

UI Partners with Singapore to Give Students Broad Perspective

tudents working in major corporations, particularly multinational ones, must gain a worldwide perspective in order to succeed. But how can students gain that perspective, on top of all their class work and research?

A new joint master's degree program in chemical engineering is giving Illinois students a chance to immerse themselves in one particular culture, that of Singapore.

"Singapore is a very important industrial hub for the Asian Rim," says Asghar Mirarefi, a lecturer and Assistant to the Head of Chemical Engineering, who helps run the program and has been instrumental in building it. "Singaporean society is very supportive of education and research activities, so it is a natural partner in this joint program."

The partnership, established in 1998, joins National University of Singapore's Department of Chemical and Environmental Engineering with the University of Illinois Department of Chemical Engineering. The program allows students from both countries a chance to learn not only about academics and business, but also to immerse themselves in each other's society and culture.

The program takes an equal number of students from National University of Singapore and the University of Illinois in

Urbana-Champaign. This year's group the fourth—is 10 students. The program begins in July, when the American students travel to Singapore to study for one semester and then complete an internship in Singapore. Then, in April, all students travel to Urbana-Champaign, where they intern at an American company until August. In August they take classes at the University of Illinois.

Students are paired like buddies, so while in Singapore, the Illinois students have a built-in friend, colleague, and host. During the Urbana leg of the exchange, the Illinois students return the favor for their Singapore hosts. The students even participate in internships in pairs.

"I couldn't imagine a better program," says Steve Wozniak, a student who participated in the program last year. "It helped me learn to overcome adverse situations to the point where I learned how to set myself up and get ready to go. And because most people in Singapore speak English, you can get around easily."

Faculty and student participants in the 2001 NUS-UIUC program.

"Singapore has a very dynamic culture aiming to become the research and education hub of the Asian Rim," says Charles Zukoski, Head of the Chemical Engineering Department. "Singapore has a large chemical manufacturing base, and companies there have a huge desire to hire chemical engineers. This combination of strategic vision and corporate need makes the National University of Singapore a natural partner in international education. Students who participate in this program have a unique opportunity to gain advanced education from two very strong universities, as well as corporate experience in one of the world's largest and fastest growing economies."

The program has built partnerships with the Singapore Economic Development Board which helps to support the program. In addition, companies providing internships include DuPont, Applied Materials, ExxonMobil, Glaxo-Smithkline, Kraft, TECH SemiConductor, Shell, Schering Plough, and Honeywell.



From the Director

he integration of teaching and research is a hallmark of the School of Chemical Sciences. Research provides an ideal vehicle for teaching, and the teaching environment is ideal for research.



This philosophy is illustrated throughout this issue. Faculty research on microfabrication instructs students (and faculty!) about concepts that describe the solid-liquid interface: fluid dynamics, chemically modified surfaces, and microchemistry. Professor Scott Denmark makes it his students' business to explore the uncharted regions of main group reagent chemistry. The Illinois-National University of Singapore program is founded on instructional sharing at both the classroom and industrial levels, but this outreach program vitally informs the research agenda by providing novel scientific and cultural context. And finally, our teaching-research agenda is enhanced by the benevolence and foresight of our alumni colleagues, as illustrated by the gift of Henry and Sharron Isaacson. Thomas B, 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, alueroi 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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Written by Deb Aronson



College of Liberal Arts and Sciences UNIVERSITY OF ILLINGIS AT URBANA CHAMPAIGN

Chemistry on a Chip

A new field of microfabrication is emerging that incorporates chemistry and chemical engineering. Within this new field, the School of Chemical Sciences is particularly strong in the areas of microchemical and microanalytical systems thanks to the work of faculty such as Rich Masel, Ralph Nuzzo, Jonathan Sweedler, and Paul Kenis.

"A lot of chemistry is moving into a small scale," says Masel, Professor of Chemical Engineering. "While we used to work at the beaker-scale size, now we'd like to do the same chemistry on chip-size devices."

Masel, an expert in microchemical systems, and Mark Shannon, Associate Professor of Mechanical and Industrial Engineering, recently patented the first self-sustaining microburner. Their goal was to create an energy source that was small enough to carry, hot enough to effect the chemistry, and cool enough to touch. The challenge was that the walls of typical microburners absorb the heat and radicals required to sustain the flame. The Masel-Shannon device features "quenchless walls" that support micro-flames but that are thermal insulators, thus allowing the device to be handled. A whole host of microchemical applications are now possible, from microsteam engines to heated clothing, and micro-medical diagnosis tools. Masel and others at the School are poised to launch a new Center for Microfabrication, which will foster collaboration and growth in this exciting area.

> "It's like a ship in the bottle, basically, you have an enclosed space; how are you going to fabricate inside it? You need special tools."

Paul Kenis, Assistant Professor of Chemical Engineering, integrates knowledge of fluids at the microscale ("microfluidics") with knowledge of fabrication. Kenis is interested in conducting chemical reactions at the microscale, socalled microreactions. Masel, Kenis, and Shannon have collaborated on using microreactors to reform liquid fuels into hydrogen, the ultimate clean fuel.

Kenis also has taken advantage of the unique properties of fluids at the microscale level to do some unusual fabri-



Work Co-Op Small But Mighty at Illinois



Ralph Nuzzo, William H. and Janet Lycan Professor of Chemistry and Material Science in one of his laboratories.

cation. For example, he fabricated microstructures inside minute capillaries by taking advantage of laminar flow (at microscale levels, turbulence in fluids disappears, and mixing occurs only through diffusion). Kenis's technique can be used to generate structures with feature sizes of less than five micrometers and can be used to pattern metals, organic polymers, inorganic crystals, and ceramics on the inner walls of preformed capillaries.

"It's like a ship in the bottle, basically," says Kenis. "You have an enclosed space; how are you going to fabricate inside it? You need special tools."

The research of Ralph Nuzzo, Lycan Professor of Chemistry and Professor of Materials Science and Engineering, is also highly relevant to microfabrication. Nuzzo is renowned for his work on self-assembling monolayers (SAMs), in which molecules spontaneously form specific patterns on surfaces. These SAMs have different properties, depending on their orientation and the exposed end group of the surface-bound molecules.

"These patterns can be used to create complex structures that are simple to print on many different surfaces," says Nuzzo. "This gives us a much richer palette of materials and structures to work with."

This kind of basic research being conducted at the School of Chemical Sciences is key to future applications, some of which may change daily life as dramatically as computers and handheld electronic devices have. ompanies that recruit chemistry and chemical engineering graduates from the University of Illinois love to hire students who have extensive work experience.

"Companies that see kids with co-op experience put them on the top of the pile when sifting through resumes," says

Debe Williams, Director of the Placement and Student Service Office in the School of Chemical Sciences (SCS).

Co-operative education is one way for students to gain that work experience. All SCS undergraduates are eligible for the co-op program. While some companies require a minimum GPA, many do not. Participating industries range from

petrochemicals to pharmaceuticals. Some co-op partners include Cytec Industries, Dow Chemical, Equistar, FMC Corporation, Hamilton Sundstrand, Kimberly-Clark, Mobil Corporation, Nalco Chemical, Quantum Chemical, Solutia, and 3M.

Co-op students alternate a semester of work and a semester of classes until they have completed a minimum of three semesters of work. This means that typical students in the co-op program take a year longer to complete their degree. About one dozen students in the SCS have decided that the extra time required by the co-op program is justified by the experience and perspective.

"Co-op is about taking the theoretical material you learn in class and seeing that theory doesn't always work," says Williams. "Students tell me that the coop experience strengthens their academics. Students with stronger GPAs learn that theory and practice don't always mesh, and students with lower GPAs can see the theories put to practical use, and it helps them understand the importance of those theories."

Ideally, students work at the same company all three semesters. Students who return to the same employer enjoy increased responsibilities each work term,



which makes it more interesting for them and enhances their appeal in the job market. Students receive a certificate of completion from the Placement Office at the end of their co-op period.

This year co-op students are participating in a seminar program intended to enhance the co-op experience. Seminar topics cover untraditional topics such as generation theory, ethics, emotional intelligence, decision-making theory, and company culture.

Demand for co-op students is much greater than the number of students in the program. Williams believes that the success of the program will be contagious, and more students will see that the extra time in the program is well worth it.

By Debe Williams



Steve Zumdahl: Beloved Teacher Has Passion for Teaching

remember the first day of class, Dr. Z held a pop bottle full of hydrogen gas up to a flame, and there was a big explosion," says sophomore Matthew Wagoner. "He knew what kept our attention."

Steve Zumdahl, professor, Associate Head and Director of the General Chemistry program, has taught general chemistry to undergraduates for three decades. That means he has taught about 10,000 students: 9,414 more people than are in Zumdahl's hometown of Chadwick, Illinois. Luckily, Zumdahl has a good memory for names. If students come to see him outside of class, Zumdahl will remember their names and greet them by name from then on. Zumdahl also provides a sign-up sheet for office hours so students aren't forced to wait long to see him.

Students rave about him, although they concede his course is tough. Those feelings are shared by Zumdahl's colleagues: He has won teaching awards at every level, from the department, the school, the college, and even at the national level. But awards are not what counts for him.

"Teaching is my passion. I always wanted to be a teacher," says Zumdahl, who teaches honors chemistry (Chemistry 107 and 108). "I like to be interactive. I can always tell when I've connected with the kids."

"Dr. Z is good at turning a large lecture hall into a small classroom," notes Wagoner. "He never lets on that he knows much more than we do, even though he does. He makes a normally intimidating subject much more approachable."



Dedicated couple makes chemistry approachable, less intimidating and "fun".

As Director of the General Chemistry Program, Zumdahl oversees the teaching of Chem 100, 101, 102, 105, 106, 109, *i* and 110. The University of Illinois is one of the few chemistry programs in the country that has a general chemistry faculty.

"Most places, the professor who gets the head of the department mad at him teaches general chemistry," says Timothy Christopher Loftus, an undergraduate in chemistry and a TA for Chem 107-108. He is only half joking. "Here, Dr. Z coordinates the whole 'Gen Chem' program and chooses people who really want to teach the subject. That's one of the reasons why the chemistry program is so outstanding." Zumdahl also hand-picks the teaching assistants for Chem 107/108.

In addition to his teaching responsibilities, Zumdahl has written four chemistry books targeting different flavors of introductory courses. Zumdahl co-wrote *The World of Chemistry*—for the first course in high school—with his wife, Susan Arena Zumdahl, who directs the Merit Program (see sidebar), and Don De Coste, a colleague in the general chemistry program. Susan Arena Zumdahl also has written chemistry books for college students with no high school chemistry and for other markets. In fact, the Zumdahls first met through a book representative.

Chemistry, Zumdahl's first book, was a sensation when it first appeared in 1986 because of its conversational style and its use of high-quality color photographs. While many other texts have followed suit, Zumdahl's *Chemistry* remains at the top of the competitive textbook market worldwide.

"Dr. Z writes his books so you can read them," says Heather Vanderwoude, a senior majoring in biology honors and biochemistry. "A lot of other textbooks use acronyms that aren't defined. He explains terms so that you can understand."

Vanderwoude, a teaching assistant for Zumdahl, always counsels her students to keep their copy of *Chemistry*.

"I tell them, 'Do not sell your book back," she says. "You'll use it all four years, I guarantee it."

Merit Program Helps Chemistry "Come Alive"



he Merit Program in Chemistry is founded on the principle that learning chemistry is a dynamic, partly social activity. Originally the program targeted students from rural communities or underrepresented minorities in science, but many other students who hear about it sign on, too.

"We work to include certain target groups, but we are not exclusive in any way," says Susan Arena Zumdahl, Director of the program.

Participating students attend the same lectures and read the same text as other chemistry students. The difference is in the discussion sections. Merit students typically meet twice a week for two hours each time (compared to two onehour discussion sections for other courses). There are no desks in the merit room, only large tables. Students spend the time working in groups of four or five to solve problems from a worksheet. Merit facilitators, or teaching assistants, circutate in the room giving feedback, but never answers.

Says Heather Vanderwoude, a senior majoring in biochemistry, "It gave me more confidence since I had done it myself. And working in groups really makes the chemistry come off the page; the chemistry came alive for me."

Vanderwoude participated in the Merit Program for every class she could. "Once I knew about it, I didn't want to give it up," she says.

Merit sections are available for general chemistry, quantitative analysis, and organic chemistry. Merit workshops also are offered for freshman and sophomore math, engineering, and science students. Denmark to Deliver Pedlar Lectures in UK —New Concepts for Chemical Synthesis

eople call Scott Denmark driven, a taskmaster. His 7:30 p.m. group meetings that go until 11:00 p.m. are legendary. This R.C. Fuson Professor of Chemistry rarely leaves the office before midnight. He has written almost 200 papers and has delivered more than 300 invited lectures. In the 21 years since Denmark got his doctorate in Zürich, he has been an Alfred P. Sloan Fellow, an NSF Presidential Young Investigator, a University of Illinois Scholar, and an American Association for the Advancement of Science Fellow. He received the Stuart Pharmaceuticals Award in Chemistry, a Procter & Gamble University Exploratory Research Program Award, an Arthur C. Cope Scholar Award from the ACS and a Humbolt Senior Scientist Award. In 1991, he became R.C. Fuson Professor of Chemistry.

Now the British Royal Society of Chemists (RSC) is recognizing Denmark. He has been invited to deliver the Pedlar Lectures in the United Kingdom next academic year. The Pedlar Lectures, named for Alexander Pedlar, are delivered in alternate years at five different British universities chosen by the RSC, the main professional organization for chemists in the United Kingdom.

"This is a great honor," says Denmark. "The list of past lecturers is a virtual Who's Who' of British organic chemists since 1927. It is still more unusual for a non-British chemist to be selected."

Denmark plans to talk about two areas of current research in his laboratory group. One area is asymmetric catalysis using main group elements. This work is based on the underdeveloped catalysts potential of Lewis bases to activate reactions of main group elements. The defining feature of all catalytic processes is the ability of a very small amount of the active ingredient to convert a simple, bulk precursor to a high, valueadded product. Denmark's Lewis base approach allows a greater range of transformation to take place with this desirable characteristic.

"This opens up new avenues for chemists to make stereo-defined compounds with a high degree of efficiency and selectivity. That's important because the majority of chemical entities that are made in industry are more and more complex and thus require specialized methods for their synthesis." says Denmark.

A second area of research that Denmark will talk about at the Pedlar Lectures is an effort to develop environmentally benign reactions. Denmark's group is developing an important class of carbon-carbon bond forming reactions that use nontoxic and inexpensive organosilicon reagents instead of the more commonly used (and highly toxic) organotin reagents. As part of this work, Denmark's group has invented and applied a new way of linking aromatic, olefinic, and other unsaturated moieties to each other under mild conditions, using these organosilicon reagents. Denmark has applied for a patent pertaining to this work.

While there's no telling what additional accolades the future will bring, it's clear that Denmark's drive and enthusiasm will enable him to contributing in major ways to his field.

New Faculty



Paul J. Hergenrother

joined the faculty at Illinois last June following a twoyear American Cancer Society postdoctoral fellowship

at Harvard University. Hergenrother received his B.S. in Chemistry from the University of Notre Dame in 1994. He went on to the University of Texas at Austin and obtained his Ph.D. in 1999. As a graduate student, he received an American Chemical Society graduate student fellowship and the Roche Award for Excellence in Organic Chemistry.

He chose Illinois' Department of Chemistry as the next step in his career because of "its excellent reputation and the high quality of the faculty and graduate students." His research interests are in the areas of synthetic organic chemistry, chemical biology, and biochemistry. His research group will be pursuing the synthesis and identification of novel compounds that target multi-drug-resistant bacteria and cancerous cells.

When he is not preparing for lectures or working in the lab, Hergenrother enjoys "family time" with his wife and two young children. He also likes political history and Notre Dame football. He states that it is great to be back in the Midwest "where people are genuinely nice to one another."

Teaching Excellence Awarded

Scott Silverman (left), Chemistry, and Bill Hammack, Chemical Engineering, are two of the recipients of this year's Roger Adams Excellence in Teaching Award. Todd Martinez (not in photo), Chemistry, also earned this distinction. Each academic year, faculty and graduate students nominate their peers for the Adams Award.





Classroom teaching experience is a mandate of the PhD program. Nine graduate students from the Chemical Engineering and Chemistry Departments received the Teaching Assistant Award for the 2000-01 academic year. Back row, from left: Pranod Subramanian, Malcolm Talbot, Matthew Libeiatore, Rico Gunawan. Middle row: Tyson Miller, Heather Heidron, Stephen Hopkins, Moushumi Paul. Front Row: Amanda Leonard and Jennifer Jakubowski.

Alumnus Donates \$100,000 to Chemistry

Henry and Sharron Isaacson have donated \$100,000 to the Department of Chemistry in the form of an unrestricted gift. Isaacson received his bachelors of science degree in Chemistry in 1961. Tom Rauchfuss, Director of the School of Chemical Sciences, praised the Isaacsons' generosity and foresight, noting that this kind of gift is "extremely valuable to advancing the scholarly and educational mission of the Department of Chemistry, especially since these funds are flexible. We need to address changing needs in our changing environment." The Isaacsons live outside of Rochester, New York.

IN MEMORIUM

Louis H. Bock, BS '29/MS '31, Chemistry (Adams), April 17, 2001.

Robert C. Gunther, PhD '42, Chemistry (Marvel), June 16, 2001, in Woodruff, WI. A chemist who worked in photography and food sciences, Gunther was a 50-year member of both the ACS and the Institute of Food Technologists. Following service in the Chemical Warfare Service Development Lab at MIT in WWII, he worked three years as a research chemist for General Aniline Film Corp. His career culminated with 30 years as Vice President and then General Manager of Gunther Products in Galesburg, IL, a division of A. E. Staley Manufacturing Co., Decatur, IL.

ALUMNI NEWS

1999

Ken Kolbeck, MD/PhD '99, Chemistry (Suslick), has completed a neurosurgery residency at the University of New Hampshire and is currently at the University of Pennsylvania.

1998

Evan L. Russell, PhD '98, Chemical Engineering (Braatz), has co-authored two books with Prof. Braatz and **Leo H. Chiang**, PhD '00. The books are entitled: *Data-Driven Techniques for Fault Detection* and *Diagnosis in Chemical Processes and Fault Detection and Diagnosis in Industrial Systems*, published by Springer-Verlag, London, in 2000. Drs. Russell and Chiang are currently employed at ExxonMobil and Dow Chemical, respectively.

1997

Andrew P. Featherstone, PhD '97, Chemical Engineering (Braatz), and Jeremy G. VanAntwerp, PhD '99, Chemical Engineering (Braatz), have co-authored a book entitled, *Identification and Control of Sheet and Film Processes*, with their advisor Prof. Braatz. It was published by Springer-Verlag, London, in 2000. Drs. Featherstone and VanAntwerp are currently employed at International Paper and Calvin College, respectively.

1996

Stephanie A. Mabry, PhD '96, Chemistry (J. Jonas), is Assistant Research Scientist in the Department of Chemistry and Biochemistry at the University of Maryland, Baltimore County.

1992

Chin-Ti Chen, PhD '92, Chemistry (Suslick), is Professor of Chemistry at Academia Sinica, Institute of Chemistry, Taiwan.

Stephen E. Lin, BS '92, Chemical Engineering, is currently pursuing his MBA at Tuck School of Business at Dartmouth College. He will graduate in June 2002.

1991

Jocelyn Bautista, BSc '91, received her MD from Washington University completed a neurology residency at Yale University School of Medicine. She was awarded an Epilepsy Fellowship at the Cleveland Clinic. Xiaohong Joe Zhou, Ph.D. '91, Chemistry (Lauterbur), is an Associate Professor in the Department of Radiology, University of Texas M. D. Anderson Cancer Center. Zhou has become a certified medical physicist by the American Board of Radiology.

1990

Cristi Hamilton Hunnes, PhD '90, chemistry (Scott), has been granted tenure and promoted to associate professor at Rocky Mountain College, Billings, MT.

1989

Anita Yu, BSc '89, is currently Assistant Professor of Chemistry at the University of Wisconsin-Eau Claire.

1987

Eugene Mueller, BSc '87, was promoted in May 2001 to Associate Professor of Chemistry at the University of Delaware, Department of Chemistry and Biochemistry.

Shannon Nebolsky, BSc '87, Chemistry, has joined the law firm of Welsh & Katz Ltd., and is practicing patent, trademark, and copyright law.

1985

Gregg Zank, PhD '85, Chemistry (Rauchfuss), will be named New Ventures R&D Director early in 2002. In this capacity, he will have strong links to science and technology excellence and will join the NV Project Approval and Global S&T leadership teams.

1984

Scott L. Menzel, BS '84, Chemical Engineering, was awarded the Protein Technologies Internationals' first certification as Six Sigma Master Black Belt on February 9. He and his family reside in Louisville, KY.

1982

Paul Schubert, PhD '82, Chemistry (Suslick), has become Vice President of R&D for Syntroleum Corporation.

1966

Kenneth Jolls, PhD '66, Chemical Engineering (Hanratty), has followed the advice of the father of modern thermodynamics, J. Willard Gibbs, who advocated geometric representations: Jolls's work with computer simulations was recently described in the Sunday Arts section of the New York Times (May 6, 2001).

(See www.public.iastate.edu/~jolls/)

1955

Leroy Whitaker, PhD '55, Chemistry (Adams), is trying to arrange a reunion of Adams's PhD students from the midto late-1950s. If you have information about any of these students, please contact the newsletter editor, who will forward all information to Dr. Whitaker.

1940

Sr. Mary Joan Preising, MS '40, Chemistry (Reedy), will celebrate her 100th birthday in January 2002.

1932

Charles H. Fisher, PhD '32, Chemistry (Fuson), is currently an Adjunct Research Professor at Roanoke College in Salem, VA. He has authored more than 200 publications and holds 72 patents in the fields of organic and polymer chemistry.

Keep in Touch

Clip and mail to SCS News editor.

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Alumni Make a Difference

Alumni support is critical to maintaining excellence. Two important funds are the **Partnership in Chemistry Fund** and the **Chemical Engineering Instructional Leadership Fund**. Unless designated, your donation will go to the **School of Chemical Sciences Facilities Fund**, which supports the library, instrumentation, and computation for both departments. If your company has a matching gift plan, please be certain to include the appropriate form from your company with your contribution.

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Noyes Laboratory Celebrates 100 Years

Mark those calendars! Join us for the Noyes Centennial festivities, scheduled for September 13–15, 2002. In addition to the lab-related celebrations, you can attend the Illini home football game that weekend.

Area hotels have reserved blocks of rooms, but you must book early. Ask for the **Noyes Centennial** block when you phone. Hotels with special rates include: Eastland Suites, Hawthorn Suites, Holiday Inn, Park Inn International, Jumer's Castle Lodge, Baymont Inn, Best Western Paradise Inn, and Best Western Monticello Gateway.

Contact information for the hotels, as well as other details about the weekend's festivities, are available on the website: http://www.scs.uiuc.edu/centennial. For more information, send email to johodge@scs.uiuc.edu.

Noyes 100 renovation-2001.



Did You Know?

The first artificial sweetener was discovered in Noyes Lab by accident in 1939. Michael Sveda identified sodium cyclohexyl sulfamate while conducting experiments on organic aquo-ammopo-sufuric acid in Dr. Audrieth's laboratory.



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