SCS
SCHOOL OF CHEMICAL SCIENCES
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
ALUMNI NEWS
DEPARTMENTS OF CHEMICAL ENGINEERING AND CHEMISTRY SPRING/SUMMER 2001

Jonathan Sweedler works to understand what makes slugs—like the one shown in the upper right of the photograph—think.

Thompson-McClellan

Jonathan Sweedler: Understanding What Makes Slugs Think

With 10,000 neurons, slugs, while not cute and cuddly, are an ideal system for Jonathan Sweedler, professor of chemistry and Beckman Institute fellow.

"Slugs, such as *Aplysia californica* and *Pleurobranchaea californica*, are simple enough to study easily, and yet have enough neurons to have basic neural networks that control behavior and learning," says Sweedler.

Sweedler, who is a chemist by training, developed a strong interest in neuroscience as a graduate student. "I'm probably one of the strangest people in the chemistry department," says Sweedler, referring to his combined interests in neuroscience and chemistry.

Sweedler's group investigates the interactions of neurotransmitters and neuropeptides using the already well-understood neuronal networks in mollusks. The group also investigates the roles that peptide hormones and neurotransmitters play in behavior, learning, and memory.

"The problem we came up against is, the chemical measurements we wanted to make couldn't be made on the small scale we needed," says Sweedler. "So we work to develop new methods to probe the cellular environment."

Consequently, Sweedler's research focus is twofold. First, his group works to develop new analytical methods for sampling and chemically characterizing nanoliter- and picoliter-size samples. For example, Sweedler and his collaborators pioneered the development of a high-resolution, nanoliter-volume NMR probe to assay picomole amounts of mass-limited samples. That project resulted in a *Science* paper and formed the basis of a Champaign-based company.

"It's always great when a new tool has potential outside your own area," says Sweedler of the commercial applications of his work. Sweedler's group also developed mass spectrometry protocols to measure the peptides in individual neurons and cellular processes. In another project, a wavelength-resolved fluorescence detector provides less than 100-molecule detection limits. Using this system, tyrosine- or tryptophan-containing peptides, the catecholamines, indolamines and nitric oxide synthase cofactors can be detected from a small fraction of a single cell.

Secondly, his group studies the dynamics of neuronal communication on a molecular level. Using the techniques his group developed with other appropriate analytical tools, Sweedler works to characterize the neurotransmitters in the neurons making up the network in molluscs. They have identified novel neuropeptides and neurohormones in *Aplysia californica*, including cerebrin and insulin, and documented the unique processing of a number of additional prohormones, yielding many additional neuroactive peptides.

Sweedler is collaborating with researchers at the Beckman Institute to explore the physiological and behavioral roles of these new signaling molecules. Several identified neurons use a combination of gaseous signaling (NO), classical transmitters such as the catecholamines, and a variety of neuropeptides. Understanding how these three classes of intercellular messengers function in the same cell is one of many ongoing projects in Sweedler's lab.

by Deb Aronson

From the Director's Desk

Service and Excellence. In the School of Chemical Sciences and its two departments, Chemical Engineering and Chemistry, we focus on service with excellence, through our research, through our facilities, and through our instruction. Service with excellence is illustrated throughout this newsletter. Stan Smith, a pioneer in educational software, oversees a center that breaks through chemistry's intimidation factor. Technical staffers Bill Knight and Vera Mainz were honored for outstanding service to research at Illinois. A new graduating class is sent into the world where they will meet society's needs, as illustrated by alumna Elizabeth Hanna's thriving career in the pharmaceutical industry. Our outstanding faculty continue to be recognized for their accomplishments, such as the research described herein.

On behalf of the School of Chemical Sciences, I hope that you enjoy reading this issue as much as we enjoyed writing about what we do and whom we serve.

Tom Rauchfuss

To reach the editor...

You can reach our office by email at scsnews@scs.uiuc.edu or by fax at (217) 333-3120. Please continue to send your news and also include comments on the newsletter, alumni and development programs and any questions you may have on any of the above. Have an idea for a story? We enjoy hearing from you.

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Engineering a Career in Business

When Elizabeth (Betsy) Hanna graduated in 1986 with a degree in chemical engineering, she never thought she'd be managing companies rather than managing experiments. But, she says, her Illinois education prepared her for both.

"I learned phenomenal amounts," says Hanna, who notes that she was one of only about 15 women students. "Although I've rarely practiced chemical engineering, the problem-solving skills—the ability to be analytical, to not be intimidated by numbers, by science, or by complex problems—have suited me very well in my career."

Hanna came from Kansas City to attend the University of Illinois.

"I was a bit of an odd bird in that I was from out of state," remembers Hanna. "But I had a long and rich family history at Illinois: my grandparents, Louise and Rocho Sinderson, were both alums in the early 1930s. They met at Illinois on a blind date; and my great uncle, Roger Sonnemann, majored in chemical engineering in the early 1940s."

Hanna had her own rich history while at Illinois. One chapter even involved an emergency appendectomy her freshman year—four days before her final exams.

As an undergraduate, Hanna looked beyond the classroom to hone her leadership skills with two different campus organizations. Her junior year, Hanna was president of the American Chemical Society student chapter, and her senior year she was president of the American Institute of Chemical Engineering student chapter. These student chapters worked closely with the placement office, recruiters, and fellow students.

"This was one of the most rewarding things I did extra-curricularly at Illinois," says Hanna. "I got lots of experience working with and influencing people—skills which have been invaluable in my job today."

Hanna has since been able to combine her undergraduate skills in problem solving and leadership with her business experiences to play key roles in many major corporations.

Elizabeth Hanna

After graduating, Hanna returned to Kansas City, where she worked first at Procter and Gamble, in manufacturing logistics, and then at Hallmark Cards.

Hanna was at Hallmark for 3 1/2 years, where she oversaw the production of writing instruments, greeting cards, and other items. As manager, Hanna was in charge of manufacturing schedules, inventory and shipment of goods, as well as all the people involved in these processes.

"Hallmark is a very interesting company," says Hanna. "I've never been in another business with that extreme contrast of the creative and artistic side and the business operations and manufacturing side, where both sides are equally important players."

During the first 10 years of her career, Hanna focused almost solely on improving manufacturing and reducing cost. At that point, she decided she wanted to get a broader view of business, so she attended the Harvard Business School and received her MBA in 1997.

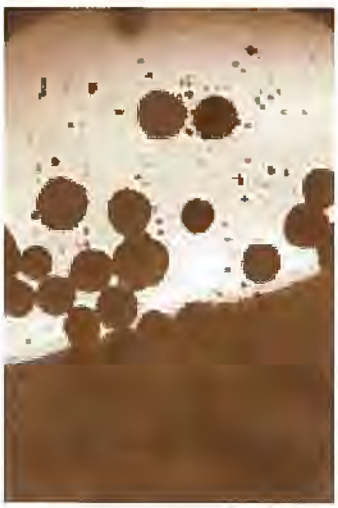
"Long term, I'd really like general management responsibilities where I can work to improve the overall productivity of a company," says Hanna. "That involves profit responsibility, not just for the manufacturing side, but also for things like sales, marketing, and research for a particular product or brand."

At Bristol-Myers Squibb, Hanna is working toward realizing that objective. Since joining the company in January 2000, Hanna has been senior director for operational excellence in the pharmaceutical division. In this position, Hanna works closely with many managers to determine ways—from a sales and marketing perspective—to improve business productivity.

"One of the things that's been very helpful for my career is moving to the pharmaceutical industry," says Hanna. "My science background is very important to being able to understand what researchers are talking about. I appreciate the issues and challenges they face doing lab work. I know about the struggles involved in the large-scale production efforts. And, because I have not only engineering, but manufacturing experience, I can break the whole large process down into the key steps."

by Deb Aronson

This figure is based on a scanning electron microscope image. The chemical structure appearing to emerge from the broken capsule (which looks like a hole) is the polymerized healing agent.



An optical microscope image clearly showing the microcapsules (large circles) and the catalyst (dark specks) permeating the crack. The crack front is the line between light and dark in the image.

Self-Healing Plastics

Inspired by biological systems that automatically repair themselves when damaged, Professor Jeffrey Moore (Chemistry) along with Professors Scott White, Phillippe Guebelle (Aeronautical and Astronautical Engineering), and Nancy Sottos (Theoretical and Applied Mechanics) have developed a self-healing plastic material. Just as the human body repairs cuts and scratches autonomically, this new material does the same, offering a potential way of fixing the hairline cracks that develop in the space-age composites used in everything from tennis rackets to aircraft. The research, which was sponsored by the Air Force Office of Scientific Research (AFOSR), was recently published in *Nature*. The article stated, "while this is not the first group to develop a self-healing structural composite, the choice of self-healing agent is particularly elegant and practical."

"When you cut your finger, you actually set off chemical signals that tell your body's own self-healing system, 'I'm damaged here, and you need to start healing me now,'" pointed out Professor Moore.

The team of researchers mimicked this model by building tiny capsules throughout their high-tech fiberglass or plastic material. Microscopic drops of monomer—he building blocks of polymers—were placed in microcapsules the size of a human hair, and mixed into the original resin matrix. Then tiny crystals of catalyst were blended in. The mixture was molded and set as a polymer composite.

When a crack or break occurs, the capsules in the area break open and release the monomer, which fills the crack, reacts with the catalyst, and hardens. The repairs appear to be 75 percent as strong as before the fracture. The team sees applications in the computer and construction industries as well as some health and leisure areas, such as self-healing dentures and dental fillings, tennis rackets, car bodies, inline skates, and skis.

Moore's research involves the synthesis and study of large organic molecules and the discovery of new polymeric materials. Most of his projects relate to one of three areas: the design of chain segments that fold into well-defined solution conformations, the preparation and study of hyperbranched polymers, and the development of organic materials for use in nano- and meso-scale devices. In general, his group addresses problems of both chemistry and materials science by using the tools of synthetic and physical chemistry.

For a complete article see "Autonomic healing of polymer composites," S. R. White, N. R. Sottos, P. H. Geubelle, J. S. Moore, M. R. Kessler, S. R. Sriram, E. N. Brown, S., *Nature* 409, 794-797 (2001).

Bill Wiegand

Jeffrey Moore, professor of chemistry (second from left) is part of the team that has developed a plastic material that can heal itself when cracked or broken. Other researchers on the team include (from left) Nancy Sottos, Philippe Geubelle and Scott White.

Thompson-McClellan

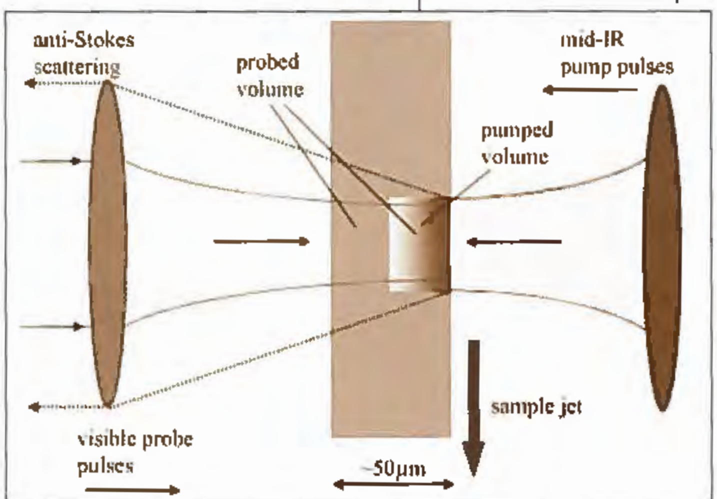
Chemist Dana Dlott has developed a three-dimensional spectral technique for identifying molecules.

Multidimensional Technique Enhances Vibrational Spectroscopy

By combining ultrashort pulses from a mid-infrared laser with pulses of visible light, chemists have added an important new dimension to vibrational spectroscopy.

The new spectroscopic technique allows researchers to investigate vibrational energy redistribution in molecules with unprecedented detail.

"Molecules have specific vibrational motions, which can be used as spectroscopic fingerprints," says Dana Dlott, a professor of chemistry. "Our spectroscopic method allows us to monitor vibrational energy flow through a molecule on femtosecond time scales. We can therefore characterize the dynamic mechanical properties of molecules in real time—which is important in virtually every chemical process and of special interest in the field of nanotechnology, where machines will be the size of molecules."



Optical arrangement, including sample jet.

Ordinary infrared spectroscopy is a one-dimensional technique that is widely used to identify molecules by their spectral fingerprints. By adding both a time dimension and an additional spectral dimension, Dlott and his colleagues—postdoctoral research associate John Dek and graduate student Lawrence Iwaki— have developed a three-dimensional technique that yields much more information.

Instead of getting just a fingerprint, they obtain an entire library of "motion pictures."

"When a molecule is laser-pumped by an infrared pulse, it executes a complicated, time-dependent dance," Dlott says. "We can watch that dance by obtaining a two-dimensional time-series of Raman spectra that shows how the vibrational energy flows through the molecule. Then, by tuning the infrared pulse into different parts of the molecule's spectrum, we get different dances. After recording all the possible dances the molecule can execute, we have a complete picture of the molecular mechanics."

Using their technique, the researchers studied two common and important liquids, water and methyl alcohol, with extremely fine detail. "Of particular interest was how the vibrational energy redistribution dance changed as the pump pulse was tuned through the third dimension," Dlott says. "Earlier work by other researchers suggested this dance might not depend much on where the infrared pulse occurs. But we found that it depends a great deal on where we excite the molecules; and more importantly, that measuring the dependence of the vibrational energy redistribution on infrared frequency provides the key to elucidating the fundamental mechanics involved."

Ultimately, by providing femtosecond-resolved snapshots of molecular motions, multidimensional vibrational spectroscopy could allow researchers to learn much more about the mechanics of molecules.

This, in turn, could lead to a greatly improved understanding of chemical processes, and even better analytical techniques for studying complicated mixtures of large molecules such as biological systems.

by James Kloeppel

The Chemistry Learning Center has 75 PCs networked to six servers that run interactive chemistry software for undergraduates.

Jim Gray

An Inviting Study Space: Chemistry Learning Center Evolves Over 30 Years

Chances are, any student who took a chemistry course at the University after 1972 remembers the Chemistry Learning Center. Centrally located in Chemistry Annex, the CLC has evolved from having 25 PLATO IV terminals connected to a CDC mainframe to having 75 PCs networked to six servers. The computers provide interactive chemistry software that enables students—from introductory to advanced levels—to learn much more efficiently and effectively.

Students also use the CLC to do their homework, which is then automatically graded and recorded.

Although many people are responsible for maintaining the CLC, Stanley Smith, Murchison-Mallory Professor of Chemistry and Chemical Education, has been the catalyst and primary organizer since the CLC was established in 1972. Smith also wrote much of the software in use in CLC, including Exploring Chemistry and ChemNet.

"The barriers to learning become lower," says Smith, explaining his motivation for both writing the software and setting up the CLC. "With the software it's easier now to imagine chemical structures, you can balance equations visually, not rely solely on your imagination. Learning chemistry becomes conceptually easier."

The CLC is centrally located and is open daily including most evenings. In addition to the computers, the CLC houses textbooks and other resources students might need for classes. On weekdays and weekends alike, tutors are on hand to answer questions. Student proctors are in charge in the evening and on weekends.

Patricia Phillips-Batoma, who oversees the CLC, makes it a priority to maintain an environment that attracts students. Traffic during the fall semester is generally 2,000 to 3,000 students per week, and about 1,200 to 1,500 students per week during the spring semester. At peak times—such as just before exams in large classes—there can be as many as 700 to 800 students per day in the center.

"We can have a line of six or seven people at times when all the computers are in use," says Rob Shimmin (BS '00, chemical engineering) who runs the daily operations of CLC until August, when he begins his graduate studies at Illinois.

CLC is centrally located and students drop by throughout the day and evening to study or get help from tutors.

Jim Gray

Technical Staff Recognized for Excellence

This spring two senior staff in the School of Chemical Sciences received top campus honors.

Bill Knight, who heads the SCS Machine Shop, received one of this year's Chancellor's Distinguished Staff Award, which recognizes excellence, initiative, and creativity. Knight began his career at Illinois as a research machinist in 1985 before assuming leadership of our machine shop and its staff of seven. Among his recent accomplishments, Bill introduced a computerized milling to expand the shop's almost legendary capabilities. "In honoring Bill Knight," wrote Harry Drickamer, emeritus professor of chemical engineering, chemistry, and physics, "you will be honoring the epitome of what makes this place an exceptional one for accomplishing experimental research."

In a ceremony on March 29, Chancellor Aiken recognized Dr. Vera Mainz with a Chancellor's Academic Professional Excellence Award. In his recognition speech, the Chancellor quoted Scott Denmark, Fuson Professor of Chemistry: "We are better faculty, researchers, and students because Dr. Mainz is our colleague." Soon after coming to the University in 1983 as a postdoc with Walter Klemperer, Vera assumed the directorship of the Molecular Spectroscopy Laboratory, which she completely overhauled through a vigorous instrument acquisition campaign and a strong management policy. Mainz also is the founder of the Midwest Association of Managers in Magnetic Resonance Laboratories, chairs the American Chemical Society's Division of History, and is active on the Professional Advisory and University Professional Personnel committees.

Graduate Student Shares Business Plan Competition Prize

A business plan by Julie Thompson, a graduate student in chemistry, and Larry Markoski, a staff member at U of I's Beckman Institute, won the top prize and $12,000 in the first annual V. Dale Cozad Business Plan Competition. Thompson and partner Larry Markoski wrote the business plan for marketing the Profiler, which takes a multi-ingredient substance, for example, the end result of a chemical reaction, and separates all the components using liquid chromatography. The Profiler's ability to run multiple tests simultaneously allows for quicker and more accurate analysis of substances than does conventional chromatography. A U.S. patent will be issued within the year, and Markoski has applied for European patents.

Markoski credits the Cozad competition with connecting him and Thompson to Illinois-based Cole-Parmer, one of the largest distributors of scientific equipment, which is now distributing Profiler. The device was developed and is being marketed through ChroMax, the company Markoski founded. Thompson also works at ChroMax, part time, as the company's operations manager.

After her experience with the Cozad competition, Thompson became interested in pursuing a career that used her science background but didn't require her to be in the laboratory. She subsequently applied to, and was accepted into, to the University's MBA program. She will receive both her M.S. in chemistry and her MBA in 2002.

The Cozad competition was established this year in memory of V. Dale Cozad, who founded Cozad Asset Management, Champaign. The competition was sponsored by entrepreneur Peter Fox, and his wife, Kim.

by Deb Aronson

Congratulations to the Class of 2001

The School of Chemical Sciences is proud to congratulate another outstanding class. The Department of Chemistry awarded 69 bachelor's degrees, 22 master's degrees and 50 doctorates this year. The Department of Chemical Engineering awarded 83 bachelor's, 17 master's and 9 doctorate degrees. Three of the Chemical Engineering students—Jeffrey Paul Buchik, Terry Yew Meng Lim, and Nitida Wongthipkongka—were awarded the Bronze Tablet, the University's highest honor, which is given to only the top three percent of the graduating class. Named as Chancellor Scholars were, from Chemistry, Laura Brooke Ballard and Leslie Murli Manohar, and from Chemical Engineering, Eric Joseph Walkowiak.

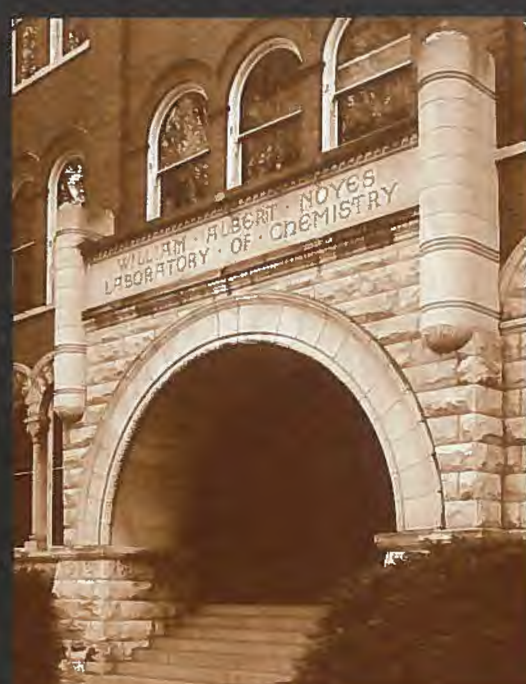
Congratulations to all graduates. We are proud of your accomplishments.

Profile of a Graduate

Brad Jellerichs graduated in May with something more valuable to him than top honors. A research project he worked on while at Illinois showed him where his heart lies. Laboratory experience be gained while an undergraduate persuaded him to continue on to graduate school at the University of Texas at Austin even though he had numerous lucrative job offers. "Companies were drooling all over me because of my lab experience," he says.

Jellerichs, who describes himself as only an average student in the classroom, really blossomed in the laboratory. "I never saw myself as an experimentalist until my junior year, but I love it. It gets my heart pumping," says Jellerichs, "I discovered that I liked using the equipment, solving problems, figuring out the questions."

Jellerichs, who grew up in a farming community in northern Illinois, attended the University on a full tuition scholarship for Illinois Children of Veterans. Since his sophomore year, Jellerichs also worked part-time at the Illinois State Geological Society in the Department of Environmental Geology. The summer after his junior year, Jellerichs was able to work in the lab full-time thanks to a Snyder fellowship.



Alumni and friends of the Departments of Biochemistry, Chemical Engineering, and Chemistry

Mark your calendars for **September 13-15, 2002**. The School of Chemical Sciences will be hosting a weekend gala to celebrate the Centennial of Noyes Laboratory. Take advantage of this special weekend to meet old friends and reminisce about the campus. You may be surprised by the changes at your Alma Mater.

www.scs.uiuc.edu/centennial

1998

Kokkoli, Efrosini, PhD '98, chemical engineering (Zukoski), will be joining UMass as an assistant professor in chemical engineering next fall after getting married this summer.

1996

Forbes, David, PhD '96, chemistry (Denmark), was appointed assistant professor of chemistry, University of Alabama-Huntsville.

1993

Kesler, Brenda, PhD '93, chemistry (Denmark), was promoted to associate professor at San Jose State University.

1992

Almstead, Neal, PhD '92, chemistry (Denmark), was appointed director of chemistry, PTC Therapeutics.

Lockledge, Scott P., PhD '92, chemistry (Klemperer), has recently accepted a one-year congressional fellowship from the ACS. He will be involved in government affairs concerning various aspects of local, state, and federal governments on scientific-technology issues relating to the chemical sciences.

1990

Hampton, Michelle, MS '90, chemistry (Schuster), is technical registration manager of residue chemistry for Syngenta Crop Protection Canada, Inc. in Ontario.

1989

Brennecke, Joan, MS '87, PhD '89, chemical engineering (Eckert), won the Ipatieff Prize given by the ACS. She is currently on the faculty at Notre Dame University.

Henke, Brad, PhD '89, chemistry (Denmark), is director of metabolic diseases drug discovery chemistry, GlaxoSmithKline.

1986

Hanna, Elizabeth, BS '86, chemical engineering, has been appointed senior director of operational excellence for Bristol-Myers Squibb. (See Alumni Profile).

Pytosh, Mark A., BS '86, chemistry, is managing director of Lehman Brothers and is co-head of Lehman's global industrial banking group.

1985

Harmata, Mike, PhD '85, chemistry (Denmark), has been named Norman Rabjohn Professor at Univerisity of Missouri, Columbia.

Ruffing, Charles J., PhD '85, chemistry (Rauchfuss), became director of strategic planning and quality for the Health, Safety, and Environment Division of Kodak.

1984

Jones, Todd, PhD '84, chemistry (Denmark), is currently director of chemistry, RW Johnson Pharmaceutical Research Institute.

Mohan, Raju, PhD '84, chemistry (Katzenellenbogen), recently moved to San Diego to become director of chemistry at X-Ceptor Parmaceuticals, a new Biotechnology company specializing in the discovery of thereapeutic agents based on orphan nuclear hormone receptors.

1978

O'Brien, Thomas A., PhD '78, biophysical chemistry (Gennis), is program director of Immunohematology for Ortho-Clinical Diagnostics Division of Johnson & Johnson Co., Raritan, NJ.

1977

Martin, Steven J., PhD '77, chemistry (Malmstadt), was awarded the ACS Midland Section award for Outstanding Achievement and Promotion of the Chemical Sciences. He is currently senior scientist in advanced electronic materials group of new businesses R&D at Dow. He is also one of only six Dow research fellows.

1970

Ho, W.S. Winston, PhD '70, chemical engineering (Quinn), is professor at the University of Kentucky in the Department of Chemical and Materials Engineering, Lexington, KY.

1967

Miller, Steve, BS '67, chemical engineering, as president and CEO of Shell Oil Co. sponsored the 2001 Shell Houston Open, an internationally recognized golf tournament that raised $4.4 M dollars for charity.

1966

White, J. Michael (Mike), PhD '66, chemistry (Yankwich), won the Arthur Adamson Award for Distinguished Service in the Advancement of Surface Science from the ACS.

1960

Hadjiioannou, Themistocles P., MS '58, PhD '60, chemistry (Malmstadt), professor of chemistry, Athens University, Greece, was recently elected a member of the Greek National Academy of Sciences. Hadjiioannou joined the analytical chemistry faculty of the University of Athens in 1966. He taught in both analytical chemistry and instrument analysis. His fields of interest included: electroanalytical chemistry, flow injection analysis, reaction rate methods, and spectrophotometry. He authored 11 books in both Greek and English and over 150 scholarly publications in scientific journals of analytical chemistry. Hadjiioannou attained emeritus status in 1994.

1951

Robb, Walter, PhD '51, chemical engineering (Drickamer), received U of I's Alumni Award at the May 2001 graduation ceremonies.

In Memorium

Norman Rabjohn, PhD '42, chemistry (Fuson), Sept. 2, 2000, Columbia, MO, at the age of 84. He was an instructor in organic chemistry and was an early investigator in studies of synthetic rubber. He retired from Missouri University Department of Chemistry in 1983. The Norman Rabjohn Distinguished Professorship was established in his honor in 1994.

Newton Davis Werner, BS '59, MS'62, chemistry (Applequist), Oct. 3, 2000, in California.

Thomas Patrick Quinn, BS '35, chemical engineering, Oct. 29, 2000, Ft. Lauderdale, FL, at the age of 88.

Daniel L. Leussing, MS '47, chemistry, professor emeritus of chemistry, Ohio State University, Dec. 6, 2000, Worthington, OH.

Wandalou M. Ziegler, long time (35 years) chief clerk at Noyes Lab, February 4, 2001, Urbana, IL, at the age of 77.

Charles C. Price, III, emeritus professor of chemistry, University of Pennsylvania, (U of I faculty, 1942-46), February 11, 2001, Haverford, PA, at the age of 87.

Alumni Make a Difference

Invest in Excellence. Support the School of Chemical Sciences by contributing to the Roger Adams Fund or the Chemical Engineering Instructional Leadership Fund. If your company has a matching gift plan, include the appropriate form from your company along with your contribution. Unless otherwise designated, your donation will go to the School of Chemical Sciences Facilities Fund, which supports the library, instrumentation facilities, classrooms, and computation.

This gift is for ______________________________

Name ______________________________

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Did You Know?

Georgia E. Bennett and **Florence Clarke (Michalek)**, roommates and friends, were the first two women to graduate in Chemistry from the University of Illinois in the class of 1896!

SCS Alumni Newsletter
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Address Correction Requested