

photo by Dash

THE MIME TROUPE (see article below)

Only  
34 More  
Days!

# California Tech

Associated Students of the California Institute of Technology

See Noah  
for Further  
Details

Volume LXX

Pasadena, California, Thursday, January 23, 1969

Number 14

## Grad Drafting to Result In Serious Loss of Ph.D.s

WASHINGTON (CPS) — Unless changes are made in the present draft regulations as they affect students, the nation's supply of trained Ph.D.s in the sciences will be "seriously curtailed" in the 1970's.

That is the conclusion of a survey of the draft's affect of male students now in their first or second year of graduate school in the sciences, released this week by the Scientific Manpower Commission, an independent Washington research firm.

According to data furnished by 1,237 Ph.D. granting science departments in institutions throughout the U.S., as many as 46 per cent first and second-year male graduate students are potentially liable to induction in the next few months.

That's 50 per cent of all graduate students who are also employed by universities to teach undergraduate classes, and 47 per cent of those who are employed to do research in the sciences.

Many universities told the Commission they will not be able to find enough students to teach courses during the next year, and that research projects may have to be curtailed, reduced or delayed if no changes in graduate deferment are made this year.

**Women and Children First?**  
The present policy of drafting oldest eligible men first means that first-and second-year graduate students, most recently reclassified since last spring's polich change, are first priority to fill draft calls, which are expected to stay at the 30,000-plus level through the coming summer.

The survey was limited to science departments because the organizations which sponsor the Commission are scientific academic groups. It believes, however, that results of this first survey are roughly applicable to general graduate school enrollment.

The Commission also speculated about the reasons for the failure of Fall 1968's projected enrollment drop to materialize. The slowness of the reclassification process, it said, combined with the summer setback in physical examinations, was a major reason.

### Start School Anyway

Another was that many stu-

dents returned to or started graduate school although in imminent danger of reclassification, because "they just wanted to get as far as they could," or because they had federal scholarships or grants which required that they enroll immediately. Those scholarships would then be waiting for them after they came out of military service, if they were drafted.

Of the more than 4,000 male graduate students who were reported to have been accepted to a department and then failed to enroll, however, about one-fourth were known to have either been drafted or to have voluntarily entered military service.

Many students, of course, when faced with imminent drafting, have chosen to join a service other than the Army, hoping to avoid duty in Vietnam.

Will the bad predictions of the Commission come true this spring?

"There is no way," the survey report states, "to predict accurately how many of the first and second year graduate students who are liable to induction will be called to service before summer.

"But inductions are likely to be highest among this group, since current regulations require that a draft board fill its quota from the oldest available men. Few non-college men are available in the age group 22-25, where most of these students fall."

According to the Commission, the important thing in all of this is not how many students are lost during the 1968-69 school year itself, or during any given semester, but the final toll on students and universities in the next five-year period.

### Few Will Get Ph.D.s

"Although many may be allowed to complete this school year if an induction notice is not issued before they are in the final term, this does not change the fact that most of these draft-eligible men may be unable to complete their graduate training prior to entry into the service. A substantial loss of first-and second-year graduate students inevitably will reduce the size of advanced Ph.D. classes in following years.

(Continued on page 3)

## Mime Throop? Never!

# Mime Draws Maximum Crowd

At 2:00 last Sunday at Culbertson Hall an audience was treated to an experience in theater. The admission price was a reasonable \$1.00. The San Francisco Mime Troupe appeared under the auspices of ASCIT to perform "The Farce of Patelin" and a series of three puppet shows for adults.

For a ten year old, the San

Francisco Mime Troupe is doing excellently, but still suffers from the youthful malady of not controlling the loudness of its voice. The actual volume of their speech was correct, but the message it carried battered the senses in the second part of the program.

The first half of the program

was superbly done. A personal feeling developed between the actors and the audience by seeing the set made of painted curtains being put up. Then, the cast stood to the side of Culbertson and began to sing songs to the accompaniment of a drum, a recorder and other rhythm instruments. The songs ranged from old English tunes to a Cuban revolutionary song. The actors then walked onto the stage, to be announced, and introduced. They wore linen medieval-type robes and masks.

The play, "The Farce of Patelin" is French, and from the 15th century. The basic plot presents a shyster (Patelin) who decides to defend a shepherd in court. The shepherd is accused of killing the sheep of a merchant (Pantalon). The merchant, however, has also been fleeced by Patelin. The merchant confuses the two stories in court, and the shepherd goes free. When Patelin asks the shepherd for his fee, he finds that the shepherd has cheated him too.

### Medieval Style

The performance was in excellent style. (Continued on page 4)

## Computers Pass English 1a; But No Fibbers They

Potentially anyone can make use of computers now that the language barrier between them and people is being dissolved, Dr. Frederick B. Thompson said today.

The capability to ask questions, add data, and define new concepts in ordinary English was demonstrated by the professor of philosophy and applied science to the Los Angeles chapter of the special interest group on programming languages of the Association for Computing Machinery.

"Busy managers and researchers as well as high school and college students should be able to make direct use of the computer, even though too preoccupied to learn the specialized languages now required," Dr. Thompson told the meeting at the System Development Corporation's auditorium.

This is the purpose of the Rapidly Extensible Language system (REL) he and his colleagues, Dr. Peter C. Lockemann and Dr. Bozena H. Dostert, are developing.

### "Hello, Hal"

"REL makes it possible to converse with the computer in English through an ordinary typewriter keyboard," Dr. Thompson explained. "The computer can converse and provide answers in any field desired. It understands most English constructions, including verbs, tenses, and subordinate clauses.

"Thus it can answer a great variety of questions, though it is not expected to answer questions starting with 'Do you believe?' or 'What is your opinion of?'"

"Think of the average student in an American history class and consider how much the raw in-

redients of our past national life have been distilled before they are passed along to him in stereotyped form.

"A few years hence he will be able to explore the raw data of history and trace for himself the rich interplay of forces that shaped those aspects of our past which are of interest to him," Dr. Thompson continued.

### Information, Please

"I understand, for example, that votes of all congressmen on the bills that have passed before past congresses will be available on computers shortly. And with (Continued on page 3)

## Biologists Freak Out; Crash Pad Sought

"Sounds good, but it'll never work," was the typical response of non-participants to a new experimental seminar course in the Biology Division. Imagine seventeen people, all gathered together in a bread box-sized office in Kerchoff, trying to communicate their excitement about molecular biology. Excited about coursework? That, I feel, is sufficient to undercut the dubious feeling referred to above.

Last term, William Wood and Robert S. Edgar of the Biology Division decided to try an experiment in undergraduate education — to integrate biochemistry and genetics into a unified, two semester course. What is unusual about the course was that Edgar and Wood hoped to implement some of Carl Roger's ideas concerning student-centered teaching. The final group in-

cluded consisted of twelve undergraduates, there T.A.'s (two of whom are seniors: Greg Wright and Mike Macleod; the other is a grad student, John Wilson), and the two faculty members.

### Perpetuum Mobile

The class kicked off with a twenty-four hour marathon encounter group, to get the group going in the direction of working together efficiently. Since the same people would be involved in the course for twenty weeks, this was seen as a necessary prerequisite for successful functioning. Rather than the two faculty imposing a structure on the course, they left this up to the decision of the class. So far, the structure of the course has remained implicit rather than becoming rigid. The only requirement being that the participants (Continued on page 6)

## Editorial

## Dear Dr. DuBridge:

You have served us, the students of the California Institute of Technology, faithfully and well for over two decades. We feel that some token of our respect is in order, and so, for the first time in the history of the **California Tech**, we are presenting an honorary lifetime subscription to the **Tech**. Your only responsibility will be to keep us supplied with your address, so that we may continue to send you the paper. Good luck in your future efforts to make the world safe for science.

With the greatest respect,

The Editors-in-Chief of the  
**California Tech**  
Alan Stein  
David Lewin  
James Cooper

## Dear Joseph Rhodes:

It is our belief that you have served the student body, as student president, in a most extraordinary and commendable manner. Because of your exceptional service, are presenting you with an honorary lifetime subscription to the **California Tech**. In order to be completely worthy of this honor, your duty will be to keep us supplied with your future addresses. Best of luck to you, at Harvard.

With the greatest respect,

The Editors-in-Chief of the  
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James Cooper

## Electric Rocket Advances Swiftly

The first flights of electric rockets — the ultimate propulsion system that eventually will push spacecraft to the outer planets and beyond — will be made within 10 years, a rocket expert at Caltech's Jet Propulsion Laboratory predicted Monday night.

Declaring that "travel anywhere in the solar system can be made rapid and efficient" with electric rockets, Dr. David G. Elliott said, "Some components, such as electrical thrusters are ready to fly now. There is a steadily moving research and development effort on power conversion."

## Pile It High

The first electric power flights, he said in the opening talk of the winter Caltech Lecture Series, will use as a heat source the energy of the sun captured by panels of solar cells attached to the spacecraft.

For flights beyond Mars where solar energy is greatly diminished, the electric rockets will use as a heat source a nuclear reactor, which must be as small as an ordinary wastebasket, Dr. Elliott said.

Nuclear-electric spacecraft might prove flyable in the 1980's, depending on technological progress, he added. Much effort will be required to develop a suitably small spacecraft reactor.

"The electric rocket solves the problem of how to travel efficiently beyond Mars," Elliott stressed. "It is also the ultimate form of space propulsion. No method of space propulsion beyond it can be imagined within our present knowledge, and we can expect that it will be some form of electric propulsion that may eventually propel men beyond the solar system to other stars and even other galaxies."

Dr. Elliott is supervisor of the propulsion energy conversion group at JPL, which Caltech operates for the National Aeronautics and Space Administration. His topic was "Beyond Mars With Nuclear-electric Propulsion."

## Pile It Deep

Nuclear-electric spaceships weighing up to 30,000 pounds at launch could reach Jupiter in

two years or less, and Neptune in five years, Elliott said. Jupiter is roughly 400 million miles from earth. Neptune is 2.7 billion miles out.

A nuclear-electric rocket would have three main parts. Up front would be a nuclear reactor. Separated from it by a radiation shield would be a conversion system to generate electric power from the reactor heat. Finally, the power would run thrusters expelling a propellant material, such as mercury, in the form of ions (charged atoms).

Ion thruster engines have withstood thousands of test hours and appear practicable with solar panels or nuclear systems. The advantage of nuclear power is that it would enable spacecraft to operate regardless of distance from the sun.

Elliott likened deep-space missions to "trying to run a celestial drag race." He said speeds of 19 to 22 miles per second would be needed to place spacecraft in orbit around Jupiter and Neptune, if all acceleration occurred in a straight line without gravity. That's 68,400 and 79,200 miles an hour.

## For More Efficiency

"The speed required is so great that the drag racer can't carry enough gas," he observed. "What we need is better mileage."

To obtain this, space engineers seek propulsion systems with higher specific impulse (thrust per pound per second expelled). Ion engines provide specific impulses 10 to 20 times as potent as chemical propulsion engines.

Mercury ion engines could fly a 30,000-pound spacecraft to Jupiter on 5,000 pounds of mercury, less than 10 per cent of the fuel which a chemical rocket would require, Elliott said. The spacecraft reactor would carry about 200 pounds of uranium or plutonium, of which only a pound or two would be fissioned on a trip to Jupiter.

An important goal in nuclear-electric propulsion is reducing the weight of the reactor and conversions system. A power system weight ratio of 50 pounds per kilowatt is the maximum allowable, and 20 pounds per kilowatt is needed for top perfor-

## Into the Incinerator

## Out of the Frying Pan . . .

by Jim Cooper

Soph Edward B. Barrelmaker of Mythological Institute of Theocracy glared down at the broken point of his pencil, sighed, stood up, and assumed a place in the line at the pencil sharpener.

It was registration time at Theoc, and the administration building of the campus was thronged with students signing away their lives for another semester.

After a five minute wait—the line was long and the sharpener was dull—Barrelmaker took his few turns at the sharpener and resumed his seat at the radiator.

He glanced furtively around to see if a clear spot had appeared at one of the desks in the large room; but seeing that they were all still occupied, he sighed again and returned to his work.

## Barrel, Barrel

He folded the papers over an edge of the radiator in an effort to get a hard surface upon which to write and noted that the constant refolding of the papers had made them barely legible. "Oh well," he thought, "I've written all this information at every previous registration; certainly, they won't need all of it again."

Although the questions were long, Barrelmaker had to admit to himself that they were interesting. For instance, one form required that he list, in descending order, his favorite 10 ice-cream flavors. In another two-inch blank, he was asked to describe the most significant experience in his life in 1,000 words or less.

After three hours, Barrelmaker came to the end of the 27-page form, stood up, and journeyed to the end of a lengthy line which wound into the next building, some 25 yards across a recently watered lawn.

Some 45 minutes later, Barrelmaker found himself in front of a lady who was in charge of collecting the forms. She took one look at his form and exclaimed, "Oh no! Your form just won't do at all!"

## All Filled Up

Before Barrelmaker could do anything, she had torn up all 27 pages, and handed him a clean, blank form. "You'll just have to take these and fill them all out again. And this time pay attention to the fact that the forms are not to be bent, folded, spindled, mutilated, or altered in any way!"

Some three hours and 45 minutes later, Barrelmaker again appeared before the clerk and handed her his forms. "These

mance, Elliott said. A Jupiter-and-beyond rocket should have 300 kilowatt output with existing booster rockets, he added.

Elliott's group at JPL is working on a promising way of converting reactor heat into electric power. This would utilize lithium, a liquid metal used as a coolant in higher temperature reactors, and cesium in vapor form.

Preliminary studies and tests indicate a conversion system made of niobium-zirconium alloy can handle lithium as hot as 2,000 degrees Fahrenheit. The system will operate by accelerating lithium with cesium vapor, then slowing the flow to produce power in a magnetohydrodynamic generator.

## In Filling Space

Other conversion systems being studied include a thermionic, which uses diodes inside a reactor, and a turbine using potassium vapor. All space power (Continued on page 8)

are fine," she said, "but you're in pretty disgraceful shape. Have you no pride?"

Barrelmaker tried to explain to her that since there were still no desks available, he had been forced to sprawl on the floor in order to fill out his forms neatly, and that several people had stepped on him, mistaking him for a rug. She was not satisfied with his explanation, however, and before he had left her desk he had received a lecture on the importance of neatness.

## Why Don't You Let

Staring at the multi-paged forms which the clerk had given him to fill out, Barrelmaker again sighed and returned to the form-filling-out area.

This time, the questions were of a financial nature; and Barrelmaker was again engrossed in answering such items as "How much is your yearly expenditure on baseball bubble gum cards?" and "How many colors of ink are used in printing U.S. currency?"

Completing his form with strict attention to neatness in a little less than two hours, Barrelmaker got into another line, leading into another building.

By the time Barrelmaker had gotten into the building, however, it was after 5:30 p.m., and the registrar's staff—always concerned with punctuality—had gone home for the day. Thus Barrelmaker and the others yet in line had to look forward to spending the night in the building or lose their place in line.

The night passed slowly; but it was generally calm, with the exception of one Theocer who went berserk, burned his registration papers, and had to be carried off by campus guards.

The next morning, punctually at 8, the staff returned and registration was again able to proceed.

## It All Hang Out

Finally, Barrelmaker reached the point at which he was able to turn in his forms and receive his white validation form—the last step in the registration process.

Seeing three lines before him, Barrelmaker asked the lady at the desk which one he should get in. Glancing at his form, the lady instructed him to take the line in the center.

Some 30 minutes later, after discovering that he was in the wrong line, Barrelmaker again asked the lady at the desk which line he should get into. The lady said she was sorry and told him

## Soprano Verrett Plays Beckman

Shirley Verrett, the talented mezzo-soprano who will give a recital in Caltech's Beckman Auditorium on Saturday, February 1, at 8:30 p.m., has taken her place among the greats of performing artists. She was catapulted to fame recently with her Met debut as "Carmen" and also for the "Princess Eboli" role in **Don Carlos**. For her first solo recital in New York's Philharmonic Hall, her mastery of the art song and **lieder** brought critical acclaim. Miss Verrett has appeared with virtually every major orchestra in the United States. Igor Stravinsky selected her as the "definitive" Jocasta for both stage performance and for the recording of "Oedipus Rex."

to get into the line on his left.

## For The Water

With a strong feeling of futility, Barrelmaker got into the line on his right, and 38 minutes later discovered that he was finally in the correct line.

At the end of the line was the Institute's financier, who was busy validating the students' white validation forms. Seeing that each student seemed to converse at some length with the financier, Barrelmaker's curiosity was aroused, and he decided that he must find out what all the students were talking with the financier.

As soon as he got to the man's desk, Barrelmaker asked, "Sir, if I may be so bold, what were you talking about with all the other students?"

"Why, they were all asking me what I was talking about with the other students," said the financier. "Why do you ask?"

"Oh, I was just curious," said Barrelmaker.

"By the way," Barrelmaker said as the financier stamped his validation on the validation card, "do you think there is any way for the time it takes to register to be shortened?"

## To Cover Up

"What!" exclaimed the financier. "Do you expect us to streamline a procedure which has been so effective here at the Institute for the past 35 years? Admittedly it has its faults, but overall it's a fairly operational system. However, we always have an eye out for ways to speed things up, and next term you certainly will find that things move faster as a result of a planned change."

"And what's the change?" asked Barrelmaker.

"We're installing a second pencil sharpener in the form-filling-out area," said the financier.

"Oh!" sighed Barrelmaker as he collapsed to the floor from exhaustion.

## California Tech

Published weekly during the school year except during holidays and exams by the Associated Students of the California Institute of Technology. The opinions contained herein are solely those of the newspaper staff.

**Editors:** Dave Lewin, Alan Stein, Jim Cooper, Editors - in - Chief; Craig Sarazin, Managing; Ira Moskatel, Copy; Dave Dixon, Sports; Churchy LaFemme, Associate Editor.

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**Photographers:** Stephen Dashiell, John Bean, Paul Levin.

**Business:** Jeff Hecht, Manager; Art Selly, Circulation Manager. Bob Curtis.

**Typist:** Flora Boyer

California Tech, Publication Offices: 1201 E. California Blvd., Pasadena, California, 91109. Second-class postage paid at Pasadena, California. Represented nationally by National Educational Advertising Services, Inc. Subscriptions: \$1.50 per term, \$4.00 per year. Life subscription: \$100.00. Printed by Bickley Printing Co., 25 South Fair Oaks Ave., Pasadena, Calif. Volume LXX, Number 14, Thursday, January 23, 1969.





# What's Bugging You MAC

(Continued from page 1)

a system like REL, the ability to ask penetrating questions and receive immediate answers of such bodies of data, of census statistics, stock market records, even sports records, should be as available as the services of the library today."

The ability of the computer to answer depends upon whether the information is stored in its memory.

"If the computer is asked a question it does not have the ability to answer, it is not embarrassed to say so," Dr. Thompson pointed out. "It can be provided with new information immediately and will remember it for future use. This power to extend its capabilities rapidly is an important part of the REL system."

Dr. Thompson demonstrated REL using a typewriter linked over ordinary telephone lines between Santa Monica and Caltech's Booth Computing Center in Pasadena.

### That's Gross

The computer's memory now contains some 60 facts about each of the world's nations—including population, gross national product, working age population, life expectancy, defense expenditures, numbers of people in each major religion, unemployment, number of physicians, TV and radio distribution.

Having defined for the computer the notion of "underdeveloped

nations whose per capita gross national product is less than 0.2, Dr. Thompson asked the computer:

"What underdeveloped American nations have a ratio of industrial employment to working age population less than one-tenth?"

The computer replied: "Nicaragua, Guatemala, Honduras, Paraguay."

The scientist then asked: "What are the per capita newspaper circulations of Guatemala, Paraguay, England and the United States?"

Immediately the reply came from the computer: "Guatemala .02, Paraguay .04, England .51, United States .33."

### Story of My Life

Another series of question concerned a family that the computer had some knowledge about. The questions included: "What was the average between 1960 and 1965 of the incomes of Bob Barton's uncles?" "When did the Smith who lived in New York arrive in Los Angeles?" and "Where were Stan Smith's parents when Stan Smith married Jill Jones?" Without hesitation, the computer answered correctly every time.

According to Dr. Thompson, there are now available in forms readily understood by computers vast archives of social and economic data. The REL system is designed to put this information at the finger tips of all those who can make use of it.

## Now That Will Take a Pill!

# 27 Day Sun Cycle Shown

A seven-year history of the sun has just been published in the unique form of 93 colorful maps that show the continual birth, expansion and decay of magnetic fields on the solar surface.

Each map, 11 by 28 inches in diameter, displays in blue and red the magnetic field patterns for a period of 27.2753 days,

which is the time required for the sun to make one complete rotation on its axis.

Because the complicated movement of hot gases in the sun's chromosphere is reflected in its magnetic fields, the maps show a continuous record of solar happenings from 1959 into 1966.

"The atlas provides a new way, heretofore impossible, of looking

at how solar activity evolves," explained Dr. Robert Howard of the Mt. Wilson and Palomar Observatories, which are operated by Caltech and the Carnegie Institution of Washington.

### Are You Bored?

Co-authors of the atlas with solar astronomer Howard are Dr. V. Bumba of the Astronomical Institute of the Czechoslovak Academy of Sciences, and Sara F. Smith, Lockheed Solar Observatory, Burbank, Calif. The Office of Naval Research sponsored publication of the atlas, which was printed at the Naval Printing Office, San Diego, and published by the Carnegie Institution of Washington. The price of \$12.50 per copy does not cover the publication costs.

Three kinds of scientists are especially interested in the "Atlas of Solar Magnetic Fields," Dr. Howard said. Solar physicists will use it to study solar activity. Geophysicists will employ it to correlate such phenomena as geomagnetic storms on earth with solar storms. Space scientists will use the atlas in studies of the solar storms. Space scientists will terplanetary magnetic fields.

Interestingly, the magnetic fields on the sun are the same ones that extend all the way out through the solar system past the earth. The latter are called the interplanetary fields.

### So Are We

"The interplanetary magnetic fields are extensions of the solar fields," said Dr. Howard. "The fields on the sun have the same polarity as those that move by the earth some 4½ earth-days later."

On the maps the positive magnetic fields are designated in the color blue and the negative fields in red. There is an overall pattern in the shapes of these fields. They tend to be pulled ahead at the solar equator and fall behind at the higher latitudes. Dr. Howard explained that this is due to the fact that the sun rotates faster at the equator than nearer the poles. The magnetic activity tends to originate near the equator and drift outward toward the poles.

At present, in the sun's northern hemisphere the negative polarity is leading the positive polarity, and the reverse is true in the southern hemisphere.

### But We Had This

"For reasons not understood," Dr. Howard said, "there was much more solar activity in the northern hemisphere during the seven years of the observations than in the southern hemisphere."

In 1964 when the sun was at its quietest during its 11-year activity cycle, the maps show very little magnetic movement. During that time the magnetic activity covered perhaps only a tenth of the solar surface. By contrast, virtually all the surface showed magnetic field patterns during the active time in the cycle — in 1959.

(Continued on page 4)

## Visiting Prof

# Lacey ChemE Stirs Brew

A distinguished, award-winning chemical engineer — Dr. John M. Prausnitz — will visit Caltech January 28-30 as the recipient of the second annual W. N. Lacey lectureship in chemical engineering.

Prausnitz, 40, is professor of chemical engineering at the University of California, Berkeley. His main research interests have dealt with thermodynamics, statistical mechanics and molecular physics, directed mainly toward the petroleum, natural gas, cryogenic and petrochemical industries.

The lectureship, established last year, honors Dr. William Noble Lacey, Caltech professor emeritus of chemical engineering. Lacey, a faculty member for 53 years, joined Caltech in 1916 and became professor in 1931. He also served as dean of graduate studies and dean of the faculty during his tenure. Lacey was honored last month with a Founders Award from the American Institute of Chemical Engineers.

### Two Lectures

Prausnitz, a native of Berlin, Germany, will give two lectures at Caltech each starting at 4 p.m.

The first, on Tuesday, Jan. 28, will concern "Physical and Chemical Representation of Liquid Mixtures." The second, on Thursday, Jan. 30, will be "High-Pressure Phase Equilibria."

Prausnitz has received numerous awards for his contributions to chemical engineering, including the AIChE's 1962 Colburn Award, given annually to a chemical engineer who has published an unusually significant article on work completed before reaching age 35. He has also held a Guggenheim Fellowship and a Miller Research Professorship at the University of California, Berkeley. In 1967, at age 39, he received the AIChE's Walker Award, the most prestigious award given by the institute in recognition of unusual accomplishments in research.

The lectures, in 102 of Steele, are open to the public.


The Lacey lectures were made possible by the W. N. Lacey Fund, established by the professor's friends and former students. The objective of the lectureship is to bring world-renowned experts currently active in chemical engineering to the Caltech campus.

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## Gradraft

(Continued from page 1)

"The Commission believes that the results obtained in this survey," the report concludes, "are substantial enough to provide those concerned with scientific manpower an insight into the potential impact of current draft policy on graduate education in the sciences, and on the future supply of highly trained personnel in disciplines crucial to the future well-being of the nation."

# Towering Earful

"The Holy Mackerel," by The Holy Mackerel, Reprise Records RS6311.

by Nick Smith

According to the album notes, the Holy Mackerel had a rather odd beginning. It seems that Paul Williams wrote a song for Tiny Tim, doing the demo record himself. People liked the demo, and solidified Paul's plans to form a group. Two close friends, George Hiller and Cindy Fitzpatrick, joined him to form a trio. They found a fourth in Paul's older brother Mentor, who was working as a singer and bouncer in Redondo Beach. Eventually Michael Cannon and Jeremiah Scheff joined the group, to make six in all. In addition to the standard guitars, bass and drums, they use flutes, banjos, harmonica, organ, and something called a dobro. Now, on the album itself.

The first cut is a thing called "The Secret of Pleasure," which is just good enough to make you want to listen to the rest of the record. The cut includes some nice flute work by Cindy, and the vocals are better than those of the average new group.

Frankly

"Scorpio Red" gave me the impression that it is kind of like what Hendrix's "Foxey Lady" would sound like if done by the First Edition. It proves that Paul

writes good lyrics, at least when describing a deadly Scorpio girl.

"The Lady is Waiting" is our first real taste of brother Mentor's voice. The song opens with just his voice and a haunting flute. It would seem that Mentor's singing is as good as Paul's writing.

"Wildflower" is an oriental-electric departure from the mainstream of the album, which is perhaps unfortunate. It isn't as good as the first three cuts, although it feels like it could be good done by another group.

It

"The Somewhere in Arizona at 4:30 A.M. Restaurant Song (And Now I Am Alone)" should undoubtedly hold some kind of record for long titles of short songs. It's Mentor singing a country-western song, backed by harmonica, guitars, and percussion.

"Prinderella" ends the first side, a comedy bit about a girl, her two sisty uglers, and a mairy fodgother. It doesn't fit with the rest, but it could be worse.

"Bitter Honey" has Paul singing lead again, and on this song it sounds as if he tried to sound like Davy Jones of the Monkees.

In "Nothing Short of Misery," Mentor sings a modern light blues number, and does quite an adequate job. He doesn't try to

(Continued on page 7)

# S.F. Troopers Undermime System

(Continued from page 1)

cellent medieval style. The sets were changed by pulling back curtains, and at intervals a device called a cranky was used to describe some aspects of the life of one of the characters. This device consists of two rollers in a framework with a roll of paper that has the illustrations to fit the story, which is rolled by.

The performance was hindered because it took place in Culbertson instead of on the lawn in front of the Athenaeum where it was originally intended, but it is obvious that the S.F. Mime Troup is reviving the personal

theatre. They expose the actors as real people, and they ad-lib lines to fit the audience and surroundings. The actors great enthusiasm livened the audience immeasurably.

Sledgehammer Blow

After so carefully constructing before our eyes the framework for their message, they put the finishing nails in with a sledgehammer, demolishing the cabinet. The second show took the idea of a cheating society and expanded it to an attack on the Establishment. First, there was a march by the S.F. Mime Troupe Gorilla Band. This was

followed by an unfortunately blatant parody of a draft induction, ending with a picture of Uncle Sam, supplied with a real hand flipping the bird.

Then, a sequence of a girl in legal trouble because of an unpaid parking meter ticket. It had some good jokes, but ended with the girl being shot by a meter maid.

Little Fuzz

The best part of the second half was the story of the little black panther and the little white fuzz. Little black panther travels out of the forest to see the sunlight and is hit by it as he reaches a clearing (Blam!). Little white fuzz tries to prevent panther from coming into the clearing, but big black panther enters the scene, defends little black panther from fuzz, and tells panther to go back and organize his cave.

After so carefully constructing this bond of trust, interest, and respect with the audience in the first half, the players insult the audience with their crudeness (not vulgarity) of expression, thereby destroying their own creation.

# Solar Perplexes Surveyed

(Continued from page 3)

During the activity minimum, Dr. Howard observed, the weak magnetic fields quickly spread out over parts of the solar surface and disappeared — lasting perhaps only two to three weeks at the longest. Whereas, during the active time, individual magnetic features persisted for as long as three to four months.

Big Hole And Needed

The strength of the magnetic fields range from 4 to 80 gauss, which is the unit of measuring the strength of magnetic fields. For example, the over-all magnetic field strength of the earth measures less than one gauss.

The observations cover the solar disk from the equator to 40 to 60 degrees north and south latitudes. Observations become difficult near the poles.

The observations were made with the 150-foot tower solar telescope at Mt. Wilson. Attached to it is a magnetograph that scans back and forth across the solar disk, covering about 9,000 miles at a sweep, and moving gradually from north to south. The scanning pattern is called boustrophedonic, from Greek words meaning "ox" and "turn," and has to do with the way oxen plow a field.

Space Filler

The magnetograph makes use

of the Zeeman effect. With it the presence, strength and polarity of magnetic fields in hot solar gases can be determined. A magnetic field splits in two each spectral line from a light source, such as the sun. The distance between the two segments of each line varies with the strength of the magnetic field; the greater the separation of the lines, the stronger the field. With the proper optics, the small distances between the split lines can be measured and hence the field can be detected and its strength determined.

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## Notices

### EDITORS

WHEN NOT WHERE DUM-DUMS

### CALTECH-OCCIDENTAL BAND CONCERT

The combined Caltech and Occidental bands will give a concert on Saturday, February 1, 8:15 p.m. at Thorne Hall on the Occidental College campus. Tickets at \$1.00 are available from the Caltech Ticket Office and from band members.

### GRAFT, CORRUPTION, MONEY!!

The California Tech circulation staff says he needs help. Desperately. Get the moral satisfaction of seeing that your parents' subscription gets out to them on time. Get the real satisfaction of access to a phone that does not gobble your dimes, and to the air-conditioned Tech office during hot months. Plus some of that lovely useful green stuff called money. Plus assorted other forms of graft and corruption. All for folding and bundling papers. Call Extension 2154, or drop by the Tech office Thurs. afternoon.

### TAKE OVER THE WORLD!

PME sign-ups continue in the Houses and the Y office. The game itself will be held the weekend of April 11-12 and is set in Europe. See Guy Smith (Ri), Charles Fisher (L1), or Ed Murphy (Da) for further details. This is your chance to seize power!

### INDUSTRIAL ASSOCIATES CONFERENCE ON METAL COMPLEXES IN CHEMICAL SYNTHESIS, January 27 and 28,

Room 153 Noyes Laboratory, 9:15 a.m. Students are invited.

### WELL-KNOWN GEOLOGIST TO BE DISPLAYED AT THE PHYSICS CLUB

The Caltech Physics Club has kidnapped from the Geology Division Professor J. Wasserburg to speak on **Fine Scale Chronology in the History of the Early Solar System**. The meeting will be held Wednesday night, January 29, 8 p.m. at the home of Professor Barnes (1546 Rose Villa). All are invited to attend. Refreshments served afterwards.

### RADIO CLUB

Meets Mon., Jan. 27 at 7:45 p.m. in Clubroom one.

### INDUSTRIAL ASSOCIATES CONFERENCE ON COMPUTER PROCESS CONTROL

Monday and Tuesday, January 20-21, Room 135 Noyes Laboratory, 9 a.m. Students are invited.

### CALTECH Y ELECTIONS

Persons interested in seeking office in the Caltech YMCA should contact one of the following persons: David Schor, President (Y Office); Bob Fisher, V-P (Dabney); Guy Smith, Secretary (Ricketts); Ben Barker, Rep-at-Large (Dabney); or Wes Hershey and Pat Davis at the Y Office.

Editors—

you're running out of notice forms.

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**NOTICES**

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**FEBRUARY 3 AND 4, 1969**

**SEE YOUR PLACEMENT OFFICE**

**'4th?'**

by Robert Geller  
North

S A 8 2  
H J 10 9 6 4  
D J 9 3  
C 8 4

<b>West</b>	<b>East</b>
S Q J 10 5	S K 9 7 4 3
H K 5	H 7
D 7 6 2	D Q 10 8 4
C Q 10 6 5	C A 9 2

**South**

S 6  
H A Q 8 3 2  
D A K 5  
C K J 7 3

Neither vulnerable

The Bidding:

<b>South</b>	<b>West</b>	<b>North</b>	<b>East</b>
1H	Pass	2H	Pass
4H	Pass	Pass	Pass

West led the queen of spades.

In today's hand, which occurred in the recent Long Beach Sectional, very few players found the correct line of play to make four hearts. Since there is nothing very advanced about the correct strategy, one can only assume that those who went down were victims of over-confidence.

After the lead of the queen of spades South saw that he had to set up the clubs for a diamond discard. This was the technically superior line of play, and it also gave the best chance for an overtrick. The ace of spades won the first trick and the jack of hearts was led for a finesse. South ruffed the spade return high, and led a trump to the board, drawing the last trump. The finesse of the jack of clubs lost to the queen, and South ruffed the spade return high. The last trump in declarer's hand was led to the board and the club finesse tried again, East taking his ace. Now South could discard one of the board's diamonds on the king of clubs, making his contract. The play for this contract is very simple, given the anticipation of entry problems.

**Intercollegiate**

Although the situation is not entirely clear, it appears that the four highest pairs in the Intercollegiate Qualifying Round will continue to the Regional Payoff at Stanford. These are, tied for first, Dean Ballard-Ron Stevens, and Tom Davis-Michael Lamahna, third William Delaney and Robert Geller, fourth Richard Jacobson-D. S. Remer.

**Big T Kills Gal**

Often the Tech office seems like a cross between Bedlam and the Bronx Zoo. Sometimes there are lions, and tigers, and aardvarks, and Lesser Kudus jumping around the desks, strewing papers all over the floor. How, you may ask, do we ever get any work done? I'll be damned if I know. The goats keep eating our galleys, and the associate editor retreats into his shell with a hurt expression on his face. Keeping the monkeys slaving away at the typewriters is a full-time job. That's why we sometimes need space-filler, like this.



# From Tech to Corps in One Easy Step

This is the first of a series of articles about the Peace Corps. Below are the reactions of three Caltech Alumni to their terms in the Corps. Peace Corps representatives will be on campus the week of Feb. 10.

## Michael Field, MS63Ge

Ah, Ghana—an eight-room house (plus servant's quarters) situated on one of the hills at the edge of town so that we could catch the afternoon breeze as we sat on the porch; brilliant, sunny days—a little hot, but otherwise as close to perfect as you could imagine; roads winding through clefts in the lush green forest; villages filled with noise and bustle, bright clothes, and friendly smiles; the gentle sound of far-away drums at dusk.

These are the images that first come to mind when I recall my two years in the Peace Corps. With time the memory of interminable waits, of near-collisions

on the highways, of always being a foreigner and a curiosity disappear. The memory is conveniently selective.

It is hard enough to remember what changes took place within me during those two years in Ghana. It has been another two years since, and for one of those years I have been working with VITA, an international information service, which has kept me in constant contact with Peace Corps Volunteers and other overseas workers. My overseas experience has made me empathetic enough to the situation of others that now it's difficult to remember what I have experienced in actuality and what vicariously.

To evaluate any intellectual changes my Peace Corps tour would be largely a fabrication. To describe my experiences would be misleading, since working for the Ghana Geological Survey and being in control of work

groups of African laborers does not fit well into the traditional Peace Corps image. I would really like to describe the Peace Corps as I see it from my present viewpoint—as someone outside of the group yet in daily contact with it.

One is immediately tempted to draw sweeping conclusions—either that the liberal arts majors can't get any other jobs than with the Peace Corps or that engineers couldn't care less about what happens to people. There is probably a little truth in both these statements, but neither is an explanation. I won't be able to come up with an explanation, either, for there is too much information I do not have; but I would like to raise some questions on the role of engineers and scientists in the Peace Corps and other development work—to talk about that 15 percent.

It is difficult to combine a professional engineering career with one in development; development work is too watered down. One is not using his abilities fully or pushing his knowledge further, but is working with technical skills acquired perhaps early in his undergraduate career. In my Peace Corps work as a geologist much time was spent in non-professional work. Besides being a geologist, I was in charge of a work crew of about a dozen laborers, with all the detail that involves. Field work is delayed when you find the assistant told the crew to clear a trail along that river rather than along this river. Microscope work is interrupted to hear a long emotional plea for a pay advance because of a family crisis. A couple of days a month are spent in book-keeping, and so on.

Likewise, the secondary school

teachers (the other Peace Corps group in Ghana) were using little more than their high school education—if that—and the curriculum was too rigid to permit much use of their ingenuity. In positions higher than those the Peace Corps occupies, the work might be more challenging, but there would still be a lack of equipment, a slow bureaucracy, and other restrictions. An agriculturalist I know says that after eight years at a farm school in Afghanistan he is too far behind current U.S. practice to get a good job in this country.

A decision to go into international development work at the village level is thus, in most cases, a shift away from a professional engineering career. But does this explain the reluctance of engineers to join the Peace Corps, an obligation of only two years? There is certainly a tendency among scientists and engineers to go straight through from kindergarten to MS or PhD and thence to a job without a break. Perhaps they feel that taking two years off in Thailand would put them behind in their specialty and create suspicion in the mind of their employer. More likely it is just part of the modern educational pattern to get it all at once, though I suspect the tendency for such a thorough course is less strong among liberal arts students. When one is majoring in Greek history preparatory to selling life insurance, a break of a few years won't make any difference, and it may even be helpful.

A certain percentage of "scientists" going into the Peace Corps aren't really scientists at all. We all knew people in school who took an excess of literature courses, participated in extra-

curricular activities to the detriment of their technical studies, and ended up going to business or theological school. Likewise, some people go into the Peace Corps as physicists and come out to go to graduate school in economics; in as biologists and out as public health workers. But the Peace Corps did not really change their direction; it only changed their career and confirmed the direction in which they had always wanted to go.

This is only one element; it would be unfair and untrue to say that the only engineers in the Peace Corps are those on their way out of the profession. Despite some common traits, there are many different personalities within the group we call engineers.

It seems to me that those interested in the Peace Corps are this sort of persons. They are interested in the world around them, and want to see it and contribute to it. But more important, perhaps, they feel free to take that two years off if they feel like it. I have long felt that altruism is less strong a motive for people joining the Peace Corps than a desire for adventure and fun, and such an attitude is important to a successful Peace Corps tour.

To an engineer considering the Peace Corps, I would say: If you expect any professional gain from those two years, you will be disappointed. But you are a person as well as an engineer, so make sure that your whole self is involved in the decision. If you decide not to join, be honest with yourself about the reasons. If you believe in taking a chance once in a while, this is one I recommend.

(Continued on page 7)

## PME Means Power

Next term Caltech will again host government leaders and diplomats from all over the world for two days of political and military confrontation. Will nationalism produce another war?

But it is just a game—the Political Military Exercises (PME). The PME "provides some kind of insight into international decision making," says Guy Smith, this year's Head of the Control Board. Participants must make decisions based on limited information, rather than perfect knowledge of the "big picture."

The PME will be held on April 11 and 12, but the deadline for registering is January 31. Interested undergraduates, graduates, faculty, and staff may sign up in the student houses or in the Y-office. A team from UCLA is expected, as well as scattered students from other schools.

### Majority Of One

Participants are organized into teams representing a country or group of small countries. There are government leaders, foreign ministers, diplomats, defense ministers, etc. The interval before the exercises allows the players to do research on their positions and on the European scene, which is this year's game-area. "The more research, the better they perform," says Smith.

Each team is assigned a room in Dabney Hall. They may communicate with each other by a

specially installed telephone system. All calls, however, must be routed through the Control Board, which consists of faculty and student organizers of the games. Typewriters and message-forms are also provided. Messages may be "open," "confidential," or "top secret." "Summit conferences" may be called for, etc.

The exercises will begin around 4 p.m. on April 11 when scenarios are distributed to give all teams a background on the problem-situation. The action then unfolds as countries vie for power and prestige at a rate of one game minute equal to two hours of "real" life. This projects results to June, 1970.

The exercises are run in two-hour sessions, at the end of which the Control Board distributes up-to-date scenarios and other "open" information in order to clarify events.

### Lose Your Face

When the exercises are over, the teams meet to discuss what happened. Team leaders give an account of what they tried to pull off, and the Control Board (gods) comments on the overall performance. There is no guarantee that anything will be resolved, but Smith points out that in the past he exercises have predicted several real events.

Are you tired of playing Risk, or silently condemning Vietnam? Then let PME put you in the driver's seat.

## Seething Scientists Rap

(Continued from page 1)

follow some interest in the field of molecular biology of the cell.

The reason this approach is working, appears to be the fact that only those students willing to take the responsibility for pursuing some interest in biochemistry or genetics were motivated enough to opt for the experimental seminar rather than the standard course structure. Another factor is the excitement about the field, an excitement that the faculty and T.A.'s show which finds itself being quickly transmitted to the undergrads involved.

### Crash Pad Pending

How is this being put into action? Presently there is a weekly meeting of the seminar, just to get the people together so each one can find out what the others are doing. These meetings are non-directed—anything can happen, and usually does.

Over in one corner, a small group is heatedly discussing someone's research project; another cluster of people is trying to puzzle out the structural implications of the metabolic function of some cellular component. The excitement of discovery seems almost tangible at times as all thought of time, comfort, and reserve evaporate.

Edgar and Wood are currently looking into the possibility of getting a room, or complex of rooms, which would be open for use of the seminar participants twenty-four hours a day, seven days a week. This space could conceivably include lab space to follow-up spur-of-the-moment research ideas. Other space would include a permanent meeting place for individuals or groups of those involved in the seminar could get together and rap at all hours.

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## Peace, Corn, and a Little Salt

(Continued from page 6)

Richard Karp, BS64Ma

Baguio City is a mountain tourist resort in the Philippines. The climate is temperate; the local scenery is dominated by pine trees. Baguio's restaurants serve pizza, chateaubriand, cheeseburgers, and Swiss fondue, in addition to Filipino dishes. For recreation there are three English-language movie theaters, bowling alleys, two golf courses, periodic duplicate bridge tournaments, and genuine U.S.-made slot machines. Baguio City is where I am "roughing it" for my two years as a Peace Corps Volunteer (PCV).

I teach mathematics at the University of the Philippines (U.P.) in Baguio. U.P. in Baguio is a recently constructed campus, with an enrollment of about 300 students. The physical plant is good, the classes are small, and the faculty is excellent.

Admittedly, not everything is

perfect in this apparent paradise. The city utilities (particularly the water system) are unpredictable in their operation. There are people who seem to feel that an American likes as a greeting nothing better than "Hi, Joe! Give me money." And the U.P. in Baguio library has fewer volumes than the average high school library in the U.S. Yet despite these problems, my assignment is sorely lacking in most of the so-called hardships that accompany the Peace Corps image.

In fact, the entire Peace Corps program in the Philippines seems not to follow the "thatched hut and no electricity" mythology that the Peace Corps itself sometimes seems to be slyly encouraging. The largest number of all PCV's in the Philippines are in education projects, although the Philippines has more teachers than there are jobs available in teaching. In many barrios (farming communities), the school is the best-kept, nicest building.

These considerations have almost forced Peace Corps/Philippines, if it intends to fill a useful

role, into a different type of program than found in other Peace Corps projects: a program oriented toward improving the quality of instruction available, rather than the quantity.

This quality emphasis means that Volunteers work primarily with teachers, rather than students, in the fields of math, science, and English. For it has been found to accomplish far more in the long run to convince a few teachers to adopt modern methods, than to merely teach in such a manner to a few classes.

Even within this unusual content, my assignment is unusual—in that it is usual. At U.P. in Baguio I teach regular classes and do not work with my fellow instructors, except for the few who have enrolled in my classes for credit. Actually, my fellow faculty members are already quite competent, and there is little—if anything—that I can teach them.

This makes it quite difficult for me when I try to imagine

why the school—and in a larger sense, the Philippines—needed me to come all the way from the U.S. Possibly the only visible result of any significance will be that my presence has enabled the college to give another instructor full-time study leave with pay during my tenure. This means that, because of my presence, there will be at least one better-trained professor when I leave—even though I did not actually train this instructor myself. This is not a very great accomplishment for me, and I doubt that I will be singled out in Jack Vaughn's message to the Congress. It seems, however, that as far as Peace Corps is concerned, this is accomplishment enough. If the organization is satisfied with my work, then I am content too.

For me the Peace Corps has been of great personal benefit. During my stay in the Philippines, I seem to have discovered that I like math. This is rather unexpected, and I am more surprised than anyone at this turn of events. It is something I nev-

er found out during my two years of graduate school—nor, I regret to report, during four years at Caltech. This emphasizes the extremely personal nature of the ways in which PCV's benefit from the Peace Corps experience. It has only one serious flaw—the experience agrees only too well with Peace Corps statements on the subject and, as such, it becomes immediately suspicious.

But it still seems to me that the rationale for my presence may be just a well-worked-out cliché—a cliché, in fact, that isn't even good enough to report to Congress. Considering this possibility, then, it is probably best to avoid any final judgment on the benefits of the Peace Corps, and rely instead on more pragmatic criteria. Knowing what I do now, would I do it again? Perhaps predictably (but no less valid because of it), the answer would be an emphatic yes. And maybe that's all I really need to know.

## Towering Earful

(Continued from page 4)

make it sound phony or heavier than it is, and so it comes off well.

"The Golden Ghost of Love" is one of those songs that you'll have to hear to understand. Suffice to say that it's kind of like being chased by Bob Lind's "Bright Elusive Butterfly of Love."

Sank!

"The Wild Side of Life" has got to be a country-western put-on. It opens with, "And now, here's Mentor Mackerel to sing for you." It isn't a "Rocky Raccoon," but then again it isn't supposed to be.

"10,000 Men" opens with a wailing harmonica solo that blends into the song, and becomes the sound of 10,000 heartbreaks.

"1984" is the final song of the album, and it would be a good national anthem for Utopia. It speaks of a land of happiness "From the closed shooting gallery to the now empty zoo." It is the exact opposite of Orwell's world, with singing and dancing and love. On a wall hangs a calendar which reads "Best of Luck, Joe's Garage, Live in Peace, 1984." Richard Nixon was inaugurated this week.

"And the calendars read in peace, '1984'."

Buy the album, or at least listen to it.

## Math Dept. to Give Bell Prize

The Caltech Mathematics Department has recently announced the opening of competition for two math prizes offered annually at the Institute.

The first, the E. T. Bell Undergraduate Mathematics Research Prize, will be awarded for the best original mathematics paper written by a Caltech junior or senior. The prize consists of \$150.

The second is the Morgan Ward Competition open to all Caltech freshmen and sophomores. The winners will be chosen on the basis of the originality and elegance of the solution of a math problem chosen by each entrant. Generally two to four of the best entries are honored by the award of the prize, which consists of \$25.

Further details may be obtained from the Mathematics Office 253 Sloan.

# Campus Interviews

Individuals majoring in Computer Science, Engineering (Electrical, Mechanical or Industrial), Mathematics, and Physics will be interviewed by Collins Radio Company.

February 4, 1969

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# TECH Sports

## For All You Sports Trolls The PE 125 b Midterm

by Bob Eneinstein

Since nothing has aroused my ire this past weekend, this will be a bitter-free column. In fact I've decided to give you a little treat. All you have to do is relax, chug a couple cans, pick up a pencil, and take this simple test. Scoring will be as follows: 0- Go read the bridge column, 1-3-Well, at least you probably cooled Ph 2c, 4-6- A true sports fan, 7-9- A clever true sports fan, 10- You can have my job.

### Get Ready!

1. Who said, "It's not how you play the game that counts, it's who won that matters?"
2. Who said, "Millions for tribute, but not one penny for defense?"
3. What is four score and seven?
4. What was the biggest daily double in history?
5. What do you call 6 Polacks, 2 Italians, 2 Swedes, 2 Germans, and 1 Lithuanian?
6. Who was Bo Belinsky's famous girl friend?
7. The ABA is A) a pro basketball league, B) almost as funny as Laugh-In, C) Neither of the above.
8. What did the former UCLA basketball star say when presented with a ham for an appearance on a radio program?
9. This year the Dodgers should come in A) First, B) Ninth, C) Tenth.
10. True or false. Lew Alcindor

is taller than Willie Shoemaker?

### Geller, Here I Come

Now, if you're ready here are the answers. 1) Leo Durocher, 2) Coach Gutman, 3) The point spread on the Caltech-Whittier basketball game, 4) A wrestling match between Haystacks Calhoun and Farmer Humphrey 5) The Fighting Irish, 6) Mamie Van Doren, 7) C- funnier than Laugh-In, 8) "Thanks, but I won't be needing any more pork for a while," 9) A- whether or not they will is another matter, 10) True- you didn't expect me to make you read the bridge column, did you?

Back in the real world, I am happy to say that there isn't a football game on the tube this weekend. Instead there are some good basketball games to be seen. Non-Californians will be surprised at the quality of high school basketball in L.A. by watching the city championships Saturday. UCLA plays with Northwestern, and the Lakers battle Atlanta for the Western Division lead in other weekend games.

### Where To Go

On campus, the Interhouse tennis tournament will continue — maybe. It now looks like the team championship will go to either Ricketts or Fleming. Finally, Saturday night Whittier will show whoever shows up how a good small college basketball team should play.

## Swimmers Drown UCSD

The Caltech swimming team dove to a quick start and took first in the SCIAC relays. They had 96 points, while Occidental had 89, CHM, 79 and Redlands, 42. For the first time in three years, CHM (ranked second nationally) did not win the relays.

The Beavers set two meet records, the 200 yard backstroke team of Wright, Mikowitz, Sheffield and Tyson set a record swimming in 1:51.5. The 400 yard individual medley team of Sheffield, Hall, Tyson and Wright set a record of 4:01.9.

The 200 yard breaststroke team of Tyson, Healey, Hall and Ste-

fanko captured a first place as did the 400 yard medley relay team of Wright, Stefanko, Sheffield, and Mikowitz.

Johnson and Reedy, the two Beaver divers, captured second place. The 200 yard free relay team of Watkins, Coates, eight and Rude were also second. Davis, Watkins, Stefanko and Hall were third in the 200 yard fly relay. The 500 free team made up of Watkins (50), Height (100), Rude (150), and Davis (200) were also third. The 400 free team of Rude, Coates, Height, and Mikowirz were fourth.

## Matmen Take Double Dual

The Beaver wrestlers captured a double dual meet against University of California (UCR) and Pasadena College by 21-16 and 25-12 respectively. They had previously lost two league matches. CHM, 24-21, and Redlands, 31-20.

In the CHM meet, Morris (115), Lewis (145), and Deviny (177) won by pins. Beable (191) and Johnson (heavyweight) won their matches on points as both completely dominated their opponents.

Langill (123), Cox (160), and Woodhead (167) lost decisions. Hornbuckle (130) and Taylor (152) were pinned while the Beavers forfeited the 137 pound class.

Against Redlands, Morris won

by forfeit while Woodhead, Beagle and Johnson won by pins. Cox and Deviny lost decisions. Langill, Hornbuckle, Lewis and Taylor were pinned and the 137 pound class was forfeited.

In the double dual meet against UCR, Lewis, Woodhead and Beagle won their matches by pins. Deviny and Cox won decisions while Langill and Hornbuckle dropped decisions. Taylor lost by a pin and the Beavers again forfeited the 137 pound class to round out the scoring.

Against Pasadena, Morris (123), Langill (130), Lewis, Taylor and Deviny won by pins. This was Taylor's first victory. Hornbuckle (137) Cox, Woodhead and Johnson lost decisions. This was Johnson's first loss.

## Ducks Win Relays

The Beaver ducks downed UCSD in a non-conference meet, 76-37.

The Teckers won both the 400 medley relay and the 400 free relay with the teams composed of Wright, Tyson Sheffield and Kalisvaart and Mikosicz Coates, Height and Sheffield respectively.

Most of the Beavers did well in their races while Sheffield continued his record-breaking streak by capturing the 500 free in a record time of 5:19.5. Wright won the 200 back and continues his unbeaten string.

Micowicz captured a first in the 200 free and a second in the

200 fly. Height swam to a victory in the 1000 free. Stefanko was first in the 200 breast and captured a third in the 200 SM. Kalisvaart and Height captured second place in the 500 free and 1000 free respectively. Hall placed second in the 200 IM while Coates took a second in the 100.

Davis swam to a second in the 200 free and to a third in the 200 fly. Watkins was third in the 100 free. Wells was third in the 200 breast while Hjelte captured third in the 50 free.

Johnson won both the 1-M and 3-M diving, Reedy took a second in the 3-M and a third in the 1-M events.

## Hoopsters Get By Life

The Beaver roundball team stopped its losing streak at five by downing Life, 76-72 on Hanson's two final minute baskets. They then lost a foul filled game to Pomona, 93-61, and were trounced by LaVerne 111-68.

Caltech shot 49% from the court and this proved to be their means of victory as they shot only 32% from the free throw line. Ault was high scored with 27 points while Hanson was next with 16. Bicknell had 13 while Heinz had 10. Hansen and Heinz dominated the boards, getting 13 rebounds apiece.

Against Pomona, the Beavers made less than 30% of their shots from the field. However their free throw percentage improved to 65%. High scorer was Hanson while Qult had 11 points. Hanson also led in rebounds with 11. For these two good games, he was named player of the week.

LaVerne, shooting over 50%, walked over the Beavers. The Teckers made 34% of their field shots and 56% of their gift shots. Bicknell led in scoring with 19 points, while Carrie had 10. Heinz led in rebounding with 12.

## Foilers Win

Caltech's Fencing team hosted UC Riverside and UCLA Saturday evening. The Caltech Epee team of Bob Hsu, Gene Clough, and Dick Piccard beat the UCR team 5 to 4, while the foil team of Murray Smigel, Lance Optican, and Norm Pendergraft were losing 5 to 4. Both Tech teams lost to UCLA, and in the final rounds the substitutes were able to get valuable experience. Ray Pong showed great promise for the foil team, and Paul Re and John DeVries did well in their bouts for the Epee team: DeVries beat his opponent from UCLA, and Re scored three touches.

Saturday's meet scheduled to start at 2 p.m. will be a home event with L.A. State.

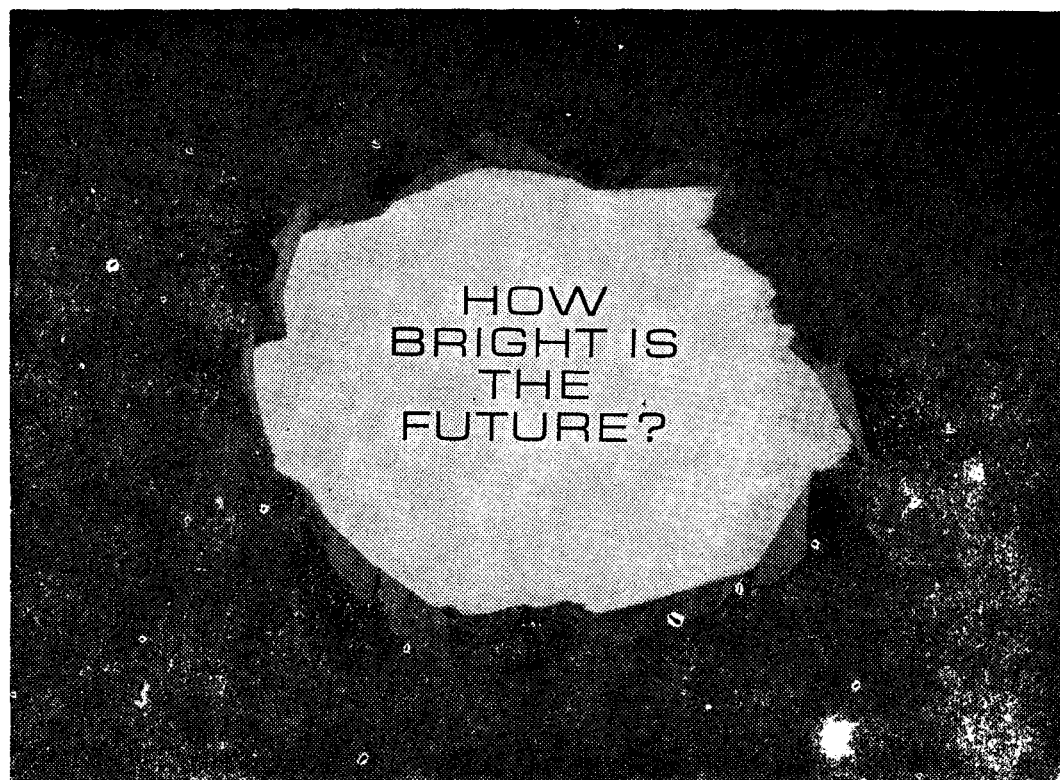
## Appleton's Ghost

(Continued from page 2)

generators have a common problem — extreme temperatures, from 1,800 to 3,000 degrees F — with the thermionic being the hottest.

The only space reactor now being developed is Aerojet's SNAP-8, Elliott said. SNAP means systems for nuclear auxiliary power. But, he added, the SNAP-8 is too heavy for electric propulsion.

Elliott, 41, has been at JPL ten years. A Caltech graduate, he received his bachelor and master of Science degrees here and went on to Purdue University for his Ph.D.



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## Engineering and Science at IBM

### "You're treated like a professional right from the start."

"The attitude here is, if you're good enough to be hired, you're good enough to be turned loose on a project," says Don Feistamel.

Don earned a B.S.E.E. in 1965. Today, he's an Associate Engineer in systems design and evaluation at IBM. Most of his work consists of determining modifications needed to make complex data processing systems fit the specialized requirements of IBM customers.

Depending on the size of the project, Don works individually or in a small team. He's now working with three other engineers on part of an air traffic control system that will process radar information by computer. Says Don: "There are only general guidelines. The assignment is simply to come up with the optimum system."

#### Set your own pace

Recently he wrote a simulation program that enables an IBM computer to predict the performance of a data processing system that will track satellites. He handled that project himself. "Nobody stands over my shoulder," Don says. "I pretty much set my own pace."

Don's informal working environment is typical of Engineering and Science at IBM. No matter how large the project, we break it down into units small enough to be handled by one person or a few people.

Don sees a lot of possibilities for the future. He says, "My job requires that I keep up to date with all the latest IBM equipment and systems programs. With that broad an outlook, I can move into almost any technical area at IBM—development, manufacturing, product test, space and defense projects, programming or marketing."

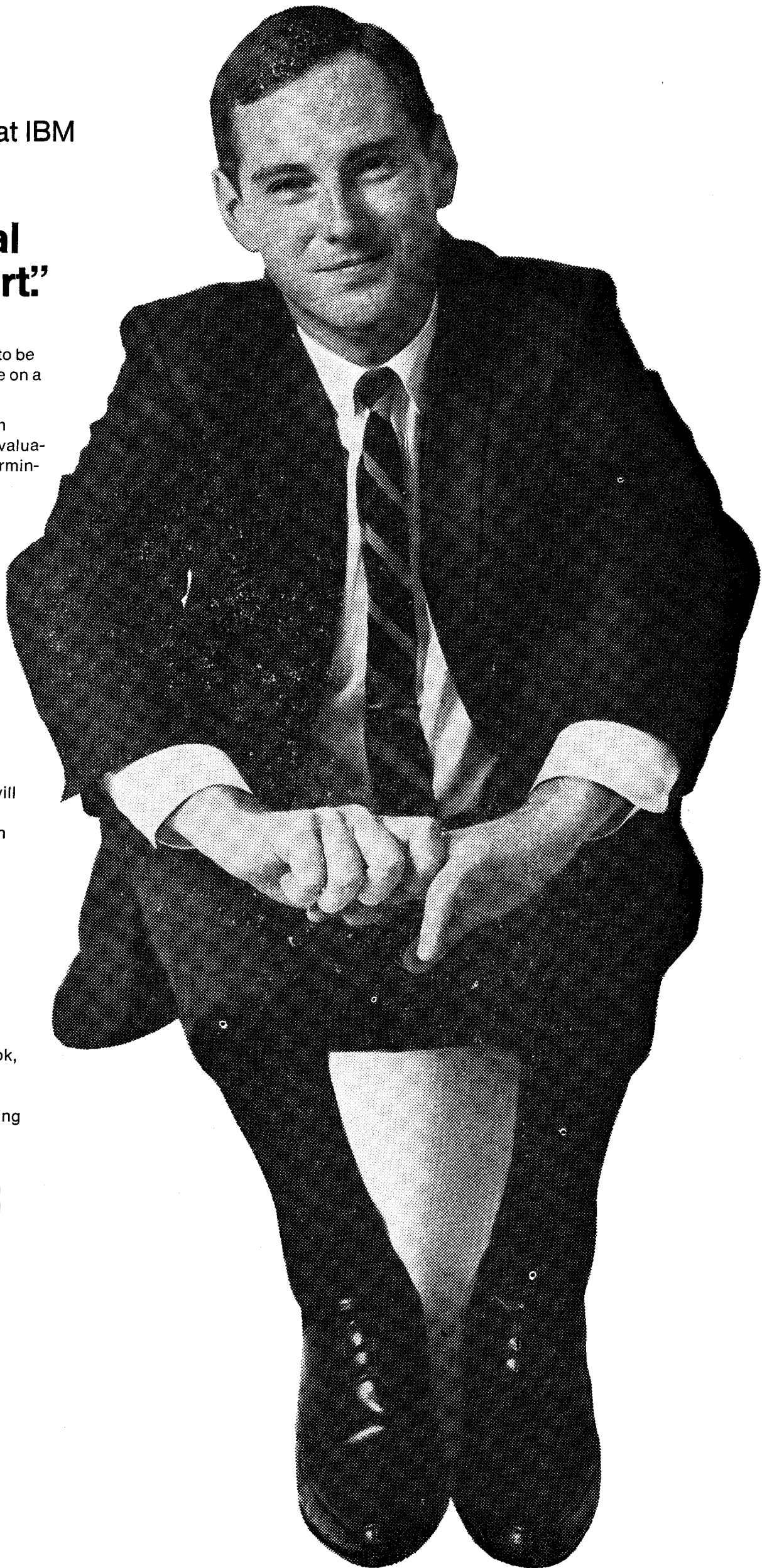
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# "By George"

...we hope you liked him.

We're talking about George Bernard Shaw as brought to life by the British actor, Max Adrian. We like him so much we are sponsoring the U.S. college tour of the "By George" London-Broadway stage production. Hope you caught it here. If not, catch it on Angel records.

But why is a billion-dollar industrial corporation like TRW having a love affair with that iconoclast, that professional cynic, that socialist, George Bernard Shaw?

Because the man is a mind-opener and we thrive, corporately speaking, on open minds. Ours. Yours. Consider what Shaw said about England decades ago: "The crying need of the nation is not for better morals, cheaper bread, temperance, liberty, culture, redemption of fallen sisters and erring brothers, nor the grace, love and fellowship of the Trinity, but simply for enough money. And the evil to be attacked is not sin, suffering, greed, priestcraft, kingcraft, demagoguery, monopoly, ignorance, drink, war, pestilence, nor any of the consequences of poverty, but just poverty itself."

It is possible for you or us to take exception to all or part of this, but it's something to chew on, here, today.

Here's another one: "Revolutions have never lightened the burden of tyranny: they have only shifted it to another shoulder." Yet, "The reasonable man adapts himself to the world; the unreasonable one persists in trying to adapt the world to himself. Therefore, all progress depends on the unreasonable man."

TRW is, in this sense, a company of unreasonable men.

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We believe that we can do something about some of the social problems that have the world uptight today. Air and water pollution. Poor housing. Traffic congestion. Crowded hospitals.

You see, we pioneered in the development of systems engineering techniques to solve complex aerospace problems. And we persist in thinking that the same techniques can solve social problems. Because, basically, systems engineering is nothing but an all-out assault on a problem using computerized common sense to analyze every last step of every factor involved. And from seeming chaos, developing an orderly solution. A system.

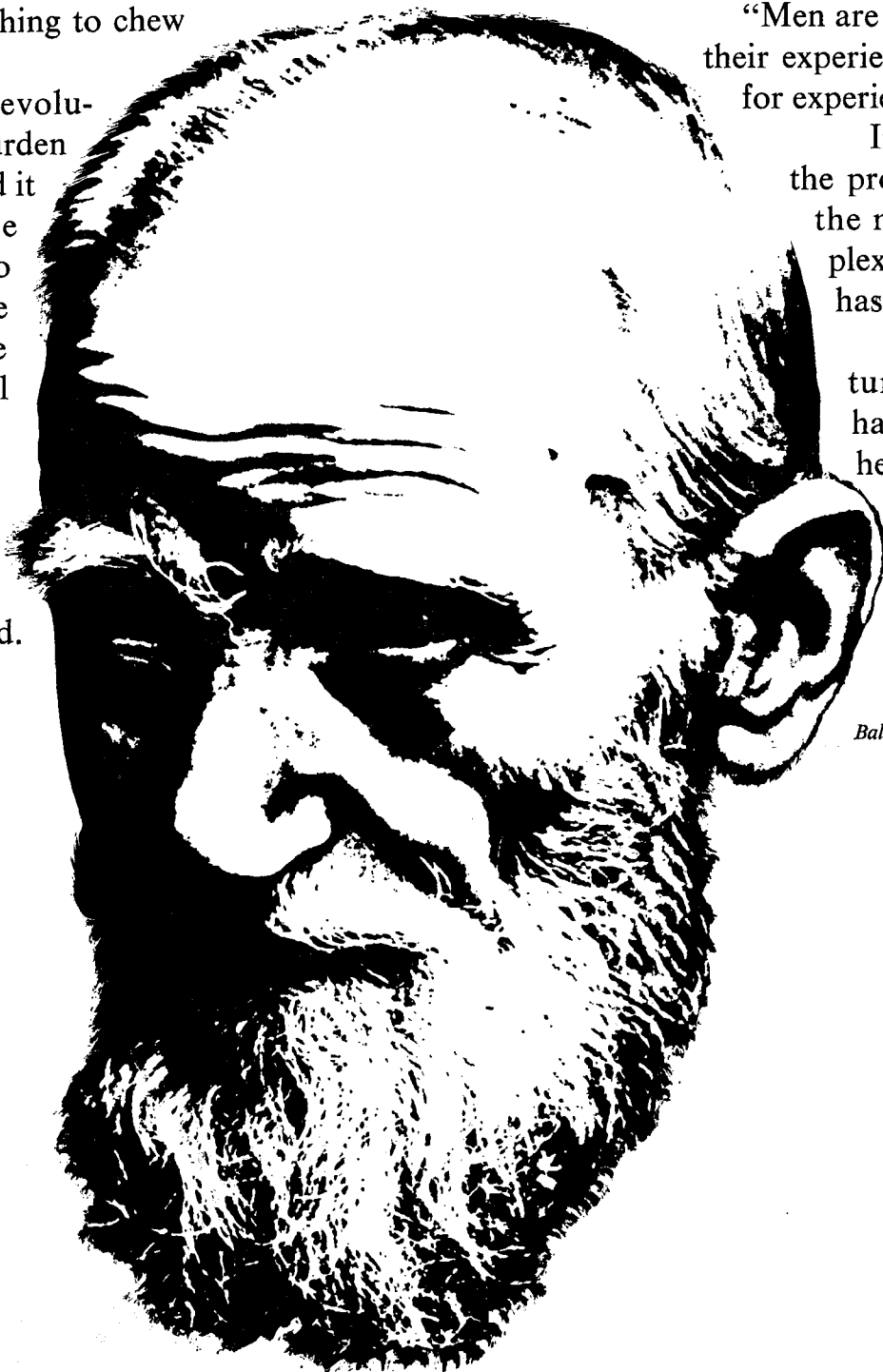
Our systems analysts have been working on such civil systems projects as a major medical center, an urban high-speed ground transportation setup, a regional land-use plan.

We expect to do more of this kind of thing, and we are equipped to do it. Among TRW's 75,000 employees are more than 7,000 with technical degrees, including over 550 Ph.D.'s and approximately 2% of the country's physicists.

"Men are wise in proportion, not to their experience, but to their capacity for experience."

In view of the complexity of the problems, the solutions and the new systems will be complex. But workable, if society has the will.

"The philosopher is Nature's pilot. And there you have our difference: to be in hell is to drift; to be in heaven is to steer." G.B.S.



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