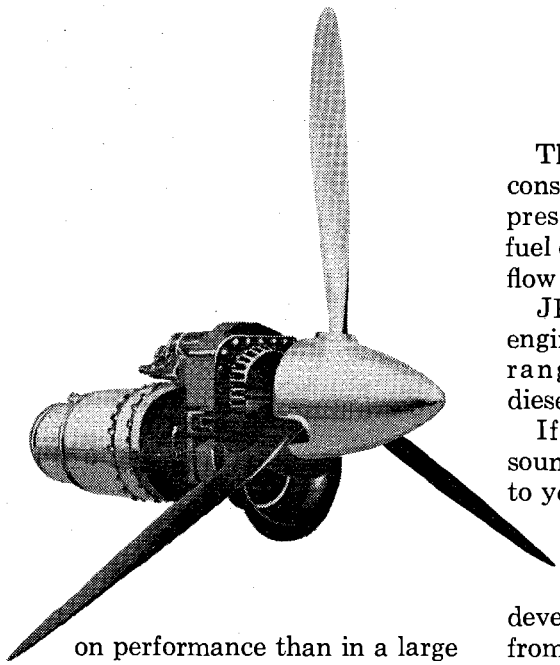
ENGINEERING | AND | SCIENCE

June 1964

Published at the California Institute of Technology

Everything we learned from building 10,000 small gas turbine engines has been packed into this new 600-horsepower turboprop engine —and it shows!



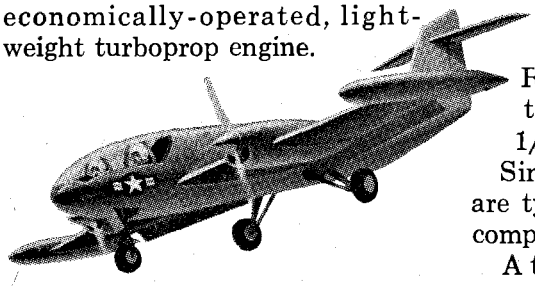
You'd probably expect the world's largest manufacturer of small gas turbine engines to turn out the world's finest small turboprop job.

And we have.

We call our new engine the TPE-331. (The military version is designated T-76.) It is a versatile turbine capable of powering many vehicles. Its 600-horsepower category makes it particularly suitable for the new generation of executive and military fixed-wing aircraft.

More specifically, our new prime propulsion engine is designed to fill the gap between reciprocating engines and larger turboprops.

And the reason we built it, is because both civil and military sources have asked for a simple, rugged, reliable, easy-to-maintain, economically-operated, lightweight turboprop engine.



The Garrett-AiResearch TPE-331 more than fills the bill.

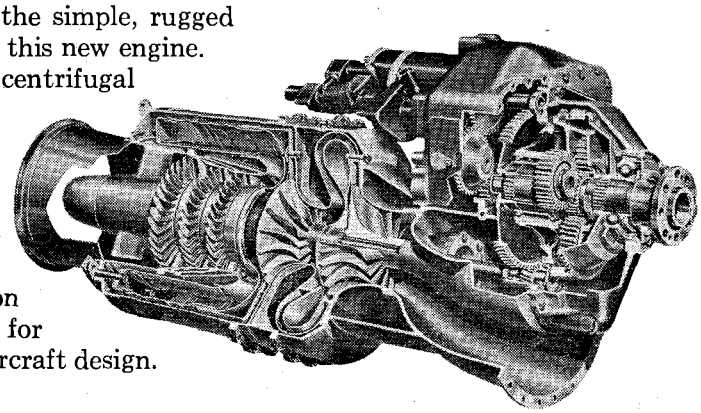
Obviously, building such an engine is a specialized art that demands experience, especially in miniaturization of controls, oil pumps, and starter motors.

Manufacturing tolerances are precise and have a greater effect on performance than in a large engine. Scaling down big engine techniques is not the answer.

The TPE-331 has a specific fuel consumption of .62 pound per shaft horsepower hour. Its weight to power ratio is .45 pound per horsepower. Response rate from flight idle to full power is approximately 1/3 of a second.

Single-casting turbine wheels are typical of the simple, rugged components of this new engine.

A two-stage centrifugal compressor is driven by a 3-stage axial turbine. Propeller drive is through a 2-step reduction gear box offset for flexibility of aircraft design.



The fuel system of the TPE-331 consists of a fuel filter, single high-pressure pump, speed-governing fuel control, manual shutoff valve, flow divider and fuel nozzles.

JP-5 is the normal fuel, but this engine will take all kinds of fuel, ranging from AV-gas to light diesel fuel.

If this new turboprop engine sounds like something very special to you, we've made our point.

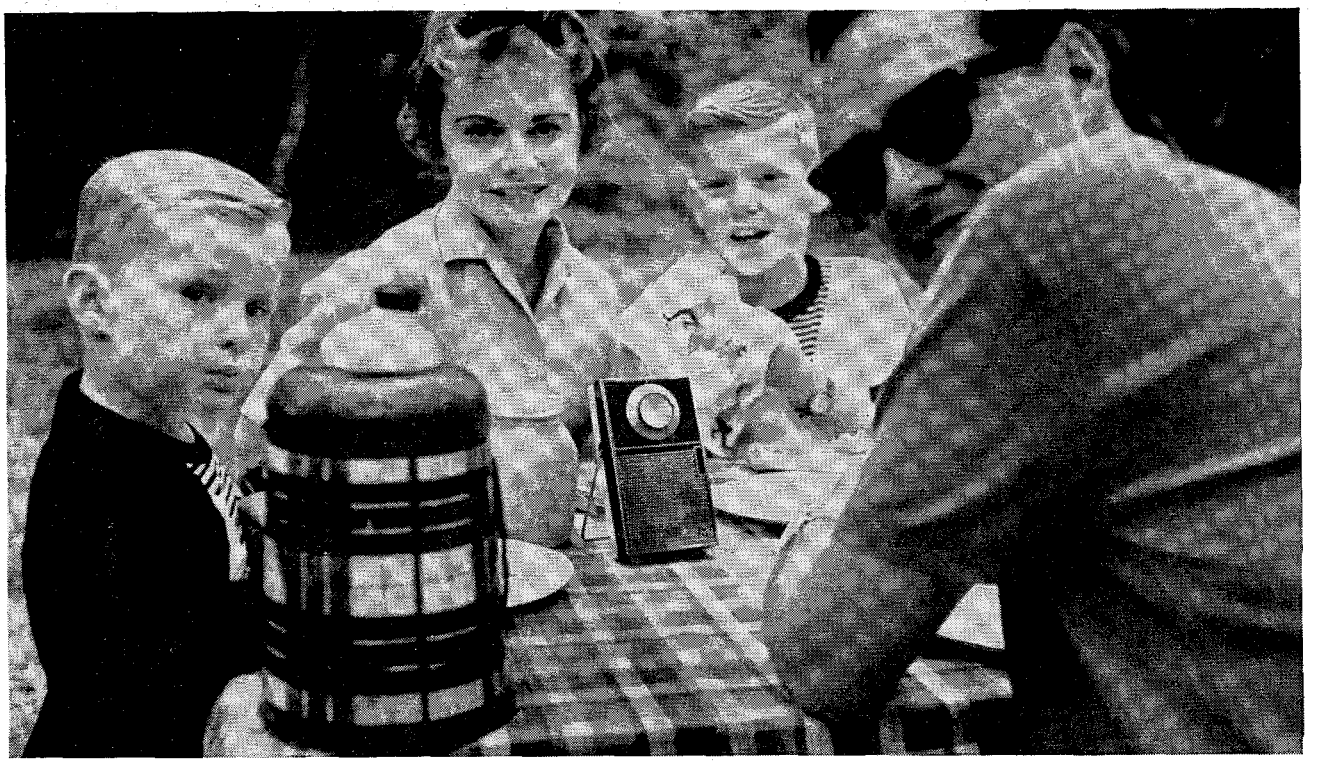
The TPE-331 *is* an exceptional engine.

It's the kind of a power development you'd expect to come from Garrett. For when it comes to turbine engines under 1000 horsepower...

Garrett *is* experience

GARRETT AIRESEARCH *Los Angeles • Phoenix*

For further information about many interesting project areas and career opportunities at The Garrett Corporation, write to Mr. G. D. Bradley at 9851 S. Sepulveda Blvd., Los Angeles. Garrett is an equal opportunity employer.



Is it a fact that a leader in nuclear research has a hand in bringing music to the Wilkies' family picnic?

Few people would be surprised to learn that a company which started mining and milling uranium ore more than 20 years ago would emerge as one of the world's most diversified private enterprises in the field of atomic energy. Today, it manages the atomic energy facilities at Oak Ridge, Tennessee, and Paducah, Kentucky, for the U.S. Atomic Energy Commission; ships radioisotopes all over the world; and operates its own nuclear research center.

And you'd certainly expect that the manufacturer of more than 400 different types of "Eveready" batteries would make the batteries preferred most for portable radios. The Wilkie family can take Bach, Basie or the baseball game anywhere they go.

But would the awesome tasks of nuclear research and the mass production of tiny batteries ever be performed within the same company? Not unless the company happened to be Union Carbide.

With Union Carbide, surprising diversification is almost commonplace. It makes half a dozen major plastics, as well as plastic bottles and packaging films; and it is one of the world's largest producers of petrochemicals. It makes the largest graphite cylinders ever produced, for use in rocket exhaust nozzles, and the arc carbons for motion picture projectors. It liquefies gases, including those that will power men to the moon. And among Union Carbide's other consumer products are such world-leaders as "Prestone" brand anti-freeze and "6-12" insect repellent.

In fact, few other corporations are so deeply involved in so many different skills and activities that will affect the technical and production capabilities of our next century.

It sounds good to the Wilkies.

UNION CARBIDE

UNION CARBIDE CORPORATION, 270 PARK AVENUE, NEW YORK, N.Y. 10017. IN CANADA: UNION CARBIDE CANADA LIMITED, TORONTO
Divisions: Carbon Products, Chemicals, Consumer Products, International, Linde, Metals, Nucleor, Olefins, Ore, Plastics, Silicones, Stellite and Visking

PERFECTIONIST

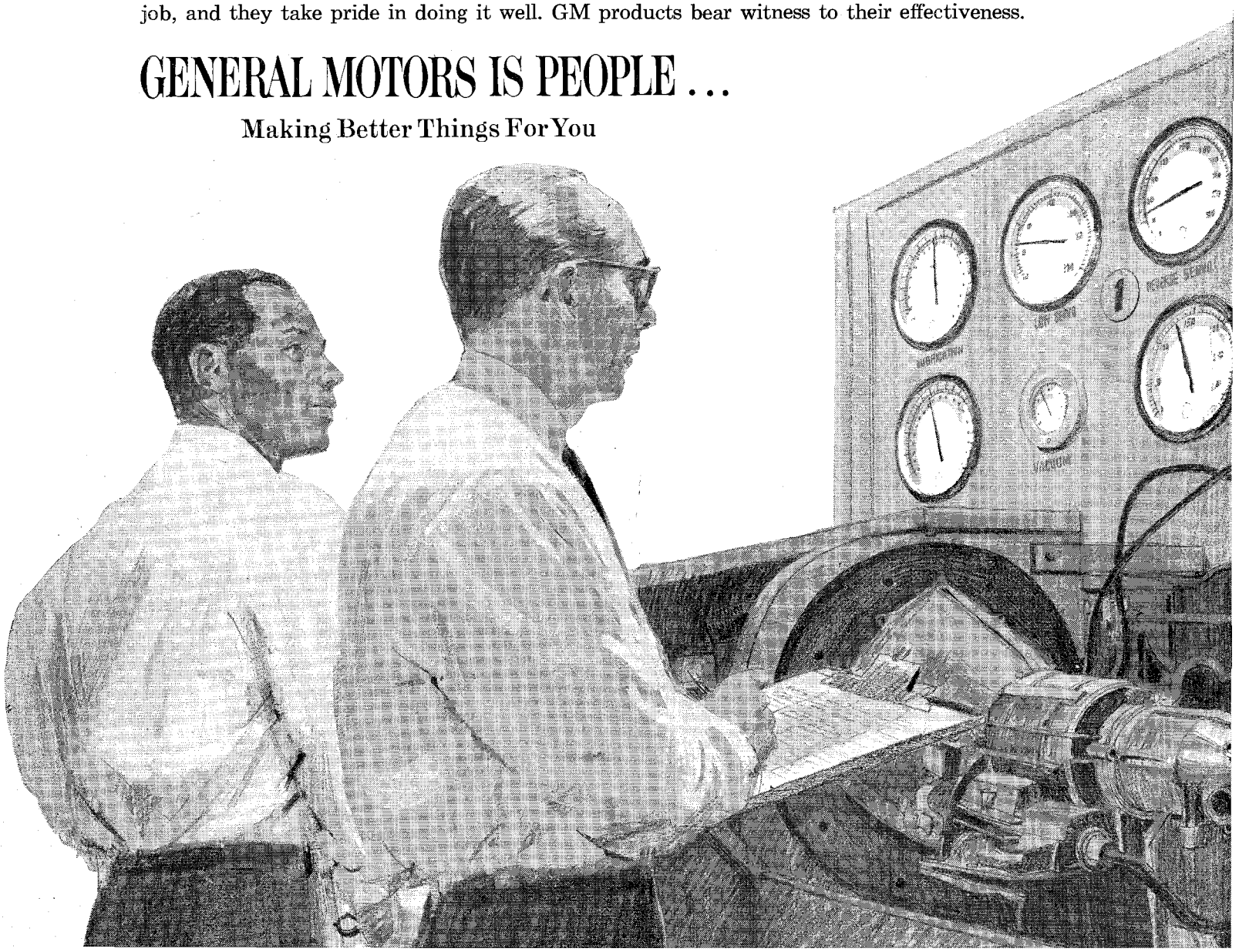
Assignment: Quality Control. He's a very special engineer at General Motors—a key man in a corporation which regards product dependability as a prime responsibility to its customers. He and a GM inspector are shown giving this transmission a final check. In addition to keeping an eagle eye on every phase of manufacturing, the quality control engineer is closely concerned with preliminary design and engineering. More than 13,000 individual parts go into a GM car, and every one must be as reliable as men and machines can make it. Raw materials, components, subassemblies—*all* get meticulous scrutiny. Tolerances to within *fifty millionths* of an inch are commonplace.

Among GM production employes, about *one of every twelve* devotes full time to quality control or inspection. Approximately 50,000 inspections are involved in the building of a single car. In addition, every machine operator has the responsibility for the quality of his work and performance of his machine. He can accept or reject any part he makes. His work is checked by the quality control engineer and the inspector, who analyze machine capabilities and predict machine inaccuracy *before* it occurs—not after.

They're mighty important people, these GM quality control engineers. They have an exacting job, and they take pride in doing it well. GM products bear witness to their effectiveness.

GENERAL MOTORS IS PEOPLE . . .

Making Better Things For You



ENGINEERING | AND | SCIENCE

JUNE 1964 VOLUME XXVII NUMBER 9

On Our Cover:

Heinz A. Lowenstam, professor of paleoecology, in his marine laboratory in Caltech's division of geological sciences. In this laboratory, Dr. Lowenstam has found the first evidence that iron can be manufactured biologically, in his studies of a sea slug, called the chiton, whose teeth are capped with iron. "The Case of the Iron Teeth" on page 8 is a report on this research.

Dr. Lowenstam came to Caltech in 1952 from the University of Chicago, where he was associate professor of geology. There he worked with Dr. Harold Urey and Dr. Samuel Epstein (now professor of geochemistry at Caltech), on pioneering research on the temperatures of prehistoric oceans.

A native of Germany, Dr. Lowenstam studied at Frankfurt and Munich, then came to the U.S. to do graduate work at the University of Chicago, where he received his PhD in 1939. He became a naturalized citizen in 1943.

Part of Dr. Lowenstam's research year is spent in tropical climes, where he dives for marine specimens for later research in his laboratory. He leaves next month for the Fiji Islands to collect marine fossils from late tertiary deposits. Then he goes to Palau in the Caroline Islands to find out just what minerals various reef-building organisms precipitate to make reefs.

Illustrations:

Cover, 9, 14-18 — James McClanahan, Graphic Arts Facilities
4-7 — Graphic Arts Facilities
11-13 — Kent McCaulley '67

Commencement 1964 4

Research in Progress 8

The Case of the Iron Teeth

Research on a slug-like sea creature called the chiton has produced the first evidence that iron can be manufactured biologically.

The Month at Caltech 11

Coffee Hour 12

RFK at CIT 14

Retiring This Year 16

Caltech's 1963 Alumni Survey 19

II. Opinions, Interests, and Concerns

by John R. Weir

Personals 24

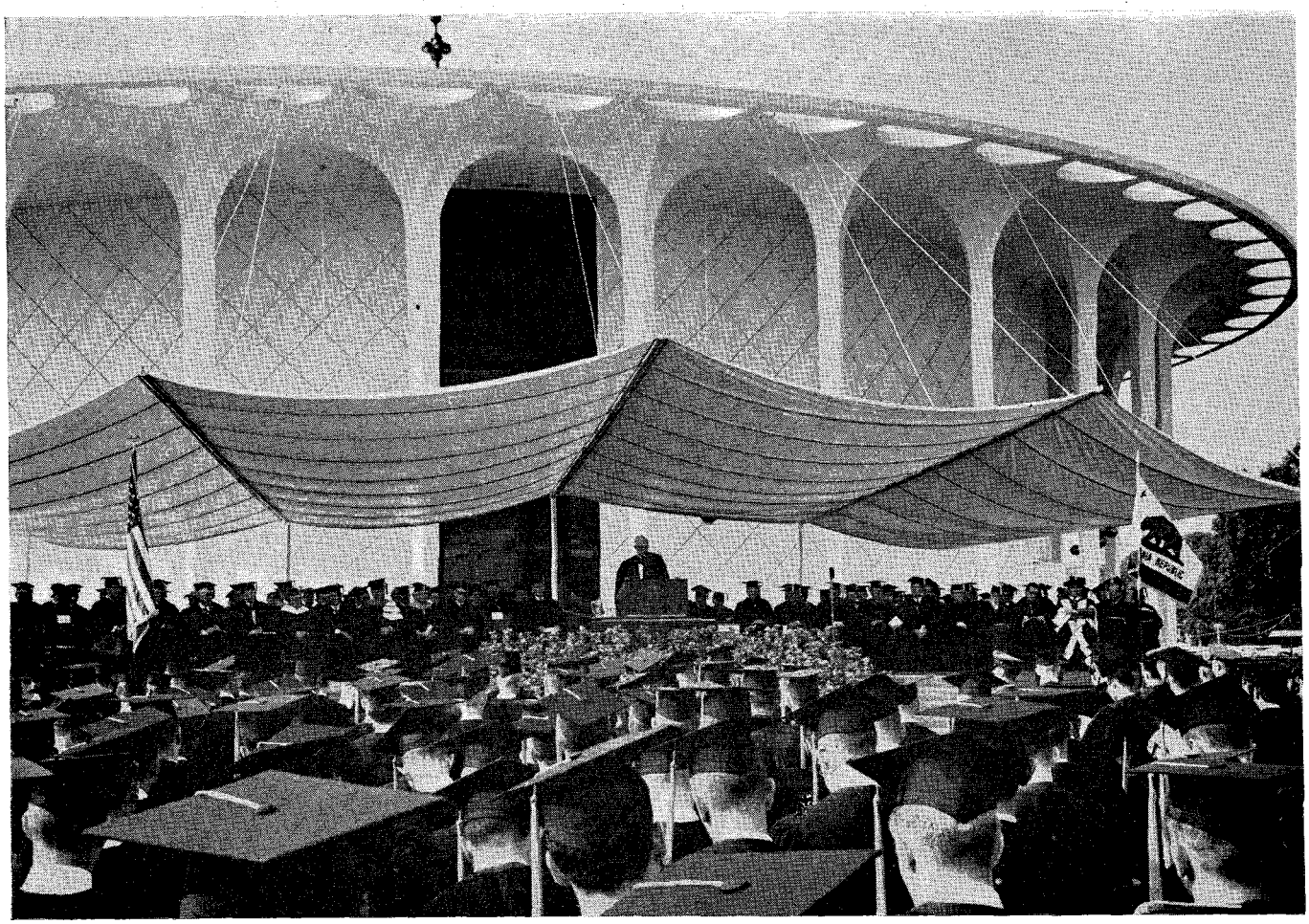
Alumni News 27

STAFF

Publisher.....Richard C. Armstrong '28
Editor and Business Manager.....Edward Hutchings, Jr.
Assistant to the Editor.....Gerda Chambers
Photographer.....James McClanahan

Published monthly, October through June, at the California Institute of Technology, 1201 East California Blvd., Pasadena, Calif. Annual subscription $4.50 domestic, $5.50 foreign, single copies 50 cents. Second class postage paid at Pasadena, California, under the Act of August 24, 1912. Manuscripts and all other editorial correspondence should be addressed to: The Editor, *Engineering and Science*, California Institute of Technology.

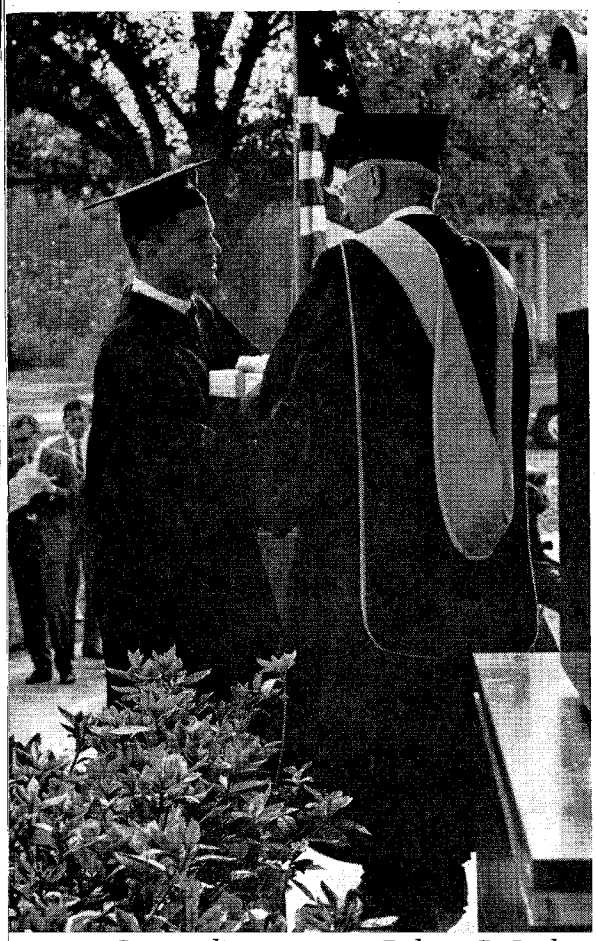
ENGINEERING AND SCIENCE
June 1964, Volume XXVII, No. 9



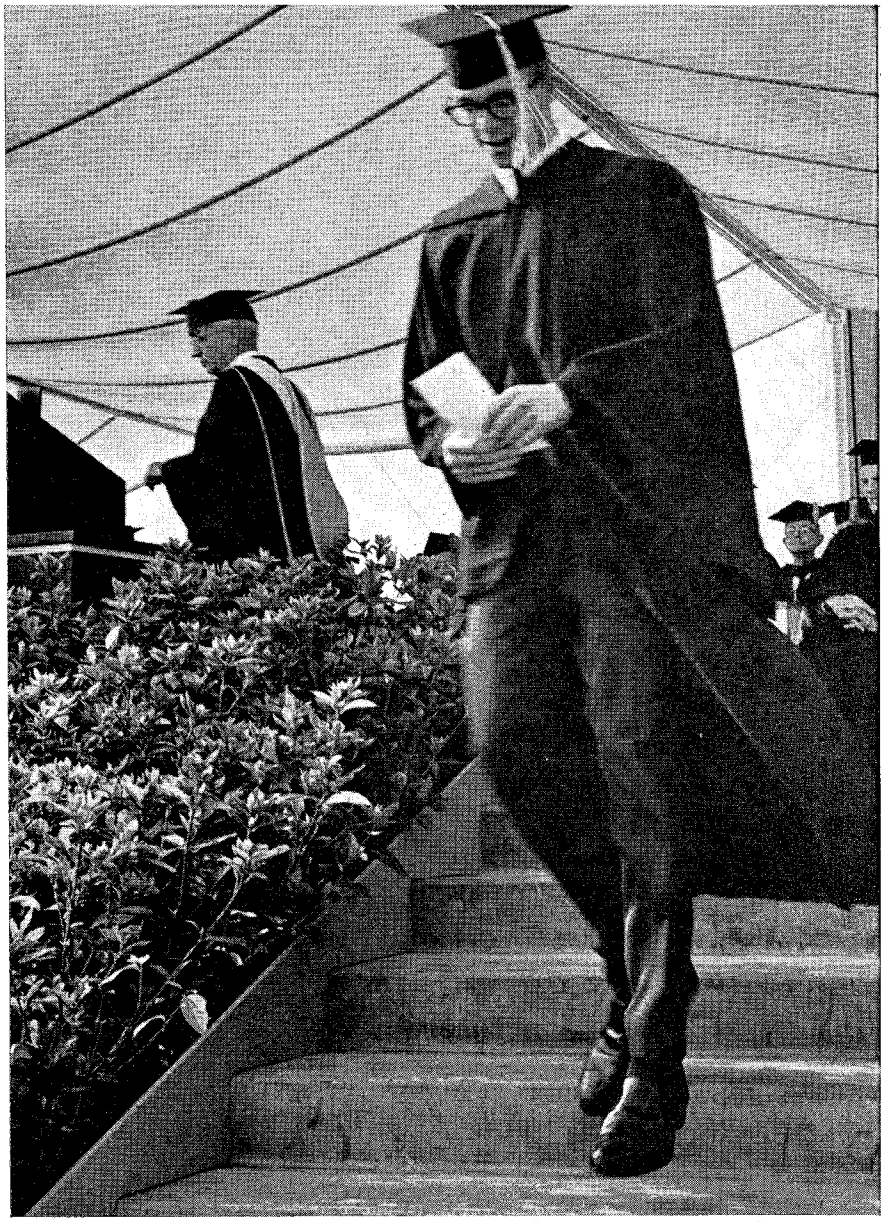
COMMENCEMENT 1964

Caltech's 70th annual commencement on June 12 is held for the first time on the Beckman Auditorium mall

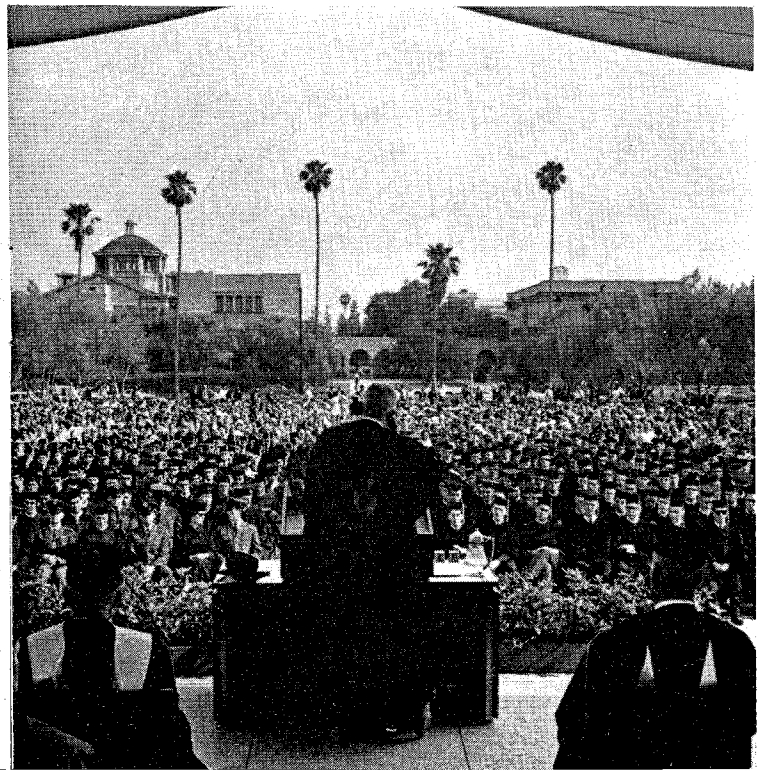
Some Highlights



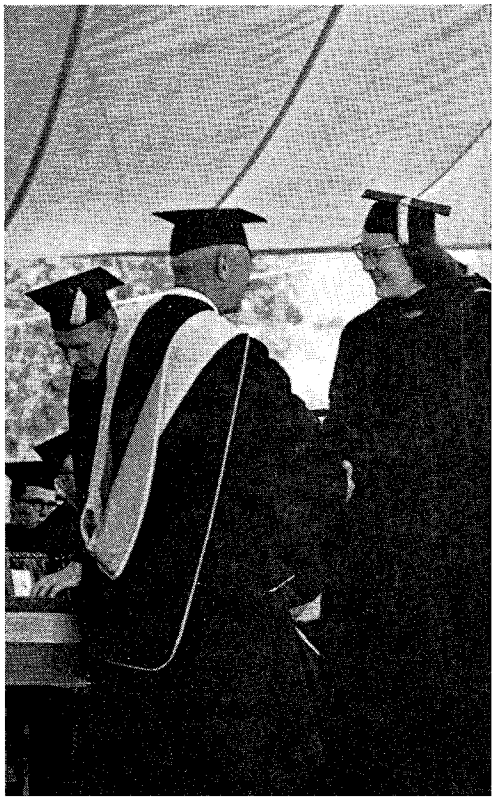
Outstanding senior — Robert C. Liebermann, student body president, wins the Frederic W. Hinrichs, Jr. Award.



Terence M. Murphy, senior in biology, receives the first George W. Green Award for creative scholarship.

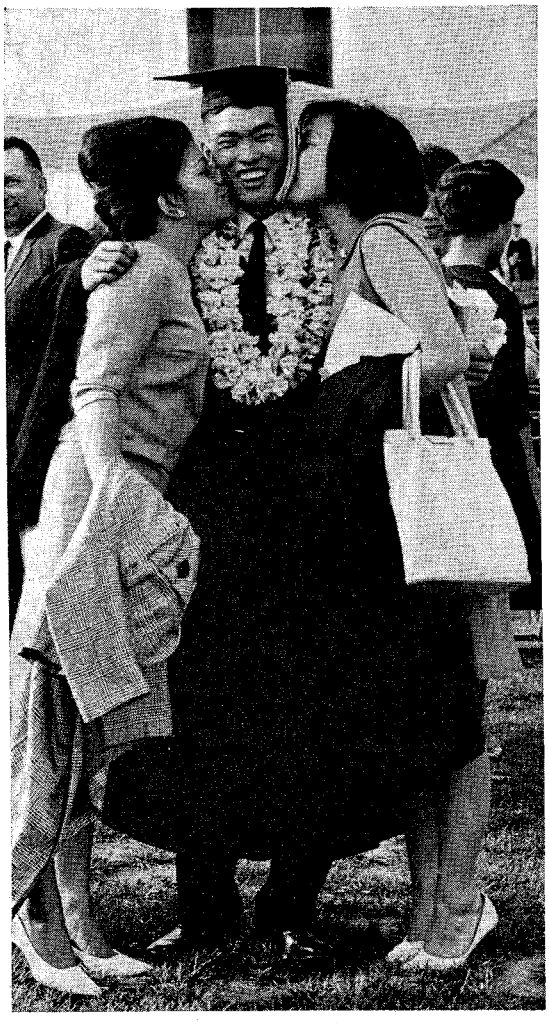


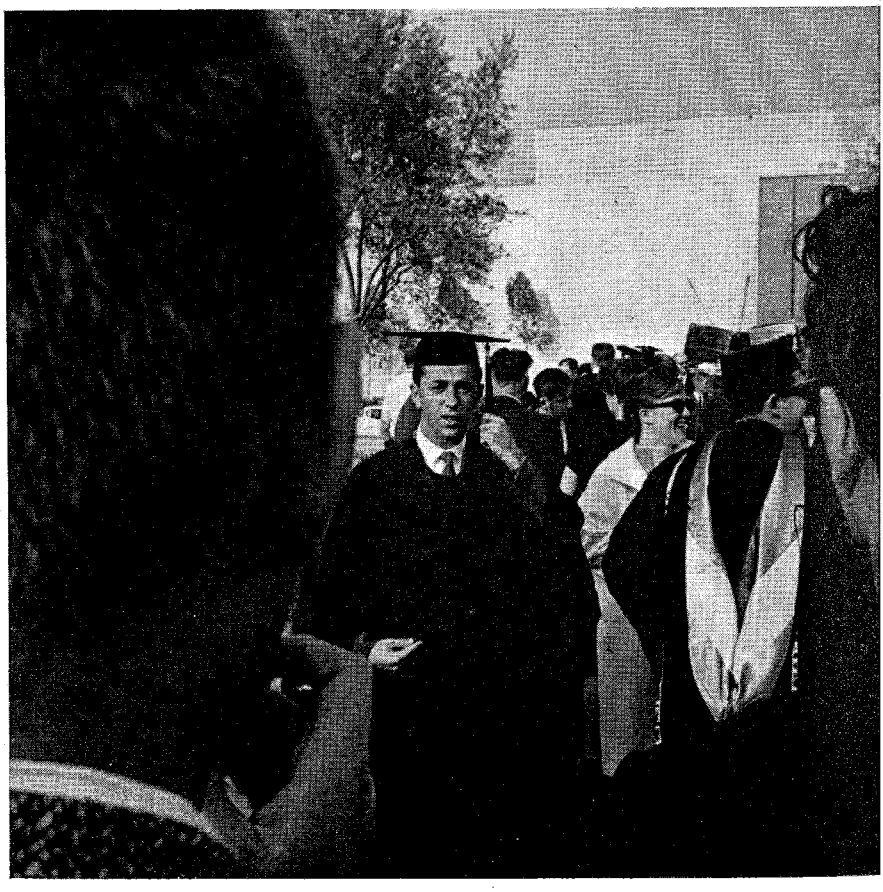
Dr. Henry T. Heald, president of the Ford Foundation, delivers the commencement address.

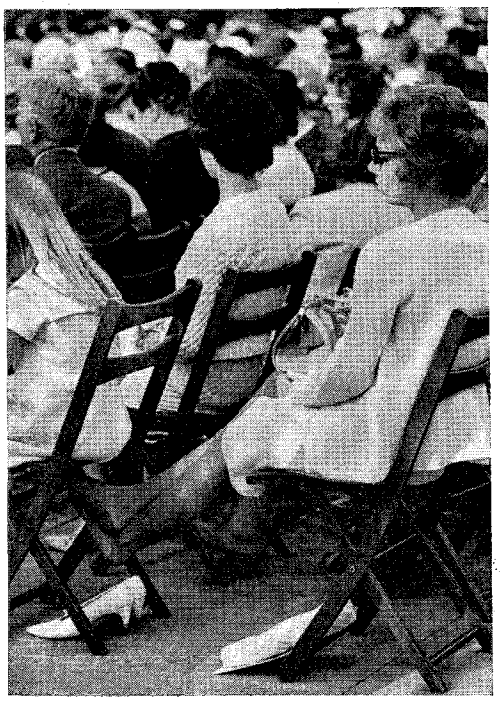


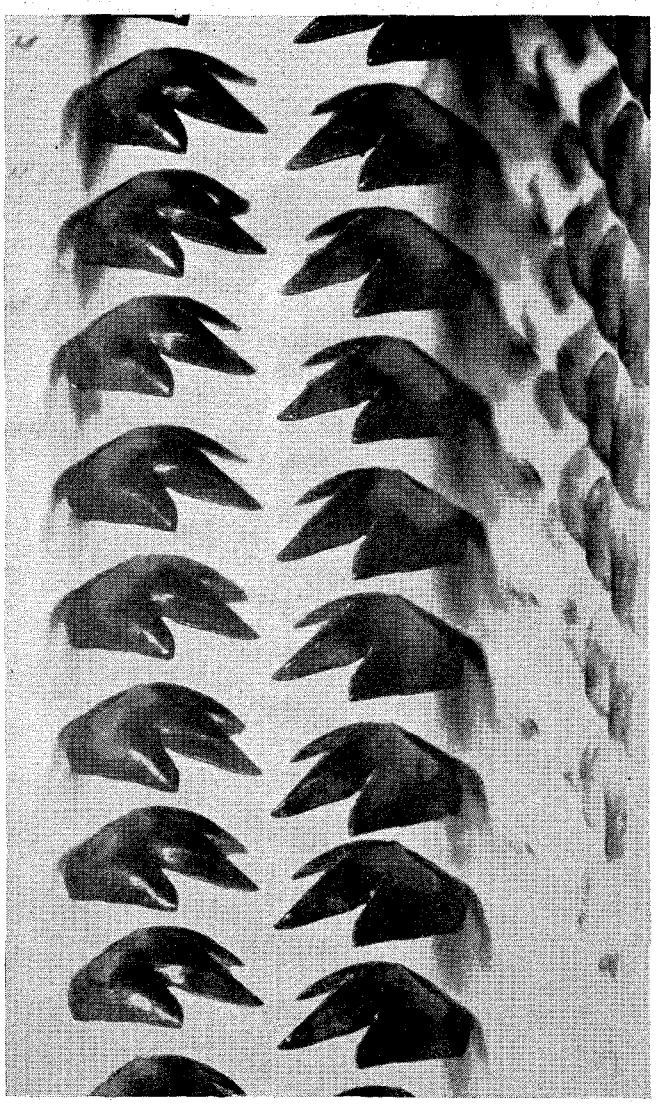
President DuBridge congratulates Mrs. Lorraine Turnbull Foster, first woman to receive a PhD in mathematics at Caltech.

And Some Sidelights









THE CASE OF THE IRON TEETH

Research on a slug-like sea creature called the chiton produces the first evidence that iron can be manufactured biologically.

Heinz A. Lowenstam, professor of paleoecology at Caltech, is a firm believer in simple observation. In fact, his idle observation of a tide pool in Bermuda has evolved into a new research project on evolutionary processes, resulting in the discovery of some new and unfamiliar minerals in sea animals.

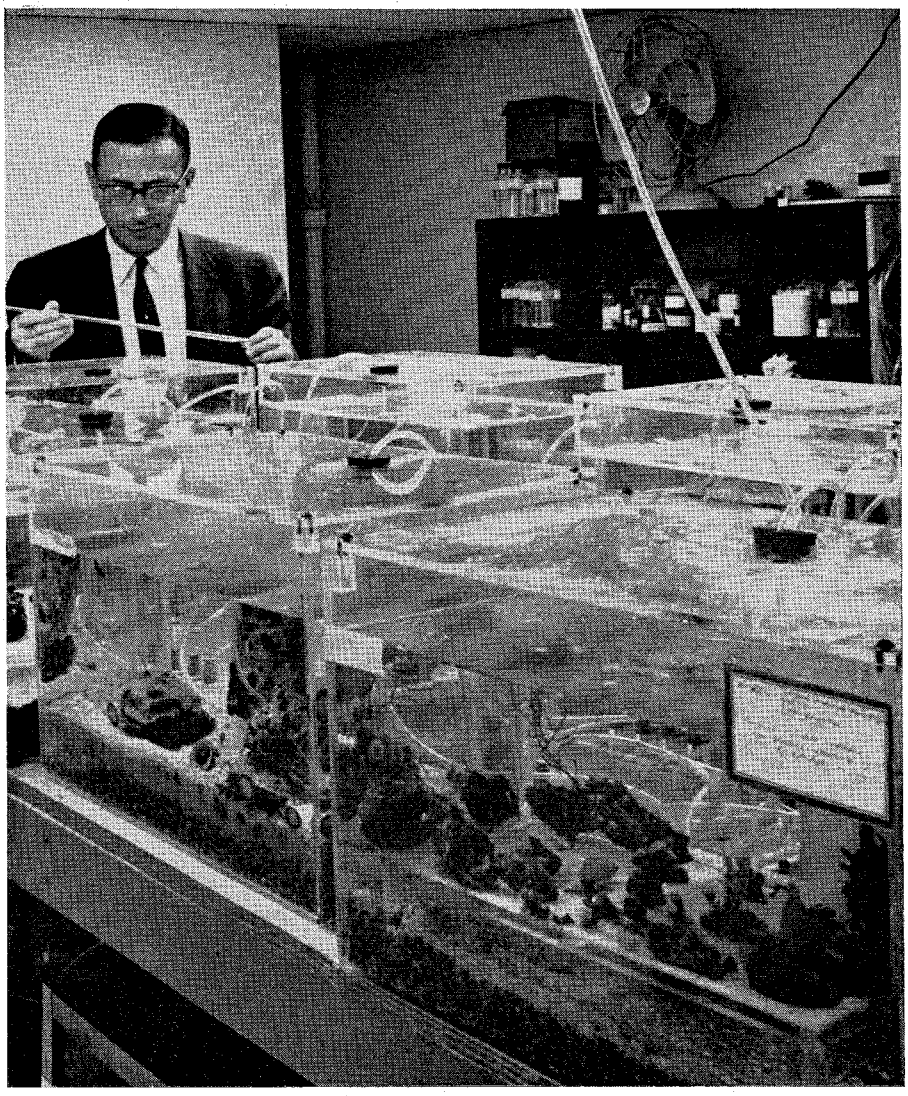
In 1961 Dr. Lowenstam was in Bermuda gathering specimens of shelled creatures for environmental studies. One morning, as he gazed into a tide pool, he noticed deep gouge marks on the rocks in the bottom of the pool. It turned out they were made by a slug-like creature called a chiton, which scrapes algae from rocks with its teeth.

The marks were so deep, even in rocks as hard as limestone, that Dr. Lowenstam's curiosity led him to investigate further. He found that the chiton's teeth were capped with shiny black magnetite, a common and very pure form of iron ore. Salt water does not damage the teeth, and they are hard enough to scratch glass. The deep gouge marks are made when the chiton scrapes off the outer layer of rocks, scooping up the algae that are growing in the deeper layers underneath.

More extensive research on the chitons revealed that these creatures have existed on the earth for about 500 million years. They range from microscopic size to almost nine inches long, and are found from the polar regions to the tropics, and from shorelines to ocean depths of about 20,000 feet. One variety has been known to live for about 20 years. Although sightless, most chitons have strong homing instincts and return unerringly to the same location on the same rock. Since their teeth have been found to be magnetic, it is possible that they serve as some sort of biological compass.

The chiton has 70 teeth in two rows of 35 on each side, attached to a tongue-like structure. The teeth operate somewhat like a belt line — rolling, scraping, and drawing food back into the mouth simultaneously. Only four to six teeth emerge from the mouth at a time, and when teeth wear down, they are discarded and replaced from both rows as they move forward. This ability to manufacture

Heinz A. Lowenstam, professor of paleoecology, in his marine laboratory in Caltech's division of geological sciences.



more teeth to replace the ones that are worn down is the first evidence scientists have that iron can be manufactured biologically.

Dr. Lowenstam has now found other sea creatures containing iron compounds which are softer than the magnetite found in the chiton's teeth — such as the deep sea clams found as far down as 18,000 feet in waters around Antarctica; and limpets, which are primitive sea snails.

All of this evidence has led Dr. Lowenstam to question how iron is distributed in molluscs which have teeth, and what the evolutionary significance of the iron distribution may be.

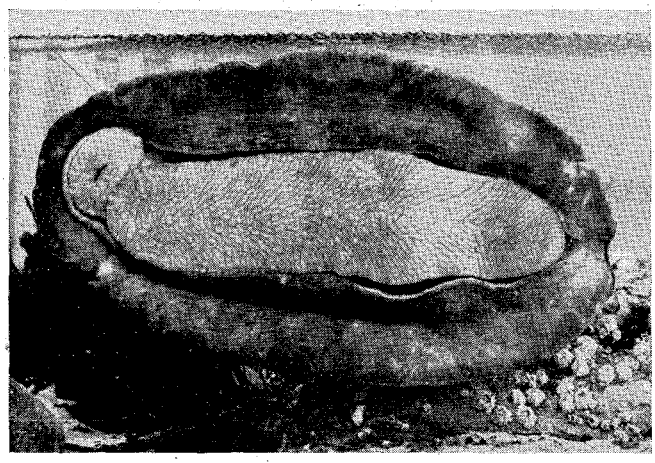
First of all, Dr. Lowenstam assumes that the chiton was in competition with other rasping organisms for algae, and in ages past, among other changes, a mutation occurred which developed harder teeth. Thus, the chiton could find food from the deeper layers of rock instead of just at the surface.

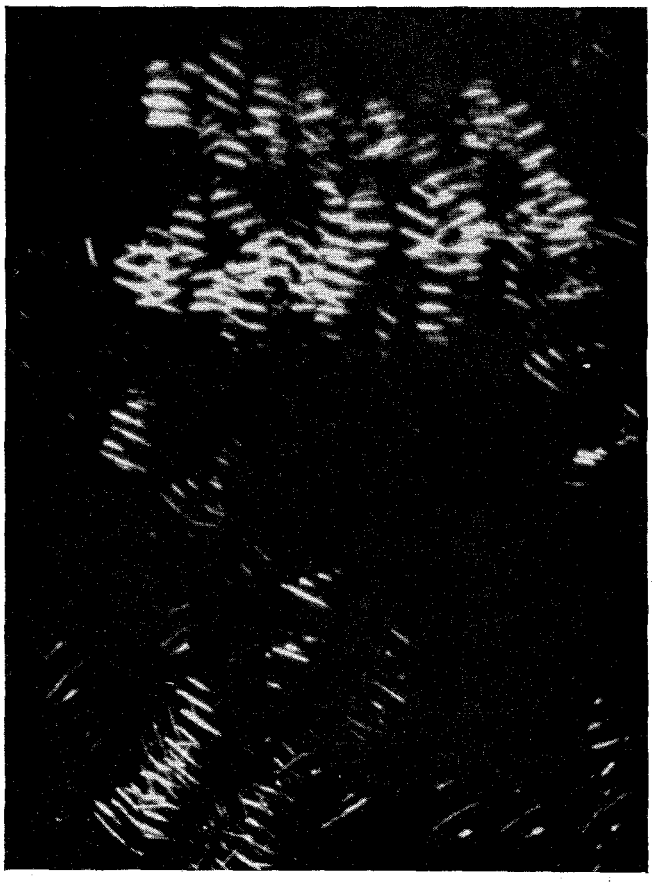
Using x-ray diffraction techniques, Dr. Lowenstam found that the tooth enamel from some chiton species corresponded with the mineral magnetite, while those from other chiton species contained some unidentified minerals, *plus* the magnetite. Some limpets showed a mineral remarkably like goethite — this being the first evidence that the mineral goethite is precipitated by marine invertebrates.

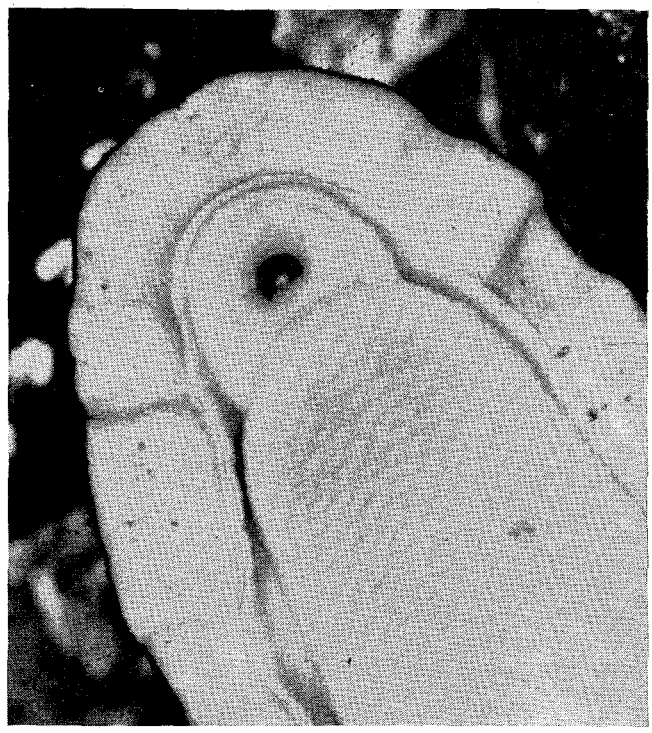
But how does the iron get on the teeth and is it really metabolized by organisms?

This question is being investigated by Michael Nesson, a graduate student in biology at Caltech, who is cooperating in the Lowenstam project. Mr. Nesson and Dr. Kenneth Towe, postdoctoral research fellow in geology, knew that there had to be an iron storage protein to develop the iron teeth. They eventually determined that this protein was ferratin — which had previously been found in only one invertebrate, a worm, although it is a common iron storage protein in all vertebrates, including man.

The compounds which form the iron could come from marine algae, which commonly enrich iron







Chitons move much like snails, creeping on one large foot, which adheres to rocks or pilings. The chiton above has opened its mouth to scrape algae from the aquarium wall with its iron teeth, leaving the deep gouge marks shown at left.

in the tissues of these sea creatures, and form the major part of the chiton's diet. The iron could also be derived from the dissolution of ingested sediment particles in the intestinal tracts of these animals. Dr. Lowenstam has in fact found the iron storage protein ferratin in the tissues surrounding the chiton's teeth.

One of the major points being investigated now is how the iron is transported through the whole system of the chiton before it becomes magnetite. Also, scientists are investigating many other sea animals to see if this same process is going on in them.

Sea water today contains, among other things, equal proportions of non-radioactive strontium, and calcium. Certain lower sea animals were believed to have the same proportions of these substances in their body chemistry. But, from the studies made so far, Dr. Lowenstam has discovered that, through an evolutionary period of about 300 million years, limpets have changed their fluid body chemistry. By a series of mutations, they have learned to progressively reject the strontium in their bodies and shells, thus becoming biochemically independent of the chemistry of their environment.

Dr. Lowenstam leaves next month for the Fiji Islands to collect fossils from late tertiary marine deposits. Preliminary studies of the shell chemistry of the sea creatures found there indicate that the deposits were laid down in deep, cold water about 50 million years ago.

He then goes to Palau in the Caroline Islands, 500 miles east of the Philippines, and 500 miles north of New Guinea, to find out what minerals various reef-building organisms precipitate to make reefs.

Dr. Lowenstam's research has been supported by the Shell Development Company and the Petroleum Research Fund of the American Chemical Society, and is being sponsored by the National Science Foundation.

The Month at Caltech

NSF Grants

Two Caltech men have received senior postdoctoral fellowships from the National Science Foundation to do research in Europe

Albert Ellis, associate professor of applied mechanics, will go to Cambridge University in England for a year to study with colleagues there the basic mechanism for drag reduction of a group of long, thin molecular chains called non-Newtonian additives. When very small quantities (about 10 parts per million) of these additives are added to a liquid, objects move through it with substantially less frictional resistance. Dr. Ellis will study their properties with the aid of the very high speed laser photographic system he developed at Caltech with the support of the Office of Naval Research.

Julian Miklowitz, professor of applied mechanics, will work, for three months each, in Rome and Israel, on the solution of mathematical problems arising from the propagation of waves in solids. These involve waves generated by earthquakes, nuclear detonations and other explosions, and the effects of such waves on the dynamics of basic structures. Early in September Dr. Miklowitz will address the 11th International Congress of Theoretical and Applied Mechanics in Munich, Germany, on the subject of wave-scattering from objects and cavities in solids. This work is important in the design of underground shelters to enable them to withstand the effects of nuclear blasts.

Caltech in India

Six Caltech men leave for India this month, with their families, to carry on research, to teach, and to develop curricula at the new Indian Institute of Technology at Kanpur for one year. Four are faculty members: Peter Fay, associate professor of history; Peter Mason, assistant professor of electrical engineering; Jon Mathews, associate professor of theoretical physics; and David Welch, associate professor of engineering design. The others are John B. Trenholme, graduate student in materials science; and Richard Carrouche, instrument specialist in electrical engineering.

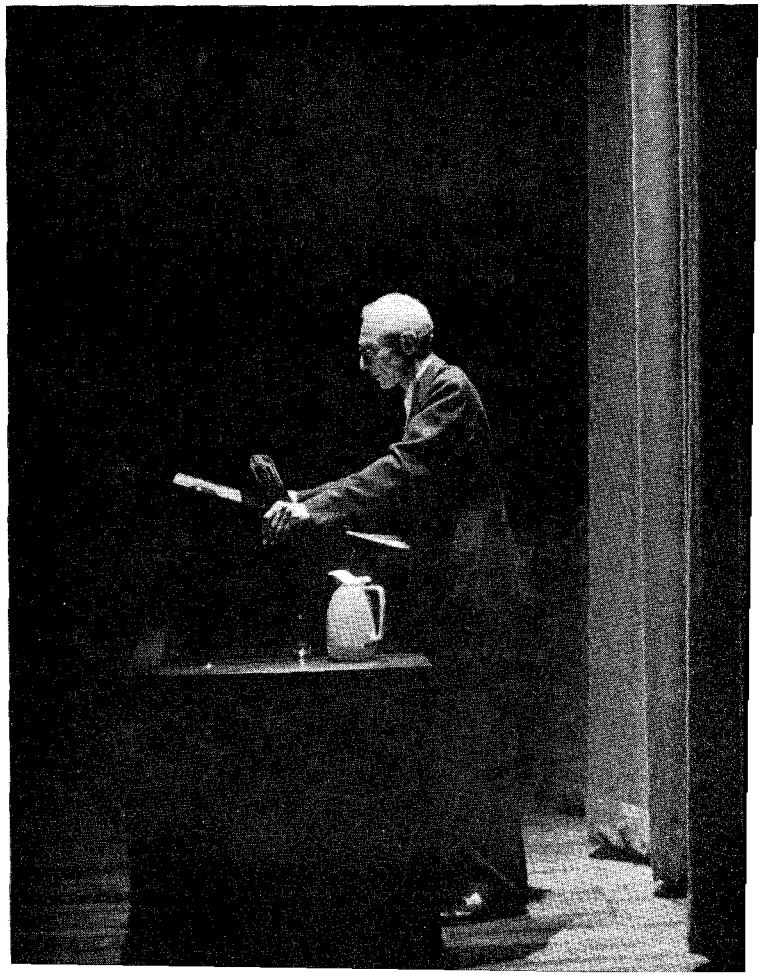
The men are participating in a program to develop two of five institutes for advanced science and technology in India, supported by the U.S. State Department's Agency for International Development. Russia, West Germany, and Great Britain are developing the three other institutes.

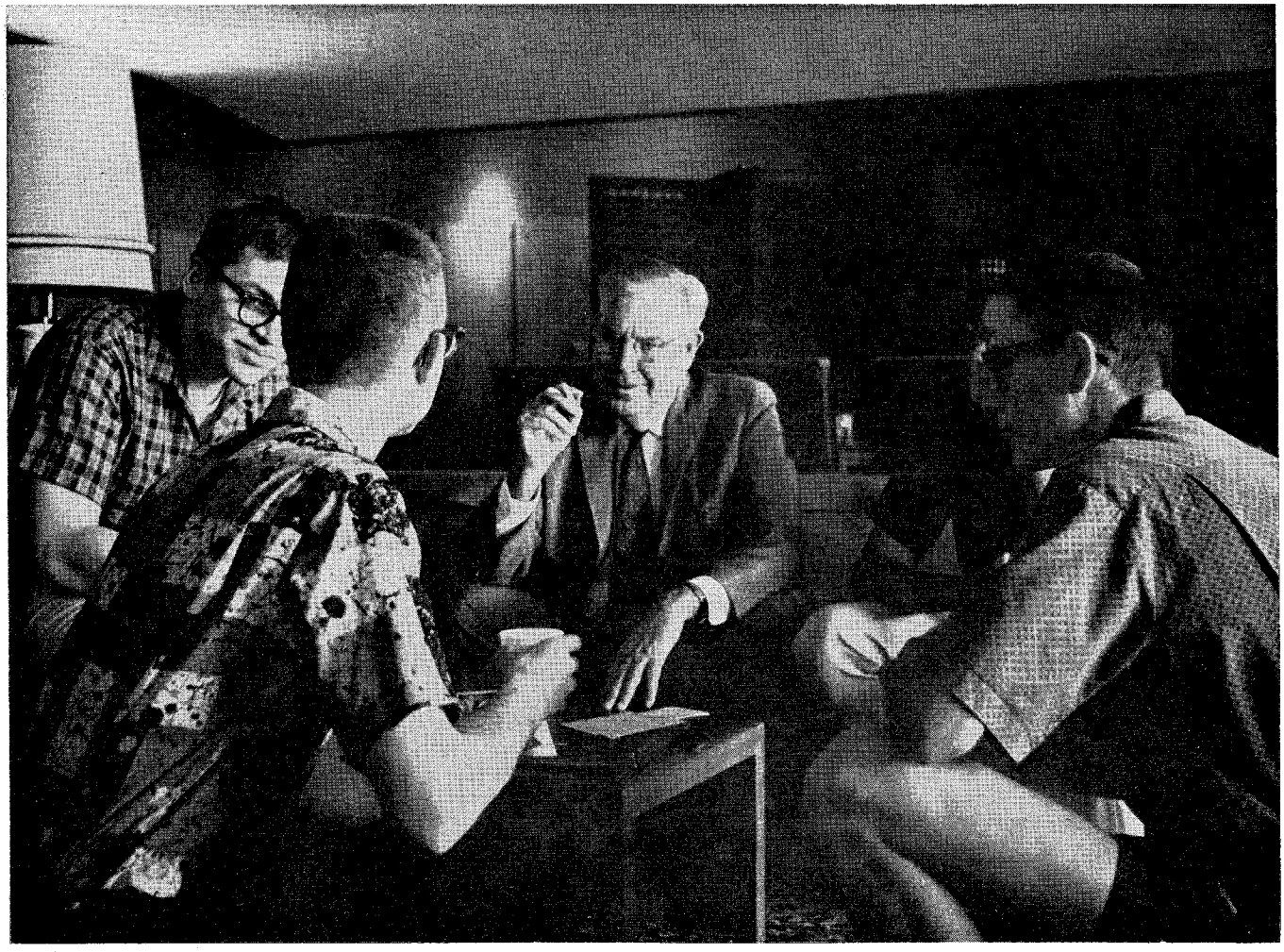
Caltech is one of nine universities in the U.S. participating in the program with the State Department through the International Cooperation Administration's Educational Services, Inc. Donald E. Hudson, professor of mechanical engineering, is the Caltech representative on the program's steering committee.

ACS Award

Bruce H. Sage, professor of chemical engineering, has received the $1000 American Chemical Society Award in Industrial and Engineering Chemistry for 1964. The award, sponsored by the Esso Research & Engineering Company, was given to Dr. Sage for "distinguished service to his country in the design and development of solid-propellant rockets," and for his research contributions to basic chemistry.

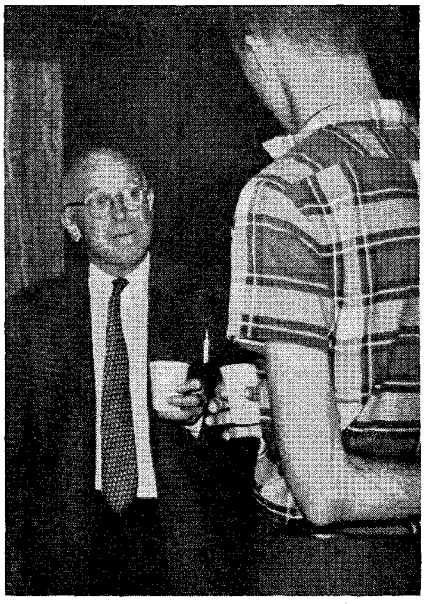
Distinguished visitor to the campus — Dr. Robert Oppenheimer, here on May 14 to deliver a lecture to faculty and students in Beckman Auditorium on "Hope and Foreknowledge."





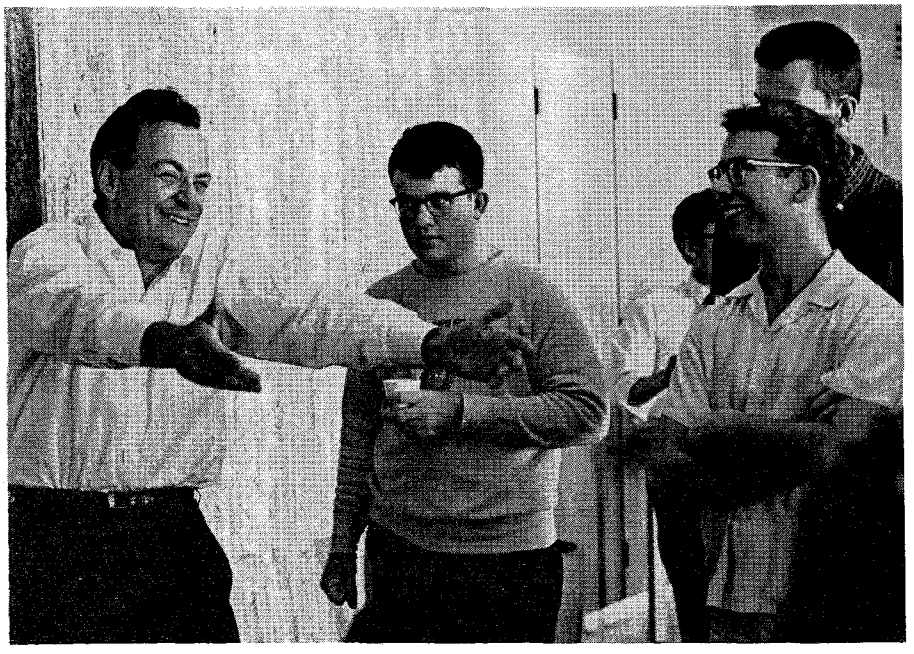
COFFEE BREAK

Started in November 1962 to help establish the Winnett Center as a meeting place for faculty and students, the weekly coffee hour is now a popular campus feature. At 3 p.m. every Thursday there is an influx of students and faculty to the Winnett Lounge. Fifteen minutes later, those who were only interested in the gastronomic delights of 15 varieties of doughnuts have eaten and run, and those remaining are heatedly discussing everything from the revised physics courses to the leaks in the rainspouts on Throop Hall. Involved in the heated discussing shown here are Dean Paul Eaton (above), Professors Sutton (right), Lindvall (left, below), and Oliver (center, below). On the opposite page, Professor Feynman regales a rapt audience with one of the classic anecdotes of his career — how he became a safe-cracker at Oak Ridge.



"So while he's reading this report I just wrote, I see this big safe standing open and I say, 'Mind if I fool with this safe?' He looks at me like I'm dopey or something — but no, he doesn't mind . . . So I fidget with the dial and figure out the combination."

"He puts my report in the safe and swings the big double doors shut and clanks down the handles. I say, 'You military guys think those big things are impregnable just because the civilian name for them is SAFE *. . . I bet I could open that up in — oh — about 45 minutes." He says, 'Well, now, why don't you just try that?'"*

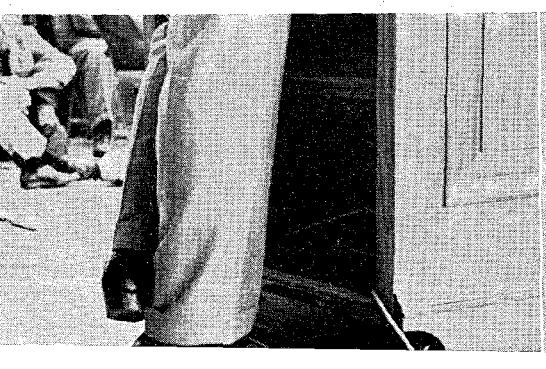


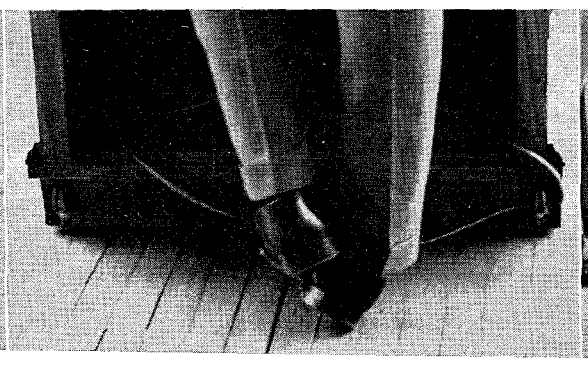
"I don't want to open it right away, so I fool around awhile. 'Making any progress?' he says. 'Progress?'" I say. "How can I make progress? *Either I open it or I don't!"*

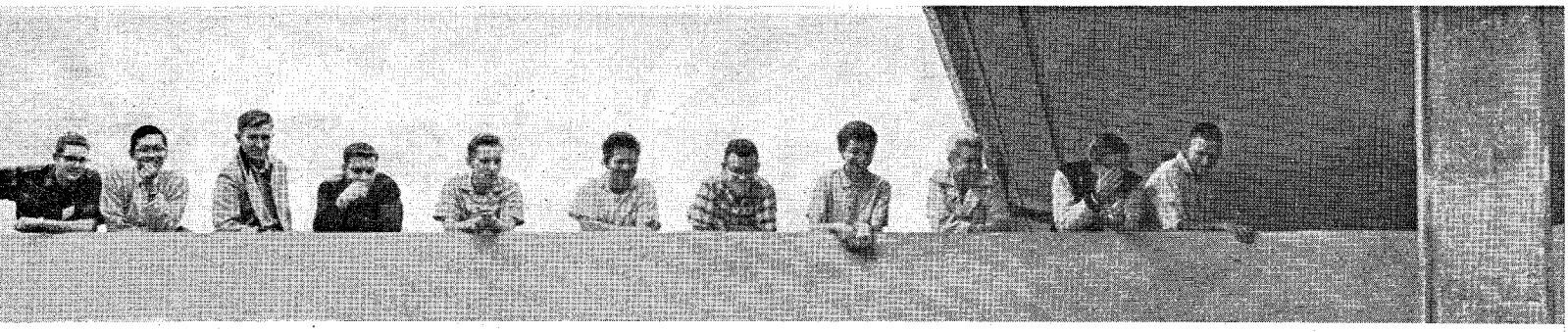
"He's sitting there all this time thumbing through a magazine, with this big fat smile on his face. So I let about 5 minutes go by and then I swing the thing open . . . He is flabbergasted!"

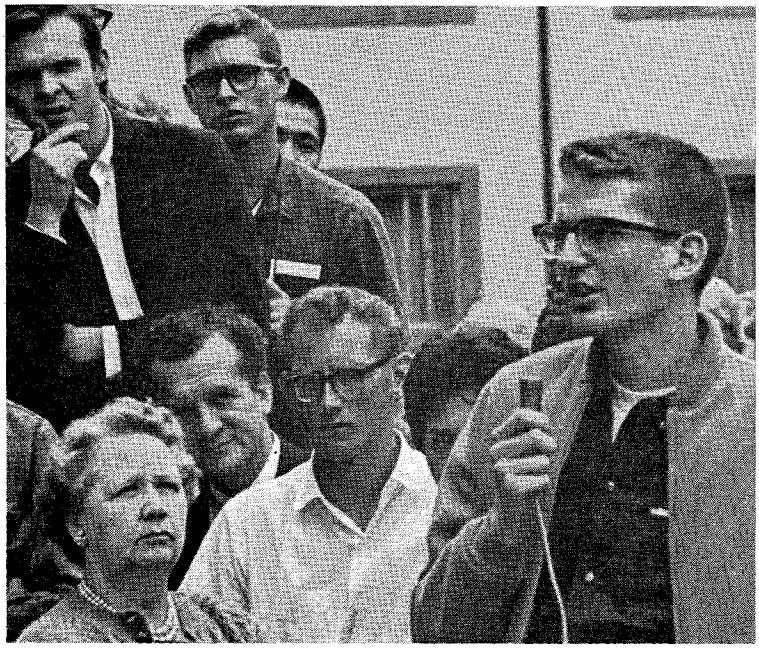
RFK AT CIT

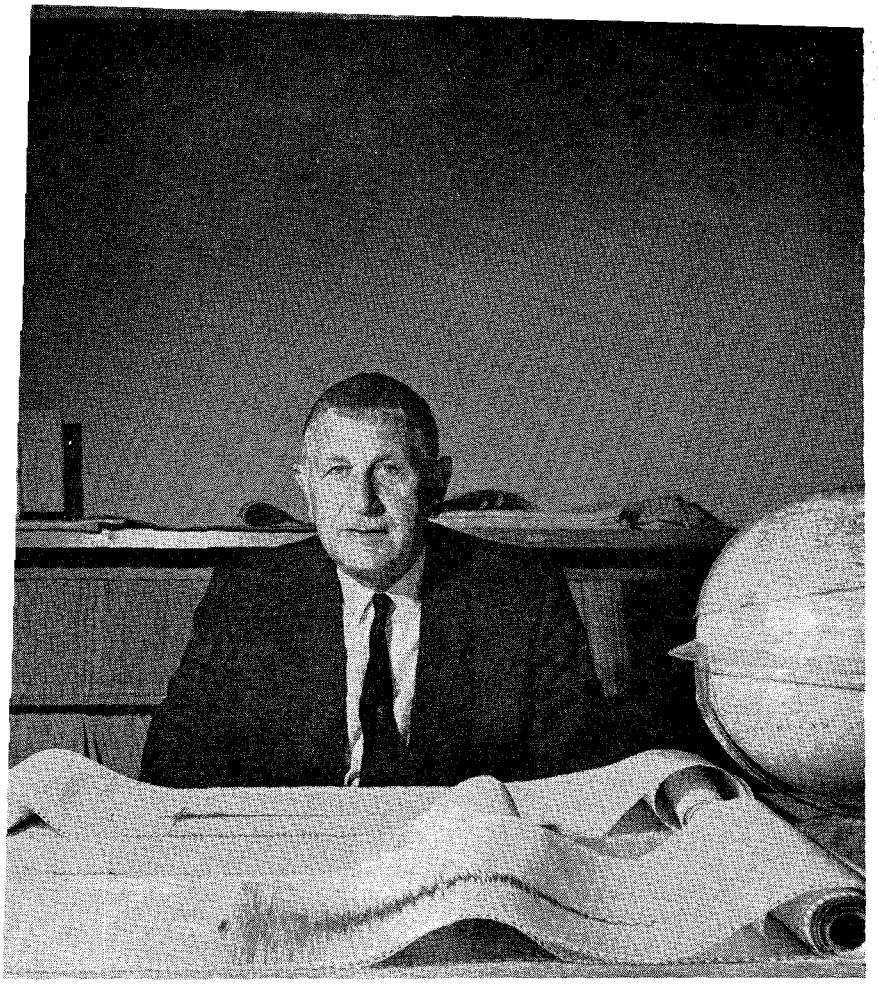
ATTORNEY General Robert F. Kennedy, on a whirlwind visit to Caltech on June 8, meets with students in the late afternoon for a fast question-and-answer session in front of the Winnett Student Center. The attorney general stayed over to give a formal address in the evening to an overflow crowd of students and faculty in Beckman Auditorium.











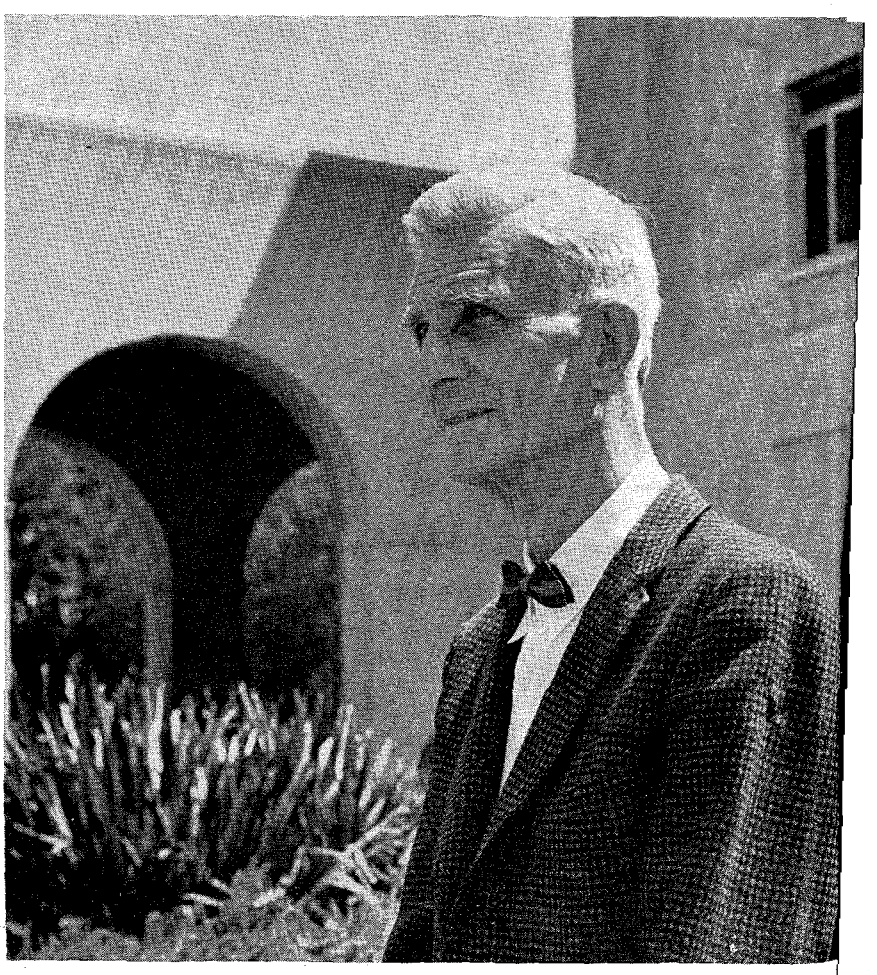
HUGO BENIOFF,
professor of seismology

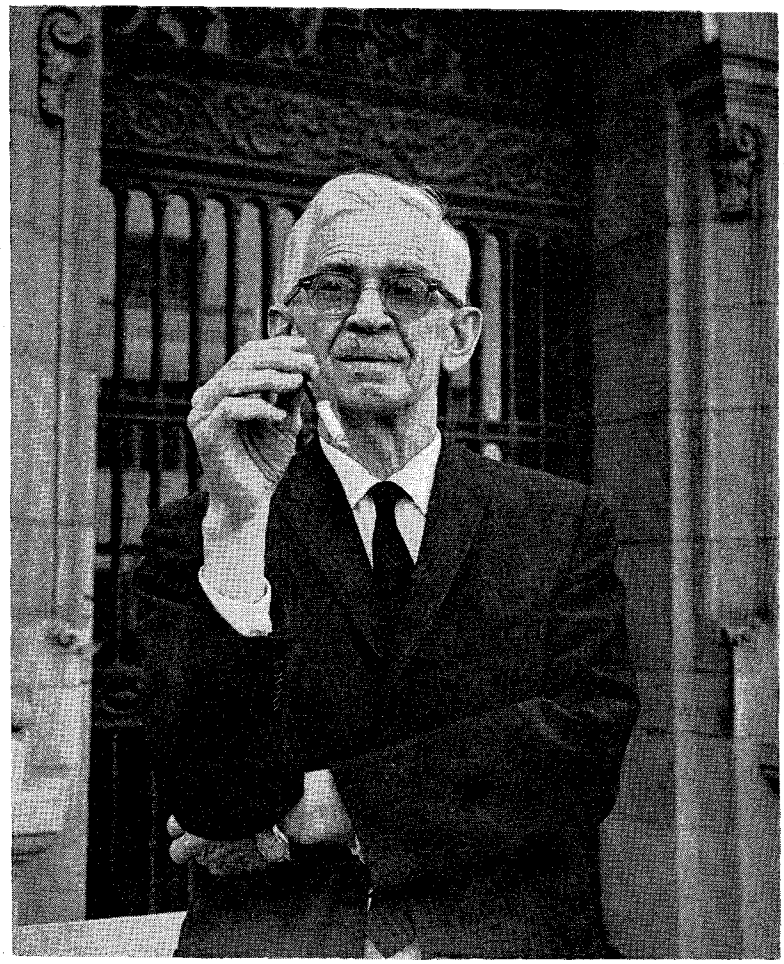
When Dr. Benioff becomes *professor emeritus* in October, he will have completed 40 years with the Seismological Laboratory. After graduating from Pomona College in 1921. Hugo Benioff began his career with the idea of being an astronomer and worked for a time at Mt. Wilson, but when he found that astronomers work at night and sleep in the daytime, he quickly switched to seismology. He joined the Seismological Laboratory in 1924 and received his PhD from Caltech in 1935. Dr. Benioff is considered a genius in the design of earthquake instruments. One of his first instruments, created in 1932, was the Benioff seismometer, which senses the movement of the earth. These instruments are now used in every country in the world. Equally famous is the Benioff strain instrument, which records the stretching of the earth's surface. One of his most recent accomplishments is a refined version of the old Benioff seismometer which has given seismologists more knowledge about the cause of very deep earthquakes. However, finely designed instruments are only a part of Dr. Benioff's research. Even more important is his intuitive and imaginative approach to the information these instruments yield.

RETIRING THIS YEAR

WILLIAM R. SMYTHE,
professor of physics

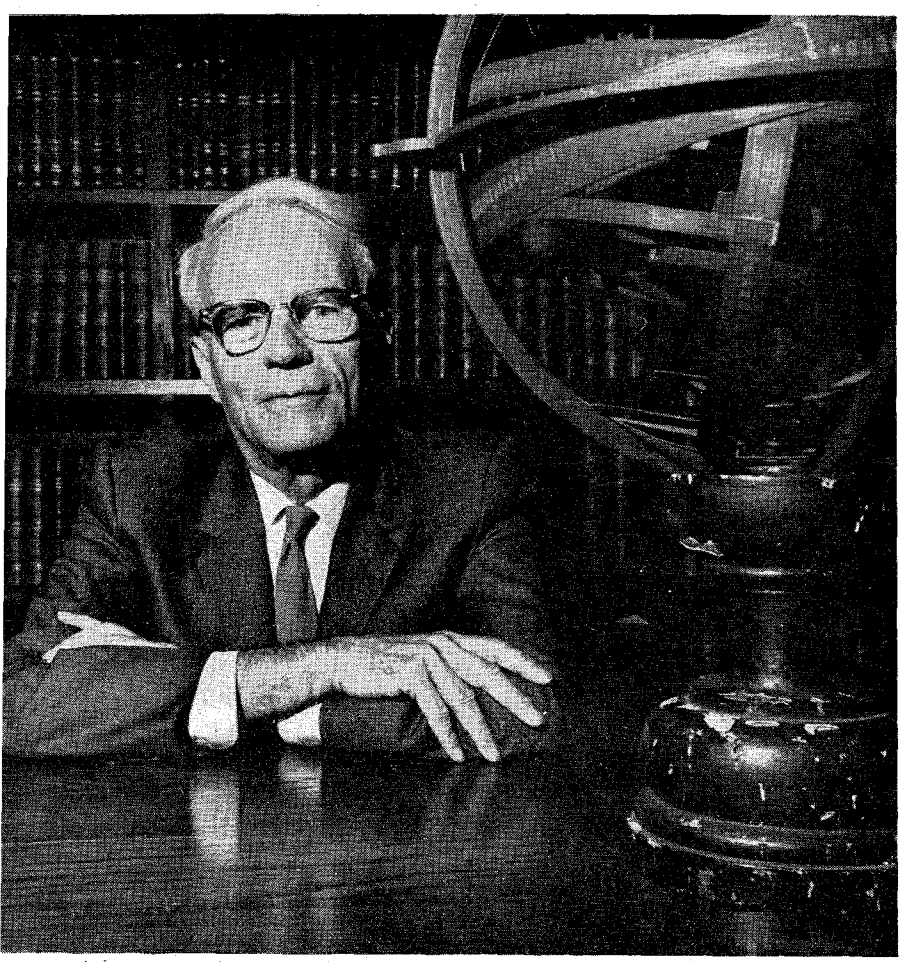
Dr. Smythe, who will be awarded the title of professor emeritus on July 1, has been a member of the Caltech faculty since 1923. His classes in electricity and magnetism at Caltech have been one of the basic standards by which the graduate students in physics have been measured for many years, even though Dr. Smythe never really wanted to become a professional teacher. He preferred to concentrate on research and, in fact, regarded it as a personal weakness when he found teaching almost immediately enjoyable. In the field of research he was the originator of a method of separating isotopes in quantity, electromagnetically. Dr. Smythe has long been the mainstay of the oral candidacy examinations, and has also served for many years on the graduate committee of the physics division for the admittance of new students. He is now concerned with research on the practical applications of magnetic waves. He is the author of *Static and Dynamic Electricity,* one of the most widely used reference books on electricity and magnetism.





DON M. YOST,
professor of inorganic chemistry

Dr. Yost becomes professor emeritus this month, after 38 years on the Caltech faculty. A graduate of the University of California in 1923, he came to Caltech for graduate study and did his research in physical inorganic chemistry as one of the small group under Arthur A. Noyes. He received his PhD from Caltech in 1926 and then joined the faculty as a research fellow. His fields of interest have included inorganic chemistry, physical chemistry, chemical physics, mathematics, rates of chemical reactions, and "the care and feeding of scientists of imagination." A firm believer in individualism, Dr. Yost always allowed his graduate students a great deal of freedom in their choice of research. He has been called by one ex-student, "the foremost anti-stuffed-shirt of American science." During World War II he was a section chairman of the OSRD and participated in the Manhattan Project. He was awarded the Presidential Certificate of Merit in 1948.



IRA S. BOWEN, *director of the Mount Wilson and Palomar Observatories*

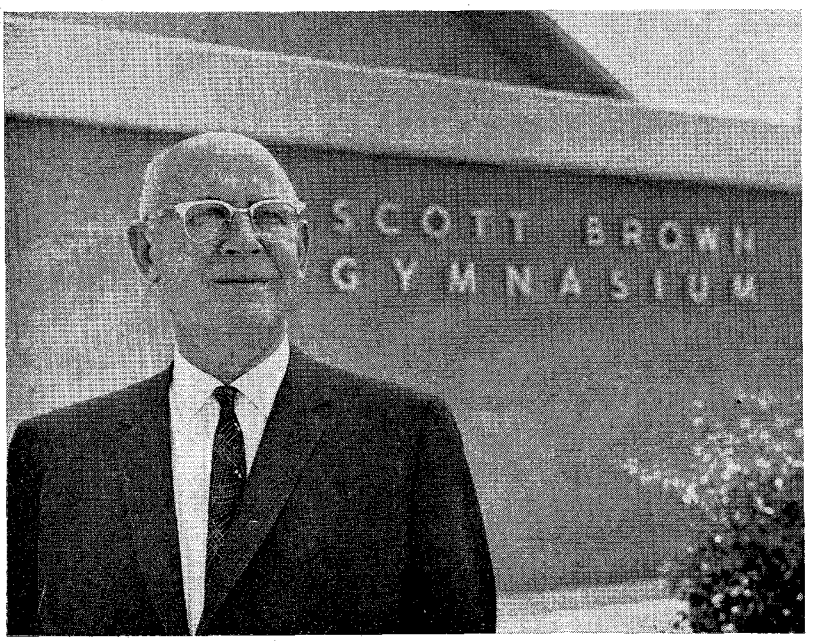
Dr. Bowen retires this month to become a Distinguished Service Staff Member of the Observatories. A graduate of Oberlin College in 1919, he went on to the University of Chicago for graduate studies and there met Robert A. Millikan, who invited him to come to Caltech. He joined the faculty in 1921 as an instructor in physics, and in 1926 received his PhD from the Institute. Dr. Bowen has contributed greatly to the superlative performance of the 200-inch Hale Telescope at Palomar. He took part in the planning of the Palomar project in the early 1930s, and was personally responsible for the final testing and finishing of the 200-inch mirror. He supervised the difficult task of devising ingenious optical tests to determine the corrections to be made in the mirror after it was mounted. He also developed improvements for spectrographic cameras used in astronomical work, and devised such instruments as the image-slicer to increase the efficiency of spectrographic observations. Dr. Bowen has been director of the Mt. Wilson and Palomar Observatories since 1946.

Retiring This Year

. . . *continued*

HERBERT G. NASH
Secretary of the Board of Trustees of the Institute

Mr. Nash retires as secretary of the Board of Trustees this month, but will continue to serve as assistant secretary-treasurer to the California Institute Associates. A native of London, England, he came to Caltech from Winnipeg, Canada, in 1922 as chief accountant, and was made assistant secretary in 1935. He has been secretary of the Institute since 1952.



HAROLD Z. MUSSELMAN,
Director of Athletics and Physical Education

Mr. Musselman retires as director this month to become administrative advisor to the Athletic and Physical Education Department for two years. A graduate of Cornell College in 1920, he was a member of the U.S. baseball team in the Inter-Allied Games in Paris in 1919. He came to Caltech as coach in 1921. Those were the days when the Institute had to get permission from Pasadena's Park Department for the students to play tennis and football in Tournament Park; and they did their swimming (when invited) at the Athletic Club. Mr. Musselman became director of athletics and physical education in 1943. He is an associate member of the Tournament of Roses Association, and former president of the Pasadena Games Association.

HENRY I. WEITZEL, *Registrar*

Dr. Weitzel retires this month after three years as registrar at Caltech. A graduate of the University of North Dakota (BS '19, MS '20), he received his PhD in education and chemistry at USC in 1933. From 1922 to 1924 he taught chemistry and physics at Pasadena High School, then served as an instructor in applied and industrial chemistry at Pasadena City College from 1924 to 1928. Before coming to Caltech, Dr. Weitzel was research director of the Pasadena City Schools. His wife, Ida, shown with him here, also retires this month as assistant to the secretary of the Board of Trustees. She has worked at Caltech since 1938.

CALTECH'S 1963 ALUMNI SURVEY

II. *Opinions, Interests, and Concerns*

by John R. Weir

The 1963 alumni survey produced considerable information on alumni interest in social and political problems. The information was gathered from two different sections of the questionnaire. In one, there were opinion statements about which the alumnus could "agree," "disagree," or have "no opinion." In the other section, he was asked to indicate "one or more of the political, cultural or philosophical problems that genuinely interest you now."

It is safe to say that scientists and engineers, at least of the Caltech variety, are no longer enclosed in ivory towers or insulated in their laboratories. Practically all of them responded to the statements, and 68 percent took the time to write of one or more current problems which were of paramount concern to them. These highly educated men, many of them in key positions in our society, are vitally interested in a broad spectrum of national and world affairs, and they hold opinions which could have considerable effect in shaping our destiny.

CURRENT OPINIONS

The opinion statements were the same ones used in the 1952 survey. There were some objections to the oversimplified and unqualified nature of many of these statements (in *both* surveys) and we recognized that they were no longer as timely or relevant in 1963 as when they were first used. However, if there were shifts of opinion from 1952 to 1963, we felt it would be useful to identify them, and this would outweigh many of the disadvantages inherent in the statements. There have been some significant changes that justify this decision.

In 1952 our alumni strongly favored free enterprise and minimal government planning and control. In 1963 they hold similar opinions, but much less strongly. They seem to share in – and, in a sense, approve of – the national trend toward more centralized planning that has characterized the past decade, as indicated by their response to all three of the following statements:

Democracy depends fundamentally on the existence of free business enterprise.

	% in '63	*% in '52*
Agree	65	71
Disagree	30	23
No opinion	5	6

The best government is one which governs least.

	% in '63	*% in '52*
Agree	52	60
Disagree	42	32
No opinion	6	8

Government planning should be strictly limited, for it almost inevitably results in the loss of essential liberties and freedom.

	% in '63	*% in '52*
Agree	54	65
Disagree	41	28
No opinion	5	7

While these percentage changes are not spectacular, they are consistent in direction and suggest a valid change in the attitudes of the respondents

– a change toward accepting more government control and less of the individual autonomy associated with "free enterprise."

Today's alumni also seem to be more tolerant of other people and other viewpoints. In spite of having an intensive education in science, nine out of ten (versus eight out of ten in 1952) think: *There are many worthwhile and important concepts which cannot be proved scientifically.* In line with this is the fact that, even though half of the alumni rarely or never go to church (*Engineering and Science,* May 1964), seven out of ten disagree with the statement: *Religion has little to offer intelligent, scientific people today.*

They disagree even more emphatically than in 1952 with the statements: *If we allow more immigrants to this country, we will lower our standard of culture,* and *Agitators and trouble-makers are more likely to be foreign born citizens than native Americans,* and *Individual liberty and justice under law are not possible in Socialist countries.*

At the same time, nine out of ten continue to agree that: *All Americans – Negroes, Jews, the foreign born, and others – should have equal opportunity in social, economic and political affairs,* and to disagree with the statement: *Children of minority groups or other races should play among themselves.*

Caltech alumni have further extended their acceptance of other people and other viewpoints to an increased endorsement of the statements: *Over the next decade, we must try to make the standard of living in the rest of the world rise more rapidly than in our own country,* and *We now have enough scientific and technical knowledge to substantially eliminate poverty, disease and ignorance in the world, if we would apply our knowledge.* Our alumni believe that the technological advances in which they are playing a leading part should be applied for the benefit of everyone.

However, the 11 intervening years of operation of the United Nations would seem to have somewhat tempered their enthusiasm for our commitments to that organization. For they agree less that:

The United Nations should have the right to make conclusions which bind members to a course of action.

	% in '63	% in '52
Agree	53	66
Disagree	36	22
No opinion	11	12

Yet there is a note of optimism in that still only one-fifth believe that: *Deep ideological differences between countries are irreconcilable.*

Upon reflection, the foregoing opinions seem to present something of a dilemma when we consider them in the light of the opinion statement that had the most change of all. In 1952 a majority agreed, whereas in 1963 a majority are now in definite disagreement, with this viewpoint:

We are not likely to have lasting peace until the U.S. and its allies are stronger than all the other countries.

	% in '63	% in '52
Agree	34	47
Disagree	53	41
No opinion	13	12

Perhaps we can infer from these data that our alumni favor international cooperation and negotiation rather than overwhelming strength as the road to peace. However, they seem loath to assign this function entirely to the United Nations.

Finally, a significant change has taken place in alumni attitudes toward government support of scientific research. In 1952 only half of the respondents agreed with the statement: *The government should promote and subsidize research in the physical and biological sciences.* In 1963 two-thirds of them hold this view.

In the decade between surveys there has been a tremendous increase in government support of research and development, and many of the alumni have been recipients of this support, so we might infer that this change of sentiment is due to a desire to share in future R and D appropriations.

However, alumni attitudes toward research in the social sciences have changed in a similar direction. In 1952 they were evenly divided on the statement: *The government should promote and subsidize research in the social sciences,* while in 1963 they favor it almost two to one. These changes seem to imply an increased approval of government support of all scientific research and would seem to be further evidence of what has already been suggested – a trend toward increased approval of government planning and coordination of economic and social affairs.

CURRENT INTERESTS AND CONCERNS

The 11 years that have passed since the 1952 survey have seen many scientific and technological advances. Computers, men in space, the discovery of the structure of the DNA molecule, and oral contraceptives are but a few of the developments which are having a significant effect on all mankind. Also, many potential difficulties only dimly foreseen in 1952 have become major problems for modern industrialized societies. Automation, tech-

nological unemployment, urbanization, and air and water pollution are some of the more technical problems that interest our alumni.

But they are even more concerned with solutions to what might be termed the more human problems of modern life. Human relations, population control, the elimination of poverty, and world peace are more frequently mentioned. At least this seems to be one conclusion to be drawn from an analysis of the replies to the request to indicate "one or more of the political, cultural or philosophical problems that genuinely interest you now." This request, followed by nine blank lines, elicited 8,081 separate interests or concerns from 3,167 alumni. We have attempted to analyze and discuss them by first dividing them into several categories. Most of them could be readily grouped under nine general headings, with a tenth provided for those miscellaneous items that were either unique or too infrequent to merit an additional category. The list that follows has these ten categories arranged in order of decreasing importance. For example, the interest that was mentioned most often – and therefore was most important to the alumni – related to civil rights. Therefore it is first on the list.

In addition, it also proved useful to subdivide each category in order to retain important shades of meaning. These subdivisions are listed under each category, again in order of decreasing importance. Thus, under Civil Rights, "for integration" occurred most frequently, "against integration" least frequently.

A. *Civil Rights*
1) For integration.
2) Integration, but no indication whether for or against.
3) Civil rights or civil liberties in general.
4) Integration, but limited or qualified in some manner.
5) Loss of liberties, censorship, a police state, House Un-American Activities Committee.
6) Against integration.

B. *Economics*
1) Population control, population explosion.
2) Aid to underdeveloped countries, foreign aid, technical assistance, Africa, Latin America.
3) U. S. government fiscal policy, defense budget, taxes, balance of payments.
4) Urban problems, city planning, transportation and traffic.
5) Industrialized society, depletion of natural resources, automation, use of leisure.
6) Economics in general.
7) Unemployment or technological unemployment.
8) The Common Market, foreign trade.
9) The farm problem, surplus food.

C. *World Peace*
1) International relations, peace in general.
2) Disarmament, arms control.
3) Communism, the communist threat.
4) Atomic war, nuclear testing.
5) The Cold War, U. S. defense.
6) Cuba, Red China.
7) U. S. foreign policy.
8) World government.
9) Improvement of intercultural relations.
10) For the United Nations.
11) Against the United Nations.

D. *Growth of Big Government*
1) Individualism, states rights, free enterprise.
2) Government controls and big government in general.
3) Creeping socialism.
4) Welfare state, government subsidies, medicare.
5) Growth of the radical right.
6) Growth of influence and power of the Defense Department, military control of industry and research.
7) The Kennedy dynasty.
8) Growth of a power elite.
9) Invasion of privacy.

E. *Miscellaneous*
1) Academic interest, such as philosophy, history, literature.
2) Political interests other than purely local or civic.
3) Local, state, civic or political problems.
4) The future of democracy.
5) The future of conservatism.

F. *Religion*
1) Religion in general.
2) The question of atheism, science versus religion.
3) Applying religious principles to modern day life.
4) The ecumenical movement.
5) Separation of church and state.

G. *Role of Science in the Modern World*
1) Role of science, scientists and engineers in the modern world.
2) Space exploration, life on other planets.
3) Conservation.
4) A specific science question which was claiming the respondent's interest.
5) Pesticides, air and water pollution.
6) Government sponsorship of science.
7) The decline of status of the engineering profession.
8) Academic freedom.

H. *Personal Development*
1) The nature and purpose of existence, the place of an individual in a mass society.
2) Interpersonal and human relations, communications.
3) Personal development or understanding in general.
4) Music.
5) Art.
6) Encouragement of the arts, the place of the artist in our culture.
7) Mental health.
8) Mental processes.
9) Drama, television.
10) Retirement, longevity.

I. *Education*
1) Education in general.
2) The improvement of public, or elementary or secondary education.
3) For federal aid to education.
4) Improvement of higher education.
5) Development of the social sciences.
6) The information explosion, professional obsolescence.
7) Improvement of adult education.
8) Improvement of international education.
9) Against federal aid to education.

J. *Concern for Ethics and Morals*
1) Concern for the deterioration of U. S. moral fibre, public apathy, materialism, loss of pride in work.
2) Concern for morals or ethics in general.
3) Concern for ethics in unions.
4) Delinquency, juveniles.
5) Ethics in government and the courts.
6) Capital punishment.
7) Narcotics.
8) Ethics in advertising.

The foregoing rank list indicates that civil rights is the most frequently mentioned category of interest, and concern for ethics and morals is least frequently mentioned. This does not imply, however, that the alumni have no regard for ethics or morals. It simply indicates that they are currently more keenly interested in civil rights problems – and

certainly this is one of the central concerns of the nation today. In fact, the sub-headings under Categories A, B, and C represent the great bulk of subject matter covered by radio, TV, and press in recent years. Our alumni interests are indeed very similar to those of the nation as a whole.

Central concerns

Another way we might identify the kinds of problems that are of central interest to our alumni is to ignore the ten major categories and just look at the most frequently mentioned sub-headings.

The single most frequently mentioned interest was under Civil Rights – "for integration" (A, 1). Mentioned almost as often was A, 2 – "integration, but no indication for or against." Together, these two account for one-eighth of all the interests mentioned, and clearly indicate the central concern of the alumni. In classifying these responses, we were forced to use a certain amount of subjective semantic selection. Where a respondent wrote merely the one word "integration," we somewhat arbitrarily decided he was probably "for" it; if he wrote something like "race relations," or "segregation," we assigned his response to "no indication either way."

The third most frequently cited problem was the population explosion and its control (B, 1). Here, perhaps, is a marked difference between Caltech alumni and the general public, which still seems to see this problem as of minor importance in world affairs.

The fourth important problem was international relations and the general problem of world peace (C,1). Many technically trained people, especially scientists, have become closely associated with arms control, disarmament, and nuclear deterrence activities, and many have become advisors to various government agencies concerned with foreign affairs. Obviously, the technically trained scientist and engineer of today has his eye on more than his scientific apparatus.

The fifth most frequently mentioned problem was aid to underdeveloped countries (B, 2). Again, this seems to represent a recognition that there must be equality of social, cultural, and economic opportunity for all if we are to have a peaceful and satisfying existence.

The sixth most frequently cited concern was U. S. government fiscal policy (B, 3); the seventh was education in general (I, 1); eighth was individualism, states rights, free enterprise (D, 1); ninth, big government, government controls (D, 2); and tenth, religion in general (F, 1).

One-interest alumni

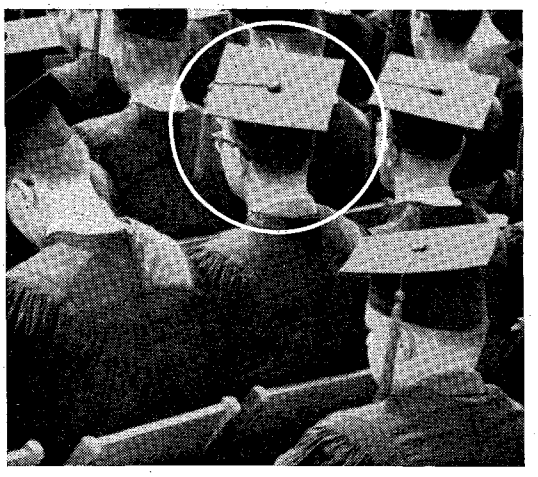
Most of the alumni named several concerns that interested them, some as many as ten. However, somewhat less than a third of the respondents listed only one interest in this section of the questionnaire.

If we examine the frequency with which they mentioned specific interests and compare these with the rankings already discussed, there are no differences among the three most popular interests. Both the one-interest alumni and the other respondents mention integration and population control most frequently. But, from here on, an interesting and provocative divergence emerges. The total group's preferential interests are for peace and international relations, foreign aid, U. S. fiscal policy, education in general, bureaucracy and big government, disarmament and arms control, and so on. These are almost all interests of a political, social, or cultural nature involving either international or institutional relationships.

By contrast, the one-interest group focuses their concerns on academic topics, individualism, the nature and purpose of existence, the individual in a mass society, creeping socialism, communism, personal understanding, and human relations. These interests clearly seem more personal, private, and self-centered, as if the respondents were more insulated, more detached from national and international affairs than the rest of the alumni. Their attention seems to be focused inward upon themselves rather than outward toward the world.

By and large, however, we think the kinds of problems that interest our alumni are undoubtedly representative of the kinds of questions that are commanding the attention of educated, public-spirited men throughout the United States. It is most gratifying to have had this kind of spontaneous response to tabulate, rather than a more circumscribed check list from which some particular interest or concern might well have been omitted. Alumni concerns are diverse, yet complementary; self-interested in the enlightened and best sense of the word, yet public-spirited. So far, it seems from our survey results that Caltech alumni are responsible, concerned, and informed citizens in whom the Institute can take a justifiable pride.

This is the second in a series of articles reporting the results of the survey of Caltech alumni conducted last year by Dr. Weir, associate professor of psychology. In our next issue (October), Dr. Weir will discuss political and civic activities and affiliations.



Tom Thomsen wanted challenging work

He found it at Western Electric

T. R. Thomsen, B.S.M.E., University of Nebraska, '58, came to Western Electric for several reasons. Important to him was the fact that our young engineers play vital roles right from the start, working on exciting engineering projects in communications including: electronic switching, thin film circuitry, microwave systems and optical masers.

The wide variety of Western Electric's challenging assignments appealed to Tom, as did the idea of advanced study through full-time graduate engineering training, numerous management courses and a company-paid Tuition Refund Plan.

Tom knows, too, that we'll need several thousand experienced engineers for supervisory positions within the next few years. And he's getting the solid experience needed to qualify. Right now, Tom is developing new and improved inspection and process control techniques to reduce manufacturing costs of telephone switching equipment. Tom is sure that Western Electric is the right place for him. What about you?

If you set the highest standards for yourself, enjoy a challenge, and have the qualifications we're looking for—we want to talk to you! Opportunities for fast-moving careers exist now for electrical, mechanical and industrial engineers, and also for physical science, liberal arts and business majors. For more detailed information, get your copy of the Western Electric Career Opportunities booklet from your Placement Officer. Or write: Western Electric Company, Room 6405, 222 Broadway, New York 38, N. Y. And be sure to arrange for a personal interview when the Bell System recruiting team visits your campus.

Western Electric MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM

AN EQUAL OPPORTUNITY EMPLOYER

Principal manufacturing locations in 13 cities • Operating centers in many of these same cities plus 36 others throughout the U. S. • Engineering Research Center, Princeton, New Jersey • Teletype Corporation, Skokie, Illinois, Little Rock, Arkansas • General headquarters, 195 Broadway, New York 7, New York

Personals

1924

SYDNEY F. DUNCAN, BS '24 ME, BS '25 EE, MS '39, died of leukemia on April 14 at the Good Samaritan Hospital in Los Angeles. He was 60. He has served as director of research and development for the Farr Company in El Segundo since 1951. Shortly after graduation, Mr. Duncan worked with the General Electric Company in Schenectady, and the Bailey Meter Company in Cleveland. He returned to teach mechanical engineering at the University of Southern California in 1929 and was made a full professor in 1947. He became head of the mechanical engineering department in 1948 and held that position until he joined the Farr Company.

He leaves his wife; a son, Alan; and a daughter, Mrs. Janice Thomas.

1925

ALBERT CHAPMAN is still on the manufacturing staff of the plant engineering office of the Ford Motor Company in Dearborn, Mich. He is responsible for worldwide company maintenance. In the past two years he has visited plants in London, Antwerp, Cologne, Amsterdam, and Copenhagen. Mr. Chapman is currently chairman of the Detroit Section of the ASME.

1928

NICHOLAS A. D' ARCY died on March 7 at a Los Angeles hospital. He was 58. He was a manufacturer's representative and was affiliated with the Registered Mechanical Engineers Association; the American Institute of Mining and Metallurgical Engineers; and the American Society of Mechanical Engineers, as well as many other organizations.

Mr. D'Arcy was an Eagle Scout, a Scout Master, and an honorary life member of the California Congress of Parents and Teachers. He was also a member of the board of the Neuropsychiatric Foundation and a former member of the Governor's Safety Council. He served as Alumni Seminar Chairman in 1947 and on the Board of Directors in 1948-50.

He is survived by his wife; a son, Anthony; and a daughter, Mary.

1932

LYNN H. RUMBAUGH, PhD, died of a heart attack at his home in Bethesda, Md. on March 11. He was a senior staff member and research director at the Research Analysis Corporation in McLean, Va. At the time of his death, he was engaged as scientific advisor in a high-priority program affecting U.S. Army tactical operations.

He was an expert in harbor defenses and undersea warfare, and served as scientific advisor to the Allied Naval Forces in the Southwest Pacific in 1941-42. In 1942 he was named chief of the Navy's research and torpedo engineering division, and in 1945 he became chief of the Navy's research department, and a deputy technical director in 1948.

He is survived by his wife; two sons, Jeffrey and Philip; and two daughters, Carolyn Gehring and Susan.

1933

ROBERT C. KENDALL, MS, has been appointed senior staff geophysicist in the exploration department of the Shell Company's New Orleans exploration and production area. He was formerly chief geophysicist for the company in Denver, Colo. He has been with Shell since 1936. The Kendalls have two children; a son, Second Lt. Robert M. Kendall, stationed at Fort Hood, Tex.; and a daughter, Elizabeth, who plans to teach in Colorado.

1941

ROBERT G. COOPER has been appointed resident director of the Upper School of the Ojai Valley School.

JOSEPH W. LEWIS, vice president of Beckman Instruments Inc., in Fullerton, has been appointed to the San Marino, Calif., Board of Education.

1942

HENRY W. MENARD, MS '47, professor of geology at the Scripps Institution of Oceanography in San Diego, was one of the speakers at a symposium on "The Oceans" at the Municipal Auditorium in Oklahoma City, Oklahoma, on April 3. He has been a leader or member of numerous expeditions to the deep Pacific and Atlantic.

1944

W. MILTON SWANSON, MS '48, ME '51, has been appointed chairman of the mechanical engineering department at Washington University in St. Louis, Mo. He has also been made professor of mechanical engineering. He has been at Washington since 1960 and, prior to that, he taught at the Case Institute of Technology. The Swansons live in Brentwood with their three children.

1945

ROBERT E. LEO writes that he "is on leave of absence from Montana State College to be technical director of the Stanford Research Institute Bangkok Communications R&D Laboratory in Thailand. We are doing research on communication problems, ionospheric physics, satellite reception, helping to solve Thai

military communications problems, and provide a research and development facility. Lab personnel consists of both Thai and Americans."

MERRITT A. WILLIAMSON, MS, dean of the College of Engineering at The Pennsylvania State University, was the key speaker at dedication ceremonies for the new Charles River Campus building and facilities of Boston University's College of Industrial Technology on Feb. 27.

1946

COL. JOHN C. NICKERSON, MS, was killed on March 1 in a two-car crash at Alamagordo, N.M. His wife also died and two sons, Danny, 12, and H. R., 9, were injured. Two older children also survive.

Col. Nickerson had been stationed at Fort Bliss in El Paso since 1960. In 1957, he drew national attention for accusing Secretary of Defense Charles E. Wilson of jeopardizing the national defense program by limiting the Army to development and use of short-range missiles. Because, in supporting his views, Col. Nickerson allegedly released confidential information, he was accused of espionage and perjury. At the time, he was stationed at Redstone Arsenal in Huntsville, Ala. The charges were later reduced to disobedience and he pleaded guilty at a court martial. He was fined $1500 and suspended from rank for one year and publicly reprimanded. His punishment, equivalent to banishment, sent him to assignment in the Panama Canal Zone.

In 1958, the Army restored his full security clearance, and in 1960 returned him from the Panama Canal assignment to Texas.

1948

ARTHUR O. SPAULDING, MS '58, petroleum administrator for the City of Los Angeles, writes that in 1949 he joined the Shell Oil Company as an exploitation engineer, and worked for them until 1957 in California, Texas and New Mexico. He received his MS in geology from Caltech in 1958, and then became an administrative geologist for the City of Los Angeles. In 1959 he was employed by the State Board of Equalization as a senior petroleum and mining appraisal engineer to appraise mineral deposits throughout California for property tax purposes. He returned to the City of Los Angeles in 1962, and is now concerned with leasing and development of lands owned by the City for the exploration of oil and gas.

JAMES C. FLETCHER, PhD, founder and chairman of the board of the Space-General Corporation in El Monte, has been named eighth president of the University of Utah, effective July 1. Dr. Fletcher is also vice president of the Aerojet-General Corporation of Azusa, which owns Space-General. He serves as a consultant to the Federal government and has taught science at UCLA, Caltech, Harvard and Princeton. The Fletchers have four children.

LEONARD F. HERZOG II, founder and president of the Nuclide Corporation, Nuclide E. Analysis Associates, and Radionuclide at State College, Pa., and Boston, Massachusetts, was the recipient of one of the 12th annual 1964 American Success Awards presented by the Free Enterprise Awards Association in April. The awards are given to ten men who rose from the ranks to own or head giant industries — examples of the success possible to all people under America's democracy.

RICHARD G. PLATZEK, MS '49, is now director of the microelectronics laboratory at the Autonetics Division of North American Aviation, Inc., in Anaheim, Calif. He had formerly been manager of Data Systems' components engineering dept. He has been with North American since 1949.

Personals . . . *continued*

1949

TORU IURA, MS, PhD '53, has been named head of the propulsion department at the Aerospace Corporation in Los Angeles. He was formerly head of the propulsion and analysis section at TRW/Space Technology Laboratories before joining Aerospace in 1960. The Iuras and their three children live in Northridge.

RADOY W. HEGGLAND, division exploration manager for the Continental Oil Company, has received a 1964-65 Sloan Fellowship at MIT. He has worked for Conoco since 1949.

JOE DOBROWOLSKI is now vice president and engineer in charge at the Brandley Engineering Laboratories in Sacramento. He was formerly associate highway engineer for the California Division of Highways.

HEINZ G. PFEIFFER, PhD, has been appointed a liaison scientist in chemistry in the liaison and transition section of the research application department of the General Electric Research Laboratory in Schenectady. He was formerly manager of the dielectric studies unit at General Electric.

1950

EDWIN REINECKE, president of Febco, Inc., manufacturer of lawn and turf irrigation equipment, has announced that he will run for United States Congress as a conservative Republican in the California 27th Congressional District. Active in local Republican activities for several years, he has served as an alternate member of the California Republican State Committee, and assistant Congressional District Precinct Chairman.

1952

MOISES LEVY, MS '55, is now assistant professor of physics at the University of Pennsylvania's College of Arts and Sciences.

1958

HAROLD S. BRAHAM, PhD, is now group director for manned orbiting laboratory (MOL) studies at the Aerospace Corporation in El Segundo, Calif. He was formerly group director for study programs in the systems research and planning division. MOL is the nation's newest space project and consists of a modified Gemini spacecraft and a pressurized cylinder about the size of a small house trailer in which astronauts may stay aloft for up to a month.

1963

JANIS VASILEVSKIS, PhD, is now on the research staff of the Shell Development Company's Emeryville, Calif., research center as a chemist in the physical chemistry department.

Alumni News

Change in By-Laws

The Board of Directors of the Alumni Association, California Institute of Technology, amended By-Law 5.01 at its meeting of April 28, 1964. This amendment was made in accordance with By-Law 12.01 and now reads as follows:

Not later than December fifteenth, the President shall appoint two Nomination Proposal Committees whose composition and duties shall be as follows:

(1) Nomination Proposal Committee for Directors shall consist of the Immediate Past-President as the Chairman, the President, the Vice-President and the Secretary as ex-officio members and four (4) members of the Association who are not members of the Board of Directors. This committee shall propose the name of a member of the Association for each of the four (4) directors to be elected, and at least one (1) alternate for each of the four (4) directors.

(2) Nomination Proposal Committee for Officers shall consist of the Immediate Past-President as the Chairman, the President, and three (3) retiring Directors, excluding the Vice-President. This committee shall propose the name of a member of the Association for each of the positions of President, Vice-President, Secretary, and Treasurer.

The Chairman of the Nomination Proposal Committee shall report to the Board of Directors not later than the first of February.

Not later than March first, the Board of Directors shall meet as a nominating committee for the purpose of making one (1) nomination for each office and for each directorship as follows:

President — shall have served on the Board of Directors within the past five (5) years.

Vice-President — shall be a junior member of the Board of Directors at the time of his nomination and shall serve his second year as a senior member of the Board as well as Vice-President.

Secretary

Treasurer

Four (4) Directors — to serve for two (2) years.

The Secretary shall cause to be published in a publication of the Association, or in a special notice sent to each member not later than April first, an announcement of such nominations. Additional nominations may be made for the four (4) Directors by petition signed by at least twenty-five (25) members in good standing provided that the petition is received by the Secretary not later than April fifteenth.

The purpose of this amendment is to clarify the proposal of names to the Board of Directors for nominations. It furthermore makes the Board of Directors, as a whole, the Nominating Committee, eliminating an inconsistency that previously existed.

— *Donald S. Clark, Secretary*

Caltech Symphony

Considerable interest has been generated by the suggestion that a Caltech Symphony Orchestra be organized. In order to achieve quality and stability it is proposed that the orchestra members should include undergraduate and graduate students, faculty members, alumni living in the Los Angeles area, and members of their families.

A preliminary survey of the undergraduates, based on information derived from their admission applications, indicated that 250 out of 600 students (37 percent) play a musical instrument. This is a remarkably high percentage.

A questionnaire was recently sent to the faculty and alumni in the area to assess their interest and to estimate their musical proficiency. A prominent orchestra conductor has indicated his interest in helping to organize and to direct the Caltech Symphony. Any alumni or members of their families who may want to help organize the orchestra are invited to call or write to the Alumni Office.

— *Donald S. Clark, Secretary*

ALUMNI FUND PROGRESS REPORT

	This Year	Last Year
Number of donors:	1650	1510
Participation percentage:	19.9%	18.8%
Number of dollars:	$ 81,810	$ 70,480
Goal:	$100,000	$ 75,000

The response to the Fund this year speaks for itself: more donors have given more dollars than last year. The goal, however, is still before us but well within reach.

Many of last year's contributors haven't been heard from but there is *still time to be counted.*

Sixteen hundred and fifty-one, sixteen hundred and fifty-two, sixteen hundred and fifty-three . . .

— *G. Russell Nance and David L. Hanna*
Co-Directors of the Caltech Alumni Fund 1963-64

PLACEMENT ASSISTANCE TO CALTECH ALUMNI

There are two ways in which the Placement Service may be of assistance to you:

(1) To help you seek new employment or a change of employment.

(2) To inform you when outstanding opportunities arise.

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

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

To: Caltech Alumni Placement Service
California Institute of Technology
Pasadena, California 91109

Please send me:

☐ An Application for Placement Assistance

☐ A form to report my field and operation so that I may be notified of any outstanding opportunities.

Name ..... Degree (s) .....

Address ..... Year (s) .....

.....

ALUMNI ASSOCIATION OFFICERS AND DIRECTORS

PRESIDENT
Peter V. H. Serrell, '36

VICE PRESIDENT
Patrick J. Fazio, '53

SECRETARY
Donald S. Clark, '29

TREASURER
John R. Fee, '51

Robert Boykin, '34
Wm. H. Corcoran, '41
David L. Hanna, '52
Wm. L. Holladay, '24

G. Russell Nance, '36
Richard W. Powell, '40
Richard P. Schuster, Jr., '46
H. M. Worcester, Jr., '40

ALUMNI CHAPTER OFFICERS

NEW YORK CHAPTER

President — Victor Wouk, '40
Electronic Energy Conversion Corp.
342 Madison Ave., Now York 17, N.Y.

Vice-President — Bruno H. Pilorz, '44
75 Echo Lane, Larchmont, N.Y.

Secretary-Treasurer — Harry J. Moore, '48
590 Madison Ave., New York, N.Y.

BOSTON CHAPTER

President — Robert C. Kausen, '56
21 Seven Oaks Rd., N. Billerica, Mass.

Vice-President — Thomas C. Stockebrand, '53
10 Bulkely Rd., Littleton, Mass.

Secretary-Treasurer — Charles K. Daniels, '59
8 Cutler Farm Rd., Lexington, Mass.

WASHINGTON, D.C. CHAPTER

Chairman — Willard M. Hanger, '43
4720 Sedgwick St., N.W., Washington, D.C.

CHICAGO CHAPTER

President — Laurence H. Nobles, '49
Dept. of Geology, Northwestern Univ., Evanston, Ill.

Vice-President — Philip E. Smith, '39
Eastman Kodak Co., 1712 Prairie Ave., Chicago, Ill.

SAN FRANCISCO CHAPTER

President — Edwin P. Schlinger, '52
G.E. Vallecitos Atomic Lab., Pleasanton, Calif.

Vice-President — Dallas L. Peck, '51
U.S. Geological Survey, Menlo Park, Calif.

Secretary-Treasurer — Thomas G. Taussig, '55
Lawrence Radiation Lab., Univ. of Calif., Berkeley, Calif.

Meetings: 15th Floor, Engineers' Club, 206 Sansome St., San Francisco
Informal luncheons every Thursday at 11:45 A.M.
Contact Mr. Farrar, EX 9-5277, on Thursday morning for reservations.

SACRAMENTO CHAPTER

President — Dudley E. Bennett, '47
4535 Marble Way, Carmichael, Calif.

Vice-President — Harris K. Mauzy, '30
2551 Carson Way, Sacramento 21, Calif.

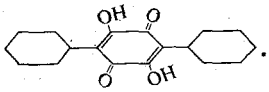
Secretary-Treasurer — William D. Pyle, '49
3920 Dunster Way, Sacramento, Calif. 95825

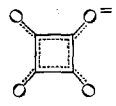
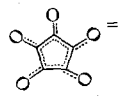
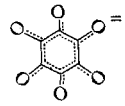
Meetings: University Club, 1319 "K" St.
Luncheon first Friday of each month at noon.
Visiting alumni cordially invited—no reservation.

Kodak reports on:

cyclic anions . . . an unsophisticated-looking receptor

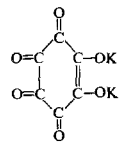
Like the dew of morn

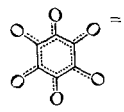
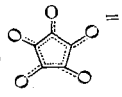
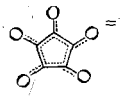
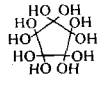
Polyporic acid is  . It has been found only in the mushroom *Polyporus rutilans*. When the two hydroxyls lose their protons, leaving the molecule a dianion, the strangest thing happens. The four oxygens become quite indistinguishable from each other. The π-electrons in the ion completely delocalize themselves, covering the whole structure like the dew of morn. Such an anion is known as an oxocarbon. It has been minutely palpated by that new chemical instrument, the high-speed digital computer. Oxocarbons constitute a new class of aromatic substances. Molecular orbital calculations, vibrational spectra, synthesis, and metal-complexing properties for such manifestations of oxocarbon symmetry as

 ,  , and 

are elaborated by Prof. Robert West, of Wisconsin and his team in a series of papers in *J.A.C.S.* for September 5, 1963.

West alleges* that we didn't even know we had been selling an oxocarbon for years. He happens to be right, but our feelings of inadequacy are softened by the fact that he has just coined the word "oxocarbon" to represent cyclic anions of the form $C_nO_n^{-m}$. He is talking about a moderately popular redox indicator, *Rhodizonic Acid Dipotassium Salt* (EASTMAN 2942),



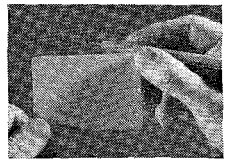
Dissolved in water it yields  . Bubble air through the solution and oxidative ring contraction results in CO_2 and the croconate ion,  . Metal derivatives of this ion have been known since 1841. A small usage that EASTMAN 2942 probably finds as an analytical reagent for Bi, Pb, Sr, and Sn may in reality depend on this ion. Reality grows ever realer, thanks to generalizers like West. Further oxidize  with nitric acid, he says, and you get 

EASTMAN 2942 is not easy to make. We first tried in 1930 and flubbed. In 1936 we tried again, for a purpose arising from internal research on photographic developers. That time we flubbed not.

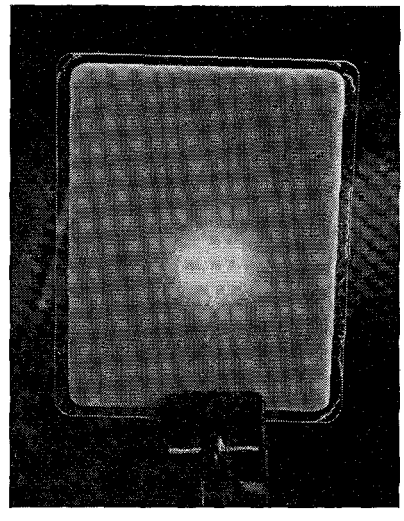
West applies the term "oxocarbon" also to triquinoyl octahydrate, which we will write merely as $C_6O_6 \cdot 8H_2O$ because its structure has been debated for 102 years. We tried selling it for 10 of them without much luck and gave up.

There are some 4400 EASTMAN *Organic Chemicals on which Distillation Products Industries, Rochester, N. Y. (Division of Eastman Kodak Company) has not given up, however, and which it offers in its "List No. 43."*

Infrared goes in, orange comes out



No, it's not raw film. Roomlight or daylight does it no harm. In fact, it is intended to be left lying around exposed to fluorescent-lamp light. That's how you charge it up. That's *all* there is to charging it up. Then you take it to the laser room. Don't rush. The energy won't leak away that fast. If the 5 o'clock bell rings and it's Friday, forget about it until Monday. But do *not* forget to protect your eyes with 7 mm of Pittsburgh No. 2043 glass (or the equivalent thereof) before firing the laser at it.



The whole point of this picture is that this is a far-field pattern not of a visible-light laser but of an infrared one.* Thus we demonstrate what should be the big market for sheets of a product for which purchasing directories will have to establish a new category, a product we choose to call KODAK IR Phosphor, an interesting bit of business from our chemists of the inorganic persuasion.

Except for a technicality, one could say that it converts infrared to orange, replacing more sophisticated-looking receptors that less vividly show the location and approximate distribution of the output from an infrared laser. The technicality is that infrared (0.7μ to 1.3μ) merely stimulates the phosphor to release as orange light (peaking at 640mμ) the energy it has soaked up while lying around in white light.

The pattern can be photographed from the phosphor on any panchromatic or color film but preferably one that comes in a yellow box.

It is very easy to acquire 2" x 3" sheets of KODAK *IR Phosphor. All you do is multiply the number you can use around the place by $25 and dispatch a purchase order valid for the product of these two numbers to Eastman Kodak Company, Apparatus and Optical Division, Rochester, N. Y. 14650.*

* Private communication, in appreciation of which we are arranging to blow him *and* the team *and* their ladies to dinner at the No. 1 steak house in Madison, with plenty of *Agaricus bisporus* (Lange) Sing. on the steaks for those in the party who enjoy it but certainly no *P. rutilans*.

* Reason for the goggles: an unlucky reflected jolt of infrared can damage an eye with little immediate awareness. Putting your eye behind the sheet is even less lucky.

Price subject to change without notice.

This is another advertisement where Eastman Kodak Company probes at random for mutual interests and occasionally a little revenue from those whose work has something to do with science

Advancement in a Big Company: How it Works

An Interview with General Electric's C. K. Rieger, Vice President and Group Executive, Electric Utility Group

C. K. Rieger

■ Charles K. Rieger joined General Electric's Technical Marketing Program after earning a BSEE at the University of Missouri in 1936. Following sales engineering assignments in motor, defense and home laundry operations, he became manager of the Heating Device and Fan Division in 1947. Other Consumer-industry management positions followed. In 1953 he was elected a vice president, one of the youngest men ever named a Company officer. Mr. Rieger became Vice President, Marketing Services in 1959 and was appointed to his present position in 1961. He is responsible for all the operations of some six divisions composed of 23 product operations oriented primarily toward the Electric Utility market.

Q. How can I be sure of getting the recognition I feel I'm capable of earning in a big company like G.E.?

A. We learned long ago we couldn't afford to let capable people get lost. That was one of the reasons why G.E. was decentralized into more than a hundred autonomous operating departments. These operations develop, engineer, manufacture and market products much as if they were independent companies. Since each department is responsible for its own success, each man's share of authority and responsibility is pinpointed. Believe me, outstanding performance is recognized, and rewarded.

Q. Can you tell me what the "promotional ladder" is at General Electric?

A. We regard each man individually. Whether you join us on a training program or are placed in a specific position opening, you'll first have to prove your ability to handle a job. Once you've done that, you'll be given more responsibility, more difficult projects—work that's important to the success of your organization and your personal development. Your ability will create a "promotional ladder" of your own.

Q. Will my development be confined to whatever department I start in?

A. Not at all! Here's where "big company" scope works to broaden your career outlook. Industry, and General Electric particularly, is constantly changing—adapting to market the fruits of research, reorganizing to maintain proper alignment with our customers, creating new operations to handle large projects. All this represents opportunity beyond the limits of any single department.

Q. Yes, but just how often do these opportunities arise?

A. To give you some idea, 25 percent of G-E's gross sales last year came from products that were unknown only five or ten years ago. These new products range from electric tooth brushes and silicone rubber compounds to atomic reactors and interplanetary space probes. This changing Company needs men with ambition and energy and talent who aren't afraid of a big job—who welcome the challenge of helping to start new businesses like these. Demonstrate your ability—whether to handle complex technical problems or to manage people, and you won't have long to wait for opportunities to fit your needs.

Q. How does General Electric help me prepare myself for advancement opportunity?

A. Programs in Engineering, Manufacturing or Technical Marketing give you valuable on-the-job training. We have Company-conducted courses to improve your professional ability no matter where you begin. Under Tuition Refund or Advanced Degree Programs you can continue your formal education. Throughout your career with General Electric you'll receive frequent appraisals to help your self-development. Your advancement will be largely up to you.

FOR MORE INFORMATION on careers for engineers and scientists at General Electric, write Personalized Career Planning, General Electric, Section 699-11, Schenectady, N. Y. 12305

GENERAL ELECTRIC

An Equal Opportunity Employer