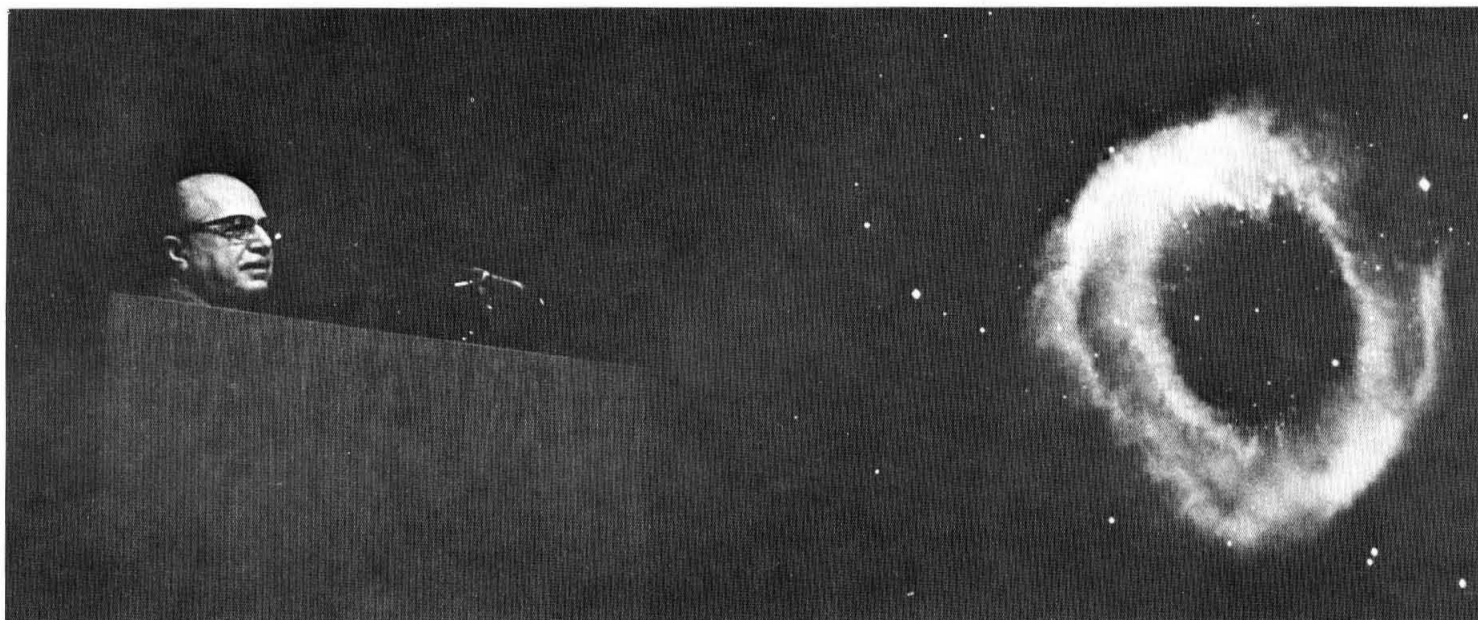


CALTECH NEWS

VOLUME 8, NUMBER 5, JUNE 1974

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On Alumni Seminar Day, Jesse L. Greenstein, Lee A. DuBridge Professor of Astrophysics, describes complex evolutionary processes in dying stars.

Caltech awards its top honor to three alumni

"One of my favorite activities as president of Caltech is to visit faculty members in their offices and laboratories to discuss their research and teaching activities," Harold Brown said as he welcomed more than 1,400 alumni to Seminar Day.

"Your opportunity today parallels my own experience. Seminar Day is an excellent way for you to review the diversity of interests on the campus and at JPL."

Richard L. Van Kirk, BS '58, chairman for the general session, introduced Arnold O. Beckman, PhD '28, chairman emeritus of the Caltech Board of Trustees, and Mrs. Beckman, and expressed appreciation for their contributions to the Institute.

Daniel J. Haughton, chairman of the Board of Lockheed Aircraft Corporation, gave the keynote address on "The Future of Air Transportation."

In ceremonies early in the general session, Brown presented three Distinguished Alumni Awards—the highest honors that Caltech can confer on its graduates—to Leo Brewer, BS '40; Clifford C. Burton, BS '40; and Louis G. Dunn, BS '36, MS '37, and PhD '40. The award consists of a silver medallion and certificate.

Brewer is professor of physical chemistry, UC Berkeley, and head of the Inorganic Materials Research Division and associate director of the Lawrence Berkeley Laboratory. He is acknowledged as the leading high-temperature chemist in the world; he also specializes in spectroscopy, ceramics, metallurgy, and thermodynamics.

Brewer was the recipient of the Ernest Orlando Lawrence Memorial Award of the U. S. Atomic Energy Commission in 1961 and the Palladium Medal Award of the Electrochemical Society in 1971. He is a member of the National Academy of Sciences, American Chemical Society, Combustion Society, and International Union of Pure and Applied Chemistry.

Burton joined C F Braun & Co as a district engineer in New York City in 1948. In the company's home office in Alhambra, he became, successively, manager of the manufacturing division, manager of the engineering division, vice president for engineering, and, in 1971, president.

Burton is a member of the Caltech Associates, the American Institute of Chemical Engineers, and the National Society of Professional Engineers. He also holds the distinction of being the undergraduate who managed, in 1937, to release enough chlorine during an experiment to force the evacuation of Gates Laboratory.

Dunn was a member of the Caltech faculty when JPL was founded. He was its director during the period when the technical basis for the space programs of the sixties and seventies was being established.

He joined the staff of TRW in 1954. There, as an executive vice president and as president of Space Technology Laboratories, he was chief engineer for the Air Force Ballistic Missile Program—responsible for developing the Thor, Atlas, Titan, and Minuteman missiles.

Hydrofoils to holographs:

Alumni share an exciting day

An embarrassment of riches—from talks by 12 faculty members to performances by the Caltech Band and Glee Club to exhibits of high speed bacteria, smog-measuring instruments, and laser pictures—greeted alumni, their husbands, wives, and children, on Seminar Day.

"What happened to the other half of Half Dome?" a woman in the audience asked Robert P. Sharp, BS '34, MS '35, professor of geology, as he concluded his talk on the role of glaciers in shaping the geological features of the Sierra Nevada—including Yosemite Valley. Sharp explained that its remains are scattered as boulders all along the Merced River Canyon.

James W. Mayer, professor of electrical

engineering, delighted his audience by interspersing slides of scuba diving among those of transistors.

And Rodman W. Paul, Edward S. Harkness Professor of History, kept his fascinated 4:15 p.m. audience eagerly asking questions about Mormon history until the moderator called a halt at 5:25.

Alumni and their families crowded into Jorgensen Laboratory where there were demonstrations every 20 minutes in the use of computers. In Keck Laboratory, they watched displays of the generation and effects of tsunamis (ocean waves caused by quakes), and earthquake engineering displays that included a shaking machine, a solar-powered seismic station, and a seismograph in operation.

A holographic (laser picture) demonstration, displays of equipment for testing hydrofoils for high speed marine craft, an optics demonstration, and the Wayland-Fraser intra-vital microscope, which studies blood flow in living creatures, were among other exhibits.

At noon, luncheon was served, picnic style, in the Athenaeum, with the Caltech Band providing music to munch by. In Baxter Lecture Hall the 30-minute color film, "The Universe from Palomar," was shown hourly.

The annual spring concert of the Caltech Glee Club concluded a busy day, as Glee Club alumni joined student members at the conclusion in singing the Caltech Alma Mater.

Haughton predicts:

Air traffic will double by 1985

Scheduled free-world air traffic will more than double by the mid-1980's, Lockheed Aircraft Corporation Board Chairman Daniel J. Haughton told Caltech alumni when he spoke on "The Future of Air Transportation" at the general session of Alumni Seminar Day.

"In 1973, the noncommunist world tabulated 315 billion scheduled revenue passenger air miles," he said. "By the middle of the next decade, the annual total will be two and a half times that figure."

Alluding to the growth in air travel, Haughton said, "In 1962, only a third of adult Americans had ever been on an airplane. Last year, more than half of them had flown." He praised the economy of the airplane, noting that a modern widebody jetliner uses less fuel per passenger mile than the standard size automobile in cross-country travel.

Haughton predicted that the U. S. will have a second generation supersonic transport at some future date. He said that, under U. S. government sponsorship, Lockheed is doing technology assessment studies of possible second generation SST's that will incorporate improved propulsion systems, greater flight efficiency, new materials and structures, noise abatement techniques, and other advances.

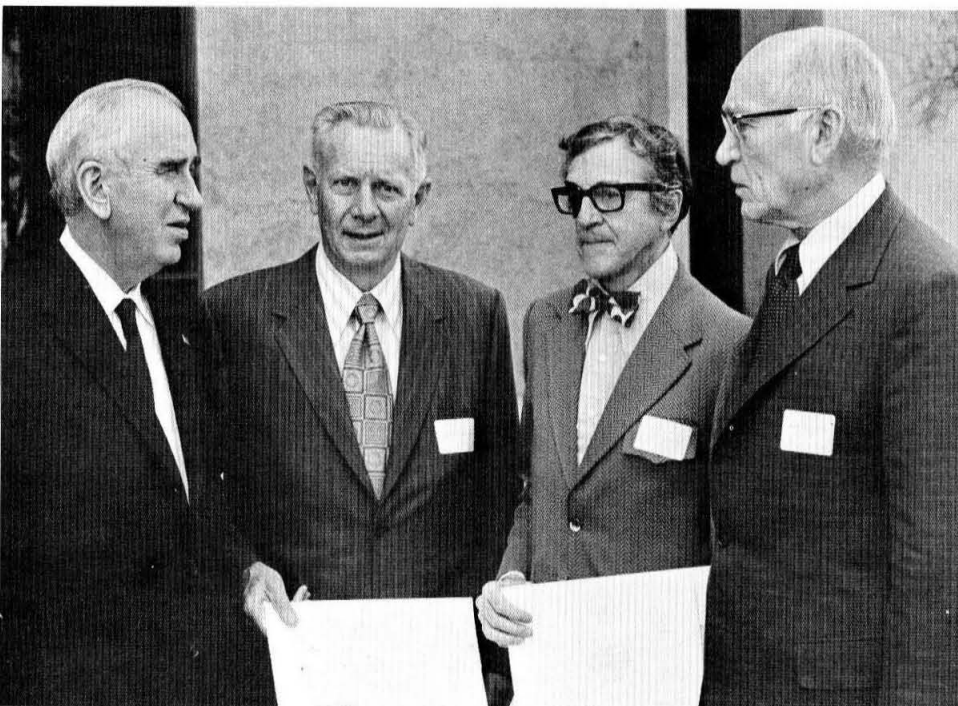
"We believe that one day our nation will have such an SST," Haughton said, "and we think it is important to keep on with these studies so that we will be in a position to go ahead when the time

comes."

He predicted there will be no new types of subsonic jetliners until well into the 1980's, because he said airlines will need several years to "digest all the present equipment they have on order or projected." Instead he said there will be improvements in existing aircraft and derivative versions.

For the time being, he said the airplane is wed to petroleum-based fuels.

"Eventually," he said, "the airplane will move to new energy sources—hydrogen, methane, or even nuclear power. But such a move probably won't occur before the end of the century."



Featured at general session: From left—Daniel J. Haughton, Lockheed Aircraft board chairman, who gave the major address; Clifford C. Burton, BS '40, and Leo Brewer, BS '40, recipients of Distinguished Alumni Awards; and Arnold O. Beckman, chairman emeritus of the Caltech Board of Trustees. Recipient of Distinguished Alumni Award, Louis G. Dunn, was unable to attend.

What faculty said on Seminar Day

Brief summaries of the Alumni Seminar Day talks given by Caltech faculty members appear below and on page 4.

Ice on the Sierra

Acting on his premise that one's appreciation of scenery is heightened through understanding how it became that way, Robert P. Sharp, BS '34, MS '35, professor of geology, discussed a three-million-year record of glacial activity in the Sierra Nevada.

Talking on "Ice on the Sierra," he described glaciers as "living dynamic geological agents, endowed with unusual powers of erosion, transportation, and deposition." He illustrated his talk with slides of geological features in Yosemite and other parts of the Sierra, and explained the role of glaciers in sculpturing the exhilaratingly beautiful landscape that we enjoy today.

Sharp said evidence indicates that the climate of the earth is colder today than has been typical throughout geological time, and that periods of heavy glaciation probably have comprised only one or two percent of its total history.

Home-grown transistors

New insight into transistors has resulted from the attempt by two Caltech scientists to understand what happens in the contact between metals and semiconductors during the fabrication of integrated circuit components. The result—the first step toward a new and simpler way of producing transistors, and toward the engineering of much smaller semiconductor devices than are yet available.

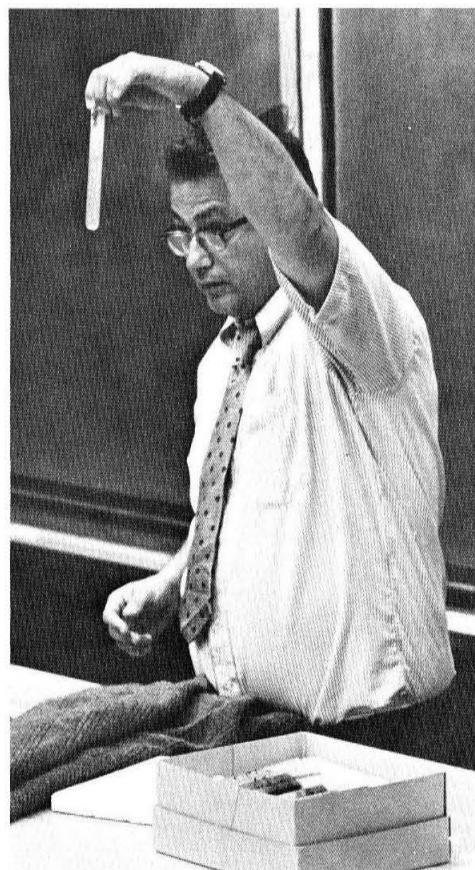
In their Alumni Seminar Day talk, "Home-Grown Transistors," James W. Mayer, professor of electrical engineering, and James O. McCaldin, professor of applied science and electrical engineering, described a process by which thin layers of metal are evaporated onto semiconductor crystals.



James O. McCaldin and James W. Mayer outline progress toward manufacture of semiconductor devices much smaller than those now available.

despite years of hardship and hostility—and despite periodic assaults by the U. S. government—were discussed by Rodman W. Paul, Edward S. Harkness Professor of History, as he talked on "The Mormons of Yesterday and Today."

Paul stressed that these factors were important in the survival and growth of the Mormons: the unity that resulted from sharing a faith that set them apart; the dynamic leadership of Brigham Young; a well-organized, centrally directed governing structure; cooperative methods of meeting challenges and carrying out community projects; and the attacks of the U. S. government, which created inner solidarity.

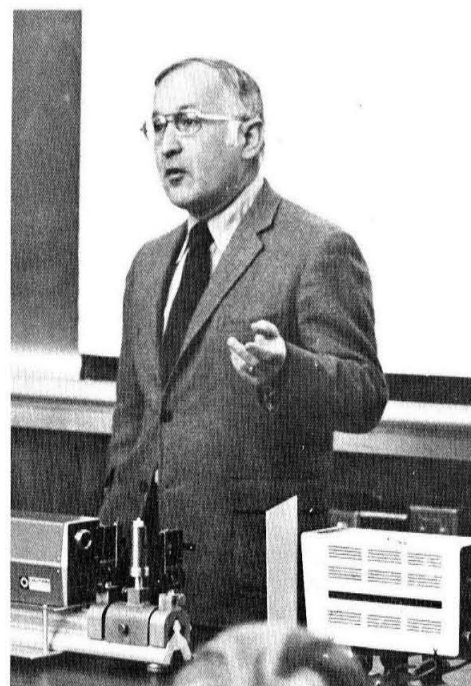


Light-mixing spectroscopy

Two properties of fluids are of fundamental importance in designing chemical processing facilities and petroleum cracking plants; these are the rates at which the liquids mix, and at which heat flows through them.

Cornelius J. Pings, professor of chemical engineering and chemical physics, vice provost and dean of graduate studies, described a new method for determining these properties that is more accurate and reliable than previous ones.

With the new technique, known as light-mixing spectroscopy, very small quantities of liquids are used and precise values can be obtained in fifteen minutes to two hours, Pings said. He explained that this technique is carried out with a spectrometer—designed and built in his laboratory—that is a million times more sensitive than a conventional one.



Cornelius J. Pings explains new technique for determining properties of fluids.

The mysterious "Dark Lady"

Numerous attempts to determine the identity of the "Dark Lady" whose wiles Shakespeare described in his sonnets have lead nowhere, according to Hallett D. Smith, professor of English, in his Seminar Day talk: "Where Was the Dark Lady When the Lights Went Out?"

Smith outlined a number of theories conceived by scholars—and later disproved—concerning the lady's identity. He quoted novelist and playwright Lawrence Durrell, recently on the Caltech campus as Andrew W. Mellon Visiting Professor of English, who said: "It will be a great day for the Elizabethan detectives when the central mystery of the sonnets is cleared up, but also an unlucky one, since it will deprive us of one of the most enjoyable of literary pastimes."

Smith assures us that this unlucky day has not yet arrived.

Evolution of dying stars

What happens to stars as they grow older was the subject of the Alumni Seminar Day talk by Jesse L. Greenstein, Lee A. DuBridge Professor of Astrophysics. As he discussed "The Evolution of a Dying Star," he drew from a technical paper about his current research subtitled "All You Ever Wanted to Know (And More—Very MUCH More) About High Latitude Blue Stars But Were Afraid to Ask."

Describing the "cosmic cemeteries" where his work is centered, he outlined studies of a wide variety of stars in the later stages of evolution, and his efforts to learn their elemental composition through analyses of their atmospheres.

"Light-mixing spectroscopy is based on the fact that when a beam of light shines through liquid, some of it is scattered," he said. "Localized differences in temperatures and composition—due to random thermal motion of the molecules in the liquid—slightly alter the color of the scattered light."

"In time, the differences both in temperature and composition dissipate by diffusion; and their dissipation is detectable with the new spectrometer. The size and shape of the spectra that result are directly related to the liquid's transport properties."

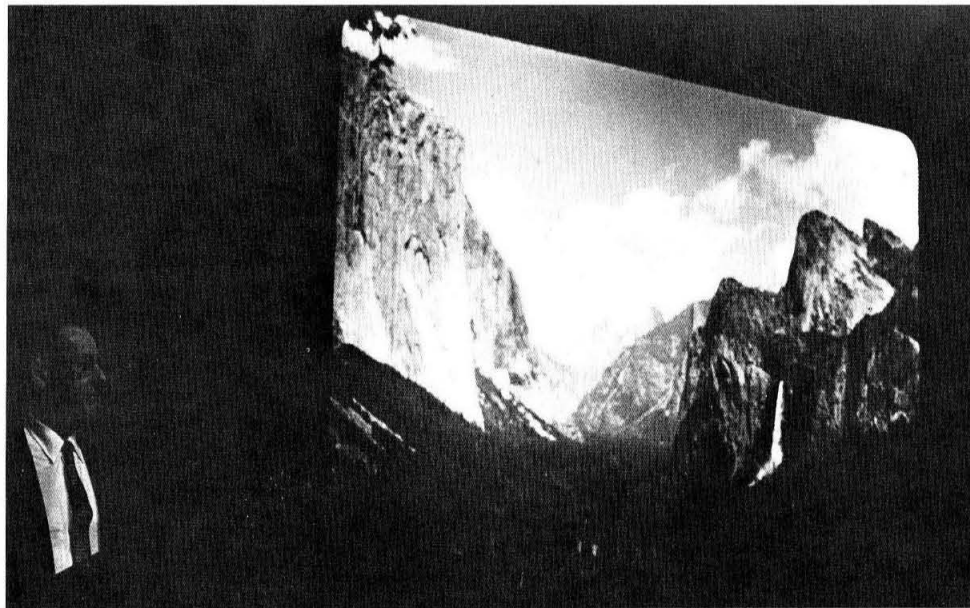
World population outlook

"A race is looming between the process of technology and social organization on the one hand and the enormous built-in momentum of population growth on the other. The fate of mankind hangs in the balance," Alan R. Sweezy, professor of economics at Caltech, told alumni as he spoke on "The World Population Outlook: Hope or Despair?"

"Survival depends on vigorous and sustained efforts to increase the production of the necessities of life, to cope with environmental deterioration, and to promote the widest possible adoption of birth control," he said.

As hopeful signs, he pointed to stabilizing populations in several highly developed countries, and to the launching of family planning programs in a number of less developed countries including Mexico, Colombia, Malaya, and others. Most hopeful of all, he said, is the initiation of a massive birth control program in mainland China.

"If, as seems likely, this program brings down the birth rate to replacement level in a short period of time, the impact on other countries may be tremendous," Sweezy said.



Above: Robert P. Sharp describes glacial heritage of geological formations. Below left: Seminar Day held attention of visitors of all ages.

Mayer explained, "Semiconductor crystals capable of exhibiting transistor action can grow through a solid metal film. The film provides a medium through which a nutrient material—a layer of loosely arranged semiconductor crystals on top of the metal—can be dissolved."

"The solid metal enables the semiconductor to dissolve and diffuse through it, atom by atom, to form a crystalline substance on the bottom. This crystalline substance is in the form necessary for transistor action."

The Mormons today

When the Mormons migrated to Utah Territory 127 years ago, they were a persecuted religious minority of 16,000 members whose crowning blasphemy, in the public mind, was polygamy. Today, the Mormon Church in the United States consists of 2 million members—most of whom are prosperous, patriotic, conservative, middle-class members of society.

The inner strengths that held the group together and enabled it to prosper



(continued on page 4)

At New York dinner:

Campaign announced in the East

Caltech's five-year development campaign to raise \$130 million was announced on the east coast with a dinner on May 13 at The Pierre Hotel in New York City.

Campaign Chairman Harry J. Volk, chairman of Union Bancorp, Inc., and of Union Bank, Los Angeles, announced that \$40 million, or 30 percent of the goal, already has been raised.

Some 150 trustees, alumni, and friends

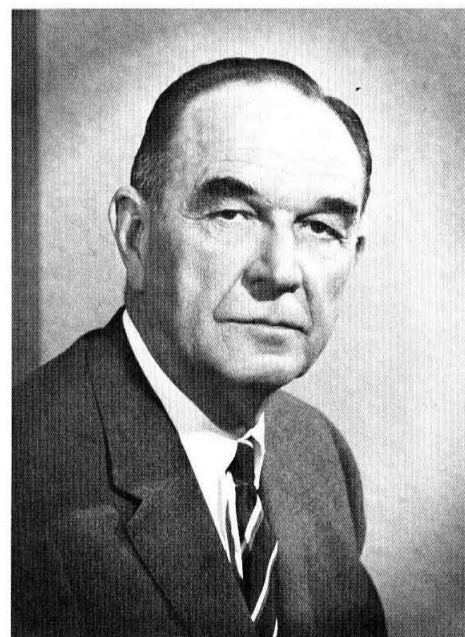
of the Institute listened to President Harold Brown explain that Caltech has launched its campaign, Caltech at the leading edge . . . , "to continue its unexcelled education of scientists and engineers and the leadership role of its productive and very substantial research program.

"As is true of many institutions," Brown said, "Caltech is barely able to keep up with inflation, even after strin-

gent economies. We are determined to keep Caltech at the leading edge of science and technology; we seek the help of the private sector of the country."

Thomas J. Watson, Jr., a Caltech trustee and chairman of the executive committee of the International Business Machines Corporation of New York, introduced James F. Bonner, professor of biology, who discussed the biological and sociological future of man.

Dr. and Mrs. James F. Bonner with Thomas J. Watson at New York dinner where Caltech's five-year development campaign was announced on the East Coast. Bonner gave the major address.



Avery named Caltech Board Chairman

R. Stanton Avery, founder and chief executive officer of Avery Products Corporation, has succeeded Arnold O. Beckman, PhD '28, as chairman of Caltech's Board of Trustees.

The announcement was made at the first east coast meeting of the Caltech trustees in New York City, which launched the Institute's development campaign in that part of the country.

Avery, whose company is the world's leading manufacturer of self-adhesive products, has been a Caltech trustee since 1971 and is active in southern California academic and cultural affairs. He was named California Manufacturer of the Year (1970) by the California Manufacturers' Association.

Avery started his company, which is headquartered in San Marino, California, three years after his graduation from Pomona College in 1932. Avery Products now has 27 factories and sales operations in more than 20 countries around the world. The industrialist is chairman of the board, in addition to being his company's founder and chief executive officer.

He is chairman of the board of trustees of the Huntington Library and Art Gallery, San Marino, California, and a member of the governing board of the Performing Arts Council of the Los Angeles Music Center, and the board of trustees of the Los Angeles World Affairs Council.

While relinquishing the chairmanship of the board, Beckman, 74, will remain active on it as chairman emeritus. He served as board chairman for ten years, and as a board member since 1953.

He headed two Caltech development campaigns, one launched in 1958 that raised \$19.5 million, and one launched in 1967 that met its goal of \$70.4 million. Caltech's Beckman Auditorium and the recently dedicated Mabel and Arnold Beckman Laboratories of Behavioral Biology were gifts from Arnold Beckman and his wife, Mabel. Dr. and Mrs. Beckman are life members of The Associates.

Beckman was a member of the chemistry faculty until 1940, when he left to devote full time to the company he had founded, Beckman Instruments, Inc., of Fullerton, California.

Haagen-Smit receives 1974 Rhineland award

Even as observers felt certain that he had received every major award in his field, Arie J. Haagen-Smit, professor of bio-organic chemistry, emeritus, at Caltech, received yet another honor: Western Europe's \$9,700 Rhineland Award for 1974.

The former chairman of the California Air Resources Board was honored for his "exceptional work in air pollution, especially concerning photochemical reactions in air." Haagen-Smit determined the chemical composition of smog and has been active for many years in developing control measures for pollution emitters.

In 1974-75:

Moulton to head Alumni Fund

Reuben B. Moulton, BS '57, has been named national chairman of the 1973-74 Alumni Fund. Moulton, who is district manager of customer operations for the Pacific Telephone Company, has been a leader in alumni activities for more than a decade.

After serving as a director for four years, he was elected president of the Alumni Association in 1971-72. Previously, he had been Alumni Seminar Day

"Our goal is to encourage as many alumni as possible to give amounts that they can afford to give on a regular basis. We want to encourage young alumni to establish a 'habit of giving' early in their careers, even though their gifts may be small. As we increase the percentage of donors each year, the dollar figure will take care of itself."

Stressing the growing importance of the Fund, Moulton said, "As we talk with increasing numbers of alumni about Caltech and its programs, the base of support grows beyond the alumni themselves. For an alumnus who is willing to support the Institute is so convinced of its value that he will become an advocate for it. His own enthusiasm will generate other gifts and the effects will be cumulative.

"The overwhelming majority of alumni have a genuine affection and respect for Caltech as well as a sense of responsibility because of the education they received. We want to convert this reservoir of good will into real support for the Institute."

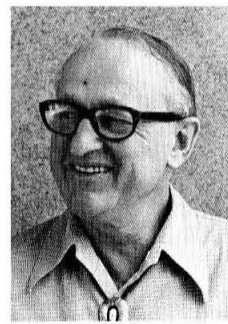
In emphasizing the importance of the money raised, he said, "In seeking oper-

ation of the Fund's success. If our workers do a good job, then we have it made."

These alumni have been appointed to new three-year terms on the Fund Council; A. Allen Ray, BS '35, president, Ray Products, Inc., El Monte; Stanley T. Wolfberg, BS '38, administrator, the Di-



Ray



Wolfberg

vision of Engineering and Applied Science, Caltech; Jack R. McInturff, MS '62, an independent management consultant, Canoga Park; and Martin J. Poggi, BS '37, president, the Martin Poggi Company, Bellevue, Washington.

Raymond L. Heacock, BS '52, MS '53, Spacecraft Systems Manager, Mariner Jupiter/Saturn 1977 Project, JPL, the 1974-75 Alumni Association president, will serve on the council during his term as association president.

Moulton announced these Alumni Fund committee chairmen for the year: Glen H. Mitchel, BS '48, long range planning; Jack R. McInturff, MS '62, special events; and Charles F. Thomas, BS '35, communications.

Continuing members of the 1974-75 Alumni Fund Council include William F. Chapin, BS '41; Donald D. Davidson, BS '38; Frank W. Davis, BS '36; Stephen H. Garrison, BS '65, MS '66; Robert J. Kieckhefer, BS '45; Herbert A. Lassen, BS '43, MS '47, PhD '51; Glen H. Mitchel, BS '48; Stanley R. Rawn, BS '52, MS '53; Harrison W. Sigworth, BS '44; Charles F. Thomas, BS '35; and Trustee Ruben F. Mettler, BS '44, MS '47, PhD '49.

Alumni who retire from the council on July 1 are: J. Benjamin Earl, BS '44; Patrick J. Fazio, BS '53; Artur Mager, PhD '53; and Robert P. Sharp, BS '34, MS '35.



McInturff



Poggi

ating funds, we are giving Caltech dollars with no strings attached; this money contributes to the flexibility of the Institute because it can be used where it is needed the most."

Moulton stressed the importance of the campaign workers. "We can't meet our goals just by working here in Pasadena," he said. "Personal contact with alumni—wherever they are—is essential. Our volunteer alumni workers—and our field organization as a whole—are vital



Reuben B. Moulton

chairman and a director of the Caltech Y. Moulton is serving a three-year term as a member of the Alumni Fund Council, and is chairman of the Friends of the Caltech Glee Club.

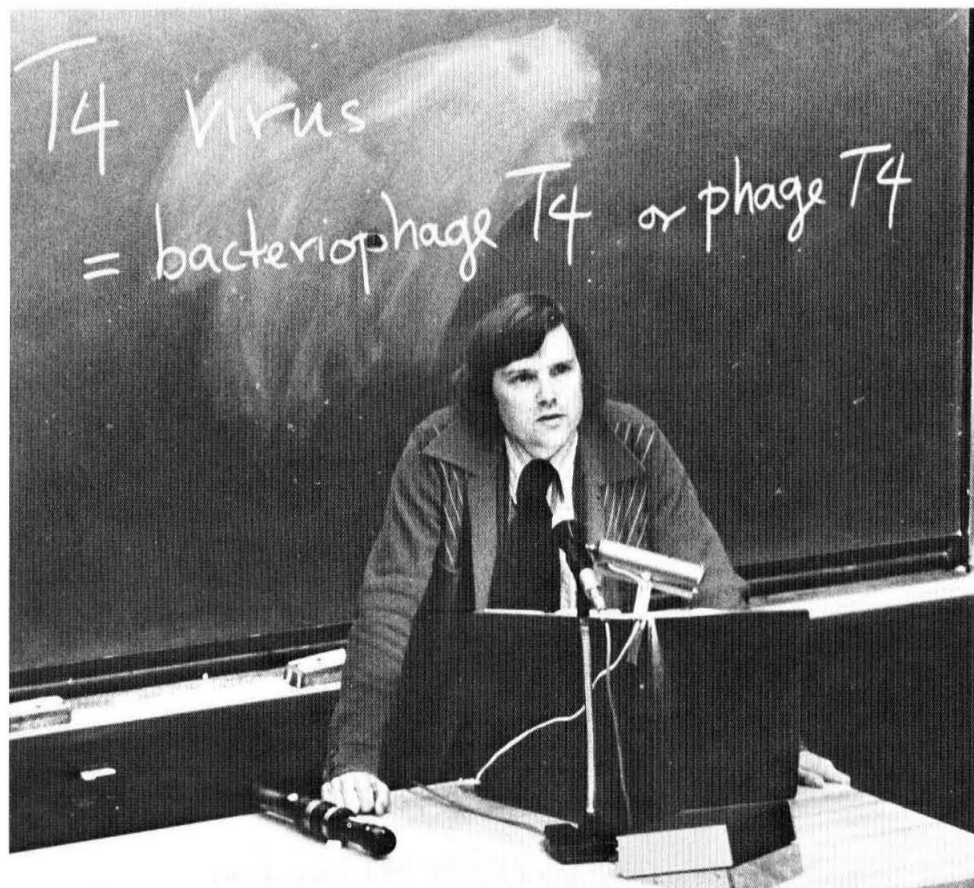
Moulton believes that persistence and organization are the keys to the Fund's success on a long-term basis. He said:

"The Alumni Fund will continue for a long time to come; it will not be preempted by any other fund-raising campaigns the Institute may undertake but will continue annually in cooperation with other Institute fund programs.

"Thus, it is important that we continue to develop a well-organized program and that we emphasize its permanence. Over the next five years, we intend to double both the number of donors and the total dollars raised each year.

Molecules to Mercury:

Seminars packed with research news



William B. Wood explains T4 virus assembly line production.



Martin Goldsmith discusses power plant sites.

(continued from page 2)

Power plant sites—where?

In the coming years, probably more and more nuclear power plants will be built inland rather than along the coast, Martin Goldsmith, visiting associate in environmental engineering, told alumni.

Goldsmith said that only short stretches of coastline are still available for nuclear power plant sites either because of seismic problems or growing concern for coastline preservation. He added that the cost of power from inland sites is only about 4 percent greater than that produced on the coast.

"With increased environmental restrictions on coastal plants, inland sites may hold the advantage," he said.

Goldsmith said inland sites with good potential are to be found in the eastern desert areas of southern California and in parts of the central valley.

The T4 virus

The T4 virus—a living hypodermic needle that is only a hundred-thousandth of an inch long—is built like an automobile, with all its parts made separately and simultaneously and then assembled in a submicroscopic biological assembly line.

The study of molecular architecture at this simple level can shed some light on the structuring of complex forms of life, such as man, William B. Wood, professor of biology, told alumni when he spoke on "Building Biological Structure."

Like all viruses, T4 is a parasite, Wood explained. It perpetuates its species by injecting its DNA, which carries its genetic pattern, into a cell of *E. coli*, a species of bacteria hundreds of times larger than the virus itself.

This act destroys the cell's own genetic material and converts the bacterium into a factory that proceeds to make

parts for some 200 T4 viruses—using the T4's genetic blueprint—in about 20 minutes. With the T4 parts assembled inside it, the cell bursts, frees the new viruses, and dies.

Avoiding the genetic lottery

The normal pattern of an animal species is to develop through mutation, evolution, and selection, and eventually die out to be replaced by a species more fitted to the environment. Can man avoid this pattern?

The answer is "perhaps," according to James F. Bonner, professor of biology, as expressed in his Alumni Seminar Day talk, "Beyond Man's Genetic Lottery."

"We may be an exception because we understand to some slight degree the processes of mutation, evolution, selection, and the control of our destiny," Bonner said.

In analyzing the possibilities in man's future, Bonner discussed ways in which medical genetics is increasingly able to alleviate human ills through means such as the prenatal detection of developmental defects. He also discussed the eventual possibility of planned selective breeding of human beings from adults chosen for such qualities as freedom from genetic defects, longevity, and high energy and intelligence.

An intimate look at Mercury

An intimate look at the problems—and the rewards—of the Mariner 10 mission was offered alumni by W. E. Giberson, JPL, manager of the Mariner Venus/Mercury '73 Project.

Illustrating his talk with slides and a short film, Giberson described the intricate cloud structure of Venus as revealed by ultraviolet photography, and the "fantastic coordinated motion" apparent in its upper atmosphere. He discussed the heavy cratering, history of vulcanism, and deep canyons apparent on the surface of Mercury.

"Mercury is unlike anything we've seen before; it is different from Mars and it is different from the moon," Giberson said. "Its core is tremendously dense—perhaps 70 to 80 percent as dense as iron. Its thin crust has been subjected to tremendous strains, as evidenced by the deep canyons on its surface."

Giberson said Mariner 10 will make another pass at Mercury—along its bright side near the south pole—to gather more data.

Ore deposit origins

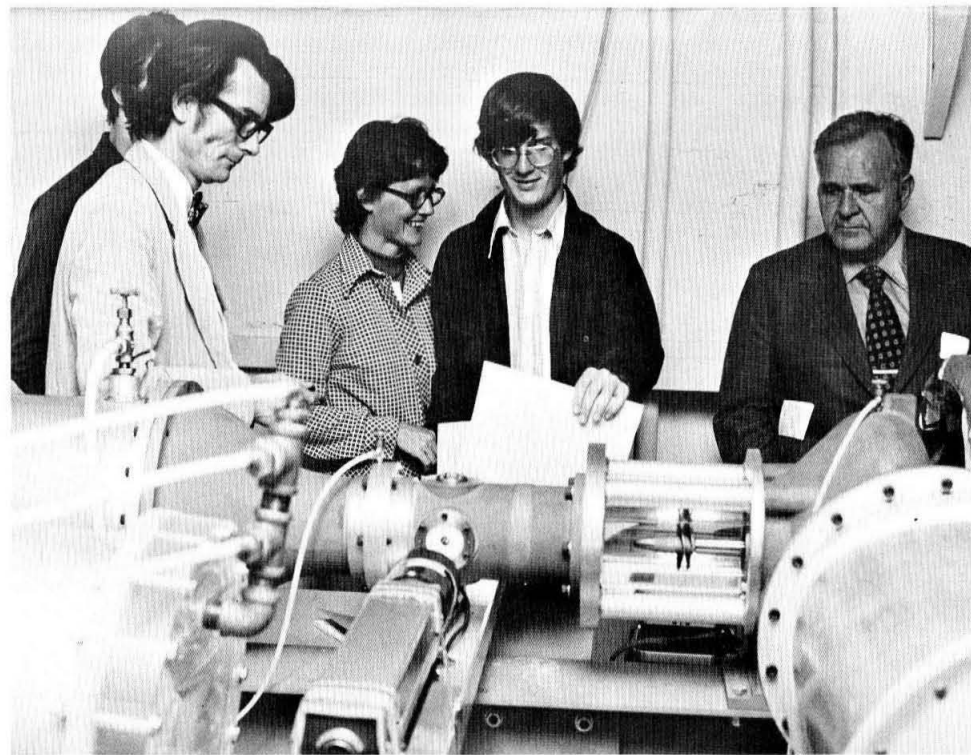
Until recently, geologists believed that most ore deposits, such as gold, silver, and copper, are formed from solutions emanating upward from molten rock deep inside the earth.

But the measurement of hydrogen and oxygen isotope ratios of natural waters and minerals is telling a different story, Hugh P. Taylor, Jr., professor of geology, told alumni in his Seminar Day talk, "A New Look at the Origin of Ore Deposits."

Taylor said, "We can now prove, by hydrogen and oxygen isotope measurement, that many ore deposits were formed as the result of heated rainwater or ocean water that flowed through fractures in the rocks to depths of two and three miles."



Hugh P. Taylor relaxes after his talk on origin of ore deposits.



Above: Visitors view facilities for studies of cavitation problems in pumps—one of many exhibits featuring work in the Division of Engineering and Applied Science. Below: A member of the class of 1927 finds his own name among those of classmates.



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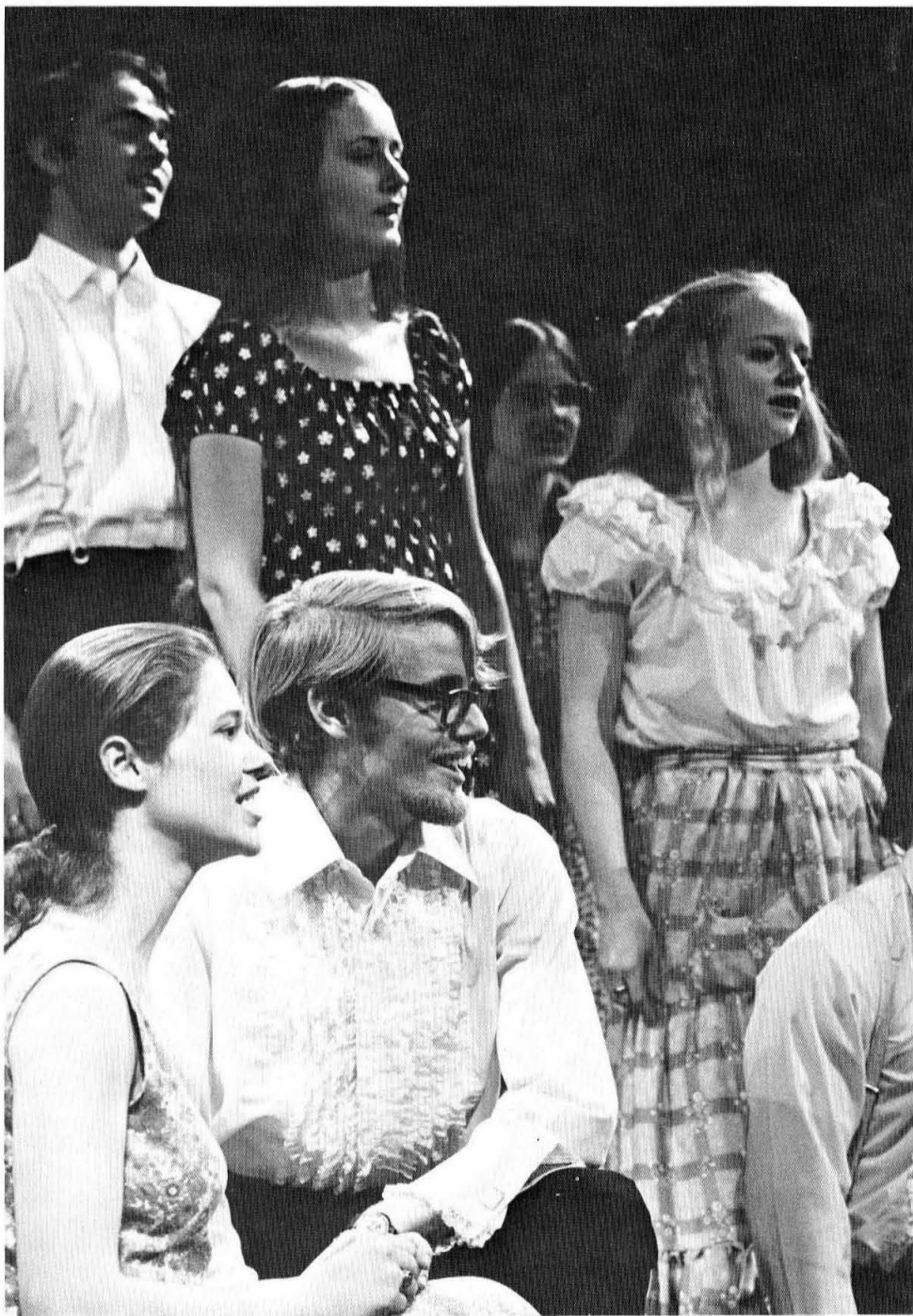
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Men's and Women's Glee Clubs combined talents in annual spring concert.

Glee Club spring concert delights alumni, friends

In a concert featuring a variety of sacred and contemporary music and folk songs, the 60-voice Caltech Men's Glee Club gave alumni and friends a rich demonstration of the mellow, closely disciplined harmonies that has earned it a reputation as one of the finest male choral groups in the west.

The Women's Glee Club of 20 voices joined in the annual concert, "Spring Jubilee." Directed by Mrs. Monica Roegler, the group demonstrated marked growth in vocal maturity over a year ago and gave promise of making increasingly important contributions to the Caltech music program.

The Glee Club was excellent in capturing the spirit of religious numbers early in the program and its performers hit a peak of excellence while singing "Shenandoah" during a potpourri of folk songs. A variety quartet dispensed some excellent barber shop harmony, and the Madrigal Singers displayed enthusiasm and a close blending of voices in their numbers. Representatives of both the men's and women's groups joined in the Chamber Singers, directed by Mrs. Roegler.

As the choir sang the theme song for its 11-day San Francisco Bay area concert tour, "I Left My Heart in San Francisco," slides of the city and its inhabitants were projected onto a screen. Near the conclusion of the concert, members dispersed through the audience, an effective placement for singing "He's Got the Whole World in His Hands."

In its 60th season—and its 21st under the direction of Olaf Frodsham—the Men's Glee Club included 10 percent of the males in the Caltech student body. Many had never sung before coming to the Institute. Membership of the Women's Glee Club—now in its third year—included 20 percent of Caltech women students.

The Glee Club began its season only a few weeks after the opening of school with a concert at the new Pasadena Conference Center. Its second annual "Festival of Light" concert during the holiday

season matched the fantastic success of the initial festival, with an early ticket sellout and standing room only in Beckman Auditorium. The concert portrayed the stories of Christmas and Hanukkah in music, pageantry, and tableau.

Now in its fourth year, the "Friends of the Glee Club" support group continues to make an important impact on plans and programs. The support group is composed of Glee Club fans who contribute at least \$25 a year through the Alumni Association office.

Proceeds for the spring concert help to finance tours and a stay at a mountain repertory camp where students engage in intensive choral training.

Air Force ROTC program to end

After 23 years, the Air Force ROTC program on the Caltech campus is being discontinued because of lack of interest. Capt. Lee T. Smith, lecturer in aerospace studies, said the program will be dropped at the end of this academic year.

Eight Caltech students are now enrolled in the program, and five of these graduate this month. Smith said arrangements have been made for the remaining undergraduates to complete their ROTC program on the USC campus.

Smith attributed the decline in interest to two factors: the end of the draft and an increase in jobs—particularly for engineers. While the draft was in effect, participation in the ROTC guaranteed a student time to complete his graduate studies before entering the service; it also assured him of a job on leaving Caltech.

Smith said negotiations are under way for an arrangement permitting any Caltech student to enroll in the Air Force ROTC at USC and to complete his program by spending one afternoon a week there.

Gift of Gnomes:

New 12-passenger van enriches campus life

With the acquisition of a 12-passenger GMC van, social life for the Caltech undergraduate is perking up. The van is a gift of the Gnome Club and is available to ASCIT members and guests for a wide range of off-campus excursions.

Richard Beatty, ASCIT representative who is coordinating use of the vehicle, commented, "The bus gives us a chance to take part in activities that would have been out of the question before it arrived." He said it has been used to drive to classes at Occidental College, to Glee Club concerts, and for trips to museums, concerts, and movies.

The idea of a student bus originated during the term of ASCIT President Steve Watkins, BS '73, as the suggestion of a committee of undergraduates considering ways to improve social life at the Institute. J. Stanley Johnson, BS '33, MS '34, was a member of the group; he proposed to John R. Fee, BS '51, the Gnome president, that the club consider buying a bus for ASCIT.

The Gnomes' board of directors agreed and a special fund-raising campaign was successful. Fee presented the money to ASCIT at the close of his own term and that of 1972-73 ASCIT President Joseph Morin, BS '73.

Its arrival was delayed throughout the term of Mark Johnson as ASCIT president, but now the Gnomes have had the satisfaction of seeing it delivered to Johnson's successor, Elizabeth McLeod.

According to Fee, "The Gnome Club welcomed the chance to participate on a no-strings-attached basis in a worthwhile undergraduate social activity. The bus is something we would have liked to have in our time."

The bus driver is required either to have a California class 2 license or to be licensed in his home state to drive a 12-passenger vehicle. Beatty reported he was the only person qualified to drive the bus at the time it arrived, and that he has been avidly encouraging others to acquire the proper credentials in order to save his own grade point average.



Ready for a ride in new ASCIT bus given students by Gnome Club are, from left: Richard Beatty, ASCIT representative responsible for coordinating use of vehicle; Gnome Club president, Oliver H. Gardner, BS '51; Gnome member Richard C. Nielsen, BS '66, MS '67, PhD '71; Gnome member John R. Fee, BS '51; Elizabeth McLeod, ASCIT president; and Gnome member Willis K. Drake, Jr., BS '70.

NAS chooses two Caltech faculty, six other alumni

Two Caltech faculty members—Roy W. Gould, BS '49, PhD '56, professor of applied physics, and Leon T. Silver, PhD '55, professor of geology—have been elected to the National Academy of Sciences.

Caltech now has 49 faculty members who are members of the academy—the highest percentage of faculty membership of any university in the country.

Gould was honored for his work in plasmas and nuclear fusion. He recently returned to Caltech from a leave, during which he managed the Atomic Energy Commission's nuclear fusion program. His research in plasmas and their interaction with electron beams and electromagnetic radiation has contributed to advancement of knowledge in that field.

Gould is a member of the fusion advisory committee of the Electrical Power Research Institute, sponsored by the nation's power industry to provide adequate power in future years. He is a member of the National Academy of Engineering.

Silver has developed techniques that combine geology, geochemistry, and geochronology, for use in analyzing the history of older and more complicated rocks in the earth's crust. He helped establish the age, impact history, and evolution of lunar surface materials, and he developed an approach using volatile lead to determine exposure history of lunar soils.

Silver is a recipient of the NASA Exceptional Scientific Achievement Medal for his work on the lunar samples and for training Apollo astronauts in geology.

Other alumni elected to NAS include:

Horace W. Davenport, BS '35, PhD '39, professor of physiology, the University of Michigan; Dan L. Lindsley, Jr., PhD '52, professor of biology, UC San Diego; Allen E. Puckett, PhD '49, executive vice president and assistant general manager, Hughes Aircraft Co.; William R. Sears, PhD '38, J. L. Given Professor of Engineering, Cornell University; Howard M. Temin, PhD '60, Wisconsin Alumni Research Foundation Professor of Cancer Research, the University of Wisconsin; and John S. Waugh, PhD '53, professor of chemistry, Massachusetts Institute of Technology.

Brooks assumes EQL leadership

Caltech's Environmental Quality Laboratory has a new director: Norman H. Brooks, professor of environmental science and civil engineering, whose appointment was effective May 1.

Academic officer for environmental engineering science, Brooks, 45, is interested in many phases of environmental pollution control. In hydraulic engineering, he has conducted extensive research on ways to reduce ocean contamination from sewage effluents and from heated-water discharges from power plants. He is a member of the Environmental Studies Board of the National Academies of Sciences and Engineering.

Lester Lees, professor of environmental engineering and aeronautics, who previously had headed the laboratory, will continue as an active member of it.

Alumnus avows the universe has come to study life on earth



James A. Harder shows pictures of UFO's taken by U. S. astronauts.

by Winifred Veronda

As a Caltech Y president, James A. Harder, BS '48, was described as "conservative and earnest—and unusually open to new ideas."

That openness must have been at work back in 1960, when Harder, then on the faculty at UC Berkeley, was intrigued by a brief newspaper item about two highway patrolmen who claimed they had observed at pistol range, over a period of several hours, a UFO the size of a DC 6. Harder drove up from the Bay Area to interview the patrolmen and came away convinced of the authenticity of their experience. He's been following UFO phenomena ever since.

Recently Harder made a return visit to his alma mater to speak in the Caltech Y Spotlight Series on "UFO-ology." To a packed audience in Winnett Lounge, he showed slides and stated his conviction: "If one looks at the evidence carefully and with an open mind, he'll be persuaded that we're dealing with an extra-terrestrial phenomenon."

Wesley L. Hershey, executive director of the Caltech Y, who knew Harder as a student, says that prior to hearing Harder's talk he was a nonbeliever in UFO's and that he is a less-confirmed nonbeliever now. But other members of the audience insisted that Harder's case is unassailable.

Why are our visitors here? Harder believes they are exploring the universe and studying its life forms, just as we may be doing in a few hundred years. He doesn't think they mean to harm us.

In view of our own efforts to learn what's going on in space, he wonders why the notion of their visits should be so disturbing. "We feel it's all right for us to go study the universe," he said, "but we object if the universe comes to study us."

Harder regrets our indifference, for he is afraid our visitors may finish studying us and go away—and then we will have lost a wonderful opportunity to learn more about another form of life.

Not that he expects them to cooperate much in our learning. "Obviously their knowledge of physics and chemistry and many other sciences far exceeds our own," he said. "They'd be as foolish to tell us much about their sciences as we would be to give the atomic bomb to a civilization at the level of Charlemagne's."

A professor of civil engineering at UC Berkeley and head of his own consulting firm, Harder says he hasn't been subjected to much teasing from his colleagues as a result of his unconventional interest.

"I consider my own attitude to be more scientifically hardheaded than that of those who scoff," he said. "You have to be hardheaded to look with an open mind at something that is potentially as unsettling as this, and still keep your wits about you."

Besides, he argued, popular opinion is moving toward his point of view. He cited a Gallup Poll showing that 9 percent of all American adults claim they have seen a UFO.

Harder doesn't feel threatened by the lunatic fringe that hangs around the UFO phenomenon; he doesn't think that hard evidence has anything to do with the connection some people have spun between UFO's and their occult theories.

Besides, he added, with a twinkle, "Maybe the reason I don't feel threatened is because I don't have that much of a scientific reputation to defend. That may be one advantage of not being an eminent scientist."

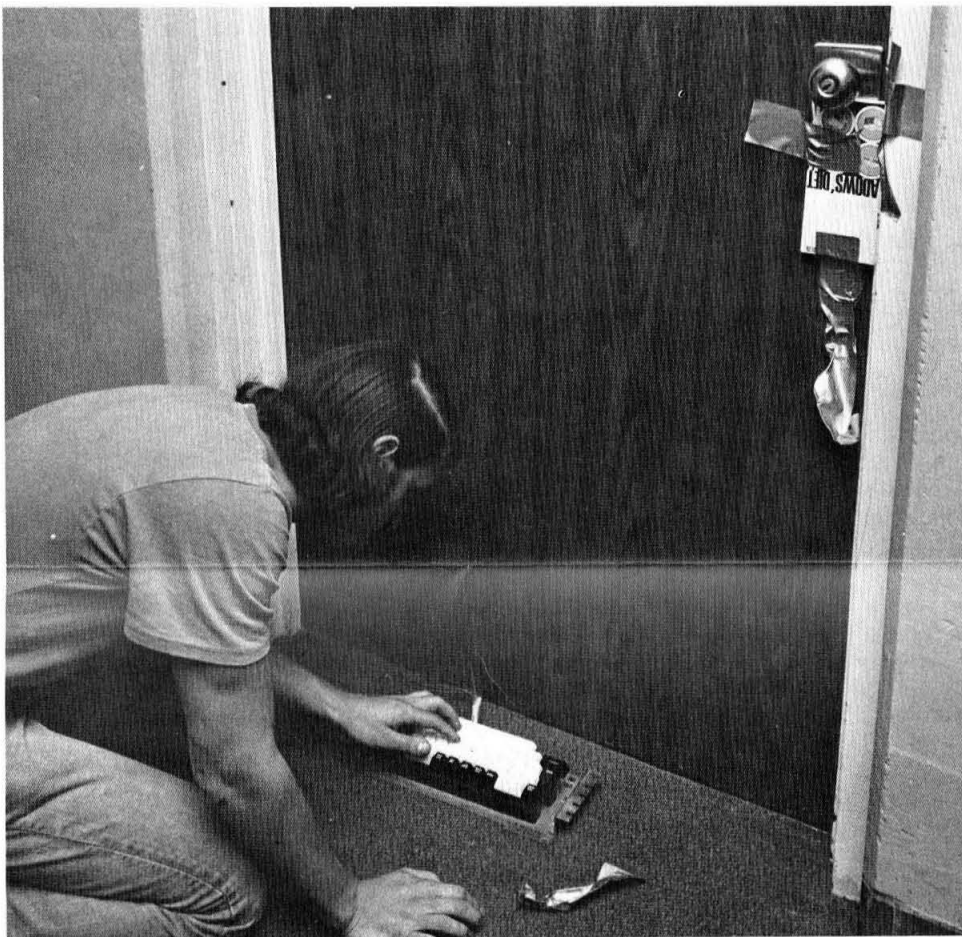
As his interest in UFO's increased, Harder affiliated with the Aerial Phenomenon Research Organization, an international UFO study group, and is now its research director. He has interviewed many persons who have had encounters with UFO's, sometimes using hypnotism to regress them to their experience.

Is there any hope that we can ever

actually settle the UFO question? Harder is optimistic. "Within the next generation, I think there will be a change of attitude sufficient to let us make a real examination of the phenomenon," he said.

"Think of the fantastic sociological benefits if we could learn what it is like to be civilized for a few hundred thousand years—or even to live with technology for a few thousand. And imagine—they might even be able to show us photographs of some of our ancestors. . . ."

Refocusing on the present, Harder commented that he is taking the time to speak about UFO's only when he is asked to do so by an old friend like Wes Hershey, or to alumni groups at the request of his employer, UC Berkeley. Speaking engagements, he said, take too much time away from his work—and until we can learn from our visitors about a technology that has evolved over thousands of years, then we must keep plugging away at our own.



Above: Digital gadgets, including microcomputers controlling door latches, were popular among seniors this year in efforts to foil attempts of freshmen to enter their rooms on Ditch Day. Below: Students reject scientific finesse in favor of brute force as they try to break through window defense. After a hard day of work, efforts succeeded at 5:15 p.m.

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Placement Assistance To Caltech Alumni

The Caltech Placement Service may be of assistance to you in one of the following ways:

- (1) Help you when you become unemployed or need to change employment.
- (2) Inform you of possible opportunities from time to time.

This service is provided to alumni by the Institute. A fee or charge is not involved. If you wish to avail yourself of this service, fill in and mail the following form to:

Caltech Placement Service
California Institute of Technology
Pasadena, California 91109

Please send me: (Check one)

- ☐ An application for placement assistance.
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Robert A. Huttenback, chairman of the Division of the Humanities and Social Sciences, with two Caltech students electing a humanities major: Laurie Schalit and Kim Border. Humanities majors make up almost one percent of Caltech graduates.

Unique as an African igloo?

Humanities majors at Caltech

by Winifred Veronda

Yes, Virginia, there *are* humanities majors at the Institute.

Among the 5,555 graduates who responded to the alumni survey, almost one percent had majored in the humanities and social sciences.

What motivates the individual—almost as rare as an African igloo—who comes to an institute of science and engineering and then elects a humanities major? With what degree of esteem is he regarded by his fellow students? And what benefits does he expect his scientific background to contribute to his future career?

Talks with three senior humanities majors yielded some interesting insights into these questions—and suggested that answers are almost as diverse as the students themselves.

Kenneth Mills, a straight-A student in both the humanities and the sciences, plans to do graduate work in environmental science after leaving the Institute. He decided as a freshman that he would major in both history and chemistry.

That decision resolved a dilemma confronting Mills when he enrolled at Caltech. Politically active in high school, he realized that he couldn't support himself, maintain good grades, and continue his political activities—all at the same time.

He discovered a solution while taking history professor Robert A. Rosenstone's freshman American history course: he would major in history as well as in a science and thus attain the breadth of social perspective that he wanted his education to provide.

"It isn't that difficult to get a double major," Mills explained. "You simply have to concentrate your humanities electives in your major field."

History as discipline

Mills believes history is a discipline that will play a valuable role in helping him use his scientific knowledge for the maximum benefit of society—and this is essential to him.

"History yields considerable insight into the way people have behaved in the past—and thus how they're likely to behave in the future," he explained. "It is especially important for a scientist to have this insight. A scientist may be involved in developing a new technology but fail to understand the repercussions it will create."

"History can help him understand how humans are likely to respond to an emerging technology—and thus what its effects may be."

Mills believes strongly in the social responsibility of a person who is technologically trained.

"Every person has a responsibility to his community," he asserted, "but a scientist's responsibility is even greater because of his capacity to stimulate change. In my opinion, a scientist isn't worth beans unless he's involved in the society he's a part of. He must be more than a scientist; he must be a citizen, too."

Besides all that, he added, "History is fun."

Mills described the Caltech history faculty as "small in number but distinguished" and said he has "nothing but praise" for them. He believes the opportunities for an undergraduate who is majoring in history at Caltech are unique because of small classes and opportunities to work closely with professors.

"Last semester one of my assignments was to read the same book that my professor was reading—and then discuss the contents with him on a one-to-one basis," he explained. "Tutorial courses like this one are tremendous—you can learn such a lot from them."

Mills would like to see more tutorial courses in the humanities made available to undergraduates; he would also like to see the humanities library expanded.

How do other students feel about his double major?

"Some of them may think I'm nuts," he said, "but frankly, that doesn't bother me."

From biology to English

Laurie Schalit, a senior majoring in English literature, had planned to major in biology when she came to Caltech but an advanced-placement freshman English class "turned her on" to Hemingway and Faulkner.

Probably she will go on to graduate school, where she believes her unusual academic background (for an English major) will stimulate one of two reactions in her professors.

"They may conclude that I don't have a good background in English literature because I've taken so many science courses," she commented, "—or they may reason that I have a unique background and, therefore, unique potential."

Schalit termed the English faculty at Caltech "magnificent" and feels she has acquired an excellent education in her field, even though her courses have been concentrated in a few areas because of the relatively small number of faculty members.

But beyond the instruction in her major area, Schalit believes she has acquired something unique through her Caltech training: a logical, precise way of thinking, oriented to problem solving—an ability that rates high in any field. In addition, she enjoys her knowledge of the physical world and the way it works.

Schalit believes that reactions of professors to the presence of a humanities major in their classes tend to be mixed.

"Occasionally I've wondered whether an instructor might have been offended because I was taking up space he believed should be filled by a scientist," she admitted. "But others seem to welcome my presence because they feel that contact with humanities majors is enriching for students in science and engineering."

Schalit dreams of the day when Caltech offers a graduate degree in English literature; she believes the Institute's close proximity to the Huntington Library is ideal, and its faculty most equal to this challenge.

Kim Border, a senior majoring in economics, had planned to major in mathematics when he came to Caltech, but decided to switch to mathematical economics after taking a first-year course in that field.

Border finds the Caltech faculty in his specialty to be excellent, the courses outstanding. An important asset in his field is the Institute's fine mathematics department and the opportunity to take courses in it. He hopes to do his graduate work at Harvard.

Border admits that the range of economics is not covered as broadly as at many universities; he would welcome the introduction of some beginning survey courses summarizing the economic effects of national policy—employment, taxation, and the like, and more upper-class courses that are applied.

How do other students react to his major?

"It's true that people here sometimes give me a hard time when they learn what my option is," he said, "but they're pretty tolerant once they find out what mathematical economics is like. After they've examined the field, they realize that the applications can be as challenging as those of physics or engineering."

"By and large, I don't consider myself in a class apart from any of the other students here—in earning a degree, we all have a demanding task to accomplish, and we're working hard to get it done."

New NAE members announced

Two Caltech faculty members, one an alumnus, and four other alumni have been honored for their contributions to engineering through election to the National Academy of Engineering.

The faculty members are Frank E. Marble, AE '47, PhD '48, professor of jet propulsion and mechanical engineering; and Ronald F. Scott, professor of civil engineering. Marble is being recognized for his work in aero-thermal chemistry and its applications to problems of gas turbines. Scott was elected for his contributions to the theory and application of soil mechanics.

Marble's research is concerned with turbulent combustion processes related to such fields as chemical lasers, central power stations, and jet engines. He has been particularly involved in work in connection with the noise associated with the internal aerodynamics of turbine and compressor components. He is studying the attenuation of noise by vaporization of liquid droplets.

Scott is conducting research on the behavior of soils in earthquakes and on the ocean bottom, and on the properties of lunar soils. He investigated the mechanical properties of the moon's surface through the Surveyor spacecraft's mechanical arm, which he controlled through JPL's communication system. The arm dug holes and performed tests on the lunar surface.

Alumni elected to the academy include: A. J. Field, BS '44, president, Global Marine Inc., Los Angeles, for contributions to technology for drilling from floating structures and ships; James C. Elms, BS '48, director of the Transportation Systems Center, the U. S. Department of Transportation, Washington, D. C., for contributions to conceptual designs and management of space, electronics, armament, and transportation systems. Philip Eisenberg, CE '48, president, Hydronautics, Inc., Laurel, Maryland, for contributions to naval architecture; and Thornton A. Wilson, MS '48, chief executive officer, the Boeing Company, Seattle, for leadership in the engineering and management of major complex aerospace systems for commercial and military use.

Election to the National Academy of Engineering is considered the highest professional distinction that can be conferred on an American engineer.



To keep visitors from wandering into an area adjoining Thomas Laboratory that had been cleared for landscaping, members of the Campus Architect's Office marked it off with brightly colored plastic flags. The flags provided instant inspiration for the fertile imaginations of several Caltech students; they parked their cars on the lot, mounted "for sale" signs on them, and christened the area "Lyman's Lemons" in honor of Lyman G. Bonner, director of student relations. Here, Bonner inspects the facility. The campus police were not altogether amused; they placed a parking ticket on each car.

PERSONALS

1924

EUGENE W. SMITH writes, "After 43 years of teaching and administration, I retired on July 31, 1973, as president emeritus of Cogswell Polytechnical College in San Francisco." He is a resident of Walnut Creek, California.

1927

ALAN E. CAPON writes, "I have retired as general manager of the Public Service Department of the City of Burbank, the water and electric power utility serving the city. Mrs. Capon and I continue to live in Burbank because of our ties with community activities such as the Red Cross, YMCA, Kiwanis service club, and other interests."

VERNON P. JAEGER, Ex '27, retired December 31, 1973, as business manager of the American Baptist Churches of Oregon, and is serving as a volunteer consultant to that group and to the Ecumenical Ministries of Oregon.

1930

IRA C. BECHTOLD has been designated Engineer of the Year by the American Institute of Chemical Engineers "in recognition of his many contributions of time and self to the growth of the Southern California Section and to the profession of chemical engineering." Bechtold is a private consultant in chemical and metallurgical engineering, geology, and electronics.

ROLAND F. HODDER writes, "I have settled down somewhat in Santa Rosa, California, after four happy years travel trailering from east Canada, all over Mexico and that interesting and colorful country, Guatemala. Those Mayans were some engineers! A Norwegian freighter is calling to go around South America this June."

1932

FREDERICK W. BOWDEN, MS '33, retired December 31, 1972, as head of the Electrical Engineering Department of the California State Polytechnic College in San Luis Obispo, California, where he lives.

1933

WINCHELL H. SIMPSON, Ex '33, retired January 1, 1974, as senior operations engineer for Mobil Oil Corporation in Bakersfield, California, and is living in Los Osos, California.

1934

ALFRED I. SWITZER writes, "I am retired and enjoying golf, fishing, hunting, some loafing, and getting involved and very active in local civic affairs." He was formerly president of Switzer, Jennings & Associates, consulting engineers, in Van Nuys, California, and now resides in Los Osos.

1935

CLIFFORD S. GARNER, PhD '38, has retired as professor in the Chemistry Department at UCLA. He lives in Santa Clara, California.

1938

CLYDE W. HARRIS writes, "I recently retired after many enjoyable years with the TE Company in Santa Barbara"—where he was senior staff physicist. "Haven't 'frozen' into any particular life pattern yet." Harris is a resident of Santa Fe, New Mexico.

1941

H. GUYFORD STEVER, PhD, director of the National Science Foundation, will deliver the keynote address opening the 1974 Instrument Society of America International Conference and Exhibit in October at the New York Sheraton Hotel. Stever assumed the post of NSF director in February 1972, following his nomination by the President to a six-year term. He has also been named by the President as science adviser and chairman of the Federal Council for Science and Technology.

1943

EDGAR W. FLAVELL became president of the McKeany-Flavell Company, Inc.—a San Francisco sugar brokerage firm—in 1973. He lives in Palo Alto, California.

ARTHUR O. MCCOUBREY, formerly vice president and director of Frequency and Time Systems, Inc., of Danvers, Massachusetts, is director of the Institute for Basic Standards for the National Bureau of Standards in Boulder, Colorado.

1944

GREGORY O. YOUNG, MS '47, formerly an associate professor of electrical engineering at USC, is a senior staff engineer for the Hughes Aircraft Company in Culver City, California.

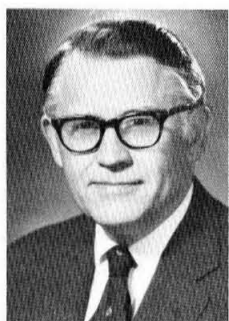
1948

GEORGE R. SCOTT writes, "I am still helping Lockheed hang in there—as program manager of new, startling 'things'!" Scott and his wife of 28 years live in Menlo Park, California, and are the parents of four children.

1951

DEAN C. DAILY II, writes, "The oldest of our four children is attending Lewis and Clark College in Portland, Oregon. I am still enjoying the industrial development business at the Van Nuys Airport Industrial Center in Van Nuys, California. Much of my 'spare' time is devoted to volunteer efforts in support of Southern California Presbyterian Homes—a group of retirement homes under the sponsorship of the Southern California Synod, United Presbyterian Church of U.S.A."

JAMES Q. DENTON will assume the rank of full professor and the chairmanship of the Mathematics Department of Amherst College in Amherst, Massachusetts, on July 1, 1974.



Stever PhD '41



Sandage PhD '53

1953

ALFRED L. JOHNSON, JR., MS '54, formerly manager of the Life Support Section of The Aerospace Corporation, has been appointed senior staff engineer of that corporation. Johnson presently lectures at Stanford University's new Institute for Energy Studies and is a special consultant to the Science Office of the United Nations Secretariat.

ALLAN R. SANDAGE, PhD, astronomer and staff member of the Hale Observatories, received an honorary Doctor of Science degree from Miami University in Oxford, Ohio, at its 135th annual commencement this month.

1954

BENJAMIN M. ROSEN writes, "After an MSEE at Stanford and four years of engineering, I sold out. An MBA at Columbia was followed by a four-year fling in consulting, and then the final transition to Wall Street, where I've been ever since. For the last nine years I've been director of research and electronics analyst at Coleman and Company, an institutional brokerage firm in New York City. Most of my time is spent analyzing the investment merits of electronics companies for banks, insurance companies, and other clientele.

"In more important areas, my bride of seven years, Sandy, and I have thus far produced a three-year-old boy, Jeffrey, and are expecting our second offspring in a few months. Living in Mount Kisco, New York, and working on Wall Street, I hereby lay claim (subject to challenge) to the longest one-way, door-to-door commute of any Caltech alumnus—one hour and forty minutes (via car, train, subway, and elevator)."

1956

JOSEPH P. GIBBS has been appointed general manager of the Spectrol Electronics Corporation in the City of Industry, California. In his new position, Gibbs is responsible for all company operations. Prior to joining Spectrol, he was general manager of AILTECH, West Coast Operations, Cutler-Hammer Inc. Gibbs, his wife, and four children are long-time residents of Arcadia, California.

1957

THOMAS E. GIBSON, JR., has been promoted to supervisor of engineering tests for the C. A. Norgren Company. He lives in Englewood, Colorado.

1957

WALTER A. SPECHT, JR., MS '61, PhD '65, formerly an engineering/scientific specialist at the LTV Aerospace Corporation, is now with General Telephone and Electronics, Sylvania, in the electro-optics organization, in Mountain View, California. He is a section head, responsible for research and development in electro-optics.

1960

NORMAN S. FARHA, MS, is the father of a third son, Brad Norman, born May 13, 1972. Farha lives in Wichita, Kansas.

EDWARD G. GIBSON, MS, PhD '64, scientist-astronaut member of the record-breaking Skylab 3 space mission, was recently awarded an honorary doctor of science degree by his alma mater, the University of Rochester.

1962

STEVEN C. CROW, MS '63, PhD '66, has become president of Poseidon Research, a new corporation for the advancement of naval hydrodynamics. He will retain his position as associate professor of engineering and applied science at UCLA.

HAL H. WYMAN is currently on leave from Xerox Data Systems to pursue doctoral studies in computer sciences at the University of Washington.



Gibbs '56

1963

RICHARD E. SEARS, formerly a design representative of Standard Oil of California in Weston, Massachusetts, is now a senior construction engineer for Standard Oil in El Segundo, California.

1964

EDWARD M. MEDOF was married to Carol Silver on February 16, 1974. Mrs. Medof is a public relations officer with the Robert B. Brigham Hospital where her husband is a rheumatology fellow. The Medofs live in Boston, Massachusetts.

JOHN R. SCHUSTER, MS, writes, "I am a staff engineer in the New Concepts Division of General Atomic Company. The division is the most active in the company, and is developing a direct-cycle HTGR which uses primary helium to drive the turbines. I am doing systems analysis on that system. My division is also doing fusion research, is developing a gas-cooled fast breeder reactor (GCBFR), and is studying ways of utilizing the reactor heat for coal gasification, shale oil and tar sands, and water splitting." Schuster lives in Encinitas, California.

1965

JON K. EVANS writes, "I now have a third-degree black belt in karate, a first-degree black belt in judo, and am western regional director for Shotokan Karate of America, Inc."

HUGH M. McALEAR, MS, a captain in the U.S. Army writes, "I am serving in the Army's Medical Service Corps as a sanitary engineer. This month I will complete the requirements for a Master of Public Health Degree from the University of Minnesota."

JERRY E. NELSON writes, "I received my PhD in 1972 from UC Berkeley, and since then I have been doing research in elementary particle physics at the Lawrence Berkeley Laboratory."

1966

STUART W. GALLEY writes, "Since receiving an SM from MIT in 1970 for a thesis in computer-aided physics education, I've worked in computer research at Project MAC, MIT. Fritz and I have a son, Jacob, born in November 1971."

R. PAUL LYNCH, who received his master's degree in physics from Princeton University,

has worked for Airco Computers in Montvale, New Jersey, for the past five years.

THOMAS C. WILLIAMS has joined the exploration staff of Florida Gas Exploration Company's New Orleans Division as a geologist. Formerly, he was with Mobil Oil in New Orleans, with responsibilities in both exploration and production.

1967

ZACHARY MARTIN has recently accepted a position with the Xerox Corporation in El Segundo, California, as a senior member of the programming staff. Prior to accepting this post, Martin was senior programmer analyst for Programmatic, Inc., in Los Angeles.

DANIEL S. METLAY writes, "I am a graduate student in political science at UC Berkeley where I am working on a dissertation about the changes in the political environment of federal agencies dealing with technology. I spent two years, from 1968 to 1970, as a Peace Corps volunteer teaching biology and physics in a bush high school in Nigeria." Metlay and his wife live in Albany, California.

GEORGE F. SHARMAN III, a graduate student in marine geology at the Scripps Institute of Oceanography, married Marti Woolery on November 24.

1968

KENNETH D. GARBADE, formerly a graduate student in the Department of Economics at Princeton University, is professor of finance at New York University in New York City.

1969

HARVEY R. BUTCHER III recently returned to the United States from Australia where he finished his PhD dissertation at the Mt. Stromlo Observatory near Canberra. While in Australia, he married an Australian girl. He and his wife were guests of the Sternberg Astronomical Institute in Moscow for five months and were able to tour the major Soviet observatories. The Butchers are looking forward to spending a least a few years in the United States, since he has been offered a research fellowship position with the Steward Observatory at the University of Arizona in Tucson starting this July.

1971

ROBERT D. NEBES, PhD, recently married Susan Ramsay in Durham, North Carolina. Nebes is an assistant professor in the psychiatry department at the Duke University Medical Center.

MARTIN T. SMITH, Ex '71, is the current holder of the U.S. record for the 50-mile, long-distance running event (at 5 hours, 26 minutes, 40 seconds). Those who were here at that time will remember that Smith participated in track and cross-country running while he was at the Institute.

1972

ROBERT N. KAVANAGH, PhD, is an associate professor in the Computational Science Department of the University of Saskatchewan, Canada. He is involved in research on computer networks.

1973

JOHN F. BELSHER III married Katherine Richards on March 23, 1974. Belsher is employed by Hughes Aircraft and is attending Stanford University where he will receive his master's degree this month.

OBITUARIES

1935

HOWARD P. GLUCKMAN of a heart attack on May 3, 1974, in Los Angeles. He worked for the Department of Water and Power for 37 years. He is survived by his wife, Dorothy, of Los Angeles, and two children, Jonathan Gluckman and Sharon Dudley.

ARTHUR T. IPPEN, MS, PhD '36, in April 1974. He retired in July 1973, as director of MIT's Laboratory for Water Resources and Hydrodynamics in the Department of Civil Engineering. He is survived by his wife, Ruth, a son, Dr. Erich P. Ippen of Red Bank, New Jersey, and a daughter, Dr. Karin E. Ihler of Pittsburgh, Pennsylvania.

1947

KAMALESH RAY of a heart attack on November 16, 1973. He was a member of the Council of Scientific and Industrial Research in New Delhi, India.