

Department of Chemical Engineering Newsletter

Academic Year 2009-2010

Dr. Shashi K. Murthy Wins \$1.9M NIH Award

Dr. Shashi K. Murthy, assistant professor of chemical engineering at Northeastern University, was awarded a three-year \$1.9 million grant from the National Institutes of Health (NIH) to develop innovative techniques for isolating and cultivating stem cells for use in tissue engineering and regenerative medicine.

A team of researchers led by Dr. Murthy will design and build microfluidic devices to extract cell types that help grow new tissue or repair cardiac muscle, skin, vascular or gastrointestinal tissue.

Dr. Murthy explains, "Stem cells play a critical role in the development of the human body and all its parts. Our goal is to advance regenerative-medicine technologies by more effectively extracting and cultivating stem cells to multiply and develop into new tissue."

Murthy's team will develop a new generation of microfluidic cell separation systems, which will enable greater efficiency and accuracy in the separation of stem cells based on size and affinity from a smaller tissue or blood sample as compared to traditional methods.

One focus of this work—to be pursued in collaboration with Dr. Rebecca Carrier, assistant professor of chemical engineering at Northeastern—is the isolation of intestinal stem cells via negative selection. These cells are extremely challenging to separate, since they tend not to survive after they are extracted from their native environment.



As part of the grant, Dr. Murthy will also collaborate with several scientists from research institutions throughout North America. Working with the University of Toronto, Dr. Murthy will explore ways of repairing diseased heart tissue by obtaining cardiac stem cells from normal tissue and implanting these cells into damaged tissue.

In collaboration with the Cardiology Department at Children's Hospital, Boston, Dr. Murthy will investigate blood-vessel tissue repair by extracting endothelial progenitor cells and implanting them into damaged blood vessels.

Lastly, Dr. Murthy will team up with researchers at Massachusetts General and Shriners Burn Hospitals, Boston, to study how stem cells extracted from hair follicles in normal skin can repair severely burned skin by regenerating new hair follicles and sweat glands.

To learn more about Dr. Murthy's research, visit his website: www.microfluidicslab.org. ■

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Images from top (left to right): NU ChemECar team with President Joseph E. Aoun of Northeastern University; ChE graduate students at 2009 AIChE National Conference in Nashville, TN; Undergraduate ChE students at the Samuel Adams Brewery Tour. Middle image: Dr. Murthy working in his laboratory.

Letter from the Chair

Welcome to the Chemical Engineering Department at Northeastern University!

The Department has changed significantly since our 2008 newsletter as we continue to grow our faculty, student enrollments, funding for research and training, and co-op placements. We look forward to welcoming Dr. Edgar Goluch to the Department in Fall 2010 to help educate our record enrollment of 260 undergraduate chemical engineering students, 22 M.S. students and 34 Ph.D. students.

The ChE faculty have been very successful in securing research funding this year, with active research grants totaling \$7.4 M. In addition to these grants, the ChE Department is a key participant in a recently-awarded five-year, \$3.1M grant from the National Science Foundation to build on the success of its innovative Integrative Graduate Education and Research Traineeship (IGERT) Nanomedicine program through the development of new global research and educational partnerships.

The NU ChE Cooperative Education program continues as the cornerstone of experiential learning in the Department. This summer, a group of 87 chemical engineers, the largest ever, has been placed with 57 companies as well as in university research laboratory positions.

As the NU ChE Department continues to grow, we hope to stay connected with the alumni who have helped support and shape our Department. I always enjoy meeting NU ChE alumni and look forward to hearing how their NU experience shaped their lives. Please do stay in touch.

Enjoy our newsletter and best wishes.

Laura J. H. Lewis

Dr. Laura H. Lewis
Cabot Professor and Chair



Northeastern University

New Faculty Spotlight: Dr. Edgar Goluch

The Chemical Engineering Department welcomes Dr. Edgar Goluch, the newest faculty member, who will be joining us in the Fall 2010 semester. Dr. Goluch was attracted to the Department due to its focus on interdisciplinary research and its eagerness towards expansion.

Dr. Edgar Goluch received his B.S. in chemical engineering from the University of Illinois at Urbana-Champaign while researching directed evolution for gene therapy with Professor Huimin Zhao. He then obtained his M.S. in mechanical engineering and a Ph.D. in bioengineering also from Illinois under the direction of Professor Chang Liu and in close collaboration with Professor Chad Mirkin (Northwestern University) in the area of "lab-on-a-chip" devices. In the last few years, he has conducted postdoctoral research at Delft University of Technology in the Netherlands as a National Science Foundation International Research Program Fellow, which involved development of an electrochemical sensing strategy in nanofluidic devices.

Dr. Goluch will be tackling several research projects while at Northeastern. His first project, an extension of his postdoctoral research, focuses on electrochemically detecting biological molecules in microfluidic and nanofluidic devices in order to provide

new insight to biological systems. His second research project entails developing new detection techniques for "chip-in-a-lab" and "lab-on-a-chip" applications. One technique utilizes infrared imaging to obtain chemical information from the materials of interest without disturbing the sample or removing it from the device. A third project involves integrating different photonic techniques such as surface plasmon resonance or surface-enhanced Raman scattering combined with nanotechnology for detector usage. Though physicists have already explored this technology, Dr. Goluch wants to apply these techniques to fluidic systems in order to investigate biological processes. He envisions his future research group working with various collaborators that are ready to fuse nanotechnology and biology.

In addition to his research, Dr. Goluch will be sharing his expertise and experience in the classroom with the students starting in Fall 2010. He plans to apply the fundamentals of chemical engineering to relevant problems applicable to the students' professional career. Dr. Goluch says he would like to implement a new nanotechnology course which would introduce students to the field, starting from synthesizing nanoparticles to characterization and applications. He states, "Nanotech is popping up everywhere in society; therefore, it is important for



all engineers to be knowledgeable as to how [nanotechnology] is being used in commercial products and research."

Dr. Goluch is an avid bowler and cyclist when outside of the lab or classroom. He enjoys mentoring and participating in student organizations such as the AIChE and Omega Chi Epsilon. He brings potential, determination, and fresh ideas for the new academic year, making him a great addition to the Department. We are very excited to see more of what his future with Northeastern will bring. The Chemical Engineering Department faculty, staff, and students warmly welcome Dr. Edgar Goluch. ■

Li Buessing ('10), ChE Graduate, Inspired by International Co-op

Northeastern senior Li Buessing started his co-op at a water and waste treatment company in Paris with the mindset of an engineer, and ended it thinking more like a corporate manager.

His co-op position with Veolia Water Solutions & Technologies over the winter transformed Buessing's career outlook, leading the graduating senior to include an MBA degree in his post-graduation plans.

During his co-op with Veolia, an international corporation with subsidiaries in more than 50 countries, Buessing used his chemistry background to promote the company's line of chemicals formulated to treat water for widely varied applications, ranging from drinking to cooling nuclear power plants.

This experiential learning opportunity afforded Buessing the chance to observe big business in action. Veolia's 300,000 employees worldwide provide more than 130 million people with water and wastewater services.



Li Buessing working at Veolia Water Solutions & Technologies in Paris, France.

"I'm going to get my MBA and I know that I'll go into business someday," he said, noting that he recently applied for a job with General Electric Power and Water, one of Veolia's top competitors.

"Instead of dealing with the small, but important details, like an engineer might do, I'd like to look at the big picture and figure out how to make everything work," he added.

Buessing's chemical engineering know-how helped him explain the technical

merits of Veolia's line of Hydrex Chemicals, but it was his interaction with the company's business side that left the greatest impression.

"It's good to have a technical background," he said, "but I was dealing with business units all over Europe, including those in Copenhagen, Milan and the UK. It made me see the business world from a different perspective and I liked what I saw."

Buessing's taste of the global business world was enough to convince him to take a job abroad should the opportunity arise. "Everyone should experience living in another country," he said. "You have to be willing to get out of your bubble and experience new things."

Buessing has also completed co-ops as a process engineer at Infineum, a New Jersey-based company that develops, manufactures and markets petroleum additives, and as a lab technician at W. R. Grace, a Cambridge-based specialty chemicals and materials company. ■

American Institute of Chemical Engineers (AIChE) Students Win First Place in National ChemECar Competition at 2009 Annual AIChE National Conference

Northeastern University AIChE students and Dr. Katherine Ziemer, the team's faculty advisor, won first place out of 26 schools in the US and Puerto Rico in the National ChemECar Competition in Nashville, TN.

The teams were challenged to design and construct a chemically-powered vehicle that fits in a boot box, carries a specified cargo load of 250 milliliters of water, and travels a specified distance of 77 feet from the start line. The car that arrives closest to the finish line in two minutes wins the competition.

The NU team designed, built, and tested their winning car, "TH₂e Aluminator", to be both powered and controlled by a chemical reaction. The car used an aluminum and sodium hydroxide reaction to generate hydrogen to power a fuel cell. The team controlled the distance the car traveled using the kinetics of an "iodine clock" timing reaction.



Dr. Ziemer and 2009 AIChE ChemECar Winners

At the competition, "TH₂e Aluminator" stopped 6.75 inches from the finish line allowing the team to take first place. Patrick McMahon, the team's captain, said "this competition allowed us to use our skills and knowledge to solve a truly relevant worldwide issue – running a car on alternative fuels."

Team Members - Yr '10: Jason Crater, Tim Lund (ECE), Patrick McMahon; Yr '12: Emma Chory, Matt Dinitto, Anthony Fusco, Michael Hess, Aaron Lamoureux, Emily Nelson, and Samantha Wallner.

AIChE ChemECar Team Qualifies for 2010 National Competition

At the Northeast Regional AIChE meeting in March 2010 in Orono, ME, the NU ChemECar team did a magnificent job at the competition. Although their chemicals never arrived at the competition site, the team was able to adjust the car's power mechanism "on the fly" by improvising with over-the-counter fertilizer chemicals. This achievement resulted in the team's qualification for the 2010 National ChemECar Competition. In addition, the team won First Place in the Poster Competition and won the Most Creative Drive Award.

Team Members - Yr '10: Tim Lund (ECE), Patrick McMahon; Yr '12: Emma Chory, Matt Dinitto, Anthony Fusco, Aaron Lamoureux, Emily Nelson, Matt VanOudenaren, and Samantha Wallner. ■

Department News

Faculty

Dr. Rebecca Carrier was awarded a two-year \$475K grant from the National Institute of Neurological Diseases and Stroke.

Dr. Shashi K. Murthy received the 2009 Søren Buus Research Award from the College of Engineering at Northeastern University.

Dr. Albert Sacco, Jr. received the 2010 Distinguished Chemist Award from the New England Institute of Chemists.

Dr. Ronald Willey received the Professor of the Year award at the 2010 NU ChE Award Ceremony.

Dr. Katherine S. Ziemer received the Vice President's Award for Outstanding Advisor Involvement for her work with the AIChE group.

Graduate

In August 2010, Radhika Barua attended the highly selective IEEE Magnetics Society Summer School held in Dresden, Germany.

In July 2010, Stephanie Fernandez received a GEM Fellowship, an award for minorities enrolled in graduate degrees in Engineering and Sciences from the National GEM Consortium.

In May 2010, Fulden Buyukozturk won Best Poster Award at the International Society for Pharmaceutical Engineering (ISPE), Boston Area Chapter Student Poster Competition.

Sheba Goklany received First Place in the International Society for Pharmaceutical

Engineering (ISPE), Boston Area Chapter Student Poster Competition in May 2010.

Melissa Loving was awarded the Eisai Research Institute Certificate of Recognition for an Excellent Oral Presentation at the 12th Annual Northeast Student Chemistry Research Conference held April 2010 in Boston, MA.

Tetiana Bairachna was awarded a Fulbright Fellowship for graduate study from the U.S. Department of State in 2009-2010.

Zhuhua Cai received the 2009 American Institute of Chemists (AIC) Outstanding Graduate Student Award.

In 2009, John Oldham received a Dissertation Fellowship from Northeastern University.

Some of the notable journals published by the graduate students and faculty within the 2009 - 2010 academic year include: *Langmuir*, *Biomaterials*, *Journal of Proteomic Research*, *Journal of Physics D: Applied Physics*, *Microporous and Mesoporous Materials*, and *Journal of Electrochemical Society*.

Undergraduate

Pin I. Chen ('11) and Devyesh Rana ('11) received Undergraduate Research Funds of \$1000 each for their research conducted in Dr. Carolyn Lee-Parsons' lab.

The 2010 ChE Awards presentation was held on April 21st at NU Varsity Club. The winners are listed below.

American Institute of Chemists Award
Patrick McMahon ('10)

AIChE Outstanding Senior Award (Local Section)

Patrick McMahon ('10)

Cronan Award for Outstanding Academic Performance

Jason Crater ('10)
Derek MacCormack ('10)
Patrick McMahon ('10)

Omega Chi Epsilon Award for Student of the Year
Blayne Phillips ('10)

President's Award for Outstanding Scholarship

Jason Crater ('10)
Thomas Dusseault ('12)
Lauren Gianino ('12)

Ralph Buonopane Award for Outstanding Hands-on Learning
Naftali Fraiman ('11)

Sears B. Condit Award for Outstanding Undergraduate Achievement
Jason Crater ('10)



ChE students celebrating 2009 AIChE ChemECar win in Nashville, TN.

Dr. Carolyn Lee-Parsons Receives \$550K NSF Grant

Drs. Carolyn Lee-Parsons and Erin Cram (Biology Dept) received a \$550K grant from the National Science Foundation (NSF) for their project entitled,



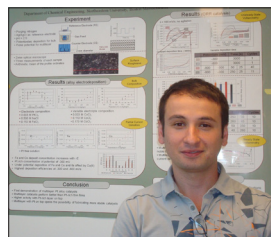
“Transcriptional Control of Alkaloid Biosynthesis in *Catharanthus roseus* Cultures.” The Madagascar periwinkle (*C. roseus*) produces several highly-valued anti-cancer drugs but the slow growth rate of the

plant and the low product concentration are significant barriers to efficient drug production. The high cost and need for these pharmaceuticals motivate their research to better understand how cells regulate production and to ultimately overproduce these pharmaceuticals using *C. roseus* cultures and a novel strategy based on gene silencing. This research will involve K-12 teachers, undergraduates, and graduate

students in interdisciplinary research that integrates biochemical engineering, genetic engineering, and molecular biology approaches. ■

Alex Avekians Wins First Place Student Poster Award

Alex Avekians, graduate student of Dr. Elizabeth J. Podlaha-Murphy, won first place Best Poster Student Award among 82



presentations at the 217th Annual Meeting of The Electrochemical Society in Vancouver, Canada in April 2010. His poster featured the “Enhancement of Oxygen Reduction Reaction (ORR) by Electrodeposited CoFePt Multilayered Alloys”. He was honored for his success at The Electrochemical Society’s Business Luncheon. Congratulations Alex on a job well done. ■

Dr. Albert Sacco, Jr. Collaborates on International Biosensor

Dr. Albert Sacco, Jr. is currently Co-Principal Investigator on an international biosensor collaboration, “Nanosensors Based on Nanomaterials (NANOBIOSENS)” supported by the European Commission via the “International Research Staff Exchange Scheme” (IRSES). This project converges nanomaterials and biosensor technologies to produce an optimum final device for detection.



The four year collaboration partner universities aside from Northeastern University include the Middle East Technical University in Turkey, the Université Claude Bernard Lyon in France, the Institute of Molecular Biology and Genetics of National Academy of Sciences Ukraine, McGill University in Canada, and Sogang University in Korea. ■

Congratulations to our 2009/2010 ChE Degree Recipients

Doctor of Philosophy (Ph.D.)

Dr. Anilkumar Harapanahalli Achyuta

Biopassive and Bioactive Coatings for Neural Implants

Advisor: Dr. Shashi K. Murthy

Dr. Zhuhua Cai

Molecular Beam Epitaxy Integration of Magnetic Ferries with Wide Bandgap Semiconductor 6H-SiC for Next Generation Microwave and Spintronic Devices

Advisor: Dr. Katherine S. Ziemer

Dr. Dilber Ece Gamsiz

Modeling the Influence of Drug Delivery Technologies on Oral Bioavailability of Insoluble Drugs

Advisor: Dr. Rebecca Carrier

Dr. John Thornton Oldham

Identifying and Investigating Metabolic Pathways Activated in High-Producing California Poppy Suspension Cultures

Advisor: Dr. Carolyn Lee-Parsons

Master of Science (M.S.)

Shihara Shafeque
Yujia Zhang

Bachelor of Science (B.S.)

Class of 2010 Top Students

Jason S. Crater
Tala H. Daya
Todd R. Eaton
Ryan E. Farrell
Johnathan M. Goldman
Derek R. MacCormack
Joshua L. Marion
Mark R. Maselli
Lindsey M. Mathews
Patrick M. McMahon

Supporting the Department

This is an opportunity to make a lasting contribution to the future of the Chemical Engineering Department and Northeastern University.

Your support is essential to furthering our mission to provide our students with education and experiences that will help transform their lives. It will also provide scholarships to students, develop new chemical engineering programs, and contribute to new facilities and equipment.

For more information on how to give, please contact:

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Associate Dean and Director of Development
Phone: (617) 373-4845

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Make check payable to: Northeastern University

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Do you have any suggestions for articles for upcoming issues?

Do you know of an alumnus who is not receiving our newsletter but would like to be on our mailing list?

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