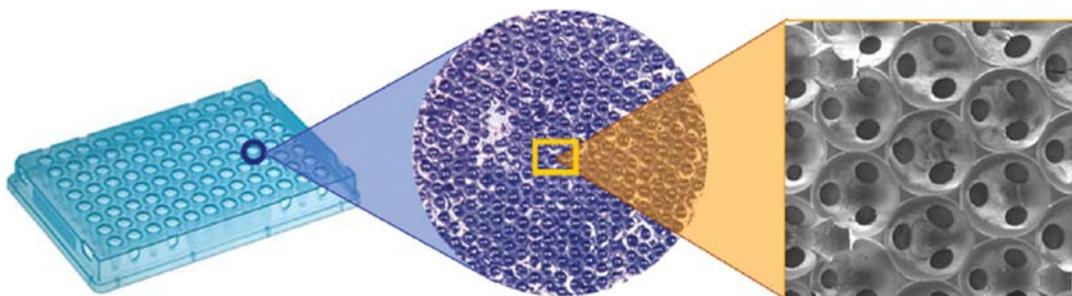


ChE News

FALL 2006

The Newsletter of
the Department of
Chemical Engineering

Perfecta3D May Cut Costs of New Drugs



A schematic of Perfecta3D. The format of Perfecta3D is a well-plate, which is the standard drug and vaccine testing system in industry. Inside each well is a highly ordered 3D substrate, which can grow consistent tissue-like environments that can test drugs more realistically than the current 2D testing environment.

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Many diseases such as mumps, measles, and polio have nearly been eradicated in the United States and many other countries, thanks to the development of breakthrough drugs and vaccines. Today's medical news is filled with stories about new treatments on the market, such as Merck's vaccine for cervical cancer, Gardasil, and about the research going on to find drugs to treat bird flu or new strains of influenza. Nevertheless, the process of drug and vaccine discovery and testing remains time-consuming and costly, requiring up to 12 years and \$900 million to bring a drug to market. A primary reason for this immense cost is the inefficient early-phase testing on living cells in the laboratory (*in vitro*), before drugs or vaccines can be tested in animals or humans. The lack of a tissue culture assay that quantitatively measures and reliably predicts the body's

response to candidate drugs and vaccines is a challenge for the pharmaceutical industry.

Associate Professor Nick Kotov and two of his graduate students, Meghan Cuddihy (chemical engineering) and Jungwoo Lee (biomedical engineering), have designed a solution aimed at accelerating the discovery and development of new medicines, improving the quality of human life and saving pharmaceutical and biotech companies millions of dollars in development costs. Their solution, Perfecta3D, is a novel, highly ordered and consistent 3D substrate combined with a standard well-plate. The 3D substrate in each well of the well-plate can regenerate the specific tissue-like cellular microenvironment of an individual animal or human body. This is a significant improvement over current testing technology, which grows cells in only two dimensions, because

CONTINUED ON PAGE 5

Note from the Chair



In our rapidly changing world, chemical engineering remains more relevant than ever. Recent graduates from our department continue to work in traditional chemical engineering fields, such as chemical processing and consumer products, but today many are choosing to go to pharmaceuticals and life sciences companies, where their unique skills in chemical process design, optimization, and economic analysis are very much needed. It now appears certain that the energy area will be requiring more attention, and you can be sure that chemical engineers will be in the forefront of developing practical solutions to the energy problems facing the country and world. Moreover, since energy usage is linked to environmental concerns, chemical engineers will be called on increasingly to find solutions that balance cost effectiveness, environmental friendliness, safety, and other societal factors. For this reason, the department and university are putting increasing emphasis on the energy area. For example, Levi Thompson is heading up the University's "Hydrogen Initiative" to examine the

role of hydrogen fuel cells in the nation's energy future. Johannes Schwank is developing methods of applying fuel cells to the transportation industry, including military applications. Ralph Yang has been developing methods to remove sulfur from fossil fuels, while Suljo Linic is developing advanced tools for development of catalytic methods that might be applied both to product and fuel synthesis.

While we believe our graduates are superbly trained to take on these challenges, we are constantly reevaluating what we teach and how to make it relevant to the changing world we live in. We have therefore introduced new courses on fuel cells, systems biology, and molecular engineering. New faculty member Peter Woolf has been leading a team of students in redesigning the metabolism of a bacterium to produce potentially useful products through genetic engineering. The use of recombinant DNA is now so routine that Peter can show our undergraduates how to do it themselves, and give them hands-on experience as part of a national competition to produce the most interesting and useful re-engineered bacterium.

We are also deeply concerned about outsourcing and the effect this will have on our profession. It is clear now that

most engineering and manufacturing will be taking place globally, and the companies that succeed will be the ones that find optimal sources of raw materials, labor supply, capital, and markets, wherever these can be found. Thus, the future chemical engineer will need to be savvy about the world as never before. For this reason, the department is involved in educational activities in China, including Shanghai Jiao Tong University and Tianjin University, and has expanded opportunities for our undergraduate and graduate students to study and find internships in China and elsewhere. We also have connections with universities in India, South Africa, and Thailand that add to the international flavor of our department.

To help us better prepare our students for the "real world," the department has formed a new alumni board, which we expect will meet annually to advise us on our curriculum, teaching, alumni outreach, and other activities vital to our mission. Arriving for the inaugural meeting this fall are: Nancy Agrawal, Stu Churchill, Craig Colling, Doris Engibous, Pete Lederman, Max Pettibone, Robert Ranger, Dan Sajkowski, John Santini, Kevin Seibert, Somesh Nigam, and James Street. We are very grateful for

their willingness to advise us.

We were delighted to welcome two new faculty members to our department this fall. Omolola "Lola" Eniola-Adefeso is joining us from the Baylor College of Medicine, after having completed a PhD in chemical engineering at the University of Pennsylvania. Xiaoxia "Nina" Lin is coming from Harvard Medical School, after having completed a PhD in chemical engineering at Princeton University. Thus, both Lola and Nina have two years of experience in medical school research, to supplement their chemical engineering training, and will bring unique skills to their teaching and research here at Michigan.

Finally, we were proud to honor our alumni award winner Doris Engibous (BSE ChE '77), CEO of GRAFTcath, at last fall's Alumni Award Dinner, and will be honoring Bill Retallick (MSE ChE '48), president of Sepracor, this October 27. We will also be hosting our new alumni board that day, and encourage you to drop by then, or any other time during the year, to visit us. We would also love to meet with as many of you as can make it to our Monday night reception at the AIChE meeting in San Francisco in November.

With Best Regards,

Molecular Engineering Introduced to Students

The Chemical Engineering Department is piloting a suite of new initiatives to introduce undergraduates to the growing field of molecular engineering. From the introductory mass and energy balances course to reaction engineering and elective offerings, students are receiving new training in how to simulate and manipulate molecular properties for engineering purposes.

The department's motivation for the initiative is that engineers are increasingly called upon to develop processes, products and devices by active manipulation of molecular and nanoscale properties. Already, many sectors require such expertise. For example, manipulation of polymers, nanoparticles and surfactants is used in the consumer products sector. Automotive sector engineers

modify the molecular structure of natural fibers to make environmentally benign composite materials. In the life sciences, polymer scaffolds are engineered to be receptive to growing cells for the construction of replacement organs. In addition, much graduate engineering research is explicitly focused on processes involving molecules.

To address these needs in the past academic year, one focus of the initiative was to incorporate molecular simulation into some of our core courses. Working with graduate student Craig Comisar, Professor Jennifer Linderman introduced simulations of molecules in a piston cylinder system to her introductory ChE course to demonstrate the molecular origin of phase transitions and differences between the equations of state of

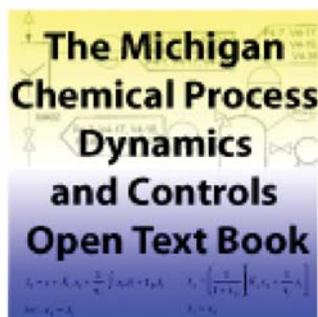
real gases. In homework sets, students operated the simulations so as to visualize molecular motion and configuration. Another graduate student, Greg DiLeo worked with Professor Phil Savage to introduce computer tools into reaction engineering and design. Here, students investigated the relationship between molecular behavior and bulk kinetics in multi-species reversible reactions. In the future, these tools will be increasingly incorporated in other courses as a thread that spans the chemical engineering core curriculum.

Also in 2006, Professors Mike Solomon and Mark Burns launched a new elective course in molecular engineering. The course, in which 17 undergraduates were enrolled, addressed the relationship between molecular properties such as size, shape and interaction and macroscopic behavior such as diffusion, phase stability and structure. In collaboration with Professor Sharon Glotzer and her students Chris Iacovella and Aaron Keys, Solomon and Burns developed simulation exercises in which students applied molecular dynamics methods to investigate topics such as spinodal decomposition, polymer coil conformation, surfactant phase equilibrium and block copolymer assembly. Students concluded the course with an independent project that applied course concepts to molecular product and process design. The course will be offered next in Winter 2007.

The department would like to hear your ideas about the current and future importance of molecular engineering as it relates the career development of our undergraduates. Please feel welcome to contact Professor Mike Solomon (mjsolo@umich.edu, 734-764-3119) with your comments and questions.

Students to Publish Online Process Control Text

In Fall 2006, Professor Peter Woolf and lecturer Barry Barkel have radically revised the senior process control course (ChE 466). In contrast to previous years, this year the students are constructing an online wiki textbook to provide a modern, accurate, and free resource for the greater chemical engineering community. In revising the course with both industry and student feedback, the faculty have eliminated many of the hand calculation tools such as Laplace transforms from the class, replacing them instead with numerical methods in Mathematica,



Matlab, and Excel. As a result, students are now learning advanced control concepts such as multiple input multiple output control strategies and nonlinear dynamics. In response to industry needs, we have also included sections on statistical process control and P&ID design. If you are interested in tracking the progress of the Michigan Chemical Process Dynamics and Control Open Textbook, go to <http://controls.engin.umich.edu> and see for yourself! If you have ideas for this course, please email them and let them know how they can make the course better in the future.

Humanities and the Chemical Engineer

When you think of the average engineer's education, you don't think of an eagerness to attend lectures on Rousseau's *Discourse on the Origins of Inequality* or discussions of Kant's political philosophy. Of course we know our students aren't average... Our department is proud that three of our recent graduating seniors have been rewarded with the opportunity for just this type of experience as recipients of the Roger M. Jones Fellowship Abroad. This fellowship covers all expenses for an academic year at a British university to pursue studies in English and the humanities. The fellowship, which honors engineering humanities professor Roger M. Jones, who strongly believed in the importance of humanistic studies in a technical age, is unique to U-M engineering. "The College has a long tradition of emphasizing the humanities and this is one way we recognize those students who successfully blend engineering and the humanities into their lives," states Jeanne Murabito, managing

director of Undergraduate Education, who helps administer the Jones program.

"I applied for the fellowship because of the allure of devoting all of my ef-

'why' and the 'how' of this expression." After a year in England, Kyle plans to start doctoral studies in biomedical engineering at Boston University.

Kyle is following in the path of Paul Albertus ('03), who studied English literature and political science at the University of York, and spent much of his free time traveling through Europe, visiting Spain, Italy, France, Greece and Germany. "Above all else my Roger Jones year gave me the opportunity to devote my time to reading literature and poetry, an opportunity I would not otherwise have had," Paul recalls. "Many of the poems and passages I read are still with me today, and often return to my mind during the course of my daily life. They remind



Paul Albertus ('03) in front of St. Mary's church on the grounds of Fountains Abbey in Yorkshire, during his tenure as a Roger M. Jones fellow. (Photo by Paul Albertus)

me of the power of expressive language to shape and create personal experience, and the ability of something as simple as words to provide beauty and a deep insight and understanding." Paul is currently a doctoral student at the University of California, Berkeley, where he is pursuing his long-standing interest in environmental issues, working on modeling and optimization of battery systems for transportation applications. He has continued his academic explorations outside of chemical engineering by taking environment-related classes in the Energy and Resources Group and the Business School.

forts towards the study of literature," states Kyle Allison ('06), the most recent recipient of this award. Kyle is currently studying modern literature at the master's level at Royal Holloway College London. "Literature is important to me because communication is important to me. Whether it be from an outer or inner necessity, people need to express themselves to one another. I'm interested in both the

Many of the poems and passages I read are still with me today, and often return to my mind during the course of my daily life.

— Paul Albertus

Queen Mary's College, part of the University of London, was John Decker Ringo's choice when he was selected for this award as a chemical and mechanical engineering dual degree graduate in 2002. Looking back on his time in England, where he studied literature, architecture, and film, he appreciates the opportunity to travel and study in another country. "Studying literature for a year taught me that liberal arts are no 'softer,' or easier than engineering—that those disciplines are formidable in their own right," he states. Decker also feels he

Studying literature for a year taught me that liberal arts are no 'softer,' or easier than engineering—that those disciplines are formidable in their own right.

— Decker Ringo

grew from the experience, realizing that "I would prefer to exercise my scientific talent in an atmosphere that is also creatively engaging." After a stint as a research engineer in industry, Decker will soon start his studies towards a master's degree in MIT's Technology and Policy Program. "Decker, Paul and Kyle all epitomize that belief of Professor Jones that humanistic studies are

incredibly important in the age of technology," says Murabito. "We are proud to have these three scholars and student leaders as our recipients and our ambassadors." We couldn't agree more.

PERFECTA 3D

CONTINUED FROM FRONT PAGE

Perfecta3D can more accurately reflect how drugs react in the body. In this consistent 3D environment, high quality and high throughput *in vitro* cellular assay results, particularly for toxicity and efficacy testing, will deliver significant and supporting information about new drug candidate materials prior to *in vivo* clinical testing.

The development of Perfecta3D has generated quite a buzz. The team, along with two MBA students from the University's Ross School of Business, formed a company named Trifecta Biomatrix, and have had great success. This winter, the team was awarded a Dare to Dream Assessment Grant from the Zell Lurie Institute for Entrepreneurial Studies at the Ross School. This grant is awarded to students to assess the commercial feasibility of a business concept for an innovative business with high-growth potential. They followed their success at Michigan by winning third prize at the BR Ventures Business Idea Competition at the Johnson School of Business at Cornell University in Ithaca, NY. The semester culminated triumphantly when the team captured the grand prize in the Entrepreneurial Challenge at the 2006 Materials Research Society Meeting in San Francisco, CA. More recently, Trifecta Biomatrix has been meeting with venture capitalists and experienced entrepreneurs to get advice about developing their discovery into a viable business.



Decker Ringo ('02) is second from left at the annual Allom Cup Boat Race between Queen Mary's College and the Medic's College. (photo courtesy of Decker Ringo)

Gulari's Group Advances DNA Synthesis

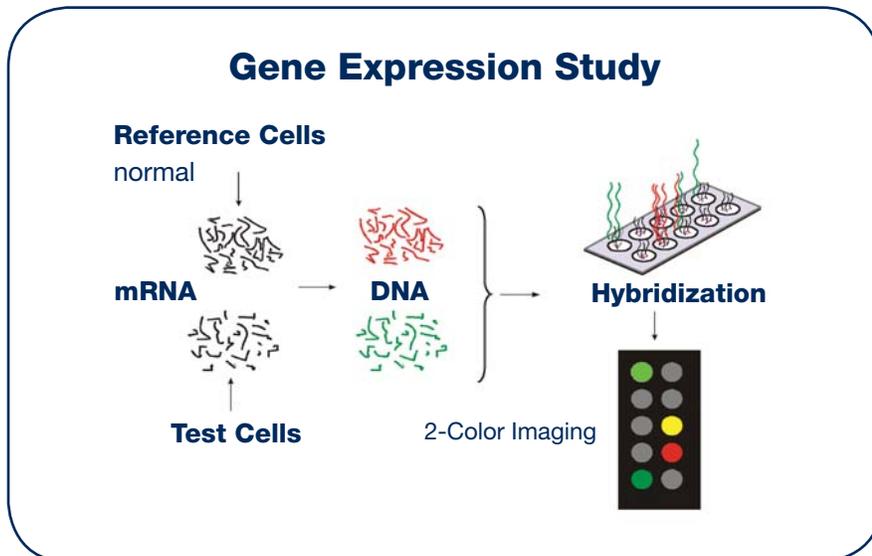


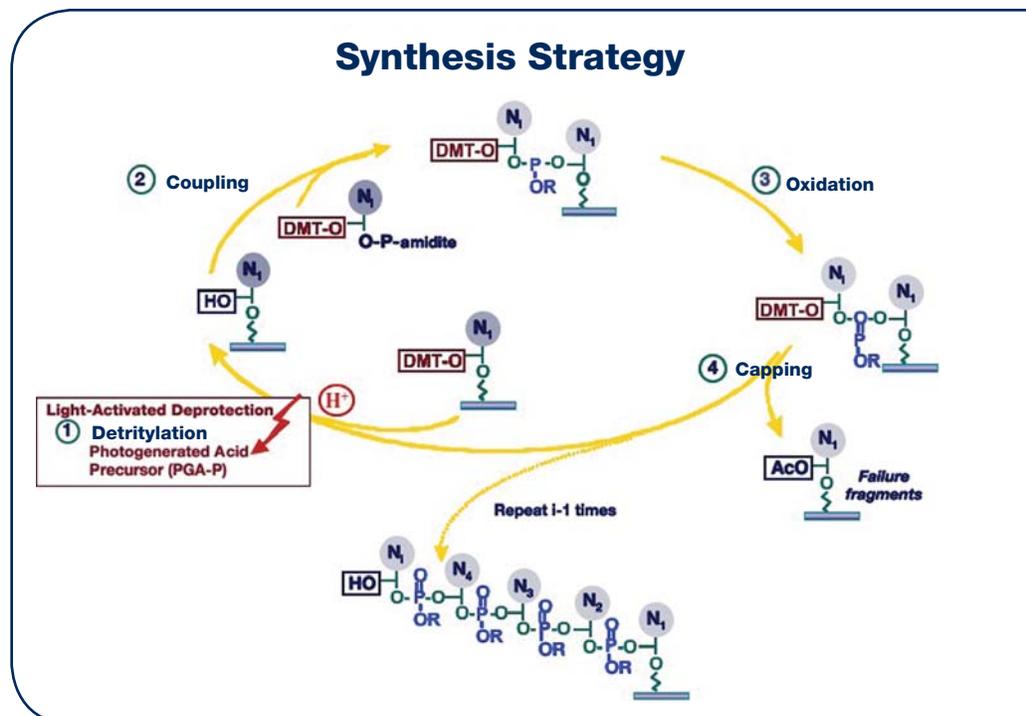
Figure 1 illustrates the principle of microarray based detection of gene expression. DNA from healthy and diseased cells is labeled with different color fluorescent tags and then hybridized to single strands of DNA connected to the surfaces with a covalently bound linker. The green indicates the expression of a gene in only diseased cells (in this example), red fluorescence is from the genes of the healthy cells. The yellow shows expression of the gene in both types of cells.

Biochips or microarrays have revolutionized medical research by making it possible to analyze the expression levels of tens of thousands of genes simultaneously with a small sample containing no more than 10 micrograms of DNA or RNA. For the past six years Professor Erdogan Gulari and his research group have focused on developing new and radically lower cost technologies for making microarrays and other massively parallel diagnostic tools. This effort has resulted in two new methods of making microarrays using off-the-shelf reagents, modified digital projectors, and two start-up companies to commercialize the technologies (Atactic Technologies of Houston, Texas and Biodiscovery of Ann Arbor, Michigan). Microarrays are made either by spotting or synthesizing *in situ* thousands of precisely known sequences of single strand fragments

of DNA or short proteins on a solid surface, usually glass. When brought into contact with an unknown solution of DNA, the surface-bound strands

will hydrogen bond (hybridize) to their complementary sequences in the unknown solution. The presence and the relative concentration of the complementary sequences is detected by fluorescence. Comparison between RNA from healthy tissue and that of diseased tissue reveals the differences in the expression levels of genes and their relationship to disease. Figure 1 (left) shows schematically how gene expression is analyzed by a microarray hybridization experiment.

Figure 2 (below) shows how they make microarrays on a flat glass or silicone surface using UV light to generate an acid that removes the protection group from the DNA monomers (A, C, G, T) at the end of a growing chain attached to the substrate surface with a linker. Since their technology enables them to synthesize very large numbers of DNA, RNA and peptide fragments simultaneously for a very low cost they



have been able to expand into application areas in addition to developing the microarray technology. One such application is producing synthetic genes. Making synthetic genes has traditionally been a very laborious, expensive and time consuming process. A synthetic gene that is 10,000 base pairs long can cost as much as \$100,000 and take up to three to four months to make. With their massively parallel DNA fragment synthesis technology they would like to reduce the time to the order of a day and the cost to approximately \$100-500. Availability of completely synthetic genes will make it possible to develop many new protein based drugs, DNA vaccination and development of disease resistant plants. Other applications they are pursuing are the discovery of new antibiotics, the identification of pathogens in the environment, and the development of rapid genetic resequencing devices.

Figure 2 shows the outline of the synthesis steps for one DNA fragment on the surface. By using a digital projector, almost 400,000 different DNA fragments can be synthesized simultaneously.

Thompson Named Balzhiser Collegiate Professor



Levi T. Thompson was appointed as the Richard E. Balzhiser Collegiate Professor of Chemical Engineering, named for the former departmental chair, leader in chemical engineering research and education, businessman and politician. Professor Thompson earned his BChE from the University of Delaware and like Dr. Balzhiser, he played college sports as an undergraduate student. He completed an MSE in chemical engineering at the University of Michigan and again like Dr. Balzhiser, Thompson earned an MSE degree in nuclear engineering and PhD in Chemical Engineering from the University of Michigan.

After working for two years at KMS Fusion, he joined the faculty of the Department of Chemical Engineering. Research in Thompson's group focuses primarily on defining relationships between the structure, composition and function of nanostructured catalytic and electrochemical materials. In addition, he has distinguished himself in areas including micro-reactor and micro-fuel cell systems, and hydrogen technologies. Thompson leads a large multi-disciplinary team developing compact devices to

convert gasoline and natural gas into hydrogen. Recently, he was appointed founding director of the Hydrogen Energy Technology Laboratory. This laboratory was established to support high risk, multidisciplinary hydrogen production, storage and conversion research at the University of Michigan, and will be housed in the renovated Phoenix Memorial Laboratory.

From 2001 to 2005, he served as Associate Dean for Undergraduate Education. In that capacity, Thompson led the College of Engineering's efforts to recruit an excellent and diverse undergraduate student body and provide them with a high quality educational experience and environment. He is presently director of the Michigan-Louis Stokes Alliance for Minority Participation (MI-LSAMP), a \$5 million, National Science Foundation funded program that teams the University of Michigan, Western Michigan University, Michigan State University and Wayne State University in an effort to significantly increase the quantity and improve the quality of students earning science, technology, engineering and mathematics baccalaureate degrees.

Thompson is recipient of a number of awards and honors including the National Science Foundation Presidential Young Investigator Award, Michigan Catalysis Society Guiseppe Parravano Award, and the Union Carbide Innovation Recognition Award. He is co-founder, with his wife Maria, of T/J Technologies, a developer of nanomaterials for advanced batteries and fuel cells.

Faculty News

KUDOS

Erdogan Gulari received the College of Engineering's 2006 Stephen S. Attwood Award. This award is given in recognition of excellence in research, teaching and service.

Sharon Glotzer received a College of Engineering Research Excellence Award.

Jinsang Kim received the College of Engineering's Jon R. and Beverly S. Holt Award for Excellence in Teaching for the outstanding contributions he made to course development and teaching.

Nick Kotov was awarded a Boeing Welliver Faculty Fellowship for his breakthrough research in ultrastrong nanocomposites. This fellowship program seeks to facilitate interaction between engineers at Boeing and in academia.

Nick Kotov received an E.T.S. Walton Visitor award sponsored by the Science Foundation Ireland. Nick was selected for his creative and outstanding achievements in nanotechnology research.

Joerg Lahann was selected by the Midwest Research University Network as one of the midwest's top 15 researchers, and was honored at the BIO 2006 conference in Chicago.

Suljo Linic received a National Science Foundation CAREER Award for his proposal, "Hybrid theoretical/experimental studies of metal/metal oxide interface chemistry: the effect of oxide

support on Au/oxide catalytic activity." This project will employ a hybrid theoretical/experimental approach combining Density Functional Theory (DFT) calculations and well-defined surface science experiments to address the issue of chemical activity at metal/oxide interfaces.

Suljo Linic was elected secretary/treasurer of the Michigan Catalysis Society.

Susan Montgomery was featured in the summer issue of *Journal of Chemical Engineering Education* (CEE). Each year CEE selects three chemical engineering educators to highlight. The educators are chosen for their excellence in teaching and for their contributions to chemical engineering education.

Phil Savage was elected 2nd vice-chair of the Catalysis and Reaction Engineering Division of AIChE. He will serve as vice-chair in 2007 and chair in 2008.

Mike Solomon was named the "American Society for Engineering Education (ASEE) 2006 Outstanding Professor of the Year" by the U-M Student Chapter of ASEE.

Levi Thompson was selected as the winner of the 2006 Giuseppe Parravano Award for Excellence in Catalysis Research and Development. Levi was chosen for outstanding contributions to the development of novel carbide and nitride catalysts, and for his passion in mentoring and educating undergraduate and graduate engineering students, in-

stilling in them enthusiasm for catalysis research.

Ralph Yang was awarded this year's ChE Department Excellence Award.

RESEARCH BRIEFS

With the help of a \$2.2 million grant from the Michigan 21st Century Fund, **Erdogan Gulari** and research investigator **Jean Marie Rouillard** have started a small company, Biodiscovery-LLC, to commercialize some of the microarray/biochip technology developed in Gulari's research laboratories. Approximately \$400,000 of this award will support Ron Larson's research on quick sample preparation. Erdogan also received another ~\$1 million from this fund for work on a biochip commercialization project that he is working on jointly with MSU professors, Syed Hashsham and James Tiedje.

Nick Kotov's group has developed a nanoscale thermometer that has potential applications in microfluidics, micro-electro-mechanical system and nano-electro-mechanical system technologies as well as in medical and homeland security applications. A paper on the topic, "Nanoparticle Assemblies with Molecular Springs: A Nanoscale Thermometer," is available online in *Angewandte Chemie International Edition*.

Joerg Lahann and several other U-M researchers have used electricity to create nanoparticles with two sides. This technique could fuel a new research direction in the field, because the limits of size and shape are expanded. The new particles are exciting for several reasons and could be used in many applications including targeted drug delivery, or to

create new self-assembling particles. The findings are published online in *Nature Materials*.

Joerg Lahann and his graduate student, David Peng, are developing a device to test breath for the presence of metabolites associated with breast cancer. The cornerstone of the device, and what makes it possible, is the switchable surface technology first developed in Lahann's lab while a post doctoral student at MIT. Theoretically, a woman could breathe into an over-the-counter device and cancer-indicating metabolites would be attracted into the nanopockets, thus causing the pored surface to fill and become dense. Then, an electrical charge would be applied so that the straight particles would bend, thus ejecting the metabolites so that multiple tests could be done in the same device.

Suljo Linic and second year PhD student, Siris Laursen, recently published a paper in *Physical Review Letters*. Suljo and his student identified the underlying physical phenomena that govern unusual chemical activity of gold nanostructures. These promising studies will have an impact on the understanding of the chemistry of small (nanometer) metallic structures.

A portable lab-on-a-chip called the Genotyper, developed by a multidisciplinary team that includes **Ron Larson**, **Michael Solomon** and Oveta Fuller, Associate Professor of Microbiology and Immunology, could eventually allow doctors to decode the genetic makeup of flu viruses in less than two hours. The technology originated in the laboratories of **Mark Burns** and David Burke, who sought to develop fast, inexpensive methods for deriving genetic information from humans.

Savage Receives Distinguished Mentor Award



Phillip Savage received a Rackham Distinguished Graduate Mentor Award. This award, in its inaugural year, seeks to honor tenured faculty who guide students throughout their professional training in a continuing, multifaceted partnership sustained by mutual respect and concern.

Phil's mentoring skills and ability to attract top students to his group have been consistently displayed throughout his 20 years at Michigan. As one of his colleagues wrote, "Professor Savage recognizes that his graduate students are individuals and that they have different interests and aspirations. He gives them both liberty and opportunities to pursue their interests and develop their professional and personal skills."

His former students attest to his exceptional ability to motivate and guide them. One said "he contributed invaluable to my development as a researcher, teacher, writer and mentor. Most importantly, he challenged me to view research problems in new ways and helped me to become an independent thinker. He demonstrated to me how to be a good listener and how to balance the many competing demands of academic life. As a graduate student instructor for two of his classes, I observed him use different instructional techniques and learned many lessons about effective teaching."

Another student simply concluded that Phil was the "best graduate advisor I could have possibly had during my time at the University of Michigan." He said that "Dr. Savage has a confidence in his graduate students that most advisors lack. He understands that PhD students get to this position in life by being self-driven individuals. With this knowledge, Dr. Savage very much trusts each student to do his or her best and obtain meaningful results. This strategy reaps many rewards, not the least of which is that he actually gets more out of his students than if he were to stand over their shoulder all of the time."

Congratulations, Phil!

New Faculty

Omolola Eniola-Adefeso



We welcomed new assistant professor Omolola “Lola” Eniola-Adefeso this fall. Lola joins us after finishing a post-doctoral appointment in pediatrics/leukocyte biology at Baylor College of Medicine with C. Wayne Smith. She received her PhD in chemical engineering from University of Pennsylvania, and her bachelor’s degree from University of Maryland, Baltimore County.

Lola’s research focuses on understanding the biophysics of blood cell adhesion and how this information can be utilized to design artificial cells for targeting therapeutics to diseased tissues. Blood flow dynamics and cell adhesion are two areas in biology where chemical engineering skills are applicable. The movement of blood in blood vessels is similar to fluid flowing through a pipe, and blood cells are simply particles in flow. Thus, knowledge of fluid dynamics can help understand shear forces on blood cells in different vessels, and this information, combined with the kinetics of blood cell receptor/ligand interactions can help

predict their adhesive interaction with blood vessel wall—an event that leads to their migration into diseased tissues. Lola uses different *in vitro* adhesion assays to isolate and study blood cell receptor-ligand interactions that govern adhesion to blood vessel walls with the goal of identifying adhesive behaviors that are solely due to physical properties of cell ligands/receptors. Her group will be able to use this information to design artificial blood cells that can target and deliver therapeutics to diseased tissues.

Lola’s previous research in this area has shown that biodegradable, polymeric microspheres display similar adhesive behavior in fluid flow to that of leukocytes *in vivo* adhesion when their surface is modified with adhesive ligands found on leukocytes. Her most recent publication in the *Journal of Biomaterials* (June 10, 2005) was featured on LeadDiscovery.com as a breaking journal article for the drug development sector. This article described a novel strategy for drug targeting that uses multiple ligands/antibodies to target multiple adhesion molecules on the human blood vessel wall. This approach offers increased efficiency and specificity for drug targeting. Lola’s research at Michigan will continue to focus on identifying disease-specific receptor-ligand pairs that can potentially be used for drug targeting in several human diseases. Her group will also work closely with polymer chemists to develop smart drug carriers for drug delivery.

Outside of work, Lola enjoys cooking, running and traveling with her husband, Kay, who is a civil engineer. She is teaching the undergraduate heat and mass transfer course this fall.

Xiaoxia Lin



Xiaoxia “Nina” Lin joined the department as an assistant professor in September. Nina received her bachelor’s degrees in chemical engineering with a minor in computer science and technology from Tsinghua University of China in 1997. After graduation she came to United States and pursued her PhD in process systems engineering under the supervision of Christodoulos A. Floudas at Princeton University. Then, from 2003 through 2006, she was engaged in postdoctoral research in the exciting new fields of systems biology and synthetic biology with Professor George Church at Harvard Medical School.

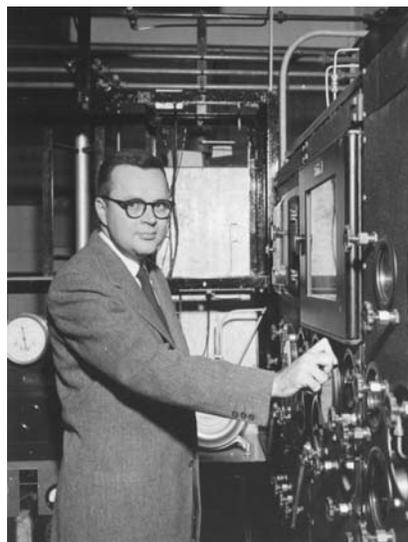
Nina is very excited to be starting the next chapter of her research career at Michigan. She will be working to discover the fundamental mechanisms underlying the diverse and complex functions of biological systems, and to engineer them for the development of beneficial biotechnologies, through a multidisciplinary approach that integrates mathematical modeling, computer simulation and wet-lab

experiments. More specifically, she is focusing on the quantitative investigation of the mechanisms for biological switching, which is a widespread feature of biological systems and is crucial for the regulation of numerous biological processes, such as cell cycle progression and cell fate decision. One fascinating mechanism that has received increasing attention in the past several years is multi-site modifications of single molecules. Another research area she is pursuing is the study and engineering of microorganisms with the goal of developing new biotechnologies for important applications such as bio-energy and bio-remediation. Examples of interesting projects in this field include system-level modeling of metabolic networks, design and construction of genetic circuits, and laboratory evolution of microbial consortia. Nina hopes to work closely with her students and to collaborate with other researchers at Michigan.

In her spare time, Nina enjoys photography. Her husband, Yaoyun Shi, is an assistant professor in the Department of Electrical Engineering and Computer Science. They have started to explore together the many aspects of Ann Arbor.

In Memoriam

Former ChE faculty member, Robert Roy White, passed away on January 22, 2006. He received a BS from Cooper Union Institute in 1936, an MS from U-M 1938, and his PhD in 1940 from U-M. After several years of working in industry, Dr. White was appointed as an instructor of chemical engineering at Michigan in 1942, rising through the ranks to professor in 1948. He won



Robert R. White in East Engineering, circa 1950.

the prestigious Henry Russell Award (for instructors or assistant professors) in 1946 for “conspicuous service.” At the University, White’s research activities and publications centered on phase equilibria, mass transfer, reaction kinetics, mixing in packed beds, and fractional and azeotropic distillation. He was also a significant contributor to G.G. Brown’s *Unit Operations*.

In 1958 he was appointed associate dean of both the Horace Rackham School of Graduate Studies and of the College of Engineering. He became the first director of the U-M’s new Institute of Science and Technology. After he left U-M in 1960 he continued his distinguished career as a consulting engineer and researcher for major companies, including Champion Paper, Standard Oil Company, Universal Oil Products, Dow Chemical and B.F. Goodrich.

From “A Century of Chemical Engineering at the University of Michigan” by James O. Wilkes.

Gifts from our Alumni, Friends and Research Partners

July 2005 to June 2006

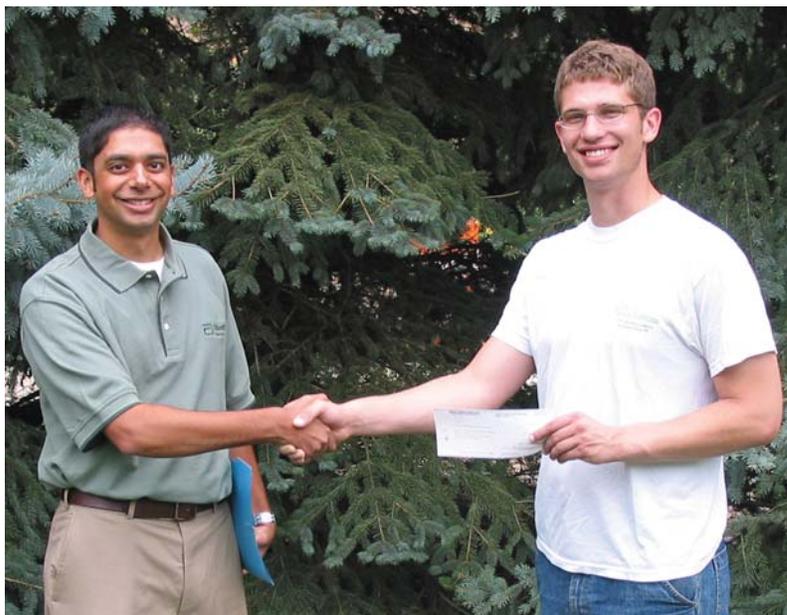
CORPORATE GIVING

Agilent Technologies
BASF Corporation
Bristol-Myers Squibb Foundation, Inc.
Chevron Oil Company
Columbia Geosciences LLC
Phillips Petroleum Company
Cormetech, Inc.
The Dow Chemical Company
Dow Corning Corporation
Envair
ExxonMobil Foundation
Ford Motor Company
General Electric Company
Johnson & Johnson Family of Companies
Eli Lilly and Company Foundation
Marathon Oil Company Foundation
Merck & Co., Inc.
Nalco Energy Services
The Procter & Gamble Company
Pfizer, Inc.
Rio Algom Mining LLC
Schlumberger
Shell Oil Company Foundation
Total E&P USA, Inc.

INDIVIDUAL GIVING

Lyle F. Albright, Ph.D.
Richard E. and Christine R. Balzhiser
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Tanuj Mehta (BSE '02) presents AICHE president, Curt Longcore, with a check of support on behalf of the Abbott Laboratories Fund.

Thank you for your generous gifts to the Department of Chemical Engineering. If we have missed someone, please accept our apology, and also let us know so we can correct our records.

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AGG BSA05 EN02

UM/MSU Joint Seminar

Jay Keasling, a U–M graduate and professor of chemical engineering at the University of California, Berkeley, was the speaker at the 24th Annual Blue-Green Seminar on November 10, 2005 at the University of Michigan. This annual joint seminar between

the Chemical Engineering Departments at the University of Michigan and Michigan State University began in the early-1980s and was started

by Scott Fogler and Charles Petty to encourage more interaction between the faculty and students of the state's Big Ten institutions. Faculty from both schools participate each year in the selection of a prominent chemical engineer to speak at the event. The seminar, which alternates between the two schools, will be held at Michigan State University in 2006.



Dr. Keasling with Scott Fogler

Dr. Keasling's lecture topic was "Engineering Microbes for Production of Anti-Malarial Drugs." Dr. Keasling received his BS in chemistry and biology from the University of Nebraska in 1986; his PhD in chemical engineering from the University of Michigan in 1991. He joined the Department of Chemical Engineering at the University of California, Berkeley in 1992. Keasling is also a professor in the Department of Bioengineering at Berkeley, a faculty scientist

and director of the Physical Biosciences Division at the Lawrence Berkeley National Laboratory, and director of the Berkeley Center for Synthetic Biology.

A graduate student poster session and a dinner followed the lecture. Hyun Su Lee, from Scott Fogler's group, and MSU's Anish Tuteja were the winners of the poster competition.

Katz Lectureship



Dr. Boger with ChE Chair, Ron Larson

David V. Boger, the 2006 Donald L. Katz lecturer, presented two talks at the 36th annual event on April 27 and 28. His lectures were entitled "Environmental Practice in the Resources and Energy Industries: Sustainability and the Triple Bottom Line" and "From Macroscopic to Microscopic Flows: Something Old, Something New, and Something Very New."

He was honored at a dinner on Thursday night at the Lurie Engineering Center Building. Guests at the dinner included Mrs. Elizabeth Katz, widow of Dr. Katz, her son and daughter-in-law, Richard and Wendy Correll, and granddaughters, Allison and Leeya.

Dr. Boger is a laureate professor at the University of Melbourne, immediate past director of the Particulate Fluids Processing Centre and a program leader in the Cooperative Research Centre for Bioproducts. His research is in non-Newtonian fluid mechanics, with interests ranging from basic polymer and particulate fluid mechanics to applications in the minerals, coal, oil, food, and polymer industries. He is best known for discovery of a class of fluids which now bear his name—Boger Fluids. These fluids are constant-viscosity elastic (non-Newtonian) fluids that behave as both liquids and solids.

GETTING TOGETHER WITH FRIENDS



Janette Nunn (BSE '01), Kamilah Turner (BSE '01, MSE '03), and Tafaya Ransom (MSE '02) at the 2006 Career Fair Reception in September.

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World Travels With Flat Charlie

In last year's newsletter we invited you to send us photographs of Flat Charlie at your place of business or on a business trip, to illustrate the broad range of career options available to our graduates and the global nature of chemical engineering. Thanks to the generosity of alumni, faculty and students, Charlie has been traveling the world this year, including watching the test firing of a space shuttle solid rocket booster in Utah with Dan Merenda, visiting Ti-

anmen Square in China with Professors Henry Wang and Bob Ziff, climbing Mt. Kilimanjaro with Lawrence Wei and Wilson Chiu and even going to Iraq, with James Shavers.

To see all the places he's visited so far, and to download your own Flat Charlie, we invite you to visit the Flat Charlie web page at www.engin.umich.edu/dept/cheme/alumni/flatcharlie.html. Please send your photos to Sandy Swisher at sandys@umich.edu.



In Iraq with Squadron Maintenance Officer James Shaver (BSE '03).



At Tiananmen Square with Professor Henry Wang on a visit to our partner universities.



Watching a test firing in Utah with Dan Merenda (BSE '01), quality engineer on the Reusable Solid Rocket Motor Program.



Atop Mt. Kilimanjaro with Lawrence Wei (BSE '01) and Wilson Chiu (BSE '01).

Class of 2006 Exits in Style



Professor Savage and Dr. Montgomery with banquet organizers Kristen Stange, Lauren Zetts, Pratima Ingle and Carrie Christensen. (photo courtesy of Professor James Wilkes)

Thanks to the hard work of four dedicated seniors, our 2006 graduates, their families, faculty and staff enjoyed the first chemical engineering graduation dinner in recent history on Friday, April 28, 2006. A suggestion from Professor Fogler, who had attended a similar dinner during a sabbatical at the University of Colorado, inspired Kristen Stange, Lauren Zetts, Pratima Ingle, and Carrie Christensen, with the help of undergraduate secretary Christine Moellering, to begin plans for a lovely evening, including centerpieces that incorporated chemi-

cal lab glassware. Over 150 people attended the banquet, with Professor Phil Savage serving as master of ceremonies. Having taught this class both thermodynamics and reactor design, he was the natural choice for this honor.

Background entertainment during dinner included a slide show of pictures submitted by the graduates of their time at Michigan. Theresa Schuelke, the student speaker, reminisced about their time at Michigan. After the presentation of senior awards, such as “cutest ChE couple”

and “most likely to ask a question during lecture,” each attending graduate was recognized individually, and received a class mug. Dr. Montgomery shared some quotes from their years at Michigan and reminded graduates to keep in contact with each other to maintain their special friendships. Professor Savage wrapped up the evening with amusing stories of famous people with chemical engineering backgrounds. It was a memorable occasion for all and we trust this is the start of a new tradition.

2005 Alumni Award Winner—Doris Engibous



Kathy Ryan, Jean Engibous, Dave Engibous, Doris Engibous, Scott Fogler, Janet Fogler and Elaine Holde.

Doris E. Engibous (’77) was selected as our 2005 Alumni Society Merit Award Winner. Doris is the CEO and president of GRAFTcath, Inc., an early-stage, venture-backed medical technology firm commit-

ted to reducing morbidity and health care costs associated with end-stage renal disease. Prior to joining GRAFTcath, she served as president of NELLCOR, now a business of Tyco Healthcare/Tyco International, Ltd. Doris began her career at McGaw Laboratories in 1979. She also serves on the board of directors of Natus Medical, Inc., a company that develops and markets devices to monitor newborn health.

She was presented the award on October 7, 2005 at the society’s dinner during Michigan Engineering Weekend.

From College of Engineering Media and Marketing

Alumni Events Calendar

Friday, October 27

Luncheon in the Department
11:30 a.m. - 1:00 p.m.
3158 H.H. Dow
(Podbielniak Lounge)

The department will host an luncheon for alumni during the Michigan Engineering Alumni Weekend at 11:30 a.m. on Friday, October 27, where we will be joined by our 2006 Alumni Society Merit Award winner, Robert L. Bratzler (BSE '68), and by our newly formed alumni board. (Please see the Chair's Note on page two for a list of board members.) You're invited to stop by and chat with alumni, faculty and students, and get the latest news about faculty research, and the graduate and undergraduate programs.

If you would like to join us on October 27, sign up for "Lunch in

the Departments" when you register for the 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 during alumni weekend, but would like to join us for lunch, please contact Sandy Swisher (734-764-7413, sandys@umich.edu)

Saturday, October 28

Come Home Alumni Open House
9:00 a.m. - 10:30 a.m.
3158 H.H. Dow
(Podbielniak Lounge)

Michigan ChE's, please come home! Remember to drop by the Dow Building on Saturday, Oct. 28 for our 2nd annual Come Home Alumni Open House. You can tour our

facilities and meet old professors and classmates. Our new ChE Alumni Board will be there to listen to your input about getting involved with the ChE program at Michigan. There will be drinks and cookies, and a raffle drawing. This is an informal gathering so bring your family and friends with you. The event will run from 9:00 to 10:30 so you will have plenty of time to get to the homecoming football game. Free parking is available that day in the lot off Hayward St., right in front of the Dow Building. Barry Barkel (BSE '65) will be your host again this year.

If you want more information, please see our alumni webpage, www.engin.umich.edu/dept/cheme/alumni.html, or contact Barry Barkel (734-647-3093, bmbarkel@umich.edu.)

Monday, November 13

Annual AIChE Meeting
Open House
7:00 p.m. - 9:00 p.m.
San Francisco Hilton

We will be hosting an open house during the annual AIChE meeting in San Francisco. If you are going to be at the meeting or are in the area, we invite you to stop by and visit with faculty, students and alumni.



The First Annual Come Home Alumni Open House, October 8, 2005.

Alumni News

Bill Retallick's (BSE '48) startup company (catacel.com) is now four years old and growing rapidly. They are developing a compact reactor to make hydrogen for a fuel cell, with the support of a Small Business Innovation Research grant from NSF. Bill has just finished his 26th year as a consultant to the process design course at the University of Pennsylvania. The design problem he submitted this year was the conversion of available liquid natural gas into electricity for sale. The professor who adopted this problem was Stuart W. Churchill (BSE '42, BSE '48, PhD '52). One of their students will present a paper about the design problem at the AIChE meeting in November.

Martin E. Gluckstein, PE, (BSE '50, MSE '51, PhD '57) who retired as manager of Process Safety for Ethyl Corporation in 1992, has now retired for a second time as staff consultant for the Center for Chemical Process Safety of the AIChE. Marty and his wife of nearly 55 years, Marjorie (M.Mus. '51), are on the board of the U-M Club of Milwaukee. Occasionally, but in his words "not frequently enough," he gets back to Ann Arbor, where two granddaughters are now undergrads, one in theatre and Asian studies and the other in the Residential College.

Marty's earliest memory of his education at Michigan was from his first day on campus. He needed to straighten out some transfer credit and he had to meet with G.G. Brown to do so. Marty was concerned and awed by G. G.'s reputation. But all ended well after a few minutes. The adjustments were made and Marty was on his way to a near 10-year stint in the department with a handshake, wishes for good luck, and a smile. Another memory was being considered for the Badger Trophy. He did not get the trophy, but recalls that the winner clearly deserved it for something so much more outlandish than his creation.

Jeff Sen (BSE '83) took a "growth assignment" in IT Communication Technology

at Procter & Gamble doing network remote access security work, after 10 years of process engineering and risk management. During that time P&G sold the IT division he was in to Hewlett-Packard. Now, after two years with HP, he is service manager for outsourced support of P&G's corporate intranet portal. The technology is interesting and the work challenging. He misses engineering but likes working from home.

Jeff passed the 20-year milestone in his naval career, which started the day he graduated from U-M in 1983, and has continued through the Navy Reserve today. His unit is part of NAVSEA (Naval Sea Systems Command). Jeff's hobbies continue to include musical performance and "home projects." He recently became licensed in amateur radio (HAM). His dogs keep him moving too. They should be qualified as "personal trainers!"

Michael Ferrante (BSE '93, MBA '98) recently moved to Tokyo, Japan as senior director of research planning for Banyu Pharmaceuticals (a Merck subsidiary), where he leads business operations for Banyu R&D. He and wife, Deanna, had a baby boy, Andrew Jacob, in August before moving to Tokyo. Big sister Emilia and the family are enjoying exploring Tokyo and Japan.

Serena Hung (BSE '94) went to medical school at Wake Forest University of Medicine and completed her residency and fellowship at Cornell Medical Center and the University of Toronto. She is now specialized in neurology, with a further subspecialization in Parkinson's disease and related disorders, working at the Medical College of Wisconsin in Milwaukee, WI.

After working at BASF for four years post-U-M and living in Texas, Michigan, North Carolina, and Tennessee, **Ryan Aguirre** (BSE '95) received an MBA in supply chain management from Arizona State in 2001. He then worked for a start-up and Mattel in El Segundo, CA, deciding after 4 1/2 years



Ryan and Jennifer Aguirre

to head for the mountains. He is now working in Golden, CO for the Coors Brewing Company in a strategic sourcing role with responsibility for managing approximately \$40 million in company spending. He and his wife of one year, Jennifer, are expecting their first child in November 2006.



Kirsten Zamirovski

Nicole Woltschlaeger (BSE '95) and her husband, Erik Zamirovski (BSEME '95), are the proud new parents of a beautiful little girl, Kirsten (left). She was born two weeks early on June 6, 2005 and was 7 lb. 15 oz., and 20.5 inches long. Nicole quit her job as a senior process engineer with Unilever to be a full-time stay-at-home mom.

Walter Carlson (BSE '96, MBA '03) was working at GM Lansing Car Assembly when it closed last May. Two days after leaving GM Lansing Car Assembly he started with the team at GM Lansing Delta Township. The plant has been

under construction for the past 26 months. On May 26, 2006 they rolled out the first Saturn Outlook. Walter is currently working in the paint shop as a group leader managing the Topcoat Review and EOL Areas. He has started racing ASA Late Models and is in his third year of driving the Vitroco Chevy (above).



Helen (Hennighausen) Schiavone (BSE '98) and her husband, Sebastian (BSEEE '98), recently added a daughter to their growing family. Ekaterina Schiavone was born at home on March 27. Her older brother, Gabriel, just turned two in May. She's enjoying life as a full-time mom at their home on beautiful Whidbey Island, 45 minutes north of Seattle.

Lisa Ingall (BSE '98) has recently attained IBM Certification and been promoted to

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

senior project manager in IBM's System z Storage Software organization. Lisa is two courses shy of completing her master's degree in project management from George Washington University. Lisa and her husband, Amit Saha, were thrilled to visit Lisa's former ChE classmate, **Mike Colarossi**, in China last August.

Jennifer Braganza (BSE '99, BSEIOE '01) relocated to Hannover, Germany with Continental AG, an automotive supplier, in January 2004. She currently works in portfolio management for the Passenger and Light Truck Division. The past two years have been filled with making new friends from all over the world and traveling around Europe. The summer was filled with lots of excitement as Germany hosted the World Cup.

Sam Catalano (BSE '98) was engaged to Andrea Vitiello in December 2005. A November 2006 wedding is planned.

Eric Bernath (BSE '00) has moved from Huntington Beach, CA to Charlottesville, VA to attend the Darden School of Business at the University of Virginia. He plans to return to California after completing his MBA to continue work in the biomedical industry.



Jon Timbers (BSE '00) and **Kay (Chow) Timbers** (BSE '00) relocated with the Dow Chemical Com-

pany to Joliet, IL in July 2006. Jon accepted a job with the polystyrene production plant in Joliet and Kay is working at Dow's "Great Stuff" plant in Wilmington, IL. Above is a photo of Jon and Kay with their daughters, Kaytlin and Talayah, in the FAO Schwartz toy store in NYC.

Kim Sarquis (BSE '00) has been living in San Francisco, CA and working at Genentech, Inc., since graduation. She's now working in the manufacturing science and technology department as a process engineer.

Sameena N. Ahmed (BSE '01) and Jason J. Akbar (LS&A BS '01) were married on July 27, 2002 and welcomed their first child, Amir Jamal Akbar, on August 3, 2005 at the Good Samaritan Hospital in Cincinnati, OH. The couple recently brought their son to visit the university where his parents met eight years ago, on their first day on campus as freshmen!



Amir Jamal Akbar

They look forward to many more wonderful visits to Ann Arbor. Sameena is a project engineer for L'Oréal USA and Jason is completing his residency in radiology at the University of Cincinnati.

Brandon "BT" Cesul (BSE '01, M.Eng. Space Systems '02) was elected president of the Alumni Association for Dayton OH in January 2005. He took a sabbatical from his job at Wright Patterson AFB for eight months to work on his PhD. BT was married on October 21, 2005 to Karen Campo (BS Psych '03)!

Julie Champion (BSE '01) married Kevin Boulware on April 8, 2006. Julie and Kevin are working on their PhDs in chemical engineering at University of California, Santa Barbara.

Nathan Hoffman (BSE '01) is still working for GE as a production engineer but relocated to the Albany, NY area. He was recently engaged and will get married in May 2007.



They love the summer in New England.

Ken Qian (BSE '01) and his wife, Chelsea Wang (left), moved to Manchester, CT, where he has begun working on a PhD in pharmaceuticals at the University of Connecticut.



Terri Stewart (PhD '01) was named to lead Pacific Northwest National Laboratory's Environmental Biomarkers Initiative. Through this initiative, researchers will discover and use biomarkers to transform environmental science. Terri's role is to implement the technical program, recruit new

capabilities and staff, and develop the business strategy.

Dan Viaches (BSE '01) and his wife, Laura (BBA '01), have recently moved to Boston to attend Harvard Business School, where they are pursuing their MBAs together.

Regina (Staniszewski) Iwaniw (BSE '02) started work at Dow Chemical in Midland, Michigan



Rachel Leigh Iwaniw

as a process engineer after graduation. She is still with Dow and is now working with the latex business in the technology center. Regina married another ChE alumnus, **Mike Iwaniw** (BSE '01), in September 2003. Mike also works for Dow Chemical in Engineering. They added a new addition to their family—daughter, Rachel Leigh—who was born May 24, 2006. They are excited and happy to have Rachel in their lives.

After working for three years and travelling to China with Lexmark International, **Decker Ringo** (BSE '02, BSEME '02) plans to return to school this fall. He will be pursuing a master's degree with the Technology and Policy Program at the Massachusetts Institute of Technology.

Thanks to the cooperation of Chemistry Professor Brian Coppola, and chemistry laboratory manager Jack Novodoff, **Leroy Covington** (BSE '03) got engaged to long-time friend and Michigan alumnus,



Janicca Buggs (LSA Psych '01), June 2006 in 1640 Chemistry Building. The romantic proposal, which included a bed of roses and lavender scented candles, took place exactly 2825 days after they met in that room as Chemistry 130 students in Fall 1998.

Jessica Mattis (BSE '04) announces her engagement to Marco P. Marquez-Cadena. Both work at General Motors, Jessica as a process engineer in the Paint Shop of GM Pontiac Assembly Center, and Marco as a business manager of the Paint Shop of GM Toluca in Mexico. They are planning to be married in 2008.

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

WE KNOW WHAT THEY DID LAST SUMMER

Post-summer surveys of our undergraduate students show that they have had great success securing relevant employment opportunities during the summer months. Looking at summer activities following their sophomore and junior years shows the following percentages of students active in either industrial internships or academic research positions:

	SUMMER 2005		SUMMER 2006	
	Sophomores	Juniors	Sophomores	Juniors
Internships	25%	67%	35%	56%
Research	25%	25%	20%	31%

These experiences, many available thanks to heavy involvement in recruiting by our dedicated alumni, are invaluable to helping our students experience and understand the many career opportunities available for chemical engineers. The impressive results in recent years are a testament to not only the high quality of our students, but to your generosity and thoughtfulness in generating these opportunities and informing us of them. If you have any opportunities for our students in your place of employment, please contact Susan Montgomery at smontgom@umich.edu. Thank you!



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