



BME 'Scope



Volume 3, Issue 1 - Spring 2009

New Vision for the BME Department Lead by Dr. Wang



Professor Yu-li Wang
Head of the Department of BME, Carnegie Mellon University

In the last issue of the 'Scope I explained why Carnegie Mellon University, with its top-quality research in engineering and basic sciences and long tradition of cross-discipline collaborations, represents an ideal environment for biomedical engineering. During the first 6 years of existence, the BME Department has laid a solid foundation under the leadership of Prof. Todd Przybycien, through its impressive growth in educational programs, student body, and faculty. This foundation serves as the point of departure for the growth of the BME Department in the coming decade.

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Distinguished Scientist, Dr. Shu Chien, Speaks at the 4th Annual BME Research Symposium

Sanna Gaspard

Ph.D. Candidate of BME, Carnegie Mellon University, Advisor: Todd Przybycien

On April 23rd 2009, the 4th Annual Biomedical Engineering and Biotechnology Research Symposium (BEBRS) will be hosted at Carnegie Mellon University by GBMES and the BME Department. The invited keynote speaker for the BEBRS 2009 is Dr. Shu Chien, M.D., Ph.D. Dr. Chien is a world leader in understanding how blood flow and pressure affect blood vessels. He is the director of the University of California, San Diego (UCSD) Whitaker Institute of Biomedical Engineering in addition to being a university professor of bioengineering and medicine. He is one of only a few scientists who are members of all three U.S. National Academies: the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. In 2006 he was appointed the inaugural holder of the Y.C. Fung Endowed Chair in Bioengineering at the Jacobs School of Engineering at UCSD. He is widely credited with building the bioengineering department at UCSD into a world class institution, with a focus on multi-scale bioengineering, regenerative medicine, and systems biology. In addition to his work at UCSD, Dr. Chien has also served on the Board of Directors of BMES since 2003 and was President-Elect from 2006-2008. He has published nearly 450 archival journal articles and 9 books. Throughout his career Dr. Chien has received numerous distinguished awards for his work and contributions to the field of biomedical engineering.



The symposium will be held in the Grand Room (Posner Hall, 3rd floor) from 9am to 6:30pm. The symposium will also feature graduate and undergraduate researchers who will be judged by a panel of professors. A monetary prize will be awarded to the top two research projects. The symposium is free and attendance is open.

The Advancement of BME at Carnegie Mellon University

In this article, the substantial advances of the BME Department during the 2008-2009 academic year are highlighted.

Professor Yu-li Wang

Head of the Department of BME, Carnegie Mellon University

New BME Programs:

- Master's Program – Starting Fall 2009, BME will offer a “fifth year” Master in Biomedical Engineering. This course-based program, designed by Prof. Todd Przybycien, is particularly suitable for students who seek advanced training for medical or graduate school, legal or financial BME-related career, or enhancement of BME job prospects.
- Ph.D. Admission Process – To improve the mentoring of PhD students, advisors will no longer be assigned during the admission process. Students will spend the first few weeks upon enrollment interacting with several potential advisors to determine the best fit.
- New BME Symposia – The “Biomaterials Day” symposium, aimed at drawing together researchers who develop and apply novel materials for BME from across the campus, debuted in October 2008. A “Biomechanics Day” symposium is planned for 2009. Together with the Bioimaging Day symposium, these symposia serve as part of the BME dept. efforts to promote inter-departmental interactions and collaborations.
- Enhanced Seminar Series – Since the Fall of 2008, BME departmental seminars have been held regularly each week. The faculty series features prominent and emerging leaders as well as faculty members from the Pittsburgh area. The student series provides senior PhD students the same setting to share their research, and to build skills and experience for major research presentations.

New Facilities:

- Department Headquarters – Administrative offices have been set up on the 4th floor of the Pittsburgh Technology Center building on Technology Drive to serve as the home base for the department head, the assistant to department head, and the business manager. Posters are displayed along the fourth floor

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corridor to feature the diversity of the research conducted within the department. The office in Doherty Hall 2100 remains the central office for student affairs.

- Student Lounges & Teaching Laboratories – New space has been allocated in Hamburg Hall as the graduate student lounge. GBMES is leading the effort in setting up the room. Space has also been allocated for a dual-purpose computing teaching laboratory and undergraduate lounge in Wean Hall. Smith Hall 125 has been converted to an undergraduate teaching laboratory.
- BME Web Site – Launched in December 2008, the new web site presents a clear picture of the university-wide research and education enterprise coordinated by the BME Department, featuring the synergistic interactions among BME faculty members and between BME and partner departments. Visit <http://www.bme.cmu.edu>

New Faculty & Staff Members:

- Faculty - Prof. Ge Yang joined the Department in 2009 as a joint Assistant Professor with the Lane Center for Computational Biology. See *New Faculty Focus* feature for more information on Professor Ge Yang.
- Director of Placement and Alumni Relations – Ms. Hilda Diamond is BME's first director of Placements and Alumni Relations. Over the past 40 years she has worked for several precursors of the BME Department, helping hundreds of BME students set their feet for a successful career. It is difficult to find a more appropriate person to enhance alumni relations.
- Associate Head – Prof. Conrad Zapanta became the Associate Head of BME in 2009, with the main mission of enhancing undergraduate education. BME will benefit profoundly from having a faculty member with outstanding



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teaching achievements and research experience as its Associate Head.

- **Staff Assistant** – Ms. Vanessa Calvin joined the BME Department as the Assistant to the Department Head in January 2009. She is an alumna of Carnegie Mellon University who graduated with University Honors, majoring in Business Administration, and then worked for 14 years in the university's College of Humanities & Social Sciences.



New Record, Image & Stipends

- **Record Graduate Applications** – BME graduate

programs have set a new record of attracting domestic applications. Compared with the previous record of 54 applicants, the 81 applications for Fall 2009 represents a 50% increase. The growing reputation of the program, the new web site, and the economic situation have contributed to the increase in applicants to the Department.

- **New Departmental Logo** – The new logo is a double helix motif containing the hidden letters “B”, “M”, and “E” making it an intriguing visual puzzle (See upper left corner on page 1).
- **Increased Graduate Student Stipend** – The annual stipend for PhD students has been increased to \$23,400. (See article entitled *New Guiding Principle Yields an Increase in Grad Stipends* on page 5).

Emergence of A New Research Symposium

With the diverse array of Biomaterials research being conducted within BME at Carnegie Mellon, Biomaterials are quickly gaining prominence on campus.

Newell Washburn, PhD

Assistant Professor of Biomedical Engineering and Chemistry

Biomaterials research at Carnegie Mellon University is conducted across campus; it ranges from the synthesis of advanced biomaterials, to the characterization of cell-material interactions, to the development of novel medical devices. The nature of the research is similarly diverse, from fundamental studies of molecular and cellular events at biomaterial interfaces to translational research focused on the development of new devices and therapies. In order to bring together researchers with diverse interests – and diverse locations on campus – Biomaterials Day was organized by Professor Yu-li Wang, the new head of Biomedical Engineering, Professor Mike McHenry of Materials Science and Engineering, and Newell Washburn, Assistant Professor of



This capsule endoscope displays a new class of micro patterned materials used for tissue adhesion. The three adhesive arms are deployed to anchor the capsule to the lining of the gastrointestinal (GI) tract.

Biomedical Engineering and Chemistry. Modeled on the highly successful Bioimaging Day series, Biomaterials Day covered talks given by faculty in the Carnegie Institute of Technology, the Mellon College of Science, the Robotics Institute, and Institute for Complex Engineered System.

The morning featured Yu-li Wang, the Matyjaszewski group, and an overview of the collaborative research done by the Tilton and Przybycien groups. After the break, Phil Campbell and Mike McHenry spoke along with two faculty members from the University of Pittsburgh, Thomas Gilbert (a Carnegie Mellon University alumnus – BS in MSE) and Yadong Wang, who recently moved to Pitt from Georgia Tech. There was a lunchtime poster session, followed by talks from the LeDuc, Dahl, Islam, Bockstaller, Sitti, Zappe, and Washburn Groups. The diversity of biomaterials activities presents an opportunity (and challenge) for Dr. Wang who is working to unify the very active Carnegie Mellon University biomaterials research into a coherent program. The BME Department is already planning the next Biomaterials Day and is encouraging the establishment of similar symposium “Days” to bring together researchers with related goals.

For more information on Biomaterials Day visit:

<http://www.bme.cmu.edu/research/BiomaterialsDay2008.pdf>

New Faculty Focus



Ge Yang, PhD

Assistant Professor, Department of Biomedical Engineering & Lane Center for Computational Biology

It is a great pleasure for me to introduce myself to the biomedical engineering community at Carnegie

Mellon. I was born in a small town in the southern part of China to a family of doctors: my father is a physician; my mother is a pediatrician. I received my undergraduate education in mechanical and electrical engineering at Tsinghua University in Beijing. After my graduation in 1991, I worked for a few years in industry. This experience helped me to recognize that my real interest is in research. I then studied for my Master's degree in electrical engineering at the Institute of Automation of the Chinese Academy of Sciences, working on trajectory planning and control of robots. In 1998, I came to the United States to pursue my doctoral training in mechanical engineering at the University of Minnesota, Twin Cities. I was fortunate to join the lab of Dr. Bradley Nelson, a Carnegie Mellon graduate trained at the Robotics Institute with Dr. Pradeep Khosla. From Dr. Nelson I learned the importance of always focusing on developing real solutions to real-world problems. My thesis research was mainly on microrobotics, including the development of a robotic workstation to assemble microfabricated hybrid MEMS parts. During this period, however, my research interests started to shift gradually from system development to computer vision techniques for microscopic imaging. After I graduated in early 2004, I joined the lab of Dr. Gaudenz Danuser in the Department of Cell Biology at the Scripps Research Institute for my postdoctoral training. There I started to work on integrating computer vision, computational and biophysical modeling, and fluorescence live cell imaging to investigate the molecular mechanisms of basic cellular processes. Although my original plan was to focus on developing and applying microscopic computer vision techniques, I became so attracted to the beauty and complexity of the biology of cells that I

decided to pursue my future research in computational cell biology. My transition was also assisted greatly by Dr. Danuser, who is a role model for conducting interdisciplinary research.

My research over the past five years at Scripps has been focused on understanding how force and motion are generated and regulated in cell division and axonal transport. Specifically, I have been working on analyzing the dynamic architecture of the mitotic spindle and coordination of molecular motors in driving bidirectional cargo transport in neurons. Both have profound connections to human diseases. I believe we are in the most exciting time to study biology. Development of biology over the past half a century has made it possible to identify the genome and proteome of living organisms. The challenge now is to understand how individual components work together to exhibit the function, adaptability, and complexity of living organisms as we observe. Today, biological research is increasingly dependent on engineering perspectives and techniques. Students with solid engineering and computational thinking and skills will have great opportunities to make fundamental research impacts. It is because of this I am particularly excited to join Carnegie Mellon.

“Students with solid engineering and computational skills will have great opportunities to make fundamental research impact.”

My research at Carnegie Mellon will continue to focus on integrating computation, modeling, imaging and other experimental techniques of cell biology, molecular biology, and genetics to understand the mechanisms of cell division and axonal transport, with an emphasis on understanding related human diseases. I am particularly excited about the prospect of expanding my research much further into neuroscience, with an emphasis on using integrated approaches to understand human neurodegenerative diseases such as Alzheimer's disease. In the fall of 2009, I will start to teach a class on molecular cell biology to senior and graduate engineering students. I look forward to introducing to engineering students the amazing world of cells, which are undoubtedly among the most fascinating engineering systems.

For more information on Dr. Yang visit:

<http://lccb.scripps.edu/content/profiles/profile.php?id=12>

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Michael Sacks, Ph.D.

William Kepler Whiteford Professor of Bioengineering, University of Pittsburgh

My overall research focus is characterization and modeling of the structure-function-biomechanics of native and engineered soft tissues, and linking these studies to underlying cell-tissue mechanobiological interactions. In particular, my laboratory has focused on the mechanical behavior and function of the native aortic and mitral heart valves, including the development of the first constitutive (stress-strain) models for these tissues using a structural approach. Recent work includes multi-scale studies of cell/tissue/organ mechanical interactions in native and engineered heart valves. I am particularly interested in determining the local stress environment for heart valve interstitial cells. This work aims to utilize an integrated experimental/multi-scale finite element approach to determine how hemodynamic loading on the valve translates to altered stress states on the valve interstitial cell function and, in-turn, changes in local extra-cellular structure/composition and valve function.

For more information on Dr. Sacks visit:

http://www.engr.pitt.edu/bioengineering/main/people/faculty/sacks_michael.html



Justin Crowley, Ph.D.

Assistant Professor of Biological Sciences and Biomedical Engineering

I am most pleased to be a member of the Department of Biomedical Engineering! My primary appointment is in Biological Sciences, but I have always appreciated the interface between hypothesis testing and technology development. My lab's research is focused on the development of the visual system, primarily the mechanisms that form connections in the developing brain, but we are also interested in the "plasticity" that occurs with visual experience. To explore these phenomena, my group uses a combination of structural and functional optical neuroimaging techniques as well as conventional histology.

For more information on Dr. Crowley visit:

<http://www.cmu.edu/bio/faculty/crowley.shtml>

New Guiding Principle Yields an Increase in Grad Stipends

Sanna Gaspard

Ph.D. Student, Advisor: Todd Przybycien

In the spring of 2009 the BME department head, Dr. Wang, with the support of the BME faculty, agreed to increase the Fall 2009 graduate research stipend to reflect the principle that graduate students working side-by-side in the same research group making comparable contributions for the same advisor should receive comparable financial support, regardless of their departmental affiliation. After detailed investigations into the annual stipends of graduate researchers from sister departments (Electrical and Computer Engineering, Mechanical Engineering, Chemistry etc.), Dr. Wang developed a formula to calculate a weighted average value as the new BME stipend. The formula has a built-in damping factor, such that it takes several years to reach a steady state with the first year giving the largest increase. The damping factor helps to ease the financial burden of the increased stipend to faculty members. The stipend increase will be effective starting Fall 2009 for all current and newly admitted BME graduate students at Carnegie Mellon University. The new annual stipend is \$23,400 for pre-proposal students and \$23,800 for post-proposal students. The difference in stipend between pre- and post- proposal students will be eliminated over the next year. Many thanks to the BME graduate students who brought this issue to the department's attention and to the BME Department and BME faculty for addressing the issue.

Alumnus Focus: Where Are They Now?



Gowri Srinivasa, Ph.D.

Professor of Information Science and Engineering, PES School of Engineering (PESSE), Bangalore, India

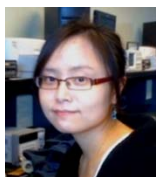
I graduated from BME in Fall 2008 under the guidance of Prof. Jelena Kovacevic at the Center for Bioimage Informatics. One of first things that struck me about Carnegie Mellon University, particularly BME, was its emphatic spirit of collaboration. How much is

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achieved when faculty and students from different backgrounds collaborate on interdisciplinary projects! After graduation, I was sure I wanted to continue to work in such a synergistic environment. Moreover, during the course of my graduate studies, Jelena gave me plenty of opportunities to work with undergraduate and masters students on different projects. I enjoyed this experience thoroughly and learned a lot. This was my first reason for considering a job in academia.

During a visit home before graduation, the Director of the PES group of Institutions (my undergraduate institution) shared the management's vision and commitment for the growth of a new campus for engineering and offered me a job straight-away. Although this was flattering, it seemed daunting to be on the 'other side of the table' so soon! Over the next few months and after many long talks with my friends, it was clear that this would be the best match for me. I am now on the faculty of the Dept. of Information Science and Engineering at the PES School of Engineering in Bangalore. The department is young and energetic and the students' potential is heartening. Apart from teaching, I am involved in developing the PES Center for Pattern Recognition. Bioimage Informatics is in its nascence here, so I am introducing it to the students and faculty. It is great to be back home, in a job that is fulfilling and gives me time to pursue my interests. I am very grateful for the continued support of my team at Carnegie Mellon University and the warm reception at PESSE.

New BME Graduate Students



Minhua Qiu

Ph.D. Student, Advisor: Ge Yang

I was born and raised in Shanghai, China. I went to Tulane University in New Orleans where I received a Master's degree in Biomedical Engineering. In January 2009, I started my Ph.D. study in the BME Department at Carnegie Mellon University in Dr. Ge Yang's Computational Cell Dynamics Lab. My research interest focuses on computational modeling and imaging cellular behaviors to explore the underlying mechanisms. In my spare time, I enjoy music, photography, tennis, jogging and aerobic exercises.

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A Spotlight on BME Achievements at Carnegie Mellon



Robert Tilton, Professor of Biomedical Engineering and Chemical Engineering

- Has been appointed to serve in the NIH Nanotechnology Study Section.
- Together with Professor Todd Przybycien has received an NSF grant to develop protein PEGylation as a means to preserve the biological efficacy of protein therapeutics delivered via biodegradable drug delivery depots.
- Completed a term as Chair of the American Chemical Society Division of Colloid and Surface Chemistry.

Robert Murphy, Ray and Stephanie Lane Professor of Computational Biology and Professor of Biological Sciences, Biomedical Engineering, and Machine Learning

- Has been appointed to the National Advisory General Medical Sciences Council by the Secretary of Health and Human Services.

Sanna Gaspard, Ph.D. Student, Advisor: Todd Przybycien

- Was selected as one of the 10 finalists for the Center for Integration of Medicine & Innovative Technology (CIMIT) Prize in Healthcare and was awarded \$10,000 to continue the development of her PhD research on pressure ulcer diagnosis. She will compete for the grand prizes of \$150,000, \$100,000, and \$50,000, respectively.

Jelena Kovacevic, Professor of Biomedical Engineering and Electrical & Computer Engineering

- Together with her Ph.D. student, Amina Chebira, published a monograph "An Introduction to Frames", in Foundations and Trends in Signal Processing Series, Now Publishers, 2008.
- Was appointed as a regular member of the NIH Microscopic Imaging Study Section, the primary review panel for the development and applications of microscopy and imaging technologies for BME research.

James Antaki, Professor of Biomedical Engineering

- Is a recipient of the Steven J. Fennes Award for System Research for his application of system

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**Bur Chu**

Ph.D. Student, Advisors: Phil Campbell and Lee Weiss

I am from Pittsburgh, PA. I graduated from Carnegie Mellon University in May 2008 and received a B.S. in Chemical Engineering with an additional degree in Biomedical Engineering. I am co-advised by Professors Phil Campbell and Lee Weiss. My research focuses on inkjet-based bioprinting applications in tissue engineering. In my free time, I enjoy traveling, cooking, and watching football and hockey.

**Jieyue Li**

Ph.D. Student, Advisor: Robert Murphy

I work with Dr. Murphy. My research interests are machine learning and pattern recognition in bio-images. Carnegie Mellon University is an excellent place; I expect to learn a lot here. I'm from Zhejiang University China, which is beside the bridge designed by Dr. Mao Yisheng, the first Ph.D. graduate of Carnegie Mellon. My hometown is very beautiful and has been called 'Eastern Venice'. Additionally, it is the home of yellow wine. Cheers!

**Cheng Chen**

Ph.D. Student, Advisor: Gustavo Rohde

I come from Hefei, a city in eastern China. I got my B.S. degree and M.S. degree in electrical engineering in 2005 and 2008 respectively, both from the University of Science and Technology of China (USTC). My advisor is Prof. Gustavo Rohde. My research interest is focuses on image registration and machine learning on biomedical datasets. Besides research, I like sports, such as table tennis and skiing.

**Matt Oberdier**

Ph.D. Student, Advisors: James Antaki and James Burgess

I earned a B.S. in chemical engineering and an M.S. in BME at the University of Akron in 2003 and 2005, respectively. For my Master's degree I designed and developed a prosthetic venous valve. I am currently working in Dr. Antaki's lab where I am co-advised by Dr. Jim Burgess, M.D. For my Ph.D., I will develop an aqueous hemostasis system for surgery. Outside of the lab, I enjoy cooking, soccer, and biking among other activities.

**Aditi Sharma**

Ph.D. Student, Advisor: Jeff Hollinger

I grew up in Louisiana and graduated from Louisiana State University with a B.S. in Biological Sciences and in Biological Engineering. I completed my Masters in Biotechnology from the University of Pennsylvania before coming to Carnegie Mellon University for the Ph.D. program. My thesis project is focused on developing a delivery system for siRNA for the inhibition of heterotopic ossification in Dr. Jeffrey Hollinger's laboratory (Bone Tissue Engineering Center). Outside of the lab I like painting (watercolor) and occasional photography.

Vision for the BME Department, continued from page 1

The immediate tasks are to establish a strong identity, to enhance connections with its partners, to project aggressively to the outside world, and to build continuously for the future. The growth will be guided by the over-arching principles of balance and collaboration. Over the past few years the BME Department has built research strengths in cardiovascular devices, image processing and informatics, and regenerative medicine. These targeted areas will be integrated into the broader strengths in clinical applications and research tools across the campus. Due to the very nature of biomedical engineering, the integration of distinct "pillars" of strength into complementary "blocks" will likely enhance the identity and reputation of the department. To further promote collaborations, the Department is strengthening its ties with courtesy members and seeking additional 50/50 joint faculty appointments.

The BME Department has started campaigns to boost its visibility both within and outside Carnegie Mellon University, through web site, publications, seminar series, and presence at meetings and conferences. Its reputation is expected to rise substantially by properly projecting its role in integrating BME research and education across the campus combined with continuous growth. The educational mission will be enhanced by improving teaching facilities and the advising system, and by developing strategies to

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meet the broad career goals of the students. In addition, the department will continue to expand its faculty with emphasis placed on balancing and integrating basic and applied research. Of particular interest to the department is "directly translatable" basic research with a broad potential impact on biomedical engineering, and research that bridges and integrates multiple areas of

current research. The Department also looks forward to relocating into a new research building on the main campus, at a strategic location and with a structure optimized for collaboration to further enhance its role in promoting synergistic interactions among its 18 partner departments, institutes, and centers.

★ 2008 Carnegie Mellon BME PhD & Master Degree Graduates ★

Amina Chebira, Ph.D.: *Adaptive Multiresolution Frame Classification of Biomedical Images.* Advisor: Professor Jelena Kovacevic.

Dana Olton, Ph.D.: *Fundamental Studies of the Synthesis, Characterization, Stabilization, 3-D Scaffolds, and Trafficking Mechanisms of Nano-Structured Calcium Phosphates (NanoCaPs) for Non-Viral Gene Delivery.* Advisor: Professor Prashant Kumta.

Ting Zhao, Ph.D.: *Generative Models of Protein Subcellular Location Patterns.* Advisor: Professor Robert Murphy.

Paul Ko, Ph.D.: *Design, Synthesis and Optimization of Nano-Structured Calcium Phosphates (NanoCaPs) and Natural Polymer based 3-D Non-Viral Gene*

Delivery Systems. Advisor: Professor Prashant Kumta.

Gowri Srinivasa, Ph.D.: *Active Mask Framework for Segmentation of Fluorescence Microscope Images.* Advisor: Professor Jelena Kovacevic.

Rui Zhao, Ph.D.: *Experimental and Theoretical Investigation of Blood Flow Dynamics Associated with Blood Contacting Device".* Advisor: Professor James Antaki.

Arielle Drummond, Ph.D.: *Biomedical Surgical Planning for Pediatric Ventricular Assist Device (PVAD).* Advisor: Professor James Antaki.

Yajuan Wang, M.S.: *Aortic Arch Morphogenesis and Flow Modeling in the Chick Embryo.* Advisor: Professor Kerem Pekkan.

BME Achievements, continued from page 6

engineering to the optimization of medical devices.

- Awarded a \$2.9 million grant from the National Institutes of Health/Heart Lung Blood Institute for a project titled: "Multi-scale Model of Thrombosis in Artificial Circulation." Professor Ender Finol, courtesy faculty member of BME, is a co-investigator on this 5-year project.
- Recently awarded a \$50,000 GAP grant from Carnegie Mellon's Office of Technology Transfer to begin development for "A Blood Purification System for the Malaria."

Ender Finol, Associate Research Professor, Institute for Complex Engineering Systems, Biomedical Engineering and Mechanical Engineering

- Has been invited to join the Editorial Board of the Journal of Endovascular Therapy for 2009-2010.
- Recently received \$200,000 in initial funding for a cofounded start-up company, NeuroInterventional Therapeutics, Inc. in Pittsburgh.

Important Dates & Events



BEBRS 09 - April 23, 2009, Grand Room, Posner Hall. 9:00am-6:30pm. Open Admission.

GBMES Social - BME Graduate Lounge Launch Party, date TBA, Hamburg Hall A224.

Carnegie Mellon University Carnival - April 16-18, 2009, Carnegie Mellon campus.

Carnegie Mellon University Graduation - May 17-18, 2009. Deadline for online registration is March 27, 2009:
<http://www.cmu.edu/hub/gol.html>

National BMES 09 Annual Meeting - October 7-10, 2009, Pittsburgh, PA. Abstracts are due May 1, 2009.