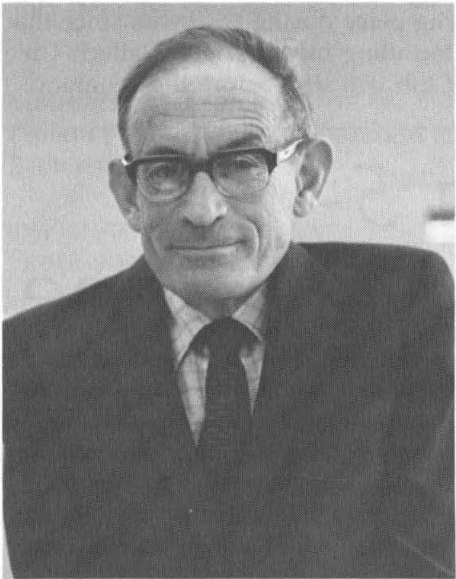


Liepmann, Vinograd

Powell, Bowles professors chosen

Two Caltech faculty members, chosen for outstanding contributions in their fields, have been named to endowed or fully funded professorships at the Institute.



Hans Liepmann

Charles Lee Powell Professor

Hans W. Liepmann, known throughout the world for his work in fluid mechanics and aerodynamics, has been named the Charles Lee Powell Professor of Fluid Mechanics and Thermodynamics at Caltech.

The professorship, made possible by a gift from the Charles Lee Powell Foundation of San Diego, is named for a prominent engineer who worked in this country and Mexico and who designed the Second Street Tunnel in Los Angeles, among other projects.

A member of the Caltech faculty for 36 years, Liepmann is director of the Graduate Aeronautics Laboratories of Caltech (GALCIT). His work has had a strong influence on the design of aircraft and rockets, and he is an authority on shock waves, plasmas, and the flow of rarefied gases.

Liepmann is involved in research on chemical reactions in turbulent mixing (a fundamental energy-related problem for combustion and chemical laser technology), in the fluid mechanics of superfluid liquid helium (related to the problems of cryogenic engineering), and the similarity laws of thermodynamics.

Initially, he worked on laminar instability and the transition to turbulence. Wartime research concerning fast aircraft led to his investigation of shock wave boundary layer interaction, transonic flow, and skin friction in high speed flows. At the same time, he developed graduate courses in gas dynamics.

He has made a major contribution to industry through the students he has taught; many of them hold key jobs in governmental and industrial laboratories as well as important academic positions throughout the world.

President Harold Brown said it is fitting that Liepmann, one of the world's outstanding engineers and scientists, has been appointed to a

professorship named for another outstanding engineer, Charles Lee Powell.

Ethel Wilson Bowles and Robert Bowles Professor

Jerome Vinograd, internationally known for his research on the structure and function of DNA in viruses and animal cells, has been named the first Ethel Wilson Bowles and Robert Bowles Professor of Chemical Biology at Caltech. The professorship will be funded by an annual gift from the Bowles Memorial Fund established by Ethel Wilson Bowles to support medical and treatment facilities.

A physician who practiced in the Bay Area for many years, Ethel Bowles was deeply interested in medicine and health throughout her lifetime. She and her husband, Robert Bowles, an oil engineer, moved to Oklahoma where they were principal stockholders and officers in the Cimarron Oil Company.

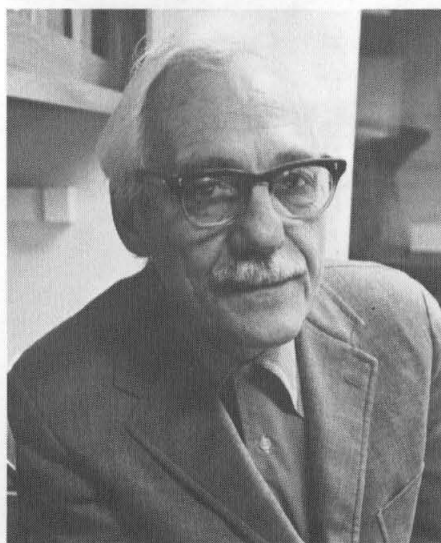
Brown said Vinograd was chosen as the Bowles Professor because he has long been involved in research that has made important contributions to our understanding of basic medically related biological processes — among these, the causes of cancer and other diseases.

Vinograd is the co-discoverer of an important method called buoyant density centrifugation for characterizing, separating, and isolating large molecules and viruses. His chemical studies of the buoyant system have enabled scientists to understand how genetic material such as DNA is reproduced, how certain large molecules are formed, and how the genet-

ic material in viruses interacts with the genes in host cells to cause the cells to become cancerous.

Vinograd is also noted for his co-discovery of an unusual form of DNA, life's basic genetic material. In this form, two DNA's occur in double-stranded, closed rings, rather than in the typical double-stranded, open-ended spirals.

Most recently, Vinograd and his



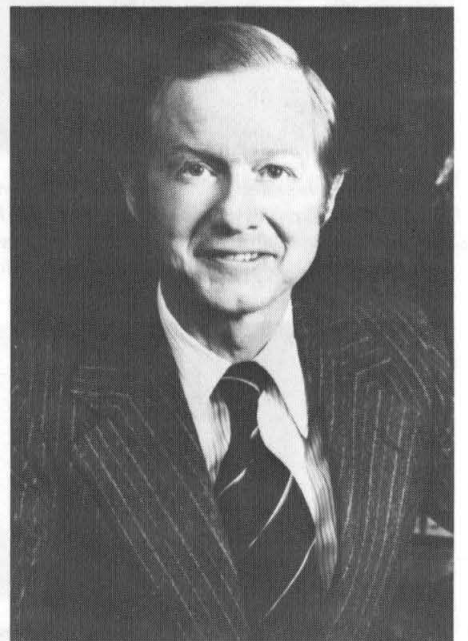
Jerome Vinograd

colleagues have discovered that the rings of mitochondrial DNA in the white blood cells of patients with one form of leukemia are twice the size of those in normal cells. One of the main objectives of his research is to find out why this size increase occurs, in order to help understand the differences between cancerous and normal cells.

Gifts for the professorships are among contributions to the current five-year development campaign, Caltech at the leading edge. . . .



This giant "ice cream cone" of plywood covered with fiberglass helped to show that kelp eventually may play a significant role in relieving the energy shortage. The one-ton cone was towed four miles offshore from Corona del Mar where it was submerged 1,500 feet below the surface and moored to a Naval research vessel. There it served as a huge "vase" for a 40-foot kelp plant. The kelp was nourished by nutrient-rich water pumped up from a depth of 1,000 feet. Wheeler J. North, professor of environmental science, said that on this diet, the growth rate of the kelp increased from the normal 4.5 percent a day to 7 percent a day. Water at the 1,000 foot-level is about 30 times more abundant in nitrates than shallow water. The experiment will be repeated at least twice. It is part of a U. S. Navy program initiated to develop uses for kelp plants which grow as much as two feet a day and reach lengths of 200 feet. Kelp may prove to be invaluable as a source of food and energy if it can be grown in sufficient quantities in the open ocean. The cone is 30 feet long by 15 feet across the top and two feet in diameter across its smallest end. Water was pumped up at the rate of about 200 gallons per minute through a 10-inch pipe attached to its base.



Dennis C. Stanfill

Stanfill elected to Board of Trustees

Dennis C. Stanfill, chairman of the board and chief executive officer of the Twentieth Century-Fox Film Corporation, has been elected a member of the Caltech Board of Trustees, according to R. Stanton Avery, chairman of the board.

A top executive at Fox since 1969, Stanfill joined the film company as executive vice president, finance, and two years later was named president, board chairman, and chief executive officer. He came to Fox from the Times Mirror Company, where he was vice president for finance. From 1959 to 1965, he was a corporate finance specialist with Lehman Brothers, New York investment bankers.

Born in Centerville, Tennessee, Stanfill graduated from the U.S. Naval Academy at Annapolis in 1949 and received a master's degree in economics in 1953 from Oxford University where he was a Rhodes Scholar. From 1949 to 1959 he served as a commissioned officer in the U.S. Navy. His last position was in the politico-military policy division of the Office of the Chief of Naval Operations.

Active in southern California community affairs, Stanfill is a trustee and treasurer of public television station KCET, as well as a trustee of other philanthropic organizations. His wife, Therese, is vice president of the Blue Ribbon 400, an Otis Art Associate, a director of the UCLA Art Council, and a member of the Board of Directors of the Center Theatre Group.

The Stanfills have three children and live in San Marino.



The Associates honored 44 new members at a dinner and reception in the Athenaeum during March. James F. Bonner, professor of biology, spoke on "The Biologist's View of Life." Above, Caltech President Emeritus Lee A. DuBridge, right, greets two new Associates: S. Mark Taper, left, and William H. Corcoran, BS '41, MS '42, PhD '48, vice president for Institute relations and professor of chemical engineering, center.



New Associates' members Mr. and Mrs. William Lang, left, are greeted by Mr. and Mrs. Howard Smits, center, and Mr. and Mrs. Joseph B. Earl. Smits is president of The Associates; Earl is first vice president. About 200 guests attended the dinner honoring new members and their sponsors.

Alumni to hear Seamans describe "Energy Realities"

Alumni who attend Seminar Day will hear a talk on "Energy Realities for Tomorrow" by Robert C. Seamans, Jr., administrator for the U.S. Energy Research and Development Administration, Washington, D.C. Seamans will address the Alumni Seminar Day general session at 2 p.m. in Beckman Auditorium on Saturday, May 15.

During the morning and after Seamans' talk, alumni and their guests will hear about some of Caltech's newest developments in research and education from 12 outstanding faculty speakers. These talks are previewed on page 3. Registration will begin at 8:30 a.m. in Dabney Lounge, and the first lectures will start at 9:30 a.m.

Luncheon will be served picnic style in the Athenaeum at 12:30 and at 1:15 p.m., with the Caltech Dixieland Band providing background music. Members of the class of 1951, who are gathering for their 25th reunion, will have lunch in Dabney Gardens.

There will be a social hour for alumni in the Athenaeum at 5:30 p.m., followed by dinner at 6:30 p.m. with members of the Caltech Glee Club as guests. After dinner, alumni will have the opportunity to hear the annual home concert of the Men's and Women's Glee Clubs, to be held at 8 p.m. in Beckman Auditorium. The concert will feature a program of all-American music including a folk opera, "The Lowland Sea."

High school age sons and daughters of alumni who are interested in applying for admission to Caltech will be offered campus tours at 12:30 p.m., and conferences with members of the

Admissions Office staff at 4:15 p.m. Thomas Laboratory of Engineering will be open so that alumni can view the centrifuge on the roof, and see a pictorial display that traces the evolution of the centrifuge from its earliest role in medicine to its modern-day use in testing earth dams.

IA conferences open to alumni

Two Industrial Associates Conferences — on Government Regulatory Agencies and Metal Complexes in Catalysis and Synthesis — are being offered during May and are open to alumni. Information is available through the IA office.

Roger G. Noll, professor of economics, is the organizer for a conference on "Government Regulatory Agencies" on May 6 and 7. This meeting will feature the most recent findings on the economic impact of existing and proposed regulatory policies. It will bring together research scholars from universities and industries to discuss the possible consequences of new policy changes.

Harry B. Gray, William R. Kenan, Jr. Professor of Chemistry, and Robert G. Bergman, professor of chemistry, are in charge of a conference on May 18-19 on "Metal Complexes in Catalysis and Synthesis." Research leaders will discuss the newest and most efficient processes for converting chemicals in nature to useful synthetic materials.

Associates to celebrate their 50th anniversary

It was 50 years ago this spring that 100 of southern California's leading civic and industrial leaders met in the home of Henry E. Huntington — now the famed Huntington Art Gallery — to form The Associates of the California Institute of Technology.

In the years since then the group has become a model for other support groups across the country and one of the most distinguished organizations of its kind in the nation. And its members have become a major force in transforming the Institute into one of the world's leading scientific centers.

On May 3, present-day members will gather at the Athenaeum — built in 1930 to serve as the "hearthstone"

of The Associates — for a festive black-tie dinner to celebrate their 50th anniversary. Dinner at 7:30 p.m. will follow a 6:30 cocktail hour.

After dinner, Howard G. Smits, president of The Associates, will introduce President Harold Brown who will speak to the guests. Then the program will shift to Lee A. DuBridge, Caltech president emeritus, and Harry B. Gray, William R. Kenan, Jr. Professor of Chemistry, for a warm, anecdote-filled dialogue about the people and events that have helped to make Caltech such an exciting place during the years since that founding meeting. The Caltech Glee Club will sing before the program.

Classes plan 5-year reunions in May, June

Classes that graduated from the Institute in 1951 and at other five-year intervals stretching back over the past 50 years will hold their reunions in May and June.

The class of 1926 will hold its 50th anniversary reunion on Friday, June 4, in the Huntington-Sheraton Hotel, where members will be inducted into the Half-Century Club. Spouses and guests are also invited.

Donald P. MacFarland, BS '26, and Theodore C. Coleman, BS '26, are helping the Alumni Association with arrangements for the reunion, which will include campus tours from the Athenaeum at 4 p.m. and a buffet dinner at 5:30 p.m. at the Colemans' home.

Members of the class of 1951 will hold their reunion on the weekend of Seminar Day, May 14-15. Their activities are featured in a separate story.

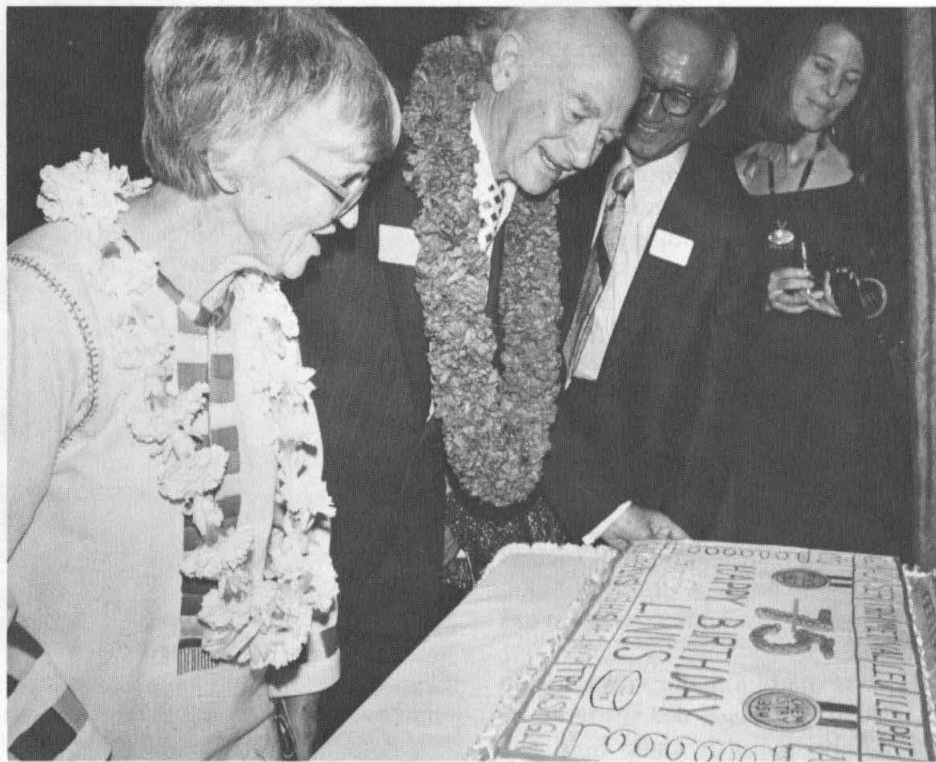
The remaining classes will hold their reunions in the Athenaeum on

June 4, 5, and 12. Those on June 4 include the class of 1931, arranged by Edwin F. Green, BS '31, MS '32; the class of 1956, arranged by Charles A. Bodeen, BS '56, MS '59, Eng '61; and the class of 1971, arranged by Donald L. Smith, BS '71, MS '72.

Reunions on June 5 include the class of 1936, arranged by Holley B. Dickinson, BS '36, MS '37; and the class of 1946, arranged by Edward "Ted" G. Neale, Jr., BS '46.

Reunions to be held on June 12 include the class of 1941, arranged by Joseph W. Lewis, BS '41; the class of 1961, arranged by Charles A. Ray, BS '61; and the class of 1966, whose arrangements chairman is still to be named.

All of these reunions will include campus tours beginning at 4 p.m., cocktail hours at 5:30 p.m. in the Athenaeum courtyard, and dinners in separate dining rooms at the Athenaeum at 6:30 p.m. After its reunion, the class of 1956 will dance at Emiliano's cantina in Pasadena.



More than 250 colleagues, former students, and family friends gathered at the Athenaeum in February to wish Nobel laureate Linus Pauling, PhD '25, professor of chemistry, emeritus, a happy 75th birthday. Mrs. J. Holmes Sturdivant, widow of the late executive officer for the chemistry division, personally supervised the decoration of a huge birthday cake. Admiring the creation, from left, are Mrs. Pauling, Pauling, Harvey A. Itano, PhD '50, who worked under Pauling as a graduate student; and the Paulings' daughter, Mrs. Barclay Kamb. Max Delbrück presented Pauling a bound volume containing hundreds of letters and greetings from well-wishers. An added gift — in recognition of his work in nutrition — was a pillow in the shape of a Vitamin E capsule. The gift complements a pillow shaped like a Vitamin C capsule on the sofa at Pauling's ranch.

Speakers for Seminar Day announced

Can the United States Achieve Energy Independence?

BY HARRISON S. BROWN
PROFESSOR OF GEOCHEMISTRY AND OF
SCIENCE AND GOVERNMENT

The United States has become increasingly dependent upon imported petroleum for its energy — an extremely vulnerable situation in a world fraught with grave political and economic uncertainties. When endowed with such vast resources of coal, oil shale, sunlight, and uranium, why does the U.S. rely increasingly upon imports of crude oil? How can this trend be reversed?

Molecular Archeology: Protein Folding and the Evolution of Bacterial Metabolism

BY RICHARD E. DICKERSON
PROFESSOR OF PHYSICAL CHEMISTRY

Evolutionary relationships between living organisms can be uncovered by comparing protein molecules, as well as by more conventional means. One essential protein, cytochrome *c*, shows the same folding pattern in all higher organisms from mammals to insects to green plants. An ancestor of this molecule is found in photosynthetic bacteria. Molecular structure comparisons suggest that respiring, or O₂-using, life evolved from these bacteria by the loss of photosynthetic abilities.

Indian Independence: The Army that Wasn't There

PETER W. FAY
PROFESSOR OF HISTORY

India won independence not by fighting but by turning the other cheek. No Bunker Hill for her, we say — and credit Gandhi. But if a rival had had his way and World War II had gone differently, India might have had a Bunker Hill and a Yorktown too. The instrument was the Indian National Army. Japan played France's part. How the venture failed — and yet succeeded — is the subject of reminiscences by two INA veterans.

Weather on the Planets: A New Look at the Earth

BY ANDREW P. INGERSOLL
ASSOCIATE PROFESSOR OF
PLANETARY SCIENCE

The best way to understand extreme climate changes on Earth may be to study other planets. Mars is now a frozen desert, but water once flowed there. Venus is a searing hothouse whose atmosphere rotates fifty times faster than the planet. Beneath Jupiter's cold upper clouds, there is a warm, humid layer that resembles the earth's tropics. Understanding these phenomena may help guide us during humanity's inadvertent climate modification experiments in the decades ahead.

Duet for Two Electric Organs

BY HENRY A. LESTER
ASSISTANT PROFESSOR OF BIOLOGY

Darwin, who was puzzled because he could not explain the natural history of the electric eel, would be delighted to learn how evolution has engineered the eel and its low-voltage relatives. For instance, two electric fish whose signals interfere with each other can detect and circumvent the "jam." A courting pair, however, plays an electronic duet.

Faced with complex electrosensory information, electric fish have evolved cerebellar neuronal circuitry rivaling that of mammals. And, like bags of salt water in a river of distilled water, these fish convince electricity to flow where it shouldn't.

The Marine Food and Energy Farm

BY WHEELER J. NORTH
PROFESSOR OF
ENVIRONMENTAL SCIENCE

The open sea, sterile near the surface, is rich in nutrients at depths too great for photosynthesis. Long, vertical floating pipes with check valves may use wave motion to pump nutrients up to tethered plants. Thus, kelp captures solar energy which bacteria can release as methane or as animal fodder.

Influencing Committee Decisions

BY CHARLES R. PLOTT
PROFESSOR OF ECONOMICS

Procedures used by committees and groups influence decisions in unexpected and sometimes perverse ways. Within wide limits, some aspects of procedure — such as the form of the agenda — actually dictate a group's decisions. These influences can be studied experimentally, mathematically modeled, and explained in terms of economic and political principles.

Soil and Rock Studies in a Centrifuge

BY RONALD F. SCOTT
PROFESSOR OF CIVIL ENGINEERING

Soil or rock structures that support buildings or form dams encompass millions of cubic meters. Full instrumentation to measure response to earthquakes is essentially impossible; failure mechanisms are conjectural. Since soil and rock properties depend on weight of overburden, the behavior of 1/100 scale is incorrect — unless placed in a centrifuge that "multiplies gravity" by 100. In geographic studies, the use of weaker "synthetic rocks" permits even greater scaling, bringing 5-kilometer fault blocks to 0.5-meter dimensions.

Spacecraft Experiments to Test General Relativity

BY KIP S. THORNE
PROFESSOR OF THEORETICAL PHYSICS

Preliminary plans will be presented for several new relativity experiments that make use of spacecraft and space technology. One experiment would search for gravitational waves from supermassive black holes in the nuclei of quasars and galaxies. Another would try to detect magnetic-type gravitational fields by measuring to high precision the gravitational attraction between spinning bodies. The Soviet-American collaboration that led to these ideas for new experiments will be described.

When a Gem Is a Colorful Gyp

BY GEORGE R. ROSSMAN
ASSISTANT PROFESSOR OF
MINERALOGY

The variation of color in minerals makes the difference between a valuable gem and a worthless stone. If we understand the processes used to change the color of gems artificially, that understanding can be used to detect such alteration or enhancement. Rossman will present examples of natural and unnatural coloration in minerals, and show some of the pitfalls associated with certain artificially colored gemstones.

Some Implications of Genetic Engineering

BY ROBERT L. SINSHEIMER
PROFESSOR OF BIOPHYSICS

Recent advances in biology have brought genetic engineering — on the level of microorganisms — to imminent reality. Sinsheimer will offer his views on this controversial area as he discusses the science and technology involved. Benign, malignant, and innocently cataclysmic consequences are readily visualized. Is the right of free scientific inquiry an absolute one? Perhaps science is too potent.

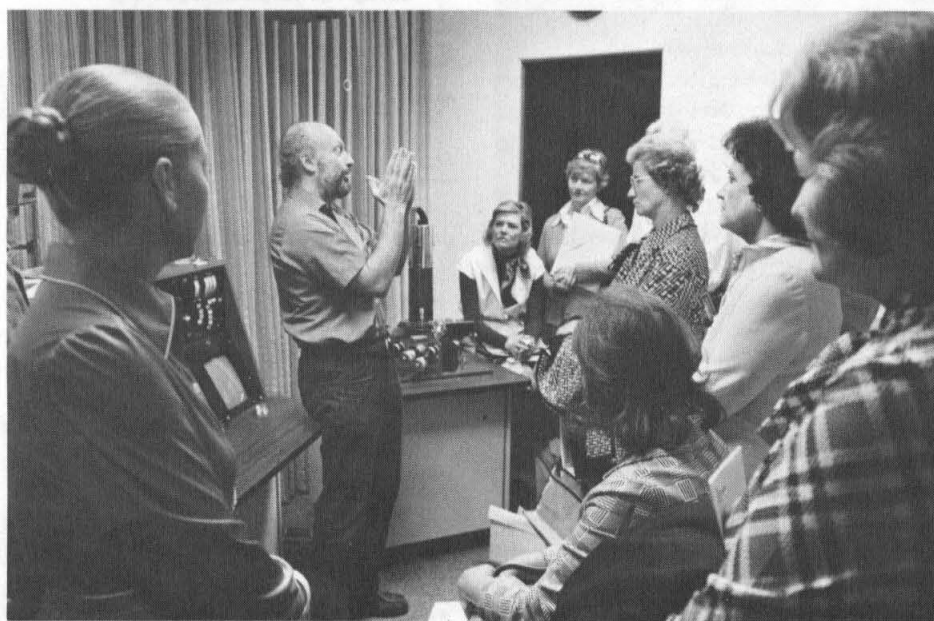
EQL advises Imperial County on geothermal development

Caltech's Environmental Quality Laboratory is helping Imperial County decide how best to develop its potential for producing electric power from subterranean steam and hot water.

Located in the southeast corner of California, this county has substantial geothermal resources and wishes to use them without disturbing the rich agricultural and recreational areas of the region. So the Imperial County Board of Supervisors has contracted with EQL and UC Riverside to study the problem and present the board with recommendations. The research is funded by the National Science Foundation.

Martin Goldsmith, deputy director of EQL and Caltech associate in environmental engineering, said the studies will provide information for regions with underground steam and hot water deposits in other areas of California and in Oregon, Montana, and Idaho. EQL will investigate the engineering, political, and legal problems involved in developing geothermal energy, and UC Riverside will assess the geological, environmental, and economic impacts.

Imperial County has several geothermal fields — a large one at the southeast edge of the Salton Sea, one at Heber, one near Brawley, and one at East Mesa — all from an underground reservoir thought to be built up by overflows from the Colorado River and drainage from a wide area.



A demonstration of electron microscopy in the laboratory of Jean-Paul Revel, professor of biology, above, was just one of the features of a tour of the Caltech campus by the Northern California Chapter of ARCS (Achievement Rewards for College Scientists). Mrs. Harold Brown, who accompanied the group on the tour, is in the foreground at left. The ARCS also visited the laboratory of Seymour Benzer, James G. Boswell Professor of Neuroscience, and heard a talk by Robert L. Sinsheimer, professor of biophysics, on genetic engineering. Members combined their afternoon on campus with a morning field trip to the California Museum of Science and Industry. Mrs. Joseph W. Cochran III is the chapter president.

Tschoegl given U.S. Senior Scientist Award

Nicholas W. Tschoegl, professor of chemical engineering at Caltech and widely known for his work on the properties of rubber and rubberlike materials, has received a Senior U.S. Scientist Award from West Germany's Alexander von Humboldt Foundation.

The award program, established in 1972 to commemorate America's Marshall Plan, honors highly qualified scientists whose work has earned them an international reputation.

Tschoegl will spend six months at the Johannes Gutenberg University in Mainz, conducting research on the properties of elastomers.

Class of 1951 completes plans for gala reunion

Plans have been completed by the class of 1951 for its giant 25th reunion weekend on May 14-15, according to John R. Fee, BS '51, class secretary, and Earl C. Hefner, BS '51, reunion publicity chairman. These events are planned:

Friday, May 14: 4 p.m., campus tours from the Athenaeum; 5:30 p.m., "Welcome Back" cocktail party in the Athenaeum patio. Artifacts from the 1951 era will be displayed, including photographs and copies of the *California Tech* and *Big T*; 7 p.m., dinner in the Athenaeum dining room, with a program of slides, awards, and reminiscences, plus dancing to the music of Tommy Vig.

Saturday, May 15: All-day Alumni Seminar Day events; 12:30 p.m., class luncheon in Dabney Gardens, including a keg of beer and soft drinks; 5 p.m., cocktail party in Millikan Board Room with faculty members as guests.

A questionnaire has been mailed to class members so that profiles of those attending the reunion festivities can be prepared. Out-of-town visitors can make overnight reservations at the Athenaeum or the Huntington-Sheraton Hotel through the Alumni Office, according to Fee.

"We're looking forward to the biggest and best of class reunions, thanks to the hard work of our many committee members and the help of the

Alumni Office," Fee said. "We think our reunion weekend offers a grand chance for 1951 class members to renew acquaintanceships, become reacquainted with the campus, and have a great time.

"Our theme, 'Even Nostalgia Isn't What It Used to Be,' will set the stage for two days that will be memorable for all of us."

Marshall Hall elected an AAAS Fellow

Marshall Hall, Jr., IBM Professor of Mathematics at Caltech, has been elected a Fellow of the American Association for the Advancement of Science. The fellowship was given for "his extremely fundamental contributions to combinatorial theory and to group theory."

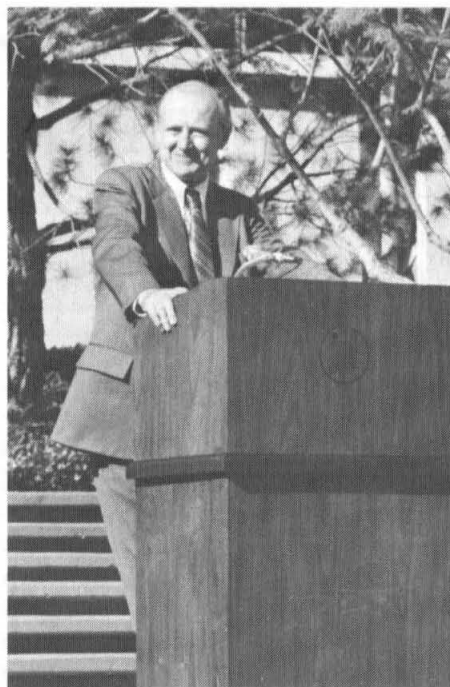
Hall is considered one of the world's outstanding research mathematicians and a founding father of modern mathematics. He has received many distinguished fellowships and awards, including a Guggenheim Fellowship in 1971 and the Wilbur Lucius Cross Medal in 1973, which is given to Yale graduates who have achieved excellence in one of several fields.



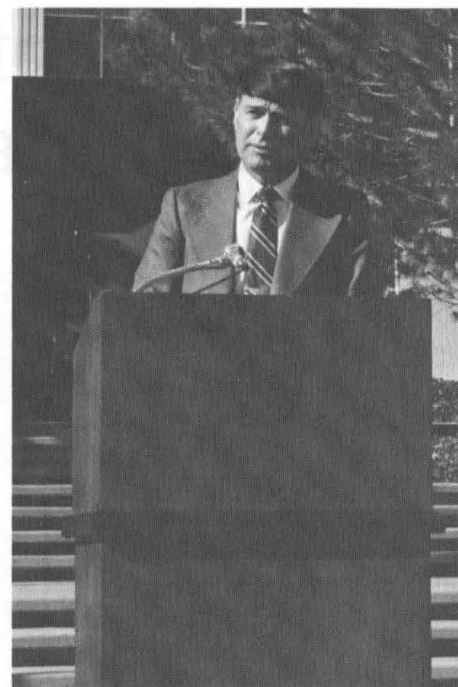
Of the fraternities that were part of Caltech student life until 1932, only the Gnomes continue to initiate new members. Thus Caltech's oldest social organization continues as a vigorous group of alumni devoted to the Institute's welfare. Four of the new members initiated this year join with the oldest member, Elmer E. Frey, BS '07, in the photograph above. From left they are: John P. Huchra, Caltech graduate student in astronomy; Marie Beall, BS '75, a UCLA medical student; Frey; Louise Kirkbride, BS '75, a Caltech graduate student in electrical engineering; and Daniel B. Diner, MS '73, a Caltech graduate student in engineering science. More than 100 Gnomes attended the Founder's Day Dinner in the Athenaeum, where President Oliver H. Gardner, BS '51, passed the gavel on to incoming President Fred A. Wheeler, BS '29. Science fiction writer Ray Bradbury spoke to the members and read excerpts from his work.



Charles F. Thomas, BS '35, national chairman of the 1975-76 Alumni Fund, places the first call in the Fund's annual telephone program to contact Caltech graduates throughout the country. Offering him advice — perhaps more than he needs — are, from left, Charles H. McDougall, Jr., BS '47; Reuben B. Moulton, BS '47; and Philip M. Neches, BS '73. McDougall, an executive with Sears Roebuck and Company, has made the Sears telephone system available to the Alumni Fund organization for the past three years for nationwide calls to alumni. Both Moulton and Neches are members of the Alumni Fund Council. More than 100 alumni volunteers are calling other Caltech graduates during April and May, seeking gift support through the Fund for the Institute.



A pioneering leader in the exploration of space, Bruce C. Murray, Caltech professor of planetary science, became the director of Caltech's Jet Propulsion Laboratory on April 1. It had been announced last June that he would succeed William H. Pickering, BS '32, MS '33, PhD '36, who is retiring after 21 years as JPL director. Pickering continues at Caltech as a professor of electrical engineering. The formal transfer took place in a brief ceremony on March 31 with President Harold Brown presiding. In the picture above, Pickering is at left and Murray is at right, during the transfer ceremonies.



Way to study gravitational waves found by physicists

Gravitational waves caused by the explosion of a supernova can measure 200 miles or more from crest to crest. And these waves are puny compared to the length of the waves created by more powerful explosions in the heavens. For example, an explosion in the nucleus of a quasar or galaxy can make waves 6,000,000 miles or more in length.

These great waves, predicted by Einstein, have always proved to be elusive, but now two physicists have developed a process for detecting and studying them.

Kip S. Thorne, Caltech professor of theoretical physics, and Vladimir B. Braginsky, a professor at Moscow State University, describe the new technique in the current issue of *Astrophysical Journal*. This method involves the use of the radio signals by which interplanetary spacecraft are tracked. It also requires the use of some extremely accurate clocks that

are still being developed and probably will not be ready for another five years.

According to Thorne, physicists are less interested in the actual discovery of gravitational waves (which they know are there) than in learning how to use them for astronomical purposes. "Once you've found them," he says, "you can use them to tell you what's going on in the universe."

The gravitational waves could become the ultimate means of finding out what happens deep in the interiors of stars and star clusters, in the cores of galaxies and quasars, and even in black holes.

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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Photographer: Floyd Clark.

Carroll honored for engineering achievements

William J. Carroll, BS '48, MS '49, president of the Caltech Alumni Association, has received an Outstanding Engineer Merit Award from the Institute for the Advancement of Engineering. The award was presented for outstanding achievements and contributions to his profession on the basis of past engineering projects, awards and recognition for technical accomplishment, contributions to professional and civic activities, and professional standing.

Carroll has been with James M. Montgomery Consulting Engineers Inc. since 1951, and has been its president since 1969. Under his management, JMM has become one of the leading environmental engineering firms in the United States with nine branches throughout this country and overseas. JMM has been responsible for many improvements and innovations in the treatment of water and wastewater.