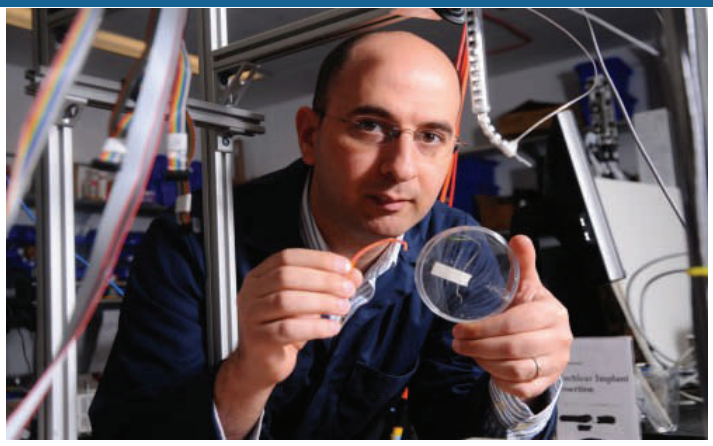
Fall 2009, Volume 2, Issue 1

Mechanical Engineering Newsletter

The Fu Foundation School of Engineering & Applied Science, Columbia University in the City of New York



Professors Gerard Ateshian (L) and Nabil Simaan (R) as featured in the Fall 2009 Columbia Engineering News, *which is devoted to health-related research. Six ME faculty were featured for their work in this field.* *For more information, please see page 4.*

Message from the Chair

Dear Alumni and Friends,

I am very pleased to bring you another edition of exciting news and significant development.

We welcomed our new Dean, Feniosky Peña-Mora and new Provost, Claude Steele. We look forward to closely working with them in continuously bettering the Department, School and University.

Over the past several months, our students have received major recognitions such as winning a national design competition, hosting a regional leadership conference, and receiving major awards. They also continue to be engaged in activities with a societal and environmental impact.

Our faculty have recently published in the most prominent journals including *Nature, Nature Nanotechnology*, and *MRS Bulletin* and received prestigious research awards from NSF, NIH, DOE and DOD. Collaborative efforts are on a significant rise, ranging from Jim Hone and Chee Wei Wong's participation in the $15M Energy Frontier Research Center, to Qiao Lin's teaming up with UT Austin and Hospital of Special Surgery, to Nabil Simaan's joining hands with Computer Science and SAIC in medical robotics, to James Hone's role as Co-PI with Mt. Sinai and in a *MURI* effort, to Daniel Attinger's collaboration with the Nevis Labs, and to Vijay Modi's on-going leadership activities with Columbia's Earth Institute. Also noteworthy is the fact that six ME faculty are prominently featured in the latest issue of SEAS' *Engineering News* devoted to health-related research, which is inherently interdisciplinary.

We profile our Lab Manager, Bob Stark, for his invaluable service to our students over 20 years and counting. We congratulate our alumna, Ursula Burns, in taking over as Xerox CEO, thank alumnus, Darcy Hunter, for a generous gift to our teaching lab, and welcome alumnus Ernest Ruppe to join the departmental External Advisory Board.

With the holidays just around the corner, I wish you all the best. Please keep in touch.

Y. Lawrence Yao
Professor and Chair

In this issue

CONGRATULATIONS GRADS!

BACHELOR OF SCIENCE, CLASS OF 2009

Jonathan Battat, Edward Bossange, Alexander Bremer, Peter Capraro, Mateo Chaskel-Steiner, Andrew Dixon, Xavier Ducher, Patrick Duggan, Chiviya Fariku, Marshall Fox, Myron Qian Gao, Christopher Guerrero, Matthew Guido, Julie Ann Haney, Daniel Hould, Ample Hout, Tzvi Karoly, Samuel Lara Santiago Kemp, Andrew I. Kim, Melinda Kim, Andrew Tevin Kim, Daniel Ko, John Lee, Mark Lombardi, Michael Long, Andrew Macaluso, Emily Marquardt, Ross Myers, David Norris, Temitope Oladapo, Daniel Pacheco, Mika Berkovitz Pegors, Costi Hanna Quffa, Luis Quinteros, Kelly Russell, Mirza Sajjal, Christian Senu, Hang Shu, Robert Sokola, Joshua Southerland, Evan Stein, Steven Thomas, Travis Thurber, Nathan Tishberg, Eli Waltz, Alexander Williams, Christopher Williams, Kenneth Yearwood, Donnie Yeganeh, Krystle Zambrano, Crystal Zhou

***SPECIAL CONGRATULATIONS TO THE 2009 MECHANICAL ENGINEERING AWARD RECIPIENTS:**

The American Society of Mechanical Engineers Award: Patrick Duggan

Edward A. Darling Prize in Mechanical Engineering: Hang Shu

William A. Hadley Award in Mechanical Engineering: Alexander Williams

2009 James F. Parker Award in Mechanical Engineering: Robert Sokola

Mechanical Engineering Certificates of Merit: Jonathan Battat, Edward Bossange, Marshall Fox, Christopher Williams

Spring 2009 Outstanding Teaching Assistant Award: John Paul Hilton

Spring 2009 Outstanding Teaching Assistant Honorable Mention: Sibylle Delaporte

Excellence Award (1st Place) for Senior Capstone Design: *Mo' Monet, Mo' Problems Team: Drawing System for Handicapped Students*—Andrew Dixon, Daniel Hould, Ample Hout, Christopher Williams, Krissie Zambrano

Certificate of Merit (2nd Place) for Senior Capstone Design: *Team Coandă: Coandă Effect UAV*—Jonathan Battat, Ross Myers, Robert Vlacich (EE '09)

ACADEMIC YEAR 2009

MASTER OF SCIENCE

Jagreet Baghasingh, Andrea Bajo, Jonathan T. Belmont, Carlo Canetta, Tasos Charalambides, Un Long Chio, Fredric Constantino, Stefan Englert, Zhi Gong, Elliot Greenblatt, Saleem Hamid, Mehmet Isik, Jennifer Jassawalla, Haohao Jiao, Andreina Jimenez, Minseok Kang, Panjawat Kongsuwan, JongHyun Lee, Yayi Lin, Kenneth Lloren, Ethan Mandelup, Keith Molina, Shakthi Nellaiappan, Andrew Pappas, Sanjay Parimi, Hiral Patel, Nuttapol Pongthanya, Disha Shah, Yunde Shi, Jiho Song, Nathan Bales Stodola, Hao Tian, Ying Lai Tsui, Roberto Valdes, Eric West, Jimmy Wu

MASTER OF PHILOSOPHY

John Paul Hilton, Mingyuan Huang, Thaihuu Nguyen, Andrew O'Grady, Sinisa Vukelic, Xiaoding Wei

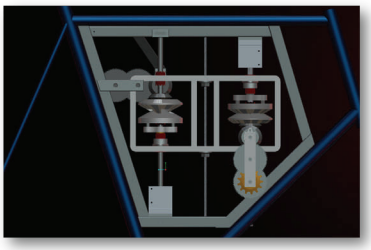
DOCTOR OF PHILOSOPHY

Andrew Birnbaum, Ranojoy Bose, Bhupesh Chandra, Mingyuan Huang, Sinisa Vukelic, Xiaoding Wei, Kai Xu, Xiaodong Yang

SENIOR DESIGN PROJECT WINS PRIZE AT NATIONAL LEVEL

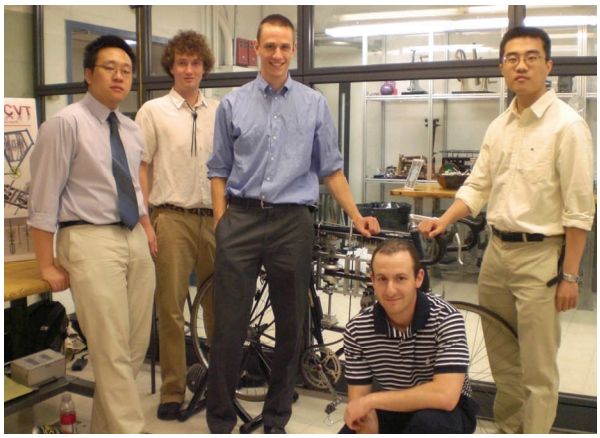
In October, students **Myron Gao**, **Matthew Guido**, **Michael Long**, **Michael Shu** and **Travis Thurber** had the honor of receiving 3rd prize, along with a $500 cash award, in the Design Competition of the ASME International Manufacturing Science and Engineering Conference (MSEC), held at Purdue University. The competition featured projects from universities across the country.

The project, a Continuously Variable Transmission for Bicycle Applications, was the culmination of the semester-long senior design project at Columbia. Professor **Fred Stolfi**, who supervised the senior design projects remarked, **"**I think that what was most remarkable about the CVT bicycle project was that the team designed the entire mechanism in CAD and animated the motion before they fabricated a single part. It was an outstanding approach to design."



ProEngineer® CAD Model of Bicycle CVT (Continuously Variable Transmission): the model takes into account the materials used for each component.

The team entered the design in the national competition last April, and were among the eight finalists selected to compete in October. The belt-driven friction based transmission was designed and manufactured entirely from stock materials and implemented into a road bicycle. The design features a novel implementation of linear rotary bearings allowing for translation and rotation of 2 co-axial components.



A Winning Team: (L-R) Michael Shu, Travis Thurber, Michael Long, Matthew Guido, Myron Gao

Matthew Guido, who presented on behalf of the group at the MSEC competition described the device as the "unconventional application of a variety of conventional machining processes." He highlighted the group's use of MIG and TIG welding, the CNC mill and lathe, stereolithography, laser cutting and aluminum anodizing. This is the first documented Bicycle CVT which is completely removable from the bicycle frame and fits directly into the frames natural voids.

Professor **Larry Yao**, the ME Dept Chair, was present at Purdue University during the Competition. He commented, "I am very proud of the achievement of our students and the dedication of our faculty and staff. It affirms our competitiveness at the national level."

CU CHAPTER OF ASME HOSTS REGIONAL LEADERSHIP CONFERENCE

On October 31, the Columbia University chapter of the American Society of Mechanical Engineers (ASME) hosted student leaders and faculty advisers from various ASME chapters throughout the Tri-State area and the Northeast US for the daylong District A 2009 Student Leadership Section (SLS) Conference at Alfred Lerner Hall.

CU ASME chapter Faculty Adviser Nabil Simaan welcomes regional ASME chapters at the 2009 SLS Conference.

Columbia faculty adviser, ME Professor **Nabil Simaan**, gave the welcoming remarks. **Edward Kim**, president of Columbia's ASME chapter, hailed the Conference as an excellent opportunity to "strategize plans for improving student chapters" and "network with regional ASME leaders." ME Chair, **Larry Yao**, acknowledged the honor of hosting the conference, a testament to an active chapter over the last few years. There was also a special Engineers Without Borders presentation given by **Emil Sandoz-Rosado**, a current ME graduate student. During the conference, student leaders listened to several presentations on resources and opportunities available through ASME, and students exchanged ideas about successful ventures on their respective campuses.

MISSION POSSIBLE: LISANDRO QUINONES SPENDS SUMMER AT THE NVFEL

By Lisandro Quinones, MSME '10

Nowadays with a simple key stroke to your PC, almost everything is reachable on the spot. How about running your car engine from your laptop? How about running car engines via the Internet from abroad? New advances in field-programmable gate array (FPGA) technology along with the latest on real-time embedded controllers and reconfigurable I/O hardware have extended the boundaries of engineering imagination. However, with power comes responsibility, hence, such empowering technology should be applied with "greener" intentions.

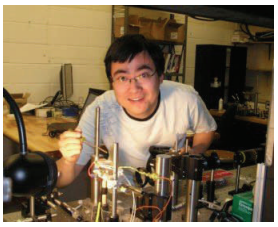
As a GEM (National Consortium for Graduate Degrees for Minorities in Engineering and Science) Fellow I have spent two wonderful summers at Ann Arbor, Michigan working at the U.S. Environmental Protections Agency's National Vehicle and Fuel Emissions Laboratory (NVFEL). NVFEL is responsible for developing national regulatory programs to reduce mobile source related air pollution from cars, trucks, buses, and non-road engines and vehicles; evaluating emission control technology; providing state and local air quality regulators; testing vehicles, engines, fuels, and determining compliance with federal emissions and fuel economy standards. Working under the mentorship of Test Coordinator Charles Schenk and Heavy-Duty Onroad Director Byron J. Bunker, I was assigned the task of implementing the design of a full-authority FPGA-based open engine control unit (ECU) for a turbocharged diesel engine assembled for testing procedures.

At first it seemed like too much to handle in just one summer; current off-the shelf programmable ECUs are not suitable for test procedures and research because they are limited in programming capabilities, take a predefined set of input variables (sensors), and are usually specifically optimized for racing applications. By definition, a full-authority ECU should allow the engineer to adjust most of the engine control parameters. By the end of the summer and to the surprise of my fellow engineers and myself, I was running a working version of the first PC open ECU to be used for testing and compliance at an EPA National Laboratory. The possibilities with this project are virtually endless.

PHD STUDENTS KAI XU AND JIE XU RECEIVE 2009 CHINESE GOVERNMENT AWARD

Ph.D students **Kai Xu** ('09) and **Jie Xu** were both awarded the 2009 Chinese Government Award for Outstanding Students Abroad. This award recognizes top Chinese Ph.D. students across all fields of study in the world.

Kai Xu (pictured left) was a member of Professor **Nabil Simaan**'s research group, whose work focused on statics, kinematics, stiffness, actuation, wrench sensing, and synthesis of a snake-like continuum robot as well as its implementation in telerobotic systems for Minimally Invasive Surgery of the throat and Single Port Abdominal Surgery. "This is a high honor and we are very proud that both students have been recognized for their hard work," commented Professor Simaan. Kai has since received his Ph.D and currently is an Assistant Professor with the UM-SJTU (University of Michigan-Shanghai Jiao Tong University) Joint Institute at SJTU in Shanghai.



Jie Xu (pictured right) is in his fifth year of his Ph.D. program with Professor **Daniel Attinger**'s research group. His current work focuses on experimental and numerical study on microscale bubble/drop dynamics with microfluidic applications. He has published five journal articles including a "best Journal of Micromechanics and Microengineering paper of the year" (among 31 others). Professor Attinger says: "I am very proud of Jie's award. Four years ago he was hired from the prestigious Tsinghua University where he had done some nice research on heat transfer through coconuts. Jie expressed and developed his skills in many projects we have done since. He is an amazing character, extremely sharp, funny, generous and dedicated. His scientific curiosity has no bounds and I wish him lots of future successes." Jie is also a full member of Sigma Xi, The Scientific Research Society and member of several other professional societies including ASME.

ENGINEERS WITHOUT BORDERS TEAM IMPLEMENTS MULTIFUNCTION PLATFORMS IN UGANDA

By Alison Ferris, BSME '12

You're in a small, remote, rural village in eastern Africa. You need to fix a broken starter handle of an engine. After checking your pockets, you find that you only have a small spiral memo notebook, a pen, and a pocket knife. What do you do? As mechanical engineers there's always that tinkering kid inside of us that loves being faced with a real-world problem. I used the pocket knife to cut off part of the notebook's spiral and the pen to wrap the spiral wire into a spring. But realistically, how often do we find ourselves in a position to use our ingenuity and engineering background to make something for immediate use? In a third world country, such as Uganda, the opportunity presents itself on a regular basis.

This summer, Columbia's Engineers Without Borders (CU-EWB) program sent seven students, including myself, to Soroti, Uganda to work with an indigenous NGO on both implementing and assessing a Multifunction Platform (MFP) pilot program in the region. MFPs are stationary diesel engines that attach to various agricultural processing units, an electric generator, or a water pump. The engines can be modified to run off of straight vegetable oil, in addition to diesel fuel. I was part of the CU-EWB Uganda team that installed two MFPs in the rural villages of Orungo and Usuk, and, in the weeks that followed, came up with and presented a comprehensive training program to the villagers. My month in Uganda taught me that my Columbia training allows me to put myself in situations where I can spontaneously apply a hands-on technique to solve a problem and to apply what I've learned in a way that is not only meaningful to me, but makes a world of difference to someone else.

Alison Ferris, BSME '12 provides MFP training in Uganda this summer.

PROFESSORS HONE AND WONG PART OF NEW DEPT. OF ENERGY SPONSORED RESEARCH CENTER AT CU

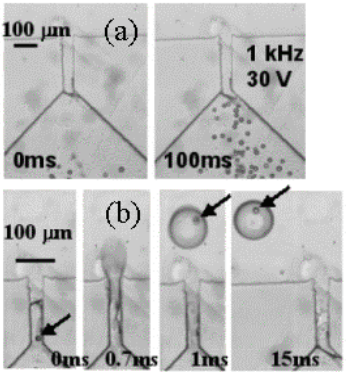
The U.S. Department of Energy awarded a $15 million grant to establish an Energy Frontier Research Center (EFRC) entitled *Re-Defining Photovoltaic Efficiency Through Molecule Scale Control* at Columbia to make photovoltaic technology more efficient. The Center is co-directed by Dr. **James Yardley** of Electrical Engineering, **Tony Heinz**, professor of Electrical Engineering and Physics, and **Louis Brus**, professor of Chemistry. Prof. **James Hone**'s group, as part of the EFRC, are studying the optoelectronic properties of carbon nanotubes to understand the potential for using low-dimensional materials in ultra-efficient solar cells. The program builds on the significant success of the NSF-sponsored Columbia Nanoscale Science and Engineering Center (NSEC), of which Professor Hone is part.

Prof. **Chee-Wei Wong** and his team will examine the role of multiexciton generation in the nanostructured thin-film for the solar photovoltaics. Fundamental processes will be investigated in femtosecond time-resolved spectroscopy, along with possibilities of upconversion mechanisms, concurrently with applied implementation of solar photovoltaic devices with light trapping for high efficiencies at the single- and multi-sun illumination levels. The Center also draws significant strength from the Columbia Center for Integrated Science & Engineering (CISE), of which Prof. Wong is part. For more information about the EFRC, please visit: www.engineering.columbia.edu/announcements/2009/efrc4_27/index.html

ATTINGER'S LAB ENTERS 5-YEAR MEDICAL COLLABORATION WITH NEVIS LABORATORIES

As of September, the laboratory of Professor **Daniel Attinger**, funded by a grant from the National Institute of Health, has begun to design and fabricate microfluidic devices to manipulate single biological cells for experiments involving radiation microbeams. Microfluidic devices are tiny micromachined plumbing systems that handle fluids and biological cells using pressure, electrostatic or optical forces. A single-cell microbeam is an extremely narrow beam of radiation that allows biological damage to be induced at precisely defined locations within cells. Attinger and Dr. **David Brenner**, the principal investigator of the project and Director, Center of Radiological Research at the Columbia University Medical Center, consider microfluidics to be a key technology to bring cells toward the microbeam, perform irradiation, sorting and analysis with high throughput and reliability.

This research will provide tools to understand the risks associated with radiation cancer therapy and low levels of ionizing radiations. "We will develop a technology that we invented one year ago, where a single cell is encapsulated in a single picoliter drop, generated on demand," Attinger explains. The picoliter drop acts as a minuscule beaker, and allows controlling and analyzing the activity of an individual cell rather than an ensemble of cells. "This project," Attinger says, "combines the relevance of designing useful devices with the challenge of understanding the complex coupling of forces governing particulate flow in microscopic channels."

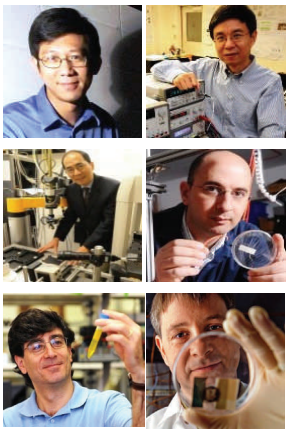


Microfluidic encapsulation of single cell: acoustic streaming and piezoelectric actuation are combined to encapsulate a single biological cell in a single aqueous drop dispensed into an oil-filled channel.

ME FACULTY FEATURED PROMINENTLY IN CU'S ENGINEERING NEWS: MAKING AN IMPACT ON HEALTH

The magazine of Columbia University's Fu Foundation School of Engineering and Applied Science (SEAS), *Columbia Engineering News,* recently published a fall issue devoted to SEAS researchers' worldwide impact on health and medical advancement. Mechanical Engineering faculty had a notable presence in these pages: six ME faculty were featured for their significant contributions to health-related research.

Prof. **Jung-Chi Liao** was featured for his research on exploring the DNA helicase of the hepatitis C virus. Based on this discovery of dynamical coupling mechanisms and the resulting different conformations, more effective treatments could be developed. Prof. **Qiao Lin's** work on a bloodless glucose monitoring system for type 1 diabetes was also featured. Qiao has invented a microfabricated miniature sensor that can eventually be implanted in a patient's body for long-term, continuous glucose monitoring. Prof. **Y. Lawrence Yao** was profiled for the development of a high-throughput biodosimetry device capable of rapidly testing a large swath of the population in the event that an RDD (radioactive dispersal device) or, "dirty bomb" is detonated in a major metropolitan area. The device determines the scope of radiation exposure based on micronuclei formation during cell divisions. Prof. **Nabil Simaan**'s work on a robotic system to aid in surgical cochlear implants was also featured. Simaan and his team have developed a steerable snake-like electrode array that helps surgeons install implants safely and trauma free. Also highlighted was Prof. **Gerard Ateshian**'s research; he is trying to understand how normal cartilage provides lubrication. The goal is to slow down the degeneration of the cartilage or come up with substitutes to repair worn joints. Lubrication is traditionally a mechanical engineering topic, making Ateshian's research a true marriage of engineering and medicine. Prof. **James Hone's** work falls under this category as well: he is researching ways to reprogram cells to boost immunity. Specifically, in terms of HIV, his research looks at HIV resistant genes and ways to grow a supply of these genes. The goal is to create the basic tools needed to engineer the immune system outside the body, and then to put it back inside the body.



From L-R, Row 1: Jung-Chi Liao, Qiao Lin. Row 2: Y. Lawrence Yao, Nabil Simaan. Row 3: Gerard Ateshian, James Hone.

Yao commented, "While one often relates mechanical engineering with machines and airplanes, the *Engineering News* article showcases Columbia mechanical engineers as being on the frontline of health related research. In fact, it is exciting to point out that the ME Department was the most represented department in the article just after the Biomedical Engineering Department (BME)." Columbia Engineering has had a strong impact on health-related advancements since its founding in 1864. Today it is making strides at the cutting edge of this research and, in the words of SEAS Dean **Feniosky Peña-Mora**, "amazing breakthroughs [that] have happened or are about to happen," using their skills and talents, as Dean Pena-Mora wrote, "to chip away at the problems that affect the quality of life and, indeed, life itself."

ENGINEER OF CHANGE: VIJAY MODI EMPHASIZES COLLABORATION TO MAKE A DIFFERENCE

Professor **Vijay Modi** of Mechanical Engineering is leading the Earth Institute's efforts that cut across energy, rural infrastructure and development, as the Infrastructure and Water Sector Coordinator of the Millennium Villages Project. The Earth Institute at Columbia University combines 850 scientists, postdoctoral fellows and students working in and across more than 30 CU research centers, to advance interconnected global issues.

Currently, he is focused on three projects: leading the infrastructure team for the Millennium Village (10 countries, 14 sites across sub-Saharan Africa); developing planning and decision-support tools for infrastructure; and looking at the food-energy-water nexus in Indian agriculture. "Mechanical engineers have an integral role," Modi says, "because there are many issues of sustainable development. For example, lower costs of products, better design, better manufacturing." Engineers have a major hand in trying to reduce energy consumption; people all over the world are trying to "go green" and search for renewable energy. When it comes to developing countries, renewable energy practices pose a substantial challenge. "The problem is," Modi explains, "these techniques are often expensive, so what happens to the very poor, who rely on traditional methods which are often very low-efficiency?" One solution that Professor Modi's research group is working on is creating a stove that burns less wood, produces less emissions and runs for about $10 to $20. Another challenge his group is concerned with is water and energy, as it relates to food production. In India, it takes 1 unit kWh of energy to produce 1 kg of food, which means 1000L of water is needed. Therefore, India is extracting water at a rate/volume which is threatening sustainability. The Earth Institute's role is to create incentives for farmers to conserve; mechanical engineers can design and implement the techniques.

"This is engineering at the intersection of social science," Modi says. "People who live hand to mouth can't have a long view, but decisions that involve sustainability need people to take the long view. The engineer's role is to work on making practices efficient." Professor Modi emphasizes that the collaborative model of the Earth Institute, and working across disciplines is paramount to the success of these projects, "Mechanical Engineers can work with people in public health, chemistry, political science and social marketing," he says. "When working with issues of sustainability, having these specific perspectives considered along with your work is very valuable."

HOME 'SWEET' HOME: SPOTLIGHT ON BOB STARK

As Mechanical Engineering students are heading to the Mudd building in the morning, it is perhaps not uncommon for them to see a familiar face zipping by them on rollerblades down Riverside Drive—this is **Bob Stark**'s preferred method of commute, and his face is indeed familiar to ME students and faculty as he has served as Lab Manager in the department for over 20 years.

As unconventional as his method of transportation might be, his path to the Lab was similarly unique. After graduating with a BS in Mechanical Engineering from the Cooper Union, Bob was employed at Bell Laboratories in New Jersey. He worked at Bell for 5 years, while obtaining his MS in ME at Columbia. In the years that followed, Bob worked as an NYC public school math teacher, then teamed up with his brother as self employed inventors. Bob recalls a 3-D gaming system they created: "We designed these glasses with a rotating visor; one side was clear and the other side darkened. The rotation of the visor would synchronize with the images on the screen." Though it worked, he and his brother unfortunately never hooked a company on their creation. "We were not good businessmen," he laughs.

When Bob returned to Columbia in 1988, he thought working in the Lab might lead him back to a corporate engineering position, but luckily for us, he's been here ever since. It seems that the MECE Lab is the perfect home for Bob's hands-on talent, *and* his need to reach out and teach others. "I really enjoy working with the students," he says; "I get to play with a lot of 'toys;' These are the great elements of my daily work."

On any given day, Bob's "home" is filled with the sounds of students asking questions, running experiments and working for hours on end; it's clear that students find themselves at home, too. "Year after year," notes Professor **Larry Yao**, Chair of the Mechanical Engineering department, "we receive feedback from students who recall Lab as one of the most positive experiences of the ME program, largely due to Bob's dedication and expertise, among other reasons." Bob sees students through many aspects of the ME program—from helping with experiments and machinery, to training students to mentor underserved high school students in the First Robotics program, to seeing seniors through their final design projects; Bob is a constant source of inspiration and help, and the Lab a constant hub of student activity and community. **Matthew Guido**, current MS student who also completed his BSME at Columbia in 2009, sees Bob as a beacon for students, describing Lab as a place students feel like a home and enjoy spending time. As undergraduates, we're "immersed in classwork and theory," Matt says, "but the Lab is where you run own program, and experience CNC machining." He stresses that Bob is an invaluable resource because "he knows the theory, *and* also has years of experience putting it into practice." **Walter Khan**, who works alongside Bob and who has been the ME Lab technician for the past 25 years, affirms the sense of community Bob and he create in the Lab: "His unselfish devotion in assisting, instructing and mentoring students have created an atmosphere where students are made to feel comfortable and inclusive." This sentiment is certainly shared by Profs. **Jeff Kysar, Chee Wei Wong** and **Fred Stolfi**, who teach the three-semester sequence of ME Lab I, II and III.

In the Mechanical Engineering Lab, Bob Stark (r) and ME senior Islam Shawki discuss the latest phase in Islam's project.

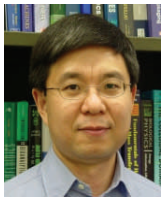
The Lab is a special environment, where students develop more than experiments or practice with machinery; it is also a distinct culture of cooperation and socialization. "The radio's on, it's relaxed in the sense that it's not a classroom, but it's very dynamic," Bob explains. "Being surrounded by machines and one's peers creates a social place, but one which drives intellectual creativity." Walter Khan notes that Bob himself often fosters that creativity; "he makes each and every day something of an adventure, with his keen insight and attention to detail in everything he does, interspersed with humor." "'*Sweet.*' That's Bob's phrase," Matt Guido smiles, "He has a positive outlook on everything. No matter how simple an experiment might be, Bob makes it interesting and is invested." With more difficult challenges, he inspires confidence in his students with his enthusiasm and asserts, with perhaps a bit of inventor's optimism, "this is definitely going to work!" With the passion and encouragement Bob displays daily to help students achieve their goals, the Lab is a "sweet" home for him as well as students indeed.

The National Institute of Health awarded a team from Mt. Sinai and Columbia a five-year, $6 million grant from its Transformative Research Projects (T-R01) program for "Dynamics Underlying Tissue Integrity." Professor **James Hone** is a co-Principal Investigator in the project. Professor Hone's group will construct three-dimensional environments that will allow the team to study how tissues maintain the complex shapes required for many functions.

Professor Hone is also co-PI on an interdisciplinary team of Columbia researchers who won a major collaborative MURI (Multidisciplinary University Research Initiative) grant from the Department of Defense to develop new materials technology. More information on the MURI grant can be found at: www.engineering.columbia.edu/announcements/2009/MURI_Grant5-14-09/index.html

Professor James Hone and co-authors were recently published in the September 20 issue of *Nature Nanotechnology*. The paper, "Performance of monolayer graphene nanomechanical resonators with electrical readout" details the fabrication and electrical readout of high-frequency mechanical resonators from single atomic sheets of carbon (graphene), and testing of their response to changes in mass and temperature. The paper establishes many of the basic attributes of graphene resonators, to lay the groundwork for applications in signal processing and ultrasensitive detection. The article can be found at: http://www.nature.com/nnano/journal/vaop/ncurrent/pdf/nnano.2009.267.pdf

Jeffrey Kysar has published an invited paper in the August 2009 special issue of the *Materials Research Society Bulletin* on Hard Materials with Tunable Porosity. The paper, entitled "Nanoporous Metals by Alloy Corrosion: Formation and Mechanical Properties," gives an overview of fabrication methods of nanoporous metal thin films as well as a discussion the coupling between mechanical properties of nanoporous metals and their electrical and chemical potentials. The paper can be found at: http://www.mrs.org/s_mrs/bin.asp?CID=21422&DID=246831&DOC=FILE.PDF



Qiao Lin has been awarded a three-year grant of $300,000 from the National Science Foundation for a project titled "Integrated Selection of Thermally Responsive Aptamers for Specific Purification and Enrichment of Biomolecules." The major goals of this project are to develop a microfluidic system for automated and integrated isolation of aptamers, i.e., nucleic acids that recognize biomolecules with specific affinity binding. The isolated aptamers will have predefined temperature-dependent binding characteristics and will be used to demonstrate highly selective purification and enrichment of biomolecular analytes.

The National Institute of Health awarded a team from Columbia University, the University of Texas at Austin, and the Hospital for Special Surgery a grant entitled "Theranostic Molecular Automata for Specific Cell Elimination." The two-year award was made under the American Recovery and Reinvestment Act of 2009 (ARRA), with first-year funding in the amount of $902,220. Professor Qiao Lin is a Co-Investigator in the project. His group will study molecular computing cascades ("automata") on cell surfaces, within microfluidic devices that mimic *in vivo* microenvironments such as those found in blood vessels. Results from this study will contribute to the development of molecular nanostructures, which, with specific cell elimination capabilities, can be used as combined diagnostic and therapeutic devices for healthcare applications.

Richard Longman recently served on the Fellows Committees of both the American Astronautical Society and the American Institute of Aeronautics and Astronautics, and was recently selected to serve on the Board for the Sperry Board of Award which honors the legacy of Elmer A. Sperry by recognizing path breaking advancements in air, sea, land or space transportation. It is a joint entity of the AIAA, ASCE, ASME, IEEE, SAE International, and the Society of Naval Architects and Marine Engineers (SNAME).

During the summer Professor Richard Longman gave seminars at the University of Marburg in Germany, at National Cheng Kung University (NCKU) in Taiwan, and two lectures at the National Space Organization (NSPO) of Taiwan. He also had funded visits to the University of Heidelberg in Germany for one month, to NSPO, and to the Engineering Sciences Department at NCKU. Notably, Professor Longman's first connection with NCKU's Department was in 1981 when he co-chaired a conference there with the President of NCKU. The Ex-President of Taiwan, H. E. Yen Chia-Kan, gave the opening keynote speech.

Dr. Nabil Simaan and Dr. Peter Allen (Computer Science) won a $1,152,000 award from Science Applications International (SAIC). This 27 month research grant is part of a larger research consortium for a DARPA-funded proposal titled "COBRA: Cooperative Bio-inspired Remote Manipulator Architecture." The aim of this research project is to investigate the feasibility of integrated user interfaces, vision feedback, and cooperative sensory feedback control for enabling underwater dual-arm micro assembly. Dr. Simaan's lab leads the effort of design and modeling, integration, and low level control of flexible underwater telemanipulation slaves.

This summer, **Elon Terrell's** Energy and Tribology Laboratory received a two-year, $175,000 grant from NSF entitled "A Research and Education Program for the Multiphase Analysis of Third-Body Contaminants in Cyclical Rolling-Sliding Contact." The primary goal of this program involves the development of a prediction of the surface damage which is sustained by a geartrain as a result of particulate contamination. The NSF grant will fund the development of numerical models and experimental measurements to analyze the interaction of two contacting gear teeth in the presence of both lubricant and varying levels of contaminant particles. The program also contains educational and outreach activities, such as graduate course development in lubrication theory and the creation of educational modules in fluid dynamics and lubrication for local high school students.

Professor **Chee-Wei Wong**'s co-authored paper, "Near-field focusing and magnification through self-assembled nanoscale spherical lenses" was published in the July 23 issue of *Nature*. The article reports near-field high resolution by said lenses by bottom-up integration of organic molecules. Such spherical nanolenses provide new pathways for lens-based near-field focusing and high-resolution optical imaging at very low intensities, which are useful for bio-imaging, near-field lithography, optical memory storage, light harvesting, spectral signal enhancing, and optical nano-sensing. Professor Wong's paper can be found at: http://www.nature.com/nature/journal/v460/n7254/pdf/nature08173.pdf

Professor **Y. Lawrence Yao** received a NSF grant titled "Transmission Welding and Single-Step Channeling of Transparent Materials by Ultrafast Lasers." Process feasibility and fundamental mechanism will be investigated aiming for potential applications in flat panel display and medical device industry.

Professor Y. Lawrence Yao was elected 2009-2010 President of the North America Manufacturing Research Institution (NAMRI) of Society of Manufacturing Engineers (SME). NAMRI is the research and education arm of SME and has been sponsoring the annual North American Manufacturing Research Conference (NAMRC) since 1973.

Professor Yao also received the 2009 Janette and Armen Avanessians Diversity Award. This award, established in 2007 by University Trustee Armen A. Avanessians, MS'83, honors faculty members whose actions encourage women and men from diverse backgrounds to become part of the academic community of engineering education. He was presented the award at the SEAS Class Day ceremony on May 18th, 2009.

ALUMNI SPOTLIGHT

Ursula Burns, MSME '82, was recently appointed CEO of Xerox, succeeding CEO Anne M. Mulcahy, who retired as of July 1. **Burns** joined Xerox in 1980 as a mechanical engineering summer intern. She received her MS in Mechanical Engineering at Columbia in 1982. In 2000, she was named senior vice president of Corporate Strategic Services and took the helm of Xerox's global research, product development, marketing and delivery. In 2007 she expanded her leadership to include the company's IT, corporate strategy, human resources, corporate marketing and global accounts.

Darcy Hunter, BSME '84 , Vice President of Sales and Service of *Instron* Corporation, recently arranged donating an Instron mechanical testing system to the Mechnical Engineering Department at Columbia. The Model 5567A Testing System is a very welcome addition to the Mechanical Engineering teaching laboratory. Hunter joined Instron in 1984 and has responsibility for all sales and service areas of Instron's Materials Testing business (IMT) for the Americas and also serves on the External Advisory Board of the Mechanical Engineering Dept. at Columbia.

Glenn Wattley, **BSME '75**, lectured in China at Tsinghua University and Renmin University of China on September 11th and 12th respectively. The topic was "Energy and the Environment" with a key message that the global warming solutions must be "viable" – both technically and economically. Topics in the presentation included coal gasification and CCS; smart grid; distributed generation. Wattley is currently the Managing Director of West Bay Energy, LLC in Boston and also serves on the External Advisory Board of the Mechanical Engineering Dept. at Columbia.

Glenn Wattley (far right), at Tsinghua University, China, in September.

Ernest Ruppe, BSME '49, MSME '50, joined the External Advisory Board of Mechanical Engineering at Columbia in October 2009. Ruppe was a long-time employee of DuPont. He rose through the ranks and became Vice President-Petrochemicals, and was responsible for the Fluorocarbons, Petroleum Chemicals, Explosives, Intermediates, and Atomic Energy Divisions. After his retirement, he began work with the Chemical Manufacturers' Association leading development of Responsible Care, an industry wide program to improve safety, health, and environmental performance. Ruppe has also served two terms on the Columbia Engineering Council, the Dean's Advisory Board.

ALUMNI: CCE ANNOUNCES SPONSORED INTERNSHIP PROGRAM FOR ENGINEERS

by Megan Massimiano, CCE Counselor

We are delighted to invite you to champion a Columbia engineer by participating in the Center for Career Education's upcoming New York Engineering Internship Program. The Program is targeted for Summer 2010 and designed exclusively for SEAS students.

COLUMBIA UNIVERSITY CENTER FOR Career Education

CCE will offer 20 summer internship opportunities - from all major engineering disciplines – with 10 opportunities targeted at graduate students and 10 targeted at undergraduates. Opportunities will be extensively marketed to relevant student segments helping build employer brand awareness on campus and ensuring a large selection of qualified candidates. CCE will provide each student participant with an alum mentor, pre-program training, check-ins throughout the summer, and a celebratory event for employers, mentors and student participants. If interested, please contact Patrick Smith at 212-854-5496 or ps2211@columbia.edu. Your support is greatly appreciated!

The Center for Career Education (CCE) offers many opportunities to connect with Columbia alumni and students through internships, industry panels, networking events and online programs, and recruitment programs. CCE also offers support to alumni through career counseling, career development workshops, and career resources. To learn about CCE's broad range of programming offerings and resources, please visit our Web site: http://www.careereducation.columbia.edu

Department of Mechanical Engineering Fund

Yes, I want to support the Mechanical Engineering Department with my gift of:

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This gift is tax deductible as allowed by law. Please return this form and your check to:

Professor Y. Lawrence Yao, Chair,
Department of Mechanical Engineering, Columbia University
220 Mudd Building, MC 4703, 500 West 120th Street, New York, NY 10027

SEAS CELEBRATES FACULTY EXCELLENCE: ME PROFESSORS HONORED

SEAS Dean Feniosky Peña-Mora warmly introduces faculty honorees at the Faculty Excellence reception in October.

At Columbia's *Celebrating Faculty Excellence* reception on Tuesday, October 27, Mechanical Engineering Professors **Nabil Simaan**, **Chee-Wei Wong** and **Y. Lawrence Yao** were honored, among selected faculty members from other departments, for awards, honors and recognitions received over the past academic year.

Assistant Professor Nabil Simaan was recognized for receiving the National Science Foundation (NSF) Faculty Early Career Development (CAREER) Award to support his research to provide the theoretical foundation for modeling and control of flexible robots for intelligent and safe interaction with the anatomy. Associate Professor Chee-Wei Wong was honored for receiving the 2009 3M Young Faculty Award to support his research into sub-wavelength nanostructures. Professor and Department Chair Y. Lawrence Yao was recognized for his election as Fellow in the Society of Manufacturing Engineers (SME) and as President of the North American Manufacturing Research Institution of SME (NAMRI/SME). SME is the world's leading professional society serving the manufacturing industry.

School of Engineering and Applied Sciences Dean **Feniosky Peña-Mora**, in his introduction of the honorees, congratulated "the newest members to the prestigious circle of outstanding faculty members who have made our School their academic home." He noted that the recipients "are joining the continuum of faculty excellence that has been, and continues to be, a hallmark of the School."

For more information about the SEAS celebration of faculty excellence, please go to: http://engineering.columbia.edu/celebrating-faculty-excellence

We welcome submissions for our department newsletter.

Please send your news and your contact information to the address below or send an e-mail to:

seasinfo.me@columbia.edu

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