



Northeastern

Department of Chemical Engineering

GREETINGS FROM THE DEPARTMENT CHAIR



As you know, the field of Chemical Engineering attracts extraordinarily creative and inspiring individuals from all facets of society. A quick perusal of great leaders in industry, arts, politics and science reveal a healthy sprinkling of chemical engineers: industry found Arthur D. Little, Andrew Grove (Intel Founder and President) and John (Jack) F. Welch, Jr. (Chairman and CEO of General Electric). Frank Capra moved from Cal Tech to Hollywood to become an iconic film director, and Samuel L. Bodman is the current U.S. Secretary of Energy in the Bush Administration.

Engineering students at Northeastern University have likewise been inspired to pursue Chemical Engineering: a record 79 freshman students have declared their major as Chemical Engineering in 2008. The NU ChE undergraduate enrollment stands at 177 students, marking a 48% increase since 2003. On the graduate study side, we currently have 32 students enrolled as Ph.D. or M.S. students, and Fall 2008 will bring in a vibrant and diverse group of 10 new M.S. and Ph.D. students with bachelor's degrees from top schools in the U.S. and abroad.

If I had to select one word to describe the atmosphere of the NU Chemical Engineering Department, I would choose the word "new". We heartily congratulate Professor Katherine S. Ziemer, who was granted tenure as a new Associate Professor in July 2008. A new state-of-the-art laboratory was completed for Associate Professor Elizabeth Podlaha-Murphy, and we are happy to welcome Mr. Robert Eagan as our new technician and machinist and Ms. Patricia Rowe as our new Departmental Staff Assistant. The Department's efforts are supported by the new Dean of the College of Engineering, Dr. David Luzzi, who arrived at NU in September 2007. Dean Luzzi was previously Professor of Materials Science and Engineering at the University of Pennsylvania and possesses an

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Academic Year 2008-2009

PROFESSOR REBECCA L. CARRIER RECEIVES NSF CAREER AWARD



We congratulate Professor Rebecca L. Carrier on her receipt of 2008 NSF Career Award. Assistant Professor Rebecca Carrier became interested in biological systems as an undergraduate in Chemical Engineering at Rensselaer Polytechnic Institute. She explored this area further while attending the Massachusetts Institute of Technology where she worked with Dr. Robert Langer, a leader in the field of Biotechnology. Her focus was the influence of chemical and hydrodynamic factors in the bioreactor environment on the structural, biochemical, and molecular properties of tissue engineered heart muscle. Upon graduation Dr. Carrier worked for three years at Pfizer as a Senior Research Scientist in controlled release drug delivery, where she enjoyed learning the processes of formulating and manufacturing controlled release materials for clinical and commercial applications. She also conducted research in the influence of materials properties on the function of controlled release dosage forms in the biological environment. Due to a strong desire to devote more time to research and to teaching in a university environment, Dr. Carrier sought and was excited to obtain an academic position at Northeastern University, joining the Chemical Engineering faculty in September 2003.

At Northeastern, Dr. Carrier has taught the undergraduate the Transport Processes and the Operations 1 courses as well as a special topics course in Drug Delivery. Dr. Carrier also designed and taught, in her research laboratory, a Unit Operations Laboratory module focused on the use of cell culture for biocompatibility assessment. Dr. Carrier has been heavily involved in a number of Departmental service activities, including the Graduate Committee, faculty search committees, and Building Bridges, a high school outreach program run by the College of Engineering. She is also the faculty advisor for the Chemical Engineering

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CREATING THE TECHNOLOGIES AND INSPIRING THE ENGINEERS OF THE FUTURE, DR. KATHERINE S. ZIEMER

Katherine (Kate) S. Ziemer, Ph.D., joined Northeastern University in 2001 as a DiPietro Assistant Professor of Chemical Engineering, and earned tenure and promotion to Associate Professor in Spring 2008.

Kate has seven years' of successful industrial experience as a

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DR. ZIEMER (SECOND ON THE LEFT IN THE BOTTOM ROW) AND HER GROUP

GREETINGS FROM THE DEPARTMENT CHAIR

(CONTINUED FROM PAGE 1)

MBA from the Wharton School of Business. Additionally, we look forward to working with Dr. Stephen W. Director, who began his position as NU Provost and Senior Vice President for academic affairs in July 2008. Dr. Director is a member of the National Academy of Engineering and a Fellow of the Institute of Electrical and Electronics Engineers; he previously served as dean of engineering at both the University of Michigan and Carnegie Mellon University. Finally, the Department is looking to expand the faculty roster with new faculty hires who will complement and augment our research strengths at the interfaces between materials, biosciences, and energy.

The Chemical Engineering Co-op Education program continues to flourish despite the uncertain economy. The fall and spring of this academic year saw 116 students placed in 35 companies. Businesses vary from Biotechnology, Nanotechnology, Alternative Fuels, Consumer Products and the Oil Industry. Students are placed in co-op jobs mostly in the Northeast but some students are traveling to the UK, France and Switzerland for international co-op. Next year the number will jump significantly to approximately 145 students who will be placed in more than 40 companies. We are always looking for Alumni that would be interested in hosting one of our Chemical Engineers. If you would like to get involved in Northeastern's Co-op Program for Chemical Engineers, please contact John Gabriel, Assistant Co-op Coordinator, at 617-373-3460; email: j.gabriel@neu.edu.

I invite you to take a look at the feature sections in this newsletter that focus on our award winning faculty and students.

With warmest wishes,
Laura H. Lewis
Department Chair

DR. KATHERINE S. ZIEMER

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chemical engineer with DuPont, including two years' of management experience, prior to earning her Ph.D. in Chemical Engineering from West Virginia University. During her Northeastern University career, she has had over \$1.8 million in external research funding, 29 publications, and over 25 professional presentations plus an additional 15 invited presentations. She has taught both undergraduate and graduate courses including Conservation Principles, Computations Laboratory, Electronic Materials and Thin Films, Nanomaterials, and Nanotechnology. Kate incorporates both her industrial experience and her research in the classroom. As a dedicated teacher, she has earned several honors including the Martin W. Essigmann Outstanding Teaching Award from the University's College of Engineering, the New England Region Outstanding Teacher Award from the American Society for Engineering Education (ASEE), the Joseph J. Martin Award for the most outstanding Chemical Engineering Division paper at the ASEE Annual Conference, and the Northeastern University President's Individual Aspiration Award for bringing the Northeastern University student chapter of the American Institute of Chemical Engineers (AIChE) into the national spotlight. Her graduate and undergraduate research students have won various awards for their research including the National American Vacuum Society Student Award in 2005, 7 AIChE undergraduate research recognitions at both the regional and national level, the Northeastern University Outstanding Research Assistant Award in 2008, and finalist for the 2008 Leo M. Falicov Graduate Student Award (winner to be determined at the 2008 National AVS meeting in November).

Kate's research aims to create next-generation electronic devices based on multifunctional materials to produce a single device that interacts with its environment mechanically, electronically, optically, and magnetically. Meeting the challenges of the functional integration of different materials at the atomic level opens the potential for such applications as providing crystal-clear phone communications with as few as one-tenth the number of towers currently required or the development of pebble-sized devices that could be tossed in the ocean to record marine activity, sense undersea earthquakes, locate shipwrecks, and track ships and submarines.

Kate and her research students develop engineered surfaces designed to effectively integrate wide bandgap semiconductors with functional and multi-functional oxides, organic molecules, and/or biomaterials. Her Interface Engineering Laboratory group studies fundamental mechanisms of the growth and processing of thin films and nanostructures, literally at the atomic scale. Her work is based on the hypothesis that understanding the atomic-level interactions at a surface will lead to developing processes to create materials and effectively interface different materials for new functionalities.



DR. ZIEMER WORKING ON HER MOLECULAR BEAM EPITAXY MACHINE

FACULTY NEWS

Our faculty has been hard at work not only in the laboratories and classrooms, but also publishing research papers, presenting their work at conferences, and being active members of the Chemical Engineering community in general. Here is a list of some of the more notable journal articles published by our faculty within the last academic year:

- **Carrier, R.L.**, Miller, L.A., Ahmed, I., "The Utility of Cyclodextrins for Enhancing Oral Bioavailability," **Journal of Controlled Release**, Vol. 123, 2007, pp. 78-99.
- **Lee-Parsons, C.W.T.**, "Gas composition strategies for the successful scale-up of *Catharanthus roseus* cell cultures for the production of ajmalicine," **Phytochemistry Reviews**, Vol. 6(2-3), 2007, pp. 419-433.
- Kyongha Kang, **L.H. Lewis**, A.R. Moodenbaugh, "MnBi Nanostructures: Size Dependence of Magnetostructural Transition and Matrix Templating," **Applied Physics Letters**, Vol. 90, 153112 (2007).
- Plouffe, B.D., Njoka, D.N., Harris, J., Liao, J., Horick, N.K., Radisic M., **Murthy, S.K.**, "Peptide-Mediated Selective Adhesion of Smooth Muscle and Endothelial Cells in Microfluidic Shear Flow," **Langmuir**, Vol. 23, 2007, pp. 5050-5055.
- Zh. Guo, M. Moldovan, D.P. Young, L.L. Henry, **E.J. Podlaha**, "Magnetoresistance and Annealing Behaviors of Particulate Co-Au Nanocomposites," **Electrochemical and Solid State Letters**, Vol. 10(12), E31-E35 (2007).
- Yilmaz, B., Jiangdong Deng, **Sacco Jr., A.**, "Electrical Transport through Monatomic Titania Chains in Titanosilicate ETS-4," **Applied Physics Letters**, Vol. 90, 152101 (2007).
- Richter, C., Wu, Z., Panaitescu, E., **Willey, R.J.**, Menon, L., "Ultrahigh-Aspect-Ratio Titania Nanotubes," **Advanced Materials**, Vol. 19, 2007, pp. 946-948.
- T.L. Goodrich, J. Parisi, Z. Cai, **K.S. Ziemer**, "Low Temperature Growth of Crystalline Magnesium Oxide on Hexagonal Silicon Carbide (0001) by Molecular Beam Epitaxy," **Applied Physics Letters**, Vol. 90 (4), 042910 (2007).

ANOTHER REASON TO BE PROUD

The Princeton Review has rated Northeastern University as the best school in the country in providing students with career/job placement opportunities. This, undoubtedly, is the result of the hard work of many on our campus, particularly those in Co-op and Career Services.

To find out more visit the NEU Alumni eNewsletter website at: <http://www.neu.edu/alumni/eline/july08/review.html>.



FROM LEFT TO RIGHT: DR. DANIEL BURKEY, COURTNEY PFLUGER, AND DR. REBECCA CARRIER AT THE AIChE NATIONAL CONFERENCE

DR. REBECCA L. CARRIER CONTINUED FROM PAGE 1

Graduate Student Council and the graduate student group Graduate Materials Links, as well as the co-advisor for the NEU student chapter of the International Society of Pharmaceutical Engineers (ISPE).

The goal of Dr. Carrier's research program is to increase understanding of chemical compound transport through the body, which is crucial to the rational design of drug delivery systems. Research activities in the Carrier lab include study of phenomena at the molecular, nano-, and macro-scale that influence the delivery of therapeutic agents to a biological environment of interest (GI tract, eye, muscle, lung, skin, etc.). In one project, the transport of drugs and nanoparticle drug delivery systems are being studied across mucus, an important barrier to the delivery of drugs to the GI tract and lungs. In another project, conducted in collaboration with Assistant Professors Murthy and Burkey, the influence of biomimetic micro-topography on the phenotype and behavior of cultured intestinal cells is being studied.

A third project is focused on understanding the functioning of lipids in the GI tract. This spring, Dr. Carrier was awarded an NSF CAREER award for her integrated education and research plan entitled, "Mechanistic Studies and Modeling of Self-Emulsifying Drug Delivery Systems." The research funded by this award will shed light on the influence of nanoemulsions, which are used as drug delivery systems and naturally exist in the GI tract after food ingestion, on the absorption of drugs and other compounds into the bloodstream. This information could enable the delivery of drugs that may not otherwise be viable products and shed light on the "food effect," a poorly understood phenomenon that influences the oral bioavailability of most drugs. Integrated with this research is a practice-oriented educational plan including graduate co-op experiences, design of an industry-mentored course and development of collaborations with Northeastern's industrial co-op partners.

GRADUATE STUDENT NEWS

In the 2007-2008 academic year the department awarded 7 M.S. and 3 Ph.D. degrees. Within the last year the research done by our Department was well represented by our graduate students at the following conferences: the Electrochemical Society Spring Meetings May 2007 and May 2008, the ISPE Northeast Regional Conferences in June 2007 and April 2008, the Methods in Bioengineering Conference in July 2007, the American Chemical Society National Meeting in August 2007, the Materials Research Society Fall Meeting in November 2007, the AIChE Annual Meeting in November 2007, the Northeastern University Graduate Materials Links Symposium in February 2008, the Northeastern University Research and Scholarship Expo in March 2008, the New England Science Symposium in April 2008, and the 5th International Conference on Hot-Wire Chemical Vapor Deposition in August 2008.

Hana Kim (Ph.D. candidate) was awarded the second place award in the student poster section at the Electrochemical Society Spring Meeting in May 2007. She is also the recipient of a \$750 travel award from the Electrodeposition Division of the Electrochemical Society, with the help of which she will travel to the 214th ECS Meeting in Honolulu, Hawaii, in October 2008 to present her paper: "Electrodeposition of Super Invar and Multilayered Super Invar/Cu into Micro-recesses." **Trevor Goodrich** (Ph.D. 2008) received the Graduate and Professional Student Award for his exceptional performance as a scholar and a researcher.



MEMBERS OF THE CHEMICAL ENGINEERING GRADUATE STUDENT COUNCIL AT THE GSC/AICHE FIELD DAY IN MAY 2008

ABET CORNER

Northeastern University Chemical Engineering Department passed the 2007 ABET Accreditation Exercise with flying colors. Thank you to all alums and employers of ChE graduates who participated in our surveys. In particular, the NU Chemical Engineering Program was lauded for its excellent and diverse faculty, for its integration with the co-op program that lends a strong background for well-trained chemical engineers, and for its comprehensive design experience that builds on a strong foundation in the fundamentals of Chemical Engineering.

GRADUATE STUDENT SPOTLIGHT

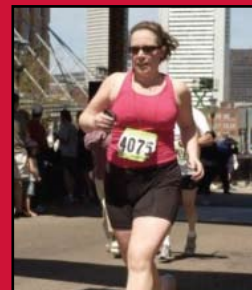
BRIAN PLOUFFE (Ph.D. candidate, class of 2011) received the IGERT Nanomedicine Doctoral Fellowship for his work, "Microfluidic Separation of Magnetically Labelled Circulating Tumor Cells from Whole Blood." His work focuses on the development of a point-of-care, disposable microfluidic device capable of efficient and rapid isolation of circulating tumor cells (CTCs), which cause metastasis from the primary tumor to distant organs, causing 90% of cancer-related deaths. Brian hopes that his approach will provide a unique platform technology to detect cancer and capture circulating tumor cells.



Brian has co-authored several journal articles in publications such as *Langmuir* and *Lab on a Chip*, as well as a book chapter in *Micro- and Nanoengineering of the Cell Microenvironment: Technologies and Applications*. He has presented his research at numerous conferences such as the AIChE, MRS, and Society for Biomaterials annual meetings.

Brian holds his B.S. degree in Chemical Engineering from University of Rhode Island (May 2004) and an M.S. degree from Northeastern University (May 2007). He returned to Northeastern University in January 2008 to pursue his Ph.D. under the advisement of Dr. Laura Lewis and Dr. Shashi Murthy. In his time off from school Brian worked at Charles Stark Draper Laboratories on microfluidic vascular tissue engineering. He commutes to campus daily from Lincoln, RI, where he resides with his wife Aimée. Between being a highly productive graduate student and a loving husband Brian also finds time to read historical fiction.

COURTNEY PFLUGER has been an active member of the Northeastern University Chemical Engineering community since Fall 2000, when she joined the department as a freshman. She received her B.S. in December 2004 and joined Ipsen Biomeasure as a Process Development Research Associate in the cell culture department. She returned to Northeastern University in the Fall of 2006 and is currently a graduate student (class of 2008) working under the co-advisement of Professors Daniel Burkey and Rebecca Carrier. Her thesis work elegantly combines materials science with biotechnology: Courtney is working on the replication of the nano- and micro-topology of the intestinal basement membrane using Chemical Vapor Deposition (CVD), for future use as a tissue culture substrate.



Courtney has given several presentations on her research at conferences such as the ISPE Northeast Regional Conference, the AIChE Annual Meeting, the Northeastern University Graduate Materials Links Symposium, and the Northeastern University Research and Scholarship Expo.

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Courtney, a Poughkeepsie, NY native, is now a diehard fan of all Boston sports teams. She is also an athlete herself: she rows at Community Rowing Inc. in Watertown, MA and she ran the Boston Run to Remember half marathon in May 2008. Additionally, she is the Activities Coordinator for the Graduate Student Council.

UNDERGRADUATE STUDENT SPOTLIGHT

KYLE STEPHENS (class of 2009) was granted the opportunity to engage in his own project in nanomedicine with the support of the IGERT Associate program. His project, co-advised by Dr. Daniel Burkey and Dr. Shashi Murthy, involves using Chemical Vapor Deposition (CVD) technique to coat neuroprosthetic implants with novel polymer thin films, in order to protect these implants from corrosion and to mitigate scar tissue formation. The implants are silicon based microelectronic devices designed to send and receive electrical signals to and from neurons in the central nervous system, thus, enhancing or replacing the function of an impaired nervous system.



Kyle presented his work at the 2008 AIChE Northeast Regional Conference, where he became the winner of the Student Paper Competition.

Kyle, who is a transplant from Huntington Beach, CA, has grown quite fond of our New England weather through his love for outdoor activities, such as long distance running. He is involved with the Northeastern University Chem E Car team as well as peer tutoring. In addition to being a Chemical Engineer, Kyle is also an avid reader and a musician. He is hoping to graduate in May 2009 with a dual B.S. degree in Chemical Engineering and Mathematics.

ANNALICIA POEHLER (class of 2008) also had a chance to do her own research during her undergraduate career thanks to an undergraduate research grant from the Provost Office. Anna explored photoinitiated Chemical Vapor Deposition (piCVD) to generate a hydrogel for cell selection within the framework of her research under the advisement of Prof. Daniel Burkey.

This was yet another way for Anna to challenge herself: something she had been doing since the tender age of 14, when the New Jersey native started her college career at Burlington County College. She received her Associate's degree in Chemistry and joined the Chemical Engineering Department at Northeastern University as a transfer student. Having received her Bachelor's degree in May of this year, Anna joined the National University of Singapore as a Ph.D. student in the Singapore MIT Alliance (SMA) program. She felt that the diverse community would not only broaden her horizons but would also benefit her research.



ANNALICIA
IN FRONT OF
THE MERLION
STATUE,
THE MOST
WELL-KNOWN
TOURIST ICON
IN SINGAPORE

UNDERGRADUATE STUDENT NEWS

In the 2007-2008 academic year the Department awarded 35 B.S. degrees. Our undergraduates are not only successful in their studies but also active members of the Chemical Engineering community: **Jeiran Jahani, Brian McMahan, and Melissa Semple** (all class of 2007) received the AIChE William A. Cunningham Award for the first place in the National Student Design Competition, along with the Ephraim Scheier Team Award for the safety of their project. The NEU AIChE Chapter under the leadership of **Matthew Marino and Katie Megley** (both class of 2008) with faculty advisement from **Dr. Daniel Burkey and Dr. Katherine Ziemer** received the AIChE Outstanding Student Chapter Award. **Katie Megley** was also one of 15 national AIChE student members to be awarded the AIChE Donald F. and Mildred Topp Othmer National Scholarship Award, which is presented on the basis of academic achievement and involvement in student chapter activities. **Abby Deleault** (class of 2009) was the recipient of the AIChE Donald F. Othmer Sophomore Academic Excellence Award, which is presented to one national AIChE student member in each student chapter who has attained the highest scholastic grade-point average during his/her freshman and sophomore years. **Kyle Stephens** (class of 2009) was the winner of the Student Paper Competition at the 2008 AIChE Northeast Regional Conference for his work: "Vapor Deposited Polymer Coatings for Implantable Neuroprosthetic Devices." **Jason Boomer, Rebecca Harvey, and Joseph Marcella** (all class of 2008) were given the Calvin Cronan award for outstanding academic performance, while **Abby Deleault** received the Ralph A. Buonopane Award, which is given each year to a junior based on academic performance and excellence in experiential learning. **Dennis Callahan and Matthew Marino** were honored with the Omega Chi Epsilon Student of the Year Award.

KYLE STEPHENS
(CLASS OF 2009)
AND DR. DANIEL
BURKEY BRING THE
ICHTHOLOGISTS
TROPHY BACK TO
NORTHEASTERN
FROM THE AIChE
NORTHEAST
REGIONAL
CONFERENCE



CO-OP CORNER

Real life work experience in the field of their choice is one of the top reasons why students chose Northeastern University. So it is a comfort to see that despite the shaky economy the Chemical Engineering Co-op Program continues to grow.

Over 120 students were placed in co-op positions with 50 local, regional, national, as well as international employers over the last year. The hourly wage our students received ranged between \$9.50 and \$29.00, with an average hourly salary of \$18.71. 100 % of the 2008 graduating seniors had participated in the co-op program during their stay at Northeastern.

KEEPING IN TOUCH

NAME _____

STREET ADDRESS _____

CITY / STATE / ZIP _____

TELEPHONE _____

E-MAIL _____

GRADUATION YEAR & DEGREE _____

CURRENT OCCUPATION _____

GRADUATION YEAR & DEGREE _____

EMPLOYER & LOCATION _____

NEWS OF RECENT ACCOMPLISHMENTS, AWARDS, OR PROMOTIONS _____

To learn more about gift giving, getting involved at the College or to submit your personal and professional updates, please contact LeeMarie Kennedy at 617-373-7910, or via email to l.kennedy@neu.edu.

GIFT INFORMATION

I wish to make a gift to Northeastern University Chemical Engineering Department in the amount of:

\$1,000 \$500 \$250 Other _____

My total gift will be paid as indicated:

Check payable to "Northeastern University"

Credit charge to: MasterCard Visa
 Discover AmEx

CREDIT CARD NUMBER _____

CREDIT CARD EXPIRATION DATE _____

NAME AS IT APPEARS ON THE CARD _____

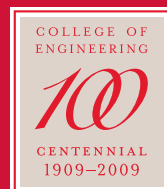
SIGNATURE _____

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100 YEARS OF NORTHEASTERN UNIVERSITY COLLEGE OF ENGINEERING

Starting January 2009, the Northeastern University College of Engineering will celebrate its 100th year. The NEU COE Centennial Celebration will include special events to highlight the history of leadership and innovation, as Northeastern's first college to offer cooperative education.

This milestone year will be marked with a variety of events and programs designed for alumni, students, and University community members to partake in and enjoy.

Watch the NEU COE Website for updates:
<http://www.coe.neu.edu>.