CALTECH NEWS

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Two hundred friends and members of the family of the late Donald E. Baxter, M.D., attended the dedication of the new Baxter Hall of the Humanities and Social Sciences on May 10.

Baxter Hall: new home for humanities, social sciences

There are three significant events in the short history of the new Donald E. Baxter, M.D., Hall of the Humanities and Social Sciences. The first was May 21, 1969, when Hallett Smith, then chairman of the division of humanities and social sciences, broke ground with a golden shovel to start the building's construction. The second was March 29, 1971, when the faculty of the humanities and social sciences moved into its new home, all housed for the first time under one roof. The third was May 10, 1971, when—appropriately—under a light rain, the building was officially dedicated.

The new Baxter building, one of the most architecturally distinctive on campus, was made possible by a gift from Mrs. Donald E. Baxter, and is named in honor of her late husband, a distinguished physician and humanitarian.

Representing the Baxter family in the dedication ceremony was Mrs. Jane Baxter Baker, one of the Baxters' three daughters. "The main traits and character of my father," said Mrs. Baker, "were his inquiring mind and thirst for knowledge, which led him into the research field. During his career as a doctor, he contributed greatly to the needs of people through his research and ideas, and consequently, we find it fitting that his name appears on this hall of humanities and social sciences."

The new building is situated southeast of Beckman Auditorium. A similar structure for the study of behavioral biology is planned for the opposite side of the courtyard, and upon its completion will join Baxter and Beckman to form the Court of Man.

Based on a hexagonal design repeated throughout the building, Baxter's offices, classrooms, and seminar rooms have been built to enhance the informal small-group atmosphere that has always characterized Caltech's humanities courses.

The building's features include a public affairs room, an Africana library, art galleries, and music practice and listening rooms. Other facilities include the 435-seat Ramo Auditorium and a smaller 297-seat lecture hall.

In his talk, "Baxter Hall—Where the Action's Going to be," Robert Huttenback, acting chairman of the division of humanities and social sciences, said that the new building will serve as a catalyst to a whole new set of directions in humanities and social sciences education at Caltech. One of these is a proposed

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Distinguished careers bring top honors to four alumni

The highest award that Caltech can confer on an alumnus, the Alumni Distinguished Service Award, was presented by President Harold Brown to four men at the general session of the 34th annual Alumni Seminar Day on May 15. The awards, consisting of a silver medallion and a certificate, are given annually to those graduates of the Institute who have demonstrated outstanding achievement in science, engineering, business, industry, or public service. The 1971 honorees are:

JULIAN D. COLE, PhD '49, chairman of the mechanics and structures department at the University of California at Los Angeles.

Julian Cole received his BS in mechanical engineering from Cornell University in 1944 and his PhD from Caltech in aeronautics in 1949. He joined the Institute's staff in aeronautics as a research fellow that same year, becoming assistant professor of aeronautics in 1951, associate professor in 1955, full professor in 1959, and professor of applied mathematics in 1967.

Cole went to UCLA in 1969 as professor of engineering, and since 1970 has been chairman of the mechanics and structures department there. His research has focused upon theoretical fluid dynamics. He is a fellow of the American Physical Society, and a member of the

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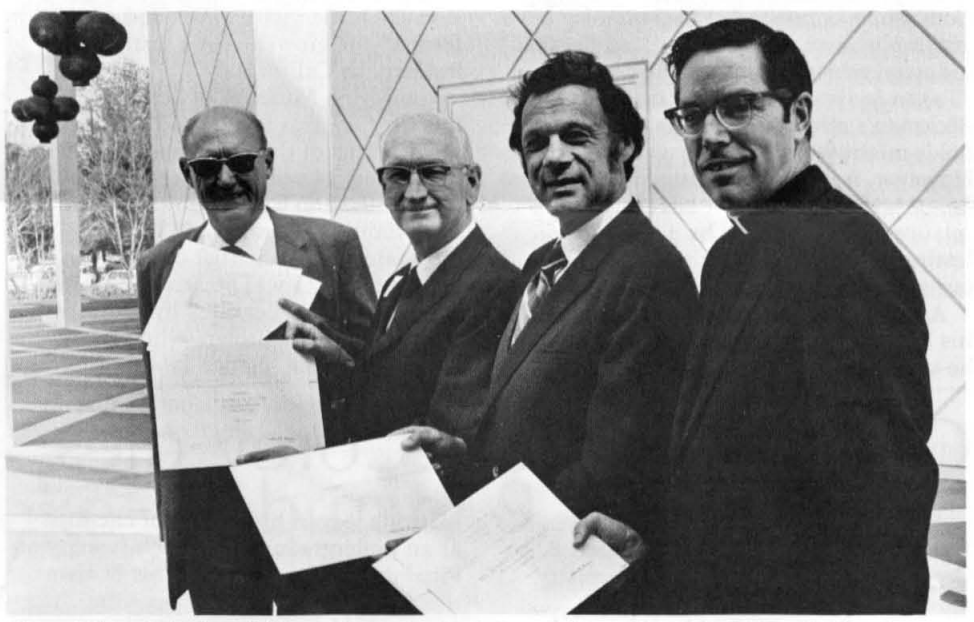


Alumni (from left) Joseph Mayer, Mort Jacobs, Julian Cole, and Rev. Paul Merrifield gather outside of Beckman Auditorium after receiving their Distinguished Service Awards.

Seminar Day sets fast pace for alumni

"Hurry up and drink your coffee."

"Hurry! Why! It's early."

"But I want to be sure to get a seat for the lady professor."

"Lady professor! We're signed up for the Hood talk on cancer."

"Why don't we hear him later. He gives it again, doesn't he?"

"Yeah—but so does she."

"Well, hurry anyway—we might miss something."

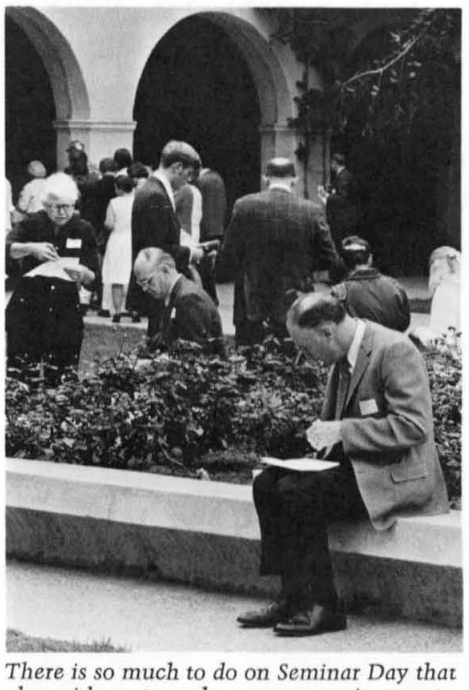
It's the start of another Alumni Seminar, the 34th, and on May 15 even the sun turned out for it—along with nearly 1,400 alumni and their families and guests. As always, it offered an embarrassment of riches, from the first lecture session at 9:30 a.m. till the last notes of the Alma Mater more than 12 hours later.

What lecture to attend and when was never an easy choice, even though all 12 of the day's speakers did repeat performances. But the fatigue factor was considerably lessened by a never-failing supply of coffee and doughnuts, and the eat-it-anywhere box lunch at noon was livened up with a jazz concert by the Caltech band. For those who had more on their minds than eating and chatting with old friends between 12:30 and 1:45, there were bonuses—a pictorial display of some of the results of the San Fernando earthquake of February 9, an art exhibit of the world-famous Hiroshima Panels, and two showings of a Mariner-Mars film produced by JPL.

The general session, held at 2 p.m. in Beckman Auditorium, featured Caltech's president emeritus, Lee DuBridge, speaking on "Caltech, Science, Government," and the presentation of Distinguished Service Awards to four alumni.

Dinner at the Athenaeum was preceded by a social hour and followed by the annual Home Concert of the Caltech Glee Club. A liberal lacing of nostalgia wound it all up as the glee club alumni joined the current members on the Beckman stage to sing the Alma Mater.

Reports on the Seminar Day lectures appear in a special section of this issue of *Caltech News*. Just turn to page three.



There is so much to do on Seminar Day that alumni have to make numerous pit stops to double-check their program schedules.

At the museum awards banquet, Arnold Beckman, right, and Lt. Gov. Edwin Reinecke, center, examine a rotor that Peter Duesberg, left, uses in his cancer studies at Berkeley. The biomedical instrument is made by Beckman's Spinco Division in Palo Alto, California.

Industrialist of the Year

Arnold O. Beckman, chairman of Caltech's board of trustees, has received the 1971 Industrialist of the Year Award of the California Museum of Science and Industry. In presenting the bronze plaque, Samuel B. Stewart, president of the Greater San Francisco Chamber of Commerce, commended Beckman for his accomplishments in three related fields—industry, education, and public service. "Taken individually," Stewart said, "Dr. Beckman's efforts in any one of these fields might well merit the award. However, it is in contributing to the progress of each, and the effective interrelationship of all, that he has made lasting contributions to the progress of our state and the nation as a whole."

A Caltech alumnus, Beckman received his PhD in photochemistry in 1928, and he was on the faculty of the Institute from then until 1940. While at Caltech he became interested in applying electronic techniques to problems of chemical analysis and subsequently Founded Beckman Instruments, Inc. This company has become one of the world's leading manufacturers of precision scientific instruments and a major force in the growth of the instrument industry in California.

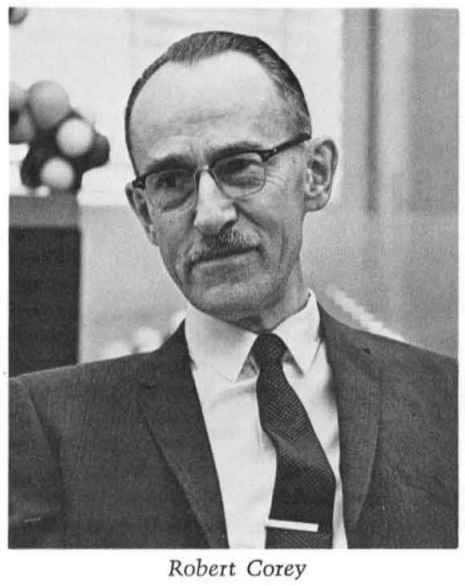
California Museum of Science and Industry Awards for the industrialist and the scientist of the year have been made for the last 14 years "to give recognition and inspiration to the richly creative men and women of science and industry in our State." The Scientist of the Year Award for 1971 was presented to Peter Duesberg of UC Berkeley by Caltech's president Harold Brown, who was chairman of the science award jury.

Chemist Robert Corey dies

A memorial service was held in Dabney Lounge on May 5 for Robert B. Corey, professor of structural chemistry emeritus, who died on April 23 in Pasadena. Corey, 73, had been a member of the Caltech faculty for 34 years.

About 100 people attended the service, at which George Hammond, chairman of the division of chemistry and chemical engineering, presided; and Linus Pauling and Ernest Swift, both past chairmen of the division; and Richard Marsh, senior research fellow in chemistry, gave tributes to their colleague.

Corey, who is credited with being the father of protein crystallography at the Institute, began his studies of chemistry as an undergraduate at the University of Pittsburgh. After receiving his BChem there in 1919, he took his doctorate in inorganic chemistry at Cornell University in 1924 and remained there as an instructor in chemistry for the next five years. In 1929 he joined the staff of the Rockefeller Institute for Medical Research where he became interested in the structure of molecules—the focus of his work for the next 30 years.



Robert Corey

In 1937 Corey came to Caltech as a senior research fellow because the Institute had the necessary equipment for his studies in x-ray crystallography. At the request of Linus Pauling, who had been working on the structure of proteins, Corey then undertook a project to determine the structure of several peptides and amino acids.

From 1942 to 1946 Corey took a leave of absence but after the war he returned to Caltech where he developed and improved precise space-filling molecular models for use in the study of proteins. These first models, made under his direction, have become an indispensable part of present-day chemistry and molecular biology.

After 1956, Corey turned his attention from the fibrous repeating type of protein to focus on crystalline proteins and enzymes. His studies in this area had a profound effect upon the development of protein crystallography and started the group here that became proficient in handling proteins.

DuBridge sees brighter future in better use of technology

Seminar Day was not only a homecoming for the alumni, it was also a homecoming for Lee DuBridge, Caltech's president emeritus. After missing two alumni seminars while serving as President Nixon's science adviser in Washington, D.C., DuBridge came back this year as the featured speaker at the Saturday afternoon general session in Beckman Auditorium. His topic: "Caltech, Science, Government."

While he was president of Caltech, DuBridge never hesitated to say that Caltech was the greatest place in the world. Now, two years later, he still feels the same way. In fact, "no matter where one looks," he said, "one runs into the distinctive achievements of Caltech and the high quality of its faculty, students, and alumni." It was almost always possible for him to think of a name associated with Caltech when he needed to fill government positions, but not wanting to strip Caltech of all its talent or overload the various committees and boards with Caltech people, DuBridge didn't push all of those potential candidates.

While he was in Washington, DuBridge had the sad duty of presiding over a government cutback in science funding. In 1967 several factors made the government reassess its support of scientific research and science education. The war in southeast Asia was certainly a major contributor. As war expenses skyrocketed, Congress began nibbling—and finally slashing—NASA, AEC, and NSF appropriations. Senator Mike Mansfield contributed the crowning blow when he successfully sponsored an amendment forcing the Department of Defense to stop its sponsorship of nondefense-oriented research.

Once the Apollo program was far enough along so that landing on the moon appeared imminent, its budget, too, was sharply curtailed. Instead, the money went to projects deemed to be of more immediate concern: crime in the streets, poverty, and undernourishment.

Then there were problems with students, especially graduate students. While PhD's were being produced in ever increasing numbers, the Bureau of the Budget projected a lessening demand for them; as a result, government expenditures for graduate training were drastically reduced.

President Nixon is now trying to reverse this trend. If Congress goes along, there will be more money for research—not research in the present fields of endeavor, but in those of more pressing social concern such as the fights against cancer and pollution.

Environmental protection was, in fact, the first task to which President Nixon assigned DuBridge. A cabinet committee, with Nixon as its chairman (the precursor to the Environmental Quality Council) imposed stricter controls on the use of insecticides and herbicides and got the auto industry to accept the 1971 emissions standards.

Then, DuBridge said, the environmental problem was picked up by the public in a big way and some of them began carrying it to extremes. For example, Congress enacted legislation banning the use of DDT and phosphate detergents, and requiring 1975 cars to have emissions of oxides reduced by 90 percent. This last measure (known as the Muskie Bill) requires a device not yet invented, according to DuBridge.

Lee DuBridge

Unfortunately, scientists don't always agree when the problem at hand touches on politics, which is all right—as long as it is understood that the dispute is over politics. But there have been recent cases where scientists have attacked the objectivity and even the integrity of their colleagues. This has got to stop, DuBridge said, for while science can survive with reduced funding, it cannot survive if society begins to doubt its integrity.

Is science good? "Yes," said DuBridge, "just look at all the good things we now have through the efforts of science. Our science and technology is not a burden imposed upon us by unthinking people. It is a tool which men have used to provide themselves with a better life . . . Our hope for the future is not in abolishing technology, but in developing better technology and using it more wisely and more considerately."

Baxter dedication

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center for the creative arts that will promote the talents of students in music, the arts, and literature. A start in this program will bring poets Diane Wakowski and Robert Kelly to the campus next September. Arrangements have also been made to have psychoanalyst Erik Erikson on campus in January 1972 to deliver the Haynes Foundation Lecture series. He will return in the fall to conduct a course in the nature of creativity.

Aside from the center for the creative arts, a center is planned for applied and theoretical research on the social aspects of public needs.

The center will initially involve only faculty members, but Huttenback said there were plans to start a small program in the social sciences that would include graduate students in the center's work as well.

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What They Said on Seminar Day

James Bonner

Harvesting with Hormones

James Bonner, professor of biology, responded on alumni Seminar Day to what he termed the current congressional and public outcry against scientists for not doing more to help cure or alleviate societal problems. He pointed out that science is responding to this mood, and mentioned the National Science Foundation and its program on Research Relevant to National Needs, the National Institutes of Health and its goal to conquer cancer by 1975, and Caltech's own Environmental Quality Laboratory. He then settled down to describe two of his own past efforts to be useful to society—efforts relating to those popular commodities, rubber and orange juice.

"They are modest," he admitted, "but they illustrate some of the problems involved."

In 1966 the U.S. Department of Agriculture asked Caltech's biology department to undertake a crash program to help find out how Florida's orange crop—one of the main bases of its economy—could be harvested mechanically. This was crucial, because the U.S. had banned any further importing of Mexican labor. And, according to Bonner, the Floridians themselves turned out to be less than anxious to climb up and down ladders with 50 pounds of oranges on their backs.

Bonner and his group studied various agents which would cause the ripe fruit to drop. Some worked fine, but caused the green fruit to fall off as well. Eventually the researchers evolved a method of spraying the groves with cycloheximide. This caused the trees to produce their own ethylene—a plant hormone that turns on certain genes which cause only the ripe fruit to fall. Five days after the spraying, workers go through the groves, fan the fruit off, vacuum it from the ground, and cart

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Astrochemistry

Radio astronomers have found chemistry going on in the most unexpected places—deep in space between the stars of our Milky Way Galaxy—Peter Goldreich, professor of planetary science and astronomy, told alumni on Seminar Day.

"The first molecule discovered by radio astronomers in space—where the temperature is around 450 degrees below zero Fahrenheit and hazardous ultraviolet radiation abounds—was the discovery of OH molecules, a hydroxyl ion that is indicative of water," he said. "That was eight years ago."

Now water itself has been found, as well as other molecules such as ammonia, methyl alcohol, and formaldehyde. In fact, formaldehyde is found universally in the dust and gas clouds of our galaxy. It is one of the most powerful tools with which to study the distribution of matter in space.

The molecules were found in the dense, dusty gas clouds which are present both in regions of star formation and in shells surrounding old cool stars. We know that the presence of dust is essential to the survival of the molecules in interstellar space.

Nearly a score of different molecules already have been found, some of them rather complex. Perhaps up to 100 different ones will be discovered eventually. All the discoveries are made possible by the application of spectroscopic observations to radio astronomy.

How are molecules formed in space? Molecular hydrogen (two atoms of hydrogen) can form only on dust grains. Individual atoms of hydrogen can alight on a dust grain, and two of them eventually can meet. Other molecules can be formed by direct collision.

The dust of the great clouds probably was formed in the atmosphere of cool stars and then blown out into space on the stellar winds. Goldreich said the molecules almost certainly were not formed in the atmosphere of stars because

Peter Goldreich

as they were blown away they would encounter ultraviolet radiation and be disassociated. Some of the molecules are in excited states that last only for seconds, indicating they have just collided with other molecules.

"As for the density of the molecules, there is an average of only one atom of hydrogen per cubic centimeter in space, while in the clouds the density may increase up to 10 million molecular hydrogens per centimeter cubed. Such very dense regions may be in the process of forming stars."

Another indication of the density of these regions is that young stars are found there. Temperature in these clouds probably ranges from about minus 430 degrees below zero to plus 1,300 degrees.

"In the dust and gas clouds are very small 'maser clouds' about the size of the solar system. We know that these clouds are amplifiers of radio signals, although we are not yet certain what input signals they are amplifying. My prejudice is that they are putting out radiation from a region about the size of our solar system. We think we are dealing here with a mass about that of a star.

"Thus is opening up an exciting new field in radio astronomy—that of astrochemistry."

San Fernando Earthquake—February 9, 1971

It was in no sense a great earthquake—geologically or seismologically. It was not the big earthquake that will some day occur on the San Andreas fault. It wasn't even uncommon—in fact, one that size (6.6 on the Richter scale) hits southern California about every four years. And all those aftershocks are normal too.

For a nonscientist, it would take a mighty stretch of the imagination to find even a faint resemblance between this description and the destructive earthquake that rocked Los Angeles on the morning of February 9, but that was the way Clarence Allen, professor of geology and geophysics, described the event to a full house in Beckman Auditorium on Seminar Day.

Allen was not trying to devaluate the San Fernando earthquake as a geologic event. He was just putting it into perspective. He did make it clear, however, that the San Fernando earthquake will go down in history as the most thoroughly recorded seismic event to this day. And it was an extremely valuable event because of several lessons to be learned from it:

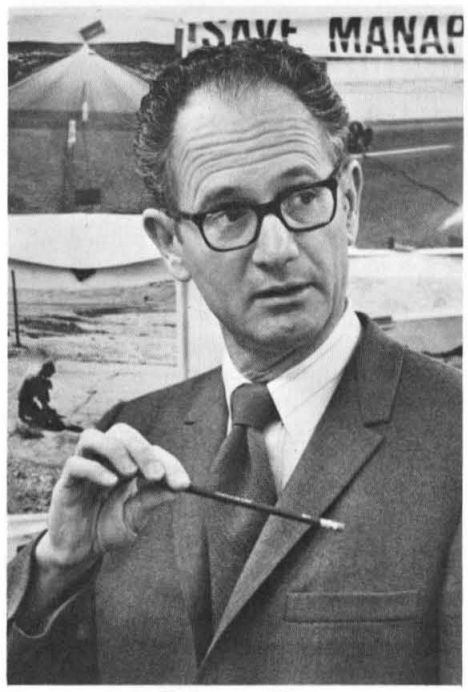
1. In the future more care must be taken if we build across active faults. "I know it's an easy statement to make, and much harder to implement—particularly considering the kinds of faults that broke in San Fernando that had not been clearly recognized ahead of time—but, certainly, this earthquake must accelerate our efforts to delineate these faults, and to understand their degree of activity."

2. From an engineering standpoint, revisions must be made in the building codes to provide better damage control features than are now available.

3. This earthquake proved that the most dangerous structures are the very old buildings—especially those in urban areas—that were constructed prior to modern building codes and modern construction practices. Their removal or rehabilitation would involve tremendous social, economic, and political problems, but it's something that must be faced up to better than has been done in the past.

4. The near catastrophe created by the damage to the lower Van Norman dam reemphasizes the need for more critical inspections and evaluations of old dams.

5. The great value of the Field Act of 1933—enacted after the Long Beach earthquake to upgrade school construction practices—was dramatically demonstrated in the San Fernando earthquake. Allen pointed out that not one child has been killed or seriously injured at schools that meet or exceed Field Act standards. It is also important to note that, at present, hospitals, police



Clarence Allen

stations, and fire stations do not have to be built according to those standards. However, efforts are being made in Sacramento to enact laws to bring construction practices for those structures up to standards comparable to those set for schools.

6. Policies regarding earthquake insurance must be reevaluated. "There were simply too many innocent victims in this earthquake. It's not that earthquake insurance isn't available, but somehow we have got to make sure that everybody has it—to spread the risk—so that when there are innocent victims, they won't be out the tremendous financial loss that so many people suffered in the Sylmar and San Fernando area."

7. There is an increasing need to pay closer attention to vital support systems: water, power, freeways. "We have to have more regional planning to insure that the loss of a single freeway interchange or critical power facility won't incapacitate the entire metropolitan area."

8. Efforts must be increased for making adequate seismic zoning maps. "To this day you can find housing tracts being built squarely across some of our major faults that are easily identifiable."

9. More financial support is needed for basic engineering, seismological, and geological studies to help provide a better understanding of earthquakes and their effects on structures.

There is no question, Allen concluded, that because of the San Fernando earthquake and the lessons we have learned from it, that not only California, but all earthquake-prone areas throughout the world will be safer places to live.

Moving People in Morgantown

Designing a system to move college students from one end of their campus to the other does not seem like a big order for engineers who have put a television camera in orbit around Mars. But A. R. Hibbs, senior staff scientist at Caltech's Jet Propulsion Laboratory, told his Seminar Day listeners that there is one factor that makes transportation systems on earth even more challenging to design than systems for outer space. That factor is people.

In "The New Engineers Versus the Old Transportation," Hibbs described the problems he and other engineers at JPL face in designing a "people-moving" system for the campus town of Morgantown, West Virginia.

This Personal Rapid Transit (PRT) system will be computer-operated and will use rubber-tired, electrically powered vehicles running on tracks built around and through the campus of the University of West Virginia. The $23-million project is sponsored by the new Urban Mass Transit Administration of the Department of Transportation.

The Morgantown project is not only an experiment to test the feasibility of a new rapid transit system; it is also a test of the ability of JPL's aerospace-oriented engineers to adapt their technology to the solution of a public problem. JPL chose to tackle transportation because the solutions seemed to be based primarily on some sort of technological advancement rather than a fundamental change in political or social conditions.

However, Hibbs pointed out that the big need in the field of transportation is not new inventions but better ways of implementing the inventions already at hand. He believes that the potential benefit of introducing modern systems management into the old traditions of transportation are so great that this could be considered the major objective of the project.

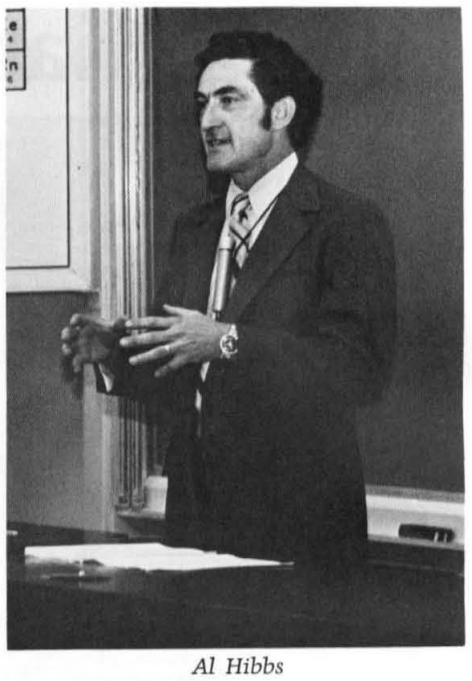
Morgantown was selected for the demonstration project because of a combination of technical, political, and social reasons. The nature of the community is such as to give a very thorough test to all aspects of the system. It is so hilly that some of the grades the cars must execute are as steep as 10 percent. The weather varies from hot summers to snowy winters, regularly interspersed with wind, rain, and sleet. "Because of the university nature of the community, the peak hours are even more demanding than in many other communities," Hibbs said. "In a typical rush hour, such as the noontime break, the congestion in Morgantown is a sight to behold.

"It's about a mile and a half from the downtown campus to the large dormitory complex, and now it takes about half an hour to make the trip. It doesn't matter whether you drive your own car, ride the university bus, or walk. It still takes about half an hour."

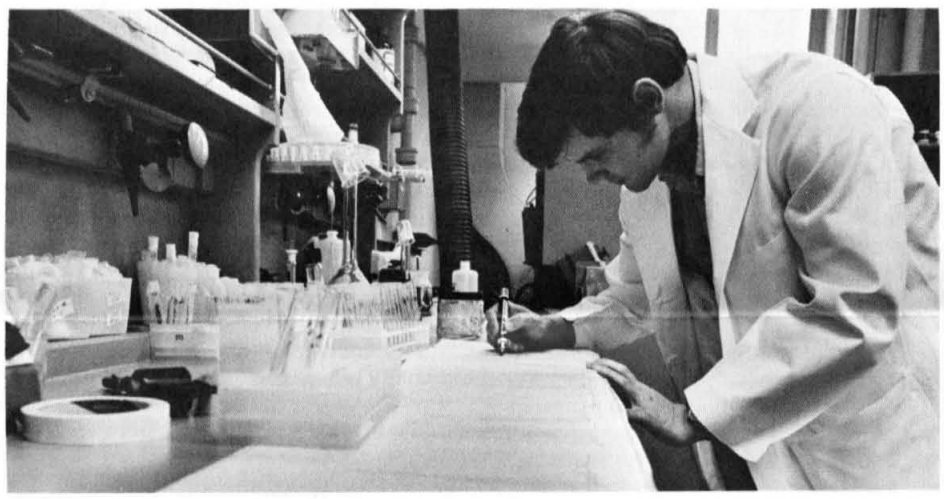
The fully automated, computer-controlled PRT cars will all be, in a sense, express cars. A passenger will enter the station, pay his fare, and push a button for his destination. A waiting car—or one that will arrive within two minutes—will be coded to proceed to that station. After a wait of no more than 30 seconds, the car will depart with up to 12 passengers, and travel at up to 30 miles an hour, without stops, to the selected station.

Unlike aerospace projects, the Morgantown project has required JPL engineers to pay close attention to the aesthetic and social objectives desired by the community as well as performance requirements and economics. One of the reasons for trying to select attractive vehicles is to entice people to leave their cars in a parking lot and ride the system to their downtown destinations.

The Morgantown system is only one of many new transportation concepts that will be developed by JPL in the next few years. "But in order to bring them into being," Hibbs said, "the first and foremost requirement is to adapt our new abilities in systems management to the old requirements of transportation—adapting to match the environment in which we find ourselves; and that includes politics, economics, social problems, and the basic cussedness of the individual human being—which, of course, includes each of us."



Al Hibbs



Leroy Hood

Cancer and Molecules

Although cancer is still one of the leading killers of all age groups in the United States today, perhaps as many as 80 percent of those who contract cancer may be saved through early and effective diagnostic techniques. The key to such a dramatic step, LeRoy Hood, assistant professor of biology, told alumni, lies surprisingly enough, with the use of our own immune system as a diagnostic and therapeutic tool.

To realize the possibilities involved, one needs to understand the body's immune system. The immune system is present in all vertebrate animals and is essentially an adaptive response to the entry into the system of a foreign stimulus. When a foreign stimulus appears, the body's immune system dispenses antibody molecules which act as specific responses to the invading stimulus. The antibody then combines with the foreign stimulus, and, through a variety of techniques, destroys it.

The immune system is capable of producing two responses to foreign cell intervention—humoral and cellular. The two responses are alike only in that they both possess cells that produce antibody molecules. In the humoral response, which dispenses antibodies that protect against bacterial and viral infection, the antibodies are secreted into the blood flow where they can freely move to attack a foreign cell. In the cellular response, which offers the body's best protection from cancer, the antibodies attach themselves to the membrane of the molecule that produces them, and act as surveillance mechanisms to locate and destroy the foreign cells. The cellular antibodies can recognize the tumor cells by cancer molecules on the cell's surface which differentiate it from normal cells.

The antibodies produced against these cancer molecules can be analyzed in a serum (blood) sample for the purpose of cancer molecule detection. One such test for cancer of the colon has been successfully completed by Dr. Philip Gold of Montreal General Hospital. Results of Gold's test allowed him to detect and identify incipient cancer molecules at very early stages.

The hope is," Hood said, "that cancer molecules from other types of tumors can also be identified and antibodies made against them for diagnostic purposes. If this is successful, then one can conceive a battery of diagnostic antibodies for the early detection of many types of cancer."

The therapeutic potential of immuno therapy (treatment of cancer through the use of the immune system) is somewhat limited at this time by the fact that the humoral response often makes "blocking antibodies" which cover the tumor molecules of the cancer cells' surface, and protects them from the destructive effects of the cellular response. "The future hope for immuno therapy," Hood said, "is that we will somehow be able to manipulate each immune response independently."

What is the Price of Wisdom?

When, in the late 18th century, the English poet-engraver William Blake executed a series of 21 plates illustrating the Book of Job, he also set forth an interpretation of the biblical story in terms of his own religious beliefs.

Speaking to alumni on Seminar Day, Jenijoy LaBelle, assistant professor of English, described how Blake deals with questions about man and God—not in the form of a theological treatise, but in the forms of the engraver's art.

Blake's interpretation of Job is unlike the biblical version: Job is not "perfect and upright and one that feared God and eschewed evil." Rather, he is a fallen man from the beginning. In the first illustration, Job sits complacently with his wife and children under a tree, surrounded by sleeping sheep. He is, as Blake wrote, rejoicing in "the tents of prosperity," deluded by superficial piety, and above all, blinded by a false vision of God whom he has conceived in his own image.

In the succeeding ten illustrations, Blake depicts what suffering and destruction befall Job as a consequence of his mistaken vision of God, until ultimately Job confronts that vision, which Dr. LaBelle interprets as a "reflection of his own fallen conception of himself and thus as Satan."

Each of the illustrations consists of a central anecdotal composition, encased by margins that contain both text from the Bible (mainly the Book of Job) and supplemental pictorial elements that reinforce Blake's interpretation. As the story proceeds, Job is challenged by increasingly torturous and ruinous events until, in the eleventh plate, Job confronts his vision of God-turned-Satan, and Blake shows Job lying in extreme agony, engulfed by black sky and flames. This, Dr. LaBelle said, is the lowest point of Job's despair, but it is also the turning point; for Blake believed that when evil is fully revealed, it can be recognized and cast out.

In the ten remaining plates, Blake shows how Job's recognition of his false piety permits the gradual restoration of his material well-being and the renewal of his spiritual self. Blake illustrates the cleansing of Job's vision, through a gradual restoration of serenity and light to the engravings.

By Plate 21, Job and his wife have recovered their material prosperity and spiritual peace. Dr. LaBelle compared the last plate with the first, noting that "instead of kneeling pietistically, the reunited family, serene and joyful, is standing up, making music. The moon is setting, the sun is rising. The dark night of the soul is over. Even the sheep are awake."

Interpreting this illustration, Dr. LaBelle said that, for Blake, Job has now achieved "that higher innocence that can only be won through experience." She quoted from Blake's poem, "The Four Zoas":

> What is the price of Experience,
> do men buy it for a song, or
> wisdom for a dance in the street?
> No, it is bought with the price of
> all that a man hath—his house, his
> wife, his children.
> Wisdom is sold in the desolate market
> where none come to buy,
> And in the wither'd field where the
> farmer ploughs for bread in vain.

"Such it is for Blake's Job," Dr. LaBelle concluded. "He does not merely suffer—he (and we) learn through his suffering."

Jenijoy LaBelle

Political Turmoil in Africa

Alumni were whisked through 15 African countries in about 30 minutes when Ned Munger, professor of political geography, presented an analysis of "Political Turmoil in Sub-Saharan Africa." Drawing on the experiences and observations of 27 years and 25 visits to Africa, he described three current conditions that are affecting the political climate in that part of Africa—(1) the changes resulting from the transition from colonialism to neo-colonialism; (2) the increasing dialogue between black Africa and the Republic of South Africa; and (3) the detente between the U.S. and the Soviet Union.

Ned Munger

The first condition—the move away from colonialism—has enlightened most black African nations in that, after 10 years of independence, they must now admit that some faults of their countries are their own. Clashes among ethnic groups, for instance, continue to be a major problem throughout Africa. Nigeria's civil war is timely evidence, although a more nationalistic feeling seems to be emerging as that country returns to a state of relative peace.

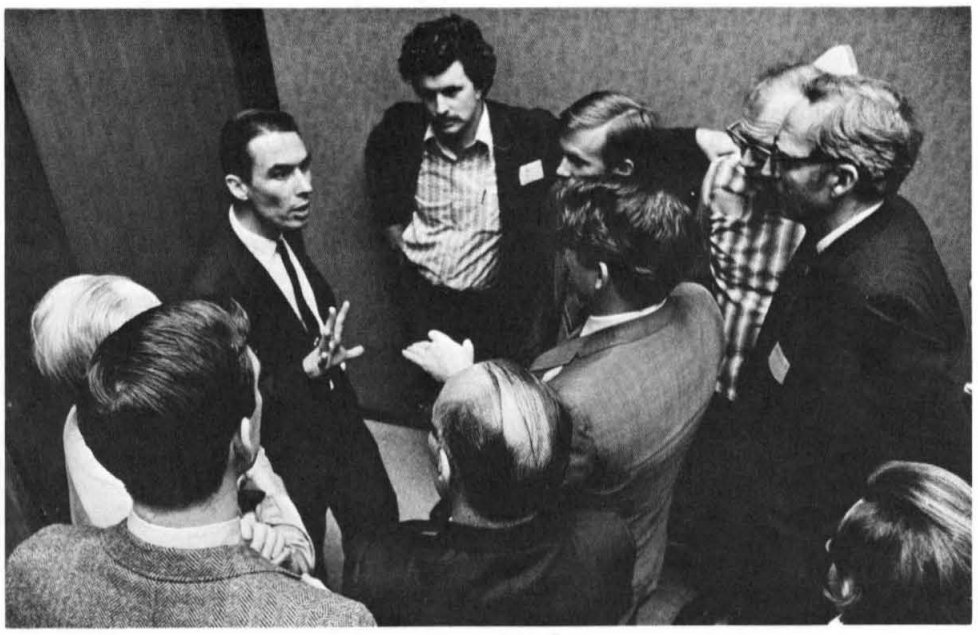
Zambia, which Munger thinks is potentially one of the richest black nations and has a very able leader, is troubled by ethnic disputes and black-white rivalries.

The second condition—the increased dialogue between black Africa and white-dominated South Africa—has gone relatively unnoticed by the outside world, but there are "great winds of change blowing in South Africa," Munger says. These changes, which may seem small and long overdue to Americans, are radical for the South Africans.

A third situation affecting Africa's political climate has been the easing of the cold war between the U.S. and the Soviets regarding sub-Saharan Africa. There is strong competition between the Chinese and the Soviets—a conflict that leaves the leaders of African nations much more freedom to choose between East and West. In fact, the Soviets would probably encourage African leaders to seek help from the West rather than give additional support to the Chinese.

These three situations show some of the over-all influences at work on African politics, though they really don't reveal the complexity of specific situations. It's true that there is still considerable turmoil—in countries like Guinea, Uganda, and Ethiopia. But there is also considerable advancement. Some nations —like the Republic of the Congo, which was the least stable of the African nations eight years ago—are now politically much stronger and are beginning to cope with their problems.

The attainment of political strength *and* stability, however, is a formidable task. More countries may have to adopt the slogan of Tanzania's government, "Uhuru na Kazi," which means freedom *and* work. This modification of the freedom cry "uhuru" of a decade ago may point the way to success for the black nations of Africa.



Carver Mead

The Future of Microelectronics

The next ten years will see a technological revolution whose effects will far exceed those of the industrial revolution of the past 200 years. That is the prediction of Carver Mead, professor of electrical engineering.

In "The Future of Microelectronics," Mead told his Seminar Day audience that in the past 200 years we have improved our ability to manufacture goods, communicate information, and move people by a factor of 100. But in the past 50 years, he said, "there has been an increase by a factor of one to ten million in the rate at which we process, store, and retrieve information. And we haven't begun to sort out what this will mean to society."

Mead bases his prediction of the coming technological revolution on the fact that the number of transistors that can be placed on a silicon chip has doubled every year since 1960, until it is now possible—using advanced techniques in photolithography—to put 10,000 transistors on a chip that would have held only one ten years ago.

This advance in microcircuitry is the result of two basic developments: the metal oxide semiconductor (MOS) transistor; and the bipolar (NPN) transistor, for which Caltech alumnus William Shockley received the Nobel Prize in 1956. Both of these transistors are produced in patterns on a silicon chip by a photographic process that reduces the size of each transistor to one ten-thousandth of an inch.

What has held up this technological revolution so far is the failure of the computer industry to keep pace with the development of transistors. Mead said that the design of computers has not changed basically since 1946, when it was first proposed. He compared the use being made of microcircuits today to that of the early days of the electric motor, when factory owners tended to use it as they had formerly used the steam engine, that is, to power systems that would run a lot of machinery. It took a long time to realize the potential of small electric motors to power each tool directly.

"We're so stuck on the idea of the big number-crunching machine for storing information that we don't yet see the real power of the new technology—ability improved by a factor of 10,000 to go and do the logic where you need the logic done. We've got computer power coming out of our ears; what we need is the kind of systems you would like to see in your automobile, in your telephone, in your typewriter, in all the kinds of applications where the human being spends vast amounts of time doing the repetitive and mundane operations involved in keeping track of a lot of little things."

The computer industry seems to be overlooking the fact that the costs of logic (electron circuitry associated with decision-making in a computer) are coming down much more rapidly than the costs of memory (devices for storage and retrieval of information). The answer to the problem of designing machines to accomplish new tasks without everyone having to become a computer programmer is to build machines with more logical and smaller memory banks. And, Mead said, the way to do this is to design integrated circuits to have the fewest possible connecting wires rather than the fewest possible transistors, which is the current practice.

Using an electron beam for generating the very small patterns required, it will probably be possible to put a million transistors on a single chip that can hold 10,000 at present. This would mean that an entire computer, consisting of a single chip, could be built for about $25.

"The next ten years are going to be a turning point for the computer industry," Mead said. "A great many contributions can be made using the rapidly evolving technology of microelectronics to do things other than just grind numbers finer and finer. We can use it for doing operations of tremendous importance to the everyday life of the society that have not yet received any attention at all."

Pollution and Society

"Everybody who visits our Environmental Quality Laboratory wants to know where the lab is," Lester Lees, professor of environmental engineering and aeronautics, told his audience on Seminar Day.

"I try to explain that the 'lab' is out there—at the Board of Supervisors, in power company executive offices, in Sacramento, Washington, San Onofre, on the freeways—everywhere."

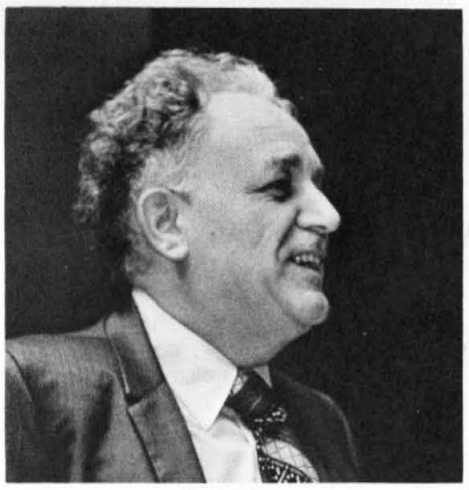
Lees, who is director of the EQL, talked about some of his staff's activities and findings as to power supply and demand in the next 40 years.

Electricity demand is growing at a rate of roughly 7 percent per person per year. Twenty years ago, total generating capacity in the state was 5,000 megawatts; today it is 24,000 MW; and 20 years from now, at the present rate of growth, it will be 115,000 MW.

It would require 14 giant power plants, each with a generating capacity four times that of Hoover dam, to meet this additional demand. This has been called "the exponential growth sydrome." Lees called it "exponential idiocy."

He suggested that the 7 percent-a-year increase in per capita electric power demand be cut by half in 10 years and by two-thirds in 20 years. Even with these substantial cutbacks in the growth of demand for electricity, we would still need 70,000 MW of power in 1990—a little less than three times what we have now.

Where do we generate all that power? Public concern about the location of new power plants is rising. Many power companies have built fossil-fuel-burning generating facilities in remote desert areas



Lester Lees

to escape the increasingly stringent emissions controls of big cities, but environmental activists have pursued them even to the heart of the desert. Utility companies favor coastal areas for nuclear power plants, but there are few remaining coastal areas remote enough for such installations—and these areas would have to have 5,000-MW plants every 40 miles by the year 2020 to meet the projected demand.

One promising solution which EQL and others have been examining is shallow-submerged floating power plants that would float 25 to 50 miles offshore, with their generators underwater.

Lees said the advantages of such power plants are their insensitivity to earthquakes—particularly important for nuclear plants; unlimited access to cooling water from the cold ocean depths; isolation from large populated areas in case of a nuclear accident; and the room for expansion to meet increased power needs.

Lees and his staff have been concerned about the immediate power crisis that is caused, in large part, by legal actions of environmental groups to block power plant construction and operation. EQL has been studying a possible way out: "open planning," where citizen groups—the whole range of them—would be involved in the planning of power plant construction from the beginning. This was the case with Northern States Power Company of Minneapolis, which worked for six months with more than 30 environmentalist groups and finally accepted their suggestion for a new plant site. For economic and operating reasons, this site was not the company's choice, but it proved best when considerations of environment, aesthetics, and recreation or land use were brought in by the citizen representatives.

"Finally," he said, "what is the opinion of the public at large? Suppose the cost of adding environmental considerations to power generation adds 25 percent to your electric bill, and this is submitted to the public in the marketplace. Perhaps the answer that comes back is that the public is willing to pay only 15 percent more. A feedback loop has to be factored into the system."

A Story of the Canyons of the Colorado River

In 1869 geologist John Wesley Powell and a crew of eight men made this country's first exploratory expedition down the Green and Colorado Rivers. Two years later, Powell started the trip again—this time with two photographers, E. O. Beaman and J. K. Hillers, to photograph and map the topography of that region. The second expedition lasted a year and a half.

Ever since the early 1900's, geologists have been going back to the Colorado plateau country to study the geologic formations of its canyon walls and riverbeds. In July 1968, Eugene M. Shoemaker, now chairman of Caltech's division of geological and planetary sciences, set out with geologist-photographer Hal Stephens, of the United States Geological Survey in Arizona, to retrace Powell's route.

Starting at Green River, Wyoming, rowed in neoprene boats to the lower end of the Grand Canyon in what is now Lake Mead in Arizona. Their purpose was to find Powell's camera stations, photograph the terrain, and then to determine how, and how fast, erosion has changed the topography of the river canyons.

In his Seminar Day lecture, Shoemaker told alumni that their success in relocating about 95 percent of the camera sites from 140 existing photographs (over 200 photographs were taken originally) has enabled him to obtain new evidence on the processes of erosion.

Comparison of the new photographs with those taken by Beaman and Hillers revealed that most of the original sites (85 to 90 percent) remain geologically the same as they were when Powell encountered them a hundred years ago.

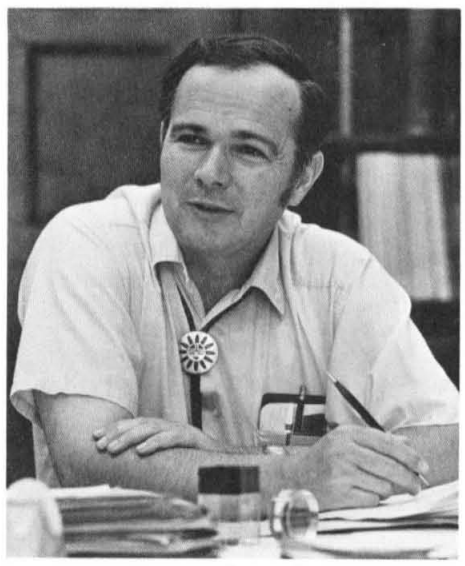
At one site—the Sockdolager Gorge in the Grand Canyon—Hillers had photographed a deposit of boulders at the mouth of a side gully. Though this deposit was inundated each spring by high, rushing water, Stevens's photo showed every rock to be in exactly the same position as in 1872. "This is the usual case," said Shoemaker. "When we went back to a site, whether on bedrock, river shore, or side canyons, almost nothing had changed at all."

He then showed slides of transitional cases, in which the topography of the canyons had undergone, at most, only minor changes. For example, at a site where Beaman had photographed a large deposit of boulders, Shoemaker and Stephens found the deposit intact, with the exception of a rock—about the size of a football—that is now missing. He noted, however, that these transitional cases are extremely rare: "Usually it's all or nothing."

At this same site, Shoemaker observed a phenomenon that he has not seen in boulder fans on any other river. (Boulder fans are accumulations of rock, brought downstream through a steep ravine, that spread out along the bank in the shape of a fan.) Upon close inspection of the rocks, composed of either sandstone or limestone, he discovered that almost all of them have been ground, as a result of vibration induced by turbulent, fast water into interlocking formations, much like pieces of a jigsaw puzzle. This self-lapping effect, exhibited by many boulder fans in the Grand Canyon, is responsible for the stability and preservation of the fan deposits along the shore at the river, even during high-water stages.

Shoemaker's last photographs showed areas in which the topography had changed dramatically: erosion of entire river banks; exchange of boulder deposits along the banks, particularly at rapids; rock falls and headward extensions of rock slides on the canyon walls; deposition of new boulder fans at the mouths of side canyons; and removal of old boulders and deposition of new ones in rapids.

In one case, a river bank had changed so completely that Shoemaker and Stephens were unable to reoccupy Powell's camera station. Along the Yampa River—a tributary that flows into the Green River in Dinosaur National Monument—the bank and boulder deposits photographed by Beaman were wiped out in 1965 by a flash flood that was witnessed by three Caltech graduate students who were camping there. Returning to Caltech, they told how, in one half-hour, the whole left bank of the Yampa was swept away and huge rocks were deposited on the opposite bank as the result of a flood that came down a side canyon.



Eugene Shoemaker

"This is the way changes take place in

Continued on page 7

What it Means to be Dammed

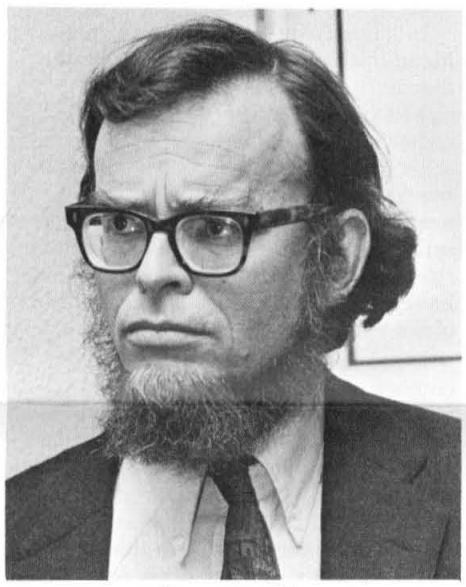
Alumni attending the seminar by Thayer Scudder, professor of anthropology, found out "What It Means To Be Dammed"—sociologically, at least. Scudder reported on his baseline study of 50,000 Tonga tribesmen prior to the building of the Kariba Dam on the Zambesi River and on 14 years of observing the effects of their subsequent relocation.

Construction of the Kariba Dam was primarily a unipurpose project—to create hydroelectric power. It was foreseen by the government of what was then Northern Rhodesia that a by-product would be improved social services and perhaps spiraling per capita income for the Tonga. What was not adequately planned for was the ecological and sociological disturbance caused by uprooting a relatively static population and changing it into a mobile society.

Until 1957, when relocation began, the Tonga were a geographically isolated people, living in villages of 100 to 500 people, dependent upon agriculture for almost all their needs, and with each family head attempting to achieve an independent homestead. Prestige was associated with the number of dependents supported by the head of each family group; society was based on kinship; and maintaining the system required the cultivation of about one acre per capita.

The first thing that vanished with the building of the dam was the isolation of the tribe. At the height of the construction the area had a labor force of over 7,000 people, plus such camp followers as traders, missionaries, and prostitutes. There were new roads on which anyone could travel in or out, and there were wages to be spent.

In the four years it took the reservoir behind the dam to fill, one village after another was inundated. While the government tried to let people participate in decisions about resettlement and to relocate them along the lake shore in order to maintain as much of their accustomed life style as possible, unoccupied fertile land was hard to find, and compromises had to be made. The water supply, once entirely dependent on the rains and the Zambesi River, became more predictable and controllable because of the storage capacity of the reservoir. But the water for some inland villages had to be pumped out of the lake or the ground, and pumps require repair and maintenance. Suddenly a primitive, subsistence society became dependent upon a technology that it did not understand.



Thayer Scudder

Another major change in the lives of many Tonga was the integration of livestock into their agricultural system, but the cattle industry was almost wiped out by bovine sleeping sickness—a disease carried by tsetse flies, which multiplied their numbers when they found a favorable habitat around the edge of the new reservoir. The government took action with a successful innoculation and spraying program, and the cattle are again multiplying. What the effect of the extensive spraying by Dieldrin and DDT will be in terms of ecological balance is still to be determined.

With government help and encouragement, fishing has become a commercial enterprise, and by local standards the fishermen are prosperous. Many have used their surplus income to set up stores, and their houses are better than those of their neighbors. Thus, in what has been an egalitarian society, a small group of entrepreneurs is emerging.

In spite of all the changes, some aspects of village life remain unchanged at this point. There is still a kind of togetherness in the family structure, and religion is still based on propitiating one's ancestors. Scudder plans a long-term observation of what he is sure will be continuing change for the Tonga—and for other tribal groups that must be relocated as more and more African rivers are dammed.

A Day in the Life of Los Angeles

A severe episode of smog in the Los Angeles Basin could result from two or three windless days and an unusually low inversion layer of air over the city, John H. Seinfeld, associate professor of chemical engineering, told Caltech alumni on May 15.

"If we had a condition in which the wind didn't drain the pollutants toward the desert for two or three days, coupled with a low inversion layer at, say, 300 to 400 feet, compressing the pollutants into a smaller volume of air, we could get quite high concentrations of smog—certainly over first-stage alert levels."

Seinfeld has been constructing a computer simulation of air pollution in the Los Angeles Basin. His research is designated to determine where and when pollutants are concentrated and to measure the products of the photochemical process which transforms some of the airborne substances into ozone and eye-irritating compounds.

Seinfeld and his graduate students also want to be able to make predictions about the effect that control levels will have upon smog levels. "After measures are enacted, we don't want to wait four or five years until they are fully in effect to assess air quality because, if we do, we may get some surprises." Seinfeld cited, as an example, the unexpected result of hydrocarbon control measures that were instituted in 1966, which resulted in higher emissions of oxides of nitrogen, thereby negating any beneficial result of the hydrocarbon reduction.

The 1966 surprise hit very close to home. When the new automobiles put a little different mixture of primary smog ingredients into the air—less hydrocarbons and more oxides of nitrogen—it changed the rate of chemical reactions in the air. "We ended up with everything collecting over Pasadena."

"Everything" includes the end products of the photochemical smog process: ozone, aldehydes, ketones, aerosols, and others. Before 1966, the air between Pasadena and the coast had a greater share of these smog components, since the coastal winds slowly moved the accumulating photochemical process across the basin. The average wind remained constant, but the reactions slowed down a bit.

"It may be six or seven years before we see any appreciable improvement in Los Angeles smog, and by 1981 or 1982, the present rate of increase in the population of cars should cancel any reductions made from the emission controls through 1974."

John Seinfeld

Seinfeld criticized the current system of smog alerts, which, he says, are simply "toothless" recommendations to curtail activity. "What are the levels at which you call an alert? Ideally they should have a medical basis, but one of the problems is that we really don't know the medical effects related to the specific levels, which are found in the Los Angeles atmosphere."

Experience with "killer smogs" of the past—for example, the famous ones of London and Donora, Pa.—"leads us to believe that people who are most injured by a severe smog spell are those with lung disorders; a healthy person should be able to withstand a three- or four-day episode."

Guggenheim fellows named

Three Caltech faculty members and four alumni have won John Simon Guggenheim Memorial fellowships for 1971. The fellowships are awarded for demonstrated accomplishment in the past and strong promise of achievement for the future.

Steven Frautschi, professor of theoretical physics, will be on leave from the Institute for one year beginning in September to do theoretical studies in high energy particle physics at CERN, a Swiss research center for the study of nuclear and particle physics.

Murray Gell-Mann, Robert Andrews Millikan Professor of Theoretical Physics, will also go to CERN during the same period for theoretical research in elementary particle physics. Gell-Mann was the winner of the Nobel Prize in physics in 1969.

G. Wilse Robinson, professor of physical chemistry, left Caltech last month to spend five weeks in England making studies in photobiology. After a summer back in Pasadena, he will spend three to five months in New Zealand.

Caltech alumni who received Guggenheim fellowships this year include Robert L. Kovach, PhD '62, professor of geophysics at Stanford University, who will study man's intervention in geologic processes; David E. Metzler, BS '48, professor of biochemistry at Iowa State University, who will research the chemical reactions of living cells; Steven E. Schwarz, BS '59, MS '61, and PhD '64, associate professor of electrical engineering and computer sciences at UC Berkeley, who will do research in quantum electronics; and Norman J. Zabusky, PhD '59, head of the plasma and computation physics research department at Bell Telephone Laboratories, Inc.

Four distinguished alumni

Continued from page 1

council of the Society for Industrial and Applied Mathematics.

W. MORTON JACOBS, BS '28, president and chief executive officer and director of the Southern California Gas Company.

Mort Jacobs graduated from Caltech with honors in mechanical engineering in 1928. Active in Institute affairs ever since, he is a former president of the Caltech Alumni Association (1947), and is now president of The Institute Associates and a member of the President's Council. Jacobs joined the Southern California Gas Company in 1930, and he served as president of the Pacific Coast Gas Association in 1952 and as president of the American Gas Association in 1969. He is currently president of the Central City Association of Los Angeles and senior vice president of the Los Angeles Area Chamber of Commerce.

JOSEPH E. MAYER, BS '24, professor of chemistry at the University of California at San Diego.

After receiving his BS in chemistry from Caltech in 1924, Joseph Mayer went to the University of California at Berkeley where he received his doctorate in 1927. He taught chemistry at Johns Hopkins University from 1930 to 1939, and at Columbia University from 1939 to 1945. He then joined the staff of the University of Chicago's Institute of Nuclear Studies, becoming Carl Eisendraht Professor in 1955. Since 1960 Mayer has been professor of chemistry at UCSD and, from 1963 to 1966, was chairman of the department there. His principal work has been in statistical mechanics and its application to dense gases and to liquids.

Mayer is a member of the National Academy of Sciences, the American Philosophical Society, and the American Academy of Arts and Sciences.

REV. DONALD PAUL MERRIFIELD, S.J., BS '50, president of Loyola University of Los Angeles.

Father Merrifield graduated in physics from Caltech in 1950, then completed studies at the University of Notre Dame and St. Louis University for master's degrees in both physics and philosophy. After receiving his PhD in physics from MIT in 1962, Merrifield did advanced work in theology at the University of Santa Clara, for which he received an STM degree in 1966.

Father Merrifield was ordained a priest at Blessed Sacrament Church in Hollywood on June 9, 1965. He has taught physics at Loyola University, the University of Santa Clara, and the University of San Francisco, and has served as a consultant to Caltech's Jet Propulsion Laboratory. His research includes studies of the theoretical physics of molecular structure, intermolecular forces, and the interaction of molecules with surfaces.

Colorado canyons

Continued from page 6

this country," Shoemaker said. "You either see rocks that were there 100, 200, or even 500 years ago, or else you see a completely new deposit. And these changes transpire within an hour or less."

Shoemaker concludes that most of the geological changes in the Green and Colorado river region have not taken place through grain-by-grain erosion of the countryside, but rather, by small and large catastrophes. "In fact," he said, "as we go back and look at the processes elswhere on earth, not just in this canyon region, it's fairly clear that this is the way in which most of the sculpturing of the face of the earth occurs. It is true that some material and fine sediment are moved each year in the normal annual runoff, but the majority of changes are the result of the rare occurrences—about every 500 to 1,000 years, at any given place—of catastrophes. It is by such catastrophes that the Grand Canyon itself has been carved."

Harvesting with hormones

Continued from page 3

it away to orange juice concentrate plants. Since Florida's economy swims happily in orange juice to a large extent, Bonner feels good about having had a part in harvesting the crops successfully in the absence of human hands.

He also traced his efforts in the field of rubber production. During World War II he worked in the emergency rubber program trying to learn how to grow rubber-producing trees on this continent. Although he admitted that the results were only enough "to recap a few bicycle tires," the important lesson Bonner learned was that nobody knew the successive chemical steps by which rubber-producing plants make the rubber molecule. In the 1950's he found out how it is done.

Ten years ago he started working with the Malaysian government in exploring means of stepping up rubber production biochemically. By 1968 he had been instrumental in establishing a method of dissolving ethrel in palm oil and painting the rubber tree trunks below the tapping cuts. The principle was basically the same as in the citrus experiments—to get the trees to produce ethylene. In this case, the ethrel goes into the bark, decomposes, and produces ethylene. The ethylene, Bonner found, causes the latex in the trunk to flow longer and from a larger area and results in as much as three times the normal yield of rubber. Tests showed that the method had no adverse effect on the tree.

Bonner said this process will help Malaysia double its gross national product within five years, since rubber is the principal agent of its social, economic, agricultural, and industrial development. Already, Malaysia is changing from a peasant culture to a technological society.

Bonner's two conclusions concerning his "useful" work were: (1) It isn't hard for biologists to do little bits of societal good if the problems presented are simple enough; and (2) It is much easier to do good in underdeveloped countries.

Brigadier General Daniel James, on campus for a two-day visit sponsored by the Caltech Y's Leaders of America program, adds some body English to his faculty interview.

General James visits Caltech

As a part of the Caltech Y's "Leaders of America" program, Brigadier General Daniel "Chappie" James visited the campus on May 17 and 18, and took part in seminars and an Olive Walk Talk.

James, the first black general in the Air Force, is Deputy Assistant Secretary of Defense for Public Affairs. One of his functions has been to inform Americans about the prisoner-of-war situation in Vietnam, and he has acquired a reputation among students for being candid in his discussion about United States military involvements. James's visit was the suggestion of senior student Mike Turner who had met him at a White House Conference in Washington, D.C.

Monday evening, May 17, James spoke to a gathering of students and faculty in the lecture hall in the new Baxter Hall of the Humanities and Social Sciences. He discussed his experiences in the military, with particular emphasis on the conditions for minority groups. As vice commander of the Bentwaters, England, air station in 1961, James was involved in an effort to stamp out prejudicial practices in officers' and enlisted men's clubs. After the Baxter speech, James talked informally with students in Fleming House about the feelings of the professional soldier, and the communications breakdown between the military and the rest of society.

The next day, James was interviewed on American tactics and political involvement in Vietnam by Morgan Kousser, instructor in history; Daniel McMahon, assistant professor of biology; and Rochus Vogt, professor of physics. Even though Vogt opened with the statement that he hoped the interview would be a discussion rather than a confrontation, the hour-long exchange became heated and ended in considerable acrimony. A proposed afternoon seminar with James had been cancelled prior to the panel discussion, so students were unable to resolve the questions raised by their professors at noon.

Daniel James was born in Pensacola, Florida, in 1920 and received his bachelors' degree from Tuskegee Institute. The recipient of many civilian and military awards, James was promoted to Brigadier General and sworn in as Deputy Assistant Secretary of Defense in March 1970.

Chapter notes

Detroit

Mahlon Easterling was the featured speaker at the annual meeting of the Detroit chapter on May 25. Easterling, who is a visiting professor of applied science at Caltech and a member of the space communications and information engineering staff at JPL, told the 30 alumni in attendance how the visiting professor program operates within the division of engineering and applied science. He then explained the activities and goals of Caltech's Environmental Quality Laboratory. Easterling, who considers himself a generalist in the field of "social engineering," works interdependently with the other 12 members of the EQL staff on problems of the environment.

James B. Black, executive director of the Alumni Association, also brought alumni up to date on the recent activities of students, faculty, and alumni at the Institute.

Chicago

Two guest speakers and the election of new officers drew 40 Chicago area alumni to their annual chapter meeting on May 26.

Alumni Association president William A. Freed, '50, outlined future plans of the Association and some of its current goals, which include improved communications between the Institute and alumni, and the establishment of a well-informed core of advocates to speak to people outside the Institute in its behalf. He also spoke of Caltech's need for continuing financial support from alumni.

Easterling, who was making his second appearance before a Caltech alumni group in two days, again described the visiting professor program of the engineering division and the work of the new Environmental Quality Laboratory.

As a result of the chapter elections, Walfred E. Swanson, '36, former vice president, succeeds Robert J. Kieckhefer, '45, as president; Howard E. Jessen, '46, former secretary-treasurer, is the new vice president.

PERSONALS

1926
WILLIAM A. LEWIS, MS '27, PhD '29, formerly a member of the electrical engineering faculty at the Illinois Institute of Technology, has become an independent consultant in electrical engineering. He is associated with Systems Control, Inc., in Palo Alto.

1928
RICHARD G. FOLSOM, MS '29, PhD '32, president of Rensselaer Polytechnic Institute, has won the U.S. Navy's highest civilian honor—the Distinguished Public Service Award—in recognition of his service to the Navy during the past 12 years. Folsom, who retires from RPI this July, has been chairman of the Navy's curriculum review board on educational requirements, and a member of the academic advisory board to the superintendent of the U.S. Naval Academy. He has also done research on the upper atmosphere, food preservation by atomic energy, landing of supersonic aircraft, machining of tough metals, high temperature metallurgy, and industrial air pollution.

1932
ROBERT B. FREEMAN, MS '33, PhD '36, a principal engineer with the Bechtel Corporation, is now located in Metz, France.

1934
G. SIDNEY SMITH, who was plant manager for Cabot Piping Systems in Santa Ana, Calif., is now working in the Carlon Products division of the Continental Oil Co. in Tustin, Calif.

1936
WILLIAM E. CAMPBELL has retired as director of Reliability and Quality Control section of Aerojet-General Corporation in Azusa.

1937
DONALD P. GRAUL, MS, formerly a special assistant to the vice president of technology for Communications Satellite Corporation, has retired as a major general in the U.S. Air Force.

VSEVOLOD TULAGIN, research manager with the Xerox Corporation, received the Kosar Memorial Award from the Society of Photographic Scientists and Engineers for his contributions to photographic knowledge through his work on the generation of color images by polychrome photoelectrophoresis.

1939
A. MARTIN EICHELBERGER, MS, formerly a division manager for Dividends, Inc., is now manager for Sea Pool Fisheries, Ltd., at Lake Charlotte, Nova Scotia.

1943
ARTHUR J. SCHNEIDER, MS '43, PhD '49, moved to Cambridge, Mass., from California last month to work for the U.S. Department of Transportation in the division of mechanical engineering for the Transportation Systems Center.

1945
BURTON G. MENDELSON has been named executive vice president and member of the board of directors for Western Union Computer Utilities, Inc., a Florida-based firm. Mendelson joined Western Union in 1966 and was most recently vice president of corporate development for the company's New York City branch.

1946
CALVIN E. KEMPTON, an electronics engineer, has left his job with Hydro-Aire and is now employed by Olson-Horiba in Santa Ana.

OLAV NJUS, MS, colonel in the U.S. Air Force, has become a manager for Litton Data Systems in Van Nuys.

PAUL C. RICKS Jr., former assistant chief of electric and electromechanical systems for the Garrett Corporation/AiResearch Manufacturing, of Los Angeles, is now engineering manager for the Rohr Corporation's rail transportation division.

WILLIAM M. LIPSCOMB, PhD, professor of chemistry at Harvard University, has won the George Ledlie Prize for his X-ray diffraction analysis of the structure of biomedically important complex molecules. A member of Harvard's faculty since 1959, Lipscomb is cited for contributions to the understanding of the mechanism of action of enzymes.


Mendelson, '45


Hall, '47

1947
ELMER E. HALL JR., MS, promoted to the new position of chief siting engineer for Pacific Gas and Electric Company in San Francisco, will take on responsibilities for future siting of the company's major power facilities, licensing, and new bulk power contracts. Hall, who was previously assistant to the executive vice president, joined PG&E in 1947.

1952
RICHARD R. DICKINSON, formerly general manager of supply and distribution for Texaco Ltd., London, has been transferred to New York as staff coordinator for the strategic planning group in the executive offices of Texaco Inc. The Dickinsons are again living in Darien, Conn.

MOISES LEVY, MS '55, who has been assistant professor of physics at UCLA, is now an associate professor at the University of Wisconsin, Milwaukee.

MARTIN L. SANDELL has been named senior engineering associate at Aerojet Electrosystems Co. in Azusa. He was formerly assistant manager of the reliability section in Aerojet's space science department.

1955
MERVYN L. BARMAN, formerly a student at California State College at Long Beach, is now a systems analyst for Coras Iompair Eirann in Dublin, Ireland.

1957
DANIEL E. HARRIS, MS, PhD '61, is a lecturer and research associate at Harvard College Observatory in Cambridge, Mass. He has returned to the United States following work at the Arecibo Ionospheric Observatory in Puerto Rico, and most recently at the Institucion Argentino de Radioastronomia in Buenos Aires, Argentina.

RICHARD E. SKINNER, MS, former vice president of Parzen Research, Inc., a subsidiary of Ovitron Corp., N.Y., is now a sales consultant for Mayfair Realty Inc. in Portland, Ore.

1958
RICHARD W. THURSTON, AE, has been named assistant dean of the College of Physical and Engineering Sciences at Brigham Young University in Provo, Utah. He was previously a commander in the U.S. Navy.

1960
GARNETT H. PESSELL, MS '60, writes that he has left his job as geophysicist with Atlantic-Richfield Co. in Anchorage, Alaska, to join the State of Alaska's Department of Natural Resources as a petroleum geologist.

1961
DELMAR E. CURTIS, formerly a senior research engineer in the Winston Division of United Control company in Granada Hills, Calif., has moved to Sunnyvale where he is now manager of data and address systems for the International Video Corporation.

PETER LIPPMAN writes: "After nine years with Cary Instruments in Monrovia, I was invited to stop drawing salary there (at the end of September) and am now trying to establish myself as a free-lance 'technical documentation specialist (writing, editing) and patent agent.' " He lives in Monrovia with his wife, Ethel.

GARY G. TIBBETTS, who graduated from Caltech in physics, has left the University of Illinois where he was a research assistant, to join General Motors as an associate senior research scientist. He is living in Warren, Mich.

1962
JOHN A. NEWMYER, formerly a teaching fellow at Harvard University, is now teaching psychology at San Francisco State College.

1963
JAMES T. GEDDIS writes that he was recently transferred to Okinawa for Esso Standard Ltd. He had been assistant manager for petroleum economics for Esso's plant in Kuala Lumpur, Malaysia.

RICHARD E. PETERSON writes: "After graduating from Caltech, I got my MS in geophysical sciences from the University of Chicago, and after a stint with the aeronutronic division of Philco-Ford Corp. in Newport Beach as a planetary meteorologist (and my marriage to Becky Tobin in Kansas City), I returned to graduate school. In June I will receive my PhD in atmospheric science from the University of Missouri. Immediately thereafter I will take my wife and son to Norway where I will study for a year under a NATO postdoctoral fellowship at the University of Oslo.

1964
RALPH H. YOUNG has joined Eastman Kodak as a research chemist in the company's physical chemistry laboratory located in Rochester, N.Y. Prior to taking this new position, Young was an assistant professor of chemistry at Jackson State College in Jackson, Miss.

Obituaries

1933
CHUEN CHANG HSU, MS, on April 13, of a heart attack. He had worked in the installation and service engineering department for the General Electric Co. before retiring in 1968. In 1958, Hsu went to work for the steel mills in India by International General Electric. He leaves his wife, Peggy, of Orinda, two sons, and three grandchildren.

1939
FRANK B. STEPHENS, MS. He had been a member of the metallurgy faculty at Pennsylvania State University.

1940
BOYD M. MEWBORN, PhD, on April 24 in Monterey, Calif. He had been affiliated with the mathematics department of the Naval Postgraduate School in Monterey for 20 years before retiring as Distinguished Professor Emeritus in 1966. The school's chapter of Sigma Xi has established an award bearing his name, to be given to the student who shows the greatest research potential. Mewborn had also been secretary-treasurer of the Postgraduate School faculty and served as a commander in the Naval Reserve. He leaves his widow, Hazel.

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