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## Spring Phonathon!

First week of April 2009

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

## BioSci Seniors Design, Complete Service-Learning Projects

During the Fall 2008 semester, the Biological Sciences department implemented a service-learning practicum in their required capstone senior seminar course. Students worked in small teams to identify specific needs in the local, campus, or national community, and worked to address those needs in a semester long project, often in conjunction with a partnering organization.

"Biology is inherently a service-related major," said **DR. ANNE MAGLIA**, Associate Professor of BioSci and co-instructor of the course. "Most of our graduates go on to careers in health-care, the environment, or biomedical research. As a department, we felt it was important to engage all of our students in service activities to encourage them to be proactive leaders in society and difference makers in the community."

**DR. ROBERT ARONSTAM**, Chair of BioSci and co-instructor of the course said, "An important aspect of service learning at Missouri S&T is the small work group structure. Our industrial partners tell us that the majority of their work is accomplished by small teams assembled to complete specific tasks, and they are interested in hiring employees with experience in working in such an environment." The BioSci course follows the industry model closely, helping students develop their leadership and teamwork skills.

Students planned and implemented all aspects of a biology-related service project in small teams, from identifying needs, outlining a solution, setting landmark goals and deliverables, proposing and working within an allotted budget and timeframe, conducting periodic self, group, and impact assessments, and developing a strategy for project sustainability. Said one student in the class, "I like learning to work effectively as a team while positively impacting the community. I felt like we all accomplished something with this course."



**Andrew Moss (left) and Michael Abernathy speak to elementary students about environmental issues.**

The Fall 2008 class included 31 BioSci students who completed eight service projects. Partnering organizations included the Russell House, the Tri-County Animal Shelter, Mark Twain National Forest, and Rolla Middle School. Our students volunteered over 1000 hours to the community, gave lectures and presentations to more than 200 people, and raised over \$1100 for local organizations.

### Projects Included:

1. Tri-County Humane Society Fundraising
2. Website Development for Russell House Shelter
3. Halloween Dance Fundrasier for Animal Shelter
4. Freshman Mentoring/ Tutoring Sessions
5. Mill Creek Area Trail Reconstruction
6. On-Line Sciences Help Forum for High School Students
7. Cold & Flu Awareness Program
8. Microbiology Curriculum for Elementary Students

# Faculty Activities

**YUE-WERN HUANG**, associate professor of BioSci, received a Missouri S&T Faculty Excellence Award. Dr. Huang was the keynote speaker at The 5th Life Science and Biotechnology Forum between Taiwan and China in December.

**MELANIE MORMILE**, associate professor of BioSci, was named Missouri S&T's 2008 Woman of the Year. Dr. Mormile was also awarded a Faculty Excellence Award and recognition for receiving her 5th Faculty Excellence Award.



## 2008 Faculty Publications

**Aronstam, R.S.** and P. Patil. 2008. Receptors on Autonomic Neurons and Neuroeffector Cells: Muscarinic Receptors, acetylcholine receptors, In: Encyclopedia of Neuroscience (G. Adelman and B Smith, eds.), CD-ROM, Elsevier Press, Amsterdam, (Fourth Edition).

Benison, K.C., E.A. Jagniecki, T.B. Edwards, **M.R. Mormile**, M.C. Storrer-Lombardi. 2008. "Hairy blobs": Microbial suspects preserved in modern and ancient extremely acid lake evaporites. *Astrobiology*, 8: 489-503.

Bray, J.P., P.A. Broady, **D.K. Niyogi**, and J.S. Harding. 2008. Periphyton communities in New Zealand streams impacted by acid mine drainage. *Marine and Freshwater Research*. 59:1084-1091.

Bowen, B.B., K.C. Benison, **F.E. Oboh-Ikuenobe**, S.L. Story, and **M.R. Mormile**. 2008. Active hematite concretion formation in modern acid saline lake sediments: A model for early diagenetic hematite on Mars? *Earth and Planetary Science Letters*, 268: 52-63.

**Brown, R.F.**, M.N. Rahaman, **A. Dwilewicz**, W. Huang, D.E. Day, Y. Li, and B. Bal, 'Effect of borate glass composition on its conversion to hydroxyapatite and on the proliferation of MC3T3-E1 cells. *Journal of Biomedical Materials Research* (published online Feb 27, 2008).

**Brown, R.F.**, D.E. Day, T. Day, M.N. Rahaman, S. Jung, and Q. Fu. 2008. Growth and Differentiation of Osteoblastic Cells on 13-93 Bioactive Glass Fibers and Scaffolds, *Acta Biomaterialia* 4: 387-396.

**Dimitriu, P.A.**, B.M. Peyton, H.C. Pinkart, and **M.R. Mormile**. 2008. Microbial diversity of a meromictic soda lake in Washington, USA: Spatial and temporal patterns. *Applied and Environmental Microbiology*, 74: 4877- 4888.

**Frank RL**, Kandoth C, and Ercal F. 2008. Validation of an NSP-based (negative selection pattern) gene family identification strategy. *BMC Bioinformatics* 9(Suppl 9):S2.

Fu, Q., M.N. Rahaman, **R.F. Brown**, B.S. Bal, D.E. Day. 2008. Macroporous Bioactive Glass Scaffolds Fabricated by a PolymerFoam Replication Technique for Bone Tissue Engineering, *Acta Biomaterialia* 4:1854-1864.

**Hunter, L.**, Gadbury, G. and **Y. Huang**. 2008. Atrazine exposure and breast cancer incidence: an ecologic study of Missouri counties. *Toxicological and Environmental Chemistry* 90:367-376.

Lin, W., Xu, Y., Huang, C., Ma, Y., **Shannon, K.B.**, **Chen, D.** and **Huang, Y.** 2008. In Vitro Oxidative Stress and DNA Damage Induced by Nano- and Micro-sized ZnO Particles in Human Lung Epithelial Cells. *Journal of Nanoparticle Research Special Issue: Nanoparticles and Occupation Safety*.

Kandoth C, **Frank R.L.**, and Ercal F. 2008. Automation of an NSP-based (negative selection pattern) gene family identification strategy. In: *Intelligent Engineering Systems Through Artificial Neural Networks*. Vol. 18. CH Dagli, DL Enke, KM Bryden, H Ceylan, M Gen, eds. ASME Press, Three Park Ave., New York, NY. 319-326.

Peddi, L., R.K. Brow, and **R.F. Brown**. (in press). Bioactive Borate Glass Coatings for Titanium Alloys, *Journal of Materials Science Materials in Medicine*.

**Pugener, L.A.** and **A.M. Maglia**. 2008. Skeletal morphogenesis of the vertebral column of the miniature hydrid frog *Acris crepitans*, with comments on anomalies. *Journal of Morphology* (early view. Oct 22)

VanEngelen, M.R., B.M. Peyton, **M.R. Mormile**, and H.C. Pinkart. 2008. Fe(III), Cr(VI), and Fe(III) mediated Cr(VI) reduction in alkaline media using a Halomonas isolate from Soap Lake, Washington. *Biodegradation*, 19: 841-850.

Weisheng, L., Stayton, I., **Huang, Y.**, Zhou, X.D. and Y. Ma. 2008. Cytotoxicity and cell membrane depolarization induced by aluminum oxide nanoparticles in human lung epithelial cells A549. *Toxicological and Environmental Chemistry* 90:983-996.

## Fifty-Two S&T BioSci Students Named to Academic Honors

BioSci is pleased to announce the following students were named to the Spring 2008 Scholars List:

Michael Abernathy

Elizabeth Honeycutt

Jacob Lister

Jennifer O'Hara

Krista Stewart

Stuart Brune

Ian Jay

Jennifer Lubbering

Ajay Rao

Brett Vessell

Angie Bulen

Tyler Johnson

Amanda Lueckenhoff

April Rocha

Katherine Stockstill

Cory Cheatham

Robert Kayser

Melanie Maassen

Jimmy Rolufs JR

Sherea Stricklin

Thomas Deason

Amber Kirkpatrick

Teresa MacPhail

Karen Schilli

Brandon Tucker

Isaac Deatherage

Fawn Kostal

Alexis Martin

Donald Schneider

Brett Vessell

Katie Dornstadter

Caset Kotschedoff

Trey Metztes

Daniel Schwent

Jill Wildhaber

Casey Growcock

Megan Kreitner

Drew Menke

Erica Shannon

Kaitlyn Wong

Benjamin Hale

Jennifeer Kresse

Margarat Meyer

Courtney Smith

Crystal Halloran

Paige Kruse

Andrew Moss

Jamie Statler

Kristen Hinton

Heather Lavezzi

Ashley Muehler

Ryan Steele

# Department Update

## The Good News:

Every year brings its accomplishments and unique challenges. Overall, there was a great deal for the BioSci community to celebrate in 2008. Many of these are detailed in our 2008 Annual Report, which is available on our website: [biosci.mst.edu/documents/AnnualReport08.pdf](http://biosci.mst.edu/documents/AnnualReport08.pdf). A few highlights from this report are presented below.

**BioSci Communications:** The annual report and current and past newsletters can now be accessed on the site. Look in the Departmental Overview menu at [biosci.mst.edu](http://biosci.mst.edu).

**BioSci Growth:** We reached new highs in the number of majors, minors, student credit hours, applicants, graduates, and scholarships awarded. We remain one of the fastest growing departments on campus.

**Curriculum:** A plan to incorporate bioinformatics throughout the curriculum was adopted by the faculty.

**Even more Faculty Awards:** Dr. Yue-wern Huang and Dr. Melanie Mormile received Faculty Excellence Awards last semester. This is Dr. Mormile's fifth award.

**Design Team:** Our iGEM team competed in a national event at MIT in November. A second team has been formed, corporate sponsors have been secured, and the team will soon be recognized as an official student organization.

**Graduate Program:** We graduated 4 Masters students in 2008, and our program continues to operate at full capacity. Our graduates are evenly split between PhD programs and employment in biology-related industries. An initial proposal for a doctoral level training program in Interdisciplinary Biology has been submitted.

**From the "Not So Good" news category:** Dr. Nathan Chen

## Strategic Action Plan Summary (1/2009)

### Goals:

The Biological Sciences Department will

- 1) provide outstanding undergraduate instruction in biology, preparing students for careers in research, health care, teaching, and applied biology;
- 2) prepare graduate students to make fundamental discoveries in the biological sciences;
- 3) make new discoveries of significant in the biological sciences, especially in the fields of cell/molecular biology, bioinformatics, microbiology and environmental sciences.

## The Big Challenges:

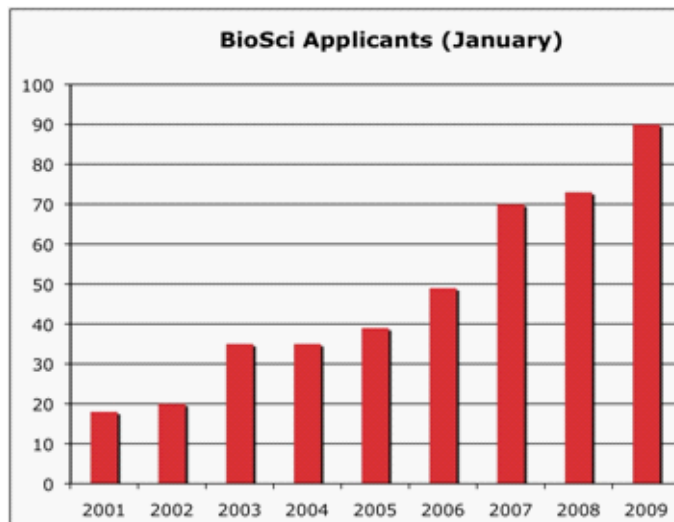
**Facilities:** Our research and teaching laboratories are in dire need of renovation and new equipment. The growth in the size of the BioSci academic community exacerbates these deficiencies.

**Financial Challenges.** The economic challenges facing the nation and state will, of course, affect our operations. State revenues are down, and the state provides about \$40 million to Missouri S&T, about one third of our general operating budget (and perhaps one fifth of our total budget). The challenge for BioSci (and Missouri S&T) is to weather the storm while preserving the critical elements of our programs. To do this we must increase our efficiency while broadening our resource base, including income grants, biotech ventures and alumni support.

I am pleased to be able to report our activities to you. Your comments and suggestions are always welcome. Also, I reiterate my invitation to visit the department for a tour and update on our work.

Sincerely,

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



## Tactical Plan:

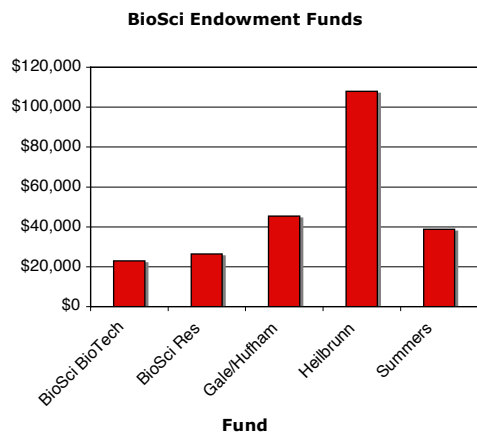
- 1) Increase the number of undergraduate students.
- 2) Institute a doctoral training program.
- 3) Increase research productivity.
- 4) Increase departmental resources to support teaching and research functions.



## 2008 Research Partners

We are pleased to acknowledge the support we receive from our alumni and friends. Your consistent support provides the means to strengthen our academic community and support innovation in both teaching and research.

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



### Donations up to \$100

Mr. Michael Abernathy  
Matthew & Amy Banks  
Bikis Water Consultants LLC  
Dr. Kathleen Bottroff  
Rachel Carter  
Timothy Carter  
Meghan Donnellan  
Richalle Day  
Lisa Delaney  
Dr. James & Rebecca Fiechtl  
Jessica Gorman  
Gerald Griffith  
Sue Hufham  
Amy Hunt  
IBM  
Jonathan Kwantes  
Jeffrey Lewallen  
Lisa & Stanley Lindesmith  
Dr. Anne Maglia  
Dr. Larry & Lynn McCallister  
Linda Michaelsen  
Kerstien & Hal Padgett  
Robert & Katherine Phillips  
Amanda Posgai  
Daniel Roth

Marcie & Brad Rucker  
Dr. David Schlarman  
Jessica Shaffer  
Ashley Sheek  
Shelley Spears  
Joseph Sueme III  
Margaret Thompson  
Julie Townsend  
Matthew Vogel  
Adrian Winters  
Youth Sports Awareness

### Donations up to \$999

Mark Algaier  
Michael W McMenus  
Steven Peppers  
Mark Starler  
Dr. Paul Stricker  
Pauline Wyss

### Donations > \$1,000

Robert & Joan Aronstam  
Joseph Safron

### Equipment Donations

Federick Kielhorn  
MSC Company

## Westenberg's Lab Group Gets to the Root of the Problem

Research in **DR. DAVID WESTENBERG'S** Laboratory of Microbiology is centered on the interactions between bacteria and plants. Research to date has focused in the soil bacterium, *Bradyrhizobium japonicum*, and its interaction with soybean. The lab continues to work on this important symbiotic relationship while developing some new and exciting collaborations.

BioSci undergraduate **APRIL ROCHA** has been working to characterize cell-cell communication that plays a role in how the bacteria recognize the plant. **ROCHA** is following up on results from **JASON ELROD'S** (BioSc BS '02, MS '04) master's thesis. She has shown that most of the strains of *B. japonicum* that produces detectable levels of cell-cell signaling molecules known as homoserine lactones (HSLs) do not appear to have the corresponding gene predicted from the *B. japonicum* genome. In addition, most strains that have the corresponding gene do not to produce detectable levels of HSLs. The hypothesis is that most *B. japonicum* strains produce a modified HSL that is not recognized by the common indicators. **ROCHA** is constructing a new HSL indicator to address this question. Undergraduate **KRISTEN HINTON** is also working with *B. japonicum* and is constructing new strains for studying iron regulation of key genes in metabolism.

Recently, the Westenberg lab has been following-up on research started by **AMANDA GILBERTSON** (BioSc BS '99) who completed her PhD Dissertation in Environmental Engineering in 2006 under the supervision of Dr. Joel Burken at Missouri S&T. Students **JEN** I6S ribosomal RNA genes from each isolate for sequencing and species identification.

### KRESSE, KAITLYN WONG and RICHARD CAMPOS

are isolating potential PCB degrading bacteria from the roots of grasses grown in PCB contaminated soils. The students are PCR amplifying the

The long-term goal of the project is to identify candidate organisms that can be modified to enhance PCB degradation in association with plants. Another student in the lab, **ERIN SIND**, is working on a project in collaboration with Dr. Burken and Dr. Lee Newman at Brookhaven National Laboratory. **SIND** is isolating root nodule bacteria from legumes that can be used for bioremediation. **SIND** is also using PCR for amplification and sequencing to identify the bacteria she has isolated from the root nodules.

**WESTENBERG** has presented the results of these projects in seminars at the National Chung-Hsing University in Taichung, Taiwan, Clemson University, and at Missouri S&T. Most of his students are being supported by the Missouri S&T OURE program and the Biological Sciences department.



From Left: Dr. David Westenberg, Richard Campos, Kristen Hinton, April Rocha, Karissa Braaten, and Kaitlyn Wong.

# Student Organization News

On November 7, 30 **HELIX** students boarded a bus bound for Chicago. Saturday morning the students toured the Museum of Science and Industry, one of the largest science museums in the world with 14 acres of hands-on exhibits. Popular exhibits included: Ships Through the Ages, Transportation Gallery, Yesterday's Main Street, The Idea Factory, The Space Center, NetWorld, and Petroleum Planet. One of our favorite exhibits was the Smart Home: Green and Wired, the "greenest home" in Chicago.

The afternoon was spent at the International Museum of Surgical Sciences. This story museum housed exhibits on: Milestones in Medical Imaging, Conquering Heart Disease, Anatomy in the Gallery, Turn of the Century Apothecary Shop, and a Polio Exhibit that featured a rare working iron lung. Sunday was spent at Shedd's Aquarium, home to more than 30,000 aquatic animals. **HELIX** got a behind-the-scenes tour of the Aquarium that included the animal hospital, water-quality lab and pathology lab. Another highlight was the divers in a 90,000 gallon circular tank feed fish, sharks, eels and turtles. It was a fun and exciting weekend. **HELIX** would like to thank BioSci for helping fund this amazing trip.



SCRUBS raised over \$600 for the Cystic Fibrosis Foundation in sponsorship donations during the Fall 5K Run/Walk. The total amount raised this year was \$3,000. SCRUBS would like to thank all the volunteers and donors who helped them reach their goals.



*BioSci major Jennifer Kresse (right) receives the Female Student of the Year from Provost Wray for her service, academic and leadership accomplishments.*

## Graduate Student News

**MALAVIKA SINHA** successfully defended her thesis "Characterization of selected isolates from hypersaline lakes in Western Australia and Victoria, Australia" in December.

**BARBARA FEARS** and **SARAH HAVENS** presented their research at the Society for Integrative and Comparative Biology meetings in Boston in January. **FEARS** presented a poster entitled "Evolution of Hyoid Morphology and Call Structure in North American Hylids" and **HAVENS** gave a talk entitled "Larval developmental patterns in *Acris crepitans blanchardi* (Anura: Hylidae) and their implications."

## December '09 BioSci Grads

Nine students were awarded Bachelor's degrees in BioSci during the December commencement ceremonies.



*Left to right: Mariann Fisher, Amber Kirkpatrick, Michael Abernathy, Emily Bahram-ahi.*



# BioSci Grad Student Conducts Calcium Imaging Study

Calcium is one of the most potent intracellular second messengers, activating or inhibiting a plethora of cellular processes. Accordingly, cells spend a great deal of metabolic energy to keep the concentration of intracellular calcium  $[Ca^{2+}]_i$  at very low levels. In fact, most neurons maintain a 10,000:1 gradient of calcium across their membranes.

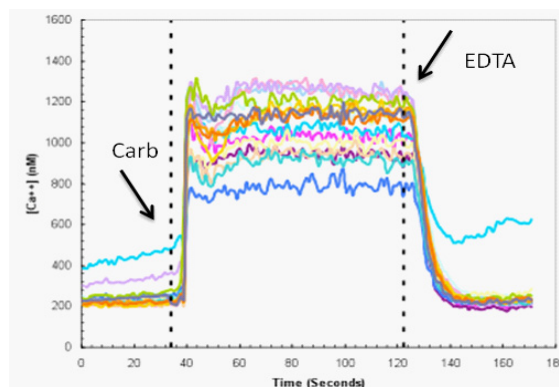
For this reason, changes in  $[Ca^{2+}]_i$  tend to have profound physiological effects, and simulation of cells frequently involves a change in  $[Ca^{2+}]_i$ . BioSci graduate student **HSUI-JEN WANG** has been using a new calcium imager in the department to elucidate the effects of modulators of synaptic transmission on the response of cells to activation of neurotransmitter receptors. Typical cell responses are shown in the accompanying figure. These Chinese Hamster Ovary (CHO) cells have been engineered to express the gene for the human M3 muscarinic acetylcholine receptor.

When stimulated by a muscarinic agonist (carbamylcholine), the intracellular concentration of calcium  $[Ca^{2+}]_i$  rises rapidly. The initial phase of this increase is caused by the release of  $Ca^{2+}$  from intracellular stores in the endoplasmic reticulum. The sustained tonic phase (not seen in all cells) is caused by entry of  $Ca^{2+}$  from outside the cells through specific  $Ca^{2+}$  ion channels. The tonic (but not the initial) phase of the response is eliminated when extracellular calcium is removed. In addition to monitoring intracellular and extracellular  $Ca^{2+}$  responses, this system can be used to monitor desensitization of the signaling process.

**WANG** has demonstrated that exposing CHO cells to high hydrogen ion concentrations (e.g., pH 5.8) irreversibly inactivates  $Ca^{2+}$  entry from outside the cell without affecting intracellular release in response to muscarinic receptor activation. Reducing disulfide bonds on the surface of the cell had little effect on responses to high concentrations of carbamylcholine, even though an external disulfide bond is a prominent feature of muscarinic receptors. **WANG'S** results were presented at the recent annual meeting of the Society for Toxicology in Baltimore (March 2009). **WANG'S** these research will involve the influence of

In another series of experiments, **WANG** and undergraduate students **BARBARA WHELDEN** and **ANNA GROW-COCK** have demonstrated that nitric oxide (NO), a gaseous signaling molecule, reduces the sensitivity of CHO cells to M3 agonists. NO decreased the initial M3 receptor-mediated increase in  $Ca^{2+}$  that reflects release from the endoplasmic reticulum. Moreover, NO donors increased the frequency of calcium oscillations in response to very low concentrations of carbamylcholine, an indication of receptor subsensitivity. These findings suggest that NO is a natural regulator of muscarinic signaling.

The use of fluorescent imaging of single cells with genetic manipulation of cell metabolism is a powerful tool in the discovery of physiological, pharmacological and toxicological properties of cell signaling pathways. **WANG** is performing her research in the Laboratory of Neurobiology under the direction of **DR. ROBERT ARONSTAM**.



*The increase in intracellular calcium caused by activation of muscarinic acetylcholine receptors expressed in CHO cells. Each line represents the response of a different cell. The receptor agonist (10  $\mu$ M carbamylcholine; Carb) was added at the indicated time. The calcium chelator EDTA was added at the 120 sec mark. EDTA eliminated the influx of extracellular calcium, terminating the response.*



MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY  
Department of Biological Sciences  
105 Schrenk Hall  
400 West 11th Street  
Rolla, MO 65409-1120

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