



BME 'Scope

A Graduate Biomedical Engineering Society and Biomedical Engineering Department Newsletter

A Message from the Department Head

Dr. Todd Przybycien

Head of Biomedical Engineering and Professor of Chemical Engineering and Biomedical Engineering



The passing of the baton. As my time as Department Head draws to a close, it's time for updates, reflection and thanksgiving. Six years as Department Head and another two as Program Head before that went by mighty quickly.

We witnessed some incredible internal and external growth. In 2001, we had our first intrepid additional major degree graduate in BME and another twelve BME minor program graduates. This May, we graduated 43 additional major degree students and 18 minor program students. Our alumni base has grown dramatically. In 2002, we had two faculty members and three graduate students; our current strength is twelve faculty members with another starting in January 2009 and about forty graduate students.

We've had a good deal of good news and interesting developments over the past semester: Courtney Ondeck, a BME-MSE BS graduate, received a Churchill Foundation Fellowship; Rebecca Snyder another BME-MSE BS graduate, received a Fulbright Scholarship; Luke Xie became the first graduate of the course-option Masters program we established this spring; Prof. Stephan Zappe received a Career Award from the National Science Foundation; Prof. Jeffrey Hollinger received the Clemson Award from the Society For Biomaterials at a ceremony in Amsterdam; and Denise Murrin-Macey joined us as the new Business Manager from her prior financial support position within the CIT Dean's Office. As I intimated above, we've hired a new faculty member jointly with the Lane Center for Computational Biology, Dr. Ge Yang. Dr. Yang conducts research at the interface between subcellular mechanics, cellular imaging and computational biology

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Notes from Yu-li Wang

Dr. Yu-li Wang

Incoming Professor and Department Head, Biomedical Engineering, Carnegie Mellon University

It may seem odd why I, as a cellular biophysicist who has never been affiliated with an engineering school, should join the faculty of engineering at Carnegie Mellon. However, with each visit to Pittsburgh it has only become clearer how exciting a place the BME Department is, and how much it matches my interests. I am delighted to share my thoughts.

Like many nerdy kids, I grew up in Taiwan building contraptions, mixing chemicals, and gazing at galaxies. However biology has always been something special for me, and microscopes carried an irresistible appeal. I chose to major in Physics when I entered National Taiwan University, in part because it was the most competitive department for science majors at the time. However my goal was not to become a physicist, but to mix different scientific disciplines to understand life. Training in physics turned out to be highly beneficial, in its demand to balance imagination with rigorous logic, quantification, and experimentation.

My Ph.D. training at Harvard was in Biophysics. I appreciated the freedom of the program, which allowed physics students to explore biology and to learn the different ways of thinking for biologists. I chose optical microscopy as my main approach, which provided joyous opportunities to tinker with optics and electronics. I was particularly excited about my thesis project, where I developed strategies to tag proteins

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Notes from Yu-Li Wang

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with fluorescent labels and deliver into live cells as tracers for molecular events. Equally exciting was the topic of cell migration, which I thought was a perfect ground for merging biology, chemistry, and physics.

I took my first faculty position in 1982 at the National Jewish Hospital in Denver, Colorado. Five years later I returned to Massachusetts to join the Worcester Foundation for Experimental Biology, a free-spirited research institution that merged with University of Massachusetts Medical School in 1997. My research orientation has remained close to that of the former Worcester Foundation, where the exploration of "small science" led to the discovery of birth control pills, and my associations with hospitals and medical schools have not affected my passion for basic sciences. My research has never veered far from cell migration and mechanics. Particularly satisfying was the increasing incorporation of physical and mathematical approaches, including laser ablation, confocal and evanescent optics, single molecular imaging, photon correlation, and sophisticated image processing. Combining material development, microscope imaging and computation, my laboratory started to manipulate the mechanical environment of live cells and measure their mechanical output. Physics, chemistry, and biology have finally come together seamlessly, while various forms of engineering provided the technical driving forces.

Equally exciting was the development of regenerative medicine. It was extremely satisfying to see how basic cell biology, particularly the responses of cells to mechanical signals, has led to advances in stem cell differentiation, tissue formation, and wound repair. The progress underscores the importance to expand our knowledge in biology for BME. Without understanding the fundamental principles, much of BME will have to rely on hacking. The complexity of life and the deficiency in fundamental knowledge mark a key difference between BME and other engineering sciences. It has also become clear that BME cannot be developed in isolation, but must be combined with the engineering of materials, devices, or algorithms.

These unique characteristics argue that a first-class BME department cannot be managed in the same way as other engineering departments. Moreover,

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institutions like Carnegie Mellon University, with its balanced strengths in engineering and basic sciences, and its highly collaborative culture, represent the ideal environment for BME - BME benefits tremendously from close interactions with basic sciences and other engineering disciplines, while providing equally strong stimuli for the progress of its partners.

Thus, the organization of BME at Carnegie Mellon represents a distinct advantage. I wish there were a better term than "courtesy faculty," but these BME faculty members, spread over many basic science and engineering departments, represent a critical part of the BME department. They allow BME to reach great breadth and depth in multiple dimensions, while allowing the department to pay individual attention to its core faculty members and students. A central mission of the BME Department and its core faculty will be to tie the community together, to promote interactions, and to facilitate an overall balance and cohesion. I am proud to be part of this endeavor, and look forward to the exciting years that lie ahead. ♦

Jeffrey Hollinger to Direct Craniofacial Reconstruction Program

Chriss Swaney

Director Media Relations, Carnegie Institute of Technology

Carnegie Mellon University's Jeffrey O. Hollinger will be the director of the Craniofacial Program, one of five research programs comprising the Rutgers University-led consortium in the Armed Forces Institute of Regenerative Medicine (AFIRM).

The consortium will be led by Joachim Kohn, the Board of Governors Professor of Chemistry and Chemical Biology in Rutgers' School of Arts and Science, and co-principle investigator George Muschler, an orthopedic surgeon in the Cleveland Clinic.

This consortium, along with a second led by the Wake

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Hollinger to Direct Craniofacial Program

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Forest University Baptist Medical Center, received \$42.6 million from a combination of sources that include the U.S. Army Medical Research and Material Command, in conjunction with the Office of Naval Research, the National Institutes of Health, the Air Force Office of the Surgeon General and the Department of Veteran Affairs. The consortia will work closely with the U.S. Army Institute of Surgical Research at the Brooke Army Medical Center at Fort Sam Houston in San Antonio, Texas.

Dr. Hollinger, a professor of Biomedical Engineering and Biological Sciences in the Colleges of Engineering and Sciences, respectively, and the director of Carnegie Mellon's Bone Tissue Engineering Center (BTEC), will receive \$2.1 million over the next five years that will enable clinical treatments to be developed for U.S. troops and support personnel in Iraq and Afghanistan who incurred severe combat injuries to the face and jaws.

Dr. Hollinger's craniofacial team includes the two renowned "fathers of tissue engineering," Robert Langer at the Massachusetts Institute of Technology and Joseph Vacanti from Harvard University, as well as Rutgers' Kohn and Scott Guelcher at Vanderbilt University.

Other highly distinguished clinical members of Dr. Hollinger's team include: Dr. William Futrel, former chair of plastic surgery at UPMC; Dr. Frank Papay, chair of plastic surgery and dermatology at the Cleveland Clinic; Dr. Chris Post of Allegheny General Hospital, with whom Dr. Hollinger will do much of the pre-clinical work; Dr. Joe Rosen of Dartmouth University; Dr. Raymond Harshbarger, director of craniofacial surgery for Walter Reed Army Medical Center; Dr. Robert Hale, chair of oral and maxillofacial surgery at Brooke Army Medical Center; Dr. John P. Schmitz, an international authority on oral and maxillofacial surgery; Dr. Josh Wenke, director of the bone program at the Institute of Surgical Research; and Dr. Rear Admiral Bruce Doll, who until he was activated for military duty in November was a professor at the University of Pittsburgh School of Dentistry, and an adjunct professor in biomedical engineering at Carnegie Mellon working with Dr. Hollinger at BTEC.

Dr. Hollinger's team, in conjunction with corporate

partners, will develop bone regeneration therapies that will progress to clinical stage within three years and include novel biodegradable, biocompatible polymers and recombinant proteins.

In addition to tissue and biomedical engineering, AFIRM will exploit innovative approaches to regenerative medicine that will include stem cells and transplants to stimulate the body to repair and regenerate damaged tissues and organs. Moreover, AFIRM will dramatically accelerate the advancement of promising biomaterials, and cell-based and combined regenerative medicine technologies to restore form and function to wounded service members and civilians.

"The craniofacial AFIRM funding at the BTEC will be a terrific boost to our academic thrust; it will support several post docs and Ph.D.s, as well as Joe King, who will receive his master's degree with us," Dr. Hollinger said. "AFIRM and its mission are especially significant to King because he is a member of the elite 82nd U.S. Army Airborne currently on active duty in Afghanistan, and he has seen first-hand the devastation of combat injuries."

This article has been modified from a Carnegie Mellon University press release. ♦

In the Spotlight

Sanna Gaspard, Amina Chebira, Rowena Mittal and Dr. Elvira Garcia Osuna have been recognized with an honorable mention for the Carnegie Mellon Graduate Student Service Award for their effort in establishing GBMES.

Dr. Jelena Kovacevic

Professor, Biomedical Engineering, Carnegie Mellon University
Dr. Kovacevic has been appointed as a regular member of the Microscopic Imaging Study Section at the National Institutes of Health.

Gail Siewiorek

Ph.D. candidate, 3rd year, Advisor: Dr. Ender Finol
Gail has published four peer-reviewed journal articles in the last eight months. She is now supported by an NIH T32 training grant (BiRM).

Dr. Ender Finol

Associate Research Professor, Institute for Complex Engineered Systems, Carnegie Mellon University
Dr. Finol has been awarded two NIH grants totaling over \$600,000 for the next two years.

Image-Based Assessment of Abdominal Aortic Aneurysm Rupture Potential

Dr. Ender A. Finol

Associate Research Professor, Institute for Complex Engineered Systems, Biomedical Engineering (by courtesy) and Mechanical Engineering (by courtesy)

In recent decades, the role of blood flow and its relationship with disease has created a common focus for both prevention and clinical management of vascular diseases. During the past few years, biofluid mechanics has been recognized more widely by researchers in medicine and biology as a key factor in the cause of arterial disease and the regulation of haemostasis in normal and diseased blood vessels. The ability to model biological flow systems experimentally and numerically is now an important component to fundamental research of vascular disease.

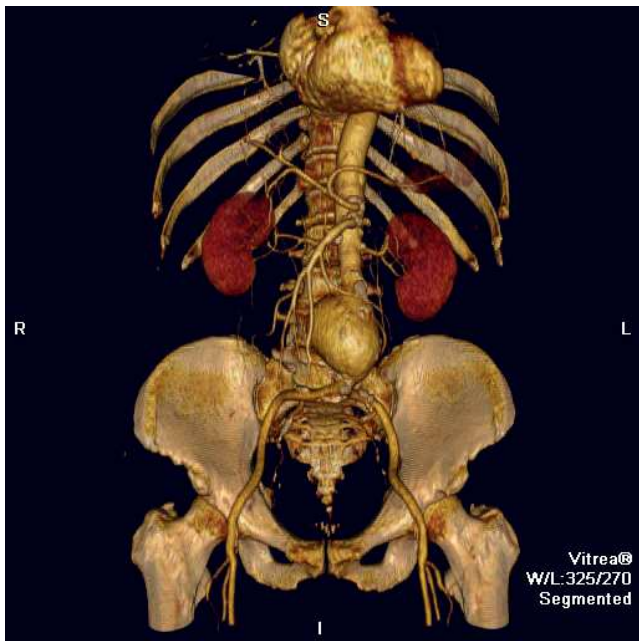


Figure 1. Visualization of a multi-slice thoracic and abdominal computed tomography revealing the presence of an abdominal aortic aneurysm.

The formation of an aneurysm represents the loss of structural integrity of the vessel wall. The abdominal aortic aneurysm (AAA), a focal enlargement of the aorta that occurs preferentially below the renal bifurcation (see Figure 1), is a socially relevant cardiovascular health disease. The prevalence of AAA disease is 8.8% in the population above 65 years of

age and men are affected more often than women at a ratio of 4:1. Fifteen thousand people per year die from AAA rupture in the United States alone, making it the 13th leading cause of death in this country and affecting 1 in 250 individuals over 50 years of age. Despite significant improvements in surgical procedures and imaging techniques, the mortality and morbidity rates associated with untreated ruptured AAAs are still very high. AAA disease is a health risk of significant importance since this kind of aneurysm is mostly asymptomatic until its rupture, which is frequently a lethal event with an overall mortality rate in the 80% to 90% range. The optimal strategy is clear: prevention of aneurysm rupture is the primary goal in management of aneurysmal disease.

At the Vascular Biomechanics and Biofluids Laboratory (<http://www.ices.cmu.edu/vascular-biomechanics/>), Dr. Finol and his research team have applied methodologies to investigate the role played by the native abdominal aortic aneurysm geometry on the flow-induced wall stress in the presence of an intact aneurysm and after its surgical repair. This research led to the development of a procedure for the calculation of shear stresses at the inner wall of dilated large arteries and is currently conducted within the context of improving the assessment of aneurysm rupture potential and design of endovascular grafts used for repair. The modeling approach taken in this research differentiates the team from other researchers in the field in that they have hypothesized that the stresses at the blood vessel wall are primarily caused by the dynamics of pulsatile blood flow rather than wall mechanics alone induced by a uniform intraluminal pressure. This was also the thesis research area of Dr. Christine Scotti, who successfully completed her Ph.D. requirements in the Fall 2007 semester. The fluid-structure interaction modeling of aortic aneurysm geometries has led to more accurate predictions of the flow-induced stresses on the vessel wall that are deemed to increase the risk of rupture of these aneurysms. Currently, Dr. Finol's team is investigating the hypothesis that, once an aneurysm is diagnosed, the primary biomechanical determinant of rupture potential is the non-uniform arterial wall thickness, within the context of a dynamic assessment of aneurysm mechanics.

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Assessment of AAA Rupture Potential

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This work has been made possible with the help of initial seed funding by the Pennsylvania Infrastructure Technology Alliance (PITA), as well as initial graduate student fellowship funding by the Philip and Marsha Dowd Engineering Seed Fund, which were leveraged to gain additional monies from the National Institutes of Health. Dr. Finol was recently awarded two NIH grants for the projects entitled "In Vivo Assessment of AAA Biomechanics with Dynamic Wall Properties" and "Bioengineering Studies of Abdominal Aortic Aneurysm Fluid and Wall Dynamics". This research will enhance the Cardiovascular Biomechanics pillar of the Biomedical Engineering Department as well as the Bioengineering Technologies thrust of the Institute for Complex Engineered Systems. The body of work requires a collaborative team effort. The team includes Drs. Satish C. Muluk, Robert W. Biederman and Jan Silverman of Allegheny General Hospital; Prof. James Antaki of the Biomedical Engineering Department; Prof. Jose Rodriguez of the University of Zaragoza in Spain; and graduate students Judy Shum, Giampaolo Martufi and Christine Scotti [now a Biomedical Design Analyst with W.L. Gore and Associates, Inc.].♦

NSF Faculty Early Career Award: Automated MEMS-based *Drosophila* Embryo Injection Technologies for High-throughput Functional Genomics Screens

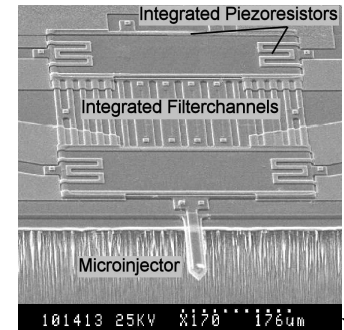
Dr. Stefan Zappe

Assistant Professor, Biomedical Engineering

The fruit fly *Drosophila* serves as an important model organism for human biology and diseases such as cancer, Alzheimer's or Parkinson's. In addition to the genome sequence of *D. melanogaster*, the genome sequences of 11 other *Drosophila* species have been made publicly available over the past two years. These genome sequences have brought unprecedented opportunities to study functions of genes and their implications in development and disease. Gene functions are often inferred from specific perturbations of the genetic makeup of an organism and subsequent analysis of the effects on the organism. Two powerful methods have been established in the past for such

analysis in *Drosophila*: permanent genetic transformation based on transposable genetic elements, and transient specific gene silencing through RNA interference (RNAi). Both methods require reliable and rapid injection of DNA and doublestranded RNA (dsRNA), respectively, during the earliest stages of embryonic development.

Figure 1: Novel MEMS injection devices are fabricated and used at the core of automated systems for high-throughput *Drosophila* embryo microinjection. An integrated differential pressure sensor based on polysilicon piezoresistors enables device monitoring and reliable operation. The well-defined device geometry ensures precise dosing of injected volumes of typically 60 picoliters per embryo.



Within the frame of the NSF CAREER award, two automated *Drosophila* embryo injection systems termed 'Feed and Inject' and 'Search and Inject' are being developed to enable high-throughput screens for gene functions. Novel microelectromechanical system (MEMS) injection devices are used at the core of these injection systems (Figure 1). For example, the 'Feed and Inject' technology can be used to create a line of transgenic flies that express green fluorescent protein (GFP) in brain tissue. The 'Search and Inject' system can then be used to silence specific genes in embryos of the generated line. The effects of gene silencing on the developing embryonic brain can be easily studied through confocal fluorescence microscopy at the single cell level. Injection systems developed under the CAREER award are complemented with a programmable Leica TCS SP5 microscope for high-throughput, confocal imaging of *Drosophila* embryos (Figure 2), as well as image analysis software for reliable, automated recognition of phenotypes due to gene silencing.

Application of these screening tools will lead to a better understanding of molecular mechanisms of development and disease in *Drosophila* and will indirectly lead to development of better therapies for human diseases. In follow-on projects, the generated technical knowledge can help create other MEMS-based systems for automated handling of DNA, RNA,

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NSF Faculty Early Career Award

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other biochemical reagents, cells, oocytes, embryos, and micro- and nanoparticles; with wide-spread applications in biological research, biotechnology, drug discovery, high-throughput screening, and medical diagnostics.

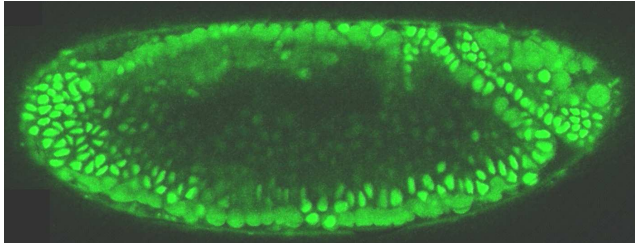


Figure 2: Confocal image of a transgenic *Drosophila* embryo that expresses nuclear-localized GFP in all of its cells. Automated imaging systems and software for automated image analysis will complement injection technologies developed under the CAREER award and will enable high-throughput screens for gene functions. ♦

Experimental and Theoretical Investigation of Blood Flow Dynamics Associated with Blood Contacting Devices

Rui Zhao

Ph.D. candidate, 3rd year, Advisor: Dr. James Antaki

Prosthetic blood contacting cardiovascular devices have been commonly used in clinical practice for end stage cardiovascular disease patients. However, device-induced blood damage often causes catastrophic complications such as hemolysis and thrombosis. The design optimization for blood-wetted devices is stilled and is still a trial and error process due to the lack of a fundamental understanding of device-induced blood damage.

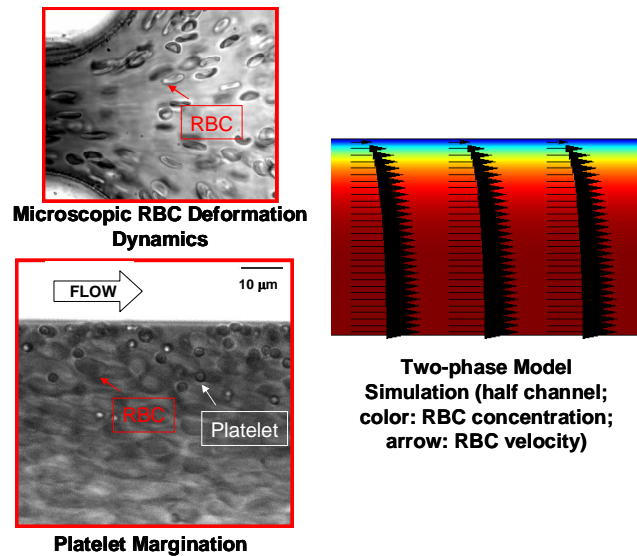
The primary objective of my research is to advance the basic knowledge of hemorheology and blood damage in blood-wetted cardiovascular devices, thus providing a more accurate predictive model for future device designs. Instead of measuring bulk blood damage effects in cardiovascular devices, the unique rheological properties of blood under typical conditions in cardiovascular devices were observed and quantified microscopically in the *in vitro* microfluidic experiments. A two-phase flow model based on

mixture theory was also developed to better predict the dynamic interaction of red blood cells (RBC) with plasma in shear flow. The outcome of my research will reveal the underlying mechanism of typical hemorheology phenomena in cardiovascular devices and provide useful information for future device design and optimization. This research will draw upon the following methods.

1. Microfluidic experiments

A series of *in vitro* hemorheological experiments was conducted under the typical conditions blood experiences within cardiovascular devices. The results of the *in vitro* experiments not only further the understanding of microscopic device-related blood cell dynamics but also provide experimental data to validate the mixture model, which is described below, in various flow conditions.

Microchannels with different geometries were designed for the *in vitro* experiments. Blood samples were pushed through the microchannels under a microscope. By synchronizing the illumination system and CCD camera, a series of images were taken. The information from the raw image was collected to reveal the blood cell strain and transport phenomenon by user designed image processing tools.



2. Two-phase rheological constitutive model for blood

A two-phase constitutive model for blood using the theory of interacting continua, or Mixture Theory, was developed to predict red blood cell-plasma phase

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Investigation of Blood Flow Dynamics

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separation. The model can be applied to blood samples with physiological concentrations in an arbitrary geometry. Model simulations were conducted in both a rectangular microchannel and a sudden expansion using Femlab. Numerical solutions to the velocity, pressure, and volume fraction profiles were obtained. The results showed a distribution of RBCs with a diminished near-wall concentration, which is consistent with experimental observations. Both the RBCs and the plasma showed a plug flow profile with dramatic increase of shear rate near the wall. These results imply that the two-phase blood model based on mixture theory is a promising approach to better predict hemorheological phenomena relevant to blood trauma. ♦

New Student Focus

New students that joined Carnegie Mellon's BME Department in Spring 2008 introduce themselves.

Daniel Delubac

I was born in Malaga, Spain and grew up in different towns in France, mostly Chartres near Paris. I went to college in Rennes, France, and finished my last year as an exchange student in Montreal, Canada. I graduated from both those schools with a master's in Physics Engineering. I joined Stefan Zappe's lab this January, after spending 6 months here as a staff member, and I'm now working on developing tools for automated *Drosophila* embryo injection, imaging and image analysis; with applications in high-throughput siRNA screens and generation of stable transgenic fly lines. This is a continuation of professor Zappe's post-doctoral work at Stanford University. In my spare time, I enjoy soccer and racket sports.



Onur Dur

I was born and raised in Ankara, Turkey. I graduated from the Mechanical Engineering Department of Middle East Technical University, Ankara with a B.S degree in 2005. In December 2007, I received my master's degree in Mechanical Engineering from University of Nevada, Reno where I was engaged in Computational Fluid Dynamics, particularly in aerodynamic optimization of

wake flow for a project sponsored by the Department of Transportation. Before I completed my master's, I had an opportunity to work with Dr. Kerem Pekkan, my current academic advisor at Carnegie Mellon University, on computational modeling of the hemodynamics of the neonatal aortic arch and simulation of perfusion during cardiopulmonary bypass which was recently published in the Journal of Biomechanical Engineering. I am now pursuing a Ph.D. and working on cardiovascular flow mechanics with emphasis in pre-surgical planning for patients with congenital heart defects and other patho-physiologies. My research interests also include the role of flow-driven hemodynamic loading on vasculature in development and disease states.

Ryan Kellogg

I am from Houston, Texas, and ventured to Carnegie Mellon for undergrad because I had joint interests in music performance and engineering, and Carnegie Mellon was the best place where I could reasonably try to do both. I ended up sticking with engineering, and completed a B.S. in Electrical & Computer Engineering and Biomedical Engineering, along the way working on research in Microrobotics and Bioimaging. At the end up of my undergrad, I continued one additional semester and completed a master's degree in Engineering & Technology Innovation Management. I continued immediately on to pursue my third Carnegie Mellon degree, a Ph.D in BME, studying primarily with Prof. Stefan Zappe (and collaborating with the Center for Bioimage Informatics). My research interests are new therapeutic and investigational platforms enabled through informatics, MEMS, and cell engineering.



Dennis Trumble

I grew up in a small town in upstate New York and have lived in Pittsburgh since 1988. I joined the BME program this past spring having already worked as a Biomedical Engineer at Allegheny General Hospital for nearly two decades. I graduated from Notre Dame with two degrees in Electrical Engineering (BS, MS) before heading off to Penn State where I completed a second master's degree, this one in Bioengineering. I have been working in the Surgical Research Department at AGH ever since, developing various and sundry ways to improve patient outcomes.

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New Student Focus

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Much of this work has involved capturing muscle power for long-term circulatory support, an area of research that continues to show great promise. As a Ph.D. candidate I will be working with Drs. Antaki and Pekkan to build and test a novel cardiac assist mechanism based on apical torsion. In my free time – what little there is – I enjoy traveling, writing, winemaking, ballroom dancing, and playing hoops. ♦

GBMES Symposium 2008

Justin Newberg

Ph.D. candidate, 4th year, Advisor: Dr. Robert Murphy

As Biomedical Engineering plays an increasingly prevalent role throughout Carnegie Mellon and the greater Pittsburgh community, the BME department and GBMES have developed the Biomedical Engineering and Biotechnology Research Symposium to foster dialog in our biomedical community. The first iteration of the symposium in 2006 was aimed at connecting undergraduate and graduate student researchers with faculty: students gave oral and poster presentations and prizes were awarded to those students deemed to be the best by a panel of judges composed of BME professors. In the second symposium, efforts were made to reach across campus to involve other student groups with biomedical interests. This year's symposium has expanded to involve presenters from the University of Pittsburgh, as well as sponsorship from various local and national biomedical companies.

The symposium was held in the Tepper School of Business's Posner Hall on April 25th. Talks were given in the Grand Room throughout the day, while research posters and sponsor exhibits were displayed in the adjacent foyer.

Two of the highlights of this year's program came from guest speakers. MIT professor Harvey Lodish, whom many students recognize as the voice behind *Molecular Cell Biology*, and whom many faculty cite as a pioneer in the field of cell biology, spoke about a new approach towards purifying and expanding human hematopoietic stem cells. Later in the day, Dr. Yu-li Wang, renowned for his work in cell mechanics, discussed biomedical engineering and its crosstalk with other scientific and engineering disciplines.

As in past symposia, this year's student presentations consisted of a wide range of topics. The ten presentations spanned medical devices, biomaterials, tissue engineering, and rheological modeling. The judging panel awarded Sasha Bakhru the top prize – the first annual Johnson and Johnson Award for Excellence in Biomedical Engineering Research Award – for his talk, "Polymeric Microcapsules for Neural Stem Cell Expansion and Delivery," with Sam Rothstein and Jane Valentine as runners up.

While all of the oral presentations were given by graduate students, both graduates and undergraduates were involved in an hour-and-a-half-long poster session. The top prize for this session – the first annual Pittsburgh Life Sciences Greenhouse Award for Excellence in Biomedical Engineering – went to Denver Faulk, with Steve Sun and Byoungkoo Lee as runners up.

This year's symposium was made possible in part from contributions by the Johnson & Johnson Corporation. ♦

A Message from the Department Head

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and is currently a postdoctoral associate with the Danuser group at Scripps. The energy and excitement levels within the Department continue to grow.

In my prior newsletter piece, I introduced the incoming Department Head, Prof. Yu-li Wang. Yu-li will arrive on the scene on or about 1 August and the trucks bearing his research materiel shortly thereafter. Beyond his stature as an eminent cellular mechanics researcher, he is a pleasure to work with on all levels. He has already been very active in talking with students, faculty and staff to get us moving forward to the next level and Yu-li, together with Bob Murphy, was a key partner in the hiring of Dr. Yang during this transition period. I know that as you have the opportunity, you will enjoy working with Yu-li as much as I have during the past six months. Welcome aboard, Yu-li!

Touting the accomplishments of our new department has been a perk of this position, but, the absolute best part has been working with its students, faculty and staff on a day-to-day basis. While we've faced many challenges together, and more are surely ahead, the quality and kindness of the people of BME just plain make it all worthwhile – thank you. ♦

Visit GBMES (www.andrew.cmu.edu/org/gbmes) and the BME Department (www.bme.cmu.edu) on the web