SPRING 2007

BIOFEEDBACK

THE FISCHELL DEPARTMENT *of* BIOENGINEERING
A. JAMES CLARK SCHOOL *of* ENGINEERING

www.bioe.umd.edu

A NEWSLETTER FOR ALUMNI AND FRIENDS OF THE FISCHELL DEPARTMENT OF BIOENGINEERING AT THE A. JAMES CLARK SCHOOL OF ENGINEERING, UNIVERSITY OF MARYLAND, COLLEGE PARK.

IN THIS ISSUE:

Fischell Family Donates $31M to Create Bioengineering Department

Clark School benefactor Robert E. Fischell and his family have donated $31 million to establish The Fischell Department of Bioengineering and The Robert E. Fischell Institute for Biomedical Devices. The Clark School announced the gift on December 19, 2005 in a ceremony in the Jeong H. Kim Engineering Building. Fischell's sons David, Scott and Tim took part in the ceremony along with their own families. The donation is not Fischell's first; this spring, the Graduate Program in Bioenginering will name the fourth recipient of the Fischell Fellowship in Biomedical Engineering.

The Undergraduate Program, which launched in Fall 2006, has completed its first academic year. The 4 year-old multidisciplinary Graduate Program in Bioengineering, now administered by the new department, will continue to draw participating faculty from across the University, including the A. James Clark School of Engineering, the College of Chemical and Life Sciences, the College of Computer, Mathematical and Physical Sciences, the Maryland Technology Enterprise Institute, the University of Maryland Biotechnology Institute, and the Schools of Medicine, Dentistry, and Pharmacy.

The Fischells see the gift as their chance to make the world a better place.

"The finest goal that engineering can achieve is to improve the quality of life for millions of people throughout the world," Fischell told the audience at the 2005 ceremony, "Bioengineering and biomedical devices are the most direct means to achieve that goal.

ROBERT FISCHELL

"Wealth allows us to do good works and to remove impediments to bettering the human condition. Our gift to the Clark School will help engineering students to develop their ideas to improve health care for human beings throughout the world."

Fischell, who holds more than 200 patents, is the father of modern medical stents, lifetime pacemaker batteries and implantable insulin pumps. His latest inventions could warn of impending heart attacks, end epileptic seizures and stop migraine headaches. He serves on the Clark School Board of Visitors and the University of Maryland Foundation Board of Trustees, and was recently inducted into the Clark School's Innovation Hall of Fame. He received a Masters degree in physics from the University in 1953.

chair's MESSAGE

WILLIAM BENTLEY

IT'S AN EXCITING TIME TO BE AT THE A. JAMES CLARK SCHOOL OF ENGINEERING!

The Fischell Department of Bioengineering is just a year old and has started a new Bioengineering undergraduate program. This past winter marked the first ever undergraduate recruiting effort for the Bioengineering B.S. program and already 173 students have been admitted to it—the second-highest number of students in a single program in the entire Clark School! This clearly signals a strong and positive vote of confidence in our curriculum, our faculty and our staff. To forge our journey, Professor Peter Kofinas (see p. 3) will now serve as the director of the Graduate Program in Bioegineering, and the new undergraduate program will be directed by Professor Adel Shirmohammadi (see pp. 2–3). Both will be supported by an entirely new staff (see page 14)!

And we've only just begun!

In addition to our over 50 graduate program faculty members from across the University of Maryland, we've built an excellent core department faculty from professors within the Clark School, as well as new arrivals. Professors Helim Aranda-Espinoza, John Fisher, Peter Kofinas and I come from the Department of Chemical and Biomolecular Engineering and the Graduate Program in Bioengneering; professors Keith Herold and Adam Hsieh join us from Mechanical Engineering and the Graduate Program in Bioengineering; and professors Arthur Johnson, Hubert Montas, Adel Shirmohammadi, and Yang Tao join us from the Department of Biological Resources Engineering. In Fall 2006 Sameer Shah (see page 4) came to the Clark School from the University of California, San Diego. Joonil Seog (see page 4) from the CBR Institute for Biomedical Research, Inc., located at the Harvard Medical School joined us in Spring 2007 with a joint appointment with the Department of Materials Science and Engineering. Our most recent addition is Professor Bruce Yu (see page 5), who comes from the University of Utah in Pharmacy and Bioengineering, to a position that for the first time bridges the Clark School and the University of Maryland, Baltimore (home of our Schools of Pharmacy, Dentistry, and Medicine). Searches are currently underway for additional faculty members. You can learn more about all of our faculty—department, undergraduate program, and graduate program—and their research interests by visiting our web site at www.bioe.umd.edu/facstaff/.

Finally, one might ask where are all of these students, staff, and faculty going to reside? Due to the tremendous generosity of Dr. Robert Fischell and his family, we are already building onto the 2 year-old Kim Engineering Building—we are scheduled to have a new 6000 f^2 of laboratory and office space ready for occupation by the year's end. You can see the progress live online by visiting www.bioe.umd.edu/webcam/.

Why don't you stop by or drop me a line? We'd be happy to host a visit and share with you our achievements and progress. E-mail me at bentley@umd.edu or call me at (301) 405-4321.

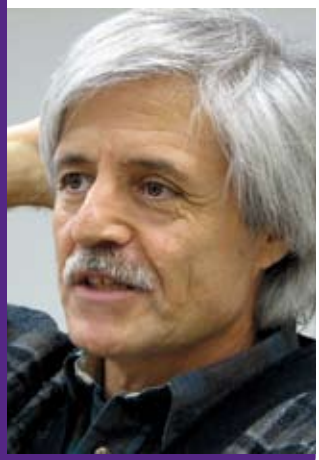
William E. Bentley
Herbert Rabin Distinguished Professor and Chair

educationNEWS

LAYING THE FOUNDATION OF OUR UNDERGRADUATE PROGRAM

Adel Shirmohammadi, Professor, Associate Chair, and Director of Undergraduate Studies

I assumed the role of Associate Department Chair and the Director of the Undergraduate Program in the Fischell Department of Bioengineering (BioE) in September 2006. I was asked to serve in this capacity after having had over 19 years of experience coordinating the advising of the Undergraduate Program in Biological Resources Engineering (BRE), which transitioned into the Undergraduate Program in Bioengineering in July 2006. The faculty and staff of both departments have been very helpful throughout the process, making the experience rewarding for both our students and myself. Supportive fellow faculty advisors, dedicated and kind Clark School advising staff, and strong leadership on the part of both departments' chairs have made it all possible.



ADEL SHIRMOHAMMADI

Advising is something I have been dedicated to for many years. I was honored to be recognized as a finalist for the 2002 Outstanding Advisor of the Year Award by the University of Maryland's Parent Association; was awarded the 2003-2004 Faculty Academic Advisor of the Year Award by the Provost's Commission on Academic Advising; and was honored by the Philip Merrill Presidential Scholar Program in 2004 for my work as a faculty mentor.

In my new position, I work closely with our Assistant Director of Academic Studies and Student Affairs, Jaclin Warner,

to advance the objectives of our program on many levels. She and I coordinate all the tasks related to our curriculum committee, where discussions on teaching assignments, biological and engineering science electives, new course offerings, VPAC approvals, and more take place. We also organize tours of our laboratories and the department during Visit Maryland Days, Open Houses for Academically Talented Students, and Open Houses for Admitted Students. We also work with Dr. Pertmer, Associate Dean of the Clark School, and his advising staff in the Student Affairs Office, on all issues related to advising, admission criteria, benchmarks for student progress, and audit criteria for graduation.

I also work closely with our students to help them achieve their academic objectives and expand their horizons by joining different research and internship programs. The Baltimore/Washington, D.C. corridor provides many opportunities for our undergraduates to work at Federal agencies such as the NIH, FDA, EPA, and USDA-ARS. Our students can take advantage of the Clark School's Co-op & Career Services, which helps them find internships at the diverse engineering firms in the area. We also offer many undergraduate research opportunities in our faculty's laboratories, both here at UMCP and with our partners at the University of Maryland's Medical, Dental, and Pharmacy Schools in Baltimore. Research opportunities are offered in the summer though our NSF-funded REU (Research Experiences for Undergraduates) program, directed by Assistant Professor John Fisher.

Despite the fact that Undergraduate Program in Bioengineering started so recently, the backbone of the academic curriculum had been offered by the Department of Biological Resources Engineering since 1990. We have a track record of over 16 years of offering courses that link engineering to biology. Our program objectives are to teach students to apply engineering principles and design concepts to biology at different scales ranging from cellular to systems level. We train students who will base their engineering education on biological principles, enabling them to help prevent diseases, improve health, and sustain the biosystem integrity. Graduates may choose to go into the medical, dental, and pharmacy fields, pursue graduate degrees (both M.S. and Ph.D.), or work in industry or government. Their broad-based bioengineering education provides them the skills and knowledge needed to work in biomedical, biotechnology, and environmental firms, as well as many other federal and state agencies. Our successful track record with the BRE program is a testament to the future success of our graduates in any career or educational direction they wish to pursue.

Providing the best advising and mentoring services to our students has always been and will continue to be my primary goal. I consider it an honor to help our great group of students be efficient in taking their courses and dealing with academic challenges, whether in my classes or through our mentorship programs.

If you wish to contact me regarding our exciting and new BioE program, please send me an e-mail at ashirmo@umd.edu or call me at (301) 405-1185.

MAKING A GREAT GRADUATE PROGRAM EVEN BETTER

Peter Kofinas, Keystone Professor, Associate Chair, and Director of Graduate Studies

As the new Director of the Graduate Program in Bioengineering, I have two important goals: to develop and maintain a top-ranked program for the best faculty and students; and to make sure we earn that recognition amongst our peers in academia, government, and industry.

On the academic side, I'll be working closely with Jaclin Warner, our Assistant Director of Academic Studies and Student Affairs, on the recruitment and retention of students, the admissions process, and the registration and advising of first year students. I'll also be coordinating the development of courses, faculty and T.A. assignments, and the administration of the Ph.D. Research Aptitude Exam, as well as participate in the Graduate Advisory Council, which formulates and implements policies common to all graduate programs in the Clark School.

Getting the word out about the department and program, and encouraging dialogue and collaboration with other researchers in public and private sectors, helps us stay competitive, brings in funding, and keeps things interesting! In the past year we've enjoyed new print materials, a remodeled website (www.bioe.umd.edu) and another great Bioengineering Seminar Series. We've also partnered with major labs and organizations such as the FDA, NIH and NIST on research projects and to promote the program.

Supporting great students is a priority. One of my duties is to nominate the best for fellowships including the new Future Faculty Program (see page 12) and the Flagship Fellowship. Working with the Maryland Technology Enterprise Institute (MTECH), I have revised the format of our own Fischell Fellowship in Biomedical Engineering to include a business plan competition component which we feel reflects Dr. Fischell's emphasis on the entrepreneurial spirit.

So far, my day to day duties are full of new experiences, and I look forward to them all. If you have any questions or would like discuss the program, please feel free to contact me at kofinas@umd.edu or (301) 405-7335.

PETER KOFINAS

facultyNEWS

NEW FACULTY MEMBERS ENRICH DEPARTMENT, GRADUATE PROGRAM

JOONIL SEOG

SEOG JOINS FACULTY

The Fischell Department of Bioengineering and the Department of Materials Science and Engineering are pleased to welcome faculty member Dr. **Joonil Seog**, who was jointly appointed to the departments as an Assistant Professor in Spring 2007.

Seog received his Ph.D. from the Massachusetts Institute of Technology (MIT) in 2003. Before joining our faculty he was a research fellow at the CBR Institute for Biomedical Research, Inc., located at the Harvard Medical School. He will be developing and teaching graduate level and lab courses on single molecule mechanics in which students can be involved in cutting-edge research and get hands-on experience with experiments and related equipment.

Seog's research will provide insight into the design of nanomechanically tailored smart biomaterials that can enhance tissue regeneration or slow down disease progression. He focuses on studying the structure-function relationship of biological molecules using single molecule force spectroscopy. Previously, Seog examined the molecular origin of cartilage biomechanical properties, and conducted the first study elucidating the structure and biomechanical function of polysaccharides in cartilage using tools that could measure very small forces such as individual molecular interactions.

Seog is currently pursuing a study of the structural change of biological molecules in a disease state. Many diseases are caused by mutations in the genes that cause structural change, leading to the degeneration of the body's auto-immune response. Seog believes that understanding how these changes affect the nanomechanical properties of proteins and tissues can help prevent or cure diseases.

He also explores the interaction between synthetic and biological materials. His research in this area will support current efforts to incorporate biological molecules into small devices in order to utilize them as molecular sensing devices such as DNA chips, protein chips, and silicon-based drug delivery devices.

Seog will also be examining the single molecule mechanical properties of synthetic and biological macromolecules. His goal is to enhance our understanding of basic biological and physical phenomena, as well as enable us to apply them directly when building smart molecular devices or single molecule devices.

SHAH JOINS FACULTY

The Department is pleased to announce that Dr. **Sameer Shah** joined the bioengineering faculty as an Assistant Professor in Fall 2006. Shah comes to UMD from the University of California, San Diego, where he had been a postdoctoral fellow in the Department of Cellular and Molecular Medicine since 2002. He earned his Ph.D. from the University of California, San Diego in 2002.

Shah leads the Neuromuscular Bioengineering Laboratory. His research interests include the study of neuronal transport, neuromuscular plasticity and disease, nerve biomechanics, and the development of intraneuronal diagnostic and therapeutic solutions.

Shah's research broadly falls under the field of "neuroscience"—understanding how the nervous system functions normally, how it breaks down during the course of neurodegenerative diseases, and how we can diagnose and treat neurodegeneration. His research group is studying how neurons interact with other cells in their environment, including targets such as muscle cells, and regulatory cells such as myelin.

SAMEER SHAH

The nervous system is generally thought of as an electrical network. However, nerves also face a tremendous trafficking challenge. Many of the nutritional, structural, and signaling proteins required for a neuron to function electrically are moved back and forth by molecular motors on microtubule tracks running within long tubes called axons. The distances over which these cargoes are transported can be up to a meter in length (for example, from protein manufacturing sites located in the spinal cord to nerve terminals in a person's toes).

To study transport, Shah and his group make movies of endogenous and synthetic cargoes moving in cultured cells, or in some cases, in small animal models. They use several imaging techniques, including high resolution fluorescence microscopy. They study cargo traffic patterns in these movies by measuring parameters of cargo motion such as velocities, cargo flux, and pause frequencies, determined by using a custom particle-tracking software developed with collaborators at The Scripps Research Institute in La Jolla, Ca. and the University of California, San Diego.

BRUCE YU

Shah continues his collaborations with colleagues from his graduate and postdoctoral work at UCSD, and is developing new collaborations with members of the department and the University of Maryland community.

UPADHYAYA JOINS GRADUATE PROGRAM FACULTY

The Graduate Program in Bioengineering is pleased to announce that Assistant Professor **Arpita Upadhyaya** (Physics, IPST) has become a participating faculty member.

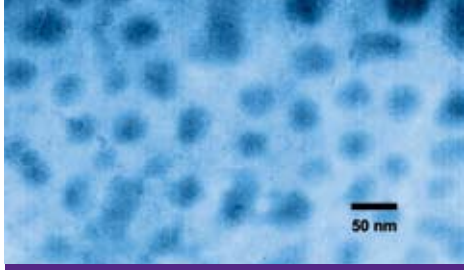
Nature has engineered many molecular and cellular machines that induce motion at different scales, from the level of single cells to that of multicellular tissues. The cell membrane, the cytoskeletal polymers and other proteins collectively form a highly nonlinear, adaptive dynamical system that allows the cell to respond to its environment. Research in Professor Upadhyaya's laboratory combines mathematical modeling, quantitative imaging and genetic manipulation to uncover how signaling networks and physical properties of the cell and its surroundings control force generation and directed cell motion. Current projects include actin polymerization, biological springs, morphogenetic cell movements, surface mechanics in yeast, membrane nanotubes, and direction sensing.

SUKHAREV JOINS GRADUATE PROGRAM FACULTY

The Graduate Program in Bioengineering welcomes Associate Professor **Sergei Sukharev** (Biology), who has become a participating faculty member.

Sukharev teaches Mammalian Physiology (BSCI 440/441) and Molecular Physiology of Ion Channels, Receptors and Transporters (BIOL 608R seminar). In the Spring 2007 semester he and Professor Marco Colombini (Biology) offered a new course titled Cell Biology from a Biophysical Perspective, which has been designed for physicists, chemists and engineers interested in biophysics.

Sukharev investigates how cells detect mechanical force and pressure in order to adapt to changes in their environment, or to facilitate functions such as hearing and balance. He studies ion channels—natural nano-valves that conduct ions across plasma membranes—which are thought to convert mechanical stimuli into electrical or chemical signals received by cells. His projects involve both experimental approaches and molecular modeling and simulation. He utilizes a wide variety of activities and techniques, including molecular modeling and simulations, genetic modifications of ion channel genes, disulfide cross-linking, biochemical purification of proteins and reconstitution into phospholipid membranes, single-channel recording and video imaging of patch-clamped membranes, and kinetic and thermodynamic analysis of channel behavior.



FROM THE FUNCTIONAL MACROMOLECULAR LABORATORY

A TRANSMISSION ELECTRON MICROSCOPY PICTURE OF NICKEL NANOSPHERES TEMPLATED BY A SELF-ASSEMBLED BLOCK COPOLYMER. RECOMBINANT PROTEINS SELECTIVELY BIND TO THE NANOSCALE NICKEL PATTERN, AND ARE IMMOBILIZED ON THE POLYMER SURFACE. SUCH INTERACTIONS OF RECOMBINANT PROTEINS WITH BLOCK COPOLYMER SURFACES DISPLAYING NANOSCALE ORDER COULD BE USED TO INVESTIGATE INTERCELLULAR SIGNALING, AND FOR CREATING ARRAYS OF NANOREACTORS FOR LAB-ON-A-CHIP DEVICES.

YU JOINS FACULTY

The department welcomes our newest faculty member, Associate Professor **Bruce Yu**, who joined us in March 2007. Yu holds a joint appointment with the University of Maryland, Baltimore's School of Pharmacy.

Yu received his Ph.D. from Johns Hopkins University in 1996. Before coming to Maryland he held a postdoctoral position at the University of Alberta, Canada and served as an assistant professor in the Department of Pharmaceutics and Pharmaceutical Chemistry at the University of Utah. He is the recipient of a Kimmel Scholar Award in cancer research (2004) and a Presidential Early Career Award for Scientists and Engineers (PECASE) for his biomaterials research (2005).

With firm roots in chemistry, Yu's research falls into two categories: the engineering of mechanosensors to aid the repair and rehabilitation of injured musculoskeletal tissues, and the delivery of radiopharmaceuticals for cancer therapy. He also plans to begin surface coating research.

Currently, mechanosensors that measure mechanical forces in the human body are made of metals, ceramics and plastics. Surgery is required both to implant and retrieve them. Yu is developing force-sensitive nanofiber networks (FSNN). FSNN are made of pliable biomaterials (peptides and their derivatives), so that they are both injectable and biodegradable. FSNN are embedded with magnetic probes that can be detected by magnetic resonance imaging (MRI).

For the delivery of radiopharmaceuticals (drugs that carry radionuclides as part of radiation therapy for cancer), Yu is developing fluorocarbon nanoparticles as multifunctional delivery vehicles. His approach is to integrate MRI with targeted therapy, allowing doctors to monitor radiopharmaceuticals in real time and to create individualized treatment plans for cancer patients based on their responses to medication. The project has received funding from the NIH, the PHRMA Foundation, and the Kimmel Foundation.


JOHN FISHER

FISHER EDITS BOOKS, JOURNALS ON TISSUE ENGINEERING

Assistant Professor **John Fisher** has edited two recently-published works on tissue engineering: *Advances in Experimental Medicine and Biology, Vol. 585: Tissue Engineering* (Springer, 2006); and the tissue engineering section of *The Biomedical Engineering Handbook, 3rd edition* (CRC, 2006). Both volumes are aimed at serving the needs of researchers, advanced students, and industrial investigators.

The Biomedical Engineering Handbook is a timely, multi-volume reference covering all aspects of bioengineering. Fisher co-edited the tissue engineering section—which covers fundamentals, enabling technologies, and applications—with colleague Dr. **Antonios Mikos** of Rice University. Contributors include leaders and experts in the field from around the world, including Fisher himself, whose paper titled "Polymeric Scaffolds for Tissue Engineering Applications," was co-authored with graduate student and Fischell Fellow Diana Yoon. Bioengineering Professor and Chair **William Bentley** also has a paper in the *Handbook,* titled "Systems and Technology Involving Bacteria," co-authored with alumna **Nicole Bleckwenn** (Chemical Engineering '04); as does Professor **Art Johnson**, who contributed "Factors Affecting Mechanical Work in Humans."

Fisher is the primary editor of *Advances in Experimental Medicine and Biology, Vol. 585: Tissue Engineering,* a project that emerged from the 2nd International Tissue Engineering Conference held in Crete in 2005. Colleagues and conference organizers approached him after the successful event, asking him to oversee the compilation and publication of the research. The book includes review papers and new research in stem cells, signals, scaffolds, applied technologies, animal models, regulatory issues, and tissue engineering strategies. As with the *Handbook,* Fisher is one of many world-recognized experts whose work is featured in the book. His paper titled "Chondrocyte Signaling and Artificial Matrices for Articular Cartilage Engineering," also co-authored with Yoon, describes how cellular functions are affected by exposure to biomaterials.

Most recently, Fisher was named Reviews Editor for *Tissue Engineering,* the leading journal in its field and the official journal of the Tissue Engineering and Regenerative Medicine International Society. In this position, he will be involved in the recruitment of and editorial processes for manuscripts which provide a broad and current analysis of tissue engineering.

2 BIOE FACULTY NAMED KEYSTONE PROFESSORS

Please join us in extending our congratulations to Associate Professor **Kenneth Kiger** (Mechanical Engineering, Graduate Program in Bioengineering) and Professor **Peter Kofinas**, who were selected to join Keystone: The Clark School Academy of Distinguished Professors, which honors professors who have made a commitment to the improvement of education in fundamental engineering courses. The program recognizes the Clark School's most outstanding instructors and enlists their support to promote excellence in education. Keystone aims to improve student retention and graduation rates by ensuring students the best learning experiences in the early, formative stages.

PROFESSORS RECOGNIZED AS RESEARCH LEADERS

Professor **Peter Kofinas**, director of the Graduate Program in Bioengineering, and Associate Professor **Sergei Sukharev** (Biology), a participating faculty member in the graduate program, were among 233 university faculty recognized for their efforts in bringing sponsored research dollars to campus.

Kofinas' grant earnings fund graduate and undergraduate students, as well as supplies and equipment for the Functional Macromolecular Laboratory. His projects are supported by the Air Force Office of Scientific Research, the intelligence community, the National Science Foundation (NSF), the Office of Naval Research, and the United States Department of Agriculture (USDA).

Sukharev's research focuses on molecular mechanisms of mechanosensitive ion channels. His grants from the NIH currently support the study of protein-lipid interactions that mediate the transmission of tension, hydration of channel pores, and the computational modeling and analysis of the main functional states of bacterial tension-activated channels known as MscS and MscL.

KOFINAS AWARDED U.S. AIR FORCE GRANT

Professor **Peter Kofinas** was awarded a single investigator grant from the Air Force Office of Scientific Research to develop nanostructured polymers for flexible antennas and other radio frequency devices. The goal of this research is to develop flexible polymeric nanocomposites having high permitivities & permeabilities for use in radio frequency (RF) applications.


J. HELIM ARANDA-ESPINOZA

YANG TAO

TAO INVITED TO SPEAK AT SMITH SCHOOL OF BUSINESS

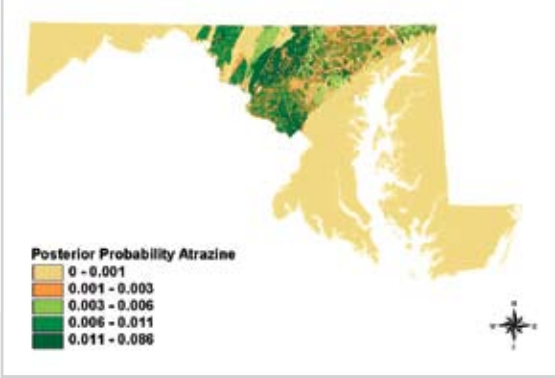
Professor **Yang Tao** was invited to speak at an invitation-only event at the Robert H. Smith School of Business. Tao discussed imaging technologies at a Technology Visionary Series panel called "The Digital Divide." The panel brings together researchers and leaders from throughout the University of Maryland to provide insight to the venture capital community on how to understand technological developments, and what market opportunities are ripe for investment over the coming years.

SHIRMOHAMMADI DELIVERS KEYNOTES AT INTERNATIONAL EVENTS

In 2006, Professor **Adel Shirmohammadi** was invited to deliver the keynote address at two major events focusing on the environment and human health.

In April 2006, he headlined the International Symposium on Water and Land Management for Sustainable Irrigated Agriculture, sponsored by the Cukurova University in Adana, Turkey, speaking on the topic of "Environmental Impacts of Irrigation and Drainage."

He was also the keynote speaker at the June 2006 Transport and Retention of Pollutants from Different Production Systems Conference, held in Tartu, Estonia and sponsored by the Nordic Association of Agricultural Scientists. His presentation was titled "Modeling at Catchment Scale," which explored the relationship of herbicides and nitrates in groundwater to incidents of childhood cancers, and uncertainty in watershed scale models in predicting nutrient and pesticide loadings to stream systems.



FROM "MODELING AT CATCHMENT SCALE"

FISHER TEAM WINS LIFE SCIENCE INVENTION OF THE YEAR

In April 2006, Assistant Professor **John Fisher**, Biological Resources Engineering undergraduate **Parth Modi**, Chemical and Biomolecular Engineering graduate student **Jennifer Lynn Moreau** (M.S. '06), and visiting graduate student **Sachiko Kaihara** (Keio University, Tokyo, Japan) were awarded the University of Maryland Office of Technology Commercialization's 2005 Life Science Invention of the Year Award.

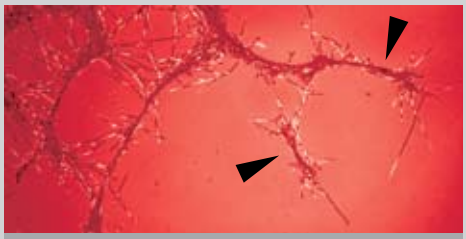
The team produced new, patent-pending biomaterials for tissue engineering that avoid problems with premature degradation associated with previous materials developed for growing new cells within the body.

ARANDA-ESPINOZA WINS NSF CAREER AWARD

Assistant Professor **J. Helim Aranda-Espinoza** has received a National Science Foundation (NSF) Faculty Early Career Development (CAREER) Award. He received the $400,000 award for his proposal "Mechanotaxis of Axons and Neurons." The goal of the project is to understand, at a fundamental level, how neurons migrate and axons elongate as a function of the mechanical properties of the substrate. The knowledge acquired in this research will allow for precise tailoring of the mechanical properties of substrates to direct the growth of axons, which could be used for nerve regeneration after trauma in the peripheral or central nervous system.

Aranda-Espinoza leads the Cell Biophysics Laboratory, which applies the theoretical and experimental machinery of physics and engineering to obtain a quantitative understanding of specific problems inspired by biological systems. The group studies the mechanics and motility of healthy cells, as well as those of cells with pathological conditions. Of particular interest for the group is to understand how the mechanical environment dictates cell functions.

The NSF CAREER program supports the career development of outstanding junior faculty who most effectively integrate research and education within the goals and missions of their programs, departments, and schools.



FROM THE CELL BIOPHYSICS LAB

IRM (INTERFERENCE REFLECTION MICROSCOPY) WAS PERFORMED ON PC12 CELLS ATTACHED TO POLY-D-LYSINE COATED DISHES. THIS TECHNIQUE IDENTIFIES STRONGLY ATTACHED VERSUS WEAKLY OR UNATTACHED AREAS OF PC12 CELLS. ATTACHED AREAS ARE DARK IN COLOR, WHILE LESS ATTACHED SECTIONS OF THE CELLS ARE LIGHTER OR WHITE. WHEN CULTURED IN THE PRESENCE OF NERVE GROWTH FACTOR, PC12 CELLS EXTEND AXON-LIKE PROCESSES (ARROWS), WHICH ALLOW FOR AN EXPERIMENTAL MODEL OF AXON ELONGATION.

DEUTSCH FOUNDATION: $1 MILLION FOR NANO-BIO INITIATIVE

The Robert W. Deutsch Foundation will give more than $1 million over four years to the University of Maryland's A. James Clark School of Engineering for biological research on the nanoscale.

A cross-disciplinary group of researchers associated with the Clark School, including Fischell Department of Bioengineering Professor and Chair **William Bentley** and Graduate Program in Bioengineering faculty Professors **Reza Ghodssi** (Electrical and Computer Engineering) and **Gregory Payne** (UM Biotechnology Institute), is developing a new "biochip" technology that promises to give doctors a new way to discover drugs to treat bacterial infections—without stimulating resistance-building mutations.

The Deutsch Foundation, based in Baltimore, is funding the work in the hope of speeding development of new life-saving drugs and advancing the new field of nano-biotechnology.

"We are very excited and pleased to support this pioneering research, which represents the enormous potential in the merging of biology and nanotechnology," said **Robert W. Deutsch**, foundation president. "We believe that practical applications of this research could become the source of future innovations."

Anthrax, tuberculosis, meningitis and pneumonia are all caused by bacteria and treated through the use of antibiotics. But bacteria can mutate, and develop resistance to the antibiotics—even to vancomycin, the most potent antibiotic currently available to doctors.

Researchers from the Clark School and the University of Maryland Biotechnology Institute (UMBI) in College Park, and the School of Pharmacy in Baltimore, are developing a nanoscale, microfluidic biochip that can serve as a tiny drug discovery laboratory. The chip can, in effect, serve as a miniature test subject—accepting a drug and reporting back on how it performs.

The Deutsch Foundation is funding a specific biochip research program designed to complete the group's work and demonstrate its usefulness. The program will investigate biochips that address quorum-sensing bacteria, or bacteria that gather in an area of the body and signal each other until there are enough bacteria gathered to mount an attack. If a drug is found that can block the bacteria from signaling each other, the attack can be prevented.

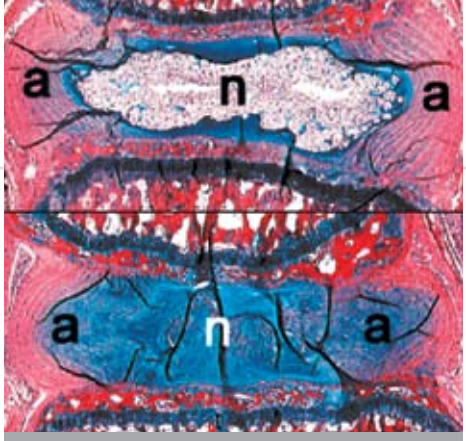
The biochip can be used as a testbed for such drugs—drugs that the bacteria won't be able to develop a resistance to, unlike antibiotics. Success for this application could have widespread implications for testing drugs for a wide range of health problems.

CROSS-DISCIPLINARY TEAM SEEKS TO IMPROVE CONTROL SYSTEM FOR CANCER DIAGNOSIS, TREATMENT

Professor **Thomas McAvoy** (Emeritus, ChBE, Institute for Systems Research, and Bioengineering) is part of a team of University of Maryland engineers, scientists, and oncologists awarded an NIH grant for a project titled "Feedback Control and Inferential Modeling for Radiotherapy." The project's goal is to develop a new approach to planning and conducting radiation treatment in cancer patients.

While receiving treatment, a patient's respiration may cause a tumor to move, making the delivery of radiation to the right place more difficult, and irradiating healthy tissue in the process. Previous attempts at addressing the problem included having the patient hold his or her breath and gating, a system in which delivery is synchronized with the patient's breathing. Holding breath can be difficult for patients, while gating increases the amount of time needed to deliver the treatment, and as a result increases the cost.

McAvoy and his team are developing a motion-synchronized "treatment couch" that uses feedback control and inferential skin markers to follow tumor movement and direct the radiation therapy. While tumors are not monitored during radiation treatment, markers on the patient's skin can be, allowing the system to estimate where a tumor is based on the markers' position. This information on tumor location is then used via a feedback control system to move the treatment couch to compensate for breathing-induced tumor motion, resulting in the tumor being effectively held in a stationery position. McAvoy has four decades of experience developing feedback control systems and also specializes in inferential sensing, making him a key member of the development process. As part of the research, the team will build a working prototype treatment couch. If ultimately put into clinical use, the couch could significantly increase the accuracy and effectiveness of treatments for lung and upper abdominal cancers.



FROM THE ORTHOPAEDIC MECHANOBIOLOGY LAB

TOP: HISTOLOGY SECTIONS ILLUSTRATING THE NORMAL COMPOSITION AND MICROARCHITECTURE OF THE INTERVERTEBRAL DISC FROM THE SPINE OF A MOUSE. THE LAB USES RODENTS AS MODEL SYSTEM TO STUDY THE EFFECTS OF CONTROLLED LOADING ON DISC DEGENERATION. **BOTTOM:** A DISC THAT HAS BEEN EXPOSED TO MECHANICAL OVERLOADING EXHIBITS DEGENERATIVE CHANGES THAT RESEMBLE WHAT HAPPENS IN HUMANS DURING AGING. IT IS ONE OF THE KEY PIECES OF EVIDENCE THAT MECHANICAL STRESS CONTRIBUTES TO THE ACCELERATION OF DEGENERATIVE PROCESSES IN INTERVERTEBRAL DISCS.

FOR MORE INFORMATION ON THE LAB'S RESEARCH EFFORTS, PLEASE SEE THE RELATED STORY AT RIGHT.

HSIEH RECEIVES GRANT FROM SYNTHES, INC.

Assistant Professor **Adam Hsieh**, Director of the Orthopaedic Mechanobiology Lab, has been awarded an industry grant from Synthes, Inc. totaling over $260,000 to fund research on tissue and bone remodeling.

Synthes is a leading worldwide manufacturer of devices and implants used in the repair, correction, and regeneration of human bones and tissues, with particular emphases on the spine, skull, face, and fracture healing. The company is also exploring biologics, non-invasive means of stimulating healing in orthopaedic tissues. Synthes learned about Hsieh's research through University of Maryland shock-trauma surgeon Robert O'Toole, with whom Hsieh is collaborating on a project to study intermediate-stage bone healing, and recognized the Orthopaedic Mechanobiology Lab was a good fit with their interests and goals.

Hsieh's lab studies the role of mechanical stress on the behavior and biological response of musculoskeletal tissues, with a particular focus on finding preventative and therapeutic interventions against disc degeneration. In addition to Synthes, the Orthopaedic Mechanobiology Lab has also received funding from or partnered with organizations such at the National Institutes of Health (NIH) and the National Institute of Standards and Technology (NIST).

Synthes' nonspecific grant will allow Hsieh and his group both to continue current research and to explore new territory in collaborative projects with other members of the University and the clinical faculty in the Orthopaedics department at the University of Maryland, Baltimore School of Medicine. "There is a culture of support in the orthopaedic community," Hsieh explained. "Industry often funds academic research even if it's not immediately tied to a specific product."

LEFT: ROHAN FERNANDES. TOP RIGHT: TRANSMISSION ELECTRON MICROSCOPE IMAGE OF THE MAGNETIC NANOFACTORIES (SMALL, DARK CLUSTERS) ATTACHED TO TARGETED *E. COLI* CELLS. TOP LEFT: SCANNING ELECTRON MICROSCOPE IMAGE OF THE NANOFACTORIES (WHITE CLUSTERS) ATTACHED TO THE SAME CELLS.

researchFEATURE

"SIDE EFFECTS MAY *NOT* INCLUDE..."

The list of side effects on your prescription bottle may one day be a lot shorter, according to researchers in the lab of Fischell Department of Bioengineering Professor and Chair **William Bentley**.

That's because instead of taking a conventional medication, you may swallow tiny "nanofactories," biochemical machines that act like cells, first conceived of at the Clark School.

For example, these ingested nanofactories, using magnetism, could detect a bacterial infection, produce a medication using the body's own materials, and deliver a dose directly to the bacteria. The drug would do its work only at the infection site, and thus not cause the side effects that may arise when an antibiotic travels throughout the body in search of infections.

Bentley, colleague **Gregory Payne** (University of Maryland Biotechnology Institute), and several graduate students including **Rohan Fernandes**, have developed this "magnetic nanofactory" concept and published their research in *Metabolic Engineering* in December of last year. Colleagues around the country voiced their support for the technology in *Nature Nanotechnology* last month.

"In the lab," Bentley says, "our group showed we can produce a tiny nanofactory and attach it to a target cell magnetically. The nanofactory then makes small molecules from surrounding materials and delivers the molecules—potentially drug molecules—to the targeted cell."

Besides drug molecules, the researchers showed that the nanofactory could produce signaling molecules that communicate with the target cell or block the target cell from communicating with other, similar cells (a process called "quorum sensing") and thus prevent infection. The researchers attached the nanofactories to *E. coli* cells, targeting them with the help of a mixture of iron particles and chitosan, a substance derived from the shells of crustaceans like crabs and shrimp. The nanofactories then produced a signaling molecule that could render the *E. coli* harmless. Nanofactories could be designed to produce the needed drug molecules over an extended period of time.

Now that the viability of nanofactories has been shown, researchers must overcome a few challenges before they can be used in humans. First, nanofactories must be cloaked so that the body does not react to them as a foreign substance and try to attack them. Another goal is to find a method to shut down the nanofactory once it has produced the needed substance—a type of off-switch that could be activated from outside the body. These and other topics are being investigated in the Fischell Department of Bioengineering.

studentNEWS: UNDERGRADUATE

STUDENTS IMPRESS AT CAPSTONE I WRAP-UP

It may have been a study day at the University of Maryland, but it was showtime for approximately three dozen Biological Resources Engineering (BRE) seniors enrolled in the first semester of their Capstone Design experience. The two-part course, taken in the fall and spring semesters by seniors in all majors, is one of the most important parts of the Clark School's engineering program. (BRE's capstone courses will subsequently be taught as BIOE 485 and 486 during its transition into the Fischell Department of Bioengineering, which is now administering both undergraduate programs.) In it, teams of students utilize what they have learned throughout their undergraduate studies to create their own engineering designs from concept to product. This semester, students, faculty and staff saw the presentation of eight designs covering a diverse range of ideas for biological and medical devices.

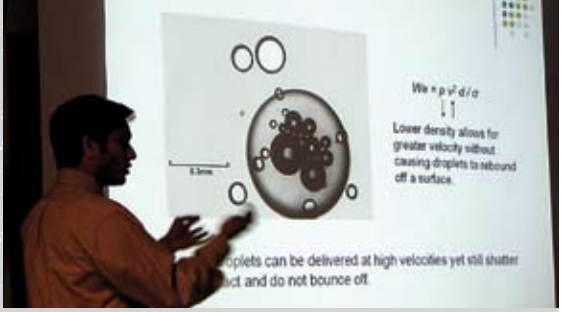
In Capstone I, lead in the Fall semester by Professor **Yang Tao**, coming up with an idea for a product is only the beginning. Teams must justify its need, prepare a budget, and research issues such as feasibility, target audience(s), materials, potential pitfalls, environmental impact, and already existing products or patents on a similar theme. Each team has a faculty mentor, and may also consult with and seek financial and other support from outside companies. Once their ideas are approved, a group of faculty serving as the "Board of Directors" provides funding through the Fischell Department of Bioengineering, allowing the teams to produce working prototypes of their designs in Capstone II the following semester.

Faculty mentors supporting the teams throughout the Capstone experience this year include Professors **Elias Balaras**, **Keith Herold**, **Adam Hsieh**, **Hubert Montas**, **Adel Shirmohammadi**, and **Yang Tao**. During the production process in the spring semester, students will also have the support of machinery and fabrication shop manager **Gary Siebel** and technician **Ali Jamshidi.**

The students' product ideas were both ambitious and realistic, and were all imagined with the ultimate goal of implementation in industry, medicine, or improving the quality of life for people in need. Designs included:

- a new, wireless means of monitoring heart patients' EKGs, providing better data collection and an early warning system if problems are detected;
- a device to reduce risks to patients during dialysis by analyzing blood in real-time;
- a portable, efficient, and inexpensive way to sterilize bacterial mediums used in a wide variety of research;
- a safer way to remove casts;
- an easy-to-use, hygienic, and inexpensive food and crop storage container for subsistence farmers in third-world countries;
- a device to manage and monitor dosing for people taking a large number of medications;
- an automated device that provides both back support and pain therapy; and
- a portable container that simultaneously heats and cools food, allowing for safer transportation and reducing the risk of food-borne illnesses.

A Q&A session followed each presentation, giving everyone in attendance the opportunity to comment, make suggestions, and ask sometimes tough questions. Professor Tao wrapped up the event by praising the Capstone students for their hard work, growth, and maturing engineering skills.



CAPSTONE I

UNDERGRADUATE PROFILE: STEVEN GRAFF

Gil Graff, B.S. '72, aerospace engineering, has spent the better part of his career in research and technological development in the Office of Naval Research, where his work has focused on the application of high-speed aerospace technologies to naval weapons.

Now Gil is watching another career unfold as his son Steven embarks on his own engineering quest as a member of the first freshman class of the Fischell Department of Bioengineering. "We share an interest in engineering," says Gil. But, he adds, "Steven is not following in my footsteps. This interest is all coming from him; he has always been a self-motivated child."

Steven Graff was admitted to several Ivy League schools, but chose the Clark School bioengineering program for its "newness." While some people might have been intimidated by that, or considered it an educational risk, he felt differently. "'Newness' gives so many advantages and opportunities that an established program does not offer," he explained. "First, they are more accepting of many different types of students, while in older, more established programs students have to fit their 'mold' of a bioengineering applicant." He was also attracted to the energetic faculty. "The attitude in the department is considerably more optimistic and full of buzz than a program that has already been well-established. [The faculty] are ready to work with you, ready to teach. [They] are open to new ideas from students and they know how to interact with us."

That interaction is especially important to Graff, who comes to the Clark School with an agenda. Afflicted with muscular dystrophy since birth he is acutely aware of the limita-

tions of the nation's health insurance system. "I dream about telling insurance companies that they had better give me health insurance coverage because I discovered the cause of muscular dystrophy," says Graff, who maneuvers around campus in his electric wheelchair. In years to come, he would like to attend medical school and conduct neurological or genetic research to "engineer" a cure and broaden health care coverage for individuals diagnosed with the disease.

Graff's inspiration came in high school, when he worked as a member of his school's first robotics team in a project sponsored by technology pioneer and Segway founder Dean Kamen. "He is one of the biggest names in the field of prosthetics," he told us. "We had to design and build a robot in six weeks with a goal to improve biomedics or prosthetic limbs." Now, to maintain that enthusiasm, he participates in the University's Gemstone program, which provides intensive research experiences for selected undergraduate honors students with interests in science and technology. He has also joined the Biological Resources Engineering Society.

While Graff told us he was pleasantly surprised at how interesting the undergraduate program in bioengineering was and how much it has to offer, he also confessed it has its challenges, and offered some advice for future freshmen: "Have a good biology background and pay attention to that as you go through the engineering fundamentals, like calculus, statics, physics and organic chemistry. Get a tutor, even if you aren't failing or understand the material. It can mean the difference between a B and an A." He also recommends prospective students take as many Advanced Placement classes and tests as possible.

And, he says, "Realize that everything you're doing has social implications whether you see it or not."

Nancy Grund contributed to this article.

BIOLOGICAL RESOURCES ENGINEERING/BIOENGINEERING STUDENT AWARDS 2006-2007

The Fischell Department of Bioengineering would like to congratulate the following outstanding undergraduates, who are this year's student award recipients.

THE ASABE, AMERICAN SOCIETY OF AGRICULTURAL & BIOLOGICAL ENGINEERS' STUDENT HONOR AWARD

Presented by ASABE on the basis of academic achievement, service to the department, student branch participation, and other extracurricular activities.

Awarded to Mckenzie C. Primerano

THE WASHINGTON, D.C.-MARYLAND SECTION OF ASABE, AMERICAN SOCIETY OF AGRICULTURAL AND BIOLOGICAL ENGINEERS' SCHOLARSHIP

Presented to an outstanding student based on academic achievement and contribution to the department and student ASABE branch.

Awarded to Stephanie N. Rew and Kchersti A. Ulvestad

THE ROBERT L. AND FRANCES C. GREEN SCHOLARSHIP IN THE DEPARTMENT OF BIOLOGICAL RESOURCES ENGINEERING/ BIOENGINEERING

Presented for academic achievement and contribution to the department and student body.

Awarded to Rachel L. Emmel

THE DEPARTMENT OF BIOLOGICAL RESOURCES ENGINEERING'S/ FISCHELL DEPARTMENT OF BIOENGINEERING'S OUTSTANDING JUNIOR AWARD

Presented by the Chair on the basis of outstanding academic achievement and contributions to the department.

Awarded to Rachel L. Emmel

THE DEPARTMENT OF BIOLOGICAL RESOURCES ENGINEERING'S/ FISCHELL DEPARTMENT OF BIOENGINEERING'S OUTSTANDING SENIOR AWARD

Presented by the faculty on the basis of academic achievement and contributions to the profession and the department.

Awarded to Yue-Hin Loke

STEVEN GRAFF

PHOTO BY MIKE MORGAN

TRENT BRADBERRY

BRADBERRY, GIFFORD SELECTED FOR FUTURE FACULTY PROGRAM

BioE graduate students **Trent Bradberry** and **Ian Gifford** were among only 20 students chosen to participate in the Clark School's new Future Faculty Program. Bradberry is advised by Professor José L. Contreras-Vidal of the College of Health and Human Performance's Department of Kinesiology. Gifford is advised by Department of Materials Science and Engineering Professor Mohammad Al-Sheikhly.

The Future Faculty Program (FFP), launched this year, was created to prepare students for academic careers in top-50 engineering schools. The program includes seminars, a teaching practicum, and a research mentoring practicum.

Bradberry explained his interest in becoming a professor: "What has pulled me the most to an academic career is the freedom to create, to imagine that which has never been done and to engineer it into existence without the boundaries sometimes present in private industry. I look forward to acquiring skills in the Future Faculty Program that will greatly aid me in obtaining and succeeding in a tenure-track faculty position in a top engineering school."

IAN GIFFORD

The initial noncredit component of the program was open to all graduate students interested in a career in academia. It introduced them to faculty "role models" who discussed why they chose a career in academia, how they secured tenure-track positions, and how they have achieved success.

Students who wished to stay with the program were required to apply. After a competitive selection process 20 students, including at least one representative from each of the Clark School's departments, were chosen to be Future Faculty Fellows. Fellows are awarded a supplemental fellowship, in addition to any teaching or research assistantships they may already have. Half of the funds are reserved for travel to professional conferences.

During the second, third, and fourth semesters of the program, Future Faculty Fellows attend seminars on topics such as technical writing, oral presentations, creating syllabi and curriculum, teaching and learning styles, identifying research areas, writing grants, and interviewing for faculty positions. Each Fellow is also paired with a senior faculty with whom they will teach a course and supervise an undergraduate research project, and from whom they will receive mentoring and career counseling.

GRADUATE POLYMER SYMPOSIUM

The Fischell Department of Bioengineering (BioE), Chemistry and Biochemistry, Chemical and Biomolecular Engineering (ChBE), and Materials Science and Engineering (MSE) hosted a half-day symposium on current polymer research at the University of Maryland.

Approximately 35 undergraduate, graduate, and postdoctoral students from the research groups of Professors **Al-Sheikhly** (MSE), **Briber** (MSE), **Greer** (ChBE and Chemistry), **Kofinas** (BioE), **Raghavan** (ChBE), and **Sita** (Chemistry) presented the results of recent projects. The goal of the symposium was to foster interactions and collaborations between students in different research groups.

POLYMER SYMPOSIUM

ChBE Assistant Professor Srinivasa Raghavan came up with the idea as a result of his desire to enhance interactions between his, MSE Professor and Chair Robert Briber's, and Fischell Department of Bioeningeering Professor Peter Kofinas' research groups. Briber and Kofinas' groups meet regularly and were familiar with each others' work, but wanted to know more about other polymer-related research being conducted at the University of Maryland. Kofinas then extended the invitation to the symposium to Professors Al-Sheikhly, Greer, and Sita, and their students.

"I believe this was a very successful event," said Kofinas. "Students were very pleased, and they got to know each other. It is important for like-minded groups to learn about each others' research to enhance research interactions and collaborations." Plans are in the works to make the polymer symposium an annual event, with even more research groups participating.

The symposium's subjects covered a broad range of science and engineering on polymer and biopolymer systems, including these from bioengineering students:

- "New types of polymer hydrogels, organogels, and nanocomposites"—**Bani Cipriano** (ChBE) and **Peter Thomas**
- "Soft materials based on biopolymers and vesicles"—**Matt Dowling**, **Chao Zhu**, and **Jenny Hong**
- "Ultra high molecular weight polyethylene for hip replacement" —**Marina Chumakov**

BIOENGINEERING GRADUATE PROGRAM CELEBRATES ITS FIRST GRADUATE

In May 2006 **Susan Lee** became the first student to earn a degree from the Graduate Program in Bioengineering. Lee, working under the supervision of Chemical and Biomolecular Engineering Professor Nam Sun Wang, earned her Master of Science in Bioengineering. She is currently a biomedical engineering Ph.D. student at the University of Southern California, studying ocular drug distribution using magnetic resonance imaging (MRI).

Asked about her experiences here, she told us, "The UMD bioengineering program helped me develop a firm foundation in research and fundamental biomedical topics, as I was able to dive right back into the research I have been so interested in. I am very thankful to have learned these skills at Maryland, and to be able to apply them to my research here at USC."

THE FISCHELL FELLOWSHIP IN BIOMEDICAL ENGINEERING

The Fischell Fellowship in Biomedical Engineering is a unique opportunity for talented and innovative graduate students interested in applied research and product design in the biomedical industry. The Fischell Fellowship is a competitive doctoral fellowship, awarded through a business plan competition, featuring:

- $35,000 (12-month stipend)
- Full tuition waiver
- Full health benefits

The Fischell Fellowship is renewable for up to 5 years as long as the recipient remains in good academic standing and continues his/her course of study.

At press time, the 2007 Fischell Fellow had yet to be named at our first annual Fischell Festival on May 3. We'll be sure to fill you in online and in the next newsletter!

To learn more about the Fellowship, including how to apply, visit:

www.bioe.umd.edu/fischell-fellowship/

fischellFELLOW

DIANA YOON: A Kinder, Gentler Knee Surgery

PHOTO BY MIKE MORGAN

DIANA YOON

If Diana Yoon has her way, knee surgery might not be so bad.

Our bodies do not naturally repair and regenerate the articular cartilage in our knees, and as a result we can be left with long-term damage or deterioration. In extreme cases the entire knee must be replaced. Yoon's goal is to support the regeneration of cartilage to restore the knee to health and functionality, without the need for highly invasive and painful surgery.

Her proposal, "Implantable Hydrogel Constructs for Assisting Articular Cartilage Regeneration" earned her the 2006 Fischell Fellowship in Biomedical Engineering.

Her tissue engineering technique involves the use of polymer scaffolding, a synthetic, supportive environment in which new, healthy cartilage can grow. The scaffolding is in the form of a hydrogel that mimics the environment tissue inhabits in our knees. Healthy cartilage is grown in the hydrogel, nourished by additives of salts and proteins that would normally be provided by the body. At this point in the process, it is fluid, and can easily be injected into the injury site, taking the form of a patch. Once the hydrogel is in the body, additional substances within it induce a state change, causing it to firm up and stay in place. Over time, the new cartilage grows while the hydrogel degrades, leaving only healthy cells behind.

A polymer gel procedure is far less invasive than traditional knee surgery, resulting in less damage to the body, less inflammation, fewer immune responses and a shorter recovery time. Previous research has made use of alginate (a natural polymer made from certain types of algae and seaweed) as the scaffolding, but Yoon's uses a novel polymer developed by her advisor, Professor John Fisher. Fisher's polymer, unlike alginate, produces no acidic byproducts as it degrades, making it safer for use in the human body.

Yoon currently works in Professor Fisher's Biomaterials Lab, conducting *in vitro* studies to determine the best growing conditions for cartilage tissue within the hydrogel.

Being able to envision the ultimate implementation of her ideas, and knowing her work will bolster others' in the biomedical engineering field, inspires Yoon as she works. Her highest hopes are to have an impact on the regeneration of articular cartilage and to see the end product used in patients. "I want to help people," she says. "I want to affect somebody positively." After completing her doctorate, Yoon is interested in continuing her research in a hospital setting.

Yoon came to the Clark School from Carnegie Mellon University, where she majored in chemical engineering. She began her graduate studies the same year Professor Fisher joined the faculty and established the Biomaterials Lab. "When I met him," she says, "I felt he was, like me, very goal-oriented. He was very clear about what he thought I could accomplish, and I thought his work was very interesting."

The sense of feeling academically "at home" drew Yoon to the Clark School even before she was accepted into the graduate program. She was searching for a small department that would foster not only great research, but also solid academic, professional, and social relationships. On a visit to campus, she recalls, she felt very comfortable as she met faculty, staff and students while touring the Clark School's facilities. "The people I've met here are amazing," she says. "They'll work to try to make you happy, to help you accomplish what you want to. The professors are understanding and helpful, and the graduate community is growing...You can get a lot from this University."

staffNEWS

We've grown so rapidly since the department launched that all of our staff is new in one way or another! Sadly, we had to say goodbye to our original Graduate Program Coordinator, Julia Holbrook. For 3 years, she and Professor William Bentley were the *only* staff of the Graduate Program in Bioengineering! She now lives in Boston, and we are happy to report that in July 2006 she gave birth to her first child, Ellie Holbrook.

The Fischell Department of Bioengineering is a dynamic environment, and it continues to grow. If you are interested in learning more about open faculty and staff positions, please visit **www.bioe.umd.edu/employment/**.

Catherine Carroll is our Coordinator for Personnel and Payroll. She has been at the university for 19 years. Before joining the Fischell Department of Bioengineering, she worked in the Provost's Office for the last 12 years. She will be assisting faculty, staff and students with all their personnel and payroll issues. Drop by and see her anytime, or give her a call at (301) 405-0105.

Michiko Chand came to the U.S.A. in August of 2005 to pursue her Masters in Information Management. She joined the Fischell Department of Bioengineering in February 2006 as a Graduate Assistant. She provides administrative support to the overall department and will continue with us until she graduates in August 2007. She finds her present position extremely exciting and loves the work environment. After graduating, she hopes to make a mark in the IT industry as a business analyst.

Katie Helene, our Administrative Assistant, is a long-time employee of the University of Maryland. She has worked in the Departments of American Studies, Meteorology, Engineering Administration and, most recently, Biological Resources Engineering. She is an avid horsewoman and rides every week after volunteering with the Therapeutic Riding and Recreation Center in Howard County. Katie can be reached at (301) 405-1192.

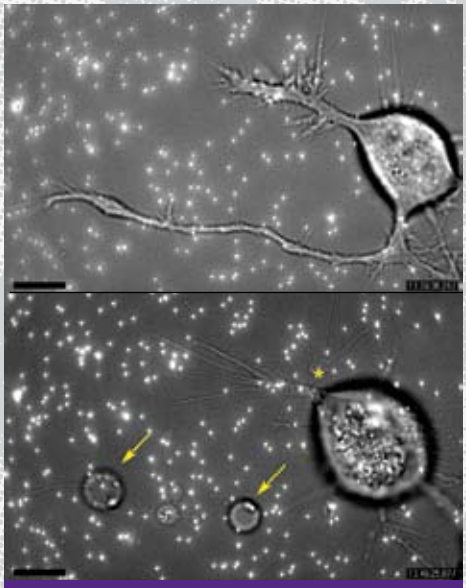
Melvin Hill joined us from the Department of Biological Resources Engineering. He continues his role as a lab manager for facilities that are now part of the Fischell Department of Bioengineering. Melvin assists graduate and undergraduate students with research and electronic projects, helping and teaching them to solve problems. He works from design specifications to build circuits, maintains shop inventories, and orders supplies and equipment. Melvin can be reached at (301) 405-1180.

Sandra Huskamp joined us in 2005 as our Acting Director of Operations. Working with Dr. Bentley, she facilitated the creation of the department and established its administrative unit and infrastructure. She supervises the operation of the department, including managing finance, budget, hirings, administration, and establishing policy and procedure. Before coming to UMCP, she was the director of the Center for Interdisciplinary Instructional Technology Research at East Carolina University. Sandra can be reached at (301) 405-7771.

Karen Lasher has been on campus for over 20 years. She joined us from the Department of Cell Biology and Molecular Genetics, where she had worked for 9 years. She has also worked for the university's office of International Affairs and the Maryland Sea Grant College. She is now our Administrative Coordinator, serving as primary support for the Chair, assisting with conference and seminar planning, and providing support for faculty searches. Karen can be reached at (301) 405-9673.

Faye Levine is the Communications Coordinator for 3 Clark School departments, including bioengineering. Before coming to UMCP in January 2005, she worked as a print and web designer in "corporate America" and taught visual design courses as an adjunct faculty member at several community colleges. She handles web, print, news and collateral projects, and can be reached at (301) 405-0379.

Jaclin Warner, our Assistant Director for Academic Studies and Student Affairs, joined the department in June 2006 as the Coordinator for the Undergraduate Program in Bioengineering. She is now responsible for overseeing academic and student affairs for both the undergraduate and graduate programs, including student services, advising, course scheduling, reporting, and recruitment. She can be reached at (301) 405-0285.



FROM THE NEUROMUSCULAR BIOENGINEERING LABORATORY

IMAGES OF A NEURONAL CELL BEFORE (TOP) AND AFTER (BOTTOM) THE INGESTION OF FLUORESCENT BEADS 200NM IN DIAMETER. BEADS (BRIGHT WHITE DOTS) OF SUFFICIENT SIZE BLOCK LANES OF MICROTUBULE-BASED PROTEIN TRAFFICKING WITHIN NEURONAL PROJECTIONS, RESULTING IN NEURITE SWELLINGS (ARROWS) OR RETRACTION TOWARDS THE CELL BODY (ASTERISK). THE ACCUMULATION OF NUTRITIONAL, STRUCTURAL, AND SIGNALING PROTEINS RESULTING FROM IMPAIRED NEURONAL TRANSPORT, ANALAGOUS TO TRAFFIC JAMS CAUSED BY ACCIDENTS ON A FREEWAY, HAS IMPLICATIONS FOR THE PROGRESSION OF NEURODEGENERATIVE DISEASES SUCH AS ALZHEIMER'S AND ALS. NEW FACULTY MEMBER SAMEER SHAH (SEE PAGE 4) IS THE P.I. OF THIS RESEARCH.

FISCHELL ADDRESSES FRESHMEN

Robert E. Fischell, benefactor of the Clark School's Fischell Department of Bioengineering and a mechanical engineering professor of the practice, spoke to freshman enrolled this fall in ENES 181, "Dialogue with the Dean."

Fischell's talk, "Engineering for Humanity, Fun and Profit," included examples of his work on different biomedical inventions including stents, heart attack detection devices, and implantable devices for epilepsy treatment.

Fischell elaborated on the impact of his inventions on human life, focusing on the joy and challenges of inventing new devices and taking them to market.

"Dialogue with the Dean" is an introductory course for incoming freshman and transfer students. Dean Nariman Farvardin teaches the course and invites many guest speakers from the field throughout the semester.

UM AMONG KIPLINGER'S "BEST VALUES"; CLARK SCHOOL RANKED 13TH IN ENGINEERING WORLDWIDE

The latest Kiplinger Personal and Finance Magazine rankings for the best value in higher education for 2006 shows the University of Maryland at No. 15—up three positions from last year. Kiplinger's also ranks the value of an education for out-of-state students. This year, UM rose from No. 20 to No. 13—another all-time best ranking.

The Institute of Higher Education and Center for World-Class Universities has ranked the Clark School 13th in the world among all engineering programs for 2007.

The institute, a unit of Shanghai Jiao Tong University in China, based the rankings on total engineering-related research expenditures, highly cited research articles, articles included in the Scientific Citation index and the percentage of articles published in the top 20 percent of engineering journals.

FDA ACTING COMMISSIONER VISITS BIOENGINEERING

Andrew von Eschenbach, M.D., Acting Commissioner of the Food and Drug Administration (FDA), met with University of Maryland President Dr. **C.D. Mote**, Jr. and other campus representatives on September 7, and toured bioengineering laboratories in the Jeong H. Kim Engineering Building.

Dr. von Eschenbach visited campus to learn more about the relationship between the FDA and the University of Maryland, and to explore ways in which the two organizations could enhance their collaboration, particularly since the FDA will be relocating to White Oak, Md., only 5 miles from College Park. Dr. von Eschenbach toured the labs of Drs. Hsieh and Fisher in the Fischell Department of Bioengineering, as well as the planned site for the new bioengineering wing in the Kim Engineering Building. He commented on the value of research interactions already in place between UMCP and the FDA, and the importance of connecting the FDA with the graduate and new undergraduate programs in bioengineering so future engineers could gain insight into and experience with the FDA and its mission in fostering human health.

KIM BUILDING TO EXPAND FOR BIOENGINEERING

Clark Construction designed an $8.3 million addition for the Jeong H. Kim Engineering Building *(see back cover)* to house the department. The addition will provide labs for new faculty and will be funded by a portion of the $31 million gift by Robert Fischell and his family late last year.

The Kim Building was designed to support such an addition. Construction began in summer 2006, with a tentative completion date is set for fall 2007. You can watch the construction live via webcam by visiting **www.bioe.umd.edu/webcam/**.

BIOENGINEERING ADMINISTERS REU PROGRAM

BEGINNING IN THE SUMMER OF 2007, THE FISCHELL DEPARTMENT OF BIOENGINEERING WILL BE ADMINISTERING THE MOLECULAR AND CELLULAR BIOENGINEERING REU PROGRAM, FORMERLY HOSTED BY THE DEPARTMENT OF CHEMICAL AND BIOMOLECULAR ENGINEERING. PARTICIPANTS CAN CONTINUE TO EXPECT GREAT RESEARCH OPPORTUNITIES WITH FACULTY FROM BIOE, CHBE, THE DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING, AND THE SCHOOL OF PHARMACY. TO LEARN MORE ABOUT THE PROGRAM, PARTICIPATING FACULTY, AND PROJECTS, VISIT **www.bioe.umd.edu/reu/.**

TBP CHAPTER RANKED NATION'S MOST OUTSTANDING

In the 2005-06 academic year, the Clark School's chapter of Tau Beta Pi (TBP), the nation's engineering student honor society, received the R.C. Matthews Award for Most Outstanding Chapter for the 11th time in its history, beating out more than 300 chapters across the country for the honor.

According to the national TBP website, the award encourages and recognizes high-grade work by the chapters in both routine and special affairs. The award is based on how well chapter service projects fulfill the objectives of TBP and on the quality and promptness of chapter reports to the national headquarters.

Last year, the Clark School chapter sent students to the Gulf states over winter and spring breaks to help those who were affected by Hurricane Katrina.

NEW BIOENGINEERING WING

greatEXPECTATIONS

Contribute to the department through the University of Maryland's *Great Expectations* campaign and support our mission to transform lives through exceptional educational and research opportunities. Your contributions can support bioengineering initiatives such as graduate fellowships, undergraduate scholarships, and named professorships. Please visit www.greatexpectations.umd.edu to learn more.

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