DEPARTMENT OF

Chemistry News

SPRING 2010 UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

A Tradition of Innovative Thinking Since 1868

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Letter from the Department Head

Except for uploading final grades, this past semester is complete, and the campus is quiet with the departure of the undergraduate students. The past two months were the busiest of my career. Serving as Department Head is a full-time job, yet I have followed the lead of all modern day department heads and happily maintained an active research program. With this full slate of activities, the head position provides a full release from teaching so by the fall I found myself having been out of the classroom for more than four years. Not only do I enjoy teaching, I feel much more connected through interactions with the students.

This past semester, I chose to team teach with Emeritus Professor Peter Beak the first semester organic chemistry course for majors (Chemistry 236). Peter covered the first half and I did the second. In addition to learning from a colleague with more than 40 years of experience, it was an outstanding chance for me to reevaluate how we teach and how students learn. There is a lot of research today suggesting that a 50-minute lecture is one of the least effective means for learning. That certainly was consistent with my observations. After about 20 minutes, despite my best efforts to talk about interesting everyday applications of the chemistry being taught and engaging the students by calling on them by name, I often saw eyes glazing over and tired heads bobbing.

One cannot mandate more sleep, but the question is: might there be a better way to teach? At the University of Illinois and throughout academia there is considerable discussion about online courses. About 40 years ago in our Department, Emeritus Professor Stan Smith pioneered the use of computers in instruction. The concept was to have available to students at anytime—provided that they had access to a PLATO terminal—chemistry tutorials that they could work at their own pace. Today the technology has advanced dramatically. Students can watch full lectures via streaming videos, they can download podcasts of faculty lectures to watch on their iPods, or they can participate in online chats with their instructor or other students.

The move to online and technology driven instruction is not without its critics. Some view it as a poor substitute for the skill of an experienced lecturer. Additionally, there is suspicion that the goal is not better teaching but cost-cutting or a desire by some faculty to spend more time on research. In most cases none of these viewpoints is supported. The effectiveness of e-learning or technology enhanced learning has considerable support. In 2009, the U.S. Department of Education published a review of 18 years of research taken from the literature and in their executive summary noted that: "The meta-analysis found that, on average, students in online learning conditions performed better than those receiving face-to-face instruction."

In the past two years, Professor Jeff Moore has been pioneering an online version of organic chemistry for non-majors that involves short video modules followed by working problems online with instant feedback and assessment, as well as in-class and online discussions. Quantitative comparison of the two approaches will be available soon. One of the challenges is that different learning styles lead different students to value different types of courses. Indeed, students are starting to ask for more than one type of delivery within our courses.

A number of other teaching strategies do not involve technology at all. One proven technique is known as Peer Led Team Learning or PLTL. The Department of Chemistry has used a variant of PLTL in its Merit Workshops for many years. These special sections of a number of lower level courses replace traditional recitation sections. The teaching assistants in the Merit Program are trained to take a hands-off approach. The students are given problems to solve with minimum guidance. They work together to find solutions and build a support structure that has been very successful at increasing learning and keeping students in chemistry.

One often hears that teaching involves both information and inspiration transfer. The chalk and chalkboard is not gone yet. For inspiration transfer there seems to be nothing that compares with direct, face-to-face contact in the classroom. Indeed, one of the most joyful aspects of my own teaching experience is watching undergraduates become excited by chemistry, with some indicating a desire to switch their major to chemistry.

Sincerely yours,

Steve C. Zimmerman
Head and Roger Adams Professor
Department of Chemistry

Elaine Fuchs Receives National Medal of Science

Over the years, Illinois Chemistry faculty and alumni have been recognized as among the best in the world. Among our ranks, we list 10 Nobel Prizes, 13 Priestley Medals and 12 National Medals of Science. The newest member of this esteemed group of award winners is Elaine Fuchs (B.S. '72, Hon. '06). On October 7, 2009 Fuchs, and eight other scientists, received the National Medal of Science, the nation's highest scientific honor, from President Barack Obama in a ceremony in Washington D.C. During the ceremony, President Obama stated that, "These scientists, engineers and inventors are national icons, embodying the very best of American ingenuity and inspiring a new nation generation of thinkers and innovators. Their extraordinary achievements strengthen our nation every day – not just intellectually and technologically but also economically, by helping to create new industries and opportunities that others before them could never have imagined."

Fuchs grew up outside Chicago, surrounded by a family of scientists; her father, aunt and sister were also scientists and encouraged her to pursue higher education. Fuchs took their advice and headed to Champaign-Urbana to pursue a degree in Chemistry. Here, in addition to carrying out thesis research on the electrodiffusion of nickel through quartz, she learned the problem-solving skills that served her throughout her career. After graduating from Illinois in 1972 with highest honors in Chemistry, Fuchs pursued her Ph.D. at Princeton [in biochemistry] and then carried out postdoctoral work at M.I.T. It was during her time at M.I.T. that Fuchs discovered her life's work in the area of skin biology. She accepted a faculty position at the University of Chicago in 1980 as the first woman in the biochemistry department. At Chicago, she rapidly rose through the ranks ultimately being appointed the Amgen Professor of Molecular Genetics and Cell Biology. In 2002 Rockefeller University recruited her away from Chicago. Currently, Fuchs serves as the Rebecca C. Lancefield Professor and head of the Laboratory of Mammalian Cell Biology.

Fuchs' ground-breaking research into the mechanism of skin renewal has been recognized around the world. She explained her outstanding research on human skin in a commencement address at the University of Chicago as follows:

"I explore how [skin] functions at a molecular level to keep microbes out, to keep body fluids in so we don't dehydrate, and to protect us from the mechanical and physical stresses of our environment. Through elucidating the normal functions of the skin, my laboratory has been guided to the genetic bases of different types of inherited and acquired disorders of the skin, ranging from severe blistering to skin cancers."

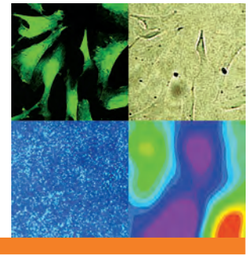
Fuchs states that her research on how skin stem cells are constantly replacing and repairing the body is a joy because of the complex challenges they present. Ironically, during her time at Illinois, what was appealing about physical chemistry was the comparative simplicity of the problems, each of which had a solution. She likened these problems to those presented by crossword puzzles.

"I'm sure it's an unfair comparison, since I only have my undergraduate youth to go on for experience. When I was [working] in physical chemistry [at Illinois], I felt that problems had solutions, and I got an enormous sense of joy in solving equations. If there are an appropriate number of variables, the problems were challenging but solvable. But in biology there are far too many variables and you can't possibly solve the equation.

At the height of my excitement for crossword puzzles, [I was] feeling a sense of delight in taking physical chemistry exams [at Illinois]. In making the transition to biology, I struggled with [the field's] uncertainty; I found it very frustrating that I could never solve the problem. But that's the excitement for me now; that you can't solve the problem, that every time you come close, there's some new dimension, some new twist, and every new twist becomes an avenue for exploration. You have to be a passionate scientist to crave the uncertainty of science." *Nature Reports* http:www.nature.com/stemcells/2009/0905/090514/stemcells

Fuch's undaunting passion for science has led to outstanding scientific breakthroughs and numerous awards and recognition. Dr. Fuchs has been a Howard Hughes Medical Institute Medical Investigator since 1988 and was elected a member of the National Academy of Sciences in 1996. Fuchs has served as a role model and been a champion for women in science. In 2006 Fuchs came back to her alma mater to receive an Honorary Degree. This spring she will also make it back to campus to give the commencement address for the 2010 graduating class….inspiring the next generation of Illinois award winning scientists. ■

Chemistry Alumna Returns to Alma Mater: One on One with Catherine Murphy



We would say welcome to Illinois, but you received your bachelor's degree here. What it is like coming back to your undergraduate institution?
I think it would have been a little weird to come back right after my postdoc at Caltech—but now it has been long enough (23 years) that I do not feel like Tom Rauchfuss' undergrad anymore! Illinois is a great place, and both my husband, Bob, and I were thrilled at the chance to be back home.

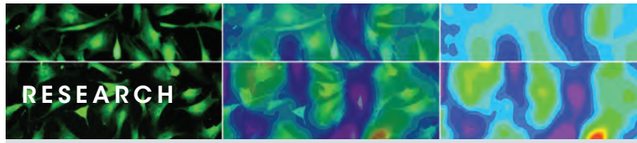
How has the department changed?
In some ways not at all: the inorganic faculty members here have remarkable staying power. Noyes Lab and Chem Annex look and smell just the same to me. But there are, of course, many changes since I graduated with my bachelor's degrees (actually two, one in chemistry and one in biochemistry) in 1986. We have a new building, Chemical and Life Science Laboratory (CLSL). We have the Institute for Genomic Biology (IGB) and the Beckman Institute, facilities that my graduate students and I have been visiting to see what tools and expertise are available. We have more women on the faculty—in fact, I am not even sure if chemistry had any women professors when I was here.

Do you have any special memories of your time here as an undergraduate?
I remember one of my first undergraduate research experiments very well. I was a second-semester freshman and starting to do research in Tom Rauchfuss' lab, which was on the third floor of Noyes at the time. I had class until 7 p.m. so I did not get to the lab until 8 p.m. Len Bogan was my graduate student mentor then; Gregg Zank and Dean Giolando were the grad students I worked with a lot later. Len had an iron carbonyl cluster that he wanted to acidify. He gave me a syringe filled with an acid solution that had a very long needle. He stuck the needle through the rubber septum of his three-necked flask and told me to drip in the acid very, very slowly or else the reaction would explode. I was very nervous, of course, so I stood there until midnight, slowly dripping in the acid. Len himself went in and out, offering to get me a candy bar, but I was too fixated on not exploding to be able to eat anything, or even let go of the syringe. At the end of the whole process Len complimented me on a job well done; only later did I learn that there were such things as addition funnels which could have done the job just as well!

My favorite lecture classes were accelerated general chemistry with Steve Zumdahl and inorganic chemistry with Tom. I also have a very vivid memory of John Katzenellenbogen waving his arms to demonstrate symmetric and asymmetric stretches of CO_2 in organic lab.

You are widely regarded as one of the world's pioneers in the synthesis of nanoparticles with controlled shapes and sizes. Tell us about this work and its potential applications.
We work with gold and silver nanoparticles, which have brilliant colors that change depending on the particles' size and shape. We try to make these particles in the easiest way possible—in water, in air, at room temperature. From my Illinois experience I highly value undergraduate research, and the more we can make our syntheses amenable for undergraduate work (and for use by anyone), the better. The applications of these particular nanomaterials just keep growing, all of which ultimately result from the control we have of particle shape and size, and therefore how much light the particles absorb at different wavelengths. For example, we do experiments where we sprinkle our particles in a deformable protein gel, put living cells on top, and when the cells move around on the gel, they move our particles. With the imaging setup we use, we are able to map out positional displacements of the nanoparticles without getting any interference from the cells, and can translate our raw data into the strain fields that the cells induce on their local environment. This is valuable information especially for the cells we are using: heart cells, which continually assess and respond to their local mechanical environment. We also have used our nanoparticles for chemical sensing via surface-enhanced Raman scattering, which is a vibrational technique that requires, for good signals, the presence of metal nanoparticles. Finally, we have made gold nanorods that absorb light at a certain wavelength; if we functionalize the surface of the nanorods properly, we can target pathogenic bacteria and kill the bacteria by shining the right wavelength of light. So, the applications span chemical detection, biological imaging and cellular therapeutics. Since we arrived at Illinois a few weeks ago, we are starting to talk to other research groups about other applications of our materials. I'm sure our list of applications will grow!

You are now a co-author with Ted Brown on the latest edition of Chemistry: the Central Science, a widely used general chemistry textbook. What got you interested in working on textbooks?
At the University of South Carolina, my former institution, I ended up teaching general chemistry for nine years. I really enjoy general chemistry (it's amazing how much chemical research goes back to the basics there), but it never occurred to me to work on a textbook until Bruce Bursten, one of Ted's co-authors, contacted me about the possibility of joining the author team. The three authors (Ted, Gene LeMay,and Bruce) were getting to the age range where they wanted younger co-authors to carry the book into the future. I had known Bruce from the ACS Division of Inorganic Chemistry, when we were both officers, and also I had spent a bit of my sabbatical at Ohio State when Bruce was chair there. Ironically, I had never used Chemistry: the Central Science myself either as a student or as an instructor, but when I started to read it, I thought: "If I was going to write a textbook by myself, it would sound just like this!" Our current author team is Ted, Gene LeMay, Bruce, myself and Pat Woodward of Ohio State. It is a pleasure to work with such outstanding scholar-teachers, and I feel like my own knowledge of chemistry keeps improving all the time as a result of working on this book. ■

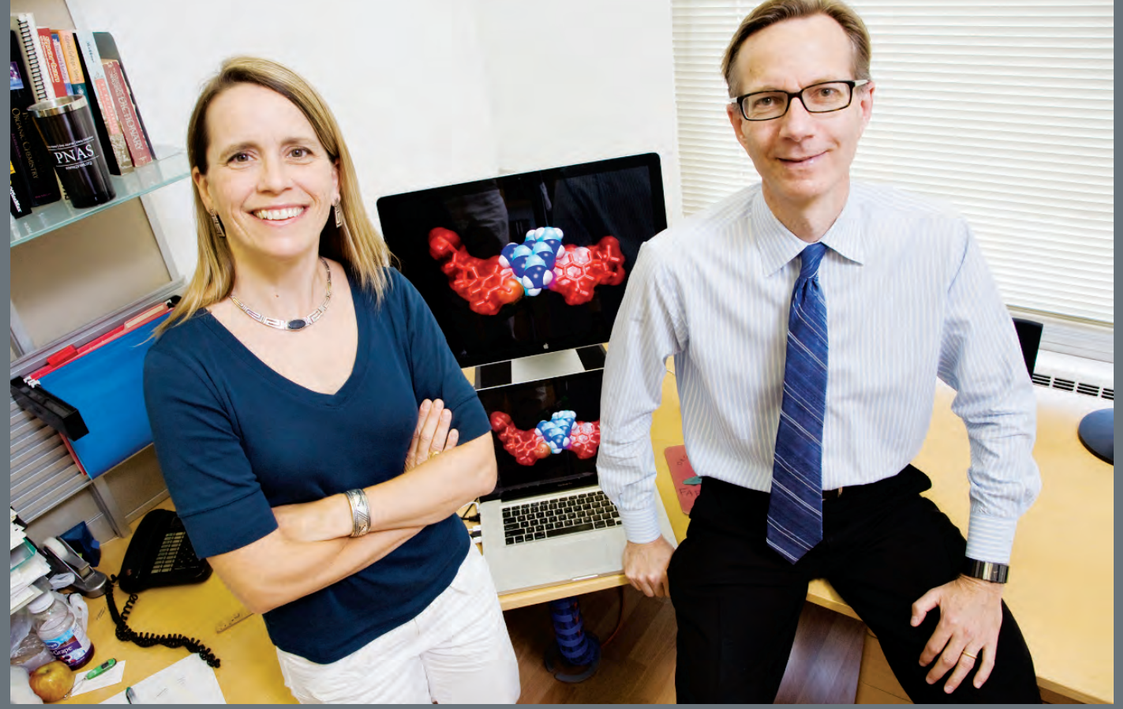


Research in Catherine J. Murphy's group is at the interface of materials chemistry, inorganic chemistry, biophysical chemistry and nanotechnology. Their primary goal is to develop inorganic nanomaterials for biological and energy-related applications, and understand the chemical interactions of these nanomaterials with their surroundings. A range of projects are currently being pursued:

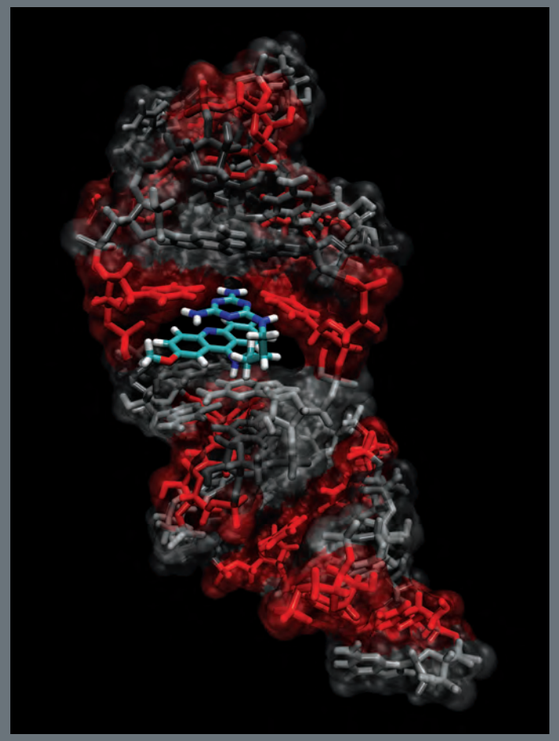
Inorganic Nanoparticle Fabrication and Functionalization
"Finely-divided metals" such as gold, silver and copper have been known since Roman times for their brilliant colors. These brilliant colors arise fundamentally from the interaction of light with the conduction band electrons in these nanoscale metal particles, producing what is known as a plasmon resonance at particular optical frequencies. Nanorods, compared to nanospheres, have multiple plasmon bands whose position and intensity are intimately connected to the size, shape, degree of aggregation, and local dielectric environment of the nanorods. The absorption and scattering of light by gold and silver nanorods can be tuned throughout the visible and near-infrared portions of the electromagnetic spectrum. Group members have developed a set of synthetic approaches to fabricate gold and silver nanorods of controlled size and shape in high yields. Molecules can be placed on the nanorod surface using covalent attachment chemistries or polyelectrolyte layer-by-layer adsorption to position them at desired distances, and possibly orientations, from the nanoscale metal surface. On-particle reactions are being explored to improve the compatibility and ease of processing these materials. Copper oxide and other oxide nanomaterials are of interest for solar energy and energy storage applications.

Cellular Imaging, Chemical Sensing, and Photothermal Therapy Using Gold Nanorods
The strong plasmon bands of noble metal nanoparticles make them ideal for biological sensing and imaging applications. The Murphy Group has used the elastic light scattering properties of gold nanorods as "nano strain gauges" to measure the deformation of soft matrices by living cells. The inelastic light scattering (Raman) properties of gold nanorods can be used to interrogate the local chemical environment of the nanorods. Irradiation into nanorod plasmon bands causes large temperature jumps in the local environment, which group members have exploited as a way to kill pathogenic bacteria (once the nanorods are surface-modified to recognize the bacteria).

Environmental Implications of Nanoparticles
How are nanoparticles distributed and modified in complex biological systems? Can nanoparticles sequester or deliver small molecules across interfaces? How do these processes depend, if at all, on nanoparticle size, shape, aggregation state, and surface chemistry? The Murphy Group seeks to address these questions using a battery of analytical, physical and biochemical techniques.



Chemistry professors Anne Baranger and Steven Zimmerman and their colleagues designed a small molecule that prevents an abnormal RNA from binding to a protein that normally splices other RNAs.



Small Molecule Inhibits Pathology Associated with Myotonic Dystrophy Type 1

Researchers at the University of Illinois have designed a small molecule that blocks an aberrant pathway associated with myotonic dystrophy type 1, the most common form of muscular dystrophy.

The new compound, soon to be tested in cells, binds tightly to its target, an abnormally elongated RNA that hijacks part of the normal cellular machinery and brings on symptoms of the disease. The newly developed compound is the first to show high selectivity in binding the target while not disrupting other important RNA functions. The study appears in the September 8, 2009 issue of the Proceedings of the National Academy of Sciences.

Myotonic dystrophy type 1, a muscle degeneration disease that so far is untreatable, affects about one in 8,000 people worldwide. Some cases are mild, but others lead to a debilitating loss of muscle control, declines in organ function and other potentially life-threatening conditions.

Scientists have recently identified a primary causative agent of the disease, a mutant version of a gene, called DMPK, which contains an excessive number of tri-nucleotide repeats. Nucleotides are the chemical letters that spell out the sequence of a gene, and the normal version of the DMPK gene includes five to 34 cytosine-thymine-guanine (CTG) repeats. The mutant version of the gene includes 50 to as many as 10,000 CTG repeats.

"The longer the repeat the worse the disease and the earlier the onset of the disease," said U. of I. chemistry professor and department head Steven Zimmerman, who co-led the research with his colleague, chemistry professor Anne Baranger.

When the mutant DMPK is transcribed into RNA, the first step toward building a protein, these (now CUG) repeats bind to a cellular protein, MBNL, which normally splices other RNA transcripts. The bound MBNL cannot function properly, causing a cascade of negative effects in the cell. Improperly spliced RNAs lead to improperly formed proteins.

Preventing the MBNL protein from binding to the CUG repeats has been shown to ease the symptoms of the disease.

"The RNA is the primary target" for drug design, Zimmerman said. "It's quite clear that if we can bind to the RNA and displace the protein, it's very likely to relieve the symptoms."

The CUG repeats in the aberrant RNA are an ideal target for drug development because they are not found in any other known RNA molecule, Baranger said.

"They don't have a normal function, so it's okay to bind to those repeats," she said. "You certainly don't want to target the protein because you want it to go perform its normal function."

In the course of basic research into compounds that bind to DNA or RNA, the researchers designed a molecule that would selectively bind to T-T or U-U mismatches in DNA or RNA, respectively. (Mismatches occur when two nucleotides in a double-stranded molecule are improperly paired, as occurs in the CTG repeats in the mutant DNA and the CUG repeats in the RNA.) Their compound, which they call Ligand 1, binds to the region of excessive repeats in both the RNA and DNA from the aberrant DMPK gene. More importantly, Ligand 1 prevents the MBNL protein from binding to the RNA.

The newly developed compound is the first to show high selectivity in binding the target while not disrupting other important RNA functions.

Further tests revealed that the new compound has significantly lower affinity for other mismatches in DNA or RNA. Baranger's lab also tested the compound on other normal protein-RNA complexes, and found that it did not disrupt those interactions.

This last finding was critical, Zimmerman said.

"The danger is if you make something that binds to RNA or DNA, it's going to bind to all these other molecules and disrupt those complexes, so you help one problem but you cause all these others. Our molecule doesn't do that."

Zimmerman and Baranger, with their colleague, chemistry professor Paul Hergenrother, are the recipients of a new five-year nearly $2 million grant from the National Institute of Arthritis and Musculoskeletal and Skin Diseases at the National Institutes of Health to pursue this research. ■

By Diana Yates, Illinois News Bureau Life Sciences Editor

A Moment with Mark Pytosh

Mark A. Pytosh (B.S. '86), the Chief Financial Officer of CSS Corporation, is one of the University of Illinois' most loyal and successful alumni. Currently, he is serving on the University of Illinois Foundation Board of Directors and has made the lead gift to the Department of Chemistry's new Vision 2020 Fund.

Mark left Urbana in 1986 to work on Wall Street, gaining considerable experience in investment banking at Donaldson, Lufkin & Jenrette and Kidder, Peabody over a 15-year period. In 2000 he joined Lehman Brothers serving as a Managing Director in Investment Banking and led the firm's Global Industrial Group. He then moved to Waste Services, Inc., a publicly-traded, integrated waste services company, serving as Executive Vice President and Chief Financial Officer. In 2006 he joined Covanta Holding Company, but just last month joined CSS Corporation of Calgary, where he is the Chief Financial Officer. We caught up with Mark to find out more about CSS Corporation and how his degree in chemistry prepared him for his remarkably successful career.

You just joined the CSS Corporation. What can you tell us about CSS Corporation and your new role in the company?
CSS Corporation provides energy and environmentally responsible services to upstream and downstream oil and gas companies in Canada and the U.S. I am the Company's Chief Financial Officer in charge of all of the financial functions and strategy for the company.

You previously worked for Lehman Brothers and Waste Services, Inc. How did your bachelor's degree in Chemistry from Illinois prepare you for such different companies and positions?
While I never have been a practicing chemist, my education instilled in me analytical tools that have become invaluable and applicable to the field of finance. Some of the key building blocks I learned at the University of Illinois include analytical problem solving, logical thinking, intellectual curiosity and comfort around technical matters in the operations in business.

Do you have any special memories of your time at Illinois that you'd like to share?
The one experience that I would share is how I decided to move to New York. In my senior year, there was a visiting professor named David Paisley who had received his Ph.D. in Chemistry from the University of Illinois (Ph.D. with Marvel, '61). He had a long, distinguished career on Wall Street and decided to give back to the University by teaching a business-oriented course for chemists. I took his course in my senior year and he served as a mentor for me because I wasn't sure what I wanted to do after graduation. David Paisley convinced me that I had the background and skills to work on Wall Street and that gave me the courage to seek a job in New York. Without meeting him, I would have had a completely different career.

You are a native of Kankakee, Ill. and spent your college days in Urbana. How did you like living in Manhattan for so many years?
In 1986 I moved from Champaign to New York and have always lived in New York. The transition to the city was not easy but there is so much to be gained in terms of culture and activities. At the same time I am equally comfortable returning to campus and removing myself from the frenetic pace of New York. I believe that the Midwestern values that I grew up with and were reinforced at Illinois have helped me greatly in my career.

You have been a significant donor to the Department of Chemistry, most recently, donating $100,000 to the new Vision 2020 fund. Could you tell us your reason for giving?
I feel fortunate to have received a great education at the University of Illinois driven by my degree in Chemistry. The Department is one of the best in the United States and perhaps, the world. If I can contribute to maintaining the high standards of the Department so that future undergraduate and graduate students can benefit from this high quality education it would be very satisfying. I have been fortunate to have had success in my career and this is a way to pay back the University for setting me on that path.

Vision 2020 is a newly established endowed fund, which has the ambitious goal of raising a $20 million endowment for Chemistry by the year 2020. What aspects of Vision 2020 made you want to donate to this fund?
The Vision 2020 endowment fund is one of the critical tools I believe is needed for the Department of Chemistry to maintain its excellence in perpetuity. Due to the great financial pressures the University is feeling because of declining support from the state of Illinois that will likely persist in the future, it is imperative for private donors to provide their support to the University to help make up the shortfalls. I also like that Vision 2020 will provide the leadership of the Department some flexibility and funding to address evolving critical needs. Conditions and issues change over long periods of time and the Chemistry Department's leadership needs the flexibility to address the urgent needs as they evolve.

How has your position as a University of Illinois Foundation Officer and Director affected your appreciation for the giving needs of the institution?
There are several aspects about my involvement in the Foundation that are interesting. First, it keeps me closer to the University and provides a great deal of awareness of the current events and dynamics. Second, it allows me to make an effort to help the University further its objectives through the activities of the Foundation. And finally, it allows me to visit Champaign regularly to stay in touch with friends and staff at the University and alumni friends who I see at meetings or social events. Personally, it feels like I am returning home by keeping my roots in Illinois. ■

Marion Sparks
Former Chemistry Librarian Continues to Influence Today's Students

The Chemistry Library is a place where students study, do research and learn about chemistry literature and resources. The library staff keeps track of how many students are in the library and the resources they are using. This is normal procedure at present, in 2009, and it was also the way things were done in 1911, when Marion Sparks started her new position as Library Assistant in the Chemistry Library.

Miss Sparks came to the University of Illinois as a student in 1892, the same year that the chemistry collection became a separate entity from the main library. She studied the classics, earning a bachelor of arts degree in 1895. While enrolled she took courses in languages, including Greek, German, Latin and French, and she worked in the University Library. In 1899 she earned a second bachelor's degree in library science. She then went back to the classics, earning a master's degree in 1900. Finally finished with her studies, she gained employment at the Urbana Free Library and later worked at many libraries throughout the Midwest in Illinois, Indiana, Kansas and Michigan.

Returning to Urbana in 1904, Marion Sparks was again employed by the University Library and worked to create the first catalog of the chemistry collection. By 1911 she was named Library Assistant in the Chemistry Library, and in 1913 her title was changed to Chemistry Librarian. She held this position until her death in 1929. After many years of various library positions, she found her niche in the Chemistry Library.

Her letters of recommendation from the early 1900s praise her abilities and describe her as having "unfailing industry, always devoting herself conscientiously to any tasks" (Letter of Recommendation, 1910). However, Miss Sparks appears to have been an independent woman who did not necessarily concern herself with social niceties and fashions, traits that also were mentioned in her letters of recommendation. Her direct manner may have been an asset, though, in dealing with the scientists in the Chemistry Library. The 1915 Illinois Chemist contained a word of advice for juniors in chemistry to seek out Miss Sparks, "our genial librarian," because "her only joy in life is in helping you" (Zeen, 1915).

Teaching seems to have been a long-time interest of Marion Sparks. While in high school she wrote an essay entitled, "How I would teach arithmetic" (Essays, n.d.). As part of her Chemistry Library duties in 1912 she began giving library research lectures, and her lectures became a required course for juniors. Her class notes became a self-published book, Chemical Literature and Its Use. Copies were purchased by academics and those in the private chemical industry. She wrote numerous articles, especially for Illinois Chemist, a publication of the University of Illinois Chemistry Department, and continued her scholarly writings on chemical literature. Her interests included additional topics, as well. For example, as a student at Illinois, she contributed a description of a meteor sighting in Urbana to Popular Astronomy (Sparks, 1897).

Later, in 1905 she researched and wrote an article on how the "new" electric cars were affecting the local bird population (Sparks, 1905).

Marion Sparks was a holistic librarian long before the term became commonplace to describe librarians who are skilled in many areas—cataloging, public service and everything in between. Her language skills helped her sift through the increasing amount of chemical literature and served her patrons as she translated articles for their use. She offered interlibrary loan from the Chemistry Library, typing articles for use by patrons, created bibliographic access to materials and all the while continued her research. The Chemistry students appreciated her efforts and her involvement in their clubs and activities. Her concern for them is evidenced by the letters of correspondence as some went off to fight in World War I, and her many pictures of graduating chemistry students are included in the University Archives.

Her influence is still felt in the Chemistry Library today, as the work she did continues in new ways. Her memory will live on and new generations will know her through the plaque that hangs in the library in her memory. ■

By Meg Griffin, Graduate Assistant, Chemistry Library

Marty Burke Honored by
Howard Hughes Medical Institute

Two University of Illinois professors, Martin D. Burke, a professor of chemistry, and Maria Spies, a professor of biochemistry, have been named Howard Hughes Medical Institute Early Career Scientists.

Burke and Spies are among 50 scientists chosen from a national competition of more than 2,000 applicants to identify the best biomedical researchers and provide them with flexible funding to develop scientific programs of exceptional merit. HHMI sought scientists in all areas of basic biological and biomedical research, and in areas of chemistry, physics, computer science and engineering that are directly related to biology or medicine.

The award allows "promising scientists to pursue their best ideas during this early stage of their careers," said Thomas R. Cech, the President of the Institute.

The Maryland-based Institute is a private philanthropy dedicated to supporting biomedical research and science education in the United States.

Each Early Career Scientist is awarded his or her full salary, benefits and a research budget of $1.5 million over the six-year appointment. The Institute also will cover other expenses, including research space and the purchase of critical equipment, allowing the researchers to devote their time and energy to making discoveries in the laboratory and mentoring the next generation of scientists.

Burke excels at creating ways to generate diverse chemical compounds, including "small molecules that can imitate proteins that malfunction in diseases," the Institute said.

Burke calls the compounds "molecular prosthetics" because he hopes they may be able to help a person compensate for missing or dysfunctional proteins, much like a prosthetic limb can substitute for one lost to injury or disease. Burke believes such a chemical prosthesis could be the prototype for treating a number of diseases caused by protein deficiencies, including cystic fibrosis.

"The Department of Chemistry is very proud of Marty's selection as an HHMI Early Career Scientist," Department Head Steven C. Zimmerman said. "He offers a rare combination of talents. He has demonstrated considerable skill as a synthetic organic chemist, having developed powerful new methods for preparing complex natural products and their analogs. At the same time, thanks to his training as a medical doctor, he is driven to find new therapeutic approaches to disease that harness his synthetic skills but with an eye toward what is likely to be best for the patient."

"These scientists are at the early stage of their careers, when they are full of energy and not afraid to try something new," said Jack Dixon, Vice President and Chief Scientific Officer of the Institute. "They have already demonstrated that they are not apt to play it safe – and we hope they will continue to do something really original."

Four other UI faculty members have received HHMI awards. Chemistry professor Yi Lu was named an HHMI professor in 2002; physics professor Taekjip Ha became an HHMI investigator in 2005; and cell and developmental biology professor Phillip A. Newmark and chemistry professor Wilfred A. van der Donk were named HHMI investigators in 2008. The Urbana campus has received numerous educational grants from the Institute, beginning in 1993.

Burke and Spies will begin their six-year, non-renewable appointments to HHMI in September 2009.

More information can be found on the HHMI Web site: www.hhmi.org/press. ■

By Phil Ciciora, Illinois News Bureau News Editor


Scott Denmark


Deborah Leckband


Thomas Rauchfuss


Steven Zimmerman

12 Illinois Chemists Faculty Among the First
American Chemical Society Fellows

Four current faculty, Scott Denmark, Deborah Leckband, Thomas Rauchfuss and Steven Zimmerman, two past faculty, David Chandler and E. J. Corey, and six Illinois alumni, Michael T. Bowers (Ph.D., '66, Flygare), Daryle H. Busch (Ph.D., '54, Bailar), H. N. Cheng (Ph.D., '74, Gutowsky), Marcetta Y. Darensbourg (Ph.D., '67, Brown), Glenn Fuller (Ph.D., '53, Leonard), Carl R. Johnson (Ph.D., '62, Leonard), were among the first group of scientists elected Fellows of the American Chemical Society (ACS). The ACS Fellows Program recognizes members of the American Chemical Society "for outstanding achievements in and contributions to Science, the Profession and the Society."

A ceremony was held August 17, 2009 in Washington, D.C. to recognize the 162 inaugural fellows. These individuals "share a common set of accomplishments, namely true excellence in their contributions to the chemical enterprise coupled with distinctive service to ACS or to the broader world of chemistry," stated Immediate Past-President Bruce E. Bursten, who championed creation of the program and shepherded it through board approval last year.

Although ACS is late among professional societies in creating a fellows program, "it has many advantages beyond celebrating the excellence of our own," Bursten says. "It will also provide recognition of our members to constituencies outside ACS, such as employers, other scientific societies, and civic groups."

Fellows come from the entire breadth of ACS's membership and the chemical enterprise—including high school teaching, entrepreneurship, government service and all sectors of industry and academia. Academic chemists make up 72% of the new class of fellows with 15% from industry, 7% retired nonacademic, 5% government and 1% consultants. ■

The Department of Chemistry wishes to thank these donors for their continued and generous support of our research and teaching mission.

The list of donors includes individuals who have directed their gifts to the Department of Chemistry between July 1, 2008 and June 30, 2009.

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Alumni Notes

We'd like to hear from you. To submit your alumni note visit chemistry.illinois.edu/alumni/chem_alum_news.html

Christopher W. Bielawski (B.S. 1997, Moore) is the recipient of The 2009 Journal of Physical Organic Chemistry Award for Early Excellence in the field of Physical Organic Chemistry. The award is given annually to recognize the accomplishments of an individual working in the field of physical organic chemistry or applying the principles of this field to other areas. Professor Bielawski is a faculty member at The University of Texas at Austin.

Louis L. Lee (B.S. 1998) earned his Ed.D. in Educational Leadership in May 2009 at Lewis University (Romeoville, IL). He was one of four who were the first graduates of their doctoral program. Read about their conferring of degrees where the speaker was U.S. Secretary of Education Arne Duncan. http://lewisu.edu/news/Newsarticle.htm?PArticleID=4359

Sander (Sandy) Mills (Ph.D. 1983, Beak) has been promoted to Site Head for Rahway in the basic research area of Merck & Co., Inc.

Michael P. Jennings (B.S. 1997, Beak) is the recipient of an NSF-CAREER award in March of 2009. He also received tenure and a promotion in August to associate professor, while also becoming the Director of Undergraduate Studies in the Chemistry Department at the University of Alabama.

Kevin Sill (B.S. 2001, Moore) has been selected as the Young Innovator of the Year by R&D Magazine for designing the IVECT Method, which allows drug-carrying micelles to bind to and release their contents into targeted sites. Sill is the Chief Science Officer at Intezyne Technologies, Inc.

One on One with Alfred Baca

What can you tell me about your personal background? Did your family attend Illinois? Where are you from?
I was born in Los Angeles, CA., and I grew up in La Puente, CA., which is 30 miles east of Los Angeles. My father, Alfred Baca, is from Ecuador, South America and my mother, Ana M. Baca, is from El Salvador, Central America. Neither of my parents attended Illinois nor received their education in the US. I met my beautiful wife, Dulce C. Baca when I was 19, and we have been married ever since. We have two wonderful children: Athena N. Baca and Nicholas J. Baca.

Can you tell me about your educational background? Where did you study and what were your plans for college education when you came here?
I started this long journey at Mount San Antonio Community College in 1996 and then transferred to California State University, Los Angeles, where I received my Bachelor's of Science degree in Chemistry in 2004. Afterward, I pursued a Ph.D. in Chemistry under the direction of Professor John A. Rogers. I was a fellow of Science and Mathematics for Research Transformation (SMART) from 2006 to 2009.

What led you to Chemistry at Illinois?
In the fall of 2003, I was debating whether I wanted to pursue graduate school or find a job since I had a family to support. Consequently, I missed most of the deadlines for applying to various graduate schools. However, Illinois Chemistry has a later deadline, so it was one of the few schools to which I was able to apply. I was accepted to various schools and visited most of them, but when I came to Illinois during grad recruitment weekend, I was impressed by the great research facilities and all of the great science that was going on in the Department of Chemistry. Therefore, I decided to attend Illinois. Unfortunately, I had to defer a semester, but I ended up starting in the spring of 2005, which was primarily facilitated by Professor Alexander Scheeline's advice and guidance. So, I guess one could say that Professor Scheeline led me to Illinois.

Will you tell us about your research and focus?
My research focus is in the general area of macroelectronics, also known as large area, bendable electronics. The goal is to fabricate collections of semiconductor form factors in the shape of wires, ribbons or bars by using special etching techniques. These form factors are subsequently assembled by a 'stamping' method into optical and electronic systems for various applications.

What are your plans following graduation?
Upon completion of my degree, I have decided to be a member of the chemistry staff at the Naval Air Warfare Center, Weapons Division, China Lake, CA. While there, I will develop my own research program, which will leverage the graduate work that I developed here at the University of Illinois. I am interested in developing unconventional electronic and optical systems for naval applications.

Alfred has been a great student. We'll really miss him when he graduates and leaves to his job at Naval Research Laboratory in China Lake, CA. Alfred has an enthusiastic and optimistic approach to research that is really refreshing. He is also extremely talented in the lab. He'll certainly be a leader in chemistry and materials science for many years to come.

John Rogers, Founder Professor of Materials Science and Engineering and Department of Chemistry

What are your thoughts on your time here in Chemistry at Illinois? Any special recollections or experiences that stand out to you?
Interacting with Professor John Rogers has been an invaluable experience. He has been and will be a wonderful mentor of mine. I was able to learn firsthand from one of the best scientists in the world. I really appreciate his help and guidance through the years. Also, Professor Scheeline is one of the main reasons why I am here in Illinois. He really was persistent in making sure that I gave graduate school a chance. Also, when I wanted to leave with a master's degree, Professor Scheeline and Dorothy Gordon made sure that wasn't going to happen. I was also fortunate enough to secure a fellowship, which made things go much smoother. I am forever indebted to them and appreciate their guidance and support. ■

In Memoriam

Richard E. Heckert
On January 3, 2010, the Department of Chemistry lost a dear friend and colleague, Dr. Richard E. Heckert. A full obituary and reflection on Dr. Heckert's life will be featured in the next edition of Chemistry News.

William E. Ranz, 87, of Edina, MN, passed from this life on October 20, 2009. He was born in Blue Ash, Ohio where he grew up. A decorated WWII veteran, he graduated from the University of Cincinnati, and later he received M.S. and Ph.D. degrees in Chemical Engineering from the University of Wisconsin–Madison. After working at the University of Illinois, Cambridge University–England and Pennsylvania State University, Ranz became a long-time member (1952-1992) of the faculty of the Department of Chemical Engineering at the University of Minnesota. He enjoyed his work immensely, especially the interaction with both undergraduate and graduate students. In 1965 he was recognized with a University of Minnesota Distinguished Teaching Award. His students often honored him as a tough, but enjoyable, part of their march to graduation in annual Senior Banquet skits. He enjoyed roasting them in return. After retiring, Ranz enjoyed traveling throughout the world with his wife, Virginia, and visiting his children and expanding bunch of grandchildren. Ranz is survived by his loving wife of 35 years, his children and their families: Beth Ranz Riggs of Miles City, MT, Christina Ranz Cavin of South Burlington, VT, Roger A. Ranz of Shelburne, VT and Jennifer Ranz of Greensboro, VT, his sisters-in-law, nieces and grandnieces in Minnesota, Ohio and beyond. A celebration of his life is being planned for the near future. The family requests that any gifts in his memory be directed to the William E. Ranz Fellowship Fund, Department of Chemical Engineering, University of Minnesota.

Richard L. "Doc" Kieft, 64, of Monmouth, Ill., died Wednesday, Sept. 16, 2009, at Great River Hospice in West Burlington. Born April 27, 1945, in Danville, Pa., he was the son of Lester and Norma Kieft. Kieft was a full-time member of Monmouth College's chemistry department from 1975 to 2006 and member of the college's board of trustees for three years. He worked two years as a postdoctoral teaching associate at Tulane University. He graduated from Lewisburg High School in Pennsylvania. He earned a bachelor's degree in chemistry at Dickinson College and doctoral degree in chemistry at the University of Illinois Urbana-Champaign. He was the first recipient of the Sears-Roebuck Foundation Award for Teaching Excellence and Campus Leadership in 1988 and was selected "professor of the year" by the student body in 1995. He was the first professor honored with the Garrett W. Thiessen Chair of Chemistry created at Monmouth College in 2002. He was selected as an Outstanding Young Man of America for 1980. Kieft was a member of Faith United Presbyterian Church, where he served as an elder and was a supporter of Light Eternal Medical Clinic in Kandithankulam, India. He was a member of the board of Warren County YMCA, Warren County United Way and Warren Achievement Center. He served as adviser to Zeta Beta Tau fraternity for 25 years, and he was the college's faculty athletic representative for 15 years. Survivors include two brothers, John Kieft of Colorado Springs, Colo., and James Kieft of Charlotte, N.C.; two nieces; and one nephew.

Chia-chen Chu (Cecilia) Kang, 86, a Princeton resident for 42 years, died June 22, 2009 at home. Born in Shanghai, China, she immigrated to the United States to get her advanced degree in chemistry. While at the University of Illinois, she met and married Chi Lung (Charles) Kang. At a time when women rarely had significant careers, she had a distinguished career as an analytic chemist with M.W. Kellogg, culminating in her becoming responsible for the analytic chemistry department of the company. She left the company to develop her ideas to increase the efficiency of converting coal to gas, and received multiple patents. Her success in her career enabled her to honor her father by establishing a fellowship at the University of Illinois so other Chinese women could have the same opportunities for success as she had. She is survived by her husband of 58 years, Chi Lung Kang, Princeton; two sons Jeff, West Hartford, CT., and Ray, Orono, MN; three sisters, Baofen Zhu, South River, NJ; Jiaofeng Zhu, East Brunswick, NJ; Jiacui Zhu, Shanghai, PRC; three brothers, Jiapeng Zhu, East Brunswick, NJ; Jiakun Zhu, Piscataway, NJ and Jiahong Zhu of Shanghai, PRC; five grandchildren and numerous nieces and nephews.

James G. Theivagt
On May 9, 1928 Lafe and Rita Theivagt celebrated the birth of their eldest child and son Jim in Bloomington, IL. When Jim spoke of growing up in neighboring Normal, IL it was about his lifelong friendship with his sister Peggy and about how his extended family supported one another during the Depression. Jim gained fame playing baseball for local teams and Normal Community HS. (Class of 1946) Jim honorably served the US Army from 1946-1948; stationed in Whittier, Alaska and Ft Lawton, WA. He was a recipient of the WW2 Victory medal. Jim returned home to attend Illinois Wesleyan, Bloomington, IL and earn a B.S. degree in chemistry at the University of Illinois at Urbana-Champaign. Jim was proud of his alma maters and established the James G Theivagt Class of 1952 Scholarship Fund for outstanding students majoring in chemistry and is a member and financial contributor of the William Albert Noyes and Roger Adams Club at Illinois.

Abbott Laboratories of North Chicago, IL recruited Jim in 1952 as an analytical chemist. For 34 years this was his life's work. Jim is credited with many patents and scientific papers, was certified as a Quality Engineer by the American Society for Quality Control and a member of the American Chemical Society and the American Association for the Advancement of Science. Jim lived in Lake County, IL the rest of his life. He married Abbott coworker Alice Hoffmann of Kenosha, WI and they raised their children in the Mundelein and Waukegan areas. Jim died at his Beach Park home surrounded by family on December 15, 2009. Jim's hobbies were reading and collecting. He combined his passion for airplanes and photography by earning his pilot license and taking aerial photos. He liked all types of music and movies. Jim was a keen observer of nature and loved history, historic places and maps. Pack his maps and photo gear and he was ready for a field trip. Jim was always interested in the newest gadget. Jim is survived by his beloved sister, Peggy Grove of Normal, IL; and children: Sandy (Don) Good of Zion, IL; James Theivagt, Jr. of Tacoma, WA, Debbie (Tim) Mormino of Mt. Carroll, IL; John (Kina) Theivagt of Las Vegas, NV and Tim Theivagt of Beach Park, IL. Jim leaves a legacy of generosity to his grandchildren, Natalie, Matthew and Jonathan Good; Joseph Theivagt; Lydia Kice; Danyell and Vincenzo Mormino; great grandson Erik Kice and his niece Amelia (Christopher) Ellington. Jim was preceded by his parents Lafe and Rita Theivagt (nee Brown), a sister Betty Lou Theivagt and brother-in-law Arthur Grove.

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Roger Adams Laboratory: various stages of planning and building.