CHEMICAL SCIENCE AND ENGINEERING

NEWSLETTER OF THE COLLEGE OF CHEMISTRY, UNIVERSITY OF CALIFORNIA AT BERKELEY
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Nation Honors Berkeley Chemistry Professors

National Medals for Hoffman, Johnston; NAS for Raymond

Even for the top-ranked chemistry department in the nation, the news from the White House that Professors Darleane C. Hoffman and Harold S. Johnston had won two of nine National Medals of Science awarded this year was rather extraordinary. Add to that Professor Kenneth N. Raymond's election to the National Academy of Sciences, and there was more than enough reason for champagne corks to fly.

Established by Congress in 1959, the National Medal of Science is the United States' equivalent of the Nobel Prize. It "honors the contributions made by outstanding individuals who have significantly advanced knowledge in...physics, biology, mathematics, engineering, and...behavioral sciences," according to the National Science Foundation, which administers the medal competition. The Medals will be presented at a White House ceremony later this year.

The National Medal has previously been awarded to Berkeley chemistry professors Kenneth S. Pitzer, George C. Pimentel, Yuan T. Lee, Glenn T. Seaborg, and Melvin Calvin. "Great company," said Hoffman, "I'm overawed."

Celebrating their awards are, left to right, professors Kenneth N. Raymond, Darleane C. Hoffman, and Harold S. Johnston

Darleane C. Hoffman

It took Presidential Science Advisor John Gibbons three days to catch up with the always busy Darleane Hoffman, but when he finally was able to tell her that she had won the National Medal of Science, she was "very greatly surprised and pleased."

"I was also pleased for my profession, nuclear chemistry," she added. "I was very gratified that they were willing to choose a nuclear chemist. Things nuclear have not always been held in the highest regard by the current administration."

Hoffman was cited "for her discovery of plutonium in nature and for her numerous contributions to our under-

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Harvey Blanch Will Chair Chemical Engineering

Professor Harvey W. Blanch will succeed Simon L. Goren as Chair of the Department of Chemical Engineering, effective July 1. Goren has been chair for the past three years.

In announcing the changing of the guard, Dean Alexis T. Bell stated, "I want to thank Simon Goren for his dedicated service as chair for three very busy years in which we have faced difficult issues in maintaining the strength of our programs with a sharply reduced faculty." Bell noted that Goren has been especially effective in recruiting and retaining faculty.

"I am confident that Harvey Blanch will continue to build the strengths of our chemical engineering department and provide effective leadership for the coming years," Bell said.

Internationally recognized as a leader in biochemical engineering (see related story, p. 2), Blanch earned his B.S. in chemical engineering from the University of Sydney and

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Chemical Engineers Blanch, Iglesia Win Awards

Chemical Engineering **Professor Harvey W. Blanch** received the top award in his field from the American Institute of Chemical Engineers at its annual meeting last fall: the Food, Pharmaceutical and Bioengineering Division Award. An expert in biochemical engineering, Blanch was recognized for his contributions in mass transfer in bioreactors, kinetics of microbial growth, bioseparations, and biothermodynamics.

His work has potential applications in a variety of fields. For example, he is studying the interactions of proteins in solution, which govern protein separation and purification processes. He is also studying the electrophoretic separation of DNA fragments and the interaction of proteins at liquid-liquid interfaces, an important aspect of the use of enzyme catalysts in organic solvents. Another interest is the growth and metabolism of mammalian and bacterial cells, especially hybridoma and breast cancer cells.

Blanch has been a consultant to a number of pharmaceutical and chemical companies, and he serves on several advisory boards, including the National Institutes of Health's Cell Culture Center.

A Fellow of the International Institute of Biotechnology (U.K.) and a Founding Fellow of the American Institute for Medical and Biological Engineering, Blanch also received the Johnson Award from the Biochemical Technology Division of the American Chemical Society in 1995.

Blanch has some 250 publications, including a leading textbook, *Biochemical Engineering*, which he coauthored with his colleague Professor Douglas Clark.

When Chemical Engineering Professor **Enrique Iglesia** received a string of phone messages from the North American Catalysis Society, he had a hunch that he would soon become part of a Berkeley tradition: a recipient of the coveted Paul H. Emmett Award in Fundamental Catalysis.

"I don't often get a phone call from the president of the society, and certainly not twice on the same day," Iglesia said, adding that Berkeley is the only university to have more than one winner of the prestigious honor (both Dean Alexis T. Bell and Professor Gabor Somorjai previously received the Emmett Award).

"I looked over the list of previous recipients and it was a pretty impressive bunch. It was an overwhelming experience." But with the glory comes the responsibility, Iglesia noted. "It's great news, but then you have a reputation, and there is a plenary award lecture to prepare," he said. "It increases the pressure a bit."

The Emmett Award, consisting of a plaque and a $3,000 prize, is awarded biennially by The Catalysis Society to an outstanding scientist or engineer under the age of 45. It is sponsored by the Davison Chemical Division of W. R. Grace. The award recognizes contributions in catalysis with emphasis on discovery and understanding of catalytic materials and reaction mechanisms.

Iglesia is recognized as the international leader in several areas of catalysis, most notably in the chemical conversion of natural gas into liquid products—products that could someday offer cleaner, cheaper, more efficient alternatives to petroleum and coal. His recent work on solid acid catalysts to replace toxic and corrosive liquids appears prominently in the award.

"Methane [in natural gas] is like a sphere without handles, hydrogens everywhere you look. You can't bite into it anywhere," Iglesia said. "What we do is provide the missing catalysts to make [the conversion] happen." Over the years, his research group here at Berkeley (and at Exxon before) has worked on catalysts needed at virtually every step along many difficult methane conversion routes.

photo by Dan Krauss

Enrique Iglesia

Formerly responsible for the catalysis section at Exxon Research and Engineering, where he earned the 1993 Golden Tiger Award for outstanding contributions in heterogeneous catalysis, Iglesia joined Berkeley as professor of chemical engineering in 1993. "Exxon was a great place to do research and I miss my colleagues... but doing research with young scientists and getting up in front of undergraduates and keeping them wide awake (right after lunch)... that is really fun!" His fun has not gone unnoticed. Last year, he received the Award for Excellence in Academic Teaching of the California Section of the American Institute of Chemical Engineers.

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Harvey W. Blanch

a Ph.D. in Biological Technology from the University of New South Wales. He did postdoctoral work at both ETH Zurich and E. R. Squibb. He has maintained a dual interest in the biotechnology industry and academe throughout much of his career, which included an appointment at the University of Delaware before joining the Berkeley faculty in 1978.

Blanch brings substantial administrative experience to the chairmanship. In addition to founding and directing a start-up biotech company, Engenics, in the 1980s, he has served on the UC Systemwide Biotechnology Executive Committee since 1985. He has been a member of the College's Fundraising Committee and currently serves on the Dean's Advisory Committee. Within the department, he has been active in search committees and on the curriculum and graduate admissions committee, as well as chairing a committee to review the undergraduate laboratory course.

His top priority as chair, Blanch says, will be to work with his colleagues "to come up with a set of common objectives that will take the department into the next decade. What areas will be important for chemical engineering and for our department in particular?"

Blanch noted that, in the wake of recent retirements, there is a need to reconfigure the department and emphasize new research directions.

"We need to review both our undergraduate and graduate curricula so that we can tailor them for the chemical engineering jobs in the next century," he said. "There has been a shift away from research in the chemical and oil companies and into research in the smaller companies." Blanch pointed particularly to new opportunities in chemical engineering in biotech, semiconductor, and to some extent environmental companies.

The profession is in a state of flux, Blanch noted, and traditional roles in chemical processing are changing. "I hope that our department will have a role in defining new areas for research. Materials research—from processing to the development of polymeric, structural, semiconductor, and biological materials—is one promising area," he said.

His second priority, Blanch said, will be "to solidify our support base from industry and alumni." Tan Hall has had a very positive effect in recruiting both students and faculty, he said, and "we have a greater sense of excitement about what we're doing because we are doing it in state-of-the-art facilities. But we need continued support for both our undergraduate and graduate programs."

Blanch cited the recurring need for funds to purchase equipment and support the faculty. "We are very heavily dependent on research grants. I would like to give faculty some breathing room to explore new areas rather than to be pressured by the need to bring in grant support," he said.

He looks forward to working with colleagues in both the chemistry department and the College of Engineering in the areas of materials and biological research. The joint UC San Francisco-Berkeley bioengineering program presents a nice opportunity for collaborative work, he added.

"By carefully planning our goals and approaches," he concluded, "we can both shape and respond to the changes in our profession."

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photo by Dan Krauss

Nobel laureate Glenn T. Seaborg (right) presents Ken Hulet (Ph.D. '53), co-discoverer of element 106, with a pin celebrating the tentative decision of the International Union of Pure and Applied Chemistry to name the element Seaborgium. After three years of debate, the naming will be confirmed at IUPAC's August meeting.

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standing of radioactive decay, notably of heavy nuclei. She is an internationally recognized leader in nuclear chemistry, particularly the topics of nuclear fission, properties of actinide elements, and reactions of heavy ions."

Hoffman has been interested for most of her career in the study of the transuranic elements—chemical elements heavier than uranium that typically decay to lighter elements in seconds to milliseconds. Most recently, Hoffman has been studying the heaviest elements known: 104, 105, and 106. In 1993, she was one of the researchers who confirmed the existence of element 106, named seaborgium in honor of her colleague and Nobel laureate Glenn Seaborg.

Darleane C. Hoffman

"She has been a pioneer in the nuclear chemistry of the transuranic elements since the early 1950s," said Seaborg. "This is a well-deserved honor."

Born in Iowa in 1926, Hoffman had been inspired as a young girl by the life of Marie Curie. However, she started out as an applied art major at Iowa State University. When she switched her major to chemistry—largely because of a "wonderful woman professor in chemistry" during her freshman year—she was asked by her advisor, "Is that a suitable profession for a woman?"

Hoffman persisted with her studies, and three years later applied for a position at the Institute for Atomic Research in Ames. Her first job was making geiger counters. She went on to earn her Ph.D. in chemistry at Iowa State in 1951, encouraged by her husband, Marvin, a graduate student in physics.

After a brief stint at Oak Ridge, she moved in 1953 to Los Alamos, where she remained until 1984, ultimately directing a division of some 160 scientists working on nuclear chemistry. According to Seaborg, she established herself as the world authority on spontaneous fission, the sudden decay of heavy nuclei into two "daughter" nuclei.

She also studied radionuclide migration in the environment—an area relevant to the storage of radioactive waste. She currently serves on the National Academy of Sciences' Board on Radioactive Waste Management.

Students were the main reason she accepted an appointment as professor of chemistry at Berkeley in 1984: "Students and the ability to do heavy element research," she added.

She had come to Berkeley in 1978-79 as a Guggenheim Fellow to study nuclear fission with Seaborg, and she was attracted by the idea of returning. As a Faculty Senior Scientist at the Lawrence Berkeley National Laboratory, she has used the 88-inch cyclotron to create rare heavy elements, often generating only a few atoms per day for study—and often remaining at her research station through much of the night.

Hoffman retired from the UC faculty in 1991 to become the first director of the Glenn T. Seaborg Institute for Transactinium Science, operated jointly by UC Berkeley and the Lawrence National Laboratories. She retired from this position last year, but as a professor in the graduate school she now has a research group of eight.

Hoffman's honors over the years include the Nuclear Chemistry Award and the Garvan Medal from the American Chemical Society, Fellowship in the American Institute of Chemists and the American Physical Society, and membership in the Norwegian Academy of Sciences. Last year she received the Berkeley Citation for her contributions to scholarship and university service. She was also twice honored by her alma mater, Iowa State University.

But the National Medal of Science has special meaning: It will, she believes, "help in efforts to educate more students in nuclear chemistry, and also to educate the public."

Harold S. Johnston

Harold Johnston was cited for "understanding the chemistry of nitrogen compounds and their role and reactions in the earth's stratosphere and in urban areas. His chemical and environmental research, along with his commitment to science in the service of society, have resulted in pivotal contributions to the understanding and conservation of the earth's atmosphere."

To be recognized for his lifetime of achievement was particularly sweet for the 76-year-old Johnston, whose life

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was almost cut short as a young man because rheumatic fever had left him with serious heart damage. Despite a doctor's advice that he wouldn't live long enough to use an education, Johnston graduated from Emory University in 1941, having switched from an English major to chemistry so he could contribute to the war effort.

Johnston began graduate studies at CalTech but soon joined a secret war project on defenses against possible new chemical weapons—a project that first led him to the study of meteorology and the earth's atmosphere.

Completing his Ph.D. after the war, he was a member of the Stanford University faculty from 1947 to 1956. Since 1957 he has been Professor of Chemistry at Berkeley, serving from 1966 to 1970 as Dean of the College. Although he became emeritus in 1991, he continues to publish regularly.

Johnston's work at CalTech, Stanford and Berkeley has been concerned with the chemical reactions that take place in a mixture of gases, and also how light affects these reactions. In particular, he has studied nitrogen oxides (the major constituent of smog), as well as ozone, fluorine, chlorine, and various highly reactive free radicals.

Although he has conducted primarily pure research, he has, at times, applied his results to practical problems. For example, he applied his early work in nitrogen oxides to a better understanding of urban smog in the 1950s. Also in 1952, using a vastly improved method he developed for measuring gas reaction rates, he found that the nitric acid being used to fuel rockets should be replaced with nitrogen dioxide—a compound that the space shuttle still uses for steering during space flight.

But perhaps Johnston is best known for his pioneering work in determining that human activities can have a world-wide effect on the atmosphere. In his landmark article in *Science* in 1971, he calculated that exhaust of nitrogen oxides from a proposed fleet of supersonic transports in the stratosphere could reduce global ozone by 3 to 23 percent. Because ozone protects us from the damaging ultraviolet rays of the sun, such a depletion could have a deleterious effect on life on our planet.

His article, and the attendant publicity, led Congress to establish its first program on stratospheric research. Its findings laid the groundwork for the discovery that other substances, including chlorofluorocarbons, can also reduce ozone. For his work on high altitude aircraft pollution, Johnston received the 1982 "Service to Aviation" Citation of the Federal Aviation Agency.

Twenty years after his original research on SSTs, Johnston was an advisor to a NASA team that showed that at some altitudes and conditions, supersonic aircraft could operate with little or no damage to the ozone, after all.

Johnston modestly states that the awards he has received for his research are "par for the course." They include election to the National Academy of Sciences and the American Academy of Arts and Sciences; the American Chemical Society's Pollution Control Award; the NAS Award for Service to Science and Society; and the Tyler World Prize for Environmental Achievement. He has received an honorary Doctor of Sciences from Emory, the Distinguished Alumni Award fromCalTech, and the Berkeley Citation from the University of California.

But he was "pleased, excited, and surprised" to receive the National Medal of Science. It was, he admitted, the "most significant, the most gratifying." And then, with typical grace, he adds: "Of course, the credit should be shared with many, many graduate students, especially [Nobel laureate] Dudley Herschbach, for whom I served as freshman advisor."

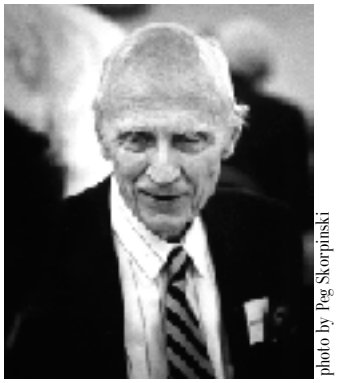

photo by Peg Skorpinski

Harold S. Johnston

Johnston is convinced that the Medal will not change his life significantly. "I will just go on doing my work," he said. Most recently, that work includes a study of the subject that indirectly launched his career: chemical warfare during World War II.

Kenneth N. Raymond

Professor of Chemistry Kenneth N. Raymond was one of five UC Berkeley faculty members elected to the National Academy of Sciences on April 29. Altogether, 60 new

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members and 15 foreign associates were elected to the prestigious organization, which is dedicated to the furtherance of science and its use for the general welfare.

Election to the Academy recognizes distinguished and continuing achievements in original research. It is considered one of the highest honors that can be accorded a U.S. scientist or engineer.

Kenneth N. Raymond

Raymond becomes the twenty-first NAS member of the College's faculty.

Raymond was elated by the news of his election. "Actually, I was in Oak Ridge serving on a review committee for the National Lab," he said. "My wife received a phone call from Washington and got an urgent message through to me to call home. I was very happily surprised to learn it was such wonderful news and not the catastrophe that I had feared."

Returning to Berkeley, he celebrated with a round of parties—the first with his current research group who "represented all the previous members as well, since their efforts and ideas are inextricably linked with my own."

Election to the Academy was a fitting way for Raymond to celebrate his thirtieth year at Berkeley. A graduate of Reed College and of Northwestern University, where he received his Ph.D. in 1968, Raymond joined the chemistry department faculty in 1967. He chaired the Department of Chemistry from 1993 to 1996.

The research for which he was honored is primarily in the areas of coordination and bio-inorganic chemistry, a field which he helped to establish. One of his main areas of inquiry is iron transport in biological systems.

The coordination chemistry of siderophores (low molecular-weight sequestering agents), and the role that molecular recognition plays in microbial iron transport, have been major contributions of Raymond's research. Using as prototypes the complexing agents by which bacteria and other microbes obtain iron, he and his coworkers have synthesized analogs that are highly specific for individual metal ions. His goal is to mimic nature by producing compounds that can sequester harmful metals from living tissue so that they can eventually be excreted by the body. Animal tests have already demonstrated the efficacy of these compounds in removing plutonium, and he is applying similar sequestering techniques to the remediation of nuclear waste sites.

Raymond has also been investigating the use of paramagnetic metal complexes as enhancement agents for magnetic resonance imaging, focusing particularly on the synthesis of gadolinium complexes. A limitation of MRI for diagnostic purposes is that diseased tissue sometimes does not look appreciably different from healthy tissue. When the gadolinium complexes are injected, however, they migrate to the normal tissue, enhancing the image and allowing the physician to differentiate between normal and abnormal tissue. A patent for one of these compounds has been licensed and is being developed for possible use in MRI diagnostics. Ironically, Raymond pointed out, his work with gadolinium and the other lanthanide complexes started out as "pure" research some 25 years ago, and it wasn't until MRI came along that there was any practical application.

His latest field of research is the modeling of symmetry-driven supramolecular assemblies or clusters, modeled after natural protein clusters such as ferritin. "At the moment this is basic research in its purest form," he said, "but who knows what will happen 25 years from now?"

The author of eight patents and more than 275 publications, Raymond has received the Ernest O. Lawrence Award of the Department of Energy, an Alexander von Humboldt Senior Scientist Award, and the American Chemical Society's Alfred Bader Award.

Raymond is also a Faculty Senior Scientist at the Lawrence Berkeley National Laboratory, from which he has received two technology transfer awards.

The *NEWSLETTER OF THE COLLEGE OF CHEMISTRY* at Berkeley is published three times each year to support the College's mission of providing excellent teaching, research, and public service in the fields of Chemistry and Chemical Engineering.

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Major Gifts From Lam Research and Dow Chemical

Two recent gifts will have a long-range impact on the College's programs. Lam Research, Inc., a leading manufacturer of semiconductor processing equipment, has given Chemical Engineering Professor David Graves a commercial-scale oxide etcher valued at $1 million and a radio frequency generator to be used with the etcher.

"I believe that this exceptionally generous gift will help David sustain one of the leading experimental facilities in academia for plasma assisted processing, certainly the leading laboratory of an individual investigator," said Chemical Engineering Chair Simon Goren. "The gift shows Lam's appreciation of Graves' leading position in experimental studies in plasma assisted processing which complement his established leadership in modeling of such systems."

Lam also contributes discretionary funds to the College as well as support for Chemistry Professor Angelica Stacy and the MultiCHEM program.

Another major gift has come from The Dow Chemical Company Foundation, which donated $250,000 to the College for the New Century Campaign. The grant, to be paid over three years, will be used in the development of a Center for the Design of New Materials.

The gift will be allocated in part to renovate facilities for materials-related research in the College and in part to establish The Dow Chemical Company Foundation Industrial Seminar Series. The seminar series is designed to strengthen the partnerships between universities and industry and to foster research in new materials by promoting the exchange of people and ideas between industry and academe and across disciplines.

"It's an honor to help support the students and research at Berkeley," said Fred P. Corson, vice president of research and development for The Dow Chemical Company. "This grant is evidence of our continued endorsement and support of this world-class research and teaching facility."

The Dow Chemical Company Foundation was established in 1979 to promote the improvement of science by supporting science and engineering education initiatives at various levels in the United States.

"We are enormously grateful for Dow's leadership in helping to launch our interdisciplinary New Materials Initiative," said Dean Alexis T. Bell. "We particularly appreciate the fact that the Foundation gift comes on top of Dow's ongoing support to both departments."

Noteworthy News

An article by chemistry professors **James McCusker** and **Charles Shank** in *Science* calls into question some fundamental principals upon which research in the inorganic photophysics and photochemistry communities has been based. Entitled "Femtosecond Dynamics of Excited State Evolution in $[Ru(bpy)_3]^{2+}$," the paper reports the time scale of the formation of the photoreactive state of the molecule to be on the order of 100 femtoseconds.

A hat trick for Assistant Professor of Chemistry **Carolyn Bertozzi**: she was elected an Alfred P. Sloan Research Fellow on the basis of potential to advance knowledge in her field; she received a three-year Burroughs Wellcome New Investigator Award in the Basic Pharmacological Sciences; and she was selected by the Carbohydrate Division of the American Chemical Society to receive the 1997 Horace S. Isbell Award in Carbohydrate Chemistry for excellence of contributions by a carbohydrate chemist under the age of 40. Congratulations!

Good news on the student front in chemical engineering: **Mike Solomon** won first prize—and a $500 check—in the AIChE Materials Student Poster competition. **Mike MacDonald** was also a finalist. Both students are in Professor **Susan Muller's** group. **Bryan Olthof**, in Dean **Alex Bell's** group, was one of 15 students from a nationwide applicant pool of 125 to be selected as a National Research Council Intern in Washington DC for the summer of 1997.

The Frank Delfino Prize of $500 each went to **Oranna Yauw** and **Amy Lum** for outstanding scholarship. The Theodore Vermeulen Prize of $1,000 each went to **Simona Kiritsov** and **Yonathan Thio** in recognition of high scholarship, outstanding character, and promise of leadership. Both prizes have been established in chemical engineering through the generosity of individual donors. The Dow Outstanding Junior Award went to **Hrish Sanghvi**, who was president of the student AIChE chapter this year.

Tan Hall Dedicated; College Marks 125th Anniversary

photo by Dan Krauss

Nobel laureate Yuan T. Lee, Dean Alexis T. Bell, and Chancellor Chang-Lin Tien cut the ribbon at dedication ceremonies for Tan Kah Kee Hall

Long anticipated and often delayed, the dedication of Tan Kah Kee Hall was celebrated on April 12 with appropriate fanfare as nearly 400 alumni, friends, faculty, students and staff gathered in a specially erected tent on the Chemistry Plaza. The occasion also marked the 125th anniversary of the establishment of the College.

Speeches by Chancellor Chang-Lin Tien and Nobel laureate and University Professor Emeritus Yuan T. Lee paid tribute to the College and honored the memory of Tan Kah Kee, a Chinese industrialist and philanthropist who devoted his fortune to education. Dean Alexis T. Bell, who presided at the day's events, and former Dean C. Bradley Moore acknowledged the efforts and generosity of the many people, including those in the audience, who had made this day possible. The ribbon-cutting ceremony, accompanied by the Cal Band, was an emotional moment.

Sir John Meurig Thomas of Britain's Royal Institution delivered the keynote address on "the Cornucopia of Chemistry," citing the many contributions to that cornucopia made by Berkeley chemical engineers and chemists.

Professor William Jolly celebrated the past 125 years with an illustrated talk, while Chemical Engineering Professor Jeffery Reimer and Chemistry Professor Paul Bartlett intrigued the audience with glimpses of future research directions in new materials and biomedicine, two of the College's main thrusts for the years ahead. New teaching methods were the focus of Professor of Chemistry Angelica Stacy's demonstration, prompting one alumnus to ask how he could take freshman chemistry all over again.

The delays in completing this project, which has been under way since the early '80s, had made skeptics of many in the University community, but even the most doubtful were convinced by the tours of the building that Tan Hall was at last a reality.

(Note: Further coverage will appear in the College's *News Journal*.)

William D. Gwinn, 1916-1997

We report, with sadness, the death of Professor Emeritus of Chemistry William D. Gwinn on May 5. He joined the faculty in 1942. He is survived by his wife, Margaret, and three children. A memorial service will be held on June 2 at 3:30pm in The Faculty Club. Memorial gifts may be made to the College of Chemistry.

Koshland Will Address '97 Graduates

Sunday, May 25
2:00 pm
Chemistry Plaza

Daniel E. Koshland, Jr., Professor of the Graduate School, Molecular and Cell Biology, will be the featured speaker at the College´s Commencement. Koshland, whose work bridges the disciplines of biology and chemistry, received his B.S. in chemistry at Berkeley in 1941. Winner of the National Medal of Science, he will speak on ˝The Chemical Frontier: Is it Endless or Ended?˝

Some 160 undergraduates and 110 graduate students are expected to receive their degrees this year.