

CALTECH NEWS

Caltech students may lose \$300,000 in financial aid under Reagan budget

Caltech students will lack \$300,000 in financial aid if the Reagan budget is approved in its present form, according to Caltech's director of financial aid, Ruth Wilson. This represents 11 percent of the total amount of aid normally awarded to students at the Institute.

Four versions of the budget, each containing varying financial aid appropriations, were circulating among Congressional committees in late April. "We're looking at a moving target," Wilson said. "This makes it very hard for us to give students reasonably accurate ideas of how much aid they can expect next year."

Wilson said that in 1981, it was August 23 before colleges and universities received final word from the federal government on student aid appropriations. Prospects do not look good for an earlier verdict this year.

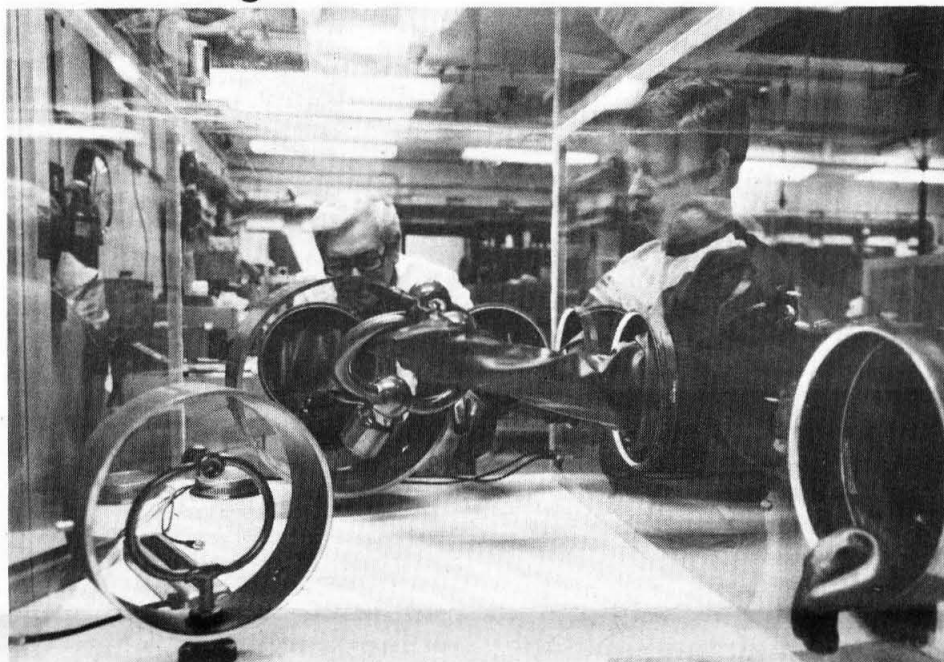
Waiting for word about appropriations are the 67 percent of Caltech students who receive some form of need-based aid. (A total of 73 percent of the student body receives some form of aid, including those whose awards are based on merit.) And waiting are their families, whose income this year averaged \$29,500.

Across the country, approximately one out of four students receives some form of federal financial aid. But at private colleges and universities with steep tuition costs, the percentage is much higher.

Earmarked for cuts under the federal budget are funds in the form of Pell Grants and Supplemental Educational Opportunity Grants for low and moderate-income families; National Direct Student Loans, which allocate funds to colleges and universities to make loans to needy

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Learning more about nuclear structure



Edward Boud and Jean Delaen assemble the split ring resonator for the superconducting particle accelerator in the Sloan low temperature physics laboratory. Inside the apparatus, high electromagnetic fields increase the velocity of atomic particles, yielding greater insight into nuclear structure. Boud and Delaen work with James E. Mercereau, professor of physics and applied physics. Their research deals extensively with the science and application of superconductors in the presence of high-frequency electromagnetic fields.

For Bruce Murray and JPL: "a time for transition"

Bruce Murray will step down later this year as director of JPL, he told colleagues in his annual "State of the Lab" address on April 2. He became the laboratory director in 1976.

"Upon assuming directorship of JPL, I anticipated a term of five to ten years before both the Laboratory and I would benefit from a change in directors," he said. "This timetable for both personal and institutional renewal has held up.

"Leading JPL has been the most meaningful experience of my life. It has been a real privilege to work so closely with so talented a group of people. JPL is one of the finest cen-

ters of advanced technology in the world and will continue to be so."

Murray, who is professor of planetary science at Caltech, said he plans a year-long sabbatical, including extensive travel and writing.

President Marvin L. Goldberger, in announcing Murray's decision to the Caltech community, said that "Bruce Murray has made an enormous contribution to space science and the exploration of the solar system, both as an academician and as an administrator.

"We are deeply indebted to him for his avid advocacy for a strong and consistent U.S. space program, and for his outstanding leadership of JPL. I am personally saddened at losing him as JPL's director, but can understand his desire to evolve professionally by moving toward a new phase in his career."

Terming this the right time for a change in leadership, Murray noted that the Laboratory is entering a

period of transition as it "transforms itself into a multimission laboratory taking a broader array of national requirements." He said that JPL is expanding its work for the Department of Defense — perhaps eventually to one-third of its total mission — "in a harmonious balance with a clear majority of NASA work.

"JPL will remain under this arrangement a full-fledged member of the NASA family, while contributing significantly to national defense," he said.

With respect to an expanded emphasis on national defense, he pointed out that President Goldberger has just concluded an agreement with the Army on new highly automated battlefield systems that enable U.S. ground military forces to be deployed at a minimum of risk to U.S. lives by putting the automated systems in the most hazardous areas. This is in addition to a long-term arrangement for JPL to support the U.S. Air Force Space Division.

"The new JPL-Army relationship complements in many ways the JPL-USAF one," he said. "Together, along with our current NASA commitments and prospects, JPL once again is positioned to acquire and execute with distinction that set of nationally important engineering challenges required for the JPL of 1990 to be as distinguished and vital as the JPL of 1980."

Murray stressed that "JPL is well on the way to an outstanding decade of following changing national priorities, but still keeping a preferred position in civilian space, especially in deep space exploration. There will be no better place to practice engineering or space science in the 1980s than JPL if the current trends continue."

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Murray describes JPL's changing role

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He commented, in outlining shifts in emphasis, that "last year, as I began to lead JPL into its necessary transition, I also began to realize that the proper time for the transition to a new director would be approaching. Now that JPL is on the threshold of a new era extending through the 1980s and beyond, it is important that the JPL director commit himself to leading JPL through the remainder of this decade. But from the time I arrived, I identified my tour here as director to be of five to ten years duration."

Last year was a difficult one for government funding of space exploration projects, Murray acknowledged. "In December," he said, "we were successfully winning the decisive political victory for the Galileo mission, for the future of the Deep Space Network, and for the Voyager mission continuation on to Uranus and even Neptune. The extraordinary U.S. exploration of the outer planets will continue through this decade with JPL as its heart and brain."

"But the setbacks last year were very great. Our plans and preparations for new missions to explore Venus, to observe the sun from its polar directions, and to encounter Halley's Comet were all swept away in an unprecedented trauma of budget cutbacks that affected every civilian federal program."

"Thus, JPL and NASA must now rebuild an Inner Planets and Solar Terrestrial program for the late '80s and beyond with new, more affordable concepts and implementation modes, such as our new Venus mapper concept and our innovative new low-cost concept to fulfill many of the objectives of the U.S. International Solar Polar Mission spacecraft that was canceled."

JPL has made an auspicious entry into the Space Shuttle payload era, Murray said, with the successful flight of two JPL experiments on the second Shuttle flight and a third one on the most recently completed flight. "Approval for a 1983 Shuttle Imaging Radar-B flight has recently been secured and other Shuttle experiments are being readied for flight," he noted.

"We are not just a leader of the exploratory outward-looking aspect of NASA but also an important part of the latest earth observation missions as well. Furthermore, JPL is being asked by NASA to contribute innovative ideas and concepts to NASA's new main thrust: a 'Space Station.' Our recognized accomplishments in autonomous systems, in cost-effective Shuttle payloads, in state-of-the-art scientific instruments, and in effective scientific utilization of space generally are especially relevant to that next big step in space. I think that JPL's skills much more naturally fit some of NASA's high-priority needs for the 'Space Station' than was the case with Shuttle development."

"Thus I feel that JPL will play an important supporting role for NASA in whatever version of the U.S. 'permanent presence in space comes into being.'"

While working on present programs, Murray said JPL must "invest effort, imagination, and energy into building the basis for the JPL of the 1990s." In this context, he said that JPL must persist in "the most effective and significant energy research and development that it can manage."

"Energy is a long-term problem," he said. "The United States will be forced both to optimize use of conventional energy sources and to bring on line new ones whose development times are beyond the usual investment horizon for entrepreneurial private capital."

"To be working on energy at JPL is to be automatically working on the future of the world, of the country, and of JPL."

Murray also stressed the importance of the Laboratory's expanding research on climate. There is growing evidence, he said, that natural changes in the earth's climate are being aggravated and complicated by human activities.

"The critical atmospheric carbon dioxide balance which governs the melting of the ice caps and the rise in sea level is perilously close to responding to human activity. Thus, some time in the future, perhaps even as early as 1990, global climate monitoring, detailed identification of crucial environmental parameters, and preliminary forecasting will become national imperatives re-

quiring the skills and dedication of NASA and JPL along with those of many other U.S. and foreign organizations."

"By then, it may have become essential to understand in detail how solar variations influence earth's climate. By then, the search for



Bruce Murray

independent records of the sun's periodic activity probably preserved in the polar regions of Mars may be viewed as a *utilitarian* endeavor more than an exploratory one!"

By the 1990s, Murray predicted that JPL will be considered the most outstanding laboratory in the world in the development and application of autonomous systems — systems that can be programmed to operate independently in space for a period of time without instructions from earth.

"Many technical organizations are working on one or another part of information systems," he said, "But JPL is a world leader in the combining of computers and communications with automatic mechanical systems that affect physical actions, that sense their environment, and that act intelligently and independently on that information to reach prescribed goals."

JPL is well prepared for a transition in directors, Murray said. "I have been developing over the last two years an effective top management structure for JPL to deal, on a continuing basis, with the external complexities that seem to have become a personal part of the national scene," he told colleagues. "Last fall I put that arrangement in final form by naming three associate directors (Fred H. Felberg, BS '42, MS '45; Robert J. Parks, BS '44; and Harris M. Schurmeier, BS '45, MS '48, Eng '49) who play a powerful and key role in the overall direction of the Laboratory."

Murray stressed that, throughout

the changes, "JPL will remain part of Caltech and must strive to maximize the value of the campus-laboratory relationship."

During the past six years, under Murray's leadership, JPL has conducted the mission operations of the Viking Mars orbiters and landers and completed development of the two Voyager spacecraft that explored Jupiter and Saturn. The Laboratory managed the earth satellite projects, Seasat, and Solar Mesosphere Explorer, is managing the Infrared Astronomy Satellite, and is developing the Galileo Jupiter orbiter and probe.

Before his appointment to head JPL, Murray was associated with the first space explorations of Mars, Venus, and Mercury. From 1961 to 1973, he was co-investigator on the television science experiments on the Mariner 4, 6, 7, and 9 missions. He was team leader of the 1974-75 Venus and Mercury television science investigations by Mariner 10.

Murray joined Caltech in 1960 after serving as an oil exploration geologist in Louisiana and as an Air Force geophysicist in Massachusetts. He was a research fellow in space science at Caltech until he was appointed associate professor of planetary science in 1963. He became a full professor in 1968. He earned his BS, MS, and PhD degrees from MIT, all in geology.

Much honored for his professional contributions, Murray was awarded the NASA Exceptional Scientific Achievement Medal in 1971, the NASA Distinguished Public Service Medal in 1975, and the NASA Distinguished Service Medal in 1981.

Vol. 16, No. 3, June 1982

Issued seven times a year (Feb., April, June, July, Aug., Oct., and Dec.) and published by the California Institute of Technology and the Alumni Association, 1201 East California Blvd., Pasadena, California 91125.

Second class postage paid at Pasadena, California.

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USPC 085-640



For the Watson Laboratories: a formal welcome to campus

The Thomas J. Watson, Sr., Laboratories of Applied Physics received a formal welcome to the campus at dedication ceremonies on May 5.

President Marvin L. Goldberger presided at the dedication program, introducing speakers including R. Stanton Avery, chairman of Caltech's Board of Trustees; Roy W. Gould, chairman of the Division of Engineering and Applied Science, Lee A. DuBridge, Caltech president emeritus, and Caltech Trustees Simon Ramo, chairman of the visiting committee for the engineering division; and Thomas J. Watson, Jr., son of the founder of IBM, in whose honor the building is named.

The new 40,000-square-foot building on the northern end of campus will provide expanded facilities for Caltech's programs in applied physics, especially in optical communication and plasma physics. It will house some 80 faculty members, research fellows, graduate students, and support staff.

The \$7 million facility is designed in four sections around an outdoor court planted with trees and shrubs and featuring a garden pool and fountain. Three of the sections are two stories high; the fourth is one

story. The building is connected to the Harry G. Steele Laboratory of Electrical Sciences by a closed passageway and is the focal point of a mall that includes — in addition to Steele — the Willis H. Booth Computing Center and the W. M. Keck Engineering Laboratories.

The new laboratories are named for Thomas J. Watson, Sr., who rose to the top of the business community as founder and head of the International Business Machines Corporation. He served in that role until his death in 1956 at the age of 82.

Funds for the building came from: members of the Watson family, the

S. D. Bechtel, Jr. Foundation, Booth Ferris Foundation, John D. Crummey Benevolent Trust II, Mr. and Mrs. Paul L. Davies, Jr., The Sherman Fairchild Foundation, Inc., Mr. and Mrs. John Clifford Folger, Keith Funston, Franklin Givens, Mr. and Mrs. George Hinman, International Business Machines Corporation, A. Lindsay and Olive B. O'Connor Foundation, Mrs. William H. Reid, Mr. and Mrs. George E. Richter, and Brinkley Smithers.

Developing better methods to transmit information using laser beams will be one research effort in the new building. Laser-beam trans-

mission is theoretically more efficient and cost-effective than conventional electrical communications, and thus could help overcome shortages of energy and materials.

The other research effort, plasma physics, is the study of matter at extremely high temperatures. Such studies may lead to controlled thermonuclear fusion as a clean, unlimited source of electrical power. Technologists at Caltech have made important contributions to the understanding of plasma waves and the development of diagnostic techniques for characterizing plasmas. They are exploring plasma heating — central to obtaining controlled nuclear fusion.

The first six Caltech faculty members to occupy the Watson Labs will be Paul M. Bellan, assistant professor of applied physics; William B. Bridges, professor of electrical engineering and applied physics; Noel Corngold, professor of applied physics; Roy W. Gould, the Simon Ramo Professor of Engineering; Thomas C. McGill, professor of applied physics; and Amnon Yariv, the Thomas G. Myers Professor of Electrical Engineering and professor of applied physics. Eventually, two more researchers will move into the building.

Los Alamos lab honors Gell-Mann

Murray Gell-Mann has been named a Fellow at Los Alamos National Laboratory. Gell-Mann is the Robert Andrews Millikan Professor of Theoretical Physics at Caltech, and winner of the 1969 Nobel Prize in physics for work on the theory of elementary particle physics.

According to Los Alamos Director Donald M. Kerr, the Fellow program was created to designate distinguished scientists whose presence at the Laboratory "will have a stimulating effect on research efforts." Said Kerr, "I hope Professor Gell-Mann will spend long periods in residence here, consulting on a broad range of topics, as he and other Fellows receive Laboratory support for their research."



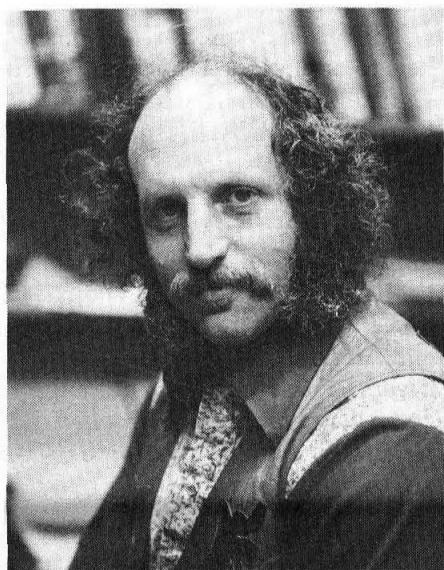
Thomas J. Watson, Jr., (left) with Caltech President Emeritus Lee A. DuBridge at dedication ceremonies for the Watson Laboratories. As a gift from the Institute, Watson received a specially designed display case with memorabilia of two manpowered aircraft — the Gossamer Condor and Gossamer Albatross, both planes designed by Paul MacCready. The box contained an original airfoil, along with photos and sketches of the craft.

Four Caltech faculty members accept endowed chairs

Eric and Norman Davidson: the Chandler Professors

Professor of Biology Eric H. Davidson and Professor of Chemistry Norman R. Davidson have been named Norman Chandler Professors. Eric Davidson will hold the title of Chandler Professor of Cell Biology, and Norman Davidson will be Chandler Professor of Chemical Biology.

The professorships were named in



Eric Davidson

honor of the late Norman Chandler, publisher of the *Los Angeles Times*, chairman of the Times-Mirror Company, and Caltech Trustee for over 30 years. The Chandler Professorship was established in 1976 by the Chandler family, the Times-Mirror Foundation, the Pfaffinger Foundation, and other friends of the Chandler family.

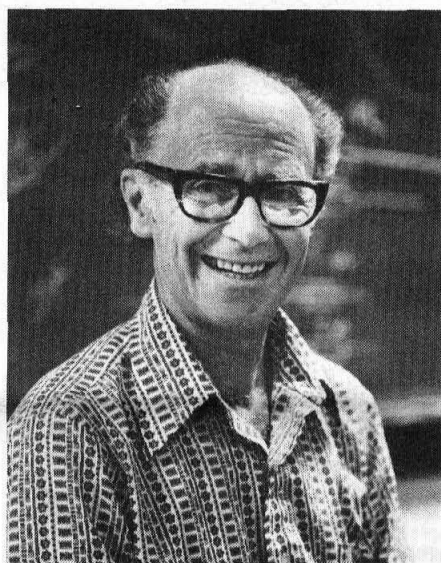
Davidson came to Caltech in 1971 as associate professor of biology. He previously taught at Rockefeller University where he earned his PhD degree. He also holds a BS degree from the University of Pennsylvania.

His research concentrates on the organization of DNA in genes, and how genetic information is expressed in animal cells. His laboratory is known for its studies on the mechanisms of embryological development, in particular in the sea urchin embryo. Current studies utilize recombi-

nant DNA methods to discover the fundamental relations between DNA organization and gene expression in the early embryo.

Norman Davidson came to Caltech in 1946. His research concentrates on the structure and control mechanisms of genes, using as models such organisms as tumor viruses and fruit flies. He pioneered in the development of methods of electron microscopy to visualize genetic material and to identify particular genes.

He is a member of the National Academy of Sciences, and his awards include the 1971 Peter Debye Award in Physical Chemistry of the American Chemical Society. In 1980 he was



Norman Davidson

named California Scientist of the Year by the California Museum of Science and Industry.

Norman Davidson received his BS degree from the University of Chicago, a BSc from Oxford University, and his PhD from the University of Chicago.

Roger Noll: Institute Professor

Roger Noll (BS '62), professor of economics and chairman of the Division of the Humanities and Social Sciences, has been named Institute Professor of Social Sciences.

Institute Professors are appointed by the Board of Trustees. The title honors faculty members who are distinguished research scholars and who have given special service to Caltech. Noll, 41, is the fifth and youngest faculty member to receive an Institute Professorship; he joins William H. Corcoran of chemical engineering, William A. Fowler of physics, John D. Roberts of chemistry, and Maarten Schmidt of astronomy.

Noll's research has embraced safety and environmental policies, public

utility regulation, the broadcasting industry, professional sports, medical care policy, group decision making, and the theory of electoral politics.



Roger Noll

Currently he is conducting research on the development of a practical method for implementing tradeable emissions permits as a means of dealing with pollution. He is also working on market-like mechanisms for small-group decision making that, from the perspective of group members, achieve faster, more satisfactory results than majority-rule voting.

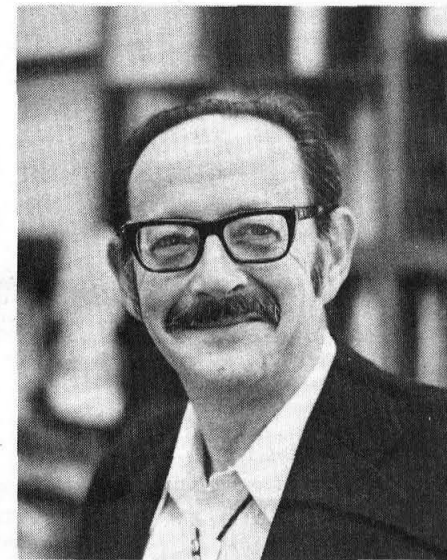
Noll has been a member of the Caltech faculty since 1965. He has been a senior economist on the President's Commission for a National Agenda for the Eighties, and was chairman of the Los Angeles School Monitoring Committee that was charged by the court to monitor progress of school desegregation in Los Angeles. In 1974 he received an award for his book *Economic Aspects of Television Regulation*, given by the National Association of Educational Broadcasters for the best book that year on some aspect of communications policy. He received his PhD from Harvard in 1967.

Gerald Wasserburg: the MacArthur Professor

Gerald J. Wasserburg, professor of geology and geophysics at Caltech, has been named the John D. MacArthur Professor of Geology and Geophysics at the Institute.

The John D. MacArthur Chair was endowed by a gift of \$1.2 million from the John D. and Catherine T. MacArthur Foundation.

John E. Corbally, president of the MacArthur Foundation, said the gift was part of a special, one-time only program in support of some 25 distinguished educational institutions. He said the program was intended to help three situations that threaten universities: erosion of faculty salaries because of inflation, the competing salaries offered by the private



Gerald Wasserburg

sector, and the need for growth opportunities for young faculty members.

Said Corbally, "Through establishment of the chair, the board of the MacArthur Foundation recognizes Caltech's contributions both in instruction and in research. We hope the grant will help Caltech to continue to build on its achievements."

The new MacArthur Professor has specialized in analyses of interplanetary dust, meteorites, moon rocks, and terrestrial materials to study the evolution of the earth, the moon, and the solar system. From his ultra-clean rock-dating laboratory, dubbed the "Lunatic Asylum," he and his colleagues and students have supplied important information on the history of the earth and moon, how the solar system was formed, and the connection between element formation in stars and in the solar system.

Wasserburg received the 1981 Arthur L. Day Prize and Lectureship from NAS for innovative and imaginative applications of chemical physics to problems in the earth sciences. In 1972 and again in 1978, he received NASA's Distinguished Public Service Medal, NASA's highest award for individuals outside the agency. His work has brought him numerous other awards, among them, the Arthur L. Day Medal from the Geological Society of America and the V. M. Goldschmidt Medal of the Geochemical Society.



After dedication ceremonies for the new Mead Laboratory, the Division of Chemistry and Chemical Engineering opened its doors in an open house for The Caltech Associates. Some 200 Associates and guests visited laboratories and talked with faculty members and graduate students about research, and attended a reception in Dabney Gardens. Above: Joseph W. Perry, a graduate student, explains research in laser spectroscopy to Joel Bonsall and Dr. Marcella Bonsall.

The new Mead chemistry lab boosts undergraduate research and The Associates pay a visit

When Gates Chemical Laboratory was vacated after suffering severe damage in the 1971 San Fernando earthquake, undergraduate chemistry courses were housed in hastily solicited laboratory space across campus. Then, in 1972, undergraduates moved into a new one-story building next door to the Noyes Laboratory of Chemical Physics where temporary laboratories had been hastily fitted with old furnishings from Gates.

But chemistry faculty members hoped that updated facilities would soon become available, and now the Clifford S. and Ruth A. Mead Memorial Undergraduate Chemistry Laboratory has fulfilled that hope. The new laboratory utilizes the external structure of the preexisting building but its interior has been completely rebuilt as a modern instructional facility.

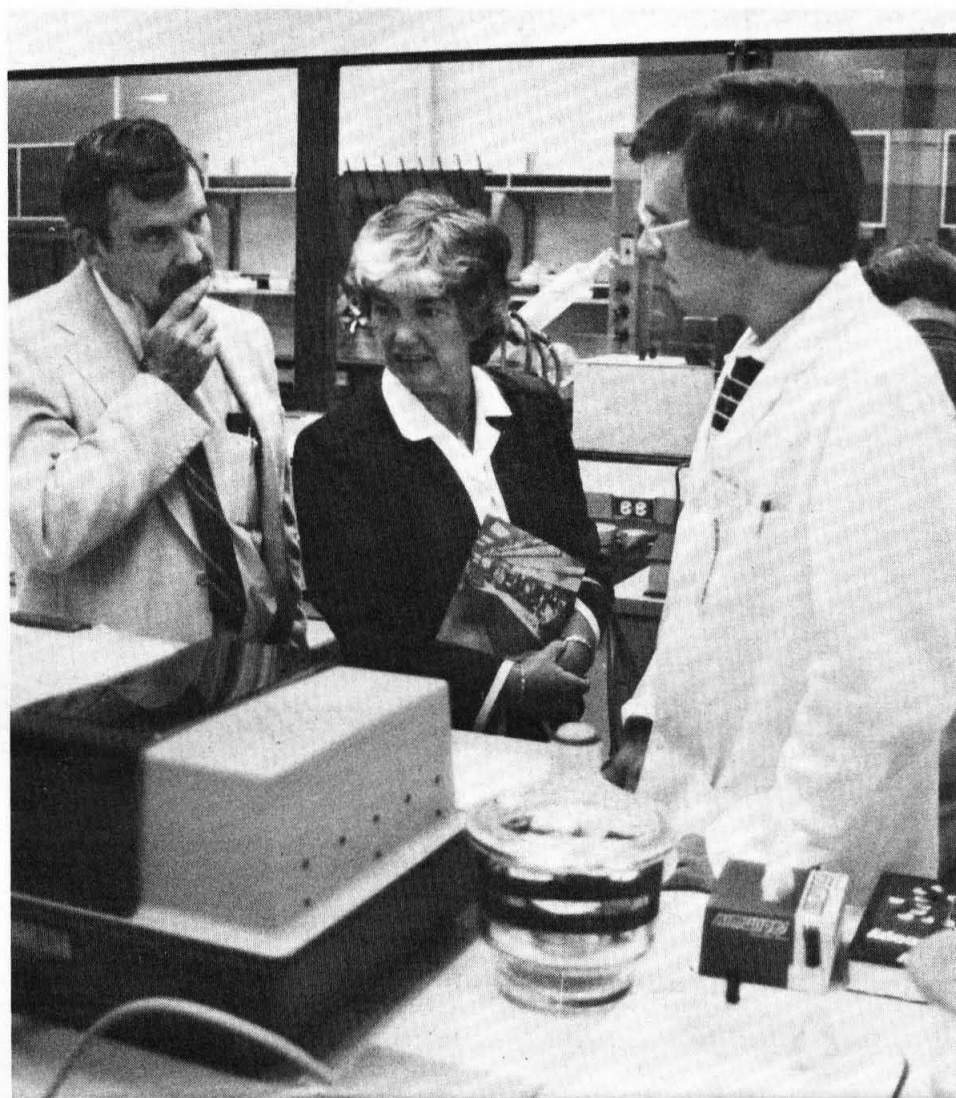
Inside the building, which harmonizes architecturally with Noyes Laboratory, are two teaching labs

based on a single module. These feature student work stations around central, glass-walled instrument rooms. The design unifies "wet" chemistry and instrumental techniques of characterization.

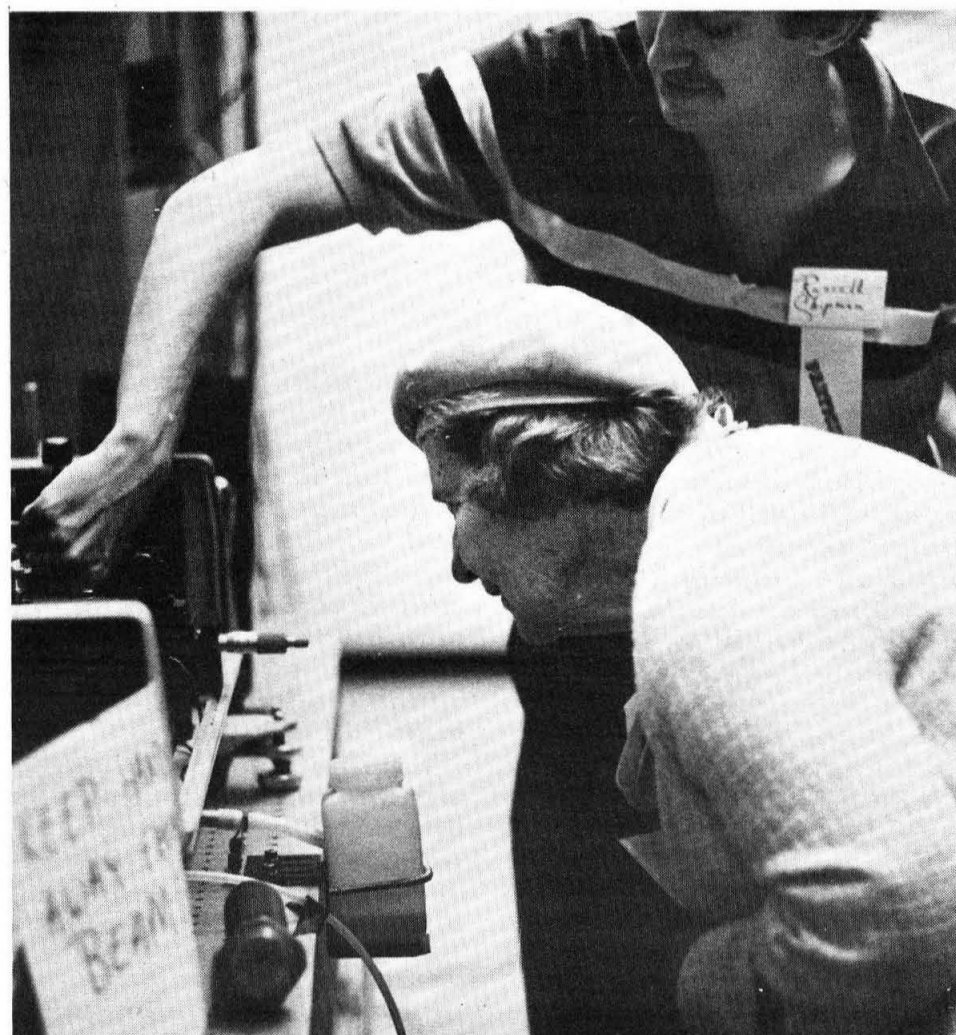
The undergraduate chemistry classes in the new facility are part of a curriculum recently redesigned to update instruction. A new sequence of courses integrates traditional organic and inorganic material and allows students to progress in experimental work at their own pace.

During the first two years, laboratory courses prepare students for research in chemical synthesis, mechanistic studies, and structural characterization — a foundation that enables some of them to begin original research projects by their junior year.

The new undergraduate laboratory is named in honor of Caltech benefactors Clifford S. and Ruth A. Mead. Mead, a prominent Pasadena businessman, established the C. S. Mead Motor Company in Pasadena in 1916 and continued in that business until he retired in 1957. His was the oldest Chevrolet dealership in the world.



Graduate student John Stille (right) describes experiments utilizing an infrared spectrophotometer in the instrument room of advanced undergraduate chemistry laboratories. Touring Mead Labs after dedication ceremonies are Collis H. Holladay, Jr., (BS '56), president of The Associates, and Mrs. Holladay.



Mrs. Ulric Bray inspects an argon-ion-pumped CW-ring dye laser, used in the study of energy-relaxation processes in large molecules. Her guide is graduate student Russell Shipman.

By Winifred Veronda

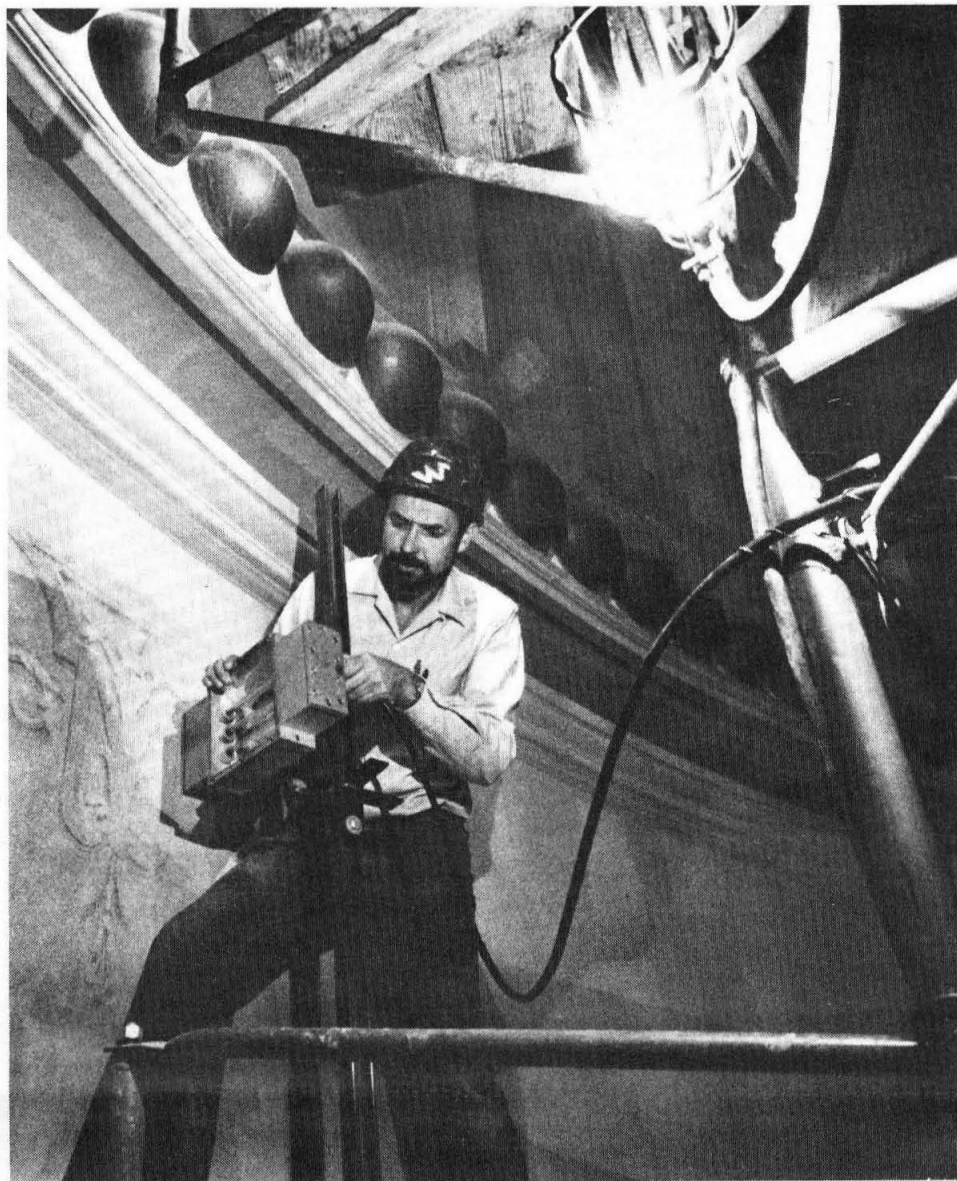
When John Asmus went to Venice in 1972 to help make holograms of deteriorating statues, he didn't dream he was on his way to a reputation as a space-age art restorer that would cause him to be sought after by the likes of J. Paul Getty, Armand Hammer, and Walter Cronkite.

Asmus (BS '58, MS '59, PhD '65), a research physicist with Maxwell Laboratories in San Diego, began his adventures in art restoration via laser technology when he joined a consortium in Venice. The team was creating a permanent record, via holograms, of deteriorating art treasures.

While he was there, he was asked to turn a laser on a grime-encrusted marble gargoyle. "We were surprised at what happened," says Asmus, now a veteran at interviews with representatives of the news media. "The laser beam cut through the encrustation but didn't affect the art. Suddenly I was besieged by Italian museum directors with statues that needed cleaning. I spent the next several months trying to slow them down. The process was then very expensive, and time a rarity."

But during the next few years, laser technology improved, parts-durability increased, and costs dropped. The Italian museum directors were joined by individuals wanting Asmus to: locate a lost Leonardo da Vinci mural, strip paint off the moleskin upholstery of Art Nouveau theater seats in Paris, clean rust from steel trusses in the old county courthouse in Dallas, uncover antique murals and frescoes in the California state capitol in Sacramento, and prepare a version of the Mona Lisa, sans dark varnish, for the audience of Walter Cronkite's television show, "Universe."

Asmus also received requests to clean medieval knights' armor, antique pottery, silver coins from Spanish shipwrecks, and pieces of submarines, battleships, and aircraft carriers. He never knew what to expect in his mail. One day, for example, it contained a large chunk of an English tombstone. The sender was involved in restoration of an English cathedral and shipped the headstone because it was made of rock of similar age and quality. "In the end," says Asmus, "they sandblasted Wells Cathedral and virtually ruined it."



On scaffolding high in the dome of the state capitol, John Asmus wields his laser in a project to uncover traces of antique frescoes as part of a restoration project.

John Asmus: space-age art restorer

The technique that has made Asmus so sought after uses specially designed equipment. With this equipment, laser beams can, when intensely focused and expertly manipulated, vaporize unwanted surface materials either by changing the molecular bonding that holds the material to a surface, or by delivering glancing blows that chip away the material — be it paint, mildew, rust, or age-old encrustations.

Thus far, Maxwell Labs (a spinoff of the General Dynamics Corporation) has built about half a dozen xenon flash-lamp systems, costing \$40,000 and capable of cleaning up to 20 square feet a minute as the beams sweep across a target area.

"We approach the cleaning by searching for a set of conditions in which the material we want to remove is more vulnerable to radiation than the material we want to preserve," says Asmus. "To achieve these conditions, we can vary any one of several parameters: the pulse rate of the optical radiation, the energy density or flux, the radiation spectrum, and the fluid under which the interaction takes place."

"By manipulating these parameters, we can usually find a recipe that works. But only in a fraction of the cases is the procedure cost effective. Conventional approaches are often faster and cheaper, though not as selective."

So far, says Asmus, he has encountered no surface whose materials can't be removed by laser, be it leather, textile, wood, bronze — "you name it."

Asmus, 45, had little interest in the arts or in art restoration when he was a Caltech student. He did his thesis on lasers with Danial Dow and later Nicholas George as his advisers. This was a time when microwaves were being supplanted by laser beams as an emerging technology with potentially wide applications in medicine, physical science, and energy-related endeavors. Laser technology was a hot new field, and job offers were abundant.

Asmus went to work for General Atomic, where he was asked to put together a laser laboratory and to use lasers in a variety of ways — from making micrometeorites in the laboratory to measuring eye floaters. Then, in 1969, he went to work in Washington for the Institute for Defense Analysis, an institution that provided coordination in laser research and development for the U.S. Department of Defense.

In Washington, he was asked by President Nixon's science adviser (E.E. David) to set up a panel to debate whether the nation should adopt a Manhattan Project-style approach in developing further laser technology. One panel member had just returned from Venice and told Asmus about efforts to preserve art treasures there.

Asmus became a participant and, in 1973, he joined the UC San Diego faculty. Here he was co-founder of the Center for Art-Science Studies, an attempt, according to Asmus, to "institutionalize serendipity in the arts and sciences." Meanwhile, requests to help in art restoration projects continued to escalate.

"I spent six or seven years at UCSD on treasure hunts and art restoration forays, and on developing a variety of analytical techniques that are used to authenticate art works," says Asmus.

These endeavors led to encounters with some of the celebrities of the world of art collecting. For example, Asmus remembers the day the telephone rang and the voice on the other end said, "My name is Armand Hammer. I deal in petroleum. Perhaps you've heard of me."

The call from Hammer triggered a search for a lost Leonardo mural, a project in which the multimillionaire was interested. Art historians had believed that Leonardo destroyed the

mural, *The Battle of Anghiari*, but salvage efforts after the 1966 flood in Florence produced evidence that this might not be the case.

During 1975-77, Asmus made several trips to Florence, using ultrasonic and infrared technology in a search for the mural, believed to be covered by a work by Vasari. Asmus received strong ultrasonic echoes in two locations, but the project became bogged down in local politics, and the mural, if it exists, remains hidden.

Another telephone call came from multimillionaire J. Paul Getty. Getty was torn between the desire to keep some of his art works at his estate in England or to send them to the museum he had founded in California.

A telephone call came from multimillionaire J. Paul Getty. Getty was torn between keeping some of his artworks in England or sending them to his museum.

Asmus proposed creating holograms of some of Getty's favorite statues, the holograms to be in one location and the originals in the other. Getty liked the idea and Asmus was commissioned to make holograms of several art works.

Thus, Asmus found himself custodian of two priceless art treasures belonging to Getty with which he was to experiment. One of them was a third-century-B.C. marble Greek head. Afraid to leave it alone, insurance notwithstanding, he took to carrying it with him everywhere, and announcing himself at dinner parties by asking the hostess, "Do you have room for a friend?" The head generally accompanied him to the dinner table. Unfortunately, Getty died before seeing his holograms.

Asmus became involved in a project closer to home when he was asked to help save some Indian paintings on limestone cliffs near Big Bend, Texas. The limestone was continuing to grow, covering the paintings.

Word of his work in this project led to a call about an Indian pictograph near Moab, Utah, that had been defaced by vandals using a

kitchen cleanser. Asmus, his wife, and two daughters loaded his 600-pound system into a station wagon and headed to Utah to conduct a feasibility study; then he turned the results over to the National Park Service and headed down the Colorado River by raft with his family.

The raft trip helped to compensate for their labor when Asmus pressed them into service in his job, hauling 600 pounds of equipment up a 600-foot cliff. "I've often been able to take my family with me on projects," he says, "and more than once they've complained that I'm a slavedriver."

Another of Asmus's endeavors involved the famed Temple of Philae in Egypt. There, workers for a decade had been carrying the ancient temple, piece by piece, from a flooded island near the Aswan Dam to higher ground.

To keep track of each piece when it came time to reassemble the temple, workers painted white stripes across the massive structure, using water soluble paint. But when the relocation was complete, the workers found that the sun-baked paint could no longer be washed off. The Egyptians considered sandblasting, but this would have left bright stripes of fresh stone in place of the paint. Asmus turned his infrared laser beam on a small piece of the temple and brushed away the stripes without a trace. But the Egyptians are still considering other alternatives before making a decision.

Closer to home, Asmus in 1978 found himself with a graduate student on 75-foot-high scaffolding in the rotunda of the state capitol in Sacramento, zapping away at old layers of paint in search of scraps of the original murals buried underneath — part of a mammoth restoration project for the building. Over two months, Asmus and his co-worker uncovered 700 square feet of decorations — one cycle of every repeating segment of the murals.

Yet another project has involved the attempt to learn what the Mona Lisa would look like without the coat of brown varnish that covers it. This query was raised by Walter Cronkite, who wanted to feature a replica of the painting sans varnish on the "Universe" television show. Asmus obtained a color transparency of the painting from the Louvre, and, working with technicians at JPL and the Scripps Institution of Oceanography,

took a first cut — by computer image enhancement — at simulating the removal of the varnish. The resulting picture was used in the opening show. Considerable more study needs to be done to obtain an accurate image, says Asmus, and this will involve a lot of time and money.

The work with the Mona Lisa points to an area in which Asmus has a particular interest. This is the use of computer image enhancement to predict how a picture will look when an old finish is removed. "Many of my art restorer friends are having trouble collecting their fees," he explains. "A customer brings in an old painting with cracked, dirty varnish. The restorer takes off the varnish, transfers the painting to a new canvas, and revarnishes it, and the owner is appalled and doesn't pay."

"The painting was dark and subdued and now it's all bright and glittery. The owner tells the art restorer that he destroyed it. A service I could perform would be to run the painting through a computer and predict what it would look like after cleaning. Perhaps then the restorer and the owner could agree on their goals, and the owner wouldn't go out and put muddy varnish on the picture to make it look old again."

Asmus is the first to concede that, through his work, he has acquired a discerning taste for fine art. He has also acquired a deep sense of frustration over the funding difficulties in the field. "When you're in art and science, you're nowhere," he says. "The National Science Foundation isn't sympathetic because you're taking funds away from someone doing hard science. On the other hand, the art endowments don't understand and often don't appreciate scientific techniques of conservation. The result is spending too much time chasing too little money."

"Meanwhile, we've learned that the techniques we developed in art conservation have applications for commercial activities — cleaning graffiti from subway cars, rust from steel building trusses, paint from airplanes, and barnacles from submarines, for example. Now, I'm finding that art restoration is a wonderful avocation. I can do it on this basis much more happily than trying to make it a full-time, pay-its-own-way career."

The years since Asmus joined a U.S. government project on laser uses have been full of surprises — one of the first being the discovery that lasers can be used for cleaning purposes. The years ahead are bound to bring more surprises, and Asmus is looking forward to them. "That's the nub of what I find exciting about all of this," he says. "There's always the unexpected."

Caltech contributes five faculty, alumni to NAE

Two Caltech faculty members, one of them an alumnus, and three other alumni are among 49 new members elected to the National Academy of Engineering.

They are: John H. Seinfeld, Caltech's Louis E. Nohl Professor and professor of chemical engineering and executive officer for chemical engineering, elected for outstanding contributions to understanding the atmospheric behavior of pollutants; Theodore Y. Wu, PhD '52, Caltech professor of engineering science, for contributions to hydrodynamics, and its application to the motions of vehicles and to the propulsion of animals through fluids.

Mihran Agbabian, MS '48, president, Agbabian Associates, Engineers and Consultants, El Segundo, California, for contributions in the application of advanced methods of applied mechanics to structural design, and contributions in the field of structural response to blast and shock and the reduction of seismic hazards to existing structures.

R. Richard Heppe, Eng '47, vice president, advanced programs, Lockheed-California Co., Burbank, for contributions to the aerodynamics, design, and disciplined technical management of numerous military and commercial aircraft developments.

Milo C. Ketchum, BS '35, principal, Ketchum, Konkel, Barrett, Nickel, Austin, Consulting Engineers, and emeritus professor of civil engineering at the University of Connecticut, for pioneering the development of folded-plate and thin-shell structures and their application to innovative, creative, and aesthetic designs.

Association members now may check out books at no cost

Caltech graduates who are members of the Alumni Association may now check books out of Millikan Library at no cost, simply by presenting their Association membership card. (Previously, it was necessary to purchase a coupon book in order to check out library materials.) The new service to Alumni Association members is being offered on a six-month trial basis.

Aid cuts: will they affect student body diversity?

Continued from page 1

students; State Student Incentive Grants, which provide matching funds for California's state grant program; and funds for work-study. Under this program, the federal government subsidizes part-time jobs for students.

The Guaranteed Student Loan Program also is expected to be revised; the best guess about its eventual form is that all GSL loans will be awarded only to undergraduates who demonstrate need and that the student will have to pay fees of 10 to 15 percent of the amount borrowed.

This year, 45 percent of Caltech undergraduates received some help through the Guaranteed Student Loan Program. The loans averaged \$2,350. (Caltech's default rate on all student loans, according to Wilson, is 2.87 percent, compared with 16.5 percent nationwide. "When we tell people at other schools," she said, "they don't believe us.")

Hardest hit by all the cuts will be students whose families are in the \$26,000-\$40,000 range who may not qualify for substantial aid, but who cannot handle college costs without help.

As proposed cuts have been receiving nationwide media attention, Wilson says she has observed a shift in the income level of students who have applied for admission to Caltech next year. Fewer families at the lower end of the income spectrum have applied, probably because, due to the publicity, they felt their chances of affording the Institute were hopeless, Wilson believes.

Cuts in financial aid and the effect the cuts may have on the diversity of the Caltech student body have been of serious concern to its current students, Wilson says. "Will only rich people be able to afford to come here next year?" is a question she's been asked several times.

So far, the answer to that question is no. The Institute is continuing to accept students on the basis of merit, irrespective of financial ability. (It has, however, had to limit the number of needy foreign students that it can accept.)

Caltech has agreed to find ways this year to meet the needs of the

students it wants to admit, even if the maximum amount of proposed cuts in aid is approved. But a bad funding year could make it necessary for the administration to consider a change, Wilson believes.

She notes that Caltech's Development department has been hard at work, looking for ways to replace missing government funds, but that "student aid is hard to sell." Over the past year, the class of 1931, conscious of the problem, established a loan fund for students that now contains \$68,000. The class of 1957 has been organizing a similar fund.

Hit by cuts in the current year's financial aid funding, Caltech students have taken on extra off-campus jobs (one, for example, works as a waiter in the Athenaeum, a teaching assistant, and an off-campus computer programmer) or have taken out additional loans — some borrowing up to \$5,000. Still others have gone out on their own to seek scholarships from corporations, foundations, etc.

This spring, Caltech students joined students throughout the nation in intensive efforts, via letter writing, to influence congressional opinion on proposed student aid cuts. Moreover, Tim Brazy, president of ASCIT, and Al Lin, president of the Graduate Student Council, joined thousands of college and university students from throughout the country in Washington, D. C., on March 1 to participate in the second annual National Student Lobby Day.

The two talked with congressmen and senators from California and from their home states, and joined with other students for a meeting at the day's end. They pronounced the reception on the part of the elected officials as "good."

Less affected by federal government student aid cuts will be graduate students. Most of these receive some form of assistance, but more frequently in the form of teaching or research assistantships, federal fellowships and traineeships, Institute or divisional fellowships, fellowships from industry, or loans from the Institute or the National Direct Student Loan Program. If funds for basic research sponsored by such organizations as the National Institutes of Health and the National Science Foundation are cut, then graduate students may suffer, Wilson said.

[THE WAY IT WAS]

1911

The *Los Angeles Examiner* reports on February 2 that "Mark Keppel, county superintendent of schools, made a triumphant return to Los Angeles yesterday, bringing from Sacramento news that the conversion of Throop Polytechnic into a state institution is almost an assured thing. He says that everyone in the legislature is enthusiastic and that even that phrase is too mild for the Los Angeles delegation." The *Los Angeles Times* elaborates: "The latest plan in the direction of securing state aid for a

(The Grizzly represented the Southern Branch, soon to be known as UCLA.)

The *Pasadena Sun* announces on December 25: "Scientific Research will benefit by Organization of 100 who will lend their material support. An organization of approximately 100 prominent men and women of Pasadena and Southern California is now being formed for the purpose of lending material and moral support to the scientific work now being carried on at the California Institute of Technology. . . . Many prominent



James A. B. Scherer (second row center) with colleagues at a local movie studio. Scherer's plan to make Throop Institute a part of the UC system failed because of opposition from Bay Area alumni of the University of California. Photo courtesy of the Caltech Archives.

higher educational institution in or near Los Angeles is to have Throop Institute taken over by the State, with appropriations sufficient to broaden its scope. . . ."

But University of California alumni protest the creation of a campus in the south, and on March 11, 1912, the *San Francisco Examiner* announces that "A more decisive defeat than had been expected was administered today to the Southern California bill for the establishment of a state institution of higher learning upon the Throop School of Pasadena," and Caltech President James A. B. Scherer withdraws his proposition for Throop's conversion as a state institution, stating that "We are unwilling to force our gift upon the state."

residents of Pasadena have already been asked to join the group, it is understood." Thus *The Caltech Associates* came into being.

1946

The *Pasadena Star News* relates on November 13: "Dr. Lee A. DuBridge, speaking at Civic Auditorium ceremonies formally inducting him as new president of the California Institute of Technology, yesterday pledged Caltech to the production of men whose intellectual power is combined with the spark of leadership and human understanding. Nearly 1,000 person braved heavy rains to attend the ceremony seating Dr. DuBridge as successor to Dr. Robert A. Millikan. . . ."

1925

Comments the *Pasadena Star-News*: "As the gun put an end to one of the most hectic sixty minutes ever witnessed at Tournament Park, a tired and crippled Grizzly Bear limped off the field with a 10-10 tie against the Caltech Engineers instead of the confidently expected victory."

Letters from alumni and friends

Caltech's athletic heritage

Dear *Caltech News* Sports Editors:

Your comments in recent issues about the victories of present and former Caltech football teams are well appreciated by the alumni who are tired of being glibed by those not familiar with the past record.

However, there is some error in your reporting of our Caltech conference championship team of 1931, which did suffer a Southern Conference defeat by Occidental College that year. More important, you overlooked the record of the first Caltech conference championship team of 1930, which was truly undefeated in its conference record.

For your information, the records of the two championship teams, which included ten lettermen who served on both squads, was as follows:

1930: Caltech 77, Glendale JC 0; Caltech 6, Santa Barbara State 6; Caltech 12, University of Arizona 26; Caltech 2, Pomona 0; Caltech 27, La Verne 13; Caltech 0, UCLA 30; Caltech 6, Occidental 0; Caltech 26, California Christian 0; Caltech 7, Stanford 37; Caltech 20, San Diego State 0.

1931: Caltech 31, Santa Barbara State 0; Caltech 13, Arizona State 0; Caltech 13, Pasadena JC 13; Caltech 0, Occidental 13; Caltech 6, Redlands 0; Caltech 20, La Verne 6; Caltech 26, Pomona 0; Caltech 0, Loyola 21; Caltech 13, San Diego State 0.

In each season there were six victories and one tie game, with losses to Oxy and the very large universities, and we did lead Stanford 7-6 at one point in the first half. As you indicated, home conference games were played in the Rose Bowl. They were played Friday evenings and drew from 8,000 to 14,000 spectators.

In short, future references should be to the Caltech football championship teams of 1930 and 1931.

It may also be of interest to know that Bill Shuler who played on these teams was appointed to West Point after graduation, and played football there for the Army team, which was allowable in those days. In his senior

year, he was captain of an Army team that beat Notre Dame and Navy, and was a universal All-American choice. Thus Caltech football has had one alumnus who was an All-American football player. This should be recollected if General William T. Shuler shows up for his 50th Caltech class reunion this coming June.

SAMUEL Y. JOHNSON, BS '33

Ed. note: The *Caltech News* sports editors appreciate Mr. Johnson's interesting and informative letter, and will be looking for General Shuler at the Half-Century Club luncheon.

Dear *Caltech News* Editor:

Health and holidays caused me to miss the December issue — until I read John Anderson's letter to the editors.

For 38 years, I have been annoyed by USC, Cal, UCLA, and Redlands attempting to erase 1944 and 1945 from history. Now *Caltech News* writers are repeating the myth that the great Tech teams didn't exist, or their records shouldn't count.

Retiring in March as city engineer of Los Angeles, where my "brawn" may have been more valuable than "brains," I shall have to sacrifice some retirement fishing time to write my "Golden Age" memoirs and set the record and youthful editorial minds straight.

DONALD C. TILLMAN, BS '45, MS '47

Ed. note: The editorial minds at *Caltech News*, actually not as youthful as we might wish, will be looking forward to the opportunity to reprint excerpts from Mr. Tillman's "Golden Age" memoirs.

Getting into graduate school

Dear Editor:

The article "Getting into Graduate School: How Caltech Students Measure Up" [in April *Caltech News*] by Winifred Veronda was interesting, but one sided. I have had both good and bad events happen to me due to my association with Caltech. I graduated with only a 2.3, so perhaps I don't fit the descriptions put forth by some of the people in the article, but I did manage a 3.96 in graduate school. While at Tech, I co-authored three papers and was active both in the social life of my house and in athletics.

After graduation, I tried to find a job in the Los Angeles area to help send my wife to graduate school. I was turned down at least three times due to my low GPA. I was finally hired by a company in Azusa based only on the fact that I graduated from Tech. I suppose you have to take the bad with the good.

As you can imagine, getting into graduate school was no easy task with such a dismal undergraduate record. I was accepted at several good schools, but without financial support. I finally was given a fellowship at a state university based only on the fact that I graduated from Caltech. Again, first take the bad, then the good.

The most amazing events, however, took place after I received my PhD. A recruiter from Sandia Labs was interested in me due to my work on radiation damage in metals, but I

could not even formally interview with this company due to my low undergraduate GPA!

Later, I interviewed with the research labs of General Motors. The interview went extremely well, and I thought an offer was in the air. The lab director disqualified me from consideration after asking me only one question, "What was your GPA?" I didn't meet their requirement. No allowance was made as to school or background. Looking back on it now, it probably was for the best.

There are many other similar stories, I am sure. In your next article it would be wise to ask former students what happened to them. I am sure that their views would be more balanced than those of the faculty and staff whose job, after all, is to place students after graduation.

RUSSELL F. PINIZZOTTO, BS '72

Ed. note: Russell Pinizzotto is a member of the technical staff with Texas Instruments in Dallas.

Fansome to grad school?

Dear Editor:

I was initially deeply gratified to observe in the recent *Caltech News* that Alluvial O. Fansome has been admitted to graduate school, even if it was only to Stanford [cover, April *Caltech News*]. However, my recollection of the famed Flem's study habits and the elusive nature of his scholarship aroused my suspicions and prompted me to examine more closely the purported admission letter. I hope that Al has noticed that the letter is dated April 1.

ANTHONY BARCELLOS, BS '73

(Fleming O/C, 1971-73)

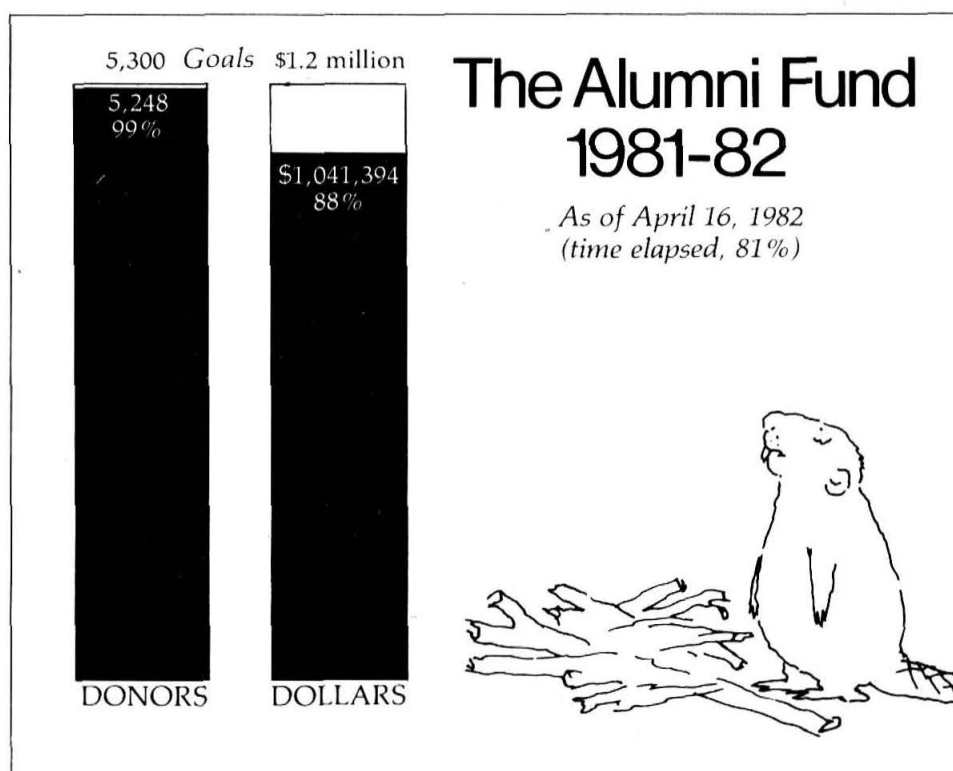
Shroud of Turin

The Editor, *Caltech News*

Dear Sir [Sic]:

I was much amused by the arrival on the same day of the *Caltech News* and of the *Albuquerque Journal Impact Magazine*, both with an article about the Shroud of Turin. The *Impact Magazine* article points out, I think convincingly, that many of the statements in your article are based on half-truths or are simply incorrect. I enclose a copy of the article for your edification.

My own view of the matter is that you have become dupes of a group whose real, though unstated, purpose



Letters

Continued from page 9

is to derogate the importance of scientific research through the promotion of the acceptance of quotidian miracles; you have lowered yourselves to the intellectual level of the Arkansas State Legislature.

BARRY G. CLARK, BS '59, PhD '64

Ed. note: After reading the *Impact Magazine* article carefully, we continue to believe that the information presented in the Shroud of Turin story in April *Caltech News* represents up-to-date objective evidence concerning research on the shroud, and that the integrity of the technologists at JPL, who offered the material, is beyond question. The *Impact Magazine* article argues extensively against the premise that the image on the burial cloth may have been created by a burst of radiation; this premise is never set forth in the *Caltech News* story. There are other examples.

WINIFRED VERONDA,
Editor, *Caltech News*

Dear Editor:

In the recent issue of *Caltech News*, I read with considerable interest your account of the scientific tests being applied to the Shroud of Turin. It is indeed, by your account and others, a tantalizing puzzle.

I would appreciate your advising me if you hear of any further scientific experiments.

EDMOND DU PONT

Humanities Division receives fine arts gift

Caltech's Division of the Humanities and Social Sciences has received a gift of six paintings by five noted contemporary American artists from Nicholas del Pesco in memory of his mother, Charlotte Itma del Pesco.

A retired TRW executive and former attorney, del Pesco has collected art for 20 years. For the memorial gift, he selected paintings by artists William Pettet and Dan Christensen of New York, Tom Holland of Berkeley, and Stephen Harger and Bruce Richards of Los Angeles.

Del Pesco says he chose Caltech as recipient of the gift because he wanted to have the memorial in intimate surroundings where visitors could share in the creative expressions of contemporary art. He praised the division's commitment to the visual arts.

Obituaries

1918

EMBERT C. NELSON on May 27, 1981. He was retired from the General Electric Company in San Francisco.

1924

CHARLES B. KAZDA, PhD. He had been living in Riverside, Illinois.

WILLIS SQUIERS in 1975. He was a founding member of Pi Alpha Tau at Caltech. He had retired from his position as manager of the building department of L. E. Dixon Company in San Gabriel, California.

1926

GEORGE FORSTER, MS, in December 1981. He had been an instructor in the physics department at Pasadena City College.

WAYNE E. GRANGER in February 1981. A retired engineer with Southern California Edison in Los Angeles, he is survived by his wife.

VICTOR F. HANSON on January 17. Retired head and founder of DuPont's Engineering Physics Laboratory, and coordinating scientist at the company's Winterthur Museum in Greenville, Delaware, he was known recently for his computerized device that uses x rays to determine the composition of art objects, revealing forgeries. He joined DuPont in 1934 at the Niagara Falls, New York, plant and was instrumental in the atomic energy project that the firm designed and built for the government in 1943. In 1945 he directed the establishment of the applied physics section of the Engineering Research Laboratory. Hanson retired in June 1981.

1927

ROBERT CREVELING on March 25 at his home in Albuquerque, New Mexico. He had been a technical staff member at Sandia National Laboratories since 1950, where he developed several patents in electronics and physics before retiring in 1968. He was also founder of the Institute of Radio Engineers of New Mexico. During his career he had also been associated with New Mexico Institute of Mining and Technology, Shell Oil Company, and General Electric. Creveling leaves his wife, Letitia, two daughters, and six grandchildren.

1928

B. HALSEY SHEPLEY, JR., on April 9, 1981. Retired in 1968 from a 24-year career with Goodyear Tire and Rubber Company, his last 13 years there were as chief chemist at the Los Angeles plant. Previously he worked for General Petroleum for 15 years. He is survived by his wife, Lucille Throop Shepley, four daughters, ten granddaughters, and one grandson.

1929

MIGUEL A. BASOCO, PhD, on December 3 after a long illness. Professor of mathematics, emeritus, at the University of Nebraska in Lincoln, he was also former chairman of the

mathematics and astronomy department. He joined the faculty in 1930, becoming a full professor in 1941. He is survived by his wife, Doris, two sons, a daughter, and seven grandchildren.

1930

JOHN E. ANDERSON on December 28 of bone cancer. He retired in 1977 as chief electrical engineer for the Southern California Metropolitan Water District in Los Angeles. His wife, Connie, and three children survive him.

EDWARD E. KINNEY, MS, on February 25. Retired, he had been living in Indian Rocks, Florida. His wife survives him.

FREDERICK S. SCOTT on January 18 of emphysema. He had retired from Union Oil in Brea, California, as a senior research associate. He leaves his wife, Elizabeth, a daughter, and two grandsons.

1932

HENRY B. POWNALL on March 12 of Alzheimer's disease. He was founder, president, and chairman of the board of Freezing Equipment Sales in York, Pennsylvania. More recently he was chairman of Imagination Farms, Inc., a dairy farm near Ft. Lauderdale, Florida. He is survived by his wife, Dooris, a son and a daughter, and seven grandchildren.

1937

ROBERT CALDWELL JONES. He had retired as department head of Elastomer Research for the Shell Development Company in San Francisco.

PAUL E. LLOYD, PhD, on July 1, 1981. Retired, he had been research associate at Western Behavioral Sciences, and was living in Rancho Santa Fe, California.

WILLARD D. PYE, MS, on November 23. He was professor of geology at the University of Arizona.

1938

WILLIAM A. SCHOECH, MS. Vice Admiral, USN, Ret., Schoech was a management consultant, living in Escondido, California.

1939

OLE LILLELAND, MS, on July 6, 1981, of a heart attack. He was a retired teacher in the physical science department at Pasadena City College. His wife survives him.

1943

WILLIAM HOVANITZ, PhD, in 1977 of a heart attack. He had retired from his position as professor of zoology at California State University at Los Angeles.

1950

ROSWELL H. POTTS on June 9, 1981, of a heart attack while on vacation in Indiana. He was engineering manager for the Aerospace Corporation in El Segundo. He is survived by his wife.

1957

DONALD C. FORSTER, MS, PhD '60, on June 17, 1981, of cancer. He was group vice president and manager of the defense systems division at Hughes Aircraft in El Segundo, California. His wife, Mary Lou, survives him.

1964

LAURENCE I. SEIDE in 1981 as a result of an industrial accident. He had been living in Ft. Lauderdale, Florida.

1965

ROBERT R. GILPIN, MS, PhD '68, on February 25 of hypothermia after becoming lost while skiing near Lake Placid, New York.

He was assistant professor of mechanical engineering at the University of Alberta in Edmonton. His wife, Annabel, and two children survive him.

1969

WILLIAM A. FERTIG on February 13 of natural causes. He received his PhD in physics at UC San Diego in 1976.

Personals

1918

FRANCIS M. PEASE reports from Pioneer, California, "I just wanted you to know I am very much alive at 84 years, enjoying the ruggedness of mountain living, namely: chopping wood, shoveling snow, raking pine needles and leaves."

1928

ARNOLD O. BECKMAN, PhD, founder and chairman of Beckman Instruments and chairman emeritus of Caltech's board of trustees, has been chosen by the American Academy of Achievement as a "giant of accomplishment" from the nation's great fields of endeavor, and will receive the Golden Plate Award during the 21st annual Salute to Excellence weekend in New Orleans, June 24-26.

ROBLEY D. EVANS, MS '29, PhD '32, MIT professor of physics emeritus, and a former national president of the Health Physics Society and of the Radiation Research Society, received the Health Physics Society's Distinguished Achievement Award at their annual meeting in Louisville, Kentucky, in June 1981, in recognition of his long-term studies of the medical effects of radiation and of his role in establishing international standards of permissible levels of radiation exposure. Evans lives in Scottsdale, Arizona.

1941

WALTER E. FELLERS, MS, former chief designer with Northrop Corporation in Hawthorne, California, has been appointed vice president and chief designer. In his 27 years at Northrop, Fellers has played a major role in the outstanding design of the firm's fighter aircraft.

RICHARD S. SHEVELL, MS, Eng '42, adjunct professor of aeronautics at Stanford, has just finished a textbook, *Fundamentals of Flight*, to be published in late 1982 by Prentice-Hall. He also reports on DAN LEVIN, MS '42, who was listed as a missing alumnus in a recent *Caltech News*: "Dan Levin has had a most unusual and distinguished career. After a stint at Convair, he went to Israel immediately after the founding of the Israeli state in 1948 when the Arab countries attacked Israel at its birth. Equipped with a few hours of flying experience, he flew in the Israeli War of Liberation, mostly with Piper Cubs, I believe. He then founded the Israeli Air Force training command. Later, he did the same for the Air Force R&D activity. After involvement with the R&D activities of the overall Israeli defense organization, he obtained an MBA at Harvard. Later he returned to Harvard, acquired a PhD in political science and became a professor of political science at Tel Aviv University. More recently, he has held government positions and is currently in

charge of a nationwide urban renewal project in Israel. After deciding to remain in Israel, he adopted a Hebrew name and has for decades been known as Dan Shimshoni."

1942

SHELDON W. BROWN, Eng, Captain, USN, Ret., owner and manager of Sheldon Brown Investment Service, writes, "Shifted investment advisory business to Longboat Key, Florida, from Bethesda, Maryland, upon marrying Mrs. Margaret F. Root. Gladys H. Brown, my first wife, died as a result of a heart attack October 5, 1980."

1945

DONALD C. TILLMAN, MS '47, retired in March as city engineer for Los Angeles after 35 years' service to the city. In February, in addition to many other awards throughout the years, he received Honorary Membership in the American Public Works Association, the group's highest award. He began his career with the city in 1947 as a civil engineering assistant in the bureau of engineering, and by 1955 was assistant district engineer. In 1960 he became the youngest, and only civil servant, appointee to the Board of Public Works Commission, where he served for three and a half years before returning as chief deputy city engineer. He was promoted to city engineer in 1972. Tillman and his wife, Doris, make their home in Sherman Oaks.

MERRITT A. WILLIAMSON, MS, Orrin Henry Ingram Distinguished Professor of Engineering Management at Vanderbilt University in Nashville, Tennessee, on the eve of being named emeritus professor, received the Ellen Gregg Ingalls Award for Excellence in Classroom Teaching. Williamson, editor of *Engineering Management International*, has also become president of the American Society for Engineering Management.

1946

KEITH DOIG writes, "I have retired from my position as Shell Oil Company vice president of exploration and production research. After 35 very interesting years with Shell, it seemed like a good time to do something else. Nancy and I will be living in Kerrville, Texas, where we built our retirement home some years ago. I have no firm plans, but am looking forward to having more time to pursue a variety of interests, including consulting, flying, travel, and arts and crafts."

1947

ROBERT S. MacALISTER writes from Wahroonga, Australia, "Obviously my involvement in the international petroleum business continues to shape a gypsy life for me. Last year I was president and chairman of the board of Canadian Occidental Petroleum Ltd. This year I am managing director of Australian Occidental Pty. Ltd. Both companies have coal, mineral, and chemical interests in addition to petroleum operations. Caltech launched me with a

mechanical engineering degree and look how well that educational start has served me. I have held responsible jobs all around the world, have managed diverse businesses and have climbed the management ladder. The sound grounding I received at Caltech in engineering fundamentals, scientific methodology, analytical thinking, and that important liberal admixture of humanities has contributed greatly to the building of my highly satisfying and enjoyable career."

1950

GEORGE E. SOLOMON, MS, PhD '53, was named executive vice president of TRW Inc., Redondo Beach, California, in 1981, as well as general manager of a newly formed operating sector, TRW Electronics and Defense. Previously Solomon was vice president and general manager of TRW's Defense and Space Systems Group, one of the units in the new operating sector.

1951

DALLAS L. PECK, MS '53, was named director of the U.S. Geological Survey by President Reagan in September.

1953

MOSHE ARENS, MS, has become Israel's ambassador to the United States. He immigrated to Israel shortly after receiving his degree at Caltech and became involved in aeronautics teaching and engineering. In 1971 he headed the development of Israel's own jet fighter, the Kfir. He was elected to the Knesset in 1974 and in 1977 became chairman of the Foreign Affairs and Security Committee.

1954

JOHN C. RUCKMICK, MS, PhD '57, has been named executive vice president of Exploration Ventures Company Inc. (EXVENCO) in Spokane, Washington. For the past seven years he has been exploration manager with the Minerals Exploration Division of Texasgulf in Golden, Colorado.

1955

ALLEN E. FUHS, MS, PhD '58, Distinguished Professor in the department of aeronautics at the Naval Postgraduate School in Monterey, California, has received the Daughters of the American Revolution Medal of Honor. He was honored for his local involvement with the Lyceum program for gifted students, his leadership with the Girl Scouts, volunteer service to philanthropic organizations, and for his work as a consultant to several government boards.

1958

ANTANAS V. DUNDZILA, MS, senior engineer and analyst/programmer with Sargent & Lundy Engineers in Chicago, served as a senior U.S. Fulbright Lecturer last fall, spending three and a half months in his native Lithuania and in Latvia, where he delivered some 30 lectures on computer science (most of them in Lithuanian).

1962

WILLIAM F. TIVOL, with the New York State Department of Health in Albany, writes, "I have been appointed 'physicist in charge' of the high voltage electron microscope. This is a biotechnology resource; if anyone is interested in using the facility, write me for details."

1968

DONALD R. GORAL sends this update: "After graduating from Caltech in 1968, I naively hoped to continue in math at the University of Wisconsin, Madison. The U.S. government had other plans for me and after a pleasant year in Madison, I was drafted into the army, where I met several other Caltech grads. I was taught Vietnamese, and after finishing an MA in math, upon my return to the states, I switched into linguistics and continued in that field at UC Berkeley. I'm interested in the comparative grammar of Southeast Asian languages, and Thailand is a nice place to absorb such things. Hence, I'm teaching English in an idyllic campus an hour's bus ride from Bangkok."

1973

JOHN C. GORD, MS '74, writes, "My wife, Laurel (sister of JACKIE SIEGEL-BARTELT, BS '74), and I were married in 1979. In October 1980 we moved to our new home in Venice, California. We are now eagerly awaiting the birth of our first child, due in May. Between preparing for the baby and taking care of the house I am working as an electrical engineering consultant, and Laurel is starting a career as a writer."

1974

PHILIP D. HATTIS, MS, was married to Beverly Kardon in June 1981 in Newton, Massachusetts. He is a programmer for the space shuttle at the Charles Draper Laboratory in Cambridge. She is a speech therapist.

JOHN LEHMANN reports, "After five lovely years in the beautiful city of Vancouver, British Columbia, doing grad studies in neuroscience, I am currently consulting for Synthelabo, a drug firm in Paris. I have found the ultimate woman, and she is French; we were wedded in the gastronomical capital of France last June, and are impatiently awaiting the arrival of our first child. We plan to move this spring to Baltimore, when I'll join the department of neuroscience at Johns Hopkins."

ROBERT STANLEY writes from Alameda, California, "Joyce (JOYCE HSIAO, BS '74, MS '77) and I were married in June of '79. Our first baby, John Hsiao Stanley, was born in September 1981. Joyce's father, C. Y. HSIAO, was a Caltech grad in 1926; Joyce graduated in 1974, so John should be a third-generation CIT grad by 2001 (no rush)."

LEE VIBBER reports from Tustin, California, that she is co-editor of *On the Mark*, a quarterly newsletter following the career of actor Mark Hamill.

ALEXANDER J. WILSON writes, "My wife, Charlotte, and I had a daughter, Lindsey Allison, on July 6, 1981. We also have a five-year-old son, Nathan Ray. I have been with Burns and McDonnell Engineering in Kansas City since 1974. I am manager of the systems department."

1975

LOUISE KIRKBRIDE, MS '76, has been named president of Computer Aided Design Resources, Inc., a newly formed Pasadena-based company that provides training, computerized design, and computer-aided manufacturing systems and software to small and midsized firms. The new center is the first of several planned for various southern California locations.

1976

KIT HUMPHREY writes, "I'm here in Cleveland doing a residency in emergency medicine, a field I find very interesting and rewarding. My husband, JAY DOTY (BS '74) is working here as an electronics consultant. 'Here' is really a euphemism — most of his jobs are still on the west coast. Our son

Gideon, age two, shows promise of being a great athlete, (and probably an engineer like his father, based on his behavior). We'd be very happy to hear from any old friends or ex-Techers who ended up in this area.

WINDSOR SUNG, PhD '81, was given the Association of Environmental Engineering Professors' NALCO award for his PhD thesis on the catalytic oxygenation of Mn(II) by ferric oxyhydroxide surface. The award is for significant chemical research in water and wastewater treatment. He is assistant professor in the department of civil engineering at the University of New Hampshire, and he and his wife, Marilyn, live in Durham.

1979

PAUL CALZADA reports, "On September 18, 1981, I was sworn in as an official Peace Corps volunteer in Ghana, West Africa. I went through two months of language training (Twi is the most common local language) and learning about the Ghanaian educational system, along with additional information about possible secondary projects that I might involve myself with to help Ghana in other ways, such as raising rabbits, growing a garden, or becoming involved with primary health education. All of these projects could help the local people in this nation with so many economic difficulties (inflation is over 100%). I was originally assigned to teach math at what would be the high school level in the U.S., but an English language teacher was transferred to another school, so now I'm teaching English, which I'm happy to do as I majored in literature at Caltech. Ghana desperately needs teachers in technical subjects, but I was glad I was flexible enough to fill an unexpected vacancy. I'll be in Ghana until June 1983."

Alumni Activities

June 19

San Diego Chapter meeting.
Alumni and their guests will tour Palomar Observatory. Registration, 12:30 p.m.; tour of the observatory, 1-5 p.m., with opportunity to view the 200-inch and 48-inch telescopes. Cost: \$9 for Alumni Association members and their guests and \$7 for their children. Cost to non-members: \$11 for adults and \$8 for children. Refreshments will be served. Dress warmly!

October 16

For Arizona alumni, a trip through Oak Creek Canyon and Meteor Crater with Eugene M. Shoemaker, Caltech professor of geology and planetary science. The bus will leave Phoenix at 7:45 a.m. (place to be announced). Alumni should bring their lunches but will eat dinner in Sedona. Price to be announced.

October 30-November 4

Second Alumni Association trip through the eastern Sierra and Yosemite Valley.

October 11

New Jersey Chapter meeting.
Speaker and other details to be announced.

Alumni Fund telephone program raises \$64,000

The Alumni Fund telephone program raised \$64,000 in pledges from 1,081 Caltech graduates, according to David L. Hanna, BS '52, national Alumni Fund chairman.

Hanna said that 160 volunteers worked 14 evenings in five West Coast locations in the fund raising effort. He termed the program "very successful."



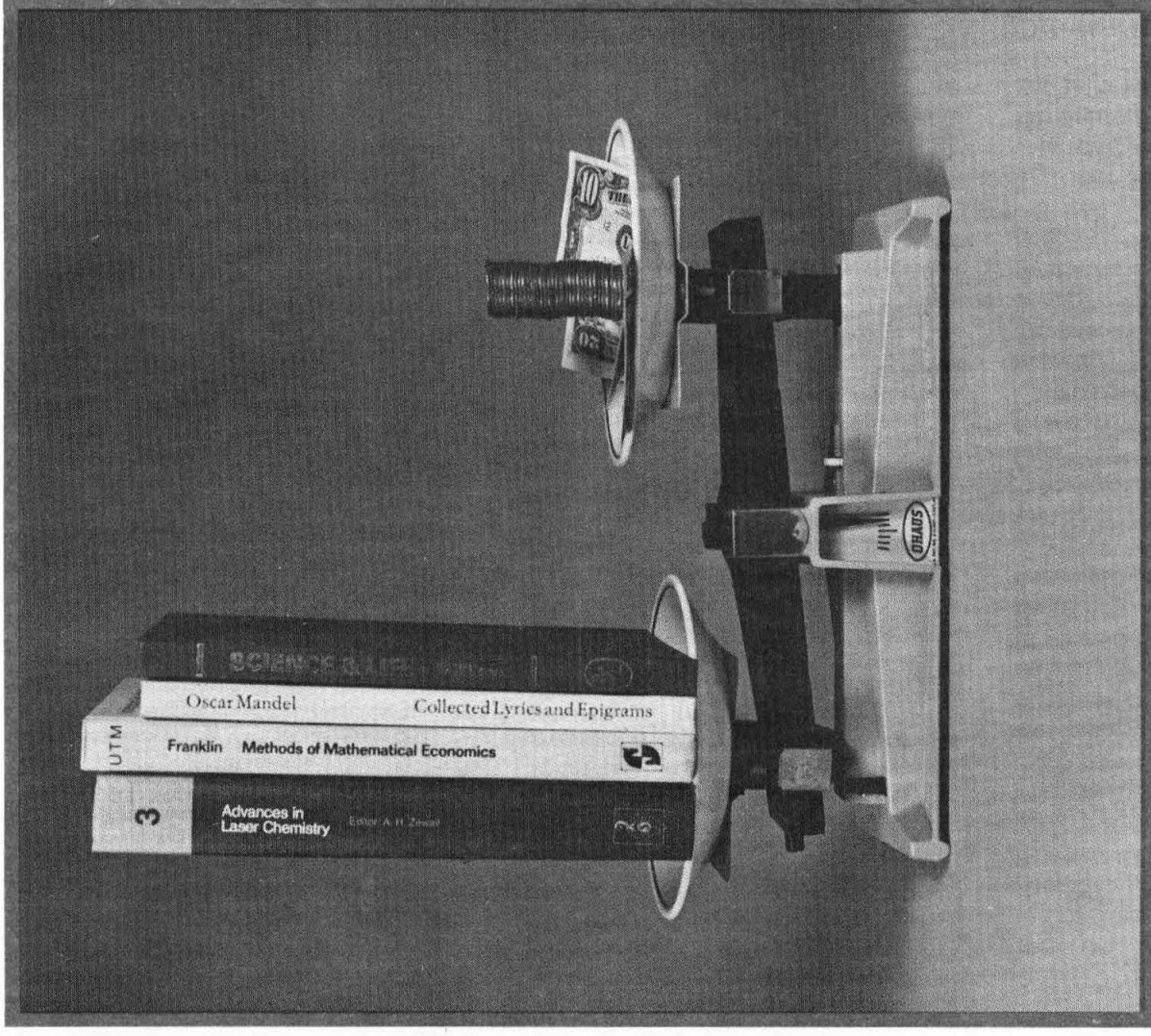
Robert A. Millikan's gold Nobel medal was suggested as an appropriate Caltech memento for Col. C. Gordon Fullerton (BS '57, MS '58) to take into space aboard the space shuttle Columbia. But the Caltech Archives demurred, and Astronaut Fullerton carried a Caltech Air Force ROTC patch instead. Here, aboard the Columbia, as crew pilot, he is busy with mealtime preparations. In his right hand, he holds a beverage in an accordion-like squeeze dispenser.

CALTECH NEWS

California Institute of Technology
1201 E. California Boulevard
Pasadena, California 91125

Published for Alumni and friends of the
California Institute of Technology
Volume 16, Number 3, June 1982

CALTECH NEWS



Financial aid cuts: balancing educational costs
June 1982