caltech.

Your association dues also benefit students in a special way. Many student activities that enhance campus life are assisted by association funding. New Student Camp, the SURF (Summer Undergraduate Research Fellowships) program, the senior banquet, athletics, music, and a wide variety of student clubs and organizations are just a few of the areas supported, in part, by the association. Just as you remember your days on campus, today we're helping to create the memories of future Caltech alumni.

Association members receive a complimentary subscription to *Engineering & Science*, our Caltech magazine, which offers information on exciting research at the Institute. We wish Joe and the membership committee much success in their efforts to increase association

memberships.

Vic Veysey (BS '36) chair of the Chapter Affairs Committee, reports that alumni chapter activity is expanding. Alumni surveys in major population centers have helped the committee identify alumni needs and leadership to meet those needs.

Details of Orange County's new chapter are mentioned in this issue. A steering committee of Colorado alumni comprised of Peter Bloomfield (BS '68), Carl Gottschall (BS '60), Richard Hackathorn (BS '67), and Richard Nielsen (BS '66, MS '67, PhD '71) met with Judy Amis, executive director of the association, in July to begin organization for a new Colorado chapter.

In San Francisco in August, Amis met with Alan Breakstone (BS '72), Stephanie Charles (BS '73), Hugh Dubb (BS '56), George Preston (BS '64), and Peter Tong (MS '81, PhD '85) to discuss reorganization of the San Francisco chapter and how best to meet needs of alumni in the Bay Area.

New Mexico alumni Jonathan Calender (BS '66), David Kauffman (BS '62, MS '63), Melvin Merritt (BS '43, PhD '50), JeanClare Seagrave (BS '76), and Warren Whiting (BS '50) met to explore the organization of a New Mexico chapter. And a tri-state chapter (New York, Connecticut, and New Jersey) is being formed under the guidance of David Peisner (BS '74), Deborah Pinck (BS '86), Clara Spalter (BS '84), and Andrew Weigel (BS '73). Best

wishes for a successful year to the alumni in each of these chapters.

In addition to chapter expansion, the Undergraduate Admission Support (UAS) program has increased significantly, with plans for continued growth. Co-chairs of the UAS committee, Ed Lambert (BS '82) and Bill Whitney (BS '51) have charted an ambitious course for expanding the UAS volunteer network. Last spring, 21 receptions for 130 admitted students were held in Miami, Honolulu, Chicago, Detroit, Minneapolis-St. Paul, St. Louis, Philadelphia, Dallas-Ft. Worth, Houston, Portland, Washington D.C., and Phoenix, Denver, Boston, Palo Alto, San Rafael, Salt Lake City, Milwaukee, New York, and Newark.

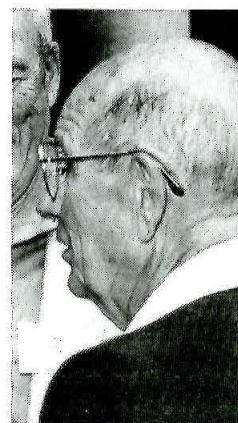
Local admitted students met with 109 Caltech alumni across the country who answered questions and shared information about the Institute. Student and alumni reaction to the receptions, up from six the previous spring, is overwhelmingly positive. The class of '93 has 216 members, of which 64 (31 percent) are women, up from 14 percent in 1988, and 12 are from the nation's underrepresented minority groups, an increase over last year's seven.

We appreciate feedback from alumni concerning any association issue. Please contact us by mail or phone: Caltech Alumni Association, Mail Code 1-97, Pasadena, California 91125, 818/356-6592.



Some of those at the Orange County chapter dinner included, from left: speaker Charles Barnes, Hans Linhardt (ENG '60, chapter president), Doris Linhardt, Joseph Rosener, Jr. (BS '47), Barbara Bowerman, and Ray Bowerman (BS '51, MS '52, ENG '55).

Correction!



George Crozier was incorrectly identified in the August Caltech News. We regret the error.



Alumni Activities

For information about any of these programs, contact the Caltech Alumni Association, mail code 1-97, Pasadena, California, 91125; (818) 356-6592.

January 1, 1990, Rose Parade event. Reserved seating at the 101st Tournament of Roses. Breakfast and lunch at

the Athenaeum, parking, and Rose Parade program included. Reservation information will be mailed to alumni in the Los Angeles area. Alumni living outside the Los Angeles area may contact the Alumni Association for information.

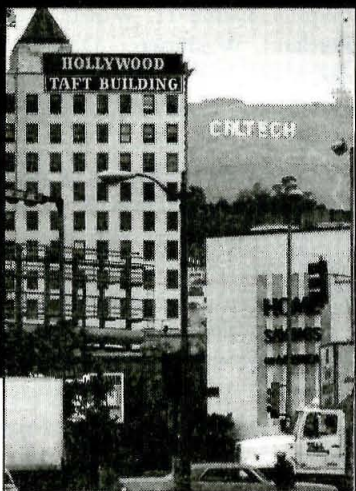
June 1, 1990, Half-Century Club luncheon, in the Athenaeum.

June 1, 1990, Reunions for the classes of 1945, 1950, 1965, and 1980, in the Athenaeum.

June 2, 1990, 53rd Alumni Seminar Day, on the campus.

June 24–July 1, 1990, Yellowstone travel/study program with Robert P. Sharp, Robert P. Sharp Professor of Geology, Emeritus.

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OBITUARIES

1929

EDWARD C. SANDBERG, MS, of Bakersfield, California, on June 1. He is survived by his wife, Arlene.

1932

VINCENT C. KELLEY, MS '32, PhD '37, of Albuquerque, New Mexico, on December 5, 1988. He is survived by his wife, Anne.

WILLIAM B. SHOCKLEY, of Palo Alto, California, of prostate cancer; he was 79. He was a professor emeritus of electrical engineering at Stanford. Shockley, co-inventor of the transistor, shared the 1956 Nobel Prize with his colleagues from Bell Laboratories, John Bardeen and Walter H. Brattain. The device they developed made vacuum tubes obsolete and made the electronic age possible. Shockley's company, Semiconductor Laboratories, founded in 1954, was instrumental in the birth of Silicon Valley and the electronics industry. He is survived by his wife, Emmy.

1933

HUNTER NICHOLSON, III, of Santa Rosa Beach, Florida, on June 25. He is survived by his wife, Elizabeth.

1935

HARRY D. ESTES, of The Sea Ranch, California, on August 14. He is survived by his wife, Pauline, and son, Frank.

PAUL W. KILPATRICK, of Danville, California, on April 18.

1938

ARTHUR C. ELLINGS, of Palos Verdes Estates, California, on June 23.

1943

CLEVELAND E. AUTRY, EX, of North Springfield, Virginia. He was a member of The Associates.

1943

JOHN W. BUCHANAN, of Rolling Hills Estates, and his wife, Eugenie, in a plane crash on August 14, near Lake Tahoe. They had been married for 44 years. He was president of Chadwick & Buchanan in Long Beach, and was a life member of The Associates. They are survived by their children, Lori Sukoff, Bill and Greg Buchanan, and Nancy Cunningham.

1950

CARL E. FOX, MS '52, of Beverly Hills, California, on June 17.

RUBIN W. LUDWIG, of Dallas, Texas, on October 22, 1988.

1954

KENNETH D. JOHNSON, PhD, of Camarillo, California, on June 12, of Parkinsonism. At his retirement in 1976, he was research director of the Chemical Manufacturer's Association in Washington, D.C. He was a member of the Alumni Association, Sigma Xi, American Chemical Society; and a fellow of the American Institute of Chemists, the Association of Clinical Chemists and the Association for the Advancement of Science. Dr. Johnson is survived by his wife, Eleanor Stewart, MD; daughters Lisa Frey, CPA and Karen Scanlon, MSW; sons, Kenneth Jr., MD, and Keith, JD; and four grandchildren.

1962

ERNEST B. SEYMOUR, VADM, of Vienna, Virginia, on May 17.

PERSONALS

1938

PETEL C. GOFF, of Ramona, California, writes, "My basic residence is in Ramona, but a beach house in Las Gaviotas, Mexico, helps when the weather gets too warm."

1939

ANDREW A. FEJER, PhD '45, of Oak Park, Illinois, was a member of the People to People Gas Turbine Technology Delegation to the Soviet Union in July. He visited research centers and industrial plants in Moscow, Kazan, Zaporvzhye, Kharkov, and Leningrad. He is currently a senior advisor in gas turbine research for the Institute of Gas Technology.

1944

EUGENE F. PISCHEL, of Sedona, Arizona, writes, "I retired from Lockheed MSC in 1985, after 33 years of most interesting and challenging work. My wife, Elsa, and I are very much enjoying retirement in Sedona, where we fly with the Civil Air Patrol, play bridge, hunt, and play tennis. Our son, Ken (BS '72), and his wife, Kathy, presented us with their first-born in June. With all boys in our 'first generation,' we're tickled that it's a girl!"

1948

FRANK F. SCHECK, of Chappaqua, New York, is a senior partner of Pennie & Edmonds, of New York City, and president-elect of the New York Patent Law Association. He has two sons, Chris and Carl, in New York; and a daughter, Jennifer S. Lee, who is a Soviet analyst for *Global Outlook*, in Palo Alto, California.

1949

BENJAMIN J. CAGLE, MS, of San Diego, California, is a consultant in oceanography. He retired, after 26 years in the Office of Naval Research and 14 years as an engineer at Caltech, to care for his invalid wife. He was a visiting professor of oceanography at the U.S. Naval Academy, conducted research in the arctic, was elected to membership in the Explorers Club, received the Navy Meritorious Civilian Service Medal, and was a member of the Astronaut Support Team.

1950

ROBERT R. GRINSTEAD, PhD, of Walnut Creek, California, just retired after 40 years as a research chemist with Dow Chemical Company. He plans to concentrate on traveling with his wife, former Caltech Y secretary Helen Stabler, playing his tuba, editing a magazine for the American Chemical Society, and stirring up trouble for the Republicans.

1951

DALLAS L. PECK, MS '53, has been reappointed by President Bush to continue serving as Director of the U.S. Geological Survey. Dr. Peck has served as director since 1981. Prior to this, he was chief geologist from 1977–1981, and a geologist from 1954–1977. Dr. Peck was head of the delegation to the International Geological Congress in Moscow in 1984, and the head of the U.S. delegation to the 28th International Geological Congress in 1989. He is the current chairman for the Committee on Earth Sciences. Dr. Peck received the Presidential Meritorious Executive Award in 1980, and Caltech's Distinguished Alumni Award in 1985.

KEEP US INFORMED!

Keep us informed so we can keep your fellow alums informed. Send us news about you and your family, about a new job, promotion, awards—anything you'd like to see printed in the Personals section of *Caltech News*. Return this coupon and any additional materials to: *Caltech News*, Caltech Mail Stop 1-71, Pasadena, CA 91125.

Name _____

Degree(s) and Year(s) Granted _____

Address _____

Is this a new address? _____ Day phone _____ Occupation _____

News _____

1956

HOWARD BRODY, MS, PhD '59, of Philadelphia, Pennsylvania, is a professor of physics at the University of Pennsylvania where, in addition to the traditional physics courses, he teaches a course in sports physics. His book, *Tennis Science for Tennis Players*, was published last year by The University of Pennsylvania Press. He is science advisor to the U.S. Professional Tennis Registry and the president of the USTA has appointed him a member of its Sports Science Committee.

1958

RICHARD L. VAN KIRK, of Arcadia, California, has been named regional director of manufacturing consulting for the west region of Ernst and Young, the world's largest professional services firm, which was formed through the merger of Arthur Young and Ernst and Whinney.

1959

ROLF ENGLEMAN, JR., PhD, of Tucson, Arizona, writes, "After 29 years at the Los Alamos National Laboratory, I have retired to Tucson where I am an adjunct professor of chemistry at the University of Arizona, still pursuing studies in atomic and molecular spectroscopy."

I. M. IDRIS, MS, of Davis, California, has joined the faculty at UC Davis as professor of civil engineering and director of the Center for Geotechnical Modeling after 20 years with Woodward-Clyde Consultants, most recently as senior principal and vice president.

AKIRA KOBAYASHI, MS, of Tokyo, Japan, has been appointed vice president of the Japan Society for Composite Materials. He is also a member of the board of directors and chairman of the international affairs committee for the JSCM. He has been nominated as the general chairman for the fifth Japan-U.S. Conference on Composite Materials for the JSCM, to be held in Tokyo in June 1990. Recently, the International Committee on Aeronautical Fatigue announced that Professor Kobayashi would be its general chairman in 1991.

1961

TERRY L. BABINEAUX, MS, of Santa Rosa, California, has formed his own recruitment firm, Photonics Resources, Inc., specializing in recruiting for high technology companies. Prior to forming PRI, Babineaux was a senior partner in the consulting firm, The RepCon Group, specializing in sales and marketing for the electro-optics industry.

PETER C. MAYER, writes, "A small-world story for my generation of Techers—near where we have been living for three years in Kobe, Japan, there is a Big Boy restaurant complete with a statue of Big Boy with pot belly and red and white checked overalls. On September 1, we returned, at least for awhile, to Guam. Guam is like a jealous lover, it just will not let go." Mayer is a lifetime member of the Alumni Association.

1965

W. ALFRED MUKATIS, PhD, associate professor of business law at Oregon State University, has had his book, *Hazardous Waste Regulations: Enforcement and Liabilities*, published by Executive Enterprises, Inc. He writes "This was supposed to be a summer project that stretched out to a year. I am happy and relieved that it is finished."

1967

SUSAN W. KIEFFER, MS, PhD '71, has become the second person from the U.S. to win the prestigious Spenski Prize from the Soviet

Union's Academy of Science. Kieffer received the 92-year-old award during the 28th convention of the International Geological Congress in Washington in July. She is a geologist with the U.S. Geological Survey and has done research on volcanic eruptions on Mount St. Helens, and on Io.

ERIK A. LIPPA, MD, of Fort Washington, Pennsylvania, writes, "Following a PhD in math at the University of Michigan and a NATO postdoctoral fellowship at Oxford University, I continued doing research in math as an assistant professor at Purdue University while pursuing an increasing interest in biomedical research. This led me to an MD at Albert Einstein College in New York followed by an ophthalmology residency at the Illinois Eye and Ear Infirmary. Currently, I manage ophthalmic clinical research at Merck, Sharp, and Dohme Research Lab as director of clinical research. I have settled in Fort Washington, Pennsylvania, with my ophthalmologist wife, Linda; and sons David, 8, and Andrew, 6.

1970

PETER C. BROWN, of Los Altos, California, has recently become an independent consultant in software engineering. His first contract is with Apple Computers, in the electronic CAD field on the Macintosh.

ROGER M. GOODMAN, EX, BS '89, writes, "As you can see, I decided to celebrate turning 40 by finally returning to Caltech this year and graduating! I couldn't have done it without the support of my wife, Melody (nee Davidson), and my sons, Joshua and Jeffrey. In the meantime, I am a computer software consultant, currently on a contract at JPL. We're still living near Century City in West L.A. I'm also a part-time cantor at Congregation B'nai Israel in Tustin." Goodman is a life member of the Alumni Association.

1971

PAUL A. KROON, MS, PhD '75, writes, "I recently moved to Brisbane to take a position as associate professor in biochemistry at the University of Queensland and as deputy director of the Clinical Research Center, Royal Brisbane Hospital Foundation."

1972

ROBERT C. DULLIEN, of Boulder, Colorado, writes, "Business and family are growing. Boulder is attracting much high-tech."

JOHN MICHAEL SHULL, of Boulder, Colorado, was married to Melissa Mahaney, a lawyer, three years ago. Their son, Taylor, is now one year old. Shull is working at the University of Colorado as an astrophysics professor and an associate dean in the College of Arts and Sciences.

1973

AHMED M. ABDEL-GHAFFAR, MS, PhD '76, professor of structural engineering at the University of Southern California, is the 1989 recipient of the American Society of Civil Engineers' (ASCE) Walter L. Huber Civil Engineering Research Prize for his research on the dynamic analysis and full-scale testing of long-span, cable-supported bridges and earth dams.

1975

RICHARD L. KAHLER, of Hudson, Ohio, just moved to Hudson with his wife and 6-month-old son, Dustin Alexander. Starting this fall, Kahler will enter the graduate physics program at the Case Western Reserve University to earn his PhD in physics.

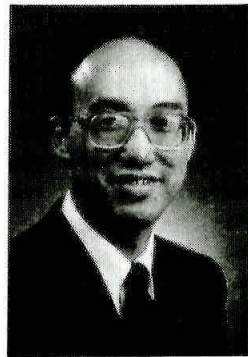
GORDON C. SMITH, PhD, of Annandale, Virginia, has been promoted to manager of the Washington Studies and Engineering Analysis Group, a Washington, D.C. technical office of the McDonnell Aircraft Company.

1976

JOEL M. GOTTESFELD, PhD, was appointed chairman of the division of developmental biology, at the Medical Biology Institute, in La Jolla, California.

1980

NORMAN T. LEE, MS '83, senior project engineer in the systems development division of TRW Inc., was awarded the TRW Chairman's Award for Innovation in June. The award recognizes outstanding achievements that contribute



Norman T. Lee

significantly to the growth and cost-effectiveness of TRW. This award was given in recognition of Lee's achievements in the design, prototyping, and fabrication of the Fast Data Finder (FDF), a system that searches text and retrieves information at speeds far exceeding conventional data retrieval systems.

1981

CHRIS H. KINGSLEY, MS '82, writes "I have just returned from the French Riviera. I worked

for two years at VLSI Technology's new software development office. I also participated in a chorale and theatre group in French. Now that I am back, I am once again acting in the San Jose City College's summer Shakespeare Festival."

KWANG-I YU, PhD, chief technologist in the defense data systems operations of TRW Inc., was awarded the TRW Chairman's Award for Innovation in June. The award recognizes outstanding achievements that contribute significantly to the growth and cost-effectiveness of TRW. This award was given in recognition of Yu's achievements in the design, prototyping, and fabrication of the Fast Data Finder (FDF), a system that searches text and retrieves information at speeds far exceeding conventional data retrieval systems.

1982

BAKI M. CETEGEN, PhD, of Stafford Springs, Connecticut, is an assistant professor of mechanical engineering at the University of Connecticut. He has received a grant of \$59,941 from the National Science Foundation to study buoyant flames such as fires. He has taught at UConn since 1987.

PERRY G. WALKER, of East Chicago, Indiana, was voted chairman-elect of the National Society of Black Engineers (NSBE) Alumni extension for 1989-1990.

1983

WALTER V. CHEN, MS, received his PhD in electrical engineering from Polytechnic University in June. He has joined Bellcore, and lives with his wife, Nancy, and sons, Aaron and Brian in Brookside, New Jersey.

1984

MILES J. GEHM Jr., MS, of Waalre, the Netherlands, married Lynn Forester (MS '80, PhD '86) in June, 1987. He is working on sub-micron photolithography for Philips Research.

A. GREGORY SORESENSEN, of Cambridge, Massachusetts, was awarded his doctor of medicine degree by the Harvard Medical School on June 8. He earned his MD degree while in the division of health sciences and technology, a joint program between MIT and Harvard, which focuses on the scientific aspect of medicine. Sorensen will spend a year as a medical intern at the New England Deaconess Hospital in Boston, then he will be in residence for four years at Massachusetts General Hospital, in the Radiology Department.

1985

SUSANNA M. CHAN, of St. Louis, Missouri, received her MD degree from the Johns Hopkins University in May and began her residency in internal medicine at Barnes Hospital in St. Louis.

J. MICHAEL LODMAN, of San Diego, California, married Kerstin E. Kemper, UCLA '85, on March 3.

1987

JOHN T. BECK, of San Jose, California, completed his MS in computer science at UC Santa Barbara in June. He has gone to work for Hewlett-Packard in Cupertino, California, as a software development engineer in the areas of operating systems and networking.

THOMAS W. RATHJEN, of Seabrook, Texas, married Cynthia Anne Haufler on April 22. He works at NASA's Johnson Space Center in Houston.

PAUL R. SCHATZLE, PhD, of Pasadena, California, and his wife, Gail Vanderlee, announce the birth of their first child, Emily Gail, on July 10.

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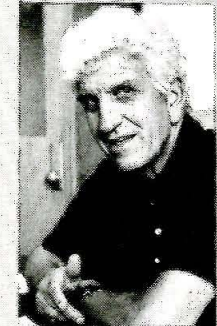
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In this
issue

Infanticide was practiced in 18th- and 19th-century China as a form of postnatal abortion, a Caltech professor concludes.

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Thomas E. Everhart shares his views on a wide variety of subjects after more than two years as president of the Institute.

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Chris Brennen made a long journey from northern Ireland to Caltech, where he's now dean of students.

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Warren Emery hands over his keys after 34 years as athletic director.

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