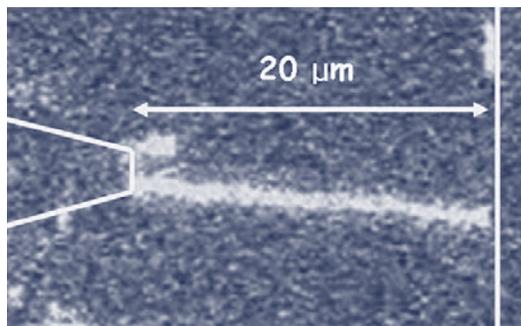


ChE News

FALL 2004

The Newsletter of
the Department of
Chemical Engineering

Stretching and Relaxing: Manipulating Single DNA Molecules



Single molecules of DNA stretched between two gold electrodes. (Image by Kyungeun Sung)

With summer coming to a close and classes beginning, most people at Michigan are reluctantly putting ideas of stretching and relaxing to rest until next year's warm weather is here to stay. However, a group of faculty including Professors Ron Larson and Mark Burns just can't seem to do that. Of course, the "stretching and relaxing" they are dealing with has nothing to do with lawn chairs and barbecues. This interdisciplinary team, including Professor Stella Pang from Electrical Engineering and Computer Science and Professor David Burke from Human Genetics, is examining the way in which single molecules of DNA behave in the presence of proteins.

DNA, the molecule that encodes the genetic information for a cell, is a long, flexible polymer that is stored inside the nucleus of eukaryotic cells. Remarkably, the nucleus of a typical mammalian eukaryotic cell is only five to ten

microns in diameter, into which over six billion basepairs (two meters!) of genomic DNA must be packaged. This molecule controls most aspects of cell growth and development, along with changing its day-to-day functions in response to external stimuli. Although the mechanism for this control is quite complex, one common step in this pathway is the binding of a variety of proteins to the DNA strand. The proteins that bind can have many functions, from merely helping the DNA coil and fit into the nucleus, as is the case with histones, to selectively amplifying and transcribing particular genes. While the binding of proteins has been extensively studied in the bulk phase, the exact mechanism and procedure on a molecular scale is not well understood. Understanding this mechanism would assist a variety of researchers, from those interested in controlling cell function to those developing new DNA identification strategies.

The collaborative group, centered in Chemical Engineering, is trying to gain this understanding by attacking the problem on several fronts. They have developed or refined techniques to stretch and observe single molecules of DNA. For example, one technique uses a high frequency (1 MegHz) AC field to induce dipoles along the DNA molecule (see image above). This induction and subsequent motion is called dielectrophoresis and allows the molecule to be controllably positioned and

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Professor Ronald G. Larson

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Sandra G. Swisher, Editor

Note from the Chair



Dear Alumni and Friends,

I'm pleased to announce that we have had a very successful year in faculty recruiting, hiring two new faculty members, Lola Eniola from the University of Pennsylvania and Peter Woolf from MIT. Lola will begin in the fall of 2006, after a two-year postdoctoral stint in Houston, Texas. Peter begins this fall, along with Suljo Linic from Delaware, whom we hired last academic year, and is now joining our faculty after a one-year postdoctoral appointment at the Fritz Haber Institute in Berlin. You will find a description of Peter's and Suljo's backgrounds and research areas in this newsletter. These new hires, along with the transfer to our department of Walt Weber, bring our faculty head-count to 21, which at last allows us to cover our teaching and research load and focus more on revising our undergraduate curriculum, including consideration of adding new "bio" components to the core courses. In addition, we now have at least five faculty in each of our critical thrust areas: biotechnology and life sciences, energy and environment, and complex fluids and nanomaterials. We are grateful to the College of Engineering and the University of Michigan for allowing us to hire these much-needed

new faculty during a time of fiscal austerity due to recent state budget cuts.

Our faculty continue to make outstanding contributions to teaching, research, and service. A few particularly notable examples include the announcement of the 2003 Chemistry Highlights in *Chemical & Engineering News*, which included Ralph Yang's work on "green" zeolites as the lead item under materials, and Joerg Lahann's work on switchable surfaces (which was hailed as "amazing") in the area of physical and surface chemistry. In addition, Erdogan Gulari was named the Donald L. Katz Collegiate Professor, and papers by Rane Curl and Phil Savage were listed among the 100 most-cited articles in the *AICbE Journal*. On the teaching side, Scott Fogler is working on a new edition of his book *The Elements of Chemical Reaction Engineering*, which will contain comprehensive web-based material to support online learning (www.engin.umich.edu/~cre/). Also, many of our faculty are developing new graduate and undergraduate courses, including ones in the areas of nanotechnology, energy, nanomaterials, and biomaterials. We will continue to do our best to make you proud of the heritage we all share and the privilege we have of serving the students of the University of Michigan.

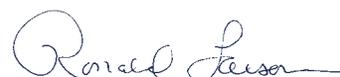
I would like to make you aware of the very significant cuts in state support of higher education in the last couple of years, which have brought the overall state percentage of the operating budget of the University of Michigan down to a historic low. This large cut in state support was coupled to a state-mandated restriction on tuition increases, which is

making it more difficult for the college and university to maintain the quality of its research and teaching missions. We believe that an important goal of a great public university such as ours is to maintain educational and research quality at the level of the best private universities, while keeping in-state tuition low enough to afford access to talented students of limited financial means. However, this objective has become more challenging

to accomplish. We therefore appreciate it more than ever when those whose lives and careers have been enriched through their education and experience at the University of Michigan choose to give back through gifts. To encourage this, the department has created two funds. The first fund is to purchase new undergraduate lab equipment that will expose our students to more biological applications of chemical engineering concepts, in

keeping with similar changes to the rest of our undergraduate curriculum. Our second fund is to help support graduate students, the backbone of our research enterprise. If you choose to make a gift to either of the funds, please complete the form below and mail it to us. Thank you.

With Best Regards,



Be a part of Michigan Chemical Engineering—help ensure excellence in research and education

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Peter Woolf



We welcomed new assistant professor **Peter Woolf** this fall. Peter joins us after finishing an interdisciplinary post-doctoral appointment in bioengineering and developmental biology at the Massachusetts Institute of Technology with Doug Lauffenburger and at Harvard University with Andrew McMahon. Peter received his Ph.D. in chemical engineering from the University of Michigan, and his bachelor's degree from Cornell University.

Peter's research focuses on the emerging field of computational and systems biology as applied to cancer diagnosis and treatment. Systems biology is an effort by both the biological and medical communities to describe how the many parts of a biological system work together to produce cellular or physiological outcomes. In practice, these descriptions are often mathematical or computational models describing the interactions of tens to thousands of components.

Cancer initiation and growth is a natural area for systems biology. The mechanisms driving cancer growth can

only rarely be described by one or two key proteins, but instead are the result of interactions between many different biochemical pathways. In particular, Peter's work focuses on cancers that arise from misregulation of the wnt and hedgehog signal transduction pathways (see box at right). Both the wnt and hedgehog pathways play key regulatory roles in the developing embryo, while in the adult, these signaling molecules have been linked to cancers such as gliomas, small-cell lung cancer, and colon cancer. With a more complete systems-level understanding of how these cancers behave, Peter is aiming to create molecular diagnoses coupled with computational tools that will identify effective patient-specific drug therapies.

For Peter, systems biology and chemical engineering are a natural combination. "In chemical engineering, much of our focus is on assembling and controlling groups of basic unit operations to produce a particular product. Similarly in systems biology, we are also interested in seeing how collections of genes, proteins, and cells work together to produce a particular physiological outcome." He adds, "The main difference is that in chemical engineering, we design the system and predict what behaviors that system will have. In contrast, in systems biology we already have a system with measurable behaviors, but want to know how it is designed."

Peter is extremely enthusiastic about returning to Michigan and says he made his decision to accept a position here because of the strength of the department, along with the access he will have here to a high caliber medical school.

In his free time, Peter enjoys cooking, hiking, and cycling. His wife, Leeann Fu, is working in a research position at the University of Michigan in the psychology department.

WHAT PATHWAY WAS THAT?

Wnt is a human and mouse protein that was first identified in fruit flies. In the fly, this gene is called "wingless" as mutations in the protein produce flies that have no wings. Similarly, the human and mouse protein, Sonic Hedgehog, was first characterized in fruit fly. In the fruit fly, the gene is called hedgehog as mutations in the gene produce flies with a fuzzy, somewhat hedgehog-like appearance.

Later work showed that the wnt and hedgehog proteins are the earliest signaling components of two previously unknown signaling pathways—the wnt and hedgehog signal transduction pathways.

Suljo Linic



Suljo Linic joined the department as an assistant professor in September. Suljo received his Ph.D. under the direction of Mark Barteau in the Department of Chemical Engineering at the University of Delaware in 2003, and received his B.S. in physics with minors in mathematics and chemistry from West Chester University. He has most recently been serving as a postdoctoral fellow at the Fritz Haber Institute der Max Planck Gesellschaft in Berlin, Germany, in the computational solid-state physics group of Mathias Scheffler. Suljo's research focuses on reaction processes that occur at solid surfaces and interfaces.

To study the role of surface processes in impacting various applications, his group uses an assortment of state-of-the-art experimental and computational techniques. By coupling computational quantum chemistry, kinetic modeling and well-defined experiments, one can understand various processes at the molecular level and use this molecular-level information to develop a variety of new materials and devices on a rational

basis. This combined experimental/theoretical approach aimed at rational design of solid-state materials has also been important in Suljo's previous research and has led to numerous publications in leading scientific journals, including the *Journal of the American Chemical Society*, *Angewandte Chemie*, and the *Journal of Catalysis*. One article about his research, published as a priority communication in the June 10 issue of the *Journal of Catalysis*, describes a successful approach to rational design of highly selective heterogeneous alloy catalysts for ethylene epoxidation. This alloy catalyst was designed based on extensive first-principles experimental and theoretical studies of the system in question. Atomic-level tailoring of novel, superior solid-state materials based on the understanding of fundamental molecular-level processes that govern their performance will be a focal point of Suljo's research at Michigan. This approach will be applied in addressing problems such as heterogeneous catalysis, solid-state gas sensors, fuel cells, heterogeneous chiral synthesis, and biology at interfaces.

Outside of work, Suljo and his wife, Jeanette, are enthusiastic travelers. They both are looking forward to the new experiences that a move to Ann Arbor will provide them.

Walter J. Weber, Jr.



Walter J. Weber, Jr., the Gordon M. Fair and Earnest Boyce Distinguished University Professor and Director of the College of Engineering's Concentrations in Environmental Sustainability (ConsEnSus) Program, formally joined our department this year after holding an honorary appointment in chemical engineering for many years.

Walt earned a bachelor's degree in chemical engineering from Brown University, master's degrees in engineering at Rutgers University and chemistry at Harvard, and a Ph.D. in engineering and applied physics at Harvard. He joined the faculty of the College of Engineering as an assistant professor in 1963, was advanced to associate in 1965, and to full professor in 1968. He began his Michigan career teaching in both his official home in the civil engineering department and his adopted chemical engineering department, working most closely at first with ChE faculty Lloyd Kempe and Jerome Schultz, but gradually interfacing

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Dr. Langer and Ron Larson

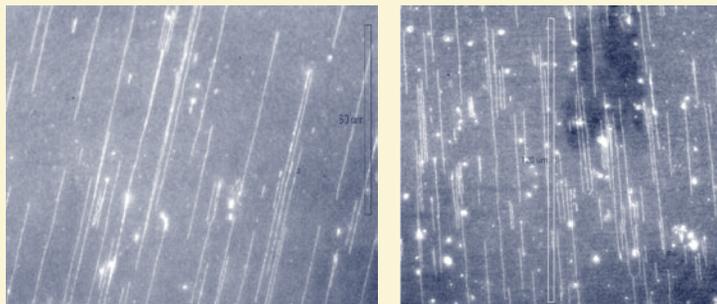
Langer Delivers Katz Lecture

Dr. Robert S. Langer, the Kenneth J. Germeshausen Professor of Chemical and Biomedical Engineering at the Massachusetts Institute of Technology, delivered the 2004 Donald L. Katz Lectures. Langer presented two talks during the two-day event in April. His first lecture was on “Biomaterials and How They Will Change Our Lives,” and his second was about “Advances in Drug Delivery and Tissue Engineering.”

A leader in the fields of biotechnology and materials science, Dr. Langer was elected to the Institute of Medicine of the National Academy of Sciences in 1989 and was elected to both the National Academy of Engineering and the National Academy of Sciences in 1992. In 2002, he received the Charles Stark Draper Prize, considered the equivalent of the Nobel Prize for engineers, from the National Academy of Engineering. Dr. Langer has written 768 articles and has over 500 issued or pending patents worldwide.

DNA MOLECULES

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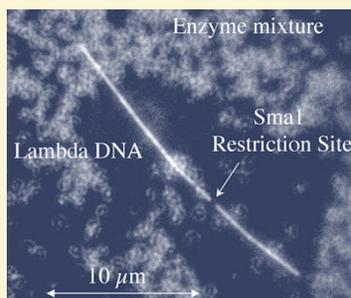


Molecularly “combed” DNA on a polystyrene surface. (Image by J. Hoon Kim)

stretched. Another technique, termed molecular combing, uses hydrodynamic forces and a receding interface to elongate the DNA (see image above). The team has also developed a technique to cut the DNA with light: magnesium ions, essential to many DNA-cutting enzymes, are trapped in cages that can be shattered with UV light. An intense UV beam is then focused on the location of the DNA to be cut and the enzyme that is present is immediately activated, cutting the DNA (see image below). These techniques for stretching and ma-

nipulating DNA require the construction of devices with nanometer-scale precision, a forte of Professor Pang’s group. The novel designs of her group, such as nanometer-sized channels, are being coupled with the above manipulation techniques to help understand DNA-protein interactions.

This work is being funded by the National Science Foundation through a Nanotechnology and Interdisciplinary Research Initiative (NIRT) grant, the first such grant for the University of Michigan.



DNA cut by light. The UV light was directed at the center of the molecule, where magnesium ions were released to activate the DNA-cutting enzyme (SmaI). (Image by Vijay Namasivayam)



David Mooney has left his position here as Professor of Chemical Engineering and Dentistry for a new appointment as the Gordon McKay Professor of Bioengineering at Harvard University. David came to Michigan in 1994 with a joint appointment in chemical engineering and biologic & materials sciences in the dental school. He developed and taught annually a highly popular course in tissue engineering, and established a

research laboratory in the same field. He has mentored many engineering graduate and undergraduate students who worked on research projects in his laboratories. He also established the NIH-funded Tissue Engineering at Michigan training program (TEAM)—www.dent.umich.edu/team/overview.html, an interdisciplinary and interschool program that will continue to provide training for students and postdoctoral fellows in this field.

David's laboratories have been developing materials and approaches to regenerate or grow new human tissues and organs. This work combines elements of engineering, life sciences, and clinical sciences, and entailed interactions with colleagues across the University of Michigan campus and at other universities. In addition to developing novel materials for these new therapies, his laboratories have focused in recent years on regeneration of bone and blood vessels in particular. He will continue this work at Harvard.

I want to thank everyone in the department who has made my experience here so wonderful. I have greatly enjoyed my interactions with the faculty, staff, and students over the past ten years. The friendships I formed with many of you made Ann Arbor a warm and welcoming home. This department, and the university overall, is a great place to work and establish research laboratories. The intellectual and physical resources available here made a huge impact on my research. Mary, the boys, and I are sad to leave Ann Arbor, but we're excited to move back to family in Boston. I am, however, looking forward to continuing the collaborations and friendships here at U-M over the coming years, and we'll continue to cheer for the Wolverines!

David Mooney



Erdogan with Steve Director, Dean of the College of Engineering, at the Collegiate Professorship Recognition program. (Photo by Paul Jaronski)

Erdogan Gulari was appointed the Donald L. Katz Collegiate Professor in Chemical Engineering, named for the former ChE professor and leader in chemical engineering and petroleum technology, who died in 1989.

Erdogan's research is substantial and focuses on understanding interactions and reactions that occur at interfaces. Current areas of research are: environmental catalysis, and development of integrated microfluidic systems for DNA and peptide microarrays and synthetic genes.

From 1986-1993, Erdogan served as senior associate dean of the College, and from 1996-2000 he was a member of the College's executive committee. He has received numerous awards, including the College's Excellence in Research Award and Excellence in Service Award, the University's Faculty Recognition Award and an American Society for Engineering Education AT&T Foundation Award.

From the College of Engineering Media and Marketing

ChE Kudos

FACULTY

Mark Burns received the College of Engineering's Research Excellence Award for 2003-2004. Burns is constructing microfabricated devices that can essentially shrink a room full of complex chemical analysis equipment down to the size of a penny. The class of devices, commonly referred to as "lab on a chip," can perform DNA analyses faster and more economically than current technology.

Scott Fogler delivered the 2004 Krug Lectureship at the School of Chemical Sciences at the University of Illinois at Champaign-Urbana. He was the first chemical engineer to receive the lectureship since its inception in 1974. Previously, the Krug lectureship has been awarded to chemists, including Paul Flory, Rudolph Marcus, and Dudley Herschbach. Scott's lecture was entitled "Fused Chemical Reactions: From the Pharmacokinetics of Acute Toxicology to Wax Removal in Subsea Pipelines."

Images from **Erdogan Gulari's** research on in-situ synthesized peptide micro-arrays appear on the cover of the special issue of *Proteomics*, the leading journal of proteins.

Articles by two of our faculty were on the *AIChE Journal's* list of the 100 most cited articles in the 50-year history of the journal. "Reactions at Supercritical Conditions: Applications and Fundamentals (Journal Review)" by **Phillip Savage**, et al., which appeared in the journal in 1995, was 17th on the list with 299 citations. **Rane Curl's** article, "Dispersed Phase Mixing: I. Theory and Effects in

Simple Reactors", published in 1963, was ranked at 33 with 239 citations.

Recent research discoveries by **Ralph T. Yang** and **Joerg Lahann** were selected as "chemistry highlights" in the December 22, 2003 issue of *Chemical & Engineering News*.

STUDENTS

Arturo-Hernandez Maldonado received the 2003 AIChE Separations Division Graduate Student Research Award in adsorption and ion exchange. Arturo and his advisor, **Ralph Yang**, were honored at last year's AIChE Annual Meeting in San Francisco.

Stephanie Teich-McGoldrick was awarded a National Science Founda-

ChE's South African Connection



Back row: Charles Shilowa, Auntony Mukwanazi, Simon Baloyi, Michael Kasumba, K.G. Leeuw, Dumisa Gina. Front row: Prof. David Glasser (Wits), Prof. Scott Fogler, Prof. Diane Hildebrandt (Wits), Gladys Clark (Wits).

For the past nine years, one or two third-year chemical engineering students from Witwatersrand University in Johannesburg (Wits), who come from disadvantaged backgrounds, have spent their summer breaks (December and January) working in Scott Fogler's laboratory with his graduate students. Wits faculty members Diane Hildebrandt and David Glasser believe that this experience has had a positive effect on each student's life. Many have gone on to get advanced degrees in chemical engineering and business. The above picture was taken at a recent reunion in South Africa.

tion Graduate Research Fellowship. NSF graduate fellowships are highly competitive and offer recognition and three years of support for advanced study to approximately 900 outstanding graduate students in the mathematical, physical, biological, engineering, and behavioral and social sciences around the country. Stephanie's research focuses on using computer simulations to design novel ways of self-assembling nanostructures for molecular electronics and nanoelectronic devices. She is a member of Sharon Glotzer's group. **Chris Iacovella**, also a Glotzer group member, was selected for honorable mention in the 2004 fellowship competition.



Ken Benjamin, Sean Holleran, and Sujit Srinivas

Three of our graduate student instructors received teaching honors from the College of Engineering. **Sean Holleran** and **Sujit Srinivas** were two of the five recipients of "Outstanding Student Instructor" awards, and **Ken Benjamin** was given an honorable mention award. The College made the awards at a ceremony on April 15 hosted by the student chapters of the American Society for Engineering Education, the Society of Women Engineers, and Tau Beta Pi.

Walt Weber

CONTINUED FROM PAGE 5

in both teaching and research with most of the ChE faculty over the next four decades. Many of his 70 doctoral graduates have received their degrees in chemical engineering. In 1965 he joined faculty leaders in LS&A, Natural Resources, and the Law School in initiating, and soon became chair of, a highly successful and long-lived (~30 years) cross-university program in water resources engineering, science, and management, and in 1968 he founded what was to become the nationally recognized Environmental and Water Resources Engineering Program in the college.

Walt, an international leader in the development of advanced technologies for water treatment, pollution control, and environmental restoration, first became interested in the field as he learned of environmental problems arising from the industrial developments of World War II. He was a doctoral student at Harvard in 1961 when newly inaugurated President John F. Kennedy delivered a special address to Congress on natural resources and the growing demands on the world's limited fresh water supplies. In that address Kennedy called for a national initiative to advance water treatment research, especially the development of new technologies that would allow waste waters to be treated and reused as water supplies.

Kennedy's address played a major role in solidifying Walt's overall research focus. He was excited by the prospects of directing his evolving research interests in adsorption science and technology into this particular applications area, and extending his work into membrane separations and advanced free radical oxidation technologies. He continues to

push the envelope today in all three of these areas of research, but is also active in the areas of superheated and supercritical water, molecular reconfiguration of macromolecular organic matter in aquatic systems, and sustainable energy and environmental systems.

In 2003, Walt was honored by the American Chemical Society for his leadership and contributions to the field of environmental science and engineering with a three-day national colloquium, "Physicochemical Processes in Environmental Systems: A Symposium in Honor of Professor Walter J. Weber, Jr." Walt feels that his former Ph.D. students, many of whom helped plan the symposium, are the ones who should be honored, "for it is they who have had the most profound effect on the field, with more than half of them now teaching at major universities."

Walt has published over 300 peer-reviewed scientific and technical publications on a wide variety of environmental research and educational topics and issues. These publications include four textbooks and several reference books. He was elected to the National Academy of Engineering (NAE) in 1985, and has received the most distinguished recognitions of numerous professional societies and organizations. We are proud to have him join the department.

Maurice Sinnott



By James Wilkes

Maurice (“Maury”) Sinnott, professor emeritus of chemical and metallurgical engineering, died Oct. 23, 2003. He retired from the university in 1984 after an outstanding career as a teacher, researcher and administrator.

Maury was born in 1916 in Detroit, where his father, an Irish immigrant, was a police lieutenant. Maury was awarded all of his degrees from the University of Michigan. From 1938 until his return in 1940 for graduate work at Michigan, he was a plant metallurgist at the Great Lakes Steel Corp. of Detroit.

Maury began his teaching career at Michigan in 1944 as an assistant professor in the Department of Chemical and Metallurgical Engineering. He was promoted to associate professor in 1948 and to professor in 1954. He was chairman for many years of both his departmental Doctoral Standards Committee and the Chairman’s Advisory Committee. From 1972-1981 he was associate dean for administra-

tion and research at the College of Engineering.

Maury’s research interests included physical metallurgy, surface phenomena and solid-state physics. He published two textbooks and 40 other articles in the areas of materials and physical metallurgy; his 1958 text, *The Solid State for Engineers*, was the first such textbook in the country, and it also appeared in French, German and Japanese editions. He introduced solid-state physics into undergraduate engineering courses, teaching nuclear materials and physical metallurgy, and was the first to incorporate computer methods into undergraduate metallurgical courses.

Former colleague Jim Wilkes said of Maury that “early on, he recognized the coming importance of the digital computer, and strongly supported my efforts in computational teaching and research. I admired him for his positive

outlook, enthusiasm, and good humor.”

During a 1969-1971 university leave, Maury served first as director of the Materials Research Office of the Defense Advance Research Projects Agency (DARPA), and then as deputy director of DARPA. He continued that professional affiliation, even after his official retirement from the university in 1984. He held a university appointment until 1993, during which time he was director of DARPA’s Materials Research Council, conducting research on campus during the academic year and organizing a month-long council conference each summer. The council consisted of eminent materials scientists, chemists, engineers and physicists (including a few Nobel Prize winners), who, in their advisory roles, had a major impact on the direction and federal funding of research in structural and electronic materials, components and systems.



G. Brymer Williams



Ruth and Brymer Williams

By James Wilkes

Our dear friend and colleague, **Professor G. Brymer Williams**, died on Sept. 19, 2003, just short of his 90th birthday. He was associated with our department for 68 years, longer than anybody else. He was one of the most loved faculty members in our history.

Brymer was born in Denver, where he started studying chemical engineering, but transferred to the University of Michigan in 1935, receiving his B.S. in 1936. His doctoral studies were interrupted during World War II by employment in New York City with the M.W. Kellogg Co. He returned to Ann Arbor in 1947, receiving his Ph.D. in 1949. He was appointed instructor in 1947, professor in 1956, and acting chairman of the department during 1956-1957.

Countless alumni remember Brymer's devoted friendship to students. He was unfailingly cheerful, helpful, and unflappable (although sometimes giving infuriatingly oblique responses to questions!). Upon his retirement in 1984, a substantial scholarship fund was

established in his name—the first in our history to be named after a living faculty member. In the classroom, he was an early proponent of open-ended problems—particularly suited to his teaching of chemical engineering plant design. Brymer was a coauthor of *Unit Operations*, one of the most significant books ever written in the field. His research activities were centered in petroleum engineering. He was a registered professional engineer and a fellow of the American Institute of Chemical Engineers. He received the highest award of the College of Engineering—the Stephen S. Attwood Award—in 1974.

Although acutely modest, Brymer had countless friends from all walks of life and was very effective in helping students and guiding the university. He played major roles in the U-M community, including chairmanship of the Senate Advisory Committee on University Affairs, and was a president of the Ann Arbor Rotary Club. He and his wife, Ruth, were ardent supporters of University of Michigan functions, and they endowed a School of Music scholarship fund in memory of his uncle, David McK. Williams, an internationally renowned organist.

Brymer had a phenomenal memory for people and events, amply illustrated by his memoirs in our history book.

A 90th birthday luncheon had been planned for Brymer on Homecoming Friday, Oct. 17, but this became instead a celebration of his life, with a large attendance. If you would like to receive a copy of the DVD of the event, please contact Sandra Swisher (sandys@umich.edu, 734-764-6413).

Contributions to the Brymer Williams' scholarship fund can be sent to Sandra at 3074 H.H. Dow, Department of Chemical Engineering, The University of Michigan, Ann Arbor, MI 48109-2136.



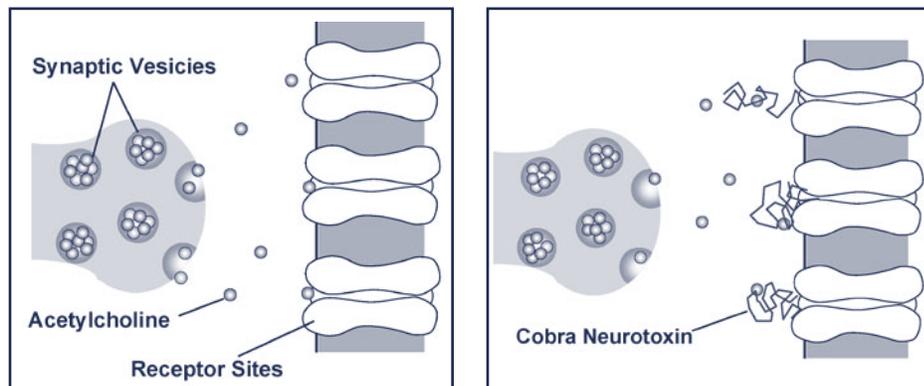
Brymer with distillation column in ChE 460 laboratory.

Kinetics Simulation Helps Save Lives

In the not too distant future, patients brought to hospital emergency rooms suffering from acute toxicosis will get better treatment thanks to kinetic simulations. Vital data about their cases will be entered into computer simulations that will predict reaction pathways. Computer simulations are becoming increasingly useful in handling complex situations such as drug interactions, alcohol poisoning, and the effects of venomous snakebites. The latter two situations have been research areas of Professor H. Scott Fogler for the past five years.

Over 100,000 people worldwide die each year from venomous snakebites. The three most common types of snake toxins are neurotoxins, hemotoxins, and myotoxins. Neurotoxins (found in cobra venom) interfere with the nerve cells' signaling capability; hemotoxins (e.g., Russell's Viper) cleave the blood, generating fibrin clots and resulting in acute renal failure; and myotoxins (e.g., Fer-de-Lance) degrade muscle cells. Scott and his students, Mike Breson, Michael Senra, and Elena Mansilla Diaz, have developed pharmacokinetic models for envenomation by each of these snake toxins. Each model uses fundamental principles of chemical reaction engineering to predict the concentration-time profile based on data obtained from bite victims.

For example, over 35,000 deaths worldwide are the result of cobra bites, one of the most deadly and complex bites, resulting in challenging treatment options. Without antivenom, death is almost certain as a result of the cobra



The figure on the left shows how acetylcholine attaches to receptor sites normally. The figure on the right shows how cobra venom prevents acetylcholine from attaching to the receptor sites. (Image by Veerapat Tantayakom)

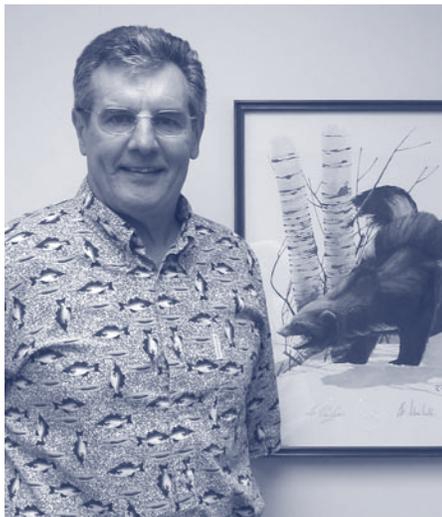
venom adsorbing on the nerve cell's receptor sites, preventing the acetylcholine neurotransmitters from adsorbing on the sites. As a result, the nerve cell is unable to generate a signal to breathe and death occurs due to suffocation.

What makes the antivenom treatment process extremely delicate and tricky is that the antivenom, while neutralizing the cobra venom, also adsorbs reversibly on the receptor sites, blocking them. Consequently, death can occur not only from too little antivenom, but will also occur at an even accelerated rate if too much antivenom is injected. Consequently, physiologically-based-pharmacokinetic models will be of great value in helping to maintain this delicate venom/antivenom balance. In this model, the adsorption and reaction processes of the venom and antivenom are modeled as elementary reactions which are coupled with mass balances on the body compartments to predict free and blocked receptor site concentrations. The model has been found to be in excellent agreement with

experimental data obtained from rabbits injected with cobra venom.

Scott's interests also extend to alcohol poisoning. Learning that there were no self-consistent models to predict the concentration of alcohol and its metabolites as a function of time in the body, Scott, together with David Umulis, an undergraduate, and a post-doctoral student, Nihat Gurmen, developed a self-consistent physiology-based model for alcohol metabolism. By modeling the body as five compartments, stomach, GI tract, liver, muscle, and central fluid, they have been able to accurately predict both alcohol and acetaldehyde concentration-time trajectories, which are responsible for most alcohol-related problems in the body. Dr. Brian Zink of the University of Michigan's Emergency Medicine Department, a collaborator in this work, notes that predicting ethanol metabolism and elimination will be helpful in a clinical setting of acute ethanol intoxication. Zink further notes that ethanol intoxication is known by clinicians to be capable of mimicking or concealing other

CONTINUED ON NEXT PAGE



Jerry Mader

Two new department staff members, **Jerry Mader**, energy research director and, **Tina Jimenez**, administrative associate, are working with Professor Johannes Schwank on the Advanced Energy and Manufacturing Initiative, a major new project funded by the National Automotive Center (NAC) in Warren, MI. Jerry has over 25 years of experience in advanced energy technology research and development (R&D). He worked for more than 15 years for the Electric Power Research

Institute (EPRI) in Palo Alto, California, and its affiliate, the Electric Vehicle Development Corporation (EVDC). Hired by former ChE faculty member and co-founder of EPRI, Dick Balzhiser, Jerry was instrumental in creating the electric utility industry's programmatic efforts in the development and commercialization of electric vehicle powertrain and battery technologies. After 23 years of energy technology R&D efforts in California, Jerry has returned to his professional roots here in Michigan.

Jerry received both his bachelor's and master's degree in industrial engineering in the 1960's, and was a member of the 1965 Rose Bowl Champion football team, earning three varsity letters. He is passionate about Michigan football to say the least!

Tina Jimenez will assist Johannes and Jerry in ongoing administrative activities involving energy research, as well as with the effort to establish an energy research institute. Tina previously worked at the university in the Office for the Study of Automotive Transportation (OSAT) at the Transportation Research Institute.



In May, **Laura Bracken** received a 2004 Excellence in Staff Award, presented each year to outstanding staff members in the College of Engineering. Laura has worked as a research secretary for Scott Fogler since 1983 and is an integral member of his research group. She manages the manuscript review process for the *Journal of Engineering Education*, for which Professor Fogler is associate editor, and she has typed and revised four textbooks, including Fogler's *Elements of Chemical Reaction Engineering*. Laura also coordinates the plans for students who come to the department from South Africa and Thailand to work in Professor Fogler's laboratory.

Laura is known by her colleagues for her "sharp organizational skills and unmatched motivation, and for her ability to inspire creativity in others." We congratulate Laura on receiving this recognition and thank her for her many years of dedicated service to the department!

From the College of Engineering

Kinetics Simulation

CONTINUED FROM PAGE 12

disease states. A reliable model of ethanol elimination will help in treatment decisions in patients with a history of alcohol withdrawal, seizures, concurrent ethanol intoxication and brain injury, and mixed drug overdoses.

Scott's creativity extends to the classroom, where projects based on this research have given our students a hands-on sense of the wide range of applications of chemical engineering principles.

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July 2003 to June 2004

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Jim and Mary Ann Wilkes, Dick Balzhiser, and Sharon Thatcher at Brymer Williams' memorial on October 17, 2003

Undergraduate Curriculum Update

We were proud to learn that our undergraduate program ranking in U.S. News and World Report went up from 10th to 9th place this year (see box below), thanks to our outstanding alumni, who enhance our reputation. We've continually updated our undergraduate curriculum to make sure it prepares our student to enter the ever-broadening discipline of chemical engineering. Recent changes include:

- Addition of a biology/life science requirement, to provide students with, at a minimum, a basic understanding of biological sciences.
- Broadening of our technical elective requirements to allow our students to personalize their curriculum by replacing up to four engineering credits with either advanced science or advanced mathematics credits.
- Incorporation of applications of chemical engineering concepts to biological systems into our core chemical engineering courses through homework sets, projects,

and exam questions.

- Development of new advanced chemical engineering electives, such as Statistical Analysis of Engineering Experiments; Rheology of Polymeric Materials; Introduction to Bioinformatics, Systems Biology, and Predictive Modeling; Health Science and Engineering Seminar; and Regulatory Issues for Scientists, Engineers and Managers.
- Replacement of inorganic chemistry requirement by analytical chemistry, providing our students greater exposure to analytical techniques and data analysis.
- Establishment of concentrations within our program. By taking one or two additional technical elective courses, students can earn a BSEChE degree with a concentration in one of the following areas: Electrical Engineering – Electronic Devices, Environmental Engineering, Life Sciences, Materials Science and Engineering, or Mechanical Engineering. This allows our

students to differentiate themselves with a depth of knowledge in an area of interest.

- Increasing options for joint BS/MS programs. Students now have the option to double-count elective credits toward master's degrees in one of eight college programs, making it possible for them to earn a master's degree in one year.

In the near future, we will be working on a number of exciting new projects, including:

- Establishing an Engineering Global Leadership Honors Program, which will allow students to earn BSE and MSE chemical engineering degrees with an emphasis on international experiences and business courses.
- Updating our two laboratory courses to include more biologically related applications.
- Improving the teaching of professional skills within our core courses, such as professional and ethical responsibility, global and societal impact of engineering, life-long learning and critical thinking, and awareness of contemporary issues.

We invite you to visit our undergraduate program web page at www.engin.umich.edu/dept/cheme/ugoffice/ugprog.html for more information, and to contact Dr. Susan Montgomery, Undergraduate Program Advisor, with your comments and suggestions. Thank you!

Best Undergraduate Chemical Engineering Programs

(Institutions that offer Ph.D. programs in engineering)

From U.S. News & World Report

1. Massachusetts Institute of Technology
2. University of Minnesota-Twin Cities
3. University of California-Berkeley
4. University of Wisconsin-Madison
5. University of Texas-Austin
6. Stanford University
7. University of Delaware
- University of Illinois-Urbana/Champaign
- 9. University of Michigan-Ann Arbor**
10. California Institute of Technology



Arthur Nicholas, 2003 ChE Alumni Society Merit Award Winner, with his wife, Bess, and Ron Larson

2003 Alumni Award Winner

Arthur Nicholas (BSE '53) was selected as our 2003 Alumni Society Merit Award recipient. Mr. Nicholas, the owner and president of the Antech Group, a private investment and business development firm, was presented with the award on October 17, 2003 at the society's dinner during Alumni Weekend. Earlier that day faculty, students, and alumni honored him at a breakfast in the department.

Nicholas began his career in 1953 at the B.F. Goodrich Chemical Company as a project engineer. The following year he joined the Cadillac Plastics and Chemical Company in Detroit as plant manager. In 1960, he founded Leon Chemical and Plastics, Inc., which was bought out eight years later by U.S. Industries, Inc. He eventually served as president and chief operating officer of this company. In 1973, Nicholas was named president and chief executive officer of APECO Corporation.

From the College of Engineering Media and Marketing

September 27, 2004

Alumni/Student Reception
4:30-6:00 p.m.
3158 H. H. Dow
(Podbielniak Lounge)

We hope you can join us this year at our Alumni/Student Reception during the SWE/Tau Beta Pi Career Fair. It's a great time to meet our graduating seniors and to visit with other alumni and faculty.

October 8, 2004

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

We will be honoring our 2004 ChE Alumni Society Merit Award recipient, William W. Graessley (BSC '56 LSA, MSE '57, PhD '60), at a luncheon in the department during the 2004 Michigan Engineering Weekend, October 7-9. If you would like to join us on October 8, make sure you sign up for "Lunch in the Departments" when you register for alumni weekend. If you have not made reservations yet for the weekend's activities, you can register online at www.engin.umich.edu/alumni/events/weekend or call 734-647-7046.

Immediately preceding our luncheon, Levi Thompson, ChE professor and associate dean for undergraduate education will be leading a forum on "The Hydrogen Economy--Fantasy or Fantastic?" at 10:15 a.m. in the Johnson Rooms at the Lurie Engineering Center.

You can visit the webpage listed previously for a complete schedule of events taking place during alumni weekend.

November 8, 2004

Open House at the
2004 AIChE Annual Meeting
7:00-9:00 p.m.
Salon D, Hilton Hotel Austin
500 East 4th Street
Austin, TX

Join us at our open house during the annual meeting in Austin, TX. You can talk to the faculty and graduate students and catch up on all the news from the department.

Sign up to Mentor!

Many of you have made offers in the past to mentor engineering students—thank you! We would greatly appreciate your participation in the college's student-alumni mentoring program. To sign up for the network:

- Contact Ms. Robin Dall at robdall@umich.edu to get your password.
- Go to <http://career.engin.umich.edu/EnginTrak/alumninetworkinfo.html> and click on the link at the bottom to get to the alumni network page.
- Register under "University of Michigan, Ann Arbor-Engineering".

On our side, we will encourage our students periodically to take advantage of this opportunity. Thanks as always for your support of Michigan Chemical Engineering.

Alumni Notes

William Retallick (BSE '48) is vice president of research and development at Catacel Corp. (catacel.com). The business is growing! One of the products they make is compact heat exchangers to go with fuel cells.

George Nersesian (BSE '58) retired in 1995 after a 37-year career with Amoco Chemicals. He moved to Tucson, AZ four years ago. He loves the desert southwest very much.

Tom Schriber, (MSE '58, PhD '64) just finished his 38th year as professor of computer and information systems (CIS) in the University of Michigan's MBA Program. He started Michigan's MBA CIS department in 1966. His research area is discrete-event simulation, a subject for which he produced a five-day course in the U-M Engineering Summer Conferences for 24 years.

Irving Miller (BSE '60) returned to Chicago after retiring from academia in 2000 and is now working part time as director of corporate operations at BioTechPlex, a Chicago-based biotech company. The rest of his time is devoted to his family (his retired artist spouse, two adult children, three grandchildren—soon to increase to five), commercial arbitration (American Arbitration Association) and writing poetry (and even getting some published). He would love to hear from old friends (ifmiller@uic.edu).

Under the sponsorship of the International Atomic Energy Agency (IAEA), **Dr. Dennis Stover** (BSE '67, MSE '68, PhD '75) presented a two-week short course on "Alkaline In Situ Uranium Mining" at the Beijing Research Institute for ChE and Metallurgy in 2003. For nearly thirty years, Stover has specialized in the technology of in situ leaching of uranium minerals and associated recovery processes. During the 1990's he was responsible for uranium exploration and mining development with the Rio Algom Mining Corp. He retired in 2002 and now serves as a technical consultant to major international uranium mining companies and the IAEA.

Marty Javinsky (PhD '67) retired in 2003 after a terrific 35-year career with Chevron. His new challenge is learning how to play golf (much more difficult than transport phenomena). He gives his best regards to all present and past members of the department!

G. Jean Hoppert (BSE '71) retired from Masterfoods, USA in October 2004. Now in private practice, Jean and her husband, Herschel, reside in Las Vegas, NV.

Michael L. Surmanian (BSE '72, MBS '76) has founded a new company, Diagnostic Consulting Network, LLC (DCN). DCN markets reagents and chemistries to companies worldwide that manufacture rapid diagnostic test kits such as pregnancy, drugs-of-abuse, and disease detection tests. Mike has also founded four other companies in the past 15 years. He remains a loyal U-M alum in Southern California.

Steve Pondell (BSE '79) recently assumed the position of director of manufacturing for Encysive Pharmaceuticals in Houston, TX. Encysive is a small biotech firm with no manufacturing capabilities of its own, so his job is to find, develop, and manage third party suppliers in the manufacturing and distribution of new products. He says he will miss the midwest and Big Ten country. However, golfing in December will definitely be a plus!

Catherine Peters (BSE '85) has just been appointed associate dean of academic affairs in the School of Engineering and Applied Science at Princeton University. She will retain her position as associate professor in civil and environmental engineering, where she teaches and conducts research in the area of environmental chemistry.

Paul Theisen (BSE '85) is working in agricultural chemicals manufacturing for Dow Chemical in Midland, MI. He joined Dow Chemical on March 3, 1986 and has worked in Midland his entire career. He and his wife,

Kristine, have been married for 11 years and have two daughters, Casey (age 5) and Jessica (age 2). Dad makes sure that the girls have plenty of maize and blue in their wardrobes!

Greg Poterala (BSE '86) has been with Asahi Thermofil in Fowlerville, MI since 1998 as a national account manager, commercializing reinforced polypropylene for automotive underhood applications. This is his latest position in a 17-year "temporary" sales career. He resides in Commerce Township with his wife, Anne Marie Garbinski, and wheaten terrier, Foster. In his spare time he plays trombone with the U-M Alumni Pep Band, Motor City Brass Band, and Baseline Brass Quintet. He and Anne Marie also enjoy traveling, golfing, movies, volunteering at the Fisher Theater and with America's Thanksgiving Parade in Detroit.

Divyesh R. Bhakta (BSE '89) graduated from medical school at Michigan State University in 1994. Following graduation he finished an internal medicine residency and cardiology fellowship training at University of Kentucky in Lexington. Divyesh is now in private practice in interventional cardiology with CardioVascular Associates in Louisville, KY.

Anne Bork (BSE '92, MBA '98) is the director of investor relations for Lear Corporation in Southfield, MI.

Atisa Sioshansi (BSE '92, MBA '98) just completed her MBA at U-M Business School and began her new career as a marketing manager for Baxter Healthcare in Chicago after returning from a language immersion program in China this summer. She's part of the marketing development program and will rotate through three positions over the next couple of years.

Deanna Thompson (BSE '93) finished a post-doctoral fellowship at Harvard Medical School and is now an assistant professor in biomedical engineering at Rensselaer Polytechnic Institute (RPI). To make her life more interesting, she spent the summer traveling with her fiancé in Alaska on an eight-week road trip. They were married in Michigan in August.

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

Matthew Birchmeier (BSE '94) transitioned in 2003 from Pharmacia (Skokie, IL) to Pfizer (Kalamazoo, MI) in the same role, as a process development engineer. He recently married Dr. Amy Doil of Appleton, WI (now Dr. Amy Birchmeier of Kalamazoo, MI).

Christopher Fletcher (BSE '94) has been with the same chemical company since graduation, IRMCO in Evanston, IL. He is technical service & engineering director, where he directs technical engineers in the field and assists trade partners around the world. Additions to his family include Matthew, who was born in June, and his older siblings: Abigail, 3, Jacob, 5, and Caleb, 8. Chris and his family are currently residing in Fenton, MI.

Chris Hermanson (BSE '94) was a product engineer at DaimlerChrysler for almost seven years before moving to San Diego, CA in 2001. He is currently a senior engineer designing membrane filtration systems for municipal water applications. He's still single and bleeds maize and blue!

Peter Valianatos (BSE '94) received an MS in chemical engineering from the University of Rochester in 2001. Pete has been working as a senior process development engineer at E Ink in Cambridge, MA, working on electronic paper. He celebrated his second wedding anniversary with wife, Tricia. He would like to hear from any ChE's in the Boston area (pvalianatos@eink.com).

Eric Hunsanger (BSE '95) received his MEng in automotive engineering from the University of Michigan in April of 2004. He is employed as a car & truck certification engineer at the Ford Motor Company. He can usually be found tailgating at the golf course prior to home football games with fellow ChE alums, Alan Bell ('95), Paul Gross ('96), and Darius Harrison ('99).

Tommy Golczynski (BSE '97) worked initially for Stone & Webster doing oil refinery/petrochemical plant design in Houston, TX. He left to join a start-up consulting company in Houston for the offshore oil industry, Multiphase Solutions. He is general manager

and has authored/presented papers throughout the world, most recently in Southeast Asia and Africa.

Carrie Worthen (BSE '97) has been working for DuPont since graduation and until recently was working as a safety manager and quality engineer at the DuPont Holographics site in Logan, Utah. She's decided to stay in Utah and is now working as a health and safety services coordinator for the University of Utah Environmental Health and Safety Department. She got married in January 2004 in Las Vegas and is living in Kaysville, UT.

Sarah Cunningham (BSE '98) married longtime beau, Brendan, on December 31, 2003. Brendan and Sarah have been together since high school. Her name has changed officially...she's Sarah Kusisto now. Brendan is a nuclear engineering officer stationed on the USS Nimitz in San Diego and she is working as a process engineer at Illumina, also in San Diego, where she works in their oligonucleotide manufacturing area.

Matt Daily (BSE '98) was married to Roni Goldleaf of Kingston, NY, on May 30, 2003. They spent their honeymoon in Greece. Matt and Roni both work for IBM Microelectronics in East Fishkill, NY, and live with their two dogs, Ben and Axelle, in Poughquag, NY.

Don Gualdoni (BSE '98) graduated with his MBA in marketing and strategy from the Kellogg School of Management at Northwestern University in June. He accepted a position as an associate with McKinsey & Co., based out of the Miami office.

Helena (Hennighausen) Schiavone (BSE '98) and her husband, Sebastian, welcomed their son, Gabriel Dante, into this world on May 18. Gabriel weighed in at 9 pounds, 6 ounces! After putting in five years at Nektar Therapeutics in San Carlos, CA, Helen is looking forward to taking six months off to care for the new baby and adjust to family life.

Michael Sproule (BSE '98) has worked for Ford Motor Company/Visteon Corporation for seven years. He most recently joined Visteon's advanced materials department

supporting research and development of polymers for automotive interior applications. Michael wed Diahann Pearson in the fall of 2003.

Carmita Burnette (BSE '99) went abroad this year to study at the London Business School. While there, her long-time love, Damon Vaughan, proposed marriage during a romantic evening in Paris under the Eiffel Tower. She graduated from the Kellogg School of Management and has joined the leadership development program for Danaher Corp. She'll be staying in Chicago and her first assignment will be with Videojet Technologies as a product manager.

Andrea (Bologna) Barringer (BSE '99) has a new baby boy, Jonathon Thomas Barringer, born March 22. Andrea is still working as a sales account manager at Lear Corporation.

Thomas Kaminski (BSE '99) got married in Ann Arbor in May and moved to Durham, NC in June. He will continue working for Accenture and is now based out of their Raleigh office.

LaRuth McAfee (BSE '99) received the Dr. Martin Luther King Leadership Award at MIT in February 2004. LaRuth, a doctoral student in chemical engineering, is treasurer of the Graduate Student Council (GSC) and co-chair of the Black Graduate Students Association. In addition to her work on campus, McAfee tutors children in math and science on Saturday mornings at a Cambridge church.

Matt Skindzier (BSE '99) had been living in Chicago, IL since graduation. Matt graduated from the manufacturing professional development program at Abbott Laboratories in 2003 and spent the last year as a materials management supervisor in Abbott's Hospital Products Division. Matt was recently accepted to the MBA program and the Tauber Manufacturing Institute program (TMI) at Michigan, and returned to Ann Arbor this summer.

Kristen (Walkush) Yeh (BSE '99) and her husband, Elbert, welcomed a new member to their family last fall. Nathan Hao-Ran was born on November 15, 2003. Kristen and

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

her family have moved back to Michigan and now reside in Grand Rapids. Kristen is enjoying her new career as a stay-at-home mom.

Rebecca Aron (BSE '01) completed her master's degree in biomedical engineering from U-M in 2002 and has been working for Guidant Corporation, a large medical device company, in St. Paul, MN for the past two years. This fall she's back in Ann Arbor to continue her education in medical school.

Andy Valiquett (BSE '01) received his master's in pharmaceutical engineering from U-M in 2002 and is working at Eli Lilly and Company in Indianapolis. He is working in the technical service and process engineering departments in dry product manufacturing, specifically for the validation and launch of Cymbalta and Cialis. Andy was married in May 2002.

Jessica Motyl (BSE '02) recently completed GE's operations management leadership program and is now working as a process engineer for GE infrastructure, water and process technologies. She resides in Oceanside, CA and spends her free time training for and competing in triathalons.

Tamika L. Young (BSE '02) will be marrying her high school sweetheart, Terrence Banks, in October 2004. The two welcomed their first child, Takima Shalon, on July 13, 2003 at U-M Hospital. Tamika recently accepted a new position with Masco Corporation in Taylor, MI as a corporate environmental engineer. Tamika and her family live in Ypsilanti.

S. Kelvin Lau (BSE '03) moved to Worcester, MA after graduation in April 2003 to take a job at Abbott Bioresearch Center. He provides technical support for downstream purification of a monoclonal antibody manufacturing process.

Jessica Mattis (BSE '04) has just started a new job at General Motors in the paint & polymers engineering department at the world headquarters in Warren, MI. Jessica worked on topcoat appearance projects this summer, before beginning an 8-1/2 month paint development training program.

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

If you would like to be added to our ChE alumni e-mail group so you can receive periodic news updates, please send us a request to the e-mail address listed above.



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