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The California Tech

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PASADENA, CALIFORNIA

FRIDAY 19 FEBRUARY 1988

Richard Feynman Remembered: 1918-1988 A Physicist

by Randy Kamien

A numbness swept over campus Tuesday when it was learned that Richard Feynman had passed away the previous night. There was a feeling of the loss of a treasure—a treasure beyond value. We were told last Friday that Dr. Feynman had become very weak and was nearing the end. All weekend I reflected upon this turn of events and upon Feynman.

Feynman has always been the epitome of a physicist to me. The ideal physicist. The perfect example. His insight and intuition allowed him to perform miracles of intellect. In physics, it is possible for one man to do the work of one million. Dr. Feynman was one such man. What secrets of the universe must he have died with!

Feynman's brilliance and imagination are well known. He invented the "sum over histories" approach to quantum mechanics, also known as the path integral approach. This idea and methodology is fundamental in the theory of particles, fields and statistical mechanics. The paper which introduces the path integral is characteristic of Feynman's papers and his approach to physics. It is not highly mathematical or technical. Feynman merely presents the answer and justifies it.

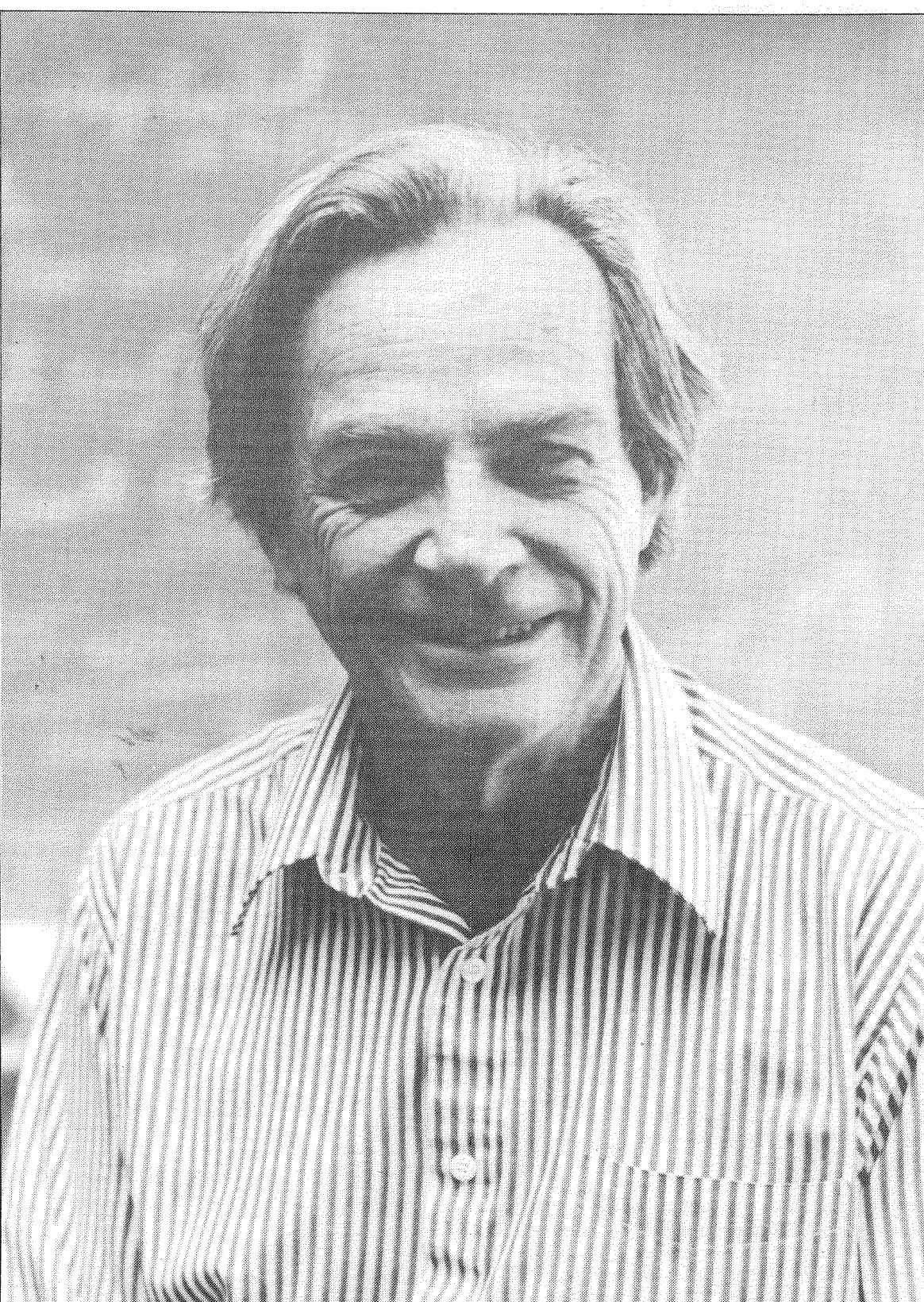
It was this approach which enabled him to perform calculations with ease in the theory of electrons, positrons and photons—quantum electrodynamics. His use of diagrams gave physicists a concise and intuitive algorithm for calculating physical processes. Feynman diagrams have been absorbed into the language of particle physics.

With one problem solved, Feynman turned to meson physics. The physics of the nucleus has two dynamical scales. The strong interaction holds the nucleus together despite the tremendous repulsive force between protons. The weak interaction is responsible for the beta decay of a nucleus.

Feynman turned his attention to the weak interaction. With Professor Murray Gell-Mann, he worked on the theory of the weak interaction, known as V-A. When a particle with spin moves, it can be thought of as tracing out a helix. The handedness of the helix is known as the helicity. Their theory predicted the helicity of the neutrino. Despite disagreement with initial experiments, they held firm to their theory. It was later vindicated by more careful experiments.

Feynman is also credited with the parton model. Though it was known that hadrons could be described as if they were composed of quarks, he was the first to take seriously the idea that the quarks were real. Experiment showed that hadrons contained additional constituents, gluons. Evidence for smaller particles inside the proton was soon found. Quantum chromodynamics shed light on the dynamics of the partons.

Feynman's abilities were not limited to the physics of particles. He was the first to understand the physics of liquid helium. Helium becomes a superfluid at low temperatures. Superfluids have no viscosity—things can move through them without friction.



Richard Feynman: the man, the teacher, the scientist, the friend, the artist, the actor, the bongo-drummer. He will remain in the hearts and minds and memories of all who knew him, and his impact on humanity shall never diminish.

photo by Bob Paz

They are analogous to superconductors. The style of his approach was perfect. An unsolved problem was solved through insight followed with the technical ability to convince the world that he was right.

Most recently, Feynman had turned his attention to quantum chromodynamics (QCD), the theory of quarks and gluons. Through this theory has striking similarities to quantum electrodynamics, its dynamical structure is vastly different. This year he was teaching Physics 230, and the content of the course was quantum chromodynamics. He intended to devote his full time to this problem.

His explanations of the technical aspects of QCD were not the main attraction of the class. It was his wonderful, *physical* ideas that made the class exciting. Every question that was asked prompted Feynman to give us a puzzle or an idea to work out.

In his final few classes, we could all see that Feynman was growing weak. He would take breaks in the middle of lecture, and would eat while talking to keep up

please see PHYSICIST, page 2

A Legend During His Lifetime

[CPR] Nobel Laureate Richard Feynman, 69, died at 10:34PM on Mon., Feb. 15, 1988, at UCLA Medical Center. Feynman, born May 11, 1918, in New York City, was the Richard Chase Tolman Professor of Theoretical Physics. He joined the Caltech faculty in 1950, and was widely heralded as one of this century's most brilliant theoretical physicists and original thinkers.

Professor Feynman earned his B.S. from MIT in 1939, and received his Ph.D. from Princeton in 1942. After wartime work at the Los Alamos Scientific Laboratory—where he divided his time between trying to solve the secrets of the atom and of cracking safes—Feynman became professor of theoretical physics at Cornell, where he worked with Hans Bethe. It was there in 1947 that he did the work that led to his receiving the Nobel Prize in Physics in 1965, which he shared with Shinichiro Tomonaga of Tokyo and Julian Schwinger of

Harvard, who had worked independently on problems in the existing theory of quantum electrodynamics.

At Caltech, he became a legend during his lifetime, known not only for his science but also for his extraordinary ability to communicate its meaning to audiences at all levels. His lectures to freshman physics classes over the years were very well attended, by students and faculty alike. In 1982, for example, he was honored by the Associated Students of the California Institute of Technology for his teaching excellence, an award based on students' evaluations of the instructor's clarity, enthusiasm, command of the subject, rapport with the class, and interest in the students as individuals. This latter quality was demonstrated by his regular attendance at commencement ceremonies, whenever his health permitted.

Most recently, Feynman attracted attention as the author of the

1985 best-seller, *Surely You're Joking, Mr. Feynman*, and as a member of the President's Commission on the Space Shuttle Challenger Accident, for which he filed an explanatory addendum on the panel's final report. Feynman's other publications included *QED: The Strange Theory of Light and Matter* (1986), and *The Feynman Lectures on Physics* (1963).

In addition to the Nobel Prize, Feynman had been awarded the Albert Einstein Award from Princeton and the Einstein Award of the Albert Einstein College of Medicine, the E.O. Lawrence Award of the Atomic Energy Commission, the Oersted Medal for Teaching, and the Niels Bohr International Gold Medal.

Dr. Feynman is survived by his wife, Gweneth Howarth Feynman, formerly of Rippowden, Halifax, England, now of Altadena; a son, Carl Richard; a daughter, Michelle Catherine, and his sister, Joan.

Dick!

in memoriam

For the first few days as a brand new Caltech freshman, I lived in Dabney House. Over one of the courtyard passageways was the neatly lettered word, "Feynman," in the manner one encounters Aristotle and other legends written on ivy-covered walls. That was in 1968. I suppose it is still there. Perhaps someone knows the story of who wrote it.

In the intervening twenty years, I have had cause to encounter the name and the man on countless occasions. His contributions to theoretical physics are profound, and as a particle physicist, I live with his ideas daily. Experimentalists like myself can relate with Feynman's perspective. He recognized that physics is an experimental science, and sometimes reminded seminar speakers of this (even if they happened to be experimentalists). Intuition was the starting point in trying to understand the world; rigor could follow to tidy up if the idea had merit.

I am glad I was not the colloquium speaker, who, when asked to create a clearer physical picture of what he was propounding, said he could not, only to have a familiar voice in the front row pipe up, "I think I can." I suspect, because of his approach, Feynman has caused as much stimulation of thought in the experimental world as in the theoretical.

Science has lost a great asset with the passing of Richard Feynman. Fortunately, science gets to keep his enormous contribution, and will continue to benefit from his influence.

*Frank Porter
Assistant Professor of Physics*

When I was a post doc we'd have these regular meetings in his office in Bridge. I went in one time and he was opening an envelope from Mexico. I saw the stamps, and I said, "Who's writing you from Mexico?" just passing the time. He's pulling out what's in the envelope so it's clear he wants me to see it, or at least doesn't mind if I see it, and he pulls out this great big picture of some big heiroglyph. I said, "What's that?" Then he pulls out the letter and it's from the curator of some museum in Mexico who had sent by him to see if Feynman could authenticate it and read it. Feynman looked at it and said, "It's a fake." He said, "They're making these fakes," and evidently the curator of the Mexican museum wasn't good enough to tell if it was a fake or not so he sent it to Feynman. Feynman said, "Look, someone strung this together, but this is nonsense because these are numbers. If this is done right this would be some sensible sequence of numbers, but they wrote these and they're not sensible. It's like gibberish."

On his honeymoon, he had bought postcards of heiroglyphs and he decided he would figure out

The Professor and the General: It is the greatest loss for me that I could ever think of, and yet the greatest experience I have had—being able to work that closely with the guy. Despite the short time of our acquaintance, I can't think of a closer friend I have ever had, a man that I loved more, or a guy that I respected more highly than Professor Feynman.

*General Donald J. Kutyna
Commander,
Air Force Space Command*

7 July 1966

I stand at the seashore, alone, and start to think... There are the rushing waves... Mountains of molecules, each stupidly minding its own business...

trillions apart... yet forming white surf in unison.

Ages on ages... before any could see... year after year thunderously pounding the shore as now.

For whom, for what?... on a dead planet, with no life to entertain.

Never at rest... tortured by energy wasted prodigiously by the sun...

poured into space. A mite makes the sea roar.

Deep in the sea, all molecules repeat the patterns of one another till complex new ones are formed.

They make others like themselves..

And a new dance starts.

Growing in size and complexity...

living things, masses of atoms, DNA, protein...

Dancing a pattern ever more intricate.

Out of the cradle onto the dry land...

Here it is standing... atoms with consciousness... matter with curiosity.

Stands at the sea... wonders with wondering... I... a universe of atoms... an atom in the universe.

-Richard P. Feynman (Science and Ideas, A.B. Arons, Ed., Prentice-Hall, 1964, p.5)

--Decoded by Tomas E. Firle, July 6, 1966

what they said, and he thought he had figured it out, that they were dates and numbers and he assumed someone had already figured it out and it would be in the books, so he went to the museum to see if it was in the books. And he thought, "Well, before I look in the book I'll see if I can do it myself." But it turned out it was original.

*Robert Hellworth
Professor of Physics, USC*

A memorial fund for cancer research will be established in Professor Feynman's name. Information about how to contribute will be available next week.

Feynman's teacher instinct: He had a wonderful instinct to share this excitement. "I'm so excited. Everyone should be so excited. If you could only see what I see you'd all be jumping up and down! Let's jump up and down together." And when I saw what he saw I would jump up and down. The excitement is hard to describe.

He'd always assume he was the last to discover something, and he always liked to discover things for himself. He said it was faster than to find it in a book. But he always figured it was in a book; much less of it, though, was than he actually thought. I don't know any man with more unwritten articles. I would say a normal human having done what he did would have published another 200 articles.

I learned more from Feynman's lectures at Hughes than I did in graduate school.

*Robert Hellworth
Professor of Engineering, USC*

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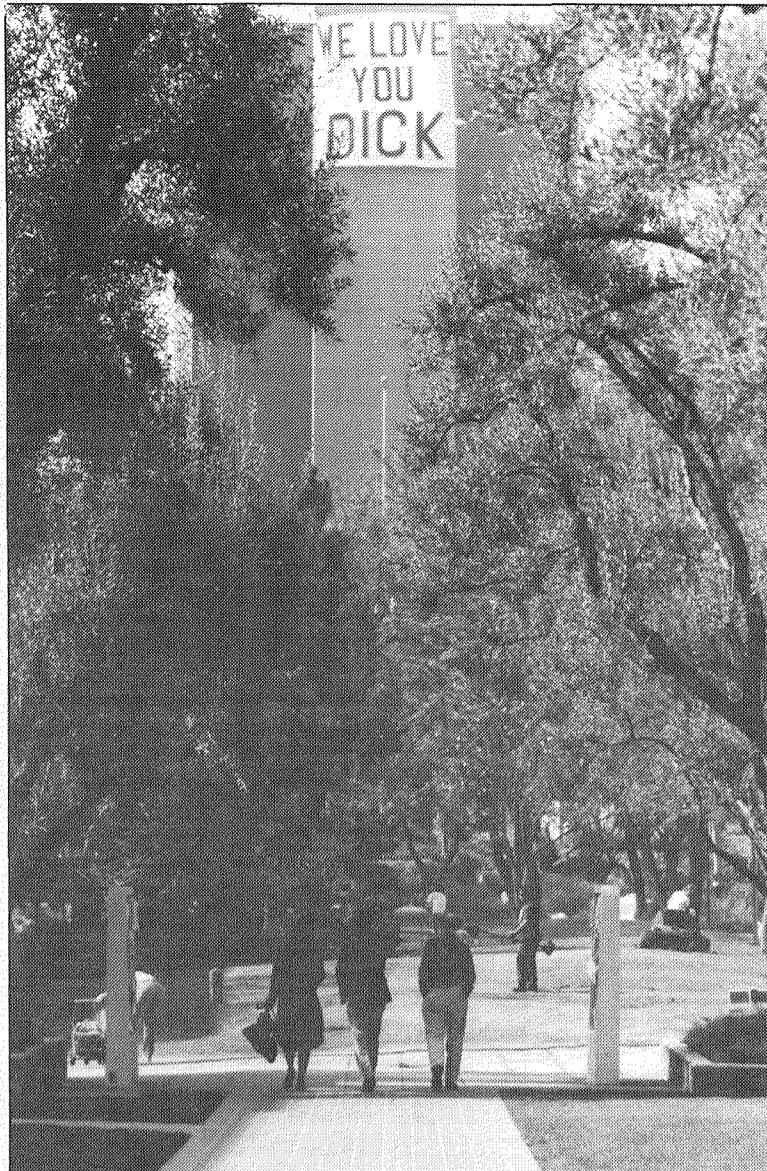


photo by Michael Keating

Friend, cont'd.

from page 1

Safecracker, Decoder of Mayan Hieroglyphics, Tuvanist. Local deity.

Recreations: physics, optical engineering, biology, computer science, teaching.

There is no succinct way to convey an impression of the effect Richard Feynman had on the Caltech community, and I am inadequate to the task. Richard Feynman's joy of living, of teaching, and especially of learning and understanding inhabits everything I know about him. His spirit lights up the stories told by his acquaintances, and there are so many.

Physicist, cont'd.

from page 1

his energy. His devotion to teaching was incredible and inspiring.

I did not know Professor Feynman as well as I would have liked to, and there were many people who knew him better. I have tried to take in as much of his wisdom as possible. In class, he would tell us not to be intimidated by the theories, and the "great men" who invented them. He often told us that, "what one fool can do, another fool can do better!" This is one fool who will heed those words.

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Illnesses not Due to Food Service

by David Lipin

Thurs., Feb. 18, the Pasadena Health Department rescinded the order which had kept the food service and Chandler Dining Hall closed since last Friday.

Concern over the food service began when many students became ill on Tuesday night of last week, several of whom spent Wednesday morning in the emergency room at the hospital. The Health Department was called in that day to inspect the kitchens and dining facilities, at which time they found nothing wrong.

They returned Thursday morning after more students became ill, and decided to close down the food service as a precautionary measure until the cause of the illness could be determined. They took food samples and tested the water supply and equipment in the kitchens. Stool samples were collected from students and food service employees.

Students continued to get sick, even after the food service was shut down. Some of the students who became ill had not eaten board food at all, and even some staff members and graduate students became ill. These facts, and the fact that none of the test results showed any signs of the bacteria which would cause food poisoning, led the Health Department to decide that the mysterious illness

was not food-related, but was in fact a type of acute contagious gastrointestinal disorder caused by a virus.

By the time the food service was reopened yesterday, nearly 100 undergraduates, graduates, and staff members had become ill. Many news agencies have called for information and/or run articles on the illness: the *Star News*, *Herald Examiner*, *Los Angeles Times*, *Pasadena Weekly*, Associated Press, and the *Chronicle of Higher Education*.

In the meantime, students on board were told to eat out and to save their receipts for reimbursement. The Housing Office began yesterday to process cash refunds for those students with receipts. Business has been quite brisk, with refunds ranging from \$3 for individual fast-food meals to over \$100 for groups of people. In addition to cash refunds, students will be credited for the meals not served when the food service was closed.

Gary Hindoyan, the food ser-

vice owner, remarked about the situation, "It's been a very stressful week...I've been trying very hard to make the students happy, and now I'll try even harder. I only wish people had waited for the facts before making accusations. But if you're here, like me, every day from the time we open until the time we close, and you have good intentions, good ingredients, and you keep a close watch on everything that goes on...then you can sleep at night, because you know that everything's ok."

and this image cannot entirely be changed by direct efforts at recruitment.

The Cain Committee found that many high school students think of Caltech as a "grim" place, where the students are unhappy due to the excessive workload and the lack of excitement around them. Caltech is also thought to be weak in the humanities and social sciences, and have a student body that is focused and lack diversity. These images are often misperceptions (e.g., the Caltech humanities and social sciences faculty are anything but weak), but some have truth to them.

The Cain Committee believed that promising high school students were being scared away from applying to Caltech, due to these negative images. For these reasons the Committee made two kinds of recommendations geared at changing these images: recommendations to balance these negative conceptions with positive publicity, and recommendations to change Caltech itself.

The first recommendation to balance perception includes such ideas as publishing a brochure on the humanities and social sciences faculty, and emphasizing Caltech's appealing characteristics such as its small size and students' chances of doing research. The admissions office has already made substantial progress in these areas.

Other recommendations were to change the admissions process to introduce more diversity in the student body, expanding Caltech's 3/2 dual degree program, and on a more general level, exploring "ways to reduce student pressure and the curriculum's inflexibility." This last change would probably be the most sweeping, if it could be affected. Progress has already begun in this area.

The Cain Committee also discussed ways in which to attract admitted students to Caltech, or to "enhance the yield." As mentioned before, the yield is roughly 50. The number varies, due in large part to financial reasons, and is lower than that for most state universities.

Since Caltech is a very selective university, the students who are admitted are often admitted to many other selective universities as well, so Caltech is not necessarily the obvious choice. This is true of most selective universities, and the Cain Committee did not feel it would be justifiable to lower admissions criteria simply to raise the yield.

It was found as of the time of the report that several other selective universities had higher yields than Caltech, notably Harvard, MIT, and Stanford. This problem was said to be another result of the image problem described above, although it was suggested that enhancing financial aid offers would be a desirable and an affordable way for Caltech to combat this problem.

Although much can be done to improve the admissions process, Caltech in general, and the admissions committee in particular are moving forward, much has already been done.

Minutes: Term-ending ASCIT meeting

ASCIT Minutes 10PM 16 Feb 1988

- Representatives from Hillel and the Middle East Studies Group would like to sponsor two events. The first is to be held Feb. 24, and is an Arab-Jewish dialogue. For the two speakers' honorarium, dinner, and publicity, they need \$460. Mar. 9, they would like to have a debate: "Options for Peace." They plan to have some big shots in this debate. Honorarium would be \$100 per debator (4 debators), and publicity would be \$80. The total is \$940, and they would like \$200

Last in a Series

Caltech Undertakes Recruiting Measures

by Ruchira Datta

In what ways is the admissions process changing? The Cain Committee Report, the most recent report on the topic of admissions made a number of recommendations, many of which have been or are in the process of being implemented.

The Cain Committee's recommendations can be divided into several major areas: recruitment of students and building of Caltech's image among them; selections of students; enhancing the "yield," or percentage of admitted students who decide to come to Caltech; and organization of the admissions process. It is the areas of recruitment and yield enhancement which are of most interest.

Increasing Name-Recognition

In the past, Caltech has not done active recruitment of students. The motivation for this policy was the belief that the top science students would naturally want to go to the top science college, which, of course, was

Caltech.

The Cain Committee, however, found that many top high school students had either never heard of Caltech, or heard only a negative viewpoint. The Report saw that Caltech was losing top students because of its lack of visibility among high school students, their teachers, and college counselors.

For these reasons, the committee recommended that the Institute should actively recruit to enlarge the applicant pool. This would increase the likelihood that top students would hear of and apply to Caltech.

One important facet of the new recruitment program is establishing and maintaining relations with high school counselors, since they greatly influence a student's decision of which colleges to apply to and which college to eventually attend. The Committee found that some high school counselors were ignorant of Caltech, and some even had a hostile attitude towards Caltech which was reducing Caltech's applicant pool.

The use of the Student Search Service is another major facet of the recruitment program. To take advantage of this service of the College Board, students fill in an oval on the PSAT or SAT indicating that they want information from colleges. Based on the range into which the students test scores fall, interested colleges will send brochures and reply cards to the individual high school students. Caltech will send information to students who receive high scores on the math section of the tests.

Caltech is particularly keen on recruiting female and minority students (such as blacks and Hispanics, but not necessarily Asians). Thus Caltech is going out of its way to maintain relationships with public high schools in areas where high concentrations of minorities live. Also, Caltech runs the Special Students Program, or SSP, which provides students whose high school education may have been deficient in some areas, with preparation the summer before entering the freshman class. The program includes but is not necessarily limited to minority students. For women, Caltech publishes a special brochure discussing the situation of "Women at Caltech."

One suggestion of the Cain Committee was that Caltech should send students brochures about the particular option in which they are interested, such as biology or chemical engineering. To this end, the admissions office has printed separate brochures on "the sciences" and "engineering and applied science" at Caltech.

Caltech has also maintained two programs for high school students to come and take sciences classes at Caltech, one on Saturdays and one in the summer. These are designed to get students interested in science in general, and in Caltech in particular.

Improving the Image

Despite all these efforts at recruitment, one problem remains: in general, high school students have a negative image of Caltech,

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in memoriam

The *California Tech* has compiled the following comments from persons who were associated with Richard Feynman.

My first instinct was to say, "No, I didn't want to write anything about Dr. Feynman." Then I thought surely I could find some words to express how very much I will miss him. I'll miss the way he would come down the hall in the morning, singing (softly going "dah-te-dah-te-dah") and then stopping in my office doorway and saying, "I feel great today!" That was his normal greeting for many years. And there would be the many times he would stand and tap out a riff on my file cabinets; he could practically get a jam session going all by himself just because he felt good about everything. How could you not love being around someone like him: working for him these many years was my very great privilege, and I know that a lot of 'fun' has gone out of my life.

*Helen Tuck
Secretary, Richard Feynman*

Although I was not privileged to know Dr. Feynman for long, I did know him through his books and certain other publications. On coming to Caltech last fall, it was immediately obvious that he was held in the highest regard by his colleagues on the faculty and by the students, too. In some ways, he was "Mr. Caltech."

I was privileged to have two long conversations with him, one shortly after I arrived on campus, and one just last week. Both were a delight to me, and I believe he enjoyed them, too. Both were in his offices, as he had not been completely well. In the first, he asked many questions, and we both discussed their answers. He was excellent at questioning assumptions in any field, and clearly had thought deeply about many matters outside of physics- and outside of science. However, physics and science were clearly his first loves. He stayed at Caltech throughout most of his career for the reason most others do - there is more of importance occurring in science and technology here - and he liked to be in the midst of the action. Much of it, no doubt, he had a direct or indirect role in stimulating.

The world has lost a great citizen and a great intellect. Those of us at Caltech were privileged to know him better than most, and our lives have been enriched. We likewise will miss his stimulating questions and comments more than most. He was a great man.

*Thomas Everhart
President,
California Institute of Technology*

Richard Feynman, a towering figure in 20th-century physics, always curious, always modest, always ebullient, always willing to share his deep insights with students and colleagues.

*Marvin Goldberger
Director,
Institute for Advanced Study
Former President,
California Institute of Technology*

In the death of Richard Feynman, the world has lost one of its greatest intellects, the nation has lost a most extraordinary and versatile citizen. The academic community has lost one of its greatest and most beloved teachers, and we have all lost one of the world's greatest men.

*Lee A. DuBridge
President Emeritus,
California Institute of Technology*

Last night, Mon., Feb. 15, 1988, Richard Feynman died. For the past eight years, ever since I've known he had cancer, my first order of business each morning has been to look at the Caltech flagpole to see if it was at half mast. But when the event finally came, I found out about it from the headline of Lee Dye's excellent first page obituary in the *Los Angeles Times*.

Rather than go through the motions of routine work this morning, I'd like to put down on paper a few of the many personal Feynman stories I've accumulated over more than 20 years as friend and colleague. These are not as racy as the stories in his best-selling book. In fact, they're not the kinds of stories Feynman likes to tell about himself at all. But perhaps they shed a small measure of light on some aspects of this truly singular man.

The first story goes back to the week I first learned of his illness from his faithful secretary, Helen Tuck. She told me he was to go into the hospital for surgery the following week. He might not survive.

I ran into him that Friday morning, while we were robing up for graduation (yes, Dick Feynman put on silly academic robes and marched in the commencement procession the week before his first cancer operation). Someone had said there was something wrong with a paper we had published and I couldn't find the source of the mistake. Would he like to talk about it? We made an appointment for the following Monday morning.

On Monday morning, we got to work. Or rather, he did. I mostly watched and commented, and marveled to myself about this man, facing into the abyss, but working with unflagging patience and energy on an arcane problem in two-dimensional elastic theory. Of course he didn't know that I knew his terrible secret.

The problem proved intractable - at six o'clock that evening, we hadn't succeeded. He declared the situation hopeless, and we went home.

Two hours later, he called me at home with the solution of the problem. He was very excited. He could not stop working on it, had not stopped, and had finally solved it. He was in a very good mood.

The second story goes back to the beginnings of that same paper in which there was a small mistake. Feynman and I had been discussing some experiments one of my students had done. One morning, he marched into my office, walked to the blackboard and said, "Look, it's obvious that...," and proceeded in a few minutes to sketch out a theory that might explain our results. I was dumbstruck. It was simple, intuitive, beautiful. Exactly what physicists call "elegant." I got to work immediately putting the data in a form that could be compared to his theory. That worked pretty well, so I wrote the first draft of a paper. Just as I was finishing it, I got in the mail a "preprint," the manuscript of a paper not yet published, from two English physicists, Kosterlitz and Thouless. It

presented exactly the same theory Feynman had sketched out on my blackboard.

In my long experience, beneath the surface of every scientist, there lurks a wounded person who believes his work has never been fully appreciated. Feynman was a rare, perhaps even unique exception. In fact, I many times saw him go to some length to make sure that he didn't take credit away from some younger theorist who needed it much more.

When the Kosterlitz-Thouless paper arrived, I went directly to Feynman to tell him what had happened. For just an instant I saw the smallest shadow of disappointment flutter across his face. Then he brightened and said, "Look, if two guys (he must have thought K and T were one person) in different parts of the world thinking about different problems get the same idea, it must be right!" The Kosterlitz-Thouless theory has gone on to become one of the most important ideas in a whole branch of physics over the past ten years or so.

The last story took place sometime during that same era, when the world of physics was in a state of high excitement over the discovery of a new elementary particle called the J/psi (two groups had discovered it independently and given it different names, J and psi).

I was at the time chairman of the colloquium committee, and the committee asked me to get Dick to give a talk on the new discovery. When I asked him, he agreed immediately, and outlined the kind of talk he wanted to give. We set a date early in Jan., I penciled him in on the calendar, and promptly forgot about it.

The exact title of every seminar at Caltech must be ready two weeks in advance for publication in the weekly Campus Calendar. Two weeks before Feynman's talk, during the Christmas break, the calendar called, asking me for a title. Feynman was away at his Baja retreat, which, quite purposely, had no phone. There was no choice but to make up a title for him. The one I cooked up was approximately: "The broad theoretical background of two narrow experimental resonances." To a physicist, this title is a gentle play on words. To anyone else, it is utterly incomprehensible.

I called a mutual friend, Jon Mathews, to ask whether I should use that title. Jon laughed when he heard it, then said quickly, "No. Dick has a wonderful sense of humor about everything but physics. don't use it." I was enamored of my title, though, because it did accurately describe the talk Feynman wanted to give, and because Jon had laughed when he heard it. So, against Jon's advice, I submitted it to the Calendar, and once again forgot about the whole thing.

The next time I saw Feynman was the first Thurs. in Jan., at tea before the colloquium that preceded his by one week. At that instant, I realized the Calendar was out that day and he would have seen my title. I said to him, "I'm sorry, Dick, I had to make up a title, and did the best I could." He said grimly, "It's

all right." I had a feeling the story wasn't finished.

We went upstairs to the colloquium, and he sat down next to me in the first row (as he often did). Throughout the talk, he whispered wisecracks and comments in my ear (as he often did). Physics seminars are notoriously difficult to understand, even for experts, and this one was more difficult than most. With Feynman's help, by the end, I had lost the thread entirely.

Nevertheless, when the question period started, Willie Fowler (also in the first row, later to win his own Nobel Prize) asked one, and for some reason, I thought I knew the answer. I whispered my answer to Feynman as the speaker was stumbling around trying to formulate a response. Feynman's hand shot up.

Total silence instantly fell on the auditorium. The speaker's head snapped around as if it had been on a rubber band. He called on Feynman. Feynman stood (most questions are asked sitting). In his most stentorian tone, Feynman began, "Goodstein says..." (he purposefully mispronounced my name, saying it somewhat like the German pronunciation of Einstein) and he proceeded to give my answer, not in my words, but elegantly phrased as I could not have done it. I, in the meantime, was doing my best to slide under the seat in the hope of not being noticed. When he finished, the speaker said, "Yes, yes, that's exactly it. That's just what I've been trying to say." "Well don't ask me," Feynman said. "I don't understand it. That's what Goodstein [sic] says."

That was it. The end of the story. Feynman had had his little revenge. The incident was never mentioned again.

*David L. Goodstein
Vice Provost,
Professor of Physics
and Applied Physics*

The thing I loved most about Dick Feynman was his marvelous freshness and spontaneity. Unlike the rest of us, Dick didn't seem to have any habits or stock responses. He seemed to be constantly reassessing his experience, finding it sillier than he had previously thought, and giving his tentative conclusions - usually brilliant - as of that moment.

Dick, of course, as a certified card-carrying genius, was as privileged around Caltech as the Fool in *King Lear*; he could tell the truth any way he saw it, and he ordinarily saw it from an acute angle - always with fascination and never with malice. Since Feynman was always Feynman - always exploring, always spontaneous, and

always in process - talking with him was always something like a shot of adrenalin or a blood transfusion - or as if he had transferred to his friends some of his great mental wattage (vast enough to light up Las Vegas). All this, I suppose, is another way of saying that Dick was engaged in the life-long project of improving his vision, both figuratively and literally. (He once told me, for example, that he had never really seen how women's necks "hook on" to their shoulders until he took drawing lessons from Zorthian.)

The fact that he found exploration exciting, adventurous, and ever so slightly crazy, and the further fact that he wanted to share his perceptions with his friends made him a great joy to have around. So too did his classic irreverence and his legendary contempt for legends. He was a living contradiction to the (revised) Caltech motto: "The Truth Shall Make You Free."

With his hang-loose manner, his insouciance, and his zest for experience, he seemed to demonstrate that the search for truth is much too exciting to be solemn and much too kinetic to be frozen into static form. When his friends remember Dick, then, they'll probably think of his unblinking, unthreatened style, as well as the astounding range of his vision; and they'll probably make him a legend in spite of his and their intentions. After all, we can only talk about him in hyperbole.

*Kent Clark
Professor Emeritus, Literature*

We will miss Dick more deeply than any other member of our community. He touched all of us, students, staff, and faculty. He was unique, a combination of a brilliant dedicated scientist who would brook no sham or pretense, with a man of very earthly tastes and a consummate showman. I knew him and admired him for forty-five years and loved him for all his qualities.

*Robert Christy
Institute Professor,
Theoretical Physics, Emeritus*

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in memoriam

In 1981 Feynman underwent his second operation for cancer. The day before, we didn't really expect to see him in seminar, but there he was. Uncharacteristically, he fell asleep. Afterwards when there were only two or three of us left he apologized to the speaker, Stephen Wolfram, and explained that he'd been to see the doctor and some medication had made him sleepy.

He then started to talk about the operation and his efforts to extract the true facts, unpromising as they might be, from the surgeon. As usual it became a story told with gusto: how he had to get the doctor separated from the medical students before he would open up, how Feynman's cancer was a rare type with only about 100 examples in the U.S. case records, how he had already survived longer than the average patient with this type, the pros and cons of various treatment strategies, how the cancer was not a physicist's hard sphere but a biologist's organism covered with little roots fuzzing out into the surroundings, forcing the surgeon to cut as close as possible to the bone and neighboring organs in attempt to get it all.

Finally, the story was finished. As he left the room, Feynman turned to us and said, "Thank you for listening. It was hard to talk about this, but I'm glad I did."

This may not be your typical Feynman tale, but how characteristic of him to attend seminar event at such a time, to turn even matters of life and death into a story, and to insist on the true facts no matter where that led him! I like to think it was because of this spirit that Feynman was able to be with us another seven years.

*Steven Frautschi
Professor of Theoretical Physics*

It is impossible to express what I feel when I know that I will not see Dick's honest and smiling face again.

In this note I wish to remind the reader about two instances of Feynman's deep commitment to teaching.

Until his health did not permit it (some time around 1986) Feynman taught an unlisted course, Ph X, every Monday at 5PM. The purpose of this course was for any student to ask him any question about anything. I was acquainted with this course because occasionally when he could not attend he would ask me to substitute for him. In the various times I taught the course there were never fewer than fifteen students (remember: no credit and 5PM!).

During the many years that I have taught Freshman and Sophomore Physics I often asked Richard to give one of the lectures in the course that I was presently teaching. He never refused!

Around a year after he gave his lectures in New Zealand about QED for "non-scientists but educated people," I asked him to give them to my Sophomore Physics class. He immediately agreed but stated that it would take three one-hour lectures. I said "fine." Before the third lecture Feynman came to me and asked, "Could I give a fourth lecture?" What could I answer? "Of course!"

Last year I was asked to teach the second half of Ph 2c because Professor Prince had to travel to Australia to observe the new supernova. I decided to start my lectures with a Bang! I phoned Feynman and asked him to give the first lecture. Unfortunately he had a commitment in Boston and could not do it. Fifteen minutes later he phoned me and stated that he had rearranged his consulting trip and would love to give the lecture. This was, again, a wonderful lecture: "Irreversible Processes from Reversible Laws."

One of Feynman's most important lessons was that you can be a superb scientist and still care for and love your students!

*Ricardo Gomez
Professor of Physics*

Note: These lectures were video recorded and are available in the physics department.

One day in Ph 230, Dr. Feynman told us the story of how he failed to be the first person to discover how to properly quantize the theory of the strong force, quantum chromodynamics. He came very close, but there were some technical obstacles which he was not quite able to overcome before they were solved by others. Later, he realized that there was a very simple way to quantize the theory that involved giving up the manifest Lorentz (relativistic) symmetry.

In his earlier work on quantum electrodynamics, he had discovered that things become much simpler and more straightforward when one kept Lorentz invariance at each step, so he was determined to do the same in QCD. He felt that if he had not been so prejudiced by his previous experience in QED, he would have discovered this simple solution for QCD much earlier.

In his lectures, Dr. Feynman frequently expounded his views about the best way to learn and do research. He often urged us to work out physics for ourselves, without depending on textbooks or papers, as a means of understanding it more deeply and, he hoped, formulating it in a better way than others had done. He sometimes said, "What one fool can do, another can do better," by which he meant, "Don't be so awed by those who have gone before you, because you also have the potential to do original work, and besides, they were once students too!"

He constantly expressed his disdain for mathematical jargon with phrases like "non-Abelian hokey-poke" because he felt that the emphasis on specialized techniques in physics detracts from innovation and creative thinking. He always eschewed abstract explanations when concrete ones were available. He stressed the importance of "playing around" with the equations, and I remember him telling me once, "That's the problem with school - they keep you so goddam busy you don't have time to learn anything!"

Richard Feynman was not a conformist, and I think he wanted to help others to free themselves from that ubiquitous tendency. One symptom of conformity is the fear

of exposing ignorance by asking a question. It was his policy not to make anyone feel stupid for asking a question - although he could make one sorry for *not* asking! It was in these ways, among others, that Dr. Feynman showed that not only did he have a great love for physics, but also for people.

*Jim Cline
Graduate Student, Physics*

I was sitting under the Ath tent with Dick after graduation a couple of years ago when a visitor asked him to autograph a copy of *QED* which had just come out; Feynman graciously obliged, but stopped in mid-signature when the man said he thought the book should be required reading for all high school science students. Dick handed the book back to him and said "Nothing should be *required* reading; if it's required, then it's dead; if it's required, it means the kids don't want to read it. I don't want anyone to be *required* to read a book I write. I want them to enjoy it..."

Feynman believed passionately in the joy of knowledge, in the insatiability of our eyes, our minds, our hearts. He believed that education was hollow if it was forced or by rote... and he respected the right of all of us to *want* to learn, to *want* to know. He refused to make a chore out of life.

For him, I think, learning about ourselves, inside and outside, in diminishing and expanding increments, was something to celebrate—an embracing of a whole—be it quantum theory or dance rhythms, the precise term of a phrase or the visual line of a winter branch. He was as taken by the aesthetic quality of light as he was by the nature of light.

He never bogged down in instrumentation; technique and technology were means to an end, not the end. There was a completeness to him which made him regret his incompleteness—what he called his "ignorance" about ways of knowing beyond his own discipline.

I've never known anyone less ignorant in my life.

When we first asked Dick to come play in *Guys and Dolls*, it was on sort of a lark—"Wouldn't it be great if..." sort of thing—and he responded in kind. "Hey, why doesn't anyone tell me about this stuff before? This is fun!"

But immediately, he wanted to find out more about the stage, about acting, how to do it *well*, to really go for the principles of the form.

And though his research, classes, conferences kept him on a rigorous schedule, he always made time to come back of TACIT, each time fresh yet more skilled, each time challenging himself. Finally, as the Sewer King in *The Madwoman of Chaillot*, he pulled off a little jewel of characterization—a mix of wry humour, weary insight, delicious dubiety determined that the 'good guys' in the play should at least have a *chance* to win.

The subtleties and loving details of his performance, how he "saundered 'n blowed" his tea with an elegant lift to his pinkie finger, were noticed by a reviewer who praised his work. This worried him: "Now I gotta be good!"

He was. He was just the best. While he suffered no flatterers and few fools, his in-home courtesy was incredible. For instance, while he was rehearsing for *Kismet*, he was appointed to the President's Commission on the Challenger explosion. He called me the same

night to explain and to *ask* if I'd understand if he quit the show.

Of course, he intended to be on the Commission, there couldn't ever have been any question of priorities, all things in proportion. But Dick *asked*. And even while he was dropping "the thing in the stuff" and establishing the failure of the O-rings, he wangled his way back to Pasadena, showing up for performance in time to play drums in the Bazaar of the Caravans sequence. Which makes TACIT, which makes me, a footnote in History.

So there he is, one day the nation's iconoclastic hero, and the next sitting backstage with me trading quatrains from *The Rubiyat*, seeing it as Sufi simplicity instead of the way everyone else dismisses the poem as drunken banality.

It was that ability to juxtapose profundity, fun, social responsibility, hard science, and common sense that made him so dear to all of us.

I always meant to produce *Damn Yankees* and cast Dick as the Manager just so I could hear him sing "You Gotta Have Heart!" And now I can't, but it really doesn't matter because I can hear him in my head.

He had Heart—capital H heart—"miles 'n miles 'n miles of it."

*Shirley Maneus
Director, Theater Arts*

On this, the day after his death, I would like to set out the following highlight from one of Richard Feynman's visits to Ricketts House in the mid-60s. Some alumni and faculty may recall my recounting these events to the class of 1969 at their freshman camp.

Once a year, Feynman would dine at Ricketts on a weekday evening. He would arrive a half-hour or so before dinner and stay for a few hours afterward. Although students dressed for dinner in those days, the atmosphere was informal and Feynman himself invariably vivacious.

This visit came on the eve of a major SCIAAC swim meet, and the highly prized inner seats nearest Feynman were occupied by, among others, two members of the varsity swim team. During dinner, one of the swimmers remarked that the other had shaved the entire body in the hopes of swimming faster. Feynman responded, "Yes, but does that *really* make you swim faster?" One student suggested, "It's 98% psychological."

"Ah, but how do you know it's 98%, rather than 97.2% psychological?" Feynman piped in. "How can you tell exactly? What experiment could you do to find out?"

The students proposed a few procedures, ranging from "swim-shave-swim-again" to "find N evenly matched swimmers." Feynman himself rejected one or two of the proposals. The students briefly debated the remaining methods, but soon agreed that no "nice" solution would likely be found. The conversation then shifted in another direction.

A full time minutes after the subject had apparently changed, Feynman exclaimed, "I've got it. I know how you can tell if shaving your legs really does make you swim faster." rather than give us his solution right away, however, he insisted that we try again. Still, we eventually admitted defeat and demanded his answer.

"Shave one leg - and see if you swim in circles."

*Gary A. Ratner
Class of 1966*

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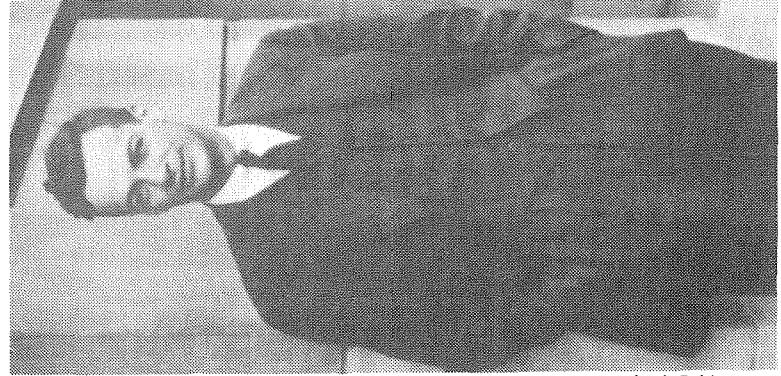


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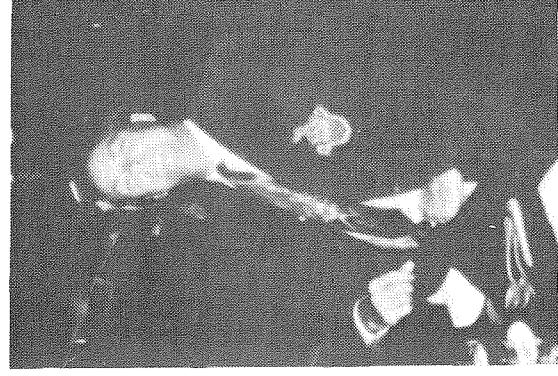


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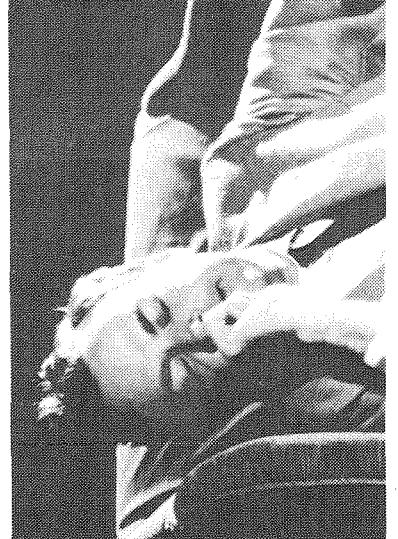


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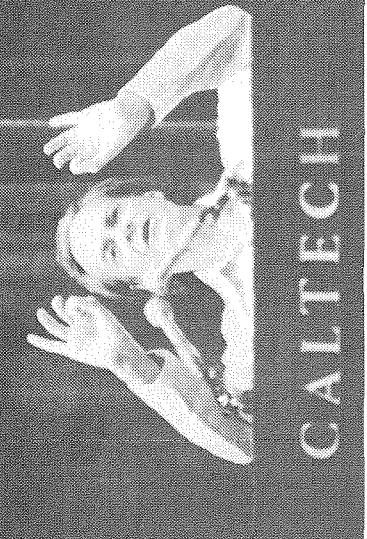


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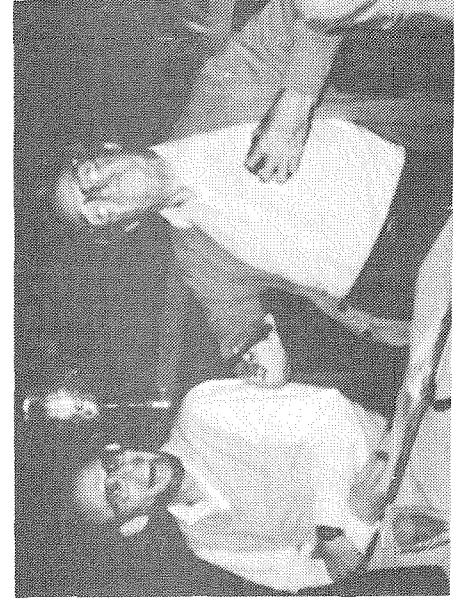


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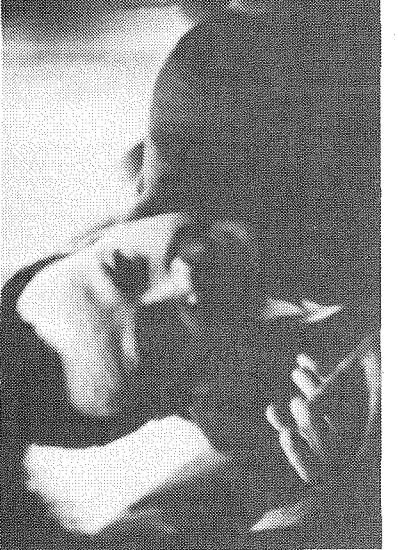


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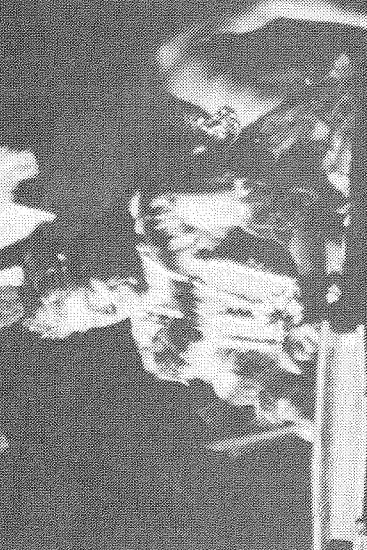


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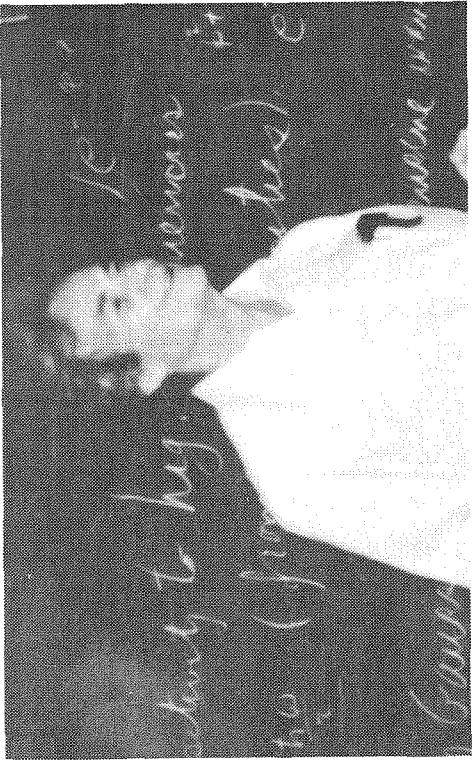


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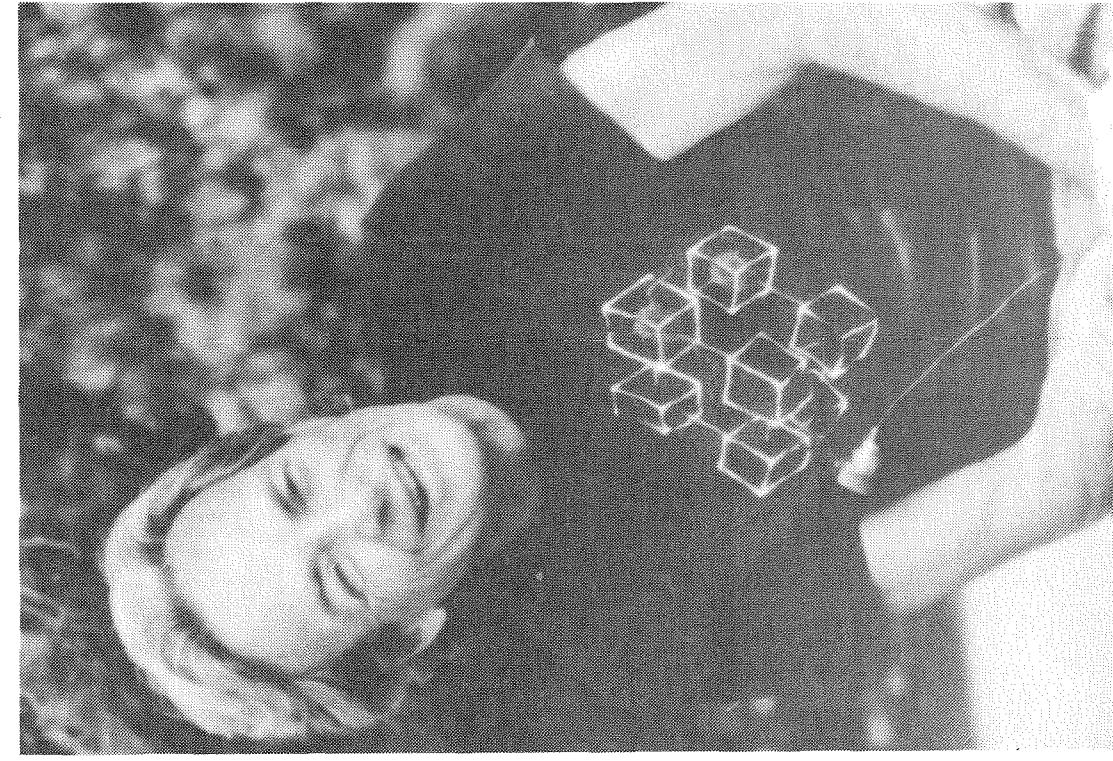


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painting by Sylvia Posner, 1981

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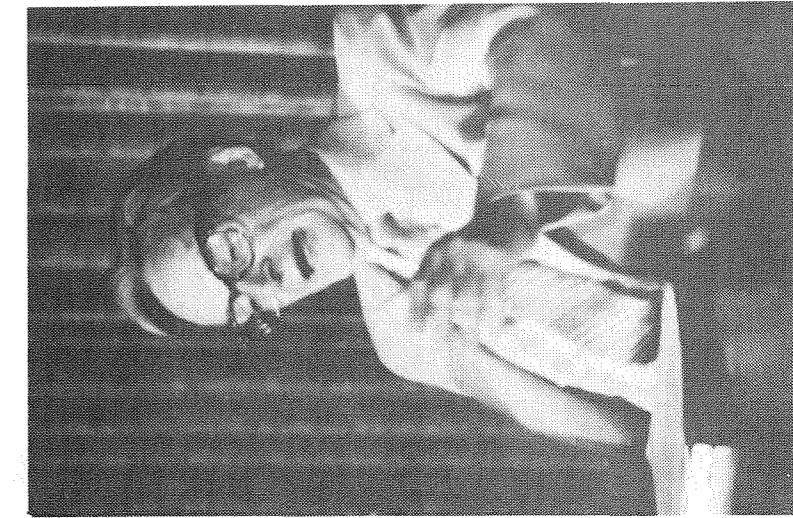
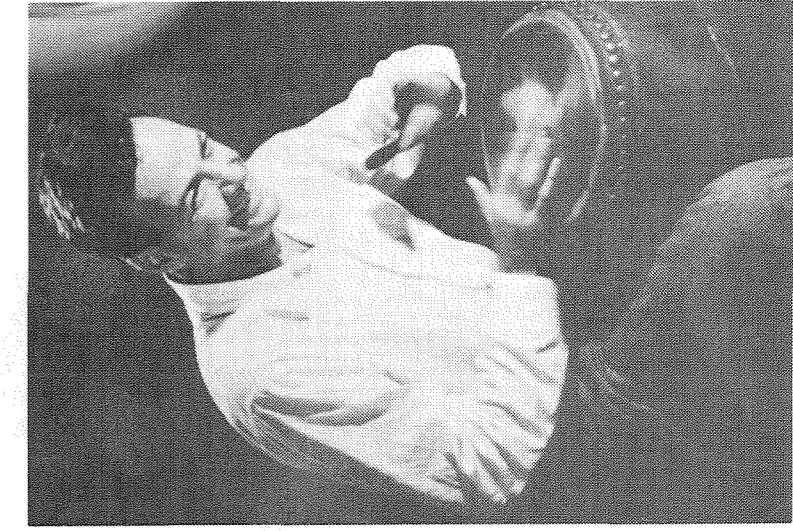


photo courtesy Caltech Public Relations

5



6



7



entertainment

The Blue Angel Poses Pitfalls of Decadence

by Drew Bailey

The darker, seedier side of sexual domination is explored on and behind the cluttered stage of *The Blue Angel*. If you ever wondered what would become of a pedantic middle-aged professor if he succumbed to the seductive legs of a cabaret singer, you can see Josef von Sternberg's *The Blue Angel* this Saturday night.

Marlene Dietrich stars as the provocative nightclub singer Lola Lola, who inspires such epithets as 'sex incarnate'. *The Blue Angel* was the first of a series of films featuring the unique sexual aura of Marlene Dietrich. Sternberg became obsessed with the direction of these films which made Dietrich a star, but eventually ended his directing career.

The Blue Angel was made in 1930 and is one of the first real classics of sound film. It tells the story of Professor Rath, the conservative tyrant of the classroom mentioned earlier. Upon discovering that his students frequent the dressing room of a certain singer, he resolves to vent his moral outrage in person.

However, once out of his own bourgeois surroundings, Rath is confused and disoriented. His indignation not only loses its force, but he falls in love with the offending Lola Lola. After spending the night in her arms he is unable to resume his old life. His students ridicule him and he must resign his position to marry Lola Lola. He joins her traveling troupe as her errand boy and eventually a ridiculous clown on stage.

The show returns to the Blue Angel, where Rath is humiliated beyond endurance. After trying to strangle Lola Lola, at once the object of his desire and degradation, he makes his way back to his darkened classroom to die clutching his old desk.

Marlene Dietrich and Emil Jannings as Rath give superb performances. The new sound media is confidently and creatively used to convey the atmosphere of the sleazy nightclub. *The Blue Angel* also marks the beginning of von Sternberg's struggle to fill dead space within the camera frame. His use of streamers, posters and nets creates a lush visual style which would soon become his trademark.

Although adapted from Heinrich Mann's biting satirical novel *Professor Unrath*, *The Blue Angel* carries a more conservative message. A warning that the decadent world of the street will dominate and destroy middle class morals without a thought if given a chance. Listen as Lola Lola sings her last song:

Falling in love again
Never wanted to
What am I to do
Can't help it.

Men cluster around me
Like moths around a flame
And if their wings burn
I know I'm not to blame.

The Blue Angel will be shown in Baxter Lecture Hall Sat. night at 7:00PM and 9:30PM. Tell your friends these times.

IHC Mini-Minutes

IHC Minutes 10PM 17 Feb 1988.

1. Dwight want the meeting next week to be at 8PM. Interviews for the new secretary and a new meeting time will be worked out.

2. Conrad's Corner

a. The food's okay, food service starts tomorrow with lunch.

b. Bets wonders if there will be mandatory board. Conrad says at least for this year.

3. Stan Borodinsky

a. Earthquake Preparedness and Safety: There will be 4 assembly areas when there is a major earthquake. Students should go to the appropriate areas, depending on which area they are in.

- Ath: UG houses area
- Wilson: Catalina Complex
- Michigan: Chester area
- Holliston: Grad Houses area

Fliers will be distributed to inform where they should go. Basically, students will have to be self-sufficient. Only 28 staff, 12 grads, and 13 undergrads trained in first aid and there isn't a large medical staff. Estimates are that 3-400 students (mainly UG's) will be injured in a major quake.

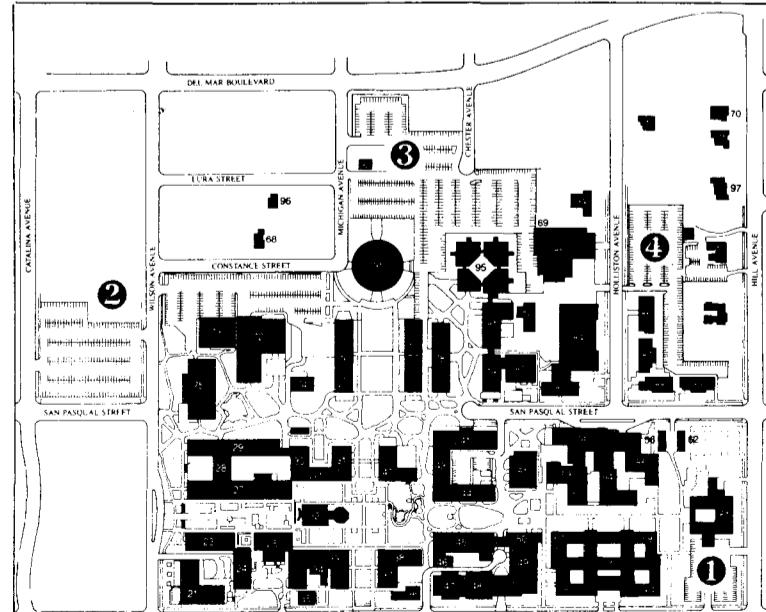
b. Stan wants houses to promote First Aid Classes. The goal is to have about 50 UG's trained in the 8 hour First Aid Course. Interested students should sign up in the Health Center.

c. Administration plans to reinstate Health Advocate Program next year.

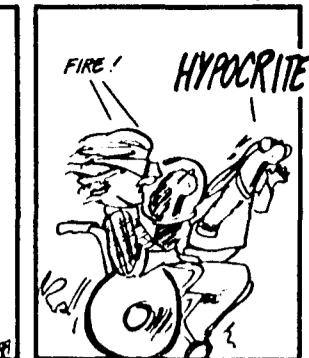
d. Adm. also wants the houses to come up with a plan to eliminate motorcycles on the Olive Walk. Stan says, people get scared.

4. Dave says Lloyd social team complained that ice from their house disappeared when they had a party. Wants policy that President or Social Team must be consulted before ice is taken from another house.

5. Bets asks if there will be a memorial service for Feynman on campus. Nobody seems to know.

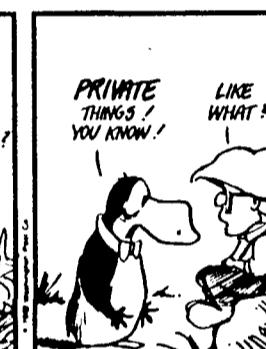
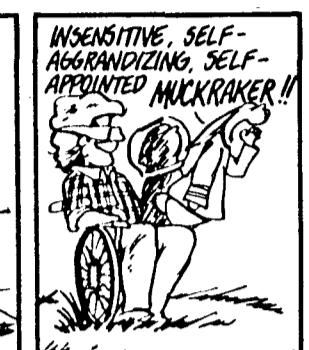
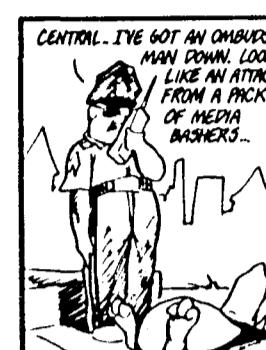


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what goes on

from page 12

Honeywell Futurist Competition

Honeywell's sixth annual Futurist Awards Competition, an essay contest open to full-time college students, asks students to predict technology advancements they foresee by the year 2013. This year's contest will offer 10 winners \$3,000 each. In addition, all entrants will receive a Futurist Award Competition poster designed by French artist Jean Michel Folon.

The 1988 contest is open to all full-time undergraduate or graduate students at any accredited U.S. college or university. Students are asked to devote the first half of the 2,000-word essay to one of the following areas: aerospace applications, aircraft capabilities, control systems for commercial buildings, control systems for homes, industrial automation and control, and microelectronic devices. The second part of the essay should reflect the societal impact of the predicted changes.

Completed essays must be postmarked no later than March 18, 1988. Essays will be judged on the bases of creativity, technical understanding, feasibility and clarity of expression. Winners will be notified by April 22 and will be flown to Minneapolis later that month for the awards ceremony.

To obtain registration information write: Honeywell Futurist Awards Competition, Box 524, Minneapolis, MN 55440, or call toll free, 1(800) 328-5111, x1581.

Cal Grant A Made Easy

If you are a California resident and are applying for need-based financial aid at Caltech for 1988-89, you must also apply for a Cal Grant A. This year it's easier than ever to apply for a Cal Grant A. Just complete the Cal Grant questions on the SAAC and have results sent to the California Student Aid Commission. The application deadline to submit your SAAC to CSS for both new and renewal applicants is March 2, 1988. Applications and details are available in the Financial Aid Office, 515 S. Wilson.

N.A.S.A.G.S.R.P.

The NASA Graduate Student Researchers Program (GSRP) is awarding approximately 80 grants of up to \$18,000 to promising U.S. graduate students whose research interests are synergistic with the goals of NASA research programs in space science and in aerospace technology. The Fellowships are awarded for one year and are renewable for up to 3 years. To be eligible the student must be a U.S. citizen and a full-time graduate student from an accredited U.S. college or university. Students may apply any time during their graduate career or prior to receiving their baccalaureate degree, and they must be sponsored by the student's graduate department chair or faculty advisor. For further information, please contact the Financial Aid Office, 515 S. Wilson.

\$\$\$For Women Engineers

The Los Angeles and San Buenaventura sections of the Society of Women Engineers are holding their annual scholarship program. Several \$1000 scholarships will be given to deserving women students of sophomore standing or higher that are enrolled in good standing in an engineering curriculum leading to a Bachelor's or higher degree in engineering. She must be in a position to accept the scholarship toward undergraduate or graduate engineering studies in an accredited school in the September following presentation of the award. Deadline for applications is March 14, 1988. For further information please contact the Financial Aid Office, 515 S. Wilson.

Northrop Fellowship

The Northrop Corporation Fellowship Program is sponsoring the Fellowships in Electromagnetics for 1988-89. Earn your M.S. in Electrical Engineering from UCLA, work at Northrop full-time during the summer and holidays, and half-time during the academic year.

Tuition, books and required fees paid by Northrop. Salary and benefits plus \$15,000 yearly stipend. For more information contact James B. McNeely, Ph.D., Northrop Corporation, Corporate College Relations, 30/136/52, One Northrop Avenue, Hawthorne, CA 90250. Phone: (213) 332-1514, or contact the Career Development Center (Caltech x6361), 08 Parsons-Gates.

Employment At The Red Door

Workstudy positions are available at the Red Door Cafe for Tuesday, Thursday and Friday afternoons. Hours are 2 to 6. Salary is \$6.00 to start. Please come by and leave your name on sign-up sheets if you are interested.

S.A.M.P.E. Symposium

The Society for the Advancement of Material and Process Engineering (SAMPE) will host its largest-ever international symposium and exhibition between March 7-10 at the Anaheim Convention Center, in Anaheim. The theme of the gathering will be: "Materials - Pathway to the Future."

Registration: March 6, 1-5 pm, March 7-9, 7:30 am-5 pm, March 10, 7:30 am-1:30 pm. Exhibits: March 7, noon to 5 pm; March 8, 10 am to 6 pm; March 9, 9 am to 5 pm; March 10, 9 am to noon.

The program will include 350 exhibits, a symposium presenting 225 papers, a keynote address entitled "Trends in Foreign Affairs: The U.S. Perspective," and an awards luncheon at the Anaheim Hilton Hotel.

For additional information about SAMPE, please contact Marge Smith, business director, at PO Box 2459, Covina, CA 91722, or phone (818) 331-0616.

Study At Oxford

The University of Detroit in conjunction with Oakland University is offering British Studies at Oxford. The setting for this idyllic, credit-bearing program is Corpus Christi College, Oxford.

The program offers tuition, private room, full board during the week, excursions to London, Stratford-upon-Avon, Bath, Coventry and other sites, theatre tickets, visits to world famous museums for six weeks, and six or eight credits, for \$3300, not including air fare. Students may opt for a three week, three/four credit program at \$1850. Most courses offered by Oxford tutors include Art History, Antiques, British Architecture, Business Management, History, Literature (Drama, Medieval Literature and Modern British Literature), and Political Science.

For further information write or call Dr. Edward J. Wolff, Director of Study Abroad, the University of Detroit, 4001 W. McNichols, Detroit, MI 48221. (313) 927-1082 or 652-3405.

Summer Research At UCLA

There are 14 summer research positions open at UCLA in biological and biomedical sciences, physical sciences and engineering designed to provide experience and encouragement to undergraduates contemplating research careers. The program lasts from June 20-August 26, 1988 (10 weeks). It is open to all college sophomores and juniors. U.S. citizenship or permanent resident status is required. There is a stipend of \$150 per week. Limited travel funds for some out-of-state applicants may be available. **Housing is not provided.**

Selected members of the UCLA faculty will accept students into their laboratories under a program hosted by the UCLA Laboratory of Biomedical and Environmental Sciences, a U.S. Department of Energy-funded facility. Students have the opportunity to experience on-going scientific research. In the past, research fields have included biology, biochemistry, chemistry, engineering, environmental sciences, molecular biology, nuclear medicine, public health, physics, etc. The program also includes weekly group discussions and seminars on applicable research-related topics.

Interested students are invited to write for applications to: Mr. Robert Stoddard, UCLA Laboratory of Biomedical and Environmental Sciences, 900 Veteran Ave., Los Angeles, CA 90024-1786. The deadline for receipt of completed applications is March 21, 1988.

Money For Economists

The National Society of the Colonial Dames of America is offering an award of \$1,000 to graduate students and undergraduate seniors majoring in economics. The deadline for entries is **March 14, 1988**. For further information please contact the Financial Aid Office, 515 S. Wilson.

San Joaquin Oil Money

The San Joaquin Valley Section of the Society of Petroleum Engineers will be awarding scholarships to qualified applicants who are enrolled as full-time undergraduate or graduate students in engineering or energy related disciplines at an accredited college or university. Preference will be given to those applicants demonstrating a sincere intent to enter the petroleum industry after graduation. Applicants should be residents or former residents of the San Joaquin Valley area, or children of current members of the San Joaquin Valley Section of the SPE. A completed application, question section, and an official transcript should be submitted by March 4, 1988. For further information please contact the Financial Aid Office, 515 S. Wilson.

Summer Molecular Biology

Robert Wood Johnson Medical School is sponsoring undergraduate summer research in molecular biology and biochemistry from June 13 to August 19, 1988. Application deadline is **April 1, 1988**. Stipends: \$2,000 to \$2,500. On site housing available.

The goal of the program is to provide undergraduates with the opportunity to perform supervised research in molecular biology and biochemistry. At the end of the summer period each student will write a progress report and will be presented with a certificate of having completed the program.

For an application form please write Dr. Masayori Inouye, Chairman, Dept. of Biochemistry, UMDNJ-Robert Wood Johnson Medical School, 675 Hoes Lane, Piscataway, NJ 08854-5635.

I.S.O.E. = S.P.I.E.?

S.P.I.E.-the International Society for Optical Engineering, is awarding scholarships and grants in sizes ranging from \$500 to \$5,000. Application may be made for funding of any activity in the field of optics. A course of study in optics or optical engineering and student travel to meetings of professional and technical societies are appropriate uses for scholarship and grant awards. Applications must be received by May 2, 1988. For further information please contact: Warren J. Smith, Chairman, SPIE Education Committee, PO Box 10, Bellingham, Washington 98227-0010, or contact the Financial Aid Office, 515 S. Wilson (2nd floor).

Living In A Material World?

The Society for the Advancement of Material and Process Engineering (SAMPE) is awarding 19 \$1,000 scholarships to college students pursuing courses leading to a career in Material and Process Engineering. Consideration is given to scholastic average, specific courses of study, academic awards and honors received, technical and other work experience and the student's communicated objectives in Materials and Processing technology. Competition is in progress, and judging takes place in February and March, 1988, with awards being announced in April, 1988. Applications and details are available in the Financial Aid Office, 12-63 (515 S. Wilson, 2nd floor).

Planetary Science Scholarships

The Planetary Society is offering five \$1,000 awards to students majoring in engineering and science. Awards will be made on the basis of scholastic achievement, a commitment to a career in planetary related science, and a written essay on a relevant topic. The deadline for completed applications is April 15, 1988. Mail in cards for further information are available in the Financial Aid Office, 12-63 (515 S. Wilson, 2nd floor).

Consulting Engineers \$\$

The Consulting Engineers Association of California announces its twelfth annual competition for upper-division, undergraduate scholarships in engineering to be awarded to a limited number of students who are interested in consulting engineering as a possible career.

To be eligible, a candidate must be (1) scheduled to enter his or her third or fourth year of undergraduate study in the fall of 1988, (2) in the upper half of his or her engineering class, (3) working for a B.S. degree in engineering, (4) interested in consulting engineering as a career, and (5) a United States citizen.

For applications and more information, stop by the Career Development Center, 08 Parsons-Gates.

Summer In Scenic Buffalo, NY

Roswell Park Memorial Institute, at 666 Elm Street in Buffalo, New York (14263) is sponsoring a summer research participation program for college juniors. In addition to other qualified students, they are actively seeking applications from minority students of Black, Alaskan Native, American Indian, Hispanic or Pacific Islands origins. [If this sounds nebulous, it's because their cover letter didn't say much.] Application deadline is March 11, 1988. Write to them for information, or call (716) 845-5706.

Hunter Rouse Fellowship

The University of Iowa College of Engineering is sponsoring the Hunter Rouse Postgraduate Fellowship in Hydraulics and Fluid Mechanics. Recipients must have earned a B.S. or M.S. by the 1988 academic year. Stop by the Career Development Center, 08 Parsons-Gates, for more information.

JFCS Grants

The Jewish Family & Children's Services is offering grants of up to \$2,000 per year for students through age 21 who are working towards an Associate's or Bachelor's Degree. They are also offering loans of up to \$5,000 per year to students enrolled in any academic or vocational program. In order to qualify, the student's primary residence must be in the JFCS service area, which includes San Francisco, the Peninsula, Marin and Sonoma counties. For further information please contact the Financial Aid Office, 515 S. Wilson (2nd floor).

Money For Kern Co. Oil Buffs

The Wilma Addington Memorial Scholarship is being offered by the Desk and Derrick Club of Bakersfield in honor of one of their past presidents, the late Wilma Addington. The scholarship is granted annually to a permanent resident of Kern County who is pursuing higher education in a petroleum or allied industry related field. Application deadline is August 15, 1988. For further information please contact the Financial Aid Office, 515 S. Wilson.

Become A WHO Doctor

The Worldwide Medical Education Institute enables students to earn the M.D., D.V.M. or D.D.S. degree in Europe, Mexico and in the United States. It offers:

Direct admission into World Health Organization (W.H.O.) listed and fully accredited Medical, Veterinary and Dental schools which participate in the U.S. Office of Education Guaranteed Student Loan Program for Health Profession Students.

Complete Language-culture and Graduate programs leading to advanced placement into accredited schools in Italy, Spain and Mexico.

The Institute has assisted many students to gain admission to U.S. and foreign medical schools and to successfully obtain the M.D., D.V.M. and D.D.S. degree, leading to licensing and practice in the United States. For further information write or phone: Dr. C.C. Sippio, Dean of Worldwide Medical Education Institute, 318 Fourth Street, Union City, NJ 07087. (201) 867-2864.

Hospice Volunteer Training

Men and women are needed to join a team of physicians, psychologists, oncology nurses and other health care professionals who provide in-home support to the terminally ill. Gain ability to deal with death and dying and to understand patient and family needs. Few of us are untouched by death and many are searching for ways to understand that experience and cope with it.

Interested volunteers should call NOW for an application. Training is scheduled for April 13-May 18, six consecutive Wednesday evenings from 6-9 pm. Special health-related background is NOT a prerequisite, but welcome. Call Bobbe Mullen, Community Resources Coordinator, Hospice of Pasadena, at (818) 577-8484.

Museum Sponsors Dig

Have you ever dreamt of discovering a lost civilization, of being the first to touch something no one has seen for hundreds of years? (Other than the bottom of your closet.) The Natural History Museum of Los Angeles County and the Crow Canyon Archaeological Center (in Colorado) are offering a week-long, no-experience-necessary course giving adults the chance to take part in the excitement of an archaeological dig. Dates for the trip are June 12-18.

For the first two days, participants will discover the Anasazi Indians through hands-on study of pottery, atlatl spear-throwing, fire making and weaving. The remainder of the week will be spent learning the layout of the site and participating in the actual excavation process.

Participants are housed in shared lodgings and are served three meals a day. Cost is \$625 for museum members and \$650 for non-members, with a \$150 deposit required (airfare not included). For more information, please contact Judith Chovan at (213) 744-3535.

Naval Research

The Research Participation Program at the Naval Training Center (NTSC) is offering postgraduates, graduates, and undergraduates opportunities to conduct hands-on research in advanced simulation and training systems technology. Applicants for the graduate and undergraduate appointments must be currently enrolled in an academic program leading to a baccalaureate or advanced degree in a discipline related to training technology. Selection of participants is based on academic records; recommendations; scientific interests; compatibility of the applicant's background and interest with needs of the research center; and the availability of funds, staff, and facilities. Graduate and undergraduate appointments are for the summer, a semester, or one year, renewable for a second term. Students may participate on a full-time (40 hours/week) or part-time (20 hours/week) basis. For further information please contact the Financial Aid Office, 515 S. Wilson.

Money For Vermontinis

Vermont Student Assistance Corporation is offering a Vermont Grant for the 1988-89 academic year to residents of Vermont. The Grants can be used at colleges throughout the country if the college is approved by the U.S. Department of Education for participation in the Student Aid Programs. The application priority date is March 1, 1988. For further information, please contact the Financial Aid Office, 515 S. Wilson.

Marinaid?

Marin Educational Foundation is offering grants to Marin County residents who will be pursuing an undergraduate degree on at least a half-time basis as of September, 1988. The deadline to apply is **April 1, 1988**. For further information please contact the Financial Aid Office, 515 S. Wilson.

Arizona Honors Academy

The University of Arizona, Arizona State, and Northern Arizona University have organized a special summer session entitled "Seeking National Security in an Insecure World." Selected students will have the opportunity to spend three weeks in an exciting seminar with faculty from all three Arizona universities, nationally and internationally distinguished experts, and exceptional undergraduate students from throughout the United States. Only 30 students will be selected.

The 1988 Academic session will be held from Saturday, June 11 through Friday, July 1, 1988 at Northern Arizona University located in Flagstaff. Applicants must be undergraduate students who have completed the equivalent of 27 semester hours with a minimum cumulative grade point average of 3.5.

Completed applications are due by **March 1, 1988**. If you are interested in applying you should come to the Deans' Office, 102 Parsons-Gates.

Money From The Blind

The National Federation of the Blind is offering seven different scholarships ranging from \$1,800 to \$10,000. The scholarships are awarded on the basis of academic excellence, service to the community and financial need. The deadline for receipt of the application is March 31, 1988. For further information please contact the Financial Aid Office, 515 S. Wilson (2nd floor).

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sports

Basketball on Target

by Hooke S. Hot

Overall, this past week was a good one for the Caltech basketball team as it followed a tough home loss to Redlands with its best game of the season — an eight point win over Whittier on the road.

Redlands gambled on defense throughout the game. This surprised Caltech, at first leading to several turnovers as Redlands built up a fifteen point lead early in the first half. As the game rolled on, the Beavers regained their poise, and with the help of strong inside play by Huck Seed and Bill Swanson, they cut Redlands' lead to nine by halftime.

In the second half, Randy Ralph sparked the Beavers with excellent outside shooting as Caltech battled its way back into the game only to fall six points short when it was unable to connect on several 3-point attempts in the closing minutes.

The final score was 45-39. Huck Seed led the team with 14

points, Bill Swanson had 12 points and an impressive 10 rebounds (hey Bill, you were just 10 assists short of your first triple-double), and Randy Ralph scored 8 points, all in the second half.

The Beavers bounced back from this tough loss with an impressive 65-57 victory over Whittier. The Poets failed to intimidate the Beavers with an aggressive full court press, as Caltech's guards, Brad Scott and Jason Karceski worked together beautifully to break Whittier's press without making a single turnover. The highest of many high points for the Beavers was their excellent defense, spearheaded by Huck Seed who had five of the team's nine steals.

"Team" was definitely the word to describe Caltech on this night. The Beavers' play was characterized by excellent passing and defense which led to good shots for the Beavers and poor shots for the Poets. Caltech and Whittier ex-

changed leads several times in the first half, but the Beavers took the lead for good early in the second half as Jason Karceski sparked the team with his typically accurate outside shooting.

Whittier gambled on defense in the closing minutes, but Caltech refused to fold, as it took advantage of Whittier's mistakes to get several layups, most notably a tremendous two-handed reverse slam by Bill Swanson. When Whittier was finally forced to foul, Jason Karceski and Brad Scott combined to make 8 out of 9 free throws in the final two minutes to clinch the game. Jason led all scorers with 18 points, followed by Bill with 17, and Huck with 15. Bill and Jason also led the team with 8 and 7 rebounds respectively.

Caltech is playing its best basketball of the season and appears ready to end its home season with a bang tonight against Occidental at 7:30.

Runners Charge Forward

by Out O. Breath

Competitive track began last Saturday with La Verne, Whittier, Masters, and Chapman colleges invited here, at Caltech. With a lot of promising freshmen in the team, this was the beginning of what looks like a great season.

Congratulations should go first to the women, who compared respectfully with the other teams, losing 50-65 to Whittier, 49-50 to Chapman, and winning Masters 68-19. This is the first time our women have beaten a team in several years.

Five of the six Beavers that competed on Saturday set school records. Freshman Liz Warner did so in the 200m (29.8) which gave her a third place, and in the long jump (4.55m), as a second place. Freshmen Susan Schima and Golda Bernstein and juniors Dee Morrison and Bibi Jentoft-Nilsen set a record in the 4x400 relay with the time of 4:58.9.

All of them also had good individual performances. Christina Garden did not set a record but ran a respectable 3000m without having much training. As the women's team is expected to grow in numbers, they may even be competitive in the conference.

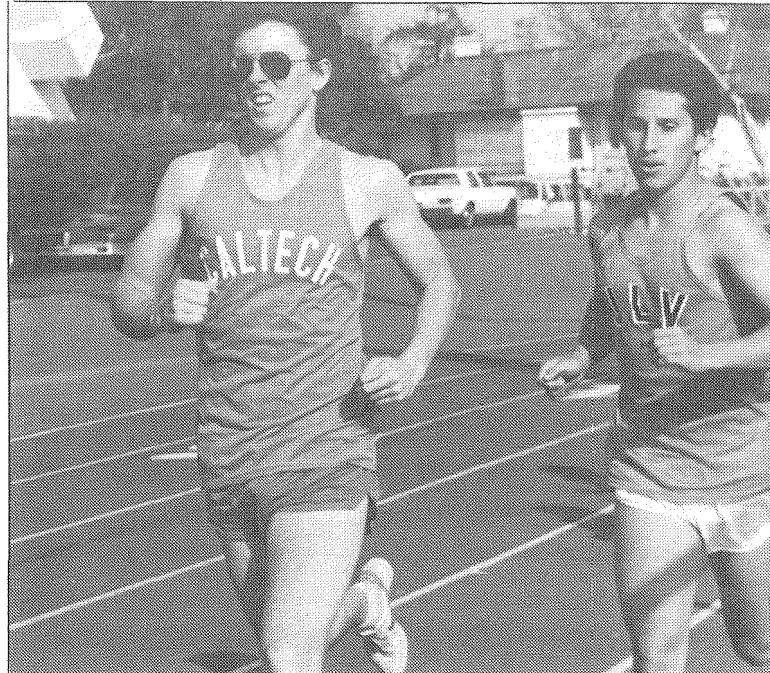
Our men had no trouble staying ahead, beating the closest competitor, La Verne 96-57. First places were won for the Beavers by Gary Eastvedt (triple jump, 11.80m), Steve Harkness (shot put,

11.47m), John Ragin (400, tied at 54.3), Joe Shiang (800, 2:02.7), and Paul Socolow (100 IH, 63.2). It should be noted that all of the above five athletes are newcomers with senior Shiang being the only non-freshman.

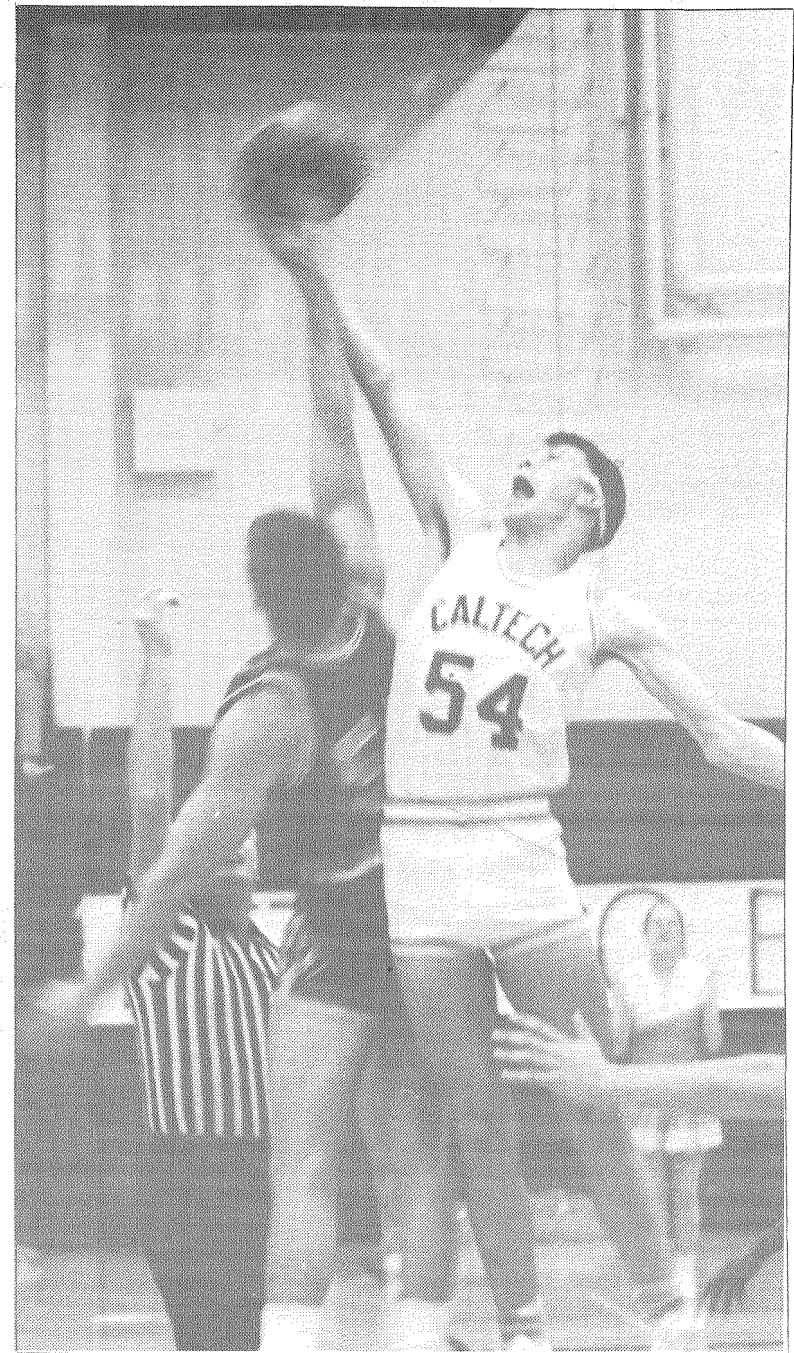
Noteworthy performances were also achieved by Ray Sidney, who ran the 110 HH, and the 400 IM, pole vaulted, triple jumped, and ran a few relays; Chris Campo, who ran the tough 10,000m in 37:18; John Gehring and Wayne

Lukens in the 1500/5000; Amezcuia, Miller, and Mao at the discus (29.84m, 29.54m, and 29.32m respectively); and Konstantin Othmer in the sprints. Running unattached, junior Alex Athanasopoulos, who is expected to be officially on the team next term, led the 1500 in 4:02.1.

The next track meet is an All-Comers' meet at Pomona-Pitzer on Saturday, February 20, at 11:00 A.M.



Caltech's Jeff Willis passes a LaVerne runner during his race in Saturday's meet at Caltech. The meet also included teams from Whittier, Masters, and Chapman.



Bill Swanson reaches to great heights in an attempt to overcome his opponent in the game against Redlands.

photo by Michael Keating

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sports

Women Drop Tennis Match

by Chris Everett Lloyd

Everyone has good days and bad days, and Caltech's women tennis players are no exception. Last Saturday, the Beavers lost 2-7 to a Whittier team which they had a very good chance to beat. It was a frustrating day for Coach Giny Marum and every team member as virtually no breaks went their way all afternoon.

The match was lost in singles play which Whittier dominated 5-1. Three of the five matches Whittier won could have just as easily gone to Caltech, but it was simply not Tech's day.

At sixth, fifth, and first singles, the Beavers had chances but fell short. Sixth seed Jennifer Low lost to a temperamental Jean Ettinger 1-6, 5-7. Ettinger is the kind of player who can fall apart if things start going wrong for her, but Jennifer could not mount any kind of offensive at any point in the match. She hung tough in the second set, but could not turn the tide.

At fifth singles, Linda Schlueter lost to Kim Taylor 6-7 (10-8), 1-6, in a match which was marked by an "injury" to Whittier. She went down in the second set with an apparently seriously painful injury which had her at the point of tears. A few minutes later however, she was hopping up and down saying she felt better. A low threshold of pain, or perhaps a subtle psychological ploy? Either way, she stayed in and won the match.

Caltech's first singles player, Carol Choy, lost yet another heart-breaker in three sets to Jennifer Lindholm. The fashion in which Carol lost this match was similar to that of some of her earlier losses in this young season. Carol played well at the start, and captured the first set 6-4. In the second set, Carol lost many close games as she

couldn't win the 3-3 game points. She ended up losing the set 2-6. Finally in the third set, Carol's game broke down early on in the set, and she found herself down 0-3. She came back strong, but couldn't break Lindholm's serve enough to force the match to a tie-breaker. Lindholm took the final set 6-3.

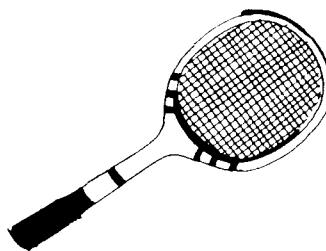
Second and fourth singles saw Laura Hernandez and Junko Munakata lose to Whittier opponents who were playing very, very well. In her seasonal debut at second singles, Laura was handed a 1-6, 4-6 loss by heavy hitter Elizabeth Cole (with an emphasis on heavy). Junko faced a tireless and virtually errorless Shelli Oye who rolled to a 6-1, 6-1 victory.

One of the lone bright spots on the day for Caltech was the play of Jane Seto. Jane beat her third singles opponent in three sets 6-3, 6-7 (9-10), 6-2, and also played very well in doubles. Jane seemed to be in great shape physically and psychologically in her singles match as she utilized a mix of "smart" tennis and aggressive play to dispose of the talented Stephanie Althaus.

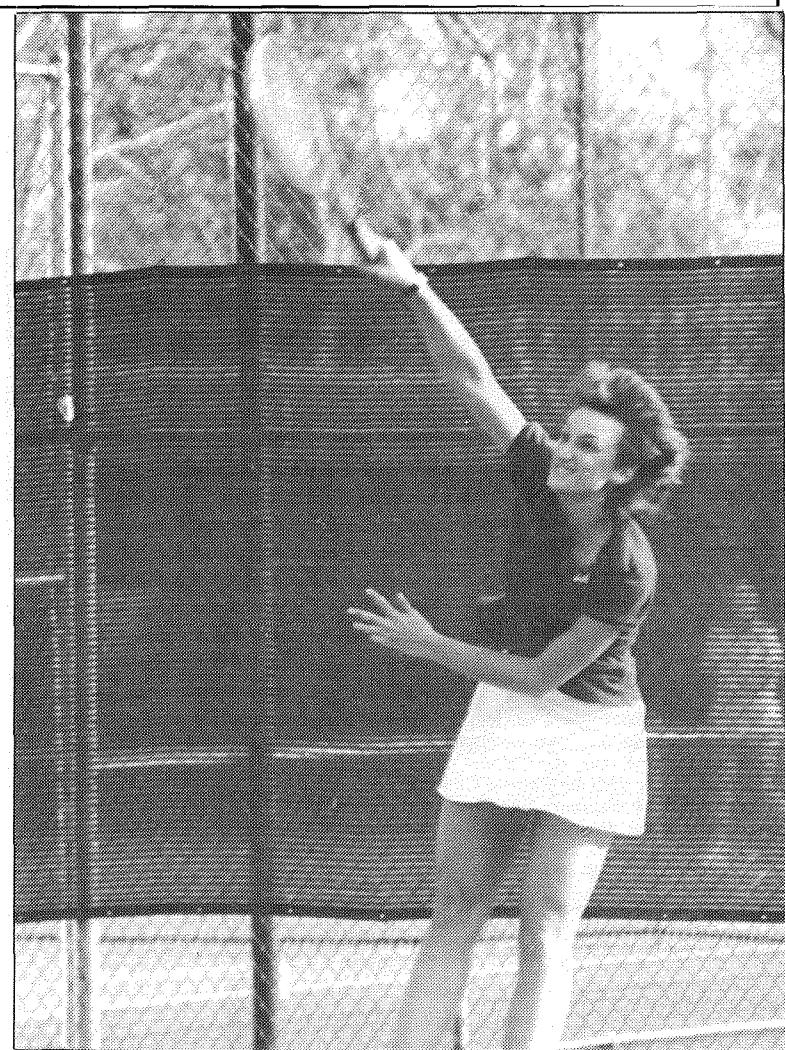
The most deceiving fact about her set score was the fact that Jane actually won her second set, but failed to see one of Althaus' serves go long in the tie-breaker. That serve, which every spectator from both sides saw as out, would have meant a double fault for the Whittier player and an 8-6 tie-breaker win for Jane. However, Jane missed it and was extremely mad at herself afterwards about failing to call it. Yet this was her day and she didn't let her blunder bother her too much, as she demolished her opponent 6-2 in the third set.

Doubles play mirrored the pattern of the singles fairly well. Each

match could have gone either way, but Caltech came up on the losing end. The first and third doubles teams of Choy-Seto and Mullenax-Munakata lost despite winning their first sets. The second doubles team of Hernandez-Schlueter made an impressive comeback in their match to win 4-6, 6-4, 6-3, despite the facts that they both individually lost in singles, they lost the first set in doubles, and the overall match had already been decided long before.



Caltech has another home match coming up this Saturday against Claremont-Mudd-Scripps at 1:30. This will be their last home Saturday match of the season. If you wish to catch all of the human drama of athletic competition live and in person, I'd suggest you come out to watch.

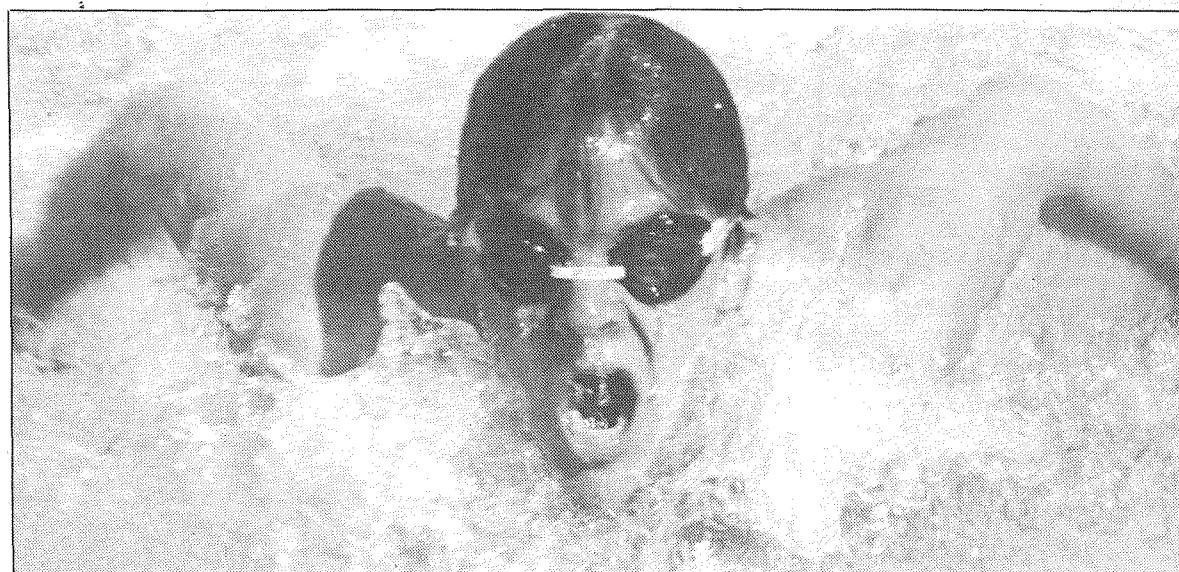


Linda Schlueter, number five singles, demonstrates great determination in her service. Caltech women lost the match, 2-7.

photo by Michael Keating

WEEKLY SPORTS CALENDAR

Day	Date	Time	Sport	Opponent	Location
Fri.	2-19	9:30 am	Swimming	SCIAC Championship	East L.A. College
Fri.	2-19	2:30 pm	Baseball	La Verne	Caltech
Fri.	2-19	7:30 pm	Basketball	Occidental JV	Caltech
Sat.	2-20	9:30 am	Swimming	SCIAC Championship	East L.A. College
Sat.	2-20	11:00 am	Baseball (2)	La Verne	Caltech
Sat.	2-20	11:00 am	Fencing	C.S.U.F. & U.C.S.D.	Cal State Long Beach
Sat.	2-20	11:00 am	Track	Pomona-Pitzer All Comers	Pomona-Pitzer
Sat.	2-20	1:30 pm	Tennis (W)	Claremont-Mudd-Scripps	Caltech
Sat.	2-20	2:00 pm	Tennis (M)	Redlands	Redlands
Sun.	2-21	10:30 am	Swimming	SCIAC Championship	East L.A. College
Sun.	2-21	3:00 pm	Soccer Club (W)	Defeat	Caltech
Mon.	2-22	1:00 pm	Golf	La Verne & Occidental	Caltech
Tue.	2-23	2:30 pm	Baseball	Pac. Coast Baptist Bible College	Caltech
Tue.	2-23	3:00 pm	Tennis (M)	Occidental	Caltech
Tue.	2-23	7:30 pm	Basketball	Redlands JV	Redlands
Wed.	2-24	3:00 pm	Tennis (W)	Occidental	Caltech
Thu.	2-25	1:00 pm	Golf	Whittier	Redlands
Fri.	2-26	3:00 pm	Baseball	Occidental	Occidental
Sat.	2-27	11:00 am	Baseball (2)	Occidental	Caltech
Sat.	2-27	1:30 pm	Tennis (M)	Whittier	Whittier
Sat.	2-27	1:30 pm	Tennis (W)	Redlands	Redlands
Sat.	2-27	TBA	Fencing	Women's West. Regionals	San Diego
Sat.	2-27	TBA	Ice Hockey	M.I.T.	M.I.T.
Sun.	2-28	TBA	Fencing	Women's West. Regionals	San Diego
Sun.	2-28	11:00 am	Soccer Club (W)	Misfits	Caltech



Caltech swimmer gasps for air as he competes in the butterfly competition. Caltech won the meet against Cal State San Bernadino and PCC.

photo by Teresa Griffie

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what goes on

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OLIVER!

Yes, it's finally here! The Musical has arrived once again! Tonight and tomorrow night at 8:00 pm, and Sunday at 2:00 pm in Ramo Auditorium, the annual Caltech Musical. Admission: \$9.50 general admission, \$8.00 for students. Call x4652 for information.

College Bowl Tourney Today!

Yes, today is the day for Caltech's first on-campus College Bowl tournament, noon to 2:00 pm, Winnett Lounge. Moderated by Professor Ned Munger, this tournament will feature four teams of Caltech undergrads, graduates and staff members. Everyone is encouraged to come watch these teams match wits.

Chinese New Year Party

Happy Chinese New Year everyone! To celebrate the new year, the Chinese Club will have a party with the Chinese Club of PCC on Saturday, February 20th. The party will be held at Winnett Lounge, and it will consist of a dinner at 6:00 pm and a dance at 9:00 pm. The cost of the dinner is \$2 for CCSA members and \$6 for non-members, and the dance is free for all Techers. Semi-formal dress is preferred. So don't miss this golden opportunity to meet the Chinese students from PCC. Come and join the fun.

The Orphanage Project

On Saturday, Feb. 6, we had the first meeting about helping the orphanage, "El Rancho Milagro," in Mexico during spring break. We will be painting and repairing the kids' dorms, sleeping in tents, and we'll probably be going down in a bus. The trip will be from Friday, March 18, to Wednesday, March 23.

If you would like to go and help, have any donations (clothes, toys, etc.) for the orphanage, or would like to support the trip in any way, please attend the second meeting in Rm. 13 (Clubroom A) of the S.A.C. on Saturday, Feb. 20 from 6:00-8:00 pm, or contact Geoff Pilling, 1-59, 578-9346.

We will be discussing exactly what we'll be doing, the costs of supplies needed, and work on a schedule for the trip itself.

The trip is open to all members of the Caltech community. Please attend!

CLASSIFIED ADS

HELP WANTED—

MALE STUDENTS WANTED!

University students as sperm donors by California's largest sperm bank. Earn \$70-105/week. 213-553-3270 California Cryobank, Inc., 2080 Century Park East #306, Los Angeles.

TUTOR WANTED

English, Math for college preparing 11th grader. Also need tutor for 9th grader. Math, Science & English. Good pay. Call 818-578-0128 San Marino.

FOR SALE—

PLANE TICKET to Philadelphia for Spring Break. \$198 round trip. Call Colin 356-6829.

SERVICES—

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PERSONALS—

GAY CALTECH UNDERGRAD, 22, quite civilised and socially competent, seeks the company of other adventurous, intelligent young men while exploring the L.A. area. Our free time is scarce. Let's make the most of it. Romance possible, friendship a must. R.S.V.P. P.O. Box 75, Pasadena, 91102.

RATES . . . \$2.50 for first 25 words; . . . 10¢ for each additional word. Send written ad with payment to 25-58. No charge for on-campus lost & found.

IHC Secretariat Up For Grabs

Nominations for IHC Secretary will run from today until Wednesday, February 24 at 6:00 pm. Sign up on the MOSH's door (or at least on the list posted on it). Interviews for the position will be held Wednesday, Feb. 24 from 8:00 pm to 9:30 pm. (A schedule of interview times will be posted shortly after 6:30 pm). Nominees must have the ability to take notes and provide the proper refreshments for the IHC meetings. If you have any questions contact Dwight Berg at 356-9111.

First-Aid Training

First-aid certification will be offered at the Health Center. This eight hour course will be taught in two our hour sessions on consecutive Wednesdays. The next session will be held on Wednesday, February 24 from 6:00 to 10:00 PM. Please register by calling the Health Center (x6393) by Monday, February 22.

New Physics Course

Physics 103b (Third Term): Topics in Contemporary Physics. A course on the techniques of experimental particle physics. Detectors that will be discussed include devices used in the measurement of position and momentum (multi-wire proportional chambers, drift chambers, time projection chambers and solid state detectors), of energy (electromagnetic and hadronic shower counters: gas, cryogenic liquid, etc.) and particle identification (time of flight, ionization loss, Cerenkov counters). Amalgamation of these elements into viable experiments will be treated. Knowledge of high energy physics, though useful, is not required. *Instructor: Wisniewski*

Big Band Swing Cabaret

The first annual Big Band Swing Cabaret will be presented at the Pasadena Convention Center, 300 E. Green St., on Saturday, Feb. 27 from 7 pm to 2 am and on Sunday, Feb. 28 from 3 to 10 pm.

The old fashioned cabaret will feature three bands each day where people can "set and watch or cut a rug" according to Harry Washington, spokesman for the bash.

General admission is \$35 each day, reserved seats \$50 each day. Both tickets include a buffet and there will be a no-host bar.

For information, call the Pasadena Center at (818) 793-2122.

Surf Club's Up!

The Surf Club is proud to announce a more than ample collection of surfboards and wetsuits to keep you stoked. If you want to check them out for a day or longer, contact Bill Foster, 795-4049 (nights) or Chris Edgington, 577-9694.

Second Term Film Series

In conjunction with H-131: History Through Film, Professor Robert Rosenthal will be screening a series of excellent feature-length films at 7:30 pm on Wednesday evenings in Baxter Lecture Hall. These screenings are open to members of the Caltech community. There is no admission charge. The film for February 24 will be *Ceddo* (Senegal-1976), directed by Ousmane Sembene.

L.A. Philharmonic Tickets

The Caltech Y has tickets for the following dates: 19 February (Haydn, Britten); 18 March (Haydn, Shostakovich); 15 April (Lutoslawski, Mozart, Brahms). For more information, like how to make use of these tickets, contact the Y Office, upstairs in Winnett.

Wanna Ski?

The Ski Club/Team plans to hold several weekend outings to Mammoth, June, Sierra Summit and Goldmine ski resorts. If you are interested in skiing, either for fun or competitively, contact Christina Garden at 356-9322 or come to a Ski Team meeting (to be announced).

SSSP Tutors Needed

We will be needing tutors for our Summer Secondary School Science Program that begins June 27th through August 11th, 1988, from 9:00 am to 3:30 pm Monday through Thursday. We will need 4 tutors each for: Molecular Biology, Chemistry, Physics/Trig, and Physics/Calculus. Our first preference is to have seniors, then juniors, and last sophomores. Applicants may call x6207 or 6208, or come by Lee Browne's office at 515 S. Wilson Ave.

We are also looking for counselors for the dormitories; applicants may sign up for the counselor positions at the Master of Student Housing Office or with Lee Browne.

Weird Bacteria At Work!

Mary Lidstrom, Associate Professor of Applied Microbiology in Environmental Engineering at Caltech, will speak on her work in a talk entitled "Genetic Studies in Unusual Bacteria: The Methanotrophs." Her lecture, to be given at 12 noon on Friday, Feb. 19 in 114 E. Bridge, is the fifth in the OWC-sponsored series, "Presenting Caltech's Women Faculty." Please bring your lunch and check out some of the hottest new science around!

Boom, Doom or Muddling?

On Tuesday, Feb. 23, the Caltech Management Association is sponsoring a talk by Knight A. Kiplinger, discussing "America in the 1990's: Boom, Doom or Muddle Through". The talk will be at von Karman Auditorium at JPL at 5:00 pm. All Caltech employees and retirees are invited to this talk, in which Mr. Kiplinger (editor of *Changing Times* magazine) will discuss America's present and future position in the world economy. He predicts strong growth in the American economy between now and the year 2000. But is that good or bad?

Industry Comes to JPL

Andrew Paterson of RimTech will talk on how students may work in transferring technology from JPL to industry. Summer positions are available. The company is a non-profit organization that is conducting a program to commercialize NASA/JPL technology. The program is aimed at helping American companies maintain world competitiveness. The talk is at 4:30 pm, Wednesday, 24 February in Rm. 22 Gates. Sponsored by the Caltech Y.

The talk was previously mistitled. There is no connection between the talk and the Caltech SURF program.



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Arab-Jewish Dialogue

Hillel and the Middle East Studies Group present lectures by Muhammad Darawshi, founder of *Legacy*, an organization promoting Arab-Jewish dialogue in the U.S., and Uzrad Lew, former personnel advisor to the director of Israeli military intelligence, 1983-84. The talks will be at 8:00 pm on Wednesday, February 24 in the Millikan Board Room. Admission free. Sponsored by Hillel, M.E.S.G., ASCIT, The Caltech Y and the GSC.

\$300,000 Will Be Awarded . . .

NCR Corporation is having an essay competition for full-time college and university students.

The competition offers a \$50,000 cash first prize for the best essay on the topic of "Creating Value for All Stakeholders in Corporations and/or Not-For-Profit Organizations." Another 100 semifinalists will receive \$1,000 cash each.

All entries must be postmarked by March 31, 1988. For more information, contact the Deans' Office, 102 Parsons-Gates.

Jake Gimbel Scholarship

The Jake Gimbel Scholarship Fund is offering approximately 15 interest-free, 10-year maturity loans of \$2,000 each for the coming academic year. To be eligible, applicant must be male, a resident of the United States and enrolled at graduate school in California at the time of tenure of the award. The deadline to submit applications is May 15. For further information please contact the Financial Aid Office, 515 S. Wilson.

E.T. Bell Research Prize

The E.T. Bell Undergraduate Mathematics Research Prize is a cash prize of \$500 awarded for the best original mathematics paper written by a Caltech junior or senior.

Contestants for the Bell prize must be nominated by a faculty member familiar with their work. Students who wish to be considered for this prize should contact a member of the Mathematics faculty prior to the end of the second term to discuss the nature of the research. If the entry is sufficiently worthy, the faculty member will nominate the contestant and act as sponsor. Each student is entitled to only one entry. All contestants nominated must submit their papers in final form to their faculty sponsors by the end of the fourth week of third term. A faculty committee will then judge the papers and announce its decision before the end of third term. The committee may award duplicate prizes in case of more than one outstanding entry. The name of the winner (or winners) will appear in the commencement program.

The Morgan Ward Competition

Any Caltech freshman or sophomore may enter this contest. An entry may be individual (submitted by one student) or joint (submitted by a group of two or more students). Each student is entitled to at most three entries, of which at most two may be individual.

An entry is to consist of a mathematical problem, together with a solution or significant contribution toward a solution. The problem may have any source, but this source should be stated in the entry. The entries will be judged on the basis of the nature of the problem and the originality and elegance of the solution. Any outside references used should be indicated.

Entries from each contestant or group must be placed in an envelope and delivered to the Mathematics Office, 253 Sloan, during the fourth week of third term. The names of the contestant, or the names of all participants in the case of a joint entry, must be written on the envelope only, not on the entry. The Judging Committee will consist of three volunteers, approved by a vote of the Caltech Mathematics Club. Each judge must be a junior or senior and a member of the Mathematics Club. The judges will select a group of finalists and submit their entries to the Mathematics Department faculty who will make awards to the winners. Prizes will ordinarily be awarded for the 2 or 4 best entries, the value of each prize being \$75. Prizes for individual entries will be limited to at most one to a contestant, and no group may receive more than one prize.

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continued on
page 9



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