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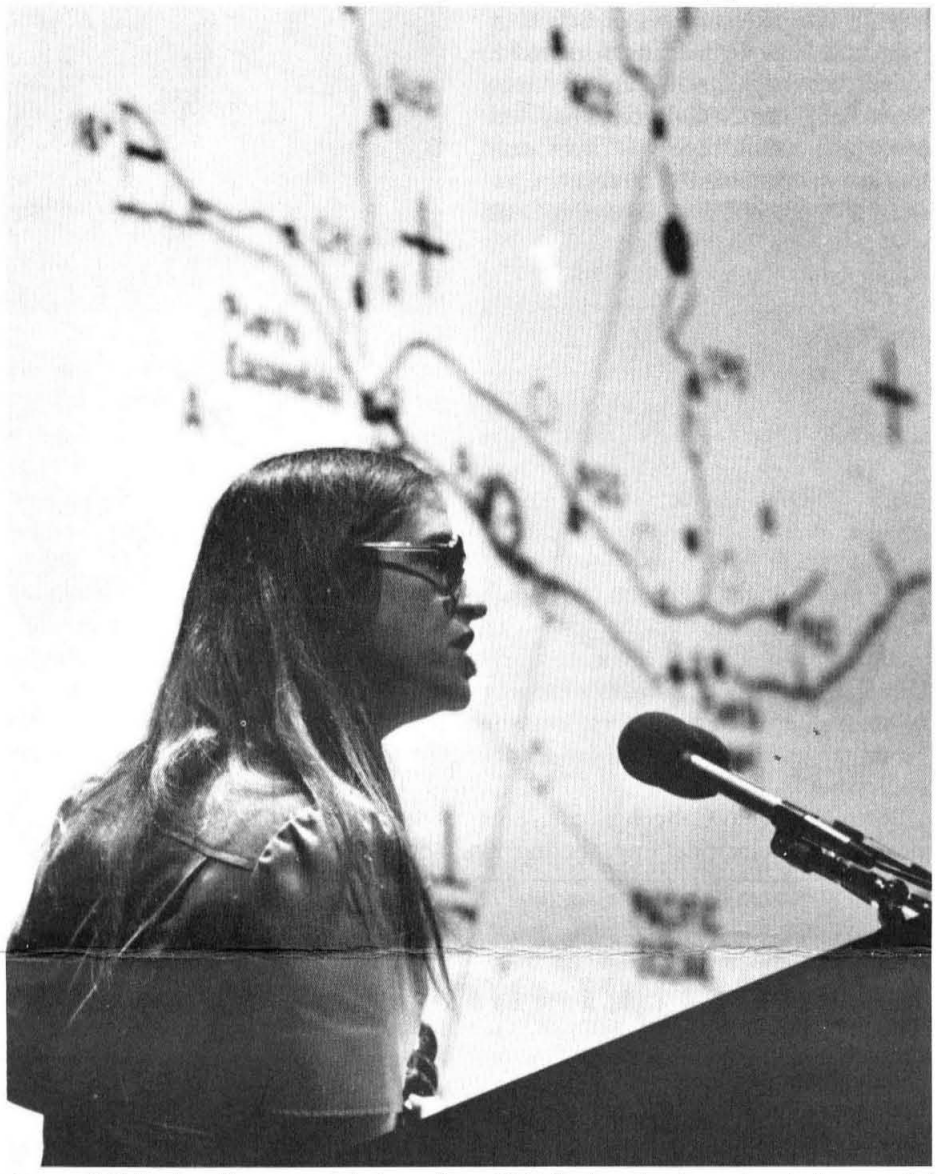
CALTECH NEWS

PUBLISHED FOR ALUMNI AND FRIENDS OF THE CALIFORNIA INSTITUTE OF TECHNOLOGY

Alumni learn how a quake was trapped



At one of 12 Seminar Day research lectures, Karen McNally describes how seismologists recorded the entire progress of the November 29, 1978, earthquake in Oaxaca, Mexico.

From Goldberger

A progress report on goals

Caltech alumni welcomed President Marvin L. Goldberger to his first Alumni Seminar Day on May 12, and heard a report from him on progress toward several priorities that he stressed in his inaugural address in October — among them, strengthening of the humanities and social sciences, undergraduate education, the appointment of more women to the faculty, and closer ties between Caltech and JPL.

Describing work in the Division of the Humanities and Social Sciences, Goldberger observed that the new division chairman, Roger Noll, BS '62, has been "extraordinarily active and vigorous — so vigorous that we can scarcely contain him" — and that under his leadership, several important appointments have been made. Two of these are "distinguished senior faculty members" — a medievalist and a political scientist — and the others are "a number of the best junior political scientists that we have been able to identify.

"We've made several additional offers to outstanding people, and we believe that this part of Caltech's education, which was recognized by Robert Millikan as such a crucial part of our activity, is being strengthened in a significant fashion," he said.

About undergraduate education, Goldberger said that a faculty committee has been hard at work, studying the Institute's core courses in physics, mathematics, and chemistry. "We want to learn how to better coordinate these fundamental subjects that are at the heart of Caltech's educational system, and to make them more responsive to the diversity of our students' needs and interests," he said, adding that "the committee is about to report, and we expect many striking recommendations."

One of the most significant changes in undergraduate education will begin next fall, Goldberger said. This will involve a revision of the freshman physics course to incorporate only one track, rather than two tracks of varying difficulty as is now the case.

The course will differentiate among student priorities by assigning freshmen to designated discussion groups, he explained, adding that "a large number of these will be taught by *professors* — and that was not a slip of the tongue."

David Goodstein, professor of physics and applied physics, will be the main lecturer in the freshman physics program, Goldberger said, "and I'm heartened by the fact that, in response to his appeal, a large number of faculty members from other disciplines — chemistry, mathematics, engineering — have volunteered to lead discussion sessions."

Concerning tenured women on the faculty, Goldberger observed that "when I came, this number was zero, and as we all know, zero is a nasty number, no matter whether you use it to add, subtract, multiply, or divide.

"We've made a serious effort to change this," he continued, noting that the new medievalist in the humanities will be a woman who comes to Caltech as a full professor; that Caltech's Jenijoy La Belle, an associate professor in English, has received tenure, and that a woman economist, "one of the brightest in the country in her field," will come to Caltech as an assistant professor.

"We have a tenure offer out to a woman astronomer, and we anticipate one or more tenure track appointments of women faculty members in biology," he concluded. "We

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Distinguished alumni honored

A prominent cancer researcher, a noted science educator, a leading Chinese physicist, and a Nobel prizewinner were awarded on Alumni Seminar Day the highest honor that Caltech can confer on a graduate — its Distinguished Alumni Award.

Although the gasoline shortage in California was at its peak, more than 1,650 graduates and their guests visited the campus on Seminar Day to view scientific exhibits and to hear faculty members describe developments in research and education.

The new distinguished alumni are Alfred G. Knudson, Jr., director of the Institute for Cancer Research in Philadelphia; Frank Oppenheimer, physicist, educator, and creator of the San Francisco Exploratorium; Hsue-Shen Tsien, the first director of Caltech's Guggenheim Jet Propulsion Center and now chairman of the Institute of Mechanics of the People's Republic of China's National Academy of Sciences in Peking; and Nobel Laureate Robert W. Wilson, head of the Bell Telephone Laboratories' radio physics research department and co-discoverer of a radiation remnant of the 18-billion-year-old "Big Bang."

Knudson, BS '44, PhD '56, whose scientific career has encompassed the fields of pediatrics and biomedical genetic research, was at the City of Hope Medical Center for 10 years after receiving BS and PhD degrees from Caltech and an MD degree from Columbia University. At the City of Hope he was first chairman of the department of pediatrics and then chairman of the department of biology. In 1966, he became associate dean for basic sciences at the Health Center for the State University of New York at Stony Brook, where he had responsibility for organizing and recruiting the new medical faculty. In 1970 he developed the new graduate school of biomedical sciences at the University of Texas in Houston while serving as dean and professor of medical genetics. He moved in 1977 to his present post.

Oppenheimer, PhD '39, who began his career in nuclear, cosmic ray, and particle physics research, went on to become a high school teacher in Colorado where he devised innovative techniques in laboratory instruction that were adopted by many institutions. On leave since 1968 from his post as a professor of

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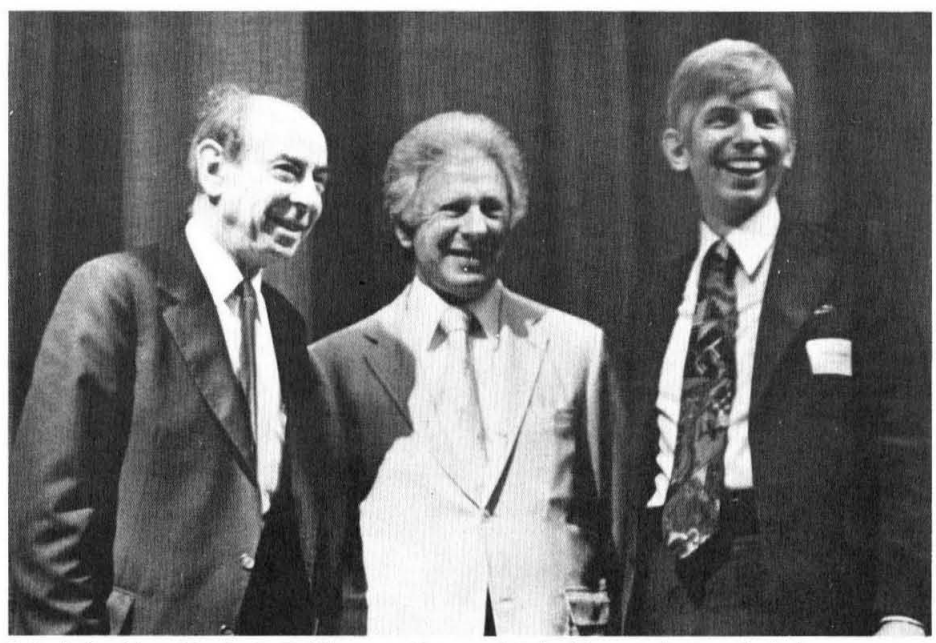
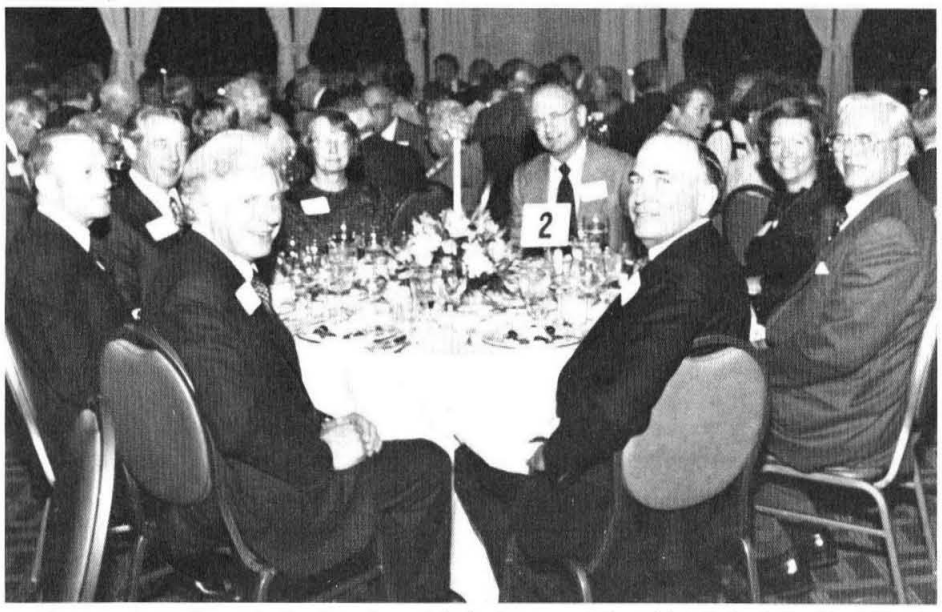


Caltech President Marvin L. Goldberger with two of Caltech's new distinguished alumni – Frank Oppenheimer, left, and Alfred G. Knudson, Jr., right. Wilson and Tsien were not able to receive their awards in person.

The Bay Area Associates' dinner

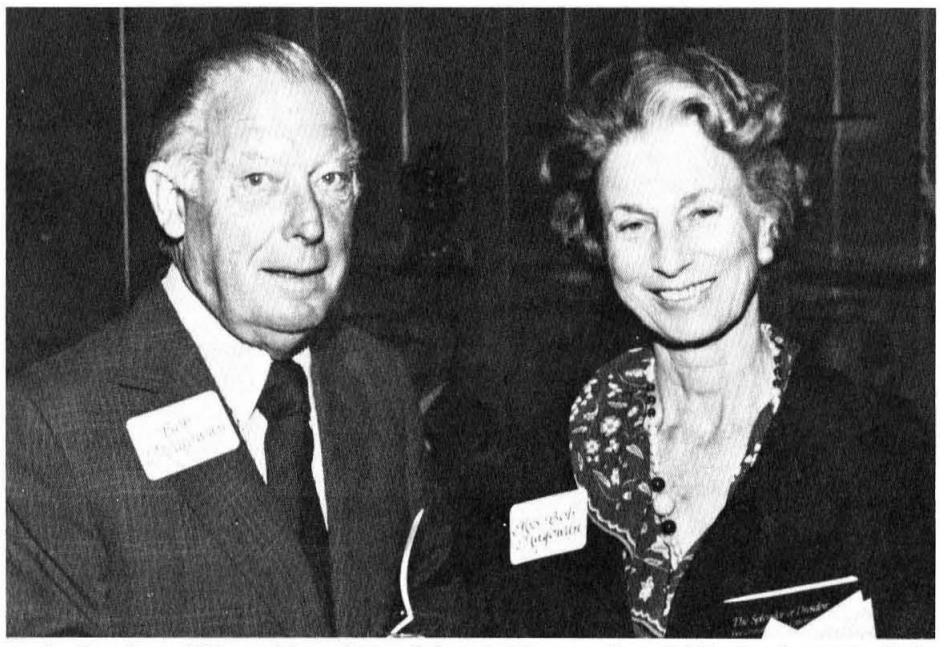
San Francisco's Fairmont Hotel was the setting for an early spring dinner for 110 Bay Area members of The Associates and their guests. Clarence R. Allen, professor of geology and geophysics, was the speaker. Above: Mr. and Mrs. W. Bertram Scarborough, contributing members, with Mr. and Mrs. Howard G. Vesper. Vesper is a Life Trustee and a member of The Associates' Northern California Membership Committee.



At The Associates' dinner in San Francisco: (clockwise around the table): Caltech President Marvin L. Goldberger, Victor K. Atkins, a member of the Board of Trustees; Arthur G. Anderson, Mrs. Dale Armstrong, Clarence R. Allen, Mrs. Atkins, Dale Armstrong, and Harrison W. Sigworth, chairman of the Northern California Membership Committee, who was in charge of the evening's program.

The Dresden exhibit

"The Splendor of Dresden," an exhibit from the German Democratic Republic, attracted 260 members of The Associates from the Bay Area and Southern California, their guests, and other friends, to a private viewing. The event included a reception at the California Palace of the Legion of Honor, where the exhibit was on display. Above: Mr. and Mrs. James G. Boswell II, Life Members of The Associates, with Walton A. Wickett, a member of the Membership Committee of The Associates of Northern California.



At the Dresden exhibit are Mr. and Mrs. Robert A. Magowan from Pebble Beach, guests of The Associates at the event.

Roy Gould

New division chairman

Roy W. Gould, BS '49, PhD '56, professor of applied physics at Caltech and a leader in research on controlled thermonuclear fusion, has been named chairman of the Institute's Division of Engineering and Applied Science. He succeeds Robert H. Cannon, professor of engineering, who has joined the faculty at Stanford University.

"Caltech is doubly fortunate — in having had the services of Bob Cannon and now in looking forward to those of Roy Gould as the new chairman," said Caltech President Marvin L. Goldberger. "Dr. Gould has distinguished himself in research and in administration, and we welcome his leadership in his new role." Gould has been the executive officer for applied physics at the Institute.

Roy Gould

The new division chairman received his BS degree in electrical engineering from Caltech with honors in 1949, his MS degree in electrical engineering from Stanford in 1950, and his PhD in physics from Caltech summa cum laude in 1956. From 1950 to 1955 he conducted research in industry with North American Aviation and Hughes Research and Development Laboratories, helping to design nuclear reactors, missile guidance systems, and military radar components.

He returned to Caltech as assistant professor of electrical engineering in 1955, becoming professor of electrical engineering and physics in 1962 and professor of applied physics in 1974. On leave from Caltech from 1970 to 1972, he was assistant director of the Division of Physical Research and director of the Division of Controlled Thermonuclear Research for the Atomic Energy Commission.

Gould is a member of both the National Academy of Sciences and the National Academy of Engineering. He is also a Fellow of the Institute of Electrical and Electronic Engineers and of the American Physical Society.

Goldberger on goals progress

Continued from page 1

feel we're making progress in this important area."

Recalling that he had stressed the importance of close ties between Caltech and JPL in his inaugural address, Goldberger said that he meets weekly with JPL Director Bruce Murray and that the two have been encouraging collaborative research efforts as well as encouraging people from the Laboratory to teach at Caltech. He added that a course in space technology, inspired by a suggestion from a student, will be taught on the campus next spring. Teaching the course will be a member of the JPL staff who will lead students through the design of a space project.

Other new programs will include major research into the detection of gravitational radiation, headed by Professor W. P. Drever who joins Caltech from the University of Glasgow. Resource geology will also be emphasized. "We're looking for the best person for this program."

Focusing on lighter areas, Goldberger said that the amount of music activity at Caltech — in performance, theory, and appreciation — will double next year because of enormous student interest. The Institute's theatrical program will also be substantially expanded, he said.

In conclusion, Goldberger said that he has been tremendously impressed by the support Caltech receives from its alumni. "Your financial contributions are vitally important," he concluded, "and so is the way you talk up the Institute among high school students and your acquaintances."

Goldberger was introduced by Vern A. Edwards, BS '50, Alumni Seminar Day chairman.

Sternberg elected to NAS

Eli Sternberg, professor of mechanics at Caltech, has been elected to membership in the National Academy of Sciences for "distinguished and continuing achievements in original research." Sternberg, who is also a member of the National Academy of Engineering, becomes the 49th member of the NAS at Caltech.

Born in Vienna, Austria, in 1917, he attended the University of London and the University of North Carolina, where he received a bachelor's degree in civil engineering. He received his MS and PhD degrees from the Illinois Institute of Technology and was a faculty member at IIT and Brown University before coming to Caltech as professor of applied mechanics in 1964.

Honors that Sternberg has received include two Fulbright Awards and one Guggenheim Award for research. He is a member of the American Academy of Arts and Sciences. At Caltech he conducts research in the fields of continuum mechanics and linear and nonlinear elasticity theory of materials.

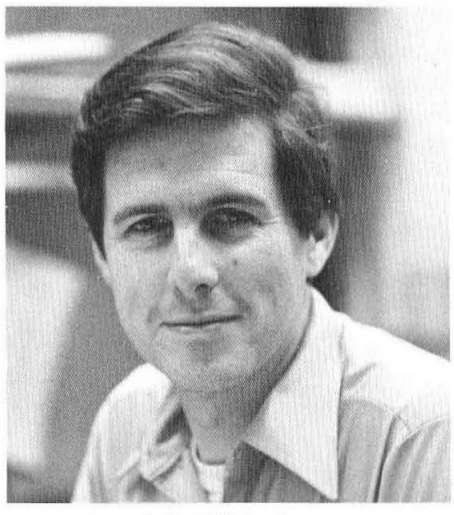
Flight 191
Crash claims two from Caltech

The Caltech community was shocked and saddened by the deaths of two of its members in the DC-10 jetliner crash in Chicago on May 25.

Among those aboard American Airlines flight 191 bound for Los Angeles were Richard P. Schuster, Jr., BS '46, BS '49, director of development, and Robert W. Vaughan, professor of chemical engineering and chemical physics.

Said Caltech President Marvin L. Goldberger, "It was with profound shock and sorrow that we learned of their deaths on the tragic flight. For the many members of the Caltech community who knew and worked with them, the loss is deep and personal.

Richard P. Schuster, Jr.



Robert W. Vaughan

"Dick was admired as a dedicated professional who has done the Institute invaluable service. Both as an alumnus and an administrator, he dedicated himself to Caltech in a way that inspired us all.

"Bob was known among his many colleagues and friends at Caltech as one of its most promising researchers, as well as a concerned and inspiring teacher. We mourn their loss."

Schuster, 53, joined the Caltech staff in 1964 as director of the Industrial Associates program, and in 1976 he was named director of foundation relations. In 1977 he became the Institute's director of development, responsible for fund raising. Earlier, after a year in the Navy, he served as a production foreman at the Procter and Gamble Manufacturing Company in Long Beach, and for the next 10 years as plant manager of the Bray Chemical Company in Los Angeles. He came to the staff of JPL as a staff engineer in 1962, working in the newly created Arms Control Study Group until he left to join Caltech.

He is survived by a son, Mark, and a daughter, Catherine.

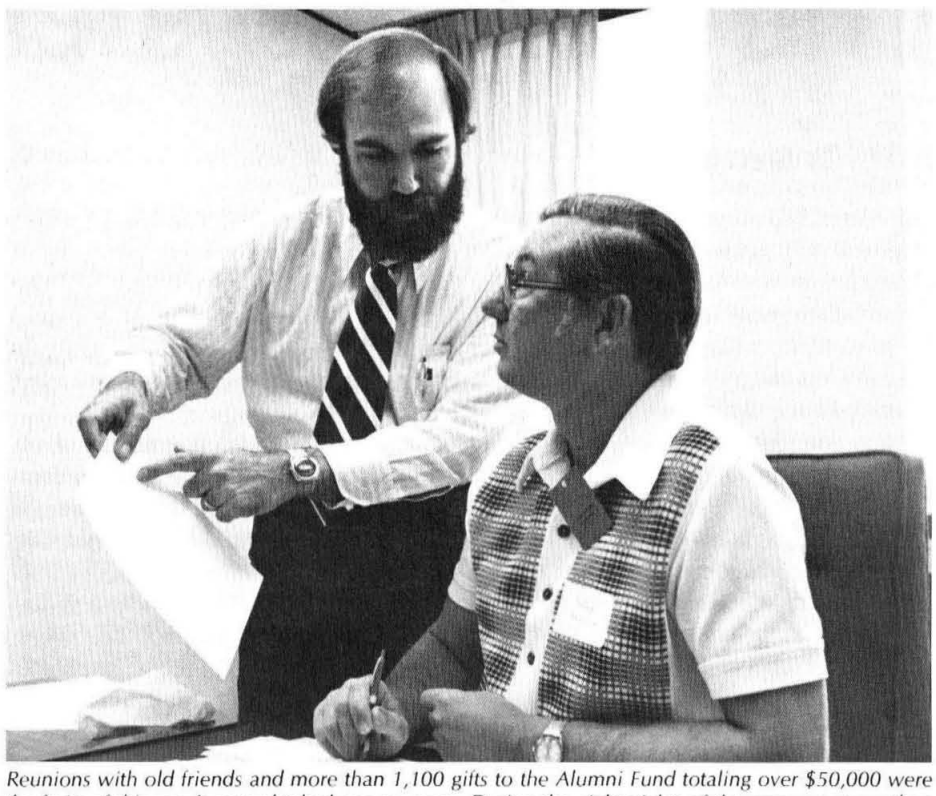
Vaughan, 37, received his BS degree from the University of Oklahoma, and his MS and PhD degrees from the University of Illinois. He came to Caltech in 1968, after serving in the U.S. Army. Beginning as a lecturer in chemical engineering, he was named a professor in 1977.

The recipient of numerous awards for both teaching and research, Vaughan conducted research in solid state and surface chemistry and physics. He was an Alfred P. Sloan Research Fellow and the recipient of a Dreyfus Teacher-Scholar Grant award, and received the Fresenius Award of Phi Lambda Upsilon, a national honorary chemical society.

He is survived by his wife, Sharon, and a daughter, Tena.

Contributions to memorial funds for the crash victims may be made through Joseph A. Farmer, Office of Memorial Funds, 1-36, Caltech, Pasadena 91125.

The Alumni Fund calling



Reunions with old friends and more than 1,100 gifts to the Alumni Fund totaling over $50,000 were the fruits of this year's annual telephone program. During the eight nights of the program, more than 220 alumni contacted some 3,300 classmates throughout the country. Charles H. McDougall, BS '47, an executive with Sears Roebuck and Company, made the Sears phone system available for the calls. Above: Joe A. Farmer, left, and Arthur Bruington, BS '49, MS '50, look over the names of alumni. This spring, Farmer succeeded Floyd Clark as director of annual giving with responsibility for the Alumni Fund. Formerly assistant manager of public events, Farmer has been a member of the Caltech staff for 10 years. Clark now manages his own business.

Celebrating the space era

They were nine or ten or eleven years old at the time of the moonwalk in July 1969. Now, on May 3, 1979, they were celebrating Space Day — the 10th anniversary (minus ten weeks) of that historic happening. More than 300 Caltech students streamed into Beckman Auditorium to hear the first in the series of 3 to 10 p.m. lectures — a recap of the events that led to the Apollo 11 landing, as told by one of the men who had a significant role in making it happen — Eugene Shoemaker, Caltech professor of geology and principal investigator for the geological field investigations of the Apollo lunar landing program.

ASCIT president Ray Beausoleil had set the tone of the occasion with his opening remarks, as he reminisced about that day 10 years ago when he sat in front of the TV screen and watched the moon landing in the company of a man whose life had spanned the horse and buggy and travel to the moon — his grandfather.

Although they belong to a generation that has reason to take space travel for granted, the audience of Caltech students was rapt as it listened to the succession of speakers — JPL director Bruce Murray; Caltech professor of geology Lee Silver; Arden Albee, Caltech professor of geology and chief scientist at JPL; and Brian O'Leary of the department of physics, Princeton — and talked with the six shuttle astronauts who were on hand for the lectures and for the 6 p.m. between-sessions dinner on the Olive Walk. The subject matter ranged from Ranger to the future ("Colonies in Space" and "The Search for Extraterrestrial Intelligence")

As *Caltech News* was in production, it was learned that Terry E. Ernest, BS '63, MS '65, died in the Chicago DC-10 jetliner crash on May 25. Ernest, a resident of Anaheim, was supervisor of operational planning for Union Oil Company in Los Angeles.

Elections announced
Four on faculty to NAE

The National Academy of Engineering has elected four Caltech faculty members, two of them alumni, and nine other alumni to its ranks. Faculty members are Pol Duwez, professor of applied physics and materials science, emeritus; Milton Plesset, professor of engineering science, emeritus; W. Duncan Rannie, PhD '51, Robert H. Goddard Professor of Jet Propulsion and professor of mechanical engineering; and Ernest E. Sechler, BS '28, MS '30, PhD '34, professor of aeronautics, emeritus.

Honored alumni are Boris Bresler, MS '46, principal of Wiss, Janney, Elstner & Associates in Emeryville, California; Yuan-Cheng B. Fung, PhD '48, professor of applied mechanics and bioengineering, UC San Diego; Welko E. Gasich, Eng '48, senior vice president and group executive, aircraft group, Northrop Corporation, in Hawthorne, California; Kenneth F. Holtby, BS '47, vice president for new programs, Boeing, in Seattle; Paul B. MacCready, MS '48, PhD '52, president of Aero-Vironment in Pasadena.

Max V. Mathews, BS '50, director of the Acoustical and Behavioral Research Center, Bell Telephone Laboratories in Murray Hill, New Jersey; Irving S. Reed, BS '44, PhD '49, Charles Lee Powell Professor of Computer Engineering, University of Southern California; Martin Summerfield, MS '37, PhD '41, Astor Professor of Applied Science and director of the Graduate Center for Applied Sciences, New York University; and Lloyd R. Welch, PhD '58, professor of electrical engineering, University of Southern California.

These men are 13 of the 99 honored this year for their important contributions to engineering theory and practice or for unusual accomplishments in the pioneering of new and developing fields of technology. Election to the NAE is the highest professional distinction that can be conferred on an engineer.

Duwez was cited for contributions to the science and technology of ceramic and metallic materials, particularly amorphous metallic alloys; Plesset, for pioneering in applied physics, including two-phase flows, and for contributions to an understanding of the thermal hydraulics and safety of nuclear reactors.

Rannie, for contributions to three-dimensional flows, stall and distortion in turbomachinery, and to turbulent heat transfer; Sechler, for his contribution to aeronautical engineering education and advancement of engineering design, particularly shell structure.

Bresler, for pioneering in the structural design of large works to withstand combined stresses, sustained loads, corrosion, fires, and earthquakes; Fung, for research concerning the theory of elasticity and aeroelasticity, and applications to bioengineering.

Gasich, for the conception and development of advanced supersonic trainer and international lightweight low-cost fighter aircraft; Holtby, for work related to the design of large jet aircraft and leadership of major aircraft programs.

MacCready, for research on the atmospheric environment and achievement in man-powered flight; Mathews, for contributions to computer generation and analysis of meaningful sounds; Reed, for work in automatic detection and processing of radar data, multiple-error-correcting communications codes and digital computer design.

Summerfield, for contributions to the development of rocketry, combustion research, and the international literature in aeronautics and astronautics; Welch, for improved understanding of possibilities, limitations, and design of communications coding for reliability, security, and synchronization.

This year's elections bring to 27 the number of Caltech faculty members who are members of the National Academy of Engineering, a 953-member body.

The honor system: alive and well

by Phyllis Brewster

A recent *Los Angeles Times* editorial entitled "America: A Nation of Cheats" expressed shame and blame about "our rip-off society" — one of the many public laments on the decline in standards of honesty and decency in our daily lives. But on the Caltech campus there seems to be a comforting antidote — the operation of the celebrated Institute tradition — the honor system.

The honor system *is* alive and well and working at Caltech — not working perfectly, but working well. Indeed, in a December 1 *California Tech* report on the results of a campus-wide questionnaire about undergraduate student life, the honor system appeared at the head of the "What I like best . . . " column.

You can use either questionnaires or random conversations with students at Caltech to discover that the honor system is a highly valued way of life. "It definitely works." "It's the reason I came here." "It's what makes Caltech really special," are standard paeans to the code.

That the system is unique to this campus is an assumption shared by students, alumni, and faculty. Al Ray, BS '35, recalls, "I felt that, in the honor system, we had something special at Caltech. I had friends at Stanford, UCLA, Berkeley, and none of them had anything like it."

Caltech Professor of Biology Ray Owen, who is vice president for student affairs and dean of students, says flatly, "I know of no other school where an honor system affects all aspects of life as much as here."

Those aspects that it affects, which are well known to both current and former students, grow out of the Golden Rule of the honor system: "Never take unfair advantage of any member of the Caltech community." That statement expresses the system's most important dimension — breadth. To students, the honor system isn't a set of rules and regulations; it is a way of life.

Specifically, the system has always applied most directly to the academic sector. But the longtime tradition of non-proctored exams has, in recent years, increasingly expanded into the practice of taking exams home. Students are allowed from two days to a week to turn in their completed tests. During this time they are responsible for honoring the established time limit; for not looking at the questions before they begin to work; and for not discussing the exam with anyone.

Recently a Caltech student emerged from his room where he had been taking an exam, rubbed his forehead in exasperation, and exploded, "If I only had another half hour, I'd have made it." He was timing himself against the three-hour limit assigned to the test by the professor.

The honor system has much broader applications, of course. For example, today, as in the past, students have access to many classrooms and laboratories at all times of the day and night. And the code has a profound influence on student interaction — with faculty and with each other.

Kerry Donovan, BS '62, former president of Ricketts House, calls it "the absence of a negative — the kind of mutual respect that is possible only when you have people trusting you rather than suspecting you."

Students' behavior toward each other is, consciously and/or unconsciously, monitored by the honor system. Questions like "Is turning up the stereo volume, when the troll down the hall doesn't like it, a violation of the honor system?" are taken seriously. Even Caltech's sophisticated prank-playing is influenced by the honor code. One senior says, "You think long and hard before you play a joke on someone. You ask yourself whether the guy will laugh or get sore."

Alumnus James Dunham, BS '29, remembers similar compunctions. "If we were talking about doing something questionable, someone was sure to remind us about the honor system."

"Easier life" is one of the most frequently given reasons for the honor system's success. Charles A. Ray, BS '61, second generation Techer (son of A. A. Ray), expressed the feeling shared by today's students that the honor system is liberating. "In an academic environment where pressure is immense, operating on the basis of trust is a welcome relief because it removes the challenge of trying to beat the system." As one student explained, "The system *is* us, not someone outside watching us."

Freedom is one of the benefits recognized by the faculty, too. C. J. Pings, BS '51, MS '52, PhD '55, vice provost and dean of graduate studies, who has experienced the honor system as an undergraduate, a graduate student, and now as a professor and dean, says, "The sense of trust between faculty and students allows the faculty to put the emphasis on teaching and problem-solving rather than on testing."

Although freedom is cited as a major motivation for the honor system, a number of other factors enter into its success. Roger Noll, BS '62, recently appointed chairman of Caltech's Division of the Humanities and Social Sciences, gives credit to the nature of the students, the closeness of the student body, and the kind of educational program that exists here.

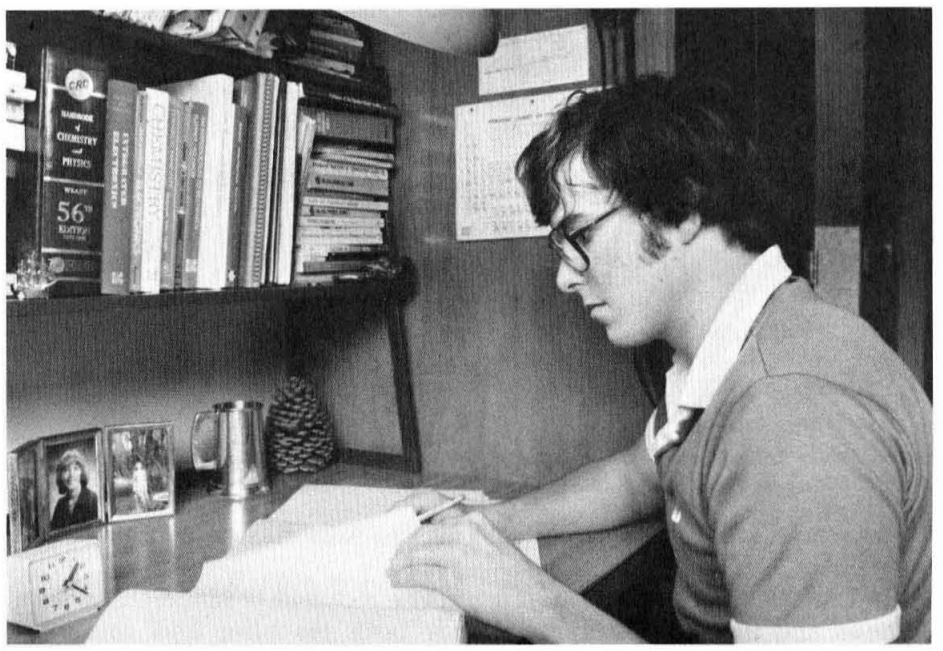
"Work at Caltech is research- and publication-oriented," he says. "Students know they can't cheat on those levels."

Today's students also give dedication to scholarship a share of the credit. "The men and women enrolled here take such an enormous pride in accomplishment that cheating simply isn't a part of their makeup," one undergraduate says. "They are intelligent enough to realize that cheating is just a short-term solution to a problem."

The close sense of community that has always been a part of life in the student houses continues to be important in the operation of the honor system. If I cheat, I only cheat myself and my friends, is an attitude expressed by a number of students.

Although almost all incoming students have read or heard about Caltech's honor system before they arrive on campus, education in the ramifications begins almost immediately — at Freshman Camp. There upperclassmen describe the system to the incoming group. Numerous discussions follow, during the first weeks of school, and the principles are again and again explained, interpreted, and generally hashed over.

The emphasis is on commitment. "Our aim is to convince new students that the honor system is so much to their advantage that they will want to preserve it," Owen says.



Alone in his room, freshman Chris Juten times himself as he takes a test on the honor system.

One of the most discussed aspects of the honor system has always been the matter of reporting a violation.

"We talked endlessly about what to do if you found a friend cheating," says (P. D.) Doug Josephson, BS '65, and a number of current students express the same perplexity.

Although it is probably the most difficult part of the system to abide by, reporting possible infringements is necessary for its preservation. Such reports have always been handled by the all-student Board of Control (BOC), in the strictest of confidence and with a great sense of responsibility.

As a former BOC member, Noll attests to the intense commitment that board members feel. "In the two or three cases a term we handled," he says, "BOC meetings often lasted a day or two, with all aspects of the case examined in great detail."

Several of the reported violations that Noll helped investigate involved identical incorrect answers given on an exam. In order to determine whether one student might have copied an answer from the other, BOC would spend a few days learning the relevant material to reach an informed judgment on whether the incorrect answers had some reasonable basis. This kind of effort required great dedication on the part of the Board members. Cases normally arose during exam periods and had to be tackled when members were studying for their own exams.

Decision-making by the BOC has always emphasized rehabilitation rather than punishment. The question to be decided is whether the violator can continue to operate within the honor system. Expulsion is a radical move, and, over the years, very few students have left Caltech as a result of an infraction. The idea is to make the code a working part of the students' lives.

Kerry Donovan says it. "Science has an integrity about it. You don't want to fool yourself. So, working under the honor system becomes a part of the educational process — inseparable from the classroom and laboratory training."

Dean Pings adds: "Young professionals need to have a concept of highly professional ethics. How better can you teach ethics than by example, and by the process of mutual trust and respect?"

25 years as alumni

Manuel Morden, BS '54, MS '55, and Mrs. Morden were among 84 members of the class of 1954 and their guests at their 25-year reunion on Seminar Day weekend. Special activities included campus tours and a banquet on Friday evening, plus a luncheon and social hour on Saturday.

For the USGS: an expanding role

by Winifred Veronda

Internationally recognized for his work in marine, atmospheric, and solid earth sciences, H. William Menard was nominated by President Carter to be director of the U.S. Geological Survey in February 1978—almost exactly a year before USGS celebrated its 100th birthday. Menard, BS '42, MS '47, had been professor of geology at Scripps Institution of Oceanography in San Diego since 1955, with time out in 1965-66 for an assignment as technical adviser in the Office of Science and Technology in the Executive Office of the President.

In his new role in Washington, Menard heads the federal Government's largest earth science research agency, with a budget of $450 million and a staff of more than 13,000 scientists, technicians, and administrators. Established during the presidency of Rutherford B. Hayes, USGS was given a mandate to "classify the public lands and examine the geological structure, mineral resources, and products of the national domain." After concentrating initially on surveying and mapmaking, USGS broadened its scope over the decades to include such activities as searching for strategic minerals during the world wars, pioneering in the use of aerial photography for mapmaking for the Tennessee Valley Authority, measuring the rate of flow of the nation's rivers, and managing petroleum exploration in Alaska's National Petroleum Reserve. Based on its data, hundreds of decisions have been made about where to locate dams, mines, housing developments, highways and airports, and where to drill for oil.

Interviewed in his Washington office two days before the USGS Centennial Day ceremonies, Menard talks about the expanding role of the USGS during its second century — and about how he likes his job.

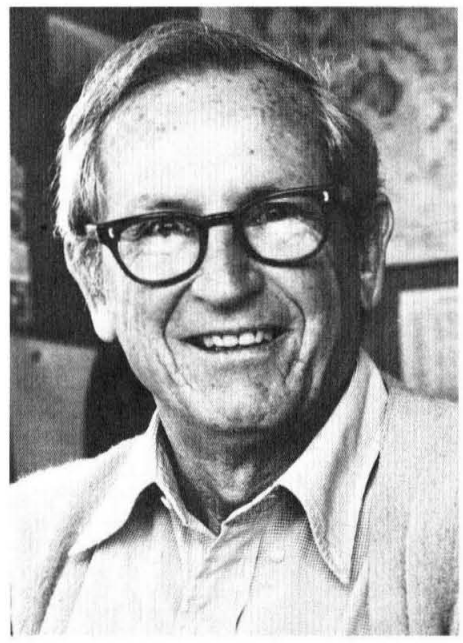
The USGS is celebrating its 100th birthday this week. How do you envision its role over the coming century?

One reason why I came back to Washington to head USGS was that I believe its role will grow and become increasingly important. The survey has the responsibility for exploring our natural resources and developing them wisely, for making rational decisions about land use, and for assessing the effects of geological hazards. These are all formidable challenges. For example, USGS tries to find minerals and predict mineral occurrences. This task is much more important now than it used to be, and it will become even more important in the future because natural resources are becoming harder and harder to find.

Another area that is growing in importance, and that we are more and more often involved with, is assessing the effects of natural hazards. At one time this wasn't very important because, except in southern California and San Francisco, hardly anybody lived on a major earthquake fault. But now, more and more facilities are being built in geologically hazardous areas because there aren't any other places to build them, and we are often asked to make predictions about the risks in building a dam or an atomic power plant in a seismically active location. The geological sciences are becoming predictive sciences, not because we geologists want them to be, but because legislation forces us to make predictions, even when we aren't sure of our answers.

Another reason why our role will grow is that there is an increase in governmental regulations. For example, the Survey is involved in regulating the production of minerals, and this is a rapidly growing responsibility. At present, the only people we're adding to our staff are concerned with regulatory functions. With the mood of the country as it is, regulations seem likely to continue proliferating.

What concerns do you have about the USGS and its changing role?



H. William Menard

Preserving our credibility as an organization is a primary concern of mine, and of everyone else in Survey management, because we're not worth anything unless people believe what we say. So we try to make it clear that we're scientifically neutral, that our role is not to render political judgments but to give the decision makers in the government the information they need to make rational decisions.

Throughout its history, the USGS has been one of the most successful government agencies. It has been highly respected. Can it continue to maintain this reputation as it is given increasing responsibilities but is limited by budget constraints?

At the moment, we're more limited with respect to people than with respect with money. This means that we can award contracts, but that we can't increase our full-time staff. We're already as efficient as anyone can anticipate, and if we're given additional responsibilities without additional staff, then we'll have to shift our priorities.

To what extent is the USGS going to be involved in basic research?

There isn't any question that doing basic research is a part of the Survey's mission. We're charged with investigating the geological development of the United States, and where research opportunities are concerned, this can take us as far as we want to go. I suppose that about 10 to 15 percent of our people are devoting their time to basic research — most of our people with PhDs and Masters degrees, for example. So basic research will prosper in the Survey. It always has and it always will.

How do you envision the interaction between the USGS and the universities over the coming years?

Interaction between the universities and the USGS has always been intimate because of the Survey's practice of hiring professors and students to work part time on a WAE basis. (Note; Personnel on a While Actually Employed basis are hired by the Survey to accomplish a specific assignment.) The Survey more or less invented WAE, and it's a great arrangement from our standpoint, although it is a terrible one for the universities because they aren't paid any overhead for their people who are working for us.

Besides hiring people to work WAE, we are going to be working increasingly with universities on a contract basis. We have to do this because we're being given more responsibilities and more money, but not more staff people. We have one contract with Caltech in seismology, and I would anticipate others.

How do you foresee the role of USGS in relation to the resources of the continental margins?

We can't tell right now. The reorganization that the President has announced leaves this matter open to discussion. We're talking with NOAA (The National Oceanic and Atmospheric Administration) about this responsibility, and we'll know more when a detailed reorganization comes out. (Note; The proposed reorganization, announced just prior to Centennial Day, would have created a new Department of Natural Resources consisting of agencies under the current Department of the Interior, plus the U.S. Forest Service and NOAA. The plan has since been dropped.)

You're in a better position than most of us to assess the seriousness of our growing shortage of natural resources. How do you feel about our capacity as a nation to come to grips with this problem?

Obviously our mineral resources are not going to last forever — particularly our oil and gas. Many scientists, including me, are saying, "Look, we're going to run out of commercially producible oil and gas by 2030 or 2050." My wife and I sold our second car a couple of years before the Arab oil embargo, and we own a house with double-paned thermal glass — and this is in La Jolla, where it isn't really necessary. So we work actively to conserve energy, but we can understand why members of Congress are not eager to take strong action on conservation when their constituents are not very concerned. Nevertheless, I believe we've got to conserve energy, and to a much greater degree than we've been doing.

The geological sciences are becoming predictive sciences, not because we geologists want them to be, but because legislation forces us to make predictions.

What do you like best about your job?

The staff here runs a whole earth sciences university for me, and so it's easy to acquire a vast amount of information. I also enjoy influencing government policy, and I like Washington; it is an exciting place. I see many of my friends from Caltech here. In fact, I run into more people from Caltech in Washington than I did in La Jolla.

What aspect of your job is the most frustrating?

Nothing about it is frustrating, but the periodic emergencies that we face are the least rewarding. It would be nice not to have them.

Paul honored

Rodman W. Paul, the Edward S. Harkness Professor of History at Caltech, has been elected a fellow of the prestigious Society of American Historians "in recognition of the literary and scholarly distinction of his published work."

Membership in the Society — limited to 200 — is based on historical research and authorship of books of distinction in the field. Among Paul's eight books, *California Gold* and its sequel, *Mining Frontiers of the Far West*, have been especially cited for giving new insights into the history of mining in the West.

Paul has been a member of the Caltech faculty since 1947 and was appointed to the Harkness chair in 1972. In 1978 he was elected to the presidency of the 2,400-member Western History Association.

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Earthquake alarm system proposed

An alarm system that could give up to several minutes' warning before seismic waves from a distant earthquake pass through an area has been proposed by Wilfred D. Iwan, an expert in the placement of strong-motion instrument arrays for measuring large earthquake motions.

Iwan, who is professor of applied mechanics at Caltech, said that a system such as he is describing could be used by business and industry to quickly shut down machinery and processes vulnerable to earthquake damage, and to bring emergency power on line. He believes the warning system could mean the difference between economic survival and catastrophic damage to an industry.

Iwan explained that an example of an early-warning system for southern California might be an array of strong-motion instruments along the San Andreas fault that would communicate with industrial subscribers via telephones. He said that the key to the system's usefulness is the fact that seismic waves travel at the speed of several kilometers per second while electrical impulses travel over wires at the speed of light.

"Obviously, if an earthquake occurred right under a plant, the system would be useless," he explained. "But if the earthquake were on the San Andreas fault, industries in southern California could have from approximately ten seconds up to more than a minute's warning between the alarm and the arrival of the seismic waves, depending on where the earthquake originated along the fault."

"Ten seconds doesn't sound like much time, but a lot can be accomplished in that period, especially if the alarm is used to trigger an automated shutdown process," Iwan said.

Cloning to smog

Alumni briefed on faculty research

Cloning: 8,000 years old

"Cloning," James Bonner, professor of biology, told his Seminar Day audience, "has been practiced since antiquity." Some 8,000 years ago Arabs cloned date palms by pulling off branches and planting them to produce trees identical to the parent plant.

In the past 20 years a new way of producing clonal plants has been developed, in part at Caltech. Plant tissue, first made asceptic, and then put in a nutrient, will grow cells in exponential numbers. These cells, immersed in coconut milk, will turn into embryos and, eventually, into adult plants.

"From a single piece of tissue you can produce millions of identical plants — agriculturally a very desirable thing to do," Bonner said.

Animal cloning, however, is still in the primitive stages. The only success so far has been with frogs. The nucleus is removed from the cells of frog tissue and introduced into a frog egg (in which the nucleus has been killed). In solution, the egg grows into an embryo, and the embryo into an adult frog with the same genes as the frog-donor of the tissue.

"Now we can get millions of genetically identical frogs," Bonner said, and added with characteristic humor, "But, you *know* — no one wants millions of genetically identical frogs."

What they do want is cloned mammals. Genetically cloned cattle, for example, would be a most important advance in the industry. To that end, a great deal of work has been done on a sample mammal — the mouse — but so far without success. However, Bonner promised, the day will come when mice will be cloned and "that will open up the door to everything else."

Recombinant DNA cloning — "the subject that has caused all the public worry," Bonner said, was invented five years ago and is widely practiced at Caltech and a few other places. Today recombinant DNA technology is being used to make human hormones. For example, genes that code for human insulin have been cloned, and researchers are now able to make such insulin in bacteria.

Ultimately we will clone human beings, Bonner concluded, and then we'll have a whole new set of human problems.

Blake's dark vision

In 1795 the English poet-painter William Blake did a series of 12 color printed drawings, considered by many to be his greatest pictorial achievements. Certain features of this series have intrigued Blake scholars into looking for a connecting theme or structure in the 12 works of art.

Using color reproductions of the Blake prints, Associate Professor of English Jenijoy La Belle shared her speculations about this artistic mystery with her Seminar Day audiences. Comparing the prints on a one-to-one basis with selected sections from the Sistine Chapel frescoes, La Belle pointed out the striking parallels in motif and style — the heroic musculature of the figures, the dramatic postures, the schematic simplicity of the backgrounds, and the mixed biblical and secular subject matter — as well as the similarity in method of presenting the artists' underlying religious outlook. At the same time La Belle examined the contrast between Michaelangelo's emphasis on the spiritual dimension of mankind rooted in hope, and Blake's dark visions of human nature as a "physical bondage burdened by despair."

In "God Creating Adam," for example, La Belle pointed out

James Bonner shares his personalized license plate with alumni.

Jenijoy La Belle probes the artistic vision of William Blake.

Michaelangelo's figure of God giving man the divine spark of intelligence and spiritual awareness, whereas in "Elohim Creating Adam" Blake's God of justice and vengeance is giving physical form to a tortured soul.

Although Blake never visited Italy, La Belle said he knew the Sistine designs so well that their structure became part of his own artistic habits of mind, and he used their plan to show his dark vision of creation, fall, death, and the promise of redemption.

On the trail of smog

The development of a remarkable technique called electron capture gas chromatography has given Frederick H. Shair, professor of chemical engineering, the technical capability to detect specific molecules down to a concentration of one part per trillion. In his Seminar Day lecture, Shair outlined how this ability has been used to study the movement of air pollution over distances of miles throughout the Los Angeles Basin, as well as over distances of feet, inside buildings.

Shair has used a system involving the release of a colorless, odorless, nontoxic gas called sulfur hexafluoride, followed by a sampling of the atmosphere downwind from the point where the gas was released. The samples are run through the chromatographic apparatus and the results indicate how the air mass has moved between the point of release and the point where the sample was gathered. Shair said the system has been used to determine the movement of polluted air in the Los Angeles basin, and that the results have been surprising.

For example, in one experiment Shair and his colleagues measured the movement of tracers released from an El Segundo power plant and found that material blown offshore by evening winds came back the next day. Thus, sulfur dioxide from power plants would move offshore at night to react with fog and could come back the next day as sulfuric acid mist.

Shair also outlined other uses of the tracer — in medical applications as a "fingerprint" system for explosives, and to trace the movement of chemicals exhausted from fume vents in laboratories. In the latter studies, he has discovered serious deficiencies in venting systems, in which vented materials are entrained by building ventilation inlets.

A monkey's eye view

About half of the monkey's cerebral cortex is used to process visual information transmitted from the eyes, David C. Van Essen, assistant professor of biology, told alumni. This part of the cortex is divided into a mosaic of at least 10 anatomically distinct regions with highly specialized functions. Together, these areas provide the monkey with perceptual capacities rivaling those of humans, Van Essen said.

Some of these areas specialize in analyzing the direction of movement of visual stimuli — for instance, from left to right or from up to down. Others analyze data according to shape; still others, according to color.

In discussing his research, Van Essen used two-dimensional maps of the surface of the cerebral cortex to illustrate the location of different visual areas and to analyze the way they process visual information. He said that considerable progress has been made in the past two decades in understanding the highly specialized functions carried out by different parts of the cortex. However, many intriguing aspects of higher mental functions, such as perception and recognition of familiar objects, remain to be explained, Van Essen said.

Sulfates and smog

Figuring out strategies to control air pollution in the Los Angeles basin has often been as murky a business as the gray smog that frequently envelops the region. In his Seminar Day talk, Glen R. Cass, assistant professor of environmental engineering, outlined how he and his colleagues have unravelled the complexities of a major contributor to smog — sulfates. According to Cass, sulfate particles are primary contributors to visibility deterioration in the basin; they also acidify rainfall and cause corrosion of materials.

Cleaning up this pollutant is no easy task, because a wide range of sources emit sulfur oxides, including power plants, petroleum refineries, industrial fuel burners, chemical plants, and transportation vehicles, Cass continued.

Sulfates, mainly ammonium sulfate stemming from primary sulfuric acid mists and conversion of emitted sulfur dioxide, can build up in winter as well as summer and can remain aloft in the Los Angeles basin for several days during periods of stagnation. Cass outlined the work he and his colleagues have done to gather data on the sources and behavior of sulfates, and the possible strategies for reducing sulfate pollution. The scientists found that no single source contributes more than a small portion of the pollutant. This means that no single pollutant control measure will make more than a dent in air quality degradation. Similar studies of particulate nitrates, ozone, nitric acid, and other nitrogen oxides are being made, Cass said.

How to trap a quake

Just as zoologists can best study an animal by trapping it for analysis, so seismologists must learn to "trap" earthquakes to really understand them. That is, they must be able to forecast where a large earthquake is likely to happen and to place dense arrays of seismic equipment to catch the entire progress of the quake, from the first jiggle of the first foreshock to the last jog of the last aftershock.

In her Seminar Day talk, Karen McNally, senior research fellow in geophysics, described how she and her colleagues at Caltech and the University of Mexico successfully trapped the November 29, 1978, earthquake in Oaxaca, Mexico. The

coastal area of Mexico undergoes about five times as many large earthquakes per unit length as does the coast of California, said McNally, but is sparsely instrumented. So when researchers forecasted a large earthquake in the Oaxaca region, the Mexican and United States seismologists immediately moved to install a dense array of seismic instruments in the area.

The gamble paid off, because the scientists captured the entire course of the earthquake, including baseline activity, foreshocks, mainshock, and aftershocks.

Plate tectonics

Introduced as a bold new hypothesis 15 years ago, plate tectonics has become a widely accepted theory that pervades all of the geological sciences, Jean-Bernard H. Minster, assistant professor of geophysics, told alumni. Plate tectonics has survived virtually intact since the concept was first formulated, providing a unifying background for our understanding of geological processes as abrupt as earthquakes and as gradual as the formation of oil deposits.

Essentially, plate tectonics describes the motions of a mosaic of 12 major plates that constitute the outer layer of the earth. For most practical purposes, these plates behave as rigid entities and interact strongly where they meet, creating earthquakes, volcanic arcs, and mountain ranges.

In his seminar, Minster presented the alumni with updated and refined estimates of plate motions that he and Thomas Jordan recently completed. Jordan, BS '69, PhD '73, is now at Scripps Institution of Oceanography.

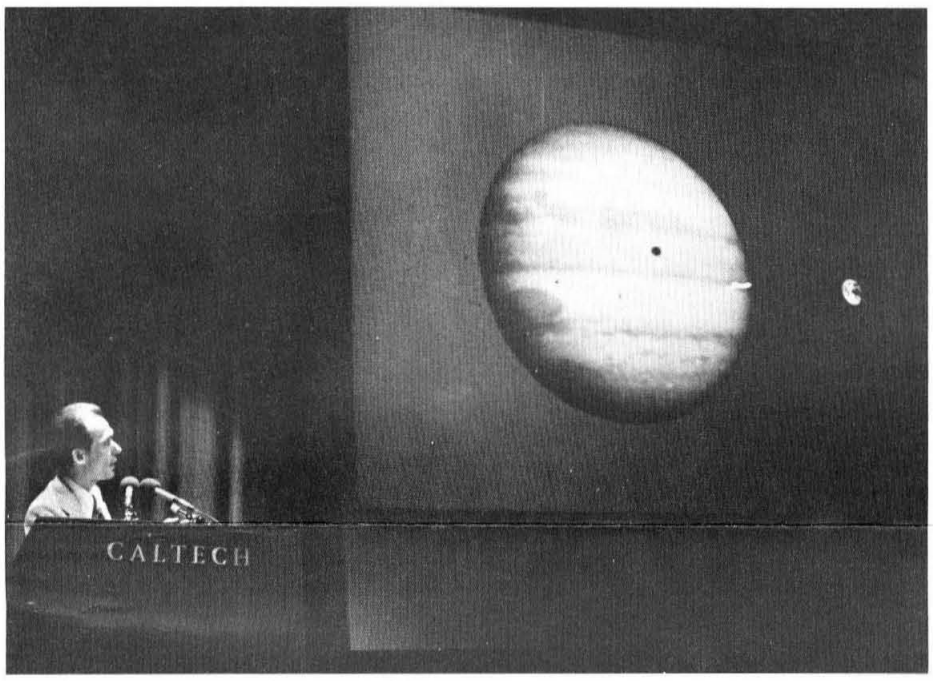
According to the researchers, as better data become available and more precise models can be constructed, plate tectonics hypotheses may require some refinement. For example, it has been known for some time that a Tibetan region in the India-Australia plate north of the Himalayas doesn't behave as if it is part of a rigid structure, and this anomaly has complicated Asian and Chinese tectonics theories. Some slow *internal* deformation may be taking place in such plates, Minster said.

Minster noted that the Ninetyeast Ridge, a range that stretches north-south for 3,000 kilometers along the floor of the Indian Ocean, was thought to be free of earthquake activity until recently. But new data show that the ridge has been the site of more seismic activity in the past 70 years than the San Andreas Fault. The San Andreas Fault is believed to be the surface boundary between the North American and Pacific plates, which are slipping past each other at an average rate of 5.8 centimeters per year.

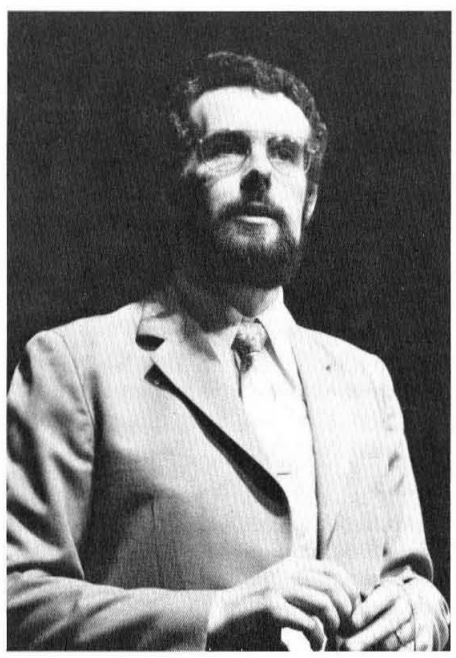
Update on Voyager

It was 369 years ago — in 1610 — that Galileo turned his telescope toward the heavens and saw four moons circling Jupiter — a discovery that convinced him that Copernicus was correct in his belief that the planets rotate around the sun. Today the Voyager spacecraft are transmitting information about Jupiter that may rival Galileo's discovery in importance, Professor of Physics Edward C. Stone told alumni as he shared data relayed by Voyager 1 as it flew past the giant planet.

Stone, who is project scientist for Voyager 1, said that the new information has greatly increased our knowledge of Jupiter's atmosphere and weather system, its magnetic field and radiation, and its satellites. The physicist showed a time-lapse film of the Jovian atmosphere, composed of 70 photographs taken over a 700-hour interval. The film reveals jet streams abutting high pressure ridges, and cloud-like formations that retain their essential shape in spite of turbulent activity. Starring in the film is the Great Red Spot — a hurricane-like structure at least 300 years old. Alumni watched as a cloud formation circled the Great Red Spot at 225 miles per hour, a journey that would require an estimated six days to complete.



Edward Stone brings Jupiter to the wide screen.



Bernard Minster summarizes plate tectonics data.

One surprise in the Voyager data is the direction of winds in the atmosphere, according to Stone. "We had expected winds to be moving broadly from east to west," he said, "but in addition we found a lot of rotational motion." He added that by studying the atmospheric features that Voyager shows, it should be possible to gain a much better understanding of the important processes in the Jovian weather system.

Other important data from Voyager concern the Jovian magnetic field and its trapped radiation. The field, which rotates with Jupiter every 10 hours, is the largest structure in the solar system. All of the moons are buried in the field — unlike our own satellite — and are subject to intense bombardment by the radiation that is trapped there.

Ted Wu describes the swimming skills of microorganisms.

Fluid-borne athletes

Fluid-borne athletes, some of them capable of zipping about at speeds up to 30 body-lengths per second, were described by Theodore Y. T. Wu, professor of engineering science, in his Alumni Seminar Day talk. The tiny swimmers that Wu is studying are single-celled microorganisms that use whip-like flagella to flail through fluids, or that row themselves about by means of hair-like organelles called cilia.

Wu shared with his audience the high-speed micrographic movies of the movements of these microorganisms that he and his colleagues have obtained by using special photographic techniques. Through their work, they have gained a better understanding of flow and propulsion in fluid, he said.

The cilia that Wu described play an essential role in life, because the lungs of humans and other mammals have ciliated surfaces. The cilia move debris-laden mucus out of the lungs through their beating motions, and the Caltech scientists are analyzing this process. Their studies are important, Wu explained, because scientists believe that a malfunction of this cleansing system may be responsible for cystic fibrosis, and that cigarette smoke may cause lung damage by suppressing ciliary motion and affecting mucus secretion. High speed photography has allowed the researchers to look closely at the way cilia move, and how they organize themselves into precise beating patterns that resemble a wheat field waving in the breeze.

Cilia are also found on the surface of the mammalian oviduct, where they move the egg from the ovary to be fertilized by the sperm. Studies of this reproductive gamete transport phenomenon could aid development of new birth control methods and contribute to an understanding of fertility problems.

Chemical bonding

The fundamental concepts of chemical bonding as they were developed by Linus Pauling at Caltech in the 1930s have provided the foundation for almost all chemical research (and a good part of the biological research) during the last 50 years, William A. Goddard III, professor of chemistry and applied physics, told alumni. In recent years, chemists have been able to expand on Pauling's concepts in order to predict the details of chemical reactions and of excited states of molecules, and to understand the atomic and molecular processes that take place on solid surfaces.

A chemical bond is the force that holds atoms together when they are combined into a molecule. An understanding of chemical bonding and how it occurs has many important implications for technology today, Goddard said. For example, chemical bonding plays an important role in heterogeneous catalysis, the process through which particular chemical reactions are selectively facilitated without the catalyst itself being changed. Heterogeneous catalysis is important in many parts of the chemical and petroleum industries and will play an increasing part in our everyday lives (e.g., in automobile exhaust systems).

A better knowledge of molecular bonding and chemical reaction mechanisms will help us create catalysts that can perform the specific roles required in future technology, Goddard said. Similar knowledge will also be important in developing the next generation of electronic devices. Here the special problems have to do with controlling the nature of the electronic states at interfaces between surfaces.

Goddard said that several experimental and theoretical groups in chemistry at Caltech are focusing on the problems of catalysis (Chemistry has launched a drive to obtain funding for the building to house this expanded effort) and several groups in applied physics at Caltech are focusing on the study of electronic states at solid-solid and gas-solid interfaces.

In his talk, Goddard illustrated some of the new ideas of chemical bonding by describing the initial steps in oxidation of semiconductor surfaces and the binding of molecular oxygen to hemoglobin.

Imperialism: a crime?

Lance Davis, professor of economics, took a "whodunit" approach to solve the "mystery" of British imperialism by posing these questions to his Seminar Day audiences: What was the crime? How was it carried out? What was the motive? And, who did it?

Beginning with the assumption that imperialism *was* a crime, and that the motive was maximum profits at minimum costs, Davis pro-

Continued on page 8

More Seminar Day summaries

Imperialism: a crime?

Continued from page 7

ceeded to the facts of the case. Comparing the percentage of profits made from foreign investments with domestic and colonial investments (between 1865 and 1910) Davis showed that foreign investments paid the highest returns, and that colonial investments paid only one quarter of one percent more than domestic investments. Certainly not excessive profits!

On the other hand, the costs of Empire — paid by the British — were high, particularly for defense. The self-governing colonies not only did not want to defend themselves, they did not even want to pay for their own defense. Perhaps, Davis commented, the lessons of the American colonies contributed to the reluctance of Parliament to insist on defense taxes from the other colonies.

Nevertheless, whatever the reasons, the result was that most of the colonies' military budget was paid for by British citizens.

If you subtract defense and administrative costs for the colonies, Davis said, from the marginal profit from imperialist investments, the net result is actually a loss, figured on a per person basis. Thus, the victims of imperialism were not the colonials, but the British citizens.

As for who the winners were — a few fortunes were made, Davis said, and some firms were family- or individually-owned, but the bulk of Empire investments were publicly owned — with 52 percent of the stockholders belonging to the "elite" (military officers, gentlemen, members of the aristocracy, and justices of the peace), compared with the 18 percent owned by the middle class (people working in trades, manufacturing, and the professions.)

And how did the elite pull it off — that is, how were the imperialists able to turn government power to their personal profit while transferring some of the costs to other citizens? According to Davis, a not-yet-completed survey of Parliamentary voting trends indicates a voting coalition between the "left" and the right, resulting in a "ripoff" of the middle class.

So, Davis concluded, if the crime was robbery, it appears that the "thieves" were Britain's elite and the victims Britain's middle class.

The Wright brothers' genius

How did it happen that a couple of bicycle mechanics from Dayton, Ohio — in six short years of only part-time involvement — were able to solve problems of flying that no one else at the time had come close to understanding?

According to Fred E.C. Culick, professor of applied physics and jet propulsion, the 1903 success of Wilbur and Orville Wright was no lucky accident, contrary to a suggestion often made in current literature on the Wrights. Instead, Culick told his Seminar Day audience, the famous brothers were brilliant aeronautical engineers — theorists and technicians — who did each step of their projects themselves, from research to design, to construction, and to the final test piloting. Every feature of their eventually successful plane was the result of careful testing and reasoning; and most of what they learned about past mistakes was discovered when they were flying their own craft.

One exception that Culick pointed out was their peculiar placement of the tail in the front of the plane instead of the rear — a feature motivated more by fear of crashing than by scientific theory. (Two leading glider pilots of their time had gone to their deaths in aircraft featuring aft tails.)

It was their development of wing warping — the predecessor of present-day ailerons — for lateral balance and turning that pushed them far ahead of their aeronautical competitors. They were also the first, Culick said, to determine the need for a single vertical tail to correct adverse yaw, and the first to learn how to construct propellers correctly. By using a movable horizontal tail and wing warping, combining stability and control, they paved the way for the modern airplane.

Distinguished alumni honored

Continued from page 1

physics at the University of Colorado, he designed and created the San Francisco Exploratorium at the Palace of Fine Arts. Visitors to this museum of science, humanism, arts, and technology learn through touching and hearing exhibits, as well as seeing them.

Born in Shanghai, China, Tsien, PhD '39, earned his MS degree from MIT and his PhD degree in 1939 from Caltech. At the Institute he worked on supersonic flight and jet propulsion as a graduate student, a research fellow, and an assistant and associate professor, later moving to MIT as that institution's youngest full professor. During World War II he served as a consultant on jet propulsion to Aerojet and the Scientific Advisory Board of the U.S. Air Force. After the war he was commended by the Air Force for his "invaluable contribution" to victory.

In 1949 the Guggenheim Foundation offered him the directorship of one of its two research centers (at Caltech and Princeton) and he chose Caltech, becoming the Goddard Professor of Jet Propulsion. He returned to China in 1955 to the Chinese Academy of Sciences.

The first U.S. astronomer to win the Nobel Prize in physics, Robert Wilson, PhD '62, shared this honor in 1978 with Arno Penzias. They were chosen for their discovery in 1965 of a universal background radiation, a remnant of the 18-billion-year-old "Big Bang." At Bell Telephone Laboratories, Wilson has been involved for many years in the development of ultra-low noise receivers for long distance satellite communication. He helped initiate millimeter-wave astronomical observations of radiation from molecules. A member of the American Astronomical Society, he received the 1977 Herschel Medal of the Royal Astronomical Society.

PERSONALS

1932
GRANT D. VENERABLE announces the establishment of the Naomi Tabron Venerable Scholarship Fund, in memory of his wife, who passed away on November 13, 1978. Contributions, which will help undergraduates at Caltech, may be sent directly to Joseph A. Farmer, Office of Memorial Funds, 1-36, Caltech 91125.

1933
THEODORE S. MITCHEL writes from Houston, Texas, "Took early retirement from Shell Oil Co. on 2/1/71; working for Bernard Haldane Associates as vice president. We counsel people on how to find their ideal job or change jobs into their ideal. I have nine grandchildren, and one great-grandchild."

1937
HSU TSI FAN, MS, MS '39, vice president of Shanghai Chao Tung University, and professor of applied mechanics, writes to report on other Caltech alumni in China. DJEN-YUEN CHU, MS '36, PhD '39, is professor of physics at the Pedagogical Institute of Kiangsu, Soochow, Kiangsu; CHI-NAN HSU, MS'47, Eng '48, is professor of mechanical engineering and materials science at Chekiang University in Hanchow; CAR CHIA-CHANG LIANG, MS '39, is dead; TSUN-KUEI WANG, MS '38, MS '39, is professor of structural mechanics at the Peking Aeronautical Institute; and SHIH-CHUN LO, PhD '51, is professor of aerodynamics at North-West Technological University, Sian, Shensi.

1943
RALPH GUN-HOU SIU, PhD, is author of a book published by John Wiley & Sons, Inc., *The Craft of Power.* Siu has drawn on Greek and Roman history, Hindu folk tales, Chinese legends, classical theorists, and modern practitioners in business and politics to present "operational specifics in the acquisition and exercise of power that have worked from the days of *Genesis* and *I Ching* to *The Prince* and *The New York Times.*"

1945
DONALD C. TILLMAN, MS '47, Los Angeles city engineer, has been presented the 1979 "Engineer of the Year — San Fernando Valley" award for his outstanding contributions to the professional engineering community. He was recently honored with the Engineering Project Achievement Award for the Mission Road High-Railway Grade Separation Project, given by the Institute for the Advancement of Engineering and the Steering Committee for Engineering.

1953
EUGENE B. MUEHLBERGER writes from London, "After being hastily evacuated from Iran, I've taken a position with Mobil Producing Netherlands, Inc., as operations manager. Am looking forward to working in civilized surroundings for a while and receiving *Caltech News* not always nine months late."

LEON L. VICKMAN has opened a law practice in Encino, California, after receiving his JD from Loyola University in Los Angeles.

1955
HARRY A. GRIFFITH, MS, a major general serving as chief, joint US Military Advisory Group, Korea, writes to Horace Gilbert, professor of business economics, emeritus, "Today marks the birth of a special body of Caltech graduates in Seoul, Korea. The name of this group will be "Disciples of Gilbert — Oracle of Dabney" (DOGOOD). Members will be known as DOGOODers. Our strength is only five, but we are stouthearted men!" The letter was also signed by SANG C. SHIM, PhD '67, YOUN S. SOHN, PhD '71; B. K. KIM, MS '69, PhD '72; and JO W. LEE, PhD '70.

1957
MARTIN C. TANGORA reports from Chicago, Illinois, "Polly and I have lived since late 1975 in a fairly grand old house in Uptown . . . The house is nice but absorbs a lot of time and money. As an avocation I continue to be active in architectural and historic preservation, and am now chairman of the Advisory Committee to the Commission on Chicago Landmarks."

1960
THOMAS K. BJORKLUND is working for Amoco Production Company in Denver, Colorado, as a staff geologist in the exploration department.

1967
PETER N. CROSS, a management analyst and economist with the U.S. Department of State, Kabul, reports, "1978 was an interesting year for us and 1979 appears to be bringing more of the same. Living in a country dominated by a government based on terror has given us a new appreciation for America. Afghanistan's government is too bad to believe; much worse, in fact, than the reports in the Western press indicate."

OBITUARIES

1923
BERNARD G. EVANS on April 24 in Santa Barbara, California. Bernie Evans was president of the Associated Student Body in 1922-23. He is survived by his wife, Constance.

1924
JULE H. COFFEY on March 3. He was retired and had been living in Claremont, California. His daughter, Priscilla Coffey McKenna, says, "He lived a long and exceedingly useful life and we will miss him very much."

1926
WILLIS HOWARD WISE, PhD, on February 2. He had been living in Fanwood, New Jersey.

1927
HILMER E. LARSON in November. He was retired and living in Orinda, California.

1928
STANLEY C. MORGAN, MS, on February 12 in his 88th year. He is survived by his wife, Gladys, of Vancouver, British Columbia.

1931
WINTON C. HOCH on March 22 from the effects of a stroke. Hoch won three Academy Awards for his cinematography in "Joan of Arc," "She Wore a Yellow Ribbon," and "The Quiet Man," and an Emmy for "Voyage to the Bottom of the Sea." He had recently been elected president of the American Society of Cinematographers. Hoch held three patents for his camera designs, and, during World War II, devised an accurate means of photographing ballistic tests for the Navy. He is survived by his wife, Helen, and three sons.

1933
JOHN K. AYERS on November 12. He had been living in Mill Valley, California.

1934
GLEN E. WOODWARD on February 24. Before his retirement he was senior vice president of DeGolyer & MacNaughton, an engineering consulting firm in Dallas. From her home at Hide-A-Way Lake in Lindale, Texas, Mrs. Woodward, a member of The Associates, writes, "The recent programs honoring Albert Einstein reminded me of how proud Woody was of the fact that he was the waiter at the Athenaeum who served Dr. Einstein when he was at Caltech."

1943
JOHN P. WARNKEN, MS, on April 22. He was retired. A resident of San Antonio, Texas, Warnken had been a member of the American Chemical Society and had also been active in the St. Vincent De Paul Society. He is survived by his wife, Elizabeth, daughter, Mrs. Lawrence (Patsy) Noll, and son, John, Jr., and two grandchildren. Contributions may be made to St. Mary's University of San Antonio.

1957
COL. GERALD W. MEDSGER, RET., MS, on September 18. He had been academic dean of the United States Military Academy Preparatory School at Ft. Monmouth, New Jersey. He is survived by his wife, Margery.

1958
DALIP SAUND on April 2 in an airplane crash in the Santa Monica Mountains. Saund, who earned a PhD in anthropology from UCLA, was planning on returning to Thailand to continue independent anthropological studies, and to achieve this goal he was employed as an electrician on an off-shore oil rig. His congressman father, a Sikh, was the first native of India to be elected to public office in the United States. His son, Eric, is a junior at Caltech.