CHEMICAL SCIENCE AND ENGINEERING

Newsletter of the College of Chemistry, University of California, Berkeley
Volume 8, Number 3, September 2000

Bristol-Myers Squibb's $1 Million Gift Helps Launch Organic Synthesis Center

The University of California, Berkeley, and Bristol-Myers Squibb Company have jointly announced a $1 million gift from the pharmaceutical company to the university to advance research and graduate training in synthetic organic chemistry. The five-year grant represents a shared commitment between the Bristol-Myers Squibb Pharmaceutical Research Institute and the Bristol-Myers Squibb Foundation. The gift—the largest corporate contribution ever received by Berkeley's Department of Chemistry—establishes Bristol-Myers Squibb as the first Sponsoring Member of Berkeley's Center for New Directions in Organic Synthesis (CNDOS).

Formed last year, the Center will provide new opportunities to enhance graduate training and research through collaborations among research groups and between academe and industry, according to its director, former Chemistry Chair Paul A. Bartlett. Bristol-Myers Squibb's support reflects the company's recognition that graduate training in organic synthesis is a high priority for the pharmaceutical industry.

Organic synthesis is critical to a broad range of industries in the areas of health and technology, especially those engaged in pharmaceutical discovery and biotechnology, and in the development of new materials. Berkeley's CNDOS has two foci, which span the medicinal and materials applications of organic synthesis. The growth of the pharmaceutical and biotechnology industries have increased the need for scientists skilled in synthesis at the same time that advances in areas like combinatorial chemistry and biological catalysis require more sophisticated training at the graduate level. "There is thus motivation in both industry and academe to find new approaches to support organic synthesis, to augment traditional funding mechanisms and continue to make the field attractive to new students and faculty members," says Bartlett.

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The College of Chemistry Is on the Move!

What has been coined the "seismic shuffle" by Dean Clayton Heathcock proceeded throughout the summer. Two major moves, one temporary and the other permanent, have now been completed.

Pitzer Center for Theoretical Chemistry Opens in Gilman

The Kenneth S. Pitzer Center for Theoretical Chemistry dedicated its newly renovated space in Gilman Hall on July 20. The Center, which is both a program and a facility, occupies more than 7,000 assignable square feet in the basement of Gilman Hall. It is named after the late Professor Kenneth Pitzer, a distinguished member of the faculty for fifty years, and Dean of the College from 1951 to 1960.

Photo by Jane Scheiber

Benefactors & Beneficiaries: (Back row) Vice Chancellor Ed Denton, Martha Pitzer, Fred Bromley, Dean Clayton Heathcock, William Lester, Arup Chakraborty, David Chandler, Claire Pitzer. (Front row) John Pitzer, Ann Pitzer, Russ Pitzer, and Center Director William Miller.

The Center is designed to enhance the education and research of students in theoretical chemistry by providing an integrated research environment that will foster interactions and collaborations across groups; to support pro-

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New Faculty Join Chemical Engineering and Chemistry Departments

By Deanna Dechaine

Balsara: Controlling the Growth of Polymer Structures

Depending on how you look at them, synthetic polymers could present either a wondrously promising contribution to virtually every field of science and technology, or an almost overwhelming burden on our landfills. Nitash Balsara, the newest professor in Chemical Engineering, sees them both ways.

Photo by Jane Scheiber

Nitash Balsara

"There is more polyethylene made today than steel. And most of it ends up in dumps," says Balsara. "It doesn't decompose, so it just stays there. We are not recycling most of it because certain thermodynamic laws prevent different polymers from mixing with each other. Coke bottles and Pepsi bottles may not mix, for example. That's how bad it is. We don't know how to incorporate large amounts of one polymer into another. They are like oil and water. If we can figure out how to suspend arbitrary amounts of the six basic plastics that dominate the market place in one another, then we will solve the recycling problem."

The potential for recycling is one of the motivations for Balsara's research, which aims at growing controlled microscopic structures of one polymer in another. Using simple chemical reactions, he synthesizes polymers, then applies physical principles in attempting to obtain specific shapes, such as microscopic cylinders or pancakes, out of polymer molecules. This control over microscopic structures in polymer mixtures appears to be the key to reusing them. "When you make a sauce, you might use wine as a surfactant to mix the oil with the water," he says. "I am looking for the wine that will make polymers mix."

"Actually, oil and water can be mixed to form organized microscopic structures," he continues. "Nature does this all the time. For example, a cell wall is oily and inside the cell is watery. Nature has many recipes to mix oil and water. I want to extend those recipes to mix polymers."

"There is a finite amount of oil from which plastic can be made—the same plastic that is in your cutting board is also used for hip replacements and lining artificial organs. I just don't see any long-term solution other than recycling," says Balsara.

Other applications for controlled growth of polymer structures are as far from landfills as one can imagine. Optics technology, for example, is emerging as one answer to the rapidly approaching speed limits of electronics-based computing. Optical computing requires producing a perfectly regular wire mesh out of wires a few tens of nanometers in diameter. Balsara hopes to learn the recipe for growing such precise structures. He observes that biology has many examples of such consistent growth on the microscopic scale. "Not that I ever hope to mimic that, but it's the yardstick."

See BALSARA, Page 4

Trauner: Synthesis of Structurally Novel Chemicals

Total synthesis of chemical compounds can turn nature's scarcity into chemistry's abundance. The usefulness of certain chemical compounds is limited because they can only be isolated from natural sources in minute quantities. Dirk Trauner, the Chemistry Department's new assistant professor, removed this barrier for halichlorine—a known anti-inflammatory—when he synthesized it in 1999 at the Sloan-Kettering Cancer Research Institute in New York City. Halichlorine inhibits the expression of certain adhesion molecules involved in the inflammatory cascade. Some indications also hint at the chemical's potential for preventing the growth of cancerous tumors by cutting off their blood supply. However, no one could evaluate the compound's full biological potential as long as it was available only from marine sponges.

Under the direction of Dr. Samuel J. Danishefsky, Trauner conducted a "retrosynthetic analysis," beginning with the target molecule and mapping its roughly ten immediate precursor chemicals, and then those precursors' ten precursors, and so on. As the possible molecule combinations increased exponentially, a "retrosynthetic tree" was formed. Using computers to help calculate the shape, or confirmation, of the molecules and their energy, he then identified dozens of possible paths leading from known and available chemicals to the target, halichlorine. One of these paths was subsequently reduced to develop the molecule synthetically.

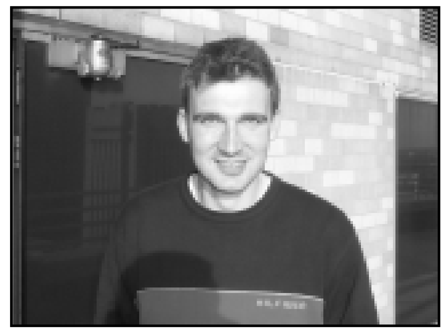
This project is a perfect example of Trauner's intended research in his new Berkeley lab. "I have an ever-changing list of compounds that I hope to synthesize," says Trauner. "I have two requirements for chemicals that I study: they must be biologically active and structurally novel." The biologically active chemicals he studies interact with cells in ways that are observable, but not yet understood; that is, the receptor molecules they are targeting to achieve the interaction are not known. "One can use these compounds to actually go fishing for these targets, or to gain insight into the mechanism of the biological interaction," says Trauner.

Structurally novel chemicals—those that display features not seen before—intrigue Trauner because "you obviously have to come up with new chemistry when you have a structurally novel compound. You have to keep your retrosynthetic analysis as flexible as possible because things may not go the way you plan." Each unplanned event holds the potential for new chemistry. "One of the major incentives around complex molecule total synthesis is to include and discover as much new methodology as possible," he says.

Trauner's second research interest is neurochemistry—specifically, "the venerable field of ion channel research." This area, he says, will gain enormous importance in the next few years. An ion channel is a protein embedded in a cell's membrane that defines the membrane potential, or voltage (defined by the difference in concentration of charged particles between the inside and the outside of the cell). Charged particles normally cannot pass through the lipid bilayer of the cell membrane. An ion channel is a pore in the membrane whose purpose is to control the transfer of ions between the outside and the inside of the cell; the pore's gate is either preferentially open or closed, depending on the presence of certain chemicals or the voltage across the membrane. Thus, the term "voltage gated ion channels."

Certain signals can trigger the reversal of the membrane's potential. "This reversal, proceeding along very lengthy cells, is essentially how nerves fire," says Trauner. "All our nervous activities involve ion channels; actually, almost all forms of cell activity involve ion channels."

The excitement around ion channel research of late stems from recent technological breakthroughs in imaging that make possible increasingly detailed studies of ion channel crystals. Two years ago, a group at Rockefeller University published an X-ray crystal structure of a model ion channel. "Such three-dimensional images of other important ion channels are likely to appear in the literature in the next few years," says Trauner. "Traditionally, you elucidated the electrophysiology of these things. You had an idea what they looked like, but you never really saw them."


Dirk Trauner

Building on the crystal structure illustrated by the Rockefeller group, Trauner hopes to develop a very general approach to ligand-specific ion channels. Certain families of ligands potentially bind to the extracellular surface of channel proteins with high affinity and selectivity. Identifying and describing these interactions will make possible a controlled process for modifying the passage of ions through specific channels. Such controls will have immediate applications to the field of neurobiological research.

"If I can come up with these compounds and prove they interact with ion channels, I hope to launch a very broad program with biologists—neurbiologists, molecular and cell biologists. The advantage that synthetic organic chemistry brings to this field of research is the ability to make molecules by design and study their interactions with systems. Biologists generally work only with compounds they can buy or find in nature."

Trauner earned his Ph.D. in 1997 at the University of Vienna, Austria. Since arriving in Berkeley in July, he has not had much time for fun, "except in the laboratory." He

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BALSARA *(Continued from page 2)*

Natural crystal growth provides a sort of model for his work, but he says that while crystals are grown on the angstrom length scale, he is trying to grow things on length scales a hundred times larger than that. "Crystals interact with electrons because of the wavelength of the electron," he says. "If you want something to interact with light, you need the length scale to be a hundred or a thousand times larger. We are working on strategies to do this."

Trying to produce such highly organized structures is an entirely new application for polymers, which traditionally have been considered "disordered materials." "Until now, we didn't care that much about the structure inside a plastic," says Balsara. "As long as you could pull a strong fiber out of it, for example, you didn't care whether the molecules were organized inside the fiber or not. But there's a whole host of things coming out that need very organized structures, in fields such as optics, catalysis, and biomimicry. We are hoping that plastics may provide a scaffolding for that organization."

Part of learning about how to control structure growth requires the determination of the structures of existing polymer samples. Much of Balsara's work centers on developing methods to probe the nature of microscopic structures within polymers. Direct imaging using microscopy is useful for probing small portions of the sample. Several more indirect probes work by inference. Just as crystal structures were inferred a hundred years ago from the way X-rays bounce off them, polymer structures can be inferred from the way a laser beam scatters when it passes through a sample.

"That technique answers questions on the large scale," Balsara says. "We can scan a whole sample with a laser beam. We don't see the structure, but we know what a particular structure would do to a laser beam if it were there." Neutron beams are also very powerful analytical tools for this purpose. Balsara travels routinely to Maryland, where a 20 mega-watt research reactor (one of only a handful in the world) has become the tool for a major part of his studies.

One more motivation for Balsara for controlling the growth of polymer structures is the curiosity they inspire. "Simply put, can we do it?" he asks. "And if we can grow these shapes—worms or pancakes, for example—can we use them? Unless we make them, we won't know if they are useful."

By its nature, Balsara's work lends itself to collaboration with scientists in many different fields. "I work at the interface between chemical engineering, chemistry, material science, and physics," says Balsara. "I have worked with physicists, chemists, and engineers. They have never seen a polymer and often don't really care how the sample is made; they just know what they want it to do. That's great, because it's exactly the way I want to work. I don't want to learn electrical engineering from the ground up, either."

Dr. Balsara grew up in India and earned his B.S. at the Indian Institute of Technology at Kanpur. He earned his Ph.D. at Rensselaer Polytechnic Institute and went on to postdoctoral research at the University of Minnesota and then at Exxon Corporation, one of the largest producers of polymers. He was on the faculty at Polytechnic University in Brooklyn for eight-and-a-half years. He arrived in Berkeley in July with his wife, Rita, and children Sonya and Matthew. He will be teaching ChemE 178 this fall. A self-taught electric guitar player, Professor Balsara will eventually be looking to form a west-coast version of the band he left behind in Brooklyn.

TRAUNER *(Continued from page 3)*

is biding his time until Yosemite's tourist season subsides. "As an Austrian, I love mountaineering, anything to do with mountains. I've been dreaming of Yosemite since I was ten years old, admiring the photos of Ansel Adams."

He misses New York a bit: "Not being able to go out to a Korean deli at two o'clock in the morning is something I am not yet used to," he said. However, he bonded immediately with the Bay Area: "It was clear to me the moment I stepped out of the plane that I belong here."

The life of a synthetic organic chemist is filled with psychological challenges as well as scientific ones, according to Trauner. In his pursuit of halichlorine, he had weeks, and even months, where he made no progress toward his goal. In the end, though, the endeavor is seemingly akin to his beloved mountain climbing: "Although the process can sometimes be frustrating, and you are at constant risk to crash, it is a great feeling to conquer a molecule," he said.

And—with apologies to George Mallory—sometimes you feel tempted to synthesize molecules simply because they are there."

MOVE *(Continued from page 1)*

grams in theoretical chemistry; and to facilitate the use of shared equipment. The idea for the Center originated largely with William Miller, the Kenneth S. Pitzer Distinguished Professor, and Professor David Chandler, who both benefited as students from a similar collaborative atmosphere at Harvard.

The transformation of their vision into the reality of the Pitzer Center was made possible by a private-public partnership. The Pitzer Family Foundation contributed $1 million for construction plus $500,000 for endowment. The State of California provided $1 million in seismic surge funds, and $.55 million came from additional private donations.

The Foundation trustees—Ann, Russell, and John Pitzer, children of the late Kenneth and Jean Pitzer—were on hand for the opening. (Jean Pitzer, who was instrumental in the funding of the Center, passed away in April.) Speaking on behalf of the family, Russell Pitzer, Professor of Chemistry at Ohio State, expressed his pleasure with the facility but warned that he would "be back next year to assess what really counts—the quality of the chemistry that will be taking place."

"The completion of the renovations on schedule is the culmination of outstanding teamwork, good planning, and concerted effort by Vice Chancellor Edward Denton and the campus's Capital Projects Office, the architectural firm of Anshen & Allen, the construction firm of Rudolf and Sletten, and our College team," said Dean Heathcock. He singled out for special mention Professor David Chandler, College Engineer Alex Shtromberg, Building Manager Susan Slavick, and Director of Information Systems Yau-Man Chan.

"Demolition of the interior of the basement didn't begin until December," said Heathcock. "It is truly remarkable what has been accomplished in six months."

The Center's new space is occupied by the research groups of Professors Chakraborty, Chandler, Head-Gordon, Lester, Miller, and Whaley—currently about 55 students. (For further information, see the fall 1999 issue of the *News Journal* at http://www.cchem.berkeley.edu/Publications.)

The *NEWSLETTER OF THE COLLEGE OF CHEMISTRY* at Berkeley is published several 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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Chemistry Library Moves to Doe

The potential threat to the safety of students in the College library in the event of a major earthquake was a major factor driving the FEMA-funded seismic upgrades to Hildebrand Hall. The ground floor of Hildebrand, used by students, faculty, and visiting researchers for more than three decades, now stands vacant. During the summer, the Chemistry Library collections were moved to the basement of Doe Memorial Library, which itself was recently reinforced.

Under the exceptionally capable management of Chemistry Librarian Mary Ann Mahoney and her staff, the new chemistry library was formally opened for business on August 11. "I am delighted that such an excellent use has been found for this rather cavernous space," said University Librarian Gerald Lowell, expressing his enthusiasm for the project. "We look forward to continuing to serve the students and faculty in chemistry and related fields." (For information regarding hours, etc., see http://library.berkeley.edu/CHEM/.)

Heathcock hopes that contributions from his discretionary funds to help cover the costs of photocopying will make the move more palatable to College students. "We hope to reoccupy the Hildebrand space in a year's time," he said. "During the next twelve months, we will be installing new shear walls in Hildebrand Hall, beginning in the D-level and working our way up. By July of 2001, the work will have passed the plaza level and it will be possible for the Chemistry Library to return from its exile."

Photo by Jane Scheiber

Clayton Heathcock cuts the ribbon on the new chemistry library facility in Doe as outgoing University Librarian Gerald Lowell and Chemistry Librarian Mary Ann Mahoney look on.

Neumark Heads Chemical Sciences Division at LBNL

Dan Neumark

Chemistry Professor Daniel M. Neumark (Ph.D. '84) has been named to succeed C. Bradley Moore as Director of the Chemical Sciences Division at the Lawrence Berkeley National Laboratory. In making the appointment, which became effective July 1, Laboratory Director Charles Shank cited Neumark's "background, talent and skills" as being "particularly well suited to this assignment."

Neumark studied with two Nobel laureates: he earned his B.A. and M.A. at Harvard under Dudley Herschbach, and went on to earn his Ph.D. at Berkeley in 1984 with Yuan T. Lee. Herschbach and Lee shared the 1986 Nobel Prize with John Polanyi for their work in chemical reaction dynamics.

Following a postdoc at the University of Colorado, Neumark joined the Chemistry faculty at Berkeley in 1986, becoming a full professor in 1993. He has been a Faculty Senior Scientist at LBNL since 1988.

His administrative experience includes a stint as Vice Chair of the Chemistry Department (1991-1995), Vice Chair of the Physical Chemistry Division of the American Chemical Society (1998-1999), and Divisional ACS Program Chair (1999-2000).

Neumark's research has concentrated on molecular structure and reaction dynamics, including the use of negative ion photoelectron spectroscopy to probe the transition state in chemical reactions. His studies of semiconductor materials are of potential significance to the high-tech industry, and he is advancing our fundamental knowledge of combustion and interstellar chemistry through his crossed molecular beam studies of hydrocarbons.

His work has been recognized with Young Investigator Awards from the Office of Naval Research and the National Science Foundation, the Camille and Henry Dreyfus Teacher-Scholar Award, and election to fellowship in the American Physical Society and the American Association for the Advancement of Science.

At LBNL, he oversees a group of some two dozen principal investigators, many of whom are UC Berkeley faculty members. Their interests range from theory to application, and include chemical physics; actinide science; atomic, molecular and optical sciences; and catalysis.

A top priority for Neumark as Divisional Director at LBNL is to seek new talent. "Chemistry's tradition at Berkeley Lab goes back to the beginning, and it's wonderful to be part of an established program," Neumark says. "But maintenance is not enough—we have to build on it as well."

GRANT *(Continued from page 1)*

"We are very excited by this opportunity to further strengthen our relationship with the University of California, Berkeley, and we look forward to collaboratively addressing the issues associated with supporting and maintaining high quality research in organic chemistry," says Dr. Peter S. Ringrose, Chief Scientific Officer and President of Bristol-Myers Squibb's Pharmaceutical Research Institute. "The grant reflects the company's continuing support of exemplary academic research in synthetic organic chemistry, as well as the ongoing training of new scientists."

"This magnificent grant will advance both graduate education and research, which are inseparable in Berkeley's top-ranked chemistry department," said Dean Clayton H. Heathcock, one of the Center's organizers. "We are enormously grateful that Bristol-Myers Squibb has become a sponsoring member of the Center."

CNDOS currently has seven other industrial members, who are participating at a more modest level. The funds contributed by industry will be used to modernize laboratories, as well as to support the ongoing work of the Center. These activities include short courses taught by Berkeley faculty for industrial participants, summer internships provided by industry for Berkeley students, and a graduate course in industrial research featuring speakers from participating companies.

Bristol-Myers Squibb is a leading diversified worldwide health and personal care company whose principal businesses are medicines, nutritional products, medical devices, and beauty care. Its foundation supports activities that extend and enhance human life. Headquartered in New York, the company has some 54,000 employees worldwide.

Adam Arkin, Assistant Professor of Chemistry and Bioengineering, was selected by *Time* Magazine as one of six young scientists whose innovations will help shape the twenty-first century. Arkin (profiled in the April issue of the *Newsletter*) is trying to design a computer model of how the cell works, with the ultimate goal of designing his own cells.

Chemical Engineering Professor **Alexis T. Bell** gave the Brdicka Lecture at the Heyrovsky Institute in Prague, Czechoslovakia, on June 29. He will also deliver the L. K. Doraiswamy Lecture at both Iowa State University and the National Chemical Laboratory in Pune, India, this academic year.

Jonathan Ellman, Professor of Chemistry, received the Arthur C. Cope Scholar Award of the American Chemical Society at its national meeting in August. The award, which consists of $5,000 for personal use and $40,000 for research, recognizes his work as a pioneer in the field of combinatorial chemistry, which has become one of the most important methods used by the pharmaceutical industry to discover new drugs. He has recently developed a widely used strategy for the asymmetric synthesis for amines.

Chemistry professors **Jean Fréchet** and **Daniel Neumark** were among 154 new fellows to be elected to the prestigious American Academy of Arts and Sciences, which recognizes distinguished contributions to science, scholarship, public affairs and the arts.

The latest kudo for Chemistry Professor **Darleane Hoffman** is induction to the Women in Technology International (WITI) Hall of Fame on June 21. She also

Noteworthy News

organized "Chemical and Nuclear Properties of the Heaviest Elements—A Symposium in Memory of Glenn T. Seaborg" for the recent ACS meetings in Washington.

Assistant Professor **Jeffrey Long**, Chemistry, is one of eighteen recipients nationwide of a Camille and Henry Dreyfus Teacher-Scholar Award for 2000. The awards, which recognize accomplishments in education and research, are designed to help young faculty members early in their careers.

Chemistry undergraduates **Chudi Ndubaku** (mentored by Prof. Paul Bartlett) and **Amy Katherine Olgin** (mentored by Prof. Judith Klinman) gave presentations at the Eighth Annual California McNair Scholars Symposium. The McNair Post-Baccalaureate Achievement Program, funded by the U.S. Department of Education, encourages students from groups underrepresented in graduate programs to enroll in graduate studies.

Chemistry faculty members **James McCusker** and **Charles Shank** published an article in the August 11 issue of *Science*, reporting on research that identifies some of the factors that contribute to the formation of a charge-transfer state in inorganic compounds in solution at time scales of less than one-trillionth of a second after the absorption of light.

Chemical Engineering Professor **Jeffrey Reimer** has accepted a half-time appointment as Associate Dean of the Graduate Division. "I have always regarded it as a tremendous privilege to serve those who have contributed so much to my own scholarly growth, namely graduate research assistants and student instructors," says Reimer. "I look forward to this challenging new opportunity to serve my community." Reimer previously served on the Graduate Council and provided oversight to the GSI Teaching and Resource Center.

David Schaffer, Assistant Professor of Chemical Engineering, received the Biomedical Engineering Society Young Investigator Award. Schaffer's research focuses on gene therapy and stem cell biology, with applications to therapies for diseases of the nervous system.

Chemistry Professor **Gabor Somorjai** will receive the Linus Pauling Award for 2000. Sponsored by the Puget Sound, Portland and Oregon Sections of the American Chemical Society, the award recognizes outstanding achievement in chemistry. Somorjai will also receive an Honorary Doctor of Technology degree from the Royal Institute of Technology (Kungl Tekniska Högskolan) in Stockholm, Sweden, in November.

Chemical engineering graduate student **Michael Tucker**, in Prof. Jeff Reimer's group, has won the Laura Marinelli Award for Outstanding NMR Research for his project on "7Li MAS NMR Studies of LiMn2O4-Based Spinels for Lithium Rechargeable Batteries." Widely regarded as the award for the best student or postdoc of the year in solids NMR work, it is sponsored by Academic Press. Selection is made by an anonymous committee of highly regarded scientists.

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EVENTS CALENDAR

Cal Homecoming, Reunion, & Family Weekend, October 13 - 14

Saturday, Oct. 14: Dean Clayton Heathcock invites alumni, parents, students and their families to an **informal reception and continental breakfast** in the McCollum Room, 775 Tan Hall, from 8:00 - 9:00 a.m. (No charge, but RSVP by 10/5 to 510/643-7379 or colufson@cchem.berkeley.edu.) Following the breakfast, from 9:00 - 10:00 in 180 Tan Hall, Assistant Professor of Chemistry **Kristie A. Boering** will speak on "Studying the Ozone Layer: The View from Satellites, Balloons, and U-2 Spyplanes." Join us for a casual **BBQ lunch**, 12-2:30, on the Campanile Esplanade sponsored by the Colleges of Chemistry and Engineering. Look for our tent!! The cost is $15.00 for adults, $10.00 for children 5 - 17 yrs., and no charge for children 4 and under. Checks should be made payable to "U.C. Regents" and sent to Camille Olufson, College of Chemistry, 420 Latimer Hall MC #1460, Berkeley, CA 94720-1460. For further information on homecoming, see http://www.urel.berkeley.edu/homecoming.

Alumni Reception, Philadelphia, October 25

Alumni in the greater Philadelphia area are invited to attend a reception hosted by Dean Clayton Heathcock. Invitations with location and time details will be mailed mid-September.

"Free Radicals" Luncheon, November 4

The "Free Radicals" (alumni from 1964 - 79) will hold their second annual luncheon in the McCollum Room, 775 Tan Hall, 12 - 2:00 p.m. Also plan on attending the Cal vs. Oregon State football game. Further details of the event will be mailed in the fall.

AIChE Alumni Reception, November 14, Westin Bonaventure Hotel, Los Angeles, CA

All College of Chemistry alumni are invited to attend this reception in connection with the AIChE national conference. Invitations with location details will be forthcoming.

"Alumni of the G. N. Lewis Era" Luncheon, November 16, 12 - 2:00 p.m.

The group will gather for their annual luncheon in the Heyns Room of The Faculty Club. Watch for a separate mailing.

For questions regarding any of the above events, please call Camille Olufson at (510) 643-7379 or email colufson@cchem.berkeley.edu.

SPECIAL SEMINARS

Melvin Calvin Lecture, Tuesday, Sept. 19, 4:00 p.m., Prof. Dieter Seebach, ETH Zentrum, "From PHB to Beta-Peptides—a Brand New Field."

Bristol-Myers Squibb Symposium, Thursday, Oct. 5, 11:00 a.m., Prof. Masakatsu Shibasaki, University of Tokyo, "Development of Lewis Acid-Lewis Base Bifunctional Asymmetric Catalysis."

G. N. Lewis Lecture (sponsored by Ford Motor Company), Tuesday, Oct. 31, 4:00 p.m., Prof. Jack Baldwin, Dept. of Chemistry, Oxford University.

Earl Muetterties Lecture, Thursday, Nov. 9, 4:00 p.m. Prof. Reinhard Nesper, ETH Zurich, "The Internal Surface Approach—Relating Crystal Structures, Hyberbolic Tilings in 3-D, and Reconstructive Phase Transformations."

Bayer Lecture in Biochemical Engineering, Wednesday, Dec. 6, 4:10 p.m., Prof. Frances Arnold, CalTech, "Laboratory Evolution of Enzymes and Pathways."

Kenneth S. Pitzer Lecture (sponsored by ICI), Tuesday, Nov. 14, 4:00 p.m., Prof. Robin Hochstrasser, University of Pennsylvania.

All lectures are in Pitzer Auditorium, 120 Latimer Hall.

ENTERING STUDENTS, FALL 2000

The College of Chemistry continues to attract an exceptionally talented group of students. Entering the College this fall are 173 new undergraduates and 106 new graduate students. The graduate class in Chemical Engineering includes two NSF fellows, one Whitaker Foundation Fellow, and one Fulbright Fellow, as well as a set of twins (who went to separate undergraduate institutions), a student who spent two years teaching in Nepal, and one who spent a year in the "Teach for America" program, and five students who have been working in industry. The new graduate class in Chemistry includes eight NSF Fellows, an American Meteorological Society/ Industry/Government Fellow, and a Howard Hughes Medical Institute Fellow.

Undergraduate Students

	Chemistry	Chem. E.
Freshmen	68	60
Transfers	17	24

Graduate Students

	Chemistry	Chem. E.
Freshmen	73	30
Transfers	--	3