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Chemical Engineering

University of Michigan
College of Engineering

ChE News

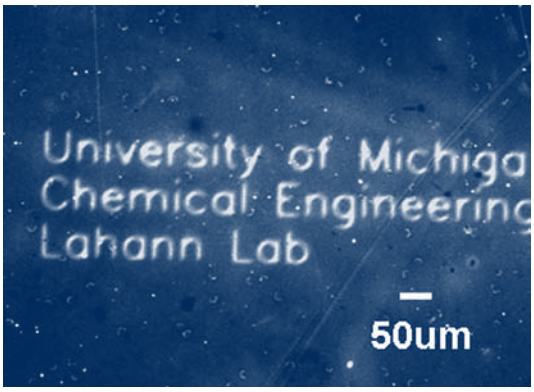
FALL 2005

The Newsletter of the Department of Chemical Engineering

Polymers: The Next Generation

Modern medicine has witnessed amazing progress during the last decade, moving from highly invasive interventions, such as bypass surgeries, to minimally invasive methods, such as angioplasty or stent placements. Today, many patients with vascular blockages can avoid the risk and difficulty of open-heart surgery. Instead, the surgeon can open the blocked vessel by inserting a stent through a small catheter, so that only a tiny incision is needed. Options for even less invasive procedures are just around the corner! The recent advent of so-called 'drug-eluting' stents will make clinical procedures even less complicated. Thin polymer coatings can be used on the drug-eluting stents to cover the surface of the stent and provide therapeutic molecules, while maintaining the overall mechanical properties of the device.

Researchers in the Lahann lab have been using engineering principles to develop what could be the next generation of surface coatings. Their challenge has been to produce coatings that are both safe and effective. Assistant Professor Joerg Lahann and his research team (five graduate students, a post-doctoral fellow, and several undergraduate students) have been developing ultra-thin coatings, using the chemical vapor deposition (CVD) method. The fact that the coating can be deposited from the vapor phase is the intriguing advantage of this process because it eliminates the use of organic solvents, plasticizers, or initiators that are traditionally used in solvent-based coatings and often make the coatings cytotoxic. In addition, vapor-based coatings adhere strongly to the substrates and can be applied to complex geometries with high precision. A unique feature of these coatings is that they can be designed to have a range of different chemical groups, which can serve as anchors. These anchors can be used to place specific biomolecules on the surface of a stent, which then will produce a surface that is more like a natural blood vessel.



The control of protein adsorption is a critical challenge when engineering biomedical coatings. In this example, high-school student Radica Laing and graduate student Hsien-Yeh Chen from the Lahann group have used CVD technology to write using proteins as "ink." Each letter is about the size of the tip of a needle.

Joerg explains that the primary benefit of using vapor-based coatings is that "the chemical anchors that are produced will mimic the many biomolecules on the surface of a cell." These coatings can also be designed to release or generate drug molecules in defined ratios. The Lahann group is collaborating with Professor Mark Meyerhoff from the Chemistry Department and an Ann Arbor-based company, MC3, to explore possible applications in this area. The group is also working with miniaturized

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Note from the Chair

This past year two new faculty members joined our department. Peter Woolf, U–M graduate and MIT post-doctoral fellow, brought to the department his expertise in "systems biology," which seeks to do for living cells what chemical engineers currently do for chemical factories–namely track and control rates of reaction, transport, and separations. In this arena, the role of the traditional chemical engineer is inverted–instead of scaling up chemical engineering knowledge and principles to the factory, one scales these principles down to the micro and nanoscales. Peter developed a popular new course on systems biology and is preparing to build a team of students who will, as participants in a national competition, use these tools to redesign and rebuild the genomes of bacteria so that they will be able to produce potentially useful products.

Our second young faculty member, Suljo Linic, has an amazing personal story. Born in Bosnia, he moved to nearby Slovenia during the war there, making a living playing on a soccer team. Meanwhile, his mother, concerned for his future, sent his high school transcript to West Chester University and they awarded him a scholarship to pursue his undergraduate degree. He also received a fellowship from the Soros Foundation. After Suljo received his bachelor's in physics he completed a PhD in chemical engineering at the University of Delaware and was a post-doctoral fellow at the Fritz-Haber Institute in Berlin. Now a faculty member in our department, he is building a research program in the area of catalysis and atomistic approach to catalyst discovery. Among other tools, Suljo employs quantum chemistry to understand important chemical processes at the molecular level. Like systems biology, quantum chemical calculations have the potential to revolutionize chemical engineering practice by making it possible to design reacting systems at their most fundamental level–that of the chemical bonds making and breaking. Suljo and Peter will be teaching our students the tools of chemical and biochemical processing at the molecular and atomic level, technology I could not even have dreamt of when I was a student.

We were honored to welcome the new CEO of Dow Chemical Company, Andrew Liveris, to the department in his first presentation as CEO to any university. Andrew delivered two stimulating talks, one to undergraduate students and the other to graduate students, on worldwide developments affecting the chemical industry and the workplace of the future chemical engineer. Globalization, rising energy and feedstock prices, and relentless competition provide constant challenge, but also opportunity, for our graduates. But we have to keep alert and move quickly to keep up with the rapidly changing world and to help our students be prepared for it. Our faculty members are studying the rapid development of industry and manufacturing in Asian countries such as China and India, and are considering how to train our students to be not only technically proficient, but also economically and politically savvy, as well as culturally sensitive. Following an intensive faculty retreat, we have developed faculty teams that are preparing to help us tackle this

and many other issues facing chemical engineering in the twenty-first century.

Finally, our faculty, staff, and students have been recognized this year, as never before, for their outstanding contributions. As just a sampling, I note that Ralph Yang was elected to the National Academy of Engineering and Scott Fogler won the American Society for Engineering Education's Lifetime Achievement Award in Chemical Engineering Pedagogy. Our department engineer, Pablo LaValle (BSE '82), won the University's Candace J. Johnson Staff Award for Excellence the first time it was offered. One of our undergraduate students, Wei Gu, won the National Collegiate Inventors Competition, a major national student competition. These, and many other wonderful accomplishments of our faculty are featured in this year's newsletter. Please read, enjoy, and do keep in touch.

We hope you can make it back to Ann Arbor for homecoming this fall. On October 7, we invite you to a special luncheon and tour of the department and some of its research labs, where the future is literally being shaped in areas of biotechnology, nanotechnology, and energy and environmental engineering. The next day we will host an open house in the Dow Building. I look forward to seeing some of you then!

We would also like to extend an invitation to you to join us at our Career Fair Reception on Monday, September 26, from 4:30–6:00 p.m. Please see the complete list of our fall alumni events on page 17.

With best regards,

Yang Elected to the National Academy of Engineering

Ralph speaks at a College reception in honor of his NAE election.

Ralph T. Yang, the Dwight F. Benton Professor of Chemical Engineering, was elected to the National Academy of Engineering (NAE). He was selected for his work in developing the theories, methods and materials for difficult separations and purifications by adsorption processes. Ralph joined the faculty at Michigan in 1995 and served as the department chair from 1995-2000. In addition to the NAE membership, he has received numerous national awards for his research accomplishments. These awards include: the William H. Walker Award (1991) for "Excellence in Contributions to Chemical Engineering Literature," the Institute Award for Excellence in Industrial Gases Technology (1996), and the Clarence Gerhold Award for Separations (1997), all from the American Institute of Chemical Engineers. Ralph also received the American Carbon Society's SGL Carbon Award in 1999 for the "Most Significant Overall Contributions to Science or Technology of Carbon Materials" and the American Chemical Society's 2003 ACS National Award in Separations Science and Technology.

Prior to coming to the University of Michigan, he taught for 17 years at the State University of New York at Buffalo, first as an associate professor (1978-1982), then as professor and Praxair Professor. He also served as the chair of the Chemical Engineering Department at SUNY Buffalo from 1989-1995. Prior to his teaching career, Dr. Yang did research at Alcoa in Pittsburgh and Brookhaven National Laboratory on Long Island, NY.

Ralph was among 74 new members elected by the National Academy of Engineering. The total U.S. membership is now 2,192. There are now three department faculty members who have received this honor; Walt Weber was elected into the academy in 1985 and Ron Larson was elected in 2003.

For more information about the National Academy of Engineering, please visit their web page at www.nae.edu.

A LIFETIME OF PEDAGOGY

Scott Fogler, the Vennema Distinguished Professor of Chemical Engineering, was the recipient of the American Society for Engineering Education (ASEE) 2005 Award for Lifetime Achievement in Chemical Engineering Pedagogical Scholarship. This award is given for "lifetime achievement, recognizing a sustained career of pedagogical scholarship that not only caused innovative and substantial changes, but also inspired younger educators to new behaviors that benefit students in chemical engineering."

One of his nominators for the award wrote that, "Scott Fogler at his core is a professor who commits himself to building chemical engineering courses like no one else. True to his engineering training, Scott believes in taking courses and developing and implementing an innovative design every single time it is taught."

She cited the example of his development of a course in chemical reaction engineering and of his experimentation with the most effective methods of having students develop a deeper meaning and discovery for the material. This led to the first version of *Elements of Chemical Reaction Engineering*, his interactive and self-paced textbook meant to "help students take ownership of their learning and develop the answers to textbook examples themselves."

Scott's textbook, now in its 4th edition, is estimated to be used in 70-80% of all chemical engineering programs in the United States and is the dominant reaction engineering textbook worldwide. He and Professor Steven LeBlanc are co-authors of *Strategies for Creative Problem Solving*, which won the Merriam-Wiley Distinguished Author Award from ASEE in 1996. In addition to his pedagogical achievements, Scott has maintained an extremely active research program and has published over 200 papers and graduated 35 PhD students.

He has received numerous teaching awards from the University during his career, including the Class of 1938 Award for Excellence in Teaching (1971), the Phi Lambda Upsilon Teaching and Leadership Award (1977), and the Stephen S. Attwood Award for Excellence in Teaching and Research (1995). In 2003, Scott was named to an Arthur F. Thurnau Professorship, an honor that recognizes and rewards faculty for outstanding contributions to undergraduate education. At the national level, he was featured as ChE Educator in Chemical Engineering Education in 1978 and was the recipient of the Warren K. Lewis Award from the American Institute of Chemical Engineers in 1995 for contributions to chemical engineering education.

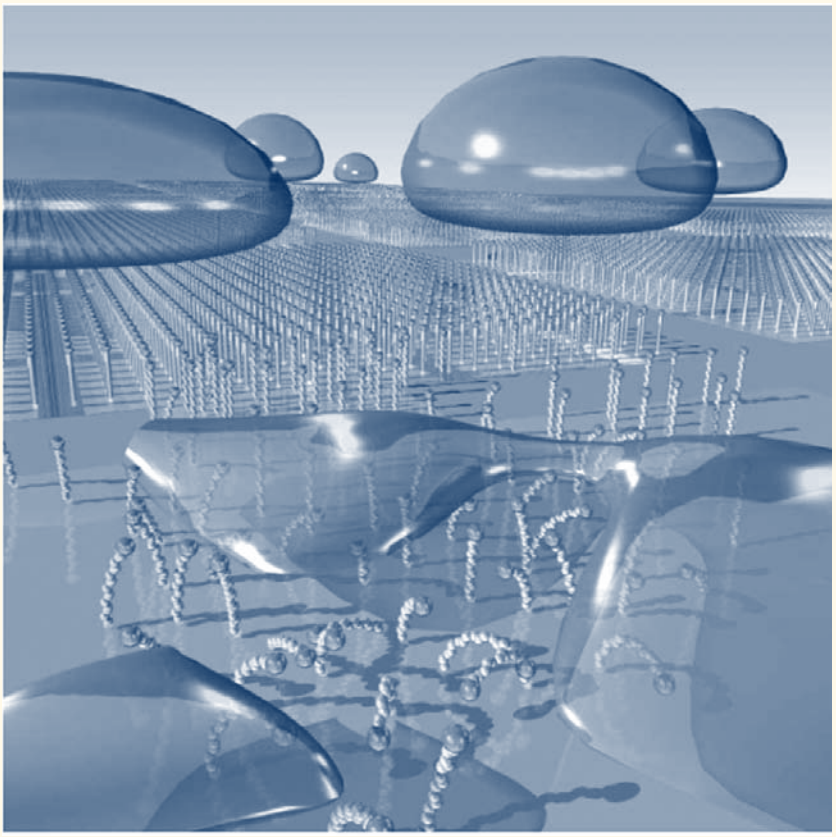
Scott's students will recall his passion for teaching and his continuous improvement of courses. One alumna of his undergraduate kinetics course noted "if you just followed his instructions, you couldn't help but learn the material." At the department level he has been instrumental in the incorporation of active learning, open-ended projects and critical thinking into our courses. We are proud to have him as a colleague. Congratulations, Scott!

POLYMERS

CONTINUED FROM FRONT PAGE

analytical systems. "With the advent of genomics and proteomics, and the exciting breakthroughs of microfabrication, the design of the surface between man-made materials and biology will emerge as one of the fundamental challenges of bioengineering," Joerg adds.

In addition to the vapor-based biomedical coatings, the Lahann group is also conducting important new research with dynamically switchable surfaces. The ability to control dynamic events on a surface, then switch it from one state to the other, has been a longtime dream of surface scientists. As with the example of the stent, this process occurs naturally on the surface of a cell. During his postdoctoral work with biomedical pioneer Bob Langer at MIT, Joerg was able to demonstrate the first reversibly-switching surface based on conformational changes in a monolayer (J. Lahann, et al., "A Reversibly Switching Surface," *Science*, 2003, 299, 371-374.) These "smart surfaces" can reversibly switch properties in response to an external stimulus. To demonstrate these findings, a surface design was developed that can be changed from water-attracting to water-repelling with the application of a weak electric field. Designed as a switch, single-layered molecular-level machines are aligned on a surface using self-assembly and then are flipped between defined microscopic states. This type of surface design may offer a new paradigm for interfacial engineering as it amplifies reversible conformational transitions at a molecular level to macroscopic changes in surface properties without altering the chemical identity of the surface. Joerg and his team are now using the switchable surface technology for biosensor applications. In March 2005 this research was featured in a cover article of *MRS Bulletin* ("Smart Materials with Dynamically Controllable Surfaces," J. Lahann and R. S. Langer, Volume 30, No. 3, 185-188.) The article highlights recent advances with respect to biological applications of smart surfaces.



Artistic rendering of a multi-electrode array of self-assembled monolayers. This image appeared on the cover of the March 2005 issue of *MRS Bulletin.*

In addition to surface-related projects, the group has also started work on biphasic nanoparticles. These polymer-based particles, about 200 to 800 nm in size, have two distinct half-shells that make them look like tiny magnets. These "nano-magnets" may be ultimately used for drug delivery or as functional elements in flexible photovoltaic devices. Recent progress raises hope that this work may have implications in drug delivery, molecular imaging, electro-rheological fluids and the fabrication of smart displays.

To read more about Joerg Lahann's research, visit www.engin.umich.edu/dept/cheme/people/lahann.html.

Polymer Drag Reduction Makes a Comeback

Old problem, new ideas–Vanapalli, Heo, Shetty and Roy take to the water as they attempt to engineer novel strategies for drag reduction.

We've long known that adding a few parts per million of high polymer to a liquid, such as water or crude oil, reduces its friction drag in turbulent pipe flow. This technology has been exploited, for example, to increase the maximum vertical reach of water from fire hoses and to decrease the number of pumping stations on the trans-Alaskan pipeline.

Researchers in the department are working to revive this technology for new applications in fast ocean transport. The strategy is to understand the microscopic origin of the polymer effects on turbulent flow structure and drag so that molecular engineering and numerical simulation can be used to optimize a given drag reducer or even design a new one.

To contribute to this effort, ChE graduate student Anshuman Roy, advised by Professor Ron Larson, created a simplified model of how polymer drag reduction works. Basically, turbulence creates high drag forces, because of the eddies that are contained in turbulence. These eddies efficiently transport drag forces from the fluid to the walls of a pipe or to an ocean-going vessel. It was deduced many years ago that if long polymers are present in the turbulence, then the turbulent eddies stretch these polymers. This stretching creates stresses that tend to damp the turbulent eddies and reduce drag. Anshuman's simplified model captures this effect and allows rapid, simple, prediction of drag reduction.

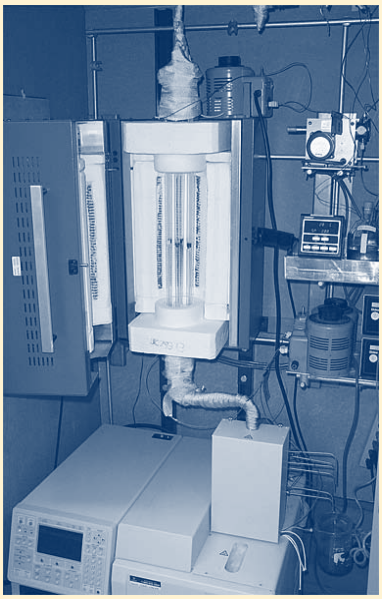
Anshuman's model shows that the molecular details of the dilute polymer solutions used for drag reduction are key. ChE graduate students Abhishek Shetty and Youngsuk Heo, from the Solomon and Larson groups respectively, have used ultra-sensitive rheometers to measure the flow properties of dilute solutions of polyethylene oxide with an accuracy rarely obtained for such solutions. These properties are used in high-powered computer simulation tools developed by collaborators at General Dynamics and elsewhere to predict the drag reduction in complex flows with polymers, including flows past ocean-going vessels. Abhishek furthermore uses light scattering techniques to relate the microscopic structure of the polyethylene oxide solutions to their solution rheology in the hope of engineering their molecular structure for optimal drag reduction.

A crucial limitation of high polymers for drag reduction is that the strength of the flow can induce scission of the molecular chains. Another one of Mike Solomon's graduate students, Siva Vanapalli, working with ChE undergraduate Robert Glied, has discovered the bounds that this mechanical scission places on maximum drag reduction. Siva applied this microscopic understanding to help design an injector that delivers the drag reducing polymer solution to a large-scale boundary layer flow. This boundary layer flow, developed by Mike and Ron's colleagues at the College, Steve Ceccio, David Dowling and Marc Perlin, is a model used to test the simulation codes that predict drag around the hull of a ship. The comprehensive program, supported by the Defense Advanced Research Projects Agency, is bearing fruit–the linking of molecular-scale polymer properties with ship-size flows is yielding new applications of an old technology.

To read more about Mike Solomon's or Ron Larson's research, visit the faculty webpages at www.engin.umich.edu/dept/cheme/people/dirfac.html

Center to Support National Energy Initiative

In his 2003 State of the Union Address, President Bush announced a $1.2 billion Hydrogen Fuel Initiative to reduce the nation's growing dependence on foreign oil by seeking to "develop hydrogen, fuel cell, and infrastructure technologies needed to make it practical and cost-effective for large numbers of Americans to choose to use fuel cell vehicles by 2020." As part of this initiative, the Department of Energy has formed collaborations with automotive and energy industries, universities, and national laboratories to move this country towards a hydrogen economy.



Bench-scale fuel processing system in one of the TEC laboratories

To read more about the Transportation Energy Center, visit www.engin.umich.edu/dept/cheme/people/schwank.html.

The establishment of a new Transportation Energy Center (TEC) at the University of Michigan, led by chemical engineering professor, Johannes Schwank, and Energy Research Director Jerry Mader, is a critical component of this initiative. This research enterprise grew out of the Advanced Energy and Manufacturing Technology program, created in 2004 with funding from the Department of Defense. This program provided the initial funding and infrastructure, including laboratory, faculty, staff and graduate student funding for the new center. Though in its formative stage, TEC scientists and engineers are currently conducting research in advanced fuel technologies for dual-use purposes (civilian/military) and in distributed generation of hydrogen for fuel cells and advanced chemical conversion processes.

One specific area of the center's research involves the analysis of the effect of transportation fuel components on the performance of reforming catalysts, and the development of deactivation-resistant advanced catalytic materials and processes. For transportation applications it is critical to be able to reform the current hydrocarbon fuels into hydrogen for onboard hydrogen demands. Auxiliary power units offer an attractive application for fuel reforming, but there are many other possible uses for mobile hydrogen, such as hydrogen internal combustion engines and improved exhaust treatment catalysts. Other areas being pursued in TEC are the development of modular hydrogen production reactor systems, hydrogen storage options, hydrogen production technologies for synthetic and bio fuels, and advanced battery technology.

As TEC continues to gain momentum, automotive, chemical and energy companies such as GM, Ford, DCX, Delphi, Fuel Cell Energy, Nuvera, and Dow have expressed an interest in forming research partnerships with TEC. Collaborative projects are under consideration with faculty at Wayne State University, Michigan State University, and Kettering University, as well as internally with colleagues in the School of Natural Resources, the Transportation Research Institute, and the Mechanical, Materials Science, and Industrial and Operations Engineering departments.

The University of Michigan has a long history of leadership in energy research and recently expanded the mission of the Michigan Memorial Phoenix Project beyond atomic energy to include research on all energy sources and policies that will promote world peace, the responsible use of the environment, and economic prosperity. As part of this expanded mission, the U–M committed initial funding of nearly $20 million to renovate and program the Phoenix Memorial Laboratory, and establish a university-wide laboratory for advanced energy materials and systems. This laboratory, which will be led by Levi Thompson, will provide funding and facilities for multidisciplinary projects on hydrogen production and storage, advanced batteries, and fuel cells. TEC's efforts will contribute to and enhance the strong energy research foundation already existing within the University and will assist the State of Michigan and our nation as they chart the path of our energy future.

ChE Kudos

FACULTY

Sharon Glotzer's, **Mike Solomon's** and **Nick Kotov's** research groups have collaborated to explore the self-assembly of colloidal particles at the nanometer and micrometer length scales, addressing the issues from both experimental and computational points of view. This work was the featured Perspective article for the December 2004 issue of the *AIChE Journal*.

Zhenli Zhang, ChE research fellow, and **Sharon Glotzer** have discovered a way to self-assemble nanoparticles into wires, sheets, shells and other unusual structures using sticky patches that make the particles group themselves together in programmed ways. This method could be used to fabricate new materials and devices for nanotechnology. The paper on this research, "Self Assembly of Patchy Particles," appeared in *Nano Letters* in August 2004.

In the paper "Inverted Colloidal Crystals as 3-D Cell Scaffolds," published in the September 2004 issue of *Langmuir*, **Nick Kotov's** research group and other collaborators introduced a way to build cell-incubating "honeycombs"–called scaffolds–so that even though the cells occupy different compartments in the scaffolds, they share the same conditions, just as they would share the same conditions if growing in the body. Nick believes that one day, the cells in those scaffolds can be used to grow spare parts for our bodies, or even an entire artificial immune system in a bottle.

Erdogan Gulari and collaborators successfully made the longest synthetic gene using short sections of DNA grown on chips. Their paper describing the work was published in *Nature* in December 2004 and written about in *The New York Times* and the *San Francisco Chronicle*.

Joerg Lahann is the co-author, with Dr. Robert S. Langer from MIT, of a cover article on dynamically switchable surfaces featured in the March 2005 of *MRS Bulletin*.

Joerg Lahann received a National Science Foundation NSF CAREER Award and was named to *Technology Review's* 100 Top Young Innovators. The "TR100" is a group of 100 creative individuals under age 35, drawn from a broad spectrum of fields, whose research is anticipated to shape how we live and work in the future.

Jennifer Linderman is a co-author with Stewart Chang and Denise Kirshner, microbiology and immunology graduate student and associate professor, respectively, of the article, "Multiple Mechanisms Allow Mycobacterium Tuberculosis to Continuously Inhibit MHC Class II-Mediated Antigen Presentation by Macrophages", published in the May 22 issue of the *Proceedings of the National Academy of Sciences*. The paper was highlighted in the "Research Roundup" feature of the March 28 issue of the *Journal of Cell Biology*.

Michael Mayer received the NSF CAREER Award, the National Science Foundation's most prestigious award for new faculty members.

Phil Savage was named an associate editor for the *AIChE Journal*, in June 2005.

Mike Solomon and his former graduate student, **Ali Mohraz**, published an article on colloidal rod assembly, "Direct Visualization of Colloidal Rod Assembly by Confocal Microscope," which was featured on the June 7, 2005 cover of *Langmuir*.

Walter J. Weber, Jr., was featured in a cover article, "Walter J. Weber Jr.'s Unique Legacy", in the November 15 issue of *Environmental Science & Technology*.

STUDENTS

Thanks to new funds coming from a Dean's office initiative, and supplemented by department funds, we were able to offer three $3,000 Summer Undergraduate Research Awards (SURA) to outstanding ChE juniors interested in participating in research with our faculty during summer 2005. Priority was given to outstanding students who had little or no research experience or who otherwise might not have had an opportunity to do research this summer. This year's recipients were **Eric Chang**, **Catherine Dansdill** and **Devin Halliday**.

Shawn Hunter received the first Ken Coulter Outstanding Graduate Student Instructor Award. Mr. Coulter, a ChE alumnus and past president of AIChE who actively supported the department, was appreciative of the education he received at Michigan. Coulter assisted ChE faculty in the department's design courses for nearly a decade, working with Brymer Williams, Ed Young and Dale Briggs. He brought an invaluable industrial perspective to these courses, based on his many years at Dow Chemical.

STAFF

Pablo LaValle (BSE '82), department engineer, was one of the first recipients of the University's Candace J. Johnson Staff Award for Excellence. Pablo organizes and maintains undergraduate teaching labs and provides assistance to research labs and other facilities in the department.

Describing his work in the large undergraduate courses, one ChE faculty member said, "What he did single-handedly for our undergrad laboratories has been nothing short of phenomenal. LaValle didn't just maintain the equipment being used–he built much of it." "The equipment is so well suited to undergraduate education that other universities have replicated it," members of the College said. Students have high praise for him as well. As one student put it, "perhaps even more important than his knowledge of the equipment was his enthusiasm for the experiments."

ChE Undergraduate Named Top Collegiate Inventor

Wei Gu, a chemical engineering undergraduate student, took the top prize in the undergraduate division of the 2004 Collegiate Inventors Competition.

While working in the lab of biomedical engineering assistant professor, Shuichi Takayama, Wei created a simple but robust microfluidic device that, in essence, acts as a miniature plumbing system, complete with microscopic pumps, valves, pipes and mixing chambers. The device provides microscopic control of liquid flows, a breakthrough that has multiple applications–in medical diagnostic procedures and complex chemical analyses, to name just two. Wei believes that, in the future, these devices will be "as common as cell phones or laptops."

In making the device, Wei used molding and lithographic techniques to produce shallow channels in a piece of rubber, which he then covered with another piece of rubber to create a "sandwich" with small tunnels running through it. Wei placed the assembly on a portable Braille machine in which small metal pins rose and fell, pressing against the rubber to close and open the tunnels. Variances in the patterns of pressure produced numerous effects, such as pumping, mixing and stemming flows.

Introduced in 1990, the Collegiate Inventors Competition is an international program that stimulates excitement and interest in technology and economic leadership. The event encourages college students to "actively practice the skills of science, engineering, mathematics, technology and creative invention."

Wei was also selected by *Current*, a magazine published in cooperation with *Newsweek*, as one of 15 undergraduate students nationwide who make up The Vanguard 2005 future leaders of the country. In selecting him in the category of "Inventor," the magazine said that he "...stands on the brink of making medical history."

This fall Wei will begin graduate studies at Stanford in the medical scientist training program or in the MD/PhD program. Although he hasn't chosen his medical or PhD field, he says he is likely to pursue either bioengineering, pharmacology, or developmental biology for his PhD.

From College of Engineering Media and Marketing

To read more about Wei Gu's award please visit www.invent.org/collegiate/2004winners.htm.

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Matt Gessford, Dave Kryscynski, and Rebecca Domzal at the 2004 Career Fair Reception.

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Dow President and CEO Visits North Campus

Andrew Liveris talks with ChE chair, Ron Larson, and ChE sophomore, Brian Byers, after the AIChE luncheon.

We were pleased to welcome Dow President and CEO Andrew Liveris to campus in March, for his first seminar at any university since becoming CEO at Dow. He met with undergraduate students at an AIChE luncheon and gave a presentation on careers in the chemical industry. He presented a seminar for faculty and graduate students later in the day. In his talk, Liveris described a sobering and challenging portrait of the global chemical business, and how prices for feedstocks are coupled to fuels prices and economic and political forces worldwide. Some of his insights will help our faculty better prepare ourselves and our students for the global engineering marketplace. Chemical engineering will have a key role to play, but we must become better informed about these powerful worldwide forces. Liveris was an extremely engaging and passionate speaker, who greatly stimulated our thinking on these topics. The seminar was followed by a roundtable discussion with faculty.

Katz Lectureship Celebrates 35th Year

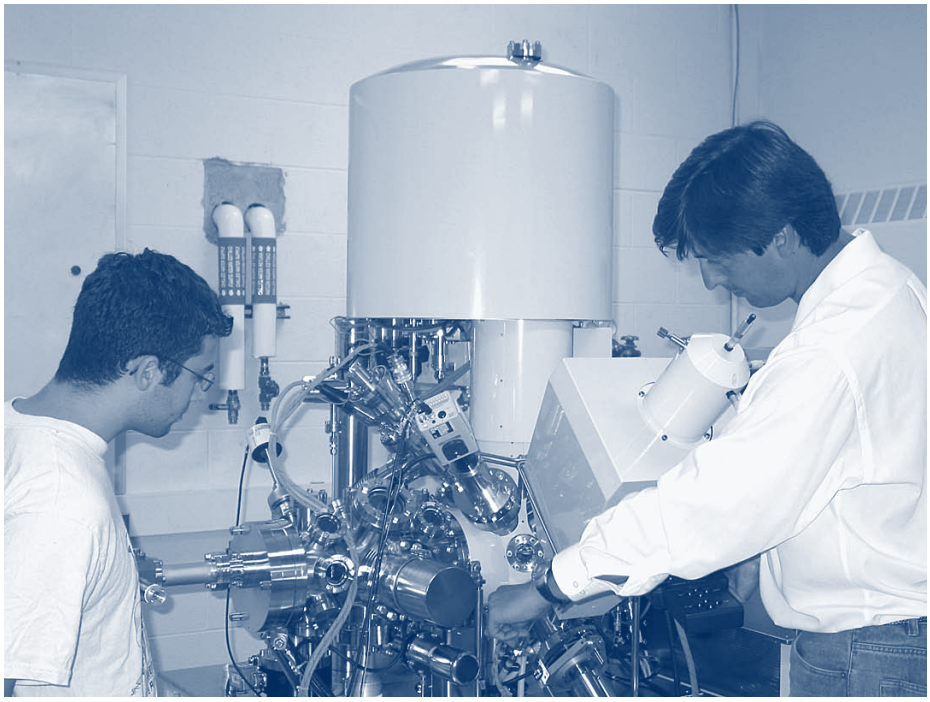
Professor Pablo Debenedetti, Class of 1950 Professor in Engineering and Applied Science at Princeton University's Chemical Engineering Department, was honored as the 2005 Donald L. Katz Lecturer. He presented lectures on "Applications of Thermodynamics to Molecular Design and Materials Characterization" and "Why Do Liquids Form Glasses?" during the two-day event in April. Professor Debenedetti's research interests include the thermodynamics of fluids and fluid mixtures; the properties of metastable liquids, especially water; the structure and thermodynamics of glasses and amorphous materials; the preservation of biomolecules in glassy matrices; and the theory of nucleation.

He is the recipient of several awards for his achievements including, the John M. Prausnitz Award in Applied Chemical Thermodynamics (2001), the Professional Progress Award from the American Institute of Chemical Engineers (1997), and a Guggenheim Memorial Foundation Fellowship (1991). In 2000, Debenedetti was elected to the National Academy of Engineering.

Pablo Debenedetti with Mrs. Elizabeth Katz, widow of Donald Katz, at the lectureship dinner.

Equipment Helps Focus in on Research

This year, several of our faculty members have been able to purchase equipment that will greatly enhance their experimental research abilities. Through the National Science Foundation's Major Research Instrumentation Program (NSF MRI), Joerg Lahann has acquired an X-ray photoelectron spectrometer (XPS) with advanced capabilities. XPS has become a critical technique in the surface characterization of various materials, including polymers, catalysts, metals, and semiconductors. Researchers will be able to use the XPS instrument to do real-time analysis of the chemical state of a surface. In addition, it will make it possible to image the chemical composition of the most layers of a material. The XPS will support a broad range of research activities in biomaterials, surface science, nanoscience, catalysis, and fuel cells, including energy-related work (Levi Thompson, Suljo Linic, and Johannes Schwank), novel nanomaterials design (Nick Kotov), and surface-engineered biomaterials development (Lahann).



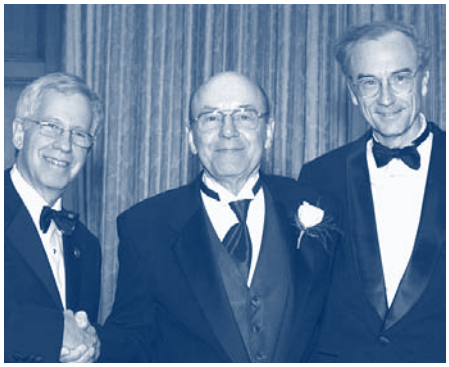
Joerg Lahann (right) and MSE master student David Alberts (left) are using the newly acquired X-ray photoelectron spectrometer for surface analysis of switchable monolayers.

The NSF MRI program has previously supported the acquisition of key equipment for departmental research. Most recently, two confocal microscopes funded by the program have supported complex fluids and biomaterials research. For example, the microscopes have been used by Mike Solomon's group to study the assembly of colloidal crystals and gels used in ceramics, coatings and optical materials. Joerg Lahann's group has used the device to image biphasic nanoparticles that can be developed as future drug delivery vehicles, and Nick Kotov's group has used it to investigate the attachment of epithelial cells to scaffolds useful for tissue engineering.

A recent grant from the College of Engineering made it possible for Joerg to also purchase a surface plasmon resonance (SPR) system. As with the XPS, this grant was due to a strong team effort among several professors in chemical engineering and related disciplines. The equipment will be of benefit to researchers, who are conducting studies on directed self-assembly of nanoparticles or are imaging the layer-by-layer deposition of nanocomposites. This latter application could be used to create tissue structures for regenerative medicine. Other research groups who will make use of this state-of-the-art instrument, with imaging capability, include Erdogan Gulari's group as they study the development and analysis of biochips for genomics and proteomics application, and Michael Meyer's group, which is working on the characterization of lipid membranes and cell membranes.

The same grant from the College allowed Michael Mayer's group, in collaboration with eight other groups from the College, to purchase a state-of-the-art microscope for Total Internal Reflection Fluorescence (TIRF) experiments. This laser-based technology enables detection of fluorescently-labeled compounds at the level of individual molecules. The major advantage of TIRF is that it reduces dramatically the background fluorescence and therefore achieves a fantastic signal-to-noise ratio. The microscope is equipped with an ultra-sensitive digital black and white camera.

2004 Alumni Society Award



Dean of the College of Engineering, Steve Director, Dr. Graessley and ChE chair, Ron Larson

William W. Graessley was honored as the department's Alumni Society Merit Award winner during alumni weekend in October 2004. Dr. Graessley earned dual bachelor's degrees, in chemical engineering and chemistry, from the University of Michigan in 1956. He continued at U–M for graduate studies, completing a master's degree in 1957 and doctoral degree in 1960, both in chemical engineering.

Dr. Graessley is professor emeritus of chemical engineering at Princeton University, and also served on the faculty of Northwestern University. He is an internationally renowned expert on polymers, particularly on the relationship between molecular structure and flow behavior. After leaving Northwestern in 1982, Dr. Graessley served as a senior scientific advisor for Exxon Corporate Research Laboratories. He joined the Princeton faculty in 1987.

In 1990, Dr. Graessley was elected to the National Academy of Engineering. He has held several distinguished lectureships and has been a visiting fellow at Cambridge University.

From the College of Engineering Media and Marketing

Send Us Your Logos!

We are working on a display for the hallway of the Dow Building that will include logos of the many companies and organizations in which our alumni work. PLEASE SEND US YOUR ORGANIZATION'S LOGO! It should be in some permanent form such as a banner, postcard, or sticker, and no larger than 4" x 6". Have all the U–M ChEs at your site autograph it and include their class year, then send it to the department c/o Sandy Swisher. This wall should make a truly impressive display of the impact of our graduates. Please be a part of it!

Welcome Linda!

Linda Casto joined the chemical engineering staff in February 2005. She provides much needed support for our department's burgeoning research activities by processing the majority of the research proposals and monitoring faculty grants. She attended Bowling Green State University and the University of Toledo. Linda has an extensive business background in the private sector, working previously for CPA firms and private businesses in a variety of financial positions. She was also the owner of a small bookkeeping and consulting business.

Linda is originally from Toledo and is the mother of a 22-year old son. After moving to Ann Arbor, she began volunteer work as an adult reading tutor through the Washtenaw Literacy. In her spare time, she enjoys getting together with friends and family, cooking, reading, and working on crafts.

UNDERGRADUATE SCHOLARSHIPS

THEODORE C. ARGUE
George Cater

HELEN B. GIBSON
Christine Andres and Samih Zaman

CLIFTON S. GODDIN
Christine Andres, Devin Halliday and Jodi Liu

LLOYD L. & BARBARA G. KEMPE
Joseph Cheng

IAN D. & FRANCIS M. PATTERSON
Jennifersue Bowker

PROCTER & GAMBLE TECHNICAL
Andrew Laskowski

RICHARD I. & WILLOGENE G. RICE
Ajay Bhasin, Jeffrey Carey, Carrie Christensen, Pratima Ingle, Wen Chung Lim, Elizabeth Ranney and Jeredine Tan

JANE & HOWARD M. TENBROECK
Noha Elmouelhi

JAMES O. WILKES
Jennifersue Bowker and Jeffrey Kennedy

G. BRYMER WILLIAMS
Carolyn Ehrenberger, Robert Glied, Debora Gondokusumo, Kelly Maitland, Jason Noelanders, Benjamin Van Kuiken and Lauren Zetts

Rice Generosity Increases Undergraduate Scholarship Funds

In past years we have not been able to award scholarships to some of our worthy applicants; our students' needs exceeded our funds. This year our situation has improved greatly and we were able to offer seven students a new award, a Richard Irwin and Willogene Guyer Rice Scholarship. This endowment from the Rices increased our total scholarship funds by over 30%. In addition, the Dean's office will be able to use funds from this gift as part of their recruitment packages, to attract top students who plan to major in chemical engineering to the College.

Richard Irwin Rice received his BSE in chemical engineering from Michigan in 1943. Both Richard and Willogene grew up in Indiana and attended Michigan, though Willogene left school to marry Richard. They returned to their hometown of Elkhart, Indiana after Richard's graduation, where he worked for the Continental Can Company. After he passed away in 1963, Willogene generously left a provision in her will to create this fund to endow a need-based scholarship in chemical engineering.

A representative recipient this year was Carrie Christensen, who recently completed her junior year. Carrie knows the value of hard work, as exemplified by the years she participated in the 4-H program while in high school, raising sheep that sold for upwards of $4,000 to raise college tuition funds. She has been active in student societies, serving as pen-pal through the K-Grams program, and team manager of her intramural volleyball team. This fall she will serve as external vice-president of our student chapter of AIChE. She has supplemented her academics with internship experience, including summers at Pfizer Global Research and Development in Groton, CT, and at General Motors Tech Center in Warren, MI. Carrie exemplifies the dedication, hard work, and generosity of spirit of a Michigan ChE, and we were pleased to be able to offer her a Rice scholarship. We thank all those of you who contribute to our various scholarship funds for making it possible for us to support such outstanding students.

WATCH FOR A LETTER FROM THE DEPARTMENT...

As you may have noticed elsewhere in this issue, we are serious about trying to reunite the Michigan chemical engineering family. Watch for a letter this fall, announcing the formation of a *Michigan Chemical Engineering Alumni Association.* This will be YOUR group, but we have some ideas to get it kicked off and rolling. Check it out. Let us know what you think.

Meet Flat Charlie

We are pleased to introduce Flat Charlie, whom we hope you'll take along on your travels. Flat Charlie represents all U–M chemical engineers, and we're excited to send Charlie off to travel with you throughout the world. We hope to get many pictures back showing Charlie in a variety of chemical engineering enterprises, working for many companies and traveling to places throughout the world. This endeavor is part of a new project to help students realize the global reach of Michigan chemical engineers.

Pictures taken with Flat Charlie sent to the department in care of Sandy Swisher or via email to sandys@umich.edu will be posted on the Flat Charlie web page: www.engin.umich.edu/dept/cheme/ /alumni/flatcharlie.html, where you can also download copies of Flat Charlie for your convenience. Only non-doctored pictures, please. *(Please treat Flat Charlie with respect, we wouldn't want any harm or embarrassment to result from this project...)*

Flat Charlie is a cousin of Flat Stanley, with whom some of you might have become acquainted as the main character in a children's book and a geography and world studies teaching tool. Those of you who had Professor Fogler as a teacher will also recognize the germ of this project in the many pictures he has taken of people reading his text book around the globe.

Come Home... to Michigan!

For many alumni, the traditional events planned for homecoming weekend don't fit into their schedules. The only day many of us are free to participate is Saturday, game day. Maybe your tailgate plans with friends and family make participation in homecoming events difficult. Sound familiar?

We want to make it easier for you to "come home" to renew or re-establish your ties with the Michigan chemical engineering family. So this year, we are planning a new event just for you, an open house the morning of game day. It will be a chance to bring your family and friends in to see your picture on the "wall of graduates" if you graduated in 1988 or after (Dad/Mom, did you REALLY dress like that when you were in college?) We'll have a few exhibits showing what other Michigan ChE's are doing today. You'll get to walk the halls of the Dow building once again. If you graduated before 1982 and haven't been back, you can marvel at the difference between the Dow and East Engineering buildings.

We'll have drinks and cookies, and maybe a raffle drawing or two. You can finish off the morning with a walk around North Campus. It'll all be very informal and family friendly…and your friends are welcome too! Barry Barkel (BSE '65) and Susan Montgomery (BSE '84) will be your hosts that morning.

The plan is to run the open house from 9:00 to 10:30 a.m. That way you will still have plenty of time to get to the game at 1 p.m. Free parking is available on Saturday mornings in the lot off Hayward, right in front of the Dow Building. So please come home and join us on October 8!

Want more information? See our alumni webpage www.engin.umich.edu/dept/cheme/alumni.html, or contact Barry Barkel (734-647-3093, bmbarkel@umich.edu.)

Alumni Events Calendar

Monday, September 26, 2005
Career Fair Reception
4:30 - 6:00 p.m.
3158 H. H. Dow
(Podbielniak Lounge)

If you're going to be in town please join us this year at our Alumni/Student Reception during the SWE/Tau Beta Pi Career Fair.

Friday, October 7, 2005
Luncheon and Afternoon in the Department
11:30 a.m. - 3:00 p.m.
3158 H. H. Dow
(Podbielniak Lounge)

If you plan to attend the Michigan Engineering Weekend activities in October, we invite you to join us for lunch with fellow alumni. Following lunch, we would like to get your input on the future of our department, and then we will offer lab tours for those of you interested in learning more about our research. We'll finish our activities before 3 p.m. so you can attend the Alumni Reception in the Lurie Building.

If you would like to join us on October 7, make sure you sign up for "Lunch in the Departments" when you register for alumni weekend. If you have not made reservations yet for alumni weekend you can register online at www.engin.umich.edu/alumni/events/weekend or call 734-647-7046.

If you are not participating in other activities at the College that weekend, but would like to join us for the afternoon, please sign-up with Sandy Swisher (734-764-7413, sandys@umich.edu.)

Saturday, October 8, 2005
Come Home Alumni Open House
9:00 a.m. - 10:30 a.m.
H. H. Dow Bldg

Please see article on left for details about this pre-game event.

Monday, October 31, 2005
Annual AIChE Meeting Open House
6:30 p.m. - 9:00 p.m.
Cincinnati Convention Center

If you will be attending the annual meeting in Cincinnati, please join us at our open house. We look forward to seeing many of you there!

Alumni News

William Saltman (BSE '38, BSE (EngrMath) '38, MS '39) has recently published, *It Began With the Gift of Fire* (AuthorHouse Publishers). The book is a history of scientists who got in trouble with authorities, both religious and secular. The book is based, in part, on lectures given at the Institute for Continued Learning at the University of California, San Diego.

Milton Meckler (MSE '55) says he was saddened to learn of the deaths of Brymer Williams and Maury Sinnott. He considers himself quite fortunate to have known Brymer, Ed Young, Stuart Churchill, Don Katz, and many others as both teachers and friends while attending ChE graduate school at U–M. Especially as it was followed a few years later by another great year of living in Ann Arbor after his marriage to his wife of 45 years, Marlys, an LSA graduate ('60). Last year Milton was selected as one of only four finalists to receive a 2004 Lifetime Achievement Award through the Global Energy award program from Platts, a division of the McGraw-Hill Companies.

Jim Briggs (BSE '59, MSE '60, PhD '63) retired in 1999 after 37 good years with Chevron. The last seven years were spent abroad with major projects in the United Kingdom and Western Australia. He and his wife, Tabby, are now living just south of Denver. He enjoys playing golf, skiing, and traveling. Recent travels include a trip to the North Pole on a nuclear icebreaker and another to India in February 2005.

Bruce Vaughen (BSE '84) presented a paper at the AIChE 2005 Spring National Meeting in Atlanta in March. In July, he led the process safety management workshop at the National Society of Professional Engineers (NSPE) 2005 Annual Convention in Chicago.

Michael Ferrante (BSE '93, MBA '98) left PricewaterhouseCoopers this summer and accepted a position at Merck in R&D operations. He will be moving to Tokyo, Japan for two years in October, where he will be working with Merck's Japan subsidiary. Mike and wife, Deanna, (and big sister Emilia) welcomed Andrew Jacob, born on August 24, 2005.

Javier Jasinki (BSE '94) and his wife had a son, Federico, on March 27, 2005, in Montevideo, Uruguay. Their daughter, Florencia, is almost three years old now. Javier is currently commercializing pharmaceutical active ingredients for the Latin American market.

Javier and his wife, Dorita, with their daughter and newborn son.

Knowing one can never have too many degrees from the University of Michigan, **Scott Adams** (BSE '94) completed U–M's Executive MBA program in April 2005. He still works for Eaton Corporation as manager of program management and advanced quality, located in Southfield, MI. Scott and Julie had their first child, Will, in February 2004. By the way, **Jen (Casteel) Carnine's** (BSE '94) mom knitted the sweater in the picture!

Will Adams

Michael Africa (BSE '94) and his wife, Chris, are expecting their first child in December. Mike has been the computer systems administrator in the U–M Chemical Engineering Department since 1994.

Tina (Maltese) DeCamp (BSE '94) gave birth to Annamaria Sophia DeCamp on March 11, 2005. Tina and her husband have moved back to the Cleveland area and are enjoying parenthood!

Rob Solem (BSE '96) and **Marie (Wiescinski) Solem** (BSE '96) received MBAs from the Kellogg School of Management. They are both consultants with the Chicago office of The Boston Consulting Group and recently moved from Evanston to Chicago. Marie and Rob can be reached at msolem2003, or rsolem2004@kellogg.northwestern.edu.

Sam Catalano (BSE '98) is still working for Marathon Petroleum Company at their Detroit refinery. He's responsible for the reforming units which produce high octane blending components and hydrogen. He's also responsible for jet fuel production. Sam is currently working on converting one of their reformers to a CCR (continuous catalyst regenerator).

After completing his PhD in bioengineering at Rice University, **Jeremy Blum** (BSE '98) worked in Northern Iraq as a medical education and research consultant for an international relief and development organization from March 2004 to February 2005. The focus of his work was supporting and implementing projects in higher education at the local universities with a specific focus in the area of biotechnology. Jeremy also taught a graduate course on the scientific method and on the engineering approach to problem solving (many were concepts taken from ChE 230). Jeremy is starting a postdoctoral fellowship in biomedical engineering at Yale University.

Stephanie (Schultz) Coleman (BSE '98) and her husband, Ray, welcomed their first baby, Joseph Ray, on October 17th, 2004. Joseph weighed 9 lbs.,10 oz. Stephanie currently works at Ford Motor Company and took eight months off to care for the new little one.

Visit the ChE Alumni News page at www.engin.umich.edu/dept/cheme/alumni.html


Hunter Daily

Matt Daily's (BSE '98) wife, Roni, gave birth to their son, Hunter, on Valentine's Day. He's growing fast and learning new things every day. They moved to Syracuse, NY in June, where he has started medical school at Upstate Medical University Syracuse.

Carmita (Burnette) Vaughan (BSE '99) has decided to leave the corporate world and use her powers for good! She has been accepted as a Broad Resident, a two-year residency that recruits MBA grads from the private sector and places them in senior leadership roles in urban school districts. As such, she is currently working as a project manager for the Chicago Public Schools reporting to the COO. She and her husband, Damon, are enjoying their first year of marriage!

A year of extensive travel through Asia inspired **Andrea Messmer** (BSE '99) to make a career transition into international development. Andrea is now working for a Bangkok-based non-government organization, World Youth Peace Summit, as program manager for a rural development project in Poi Pet, Cambodia.


Andrea and her Khmer sister, Lary, at the Siem Reap gardens


Kelly and Aaron Westerfield with their son, Shawn

Kelly (Ries) Westerfield (BSE '99) and her husband, Aaron, welcomed Shawn Michael Westerfield into their family on November 23, 2004. Kelly has returned to work at Procter and Gamble as a senior engineer in skin care product development.

Kelvin Chan (BSE '00) completed his PhD in chemical engineering at MIT in August. His research focused on making structurally well-defined polymeric thin films for biological and microelectronic applications using chemical vapor deposition.

Michael Paczas (BSE '00) graduated from the University of Michigan Medical School in 2004. He's currently living in Cleveland, OH while pursuing a residency in orthopaedic surgery at University Hospitals of Cleveland/Case Western Reserve University. Go Wolverines!

Jon Timbers (BSE '00) and **Kay (Chow) Timbers** (BSE '00) were married in 2001. They are living in Midland, MI and both work for Dow Chemical. Jon is a production engineer in Dow's Midland polystyrene plant and Kay is a production engineer in the multi-purpose pharmaceutical plant, also in Midland. They have two beautiful little girls: Kaytlin is three, and her little sister, Talayah, is one.

Prerna Chaudhry (BSE '01) and **Aashish Maheshwari** (BSE '01, MENG '02) were recently engaged, in a traditional Indian ceremony! They were honored that Professor Wilkes and his wife, Mary Ann, were able to make it for the engagement festivities! Prerna and Aashish are excited about their upcoming wedding, which will be in India this December. They are both very thankful to the ChE Department, as this is where they met! Prerna works for General Mills in Minneapolis and Aashish works for Amgen in California.


Jim Wilkes, Aashish, Prerna, and Mary Ann Wilkes

Mark Dettling (BSE '01) completed his master's degree in natural resources at Cornell University in May 2005. He plans to pursue a career in wetlands ecology.

Darrick Gross (BSE '01) moved to Philadelphia after graduation to work as an assistant director for a non-profit organization working on environmental campaigns, such as fighting to save the national wildlife refuge in Alaska. His next job was as a lab manager for a cancer biology laboratory at the University of Pennsylvania where he was coauthor for a publication in *Science*. Now Darrick is working towards a PhD in chemistry, investigating transport across the nuclear membrane using electrochemical techniques.

Nadia Ismail (BSE '01, MSE '02) is a facilities engineer with ExxonMobil Malaysia in the Upstream Production Company and gets to visit offshore oil and gas platforms every month. She and her husband, Hafeiz, welcomed their son, Noah Azlan, into the world last October. They both miss Ann Arbor and its people very much and hope to visit Ann Arbor again. Nadia says she still enjoys reading Harry Potter books!

Janette Nunn (BSE '01) has been working at Ford since graduation. She is a product design engineer for fuel systems. She recently bought a condo in Plymouth and is a student at the University of Michigan Business School, working towards an MBA.


Janette

Ken Qian (BSE '01) has been at working at a drug delivery company, Eurand, in Dayton, Ohio since graduation. He married Chelsea Wang in September 2002. This summer he will leave his job to pursue a PhD in pharmaceutics at the University of Connecticut, where he will continue to cheer for the Wolverines.

Update your contact information with the University at www.engin.umich.edu/alumni/index.html

Laura Mendricks (BSE '02, MENG '03) is a research associate working in formulation development at ICOS Corporation in Bothell, WA. She has been living in Seattle for two years and is getting married in September. She recently completed the 60 mile 3-day breast cancer walk, raising funds for the Susan G. Komen Breast Cancer Foundation.


Laura at Breast Cancer 3-Day

Following graduation, **Paul Albertus** (BSE '03) used his Roger Jones Fellowship to study English literature for about nine months at the University of York in England. The fellowship also provided for travel, so he had the opportunity to visit a number of European countries. Following a summer in Michigan, he moved to Berkeley to begin a PhD program in chemical engineering. He made it through the first year and is beginning research on the modeling of battery systems, in accord with his interest in hybrid vehicles.

Cathy (Ehehalt) Way (BSE '03) is working for Precisia, as a project engineer in their technical group. She is also developing and heading up their quality control program. Cathy married Luke Way in May 2005. They are enjoying married life and have just adopted two kittens.

After 2-1/2 years as a post-doc at the U–M College of Pharmacy, **Kurt Seefeldt** (PhD '03) started a new position at Schering-Plough in New Jersey in August 2005. Kurt is a senior scientist in the Analytical Development Division, characterizing solid-state pharmaceutical materials. He still enjoys photography when he finds time between the demands of his dog (Emma), wife (Teresa), and children (Max and Alexa).

Jessica Mattis (BSE '04) has just graduated from the General Motors Paint Development Program, which included 8-1/2 months of training to be a process engineer, where she was in classes with people from all over the world, including Mexico, Canada, Spain, Belgium, and China. After completing the program, Jessica accepted a promotion to be a paint process engineer for GM at Pontiac Assembly Center, starting in June 2005.

Please take a minute to send a note or e-mail to us (cheme@umich.edu) and let us know what you're up to. We love to hear from you!

If you would like to be added to our ChE alumni e-mail group so you can receive periodic news updates, please send a request to cheme@umich.edu.

MichiganEngineering
Chemical Engineering

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