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Another College Alumnus Wins Nobel Prize

Robert Curl honored for discovery of fullerenes

The Nobel Foundation awarded its annual prize in chemistry to Berkeley graduate Robert Curl, Jr. (Ph.D. '57), making the Rice University professor the ninth College alumnus ever to win the prestigious honor.

The award is the second in a row for College alumni—Professor Mario Molina, a 1972 Ph.D. graduate of the College, took home the prize last year.

Curl shared the honor with fellow Rice Professor Richard E. Smalley and Professor Sir Harold W. Kroto of the University of Sussex, Brighton. The three men were honored for their 1985 discovery of "fullerenes," geometric carbon clusters shaped in the pattern of soccer balls.

Though initially a subject of controversy, the discovery of spherical carbon molecules, also called "buckyballs," produced an entirely new branch of chemistry.

Scientists have since produced thousands of variations of the buckyball, including carbon sheets one atom thick and microscopic tubes with enormous strength and electrical properties.

The three scientists conducted their groundbreaking experiment over an eleven-day period in Smalley's laboratory at Rice. Using powerful lasers, the group vaporized carbon atoms from graphite and mixed them with helium gas to form carbon clusters when the mixture cooled. The result: an entirely new class of carbon structures.

"[Curl] was a full contributor to the research and it's wonderful that he's being recognized for it," said Professor Emeritus Kenneth Pitzer, Curl's research advisor when he was a graduate student at Berkeley in the mid-1950s.

Pitzer recalled the young Curl as a very quiet, but

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Buckyball: Professor Robert Curl displays a model of a C_{60} fullerene at a press conference in October.

Photo courtesy of Rice University

Chemistry Department Welcomes Fréchet

Capping off a series of high-caliber additions to the Department of Chemistry faculty, renowned organic-polymer chemist Jean Fréchet is moving his laboratory to Berkeley on January 2.

Fréchet, currently a professor at Cornell University, is widely acknowledged as one of the foremost pioneers of modern polymer design and application.

"We are all enthusiastic to have Professor Fréchet as a colleague. His research in organic materials touches so many areas of interest within the department," said Chemistry Department Chair Paul Bartlett. "His work will further enhance our position in polymer chemistry and open up additional opportunities for interaction with industry and other laboratories."

Jean Fréchet

Fréchet said that the prospect of new intellectual stimu-

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Experienced Technical Managers Join College Staff

As a chemistry graduate student at Emory University half a decade ago, **Kathy Durkin** turned to microchips rather than test tubes to help her answer questions about the reactivity of organic molecules.

"I sat down at a computer one day and never got up," recalled Durkin, who recently became the new head of the College's Computer Graphics Facility.

By the time she was finished with her research at Emory, Durkin had left her mark in the lab, helping to acquire a fleet of workstations outfitted to electronically model the action of molecules in 3-D.

Durkin went on to do post docs at Macquarie University in Australia and at the University of Georgia, where she participated in a number of molecular modeling projects as well as the development of molecular modeling programs for organic chemists.

Kathy Durkin

With her wealth of chemistry know-how and computing experience, Durkin said she feels right at home as the manager of the Graphics Facility—despite the frantic pace of the job.

"It's been hectic," she said. "I'm trying to restore a little order to the Graphics Lab."

According to Durkin, part of this effort will include making the facility more approachable to novice users.

"My goal is to have users feel comfortable and to allow them to do their science without being bogged down by computer issues," Durkin said. She added that responding to users' technical needs is an equally important aspect of her job.

Durkin has already overseen the purchase of a new Silicon Graphics Solid Impact workstation since she came on board on August 1. The workstation represents the first step toward phasing out some of the facility's older hardware and keeping pace with rapidly improving technology, according to Durkin.

Moving thirteen laboratories between two buildings is a big job. Add to that task about 50 renovation projects and you'll begin to have an idea why **Alex Shtromberg**, the College's new chief engineer, is a very busy man.

Shtromberg, who started in June, says moving research groups into Tan Hall, the College's new research and teaching building, and renovating newly-vacated labs will keep him bustling for at least the next two years.

Meanwhile, he will oversee the design and construction of Latimer Hall laboratories—a project funded in part by a substantial National Science Foundation grant.

"My goal is to bring the College into twenty-first century shape," Shtromberg said, adding that his responsibilities also include supervising the College's Liquid Air Plant and its shops.

Among Shtromberg's managerial initiatives is working with the College's Facilities Committee every week to develop an organized master plan for the College's renovation.

"Every project gets its own folder," Shtromberg said, motioning to a stack of files on his desk.

Shtromberg was most recently the lead of the multi-discipline engineering group at the LBNL's Facilities Department, where he designed new labs and modified existing ones on the hill.

"I'm glad I made the move to the College," Shtromberg said. "I think I can contribute to making this a better place."

Alex Shtromberg

Kurt Dreger, the College's new Environmental Health and Safety specialist, regards the business of safety as exactly that: a business.

"I view our researchers as customers and I want to market [safety programs] to them," Dreger said. "So what you'll see is a lot of innovative ways of communicating."

Dreger's customer approach to safety management is a result of his eclectic academic background: a Bachelor's Degree in Chemistry from Berkeley (1988) and an MBA in Entrepreneurial Management from San Francisco State.

"In recent years, the number of environment, health and safety regulations has increased dramatically," Dreger said. "Universities have to find business solutions to some of these problems."

Dreger, who started work here in July, pointed to training and self-inspection programs as his main priorities. Both programs are aimed at better preparing the College for regulatory agency inspections.

"I think we have a really great hazardous waste program," Dreger said. "I'm sure that most regulators would be

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Chakraborty Takes Home Coveted Colburn Award

When a member of Berkeley's Chemical Engineering department last brought home the Allan P. Colburn award, Professor Arup Chakraborty was less than a year old.

Now, 34 years later, Chakraborty has at last followed Professor John Prausnitz in winning the prestigious award, which the American Institute of Chemical Engineers gives each year to an investigator less than 36 years of age.

"I was very pleased," Chakraborty said from his lab at MIT, where he is on sabbatical leave. "It was good for me and it was good for Berkeley."

Chakraborty is gaining prominence in engineering circles by his unique use of "paper and pencil" theory and large-scale computation to study the relationship of molecular structure to macroscopic properties in materials.

Using sophisticated statistical and quantum mechanical calculations, Chakraborty has made remarkable insights into the adhesion of polymers to solid surfaces and new designs for catalysts that can break down nitrogen oxide, an atmospheric pollutant.

Arup Chakraborty

One of his most recent successes is with the discovery that multicomponent polymers with disordered sequences can recognize patterns on solid surfaces.

Chakraborty speculated that such polymers could someday be used as synthetic molecules which, like proteins, would be able to carry out specific biomimetic functions.

"This is the project that excites me the most right now," he enthused.

Two events mark completion of Tan Hall

Above: The first meeting of the College's new Advisory Board was held in Tan Hall on October 18. The Board was formed to advise the College on its academic programs and infrastructure, on the future research needs of industry, and on means to strengthen ties with all elements of the chemical enterprise and to respond to the decline in government support of research. Pictured (l to r) are F. L'Eplattenier (Ciba-Geigy), J. Wei (Princeton University), A. Zaffaroni (Alza), J. McTague (Ford), D. Milligan (Abbott Laboratories), C. V. Evins (Hoechst Celanese), R. Banducci (Shell), R. Kiskis (Chevron), J. Trainham (DuPont), N. Chatterjee, Chair (Air Products), M. Ramage (Mobil), D. Koshland (UC Berkeley), F. Corson (Dow), and J. Wirth (Raychem). Other Board members are M. King (Merck), Y. T. Lee (Academia Sinica), R. Lerner (Scripps), A. Narath (Lockheed Martin), and A. Voshchenkov (Lam).

Right: Gregory Stephanopoulos of MIT delivered the inaugural Bayer Lecture in Biochemical Engineering on October 17.

Fréchet

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lation lured him to Berkeley and that collaborations with the department's number-one ranked faculty should spark fresh ideas for his work.

"I see some beautiful possibilities for interactions with chemists [at Berkeley]," Fréchet said in a telephone interview from his office at Cornell. "It's very exciting. It's a bit of a new beginning for me—an excellent opportunity to start new projects in exciting areas at the interface of organic and polymer chemistry."

Fréchet will lead a research group of more than 30 students and post docs working in several areas of organic-polymer chemistry.

One important project, according to Fréchet, involves the construction of incredibly tiny devices composed of single molecules.

"I have an interest in looking at chemistry on the nanometer scale," he said, adding that most organic chemistry is done with molecules at the angstrom scale, an order of magnitude smaller.

Fréchet said the project involves the synthesis of spherical molecules, such as dendrimers and hyperbranched polymers, that are somewhat larger than the C_{60} "buckyballs" which recently earned College alumnus Robert Curl a Nobel Prize (see story, page 1).

The first step will be to synthesize the molecules with extremely precise control over their structure and size.

"We also tailor their surface chemistry since they act with the outside world mainly through their surfaces," Fréchet said. "We can modify the surface to control the way [the molecules] behave."

Such molecules could eventually be used as superlubricants acting as molecular ball bearings, as miniature targeted drug-delivery systems or even as tiny devices in electronic machines.

Fréchet is certainly no stranger to the field of electronic materials. Working with scientists at IBM, he made a major contribution to the miniaturization revolution in the modern electronics industry by inventing very fast photochemical methods for imprinting minute circuit patterns on silicon wafers.

Fréchet said that he will continue work on the next generation of this technology at Berkeley, developing new organic materials and techniques that will allow even higher-resolution, three dimensional patterns to be imprinted on wafers.

Step away from the world of electronics and nanoscopic chemistry and one can still find Fréchet's profound influence in polymer chemistry.

His highly original work in the area of molecular recognition and separation, for instance, has set a new standard for the synthesis of porous material that chemists and biologists alike can use as molecular sieves.

"We can mold a piece of porous polymer into any shape we want and we can introduce any chemistry we want into its pores," Fréchet said.

The material is essentially agglomerated polymer nodules with small holes, cavities or channels specially engineered to recognize and bind specific types of molecules flowing through a column.

Such polymers can be customized to interact specifically with biologically active molecules, for instance, or to separate molecules based on size, chemistry or handedness.

The materials are better engineered and have faster response times than silica beads typically used in the lab for molecular separations, according to Fréchet.

In addition, the materials are readily adaptable for other uses, most notably combinatorial chemistry—a process in which thousands of small volume reactions take place simultaneously for the production of vast arrays of new compounds, such as pharmaceuticals, catalysts, or electronic display materials.

Fréchet said his polymers make excellent solid supports for combinatorial chemistry reactions because of their versatility and their higher reactivity, which allow them to accommodate more test material than do the polymer beads used now.

"This is particularly important when the ultimate targets require larger sample sizes than is the case in pharmaceutical research," Fréchet pointed out.

Nobel

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unusually talented student. During his years at Berkeley, Curl published an impressive five research papers, was granted a National Science Foundation fellowship and shared with Pitzer the Clayton Prize of the Institution of Mechanical Engineers of Great Britain.

Pitzer was rejoined with Curl in the 1960s when he became President of Rice University. While at Rice, he collaborated with Curl on several scientific papers, none of which was directly related to the discovery of fullerenes.

It wasn't until almost two decades later that Curl's expertise in microwave and infrared spectroscopy helped to make scientific history. According to Pitzer, Curl was key in attaining a degree of equilibrium in the carbon vapor that allowed the group to identify a unique, 60-atom configuration of carbon.

"The Rice experiment showed that C_{60} stood out like Mt. Shasta versus all of the other little peaks in its vicinity," Pitzer said, alluding to the peaks of a spectroscopic graph.

The scientists named the spherical molecule "buckminsterfullerene" after the American architect R. Buckminster Fuller, who designed the geodetic dome for the 1967 Montreal World Exhibition.

Managers

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impressed with the efforts the College has made in complying with these complex regulations."

But, Dreger warns that rules and regulations are not always enough to keep a tight ship.

"Sometimes EH&S people are viewed as job-stoppers," he said. "I'm more interested in enhancing the whole system by decreasing the overall risk."

Kurt Dreger

Disney Looks to College for Chemistry Advice

Several members of the College of Chemistry are finding that modern Hollywood moguls have a genuine interest in making their films at least somewhat plausible to the scientific community.

Jeff Cruzan, a member of Professor Richard Saykally's group, is serving as a technical advisor for the upcoming Disney film, "Flubber," starring Robin Williams—a remake of "The Absent Minded Professor."

College Lecturer Mike West also worked as a technical advisor on the film, and the College's multimedia facility, MultiCHEM, produced computerized animations that will be displayed on monitors in the fictitious lab.

"Mostly I make sure the condensors and the flasks are right side up and the liquids are flowing in the right direction," Cruzan said of his work on the set.

Cruzan must also ensure that actors don't utter any dialogue that will send scientists out of the theater scoffing.

At one point, said Cruzan, Williams asked him for a list of scientific words he could use for ad libbing dialogue about the amazing polymer, Flubber, that his character accidently creates.

"He ended up using everything I gave him," Cruzan said. "That was really gratifying."

Cruzan said he was pleasantly surprised to find that the film crew showed a serious interest in his expertise and about science in general.

"They want to make a movie for the masses, but they're also interested in having scientists in the audience say, 'Hey, I recognize that,'" he said.

Cruzan said he was only stumped by a question once, when the director asked him what scientists call an experiment that goes wrong.

"Everyone on the set was looking at me," Cruzan recalled. "I scratched my head and said, 'normal'."

Noteworthy News

Chemistry Professors **Doug Gin** and **James McCusker** were awarded ACS-PRF Grants for Fundamental Research in the Petroleum Field.

Professor of Chemistry **Judith Klinman** was awarded one of the Chancellor's Professorships to support her work on enzyme catalysis. The new award, initiated last spring, provides $60,000 over three years for "distinguished achievement of the highest level in research, teaching and service."

The College's Analytical Services, headed by Adjunct Professor **Julie Leary**, secured two NSF matching grants for new apparatus worth more than $150,000.

Chemical Engineering Professor **Roya Maboudian** and Chemistry Professor **Yeon-Kyun Shin** were each awarded a $25,000 grant from the Hellman Family Faculty Fund.

Kelly Marshall, a graduate student in the Heathcock group, was awarded the 1996-97 Eli Lilly Graduate Fellowship in Chemistry for her outstanding scientific ability, creativity and leadership.

This year's **Outstanding GSI awardees**: P.J. Alaimo, Kendra Bowman, David Carroll, Sung-Wei Chen, Joanne Cho, Michael Furlanetto, David Gray, Melonie Hall, Judy Kim, Gary Olsen, Barbara Reisner, Paulus Wanandi, Newell Washburn, and Jerry Yang.

Vollhardt Named New Assistant Dean

Peter Vollhardt, a popular undergraduate professor and highly-regarded organic chemist, has accepted Dean Alexis Bell's offer to become the next Assistant Dean of the College.

"I was very honored," Vollhardt said. "There's a certain amount of trust that goes into this job."

Vollhardt is already planning for his new administrative duties, and pointed to allotment of research space as one of the most immediate issues he is facing.

"With research groups ready to move to Tan Hall, there will be a lot of musical chairs in the College," Vollhardt said. "[Allocation of space] has to be agreed upon so everyone feels they're getting a fair deal."

Vollhardt emphasized that giving each faculty member a chance to participate in the decisions is key to finding an agreeable solution.

"We're in good shape. [Former Assistant Dean] Bob Bergman really laid the groundwork for a lot of the space issues," he said.

Vollhardt said he will also begin work on refining the relationship between the College's Analytical Services and the faculty and business office.

"It's clearly a challenging job," Vollhardt said of his new position. "But, I like working with people and I think I can listen to what they say."

Cairns Back at College Full Time

Chemical Engineering Professor Elton Cairns has stepped down as Associate Director of Lawrence Berkeley National Laboratory to return to the College full time.

Cairns said that when he arrived in Berkeley in 1978, he intended to spend only five years in the Lab's administration. As five years turned to ten and beyond, Cairns said he felt a longing to return to more academic pursuits.

"Early this year, I decided that enough time had passed," Cairns said. "I am interested in spending more of my time on research and teaching."

Cairns will remain the head of the Lab's Electrochemical Research Center and its Energy Conversion and Storage Program. But, for the most part, Cairns is freed from administrative work on the hill.

"It feels good," he said. "My research is going very well."

Cairns' work involves research and development of high-performance batteries and fuel cells that can be used in very demanding applications such as electric vehicles. After a sabbatical in 1997, Cairns said he expects to begin teaching a full course load in Fall of 1998.

The *NEWSLETTER OF THE COLLEGE OF CHEMISTRY* at Berkeley is published four 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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