

# MEM

College of Engineering

## Mechanical Engineering & Mechanics

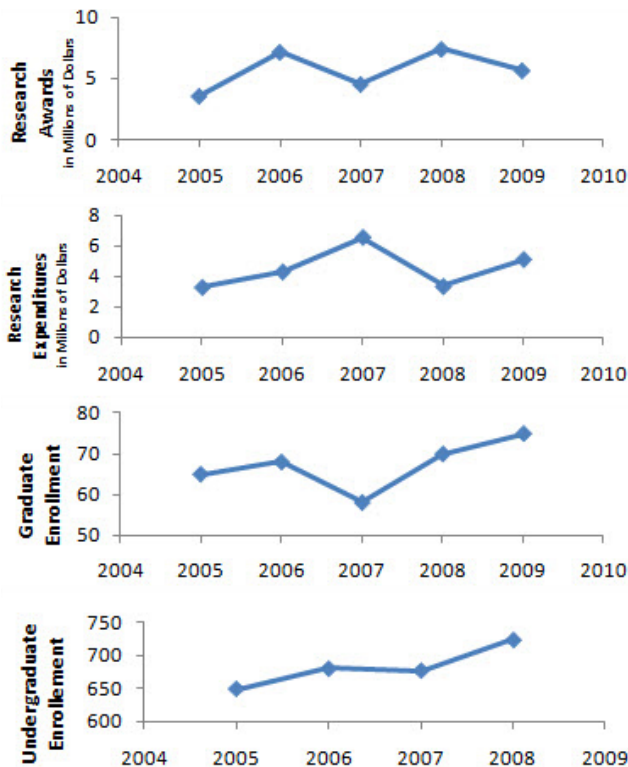
### 2008-2009 Annual Report



[www.mem.drexel.edu](http://www.mem.drexel.edu)

The mission of the Department of Mechanical Engineering and Mechanics of Drexel University is to encourage and enable knowledge through the education of engineers for leadership in industry, business, academia, and government, and the establishment of internationally recognized research programs.

## FACTS AT A GLANCE



### Co-op

- 97.5% of MEM students were successfully placed in co-op positions this year.
- Mechanical Engineering Co-op Average Salaries
  - 1st experience: \$16,518 for 6 months
  - 2nd experience: \$17,980 for 6 months
  - 3rd experience: \$18,153 for 6 months
- Popular Co-op employers: Boeing, Lockheed Martin, NAVSEA, PJM, Sunoco, Northrop Grumman, Valero Energy Corporation, Volvo Power Train, Exelon Corporation, Synthes, Johnson Matthey inc, LTK Engineering Services, Agilent Technologies, Air Products, KAIST.



|                                   |               |
|-----------------------------------|---------------|
| <b>Tenure-Track Faculty</b>       | <b>26</b>     |
| <b>Auxiliary Faculty</b>          | <b>2</b>      |
| <b>Undergraduate Students</b>     | <b>760</b>    |
| <b>Master's Students</b>          | <b>42</b>     |
| <b>Doctoral Students</b>          | <b>66</b>     |
| <b>B.S. Awarded (08-09)</b>       | <b>148</b>    |
| <b>M.S. Awarded (08-09)</b>       | <b>35</b>     |
| <b>Ph.D. Awarded (08-09)</b>      | <b>9</b>      |
| <b>New Research Awards</b>        | <b>\$5.7M</b> |
| <b>Research Expenditures</b>      | <b>\$5M</b>   |
| <b>Journal Articles Published</b> | <b>66</b>     |



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# FROM THE DEPARTMENT HEAD

I am deeply honored to be appointed as the Department Head of the Mechanical Engineering & Mechanics Department. I look forward to continuing the great tradition of excellence already established in the department. I also look forward to getting to know the various stakeholders of the department in the coming days and months. I would like to thank Professor Lau for his tremendous service to the department and helping me immensely with the transition into my new role.

2008-2009 has been an extremely successful year. We welcomed three new tenure-track faculty, Dr. Ying Sun, Dr. Caglan Kumbur and Dr. Antonios Kontsos, and two new auxiliary faculty, Dr. Andrei Jablokow and Dr. Jin Kang. Our new faculty add tremendously to the already talented and diverse faculty who continue to dedicate themselves to teaching & curriculum development, innovative research endeavors and scholarly activities of the highest caliber. The department also welcomed four new staff members, Clare Coppa, Anne Hanna, Kristin Imhoff and Brandon Terranova. Our staff have been

instrumental in implementing many of our new educational and research initiatives and have contributed much to their success.

The department awarded 148 bachelor's degrees, 35 master's degrees and 9 doctoral degrees in the June Commencement exercises. As the largest department in the College of Engineering, we welcomed 175 new freshmen into our undergraduate program in the fall, bringing our total undergraduate population to nearly 800 students. Our graduate program welcomed 16 new MSME students and 15 new PhD students.

This year saw our faculty members win highly competitive research awards and honors. Amongst these include: Dr. Ying Sun- NSF CAREER Award; Dr. Jack Zhou- NSF Grant Opportunities for Academic Liaison with Industry (GOALI) award; Dr. James Tangorra- NSF Emerging Frontiers in Research and Innovation (EFRI) award and an ONR award; Dr. Alex Fridman- Air Force Office of Scientific Research (AFOSR), Multi-University Research Initiative (MURI)



award; Dr. Baki Farouk- NSF award; Dr. Moses Noh- NSF award; and Dr. Brad Layton- NSF award. Dr. Tein-Min Tan was selected as a 2009 Boeing Welliver Fellow, Dr. Alisa Morss Clyne was selected as the 2009 Stein Family Fellowship recipient and Dr. Min Jun Kim received the 2009 Human Frontier Science Program Young Investigator Award and the U.S. Army Research Office Young Investigator Award.

Our students continue to exceed our grandest expectations and make us proud. The Formula Hybrid racer competed in an international competition, Formula ATA in Rome, Italy and placed third overall. New MEM Ph.D. alum Dr. Robert Chang received the NIST NRC Fellowship, and MEM undergraduate alum William Hesse was awarded the two most prestigious awards given to graduate students: the NSF Graduate Research Fellowship and National Defense Science and Engineering Graduate Research Fellowship.

Dr. Paul Oh and his research team debuted the humanoid robot, Jaemi HUBO, to a large press event at the Please Touch Museum, kicking off the 5 year NSF PIRE research project with researchers at the University of Pennsylvania, Colby College, Bryn Mawr College, Virginia Tech, Korea Institute of Science and Technology (KAIST), Korea University and Seoul National University, each adding their own expertise to Jaemi.

I am also delighted to inform you of two honors bestowed on our outstanding alumni in 2009:

NASA Commander Chris Ferguson, a distinguished Drexel alumnus, was honored as the College of Engineering's 2009 Engineer of the Year and Dr. G.P. Singh was selected to become a member of the prestigious *Drexel 100*. We look forward to hearing more success stories of all of our alumni and we invite you to become a fan of the Mechanical Engineering Facebook page, join our LinkedIn group and update your profile with Alumni Relations.

The department is committed to the education and development of the next generation of mechanical engineers by providing them with the tools and environment that foster scientific exploration, professional development and personal growth. We invite you to learn more about the opportunities that our department has to offer at [www.mem.drexel.edu](http://www.mem.drexel.edu).

Cheers,



Surya Kalidindi  
Department Head and Professor  
[skalidin@coe.drexel.edu](mailto:skalidin@coe.drexel.edu)

## FACULTY

**Jonathan Awerbuch** (*Ph.D., Technion*)  
Professor

**Franco Capaldi** (*Ph.D., MIT*)  
Assistant Professor

**Nicholas Cernansky** (*Ph.D., U C Berkeley*)  
Frederic O. Hess Chair Professor

**Bor-Chin Chang** (*Ph.D., Rice University*)  
Professor

**Young Cho** (*Ph.D., U. of Illinois, Chicago*)  
Professor

**Bakhtier Farouk** (*Ph.D., U. of Delaware*)  
J. Harland Billings Professor

**Alexander Fridman** (*Ph.D., Moscow Institute of Physics*)  
John A. Nyheim Chair Professor

**Ani Hsieh** (*Ph.D., U. of Pennsylvania*)  
Assistant Professor

**Surya Kalidindi** (*Ph.D., MIT*)  
Department Head

**MinJun Kim** (*Ph.D., Brown*)  
Assistant Professor

**Antonios Kontsos** (*Ph.D., Rice University*)  
Assistant Professor

**E. Caglan Kumbur** (*Ph.D., Penn State*)  
Assistant Professor

**Harry Kwatney** (*Ph.D., U. of Pennsylvania*)  
Herbert S. Raynes Professor

**Alan Lau** (*Ph.D., MIT*)  
Professor and Associate Department Head,  
Graduate Advisor

**Bradley Layton** (*Ph.D., Michigan*)  
Assistant Professor

**David Miller** (*Ph.D., LSU*)  
Professor and Associate Department Head for Undergraduate Affairs

**Alisa Morss Clyne** (*Ph.D., Harvard-MIT*)  
P.C. Chou Assistant Professor

**Hongseok Noh** (*Ph.D., Georgia Tech*)  
Assistant Professor

**Paul Oh** (*Ph.D., Columbia*)  
Associate Professor

**Sorin Siegler** (*Ph.D., Drexel*)  
Professor

**Wei Sun** (*Ph.D., Drexel*)  
Albert Soffa Chair Professor

**Ying Sun** (*Ph.D., University of Iowa*)  
Assistant Professor

**Tein-Min Tan** (*Ph.D., Purdue*)  
Associate Professor

**James Tangorra** (*Ph.D., MIT*)  
Assistant Professor

**Ajmal Yousuff** (*Ph.D., Purdue*)  
Associate Professor

**Jack Zhou** (*Ph.D., NJIT*)  
Associate Professor

## AUXILIARY FACULTY

**Andrei Jablokow** (*Ph.D., U. of Wisconsin-Madison*)  
Associate Teaching Professor

**Jin Kang** (*Ph.D., Korea Aerospace University*)  
Associate Teaching Professor

## AFFILIATED FACULTY

### **Richard Y. Chiou**

Associate Professor, Applied Engineering Technology of the  
Goodwin College of Professional Studies

### **Yury Gogotsi**

Trustee Chair Professor of Materials Science & Engineering

### **Grace Hsuan**

Professor of Civil, Architectural & Environmental Engineering

### **Yongjin (James) Kwon**

Goodwin College

### **Peter I. Lelkes**

Calhoun Chair Professor of Cellular Tissue Engineering, School of  
Biomedical Engineering, Science & Health Systems

### **Michele Marcolongo**

Associate Professor of Materials Science & Engineering

### **William Regli**

Professor of Computer Science

### **Jonathan E. Spanier**

Associate Professor of Materials Science & Engineering

### **Antonios Zavaliangos**

Department Head and Professor of Materials Science &  
Engineering

## EMERITUS FACULTY

### **Leon Y. Bahar**

### **Pei Chi Chou**

### **Gordon D. Moskowitz**

### **Donald H. Thomas**

### **Albert S. Wang**

## STAFF

### **George Ciarrocchi**

Systems Administrator

### **Clare Coppa**

Administrative Assistant

### **Kathie Donahue**

Executive Assistant

### **Anne Hanna**

Research and Graduate Coordinator

### **Kristin Imhoff**

Education Programs Coordinator

### **Kate Lang**

Finances Manager

### **Colleen M. Rzucidlo**

Recruitment & Publicity Manager

### **Brandon Terranova**

Laboratory Manager



# WELCOME NEW FACULTY

## NEW FACULTY

### **Dr. Emin C. Kumbur**

Çağlan Kumbur began his faculty appointment in September as a tenure-track Assistant Professor. Dr. Kumbur previously worked as a Research Associate and the Associate Director of Fuel Cell Dynamics and Diagnostics Laboratory at the Pennsylvania State University. He earned his B.Sc. degree in Mechanical Engineering from Middle East Technical University, Ankara, Turkey, in 2002 and he received his M.S. and Ph.D. degree in Mechanical Engineering from the Pennsylvania State University in 2006 and 2007, respectively. His research at Drexel will focus on next generation energy technologies, particularly focusing on fuel cells design and development.



### **Dr. Ying Sun**

Ying Sun began her faculty appointment in September as a tenure-track Assistant Professor. Dr. Sun was previously an Assistant Professor in the Mechanical Engineering Department at the State University of New York at Binghamton, since fall of 2006. She

obtained her B.Eng. degree in Thermal Engineering from Tsinghua University in Beijing, China, and M.S. and Ph.D. degrees both from the University of Iowa. Dr. Sun was also a visiting scholar at RWTH-Aachen, Germany and is a 2008 NSF CAREER Award-ee. Her research interests at Drexel include: multiscale modeling of transport phenomena in materials processing, colloidal suspension dynamics, thermal management in electronics packaging, and other areas of multi-phase flow and transport.



### **Dr. Antonios Kontsos**

Antonios Kontsos began his faculty appointment in September as a tenure-track Assistant Professor. Dr. Antonios Kontsos was a Post-doctoral Fellow of the Center for Mechanics of Solids, Structures and Materials in the Department of Aerospace Engineering & Engineering Mechanics at the University of Texas at Austin. He received his undergraduate degree (2002) from University of Patras in Greece, and his M.S. (2005) and Ph.D. (2007) degrees from Rice University in Houston (TX), all in Mechanical Engineer-



ing. Dr. Kontsos' research interests at Drexel are in the area of engineering mechanics with an emphasis on theoretical and computational modeling of the structure, properties and applications of multifunctional, multiscale, random and heterogeneous materials.

#### **Dr. Jin Kang**

Jin Kang began his appointment in September as an Auxiliary Faculty member. Dr. Kang received his bachelor's degree in Aerospace Engineering from the University of Michigan, his Master's degree in Aerospace Engineering from Stanford and his Ph.D. from Korea Aerospace University, also in Aerospace Engineering. Dr. Kang specializes in the area of space/satel-



lite systems, project courses, and is developing a small satellite for Drexel University. Prior to Drexel, Dr. Kang was employed as a Systems Engineer for G.E. Power Systems, taught as a full-time instructor in the Space Engineering Department of the Korean Air Force Academy for three years and taught for one year at Korea Aerospace University where he worked as a researcher during 1 yr of post-doc. Dr. Kang also lectured as a 'science ambassador' to K-12 schools in the field of space engineering.

#### **Dr. Andrei G. Jablokow**

Andrei Jablokow has been an educator and trainer for 20 years. He earned his B.S. and M.S. degrees in Mechanical Engineering from Drexel University and his Ph.D. from the University of Wisconsin-Madison. He specializes in mechanics, dynamics, and solid geometric modeling. Dr. Jablokow was formerly with Penn State University and has spent several years in various positions in industry including engineering, sales, management, and corporate training. His current area of focus is Interpersonal Skills for Engineering Management.



# WELCOME NEW STAFF

## **Clare Coppa**

Clare joined the department as an Administrative Assistant in July. She is a former technical writer and editor. She supports our faculty and students in various tasks including the filing of research proposals, teaching assistantships, student fellowships and graduate applications.



## **Kristin Imhoff**

Kristin Imhoff joined the department in September as Education Programs Coordinator. Kristin received her Bachelor's degree in Mechanical Engineering from Drexel University in September as well. She has been with the MEM department as a work study for the last two years as well as involved with several undergraduate organizations and volunteering with the College of Engineering at recruitment events and open houses. Presently she is working with both transfer students into the MEM program and pre-junior students and higher to better their plans of study and recommending courses term by term for students to take. She also handles all applications into the BS/MS program. She hopes to have increasing involvement with mechanical engineering organizations, departmental



committees, and recruiting events.

## **Anne Hanna**

Anne joined the department in December as Research and Graduate Coordinator. She has a BS in physics from the California Institute of Technology and an MS in physics from the University of Illinois at Urbana-Champaign. She will be helping faculty prepare grant proposals, assisting with graduate advising and recruitment, and coordinating undergraduate research. She is also currently serving as a teaching assistant for MEM's core engineering mathematics course sequence, MEM 591-593.



## **Brandon Terranova**

Brandon joined the department in November as Lab Manager. He has a BS in physics from the University of Delaware and an MS in physics from SUNY Binghamton. He will be managing the undergraduate labs, teaching laboratory courses and assisting the department with website and graphic design.

Brandon is also a part-time PhD student in the Materials Engineering department. His current areas of research include novel materials and educational reform.



# CONGRATULATIONS TO ALL OF OUR 2009 GRADUATES!

## Bachelor of Science in Mechanical Engineering

Mohammed T. Abba  
Sam Acacia  
Sara Dawn Acklin  
Zaheer Zueb Adenwala  
Nicholas Frederick Allen-Sandoz  
Augustus Andrew Altieri  
Joseph C. Andracchio  
Jephthe Augustin  
Jay Bagri  
Sean Martin Balbirer  
Austin M. Barolin  
John Batalha  
Jonathan Walter Bejuki  
Paul Briede, Jr.  
Michael Paul Brown  
Gary C. Bryla  
Jason Stephen Burns  
Rainer Burrow  
Donnamarie Bush  
David Casale  
Richard W. Castle  
Veronica V. Castro  
Joseph N. Cirillo  
Jamie Alfredo Cordero  
Julius A. Corrubia  
Keith Cremins  
Patrick James Crovo  
Brian M. Cucura  
Mark Patrick Cybulski  
Jason Czop  
Duc M. Dao  
Corey J. Dawson  
Jameson Detweiler  
Christopher M. Downs  
Harold L. Edwards, Jr.  
Evan Y. Epstein  
Christopher J. Esposito  
Andrew M. Evensen  
Anthony J. Ferrigno  
Christine Elizabeth Filippone  
Peter Kevin Fink  
Rory F. Flynn  
Anthony P. Frattarola  
Jesse J. Gallagher  
Brian Garvey  
Daniel J. Gialanella  
Kenneth Gick  
Seth K. Gladfelder  
Michael W. Greene  
Milton Wesley Greenstreet, Jr.

John David Gunn III  
Shilpi Halemane  
Qudus Hamid  
Kevin David Henrichsen  
William R. Hesse  
Joseph Hirschowitz  
Jason Vincent Hollstein  
Philip Joel Hufnal  
Kristin Elisabeth Imhoff  
Jerin James  
Matthew L. Janisch  
Michael Philip Jeffers  
Nevin George John  
Evan M. Johnson  
Jason Walter Johnson  
Daniel Hugh Jones  
Jessica Caitlin Kaestle  
Joseph A. Kain, Jr.  
Matthew S. Kane  
Marie Keoseyan  
Jamal S. Khalife  
Jack King, Jr.  
Jennifer Elizabeth Kingsbury  
Nicholas Paul Kozlowski  
Jonathon Allbee Lando  
Andrew J. Lavin  
Lee, Kwok Fai  
Pak Kau Lim  
Zachary Mark Linde  
Daniel Edward Livezey  
Caitlin Mary Locey  
Michael A. Loveland  
Nick J. Lu  
Sean M. Luessenhop  
James E. Luker, Jr.  
Jonathon Andrew Mahler  
Philip Paul Marino  
John Jeffery Mattero  
K. Ryan McGuinness  
Douglas Mesthos  
Basil Milton  
Matthew J. Minnick  
Christopher William Mohl  
Brendon S. Moll  
Vanessa Lynn Moyer Myers  
James Michael Napoleon  
Corey Nguyen  
Kenneth T. Nicosia  
Thomas A. Nowrey IV  
William R. O'Connor

Brian Peter Orsini  
Sabarish Padmanabhan  
John Palermo  
Jennifer Rose Papa  
David S. Paskman  
Michael J. Petragrani  
Dung Minh Phan  
Brain R. Pitcavage  
Brian Quinn  
Joshua Raizmann  
Paul Ritorto, Jr.  
Eyal Rojstaczer  
Tiffany Sine Rosenblatt  
Jonathon Rositano  
Cynthia Schavelin  
Matthew A. Schoman  
Amanda L. Schussler  
Benjamin Burke Schwartzbach  
Steven A. Seelman  
Matthew T. Sera  
Michael Russell Serina  
Christina M. Shank  
Erica Schwarz  
Katelyn P. Smith  
Jessica Elizabeth Snyder  
Marian Sorial  
Steven James Stratton  
Ian T. Swisher  
Justin M. Tashker  
Sherin Ann Thomas  
Varghese Thomas  
Benjamin D. Trabin  
Quang M. Tran  
Robert J. Traverse  
William Trinks, Jr.  
Richard Trotta  
Matthew Douglas Turner  
Patrick Brooks Twilley  
Prashanth Sidhartha Kande Veera  
Cheryl Mar Sulpico Velasco  
Christopher Walker  
Christopher D. Whitzell  
Steven William Wilrigs  
Siu Lun Wong  
Donald Andrew Wood  
Sofia Wynnytsky  
Brian Scott Yagel  
Christopher Steven Yersak

# CONGRATULATIONS TO ALL

## Masters of Science in Mechanical Engineering

Mohammed T. Abba  
Sara Dawn Acklin  
Dion Savio Antao  
Jephthe Augustin  
Alexander Michael Boyer  
Jason Stephan Burns  
Jorge Jonathon Capurro  
David Casale  
PragnayY. Choksi  
Justin Gallagher  
Brian Garvey  
Jonah R. Gottlieb  
James Walford Northway Green  
John David Gunn III  
John Paul Henry  
Michael S. Hentrich  
Phillip Joel Hufnal  
Michael John Kachmar  
Jeremi M. Leasure  
Lee, Kwok Fai  
Ho-Lung Li  
Mary LuXuan Milone  
Basil Milton  
Vanessa Lynn Moyer Myers  
Marquise N. Pullen  
Joseph Morley Roche  
Eyal Rojstaczer  
Mishah Uzziél Salman  
Quiling Shen  
Anuj Singh  
Jessica Elizabeth Snyder  
Sherin Ann Thomas  
Matthew Douglas Turner  
Christopher Walker  
Jinhan Zhu

## Doctor of Philosophy Degrees

### Kathleen B. Allen

*Dissertation Title:* Stress and Deformation of Biological Membranes during Cellular Out-growth and Cell and Liposome Injection: A Numerical and Experimental Study

*Supervising Professor:* Bradley Layton

**Current Position:** Associate, Biomechanics Department, Exponent Engineering and Scientific Consulting

### Robert Chao Chang

*Dissertation Title:* Biofabrication of Three-dimensional Cell-Embedded Tissue Constructs for In Vitro Drug Metabolism Models

*Supervising Professor:* Wei Sun

**Current Position:** National Research Council Post-doctoral Fellow, NIST

### Seuk Cheun Choi

*Dissertation Title:* Measurement and Analysis of the Dimensionless Extinction Constant for Diesel and Biodiesel Soot: Influence of Pressure, Wavelength and Fuel-Type

*Supervising Professor:* Mun Young Choi

**Current Position:** BK21 Post-Doctoral Fellow at Hanyang University





# OF OUR 2009 GRADUATES!

## **Tanvir Iqbal Farouk**

*Dissertation Title:* Modeling and Simulations of DC and RF Atmospheric Pressure Non-Thermal Micro Plasma Discharges: Analysis and Applications

*Supervising Professor:* Bakhtier Farouk

**Current Position:** Post-doctoral Research Associate Mechanical and Aerospace Engineering Department, Princeton University

## **Gregory Fridman**

*Dissertation Title:* Direct Plasma Interaction with Living Tissue

*Supervising Professor:* Gary Fridman

**Current Position:** Research Assistant Professor, School of Biomedical Engineering, Science, and Health Systems

## **Chirag Jagadish**

*Dissertation Title:* Fault Tolerant Attitude Sensing and Force Feedback Control for Unmanned Aerial Vehicles

*Supervising Professor:* Bor-Chin Chang

**Current position:** Professor, MSR School of Advanced Studies, Department of Electronics & Computer Engineering, Bangalore, India

## **F. Mert Sasoglu**

*Dissertation Title:* Highly Parallel Microscale Force Measurement and Mechanically Directed Cell Growth

*Supervising Professor:* Bradley Layton

**Current Position:** Research & Development department, Procter & Gamble in Brussels, Belgium

## **Lauren C. Shor**

*Dissertation Title:* Novel Fabrication Development for the Application of Polycaprolactane and Composite Polycaprolactane/Hydroxyapatite Scaffolds for Bone Tissue Engineering

*Supervising Professor:* Selçuk

I. Güçeri and Wei Sun

**Current Position:** Post-doctoral Fellow, Queens Mary College, London, UK

## **David Alexander Staack**

*Dissertation Title:* Characterization and Stabilization of Atmospheric Pressure DC Microplasmas and Their Applications to Thin Film Deposition

*Supervising Professor:* Bakhtier Farouk and Alexander Fridman

**Current Position:** Assistant Professor, Department of Mechanical Engineering, Texas A&M University



# AWARDS & ACHIEVEMENTS

## **Alisa Morss Clyne Receives NIH Research Grant**

P.C. Chou Assistant Professor Alisa Morss Clyne was awarded a grant from the National Institute of Health (NIH) entitled, "Design and Development of a Dielectrophoretic Device for Cell Mechanics." In this project, negative dielectrophoresis (the force induced on a polarizable particle in a spatially non-uniform electric field) will be used to determine the mechanical properties of a single, attached cell without physical contact. This device will allow dynamic analysis of cell mechanics in varied biomechanical and biochemical environments. The budget of the two year NIH award is \$142,103.



## **Alisa Morss Clyne Selected as 2009 Stein Family Fellowship Recipient**

Morss Clyne launched a new research collaboration with Dr. Gershon Golomb of Hebrew University, Israel, as the 2009 Stein Family Fellowship recipient. The Stein Family Fellowship has enabled this research collaboration to happen, bringing two sides of the world together for a common cause. Investigators Morss Clyne and Golomb will travel to each other's laboratories to conduct research, present seminars and create a course in biomimetic controlled release drug delivery that both graduate students and faculty from both universities can benefit from.

Serving as principal investigator on the project, Morss Clyne, along with Golomb, seek to create a basement membrane based drug delivery system, capitalizing on the human body's pre-existing version of a controlled release drug delivery system. Current methods of pharmaceutical delivery, such as swelling hydrogels and nanoparticles, have already made dramatic improvements in drug therapy by

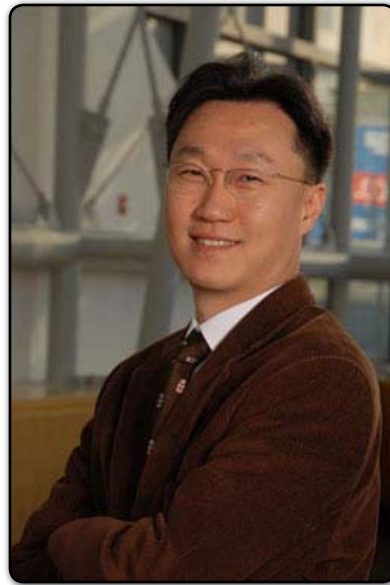
storing the treatment in the patient's system for a longer period of time.

### **Tein-Min Tan Selected as 2009 Boeing Welliver Fellow**

Tan was selected by Boeing for the eight-week long prestigious Welliver Fellowship program that provides the participating faculty with a better understanding of Boeing's research needs and help them enhance the content of undergraduate education in ways that will better prepare tomorrow's graduates for careers in a global environment. The program networks Fellows and Boeing peers that can form the basis of long-term relationships that involve research programs, educational offerings, and opportunities for our students to participate in development programs. Dr. Tan is one of nine faculty members from U.S. and international universities chosen for this year's program.



### **Kim Selected for Prestigious U.S. Army Research Office Young Investigator Award**



Assistant Professor MinJun Kim received the prestigious U.S. Army Research Office Young Investigator Award for his project entitled, "The Mechanics and

Engineering of Bacterial Flagellar Polymorphic Transformation for Adaptive Nanoelectronics". The objective of this project is to understand the unique properties of bacterial flagellar filaments and to exploit them for use in nanoscale sensing devices. The award is \$150 K for a 3 year research program.

### **MinJun Kim Receives 2009 Human Frontier Science Program Young Investigator Award**

Kim, along with his international research team comprised of Dr. Josh Edel, Imperial College London, UK and Dr. Per Jemth, Uppsala University, Sweden, were



awarded the prestigious Human Frontier Science Program Young Investigator Award for their project entitled, "High Resolution Folding/Binding Kinetics of Single Protein Molecules within Nanofluidic Structures." The HFSP Young Investigator Grants support international teams of scientists who are focusing on fundamental issues in the life science by combining expertise from different disciplines. Only 9 teams among 600 proposals over the world have made it this year! The objective of the project is to define a new single molecule nanoanalytical technology which will enable the efficient detection of noncovalent molecular interactions with microsecond resolution in order to answer fundamental



questions about these proteins, for example, what comes first, folding or binding? The budget of the HFSP Young Investigator Award program is \$1.05M for three years.

## **William Hesse Awarded Prestigious NSF GRFP and NDSEG Fellowship**

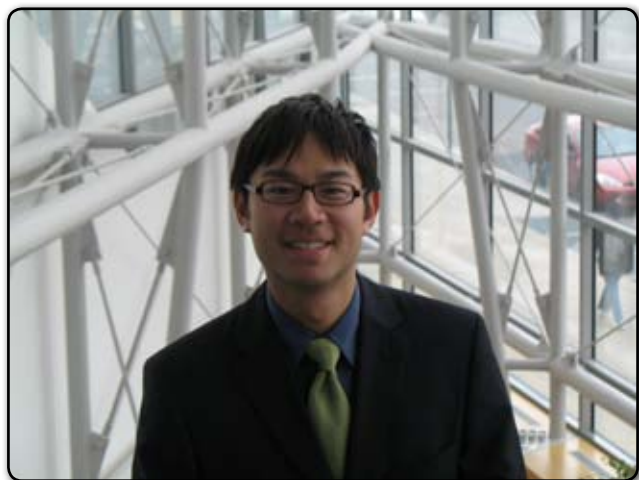
A truly unique accomplishment, Bill Hesse, a 2009 mechanical engineering BS graduate, was awarded the prestigious National Science Foundation Graduate Research Fellowship (NSF GRFP) and the National Defense Science Engineering Graduate Fellowship (NDSEG). Bill intends to continue studying mechanical engineering in the area of micro/nano-biotechnologies while attending MIT for graduate study. During his time as an undergraduate at Drexel, Bill has worked with Dr. Howard Pearlman and most recently with Dr. Minjun Kim. Under the direction of Dr. Kim, Bill has been researching the development of engineered devices that make use of bacterial flagella.

## **Robert Chang Receives NIST NRC Fellowship**

Robert Chang, a June graduate and PhD recipient, was recently awarded the prestigious National Research Council (NRC) Fellowship. The mission of the National Research Council's Research Associateship Programs is to provide advanced training for highly qualified postdoctoral students, while enhancing the research conducted



in federal laboratories, as well as providing highly competitive salaries. This mission is accomplished by recruiting, and competitively selecting, postdoctoral and senior scientists for research awards in the laboratories of more than 30 federal sponsors.



This year, Chang was sponsored by Dr. Jeeseong Hwang at NIST who works in the Optical Technology Division and whose projects include developing and utilizing new measurement platforms and standards to characterize and model the unique optical properties of nanomaterials and biomolecules in a controlled environment for their applications in biological studies including cellular diagnostics, repair, and modification, cancer detection, in vivo imaging, biological warfare agent detection, and drug research and development.

## **Nasir Uddin Receives NRC/ NIST Postdoctoral Research Associateship**

MEM PhD student Nasir Uddin was recently awarded a fellowship from the prestigious NRC/NIST Postdoctoral Research Associateships Program (<http://sites.nationalacademies.org/pga/rap/>). The program provides two-year temporary appointments for outstanding scientists and engineers chosen through a national competition administered by the National Research Council of the National Academy of Sciences.



Uddin is currently working on his dissertation titled "Atomistic modeling of carbon nanotube dispersion in solvent/surfactant/polymer systems" under his advisors Drs. Bakhtier Farouk and Franco Capaldi (MEM). Uddin plans to graduate in winter and will start the fellowship in April 2010 where he will be working at NIST, in Gaithersburg, MD.

# STUDENT SPOTLIGHTS

## **Moogega Cooper- MEM PhD Student**

Moogega Cooper didn't always know that she wanted to be a mechanical engineer, but growing up in Hampton, VA, near NASA Langley Research Center, triggered her love for science and space and her desire to be an astronaut at an early age.



While attending Hampton University in her hometown, Cooper was able to co-op at NASA Langley, where she was first introduced to plasma research- she worked with low-pressure microwave plasma to create forces on surfaces in order

to make fine adjustments to flight trajectories of high-speed objects. After receiving her B.S. degree in physics with a minor in Space, Earth, and Atmospheric Sciences in 2006, its little coincidence that Cooper would choose Drexel's Mechanical Engineering graduate program for her advanced studies, the department has three NASA astronauts as their alumni and is home to the world renowned A.J. Drexel Plasma Institute. "On my first visit to Drexel University and the Plasma Institute, I saw that many of the scientists involved were actually focused within MEM, and I knew this is where my home should also be," said Cooper.

Since August 2006, Cooper has focused her research on sterilizing spacecraft material from extremophile bacteria of concern to NASA using non-equilibrium atmospher-



ic pressure plasma at the Plasma Institute, under her advisor Dr. Alexander Fridman, John A. Nyheim Chair Professor and Director of the A.J. Drexel Plasma Institute.

She also recently wrapped up her term serving as President for the Mechanical Engineering Graduate Association (MEGA) and recommends to other graduate students to get involved in the planning and implementation of activities on campus. "It is a great way to become associated with other students with leadership abilities as well as network more with the faculty and staff within the university," she said.

Cooper recently completed her Ph.D. and has begun her post-doc appointment at NASA JPL where she will be working in depth in the area of planetary protection against extreme bacteria which are found on spacecraft-associated surfaces.



## **RJ Gross- MEM Undergraduate Student**

Freshmen year of college can be a bit intimidating for most students but for junior RJ Gross, freshmen year was an opportunity to get involved with robotics and manufacturing in an up and coming robotics lab at Drexel University-the Drexel Autonomous Systems Laboratory (DASL).



"I was captain of the FIRST Robotics Team at North Penn High School and I wanted to continue my involvement with robotics when I got to Drexel. I discovered Dr. Paul Oh's research group through an outreach presentation on a graduate trip to South Korea," said Gross.

Through his undergraduate years, Gross has worked on autonomous blimps and now concentrates on humanoid robotics. When the DASL received a grant from the National Science Founda-





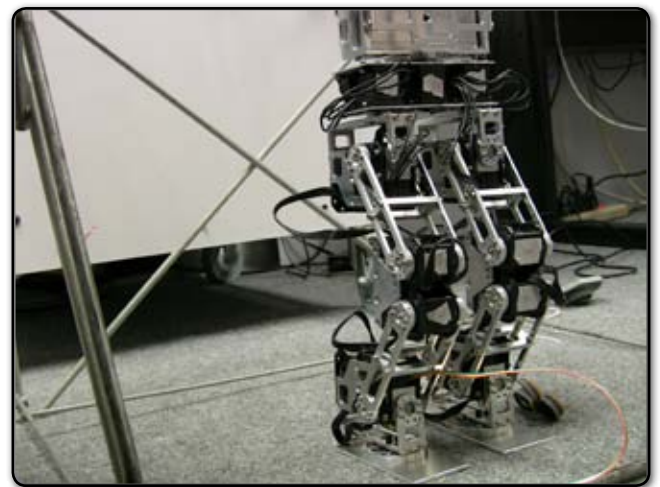
Hubo

tion and its associated Partnership for International Research and Education (PIRE) program, a five year humanoid robotics project was born. The program is coupled with Drexel's Co-Op program to send 20 students in five years to South Korea for training to create Undergraduate researchers that effectively think and work in global teams. This collaboration of American and Korean researchers will seek to draw on the expertise of each researcher and take Humanoid Robotics to the next level of development. DASL adopted "Jae-

mi Hubo" Humanoid robot into its research family from Korean Advanced Institute of Science and Technology (KAIST) in October 2008.

"I was one of the two first students to travel to South Korea for six month Co-Op research at KAIST's Hubo Lab. I experienced hands-on involvement with the manufacturing and maintenance of the Hubo robot. As well as learning about humanoid robotics, I created international business ties and created lasting friendships with students from other countries. My capstone project before I left Korea was to develop, design and manufacture my own miniature Humanoid while collaborating my efforts with DASL back at Drexel," said Gross.

The four month project produced a humanoid robot named ATLAS, and rewarded us with a



ATLAS



Gold medal at Robogames 2009 in San Francisco, California. “Interestingly enough, at Robogames I met a team from India who had been following my blog that I updated during my KAIST co-op experience. They approached me stating that they recognized me from my blog and that my design of ATLAS sparked them rethink in their own design and incorporate some similar features,” said Gross.



Mini Hubo

Gross’s current research is focused on gearing up DASL for an in-house CNC Production of Hubo’s mechanical parts. “I am re-manufacturing the robots right

leg to lay the ground work for producing our own future upgrades/additions to Hubo’s mechanical structure. I am also traveling to National Instruments (NI) for a Co-Op in Austin, Texas in January 2010. I will expand the PIRE collaboration with NI to install LabVIEW hardware and software on the Mini Hubo,” he said. The robot Mini Hubo was developed through PIRE by RoMeLa Laboratory at Virginia Tech as a low cost, open source alternative to the full size Hubo humanoid.

“I have seen the lab expand in technology and members and now I have the opportunity to pass on my knowledge to undergrads by teaching lab internal classes on CNC manufacturing, CAD/CAM techniques and Mastercam,” he said.

So what does the future have in store for this ambitious mechanical engineer? “After graduation I would like to pursue a graduate degree in Industrial Design to enrich my engineering degree with the study of creative function and form. I then would like to work in international manufacturing industry on product design and development,” said Gross.

# IN THE NEWS

## **MEM Alum and NASA Astronaut Christopher Ferguson, Honored as 2009 Engineer of the Year**

Christopher Ferguson, commander of NASA's STS-126 Endeavour, STS-115 Atlantis and a distinguished Drexel alumnus of mechanical engineering ('84) was honored as Drexel University College of Engineering's 2009 Engineer of the Year.



"We are excited Mr. Ferguson was selected as the 2009 Engineer of the Year. Mr. Ferguson has shown tremendous leadership in leading both missions and he continues to be a role model for our students as well as an accomplished alumnus," said Dr. Selcuk Guceri, Dean of the College of Engineering.

A Philadelphia native, Mr. Ferguson holds a BS in Mechanical Engineering from Drexel University and an MS in aeronautical engineering from the Naval Postgraduate School ('91). Mr. Ferguson is a veteran of two space flights and he has logged over 28 days in space. He was the pilot of STS-115 Atlantis in 2006. In 2008, as the commander of space shuttle Endeavour STS-126, Mr. Ferguson worked with his six-person crew on a 15-day space. In addition, Mr. Ferguson and his crew delivered equipment to the International Space Station including crew quarters, additional exercise gear, materials for the regenerative life support system and spare hardware that will enable larger crews



to reside aboard the complex for long-duration missions. Mr. Ferguson piloted the space shuttle Endeavour to a perfect landing on November 30, 2008.

## **G.P. Singh Inducted into Drexel 100**

MEM Alum Dr. G.P. Singh was selected to join the prestigious Drexel 100. Named for the inaugural class when Drexel celebrated its 100th anniversary, the Drexel 100 has

more than 100 members and is the highest ranking alumni award given.



Dr. Singh, founder of Karta Technologies, Inc., is an innovator and an entrepreneur. He grew his business from a one-man, garage operation to over 400 professionals, creating the largest San Antonio based defense contractor for professional services. Karta was acquired by NCI Information Systems, Inc (NCIT) in June 2007 and Dr. Singh serves on the Board of Directors of NCI Information Systems.

After receiving his Master's and Ph.D. degrees from Drexel University in Mechanical Engineering and Mechanics in 1976 and 1979 respectively, Dr. Singh joined Southwest Research Institute as a Senior Research Engineer. In 1985, Dr. Singh joined the engineering faculty at UTSA and in 1986 he formed Karta Technologies, Inc. Dr. Singh



has published over 50 technical papers and numerous reports related to nondestructive evaluation, power plant maintenance and operations, artificial intelligence and computer based learning. In addition, Dr. Singh was awarded six US patents for his innovations.

## Humanoid Robots Come to Life at the Please Touch Museum

Humanoid robot Jaemi Hubo was officially introduced to the public at the Please Touch Museum in Philadelphia's Fairmount Park in May. Guests were fascinated by Jaemi's artificial intelligence and the interactions it shared with the crowd. The robot danced, led a game of Simon Says and even exchanged greetings with audience members.



"Jaemi is not as advanced as a human but with the enhancements to come in the five-year plan, Jaemi will get there. For now, this humanoid is acting as a great tool in recruiting younger audiences into the fields of science and engineering. There isn't anywhere else in the U.S. you can see this type of robot," says Daniel Lofaro (ECE) one of the primary





care-

takers for Jaemi and a doctoral student.

Daniel is one of many researchers working on humanoids. A team of researchers led by MEM's Paul Oh is collaborating with researchers at the University of Pennsylvania, Colby College, Bryn Mawr College, Virginia Tech, Korea Institute of Science and Technology (KAIST), Korea University and Seoul National University to add their own expertise to Jaemi. The five-year project, funded through the National Science Foundation's Partnership for International Research and Education



Program (NSF-PIRE), seeks transformative models to train scientists and engineers to effectively work in global multi-disciplined design teams. In bringing the robot to the U.S., the research team has the

chance to develop the computing and artificial intelligence of the robot. Daniel, along

with Robert Ellenberg, a doctoral student in MEM and fellow caretaker of Jaemi, manage the humanoid in Drexel's Autonomous Systems Lab, its home in the U.S.

"We're excited to bring this technology not only to Drexel but to the U.S. Jaemi is attracting public support for technology. We're innovators at Drexel. Jaemi has a good home" says Robert. For more information on Jaemi, please visit <http://dasl.mem.drexel.edu/>.

## Drexel's Formula Hybrid Team Places 3rd at the Formula Electric and Hybrid 2009 Competition in Rome, Italy

Drexel's formula hybrid team took green racing to a new level in Rome, Italy October 7-9, at the Formula Electric and Hybrid 2009 competition. The Drexel team was the only United States team represented at the competition. They competed with over 15 teams from around the world for the title and the opportunity to raise awareness on the developments of technology in the ecological mobility field. The Drexel team raced their





award-winning vehicle that placed third at the New Hampshire Speedway International Formula Hybrid in May 2009. Since the May 2009 competition, the team has upgraded the vehicle which has taken the last year to develop through a joint MEM and ECE senior design project.



In preparation for Italy, the team upgraded the car even further, eliminating extra weight, improving handling and cooling and nearly doubling the performance of the car with a rear gear change and higher amperage controllers.

Teams competed in Rome's Fiat facility and where their cars were judged in a series of static and dynamic events that include technical inspection, presentation and engineering design, solo performance trials and high performance track endurance. The events were scored to determine how well the car performs. In each event, manufacturing firms used specified minimum acceptable performance levels that are reflected in scoring equations for the judging.

For more information on Drexel's formula hybrid team, please visit <http://ece.drexel.edu/formulahybrid/pics/hybrid.swf>

## Plasma Medicine Advances Field with 2nd International Conference

The A. J. Drexel Plasma Institute hosted the second International Conference on Plasma Medicine (ICPM-2) in San Antonio Texas in March. Among the 150 participants, 14 countries were represented to include France, Germany, the Netherlands, Canada, Japan, and South Korea. The first International Conference on Plasma Medicine (ICPM-1) was a great success, as can be seen from the special issue on plasma medicine consisting of selected contributions from conference participants. This year's conference saw an increase in the amount of contributing attendees, as well as the establishment of the International Society on Plasma Medicine (ISPM). Prof. Alexander Fridman (MEM) has been elected as the president of ISPM. Contributions from 19 Drexel affiliates were represented, to include four MEM faculty and four MEM students.

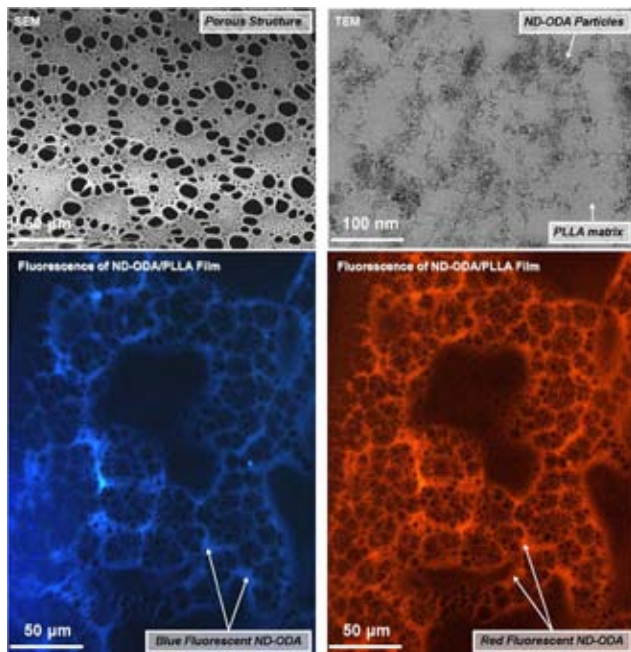


The reins of the conference were given to Dr. Klaus-Dieter Weltmann, Director of the Leibniz Institute for Plasma Science, and the host for ICPM-3. With ICPM-3 set to oc-

cur in Greifswald and future plans to host in South Korea and France, the international conference is increasing its scope and visibility throughout the world and continues to advance the field of plasma medicine.

## Jack Zhou and His Research Team Win First Place in American Ceramic Society's Ceramographic Competition

Jack Zhou and his research team consisting of Dr. Qingwei Zhang (post doctoral fellow), Dr. Vadym Mochalin (MSE), Dr. Yury Gogotsi (MSE), and Dr. Peter Lelkes (Biomed) won first place in the October Ceramographic Competition orga-



nized by The American Ceramic Society. The poster entitled "Fluorescent Nanodiamond Reinforced PLLA Scaffolds for Tissue Engineering and Bone Repair" explores bioactive surgical fixation de-

vices by incorporating gradient cellular structure and nanodiamond reinforcement. Besides mimicking the natural bone structure, the novel surgical fixation devices will also provide sufficient mechanical strength and efficient bone/tissue healing and growth.

## MEM/BioMed Project Wins 2nd Place in 2009 GEW Pitch Competition: "Green to Gold Concepts to Change the World: People, Prosperity & Planet"

Hosted by the Laurence A. Baiada Center for Entrepreneurship in Technology, the Drexel Green Initiative and the Great Works Symposium, a team of three students, Dheeraj Roy (BioMed), Kevin Freedman (MEM), and Shruti Gour (Biomed), entered the competition with the idea that a novel scientific device would contribute to the nationwide green initiative. "Carbon Nanotube Filter to Reduce Greenhouse Effect," won the team 2nd place overall and a cash prize of \$400.

The challenge of finding a unique green project was accomplished through three weeks of research and regular team meetings. After considering other potential technologies, the team decided to research the applications of carbon nanotubes which Gour first conceptualized. They proposed a filter device that would decrease harmful greenhouse emissions from automobile exhausts. "The long term goal is to return the earth's greenhouse gasses to the levels observed prior

to the Industrial Revolution while the immediate goal is to slow down the greenhouse effect,” said Freedman.

The team received high accolades from the competition’s judges, who were impressed with their novel idea based on

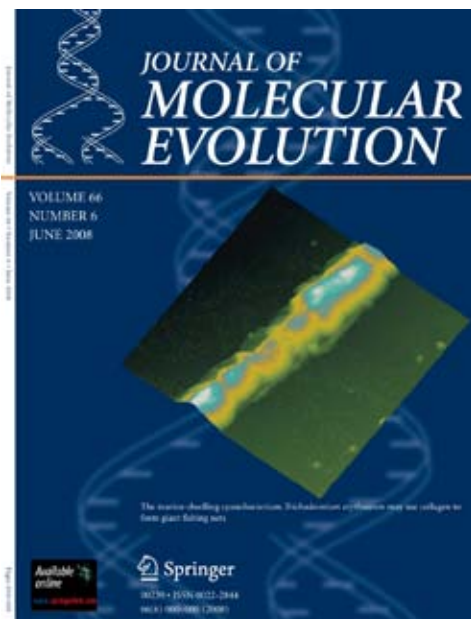


their expertise in the field of sustainable green businesses. Going forward, the team hopes to continue participating in University-wide and national green competitions. “Ideally, we hope to gain sources of funding to start-up a business that would develop our proposed device,” said Freedman.

## DASL Returns for NSF Taste of Arlington Event

For the third year in a row, the Drexel Autonomous Systems Lab (DASL) displayed a selection of robots for the National Science Foundation Taste of Arlington Event in May. Specifically invited by NSF, DASL was the only robotics lab to be showcased at the event. NSF selects, from its research portfolio, projects that

best showcase exciting research that attracts and engages the public. MEM grad and undergrad students Keith Sevcik, Rob Ellenberg and Richard Vallet, along with ECE Student Daniel Lofaro, represented Drexel at this event.



*Trichodesmium erythraeum*, a single-celled marine bacterium that holds the world record for the longest collagen molecule, and the subject of Brad Layton’s research on the molecular structure of collagen, was featured on the June 2008 cover of the *Journal of Molecular Evolution*.



# MAJOR RESEARCH INITIATIVES & ACTIVITIES

**Dr. Ying Sun** received the National Science Foundation (NSF) CAREER Award for her project entitled “Multi-Scale Study of Transport Phenomena in Printable Electronics for Enhanced Microstructure and Properties”. The five year project will advance the fundamental understanding of transport processes of inkjet-printed functional materials on flexible substrates through the integration



of innovative research and education. The total award amount is \$400,000. The Mechanical Engineering department has a total of five faculty who have received NSF CAREER awards thus far.

**Dr. Alex Fridman**, John Nyheim Chair of Mechanical Engineering and Director of the A.J. Drexel Plasma Institute (DPI), and Dr. Andrey Starikovskii, Research Professor and Associate Director of DPI received a 5-year grant, “Plasma Assisted Combustion” from the Air Force Office of Scientific Research (AFOSR), Multi-University Research Initiative (MURI) program. The objective of this project is to investigate plasma ignition and stabilization of flames especially for operation

of SCRAM-Jet engines where combustion efficiencies are low due to extremely high air velocities resulting in short residence within the engine to achieve complete combustion. The two partner institutions are Ohio State and Princeton University. The total budget of this MURI is \$7.5M.



**Dr. Baki Farouk** received a National Science Foundation award totaling \$299,998 for his project entitled, “Fundamental Studies of the Thermoacoustic Effect: Interactions of Acoustic Waves with Viscous Fluids”. The three year project is an experimental and numerical study of acoustically-driven viscous flows in resonators embedded with either a layer of closely-



spaced thin plates (a stack) or with close-packed plain-weave metal screens (a regenerator) will be carried out. This research will enhance the current level of sophistication in analyzing a wide variety of acoustically-driven problems of technological importance, specifically related to the design improvement of thermoacoustic refrigerators.

**Dr. James Tangorra**, along with a research team comprised of Harvard biologist, Professor George Lauder, and the University of Chicago neurobiologist Professor Melina Hale were awarded a grant from the Office of Naval Research (ONR). Entitled, “The Neuromechanics of Fish Pectoral Fin Sensory and Motor Control System as a Model from Controlling Agile, Autonomous Undersea Vehicles,” the

team will embark upon an investigation of the sensorimotor systems that control highly deformable pectoral fins during swimming and maneuvers, and will create biorobotic models of the fin and

the sensorimotor control system to propel and control unstable and highly maneuverable fishbased AUVs. The budget of the ONR award is \$967,800 for three years.



**Dr. Moses Noh** along with Dr. Alisa Morss Clyne, Dr. Ryszard M. Lec (Biomed),



Dr. Wei Sun, and Dr. Wei-Heng Shih (MSE) were awarded a National Science Foundation grant entitled, “MRI: Acquisition of 3-D Micromanufacturing Instruments for Bioengineering Research at Drexel University”. The

goal of this project is to improve the quality and expand the scope of bioengineering research and training at Drexel University by providing shared 3-D micromanufacturing instrumentation. Two 3-D micromanufacturing instruments will be acquired: a micro stereolithography system and an excimer laser ablation system. Micro stereolithography is an additive 3-D printing technique that can build complex microstructures via a layer-by-layer curing process while excimer laser ablation is a subtractive laser machining technique that can be used for non-planar structures made of various materials such as plastics, glass, metals, ceramics, and semiconductors. The three year project award from NSF totaled \$344,330.

**Dr. Bradley Layton** received a three year grant from the National Science Foundation for their project entitled “Multiscale Structure-Function Relationships of Colla-

gen in the Marine Cyanobacterium *Trichodesmium erythraeum*.” His co-investigators are cyanobacteria expert, Shivanthi Anandan of Drexel’s Bioscience Department, and collagen expert, Fred Silver of the University of Medicine and Dentistry of New Jersey. The collagen Layton discovered is the longest uninterrupted tri-glycine repeat ever found and may be responsible for making colony aggregation possible at the kilometer scale. Perhaps the most intriguing fact about this particular collagen sequence is its similarity to vertebrate collagen. The collagen extracted from *Trichodesmium erythraeum* has the potential for use in the pharmaceutical industry and also makes a toxin similar to Botox. The total amount of the NSF award for the project is \$403,000.



**Dr. James Tangorra** was awarded a National Science Foundation Emerging Frontiers in Research and Innovation (EFRI) grant entitled, “Multifunctional Materials Exhibiting Distributed Actuation, Sensing, and Control: Uncovering the Hierarchical Control of Fish for Developing Smarter Materials.” The work is a collaboration between Drexel University (Tangorra), Virginia Tech (Michael Philen, Harry Dorn, Don Leo, Lisa McNair), and Harvard University (George Lauder). The goals of this multiuniversity collabora-

tive research project are to achieve a greater understanding of the hierarchical organization and structure of the sensory, muscular, and control systems of fish, and to develop advanced biologically-inspired material systems having distributed sensing, actuation, and intelligent control. The total award is \$1.9 M for the four year project.

**Drs. Jack Zhou**, Dr. Peter I. Lelkes (BioMed), Dr. Vadym Mochalin (MSE), Dr. Yury Gogotsi (MSE), and Qingwei Zhang (Research associate fellow, MEM/BioMed/DrexelMed) have received a grant from the National Science Foundation for their project entitled, “GOALI/Collaborative Research: Functionalized Nanodiamond Reinforced Biopolymers for Microporous Surgical Fixation Devices.” Drexel is the leading institution in this GOALI collaborative research project with industrial partner Arthrex Inc., and the Georgia Institute of Technology. The



objective of this research is to explore new composite nano-manufacturing methods to enhance mechanical integrity of biopolymers using functionalized nanodiamond and to investigate a new micro porous structure which will assist in bioactive reagent delivery in surgical devices. The budget for this three year project is \$568,090.







# A SPECIAL THANKS



The Department of Mechanical Engineering and Mechanics gratefully acknowledges its donors. Your generosity will benefit both current and future generations of MEM students and faculty, reaching well beyond the classroom and the lab. If you are interested in making any form of contribution to the department, please visit <http://www.mem.drexel.edu/alumni/>

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