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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.

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$2M NSF Grant for "Bacterial Communication"

Fischell Department of Bioengineering Chair and newly-appointed Robert E. Fischell Distinguished Professor **William Bentley** *(see p. 8),* Associate Professor **Reza Ghodssi** (Electrical and Computer Engineering/Institute for Systems Research [ISR]) and Maryland NanoCenter Director and Professor **Gary Rubloff** (Materials Science and Engineering/ISR) are part of a new four-year, $1,968,984 National Science Foundation Emerging Frontiers in Research and Innovation-Cellular and Biomolecular Engineering (EFRI-CBE) grant.

EFRI is the NSF's newest and most competitive grant; only 12 were awarded in this cycle. The goal of "Biofunctionalized Devices—On Chip Signaling and 'Rewiring' Bacterial Cell-Cell Communication" is to demonstrate signal translation by employing device-based electrical signals to guide the assembly of biosynthetic pathways, cell-based sensors, and cell-based actuators within a microelectromechnical system (MEMS); and to use on-board electrical, magnetic, mechanical, and optical systems to provide feedback and guide the cell-based system towards user-specified outcomes.

Bentley is the principal investigator for the project. In addition to Bentley, Ghodssi and Rubloff, the investigative team also includes Dr. **Gregory Payne**, director of the Center for Biosystems Research at the University of Maryland Biotechnology Institute. Ghodssi is the PI for the ECE/ISR portion of the grant.

The target of this project is the cell-to-cell communication system mediated by bacterial signaling autoinducers in a process known as quorum sensing, which bacteria use to communicate their population density to their neighbors. After a "quorum" is reached in a locale, they change their single cell behavior and become more of a population unit, exhibiting multicellularity. Many strains of bacteria actually become more pathogenic (more resistant to antibiotics) through this process. The new devices created from this work will enable close "eavesdropping" on this communication network, ultimately leading to new drugs that target cell-to-cell communication instead of viability. This should lead to a slower emergence of drug-resistant strains of bacteria—something desperately needed in our health care system.

The PIs will enlist guidance and support from industry, which may spawn new efforts in device fabrication, embedded sensor systems, bacterial pathogenicity, biofilm formation, genetic regulation and signal transduction. Developments are envisioned that impact fields of medicine (drug discovery, synthesis, and delivery), communications (biofunctionalized microfabricated devices), and security (smart sensors).

chair's MESSAGE

OUR NEW DEPARTMENT IS WELL INTO ITS SECOND YEAR

and I'd like to update you on a few significant accomplishments since our last issue. In early May, we marked the first year of the Fischell Department of Bioengineering by hosting the 1st Annual Fischell Festival (full story, pp. 4–5). Over 300 individuals from the greater Baltimore/Washington community heard Drs. **Shu Chien**, **Bob Fischell**, **Larry Kessler**, and **Scott Roth** talk about their activities and interests. Guests were also treated to lab tours, a poster session, and a live streamcast of a laproscopic (video-guided) Nissen fundoplication procedure carried out by Dr. **Steve Kravic**, M.D. at one of our partner institutions, the School of Medicine of the University of Maryland, Baltimore. The day was historic—a first for us in many ways.

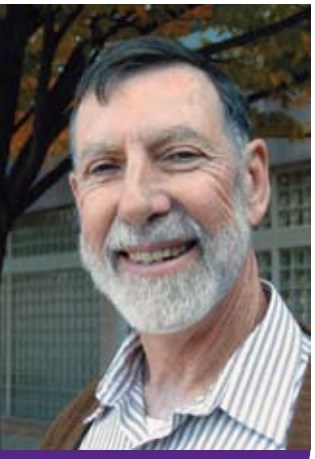
Second, this fall, we welcomed the first full cohort of undergraduates to our Bioengineering undergraduate program. These 78 students are, by every statistical measure, the best and brightest students in the entire University. They are also among the most diverse. We have a dynamite group of staff and faculty that are excited about the opportunity to help these students gain the fundamental understanding of bioengineering they will need to undertake leadership roles in their subsequent employment positions when they leave College Park four years from now.

We're also growing our faculty to 25, and building new laboratories and new relationships that will ultimately transform this institution. I invite you to explore our web site, **www.bioe.umd.edu**, to learn about all of our activities and programs and return often so we may keep you informed of our progress and exciting news.

We'd be happy to host a visit and share our achievements and progress with you. If you're interested, please e-mail me at bentley@umd.edu or call me at (301) 405-4321.

William E. Bentley
Robert E. Fischell Distinguished Professor and Chair

facultyNEWS



ART JOHNSON

JOHNSON TO PUBLISH TEXTBOOK

Professor **Art Johnson** will be publishing a new textbook scheduled to hit bookstores and classrooms in time for the Fall 2008 semester. Titled *Biology for Engineers,* the book presents an approach to teaching biology specifically to engineering students.

According to Johnson, the book is the first of its kind, and very necessary in light of the sharp rise in students pursuing degrees and careers in bioengineering and related fields. "It became apparent to me that my students needed more," he explains. "Although they were taking courses in biological sciences, they weren't able to see clearly the relationships between what they were learning in general biology, microbiology, and cell biology in their freshman and sophomore years, and the biological engineering courses they were taking in their junior and senior years. There is the possibility that the subject matter can be disconnected from what they learn in their engineering courses.

"Biology taught to engineers should be principle-based, viewed as a system, and lead to predictive expectations about typical behavioral responses," he says. "Engineers may not be interested primarily in evolution or taxonomy, but should be familiar with typical reactions by biological organisms or groups of organisms to conditions imposed by natural and human activities."

While *Biology for Engineers* is not yet on the shelves, it has been used in Johnson's classes in draft form for several years, during which time he has received feedback and suggestions from students, and has continued to refine the text. Until the book is published, anyone interested may download the draft text in PDF format from Johnson's web site at **www.bioe.umd.edu/artjohnson/books/bioforengineers.html**.

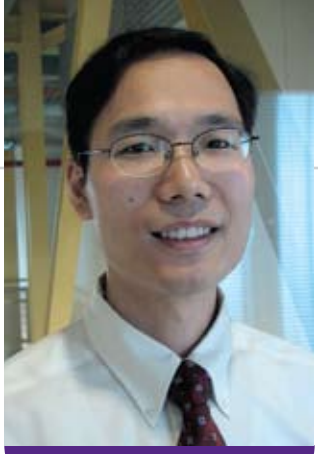
Biology for Engineers, offered by publisher Taylor & Francis, is Johnson's third book.

CHEN JOINS FACULTY

The Fischell Department of Bioengineering is pleased to welcome its newest faculty member, Assistant Professor **Yu Chen**, who joined us in November 2007. Chen received his Ph.D. in bioengineering from the University of Pennsylvania in 2001.

Before joining the Clark School, Chen was a postdoctoral fellow at M.I.T.'s Research Laboratory of Electronics, where he specialized in biomedical imaging techniques. His work included the development of ultrahigh resolution endoscopic optical coherence tomography (OCT) for imaging biological tissues, full-field and line scanning optical coherence microscopy (OCM) for cellular level imaging, an image analysis algorithm based on principle component analysis (PCA) for computer aided diagnosis (CAD), and a miniaturized imaging endoscope/catheter for OCT including a 2D MEMS-based device. Working with doctors from the Harvard Medical School, Boston VA Medical Center, Massachusetts General Hospital, and the Georgetown University School of Medicine, he also participated in clinical studies and investigations for early cancer detection in the gastrointestinal tract and non-invasive imaging of the kidneys and brain using OCT.

KOFINAS, PAYNE INTERVIEWED FOR PBS' *NIGHTLY BUSINESS REPORT*



YU CHEN

Professor and Graduate Program Director **Peter Kofinas** and Professor **Gregory Payne**, Director of UMBI's Center for Biosystems Research and Graduate Program in Bioengineering affiliate faculty member, were recently interviewed for an episode of PBS' *Nightly Business Report.* Correspondent Dana Greenspon visited the Kim Building's Functional Macromolecular Laboratory and other campus destinations to learn how nanotechnology could impact food science, technology, and packaging.

One of Payne's goals is to provide supermarkets and wholesalers with handheld devices capable of detecting pathogens, allergens or toxins in food. "A grocer needs to make a decision on whether to accept a load of produce," he explains. "He can't wait while he sends a sample to a lab, and the test can't be expensive." Payne and his team are designing biosensors that use DNA, proteins, and antibodies to detect problems by reacting to specific contaminants in food. The challenge lies in integrating these organic sensors with microelectronic devices capable of communicating with them, then recording and analyzing the data provided.

Kofinas is taking a different approach to a very similar problem: He uses molecularly imprinted polymers (MIPs)—tiny, gel-like molds into which only a specific target molecule will fit—to capture viruses or other substances. Food packaging, Kofinas explains, could be coated in a thin layer of polymer containing nanoscale cavities designed to recognize a specific food-borne pathogen such as *E. coli.* The packaging could be further designed to respond to the sensing of the target with a chemical reaction to change its color as a warning to store managers and consumers.

FACULTY RECEIVE CROSS-DISCIPLINARY SEED GRANTS

Three faculty members are co-PIs on projects awarded seed grants of up to $75K through a joint initiative between the University of Maryland College Park (UMCP) and the University of Maryland Baltimore (UMB). The initiative's goals are to prepare teams of investigators crossing campuses and disciplines to submit research proposals to the National Institutes of Health's (NIH) extramural program, which targets teams of scientists, engineers, and clinicians who address specific health issues. Teams were required to include at least one co-PI from each campus.

Assistant Professor **Adam Hsieh**'s team received a grant for its proposal, "G610C Mice: An OI Model for Phenotype Variation," which seeks to examine how the knock-in of a gene mutation in mice influences the development of a disease called osteogenesis imperfecta (OI), which leads to brittle bones. Hsieh's co-PIs are Assistant Professor **Daniel McBride** and Professor **Alan R. Shuldiner**, M.D., both from the Department of Medicine, Division of Endocrinology, Diabetes and Nutrition, at the UMB School of Medicine.

Professor **Peter Kofinas**' group's proposal, "Molecular Imprinted Polymer Coatings to Enhance the Biocompatibility of Artificial Lungs," describes the development of an artificial pump lung capable of providing oxygen and carbon dioxide exchange for patients with compromised lung function. His co-PIs are Professor **Bartley P. Griffith**, M.D. and Dr. **Trevor Snyder**, both from the UMB School of Medicine's Department of Surgery.

Assistant Professor **Sameer Shah** and co-PI Professor **Robert J. Bloch**'s (Department of Physiology, UMB School of Medicine) proposal, "Contributions of Intermediate Filaments to Skeletal Muscle Myopathy," addresses hypotheses regarding the roles of structural proteins called intermediate filaments in the stability and function of skeletal muscle.

inBRIEF

ADDITIONAL $1.8M FOR CANCER TREATMENT PROJECT

A TEAM OF MARYLAND RESEARCHERS INCLUDING PROFESSOR EMERITUS **THOMAS MCAVOY** (CHEMICAL AND BIOMOLECULAR ENGINEERING, INSTITUTE FOR SYSTEMS RESEARCH, AND GRADUATE PROGRAM IN BIOENGINEERING) HAS RECEIVED A $1.8 MILLION GRANT FROM THE NATIONAL INSTITUTES OF HEALTH TO CONTINUE WORK ON THE DEVELOPMENT OF A REAL-TIME TUMOR MOTION COMPENSATION SYSTEM USING A TREATMENT COUCH THAT WILL ENSURE ACCURATE DELIVERY OF RADIATION WITHOUT INCREASING PATIENT DISCOMFORT, TREATMENT TIME AND COST, OR BIOLOGICAL EFFECTIVENESS.

SINCE FIRST REPORTED IN OUR LAST ISSUE, THE PROJECT HAS GAINED MOMENTUM AND POTENTIAL. IN ADDITION TO THE SUBSTANTIALLY INCREASED FUNDING THE TEAM HAS PUBLISHED 2 PAPERS ABOUT THEIR RESEARCH AND FILED A PATENT APPLICATION FOR THE SYSTEM THAT HAS GENERATED LICENSING INTEREST IN INDUSTRY.

ALSO IN THE NEWS...

ASSISTANT PROFESSOR JOHN FISHER HAS GARNERED THE ONLY MARYLAND STEM CELL RESEARCH FUND GRANT FOR RESEARCH ON THE COLLEGE PARK CAMPUS FOR HIS WORK ON REGENERATING HUMAN FACIAL BONE.

FISHER HAS ALSO BEEN NAMED CO-EDITOR FOR THE NEWLY-LAUNCHED *TISSUE ENGINEERING, PART B* JOURNAL.

PROFESSOR & CHAIR WILLIAM BENTLEY WAS ELECTED TO THE AMERICAN ACADEMY OF MICROBIOLOGY (AAM), PART OF THE AMERICAN SOCIETY FOR MICROBIOLOGY (ASM), THE OLDEST AND LARGEST LIFE SCIENCES MEMBERSHIP ORGANIZATION IN THE WORLD.

PROFESSOR AND GRADUATE PROGRAM DIRECTOR PETER KOFINAS WAS INVITED TO SPEAK AT THE NATIONAL ACADEMY OF SCIENCE'S BOARD ON AGRICULTURE AND NATURAL RESOURCES. KOFINAS DISCUSSED HOW NANOTECHNOLOGY CAN IMPROVE LIFE AND INCREASE PRODUCTION FOR SUBSISTENCE FARMERS BY FILTERING WATER, DIAGNOSING CROP DISEASES, AND PROVIDING FLEXIBLE BATTERIES TO POWER EQUIPMENT IN REMOTE AREAS.

The 1st Annual Fischell Festival

A CELEBRATION OF BIOENGINEERING'S POTENTIAL TO IMPROVE LIFE FOR MILLIONS OF PEOPLE

On May 3, 2007, The Fischell Department of Bioengineering held its first annual Fischell Festival. The all-day event to celebrate the department's first anniversary featured a variety of high-profile speakers, a telesurgery broadcast, student poster session, lab tours, a bioengineering career information session, and the announcement of the 2007 Fischell Fellow, **Daniel Janiak**. Guests were also able to learn more about the Kim Building's new bioengineering wing and attend the semester's final Whiting-Turner Business and Entrepreneurial Lecture, delivered by Medtronic Chairman and CEO Art Collins.

SPEAKERS HIGHLIGHT BIOENGINEERING RESEARCH AND APPLICATIONS

A variety of distinguished speakers treated visitors to a morning of discussion and demonstration of bioengineering's future in academia, medicine, and industry.

Dr. **Shu Chien**, president of the Bio-Medical Engineering Society; professor and former chair of the Department of Bioengineering, University of California at San Diego; former director of Whitaker Institute for Biomedical Engineering; and member of the National Academy of Engineering, National Academy of Sciences, and Institute of Medicine delivered a lecture titled "Bioengineering in the New Century." Chien outlined some of the areas in which bioengineering is expected to have the largest impact: targeted drug delivery, image-guided surgery, aging, the evolution of the operating room, and the integration of education and research. He discussed the expected significant job growth within the field by the end of the decade. He stressed the importance of collaboration between biologists, engineers, government labs, doctors, and society at large to the advancement of the field, and noted the role major organizations such as the NIH, the Whitaker Foundation, and the Bio-Medical Engineering Society have played in the process.

Festival guests then watched a live telesurgery transmitted from the University of Maryland School of Medicine in Baltimore. Dr. **Scott Roth**, M.D. described the laproscopic (video-guided) Nissen fundoplication procedure being performed by colleague Dr. **Steve Kravic**, M.D., and the tools and technology that made it possible. Dr. Kravic was able to field questions from the audience as he worked. Nissen fundoplications, which are performed to control acid reflux disease, recreate a defective valve between the patient's esophagus and stomach using his or her own tissues. The procedure used to involve large and deep incisions to reach the affected area and required significant recovery time in the hospital. Today, it is performed on an outpatient basis. Surgeons find their way to the damaged area by inserting tiny cameras through a small incision in the patient. Instead of looking directly at the patient, they watch a picture transmitted to a monitor, working in an area roughly the size of a dime. Their tools, which can be a small as 5mm wide, include tiny forceps and "harmonic scalpels" which cut and coagulate tissues using sonic waves. This results in less pain, less scarring, less bleeding, fewer risks of complications, and a shorter recovery time.

While the surgery reflected amazing advances in biomedical technology, Drs. Roth and Kravic told the audience there was still room for improvement, and problems bioengineers could help surgeons solve. "It's like operating with chopsticks," Dr. Roth joked, explaining that some of the limitations of laproscopic surgery were limited mobility, no flexibility of or tactile feedback from the instruments, and its non-intuitive nature. Dr. Kravic expressed an interest in instruments that could see in three dimensions, so surgeons could avoid harming bodily structures below or adjacent to the damaged area.

Dr. **Larry Kessler**, Director, Office of Science and Engineering Laboratories, Center for Devices and Radiological Health, United States Food and Drug Administration (FDA), delivered a talk titled "Challenges and Opportunities: Medical Devices of the Future," in which he discussed the FDA's role in monitoring and regulating products, collaboration with academia and industry, and research of technology trends. He identified a number of emerging bioengineering technologies the FDA is following, including computer-aided diagnoses, gene therapy, personalized medicine, prosthetics, microelectromechanical systems-based devices (MEMS) and nanotechnology used in diagnostics, drug delivery, sensors and actuators, at-home healthcare, minimally invasive medical devices, and organ replacements.

The final speaker and guest of honor was department benefactor, medical device inventor and entrepreneur, National Academy of Engineering member, and Clark School professor of practice Dr. **Robert E. Fischell**, who spoke on "The Future of Biomedical Devices." Fischell predicted a rise in the prominence of devices used to treat and prevent illness without the side effects associated with drugs. One of the reasons for this, he explained, is our increasing understanding of the body's internal electrical systems, and our improvements to human-computer interfaces that could be used in both external and implantable medical devices. He demonstrated three examples from his own current research and development:

▲ **TELESURGERY**
DR. SCOTT ROTH (CENTER) NARRATES A LAPROSCOPIC PROCEDURE (ON SCREENS) PERFORMED BY COLLEAGUE DR. STEVE KRAVIC.

DR. FISCHELL AND PROF. BENTLEY ▶

PHOTOS: AL SANTOS

SAVE THE DATE!

THE SECOND ANNUAL FISCHELL FESTIVAL WILL BE HELD ON APRIL 11, 2008!
WATCH YOUR E-MAIL AND THE BIOE WEB SITE, WWW.BIOE.UMD.EDU, FOR MORE INFORMATION!

The AngelMed system uses an implanted device to analyze a patient's electrocardiogram (ECG, EKG), a record of the heart's electrical activity, and inform both the patient and medical personnel via wireless connections (for example, a call to a cell phone) if a heart attack is imminent.

Neuropace, a device implanted in the cranium, senses electrical activity in the brain that signals the onset of a seizure, and provides stimulation to stop it. Patients participating in tests of the device "have seen a dramatic reduction in the frequency and severity of their seizures," said Fischell.

Fischell is also developing a handheld device that uses transcranial magnetic stimulation for the treatment of migraine headaches. Migraines are caused by bands of electrically excited neurons (nerve cells) across the skull, and Fischell and his collaborators have found that magnetic pulses can depolarize their charges, effectively canceling the headache. Other potential applications of this technology include treatment of depression, Parkinson's disease, and obsessive-compulsive disorder.

NEW FISCHELL FELLOW ANNOUNCED

Fischell Department of Bioengineering Professor and Chair **William Bentley** joined Dr. Fischell to announce the winner of the 2007 Fischell Fellowship in Biomedical Engineering. Department of Materials Science and Engineering graduate student **Daniel Janiak**, who is advised by bioengineering Professor **Peter Kofinas** and works in the Functional Macromolecular Laboratory, was selected for his research in molecularly imprinted polymers (MIPs). *(See related story, p. 7.)*

TOURS, LABS, AND CURRENT RESEARCH

Guests learned more about current bioengineering research at a poster session given by students and research assistants, and through lab tours, where students and faculty discussed their work. Open labs included:

- the Functional Macromolecular Laboratory, a characterization and research facility aimed at understanding the structure of materials;
- the Biomaterials and Tissue Engineering Laboratory, which fabricates polymers into easily implantable biomaterials for the delivery of therapeutics, scaffolds for orthopedic tissue engineering applications, and the interaction of biomaterials and tissues;
- the Orthopaedic Mechanobiology Laboratory, which researches how specific exposures of mechanical stress in musculoskeletal tissues contribute to health and disease; and
- the Bioprocess Scale-Up Facility, a bioprocessing laboratory dedicated to the development and scale-up of biotechnology products and processes.

Guests also viewed the contruction site of the new bioengineering wing being added to the second floor of the Kim Building.

BIOTECH COMPANIES HOST CAREER INFORMATION SESSION

Eight companies and organizations were on hand to demonstrate products and discuss careers in bioengineering, biomedical engineering, and biotechnology with interested students, faculty and guests. These included Aid Networks, the Biomedical Engineering Society, Martek Biosciences Corporation, MedImmune, Inc., Medtronic, Inc., Sensors for Medicine and Science, Inc., the University of Maryland School of Medicine, and the Maryland Advanced Simulation, Training, Research and Innovation Center.

MEDTRONIC, INC. CHAIRMAN AND CEO DELIVERS BIOENGINEERING-THEMED WHITING-TURNER LECTURE

The evening concluded with the final Whiting-Turner Business and Entrepreneurial Lecture of the 2006-2007 series, "How Advances in Medical Technology Will Provide Greater Value to Patients and the Health Care System," delivered by Medtronic, Inc.'s chairman and CEO, **Art Collins**. Collins discussed how advances in traditional medical technology are being combined with advances in information technology, biotechnology and other breakthroughs to improve medical outcomes as well as provide more cost-effective delivery of care around the world. He characterized the environment in which these advances are being made and highlighted specific examples of how technology is either extending life or improving the quality of life for an increasing number of people. He also discussed factors that either enhance or hinder innovation within the medical technology industry, while discussing Medtronic's approach to address both the opportunities and issues that lie ahead.

PHOTOS: AL SANTOS

ART COLLINS

▲ BIOE CAREER INFO SESSION
LAB TOURS ▶

MARINA CHUMAKOV IN SPAIN

CHUMAKOV PRESENTS AT UHMWPE CONFERENCE

Graduate student **Marina Chumakov** was selected to present her work at the 3rd Ultra High Molecular Weight Polyethylene (UHMWPE) International Meeting in Madrid, Spain. The theme of this year's conference was "Polyethylene in Total Joint Replacement Systems: Concerns and Solutions." Her talk, "On the Novel Use of Nitroxides and α-Tocopherol as Radiolytically-Produced Free Radical Scavengers in UHMWPE," was co-authored with her advisor, Department of Materials Science and Engineering professor **Mohamad Al-Sheikhly**. Chumakov was invited to speak at the highly specialized conference after submitting an abstract on her work for review.

UHMWPE has been used since the 1960s as an articulating bearing material for the metal components of total hip and knee replacements. It prevents metal-to-metal contact, reducing wear and extending the life of the artificial joint.

Processing medical-grade UHMWPE involves a delicate balancing act: gamma radiation is used to both sterilize and crosslink the polymer chain, improving its mechanical properties, but also makes it susceptible to polymer oxidative degradation, which is the result of oxygen reacting with ionizing radiation products. Preventing oxidation in artificial joints is crucial, as debris from wear in total joint replacements causes a condition called peri-prosthetic osteolysis, an inflammation of the bone and muscle surrounding the implant that results in the need for its replacement. Traditionally, annealing was used in a second phase of processing to prevent oxidation, but had the side-effect of making UHMWPE less wear-resistant.

Further research showed that introducing vitamin E into the UHMWPE would help reduce oxidation without weakening it, but Chumakov and Al-Sheikhly are proposing a new approach. Instead of using vitamin E to prevent oxidation, they are exploring using nitroxides, nitrogen-containing compounds with five or six-member rings. Chumakov explains that they chose nitroxides because they are very stable and have demonstrated anti-oxidative qualities in reactions in cells in other types of research. The hope is that nitroxide can stop or minimize polymer oxidative degradation.

Chumakov was enthusiastic about the opportunity to present her and Al-Sheikhly's ideas to a group of international experts. "It was very exciting to meet the investigators whose research I have been following and reading over the past two years. I received a lot of encouragement that my research was on the right track and some were very pleased to see some new approaches."

BIOENGINEERING RECOGNIZED FOR STUDENT ACCESSIBILITY

THE UNIVERSITY'S PRESIDENT'S COMMISSION ON DISABILITY ISSUES, WHICH ADVISES THE PRESIDENT ON ISSUES TO IMPROVE THE QUALITY OF LIFE FOR STUDENTS AND EMPLOYEES WITH DISABILITIES, PRESENTED THE DEPARTMENT WITH AN HONORABLE MENTION AT ITS ANNUAL DISABILITY AWARDS CEREMONY. ACCORDING TO COMMISSION CHAIR PROFESSOR GAY GULLICKSON (HISTORY), THE DEPARTMENT WAS SELECTED "FOR ITS WORK IN MAKING THE DEPARTMENT USER-FRIENDLY FOR STUDENTS AND OTHERS WITH WHEELCHAIRS."

DEPARTMENT AWARDS 1ST PH.D.

Please join us in congratulating Dr. **Yingli Fu**, the first student to be awarded a Ph.D. from the Fischell Department of Bioengineering. She was advised by Professor Nam Sun Wang (Chemical and Biomolecular Engineering).

Fu explored a new kind of treatment for choroidal neovascularization (CNV), a type of age-related macular degeneration (AMD). AMD is a chronic eye disease that causes blind spots, distortion or blurring in the center of the field of vision. In patients with CNV, the cause is the growth of abnormal blood vessels that invade and leak fluid into the retina. There is currently no cure for the condition.

YINGLI FU

Existing treatment methods used to slow the progression of AMD require patients to receive repeated eye injections, sometimes up to twice a week. Fu developed an implant that, when placed in the eye's vitreous cavity during a single simple surgery, could release therapeutics over an extended period of time.

The implant consists of a powdered drug that is pressed into a pellet and encased in a biocompatible matrix made from a polyvinyl alcohol polymer. The matrix has pores that allow water inside the vitreous cavity to flow in and out. As the water gradually dissolves the pellet, drug particles diffuse through the pores and into the eye. The polymer also dissolves over time.

Fu performed the research in collaboration with Dr. **Karl G. Csaky** at the National Eye Institute at the National Institutes of Health, and German pharmaceutical company Merck KGaA, which wanted to test the effectiveness of a new drug it had developed for treating AMD. Animal model studies show the drug is effective and that, in combination with the implant, can inhibit and even regress AMD. Fu plans to continue her work in drug delivery and biomaterials development in a postdoctoral position at the Johns Hopkins School of Medicine, and is considering a career in academia.

BIOE STUDENTS, CONCEPTS PLACE 2ND IN BUSINESS PLAN COMPETITION

Startup company **Remedium Technologies**, which includes 2005 Fischell Fellow **Matthew Dowling** and fellow Graduate Program in Bioengineering student **Peter Thomas** took second place in the 2007 $50K Business Plan Competition. The competition, conducted by

the Maryland Technology Enterprise Institute (MTECH), encourages the University of Maryland's entrepreneurial thinkers to build their best ideas into a company over the course of a semester. Winners receive funding to help them launch their businesses.

Remedium Technologies is developing two nanotechnology-based active wound care products for the chronic and acute wound and burn healing markets. Both are based on a modification chitosan, a bipolymer which can be easily and economically derived from the shells of crustaceans such as shrimp and crabs. Chitosan is biocompatible, anti-microbial, and able to stop bleeding.

The first product, a dressing for chronic wounds such as ulcers and burns, works by packaging growth factors (proteins that stimulate cell proliferation) and other therapeutics into nano-containers (liposomes) anchored to a biocompatible matrix (chitosan) by naturally occurring self-assembly. The resulting device can deliver various bioactive compounds for wound healing. The second product is meant to stop bleeding under conditions in which sutures won't work or can't be administered. Chitosan, while known for its blood-clotting ability, becomes saturated and ceases to adhere to tissue after only 30 minutes. Remedium is developing a modified chitosan "sponge" capable of functioning for several hours. The same modified chitosan could also be used in a surgical spray. Both products have the potential to reduce healing time, pain, and costs for patients and hospitals.

Currently, Remedium is in its start-up phase as many of its founding members work on securing funding and continuing the research while still working on their degrees. Animal studies on the products are being conducted at the University of Maryland School of Medicine.

Remedium's other founding members include **Bani H. Cipriano** (Ph.D. '07, chemical and biomolecular engineering [ChBE]); **Oluwatosin Ogunsola** and **Chao Zhu**, ChBE research associates; Dr. **Akinola Dosunmu**, CFA, CPA; and ChBE Associate Professor **Srinivasa Raghavan**.

fischell FELLOW

DAN JANIAK

DAN JANIAK
Molecularly Imprinted Polymers for Viral Diagnostics

In the not-so-distant future, you may find yourself less likely to suffer from a viral infection thanks to more plentiful vaccines, have it treated more effectively if you do get one, or possibly even have viruses filtered right out of your blood. Materials Science and Engineering (MSE) graduate student **Dan Janiak** is working to make that happen, and a proposal outlining his solution, "VIPER: Solutions for Viral Diagnostics," earned him the 2007 Fischell Fellowship in Biomedical Engineering.

Janiak, who works in the Functional Macromolecular Laboratory and is advised by its director, Fischell Department of Bioengineering Professor **Peter Kofinas** (who is also appointed to MSE as an affiliate faculty member), is engineering polymers capable of recognizing and capturing specific peptides, proteins, and larger macromolecular structures—in his case, viruses. The polymers take the form of molecularly imprinted hydrogels, highly-absorbent, water-insoluble substances that, he explains with a laugh, "look like pieces of Jell-O." The gels are imprinted with a specific virus's shape. When molecules of that target virus are filtered though the gels, they—and only they—fit snugly into the imprint cavities and are trapped.

In diagnostic and treatment applications, the hydrogels could be used in blood tests as a means of detecting viral infection, and in hemodialysis, a process in which unwanted molecules are removed from the blood—probably best known as the waste-filtering treatment given to patients suffering from kidney failure. The hydrogels Janiak is developing could be used in new kinds of hemodialysis in which they would serve as tailor-made filters, catching blood borne viruses like HIV. Cleaned blood would be then returned to the body. While filtering cannot cure a viral illness, it can help patients feel better by removing viruses as they are produced by infected cells. This new technology could be integrated into existing medical equipment at a low cost to hospitals and other healthcare facilities.

Janiak's work could also benefit vaccine production. When a vaccine, which is made from inactive virus particles, is produced, the particles that are needed must be separated from the biomass in which they reside. Currently, this is a time-consuming and difficult process. According to Janiak, the biomass could be filtered through an imprinted hydrogel, which would trap only what is needed to make the vaccine while letting debris pass through. For this portion of his research, he is testing the effectiveness of the hydrogels on Human Parvovirus B19, a fever-and-rash illness that typically affects babies, and for which there is currently no vaccine. He takes advantage of the Functional Macromolecular Laboratory's relationship with the National Institutes of Health, using their facilities to cultivate the parvovirus capsids—non-infectious shells—he needs for his work.

When he applied for the Fischell Fellowship, Janiak took his ideas a step further by explaining how his hydrogels could be incorporated into marketable medical devices and used to improve existing procedures. The entrepreneurial nature of the Fellowship, he says, prompted him to "think outside the lab" and about the potential future of his work. He has even received business and product development advice from fellowship sponsor and alumnus Dr. **Robert E. Fischell**, the inventor of numerous biomedical devices.

The most rewarding outcome of his work, Janiak says, would be to see his polymers and techniques used in an industrial research setting to aid in vaccine development. "Any time you start a project you want to have some commercial application for it, and in our case I think vaccine purification is one of best ones possible."

To learn more about the Fellowship, including how to apply, visit:
www.bioe.umd.edu/fischell-fellowship/

greatEXPECTATIONS

$600K GIFT CREATES HONG JI FELLOWSHIP

The Hong Ji Distinguished Fellowship in Bioengineering has been established with a $600,000 gift to attract and support academically talented international graduate students. The gift supports the University's *Great Expectations* campaign.

"We are indebted to the Hong Ji Company for this tremendous endorsement of the quality of our young program and for understanding and supporting the crucial role graduate students play in advancing life-saving research," said Professor and Chair **William Bentley**. The gift will award a one-year, $25,000 fellowship to one graduate student each year.

BENTLEY NAMED FISCHELL DISTINGUISHED PROFESSOR

Professor and Chair **William Bentley** has been named the Clark School's inaugural **Robert E. Fischell Distinguished Professor**. The honor recognizes Bentley's sustained and influential scientific and scholarly work in the area of bioengineering. "I am honored to hold a professorship in the Fischell name," said Bentley. "It's a name that stands for exceptional ingenuity, expertise, and enormous generosity."

The professorship was established within the $31M endowment by Dr. **Robert E. Fischell** (M.S. '53) and his sons and supports the University's *Great Expectations* campaign.

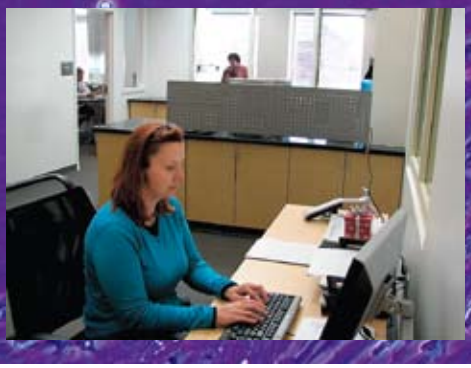
THE *GREAT EXPECTATIONS* CAMPAIGN

YOU CAN HELP SUPPORT OUR MISSION TO TRANSFORM LIVES THROUGH EXCEPTIONAL EDUCATION AND RESEARCH OPPORTUNITIES WITH A GIFT OF ANY AMOUNT! CONTRIBUTIONS CAN BENEFIT BIOENGINEERING INITIATIVES SUCH AS UNDERGRADUATE SCHOLARSHIPS, GRADUATE FELLOWSHIPS, AND NAMED PROFESSORSHIPS. PLEASE CONTACT STEVE BEELAND AT (301) 405-0317 OR SBEELAND@UMD.EDU; OR VISIT WWW.GREATEXPECTATIONS.UMD.EDU TO LEARN MORE.

GIFTS MAY BE MADE BY CHECK TO "UNIVERSITY OF MARYLAND COLLEGE PARK FOUNDATION (UMCPF)." PLEASE DESIGNATE "THE FISCHELL DEPARTMENT OF BIOENGINEERING" IN THE MEMO LINE, AND MAIL TO:

WILLIAM E. BENTLEY, PROFESSOR & CHAIR
FISCHELL DEPT. OF BIOENGINEERING
2330 JEONG H. KIM ENGINEERING BUILDING
UNIVERSITY OF MARYLAND
COLLEGE PARK, MD 20742

NEW BIOENGINEERING WING COMPLETE! OUR NEW FACILITIES WILL BE DEDICATED AT THIS YEAR'S FISCHELL FESTIVAL ON APRIL 11, 2008.



BIOFEEDBACK is published for alumni and friends of The Fischell Department of Bioengineering at the A. James Clark School of Engineering. Your alumni news and comments are welcome. Please send them to:

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