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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.

IN THIS ISSUE:

Remedium Wins $10K in Global Security Challenge

Remedium Technologies, Inc., a startup company whose founding and present members include graduate students, postdocs, faculty and alumni from the Fischell Department of Bioengineering and the Department of Chemical & Biomolecular Engineering, received the "Most Promising Security Idea" award in the 2009 4th Annual Global Security Challenge (GSC). The GSC provides an international forum for inventors, investors, and start-up companies to launch solutions designed to protect people, infrastructure, and enterprises without infringing on civil liberties.

DR. **ALASTAIR MACWILLSON** (CENTER), MANAGING DIRECTOR OF GLOBAL SECURITY PRACTICE, ACCENTURE, PRESENTS THE SECURITY CHALLENGE AWARD TO **MATTHEW DOWLING** (LEFT) AND **PETER THOMAS** (RIGHT).

Remedium CEO **Matthew Dowling** and CTO **Peter Thomas** (both bioengineering graduate students) traveled to England to accept the award at the Global Security Summit, held at the London School of Business in November 2009. This is the latest in a series of business competition wins, awards and honors Remedium has received over the past two years.

The award includes a $10,000 grant sponsored by Accenture, an international consulting, technology, and research company; mentoring from **Mark Shaheen**, managing director of Civitas Group, which provides advising and investment services for companies involved in local and national security; networking opportunities; and publicity.

The young company, selected out of a field of over 100 competitors from around the world, was recognized for a new product made with its haemostatic (blood clotting) technology that takes the form of a foam that can be applied to non-compressible wounds.

"A non-compressible injury is one that isn't going to be helped by a dressing and simple direct pressure," Dowling explains. "–for example, a large, oddly-shaped shrapnel wound in the abdomen. 90% of bleeding deaths are caused by these kinds of injuries, and there are currently no products available to effectively treat them. Our new product

continues on page 2

chair's MESSAGE

WILLIAM BENTLEY

THE FISCHELL DEPARTMENT OF BIOENGINEERING HAD A GREAT FALL SEMESTER AND IS NOW ENJOYING AN EVENTFUL SPRING. Our faculty and students are winning major grants and awards, placing in contests both locally and nationally, and are gaining tremendous recognition for their work, all of which you can read about in this issue of *Biofeedback.*

In October, our faculty, undergraduate and graduate students were exhibitors and gave ten presentations at the Pittsburgh BMES conference. Our booth was manned by a great group of people, led by Professor Peter Kofinas. Our friends from across the country stopped by and prospective students and faculty candidates were able to get a sense of the exciting activities underway here at Maryland.

This semester, for example, for the first time, doctors and clinicians from the **MedStar Hospital Group** are mentoring several teams of undergraduate students on their senior Capstone Design projects. They are progressing nicely and will be ready for the competition which precedes the **Fischell Festival** held on April 29, where the winners will be announced.

April also sees us hosting the **26th Southern Biomedical Engineering Conference** (April 30-May 2), offering everyone from the curious to the professional great ways to learn more about the latest developments in bioengineering and biomedical engineering. You can also meet us at **Maryland Day** (April 24), where our faculty, staff and students will have activities and information for the whole family! For more information about these events, visit their web sites at:

fischellfestival.umd.edu
bioe.umd.edu/sbec2010
www.marylandday.umd.edu

We also have some late-breaking news that we'll tell you more about in our next issue:

- For the third year in a row, bioengineering undergraduates have placed in the Institute of Biological Engineering's annual bioethics essay contest.
- Five teams lead by or including faculty and students from the Fischell Department of Bioengineering have been named semi-finalists in the university's **$75K Business Plan Competition**.
- Our NSF **Research Experience for Undergraduates** site, led by Professor **John Fisher**, has been renewed and is beginning its 7th year. It is now a joint program with scientists and engineers at the FDA.
- Affiliate Professor **Leigh Abts** has received a **Research Experience for Teachers** award from NSF to develop effective methodologies for Science, Technology, Engineering and Mathematics (STEM) teachers to learn and apply the fundamentals of the research, invention and innovation processes in their middle and high school classrooms.

We hope you'll take the opportunity to join us and learn more about the Fischell Department of Bioengineering. You can keep up with all the news as it happens on our web site at bioe.umd.edu/news.

With Best Regards,

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

is a lot like a can of shaving cream—when you spray it into a wound, it becomes an expandable foam, fills the space, and stops the bleeding without using any pressure. It doesn't require any special training to use so it can be distributed to soldiers, paramedics, or civilians for emergency or mass casualty situations."

Remedium was encouraged to enter the GSC competition by **Jim Chung**, Director of the Maryland Technology Enterprise Institute's (Mtech) VentureAccelerator Program, which assists University of Maryland-based companies with business planning, market analysis, recruiting, and raising capital.

Dowling is proud of Remedium's accomplishments: "At this point in time, Remedium is a real company, really trying to do something that will fit an obvious need." While the award will help the company on its way, he feels the opportunity to attend the Global Security Summit was just as important: "At the Summit, we were able to make new contacts with potential investors, government officials, and press representatives on an international scale in a single day. That's a remarkable opportunity for a startup! We're truly honored to have won our category and all the more determined to turn our idea into a commercial reality as quickly as possible."

"The trip to London was amazing," says Thomas. "The opportunity to compete in the Global Security Challenge and attend the summit was a tremendous experience. I think the competition highlighted how some of the most innovative technological ideas come from start-up companies born in university settings. We're very excited that the judges shared our enthusiasm for solving the problem of treating severe bleeding injuries—it really reinforces our excitement about it, too."

Remedium CMO and postdoctoral research associate **Oluwatosin Ogunsola** (Department of Chemical and Biomolecular Engineering) agrees. "Winning this kind of award, on an international stage, really validates everything we've been working toward," she says.

Currently, the Remedium team is conducting preliminary testing of the foam and designing a prototype dispenser. Ogunsola is researching FDA approval pathways and conducting customer analysis,

while Thomas has been performing a competitive analysis. The team has also applied for a Federal Small Business Innovation Research grant. They estimate that the foam, which still requires pre-market approval, could be on the market by 2013.

All of Remedium's past and current members have been advised by or worked for its Scientific Co-Founder and advisory board member, Department of Chemical and Biomolecular Engineering associate professor **Srinivasa Raghavan**. Raghavan is the director of the Complex Fluids and Nanomaterials Group laboratory, where the research behind Remedium's products is carried out.

The GSC is supported by companies including Accenture, BAE Systems, Blue Star Capital, Control Risks, the London Business School, ONR Global, Smiths Detection, TSWG and UKTI.

BALARAS WINS $1.5M NSF GRANT

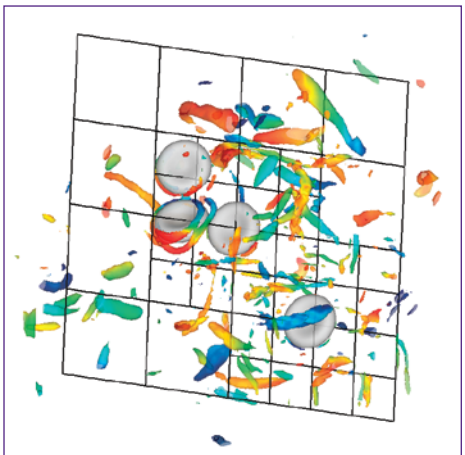
Associate Professor **Elias Balaras** is the project leader of a multidisciplinary team that has been awarded a four-year, $1.5 million National Science Foundation (NSF) grant for a project titled "Petascale Algorithms for Multi-Body, Fluid-Structure Interactions in Viscous Incompressible Flows." Balaras' co-PIs on the project are Professor **Joseph JaJa** (Department of Electrical and Computer Engineering/UMIACS), Assistant Professor **Santiago Solares** (Department of Mechanical Engineering), and Senior Computational Scientist **Anshu Dubey** (ASC/Flash Center, University of Chicago).

The objective of the project is to develop high-performance computing tools that can be used to accurately model complex fluid/structure interaction problems that occur in a variety of natural and engineered systems. The complexity of these flows and interactions are, according to Balaras, "among the most challenging problems in computational mechanics." His team is particularly focused on problems found in human cardiovascular circulation and related biomedical devices. Successful simulations will enable new research on the progression of serious and potentially fatal conditions such as hemolysis (the premature breakdown of red blood cells) and thrombosis (blood clots). What is learned about these conditions could have an impact on the future development of the biomedical devices used to treat atherosclerosis, heart valve disease, and other disorders.

Crucial to the project is the use of high-performance computing systems capable of handling the massive amount of information representing the millions of deformable blood cells traveling through and interacting with the human circulatory system. According to Balaras, by 2011, researchers should have access to systems capable of speeds in excess of one petaflop—a thousand trillion floating point operations—per second. Taking advantage of this level of computing power in the group's research, however, presents its own challenges: "These systems are expected to consist of tens of thousands to a few hundred thousand processors, with each processor containing multiple cores, [and] each core capable of executing multiple threads," Balaras explains. "These features present computational scientists with many challenges, including discovering and exploiting parallelism within algorithms and codes and overlapping different types of operations." The team will need to design their tools to work specifically at the petaflop computing scale.

"We're a multidisciplinary team with expertise in computational science, parallel computing and multiscale physics and modeling," says Balaras. "We're all very excited about the prospect of developing computational models of unprecedented complexity and size that will have a significant impact on human health care."

The project will also include training and research opportunities for high school and undergraduate research assistants, as well as summer outreach internships.



A MODEL SHOWING A CLUSTER OF RED BLOOD CELLS (ROUND, GRAY) INTERACTING WITH HOMOGENEOUS DECAYING TURBULENCE.

ADDITIONAL FUNDING FOR FLUORINATED BIOMATERIALS RESEARCH

Associate Professor **Bruce Yu** has received a $228K grant from the National Institutes of Health (NIH) to supplement a new aspect of an ongoing project titled "Engineering Peptide-Based Biomaterials." The grant is funded by the American Recovery and Reinvestment Act.

The parent research study, which is supported by the NIH's National Institute of Biomedical Imaging and BioEngineering (NIBIB), seeks to develop injectable biomaterials that can be used to repair damaged tissue.

"My group pursued the supplemental grant to help speed up the development of peptide-based biomaterials with fluorinated imaging agents embedded in them," Yu, the director of the Drug Delivery and Biomaterials Engineering Laboratory, explains. "We recently made a breakthrough that will give us a significant boost in developing biomaterials that can be monitored non-invasively using fluorine magnetic resonance imaging."

Fluorine magnetic resonance imaging, or ^{19}F MRI, is a type of specialized MRI used to visualize drugs, cells, genes, or implants administered to a patient for therapeutic reasons. "Fluorine MRI is a very useful technology, but its development has lagged far behind that of traditional proton MRI," says Yu. "One of the reasons for this is the lack of a really good imaging agent—what people use now, perfluorocarbons (PFCs), require complex formulation procedures and accumulate in the body, lingering there for months or longer. And because PFCs often emit split ^{19}F signals,

continues next page

the resulting images aren't as clear as they could be. So what we have are huge advances in the field of soft biomaterials, but until now very few in the tools we need to observe how they behave once inside a patient's body."

The Yu Group's discovery centers around the use of molecules called asymmetric bi-spherical fluorinated dendrimers, instead of PFCs. "Because the human body contains no detectable fluorine, ^{19}F is perfect for tracking injected or implanted drugs, materials, cells, and genes using MRI—you won't mistake it for anything else." says Yu. "Unlike PFCs, the compounds we developed pass quickly and harmlessly out of the body. They can also serve as sensitive indicators of *in vivo* biochemical reactions."

Yu believes these qualities will give fluorine MRI the potential to produce much clearer images of implanted materials, which will in turn allow researchers and physicians to better evaluate a biomaterial's interactions with surrounding tissues, including where it is, whether it has degraded, and, if applicable, how much of a drug has been released from it.

Currently, Yu's group is embarking on a new fluorine MRI project that would allow multiple therapeutics to be tracked simultaneously, each with its own color.

FISHER BIOREACTOR WINS PROFESSOR VENTURE FAIR

A team led by Associate Professor **John Fisher** won Best Inventor Pitch at the 2009 Professor Venture Fair, held as part of Bioscience Research & Technology Review Day, for its design of a tissue engineering bioreactor system that grows bone and other types of tissue for implantation. Fisher's technology was one of six innovations presented by faculty members and graduate students at the event, which took place in November 2009 at the University of Maryland.

"Dr. Fisher impressed the judges with his clearly defined product—the bioreactor system itself—and his ability to position himself within an already vibrant tissue engineering marketplace," says **Gayatri Varma**, executive director of the university's Office of Technology Commercialization.

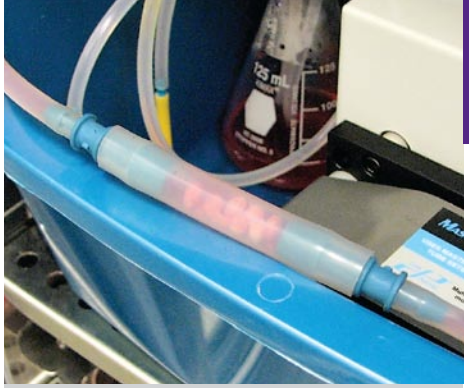
Fisher's novel, patent-pending bioreactor system makes tissue engineering more efficient by addressing many of the shortcomings of available systems, such as the high cost and complexity of the perfusion chamber and the low output of the rotating flask. His approach exposes growing tissue to an increased amount of oxygen and nutrients, making it a more prolific and cost effective bioreactor than those currently on the market.

Fisher, along with graduate student researcher **Andrew Yeatts** and undergraduate student researcher **Elyse Geibel**, both from the Fischell Department of Bioengineering, have already created a prototype in his lab using off-the-shelf products. The team plans to start a company called **ProlifiTEC** to bring the bioreactor to a commercial market.

"We're thrilled to win," says Fisher. "It's a fantastic opportunity to be able to describe our work and concept to local venture capitalists. We hope to use this award as a springboard to launch our company."

The annual Biotechnology Research & Technology Review Day Professor Venture Fair is hosted by the Maryland Technology Enterprise Institute (Mtech), the Office of Technology Commercialization, and the College of Chemical and Life Sciences. The pitch competition encourages scientists to consider the commercial potential of their work and challenges them to translate their ideas to a general, non-technical audience.

This year's Professor Venture Fair was sponsored by the Maryland Technology Development Corporation (TEDCO). This is the second year in a row—out of the three years the competition has been held—that a team led by or including members from the Fischell Department of Bioengineering has taken first place.

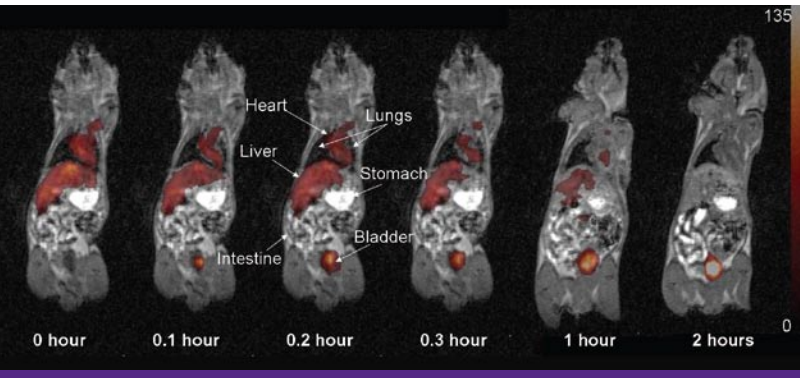


ALGINATE BEADS (ORANGE, CENTER) CONTAINING HUMAN MESENCHYMAL STEM CELLS ARE CULTURED IN THE PROLIFITEC BIOREACTOR, CREATED BY PROFESSOR **JOHN FISHER**, **ANDREW YEATTS**, AND **ELYSE GEIBEL**. THE DYNAMIC FLOW CREATES AN OPTIMAL ENVIRONMENT FOR THESE CELLS TO DIFFERENTIATE INTO BONE.

EXPLORING TUBERCULOSIS' RESISTANCE TO DISINFECTION

Bioengineering Professor and Chair **William Bentley** published research in *Applied Microbiology & Biotechnology* discussing the response of tuberculosis to disinfection with bleach. The article, titled "Global Transcriptome Analysis of the Mycobacterium bovis BCG Response to Sodium Hypochlorite," is a collaboration with Dr. **Freshteh Toghrol** (Microarray Research Laboratory, U.S. Environmental Protection Agency), Dr. **Hyeung-Jin Jang** (Department of Biochemistry, Kyung Hee University, Seoul) and Dr. **Chantal Nde** (Center for Biosystems Research, University of Maryland Biotechnology Institute).

Tuberculosis is a common and often deadly infectious disease caused by mycobacteria (gram positive bacteria), mainly *Mycobacterium tuberculosis,* and infrequently by other subspecies of the *M. tuberculosis* complex, such as *M. bovis*. *M. bovis* is the causative agent of tuberculosis in cattle, but it can also jump the species barrier to infect humans. Sodium hypochlorite (bleach) is routinely used in hospitals and health care facilities for surface sterilization to prevent the spread of tuberculosis; however, how exactly bleach acts on *M. bovis* and how the organism develops a



FROM AN EARLIER, SIMILAR STUDY BY YU: 1H/19F (WHITE/RED) MRI IMAGES OF A MOUSE INJECTED WITH 2.2 MMOLE/KG OF 19FIT. AFTER 2 HOURS, 19F IS VISIBLE ONLY IN THE BLADDER.

resistance to it have not been explained.

In the study, Bentley and his colleagues performed a global toxicogenomic analysis (one which examines an organism's genetic response to toxins) of the *M. bovis* response to exposure to sodium hypochlorite after 10 and 20 minutes. *M. bovis* growth was monitored by measuring the quantity of ATP (energy used for cellular functions) it produced over a short exposure time (10-60 minutes).

The results revealed significant regulation of oxidative stress response genes of *M. bovis,* such as oxidoreductase (an enzyme that catalyzes the transfer of electrons from one molecule to another), peroxidase (an enzyme that catalyzes a reaction to reduce toxicity), heat shock proteins, lipid transport, and metabolism genes. The group interpreted this response as a potentially more lethal interplay between fatty acid metabolism, sulfur metabolism, and oxidative stress. This study shows that the treatment of *M. bovis* with bleach slows the biosynthesis of outer cell wall mycolic acids, which play a role in tuberculosis's increased resistance to chemical damage and dehydration, and also induces oxidative damage.

TAO DESCRIBES ROBOTIC ORCHARD MAINTENANCE AT AG CONFERENCE

Professor **Yang Tao** presented research on robotic orchard thinning at an automation workshop held as part of the Penn State University Fruit Research and Extension Center's Grower Field Day in summer 2009. Tao and his colleagues, **Paul Heineman** and **Jude Liu** of Penn State University, described a system in which a combination of computer vision, artificial intelligence, and a robotic arm could simulate the decision making process of a human performing thinning on fruit trees.

"Thinning" is a process in which a grower removes blossoms or small, immature fruit from a tree to reduce the ultimate number of mature fruits it will produce. While a large harvest may seem appealing, more is not always better–if every piece of fruit is allowed to grow and ripen, their overall quality and size will be reduced, and the crop is more likely to be attacked by destructive insects.

It is, however, a time-consuming task. Thinning machinery does exist, but it lacks the decision-making power of the grower's mind–it is unable to asses the best young fruit or blossoms to leave in place.

Tao, whose research at the Bio-Imaging and Machine Vision Laboratory covers areas including food quality and safety, robotics and automation, worked with Heineman and Liu to propose an automated thinning system that simulates human decision-making and movements. A combination of computer, robotic arm and camera, mounted on a mobile platform, would move up and down a row of trees. The camera would take pictures of the trees, which would then be evaluated by the computer. When the end of a branch is detected, the system would measure back to its origin to determine its length, count the number of blossoms, use an equation based on the length of the branch and number of blossoms to determine how many blossoms should be removed, and send instructions to the robotic arm to grip the branch and do the job.

SHIRMOHAMMADI NAMED ASSOCIATE DEAN OF AG SCHOOL

The Fischell Department of Bioengineering extends its congratulations to Professor **Adel Shirmohammadi**, who was appointed the College of Agriculture and Natural Resources' (AGNR) Associate Dean for Research and Associate Director of the Maryland Agricultural Experiment Station (MAES).

"This is a tremendous recognition and promotion," said BioE Professor and Chair **William Bentley**. "We're really going to miss Adel, particularly as our students' champion in his role as our Associate Chair and Director of our Undergraduate Program. The department has benefited tremendously from his hard work since its establishment and from his leadership during our ABET accreditation process."

In his new role, Shirmohammadi will administer AGNR's research programs from the MAES, the anchor of the college's research activities, comprised of over 100 faculty members on campus and in several centers throughout the state. He will coordinate and promote departmental and multidisciplinary programs, work to secure grants and funding, and support extension and academic units.

"I had a lot of thinking to do when I decided to apply for this position, because it meant leaving a great department and wonderful colleagues," Shirmohammadi commented. "My fellow bioengineering faculty and the bioengineering staff have been wonderful to me and have made my job as the Associate Chair and Director of the Undergraduate Program successful! Our BioE students will be in my heart and I wish them all the best in their academic and professional careers."

Associate Professor **John Fisher** will assume Shirmohammadi's role as the Director of the Undergraduate Program in Bioengineering.

SHAH WINS ALZHEIMER'S RESEARCH GRANT

Assistant Professor **Sameer Shah** has been awarded an $80K New Investigator Research Grant from the Alzheimer's Association, the country's top health organization for Alzheimer's care, community and patient support, and research. He won the award for his proposal, "Mechanical Determinants of Axonal Transport and Amyloid Processing." Shah is the director of the Neuromuscular Bioengineering Laboratory, which studies the function, dysfunction, and plasticity of the nervous and muscular systems. The lab utilizes a variety of computational and experimental methods to study these systems at the molecular, cell, and tissue scales.

inBRIEF

JOHNSON ELEVATED TO IEEE FELLOWSHIP

PROFESSOR EMERITUS **ARTHUR T. JOHNSON** HAS BEEN ELEVATED TO THE RANK OF FELLOW OF THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE), EFFECTIVE JANUARY 1, 2010. HE WAS CITED FOR HIS LEADERSHIP IN BIOENGINEERING EDUCATION.

BENTLEY HOSTS WEBINAR ON QUORUM SENSING

PROFESSOR AND CHAIR **WILLIAM BENTLEY** WAS THE HOST OF A WEBINAR PRESENTED BY THE SOCIETY OF BIOLOGICAL ENGINEERING. "A BOTTOM UP APPROACH TO SYSTEMS BIOTECHNOLOGY—LESSONS LEARNED FROM BACTERIAL SIGNAL TRANSDUCTION," DISCUSSED THE BENTLEY GROUP'S EFFORTS TO EXPLAIN HOW CONTROLLING QUORUM SENSING—AN EXCHANGE OF SIGNALING MOLECULES USED BY BACTERIA TO COMMUNICATE WITH ONE ANOTHER—COULD BE USED TO PREVENT BACTERIA FROM TRIGGERING AN INFECTION, WHICH IN TURN COULD ASSIST IN THE TREATMENT OF DISEASES THAT HAVE BECOME RESISTANT TO TRADITIONAL ANTIBIOTICS.

FISHER, BETZ FEATURED ON DISCOVERY.COM

ASSOCIATE PROFESSOR **JOHN FISHER** AND GRADUATE STUDENT **MARTHA BETZ** WERE FEATURED ON AN EPISODE OF THE DISCOVERY CHANNEL'S ONLINE *DISCOVERY NEWS* PROGRAM. IN THE SEGMENT, "IS IT THE FUTURE YET? ENGINEERING TISSUE," FISHER AND BETZ DISCUSSED THEIR CURRENT RESEARCH ON TISSUE AND BONE REGENERATION. THE PATIENTS' OWN ADULT STEM CELLS ARE PLACED IN SYNTHETIC POLYMER MATERIALS CALLED "SCAFFOLDS" THAT, ONCE IMPLANTED IN THE BODY, SUPPORT THEIR GROWTH INTO NEW CARTILAGE OR BONE.

TRAUMA SOLUTIONS FEATURED IN *SCIENTIFIC AMERICAN*

TRAUMA SOLUTIONS, THE AWARD-WINNING STARTUP COMPANY FOUNDED BY PROFESSOR **PETER KOFINAS** AND MEMBERS OF HIS RESEARCH GROUP, WAS FEATURED IN THE DECEMBER 2009 ISSUE OF *SCIENTIFIC AMERICAN*. THE YOUNG, COMPANY'S SYNTHETIC BLOOD-CLOTTING PRODUCT (SEE *BIOFEEDBACK* V. 5 No. 2) WAS DESCRIBED IN THE COVER STORY, "WORLD-CHANGING IDEAS."

studentNEWS

HSU WINS BEST POSTER AWARD FOR RESEARCH ON RARE NEUROMUSCULAR DISORDER

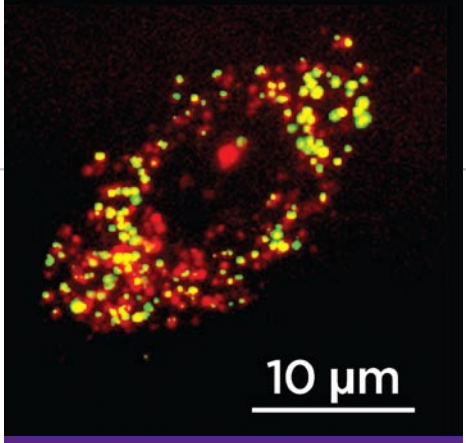
Graduate student **Janet Hsu**, advised by Assistant Professor **Silvia Muro**, received the Nanoscience/Nanotechnology Best Poster Award at the 2009 Bioscience Research & Technology Review Day, held in November 2009 at the University of Maryland.

Hsu's poster, titled "Receptor-Targeted Nanoparticles for Enzyme Replacement Therapy of Genetic Pompe Disease," described a new method of delivering therapeutics to patients suffering from Pompe disease, a rare and potentially lethal neuromuscular genetic disorder that causes the accumulation of glycogen, a form of sugar used by the body for energy.

Under normal circumstances, glycogen is broken down by cells in compartments called lysosomes, using an enzyme called alpha-glucosidase (GAA). A person with Pompe disease does not produce enough GAA to meet their cells' needs, or may not produce any at all, causing glycogen to accumulate in the lysosomes. As cells are damaged by swelling, unprocessed glycogen escapes into intercellular space throughout the body. The buildup has the most effect on muscles, which are unable to function properly and gradually weaken. Many of those who suffer from the disease ultimately die of heart or respiratory failure.

Currently enzyme replacement therapy is used to treat patients. Large doses of medication are required because only a percentage of the GAA administered is successfully delivered to the lysosomes of the cells. The body responds to the unnaturally high concentration of GAA by producing antibodies to destroy it, further reducing the efficacy of the treatment.

JANET HSU



TARGETING OF THERAPEUTIC NANOCARRIERS TO GLYCOGEN-FILLED LYSOSOMES FOR TREATMENT OF POMPE DISEASE: A CELL IS SHOWN WHERE LYSOSOMES ARE STAINED RED, NANOCARRIERS FLUORESCE GREEN, AND COLOCALIZATION OF NANOCARRIERS WITHIN LYSOSOMES IS DEPICTED AS YELLOW.

As a part of the nanobiotechnology platform that the Muro Lab is developing for the treatment of rare genetic diseases, Hsu is designing targeted nanocarriers (vesicles used to deliver drugs in a variety of treatments) to improve the delivery rate of GAA to specific organs in the body and increase the amount of it ultimately transported into the lysosomes of cells. She is part of a team that has designed a prototype therapeutic strategy consisting of polymer nanoparticles coated in GAA and designed to be attracted to a specific receptor found on the surface of the targeted cells. In testing, radioisotope tracing revealed that enzyme delivery to target organs in mice was improved using the new technique. Once at their destination, the nanoparticles were taken into cells, and the GAA was transported into the lysosomes, where it successfully broke down glycogen.

Bioscience Research & Technology Review Day, hosted annually by the College of Chemical and Life Sciences, is a special event that features research talks, presentations, mini-symposia, and demonstrations by university scientists. The program provides an opportunity for professionals in industry and government to learn more about recent advances in bioscience, bioengineering and biotechnology at the University of Maryland, meet faculty and students, identify potential collaborators, and recruit employees.

CASEY NAMED ARCS FELLOW

Graduate student **Brendan Casey**, advised by Professor **Peter Kofinas**, was awarded a 2009 Achievement Rewards for College Scientists (ARCS) Fellowship at a U.S. Supreme Court reception in October 2009. This is Casey's third year as an ARCS Fellow.

ARCS fellowships provide recipients with a renewable award of $15K per year and are sponsored by the Metropolitan Washington Chapter of the ARCS Foundation, Inc. ARCS provides science, medicine and engineering scholarships to outstanding students who are U.S. citizens contributing to the advancement of science and technology.

"The whole experience was pretty amazing, and something I will remember for the rest of my life," Casey says of the reception. "I was able to meet Justice **Anthony Kennedy**, which was a thrill for me. The award presentation took place inside the actual Supreme Court. Both **Ralph J. Cicerone** [President of the National Academy of Sciences] and Justice Kennedy gave great speeches, and I felt honored [to be] there listening to them."

Since his first year as an ARCS Fellow, Casey has been involved in several research projects at Kofinas' Functional Macromolecular Laboratory. His current efforts center on the development of a synthetic blood-clotting polymer hydrogel that can be used to control surgical or traumatic bleeding without the need for stitches or sutures. He has been studying the interactions between the hydrogel and the proteins present in the natural blood clotting process in order to optimize the material's ability to control or enhance it. Casey, Kofinas and their colleagues have launched a startup company called **Trauma Solutions, Inc.** to market the new technology, which is currently undergoing animal studies at the University of Maryland School of Medicine. Casey has presented the group's work at recent Biomedical Engineering Society and American Chemical Society conferences.

Casey says his time as an ARCS Fellow has had a substantial impact on his graduate school experience. "The financial award is a major contributor to my stipend and gives me and my advisor the freedom to focus on research rather than worrying about finding those funds to support me. Besides the financial aspect, the ARCS staff has been absolutely amazing in their support of me and my research, for which I am truly grateful. I consider them family."

Senator **Ted Kaufman** (D-Delaware), husband of ARCS member **Lynn Kaufman**, read a statement about the ARCS Scholar Awards and a list of this year's ARCS Fellows into the Congressional Record.

ALSO IN THE NEWS...

IN ADDITION TO WINNING $10K IN THE GLOBAL SECURITY CHALLENGE (SEE COVER STORY), REMEDIUM CEO AND FISCHELL FELLOW MATT DOWLING ALSO RECEIVED A MARYLAND INNOVATOR OF THE YEAR AWARD, GIVEN TO INDIVIDUALS WHOSE IDEAS HAVE HAD A POSITIVE EFFECT ON BUSINESS, COMMUNITY, OR INDUSTRY IN MARYLAND.

RUSS TAPPED FOR GENETICS JOURNAL GUEST COLUMN

Bioengineering undergraduate **Zachary Russ** was invited to pen a guest column for *Genetic Engineering & Biotechnology News (GEN)* a publication that has covered developments in bioprocess research and commercialization since 1981. Russ was asked to submit a story by *GEN*'s Opinion Editor after seeing an essay he authored in the *Journal of Biological Engineering.*

Russ' article for *GEN,* "Preserving the Integrity of Statistics," discusses the challenge of working with and proper use of statistics in bio-oriented research. This setting often finds scientists wrestling with multiple variables and living organisms that may not behave as expected, may mimic another organism's behavior, and are subject to contamination. Russ also advocates for greater transparency in published research, including complete information on how data was collected, manipulated, and culled; and for increased education for young scientists who are expected to use statistics to explain their results and justify their conclusions.

ZACHARY RUSS

"Perhaps our problem," he writes, "is that, without much emphasis on biostatistics in curricula or the workplace, students and novice researchers are not given an adequate understanding of when to use statistics, how to use them, and what they mean, yet are encouraged to use statistics whenever possible...."

Russ, who is double majoring in bioengineering and mathematics, intends to pursue a Ph.D. in bioengineering and design micro- and nanoscale devices for medical applications. In 2008 and 2009 he was the winner in the Institute of Biological Engineering's national bioethics essay contest, and in 2009 he was the recipient of a Goldwater Scholarship. He has participated in summer research programs at the University of California-Berkeley and Rice University.

"Preserving the Integrity of Statistics" appears in the November 1 (vol. 29, No. 19) issue of *GEN* and can be found online at the *GEN* web site.

BIOENGINEERING GRADUATE STUDENT **BRENDAN CASEY** (2ND FROM LEFT) WITH HIS FAMILY AT THE ARCS RECEPTION AT THE SUPREME COURT.

A. JAMES CLARK
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ABOUT THE COVER IMAGE

THE PURPLE IMAGE USED ON THE COVERS IS A FLUORESCING LIVE/DEAD IMAGE OF HUMAN MESENCHYMAL STEM CELLS CULTURED IN AN ALGINATE BEAD THAT FORMS PART OF A NEW BIOREACTOR. THE DEVICE, CREATED BY A TEAM LED BY PROFESSOR JOHN FISHER, WON "BEST INVENTOR PITCH" AT THE 2009 PROFESSOR VENTURE FAIR. YOU CAN READ MORE ABOUT THIS PROJECT ON PAGE 4.

BIOFEEDBACK is published for alumni and friends of The Fischell Department of Bioengineering at the A. James Clark School of Engineering, University of Maryland.

Alumni news and comments are welcome! Please contact us at:
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inAPPRECIATION

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