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CALTECH NEWS

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Kanamori: to predict quakes, use several tests

Just as various tests may be necessary before a sound medical verdict can be reached, so will earthquake prediction be more accurate when seismologists base their forecasts on several factors, says Hiroo Kanamori, Caltech professor of geophysics.

Today, the widely accepted method for forecasting earthquakes is by means of the dilatancy method whereby seismometers register minute changes in the velocity of seismic waves. The dilatancy theory holds that prior to an earthquake, strain in the rocks builds up and causes tiny cracks to appear, and these reduce the speed of the seismic waves that pass through them from far-off quakes or explosions.

Then the cracks, which weaken the rocks, fill up with water or close, and the seismic wave velocity returns to normal. The return to normal is a warning signal that an earthquake is about to occur. The longer the period of slow waves, and the larger the area they cover, the larger the quake is likely to be.

The dilatancy approach to prediction has proved fairly successful on several occasions. But in view of a 5.2 earthquake that occurred last June in the Mojave Desert without the least forewarning, Kanamori and his coworker, visiting research associate Gary Fuis of the U.S. Geological Survey, have recommended the adoption of a multiple approach.

Kanamori recommends that magnetic, seismic, and ground water changes, as well as strain and gravity, should be noted in prediction — in addition to the measurement of seismic wave velocity. He says that before dilatancy can be adopted as useful in predicting earthquakes, these questions need to be answered:

Does change in velocity precede *all* types of quakes? What relation does the size of the anomalous area bear to the dimension of the source? And is there a universal relationship between the time when the nontypical waves are detected and the magnitude of the quake?

Many different effects that precede a quake should be studied before an earthquake prediction, Kanamori believes.

The area in which the undetected quake was centered — California's Mojave Desert, 37 miles southeast of Barstow — was being carefully monitored by the local 10-station Caltech-USGS network at the time, but no evidence of the quake showed up on the seismographs. On the contrary, a small, 1-percent increase in wave speeds had been recorded in the area for a year before the quake. Only immediately before the shock was a very small decrease observed.

Before an audience of Caltech students, Hiroo Kanamori discusses seismological research.

Kowal finds new asteroid 2 miles wide

A belated Christmas gift rewarded the efforts of Charles Kowal, associate scientist at Caltech and an observer at the Hale Observatories. On December 26, with the 18-inch Schmidt telescope at Palomar Observatory, Kowal photographed an asteroid that spends its time wandering between the Earth and Mars. A rock less than a mile in diameter, the asteroid travels to within two million miles of the Earth and flashes by it at 35,000 miles an hour.

The newly discovered object is within the size range of normal asteroids. Its orbit is inclined 32 degrees from the eliptic plane. It comes close to the earth once every three years. Kowal, whose work is supported by the National Science Foundation, suspects that there are more of these objects, as yet unobserved because of their small size and their speed.

Of 12th magnitude and far too faint for the human eye to see, the asteroid showed up as a short streak of light on a five-minute exposure. Its approximate position was determined from further exposures on six succeeding nights. Its nine-month orbit was calculated by Brian Marsden of the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts.

This latest find by 35-year-old Kowal comes close on the heels of two other significant discoveries that he has made — the 13th and 14th moons of the planet Jupiter.

Mid-year progress:

Alumni Fund receives $446,000 from 2,000 donors

The 1975-76 Alumni Fund had raised $446,000 as of the end of January — already surpassing the total amount raised during the entire 1974-75 fund year. This amount represents a dollar increase of 47 percent over the same date a year ago. In praising the results, Charles F. Thomas, BS '35, national fund chairman, urged volunteers to continue their hard work to maintain momentum throughout the remainder of the year.

The fund had received gifts or contributions from about 2,000 donors as of late January — an increase of 19 percent in contributors over the same date last year. During 1974-75 the fund raised a total of $435,000 from 3,375 donors. This year's goals are $475,000 from 3,600 donors.

"The enthusiasm and hard work of our area chairmen and workers, and an improved stock market, have contributed to this fine first-of-the-calendar year picture," Thomas said. "Our alumni are backing the fund in a marvelous way. Many of them have now formed the habit of supporting the fund regularly, and this pattern is reflected in our results.

"In addition to regular donors, this year's fund has attracted many new supporters. Approximately 10 percent of this year's contributors are participating for the first time.

"It appears that we are in a turnaround situation this year. During each of the past two years, there has been a decline in dollars but a healthy increase in donors. This year, we are seeing increases in both donor and dollar totals."

In praising area chairmen for their hard work, Thomas noted two who lead with the highest percentage of participation in their areas: Ulrich Merten, BS '51, Pittsburgh, with 41 percent; and Frederick H. Allardt, San Luis Obispo, BS '35, MS '37, with 28 percent.

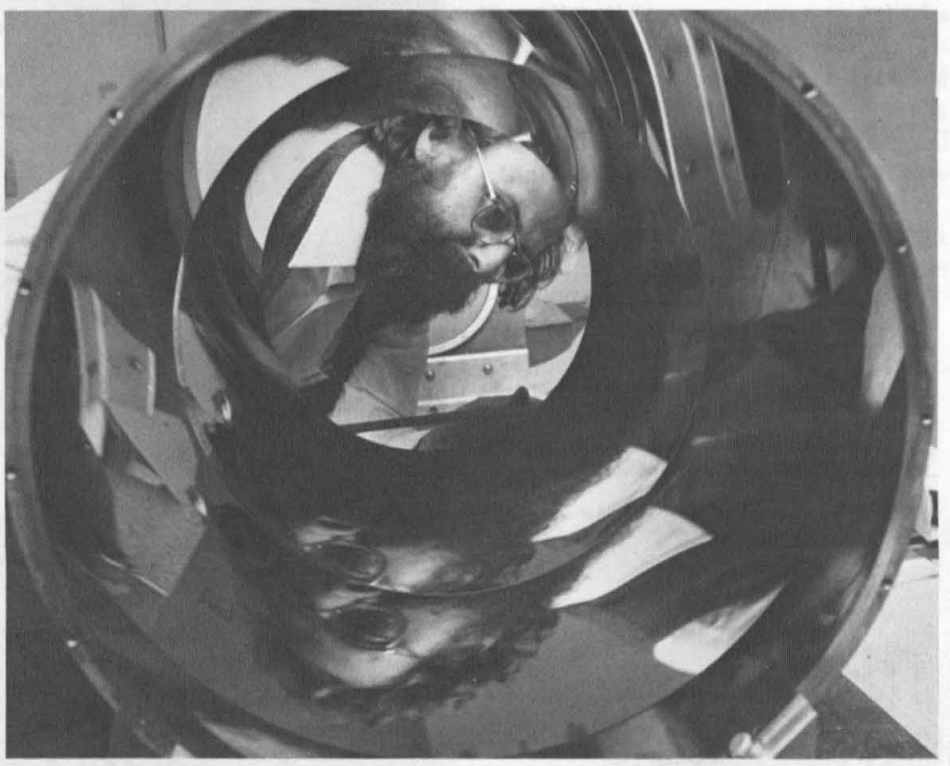
"We're pleased with the results thus far," Thomas stressed, "but we musn't slacken our efforts. We must continue to work hard throughout the year to meet both our donor and dollar goals before the books close on June 30. If we do continue our momentum, this will be the greatest year of alumni support since the current fund was initiated."

He said those alumni who have not yet contributed will continue to hear about the fund through personal contacts by volunteers, a series of mailings, and a nationwide telephoning effort during April and May. And he noted that alumni can provide a service through the fund in two ways: both by making a gift and by assisting as a volunteer. Persons interested in volunteering their time should contact their local area chairman or the fund office at the Institute, he said.

Benzer honored for microbial genetics work

Seymour Benzer, James G. Boswell Professor of Neuroscience at Caltech, is recipient of the T. Duckett Jones Memorial Award, presented at the 18th annual meeting of the Fellows of the Helen Hay Whitney Foundation. The award consists of a cash prize of $7,500 and a certificate.

Benzer was cited "for his contributions to microbial genetics and to the molecular and genetic approach to behavior."



Gordon P. Garmire, professor of physics, examines an X-ray telescope with the largest mirror of its kind. The mirror is being polished at Caltech. The X-ray telescope will be flown above the earth's atmosphere on a sounding rocket. There it will study binary X-ray stars and clusters of galaxies.

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 .....

.....

Premed students at Caltech

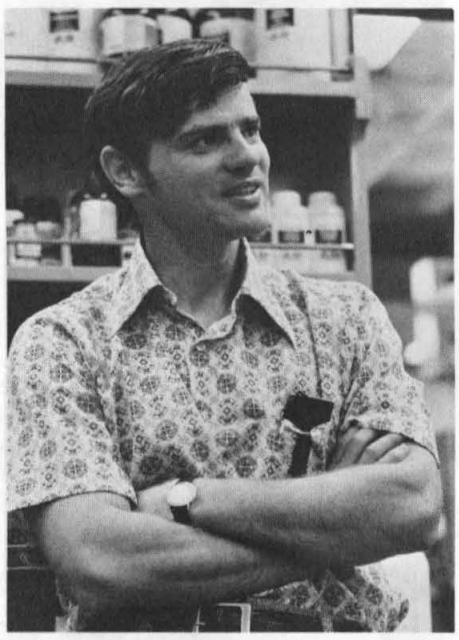
They're coached by a pro

Caltech has no premedical major and no special program for undergraduates who plan to enter medical school, but it does have a particularly well-qualified faculty member to advise those who are interested. Leroy Hood is a Caltech graduate (BS '60, PhD '67), who also received an MD degree at The Johns Hopkins University in 1964. Now a professor of biology at the Institute, he writes recommendations to medical schools for about 15 Caltech students a year — and about 80 percent of them gain admission. This is twice as good as the national average of 40 percent; there are 35,000 applicants for about 13,300 places.

Hood explains that such surging interest in the medical profession is due to two factors. First, the current generation of students is interested in people, interested in interacting with them and helping them. Second, the medical profession offers a wide range of options — clinical practice, basic research, hospital administration, academic medicine, for example.

One of the most valuable assets Hood brings to his role as premedical adviser to Caltech students is, of course, his own experience. But not far behind is the comprehensive brochure of advice that he has written for prospective premedical students and their parents. The 26-page "Guide for Premedical Students" is a distillation of what Hood has learned about medical school requirements, selection procedures, choosing medical schools, and an optimum schedule. The booklet is not only comprehensive, but also extremely practical because Hood collects and incorporates, in annual revisions, the adventures of last year's premedical students when they applied to medical schools.

Hood also has some general advice for students who are contemplating spending their premed years as undergraduates at Caltech. For example, anyone attending Caltech who intends to pursue medical research will receive a superb education for that career. But if the student's goal is simply to get an MD degree, there are much easier and safer routes to follow than attending Caltech. The Institute's orientation toward basic science may mean lower grades in



Leroy Hood

vital courses, which are a disadvantage in the student's intense competition for a place in medical school.

Hood also feels that communicating genuine motivation is all important in applying to medical school. And a student must show a uniqueness of some kind — a spark of something interesting and different — to impress an admissions committee.

About 30 or 40 students — or parents — read Hood's brochure every year. The students who then decide to take their premed studies at Caltech do so in a wide variety of courses — biology and chemistry, of course, but also engineering, physics, and mathematics. An increasing number who enroll at the Institute plan on med school from the beginning, but there are also students who decide after they are here that medicine has broader options than graduate school in physics, chemistry, or engineering.

Whoever they are and whatever they do at Caltech, in Hood, who made the transition himself, they have an adviser who has traveled every step of the way — and is genuinely eager to help them do it too, both wisely and well.

Annual wine tastings to be March 5, 12

All Caltech alumni and their friends are invited to the 12th annual Alumni Wine Tasting, March 5 and 12 in the Athenaeum. Tastings will again be held on two consecutive Friday nights because of the program's popularity.

Wineries to be featured include Burgess Cellars, Korbel Champagne Cellars, Parducci Wine Cellars, and Simi Winery.

Each program will begin at 8 p.m. with champagne tasting. Then a lecture will be given by wine authority Denny Caldwell at 8:30, followed by a wine tasting and cheese sampling. Cost for the evening is $4 per person.

According to the Alumni Association, a prompt response to invitations is important, because the wine tastings generally are sold out in advance. On their return cards, alumni should indicate their first and second choice of dates. Confirmations will be sent only to those who must be assigned their second choice.

Winding walkways, cascading streams, quiet pools and maturing greenery create a pastoral setting at the heart of the campus where Throop Hall once stood. The little parklike area was the concept of Caltech students who wanted an alternative to the broad concrete stairway that was originally planned.

The chemistry division

Strength through research diversity

The Division of Chemistry and Chemical Engineering incorporates diversity in both basic and applied work, and this is a source of great strength, Division Chairman John D. Baldeschwieler told those attending the Alumni Leadership Conference on campus in October.

"When we approach the outside world, we can make proposals that involve both basic and applied issues," he said. "This gives us a balanced portfolio."

As examples, he outlined work in the division ranging from the basic cancer research of Professors Norman R. Davidson and Jerome Vinograd, to applied research such as that in coal processing by William H. Corcoran, George R. Gavalas, and Frederick H. Shair, or in air quality by Sheldon K. Friedlander and John H. Seinfeld.

"Our span of activity is remarkable, and this has given us versatility and stability when national priorities and needs have changed," he said.

In emphasizing the importance of alumni giving, Baldeschwieler commented, "In my view, alumni gifts to Caltech provide the margin between survival and excellence, and excellence is our business.

"The critical point in determining the evolution of this division is the appointment of new faculty. This year we hope to make three new appointments: in chemical engineering, chemical biology, and chemical physics. The continuing excellence of our programs depends on these appointments, and they, in turn, are critically dependent upon the Institute's income."

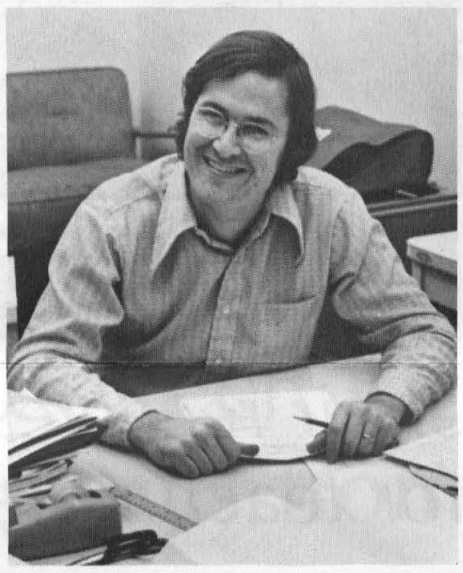
Baldeschwieler then outlined the research activities of several division members: Jesse L. Beauchamp, professor of chemistry; John E. Bercaw, assistant professor of chemistry; Richard E. Dickerson, professor of physical chemistry; David A. Evans, professor of chemistry; Michael A. Raftery, professor of chemical biology; and Robert M. Stroud, associate professor of chemistry.

Beauchamp has developed an ion cyclotron resonance spectrometer, a device that enables him to selectively inject energy into ions of certain masses in a magnetic field but not into ions of other masses, Baldeschwieler said. A marginal oscillator enables Beauchamp to detect which ions are absorbing energy.

"This year Beauchamp put uranium hexafluoride into the ICR spectrometer," Baldeschwieler said. "Uranium hexafluoride was the key to the success of the Manhattan Project, through its role in the isolation of uranium 235 from uranium 238.

"Now, Beauchamp can develop a plasma, put it into a magnetic field, apply radio-frequency electric fields, and separate the isotopes by doing selective ion chemistry on the uranium 235 isotope," Baldeschwieler said. "Potentially, this work is very important because better methods of isotope separation will play a critical role in meeting our energy needs."

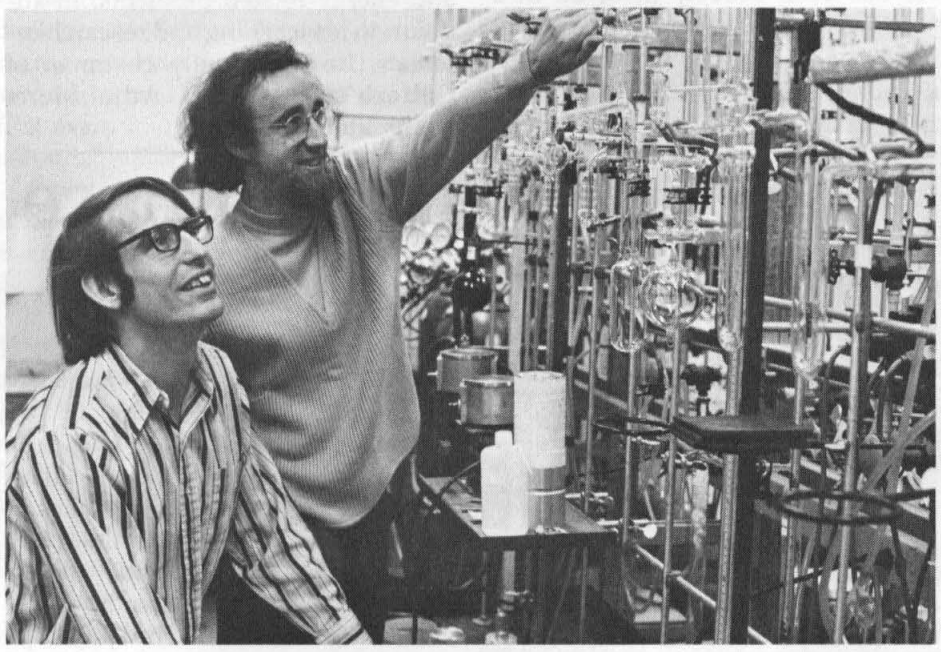
Moving to inorganic chemistry, Baldeschwieler described work of John Bercaw that may lead to more economical ways of meeting the world's demand for food and energy. Bercaw has created a synthetic molecule including either zirconium



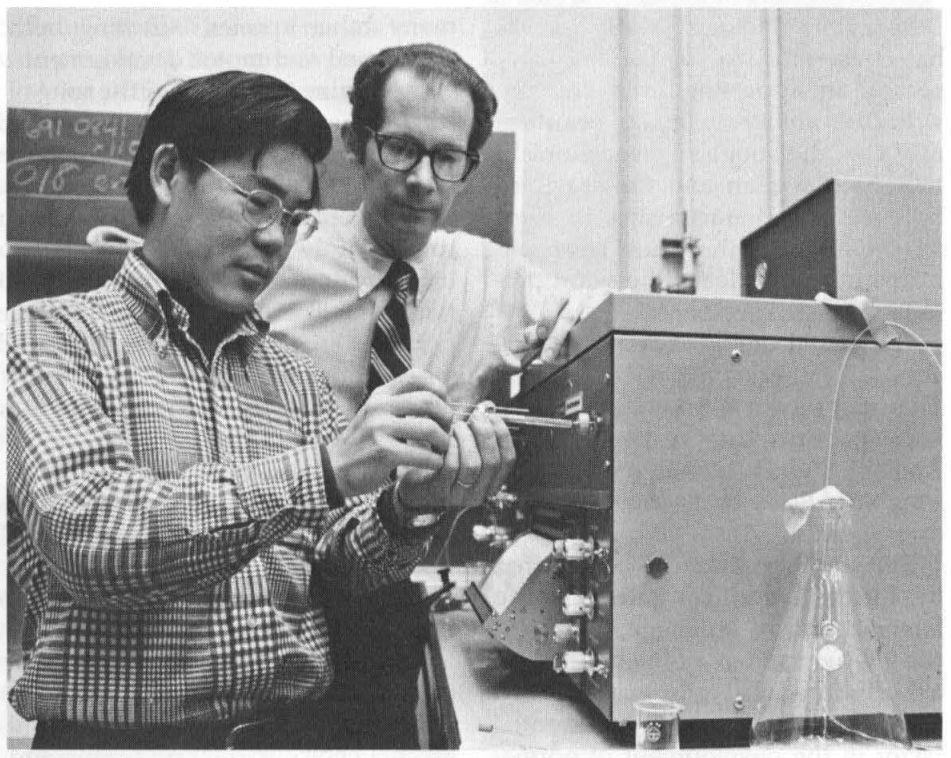
Jesse L. Beauchamp

or titanium; the molecule is a catalyst for converting nitrogen from the atmosphere into hydrazine.

"Molecular nitrogen normally is unreactive, but a few smart plants know how to convert it to useful nutrients through the process known as nitrogen fixation," Baldeschwieler explained. "Nitrogen fixation is one of the least-understood processes in nature, but it is a fundamental step in the whole process of nutrition, for it is in this way that plant protein is created. Plant protein in turn is metabolized by animals to form animal protein.



John E. Bercaw, left, and postdoctoral research fellow, Michael Duggan, monitor processes underway in the vacuum line used in Bercaw's nitrogen-fixation research. The vacuum line is used for manipulation of compounds employed in the conversion of nitrogen.



John D. Baldeschwieler, right, and postdoctoral research fellow Shen K. Yang, with the high-pressure liquid chromatograph used to separate the by-products of enzyme systems found in carcinogenic substances. Yang is now with the National Cancer Institute.

"An understanding of the chemistry of nitrogen fixation could lead to more economical production of fertilizers, and help to solve food and energy needs." But Baldeschwieler pointed out that the process is not yet economically practical because titanium and zirconium complexes are still difficult to synthesize.

Chemistry that may help us to gain insight into the evolutionary history of plants and animals is under way in Richard E. Dickerson's laboratory. For several years, Dickerson has been studying the structure of the protein, cytochrome *c*, an enzyme in forms of life ranging from primitive bacteria to modern animals, including man. Made up of a sequence of amino acids, cytochrome *c* is involved in electron transport in our respiratory systems. Its history is at least three billion years long. Through X-ray diffraction, Dickerson has obtained some of the first complete structures of the protein.

"The consistency of the structure of the enzyme in many different forms of life — from modern man to vegetables — is remarkable," Baldeschwieler said. "But Dickerson has been looking carefully at the consistencies in the structures as well as at the differences, for by doing so he is gaining insight into the entire evolutionary history of plants and animals. He can estimate when one species branched off from another, when living species changed from photosynthesis to respiration, and other critical points in evolutionary development.

"The duration of cytochrome *c* over billions of years reveals nature's wisdom in sticking with a winner. Despite the enormous diversity in plant and animal species, the basic molecules that make it all work have changed very little. Because of this consistency, a chemist can read the whole book of evolution backward and map it out."

Molecular architecture with important medical implications, being done by David A. Evans, was Baldeschwieler's next topic. A young faculty member whose research involves the synthesis of molecules with a high level of physiological activity, Evans has constructed a series of molecules called prostaglandins.

"These powerful molecules are the basis of current research concerning antifertility, the reduction of hypertension, and the treatment of ulcers," Baldeschwieler said. "Medically, Evans's work is very potent."

Baldeschwieler said Evans has learned how to construct three segments of the molecule and that he has developed the reagent that binds these large pieces together. In essence, he puts the molecule together in modules as one would build a prefabricated house.

In conclusion, Baldeschwieler showed alumni the first picture of the structure of a neuroreceptor. The model is the achievement of Robert Stroud, X-ray crystallographer and physical chemist, who used modern physical techniques including a rotating anode X-ray generator, electron microscopy, and optical diffraction.

The neuroreceptor was isolated by Michael Raftery from an electric ray, the *Torpedo Californica*. Highly important in the functioning of the nervous system, the neuroreceptor recognizes and binds a small molecule, acetylcholine. Its responsibility is to receive a chemical signal being relayed by the acetylcholine and to generate a signal that continues the information transfer.

"In my opinion, this is what a Nobel Prize looks like before it happens," Baldeschwieler concluded.

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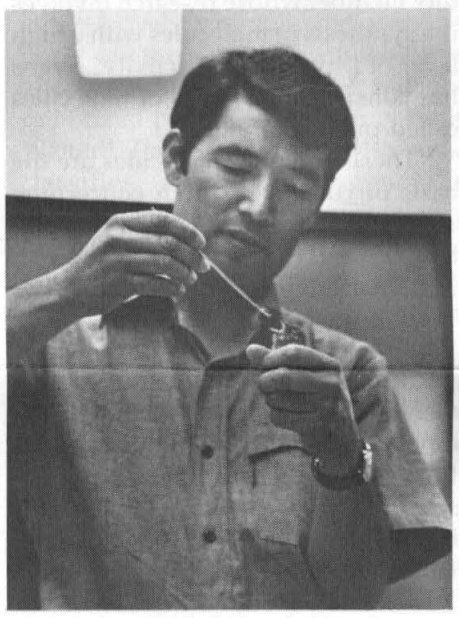
The songbird teaches man about vocal development

Behavioral biologist Mark Konishi has chosen for his companion in research an appealing little creature with the ability to make beautiful music — the songbird. And Konishi tells us that man and the songbird have several characteristics in common. One is that they must be able to hear in order to learn the vocal patterns of their species.

"Dogs and cats . . . even chimpanzees . . . inherit their vocal sounds. They can't learn sounds by imitating vocal patterns they've heard," said Konishi. "Only human beings and songbirds learn by listening to their own species."

Still another characteristic shared by humans and songbirds is the lateralization of language control in the left hemisphere of the brain. And a third shared trait is the existence of a critical learning period — an essential factor in the development of normal speech.

A professor of biology who joined the Caltech faculty in 1975, Konishi is one of six scientists in the world who



Mark Konishi with his research companion, the white-crowned sparrow.

are studying bird song. He has been conducting his research primarily with the white-crowned sparrow, a small brown bird about four inches long, plentiful along the California beaches. In addition, Konishi has used Oregon juncos, robins, black-headed grosbeaks, Australian zebra finches, and the lowly barnyard chicken in his vocal studies.

Konishi and his co-workers bring baby sparrows into the laboratory when they are about five days old and raise them in soundproof rooms. There the birds develop a type of song never produced by their species in their natural environment. But if, during their critical learning period, they hear a tape recording of their natural song, they learn to sing that song instead.

The period between the second and seventh weeks after birth is critical in song learning, Konishi explained. If a white-crowned sparrow does not hear its song during this time, the abnormal pattern that it has developed can't be corrected by later exposure to a normal one.

Similar crucial periods appear to exist for humans, during which the young are best able to learn the speech patterns of their own species — basic patterns that are inherent in all language structure. And these critical learning periods are prevalent in many other species, affecting both perceptual and motor development.

In learning to reproduce the song of its species through hearing, the white-crowned sparrow is different from birds like the ring dove and the chicken. Even if they are deafened immediately after hatching, these other birds develop normal vocalization. But like deaf humans, white-crowned sparrows that are deafened when young are unable to voice the "language" of their species in the proper way.

The white-crowned sparrow even has its own local song dialects that vary as one goes south from San Francisco to Los Angeles — dialects distinct enough for an expert like Konishi to detect the difference.

In isolation the young birds will copy their normal song if they hear it when they are young enough. And given a choice of their own song and that of another species, they'll learn their own and reject the other. By using a computer, Konishi is trying to discover how a young bird knows which song to choose.

"The sparrow must be recognizing its own species' song through acoustical cues," Konishi said. "I'm trying to discover these cues by systematically varying songs on the computer and playing them to the sparrows. Already I've created a computer song that's much, much simpler than the normal song of the white-crowned sparrow, a song that was copied by the birds.

"Our next stage will be to modify this song by eliminating some of its properties or adding new ones. Eventually we'll reach a point where the birds will refuse to learn the song because the essential cues have been changed. Then we can determine what these cues are."

Konishi said the songs are composed on computers through a special set of instructions that allow the scientists to produce any sound they want — even sounds that can't be produced by instruments.

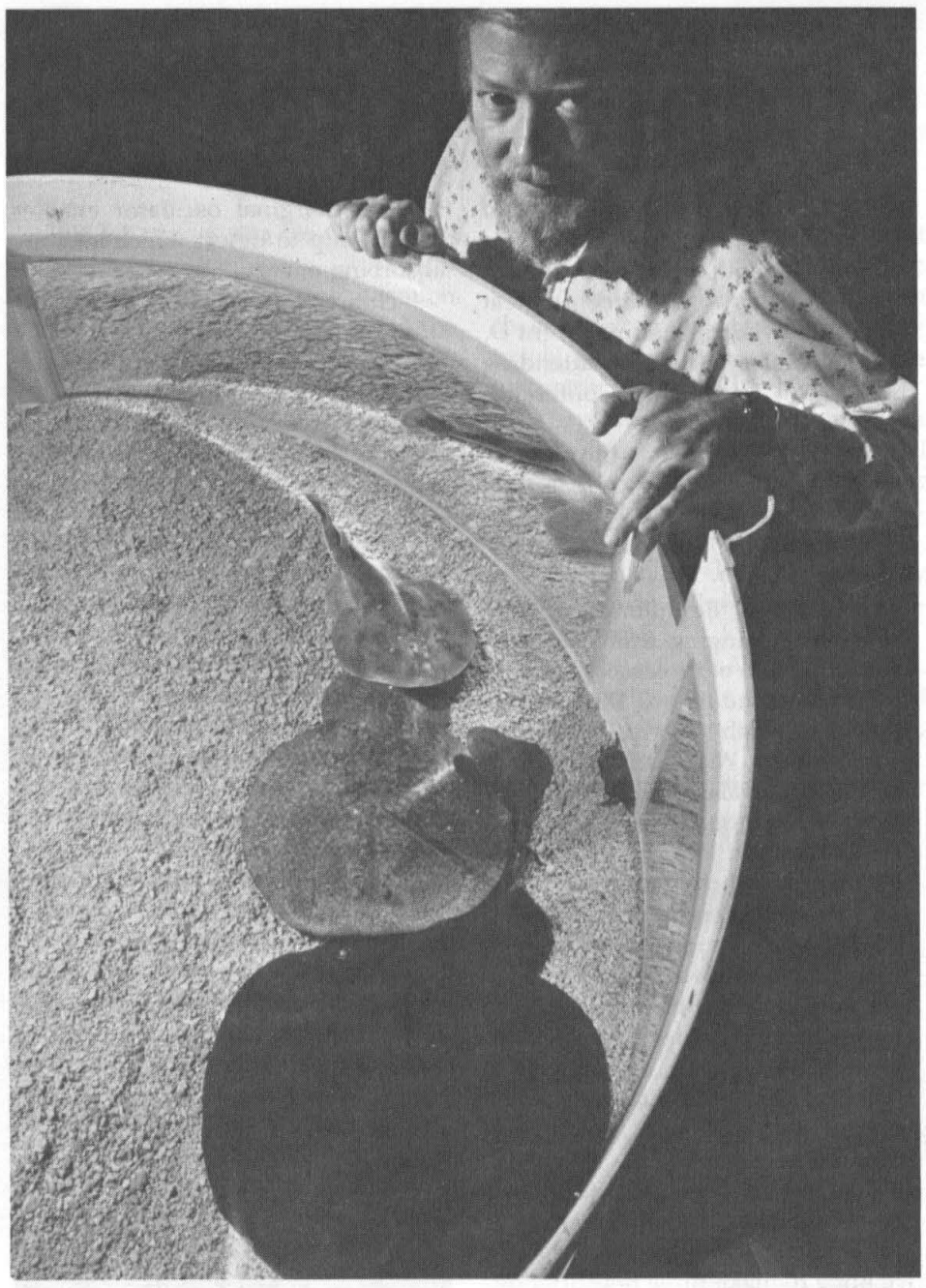
He believes the study of bird song is important because "it offers an excellent example of the way genetic and environmental factors interact in the development of behavior. And this interaction can be studied conveniently because it is easy to control a bird's auditory environment."

Songbirds use approximately 15 to 30 vocal signals in communicating with each other, Konishi explained. He said humans probably underestimate the complexity of communication among other animal species.

While collecting baby white-crowned sparrows on California beaches may be enjoyable work, caring for them in the lab is even more rigorously demanding than looking after a new-born child. "We must work as substitute parents, feeding them every 30 minutes from 6 a.m. to 8 p.m. when they're young. And some of them get up even earlier and stay up even later than that," Konishi noted.

The young sparrows eat an enviable diet of top-quality steak, eggs, wheat germ, and vitamins, combined in a blender. And like all babies, their appetites are hearty.

"We buy a lot of steak," Konishi said.



Fishing has never been better for M.A. Raftery, professor of chemical biology. In his ocean laboratory at Caltech are species of the Torpedo Californica from the Pacific Ocean, Torpedo Marmorata from the Mediterranean Sea, and Narcine Brasiliensis from the Gulf of Mexico. Raftery is using these electric rays in research concerning the functioning of the nervous system and the way the nerves transmit signals.

Shair receives award for teaching excellence

Fredrick H. Shair, associate professor of chemical engineering at Caltech, has been awarded a 1975 Western Electric Fund Award from the Pacific Southwest Section of the American Society for Engineering Education.

The $1,000 award is given annually for excellence in the instruction of engineering, and as an incentive for further teaching contributions.

A member of the Caltech faculty since 1965, Shair has built a reputation as an outstanding engineering educator as well as a fine researcher. He has been actively involved in a freshman course in chemical engineering, developed by William H. Corcoran and taught by Shair since 1969. In this course, students work on projects of interest to those inside and outside Caltech.

Some of these projects have involved the transport of urea across new membranes associated with artificial kidneys, reduction of ozone inside buildings in smoggy regions, the forced convective melting of subcooled icebergs, the reduction of emissions associated with internal combustion engines, and the dispersion of pollutants from power plants.

Shair's research interests are in plasma chemistry and in the development and application of tracers applied to a variety of environmental and energy-related problems. In addition to his teaching and research interests, he is currently chairman of Caltech's Freshman Admissions Committee.

Konrad awarded aerospace engineering fellowship

John Harrison Konrad, graduate student in aeronautics at Caltech, is the recipient of the Caltech/Pickering/Link Foundation Fellowship in Aerospace Engineering for 1975-76.

Konrad, whose nomination for the award was supported by retiring director of JPL William H. Pickering, BS '32, MS '33, PhD '36, is expected to complete his requirements for the PhD degree in 1976. His research involves experimental study of the mixing in turbulent shear layers.

The aeronautics faculty has appointed Konrad to be the organizer and leader of the Monday aeronautics seminar, Ae 150 — a role traditionally reserved for aeronautics' most mature student. He has been a leader in rejuvenating the Caltech student chapter of the American Institute of Aeronautics and Astronautics and has served as its president.

Six Nobel laureates among survivors of class to "weed out weaklings"

Among the recently announced winners of the 1975 Nobel Prizes was the sixth former student of William R. Smythe, Caltech professor emeritus of physics, to be so honored.

"This may be something of a record, I don't know," said the 82-year-old physicist, who taught at Caltech for 40 years and who still works in his office on campus every day. "At any rate, I'm glad to see the work of my former students recognized."

The latest one to win the coveted prize is L. James Rainwater, BS '39, physicist at Columbia University, who was honored for his nuclear model. Smythe's other Nobel Prize-winning students are: Charles H. Townes, PhD '39, now at UC Berkeley, in 1964, for developing the maser-laser principle; Donald A. Glaser, PhD '50, UC Berkeley, in 1960 for developing the bubble chamber; William Shockley, BS '32, Stanford University, in 1956, for work on semiconductors and the transistor effect.

Edwin McMillan, BS '28, MS '29, UC Berkeley, in 1951, for co-discovery of six radioactive elements; and Carl D. Anderson, BS '27, PhD '30, Caltech, in 1936, for discovery of the positron. All won the prize in physics except McMillan, who won it in chemistry.

The six prize-winning students all took Smythe's course in electricity and magnetism — one that he taught at Caltech for many years. It was designed to "weed out weaklings." This class and three others were especially planned to test analytical powers because too many Caltech graduate students who had transferred from other institutions were failing the oral examinations required for admission to candidacy for the PhD degree. Some seniors also enrolled in the class.

"We had to find a way to catch the weak students before they got so far in the system," Smythe noted. "It was a shame to have to flunk a fellow who'd been here for several years."

The courses succeeded admirably. "For years after we set them up, there were no failures on the PhD orals," Smythe observed.

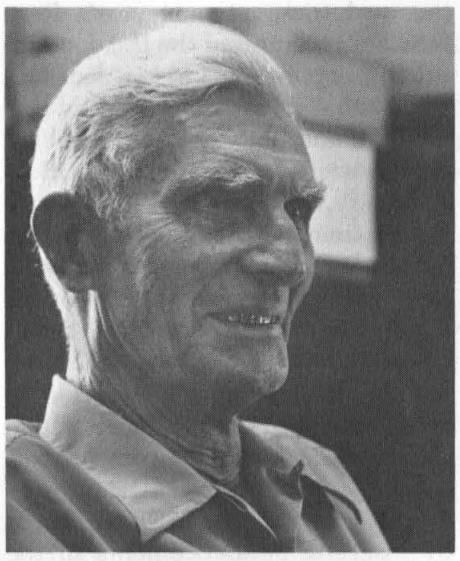
Of all his Nobel laureates, Smythe remembered Shockley as the most brilliant in his class. "He knocked my exams cold without working very hard," Smythe recalled, as he thumbed through his grade book for 1931-32. "He was the top man in my class in both the first and second terms. He made 100 on the first exam . . . dropped to 87 on the second."

Among the other laureates were some whom Smythe termed "good students but not exceptional . . . they didn't work very hard in my classes."

But the former student whom Smythe recalled as his all-time star achiever is George H. Trilling, BS '51, PhD '55, a non-Nobel laureate who is now professor of physics at UC Berkeley. Smythe pulled another grade book from his packet and displayed four perfect exam scores for Trilling with a final grade of A-plus.

Smythe recalled that another of those courses to "weed out weaklings" was taught by astrophysicist Fritz Zwicky, who was noted for devising exams in which it was almost impossible to achieve a perfect score. The Techers responded by creating a mythical student named Helmar Scieite, who turned in perfect papers written by graduate students — an episode that has become a famous bit of Caltech lore.

They tried the same stunt on Smythe but it didn't work.



William R. Smythe

"Zwicky seldom learned his students' names but I knew all of mine by the second week," Smythe observed. "When someone turned in a perfect paper on my first test, I thought it must have come from someone who wasn't coming to class any longer. Then one of my students told me what was going on, and he gave me regular reports on Zwicky's attempts to figure out which one of his students was producing the perfect papers."

Many of Smythe's other students have also built outstanding careers in science and technology. Among these are H. Guyford Stever, PhD '41, director of the National Science Foundation; James C. Fletcher, PhD '48, head of NASA; industrial leaders such as Arnold O. Beckman, PhD '28, Simon Ramo, PhD '36, Dean E. Wooldridge, PhD '36, and retiring director of JPL, William H. Pickering, BS '32, MS '33, PhD '36.

While Smythe has been working on a record for teaching the most Nobel Prize winners, his son, W.R. Smythe, professor of physics at the University of Colorado, may be setting a related record. Already he has taught the sons of two of the Nobel laureates who studied under his father — Anderson and Rainwater.

Smythe retired from teaching in 1964. To keep in shape for his current work on mathematical problems that may be useful in industry, he plays tennis and swims. In 1974 he was national AAU swim champion in the 100-yard freestyle for men over 80. He was the only contestant.

Smythe used to swim 1,000 yards a day, but he's slowed down a bit since a bout with pneumonia several months ago.

"I'm only swimming about 300 yards a day right now but I'll be back up to 500 yards before I settle down," he commented briskly.

Caltech receives two grants from Gulf Oil

Caltech has received two grants totaling $30,000 from the Gulf Oil Foundation. One grant, for $20,000, is for a research program conducted by James W. Mayer and Marc-A. Nicolet, professors of electrical engineering.

The other grant, for $10,000, will be used for new energy projects other than petroleum and nuclear energy.

"Caltech is most grateful for this continuing support from the Gulf Oil Foundation," said President Harold Brown. He added that the Institute particularly appreciates "the leeway allowed in the application of the $10,000 portion of the grant.

"Such flexibility gives us stability in our program of energy research and enables us to plan on a long-range basis and to take advantage of unexpected opportunities," he said. He noted that support from private enterprise is increasingly important.

The grants were presented by B.H. Gwynn, vice president and coordinator of the Gulf Oil Foundation in Pittsburgh, who said that they are part of the Gulf Aid to Education Program under which more than $3.2 million was distributed in 1975.

All wrapped up in his work, Roy W. Gould, professor of applied physics, gets the feel of a newly-constructed device, the tokamak, to be used for experiments concerning heating mechanisms in plasmas — work with applications for the production of energy through nuclear fusion. Coils of the tokamak are wound around a stainless steel vacuum chamber where the plasma heating takes place. These coils create the magnetic fields necessary to produce and confine the plasma.

Freshman Frank Mills demonstrates his technique for making handsome music.

Student has music well in hand

A student entertainer in the Freshman Camp talent show, Frank Mills of Costa Mesa won hands down as the most popular performer. He played the melody of "America the Beautiful" entirely with his hands.

Mills said he had mastered the art of making strange squeaks and squawks with his hands by the time he was nine. "Then I saw a guy on the Johnny Carson Show who made music with his hands, and I figured if he could do it, I could too," Mills explained. "Now, if I know the tune, I can play just about anything."

Although he can sometimes come close to perfect pitch, Mills said that his hands get out of tune if they become sweaty. To play a number, he clasps his hands and the music comes out between his first and second fingers. He varies the pitch by increasing the intensity of pressure on his palms, pressing harder to produce higher notes. A resident of Ricketts House, Mills plans to major in physics.

One listener commented that Mills's music sounded as if it were played on a comb; another, on a kazoo; and another, like nothing he'd ever heard before.

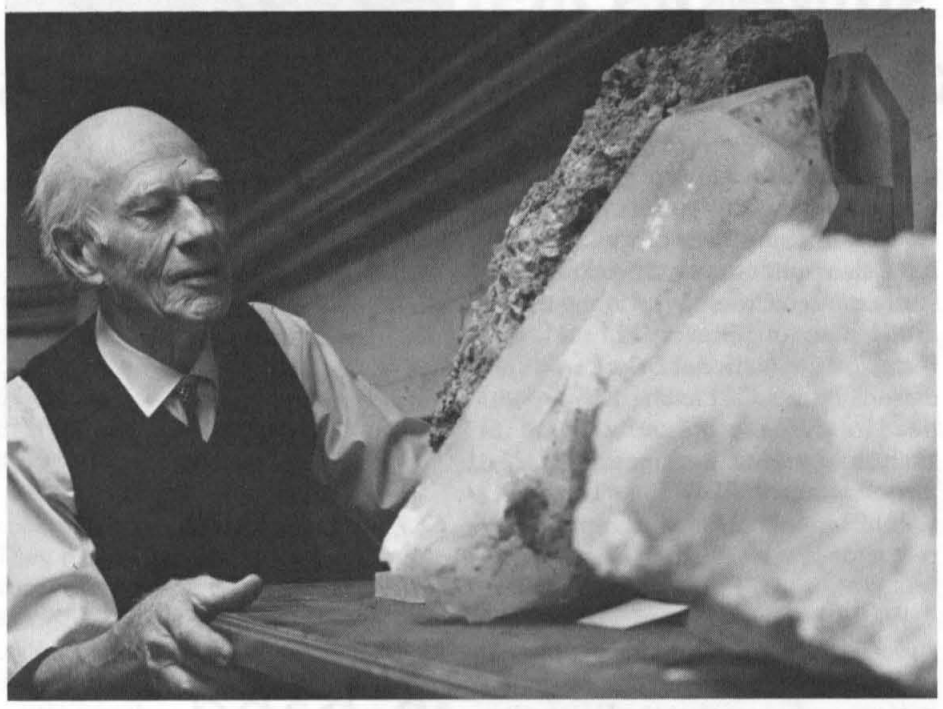
Although he has performed often for friends, Mills said the Freshman Camp appearance was his first before a large group. Because of the warm reception he was given, he played an encore: "He's Got the Whole World in His Hands."

Class of 1951 plans reunion dinner dance

A gala 25th class reunion is being planned for the evening of May 14, according to John R. Fee, BS '51, class spokesman.

"Dancing to the vibrant sounds of Tommy Vie's Band will follow a sumptuous prime rib dinner at the Athenaeum," said Fee, as he modestly described the delights planned for the evening.

To kick off the weekend's activities, the '51ers will get reacquainted at a cocktail party before dinner. Past issues of the *California Tech*, *Big T*, and other memorabilia will be on display. Later in the evening, Bradford C. Houser, BS '51, will emcee a slide presentation, "Golden Days of 1951," according to Fee, and several awards will be presented to outstanding class members.



These mineral specimens in the sub-basement of Arms Laboratory are a tiny part of the extensive Caltech collection cared for by curator Walter J. Rodekohr. Specimens range from several feet across to microscopic.

Jack Rodekohr

Crystal enthusiast tends Caltech's mineral collection

All sorts of interesting and unusual but relatively unpublicized jobs are done on the Caltech campus, and often by equally interesting but unpublicized people. A case in point is Walter J. (Jack) Rodekohr, who buys, classifies, exhibits, and generally looks after minerals for the Division of Geological and Planetary Sciences, and who has been doing so since the 1940's.

It all started when Rodekohr became entranced with mineralogical crystals back in the early thirties. Their glowing colors and delicate forms captured his imagination and have continued to absorb him.

Rodekohr's interest in minerals had been aroused when he signed up for an evening class in mineralogy at Alhambra High School. The class was taught by Caltech student Vincent C. Kelley, MS '32, PhD '37, who was doing some part-time teaching to help earn his tuition fees. Kelley, now a distinguished professor emeritus of the geology department at the University of New Mexico, was a superb teacher, and Rodekohr is only one of many of his students who became mineralogy enthusiasts. This instruction was supplemented later by some night classes in mining and geology, held at Caltech to train technicians for the war effort.

Rodekohr is still an active mineral collector. In addition to buying and exhibiting Caltech's mineral specimens, he has for many years been an active member of the Southern California Mineralogical Society and is its past president. And his personal collection of crystals is a distinguished one.

But this collection is dwarfed by the geology division's collection under Rodekohr's care. Used mainly for teaching and research, it includes over a thousand species and comes from all over the world. The collection includes at least one specimen of every mineral that has ever been identified. Whenever possible, the specimens are obtained in their crystal form, although some minerals have never yet been discovered in a crystalline state.

In the sub-basement of Arms Laboratory where Rodekohr works, there are dozens of barrels of rocks and hundreds of wooden drawers filled with mineral specimens. And these are in addition to the principal collection displayed in glass-topped cases on the main floor of Arms Laboratory.

The specimens range in size from microscopic to several feet across, and in color from brilliant blues and greens to rich browns and silver grays, pale pinks and blacks. One great block of aragonite from Titus Canyon in Inyo County is the gift of Arnold O. Beckman, PhD '28, chairman emeritus of Caltech's Board of Trustees.

The collection is of great interest scientifically, but it is also of increasing financial value, for the price of minerals has risen steeply in the last ten years. A single specimen often costs thousands of dollars, and their growing popularity among collectors has made some increasingly rare.

Collecting minerals involves, of course, much more than simply picking them up. You have to know what to look for. "The serious mineralogist," Rodekohr says, "constantly studies the literature for fresh information. New minerals are being identified every month, and modern equipment such as the microprobe enables serious collectors to determine the nature of a single crystal — even if it's only a speck."

Field trips, he will testify, can be fairly strenuous and frequently disappointing — and, once in a long while, fantastically lucky. For instance, in New Mexico, Rodekohr and a friend once found a man loading a truck for the mill.

"Have you seen any smithsonite around here?" they asked him.

"Smithsonite?" asked the man. "Oh, sure, I know where some of *that* is."

He did, indeed. Taking a shovel loader, he dug out a large mass of the stuff, leaving Rodekohr and his friend only the job of bending over to pick it up.

Jack Rodekohr takes a lot of pride in his job. He is, for example, not the least interested in lapidary — the art of cutting and polishing gems. "That's just a craft," he says, "but mineralogy, *that's* a science."

Go: a taxing pastime for sturdy students

Just what goes at a Go Club meeting?

That was the perplexing question raised by a brief announcement in the Caltech weekly calendar: "Go Club meetings. For information contact Don McAlister."

Were those attending members of a student cell planning ways to disrupt the card tricks at next year's Rose Bowl, or reconfound the fast-food industry? A phone call to McAlister revealed that nothing so devious was taking place.

McAlister, a graduate student in chemistry, explained that Go is an ancient game that has evolved in the Orient during the last 5,000 years and has attained some popularity in the United States. Recently Edward Lasker, a chess grand master, has attempted to popularize it through the American Go Association, which claims about 3,000 members.

McAlister single-handedly founded the Caltech Go Club last year by inserting announcements in the weekly calendar. He wanted to flush out playing partners for the game, which surpasses chess in its complexity. And although he hasn't packed the Baxter lounge with enthusiasts, he has found several Techers with mental energy left over from their lab work to take on this taxing pastime. One of these players is a postdoctoral research fellow from Japan, who has become as much a tutor as a participant.

McAlister explained that Go isn't for people with flabby morale. For one thing, you have to expect to lose your first 50-100 games before you attain sufficient mastery to have hope of defeating an opponent.

"This can be discouraging unless you're a true fanatic," McAlister pointed out.

Go is played with small discs that resemble mint and licorice candies. Traditional pieces are made from slate and oyster shells and the game is played on thick ginkgo wood boards; a good set costs at least $200. With some popularization in this country, however, plastic playing pieces have come into vogue. It was through exposure to such a set, owned by a relative, that McAlister's own interest in Go had its beginnings.

Go's rules are obscure and difficult to learn, and the alternative plays are almost infinite. As is the case with chess, one can't program a computer to *win* a Go game, because there are too many variables.

"There are 361 intersections on a board. This means that 361 factorial games are possible — more than there are particles in the universe," McAlister noted.

Does he think Go will eventually attract a wide following on the Caltech campus?

"I doubt it," McAlister admitted. "Mastering the game — and playing it — take a lot of time, and for Techers, time is limited."

Jürg Waser retires, plans writing projects

A face familiar to Caltech undergraduates for the past two decades will be missing this academic year. Jürg Waser, PhD '44, has elected to take an early retirement.

A native of Switzerland, Waser received his BS degree from the University of Zurich. His graduate work at Caltech was under the supervision of Linus Pauling, PhD '25, and led to a five-part thesis covering several aspects of electron and X-ray diffraction. He remained at Caltech as an instructor, research fellow, and senior research fellow until 1948 when he accepted an appointment at the University of Zurich and later, at the Rice Institute (now Rice University). Waser returned to Caltech in 1958 as professor of chemistry, and for the next 12 years he taught Ch 1, the general chemistry course for freshmen. More recently, he taught the basic course in physical chemistry as well as oral presentation—now the only required course in the chemistry curriculum.

Waser was president of the American Crystallographic Association and has been active in other professional societies. He and Mrs. Waser live in La Jolla where he plans to concentrate on writing, beginning with texts on general and physical chemistry.

When it was time for their yearly photograph to be taken, members of the Caltech fencing team decided to surprise their coach, Delmar Calvert, by adding some international color to the scene. So they showed up with an assortment of scimitars, double swords, Moroccan daggers, Indonesian swords, and maces, that they had made, borrowed, or collected. Calvert praised the team for above-average ability and said that fencing has a special appeal for the Caltech student. "Fencing is like chess played at lightning speed," he said. "It's a complex, intriguing sport. And yet it combines a physical release with intellectual agility." He added that the team lost its first meet of the season, to PCC.

Record recap: music at the leading edge

For those who are restless with rock and bored with blues, there's now a musical alternative — a fillip for fanatics who favor science set to song.

This gem of a recording, now available, is called "Let's Advance on Science," and it contains songs written during the past 20 years by J. Kent Clark, Caltech professor of English, and Elliott Davis, a lawyer and business executive, now retired.

The songs were featured in ten musical comedies performed at the Institute by the Caltech Stock Company — a sturdy band of extroverted eggheads who led double lives as professors, faculty wives, and secretaries. The musicals commemorated anniversaries, retirements, and the awarding of Nobel Prizes to Caltech luminaries. But although the luminaries came and went, the star of the show remained the same — Caltech. And Caltech, according to Clark, is an inspiring subject for comedy.

The collection of songs featured in "Let's Advance on Science" was recorded directly from the tapes of live shows. "This fact," notes Clark, "accounts for the enthusiasm of the performers and also for the fluffs in the lyrics. That the songs are intelligible at all is a tribute to Beckman Auditorium sound engineers. The songs are not necessarily the best of the Caltech show tunes; they were selected primarily because they were the most intelligible."

Clark explains that the Caltech Stock Company came into being during the 1954-55 season with two shows, "The Road to Stockholm," written to commemorate the awarding of Linus Pauling's first Nobel Prize, and "This is Science," written for a meeting of the American Association of the Advancement of Science.

The nucleus of stock company membership has remained consistent throughout the past 20 years, and many of these veteran performers starred in the company's final performance last spring — "Beautiful Beckman," to honor Dr. and Mrs. Arnold O. Beckman on the occasion of Dr. Beckman's retirement as chairman of the Caltech Board of Trustees.

"Over 20 years," noted Clark, "the company has become like a family; it also has achieved a formidable reputation for its intelligence, its verve, and its stolid indifference to good music."

Included among the regulars have been Ward Whaling, professor of physics; Ray D. Owen, professor of biology, vice president for student affairs, and dean of students; William H. Corcoran, vice president for Institute relations and professor of chemical engineering; Robert W. Oliver, professor of economics; and Edward Hutchings Jr., editor of *Engineering & Science* magazine.

Among the hit tunes from stock company shows that are included on the record are "The Richter Scale," written in honor of Charles F. Richter, professor of seismology, emeritus; "Blue Genes," from "What Makes Beadle Run," presented in 1961 to commemorate the departure of Nobel Prize-winning biologist George W. Beadle to become chancellor of the University of Chicago; "That's Not Gneiss," a geologist's version of the pure and the sinful; "C'est Watson — A View from DuBridge," which managed to honor both the late Earnest C. Watson, professor of physics, and Lee A. DuBridge, president emeritus; and "I Never See Stars," describing the plight of the modern astronomer.

A few selected lyrics from the record show what happens in this advance on science as viewed by a venerable song-writing team:

Let's Advance on Science

Science is on the march, they say, a march of many summers.
Scientists marching 50 ways to 50 different drummers.
Looking for grants, expanded plants, with all those tom-toms beating.
Marching pell-mell so you can't tell if they're charging or retreating.
Only one group, one gallant troop, can organize this mess.
Some call it the American Association for the Advancement of Science,
To us it's the triple-AS.

It's Not Gneiss

Gneiss is a laminated metamorphic rock,
The only stone a man can trust.
All the others are crude if not faintly lewd,
They fill a good man with disgust.
You won't find a dope as seductive as topaz,
It's not gneiss.
Think of the peril connected with beryl,
It's not gneiss.
A hangover starts from fooling with quartz.
Basic basalt is primeval.
Coal and bitumen are black and inhuman,
Gold is the root of all evil.
Granite's a doomstone, a head for a tombstone,
It's not gneiss.
We say once again, we're innocent men.
Nothing will lead us to vice.
You can't trap us with your lapis.
It's not gneiss.

I Never See Stars

When I was a nipper I used to watch the dipper
And every constellation in the sky.
From Betelguese to Vega, from Alpha to Omega,
I knew each lovely star that floated by.
So I took up astronomy and mastered higher math
With all the dedication of a saint.
It pays well and it's steady, my reputation's heady
But now I want to make one small complaint.
I never see stars, even when it's clear.
I muck about with photographs and paper up to here.
I never see stars, any size or shape.
I only read computers and a million miles of tape.
I never see stars, glittering and neat,
I wouldn't know a planet if I met it on the street.
I see cars, bars, lots of seminars,
I see the bloody freeways, all I never see is stars.

The Richter Scale

Charley Richter made a scale for calibrating earthquakes
Gives a true and lucid reading every time the earth shakes.
Increments are exponential, numbers O to nine.
When the first shock hit the seismo everything worked fine.
It measured
One two on the Richter scale, a shabby little shiver.
One two on the Richter scale, a queazy little quiver.
Waves brushed the seismograph as if a fly had flicked her.
One two on the Richter scale, it hardly woke up Richter.

In analyzing the sales market for "Let's Advance on Science," Clark noted that 75 copies have been sold thus far to "our cast and their tone-deaf friends." Since quite a few alumni took part in the performances over the years, he believes their purchases may eventually boost sales to 500.

In the shows that he wrote for the Caltech Stock Company, Clark has poked fun at Nobel laureates, corporate executives, and university presidents. And he praises them for their fine senses of humor.

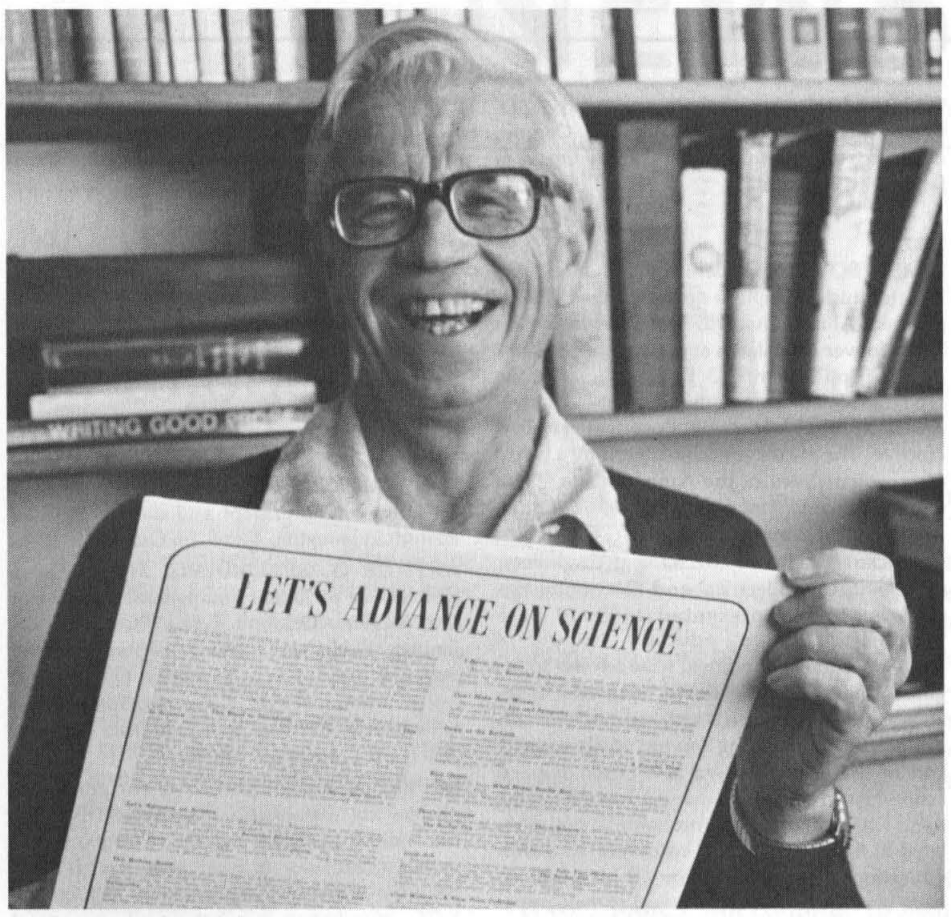
"They were all wonderful people," he said. "I never had to worry about kidding them. But the real star of the shows was Caltech — and I never had to worry about kidding it. Caltech has a great sense of humor, too."

Was last spring's "Beautiful Beckman" really the Caltech Stock Company's last performance? Yes, Clark insists.

"For one thing," he says, "writing a show is so time consuming, and for another, you go over the lyrics so many times when you write a song that eventually you bore your friends and family and yourself to death."

Is there a chance he'll relent?

"Not unless I lose my mind," Clark insisted.



Twenty years of music celebrating the glories and the foibles of Caltech are to be found on the record, "Let's Advance on Science." All the songs are from performances of the Caltech Stock Company. Writer of the lyrics, J. Kent Clark, who earns his living as a Caltech English professor, holds the recording. "Let's Advance on Science" is now for sale.

J. Kent Clark leads Caltech Stock Company performers in a number from "Beautiful Beckman."

Stern receives Austrian honor

Alfred Stern, Caltech professor of philosophy, emeritus, has received the Austrian Honor Cross for Science and Art, First Class, from the Austrian federal president. The decoration is given to scientists, philosophers, and authors who have won an international reputation for important creative work. It was presented by the Austrian consul in Puerto Rico during a ceremony at the University of Puerto Rico.

A native of Baden, near Vienna, Austria, Stern is the author of philosophical works that have been translated into five languages. His book, *The Search for Meaning,* was published in 1971, and the second enlarged Spanish edition of "The Philosophy of Laughter and Tears," originally published in French, appeared in 1975. He is the author of "Philosophical Problems of Science," being published in Spanish.

PERSONALS

1923
BERNARD G. EVANS and his wife, Connie, observed their 50th wedding anniversary in January in Hawaii.

1927
JAMES BOYD, president of Materials Associates and a recipient of the Caltech Distinguished Alumni Award, was presented the 35th Hoover Medal at a special dinner in New York City on December 3. Founded in 1929, the Hoover Medal commemorates the achievements of the late U.S. President Herbert Hoover. The award is administered by a board of representatives of the American Society of Civil Engineers, American Institute of Mining, Metallurgical and Petroleum Engineers, American Society of Mechanical Engineers, and Institute of Electrical and Electronics Engineers. It was presented to Boyd as a "geologist, engineer, educator, inspirer of youth and of his associates, wise adviser to his government at critical times, evaluator of resources — water, air land, and above all, human; an outstanding servant of his country and of the world." Boyd is a noted mineral economist who has held many positions having to do with national and international policy related to the use of natural resources, and with education in this field. Among these positions have been chairman of the board of the Copper Range Company of White Pine, Michigan; director of the U.S. Bureau of Mines, executive director of the National Committee on Minerals Policy, and chairman of the National Science Foundation's Committee on Minerals Research.

1930
CLYDE L. BLOHM, MS '31, is recuperating from heart surgery and is now retired.

1932
ROBERT B. FREEMAN, MS '33, PhD '36, retired on December 31, 1975, after 30 years with United States Steel Corporation. Freeman writes that he is doing some consulting and looks forward to a less demanding schedule.

1936
DAVID HARKER, PhD, celebrated his 69th birthday on October 19, 1975, and retires as head of biophysics, Roswell Park Memorial Institute, on November 1, 1976.

1937
RICHARD T. BRICE, PhD, retired as assistant to the president of Otis Elevator Company on September 1, 1975.

1940
LUDWIG IVAN EPSTEIN, MS '41, associate professor at Virginia Commonwealth University, is co-author of a textbook, *Basic Physics in Anesthesiology,* due out shortly.

FRANCIS MORSE, MS, associate professor of aeronautical engineering at Boston University, presented a paper entitled, "A Nonpolluting Power Plant for Large Airships," at the AIAA Lighter-Than-Air Conference in Aspen, Colorado, in July 1975.

1942
RICHARD M. HEAD, MS '42, '43, Eng. '43, PhD '49, writes, "I left NASA in 1970 to head up Solar-Environmental Sciences, Inc., whose primary areas of endeavor are research in solar and atmospheric physics and the development of new long-range weather forecasting techniques. Norwich, Vermont, was selected as the site for these endeavors because of its close proximity to the time-share computer system at Dartmouth College (across the Connecticut River in Hanover, New Hampshire), its location in the beautiful New England countryside with numerous ski areas nearby, and a desire to escape from urban congestion and pollution."

1943
ALVIN RALPH EATON, MS, received the Distinguished Public Service Award from the U.S. Navy on November 14, 1975, and is currently assistant director for tactical systems in the applied physics laboratory of The Johns Hopkins University.

1944
JOSEPH STEWART MARTIN, MS '47, resigned from the Superior Oil Company in April 1975 to accept a position as vice president for exploration with HNG Oil Company, a subsidiary of Houston Natural Gas Corporation.

1946
KENNETH O. CARTWRIGHT, MS, retired as engineer of design and construction for the Los Angeles Department of Water and Power on October 1, 1975.

1948
JAMES C. ELMS retired this year as director of the U.S. Transportation System Center and is now consulting for industry and government as well as devoting some time to skiing and soaring.

1949
WILLIAM McCARDELL, MS, was promoted to executive vice president and director of Esso Eastern in Houston, Texas, on October 1, 1975.

ARTHUR O. SPAULDING, MS '58, was elected vice president and general manager of the Western Oil and Gas Association on January 1. He was formerly regional general manager of the Rocky Mountain Oil and Gas Association in Denver, Colorado. Spaulding is a member of the Southern California Regional Advisory Council for Caltech.

ROBERT A. WEATHERUP, senior group engineer in operations analysis for the McDonnell Douglas Aircraft Company, received a certificate of merit from the National Security Industrial Association on October 23, 1975. Weatherup is working on a vertical takeoff and landing aircraft which has application in various Navy missions, including anti-submarine warfare.

1951
H.M. ELLIS, PhD, has been promoted to director of research and development of the British Columbia Hydro and Power Authority.

ROBERT McNALLY WALP, MS '53, was appointed by the governor of Alaska to the post of executive director of the state's Office of Telecommunications.

1954
G. NEAL HUNTLEY, MS '55, writes, "1975 was an eventful year for the Huntley family. Our son Chris spent the summer in Brazil as an AFS student. This year he plans to enter UCLA or USC in cinematography. My wife Charlotte realized her dream of playing the lead role in a community theater play. And in December I was named vice president and general manager of the Martin-Brower Company (a subsidiary of Clorox) in Chicago."

1955
GILBERT L. BEEBOWER has been elected a vice president of Becker Securities Corporation in New York City. Beebower is a marketing representative for Becker's Institutional Funds Evaluation Services.

JOHN L. HONSAKER, PhD '65, is involved in the study of environmental reclamation in the Athabasca oil sands for the University of Alaska.

1959
YOUNG CHUN KIM, MS, professor of civil engineering at California State University at Los Angeles, was awarded a grant from the National Science Foundation to conduct coastal engineering research in Japan.

1960
L. CAMERON MOSHER left the geosciences faculty at the University of Arizona to accept a position as research geologist with the Phillips Petroleum Company Research Center in Bartlesville, Oklahoma.

MARTIN WOLFF, MS '61, his wife Margie, and their two daughters have lived at Mercer Island, Washington, a suburb of Seattle, since 1963. And he has begun a new career. After some five years of research in shock and vibrations at the Boeing Company, a summer at JPL, four years as an assistant professor in engineering at the University of Washington, a summer as chief engineer on a salmon tender at Bristol Bay, Alaska, and three years as director of the University of Washington's center for quantitative studies in social science, Marty turned out to be a lawyer. He was awarded his JD degree at the University of Washington in June 1975 and has been admitted to practice in Washington. He plans to open an office in the Seattle area with several classmates.

1963
BRIAN C. BELANGER is chief of the advanced concepts branch, division of electric energy systems, of the U.S. Energy Research and Development Administration in Washington, D.C. He is also head of the U.S. Planning Committee for U.S.-U.S.S.R. Cooperation in Superconducting Power Transmission.

WILLIAM C. BOYLE, PhD, associate professor of civil engineering at the University of Wisconsin in Madison, received the Rudolph Hering Medal of the ASCE in October 1975. The award was in recognition of his co-authorship of a paper, "Pitfalls in Parameter Estimation for Oxygen Transfer Data."

RAYMOND H. PLAUT is professor of civil engineering at Virginia Polytechnic Institute and State University in Blacksburg, Virginia.

1964
GEORGE T. PRESTON is technical manager for resource recovery programs at Occidental Research Corporation in La Verne, California. He and his wife, Irene, became parents of their first child, Brian, on April 5, 1975.

1965
ROBERT F. PAWULA, PhD, has resigned from the faculty of UC San Diego and is doing consulting on a full-time basis.

IGNACIO RODRIQUEZ-ITURBE, MS, associate professor of civil engineering and associate head of the Water Resources Division at the Massachusetts Institute of Technology, was one of five recipients of the 1975 Walter L. Huber Civil Engineering Research Prize.

1968
BRUCE WILLIAM BAILLIE was ordained to the Presbyterian ministry on December 10, 1975, and he is now the minister of the Steamboat Rock Presbyterian Church, Steamboat Rock, Iowa. He and his wife, Marcie, have a daughter, Rebecca Jeanne.

PETER S. BLOOMFIELD has been promoted to manager, telephone utilities branch, for the information services sales department of the General Electric Company. He and his family are moving from Pasadena to a new home in the San Francisco Bay area.

1969
QUINN E. WHITING-O'KEEFE (formerly Whiting), MS, is a medical resident at the University of California at San Francisco Hospital.

GREGG F. WRIGHT is a research fellow in school and community pediatrics at the University of Texas in Galveston.

1970
VERNON F. CORMIER is a graduate student in seismology at Lamont-Doherty Geological Observatory in Palisades, New York. He married Leslie Ann Humm on May 4, 1975.

DAVID I. LEWIN is assistant to the director for public affairs at the Federation of American Societies for Experimental Biology in Bethesda, Maryland.

1971
CHARLES C. MATTHEWS, MS, is a senior research engineer at the General Motors Research Laboratories in Warren, Michigan, in charge of development and testing of passenger car gas turbine engines and related vehicle systems.

JOSEPH L. TEMPLETON received his doctorate in inorganic chemistry from Iowa State University on November 22, 1975.

1972
NIKOLAS E. KOTSOVINOS, MS, PhD '75, research fellow at Caltech, received the Lorenz G. Straub award for the most meritorious thesis in hydraulic engineering or a closely related field submitted to any graduate degree program in this area.

DAVID J. KWIATKOWSKI (formerly David J. Smith) is a first-year medical student at Columbia University College of Physicians and Surgeons.

1974
J. PATRICK CANNADY was married on August 15, 1975, and is continuing his graduate work in inorganic chemistry at the University of Illinois in Urbana.

OBITUARIES

1925
CARL F. BEED on November 29, 1975.

JOHN TEMPLETON on August 10, 1975. He was retired.

1926
JACKSON C. BAKER on October 28, 1975. He was vice president and chief engineer of Audio Arts, Inc., of Hollywood.

1929
FIRTH PIERCE on November 10, 1975, of a kidney ailment. He was retired. Surviving are his daughter, Diana Pierce Lusher, four grandchildren, a sister, and a brother.

1930
ALEX J. HAZZARD on November 4, 1975, after a long illness. He was retired. He is survived by his wife, Dorothy.

1935
BRADLEY H. YOUNG, MS '37, in 1974. He was a senior construction engineer with Lockheed Missiles and Space Corporation in Sunnyvale, California.

1936
W. HOWARD GERFEN on October 21, 1975. He owned his own consulting structural engineering business. Mrs. Gerfen survives.

BENJAMIN STERN, MS, retired U.S. Army colonel, on November 12, 1975. He is survived by his wife.

1944
FREDERICK T. SADLER in 1975. He was a management analyst with the Naval Air Systems Command.

1947
WALTER JOHN HAMMING, MS '47, on November 10, 1975, of cancer. Recognized internationally as one of the leading experts on air pollution control, he retired from the County Air Pollution Control District in March 1974. Before his retirement, he was chief of the district's evaluation and planning division. He is survived by his wife, June; a son, Robert; and a daughter, Karen Burch.

1952
HENRY GLASS MUNSON, MS, on July 16, 1975. After 25 years' service in the U.S. Navy, he became a physics instructor at Princeton High School in New Jersey.

1959
RAYMOND W. LATHAM, MS, PhD '68, on September 19, 1975, of cancer.

1968
DEAN EDWIN PETERSON on July 14, 1975, of cancer. He was an inventor of electronic recording equipment.

ALUMNI ACTIVITIES

March 19
San Francisco chapter meeting. Cocktails, 6 p.m.; dinner, 7 p.m., 16th floor, the Hong Kong Bank Building, 160 Sansome Street, San Francisco. James H. Whitcomb, senior research fellow in geophysics, Caltech, will talk on "Earthquake Prediction and Research."

March 29
Alumni dinner-Earnest C. Watson Caltech Lecture. Cocktails, 6 p.m.; dinner, 6:30 p.m., the Athenaeum. Lecture, 8 p.m., Beckman Auditorium. Robert H. Cannon, Jr., professor of engineering and chairman of the Division of Engineering and Applied Science, will speak on "Computers and Energy."

May 15
Alumni Seminar Day on the Caltech campus. Alumni and their guests will have the opportunity of hearing about Caltech's newest developments in research and education from 12 outstanding faculty speakers. Robert C. Seamans, Jr., administrator for the Energy Research and Development Administration, Washington, D.C., will be the featured speaker.