VOL. 5, No. 1

BIOFEEDBACK

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

www.bioe.umd.edu

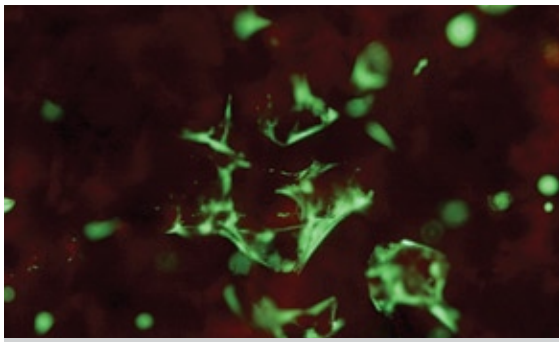
A NEWSLETTER FOR ALUMNI AND FRIENDS OF THE FISCHELL DEPARTMENT OF BIOENGINEERING AT THE A. JAMES CLARK SCHOOL OF ENGINEERING, UNIVERSITY OF MARYLAND, COLLEGE PARK.

IN THIS ISSUE:

Fisher Presents Findings at Maryland Stem Cell Symposium

Fischell Department of Bioengineering associate professor **John Fisher** presented his research on the use of adult stem cells for the regeneration of facial bone in patients with traumatic injuries at the 1st Maryland Stem Cell Research Symposium, held in December 2008. The event, hosted by Maryland Governor **Martin O'Malley**, the Maryland Technology Development Corporation, and the Maryland Stem Cell Research Commission, gave the recipients of Maryland Stem Cell Research Fund grants the opportunity to showcase their work. Fisher was the only principal investigator on the College Park campus to receive one of the first round of 24 grants awarded under the Stem Cell Research Act of 2006.

Fisher's presentation, "Human Mesenchymal Stem Cells in Macroporous Cyclic Acetal Hydrogels for Orbital Floor Regeneration," discussed the use of a patient's own autologous mesenchymal stem cells to help him or her heal more effectively from an injury to the bottom, or floor, of the eye socket. Treating these injuries is difficult because the sinuses, which lie below the floors of the eye sockets, are mostly open areas that provide little if any support for the regrowth of bone. Current treatment methods include the use of bone grafts and metal or plastic implants, but the results are often less than ideal, both physically and cosmetically.



HUMAN MESENCHYMAL STEM CELLS CULTURED IN A POROUS EH-PEG HYDROGEL CONTAINING FIBRONECTIN, A HUMAN EXTRACELLULAR MATRIX GLYCOPROTEIN THAT IS KNOWN TO AID IN THE DIFFERENTIATION OF STEM CELLS INTO OSTEOBLASTS (BONE CELLS). STEM CELLS GROWN IN THIS TYPE OF GEL WERE SHOWN TO HAVE INCREASED SYNTHESIS OF BONE-FORMING SIGNALING MOLECULES, WHICH IN TURN COULD LEAD TO QUICK AND SUCCESSFUL BONE REGENERATION.

Fisher believes that a tissue engineering strategy for the treatment of facial fractures would greatly expand a treating physician's options and improve a patient's quality of life. His proposed procedure involves transplanting stem cells from the patient's bone marrow into a synthetic biomaterial that is then transplanted into the damaged area of the face. After implantation, the biomaterial would slowly degrade away while the relocated stem cells would first "reprogram" themselves, becoming bone-forming osteoblasts, and then go on to synthesize new bone tissue at the injury site.

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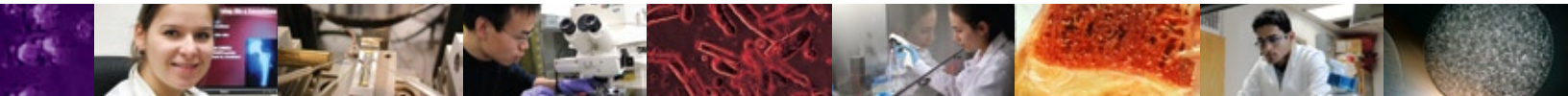


chair's MESSAGE

WILLIAM BENTLEY

I AM PLEASED TO INTRODUCE THIS NEWEST ISSUE OF *BIOFEEDBACK.* The Fischell Department of Bioengineering has enjoyed yet another semester of tremendous growth and progress—we've added new full-time faculty, a stellar cohort of new students, several outstanding adjunct faculty, and some outstanding new research facilities. One of these, our new cell characterization core facility comprised of two fluorescence activated cell sorters, is now on-line and is being directed by Dr. John Fisher.

On April 21, 2009, we will celebrate bioengineering advances in our department and worldwide at our 3rd annual Fischell Festival. Please accept this open invitation to join us! Watch your mail or e-mail, visit our web site, fischellfestival.umd.edu, or e-mail fischellfestival@umd.edu for more information.

This spring we'll also celebrate the establishment of the Robert E. Fischell Institute of Biomedical Devices—an institute that will bring discoveries to practice, helping people the world over. Our formative committee is busy defining its mission, structure, and the resources that will be required.

Finally, I'd like to take this opportunity to congratulate our first class of undergraduate bioengineering students, who are due to graduate in May! Congratulations TERPS! Stay in touch!

With warm regards,

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

STEM CELLS, continued from page 1

In time, fractures and gaps in the skull would be filled in with new, healthy bone.

"Similar approaches have been proposed by many investigators," Fisher explains, "but we feel the key factor that must be considered for successful transplantation of cells is the effect of the synthetic biomaterial on the ability of the cells to communicate with one another."

Cell-to-cell communication, known as signaling, is a process that has been widely investigated in scientific literature. Little is known, however, about how cells communicate with one another when they exist within a synthetic material, and how it might affect their typical processes, including the production and functioning of the signaling molecules they use to pass messages to each other. Part of the group's research will focus on the behavior of the transplanted cells within their biomaterials in order to determine how to create synthetic environments that will best support bone regeneration and cell transplantation in general.

Fisher's colleagues on the project are bioengineering graduate student **Martha Betz**; **John Caccamese**, Jr., M.D., D.M.D., F.A.C.S. and **Domenick Coletti**, M.D., D.D.S. from the Department of Oral & Maxillofacial Surgery at University of Maryland Dental School and the University of Maryland Medical Center's Shock Trauma Center; and **John Sauk**, D.D.S., Dean of the Dental School at the University of Louisville, Ky.

Fisher's student John Lin, who worked on a different aspect of this project, has recently won an award for his research. See pp. 6-7 for details.

REMEDIUM'S "NANO-VELCRO" CONTINUES TO IMPRESS

Fischell Fellow, bioengineering graduate student, and Remedium Technologies CEO **Matt Dowling** and his advisor, Department of Chemical and Biomolecular Engineering associate professor **Srinivasa Raghavan**, won the title of "Best Inventor Pitch" at the second annual "Professor Venture Fair," part of the university's annual Bioscience Research & Technology Review Day. Remedium won for its presentation of a new, patent-pending biomaterial being referred to as "nano-velcro", which is used to control bleeding. Two products are being designed around the material: a surgical spray and a bandage.

"Nano-velcro" is created by attaching fatty grafts to a biopolymer called chitosan, which is derived from the shells of crustaceans. The grafts gently hook onto blood or soft tissue, similar to Velcro®, enabling the chitosan to act directly and more effectively in blood coagulation and wound healing.

Sponsored by the university's Office of Technology Commercialization, the College of Chemical & Life Sciences, and the A. James Clark School of Engineering's Maryland Technology Enterprise Institute, the Professor Venture Fair gives faculty and inventors the opportunity to pitch their new technologies to a team of five regional venture capitalists and entrepreneurs.

"We're very confident in our technology, says Dowling, "but selling it is a separate and distinct challenge. This award was a good indication that investors are starting to buy into what we're selling."

Since we last reported on Remedium's progress, the young company has taken 2nd place in the graduate student division of the 2008 New Ventures World Competition at the University of Nebraska, winning $3000; and participated in both the Rice Business Plan Competition and the Moot Corp Competition held by the University of Texas at Austin. In August 2008, Remedium received a $103,950

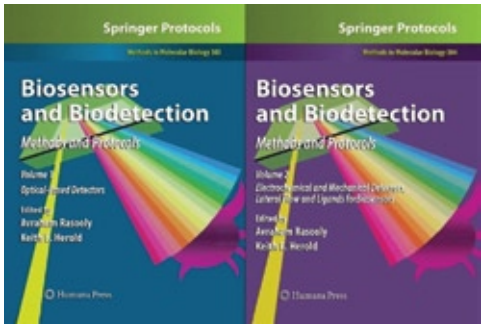
Maryland Industrial Partnerships project award to further develop its technology. The nano-velcro research was also covered by CBS affiliates WJZ-TV (Baltimore) and WUSA (Washington, D.C.).

To learn more, visit www.remediumtechnologies.com.

HEROLD EDITS 2 VOL. WORK ON BIOSENSORS, BIODETECTION

Associate Professor **Keith Herold** is an editor of and contributor to a new 2-volume work on biosensors and biodetection, which will represent the newest offering in the *Methods in Molecular Biology* series of books. **Avraham Rasooly** (National Cancer Institute, FDA) is Herold's co-editor. Both volumes are published by Humana Press.

Biosensors and Biodetection: Methods and Protocols, Volume 1: Optical-Based Detectors and *Biosensors and Biodetection: Methods and Protocols, Volume 2: Electrochemical and Mechanical Detectors, Lateral Flow and Ligands for Biosensors* cover the latest information on and techniques for the development and application of biological recognition elements and signal conversion technology for use in biodetection systems. Volume 1 focuses on optical topics, including direct and indirect optical sensors, CCDs, surface plasmon resonance, and spectrometers, while Volume 2 discusses direct and indirect measurement sensors and ligands, including the implementation of electrochemical detectors, antibodies, peptides, and aptamers. The books are intended for scientists in engineering, clinical, biological, chemical or physics research, including students, who want to develop an understanding of the types and elements of biosensors, and the technologies behind them, from an experimental perspective.



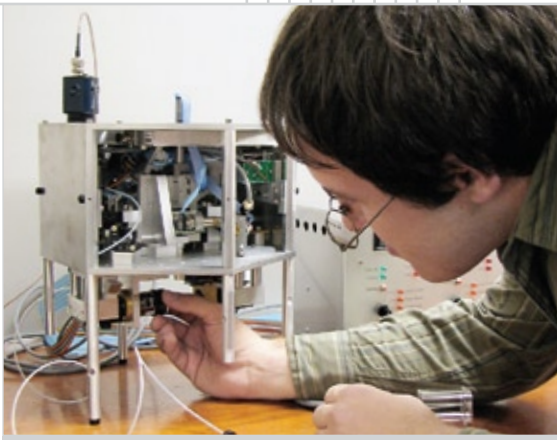
Herold co-authored two chapters: "A Simple Portable Electroluminescence Illumination Based CCD Detector" in Volume 1, and "Rapid DNA Amplification Using a Battery-powered Thin-Film Resistive Thermocycler (TFRT)" in Volume 2. Assistant Professor **Ian White** also co-authored a chapter in Volume 2, titled "Label-Free Detection with the Liquid Core Optical Ring Resonator Sensing Platform."

SEOG LAB INSTALLS OPTICAL MINI-TWEEZERS

The Molecular Mechanics Laboratory, directed by Assistant Professor **Joonil Seog** (Fischell Department of Bioengineering and Department of Materials Science and Engineering), is completing setup of a new optical tweezers unit to be used in studies of protein aggregation, gene delivery and self-assembled biomaterials. The relatively uncommon device has been specially customized to be more compact, reduce acoustic noise and other vibratory interference, and eliminate labor-intensive calibration steps, resulting in a more user-friendly experience for researchers.

Optical tweezers use the optical forces generated by a laser to capture, or "tweeze", a micron-sized dielectric particle, such as a polystyrene bead. A second particle is attached to a pipette tip. A molecule to be studied—such as a protein or peptide—is suspended between them by tethering each end to a bead using DNA "handles". The pipette is then moved back and forth to exert force on the molecule.

The end result is a device capable of applying tiny amounts of force to delicate single-molecule samples, gently stretching and relaxing them or holding them still to observe their dynamics in real time. For example, the self-assembly of specific peptide molecules



DEPT. OF MATERIALS SCIENCE & ENGINEERING GRADUATE STUDENT **ADAM KARCZ**, ADVISED BY PROFESSOR **JOONIL SEOG**, ASSEMBLING THE OPTICAL MINI-TWEEZERS. THE DESIGN IS BASED ON A DEVICE LOCATED IN THE **BUSTAMANTE LAB** AT THE UNIVERSITY OF CALIFORNIA, BERKELEY. KARCZ SPENT TIME AT THE LAB WITH RESEARCH SCIENTIST **STEVEN SMITH** TO LEARN HOW TO BUILD THE TWEEZERS FOR SEOG'S MOLECULAR MECHANICS LABORATORY, AS WELL AS CREATE DOCUMENTATION AND SCHEMATICS FOR IT.

to form well-defined nanostructures can be followed. Seog points out that his lab's optical tweezers have two advantages over most other units: instead of calculating force based on spring constants and displacements, his directly measures force without labor-intensive calibration steps. Also, its small size—not much larger than two gallons of milk, compared to more common units that require 3'x6' optical tables on which to sit—allows it to be more stable and accurate due to the reduction of the optical path length, minimizing the chances of any interference.

Seog, who previously used optical tweezers to explore the mechanical behavior of cell adhesion molecules, plans to apply the technique to further research in nanomedicine and nanobiotechnology.

One project will focus on the protein aggregates (buildups) that are known to cause neurodegenerative diseases such as Alzheimer's, Parkinson's, and Mad Cow. Although these diseases have been widely studied, what happens in their earliest stages of development is largely unknown. The optical tweezers will allow Seog and his team

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inBRIEF

THE THIRD YEAR OF ASSOCIATE PROFESSOR **JOHN FISHER**'S ARTHRITIS INVESTIGATOR AWARD WILL BE FUNDED BY THE ENGALITCHEFF RESEARCH FUND. ADMINISTERED BY THE ARTHRITIS FOUNDATION, AWARDS FROM THE FUND ARE GIVEN ANNUALLY AS A DISTINCTION TO OUTSTANDING SCIENTISTS IN HONOR OF VIRGINIA P. ENGALITCHEFF, A LONG-TIME SUPPORTER OF THE FOUNDATION.

"THE QUALITY OF YOUR RESEARCH AS WELL AS YOUR COMMITMENT AND COOPERATION ARE APPRECIATED BY THE ARTHRITIS FOUNDATION," **JOHN HARDIN**, M.D., CHIEF SCIENTIFIC OFFICER OF THE ORGANIZATION WROTE FISHER IN A RECENT LETTER, "WE LOOK FORWARD TO A LONG AND PRODUCTIVE ASSOCIATION."

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PROFESSOR **PETER KOFINAS** WAS INVITED TO PRESENT HIS WORK ON THE USE OF PATHOGEN-DETECTING FOOD PACKAGING AT A MEETING OF THE USDA INTERAGENCY WORKING GROUP ON NANOTECHNOLOGY. ATTENDEES REPRESENTED PERSONNEL RESPONSIBLE FOR FOOD SAFETY REGULATIONS AND POLICIES FROM A VARIETY OF USDA OFFICES, INCLUDING THE AGRICULTURAL RESEARCH SERVICE, THE ECONOMIC RESEARCH SERVICE, AND THE FOOD SAFETY AND INSPECTION OFFICE.

"NANOSTRUCTURED COLORIMETRIC COATING FOR FOOD PATHOGEN DETECTION" INTRODUCED THE ATTENDEES TO THE NANOSTRUCTURED POLYMER COATINGS BEING DEVELOPED IN HIS FUNCTIONAL MACROMOLECULAR LABORATORY THAT CHANGE COLOR UPON THE DETECTION OF FOODBORNE BACTERIA SUCH AS *E. COLI,* SALMONELLA, OR LISTERIA. THE COATINGS COULD BE INCORPORATED INTO EXISTING FOOD PACKAGING. KOFINAS HIGHLIGHTED THE ROLE OF NANOTECHNOLOGY IN THE CREATION OF THE PACKAGING, THE POTENTIAL IMPACT THE PRODUCT HAS ON AGRICULTURAL SYSTEMS, & ITS POSSIBLE BENEFITS TO THE USDA'S EFFORTS TO KEEP OUR FOOD SUPPLY HEALTHY.

To learn more about intelligent packaging, please see "Kofinas and Janiak's MIPs Tech Wins Awards, Industry Attention", featured in the Vol. 4, No. 2 issue of Biofeedback, *which can be downloaded online at www.bioe.umd.edu/newsletter.*

TWEEZERS, continued from page 3

to study the earliest interactions between individual proteins that will lead them to form small complexes called oligomers, and then move on to aggregation. What the group learns could lead to improved treatments that could prevent a disease's progression in its earliest stage.

Seog is also working in collaboration with Dr. **Jason Kahn** (Department of Chemistry & Biochemistry) and Dr. **A. James Mixson** (Department of Pathology, UMB School of Medicine) to develop a more effective carrier for use in gene therapy. One of the challenges in designing an artificial carrier to deliver and introduce genetic material into a cell—a process called transfection—is a lack of knowledge about the fundamental mechanisms of gene delivery. "The optical tweezers will allow us to directly observe, in real time, the process of gene carrier/DNA complex formation and DNA release at the single molecule level," Seog explains. "It will provide new insight on molecular structures for improved transfection efficiency."

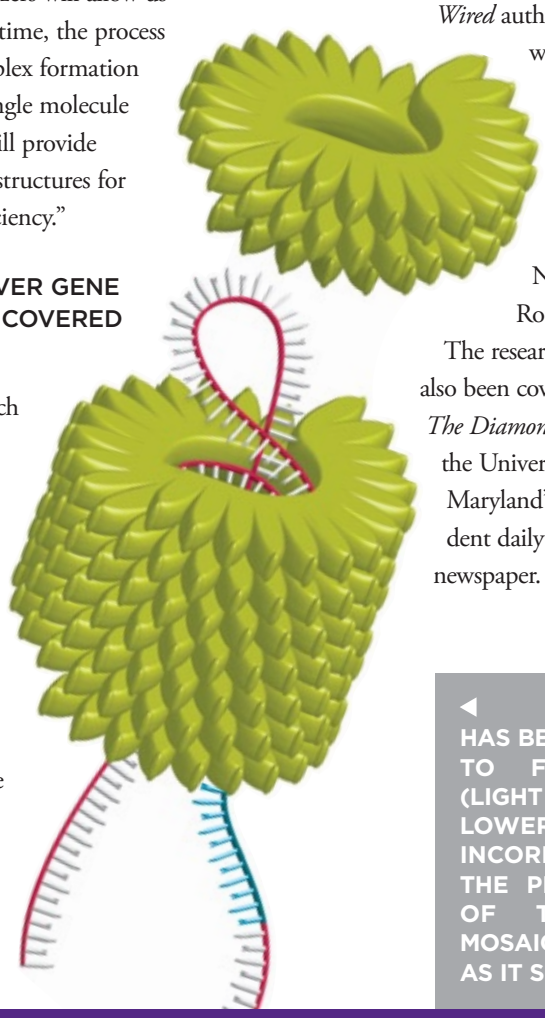
BENTLEY, HUNG, CULVER GENE THERAPY RESEARCH COVERED BY *WIRED*

Recent gene therapy research led by Professor and Chair **William Bentley**, alumnus **Chi-Wei Hung** (Ph.D. '08, chemical engineering, advised by Bentley), and Associate Professor **James Culver** (University of Maryland Biotechnology Institute) was recently featured in the online edition of *Wired* magazine.

The article by **Aaron Rowe** describes how the scientists have managed to hollow out the tobacco mosaic virus (TMV), which damages tobacco plants but is harmless to humans, and use it as a container to deliver small interfering RNA (siRNA) to diseased cells. The work has major implications for the use of gene therapy, rather than drugs, to treat cancer or viral infections.

Instead of TMV's own genetic material, specially engineered, single-strand siRNA is "wound" into an empty TMV protein sheath (a sort of capsule) as it self-assembles. The sheath protects the fragile siRNA while doing what nature designed it to do: get into cells where it can release its genetic material. In this case, what TMV delivers is not a typical viral illness, but a genetic message that instructs cells to turn on their defenses. Using this treatment technique, the patient's own body becomes capable of fighting illness more effectively, with minimal side effects.

Wired author Rowe was recently interviewed about the research on NPR's "Chemistry News Roundup." The research has also been covered by *The Diamondback,* the University of Maryland's independent daily student newspaper.



◀ siRNA THAT HAS BEEN CUSTOMIZED TO FIGHT DISEASE (LIGHT BLUE SECTION, LOWER RIGHT) IS INCORPORATED INTO THE PROTEIN SHEATH OF THE TOBACCO MOSAIC VIRUS (GREEN) AS IT SELF-ASSEMBLES.

SAVE THE DATE! THE THIRD ANNUAL FISCHELL FESTIVAL WILL BE HELD ON APRIL 21, 2009!
WATCH YOUR E-MAIL, MAIL, OR FISCHELLFESTIVAL.UMD.EDU FOR MORE INFORMATION!

alumniNEWS

ALUMNA NAMED SERVICE TO AMERICA MEDAL FINALIST

Alumna Patricia Frounkelker (neé Scott, '03, Biological Resources Engineering) was one of fewer than 30 Federal employees named as finalists for a 2008 Service to America Medal. Frounfelker, an Army Research Laboratory engineer who works for the Survivability/Lethality Analysis Directorate at Aberdeen Proving Ground, was cited for her work's contribution to improving the safety of troops in and around tactical vehicles such as tanks, Strykers, and Bradleys.

Each year, Service to America Medals (also known as "Sammies") are awarded by the Partnership for Public Service, a nonprofit and nonpartisan group, to celebrate demonstrated excellence among Federal employees and others in civil service.

Frounfelker studies the injuries to soldiers that occur, or could occur, when the reactive armor used on vehicles causes collateral damage, particularly to soldiers on the ground nearby. Her assessments of safety, casualties and the materials used in tactical vehicles have, according to her nomination, "…directly benefited soldiers and Marines by identifying and assessing potential injuries they might suffer in or near U.S. combat vehicles. This has allowed the Army to modify the vehicles or the tactics, techniques and procedures before the vehicles are fielded to better protect U.S. military personnel. Her efforts have resulted in better equipped, better protected Warfighters, who are better able to protect and defend our nation."

DODSON, DIMITRAKOPOULOS IN *PHYSICAL REVIEW LETTERS*

A research study by **Walter Dodson** (Ph.D. '08) and his former advisor, Associate Professor **Panos Dimitrakopoulos** (Department of Chemical and Biomolecular Engineering, Graduate Program in Bioengineering) that describes the behavior and deformation of capsules in high flow-rate environments has been published in *Physical Review Letters,* one of the world's top physics journals. The paper, titled "Spindles, Cusps, and Bifurcation for Capsules in Stokes Flow," presents the results of a computational investigation using a highly accurate numerical algorithm developed in Dimitrakopoulos' Biofluid Dynamics Laboratory. For more information, see *Phys. Rev. Lett.* 101, 208102 (2008).

ARE YOU A GRADUATE OF THE BIOLOGICAL RESOURCES ENGINEERING, AGRICULTURAL ENGINEERING, OR THE AGRICULTURAL AND EXTENSION EDUCATION PROGRAM?

WE'D LOVE TO HEAR FROM YOU!

You might be wondering what this newsletter has to do with *your* University of Maryland experience and why you have received it.

We've been on a journey that has taken many of us from Agricultural Engineering to Biological Resources Engineering, and now, thanks to a $31M gift in 2006 from Dr. Robert E. Fischell (M.S. '53) and his family, to the Fischell Department of Bioengineering based in the A. James Clark School of Engineering. While some things have changed, many aspects of our core curriculum and faculty have stayed the same. We continue to provide an outstanding educational experience for graduate and undergraduate students while having a significant impact on human lives.

We're proud of all of our alumni. We want to stay in touch with you so we can continue to share our accomplishments with each other. Please let us know what you're up to! We'll see to it that your news is included in future issues.

If you want to find out more about the Fischell Department of Bioengineering, please contact us or consider a visit to tour our new facilities. You can visit our web site, www.bioe.umd.edu, for all of the latest news and information, or call us at (301) 405-7426. You may also contact Professor and Chair William Bentley at **bentley@umd.edu**, or e-mail your news to **biochemmse@umd.edu**.

recentDISSERTATIONS&THESES

MAY 2008 M.S. GRADUATES

Geraldine Mijares: (Bioengineering) "Bioelectronic Sensor for Cellular Assays Using Polyelectrolyte Multilayer-Modified Electrodes." Advisor: Don DeVoe.

MAY 2008 PH.D. GRADUATES

Walter Dodson: (Bioengineering) "Dynamics of Erythrocytes and Microcapsules." Advisor: Panagiotis Dimitrakopoulos.

DECEMBER 2008 PH.D. GRADUATES

Rohan Fernandes: (Bioengineering) "Biological Nanofactories: Altering Cellular Response via Localized Synthesis and Delivery." Advisor: William Bentley.

Colin Hebert: (Bioengineering) "RNA Interference Mediated Suppression of Tn-caspase-1 as a Means of Investigating Apoptosis and Improving Recombinant Protein Production in Trichoplusia ni cells." Advisor: William Bentley.

Andreas Jahn: (Bioengineering) "Controlled Liposome Formation and Solute Encapsulation with Continuous-Flow Microfluidic Hydrodynamic Focusing." Advisor: Don DeVoe.

Fenghua Jin: (BioResources Engineering) "Machine Vision Technology for Food Quality and Safety Inspection." Advisor: Yang Tao.

Xiaolong Luo: (Bioengineering) "Programmable Biomolecule Assembly and Activity in Pre-Packaged BioMEMS." Advisor: Gary Rubloff.

Yin-Phan Tsang: (BioResources Engineering) "Use of Macroinvertebrate Predictive Models to Evaluate Stream Restoration Effect" Advisor: Gary Felton (Environmental Science & Technology).

Chung-Yu Wu: (BioResources Engineering) "Predicting Water Table Fluctuations Using Artificial Neural Networks." Advisor: Adel Shirmohammadi.

Diana Yoon: (Fischell Fellow; Chemical and Biomolecular Engineering) "Insulin-like Growth Factor-1 Signaling in Engineered Articular Cartilage." Advisor: John Fisher.

Bin Zhu: (BioResources Engineering) "Novel Statistical Pattern Recognition and 3-D Machine Vision Technologies for Automated Food-Quality Inspection" Advisor: Yang Tao.

FERNANDES WINS ACS'S PETERSON AWARD

Graduate student **Rohan Fernandes**, advised by Fischell Department of Bioengineering Professor and Chair **William Bentley**, has won the American Chemical Society's (ACS) Peterson Award. The award, sponsored by Invitrogen (a worldwide provider of products and services to the biotechnology and pharmaceutical fields), is given to the student who delivers the best oral presentation among the Biochemical Technology Division speakers at ACS's annual meeting.

ROHAN FERNANDES

Fernandes won for his talk, "Nanofactories for Synthesis and Delivery of Signaling Molecules: A Tool for Engineering Metabolism."

Nanofactories, which were first created at the Clark School, are ingested biochemical machines that act like cells. Once inside the body, they 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, reducing or eliminating the side effects that may arise when an antibiotic travels throughout the body in search of infections.

"This is the most coveted award for young engineers in the field," says Bentley of the honor. "It's typically won by students from MIT, Caltech, Stanford and Berkeley. Rohan is the first student from Maryland to have received this recognition."

Bentley also explains why he feels Fernandes is a standout: "Rohan is in many respects a renaissance engineer. His formal training was in chemical engineering, where he learned the core of the discipline. He's made a tremendous transition to bioengineering, where he's used his innate creativity and his particularly acute sensitivity to detail to devise an entirely new concept of a nanofactory which combines reactions, transport, and biological recognition in one clever miniature package."

To learn more about nanofactories, please see "Side Effects May Not *Include...", featured in the Vol. 3, No. 1 (Spring 2007) issue of* Biofeedback, *which can be downloaded online at www.bioe.umd.edu/newsletter.*

BIOSCIENCE DAY POSTER SESSION

Graduate students **Xiaolong Luo** (Fischell Department of Bioengineering, advised by Department of Materials Science and Engineering professor and Graduate Program in Bioengineering affiliate professor **Gary Rubloff**) and **Varnika Roy** (Department of Molecular and Cellular Biology, advised by Bioengineering Professor and Chair **William Bentley**) were recognized for their research at the Bioscience Research & Technology Review Day 2008 poster session. Both entered their work in the bioengineering division, which Roy won. Luo received an honorable mention.

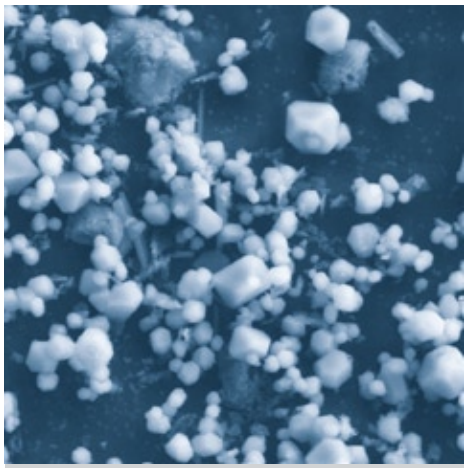
Roy's poster was titled "In vitro LsrK: Toward an AI-2 Phosphorylation Nanofactory that Modulates Bacterial Talk." Luo's was titled "Microfabrication and Biofunctionalization of Permeable Vertical Chitosan Membranes in Microfluidics".

Bioscience Research & Technology Review Day is a special event that features research talks, presentations, mini-symposia and demonstrations by university scientists. The program provides a unique opportunity for executives and professionals in industry and government to discover the most recent advances in bioscience and biotechnology at the University of Maryland; to promote the potential for academic-industry-government collaboration; to meet university scientists and interact with graduate student researchers; to network with colleagues who share an interest in the promotion of bioscience and the bioscience industry; and to recruit employees and investigate job opportunities.

LIN WINS GOLDEN KEY SCHOLARSHIP

Fischell Department of Bioengineering junior **John Lin** has been named the first place winner of the Golden Key Engineering and Technology Scholarship. The $1000 award is given by the Golden Key International Honour Society. He was recognized for the research he carried out as a 2007-2008 ASPIRE Fellow in the Tissue Engineering and Biomaterials Laboratory, directed by his academic advisor, Associate Professor **John Fisher**.

Lin's project focused on the use of hydroxyapatite hydrogels for craniofacial reconstruction. Hydroxyapatite, a naturally-occurring mineral found in human teeth and bones, is sometimes used to promote or support bone growth, or to fill in an area where bone has been removed. Lin created a biocompatible gel containing an even dispersion of hydroxyapatite *(see image, left)* that could act as a "scaffold", or supporting environment, for transplanted bone cells



A SCANNING ELECTRON MICROSCOPY IMAGE OF **JOHN LIN**'S HYDROXYAPATITE HYDROGEL. WHILE LIN FOCUSED ON PRODUCING BETTER ARTIFICIAL ENVIRONMENTS FOR TRANSPLANTED CELLS, HIS ADVISOR, ASSOCIATE PROFESSOR **JOHN FISHER**, EXPLORED ANOTHER ASPECT OF CRANIO-FACIAL RECONSTRUCTION BY STUDYING THE BEHAVIOR OF CELLS TRANSPLANTED INTO THEM (SEE P. 1).

injected into a patient with severe facial injuries. The gel would support the cells as they grow and fill in cracks or holes in damaged bone, resulting in more effective healing, fewer complications, and a more natural-looking result.

ASPIRE, A Scholars Program for Industry-Oriented Research in Engineering, offers students the opportunity to move beyond the classroom by working with engineering faculty or staff on real-world engineering projects. Lin, who was debating whether to ultimately attend medical school or remain a bioengineer, felt working with Fisher gave him the opportunity to experience "real bioengineering".

"My whole lab experience has been memorable," says Lin. "I learned how to harvest, culture, and passage cells. I performed staining experiments for live/dead assays of the cells. I isolated RNA to create cDNA to measure genetic expression using RT-PCR. I felt the responsibility of running an experiment. I experienced [performing] electron and transmission microscopy and new lab measuring techniques such as electron dispersive spectroscopy. It was truly an amazing experience. I have a great deal of gratitude and appreciation for Dr. Fisher, the ASPIRE award, and for my mentor Dr. **Minal Patel** for trusting me with this great opportunity."

After completing his B.S., Lin plans to attend graduate school, but will first take a year off to travel, visit other universities, and complete work on his current research project, a new drug targeting method for the treatment of deep surface tumors.

"John is an extremely proactive and creative researcher," Fisher says of Lin. "Based on both his ability and energy, he is very deserving of the scholarship."

You can earn more about John by reading his profile at right. For more information on Fisher's research, see p. 1.

undergraduate PROFILE

JOHN LIN

JOHN LIN

We recently spoke to junior John Lin to learn more about his experiences in bioengineering. In addition to receiving the Golden Key Engineering and Technology Scholarship, Lin has also won the 2008 H. Russell Knust Memorial Scholarship and three ASPIRE research awards, and participated in the Institute for Systems Research's REU program.

Why did you choose to study at the University of Maryland?

My guidance counselor at Walt Whitman High School highly recommended the University of Maryland for its engineering program, diversity, and affordability. Also, my teachers who were Maryland alumni had only good things to say about their college experiences. So I took a tour of Maryland's campus and it was so beautiful I couldn't say no.

Why did you decide to major in Bioengineering?

I like learning about human physiology and I'm good in physics and mathematics. The field was not exactly what I expected it to be, but in the end I am grateful for the training that I've been through and the knowledge I've learned.

You took the research position with Dr. Fisher to help you decide whether you wanted to attend medical school or stick with bioengineering. Have you made a decision?

I've thought about this question a lot for the first two years of college, and I've decided that I'd rather go to graduate school for bioengineering. After talking to many professors, postdoctoral researchers, graduate students, and medical residents, I've learned that the difference between graduate school and medical school is in their goals for the student. Graduate schools want their students to be innovative and to successfully create something, while medical schools want their students to be well trained in academic material, techniques, and decision making. Based on these goals, I found myself better suited for graduate school.

Do you have any suggestions for other students about how to survive really difficult classes in bioengineering?

Be disciplined in your study, plan enough time for all of your work, and don't overextend yourself. Also, set out your end goal—give it some deep thought—and remember that there are many ways to achieve it. Don't get stuck behind the first wall you encounter.

What do you recommend undergraduates do or get involved in to have the best experience here?

Get some lab experience, join a non-academic social organization, use the gym, and explore a serious relationship.

What's been the best thing about your academic experience here so far?

The laboratory research has been my best experience. I've been able to play with hundreds of thousands of dollars worth of technical equipment, and have seen what goes into the production of common materials and ideas used in our society. To be candid, it's just too cool!

ALSO IN STUDENT NEWS:

SENIOR JIM ABSHIRE WON THE A. JAMES CLARK SCHOOL OF ENGINEERING HONORS PROGRAM'S MOST OUTSTANDING RESEARCH AWARD FOR HIS PROJECT TITLED "PRODUCTION OF NEISSERIAL OPA MEMBRANE PROTEIN IN THE BACULOVIRUS EXPRESSION VECTOR SYSTEM" ABSHIRE IS NOW A GRADUATE STUDENT AT M.I.T.

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THE MOLECULAR AND CELLULAR BIOENGINEERING RESEARCH EXPERIENCES FOR UNDERGRADUATES (REU) PROGRAM

The University of Maryland, and specifically the Fischell Department of Bioengineering, is engaged in bioengineering research activities that bring together our traditional strength in engineering and recent advances in biological sciences, as well as collaborations with surrounding national laboratories.

Our REU program focuses on increasing the students' technical skills, critical thinking abilities, and presentation capabilities. Students work on state-of-the-art research that promises to lead to important new discoveries and technologies. They are exposed to multidisciplinary laboratories, group meetings, and scientists and engineers from local industry and research institutions. Our REU scholars also participate in non-technical seminars aimed at demystifying the graduate school process.

- Applications will be accepted from January 16–March 6, 2009.
- The REU Program will take place from June 1–August 7, 2009.
- Participants receive a $4000 stipend, up to $750 for travel expenses, and housing in furnished on-campus housing.

To view a list of participating faculty and project descriptions, and to learn how to apply, visit www.bioe.umd.edu/reu

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

THE IMAGE USED ON THE COVERS IS A SCANNING ELECTRON MICROSCOPY IMAGE OF THE BACTERIUM *ESCHERICHIA. COLI.* MANY BACTERIA, INCLUDING *E. COLI,* "TALK" TO EACH OTHER BY SECRETING AND PERCEIVING SMALL MOLECULES, A PROCESS CALLED QUORUM SENSING. FLAGELLA AND APPENDAGES THAT EXTEND OUT OF THE CELL WALLS CAN BE PRODUCED IN RESPONSE TO THIS SIGNALING. NEAREST NEIGHBORS CONTROL GROUP BEHAVIOR. DISRUPTING THIS INTERCELLULAR COMMUNICATION COULD PROVE TO BE A NEW WAY TO FIGHT INFECTION OR DISEASE. THIS LINE OF RESEARCH IS ONE OF MANY CURRENTLY UNDERWAY IN PROFESSOR WILLIAM BENTLEY'S MOLECULAR & METABOLIC ENGINEERING LABORATORIES. FOR ANOTHER OF BENTLEY'S PROJECTS, SEE P. 4.

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.
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