

Department Update

Cytokinesis Lab Research

2010 Research Partners

Senior Seminar Projects

Student News

Faculty Awards

Equipment Donation

Faculty Activities and Publications

Spring Phonathon

April 7, 10-12 2011

Your chance to update your contact info, share your thoughts and news, talk with current BioSci students, and contribute to the Biological Sciences department.

Cytokinesis lab investigates regulation of contraction

Cytokinesis is the physical division of one cell into two. Cytokinesis requires the contractile ring, which contains actin and myosin, as well as many other proteins. Actin and myosin, which are also involved in muscle contraction, are required to generate the force to divide the cell in two.

Research in **DR. KATIE SHANNON'S** cytokinesis lab focuses on understanding how actomyosin ring assembly and contraction are regulated. This regulation is important to ensure that each cell receives the correct number of chromosomes. Having the wrong number of chromosomes, called aneuploidy, is thought to be an early event in tumor formation.

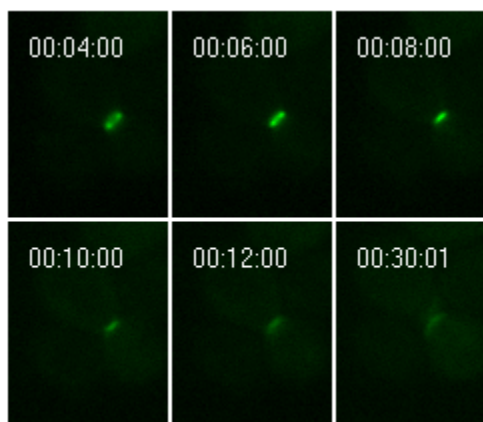
The Cytokinesis lab uses budding yeast *Saccharomyces cerevisiae* as a model organism. This yeast, which is the same as that used for baking bread or brewing beer, has many advantages, such as being cheap and easy to grow, a sequenced genome, and ease of using genetic and molecular techniques. Many cytokinesis genes are conserved between yeast and human cells.

Students in the Cytokinesis lab, including Masters student **KATIE STOCKSTILL** and undergraduates **RACHEL WILLE** and **GRACE BAY**, are focusing on a protein called HofI. HofI is required for efficient cytokinesis. The goal is to test the hypothesis that phosphorylation of HofI regulates contraction of the actomyosin ring. Phosphorylation is the addition of a small chemical group, a common cellular mechanism for activating or inactivating a protein.

Amino acids in a region of HofI called the PEST domain were mutated to prevent phosphorylation. The PEST domain is a region rich in the amino acids proline, glutamic acid, serine, and threonine. PEST domains have been implicated in protein degradation. Quantitative fluorescent microscopy shows that the mutant HofI remains at the site of cytokinesis after contraction, while the normal HofI relocalizes to the cytoplasm. Analysis of myosin contraction demonstrates that the mutant HofI causes a



Katie Stockstill working on her thesis in the Cytokinesis lab



HofI-GFP dynamics in normal cells. Images taken every two minutes show that HofI protein is localized to the bud neck, where cytokinesis occurs, and the signal decreases after completion of cytokinesis (compare 30 minute and 4 minute time points).

decrease in the rate of contraction. This data shows that the phosphorylation of HofI regulates protein dynamics during cytokinesis. **KATIE STOCKSTILL** is currently working with **DR. SHANNON** to write her thesis and a manuscript to publish the HofI results.

Department Update

Learning and discovery are the two major concerns of the faculty, students and staff that comprise the S&T BioSci academic community. As I'm sure you are aware, maintaining the quality of our programs in this time of extremely limited resources has occupied much of our attention. Many of our activities are described in our recently published 2010 Annual Report. This report can be viewed on the departmental web site (<http://biosci.mst.edu/documents/annualreport10.pdf>), or we would be happy to send you a printed copy.

Faculty: Four faculty members were recently honored with faculty excellence awards in the areas of Research (Yue-wern Huang), Teaching (David Westenberg), Service (Ronald Frank), and Faculty Achievement (Terry Wilson). The number and range of awards reflects the balanced efforts of our creative and effective faculty members.

We are in the process of searching for a new faculty member. This is a time consuming process, and the faculty is approaching it in a thoughtful manner. Selection criteria include area of expertise, research training and productivity, commitment to teaching excellence, creativity and collegiality. The department is committed to providing the resources and counseling required to ensure the appropriate professional development of our new colleague.

Students: Degrees were awarded to 23 undergraduates and 5 graduate students in 2010, bringing the number of BioSci graduates to 493. The strong recent growth of the department is continuing: as of early February, the number of applicants for fall semester had increased from 122 to 149 (2010 compared to 2011), while the number of admitted students had increased from 90 to 117. In terms of enrollment, we are now the 7th largest department on campus. One big challenge this growth presents is to continue to offer research opportunities for all of our students. The expansion of our cell engineering-research design team (iGEM) has helped in the latter regard. Historically, over 80% of our undergraduates participate in research.

Research: Faculty research publications are listed in our Annual Report. In 2010, our 8 faculty members published 15 research articles, presented 23 papers at national or international meetings, and received \$459,000 in extramural research funding. Four visiting scholars from Taiwan National Normal University spent six months in our department in 2010, and four others have joined us for the 2011 spring semester. Clone sales from the cDNA Resource Center were \$193,336 in 2010 and have totaled \$1.7 million since 2005. The sequences of 70 nuclear receptors, included 13 novel splice variants, were submitted to GenBank and made available to the scientific community.

Project Lead the Way: We are scheduled to host as many as 9 training sessions this summer for master high school teachers involved in the Project Lead The Way – Biomedical Sciences curriculum. We have established methods to offer academic credit to both the students and teachers engaged in this program.

Alumni Support: Alumni support for our programs has shown steady growth. Gifts in excess of \$20,780 were received in 2010. While the number of BioSci alumni will soon be 500, half of our students have graduated in the last 10 years and are still in the early phases of their careers. We are pleased to recognize our supporters elsewhere in this newsletter. Contributions can be made on the S&T web site (givingtomst.missouri.edu). (Of course, I'm sure you'll want to specify Biological Sciences as the recipient fund).

We appreciate all you have done to support the department and its students and hope you will continue to be able to do so. I am pleased to report to you. We welcome your feedback on any of our activities or plans, and invite you to visit the department any time you are in Rolla.

Sincerely,



Robert S. Aronstam, Ph.D.
Professor and Chair, Biological Sciences



2010 Biological Sciences Staff from left to right: Jessica Pelc, Adam Martin, Connie Behrick, Sharen Wang, Vicky Rowden

Faculty News

Faculty Publications, 2010

Fu Q, MN Rahaman, BS Bal, and **RF Brown**, Preparation and in vitro evaluation of bioactive glass (13-93) scaffolds with oriented microstructures for repair and regeneration of load-bearing bones. *Journal of Biomedical Material Research* 93A: 1380-1390, 2010.

Fu Q, MN Rahaman, BS Bal, K Kuroki, and **RF Brown**, In vivo evaluation of 13-93 bioactive glass scaffolds with trabecular and oriented microstructures in a subcutaneous rat implantation model. *Journal of Biomedical Material Research* 95A: 235-244, 2010.

Fu Q, MN Rahaman, BS Bal, LF Bonewald, K Kuroki, and **RF Brown**, Silicate, borosilicate, and borate bioactive glass scaffolds with controllable degradation rates for bone tissue engineering applications. II: In vitro and in vivo biological evaluation. *Journal of Biomedical Material Research* 95A: 172-179, 2010.

Greig HS, **DK Niyogi**, KL Hogsden, PG Jellyman, and JS Harding, Heavy metals: confounding factors in the response of New Zealand freshwater fish assemblages to natural and anthropogenic acidity. *Science of the Total Environment* 48:3240-3250, 2010.

Huang C-C, Y Xu, JT Briggler, M McKee, P Nam, and **Y-w Huang**, Heavy metals, hematology, plasma chemistry, and parasites in adult hellbenders (*Cryptobranchus alleganiensis*). *Environmental Toxicology and Chemistry* 29(5): 1132-1137, 2010.

Huang, Y-w, C-H Wu, and **RS Aronstam**, Toxicity of transition metal oxide nanoparticles: Recent insights from in vitro studies, *Materials* 3(10) 4842-4859, 2010.

Jung SB, DE Day, and **RF Brown**, Comparison of self-bonded, three dimensional bioactive glass fiber scaffolds after in-vivo implantation. *Advances in Bioceramics and Biotechnologies*, Edited by R. Narayan and J. McKittrick. *Ceramic Transactions* 218: 115-132, 2010.

Kandath C, F Ercal, and **RL Frank**, A framework for automated enrichment of functionally significant inverted repeats in whole genomes. *BMC Bioinformatics* 11(Suppl 6):S20, 2010.

Lee L, C Kandath, JL Leopold, and **RL Frank**, Protein secondary structure prediction using parallelized rule induction from coverings. *International Journal of Medicine and Medical Science* 1(2): 99-105, 2010.

Lee L, JL Leopold, C Kandath, and **RL Frank**, Protein secondary structure prediction using RT-RICO: a rule-based approach. *Open Bioinformatics Journal* 4: 17-30, 2010.

Liu BR, J-F Li, S-W Lu, H-J Lee, **Y-w Huang***, **KB Shannon**, and **RS Aronstam**, Cellular internalization of quantum dots noncovalently conjugated with arginine-rich cell-penetrating peptides. *Journal of Nanoscience and Nanotechnology* 10: 6534-6543, 2010.

Liu BR, **Y-w Huang**, H-J Chiang, and H-J Lee, Cell-penetrating peptide-functionalized quantum dots for intracellular delivery. *Journal of Nanoscience and Nanotechnology* 10: 7897-7905, 2010.

Niyogi DK, JM Bandeff, C Selman, and **DE Menke**, Nutrient flux, uptake, and transformation in a spring-fed stream in the Missouri Ozarks, USA. *Aquatic Sciences* 72: 203-212, 2010.

Wang H-J, T-H Tang, AC Growcock, J O'Hara, A. Martin, Y-w Huang, and **RS Aronstam**, ZnO Nanoparticle Inhibition Muscarinic Receptor Ligand Binding and Activation of Store-operated calcium entry, *Toxicology In Vitro* 24: 1953-1961, 2010.

Xu Y, BR Liu, H-J Lee, **KB Shannon**, JG Winiarz, T-C Wang and **Y-w Huang**, Nona-arginine facilitates delivery of quantum dots into cells via multiple pathways. *Journal of Biomedicine and Biotechnology* 2010, Article ID 948543, 11 pages. 2010.



Biological Sciences Faculty 2010: From left to right-Roger Brown, Dev Niyogi, Melanie Mormile, Dan Oerther, Dave Westenberg, Ron Frank, Terry Wilson, Yue-wern Huang, Katie Shannon, and Robert Aronstam

Presentations at Professional Meetings, 2010

Aronstam, R.S., H-J Wang, AC Growcock, J O'Hara, T-H Tang, A Martin, and Y-w Huang, Nanoparticle disruption of muscarinic receptor mediated signal transduction, American Society for Neurochemistry, 2010.

Greenwood MJ, AR McIntosh, JS Harding, KE McHugh, and **DK Niyogi**, Direct and indirect effects of riparian management on aquatic invertebrate communities in a degraded agricultural landscape. North American Benthological Society and American Society of Limnology and Oceanography, joint Annual Meeting, Sante Fe, 2010.

Huang, Y-w, C-C Huang, Y Xu, and **RS Aronstam**, Metal oxides influence cellular homeostasis via multiple interconnected signaling pathways, Society for Toxicology, 2010.

Kandath C, F Ercal, and **RL Frank**, Fast automated identification of functionally significant inverted repeats in whole genomes. Mid-South Computational Biology and Bioinformatics Society Conference, Jonesboro, AR, 2010.

Mormile MR, Are there Martians in Australia? Science Seminar Series 2010-2011, Co-sponsored by The Saint Louis Zoo and The Academy of Science - St. Louis. St. Louis, Missouri, 2010.

Mormile MR, Benefits of using extremophilic microorganisms for bio-fuel production. 60th Meeting of the Society for Industrial Microbiology, San Francisco, California, 2010.

Mormile MR, How to translate your research into a science museum exhibit. 110th General Meeting of the American Society for Microbiology, San Diego, California, 2010.

Mormile MR, Metagenomics use at a former coal mining environment to bio-prospect for enzymes with applications to sustainable energy. Research and Development Advisory Board Meeting, University of Missouri. Columbia, Missouri, 2010.

Mormile MR, Mining genomic data for extremophilic enzymes. 60th Meeting of the Society for Industrial Microbiology. San Francisco, California, 2010.

Niyogi DK, CY Hu, and JS Harding, Fungal communities in streams affected by mine drainage: responses to multiple stressors and nutrient subsidies. North American Benthological Society and American Society of Limnology and Oceanography, joint Annual Meeting, Sante Fe, 2010.

Selman, C, **DK Niyogi**, and MW Fitch, Dominant processes that affect the nutrient retention in small Missouri-Ozarks streams. North American Benthological Society and American Society of Limnology and Oceanography, joint Annual Meeting, Sante Fe, 2010.

Shannon K, Regulation of budding yeast protein-protein interactions important for cytokinesis. 50th Annual Meeting of the American Society for Cell Biology, Philadelphia, PA, 2010.

Shannon K, Using Budding Yeast To Study The Regulation Of Cytokinesis. University of Northern Iowa, Cedar Falls, IA, 2010.

Stockstill K, J Park, R Wille, and **K Shannon**, Analysis of HofI PEST domain phosphorylation and cytokinesis in budding yeast. Annual Meeting of the American Society for Cell Biology, Philadelphia, PA, 2010.

Wang H-J, T-H Tang, AC Growcock, J O'Hara, A Martin, Y-w Huang, and **RS Aronstam**, ZnO nanoparticles alter muscarinic receptor ligand binding and activation of SOCE, Society for Toxicology, 2010.

Westenberg, D.J. and Gull, K.A., Online with the American Society for Microbiology: Resources and Programs for Educators at all levels., National Association of Biology Teachers annual meeting, Minneapolis, MN, 2010.

Westenberg, D.J., convened a session on "Biotechnology", Annual Meeting of the National Association of Biology Teachers, Minneapolis, MN, 2010.

Westenberg, D.J., convened a session on the "Benefits of Outreach in Higher Education" for the 2010 General Meeting of the American Society for Microbiology, San Diego, CA, 2010.

Westenberg, D.J., Reaching out to K-12 Classrooms. General Meeting of the American Society for Microbiology. San Diego, CA, 2010.

Westenberg, D.J., Synthetic Biology: Introducing Students to Independent Research Through the International Genetically Engineered Machines (iGEM) Competition. National Association of Biology Teachers Annual Meeting, Minneapolis, MN, 2010.

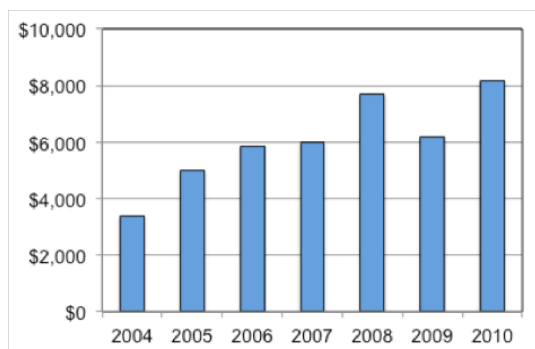
Westenberg, D.J., The American Society for Microbiology Biology Scholars Program. National Association of Biology Teachers annual meeting, Minneapolis, MN, 2010.

Westenberg, D.J., Where the Microbes Are. USA Science and Engineering Festival. Washington, DC, 2010.

2010 Research Partners

We are pleased to acknowledge those who generously supported the department in 2010. The consistent support we receive from our alumni and friends provides the means to strengthen our academic community and support innovation in both teaching and research. A record \$20,780 was received in 2010. Contributions are welcome at any time and can be made on the S&T web site (givingtomst.missouri.edu)

We appreciate all you have done to support the department and its students and hope you will continue to be able to do so. We welcome your feedback on any of our activities or plans, and invite you to visit the department any time you are in Rolla.



Donations up to \$100

Mark Steven Statler
Dr. & Mrs Anthony Kaczmarek
Lachelle Renae Arrendondo
Thias Diaz-Figueroa
David A. Elsenrath
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XL Sci-Tech Inc Match
Betsey M. Dampier
Robert & Katherine Phillips
Anne Schumer

Donations of \$500 to \$999

Lachelle R. Arredondo
Todd Rumans
Dr. & Mrs. James May

Donations > 1,000

Robert & Joan Aronstam
Marcus H. Hayer
F. Frederick Keilhorn
Joseph A. Safron &
Baxter International Match
Thomas Wetteroth and
Mary Lynn Formanack
Richard Vitek

Senior Seminar Students Conduct Service Learning Projects

In the fall, 30 seniors enrolled in Senior Seminar designed biologically related service projects. The goal was for students to practice group communication and organization skills while giving back to the community. Students work in groups to propose, develop, complete, and present service-learning projects that are related to the biological sciences. Students developed a peer mentoring program for the department, helped the Tri-County Humane Society, put on a bike safety presentation at a local elementary school, started a recycling project at Fort Leonard Wood, and raised money for Heart Disease and cancer patients at Phelps County Regional Medical Center.



Karen Schilli judges a bike rodeo event.

One successful project was a Bike Rodeo for Truman Elementary School PE club. Students who conducted the project were **KAREN SCHILLI**, **ASHLEY MUEHLER**, and **BRETT VESSELL**. Bio Sci students teamed up with the Missouri S&T Cycling Club and Bicycle Safety Officer Dennis Noel of the Rolla Police Department. The students organized both a presentation and a bicycle safety event, or bike rodeo. The presentation gave the elementary students specific information about bicycle safety, while the bicycle safety event let them actually practice what they had learned. Surveys given to the participating children revealed that 80% of the students learned something new from the project, and 100% enjoyed the event and would participate again. Dennis Noel spoke on bicycle safety to the 4th graders participating in the rodeo. The presentation included safety information such as signaling, rules of the road, proper safety gear, and the importance of bike safety. The Bike Show Rodeo consisted of multiple events, including weaving through cones, slowest ride through two straight lines, stopping within a certain distance, figure 8 weave, touch and go u-turn, signaling, and bike safety checklist. After the rodeo, there were award presentations and prize give-a-ways. According to the students who organized the project, "Bicycle safety in small, rural areas is especially important because of the localized nature of a small community. Children have the opportunity to use their bicycles as a mode of transportation, not just as a means of entertainment".

Biological Sciences Student News

iGEM Team Becomes Student Organization

iGEM is the international Genetically Engineered Machines team. This student design team uses genetic engineering techniques to produce biological “machines.” Students compete each year at a Jamboree at MIT. The goal of the 2010 iGEM team project was to manipulate *E. coli*, endowing them with the ability to release electrons at the anode of a microbial fuel cell. Students isolated and cloned the outer membrane cytochromes of *Geobacter sulfurreducens* and introduced them into *E. coli* to create a living electrical generator. The goal was to harness electron export from a biological system and use the current to power a biological battery. Beyond the simple exploitation of *G. sulfurreducens* electron shuttling pathway, the team made strides in microbial fuel cell technology research. One of the key features was the use of carbon aerogel anodes to dramatically increase the efficiency of electron capture at the anode of a microbial fuel cell.



iGEM members back row: Mike Little, Hamilton Vernon, Nick Jentsch. Next row: Kristen Kelly, Lauren Townzen, Nicole Hurd, Josh Erickson, Erica Shannon, Alison Hart, Kyle Eby. Next row: Amelia Sipe, Meghan Ray, Lindsey Schobert, Jarrett Stechschulte, Daniel Roush, Amanda Foster. Front row: Patrick Martin, April Pummel, Helen Cardwell, Karen Schilli, Amber Kreps.

Seventy-four BioSci Students Named Academic Scholars

Bethany Bray	Mindy Merenghi	Nicole Buxton	Crystal Halloran	Tyler Knobbe	Jeff Nye	Stephen Taul
Aaron Carson	Katie Payne	Hannah Chambers	Brian Haslag	Desirae Lavatai	Megan Ottomeyer	Laura Townzen
Kevin Creighton	Suzanne Simpson	Samantha Clemens	Peter Haw	Kent Lin	Ryan Rader	Natalie Updyke
Nancy Davis	Brett Vessell	Matt Coates	Cathryn Heil	Michael Little	Rhett Reichard	Stephanie Voertman
Deborah Edens	Danielle Warchol	Whitney Cowan	Katelyn Heil	Patrick Martin	Jimmy Rolufs Jr.	Nicole Vossmeier
Carolyn Harper	Jill Wildhaber	Brandon Drennen	Elizabeth Honeycutt	Alexis Martin	Greg Romine	Laura Welsh
Avery Joseph	Alex Willis	Shelby Emmett	Kelsey Hunt	Erica Mcfarland	Karen Schilli	Rebecca Wentz
Timothy Kenny	Christine Wood	Josh Erickson	Habiba Inusah	Jamila McNair	Lindsey Schobert	Rachel Willie
Paige Kruse	Grace Bay	Shannon Franks	Robert Kayser	Margaret Meyer	Shalyn Selby	
Leslie Louis	Brandon Boies	Nikki Gomez	Kristin Kelly	Ashley Muehler	Erica Shannon	
Andrew Lott	Heather Branstetter	Jennifer Gumpenberger	Antonette Knar	Anna Neubert	Elizabeth Studt	

December 2010 BioSci Graduates

Ten Missouri S&T students received a B.A. or B.S. in Biological Sciences during the Dec. 2010 Missouri S&T Commencement ceremony.



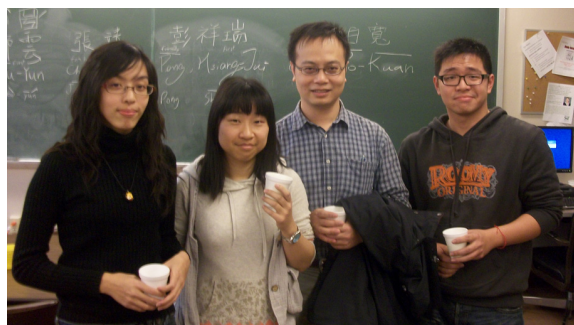
Back row left to right: Nicole Buxton, Margaret Meyers, Teresa MacPhail, Emily Page, Rebecca Wentz, Andrew Wessell, Michelle Brosnahan. Front row left to right: Sara Stephans, Crystal Halloran, Danielle Warchol.

Graduate Student News

One Graduate Student received a M.S. in Biological Sciences this December.

HSUI-JEN WANG'S-Thesis title was “Zinc Oxide Nanoparticle Disruption of Store-Operated Calcium Entry in a Muscarinic Receptor Signaling Pathway”

Biological Sciences welcomes students from Tiawan



From left to right: Ching Chan, Yu-Yun Huang, Po-Kuan Chao, and Hsiang-Jui Peng

Four Biological Sciences Faculty Win Awards



From left to right: Award winners Dr. Huang, Ms. Wilson, Chancellor Carney, and award-ees Dr. Frank and Dr. Westenberg.

Four faculty members received academic year 2010 Achievement Awards. **DR. RONALD FRANK** received a faculty service award, **DR. DAVID WESTENBERG** received a faculty teaching award, **TERRY WILSON** received a faculty achievement award and **DR. YUE-WERN HUANG** received a faculty research award from Chancellor Dr. John F. Carney III. Awardees were nominated by Missouri S&T faculty and chosen by a committee organized by the office of the Vice Provost for Academic Affairs. The winners received a plaque and \$1,000 stipend that were presented at an Awards Dinner held on February 8, 2011 in the Havener Center. Biological Sciences was the only department to have winners in all four categories. Congratulations to the winners!

Donation of Lab Equipment from Mr. Vitek of Fotodyne

The Department received a very generous donation of equipment from Richard Vitek to support our teaching labs and student groups. Mr. Vitek donated equipment from Fotodyne Inc., including agarose and polyacrylamide gel stands, power supplies, PCR machine and photodocumentation system. In addition to the equipment, the donation included molecular biology educational kits for use in the Molecular Genetics laboratory course. The equipment is used extensively in the Molecular Genetics, Microbiology, Cell Biology and General Biology laboratory courses, and also by the iGEM team. Fotodyne equipment has always been an important workhorse in our courses and the generous donation of this new equipment will enable us to enhance the laboratory experience for all our students.



iGEM team members Amanda Foster and Mike Little using the equipment donated by Mr. Vitek from Fotodyne Inc.