



Among those attending The Associates' dinner: left to right—William H. Corcoran, vice president for Institute relations and professor of chemical engineering; Mrs. Joseph Messler, chairman of The Associates' Program Committee; H. Warner Griggs, The Associates' president; Dr. Joseph Messler and Dr. Henry Lee, members of The Associates' Board of Directors.

at Associates' dinner

Peterson urges rich nations to help close technology gap

In spite of efforts to improve the lot of developing countries, science and technology may have helped to widen the gap between the rich and the poor nations of the earth, some 350 members of The Associates were told at a black-tie dinner on May 12.

H. Warner Griggs, president of The Associates, presided at the dinner in the Beverly Wilshire Hotel.

Rudolph A. Peterson, administrator of the UN Development Programme and a member of the Caltech Board of Trustees, said that science and technological resources are concentrated so heavily within rich countries that the rich nations almost automatically are able to move ahead faster than the poor ones.

There are no easy remedies for this situation, Peterson emphasized. "The transfer of technology—like management skills—can no longer usefully and equitably touch only one select level in a developing country. It must filter down and radiate out. The poor countries cry out in an increasingly impatient voice, saying, 'Slow down your part of the world or speed up the sharing of your skills.'"

He said that developing nations in the southern part of the world see nations in the north as part of a voracious scientific juggernaut, grinding ahead, consuming ever more of total earth resources, and continually reinvesting its technological lead within its own area.

Peterson outlined the objectives of the UNDP, which he described as the world's largest technical assistance effort.

A distinguished member of the international banking and financial community, Peterson was named president of the Bank of America in 1963 and in 1968, president of the BankAmerica Corporation. He remained as chairman of the Executive Committee for both organizations after his retirement in 1970. Since February of this year he has been an honorary director.

In his remarks to The Associates, President Harold Brown said, "Your support has been a major factor in maintaining the vitality and strength of Caltech. Thus you have contributed to Caltech's capacity to train scholars, teachers, and executives who have changed the world. Few,

if any, schools—including those that are much larger—can match Caltech's record of discovery and innovation."

Stressing the importance of private philanthropy, Brown said, "We must not forget its importance, for this system is facing a serious challenge by several tax proposals in Congress. These proposals would change current tax laws and reduce the incentives for philanthropic giving.

"We are particularly concerned with the integrity of the principle of full deductibility of charitable gifts. It is important that we—and you—work to ensure that Congress will reaffirm its support of this principle when it considers tax changes later this year."

1,520 alumni and guests at Caltech on Seminar Day

A crowd of 1,520 alumni, their husbands, wives, and children—the second largest number ever to attend—visited the Caltech campus for the 38th annual Alumni Seminar Day on May 17. The weather cooperated by providing a balmy, sunny day.

Guests chose from talks by 12 faculty members, ate picnic-style box-lunches to the accompaniment of the Caltech Dixieland Band—composed primarily of faculty members—browsed through a crafts bazaar arranged by the Caltech Y, visited exhibits in the new Seeley G. Mudd Building of Geophysics and Planetary Science, attended a social hour and dinner in the Athenaeum, and listened to a concert by the Caltech Women's Glee Club, the Apollo Singers, the Chamber Singers, and a men's quartet.

A special feature of this year's Seminar Day was a session for the sons and daughters of alumni, at which Stirling L. Huntley, director of admissions, provided information about Caltech.

The consensus: This was one of the most stimulating Seminar Days on record. See pages 2, 3, and 4 for coverage.

Six Caltech affiliates and alumni elected to NAE

A member of the Board of Trustees, two Caltech faculty members, and three alumni have been elected to the National Academy of Engineering.

A member of the Board, Stephen D. Bechtel, Jr., chairman of the Bechtel Group of Companies, has been elected for his leadership of engineers in the design and construction of energy-related facilities.

The faculty members elected are Sheldon K. Friedlander, professor of chemical and environmental health engineering, and Eli Sternberg, professor of mechanics. Friedlander was elected for his contribution to the understanding of the origin and control of pollution by particulate matter; Sternberg, for his contribution to the fundamental theory of stress analysis and the successful solution of difficult stress problems.

Alumni elected to the academy include: Leo R. Beard, BS '39, technical director for research and water, the University of Texas, Austin, for his leadership in the field of statistical

applications and systems analyses in hydrologic design and operation; Dean R. Chapman, BS '44, MS '44, PhD '48, director of astronautics at NASA's Ames Research Center, for his work with supersonic aerodynamics and the recovery of vehicles from space; and Wallace D. Hayes, BS '41, AE '43, PhD '47, professor of aerospace sciences in the department of aeronautical engineering, Princeton University, for his contributions to the basic understanding of transonic and supersonic flow.

There are now 21 Caltech trustees, faculty, administrators, or JPL staff persons who are members of the NAE, and 53 alumni who have been elected.

Election to the National Academy of Engineering is considered to be the highest professional distinction that can be conferred upon an American engineer. This year, 86 new members were elected, bringing the total membership of the Academy to 587.

Standard Oil pledges \$500,000 to Caltech

Standard Oil Company of California has pledged \$500,000 to Caltech's development campaign, Caltech at the leading edge . . . The pledge is made up of five components. One part is a grant that will enable a visiting professor to conduct research in energy-related areas, reflecting Caltech's and Standard Oil's common interests in energy problems.

Another part of the pledge ensures Standard Oil's continuing membership in the Industrial Associates program. Standard Oil was the first founding member of the program in 1949. The Industrial Associates program emphasizes research interactions between members of the Caltech faculty and scientists and engineers in industry.

The pledge also provides for unrestricted aid to Caltech, together with pledges for student aid in the form of undergraduate scholarships in chemical engineering and geophysics and a graduate fellowship in chemical engineering.

In announcing the pledge, H. J. Haynes, chairman of the board of Standard Oil of California and a member of the Caltech Board of Trustees, said, "We readily accept industry's dependence on higher education, and feel that we have a responsibility to support private institutions such as Caltech."

In acknowledging the grant, Caltech President Harold Brown commented, "This pledge comes at a most opportune time. We plan to continue Caltech's programs of education and research, with excellence as our primary objective. Excellence is expensive, but it is worth the price. Generosity—as demonstrated by this gift from Standard—will help us sustain our reputation at the leading edge of discovery."

More than \$54 million has already been given or pledged to Caltech toward the development campaign, which is now in its second year. The Institute is seeking to raise \$130 million over a five-year period.



Recipients of the Distinguished Alumni Award were Matthew S. Meselson and Gordon E. Moore. See story on page 2.



During Seminar Day, Thomas J. Ahrens, associate professor of geophysics, describes purpose of the light-gas gun, designed to produce information about the way minerals behave under tremendous pressures and temperatures. Gun is located in the Helen and Roland W. Lindhurst Laboratory of Experimental Geophysics, one of several features of the new Seeley G. Mudd Building of Geophysics and Planetary Science that were on display to alumni.

Caltech confers its top honor on two graduates

"Alumni Seminar Day is exciting because Caltech is an exciting place—exciting because of the work of its faculty and students and the discoveries that are being made in its laboratories," President Harold Brown said as he welcomed alumni to the Seminar Day general session.

"In time, these discoveries may change the world," he said, "just as previous discoveries at Caltech have already done."

Raymond E. Brow, BS '50, MD, general chairman of Alumni Seminar Day, introduced R. Stanton Avery, chairman of the Caltech Board of Trustees; Arnold O. Beckman, chairman emeritus of the Board; and Mrs. Beckman. He expressed appreciation for their contributions to the Institute.

Brown presented two Distinguished Alumni Awards—the highest honor that Caltech can confer on its graduates—to Matthew S. Meselson, PhD '57, professor of biochemistry and molecular biology at Harvard University; and Gordon E. Moore, PhD '54, president of the Intel Corporation, Santa Clara. The award consists of a silver medallion and a certificate.

Meselson has distinguished himself both in scientific research and public policy. He has won an international reputation for demonstrating how DNA duplicates itself in dividing cells, and he achieved dis-

tinction by inventing an important method for analyzing the densities of giant molecules.

Through his research, he demonstrated that genetic recombination results from splicing DNA molecules. This is the process by which genes from each parent contribute to the genetic makeup of their offspring. His work has also contributed to our understanding of the process by which cells recognize and destroy DNA from foreign species.

In the field of public service, Meselson played a major role in the negotiations that led to the administration's decision to renounce the use of biological warfare, and to U.S. agreement to a 50-year treaty banning chemical warfare.

Moore is one of the most honored and respected people in modern electronics technology. He was a founder of the Fairchild Semiconductor Corporation, which became the Semiconductor Division of the Fairchild Camera and Instrument Corporation—the leading innovator in its field during the 1960's.

Under his leadership, as director of research and development for the company, much of the work took place on which the modern semiconductor industry is based.

Later, Moore was a co-founder of the Intel Corporation. With this firm, he has played a leading role in introducing many new semiconductor products.

Ray Owen appointed vice president for student affairs

Ray D. Owen, professor of biology, has been appointed by President Harold Brown as vice president for student affairs and dean of students, effective September 1.

In announcing the appointment, President Harold Brown said, "The vice presidency for student affairs is a new position created to coordinate the many and diverse student-related activities at Caltech, ranging from admissions to student health. Ray Owen will perform an outstanding service to the Institute in his new position. He has great rapport with people, the confidence of the faculty, and great sympathy for the problems of young people in general and Caltech students in particular."

Distinguished for his work in immunogenetics, serology, and vertebrate and developmental genetics, Owen has been at Caltech for 28 years. He is a member of the three-man President's Cancer Panel that advises President Ford, and has

served as a consultant to the federal government and the State of California in various capacities. Owen was the chairman of the Caltech Division of Biology for seven years.

As dean of students, Owen succeeds James J. Morgan, professor and executive officer for environmental engineering science, who had asked to be relieved of the position of dean because of additional academic responsibilities when he became executive officer.

Owen has been active for many years in matters concerning students. He was chairman of an ad hoc committee on freshmen that was responsible for decisions to admit women undergraduates, to institute pass-fail grading for freshmen, and to open elective courses to freshmen.

Owen has pioneered in research in immunogenetics, especially in relation to blood groups and tissue transplantation.

Rhoads praises Caltech as a resource in cancer research

Caltech is one of the most important sources of cancer research talent in the country, Jonathan E. Rhoads, MD, speaker at the Seminar Day general session, told alumni in a talk entitled "Askers, Seekers, Knockers, and the National Cancer Program."

The National Cancer Program, which administers \$600 million annually for cancer research and treatment, probably provides the best method available for assuring that important areas of research are not neglected, Rhoads said. Chairman of the National Cancer Advisory Board and nationally known for his work in cancer, Rhoads said the program is constantly being reevaluated and updated. He summarized research developments since its origin.

In referring to criticisms of the program, Rhoads mentioned curtailment of funds for postdoctoral training grants and lack of funds for applied research as being the most serious. In reviewing accomplishments in cancer control and treatment, he stressed:

a decline in cancer of the stomach; long-term remissions in acute lymphatic leukemia resulting from chemotherapy; success in the treatment of Hodgkin's disease, cancer of the kidney, certain tumors, and bone cancer through chemotherapy; refinements in the treatment of breast cancer, and better control and treatment methods for skin cancer.

He said that new diagnostic methods are making earlier detection possible, and, consequently, have improved the chances of cures for many kinds of cancer. An environmental factor has been found in many cancers, he added.

Rhoads is director of the Department of Surgery at the hospital of the University of Pennsylvania, Philadelphia. He has received the American Cancer Society's National Award and its Award for Distinguished Service in Cancer Control, and he is editor of *Cancer*, the journal of the American Cancer Society.



Members of the Women's Glee Club perform for alumni.

Women's Glee Club pleases the audience at its spring concert

A refreshing and spirited program of music ranging from early Italian works to up-to-the-minute show tunes, pleased the audience at the first spring concert of the Women's Glee Club on the evening of Seminar Day.

Showing a marked increase in vocal maturity and polish, the 18-member Women's Glee Club combined its talents with those of a mixed chorus of Chamber Singers, the all-male Apollo Singers, and a men's quartet in a warm and diversified presentation.

Mrs. Monica Roegler, assistant director of choral music at Caltech, directs both the Women's Glee Club and the Chamber Singers. Kathleen Kong, a Caltech sophomore who is majoring in mathematics, accompanied the singers. Miss Kong was featured as a solo pianist with the Long

Beach Symphony Orchestra in April.

The ensembles joined to sing selections ranging from "Bye Bye Birdie" and Paul Tchesnokov's "Salvation" to the Caltech alma mater. Following tradition, former members of the Caltech Men's and Women's Glee Clubs who were in the audience were invited to come on stage to join in the closing songs. Friends and alumni of the glee clubs were invited to a reception immediately after the concert.

The Women's Glee Club includes 15 women graduate and undergraduate students and three members of the Caltech staff. Mrs. Roegler praised the members for their enthusiasm and hard work, and applauded their musical growth and development. She expressed the hope that the organization will grow in size as it becomes better known.



Two members of the Caltech Dixieland Band who provided musical entertainment at lunchtime: James P. Quirk, professor of economics, and John A. Ferejohn, associate professor of political science.

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Cells to satellites

Faculty members describe research



Felix Strumwasser describes his research concerning biological clocks and their role in regulating the habits of organisms.

24-hour internal clocks

Virtually all forms of life possessing eucaryotic cells have biological clocks that link them with the 24-hour, light-dark cycle of the earth, Felix Strumwasser, professor of biology, told alumni. These clocks create an internal day within the organism and they play a vital role in the habits of feeding, reproduction, sleeping, and wakefulness.

"The internal 24-hour clocks can be reset by changing the external light-dark cycle, by application of potassium, or by the addition of some hormonal or pharmacological substances," Strumwasser said. "Biologists don't yet know the answer to the \$64 question: the biochemical mechanisms of the clocks. But we are learning where they are located in nervous systems and how to manipulate or reset them."

Strumwasser said it was thought for a long time that such circadian (24-hour) nerve cells were controlled by photodetectors (light detectors) located in the eye. But this is often not the case. And experiments suggest that many creatures have a variety of biological clocks distributed in different parts of the nervous system. In mammals the major clock is in the hypothalamus and is controlled by photodetection in the eye. In birds the major clock is the pineal gland and in addition there are photodetectors in the brain which are sensitive to light actually passing through the skull.

"My research with circadian rhythms has been conducted on the sea hare, a mollusc called *Aplysia*. It is a good research organism because some of its identifiable neurons are conveniently large, allowing for extended physiological and biochemical studies, and it has a distributed (ganglionic) nervous system," Strumwasser said. "*Aplysia* has a circadian oscillator built into the eye. The oscillator sends impulses to the brain via the optic nerve at the time of expected (versus actual) changes in its environment from dark to light. At the expected time for night, the oscillator will decrease impulses."

"The cells of the eye can be removed surgically—in fact, 90 percent of the cells of the eye can be removed—and the circadian oscillator still will function. We can reset the cycle to any phase we desire by adding potassium for a few hours to the solution in which the eye is kept."

"In other experiments we kept in the same dish with a living eye from another animal a ganglion that had been located in the abdomen and that had neurons with circadian rhythms of their own. A particular neuron in the ganglion increased its activity at regular circadian intervals. Its daily firing was reset to coincide with a particular phase of the eye rhythm, indicating that some hormonal substance was being released." □

Hypothesis: an ancient fault

An ancient fault zone, longer than the San Andreas, may have existed 150 to 200 million years ago near and parallel to the present Pacific Coast of the United States and Mexico, Leon T. Silver, professor of geology, told alumni.

Unlike the San Andreas, the western side of this gigantic fault, which Silver and his colleagues have called the Mojave-Sonora Megashear, would have moved south. Silver explained that studies of ancient granites, sequences of strata, and fossils indicate that land in northwestern Sonora, Mexico, once may have been near Owens Lake, California—now 500 miles to the north.

Analyses of the most ancient parts of the crust of southwestern North America that can be studied have been used to create a speculative hypothesis about the origin of this fault, Silver said. This hypothesis connects the movement of the fault with the formation of the Atlantic Ocean—an event that took place when North America broke away from a super continent that contained most of our present continental land masses.

"The existence of such a fault would also help to explain the present form of the Gulf of Mexico," Silver said.

He added that efforts to test the validity of the hypothesis are continuing, partly because it can yield insight in the search for mineral deposits in the mineral-rich regions of New Mexico, Arizona, and California. □

Airline regulation

Do we need economic regulation of airlines? No, says Michael E. Levine, Luce Professor of Law and Social Change in the Technological Society.

"Most people believe economic regulation was established to protect the consumer," Levine said, "but it was not. Our present regulatory scheme costs the consumer between one and one and a half billion dollars a year. It increases fares, and forces customers to buy fancier service than they would buy if given a choice. Why not go back to free competition?"

Levine pointed out to alumni that present regulations require a company to obtain a license to go into business and often require that new fares proposed by one airline don't hurt any others.

"As a result," he said, "no one has been licensed to operate a major airline since 1938. The industry is 300 times as large today as it was in 1938, but has about the same number of firms as it did then. As the industry grows, the CAB keeps out new entrants. The existing firms divide up the business. Someone who believes that flights could be offered at lower fares isn't given a chance to offer them."

Levine also disputed a number of the airlines' arguments for the existing system, including their claim that without regulation, only large cities would be served.

He stressed that he is not advocating the elimination of safety regulations, only economic control over prices and routes. □

of Jupiter on its way to Saturn, filled the screen in the darkened room as Johnson described the intense interest created among planetary scientists at Caltech and JPL by the Pioneer flights.

With investigation of the inner solar system in full swing, he said that prospects for further spacecraft investigation of the outer planets—along with a steadily increasing store of ground-based data—is generating much activity. The Caltech/JPL staff is deeply involved in many phases of outer-planet studies—theory, ground-based observations, and spacecraft investigations, he said.

Johnson briefly described several areas of current research: sodium emissions from the satellite Io, theoretical studies of satellite structure, and interpretation of ground-based and spacecraft data on the atmospheres of the outer planets. He said that considerable interest has been generated by the realization that the satellites are planets that merit study for themselves. □



Society and automation

Almost every facet of our society will be automated to some degree in the next 10 years. Whether this change will be for the good or not will depend on how it is done, Carver A. Mead, professor of electrical engineering, told alumni.

Since the advent of integrated circuits in 1959, the number of devices that can be economically placed on a single silicon chip in commercial quantities has doubled each year, Mead said. More than 20,000 devices can now be placed on a single chip, and soon, a transistorized chip of silicon that would be lost in the palm of one's hand may hold more than a million circuits.

These developments will trigger enormous changes in the world as we know it, Mead said. Some of these will take place in the computing industry itself.

"Computer companies accustomed to selling off-the-shelf hardware products and packaged software systems will have to put more and more of their energy into understanding in detail their customers' problems and tailoring systems to their needs," he said. "Great attention will have to be paid to making a friendly and transparent interface between users and their systems."

Other trends will involve more and more pocket calculators tailored to solve complex problems of people such as engineers and financial specialists—or for surveying, navigating, or conversion of the metric system, Mead said. He also predicted the development of electronic typewriters, dictating machines, and other human interfaces which will remove much of the drudgery of mechanical transcription of information from one form to another. □



Surrounded by youthful members of his Alumni Seminar Day audience, Gary Lorden talks about a gambler's statistical chances of being lucky.

The odds in a gambling win

Gamblers wait anxiously for a "run of luck" that will expand their small stake into a bundle of money. Meanwhile, statisticians abhor "lucky runs" because they can easily lead to wrong conclusions about the "odds" involved in a gambling win.

Now, Gary A. Lorden, associate professor of mathematics, told alumni, the statistics experts have developed new methods of calculating the chances of being lucky. These methods can help gamblers choose what to bet on and how much to bet.

Statisticians have to calculate that a gambler's chances will be subject to extreme fluctuations, Lorden said. The computations used to evaluate these fluctuations can yield insight into a person's chances of winning in a gambling casino.

Lorden said one effective means of working out the results involves a scoring system designed to produce a "fair game," for which fluctuation probabilities are easy to obtain. This method has yielded useful information about the accuracy of statistical tests. When applied to

gambling, the scoring system can provide precise comparisons between different amounts and types of bets, and the way in which each bet affects a gambler's chances of winning, Lorden explained.

"The results of such comparisons are often surprising," he said. "They contradict cherished beliefs about the importance of odds and of money management."

For example, Lorden said, the scoring system shows that a gambler is better off risking 40 percent of his stake on the red in roulette than 10 percent on the pass line in craps. □

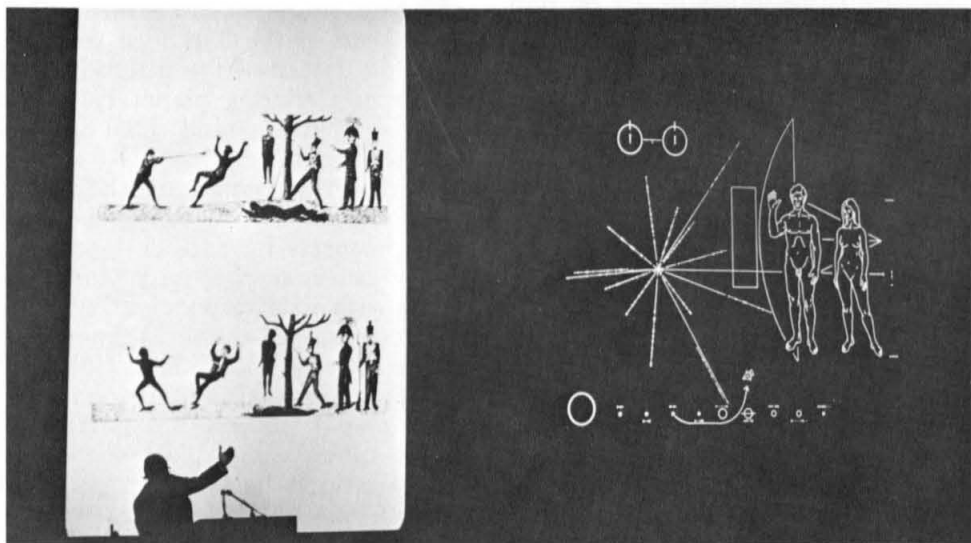
The outer planets

Current research at Caltech and JPL on the outer planets and their satellite systems was discussed on Seminar Day by Torrence V. Johnson, group supervisor, Optical Astronomy Group, Space Sciences Division, JPL.

Pictures of Jupiter, taken from Pioneer 10, and others taken from Pioneer 11 as it passed over the pole

Pictographs to perception

Depth and diversity mark seminars



Nicholas Tschoegl explains the power of pictographic forms in expressing ideas.

The Chinese script: its logic

Americans interested in learning the Chinese language should not despair. There really is logic behind this ancient pictographic script, in which characters represent words or ideas, and which looks to the uninitiated like a jumble of strokes.

There are 45,000 pictographic characters in a Chinese dictionary, but a student can acquire a working knowledge of the language by learning some 2,000 graphic elements, Nicholas W. Tschoegl, professor of chemical engineering, told alumni. Viewed in this way, the task is not so discouraging.

Tschoegl noted that the Chinese language contains an enormous number of homonyms—words that sound alike but have different meanings. He said that to give up the present system for an alphabetic one would create serious complications in dealing with these words.

"Another advantage of the Chinese script is that it can be read even by the one-third of the population which does not speak the national language," Tschoegl said. "Furthermore, classical literature more than 1,200 years old remains directly accessible." □



James Whitcomb talks about progress in the accurate prediction of earthquakes.

Earthquake prediction

"Three or four years ago a scientist would have been laughed out of the auditorium for talking about earthquake prediction," said James H. Whitcomb, senior research fellow in geophysics, in his Seminar Day talk.

However, he continued, research on methods for predicting earthquakes has expanded tremendously in the past two and a half years, at Caltech and elsewhere. Major monitoring programs using sophisticated measuring techniques have been initiated throughout southern California, he said.

Whitcomb discussed techniques used to measure parameters in the

earth that are believed to change before quakes. He said a primary goal is to develop and confirm the accuracy of a working physical model that will enable scientists to predict at least certain types of earthquakes.

He said that a valid scientific prediction should include the parameters of time, location, and magnitude. Other scientists need to be able to study all of the failures and successes of the predictions made by means of a particular method, in order to evaluate it, he explained.

"Almost all scientists are enthusiastic about the possibilities of earthquake prediction," Whitcomb said, "but some of them question its usefulness. I feel that prediction would enable us to do many things that would help diminish the damaging effects of a large quake." □

Earth exploration via satellite

"After a decade of remote measurements of the moon and planets by spacecraft, we're now applying the knowledge we have gained to the interpretation of satellite images of our own earth," Alexander F. H. Goetz, manager of the Planetology and Oceanography Section, JPL, told alumni.

The first earth-resources technology satellite (ERTS-1, now called Landsat-1) and its recently launched twin (Landsat-2), are capable of imaging any point on the earth every nine days with four-color cameras with enough resolution to detect a football field, Goetz said.

"The four spectral bands in the visible and near-infrared portion of the spectrum provide 200 million bits of information in each photographic frame," he explained. "Since all of this information can't be displayed on one piece of film at the same time, computer image-enhancement techniques are used to extract and display the data that are most useful for a particular purpose."

He said that applications include regional geologic mapping, engineering geology, and reconnaissance mineral exploration. □

Vision and early experience

The importance of early experience in the development of visual perception was described on Alumni Seminar Day by John D. Pettigrew, assistant professor of biology. Pettigrew discussed experiments with kittens that were raised in environments of horizontal or vertical stripes. As full-grown animals, they only responded to the kind of stripes to which they had been exposed as kittens.

Pettigrew explained that each of the five hundred million or so neurons in the visual cortex of a mammal is triggered by a particular feature in outside visual space—the orientation of a moving edge presented to both eyes. This "trigger feature" activates receptors in the eye, which send the information they receive on to the cortex where vision is produced.

During the critical period when interconnections between neurons in the cortex are being formed and reformed at a rapid rate, subtle changes in the environment can cause long-lasting changes in the way the visual cortex is organized—and thus in visual perception.

The discovery of the importance of this critical period in animals has enabled psychologists to test for its existence in humans, Pettigrew said. These tests have shown that a critical period for human primary visual cortex development spans the first two years of life. This means it is important to detect and correct astigmatism and other visual defects within that critical period before they can cause permanent distortions. □



John Pettigrew explains the effect of early environment on adult visual perception.

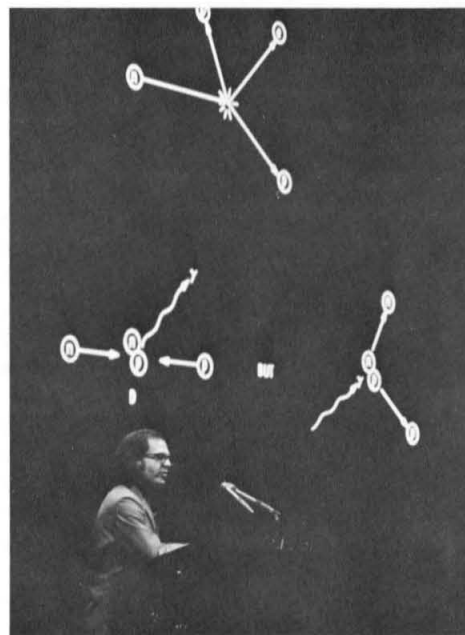
Oxygen in the blood

The latest findings in a problem under study at Caltech for 40 years—how oxygen is carried in the blood to the cells where it produces energy—were described by Harry B. Gray, professor of chemistry, on Seminar Day.

Gray explained that a major question is whether protein in the blood carries oxygen in a chemically unchanged form, as suggested by Nobel Laureate Linus Pauling, or whether it converts it into a substance similar to hydrogen peroxide. New insights into the problem have become possible by studying blood proteins that are less complex than those found in humans and other higher forms of life. These include the red-purple blood protein found in worms, and the blue blood protein found in snails, squid, lobsters, crabs, and related species.

Recent work at Caltech has shown that both red-purple and blue blood proteins convert oxygen into a hydrogen-peroxide-like molecule and transport it in that form. It is reconverted to oxygen, however, before it is released to the tissues.

Dr. Robert Gagné of Caltech has recently synthesized working models of the oxygen-carrying apparatus in hemoglobin, Gray said. Studies on these synthetic blood proteins tend to confirm Pauling's findings that hemoglobin carries oxygen in an unchanged form. Gray believes, however, that further work will be needed to prove that hemoglobin really does carry oxygen in a fundamentally different way from the red-purple and blue blood proteins. □



James Gunn tells why he thinks the universe will expand forever.

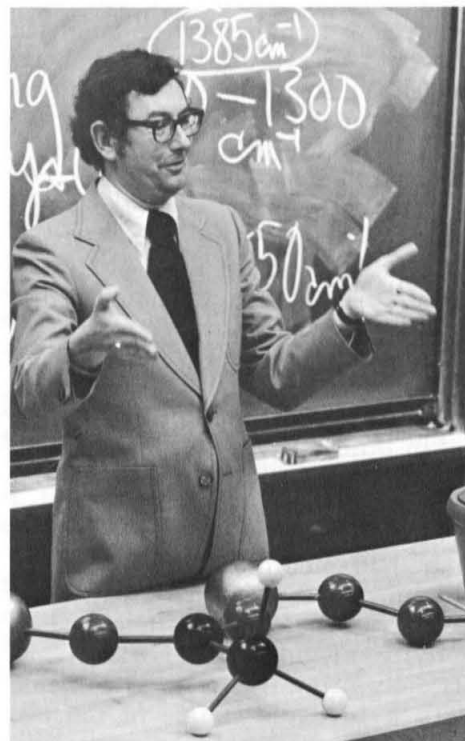
For the universe: no return

It appears likely that the universe will continue to expand forever, because apparently there is far too little matter to provide the gravity that is necessary to pull it back together again. That was the conclusion of James E. Gunn, professor of astronomy and staff member of the Hale Observatories.

Gunn's conclusions relate to a question that has concerned cosmologists for a long time: Will the universe go on expanding forever? Or does it have enough gravitational energy to reverse the expansion so that all of its matter eventually will collapse into itself, triggering another "big bang" like the primordial explosion that is supposed to have given it birth?

Gunn and three fellow astronomers believe the universe will expand endlessly. They have added up the total mass and amount of gravity that can be observed from the motion of objects in the universe and have concluded that the mass falls short of what is needed to reverse the process of expansion.

Gunn said the astronomers evaluated evidence including the rate of expansion of the universe in relation to the ages of stars and metals, the amount of visible matter, the possibility of black holes as locations of undetectable mass, the brightness of galaxies, the ages of stars and metals, the redshift of galaxies, and the production of chemical elements in the universe. □



Harry Gray describes the oxygen-carrying properties of red, purple, and blue blood.

Chuck Thomas named national 1975-76 Alumni Fund chairman

Charles F. (Chuck) Thomas, BS '35, has been named national chairman of the 1975-76 Alumni Fund. Thomas, who is manager of Raytheon's Western Region, with offices near the Los Angeles International Airport, is enthusiastic in his views about his new Alumni Fund position.

"I'm fortunate to have been a member of the Alumni Fund Council since it was initiated just over three years ago," he said, "and it's been satisfying to see the Fund moving from infancy into a more mature stage.

"Since the Fund did not solicit gifts during Caltech's Science for Mankind campaign from 1967 to 1972, we faced a difficult period in getting the project moving again. I'm glad that the Alumni Fund Council and the Institute administration are dedicated to continuing the Alumni Fund solicitation every year, so we won't be facing that problem again."



Charles F. Thomas

Thomas takes a positive stance concerning the Alumni Fund's performance during the past three years.

"We've evaluated many of our techniques and are learning which ones have been most effective," he said. "One of my goals will be to give ideas to area chairmen and individual workers in the Alumni Fund to help them perform more effectively.

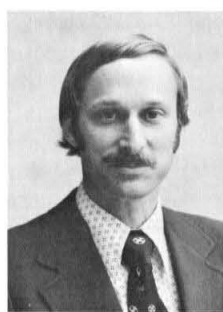
"After analyzing our activities and comparing them with those of other alumni funds, we've decided to continue to operate in the same basic style as in previous years. We expect to devote a good deal of time to working with prime prospects in the fall, to our mail program during the winter and spring, to our telephone contacts again next spring, to our annual Leadership Conference on September 20, and to other methods that have been working well for us.

"We started this activity at a time economically distressing to all of us. Consequently our volunteers have been trying to raise money when not only the Institute, but individual alumni have been finding it stiff going financially. In spite of this situation, we've done an outstanding job compared with the efforts of other schools. We now have more volunteer workers than ever before. We will also increase by 70-80 percent the number of contributing alumni this year, compared with 1972-73. All this seems proof that we're on the right track."

Thomas grew up in the Pasadena area, living only a mile from Caltech at the time he graduated from Pasadena High School in 1930. He enrolled as an electrical engineering student, then switched to aeronauti-

cal engineering, and graduated in 1935. During his undergraduate days, he received the Honor Key and was active in the Glee Club, YMCA, Throop Club, and Student Council.

While at Caltech, Thomas worked at Douglas Aircraft. After graduation, he signed on at Lockheed, where he worked until 1960. Then he moved to New Jersey to work for RCA. In 1964 he became associated with Raytheon in Massachu-



Allan M. Goldberg



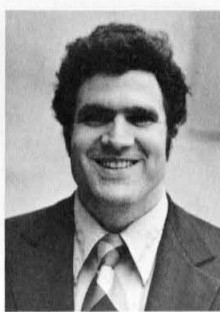
Jesse B. Graner

setts, and in 1969 he returned to California to take up his current managerial position. He has been a member of The Associates of Caltech since 1967.

He announced that the following alumni have been appointed to three-year terms on the Fund Council: Allan M. Goldberg, BS '57 ACh, MS '58 ChE, Director of Product Engineering, McGraw Labs, Santa Ana; Jesse B. Graner, BS '43 CE, owner of Graner Oil Company, Long Beach; Robert T. Jenkins, BS '65 Engrg., MS '66 EE, Plant Manager, Intel Corporation, Livermore, California; Philip M. Neches, BS '73 Engrg., Manager, Systems Evaluation Group, Transaction Technology Inc.; L. Willard Richards, BS '54 Ch, Supervisor, Atmospheric Sciences Group, Science Center, Rockwell International, Thousand Oaks.



Robert T. Jenkins



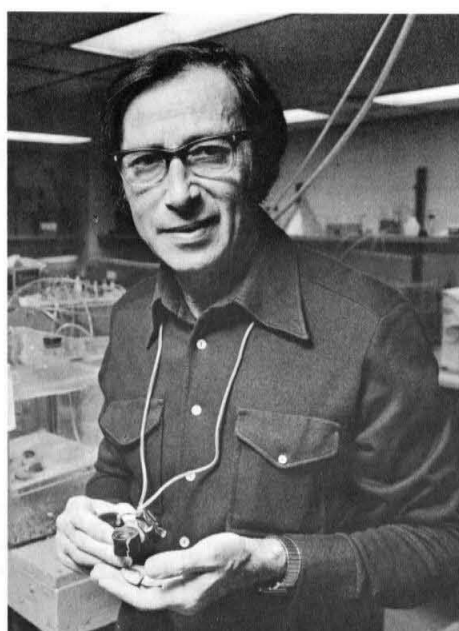
Philip M. Neches

Continuing members of the Council include: William F. Chapin, BS '41 ACh; Stephen H. Garrison, BS '65 Engrg., MS '66 ME; Herbert A. Lassen, BS '43 ME, MS '47 ME, PhD '51 ME; Jack R. McInturff, MS '62 ME; Glen H. Mitchel, Jr., BS '48 EE; Reuben B. Moulton, BS '57 ME; Martin J. Poggi, BS '37 ME; Stanley R. Rawn, Jr., BS '52 ACh, MS '53 ChE; A. Allen Ray, BS '35 ME; and Stanley T. Wolfberg, BS '38 ME.



L. Willard Richards

Members of the Council who are retiring on July 1, 1975 are: Donald D. Davidson, BS '38 ACh; Frank W. Davis, BS '36 ME; Robert J. Kieckhefer, BS '45 ME; Ruben F. Mettler, BS '44 EE, MS '47 EE, PhD '49 EE; and Harrison W. Sigworth BS' 44 ME.



Heinz Lowenstam

Iron synthesis in sea cucumber: how and why?

Why does the lowly sea cucumber—a creature that lives in the mud at the bottom of the ocean—wear a cape of microscopic iron beads a few layers beneath the surface of its skin? Is the cape the evolutionary beginning of an iron suit of armor, or is it a storehouse of protein to be withdrawn when needed to replace the tired iron in its red blood cells?

Heinz A. Lowenstam, professor of paleoecology at Caltech, finds questions like these irresistible. He is fascinated with the ability of living creatures to perform geological feats within their own bodies. Their delicate biological processes duplicate geological ones, and they synthesize aggregates of minerals without any need for the heat and pressure that are required to produce them inside the earth.

It was Lowenstam who discovered that a slug-like creature of the sea, the chiton, has teeth of iron, and that the limpet has teeth made of opal—capped with iron.

Scientists are showing increasing interest in the biological processes used for synthesizing iron, opal, calcareous shells, and other protective devices. Many present-day oil fields are formed from ancient accumulations of these deposits.

The beaded iron cape of the sea cucumber is similar to ferritin, the kind of iron stored in the spleen for incorporation into red blood cells. The iron in the blood cells carries oxygen throughout the body. As a first step in learning the purpose of the beads, Lowenstam has isolated them and observed them through an electron microscope. Round or oval in shape, they come in a variety of sizes up to one twelve-thousandth of an inch in diameter.

The beads are built up of many microlayers, like the sedimentary microlayering of rock. The microlayers themselves are composed of small spheres 80 to 100 angstroms in diameter. An angstrom is one 254-millionth of an inch.

The larger beads are composed of several chemical elements, iron being the most abundant. Above the iron beads in the skin is a layer of calcareous spicules, calcium carbonate crystals that are apparently in the process of being converted into iron beads.

The paleoecologist plans to place the sea cucumbers in mud that contains iron-55, a radioactive tracer, to determine whether they use the iron in the beads to replace the iron in their hemoglobin. As they feed on the mud they will absorb iron-55, which later on will show up in their body fluids and blood, and ultimate-

ly, Lowenstam hopes, in the outer layers of the beads. The sea cucumbers will then be transferred to mud that contains little or no iron.

"If the iron-55 is picked up in their hemoglobin, then we will know that, at least in the case of stress, they use the iron in their beads," Lowenstam said. "What we want to know is whether they make the iron soluble and transfer it back into their body fluids when unable to get iron."

Lowenstam's research is supported by the National Science Foundation. Associated with him in his study is George R. Rossman, assistant professor of mineralogy and chemistry.

Three faculty members awarded Guggenheims

Three Caltech faculty members have been awarded fellowships for past accomplishments and future promise by the John Simon Guggenheim Memorial Foundation.

They are Bruce C. Murray, professor of planetary science, for his research in the comparative planetology of the four planets nearest the sun; Thayer Scudder, professor of anthropology, for studies in the social anthropology of the Gwembe Tonga of Central Africa; and William B. Wood, professor of biology, for his work in genetic and developmental biology.

Murray was a co-investigator of television experiments on the Mariner spacecraft to Mars, and the television team leader of the Mariner 10 flight to Venus and Mercury. Scudder is studying the Gwembe Tonga region in Central Africa, and the effects on the local inhabitants of man-made lakes and population relocation. Wood is widely known for his work concerning the T4 virus and for his contribution to the determination of how it is put together on a submicroscopic assembly line.

Anderson to conduct research in Australia

Don L. Anderson, professor of geophysics and director of the Seismological Laboratory, will spend the summer at the Australian National University, Canberra, Australia, on a Senior Fulbright-Hays Award. As a visiting fellow in the Research School of Earth Sciences, Anderson will be involved in geophysics research concerning the composition of the earth's interior.

Placement Assistance To Caltech Alumni

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

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

This service is provided to alumni by the Institute. A fee or charge is not involved.

If you wish to avail yourself of this service, fill in and mail the following form to:

Caltech Placement Service
California Institute of Technology
Pasadena, California 91125

Please send me: (Check one)

- ☐ An application for placement assistance.
- ☐ A form indicating a desire to keep watch for opportunities although I am not contemplating a change.

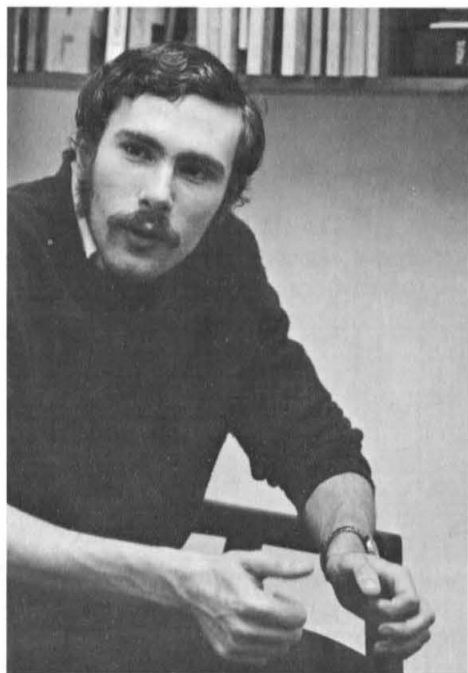
Name

Degree(s) Year(s).....

Address

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Jim Backus discusses his goals as ASCIT president



James E. Backus

James E. Backus, a 21-year-old mathematics major from Cincinnati, was elected president of the Caltech student body by a margin of five votes after a runoff. A sophomore, Backus enrolled at Caltech this fall for the second time, after a three-year break.

"I originally came here when I was only 17 and I wasn't ready for college," he said. "My grades reflected my lack of interest and I dropped out of school for three years. Then I decided I wanted to get my college degree. I had finally realized that there wasn't much future in slinging hamburgers."

In the fall of 1973, Backus persuaded the University of Cincinnati to admit him as a freshman. During the next four terms, he earned 157 of the 186 credits required for graduation. During one term, he carried 35 units—the normal load for three terms—and maintained a 3.7 average while doing so.

Backus was readmitted to Caltech this fall. Next year he will be a senior and he expects to graduate in June 1976. He wants to do graduate work in business and finance.

A resident of Dabney House, Backus ran a low-key campaign. "The average Caltech student really isn't interested in hearing speeches by a presidential candidate," he said.

Backus explained the secret of his campaign success in this way: "J. D. Salinger once wrote a book about a guy whose secret was that winning wasn't really his goal. He said that any contest is like playing gutter marbles. If you are intent upon winning, you may miss by a mile. But if you aim and shoot for the sheer joy of the experience, then you have a statistical edge." Below, Backus talks about his objectives as student body president.

What are your goals as ASCIT president?

An efficient, businesslike student government with more students involved in responsibilities for the business operations of ASCIT, and a good business manager for the corporation. I believe ASCIT could turn a profit and that the money could be used to help students—perhaps through scholarship aid.

An ombudsman to help students solve their problems and assist them in cutting through red tape is a possibility I'd like the Institute to consider.

A book cooperative is another idea in which I'm interested; the cost of books is increasing at an astronomical rate. As for the food service, I hope people will either come to me with suggestions for a better plan than we have now, or stop complaining.

How do you expect to accomplish your goals?

I want to talk with students about their concerns and then learn about the red tape that may be blocking solutions to them. I'll have to play it by ear.

How easy do you think it will be to get the administration to listen to your views?

Getting the administration to listen won't be a problem. The question is whether my views will be accepted.

What academic issues are you concerned with?

A voice for students in the granting of tenure to professors is something I'd like the Institute to consider.

Students have been much interested in the validity of the humanities and physical education requirements for graduation. What are your views?

Caltech undergraduates should be responsible and mature enough to make their own choices about their need for these courses. That's my belief. If a lot of students tell me they want these requirements eliminated, I'll see what I can do. If they don't come to me with concerns about them, I'll assume they're satisfied.

What can be done to get more students involved in student government?

As long as the average Caltech student is reasonably satisfied with his lot at the Institute, he won't get involved in student government. Politics isn't one of his major interests.

How do you think social life on campus can be improved?

Improving his social life is each person's own responsibility. You can't force social opportunities upon someone unless he's willing to accept them. But I would like to see students stage a science carnival with exhibits and displays—perhaps oriented to high schoolers—and use the money for student projects.

Describe the mood on campus today.

The mood of students is entirely different from that of the 1960's when I was in high school. That was a time of great unrest; young people were filled with cosmic gripes. Now, Caltech students are mostly concerned about the cost of living, and paying for their education, and the ways inflation is affecting them personally as prices go up.

How can alumni help ASCIT?

By giving money for scholarship aid. And if there is an alumnus who would like to be a business management consultant to ASCIT, I'd be pleased if he'd come and say, "Yes, I want to help."

Pings gives first Mason Lectures at Stanford

Cornelius J. Pings, professor of chemical engineering and chemical physics, vice provost, and dean of graduate studies at Caltech, gave the first David M. Mason Lectures in Chemical Engineering at Stanford University on April 29 and May 1.

The lectures were entitled "Application of Modern Light-Scattering Techniques to the Determination of Transport Properties in Fluids" and "Critical State Anomalies: A Singular Tale of Two Phases."

The lectures are named in honor of David M. Mason, BS '43, MS '47, PhD '49, professor and chairman of the department of chemical engineering at Stanford University. Mason received the highest honor given by the Institute to an alumnus, the Distinguished Alumnus Award, in 1966. He and Pings were instrumental in developing the chemical engineering program at Stanford.



Caltech alumni sailors, left to right: Robert C. Perpall, James S. Tyler, and Paul W. Hubay.

Team displays Caltech colors in sailing race

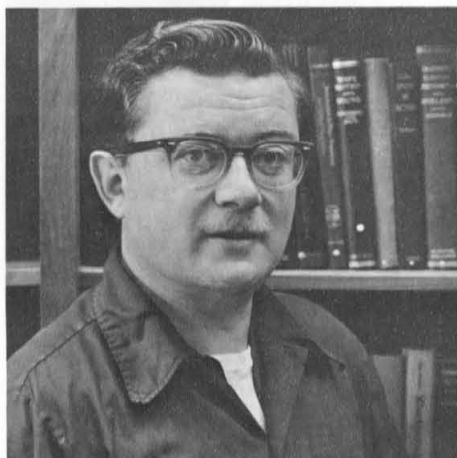
In a close competition that included representatives of nine alumni associations, a Caltech team finished eighth in the first UC Irvine Alumni After-Guard Sailing Regatta at Newport Beach. The Caltech crew defeated Harvey Mudd College.

Displaying a Caltech banner on their craft, the alumni sailors were Robert C. Perpall, BS '52, MS '56; Paul W. Hubay, BS '49; and James S. Tyler, BS '55, MS '61. UC Irvine provided identical sailboats, Shields class, for all the participants.

Orange Coast College won the three-hour race, which departed from the Intercollegiate Sailing and Rowing Base at Newport Beach. USC finished second and Stanford, third. William Ficker, winner of the America's Cup, was only able to take fourth place for UC Berkeley, evidence of the sailing skill that marked the event. The other participants were UCLA, UC Irvine, and UC San Diego.

"We were never in contention but never far behind," Perpall remarked. "This was a well-run and a fun event, and all three of us recommend that we participate next year."

Two seismometers aboard Viking to transmit data on Marsquakes



Don Anderson

Two small seismometers, each weighing less than five pounds, are undergoing tests prior to their launching late this year aboard two Viking spacecraft headed for Mars. They were designed at Caltech under the supervision of Don L. Anderson, director of the Caltech Seismological Laboratory and professor of geophysics.

Seismologists hope the instruments will send back answers to such questions as: Does the planet Mars quake, and if so, how big are Marsquakes? Do they occur randomly, or along faults as on Earth? Are there plate tectonics on Mars, and what is that planet's internal structure?

The first of the two identical seis-

Caltech clean air car entry takes first in Class 1

Driving a modified Datsun 610 sedan, a Caltech team took first place in Class 1—Gasoline Powered Vehicles, in the Intercollegiate Reduced Emissions Devices Rally. On loan from the Nissan Motors Corporation, the car was modified and driven by senior David P. Beatty, junior Edward J. O'Rourke, and sophomore Paul D. Shubert. Entries in this class can be modified only with devices that can be installed by one mechanic within four hours.

In performance-acceleration testing, the car, equipped with a turbo-charger, scored 100 out of a possible 100 points. It accelerated from 10 to 55 mph in 6.5 seconds and from 45 to 60 mph in 2.5 seconds.

Driven for three hours through San Francisco, the car averaged 21 mpg in economy testing. In a highway economy test from Monterey to Los Angeles, it achieved 27 mpg.

Caltech's propane-powered AMC Hornet finished second in Class 3—gaseous-powered fuels—and ranked third in emissions testing among all cars. It was piloted by sophomore Richard G. Beatty, freshman Leroy J. Fisher, and senior Richard S. Gruner.

The attention stealer of the show was a Class-3 entry from the University of Denver—a modified Datsun 210 with a specially designed engine that started on propane and converted to gasoline. This vehicle achieved 47 mpg on the highway and 35 mpg on the streets of San Francisco, winning top honors in the race.

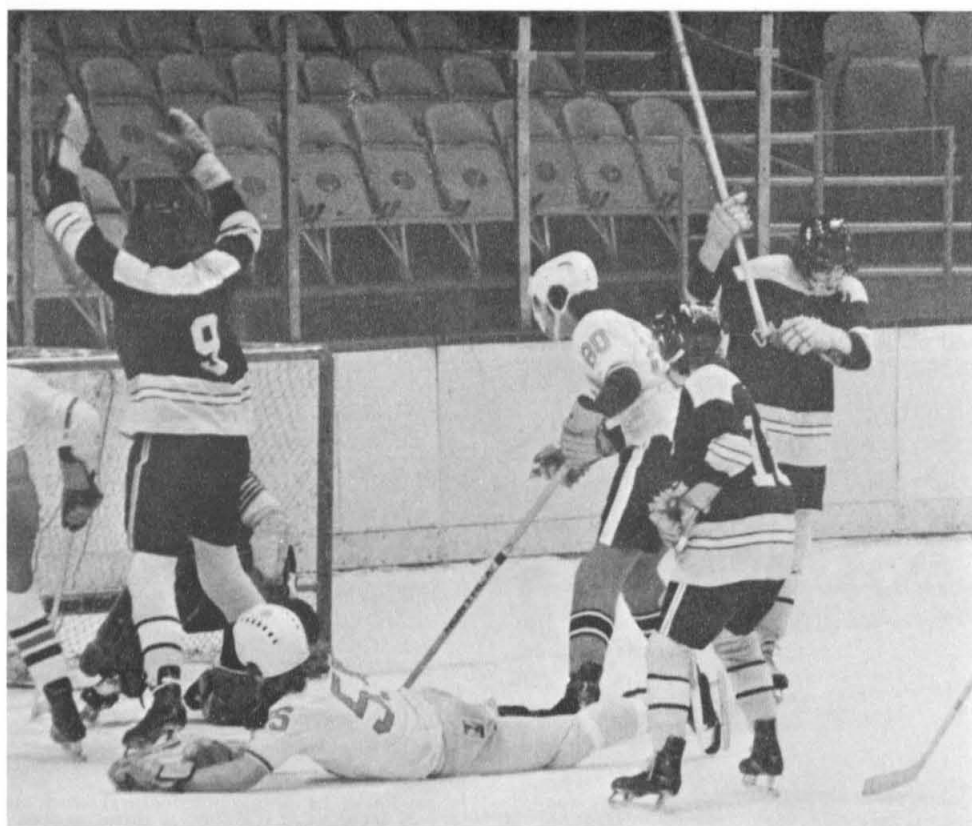
One entry that provided excitement for observers was a liquid hydrogen-burning mail jeep entered by UCLA and dubbed the "hydrogen bomb." The jeep blew up three times during the event, and its carburetor melted at the third explosion—which occurred in the starting parking lot before the second test.

mometers is scheduled to land on Mars on July 4, 1976—our nation's 200th birthday—on board the lander of a NASA Viking that will probe the planet for signs of biological life. After orbiting Mars, the Viking's lander will separate from its orbiter and make a soft landing. The second seismometer is due to land two weeks later at another site.

The main task of both seismometers is to determine whether Mars is geologically alive. Anderson believes that this may very well be the case. He suspects that the planet's 2,500-mile equatorial rift valley may indicate the beginnings of plate tectonics—symptoms of a hot, active interior. Its volcanic mountains indicate that it has been geologically active in the past even if its volcanoes are not alive now.

Another reason why Anderson believes Mars may be geologically active is that it has an irregular field of gravity—a fact revealed by Mariner 9. This means that Mars is supporting large stresses in its interior.

Because they must compete with the other Viking instruments for radio time to transmit data back to Earth, the seismometers have a unique shorthand recording system that saves up to 90 percent in transmission time and storage room. The shorthand will be decoded by a computer on Earth.



In the lone season game played at the Forum, the Caltech line scores against Oxy.

Hockey Club on rampage, ends season undefeated

by William A. Harris

The Caltech Hockey Club is not typical of Caltech teams. Its major departure from the norm has been in the won-lost dimension. This season the hockey team won every game it played for a record of 13 wins, 0 ties, 0 losses. Neither UCLA, Cal State Northridge, Occidental College, Northern Arizona University, nor San Diego State were able to eke out as much as a tie with the Tech team.

This record has caused a lot of consternation. A feature article in the *Los Angeles Times* sports section about the club was entitled "Caltech's Scandal." In it, *Times* staff writer Charles Maher wrote, "The Caltech hockey team has gotten completely out of hand and threatens to give the school a good name."

A few extremists believe a winning athletic team and academic excellence are incompatible. They are in favor of deemphasizing hockey at Caltech, thereby lessening the threat of a scholastic catastrophe. Hopefully, such a move will not be necessary.

The Caltech six is a club team—meaning it doesn't officially represent the school. It is made up of undergraduate and graduate students, faculty, and staff. It was started four years ago, and plays its home games at 11 o'clock on Sunday nights—the least-expensive time on the ice—at the West Covina arena.

Much of the credit for the team's success in the Southern California Collegiate Hockey Association goes to James Warden, a Pasadena pediatrician, father of a U.S. national team goaltender, and selfless volunteer coach. Regularly throughout the season, he arrived at the West Covina ice rink on Sunday evenings to drill the players from 11 p.m. to 12:30 a.m. Often he had to be at the Kaiser Hospital early next morning. On a recent visit to Europe, Dr. Warden collected a series of highly prized, well-guarded Czechoslovakian and Russian plays. Caltech's will be the only hockey team in the nation that knows them.

Robert Gardiner, graduate student in mechanical engineering and hockey team captain, should be congratulated for the vast amount of effort and leadership he produced this year. Joseph E. Sweeney, graduate student in aeronautics, deserves recognition as the leading scorer of the entire league.

But no one can match the sacrifices made for the team by Fred E. C. Culick, professor of jet propulsion, who cracked his skull and broke his shoulder. As a result of his injuries, helmets became mandatory even during practice.

The Southern California Collegiate Hockey Association has been in existence for two years, and Caltech has won the championship both years. The combination of secret Russian plays, new undergraduate and graduate talent, and Fred Culick's return to action should more than overcome the loss of players due to graduation, so that again next year Caltech's hockey team will be victorious.

AIAA honors two on GALCIT faculty

Two members of the GALCIT faculty were honored at the annual meeting of the American Institute of Aeronautics and Astronautics in Washington, D.C.

Hans W. Liepmann, professor of aeronautics and applied physics and director of the Graduate Aeronautical Laboratories, was named an honorary fellow of the AIAA—the highest honor bestowed by that organization on its members. Liepmann received a citation lauding his contributions to the study of transition and turbulence, shock-wave boundary layer interaction, and buffeting and aerodynamic noises.

Donald E. Coles, professor of aeronautics, was elected a fellow of the AIAA for his contributions in the area of turbulent flow and the development of sophisticated experimental techniques.

Carl Anderson honored for positron discovery

Carl D. Anderson, Nobel laureate and professor of physics, is one of 20 recipients of the Golden Plate Award of the American Academy of Achievement for his discovery of the positron. This award is given in recognition of outstanding Americans in various fields.

Political scientists learn:

The agenda is often key to voting outcome

Political science has proved what committee chairmen have long suspected—that it is possible to influence decisions if you know how to manipulate the agenda.

Charles R. Plott, professor of economics, and Michael E. Levine, Luce Professor of Law and Social Change in the Technological Society, reported that tests with groups of people and with a mathematical model combine to show that the key to the results of voting is often the sequence in which issues are listed on the agenda.

Plott said that many persons in decision-making positions manipulate an agenda intuitively.

"The ability to do so and to do it well is an art," he said. "Many people have suspected the influence of an agenda, but we are just beginning to understand the way this influence works."

"We have learned that voting doesn't necessarily express the will of the majority," Plott said, "but this doesn't mean that voting should be given up. There is no better alternative. What we are discovering is that the group process involved is richer and more complicated than people had realized."

He said that a better understanding of the way group decision-making works can eliminate bad decisions made because of accidental influences in procedure.

Plott and Levine have found that a dominating individual who tries to manipulate an agenda during a meeting may have little effect compared with the influence of the agenda itself.

The researchers explained that the first requirement for using an agenda successfully is to have as much advance knowledge as possible concerning the wishes of individual committee members. The more divided the members are and the stronger their feelings, the greater the chance to influence a decision.

The agenda can be arranged to pit the strong opinions of one side against the strong opinions of the other, Plott said. The manipulators can group their choices with the more popular ones, while listing the contending choices with a less popular group.

After an initial choice has been made and some of the close contenders have been eliminated by a

vote between the two groups of choices, then the procedure is repeated. This process continues until only the manipulators' choices remain.

Plott and Levine tested their theories by studying groups who were making important decisions. The groups under study were unaware of the researchers' theories.

Biologists find chloral hydrate inhibits cells

Chloral hydrate, often known as "knockout drops" and also used in milder dosages as a sedative for children and the elderly, inhibits cell division and the synthesis of protein. This was the conclusion of John W. Cross, a graduate student at Caltech, to the Society of Biological Chemists.

Cross described his research with Dr. Daniel McMahon, Caltech assistant professor of biology, to learn how the anesthetic inhibits these two metabolic activities. Their research is supported by the National Institutes of Health.

"Other researchers have shown that chloral hydrate prevents weight gain when used to treat cerebral irritation in babies," Cross said. "We'd like to know whether the anesthetic is inhibiting or reducing protein synthesis in infants and, if so, whether it may cause defects that will affect them as adults."

Cross pointed out that chloral hydrate has the same physiological effect as many anesthetics in causing unconsciousness by depressing the central nervous system.

Cross and McMahon are studying the effects of chloral hydrate on a microorganism, the protozoan *Chlamydomonas reinhardtii*, to learn about its action at the molecular level. The protein synthesis of *C. reinhardtii* was inhibited within one minute after a small amount of chloral hydrate (1.68 grams per liter) was added to the water in which they were swimming. Experiments showed that the anesthetic inhibited protein synthesis for as long as the cells were exposed to it.

Cross also reported that the anesthetic completely blocked cell division—a function closely related to the inhibition of protein synthesis.



At the West Coast headquarters of a major corporation, Reuben B. Moulton, BS '57, chairman of the 1974-75 Alumni Fund, center, makes the first call in a nationwide telephoning effort to ask other alumni for support. With Moulton are Charles F. Thomas, BS '35, left, and A. Allen Ray, BS '35, right. About 3,000 alumni were contacted during eight nights of telephoning on 30 WATS lines between April 15 and June 1; of those reached, 60 percent responded positively. Moulton said that 80 alumni volunteered 175 nights of work in the telephoning effort. He urged all alumni who have not yet done so to make their gift to this year's fund during its closing weeks.

PERSONALS

1920

HARVEY W. HOUSE, MS '26, is a full-time consultant on clay pipe manufacture and jointing for the technical division of Interpace Corporation in Los Angeles.

1924

MORRIS K. GOLDSMITH has semi-retired as president and chairman of the board of Goldsmith, Chi & Associates and is acting as a consultant to the firm.

1927

HALLAM E. MENDENHALL, PhD, writes that he and his wife are planning a trip to Scandinavia, Finland, and Russia this year.

1931

J. CARTER BIGGERS retired on January 1 from the Bank of America after 41 years of service. He was assistant vice president in charge of the Long Beach district appraisal office. Biggers is now in business for himself as an independent real estate appraiser.

1932

BRYANT FITCH writes, "I am retiring from Dorr-Oliver, Inc., at the end of April. During my 31 years with the firm, I have held diverse positions, but for the past few years have been chief scientist. During the 1973-74 academic year, on leave of absence from Dorr-Oliver, I had the pleasure of being a visiting industrial professor at Carnegie-Mellon University. And starting next fall, I will return to CMU for two years, researching sedimentation under a grant from the National Science Foundation. The research will be done in collaboration with Professor Howard Brenner, who will be at Caltech as a Sherman Fairchild Distinguished Scholar during the coming academic year."

PATRICK B. LYONS is retired and lives in Vero Beach, Florida. He has become an active civic and environmental leader.

1933

HARRISON S. BACKUS, MS '35, has retired from G. D. Searle & Company in Skokie, Illinois, where he was director of engineering development. He has returned to California and will soon be making his home in Marin County.



Harper Q. North



Fred W. Morris

TRENT R. DAMES, executive partner of Dames & Moore, was named Man of the Year at the Los Angeles area Chamber of Commerce's 40th annual construction industries award banquet. Dames was honored for his outstanding contributions to the industry and the community.

1936

ALBERT G. BODINE, president of Bodine Soundrive Company, received the Los Angeles Inventor of the Year Award. Bodine has patented more than 270 inventions, which primarily involve the utilization of sonic energy and are related to oil well drills and tools, farm machinery, pile drivers, cleaning and polishing tools, earth-moving machinery, dental tools, and engine fuel systems.

FRED B. STITT, PhD, former chief of the U.S. Department of Agriculture's Chemical Physics Lab, has been enjoying retirement since January 1972.

1938

HARPER Q. NORTH is the associate director of research for electronics at the Naval Research Laboratory in Washington, D.C.

SAMUEL E. WATSON has retired from Texaco and enjoys living in the hills overlooking the wine country of Santa Rosa, California.

1939

FRANCIS L. CARLISLE, MS '53, retired on December 31, 1974, after 29 years with the Naval Weapons Center in China Lake, California.

1941

JOHN H. BARBER, MS '46, retired from the Foreign Service after 21 years and is now a free-lance interpreter-translator, working on a contract basis, for the State Department and the Organization of American States.

JAMES RICHARD GARRETT, MS '52, was named an Outstanding Educator of America for 1975. The award was given on the basis of talent in the classroom, contributions to research, and administrative abilities.

1942

STANLEY CORRSIN, MS, AE '42, PhD '47, was awarded an honorary doctorate by the University of Lyon.

1944

FRED W. MORRIS is president and chairman of the board of Tele-Sciences Corporation, Washington, D.C. His firm is dedicated to public service through the provision of advisory and management services to federal and state governments and to the business community in the United States and abroad.

1948

RICHARD F. JOHNSON, MS, has returned from a month's visit to the Philippines.

HAROLD A. ROSEN, MS, PhD '51, has been named vice president of engineering for the space and communications group of Hughes Aircraft Company. Prior to this he was responsible for directing the company's commercial communications satellite systems development.

CHARLES SUSSKIND has left his position as coordinator of academic affairs in the University of California's statewide administration to return to his Berkeley professorship in engineering science. There, among other things, he teaches a course for non-engineering students based on his book, *Understanding Technology*, which Johns Hopkins University Press recently published as a paperback; the book is also being translated into several languages. "The royalties can't come soon enough," says Susskind, who has three children in college.

1951

PAUL L. ARMSTRONG, MS '55, is manager of project engineers for the Stauffer Chemical Company in Richmond, California. Previously he was technical manager of the Georgia-Pacific plant in Plaquemine, Louisiana.

ROBERT F. CONNELLY, a Tokyo resident, recently displayed the Caltech colors in an unusual event—the 30-kilometer Ome Marathon, otherwise known as "The World's Largest Road Race." Clad in a Caltech sweatshirt and running trunks, he joined 4,000 men, women, and children to race on a street 15 feet wide. Connelly, who is involved in industrial water pollution work, made it into the stretch without being trampled by the mob, but he didn't report whether he was a winner.

1953

GEORGE K. HELMKAMP, PhD, was awarded the annual campus distinguished teaching award for 1974-75 at UC Riverside, and was appointed Associate Dean of the College of Agriculture and Natural Sciences.

1954

SIDNEY B. BELLINGER, JR., a captain in the U.S. Navy, is serving as head of the thoracic surgery division of the Naval Regional Medical Center in Portsmouth, Virginia. He was also appointed assistant professor of surgery at the Eastern Virginia Medical School in Norfolk, Virginia.

ROBERT M. RUFVOLD, MS, is deputy division engineer with the U.S. Army Corps of Engineers, South Pacific division, in San Francisco. His unit is responsible for the civil works program in California, Nevada, Arizona, Utah, and part of New Mexico and Colorado, as well as the military construction program in Washington, Oregon, Idaho, and Montana.

1955

FRANCESCO G. BEUF has taken a leave of absence to work for his MD degree, after 16 years with the General Electric Company. He expects to graduate from Temple University Medical School in December 1975 and plans to take his residency in medicine in the Philadelphia area.

1963

DONALD MENFORD KING, PhD, is associate professor and chairman of the department of chemistry at Western Washington State College.

1964

JAMES C. WHITNEY has been promoted to engineering manager in the research and development center of the Dictaphone Corporation.



James C. Whitney

1965

WALTER J. DEAL, JR., PhD '69, has been promoted to associate professor of chemistry at UC Riverside.

ARTHUR EDWIN NIELL, a resident associate at JPL since 1972, is now working in the Earth and Lunar Physics Applications Group.

GARY W. SCOTT has been appointed assistant professor of chemistry at UC Riverside. He and his wife, Carolyn, became the parents of a baby boy, Geoffrey, in November 1974.

1967

STEPHAN BARRY ABRAMSON received his doctorate in biological chemistry from Harvard University in January and is now doing postdoctoral research in the division of oncology-hematology at the UCLA School of Medicine.

TERRY GEORGE ALLEN writes, "I recently received an MBA degree from USC after taking evening classes for nearly five years. I have been employed by IBM as a marketing representative in the data processing division ever since graduation from Caltech. The last four years have been spent as the account representative for Caltech and JPL. It has been enjoyable to be back on the campus in a different—and much preferable—role. I live in nearby Arcadia, am married, and have three beautiful children."

EDWARD G. TRACHMAN, MS, has joined the scientific staff of RCA Laboratories at the David Sarnoff Research Center in Princeton, New Jersey. Prior to his current assignment, Trachman was a research engineer at the General Motors Research Laboratories.

1968

GREGORY J. BREWER writes, "Our last two years were spent at MIT, where I was a postdoctoral fellow of the Damon Runyon-Walter Winchell Cancer Fund with Nobel laureate Salvador Luria. In August 1974, I was appointed assistant professor of microbiology at the USC School of Medicine. Last October 8, Yvonne gave birth to our second daughter, Jocelyn."

ROBERT J. HEMSTEAD, PhD, was promoted to vice president and actuary of Unigard Olympic Life Insurance Company of Seattle, Washington.

ARTHUR D. STRUBLE III, a captain in the U.S. Air Force, assigned to Los Angeles Air Force Station as a satellite systems project officer, was among more than 100 of the Air Force's finest skiers who represented bases around the world in a week-long ski meet held at Snow Basin, near Hill Air Force Base in Utah.

1969

DANIEL H. ADDIS writes, "We are both still working for Neptune MicroFloc. Kathe has been promoted twice. We just love our farm and try to spend as much time on it as possible."

JEFFREY C. HECHT is a managing editor of *Laser Focus*, a trade magazine. He and his wife, Lois, have a daughter, Leah, born in September 1974.

LAWRENCE ALLEN HUNT married Virginia O'Neill in the summer of 1973, received his PhD degree in biological chemistry from Harvard University in the fall of 1974, and is now a postdoctoral research fellow of the Cystic Fibrosis Foundation at the University of Utah College of Medicine.

1970

ROBERT BRACKENBURY writes, "My wife and I had a son, Jesse, while I was finishing my thesis work in Jerusalem. After my defense, I will be doing postdoctoral work in Gerald Edelman's laboratory at Rockefeller University."

DAVID M. MOG, PhD, writes, "The chemistry teaching job market being what it is, I have been trying my hand at academic administration for the past year. The result has been a considerable expansion of satisfying work opportunities. At the moment I am assistant dean of the college of arts and sciences at Oberlin College."

TSUNG-CHOW JOE SU, MS, AE '73, received his doctorate in ocean engineering at Columbia University in 1974 and is now employed by the naval architect division of John J. McMullen Associates, Inc., in New York.

1971

ROGER H. ABEL, PhD, is on the faculty of Wofford College in Spartanburg, South Carolina.

OBITUARIES

1923

WALTON E. GILBERT in April.

1924

F. DOUGLAS TELLWRIGHT on March 21. A retired Pacific Telephone executive, Tellwright lived in Carmel, California. He is survived by a daughter, Doreen Austin.

1925

WILLIAM F. AGGELER on December 23. He was professor emeritus of French at UC Santa Barbara.

EDWIN F. THAYER on April 7. He was a publisher prior to his retirement in 1963. Thayer is survived by his wife, Ruth, and a daughter.

1930

WALTER C. MICHELS, PhD, of a heart attack on February 27. He was emeritus professor of physics at Bryn Mawr College. Michels is survived by his wife, the former Dr. Agnes K. Lake, Mellon Professor of Humanities at Bryn Mawr, and a daughter.

1932

FRED FOULON, MS, on February 23. Foulon was an electronics consultant. His wife survives him.

1934

ALBERT HEINRICH, JR., of a heart attack on March 15. Surviving him are his wife, Della, two sons, and two daughters.

1935

WALLACE M. BEAKLEY, MS, on January 15. Beakley was a retired vice admiral in the U.S. Navy.

EDWARD H. G. DENNETT of a heart attack this year. He had retired from the California State Department of Fish and Game where he had been a game warden for 36 years.

1949

WHARTON W. BRYAN on December 29, 1972, in Arlington, Texas. He is survived by a daughter, Salome, and a son, Keaton.

1955

TED K. MATTHES on February 10. He is survived by his wife, Anne.