

CALTECH NEWS

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Scientists' preliminary report: no evidence for neutrino mass

In a preliminary report on a comprehensive experimental effort, an international team of scientists has reported no evidence that neutrinos have mass. The scientists — from Caltech, the Technical University of Munich, and the Swiss Institute of Nuclear Research — presented their findings at the spring meeting of the American Physical Society.

Neutrinos have been called the ghost particles of the universe because of their ability to zip through solid matter as if it didn't exist. The impact on physics and astronomy of the discovery of neutrino had even a small mass would be profound. For example, proof of a neutrino mass would mean a large increase in the calculated mass of the universe, enough to settle the debate over whether the universe is "open," expanding forever, or "closed," massive enough to eventually reverse its expansion and collapse back on itself.

The scientists' neutrino studies sought to establish that neutrinos undergo oscillations from one form of neutrino to another. According to well-established physical theories, only particles with mass undergo such oscillations.

"We believe our results show conclusively that neutrinos do not undergo oscillation and thus are not mixed states in a quantum mechanical sense," said Felix Boehm, Caltech professor of physics and a member of the research team. "As a consequence, we can give tight limits on neutrino mass parameters." The researchers' experiments encompassed

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Frank Oppenheimer, founder and director of the Exploratorium — and one of the young in spirit who find it delightful.

The Exploratorium: a playful museum delights children of all ages

It is 10 a.m. on a Wednesday morning, and several hundred young people and teachers are visiting the Exploratorium in San Francisco's Palace of Fine Arts. Almost as far as one can see, exhibits that twinkle, beep, wail, pound, flash, and bounce light are being examined from every angle by the most excited, enthusiastic, happy group of kids to be encountered since Christmas morning.

Someone said that "discovering the Exploratorium is like stumbling into the belly of a giant whale where some mad scientist has found a home." The man who made that statement was Frank Oppenheimer (PhD '39), creator of the Exploratorium, and one who, by the twinkle in his eye when he talks of it, finds the museum just as delightful as do the kids of all ages who come there.

— Oppenheimer's dream of creating a science museum began when he was teaching physics in the 1960s at the University of Colorado. "It seemed to me then, and it is still true," says

Oppenheimer, "that too many people, including young people, had given up hope of comprehending anything about nature, or even about the everyday gadgets they used, or the history and workings of the society in which they lived."

This loss of curiosity applied to many of his students at the University of Colorado. "The curriculum was so intense," he says, "that they resented digressions. They only wanted me to teach what they needed to pass the tests."

To create a museum that would invite digressions — and restore faith in the ability to understand the world — were among Oppenheimer's goals. He wanted the museum to communicate a "conviction that both nature and people can be understandable and full of newly discovered magic."

Oppenheimer brought to the endeavor a rich and diverse background. His training, besides his PhD in physics from Caltech, includes an undergraduate degree from Johns Hopkins and study at the Cavendish Laboratory in England. In addition to work at Los Alamos, and university and teaching posts, his life experiences include, during a politically difficult post-World War II period, a career as a cattle rancher and president of the local cattle ranchers' association, and work as a high school teacher in Colorado.

He is the recipient of many awards — among them, the Millikan Award from the American Association of Physics Teachers, two Guggenheim Fellowships, a Caltech Distinguished Alumni Award, the Distinguished Service Award from the University of Colorado, and the American Association of Museums' Award for Distinguished Service to Museums. In 1981 he was the subject of a NOVA program.

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Along with his scientific credentials, he brought a strong appreciation for art — and for what it should contribute to a museum. His mother had been an art teacher in New York with her own studio. His family collected art, and as a young scientist in Florence, he delved deeply into the offerings available to him there. A talented flutist as a young man, he still plays the instrument.

He also brought to the effort a prodigious energy and determination. One colleague described him as a person who “has an insatiable curiosity about all things and a strong compulsion for investigation. Focused by a deep conceptual sense, directed by a lean, hard mind, and accompanied by an awesome capacity for work, that compulsion makes him extremely productive.”

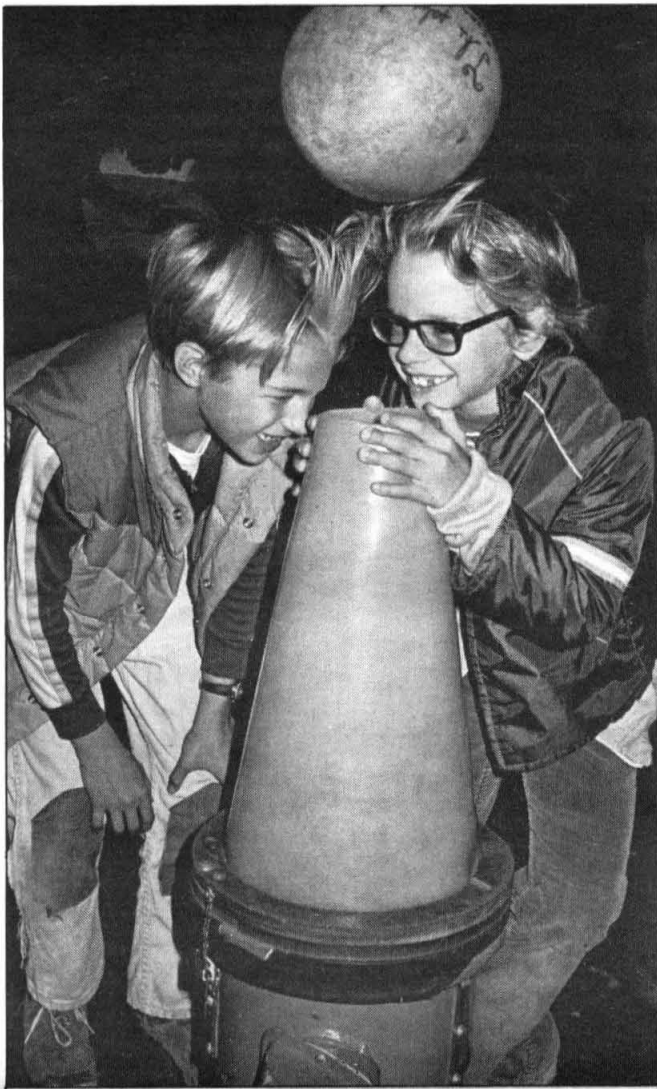
In his decision to create the Exploratorium, Oppenheimer worked with his wife, Jackie, who died in 1980. Together they built on a shoestring.

Initial funding came through a \$50,000 grant from the San Francisco Foundation when the museum leased 90,000 square feet in the Palace of Fine Arts in 1969. The Exploratorium today is supported by grants and donations and continues to operate on a lean budget that invites ingenuity and resourcefulness. More than half a million people visit the museum annually. Many are students, some of whom become “explainers” or teachers; they constitute about a third of the museum’s more than 100 full-time and part-time staff.

Inside the museum — a large open area that looks a bit like an enormous warehouse filled with an incredible sound and light show — the visitors see more than 500 exhibits on sensory perception, light and optics, sound, resonance and wave motion, electricity, rotation and angular momentum, exponentials, patterns of motion and rhythm, the nature of heat and temperature, the behavior of gasses and liquids, nerve encoding, marine animal behavior, simple engines, and a modest collection of miscellany that exists because it intrigues one or another member of the staff.

A common thread connects each topic with the starting point: human perception. “The Exploratorium is about nature, and one of the major accomplishments of science has been to demonstrate that there is a unity to the diversity of nature,” says Oppenheimer. “We hope that visitors can sense this connectedness.”

To aid comprehension, the museum displays multiple examples of especially interesting or important phenomena. For example, there are



Two young visitors learn — through experience — about the Bernoulli effect.

over a dozen exhibit pieces on binocular vision and size distance judgments. By layering the exhibits, visitors absorb what they might miss through one example alone.

“We’re continually adding exhibits, and I hope we will be able to do so for years to come,” says Oppenheimer.

Among those who find the museum most enjoyable are scientists — including some of Oppenheimer’s friends at Caltech. “They like it,” he says, “because they learn something, and because the things they know about are shown in an ingenious and open way.”

Students of all levels of mental capacity have found the museum a rich experience — from the gifted to the retarded or sensory deprived. Because many of the exhibits involve aspects of illusion, a school for the sensory deprived has had parents and staff come to the museum for workshops so they can experience how frustrating and confusing things can become for children when their senses don’t work right.

In planning the Exploratorium, Oppenheimer had come to realize how few good science museums there were in the country, and he believed

that good science museums can play an important role in science education.

“If people are going to learn about science through books,” he says, “they have to be supported by intuition-building experiences. They have to learn to think: ‘I wonder what would happen if I tried *this*?’ ”

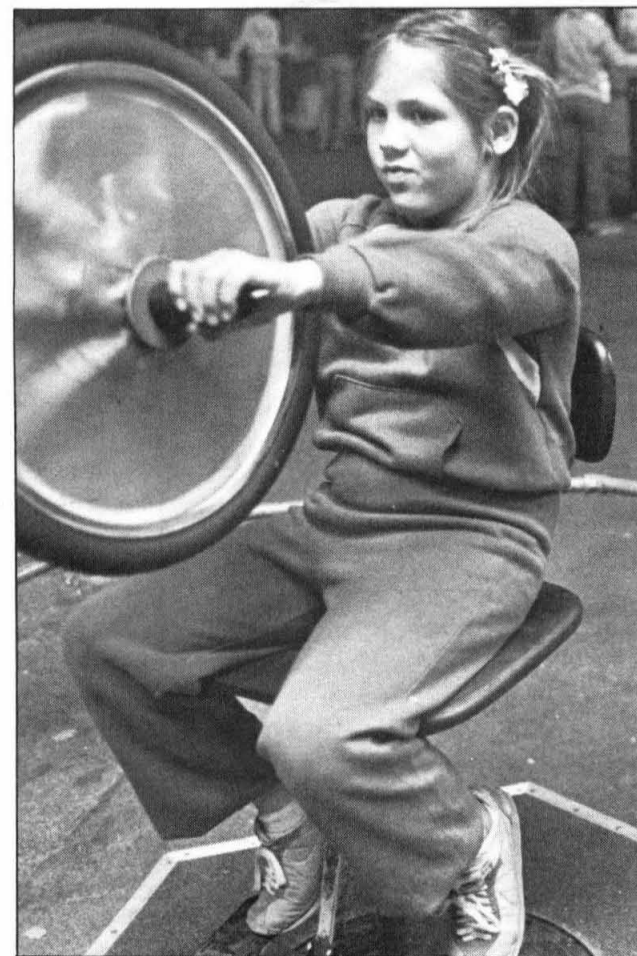
The Exploratorium is an environment where people of all ages can ask this question. And if they come back several times, they come to understand at least several of the exhibits.

“If we realize that we can understand a group of things, then we become hooked on understanding,” he says. “We think, ‘Yes, I could understand these other things if I tried.’ This is different than feeling we *can’t* understand them.

“If we feel we *can’t* understand our environment, we go on to feel that we can’t understand television, computers, homosexuality, criminal behavior, city government . . . This attitude leaves people with a sense of impotence and crankiness and with no hope for making the world a little better.”

One concrete example of the success of Oppenheimer’s goal: A woman who had visited the museum wrote him saying that she had gone home and, for the first time, changed the cord in a lamp. Nothing in the museum had taught her how to do this. She had simply gained confidence that it was possible.

In creating the Exploratorium,



A visitor samples the bicycle wheel gyro exhibit.

Oppenheimer has made playfulness a prime ingredient — along with getting visitors involved with hands as well as minds, and using art and aesthetics as an essential part of the process of learning and teaching. He often stresses the need to make people at ease. "We must make it possible for visitors to feel *they* are the clever and perceptive ones, not the scientists and engineers. But along with the down-playing, we must lead them to the point that they marvel at and are intrigued by the wonders and mysteries of nature, enraptured by the meaning and strength of art, delighted by the ingeniousness of technical inventions — and aware of the connectedness in time, history, and substance of everything they encounter in the museum, as in the outside world."

Oppenheimer likes to think of the Exploratorium as a place to sightsee, and he notes that "sightseeing is more than pleasurable. It can build the experiences and intuitions on which other opportunities for learning rely. And in a broad sense, it can help people determine where they will make their home."

Science museums have been doing that for young people for many years, Oppenheimer believes. He notes that many scientists who visit the Exploratorium say they became scientists because of early visits to the Museum of Science and Industry in Chicago, and several young people who have gone into careers in science lay the responsibility at the doorstep of the Exploratorium. But for others, the direction has been different.

For example, a young man who worked at the Exploratorium went on to study physics at a University of California campus. After three years, he switched to the social sciences. "Only once in those three years," the student told Oppenheimer, "did a physics professor mention beauty."

How does Oppenheimer like his job? "I like it fine," he says. "Everything I've ever done — cattle ranching, music, going to school, climbing mountains, the Manhattan Project and the expediting it involved — they all seem relevant to what I'm doing here."

And what Oppenheimer is doing at the Exploratorium is enriching the lives of thousands of visitors. Said one colleague, "The Exploratorium has become a mecca for all those who, regardless of discipline, have an interest in learning. No one in our years has had a greater impact on museums."

Caltech graduates' salary offers: \$2,500 higher than the national norm

Caltech students graduating in June with BS and MS degrees received salary offers averaging a full \$2,500 higher than the national norm, according to Sally J. Asmundson, director of placement and career planning services.

In the past, Caltech graduates have received salary offers on a par with those of students across the country. Asmundson attributes the differential this year to a tight job market in which employers are hiring selectively and bidding for top people. (The average annual salary offers for Caltech graduates with BS degrees was approximately \$28,000; for graduates with MS degrees, about \$31,600.)

Most in demand among the graduates were those with degrees in electrical engineering and engineering and applied science, in line with a trend across the country. At Caltech, 17 EE graduates who were looking for jobs reported receiving 58 job

The highest job offer to a BS-degree recipient was \$24,000 to a graduate in engineering and applied science.

offers. (Of the 36 students who graduated with degrees in electrical engineering, 16 accepted an offer, 16 are going on to graduate school, and 4 reported miscellaneous plans.)

Graduates in engineering and applied science reported 52 job offers among 33 students who were looking for employment. Among those graduating with engineering and applied science options, 30 accepted jobs and 21 are going to graduate school, including two who will enter medical school.

The highest job offer to a BS degree recipient was \$42,000 to a graduate in engineering and applied science. One graduate in electrical engineering received 17 job offers and accepted a position with a high-growth computer company.

"This candidate had good grades, research experience and an attractive

professional appearance. He communicated well in interviews — and he did a lot of hard work in the job hunting process," said Asmundson.

This student's experience was not an isolated example. Three other students received more than ten job offers, while last year the highest number of offers was seven. Aware of the tight market, many students began looking early for jobs, notes Asmundson, in many cases contacting firms that don't conduct formal campus interviews.

Down again this year was the demand for graduates in civil and chemical engineering — options whose graduates generally enter petroleum and other energy-related fields.

By August 1, 33 percent of the BS degree recipients had accepted full-time positions, 52 percent would enter graduate schools, and 9 students had made miscellaneous plans.

One of these has received a Watson Fellowship and will spend the year in travel and study of the architectural and engineering aspects of museum design. Another will be involved in graduate studies at Oxford, and five have been accepted to medical school. Two will become science teachers, one in the Los Angeles area and another in Japan, teaching English to engineers. Another expects to begin writing a novel.

Of the 154 students receiving MS degrees this year, 89 (58 percent) will continue in graduate school — most remaining at Caltech. Among those continuing their education elsewhere, one will attend law school, another will enter a PhD program at Hebrew University in Israel, and a third will attend the University of Karlsruhe in Germany. One will spend a year studying at the University of Bordeaux in France on a Rotary Foundation Fellowship and then return to Caltech to complete a PhD.

Another is taking time to investigate her creative potential in music, drama, and writing. One will join the Air Force, and six French students have returned to France to complete their military obligation.

Of the MS degree recipients, 43 (28 percent) took jobs — most of these in electrical engineering.

Of the 136 PhD candidates 50 (37 percent) took positions in industry, and 78 (57 percent) accepted academic positions — 15 in teaching or research and 63 as postdocs. This pattern represents a return to a more

traditional pattern than for the class of 1982, 56 percent of whose members with PhD's accepted positions in industry.

For the PhD candidates, the economic temptations of work in industry are great, Asmundson points out. For example, the salary range for postdocs is \$13,000 to \$26,700 with most positions paying less than \$20,000. But the average entry-level salary in industry is \$38,000. Two PhD candidates accepted salaries at the vice presidential level in the \$50,000 to \$60,000 range.

Schaefer elected AAAS Fellow

William P. Schaefer, senior research associate in chemistry at Caltech, has been elected a Fellow of the American Association for the Advancement of Science. He was one of 296 men and women chosen from universities throughout the country and honored for their scientifically or socially distinguished work on behalf of the advancement of science or its application. Schaefer's research interests include X-ray diffraction and the structural chemistry of transition metal complexes.

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Master from Magherafelt:

Irish-born Christopher Brennen heads Caltech's student houses

By Phyllis Brewster

Christopher Brennen credits unique circumstances for his being at Caltech — where he has just assumed the role of Master of Student Houses — rather than in County Derry, Northern Ireland, where, he says, he would probably have been a surgeon like his father.

However, a look at the facts indicates that the 41-year-old professor of mechanical engineering has had considerably more input into the direction of his life than have circumstances, no matter how unique. Among the contributing factors, in addition to scholastic aptitude, are an engaging personality, high spirits, a fine sense of the dramatic, good humor, and a sincere regard for other people.

Admittedly, it *is* unique that his relatives are the only *en* Brennens in the Ulster phone book of two million names. But that isn't one of the circumstances that brought him to southern California and the Institute.

Brennen's earliest memory is — at the age of two — hiding under the Anderson table in the living room when Belfast was being bombed, before he and his mother were evacuated to safety in the Northern Ireland countryside. It was 1942 and Germany was trying to break the British convoy system, of which Belfast was an important part.

After the war Brennen's family settled in the village of Magherafelt — the geographical center of Northern Ireland. There young Chris grew up, and there went from the first through the twelfth grades in the only school in Northern Ireland where Catholic and Protestant boys and girls were in school together. The experience gave Brennen a high regard for the mixtures that make up the public school system, a regard he continues to have. The Brennens' oldest daughter, Dana, now at UCSD, attended Pasa-

dena High School, where their second daughter, Katharine, is currently a junior. Son Patrick just finished the fourth grade at Loma Alta Elementary School.

From Magherafelt to Oxford University, where Brennen studied for six years, is a journey of about 400 miles; but psychologically it was much further for a young man from the Irish countryside. "I was just an Irish yokel," says Brennen, "and I

the reason he was assigned to Balliol was that when he was asked to indicate the colleges of his choice in order, he didn't know about any of them, so he simply listed them alphabetically. "I was lucky to have inadvertently chosen one of such high academic standing," he says.)

Six years later, by 1966, Brennen had earned a BA (with First Class Honors), an MA, and a DPhil in engineering science from Oxford.



Initiating Chris Brennen into the rites of master of student houses is Carmela Kempton who has shared the responsibilities of that office with the past three masters — Sunney Chan, Jim Mayer, and David Smith.

surprised the heck out of everyone by getting a mathematics scholarship to Oxford."

Brennen gives credit for that to his high school math teacher, Dr. A. E. Gwilliam, who, he says, "gave us a tremendous amount of material," and who encouraged the 18-year-old Brennen to try for the Oxford scholarship and then tutored him for the competition.

Settling in at Balliol College was a culture shock of the first magnitude for the Irish outsider. "Most people barely understood what I said," Brennen remembers. (He claims that

And he had learned something else that he values highly. "There's a great deal more to education than being able to do the school work," he says. "When I look back on my undergraduate experience I realize just how much I learnt from my extracurricular activities — rugby, cricket, the Oxford University Dramatic Society, the Experimental Theater Club, and the Junior Common Room Committee (student government) of Balliol.

Love of acting influenced Brennen's college life considerably. He once toyed with the idea of becoming a professional actor, and he is still attracted to the stage. Last spring he dyed his hair white for the role of Mr. Lundie, the schoolteacher, in Caltech's production of *Brigadoon*. (Six years ago he played Lt. Brannigan in *Guys and Dolls*.)

"The values that can be derived from extracurricular activities are the qualities of education that we need to preserve and enhance at Caltech," says the new master. "We are so academically oriented here that we

sometimes lose track of the importance of other aspects of a university education."

In addition to a commitment to preserve and enhance, what other reasons does Brennen have for agreeing to take on responsibility for the well-being of some 860 Caltech undergraduates?

"I think that the enjoyment I get from dealing with the 30 to 40 students I have each year in my introductory engineering classes can be extrapolated by an order of magnitude to include the entire student body."

Brennen also expresses the desire to "do something different" from his regular routine of teaching and research. He is very concerned to do what he can to improve the quality of life in the student houses, and one improvement he has in mind is sure to be popular among Caltech students. "A week's break at Christmas is really not enough," the new master believes. "After ten weeks of intensive study, students need a longer rest."

Brennen also hopes to see more undergraduate women on campus, though he is not sure how or how soon that might be accomplished. When he was an undergraduate he was engaged to Doreen Kerr (now his wife of 20 years), and although Doreen was attending Queens University in Belfast, they managed to see each other often.

From Oxford to Caltech was not as big a step as from Magherafelt to Oxford, though the mileage is many times greater. Brennen was working for the National Physical Laboratory near London in 1967 when he met Caltech's Ted Wu. Wu invited Brennen to "come out for a year." That year was 1969, and the Brennens have been here ever since, though they make regular visits back to Northern Ireland where Brennen's two brothers, one sister, and parents are still living.

Brennen had been fascinated by life in the West a few years before he came to Caltech, however. In the summer of 1963 he worked his way across the country, with the help of a travel grant — an adventure which included living with a trade union agitator in Detroit and the owner of a chemical company in Chicago, as well as a two-week stint as a cowboy at Ft. Union Ranch in New Mexico.

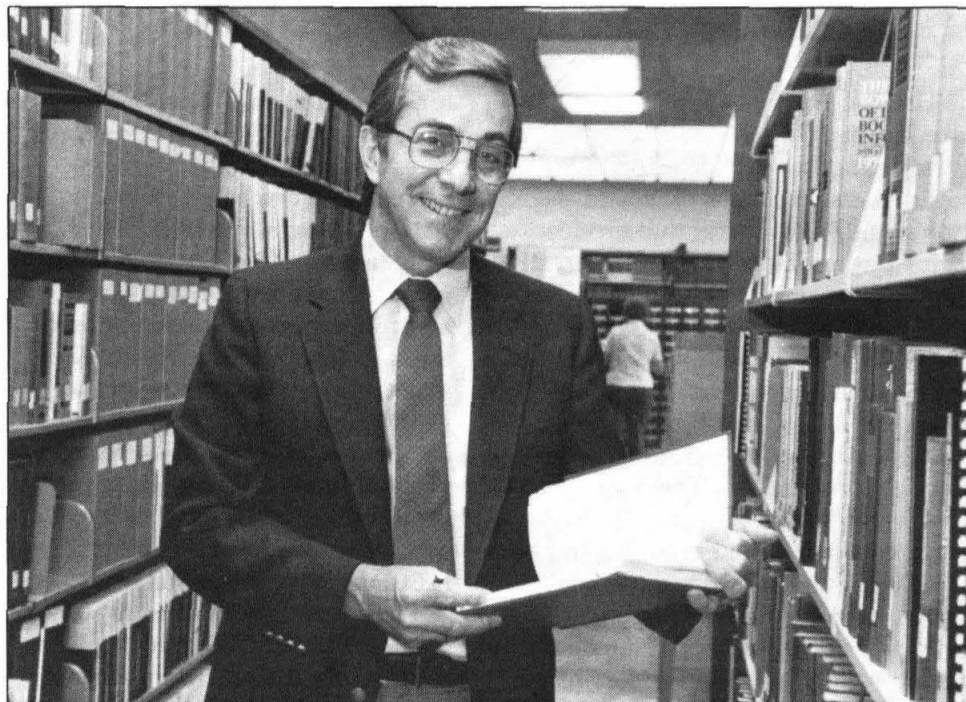
At Caltech, Brennen was at first a postdoc, working with Professor Wu in biological fluid mechanics and on the behavior of tsunamis. Later he joined Allan Acosta in developing a lab for research on problems of pumps for space propulsion machinery — work they are still involved in together. "Chris has made a number of significant contributions in this area of research that are known around the world," Acosta says.

Brennen's current research also includes the problems of three-phase flows — mixtures of air, water, and solid material — problems that he is working on independently at Caltech and JPL. In 1978 he was awarded the R. T. Knapp Award by the Fluids Engineering Division of the American Society of Mechanical Engineering (ASME) for the outstanding paper in fluids engineering in 1976/77, and in 1981 he again received the Knapp Award for his paper on hydraulic systems. In 1982 he was chosen by the Caltech students as one of the seven members of the faculty to receive an award for teaching excellence.

Since the master's job is half-time, and Brennen intends to continue teaching his graduate course in Two Phase Flows, and, of course, to keep up his research, ". . . he's going to be busier than a one-armed paper-hanger," Acosta predicts.

So a new scene begins in the drama of masters at Caltech. Just as other acts bear the individual stamp of the men who were masters here, the new one will have traces of influence from Rainey Endowed School of County Derry, Balliol College, and even the stage of the Oxford Playhouse.

Curtain going up!



Caltech's library system acquires a new mentor

Caltech has created a new position within its library system — that of *director of information resources* — and Glenn L. Brudvig (formerly director of the Bio-Medical Library and director of the Institute of Technology Libraries at the University of Minnesota) has been appointed to fill it.

As head of Caltech's library system, Brudvig has the responsibility for a unique facility — and one that places a heavy emphasis on Caltech's research interests and special strengths. The library does a particularly good job of covering journal literature of interest to students and faculty, says Brudvig. Forty percent of its holdings are bound journals, the director notes.

The library's organizational system — with six divisional libraries in Millikan and ten in other locations on campus — provides a challenge in making information convenient to users. Eventually, Brudvig envisions an automated system that will enable users to locate materials in any of the divisional libraries by going to computer terminals that will be located throughout the campus.

By that time, terminals will have replaced the card catalog as the source for information on the location and availability of books and journals. And eventually the terminals will offer access to journal

bibliographic information. Brudvig anticipates a time when library users with personal computers can build their own information systems by capturing data from the library system.

But he is quick to reassure persons who want their information straight from the printed page that he has no plans in the foreseeable future to replace books or journals with computerized information.

Much of Brudvig's work is less glamorous than developing computerized information technology for the library system. It involves tasks as mundane as deciding which books to keep, which to store — and where to store them — and which to microfilm. And of course it involves taking a long and careful look at the Institute's collections and making plans for new acquisitions.

Although Caltech's collections are strong in the Institute's areas of expertise, Brudvig is identifying some "gaps where we need to bring our basic collections up to baseline." Developing a comprehensive picture of these gaps, and then acquiring the materials, will be a continuing part of his work.

Meanwhile, the humanities collections are expanding into much-needed space on third-floor Millikan, occupying an area originally intended for them but preempted by the Caltech administration after Throop Hall was vacated due to earthquake damage. The administration has now settled into its new quarters in Parsons-Gates Hall of Administration. There is need for still more library space, Brudvig says, but this may be some time in coming.

As the library begins to offer its new information retrieval technology, it will continue with its computer-based cataloging and interlibrary loan system, which is linked by telephone wire to a nationwide computer consortium. This program gives its users access to almost 10 million catalog records across the country.

A second information retrieval service is a computer-based literature-search tool, linked by a telephone line to various national data systems with access to data bases in most subject areas.

Caltech's more traditional information system — the inter-campus station wagon with service between the Institute and USC and UCLA — continues to work well in connecting students with needed resources, and access to collections at the Huntington Library broadens resources for Caltech scholars.

In contrast to most university libraries, where materials are held under tight security, Caltech's library functions largely on the honor system. How well does Brudvig feel this system works?

"It seems to work quite well," he says. "Not many library materials are lost. My experience has been that libraries serving a large amorphous community lose a lot of literature, and that those serving a small community where people know one another do much better. The users at a small institution feel that the library is *theirs*, and that they're sharing it."

As the father of a Caltech alumnus (the Brudvigs' oldest son, Gary, received his PhD in chemistry from Caltech in 1981), the director was well acquainted with the Institute before moving to Pasadena. "I liked the idea of working on a small campus — and the intellectual atmosphere here appealed to me," he says. "I felt that this would be a place where I could make some notable contributions to the Institute — and to the library field itself."

As director of Minnesota's Bio-Medical Library, Brudvig developed automated procedures that put that institution in the forefront of medical libraries in the country. With such expertise in his background, he comes well equipped to make those hoped-for contributions a reality.

Scientists find no evidence for neutrino mass

Continued from page 1

the parameters of other neutrino experiments, including those by CERN and Brookhaven National Laboratory, although there are some differences in the other experiments.

Other members of the scientific team from Caltech, besides Dr. Boehm, are his research associates, J. L. Gimlett, A. A. Hahn, Heemin Kwon, and J. L. Vuilleumier.

Neutrinos are emitted when uranium fissions, so the Caltech—T.U. Munich—Swiss Institute scientists used a 2,800-megawatt power reactor at Gosgen, Switzerland, as their neutrino source. Near the containment building that houses the reactor core they constructed a 1,000-ton concrete bunker. Inside the bunker they installed a sophisticated computerized neutrino detector system.

The system, about a cubic meter in size, consisted of alternate layers of two kinds of particle detectors. One layer consisted of cells of "scintillation liquid," a chemical that produces a tiny flash of light when it interacts with a subatomic particle called a positron. This flash of light is detected by a photomultiplier tube.

The other type of detector is a chamber filled with a helium isotope that interacts with neutrons to produce electrical pulses. These are easily detectable by a network of wires within the chamber.

Although intense streams of neutrinos emerge from the reactor core, only occasionally does one interact with the liquid scintillation counter, resulting in a positron, which produces a flash of light, and a neutron, which is detected in the helium detec-

tor. The detector also contained systems to distinguish reactor core neutrinos from cosmic rays.

Neutrinos come in three forms — electron neutrinos, muon neutrinos, and tau neutrinos. The current experiment was designed to detect electron neutrinos—that is, those that are associated with electrons. The scientists compared the electron neutrino spectrum with what was anticipated based on measurements of the electron spectrum from the reactor core. In this way they could determine whether the reactor core neutrinos undergo oscillation.

The researchers conducted successive studies with the detector placed at 38 and 46 meters from the reactor core, essentially to determine whether giving core neutrinos a better chance to undergo oscillation

would alter the data. It did not.

Although the current experiments gave no evidence for neutrino mass, the scientists have not ruled out the possibility that neutrino mass may exist, Boehm stressed. He said his group at Caltech has begun planning for another experiment that will measure neutrino mass more directly than did the search for oscillations.

Besides its impact on theories of the evolution of the universe, the discovery of neutrino mass would also solve the enigma of the "missing mass" in galaxies. Astronomers have long been puzzled by observations indicating that galaxies of billions of stars appear to have far less mass per light emitted than do individual stars. Similarly, individual galaxies possess less mass per light than do galaxy clusters.

Biologist awarded \$224,000 — tax free, no strings attached

Caltech biophysicist John J. Hopfield has been named the recipient of a \$244,000 tax-free, "no strings attached" MacArthur Foundation Prize Fellow award, one of the world's largest single gifts to individuals.

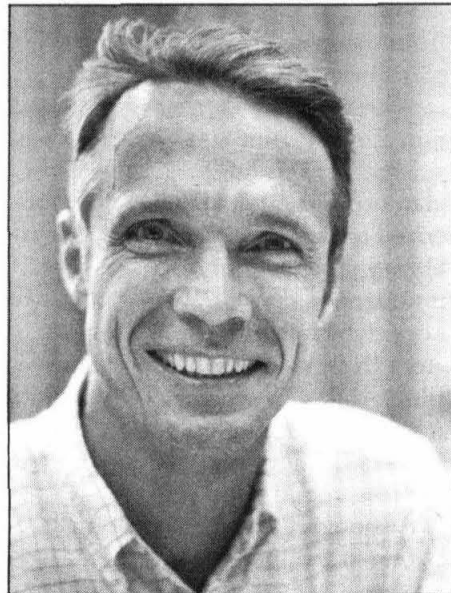
Hopfield, who is Roscoe G. Dickinson Professor of Chemistry and Biology at Caltech, is one of 14 "rugged individualists" selected for awards from the John D. and Catherine T. MacArthur Foundation of Chicago.

Hopfield will use his award to continue his current research — an attempt to understand the relation between structure and function in biological systems. He considers this work a part of his original field of solid state physics.

He has been constructing mathematical models of collections of neurons in an effort to determine how the brain functions as a physical system, believing that it is possible that some of the unique mechanisms of the brain can be incorporated into computers to dramatically change and improve computer capabilities.

The selection process for the MacArthur Fellows is highly confidential.

Applications are not accepted, and nominations are made by "scouts" whose identities are secret, and who are instructed to recommend "pioneers at the frontier of knowledge."



John Hopfield

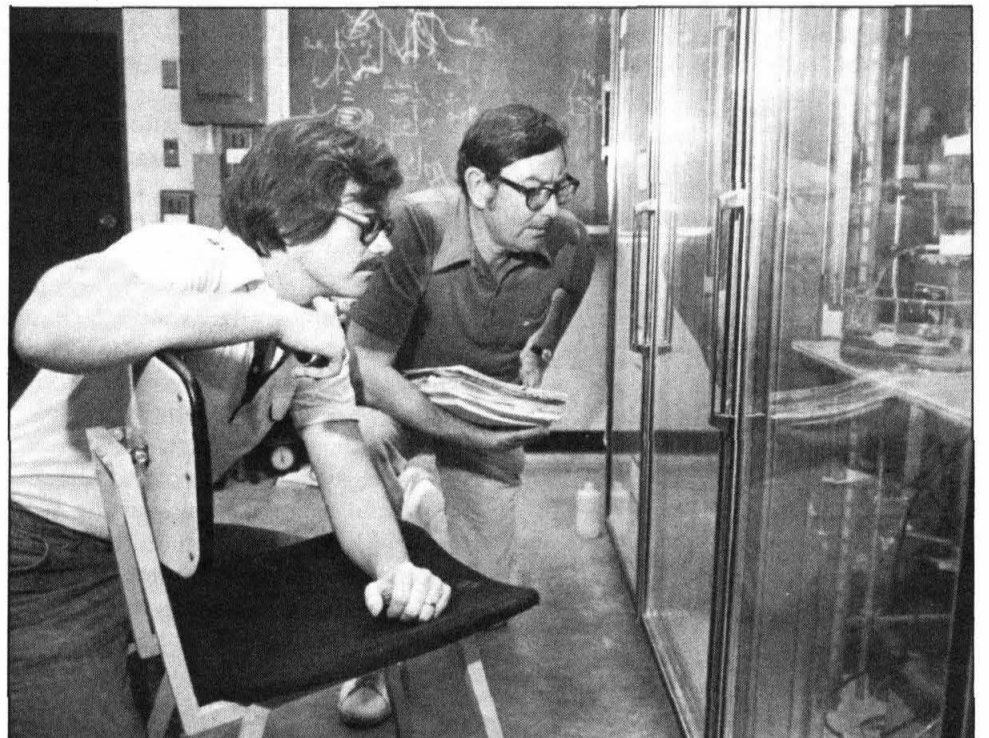
This guideline was inspired by the late John D. MacArthur, founder of the MacArthur Foundation — who preferred "risky betting on individual explorers, while everybody else is off on another track."

Recipients are under no obligation to the foundation to account for how they spend their time or their money. The purpose of the "no strings" aspect of the program is to assure them an adequate and steady income, paid in monthly stipends over a period of five years, in order to relieve them of economic pressure.

Hopfield came to Caltech in 1980 from Princeton University where he was professor of physics for 16 years.

Before that he was on the faculty at UC Berkeley. He earned his AB, with highest honors, from Swarthmore College in 1954, and his PhD at Cornell University in 1958. He was a member of the technical staff of Bell Telephone Laboratories from 1958 to 1960. He is a member of the National Academy of Sciences and of the American Academy of Arts and Sciences.

Biological systems: understanding them better



In Harry Gray's laboratory, Gray (left) and Robert Crutchley monitor the purification of metalloproteins that have been modified through binding metal complexes to their surfaces. The purification is accomplished by ion exchange chromatography. The research contributes to a better understanding of how electrons are transferred within biological systems — important to a more thorough understanding of how the systems work. Gray is the Arnold O. Beckman Professor of Chemistry; Crutchley is a post doctoral research fellow and a member of Gray's research group.

Small freshman class reflects applicant pool shrinkage

A talented swimmer from Colorado Springs, a 13-year-old theoretical physicist from Thousand Oaks, two students from Delta Junction, Alaska, and the daughter of two former Caltech graduate students and postdocs (Paul and Viviane Rupert) are among the 187 members of the class of 1987.

Caltech received applications this year from 1,382 students — and from these, drew the 153 men and 34 women who will make up its freshman class. With 187 members, the freshman class is the smallest since before the admission of women. Nationally, the competition for top students has become more intense as, through demographic trends, the number of young people of college age has declined. The pattern is one that will continue.

Every year, Caltech receives names

through the College Board of students who have scored well in science and math on PSAT tests and who form an applicant pool for the following year, explains Stirling L. Huntley, director of admissions. This coming year, the pool of potential 1984 freshmen will be down 10 percent for men and 20 percent for women — meaning that competition for top students will be even stronger next year than this.

In facing the prospect of a smaller applicant pool for some years to come, the Institute has chosen to admit fewer students, if necessary, rather than to lower its standards. SAT scores of the incoming students showed a slight drop in biology achievement and a rise in math ability. Otherwise they remained consistent with those of previous years: The average aptitude scores of the

new freshmen fell within the top two percent in the nation, and about one third were valedictorians in their high school classes.

Huntley said that the applicants this year continued to focus on computer-related projects as extracurricular science activities rather than more diverse projects. This increases the difficulty in evaluating prospective students with respect to creativity in science.

Of the class members, 38 percent are from California, and 19 percent are from other Western states. Sixteen percent come from the Midwest, 12 percent from the South, 9 percent from the Northeast, and 6 percent from overseas schools. Among these are students from Sweden, Hong Kong, Pakistan, the Philippines, India, and Greece.

Blown fuse aborts SSO experiments aboard Space Shuttle

Two experiments conceived and created by members of Caltech's Student Space Organization for flight on the seventh mission of the Space Shuttle were aborted because of a blown fuse. A three-amp fuse necessary to carry current to the flight computer and thus activate the experiments was replaced before flight with a one-amp fuse — apparently during a safety check at NASA.

None of the students available for comment were at the Cape for the safety check, but they hypothesize that, as the experiments were disassembled and reassembled under NASA inspection, a fuse may have been damaged and that an SSO member replaced it with one of the wrong size from a box containing fuses of several sizes.

The two experiments were created to investigate (1) how seeds respond under conditions of very low artificial gravity, and (2) the formation of alloys away from the effects of the earth's gravity. They were contained in one of a number of Getaway Specials aboard the spacecraft — small canisters made available by NASA to anyone with a legitimate research purpose and \$10,000 to rent the five cubic feet of space.

SSO members Darrell Schlom and Connie Bennit said that Hollywood producer Steven Spielberg — who contributed funding to the project in return for eventual possession of the canister containing the radish experiment — has agreed to let the students keep the canister until after a Space Shuttle flight scheduled for March 1984. Both experiments will be repeated on that flight.

A new experiment, involving growth of crystal cells, is being developed under Schlom's direction for a flight scheduled for late summer 1984.

SSO representatives say that thorough precautions will be taken so that a similar incident cannot occur again.

New pool, locker and weight rooms, take shape

About 350,000 gallons of water will be pumped into the new Caltech pool early in November as part of a testing period for the pumps and the filtering and circulation equipment.

The pool, plus a new women's locker room and a weight room, are being built thanks to a \$700,000 grant, earmarked for athletic facilities, from the Carl F Braun Trust and the Braun Foundation.

The 60 × 70-foot pool is located immediately west of Caltech's existing pool, and is the same size. With a depth of 7½ to 15 feet it will give Caltech a regulation water polo pool and a required safe depth for three-meter diving. The building housing the 375-space women's locker room and the weight room will be next to the new pool on the west.

Estimates are that swimmers can take their first dips by the middle of January.

The O.K. Earl Corporation is general contractor for the project. Nadar, Inc., is responsible for the pool and pool accessories. Nadar partner Walter F. Weiss (BS '57) is particularly happy to be working on a Caltech pool.



Richard Barker and George Johnson of Caltech's Physical Plant department pore over plans for Caltech's new athletic facilities as construction gets under way.

Student affairs staff moves from Dabney to Parsons-Gates

The offices of the student affairs staff in Dabney Hall have moved to Parsons-Gates: financial aid, placement and career planning, secondary school program, graduate office, admissions, registrar, and the deans' and vice president's offices. The transition took place in August.

Some time after the first of the year new tenants from Baxter Hall will settle in the vacated Dabney offices.

High school science classes draw 319 to campus

On campus this summer, 319 high school students from 93 California and 17 out of state schools spent ten weeks taking five-hour-a-day courses in Caltech's summer secondary school science program. This free educational program has been offered by the Institute every summer since 1968, when 22 students were enrolled. This summer students chose from biology, chemistry, physics, and physics with calculus.

Economic issues: how do they influence voters?

By Dennis Meredith

Ever since the first voter cast the first ballot, his choice of candidates has been heavily influenced by "bread and butter" economic issues. Questions of war and peace, scandal, foreign policy, and personality may come and go, but the economy is always there, always exerting a powerful influence on elections.

Thus, political scientists have long tried to understand how economic issues affect elections. In one approach, they've analyzed large-scale voting patterns. But it is the individual voter that interests D. Roderick Kiewiet, Caltech associate professor of political science.

In his book *Macroeconomics & Micropolitics*, published this summer by The University of Chicago Press, Dr. Kiewiet reviews past studies of voter behavior and analyzes the results of extensive voter interviews taken over the last 27 years. His conclusions offer insight into the minds of voters, as well as hints about the outcome of the 1984 presidential election.

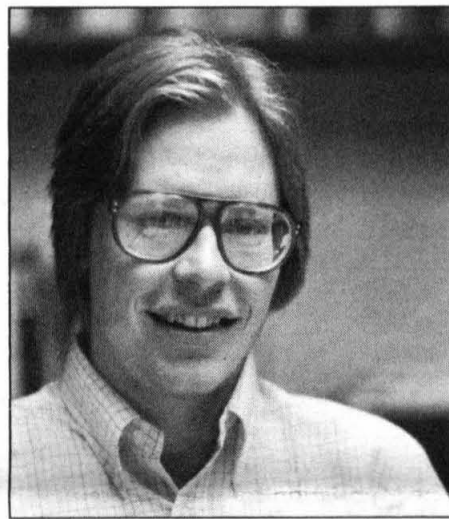
Of the wealth of theories spun by political scientists to explain how voters considering economic issues make decisions, Dr. Kiewiet identifies two key hypotheses. The first of these, called the "incumbency-oriented hypothesis," might also be called the "throw-the-bums-out theory." Basically, says Dr. Kiewiet, it holds that voters tend to vote for incumbent politicians when economic times are good, but against them when times are bad. This theory was inspired primarily by a 1971 paper by Yale researcher Gerald Kramer, and has been the most heavily favored by researchers. (Kramer is now professor of political science at Caltech.)

"The incumbency-oriented theory has a lot going for it," says Dr. Kiewiet. "After all, the incumbent's record is a solid piece of evidence the voter can use in deciding, and the results of his policies are obvious."

However, he says a persuasive alternative view is the "policy-oriented hypothesis," which holds that voters tend to vote for the party whose policies seem most likely to remedy the main economic problem of the day.

"People perceive that traditionally, Democrats tend to worry more about unemployment and Republicans tend to worry more about inflation," says Dr. Kiewiet. "Thus, the policy-oriented hypothesis would predict that people would tend to vote for Democratic candidates during periods of high unemployment and for Republicans during inflationary periods," he says.

But these two theories are not enough to explain what happens inside voters' heads in the voting booth.



D. Roderick Kiewiet

"We also have to understand the type of economic information people rely on when they vote. What is the nature of the economic concerns that move a voter to choose one candidate over another?" Here, Dr. Kiewiet identifies two basic theories that have been supported by evidence from various studies of voting behavior:

"The 'personal experiences' theory holds that people pay greatest attention to what happens to them and vote on the basis of those personal experiences. Whether they lose their job, suffer from cost increases, or see their stocks drop — all these things affect their vote.

"Another theory is the 'national assessments hypothesis.' This theory holds that voters' perceptions of national events and conditions most heavily affect their vote. People are constantly bombarded with economic news on television and in the newspapers. They don't have to pay much attention to understand generally what's going on."

To sort out how voters cast their ballots on economic issues, and what sources of economic information they used, Dr. Kiewiet examined the results of thousands of in-depth voter

interviews compiled by the University of Michigan Center for Political Studies. His results of the studies of 17 national elections will not please those looking for easy answers, but they do offer insight into the complexities of voter behavior.

"Basically, I found solid evidence for all the hypotheses," he said. "At one time or another voters may vote according to either the incumbency-oriented or the policy-oriented hypothesis, or both!" For example, Kiewiet cites the 1980 election, in which Jimmy Carter lost by a landslide.

"In 1980, the economy was sputtering and inflation was running at an historically high rate. Carter lost because people were voting both to 'throw the bum out' and to bring in the Republican Party to cure inflation."

Dr. Kiewiet's studies also showed that people tended to draw their economic information both from personal experiences and from national assessments. Overall, however, he found that voters tend to be influenced more heavily by national assessments, rather than by personal experiences.

"One reason is that voters usually look for causes of their economic fortunes close to home. For instance, they tend to attribute stock losses to bad purchases, or job loss to problems with their company or themselves.

"Of course, I'm not saying that voters selflessly vote for what is good for the country, disregarding their own interests. They can still be concerned about their own well-being and be voting for a booming economy that would likely benefit them."

In applying his theories to the 1984 election, Dr. Kiewiet emphasizes that voting is more than a year away. However, he sees indications that economic issues could favor a Reagan victory.

"Political scientists have found that voters tend to have short-term memories," he says. "Thus, even though the current high unemployment would tend to presage doom for Reagan, it really doesn't. As long as unemployment is trending downward, people will see this as a plus.

"And inflation is so feared that there will be a large reservoir of support for Reagan because the inflationary spiral has slowed."

SURFing time = summer research



Catherine Ifune is involved in research aimed at learning more about hemispheric differences in split-brain monkeys, as a participant in Caltech's Summer Undergraduate Research Fellowship program. Working full time for 10 weeks with Charles Hamilton, senior research associate in biology, she conducted research that she conceived. Students write their own research proposals. Participants receive \$2,400 stipends and faculty sponsors provide lab space and equipment.

Black holes linked to quasar power by Caltech graduate student

The first direct evidence for the widely held theory that quasars are powered by immense whirlpools of gas falling into gigantic black holes has been presented by a Caltech graduate student in astrophysics.

Writing in a recent issue of *The Astrophysical Journal*, Matthew A. Malkan describes measurements of the spectra of ultraviolet, visible, and infrared light from six quasars using a combination of ground-based telescopes and an astronomy satellite.

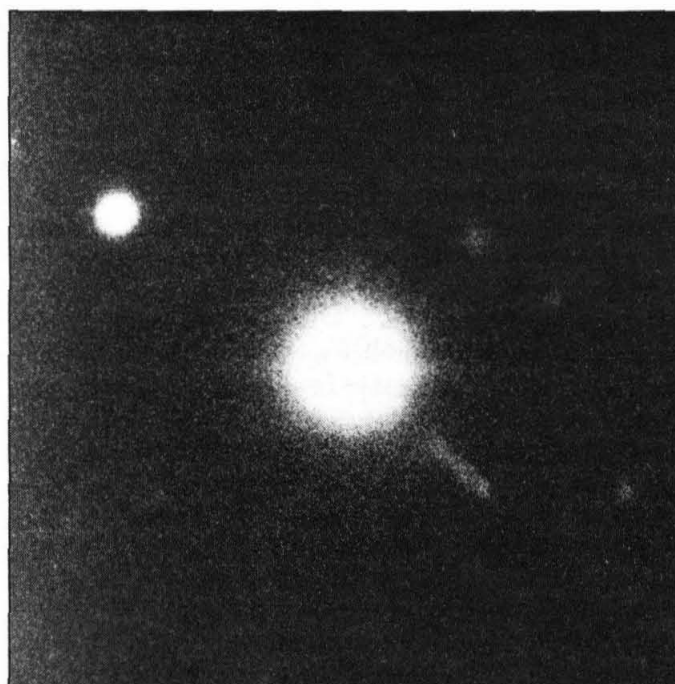
Together, these observations represent the most comprehensive range of wavelengths yet covered in a single set of quasar studies. They are like pieces of a puzzle; individually they can't yield enough information to allow quasars to be understood, but together they constitute a definitive picture.

Malkan found that the observed spectra of the quasars' light agreed perfectly with those predicted by theories that quasars are powered by doughnut-shaped disks of gas spiraling down into immense black holes, some the mass of several billion suns. The largest of these would consume the mass equivalent of ten of our suns per year.

Quasars are by far the brightest objects in the universe, emitting the energy equivalent of a thousand galaxies of stars, even though they appear no larger than our own solar system. The most distant ones are billions of light years from earth.

Since the discovery of quasars two decades ago, astronomers have tried to explain how they could spew forth such enormous amounts of energy. Their emissions were so powerful that not even thermonuclear fusion, the energy source of the sun and other stars, could explain them. Even fusion was about 1,000 times too

Quasars: the source of their power has long been a mystery to scientists.



inefficient an energy source to explain the brilliance of the quasars.

The most popular theory for the energy has been that the cores of quasars are occupied by immense black holes — matter that has collapsed into such density that its gravity allows nothing that comes close to it, not even light, to escape.

But before trapped matter reaches this point of no return, it has been caught up in a gigantic, rolling whirlpool called an accretion disk that rings the hole. Friction among the gas streams in this whirlpool heats the gas to temperatures of tens of thousands of degrees as it spirals toward the hole. During this fiery plunge, the gas radiates prodigiously at ultraviolet wavelengths.

"The basic idea of a quasar as a big black hole with gas spiraling into it has been around about a decade," says Malkan. "But the theory had never been previously applied to observations of quasars, mainly because it has only recently been possible to put together quasar observations at a wide range of wavelengths."

In his article, Malkan describes observations of six distant quasars, those with sky coordinates 0302-223, 0405-123, 1421+330, 1435+638, 1011-250, and 1226-023.

The first three of these were studied by Malkan using NASA's In-

ternational Ultraviolet Explorer for the ultraviolet spectra, Caltech's 200-inch Hale Telescope and 60-inch telescope at Palomar Observatory for visible spectra, and the 100-inch Hooker Telescope at Mount Wilson for infrared studies. Data on the last three quasars were obtained from a number of previous studies.

The foundation for the most recent study was laid in research described in an earlier paper in the March 1982 *Astrophysical Journal* by Malkan and Wallace L. W. Sargent, the Ira S. Bowen Professor of Astronomy. In this paper, Malkan and Sargent reported on the striking similarities between energy distributions of quasars and those of Seyfert galaxies. The Seyfert galaxies are tens of thousands of times less luminous than the quasars but they also appear to be powered by somewhat smaller black holes.

In analyzing light from quasars, Malkan was able to measure the total amount of energy that the quasars emitted. From this measure, he deducted the rate at which the black hole is consuming fuel. Then he estimated the average temperature of the infalling gas by observing at which ultraviolet wavelengths the quasar was brightest. This temperature is dependent on the strength of the gravitational field in which the gas is moving, and thus yields the mass of the quasar's black hole.

"Although the paper only discusses six quasars, there is little doubt that the theory will apply to all of these objects," said Malkan. "Preliminary examinations in the scientific literature of a wide range of quasars indicate that they all have the same characteristic spectrum."

Malkan's research was sponsored by NASA and the Fannie and John Hertz Foundation.

Edward Lewis lauded for contributions to genetics

Edward B. Lewis (PhD '42), the Thomas Hunt Morgan Professor of Biology, has been awarded the Thomas Hunt Morgan Medal of the Genetics Society of America, in recognition of his lifetime contributions to genetics.

Lewis's research has concentrated on the fruit fly, *Drosophila*. He has focused on analysis of "complex loci," that is, genes that are closely linked together on the chromosomes and have a similar function.

"His analysis contributed significantly to our understanding of how new genes evolve, how the genetic material is affected by spatial relation to other genes, and how genes function during development," said the society's statement on the award.

The professorship that Lewis holds is named in honor of the Nobel Prize-winning Caltech biologist who used the fruit fly to develop the basic theory of the chromosome as the basis of heredity.

Harry Gray honored by ACS for research achievement

Harry B. Gray (chairman of the Division of Chemistry and Chemical Engineering and the Arnold O. Beckman Professor of Chemistry) is recipient of the American Chemical Society's Award for Distinguished Service in the Advancement of Inorganic Chemistry.

He is honored for his accomplishments in several areas, including inorganic photochemistry (which may contribute to making solar energy more economical) and electron transfer in metalloproteins. The \$3,000 award, sponsored by Mallinckrodt, Inc., will be presented at the ACS 187th national meeting in April.

By Winifred Veronda

Arne Kalm (BS '56, MS '57) alleges that he may have been one of the few members of his class who entered Caltech convinced that he knew what he wanted to be. As a sixteen-year-old, Kalm had no doubts that he would become a civil engineer, involved in the building industry.

Kalm didn't dream as a freshman how his career plans would change. Graduating with a BS degree in civil engineering, he returned the following year for his MS in the same field. But meanwhile his goals shifted, "partly because of Horace Gilbert's economics course." He had begun to consider a career in business.

A recruiter from the Harvard MBA program with whom Kalm consulted recommended two years' work experience before enrollment there, and Kalm went into a management development program with Procter & Gamble in Long Beach.

"Procter & Gamble offered a lot of enticement to a graduate who wanted immediate responsibility, and not two years of rotating while he learned what everyone else did," he explains.

After completing two years with P & G, Kalm enrolled in the Harvard MBA program, and he has been involved in corporate management roles ever since in a career that he says has been characterized by "moving to progressively smaller organizations.

"I soon realized that I'm not a person for a big organization," he says. "I want the feel of the big picture. Almost every Harvard MBA emerges this way. We'd rather be at the top, making the decisions."

Kalm started his move toward smaller companies with a four-year stint in one of the largest — TRW. Then he was with Sunset International Petroleum for four years, acquiring his first taste of the oil business and of corporate planning and acquisitions. Over the next 15 years this would become his specialty.

Ten years ago, Kalm joined forces with the Berry family, which was looking for someone to manage its

Arne Kalm sets goals for Alumni Association:

maintain continuity,
expand the franchise

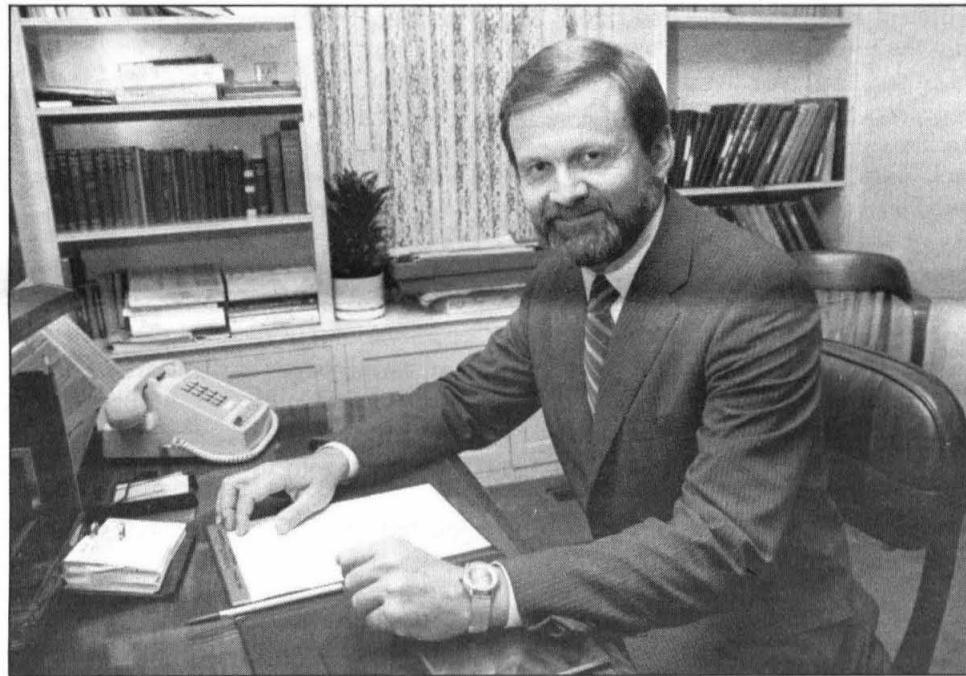
program of diversification. He is now president of Berry Industries Corporation, a public company listed on the American Stock Exchange, but with a family-owned controlling interest.

The company has been developed by 12 acquisitions since 1974. It is involved in geophysical services — processing and interpreting data and selling results to individuals in the oil business — and also in the development of oil field production equip-

and he says he has drawn on his Caltech education ever since he graduated, even though he went on to make his career in another area.

"At Caltech I was given the best possible analytical training," he says, "including a rigorous grounding in objectivity and a set of problem-solving tools that can be applied in any situation."

The father of three adult children, he lives with his wife in Arcadia, and he says that a move to that commu-



ment used at the surface to separate hydrocarbons into oil, gas, and water. The corporate headquarters were moved to a new building in Santa Fe Springs from Long Beach about a year ago.

A native of Estonia, Kalm came to the United States with his grandfather when he was nine as his country was being absorbed by the Soviet Union. This takeover claimed his father's life. He was active for many years in Estonian-American activities and in ethnic politics and in work for various captive nations groups.

A high school teacher in Oakland turned his thoughts toward Caltech,

nity eight years ago coincided with his renewed involvement with Caltech and its activities.

That year he was asked to work for the Alumni Fund. He refused, but was asked again the following year and accepted. Three years later, in 1979, he was named Alumni Fund national chairman.

At this point he became one of only a few alumni who have found themselves ascending two volunteer organizational ladders at the Institute at the same time. In 1979 he was asked by a neighbor, John Fee, to join the Alumni Association Board of Directors, and in June 1983 he was installed as its president.

As Alumni Association president, Kalm says he wants, first of all, to "maintain the continuity of existing programs. They're well attended and generally sold out in southern California. However I want to expand the franchise. As our alumni population has grown, we've developed a need to involve alumni from all over

the country in our programs. Chapter activities are one way to create this involvement."

But alumni want more than involvement in chapter activities; they want to work for the Institute in their home areas, Kalm believes. For example, "Some alumni particularly enjoy working with young people," he says. "We've had a high school relations program for many years, one that gives volunteers in different parts of the country the chance to talk to high school faculty members or students about the Institute.

"Such a contribution is particularly needed now as the number of potential applicants to Caltech is declining because of demographic patterns throughout the country.

"This is one way alumni can help. It is important to be able to offer other assignments that are challenging and that support the legitimate aspirations of the Institute. Creating programs for this kind of involvement should be a priority of the Alumni Association."

John Fee (BS '51), the man who asked Kalm to climb onto the Alumni Association ladder, describes the new president as "responsible, hard working, and dedicated. He's serious — and fun. He can see the lighter side of life, and he has a humorous comment on almost any subject."

Some of the fun that Kalm gets from involvement with the Alumni Association is the chance to "interact with people whose work is different from those I deal with every day: high tech alumni in a variety of endeavors. My business friends are mostly bankers and investors.

"There's also the chance to talk with faculty members; they're very approachable, and as interested in alumni affairs as I am. It is stimulating to be a part of the Caltech community, and a wonderful experience to be involved with the kind of people who are here."

The Way It Was

1938

Almost 400 alumni return to campus for the first Alumni Seminar Day weekend, according to the Pasadena *Star-News* on March 5. The event, intended to be annual, is so successful that many classrooms overflow.

Shocked by the bombing of civilians by his one-time friends, the Japanese, James A. B. Sherer, former president of Caltech, urges immediate action by Congress to stop all shipment of supplies to Japan, according to the Pasadena *Star-News* on June 6. Sherer has lived in Japan for 20 years and written extensively about the country.

Dedication of the William G. Kerckhoff Laboratories of Biological Sciences — the second unit of which has just been completed — was held on June 10, notes the Pasadena *Post* the following day. Mrs. Kerckhoff was present to witness the culmination of a dream — completion of a million-dollar laboratory "for the benefit of mankind."

"My main interest is getting acquainted with our new students," notes Mrs. Robert A. Millikan, wife of the chairman of Caltech's Executive Council, in an interview in the *Star-News* on October 7. There are 160 in the freshman class this winter and the Millikans invite them in groups of 30 to their home for supper, relates the *Star-News*.

Echoes of Tuesday's flat-tire incident at Caltech when the air was let out of two police motorcycles have been heard on the campus as the result of a stiff statement issued by Lt. C. H. Morris, head of the Pasadena Police Department's traffic division, according to the Pasadena *Post* on October 14. While two officers were inspecting cars in the Caltech neighborhood, and issuing citations to 20 of these for defective equipment, pranksters deflated their motorcycle tires and made off with the gasoline caps. Caltech students had previously protested the inspection.

1948

By spring, southern California will be only 25 miles from the moon, notes the Los Angeles *Examiner* on January 2. This will happen when the 200-inch telescope becomes operable. In November, the mirror was ground to 14½ tons, polished to within two millionths of an inch of perfect smoothness, and carted to its mountain home. A few weeks later, Ira



At Palomar, Robert A. Millikan (left) and John A. Anderson inspect progress as preparations are made for the first photographs by the 200-inch Hale Telescope. Anderson, for many years executive officer of Caltech's Observatory Council, helped to supervise construction of the 200-inch.

Bowen, director of Mount Wilson Observatory, reports in the San Diego *Tribune* that "the big eye atop Palomar has blinked at the heavens and taken its first pictures." "Just stars" were photographed, he notes, ". . . whatever stars were in the best position at the time."

J. E. Wallace Sterling, the Edward S. Harkness Professor of History and Government, will become director of the Huntington Library and Art Gallery on July 1, reports the *Star-News* on March 7.

More than 300 friends of Robert Millikan pay homage to the Nobel laureate and physicist at the California Club on the occasion of his 80th birthday, relates the *Star-News* on March 16. Millikan discloses that the Institute (with JPL) supplied the Armed Forces during World War II with more than 90 percent of its

rocket weapons. He estimates Caltech's wartime contribution at more than 100 million dollars.

Caltech announces the launching of a 15- to 20-year program that will enlist biologists, chemists, and physicists in an all-out attack on the basic unsolved problems of their sciences. Knowledge of the genes, basic studies of miracle drugs that stop bacterial growth, insight into why certain cells combine to become an eye while others that are genetically identical become an arm, and the nature of the chemical processes occurring in matter will be the focus of the search, according to the *Times* on March 29.

1958

Caltech scientists played a vital role in the successful launching of the first U.S. satellite, the *Explorer*. After the combined efforts of JPL and the Army Ballistic Missile Agency, a launching vehicle shot the satellite into space on January 31, according to February *Engineering & Science* magazine.

Linus Pauling acts as spokesman for more than 9,000 scientists when he presents a petition opposing nuclear weapons tests to Dag Hammarskjöld, secretary general of the United Nations. Signers include 36 Nobel Prize winners, 101 members of the National Academy of Sciences, 216 members of the Soviet Academy of Sciences, and 35 members of the Royal Society of London, notes *E & S* in February.

George W. Beadle, chairman of Caltech's Division of Biological Sciences, is one of three U.S. scientists to be awarded the 1958 Nobel Prize in medicine. All three are honored for achievement in biochemical genetics, reports *E & S* in November.

Two of the 16 buildings that (along with increased faculty salaries) are the goal of Caltech's \$16,000,000 development program have been assured by recent gifts, reports *E & S* in December. A gift of \$350,000 from Gordon A. Alles of Pasadena means that a major addition to the facilities of the biology division can now be built. And a gift of \$335,000 from P.G. Winnett of Los Angeles will provide the Institute with its first student activities center.

ALUMNI ASSOCIATION OFFICERS AND DIRECTORS

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SAN DIEGO CHAPTER
Contact David E. Groce
8243 Prestwick Drive, La Jolla, CA 92037

SACRAMENTO CHAPTER
President Melvin E. Holland
4141 Stowe Way, Sacramento, CA 95825

Meetings: Second Friday of each month, September through June, Mansion Inn, 16th and H Streets, Sacramento. Informal luncheon, visiting alumni welcome, no reservation needed.

SAN FRANCISCO CHAPTER
President Ben G. Burke
919 Carl Road, Lafayette, CA 94549

San Francisco Peninsula Luncheons: Ming's Restaurant, Palo Alto, third Thursday of every month at 12 noon. Call Hugh Dubb, 415/362/3800 or 408/287/8278.

SANTA CRUZ CHAPTER
Luncheon meetings are held each month on the second Thursday at the Hollins House on Pasatiempo golf course at 12 noon. Reservations can be made by calling Don Cleveland at 426-9322.

SEATTLE CHAPTER
Contact Guy Chambers
5065 Lakehurst Lane, Bellevue, WA 98006

WASHINGTON, D.C., CHAPTER
Contacts John T. Cookson
7508 Masters Drive, Potomac, MD 20854
or Michael B. Wilson
3119 Homewood Parkway, Kensington, MD 20795

Volunteers honored for superb achievement in 1982-83 Alumni Fund effort

Alumni fund area chairman Ken Kamm (BS '69) and Fred Tenney (BS '43) received top honors for overall achievement during 1982-83 at the Alumni Fund Leadership Conference at Caltech in August. About 50 volunteers from throughout the country attended the program, designed to help Fund leaders present Caltech's needs in their contacts with other graduates.

Attend the annual Rose Parade Special

Make plans now to attend the annual Rose Parade Special. The traditional program features Continental breakfast in the Athenaeum, 7:30 — 9:30 a.m.; a walk to Colorado Boulevard to view the parade from reserved seats, 9:30-11:15 a.m. buffet lunch in the Athenaeum, or bus to the Rose Bowl with a box lunch, 12 noon. Prices will be announced.

Caltech Day attracts 160 to day-long Bay Area program

Caltech alumni in the Bay Area came together September 10 for a successful Caltech Day program featuring research seminars, a workshop for Alumni Fund workers, and an after-dinner talk by JPL Director Lew Allen. In all, 160 attended the day program and 110, the dinner.

A Bay Area alumni committee who made arrangements for the event included Ben G. Burke (BS '61, MS '62), Hubert Dubb (BS '56), Reuben B. Moulton (BS '57), Harrison W. Sigworth (BS '44), Adrian C. (Chip) Smith (BS '70), and Thomas A. Tisch (BS '61).

Tenney, a new area chairman, received a Rookie-of-the-Year award for obtaining gifts from 44 percent of the alumni in his area — Princeton. With the help of 9 volunteers, Tenney boosted participation from Princeton from last year's 19 percent.

Kamm, from the Wilmington-Philadelphia area, with six volunteers, earned a Pro-of-the-Year award for increasing participation from 18 percent to 51 percent.

Bill Woodson (BS '48, MS '49) was honored for a high percentage of participation (63 percent) in his area — TRW — as were Don Stewart (BS '52, MS '53), Pomona-Claremont, with 52 percent; and Ken Kamm (BS '69), Wilmington-Philadelphia, with 51 percent.

Twelve area chairmen were recognized for improving participation in their areas: Bob Tookey (MS '45), Northeast Pasadena, from 14 to 39 percent; Nigel Brown (MS '51), Santa Barbara, from 12 to 35 percent; William Frampton, (BS '39), Bakersfield, from 24 to 49 percent; Gene Nelson (BS '56), Stanford, from 5 to 14 percent; Clint West (BS '57), Sierra, from 0 to 38 percent; Frank Woodward (Eng '52), North Sound, Alaska, from 0 to 27 percent; Frank Albin, (BS '58, MS '59, PhD '62), Big Sky, from 0 to 35 percent; Allen Ormsbee (PhD '55), Champaign-Urbana, from 18 to 51 percent; Ken Kamm (BS '69), Wilmington-Phila-

delphia, from 20 to 46 percent; Fred Tenney (BS '43), Princeton, from 19 to 44 percent; and Bruce Brown (MS '47, PhD '50), Northern New Jersey, from 12 to 36 percent.

Honored for achieving the best ratio of workers to prospects (smallest number of prospects for each worker to contact) were seven area chairmen: Larry Ford (PhD '74), West Michigan; Mike Mytels (MS '68), Menlo Park; Ed Foss (BS '32), Rancho Santa Fe; Ray Richards (BS '40), East San Fernando; Miles Nesman (BS '55), Aerospace; Dan Markoff (BS '50), San Luis Obispo; Bill Woodson (BS '48, MS '49), TRW.

John D. Roberts, the Institute Professor of Chemistry and formerly Caltech provost, spoke at the dinner meeting on "Recollections of Caltech." At lunch, A. Roy Menzies, director of career planning and management internships, the USC Graduate School of Business Administration, spoke to the area chairmen on "What Do I Have to Do and How Much Time Does It Take?"

During the morning and afternoon sessions, participants were involved in workshops to help them present Caltech's needs. A tour of the Institute's radio telescope facility and a presentation by students in the Summer Undergraduate Research Fellowship (SURF) program were features of the day.

Alumni Fund announces 1983-84 area chairmen

Alumni Fund area chairmen for 1982-83 are listed below, according to their geographic regions. Additional area chairmen will be announced in the December issue.

Region 1, Caltech and vicinity, Robert Brydolf, BS '44, chairman; William L. Deniston, BS '41, Alhambra-South Pasadena; Eugene Dryden, BS '55, MS '56, San Marino; Brian Muirhead, BS '82, South Central Pasadena; Robert Brydolf, BS '44, East Pasadena; Sidney K. Gally, BS '41, Northeast Pasadena; Frank Dryden, BS '54, MS '57, Arroyo; Raymond L. Heacock, BS '52, MS '53, JPL; Harold B. Crockett, MS '40, La Canada-Crescenta Valley; Robert M. Worlock, PhD '58, Altadena; David Kofahl, Ex '44, Arcadia-Sierra Madre.

Region 2, South Coast counties, Donald E. Stewart, BS '52, MS '53, chairman; Calvin E. Kempton, BS '46, Laguna Beach; Frances Janssen, BS '75, MS '77, Huntington Beach; Ross Buchanan, BS '44, Anaheim; A.E. Thompson, BS '34, Newport Beach; F.L. Aldrich, MS '47, Irvine-El Toro; Paul W. Tuinenga, BS '77, MS '78, Santa Ana; Martin J. Gould, PhD '41, Long Beach; Phillip G. Cook, MS '50, Downey-Whittier; David B. McCarroll, BS '66, Covina; Donald Stewart, Jr., BS '47, Pomona-Claremont; Frank Fleck, BS '42, desert communities; Max S. Kreston, BS '50, Riverside-San Bernardino; John A. Morgan, BS '45, South Laguna Beach.

Region 3, Western Los Angeles, Gordon B. Weir, BS '40, MS '41, chairman; Reinaldo V. Gutierrez, BS '54, Palos Verdes; Paul Dergarabedian, PhD '52, Aerospace Corporation; Carl P. Constanten, BS '72, MS '73, Torrance; Alfred P. Fay, BS '48, TRW; Gene H. Beisman, BS '58, Santa Monica; William B. Hicks, BS '42, Los Angeles-Beverly Hills; Joseph Solomon, BS '44, Los Angeles-Holly-

Yes, but do you know about the others?



Legends of Caltech tells (almost) all

The long-awaited publication *Legends of Caltech*, a collection of the best of Caltech pranks contributed by alumni and published by the Alumni Association, will be ready in late November. Order now for Christmas.

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wood; David S. Rathje, BS '51, Marina Del Rey, Los Angeles-Brentwood, and Los Angeles-downtown; Stephen D. Flanagin, BS '76, UCLA.

Region 4, Central Coast counties, Terry G. Allen, BS '67, chairman; Raymond G. Richards, BS '40, East San Fernando Valley; Satish Desai, MS '65, PhD '69, South San Fernando Valley; Paul K. Salzman, PhD '71, West San Fernando Valley; Robert O'Connell, PhD '70, North San Fernando Valley; John F. McClain, Jr., BS '42, Ventura-Thousand Oaks; Nigel P. Brown, MS '51, Santa Barbara, Bakersfield; Dan Markoff, BS '50, San Luis Obispo.

Region 5, San Francisco, Donald L. Cleveland, BS '34, chairman; Carroll Baker, BS '36, Monterey-Santa Cruz; Murray Hill, MS '69, PhD '73, San Jose; Robert M. Spencer, BS '72, Santa Clara; Fred C. Schneider, BS '49, Los Altos; Gregory W. Evans, BS '69, Sunnyvale; Evan Hughes, BS '62, MS '63, PhD '69, Palo Alto; Eugene A. Nelson, BS '56, Stanford; Michael Mytels, MS '68, Menlo Park; Reuben B. Moulton, BS '57, San Mateo; Bill Birdsey BS'34, San Francisco.

Region 6, East Bay-Northern California, Weldon H. Jackson, BS '54, chairman; Thomas V. Tarbet, BS '31, MS '32, Marin County; Willard Richards, BS '54, Napa-North Coast; Norman Bulman, PhD '52, Contra Costa; Don K. Jephcott, BS '42, Sacramento; Clinton West, BS '57, Sierra.

Region 7, Southwestern-Sun Belt, Carleton B. Moore, PhD '60, chairman; Robert E. Foss, BS '32, Rancho Santa Fe; Thomas E. Oberjat, BS '66, North San Diego County; George P. Rigsby, BS '48, MS '50, PhD '53, San Diego; Mabry Van Reed, BS '35, La Jolla; Lang Lao, BS '76, MS '76, South Bay-San Diego; C. Croxall LeGrand, BS '40, Hawaii; W. Clifford Taylor, BS '46, Phoenix; Larry A. Lebofsky, BS '69, Tucson; Dave Kauffman, BS '62, MS '63, Albuquerque.

Region 8, Northwest, Frank A. Woodward, Eng '52, chairman; Vernon P. Jaeger, Ex '27, Portland; George S. Fenn, BS '45, MS '46, Corvallis-Eugene; Frederick W. Thiele, BS '41, Seattle; Richard G. Merritt, MS '51, MS '53, Boeing; Eliot A. Butler, BS '52, PhD '56, Utah; James H. Whitcomb, PhD '73, Boulder; Thomas K. Bjorklund, BS '60, Denver.

Region 9, South, Lawrence C. Widdoes, BS '41, chairman; David Atkinson, BS '75, Oklahoma-Arkansas; Don Hook, BS '54, Dallas; Walter L. Moore, BS '37, MS '38, Austin-Fort Worth; Thor P. Hanson, BS '64, Old Houston; James R.

Lloyd, BS '56, MS '57, PhD '62, New Houston; Dean Rains, BS '50, MS '51, PhD '54, Louisiana; David K. Erwin, PhD '79, Tennessee-Alabama; D.M.W. Lindquist, Eng '60, North Florida; Arthur S. Bolles, BS '47, South Florida; Arthur J. Koblasz, MS '73, PhD '77, Georgia; William V. Wright, BS '51, PhD '55, North Carolina.

Region 10, Midwest, J. Christopher Dalton, BS '65, chairman; Ray Cosner, PhD '76, Missouri-South Illinois; George R. Dubes, PhD '53, Central Plains states; Peter A. Howell, BS '50, Minnesota; David R. Witwer, MS '75, Northeast Chicago; Robert D. Levin, BS '65, Southwest Chicago; Allen Ormsbee, PhD '55, Champaign-Urbana; James H. Koontz, BS '56, Indiana; Lawrence C. Ford, PhD '74, West Michigan; Don Peterson, PhD '55, East Michigan; Edward A. Cuellar, BS '76, Cleveland; John S. Jackson, BS '45, MS '54, Cincinnati; Fran C. McMichael, MS '59, West Pennsylvania.

Region 11, Mid Atlantic, E.T. Grinthal, PhD '69, chairman; Fred C. Brunner, BS '40, MS '41, Baltimore; Edward P. Myers, MS '69, PhD '74, East Maryland, District of Columbia; Brian C. Belanger, BS '63, West Maryland, District of Columbia; Richard I. Schoen, BS '49, Northwest Virginia; John S. Showell, BS '46, MS '49, Northeast Virginia; Rex B. Cherryman, Ex '46, South Virginia; Ken S. Lamm, BS '69, Wilmington-Philadelphia; A. Frederick Thompson, MS '65, PhD '68, Eastern Pennsylvania; Frederick H. Tenney, BS '43, Princeton; Alfred B. Brown, Jr., MS '47, PhD '50, Northern New Jersey; Kenneth F. Drake, Jr., BS '71, Central New Jersey.

Region 12, New York and New England, Claude Alan Beagle, BS '70, chairman; Kenneth N. Easley, MS '60, Long Island; Ronald S. Douglass, BS '66, MS '67, Southeastern New York; Donald P. Clausing, MS '62, PhD '66, Western New York; Del C. McCune, BS '56, Central New York; Robert N. Hall, BS '42, PhD '48, Eastern New York; J. Kelly Beatty, BS '73, Northeast Massachusetts; Norton Starr, Ex '58, Southeastern Massachusetts; George C. Munro, PhD '33, Upper New England.

John B. Nelson, BS '44, international alumni.

Caltech alumnus aboard Space Shuttle as scientist-astronaut

Robert Parker (PhD '63), scientist-astronaut, was scheduled for launch on October 28 aboard the ninth Space Shuttle mission. Landing was anticipated, after seven days, at Edwards Air Force Base.

Parker — then with the department of astronomy at the University of Wisconsin — was named to the astronaut program in 1967. He became the sixth. Caltech alumnus to join the program. Preceding him were Frank Borman (MS '57), Edward G. Gibson (MS '60, PhD '64), F. Curtis Michel (BS '55, PhD '62), and Harrison Schmitt (BS '57). C. Gordon Fullerton (BS '57, MS '58) traveled aboard the Columbia in 1982.

ALUMNI ASSOCIATION PROGRAM SCHEDULE

The Alumni Association would like to know which of the programs that it has planned for the coming year are of interest to you. Please study the program schedule and return it to the Alumni Office with the programs circled about which you would like information.

Programs	Status
Mt. St. Helens I August 19-22, 1983	Completed
Caltech Day (San Francisco) September 10, 1983	Completed
Mt. St. Helens II September 21-26, 1983	Completed
Hawaii Volcanoes Trip November 13-19, 1983	Limited Space Available
Rose Parade Program January 2, 1984	Space Available
Wine Tasting March 2, 1984	Space Available
Huntington Library Tour April 7, 1984	Space Available
Seminar Day May 19, 1984	Space Available
Yellowstone-Grand Teton Trip June 24-30, 1984	Space Available

Proposed Programs

Palomar Tour
Spring 1984

Gourmet Dinner at Alumni House
July 1984

Please send me information on the programs I have circled above as soon as it is available.

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Obituaries

1920

HARVEY W. HOUSE, MS '26, on May 22. He was retired and living in Pasadena with his wife, Geraldine. He had been a consultant with Interpace Corporation in Los Angeles, previously with R&D International Pipe and Ceramics in Los Angeles.

1921

LOUIS KORN on April 26. He had retired as a consulting architect and planner and had been living in Los Angeles. He had been very active in volunteer services for the city and had been appointed to several commissions.

1928

WILLIAM M. GOODALL on May 5. He had been an electronics engineer with the U.S. Army Electronics Command in Ft. Monmouth, New Jersey, and in recent years was a consultant in that field.

CHARLES HISSERICH in December 1981. He had been manager of the electronic division of H.W. Wright Company in Costa Mesa, California, before his retirement.

1929

WILLIAM L. BERRY on March 30. He had worked for the California Department of Water Resources since 1938 and has been called the "father of the California Water Project." He was one of two state officials assigned to advise Chile on water resources in 1964, and he worked on the Maule River development program while in South America. He became chief of planning for the Department before retiring in 1968. After retirement, Berry spent two years as an international water consultant with the United Nations development program. He is survived by his wife, Hazel, of Sacramento, two sons, and nine grandchildren.

C. ALLEN GARDENER, Ex, in August 1982. He had retired from his position as research engineer and design specialist with Lockheed Aircraft, and was living in North Hollywood, California.

1932

WILLIAM SCHULTZ. He had retired as superintendent of the ice and precooling plant for the Santa Fe Railroad in San Bernardino, California.

1935

GREER W. FERVER on April 17 of a heart attack. He was president of Ferver Engineering Company in San Diego, California,

and an internationally recognized authority on seismic engineering relating to earthquake safety. He joined National Iron Works in San Diego in 1940 and served as chief engineer until 1955, when he left to work with Associated Architects & Engineers. In 1960 he formed Ferver, Dorland & Associates with Robert Dorland, changing the company name in 1970. Ferver served on professional committees dedicated to seismic safety, including the California Governor's Earthquake Council and the seismology committee of the Structural Engineers Association of California. He is survived by his wife, Virginia, a son, a daughter, and three grandchildren.

1936

BRIG. GEN. DON Z. ZIMMERMAN, MS, on May 11. A meteorologist and educator who helped to shape the modern U.S. Air Force, he was the first director of weather for the Army Air Corps and the first dean of faculty at the Air Force Academy. He took the first command of the Air Weather Service at Army Air Force Headquarters in Washington, D.C., and was one of the first members of the high-level Advanced Study Group, a rotating triad of the military's leading theorists who advise the President and Joint Chiefs of Staff on the future of national defense. His book *Weather Manual for Pilots*, written in 1939, was the standard text on weather for many years and portions of it are still used in pilot training. Upon his retirement from the Air Force in 1958, he moved to Mercer Island, Washington, where he was a consultant to the Boeing Company. He is survived by his wife, Marion, a daughter, and a son.

1938

MAJ. GEN. RET. SAMUEL S. JACK, MS. He had retired from the U.S. Marine Corps and was living in La Jolla, California.

1940

ISYDOR HLYNKA, PhD, on May 18. One of Canada's outstanding cereal chemists, he was an adjunct professor in the department of plant science, and a member of the board of St. Andrew's College. He is survived by his wife, Olga, and two sons.

1945

ELDON C. BEAGLE on June 23 of natural causes in Dhaka, Bangladesh, while on a consulting project for the Asian Development Bank. Known internationally as a rice-processing and biomass energy consultant, he was the author of many technical papers and of a book, *Rice-Husk Conversion to Energy*, published in 1978. Between 1945 and 1974 Beagle owned and managed a family business based in West Sacramento, California, that developed processes, technologies, patents, marketing and production of rice-husk products on a commercial basis. He constructed or designed nearly all the major rice by-product plants in use today in California. In the past ten years, Beagle had served as a consultant for the United Nations Industrial Development Organization, Food and Agricultural Organization of the United Nations, as well as other organizations, and the governments of Uruguay, Malaysia, and Pakistan. He is survived by his wife, Virginia, and four children.

1951

STUART CAVERS, PhD, on May 27. He was professor of chemical engineering at the University of British Columbia.

H. KENDALL REYNOLDS, MS, PhD '53, on November 10, 1982, of complications following cancer surgery. He was professor of physics at the State University of New York College at Cortland, where he had become dean of arts and sciences in 1968, resuming full-time teaching in 1981. Previously he spent 15 years at the University of Houston, where he served as chairman of the physics department for five years. Reynolds is survived by three daughters.

1955

BASIL ROMAN (formerly VASILE MURARU), MS, on February 4. He was professor of mechanical engineering at California State University, Long Beach.

1958

HUGO FISCHER, MS '63, PhD '66, on May 22. He was killed in a mid-air sailplane collision over Bridgeport, California, during a competition. He was chairman of the Sanitary, Environmental, Coastal and Hydraulics Division of the Civil Engineering Department at UC Berkeley, a world authority in his field, and a UC professor for 17 years. He was a recognized authority on salt-water intrusion, water pollution, and heat dispersion in waterways. He is survived by his wife, Frances, and two children.

1959

EUGENE DOERING, Eng, on January 3 of a heart attack. He was program manager with the U.S. Energy Research and Development Administration in Washington, D.C. Doering is survived by his wife and two sons.

Personals

1935

J. HAROLD WAYLAND, MS, PhD '37, professor of engineering science, emeritus, at Caltech, reports on a busy year: "We spent seven months in 1982 in Heidelberg in the Institute of Physiology, where I was a U.S. senior scientist awardee of the Alexander von Humboldt-Stiftung. I also gave lectures in France, Belgium, Holland, Sweden, and Denmark. This spring I [lectured] in Japan in Tokyo and Sapporo, and again in Germany and Holland."

1936

JAMES McCULLOUGH, PhD, who is professor emeritus of chemistry at UCLA, was honored in May by the university, when the The James D. McCullough Laboratory for X-Ray Crystallography was dedicated.

1940

DWIGHT BENNETT writes, "I retired at the end of 1982 after 42+ years in the aircraft manufacturing industry. My position at retirement was F-18 Program Manager, Northrop, for McDonnell Aircraft Company of St. Louis, Missouri. We retired in Long Beach [California], where I am currently doing full time flight instruction at the Long Beach airport. My wife, Kay, is the girl I dated for three years at CIT. We will celebrate our 43rd anniversary this year."

ERIK HEEGAARD, MS, PhD '42, reports, "Retired in 1976 from Abbott Laboratories. I was European research liaison for research

division in USA. Lived in England; now I am growing avocados in the Algarve, Portugal."

1942

WOLFGANG K. H. PANOFSKY, PhD, director of the Stanford Linear Accelerator Center, received an honorary doctor of science degree from Princeton University on June 7. He was recognized because "He has led our quest for the ultimate constituents of inanimate nature, using the resources of modern technology to open the realm of high-energy elementary particle physics and to catch glimpses of a fleeting world of 'color,' 'charm,' and 'strangeness.' Knowing intimately the awesome power of the atom, he has counseled us in the arena of nuclear arms, soberly reminding us of the mutually assured destruction that is the most likely outcome of their use."

CARL SAVIT, MS '43, senior vice president for technology at Western Geophysical Company of America, was presented with the Award of Distinguished Achievement from the International Association of Geophysical Contractors on May 19. Savit, the first recipient of this award, was recognized for many outstanding contributions to the worldwide geophysical industry.

PAUL VEENHUYZEN reports from Simi Valley, California, "Retired end of February 1983 after 34½ years with Rockwell International. (I started with North American Aviation in 1948.) Have three grown sons (one with MS from Tech) and stepson and stepdaughter. Had two weeks of retirement, then started consulting in quality control. Wife and I will take a retirement trip to Greece and Greek islands."

1948

GEORGE W. ROE, JR., who has been working out of the country for the last few years, is now living in San Diego and working in construction management.

J. FRANK VALLE-RIESTRA, MS '49, senior associate scientist with Dow Chemical in Pittsburg, California, has received the Northern California Section of the American Institute of Chemical Engineers' Professional Progress Award. Valle-Riestra is also a lecturer in the department of chemical engineering at UC Berkeley, and McGraw-Hill recently published his book, *Project Evaluation in the Chemical Process Industries*.

1949

ROBERT WATERS, MS '50, writes, "Retired from McDonnell Douglas Astronautics in March '83, after 33 years in missile and spacecraft electronic systems. Building a home in our small lemon grove in Fallbrook [California], and will spend full time between grove maintenance and continuing my stoneware pottery design, making and selling."

1951

DOUGLAS CALLEY describes his unusual living situation in Flagstaff, Arizona. "There is 'cheap land' available NE of Flagstaff — probably because it is rather dry; rainfall is around 25 cm/yr; utilities consist only of fresh air. The power line is 15 km away, as are the phone and water lines. We built our house and in part, at least, designed the utilities. Although we must not waste water, so far we have had all we need for personal use and for the greenhouse — about 3×10 m of garden. We do not flush but use a composting toilet. Naturally I have to have electricity for the computer if for nothing else. A 200W wind generator + 100W of photovoltaics provide nearly enough electricity. [We originally] put in no solar heating, but when we moved in we just designed a greenhouse the south side of the house — three windows in the ground floor and two at 'basement' level — and now, even with snow on the ground, the heat pours into the first floor level all day. If anyone feels like visiting — no phone, but come out the Leupp Road from Flagstaff to milepost 439; take the first (dirt) road east, stay on the south side of Saddle Crater and you'll find us."

1957

HARRISON SCHMITT reports from Albuquerque, New Mexico, that he is now consulting on a wide variety of medical, technical, and scientific issues. He had served as U.S. Senator from New Mexico for the last six years.

1959

RAY BOWEN, MS, professor of mechanical engineering and mathematical sciences at Rice University, has been named dean of the University of Kentucky College of Engineering. For the past year Bowen has been on leave from Rice while serving as director of the division of mechanical engineering and applied mechanics at the National Science Foundation in Washington, D.C.

1960

CHARLES ANTONIAK writes from Ontario, California, "I have taken a position with Lockheed-Ontario Co. as chief systems engineer, head of the advanced studies department in the advanced systems division."

GARY GOODMAN, a senior analyst with System Development Corporation in Fredericksburg, Virginia, reports that he was married on May 14. His wife's name is Glenda.

1962

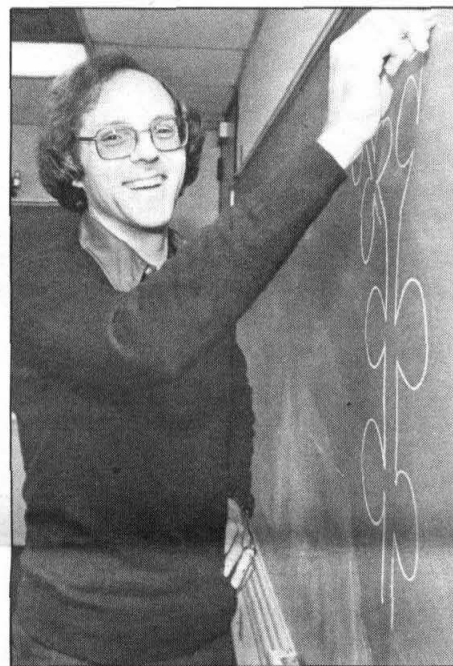
JOHN CROSSMAN writes, "As of August 1, 1983, our family will be relocating in Tokyo, Japan. I will be Ford Motor Company's Far East business strategy manager and will be working to facilitate many Ford joint ventures in Japan."

DAVID SCHLEICHER, MS, has been appointed chief of the Branch of Central Technical Reports for the U.S. Geological

Survey, with his headquarters at the Denver Federal Center. Previously central region coordinator for the former USGS Environmental Affairs Office, Schleicher has been with the USGS for 18 years.

1963

RICHARD E. PETERSON sends this update: "Since 1973 I have been with Texas Tech University, where a graduate program in the study of various aspects of thunderstorms has developed. This year I was promoted to full professor. We also have an enrollment of about 1000 students per year in a descriptive meteorology course. This year I was also the co-author of a revised edition of *Elements of Meteorology*, which for the last decade has been a leading textbook in the field."



Tommy Douglas (MS '70, PhD '74)

1965

MIKE BALL and STEVE CLAMAGE (BS'66) have formed the TauMetric Corporation in San Diego, California. They write, "We specialize in computer system software and other items aimed at the professional computer programmer. Our current projects include work in Pascal and assembly language on DEC VAX, Motorola 68000, and Intel 8086 computers."

1966

DAVID CLOSE is the new director of software engineering at Axxa Corporation in Woodland Hills, California.

1969

STEPHEN CREEKMORE, PhD, writes from Naperville, Illinois, "Just had twin baby boys born June 2, 1982 — Matthew and Benjamin; also Robert, age 4, and Elizabeth, age 3. We do have a lot of excitement!"

WALTER DENEKAS reports that he and his wife, Susan, and son, David, live in Illinois where he is vice president and controller of Counsellor, Inc., the world's largest bath scale manufacturer. He adds, "In a vain attempt to not overstep said scales, we ski, fly, bike, camp, and hike."

JAMES ISHIDA sends this update: "After leaving Tech, I struggled through some years of personal troubles relating to 'drugs, sex, the Vietnam War.' Abandoning graduate studies twice (UCSF in sociology; Stanford in linguistics), I ended up studying the Russian language on my own, working as a scientific-technical translator, and spent some time in a Buddhist seminary. After leaving it, I did on and off work in religious journalism for the Buddhist Churches of America. This work inspired me to take on creative writing. Entered the 1982 American-Japanese National Literary Award Contest. I became runner-up. In the recent past have gotten verses and poems into print, but mostly in fairly obscure publications. I do have two poems in large anthologies published by the American Poetry Association. Presently, I am revising and nursing along a novelette, a series of sketches tentatively titled *Cafe Metropolis*. Also, I have my first short story on ice awaiting a thaw."

1970

TOMMY DOUGLAS, MS, PhD '74, associate professor at the Medical Genetics Center of the University of Texas Graduate School of Biomedical Sciences in Houston, has been chosen one of six outstanding teachers of the year by students at the school's Health Science Center. He was chosen because "he interacts with students in an open and candid manner that is devoid of affectation or condescension, making him easily accessible to students who turn to him for his insight and opinions."

ARDEN STEINBACH writes, "Since July 1982 I have been assistant professor of applied physics and electrical engineering at the Oregon Graduate Center in Beaverton, Oregon. My wife, Suzanne, is currently completing her third and final year of residency in pediatrics at the University of Oregon here in Portland."

1971

SANKARAN SRINIVAS, MS, PhD '77, reports from Naperville, Illinois, "1982 was an eventful year for me. I was promoted to supervisor, network architecture group, at Bell Laboratories in February. Susana Araya (originally from Chile) and I were married in August. My parents and my sister, who had come from India to attend the wedding, stayed with us in our new home that we bought in October. 1983 proves to be no less eventful — we are expecting our first child in late September."

1972

ALAN BREAKSTONE has been working for the Ames Laboratory at Iowa State University for the past few years and is currently stationed at CERN (European Center for Nuclear Research) in Geneva, Switzerland.

1973

DANIEL REICHEL reports, "In March 1983 I married Carol Cocuzza, a young lady I met while I was at the University of Michigan. As a result of this marriage, I have moved to Columbia, Missouri, where Carol is continuing her residency in plastic surgery. I have had the good fortune of obtaining a two-year postdoctoral position at the University of Missouri, Columbia, where I will be studying the lattice dynamics of adsorbed films. I would have liked a better turnout at the ten-year reunion this past June. Maybe at 25?"

1974

VALERIAN CATANZARITE, BS '75, writes, "Now in residency program ob-gyn Stanford. Married to Karen Watson in August '82. A little Watson-Catanzarite production named Thumper due September '83. Still running marathons. Hey — I wrote a book, *The Valium Medical Center*, about internship. Copies available — call or write."

1977

MICHAEL CRAIG, MS, writes, "I'm a senior research engineer with Union Oil's science and technology division [in Brea, California]. I aid with the design of Union's offshore structures. I'm getting married in October and I'm very happy."

1979

MARK CRONSHAW, MS, writes, "Currently working for ARCO Oil and Gas Company in Dallas as a senior reservoir engineer, having worked in R&D and as a financial analyst. Only five hours to complete for my MBA. Our son Dominic is almost two years old. Would any ingenious alum please invent a child-proof toy that is really Dominic-proof! Maureen has worked in a large Dallas emergency room, and now does volunteer work. Best wishes to all."

PETER DEWEES reports, "I was just awarded a Fulbright Fellowship to study renewable energy in Kenya starting this fall. I have been working at the International Institute for Environment and Development for the last year, after having completed my MS in forest economics from Duke University. I recently returned from India, where I was evaluating a World Bank financed forestry project in the state of Gujarat."

PAUL THOMPSON, MS, a member of the technical staff with Bell Laboratories in Indianapolis, reports that he and his wife, Kathy, welcomed a son on February 3, 1982.

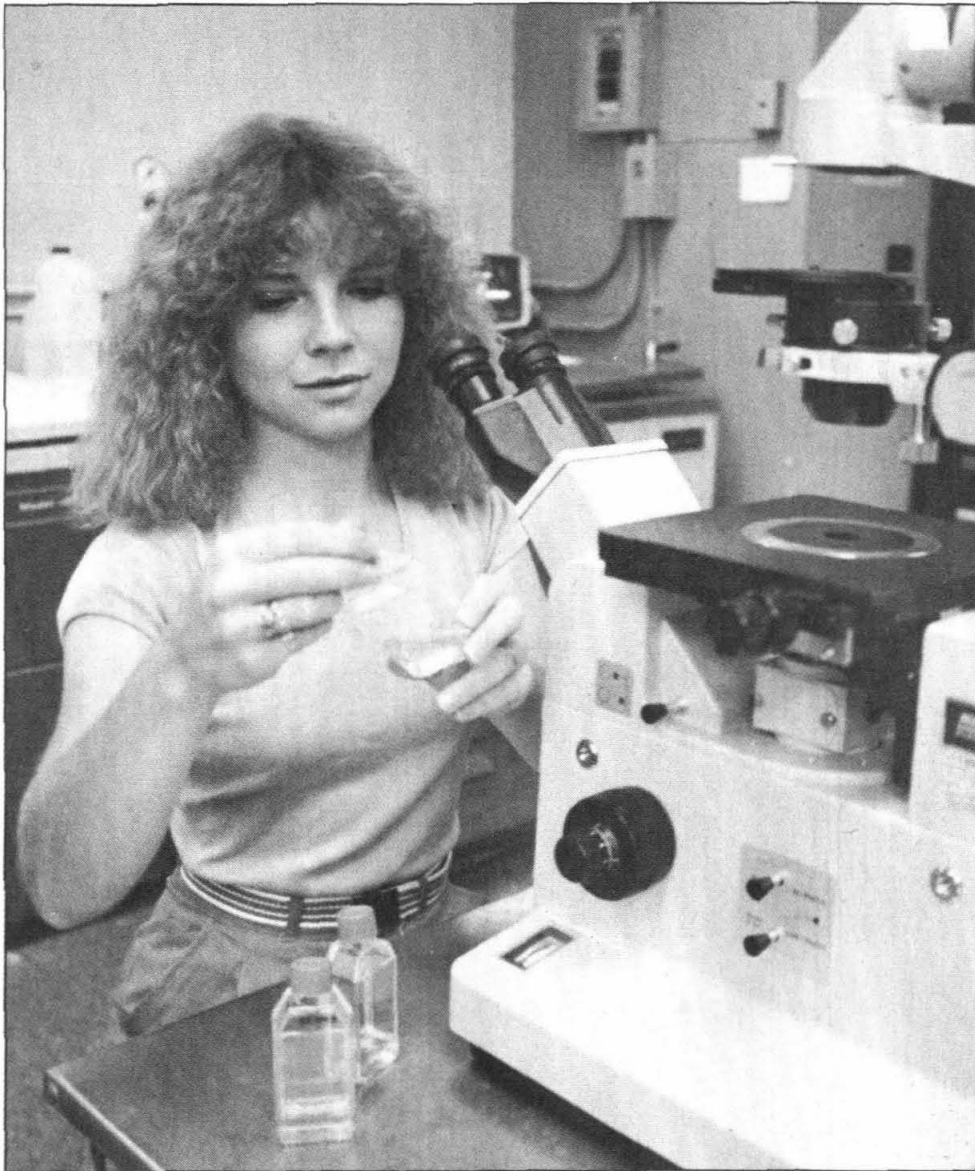
1981

KWANG-I. YU, PhD, member of the technical staff for defense and space systems at TRW in Redondo Beach, California, reports the birth of Kai-feng Yu on July 2, 1982.

1982

CHENGI KUO writes, "I wrote 'Word Challenge,' which became available for the IBM-PC last November and recently became available for the Apple and the Osborne. It is a very elaborate version of Boggle. I now work for Proximity Devices Corp. in Ft. Lauderdale as a programmer as well as being the head of the micro-software group. That just means I get more hassles than the other people. During this summer we had ten Teachers here out of a technical staff of around 15, eight Lloydies and two Moles. If anyone happens to be in Ft. Lauderdale, they're welcome to come and visit."

CALTECH NEWS

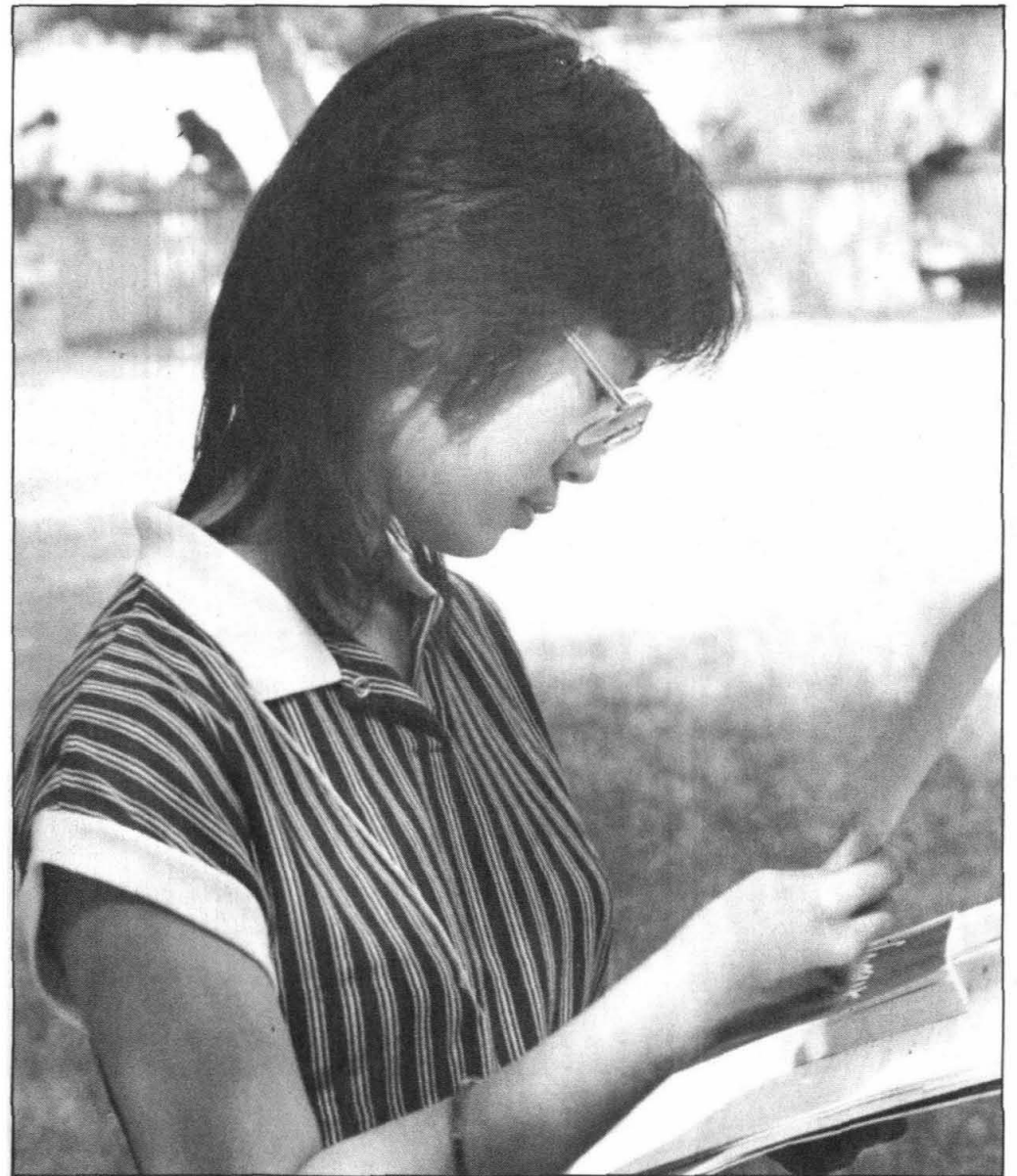


Candice McCoy, a Caltech senior, was one of 79 undergraduates who conducted research during a 10-week summer period as a participant in the Institute's Summer Undergraduate Research Fellowship program (SURF). The students worked full time on research projects that they initiated with their faculty sponsors. McCoy's project, "Terminal Transferase: The Expression of A Eukaryotic Protein in a Prokaryotic Host," was under supervision of Ellen Rothenberg, assistant professor of biology.

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Laura Sakamoto from Hilo, Hawaii, registers for her first term as a Caltech freshman.

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