Bio Files

October 2009

Missouri S&T Department of Biological Sciences

Join us for Homecoming!

MINERS OF THE ROUND TABLE 2009

Friday, Oct 23: 3-5: Departmental Picnic/Open House, East Lawn of Schrenk Hall

Saturday, Oct 24: 1 p.m. Miners vs. University of Saint Francis, Allgood-Bailey Stadium

Biological Science Professors Awarded NIH Grant to develop drug delivery system

A grant proposal to develop a new drug-delivery system was recently awarded to DR. YUE-WERN HUANG, Associate Professor of Biological Sciences. The National Institute for Health (NIH) awarded the $225,000 as part of the economic stimulus program (American Recovery and Reinvestment Act). Dr. Huang's collaborators on the project are DR. KATIE SHANNON, Assistant Professor of Biological Sciences, and Dr. Jeffery Winiarz, Assistant Professor of Chemistry.

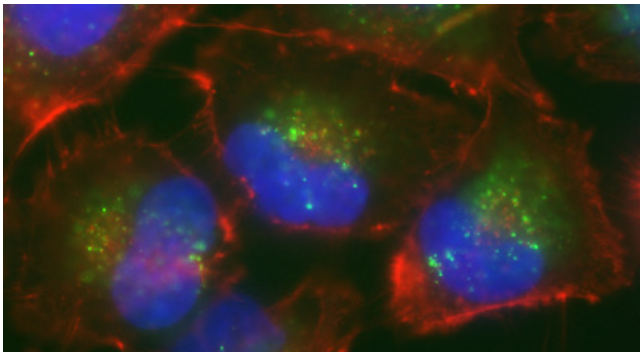
The proposed delivery system combines protein transduction domains (PTDs) with nanoparticles called Quantum Dots. PTDs are small amino acid sequences that easily cross the cell membrane. Quantum Dots (QDs) are fluorescent semiconductor nanoparticles that are extremely stable, allowing monitoring of the drug-delivery system. The PTD-QD can be linked to a therapeutic molecule such as a protein, drug, RNA, or DNA. The entry of the therapy into cells would be mediated by the PTD, and the QD would allow doctors to monitor the uptake.

DR. HUANG likens the process to the ancient story of the Trojan Horse, which according to Greek mythology was used to delivered Odysseus and his army into the enemy city of Troy. But in this instance, the vessel is a "protein transduction domain," the cargo consists of biomolecules or other therapeutic agents, and the walled city is the cell. The QD are used to monitor the delievery of the "Trojan Horse" into the cells.

In the study, DR. HUANG and colleagues will couple cadmium-based fluorescent QD to PTDs and monitor cellular uptake of a dummy cargo using fluorescence. In the image accompaning this article, the green dots indicate that the drug delievery system has entered the cells.

Preliminary results suggest that the PTD increases cellular uptake of the cargo by 10 fold. Imaging studies indicate that the delievery system is internalized by macropinocytosis, which is an energy and lipid-raft dependent endocytosis process. According to results with RNAi, cellular uptake was independent of clathrin-, and caveolin-mediated endocytosis. The research will determine the mechanism by which the PTD-QD-cargo enters the cell, where inside the cell the cargo goes, and how the cargo is transported by the cell.

Once the system has been validated, the researchers plan to use it to carry a cargo of siRNA that will promote apoptosis (programmed cell death) in cancer cells. This research may demonstrate a new way to target and destroy cancer cells. Many potential long-term applications in biomedicine may come from this research. The findings may lead to more efficient delivery of medicines and therapeutic agents, as well as improved medical imaging and monitoring.



Lung cells showing uptake of Quantum Dots (green). Nuclei are blue and actin filaments are red.

Project Lead The Way Brings Teachers to Rolla

Biological Sciences hosted an intensive two week Project Lead the Way (PLTW) Summer Training Institute (STI) Workshop for ten high school science teachers from five neighboring states. The secondary teachers were trained to teach Human Body Systems (HBS), one of four courses in the PLTW Biomedical Sciences curriculum. PLTW is a national, not-for-profit educational program whose mission is "to create dynamic partnerships with our nation's schools to prepare an increasing and more diverse group of students to be successful in science and engineering." PLTW's Biomedical Sciences program is being funded by state education departments in six states, including Missouri. The program focuses on activity-based, project-based and problem-based learning.

Master teachers, Jadee Lauer and Mary Ruether, who taught the HBS workshop this summer, tell us that not only do their students love the program but they themselves are having fun teaching the challenging courses. The Biological Sciences department looks forward to hosting future PLTW STI's that provide an enhanced teaching and learning experience for both teachers and their students.

A Project Lead The Way participant works on his clay model of the human body. Similar models will be created by students when they take the Human Body Systems course.

Westenberg Participates in Education Workshop

DR. WESTENBERG spent two weeks this summer working with thirty-five Missouri mathematics and science teachers on the Missouri S&T campus learning improved ways to teach their subjects. The teachers attended the Science Education and Quantitative Literacy workshop, an integrated professional development project for Missouri math and science teachers in grades 4 and 5. The workshop demonstrates for teachers the ways that science experiments combine with the use of mathematics to help students understand experimental data. Students apply mathematical concepts when learning science and use scientific data in learning mathematics. The SEQL program at Missouri S&T is funded by the Department of Higher Education as part of its Improving Teacher Quality Grants. Other faculty in the SEQL program are Dr. V.A. Samaranayake, professor of mathematics and statistics, Dr. Allen Pringle, Curators' Teaching Professor of physics, Dr. Ronald Bieniek, professor of physics, and Dr. Evalee Lasater, adjunct instructor in Missouri S&T's teacher education program.

Dr. Westenberg in costume as a "plague doctor"

Dr. Niyogi Promoted to Associate Professor

DR. DEV NIYOGI was recently promoted to Associate Professor of Biological Sciences and granted tenure within the University of Missouri. DR. NIYOGI joined the S&T faculty in the fall of 2002. As director of the Laboratory of Freshwater Ecology, his research program has been focused on 1) nutrient uptake in streams, 2) fungal diversity and functon and 3) biodiesel production. Dr. Niyogi's work on biodiesels has been featured in both Technofiles and the MS&T Magazine ("Prime Slime").

DR. NIYOGI has been a consistently productive researcher, publishing 23 papers since joining the Missouri S&T faculty. In addition, he has published 6 conference proceedings/book chapters, and several technical reports and fact sheets. DR. NIYOGI has advised 4 Masters students and more than 20 undergraduate students have been involved in his research program. DR. NIYOGI collaborates with ecologists in Colorado and New Zealand, and spent the 2008 Academic Year on research leave at the University of Canterbury in Christchurch, New Zealand. DR. NIYOGI chairs the department's undergraduate education committee, and works on various environmental initiatives on campus (Earth Day, student clubs, service learning projects, middle school programs), a well as with the local Audubon Society (Tanager Trails) and the Bray Conservation Area.

According to department chair DR. ARONSTAM, "DR. NIYOGI is a productive and collegial member of the department, and his promotion was enthusiastically supported by the entire faculty. DR. NIYOGI is unfailingly cooperative and collegial and one of the key faculty members around which this department will continue to develop. An academic career is ideally suited to DR. NIYOGI 'S talents and temperament."

Associate Professor Dr. Dev Niyogi

Department Update

At the beginning of every Academic Year, the BioSci faculty has a daylong retreat at which we review our past performance and current situation, and determine the issues we want to concentrate on in the upcoming year. Amid the tumult and commotion of a busy academic department, it is useful periodically to step back and examine the "bigger picture". This year we spent some time considering our Mission Statement. There was unanimity regarding the twin foci of our mission, learning and discovery. There was also a remarkable agreement on the importance of how we operate when addressing these tasks. Specifically, the faculty recognized the importance of being an inclusive academic community (comprised of faculty, students and staff) that is simultaneously collegial and challenging, and that supports the personal and professional development of all of its members. Exactly how we accomplish this vision will be the focus of discussion and effort over the course of the year.

As always, the BioSci community has much to celebrate. Here are some of the highlights since our April newsletter.

Teaching: Four faculty members received an Outstanding Teaching Award (Dr. Ron Frank) or Commendation (Drs. Anne Maglia and David Westenberg and Mr. Adam Martin) from the campus Committee of Effective Teaching.

Students: The faculty instituted BioStar awards to recognize the academic, research and teaching accomplishment of our students, undergraduate and graduate. One third of our undergraduates were recognized as Provost Academic Scholars for the spring term. Fifty undergraduates (34 first year and 16 transferring) began their studies in biology at S&T this fall, our largest class to date. We also awarded degrees to 34 undergraduate students (AY08-09).

Facilities: The BioSci department received a gift of $36,000 that allowed us to buy a variety of equipment for our teaching labs, including a gel imager, spectrophotometer, 10 gel systems, 24 pipettors, 2 stereomicroscopes, 2 balances, 1 minicentrifuge, etc. We also hosted a training session for master high school teachers involved in the Project Lead The Way – Biomedical Sciences curriculum. In support of this program, we obtained 10 oil immersion phase contract microscopes for our teaching labs. While the value of our research endowments decreased by 18.4% (along with the rest of the stock market), gifts from our alumni increased by over 30%.

Research: BioSci faculty members were awarded $399,193 in research grants in AY09, including grants from the Missouri Department of Conservation, Department of Defense, the National Science Foundation and the National Institutes of Health. Moreover, BioSci faculty members have pending grants requesting support in excess of $5 million. Clones sales from the cDNA Resource Center exceeded $220,000 in AY09 and $1.4 million since AY05.

Faculty: Dr. Dev Niyogi, director of the Laboratory of Freshwater Ecology, was promoted to Associate Professor of Biological Sciences. In addition to being a consistently productive researcher and outstanding teacher, Dr. Niyogi maintains a vigorous collaboration with ecologists in New Zealand and is chair of our undergraduate curriculum committee. Dr. Melanie Mormile will be on sabbatical at the University of Missouri Columbia campus during the spring semester. Dr. Mormile will continue her work on microbial fuel cells.

University Finances: While hiring freezes and spending limitations are in effect throughout the University System, federal stimulus money spared us major cuts in AY09 and AY10. The department presently has one faculty line that is vacant and cannot be filled. Our strategy is to preserve our programs while riding out the storm. The state provides about $50 million in operating support to S&T, representing about 27% of our total expenditures. In 2001, the state also provided $50 million n support, which represented 37% of expenditures. Clearly, the university has become more dependent on student fees, research grants, and private donations.

So, the BioSci community at S&T continues to thrive and meet its challenges. I am pleased to report our activities to you. Your comments and suggestions are always welcome. As always, I invite you to visit the department for a tour and update on our work.

Sincerely,

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

Faculty News

DEV NIYOGI-was promoted to Associate Professor (see article)

DAVE WESTENBERG-was awarded Biological Sciences Faculty Member of the Year by Phi Sigma

RON FRANK-won Outstanding Teaching Award from the Committee on Effective Teaching

MELANIE MORMILE-developed and convened a symposium entitled "Extremophiles' Potential for Industrial Applications" for the 2009 American Society for Microbiology General Meeting held in Philadelphia, PA, May 17-21. Her co-convener was Dr. Dwayne Elias (University of Missouri-Columbia) who spoke on their research on halophilic ethanol and hydrogen production from cellulosic material.

Biological Sciences Announces 2009 Bio Star Award Winners

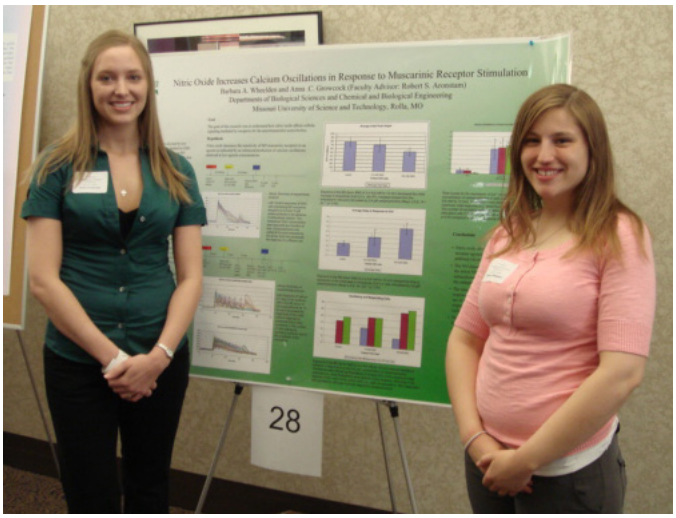
The winners of the first annual Bio Stars awards were announced at the end of semester picnic in May. The awards recognize outstanding achievements by Biological Sciences undergraduates and Masters students. Winners recieved a certificate and flash drive in recognition of their achievement. Nominations were submitted by students and faculty and the winners were chosen by a faculty committee. The 2009 Bio Stars winners are:

Graduating senior - TAYLOR HAHN
Graduate TA - KARISSA BRAATEN
First year student (freshman) - ERICA SHANNON
Graduate research - CHUAN-CHIN HUANG
Undergraduate research - KATIE STOCKSTILL
Student service - KRISTA STEWART
Student leader - RICHARD CAMPOS
First year student (transfer) - ASHLEY MUEHLER

Congratulations to all the winners!

Fron left to right, Bio Star award winners Taylor Hahn, Karissa Braaten, Erica Shannon, Chuan-Chin Huang, Katie Stockstill, Krista Stewart, Richard Campos, and Ashley Muehler.

Biological Sciences students win in Annual Undergraduate Research Symposium



Anna Growcock and Barbara Wheeldon with their winning poster

The 5th Annual Missouri S&T Undergraduate Research Symposium was held in April 2009. The symposium is held each year in the Havener Center, giving students an opportunity to share the results of their research through posters or talks. Ten Biological Science students competed in the Natural Sciences category. KATIE STOCKSTILL won 3rd place for her oral presentation, titled "Cytokinesis Defects in Budding Yeast." She conducted her research in the lab of DR. SHANNON, where she has worked for all four years as an undergraduate. This was Katie's second win, having placed 2nd in this category in 2007. ANNA GROWCOCK and BARBARA WHEELDON won 3rd place for their poster presentation "Nitric Oxide Increases Calcium Oscillations in Response to Muscarinic Receptor Stimulation." They did their research in the lab of DR. ARONSTAM. The Department is very proud of all our students who participated in the event.

Fifty-six BioSci Students Named to Academic Scholars List

The Biological Sciences department is proud to announce that the following students made the Spring 2009 Scholars List

Phillip Beck	Joshua Erickson	Joseph Karas	Patrick Martin	Jennifer O Hara	Sherea Stricklin
Brittany Bockhorst	Sean Feehan	Robert Kayser	Trey Matzes	Elizabeth Politte	Elizabeth Studt
Jordan Bridges	Anthony Gonzales	Colleen Koebbe	Jamila Mcnair	Mary Rennick	Theresa Tyree
Stuart Brune	Casey Growcock	Casey Kotschedoff	Drew Menke	Gregory Romine	Brett Vessell
Angie Bulen	Taylor Hahn	Megan Kreitner	Mindy Merenghi	Karen Schilli	Jill Wildhaber
Cory Cheatham	Benjamin Hale	Heather Lavezzi	Margaret Meyer	Erica Shannon	Mary Wilkinson
Elizabeth Coates	Kristen Hinton	Jacob Lister	Dylan Montileone	Courtney Smith	
Patrick Courtney	Elizabeth Honeycutt	Shalyn Lollar	Andrew Moss	Ryan Steele	
Katie Dornstadter	Ian Jay	Jennifer Luebbering	Ashley Muehler	Krista Stewart	
Lauren Dubbert	Tyler Johnson	Alexis Martin	Jeffrey Nye	Katherine Stockstill	

Student Summer Activities

We asked our students to tell us about summer research experiences. Here are just a few responses in the students' own words.

AMY KALLOCH- "I was a summer intern at Omaha's Henry Doorly Zoo in Omaha, NE. I worked in the aquarium with both the fish and the aquarium birds(penguins!). I worked directly with the keepers and assisted them with their everyday tasks, which included mostly cleaning. Other opportunities included sitting in on sugeries with the Vet, learning to test water qualities, preparing diets, learning feeding schedules, feeding the animals, learning what goes into running the exhibit, administering medications to sick animals, studying animal behaviors, learning species and breeding habits and many other hands on tasks. I would suggest this internship to anyone interested in Vet school or animal husbandry careers."

Amy with penguin at Omaha Zoo

BROOKE HONEYCUTT- "This summer I participated in the Summer Equity Research Program at Oregon Health and Sciences University. I spent the duration of the 8-week program working in the lab of Dr. Jacob Raber in the Behavioral Neuroscicence Department. I assisted the current students in the lab with many projects, such as the research of the effects of prenatal Methamphetamine exposure on learning and spatial memory, as well as putting together a research protocol for the research of sex hormones and their effect on learning and spatial memory in adolescents."

Brooke (bottom center) with friends in Oregon

KAREN SCHILLI-"This past summer I worked at S&T with DR. ARONSTAM in the Neurobiology Laboratory. I examined the effect of oxidative stress on synaptic signaling mediated by M3 Muscarinic receptors expressed in CHO cells. I measured changes in intracellular calcium using a fluorescent probe and cell imaging techniques Specifically, I was interested in the effect of nitric oxide (NO) on muscarinic signaling. I used microscopy to look at both the release of calcium from intracellular stores as well as the influx of calcium from outside the cell."

Anna (second from left) with Jones lab members

ANNA GROWCOCK-"This summer I interned for UMass Medical School in Worcester, MA doing work in cancer research. I looked at how MdmX suppresses proliferation and chromosome number in p53-null cells which received the first place prize in the poster presentation. I made lifelong friends in the program, and received scientific advising that has guided me to what I'm doing now."

Jen in the field in the Ozarks

JEN QUALLS-"During the summer of 2009 I traveled throughout the Ozark region of Missouri working as a field botanist intern for the Institute of Botanical Training. After completing a week of Ozark plant identification training in Van Buren, Missouri. I worked in the field with Justin Thomas installing plots and collecting data. I also learned how to navigate the terrain using a map and compass, survey plot techniques and identifying the native tree species of the area."

2009 BioSci Graduates

Thirty four Missouri S&T students received a B.A. or B.S. in Biological Sciences during the spring and summer of 2009.

BioSci graduates at the May 2009 commencement ceremony pictured with Dr. Aronstam.

Graduate Student News

Two new graduate thesis students joined the department, KATIE STOCKSTILL and APRIL ROCHA, both graduates of S&T.

Three Graduate Students received their M.S. In Biological Sciences this year:

VERNON MODGLIN'S thesis was "In Vitro Evaluation of Bioactive Glass Scaffolds and Modified Bioactive Glasses With an Osteogenic Cell Line."

VARUN PAUL'S thesis was "Electricity Generation and Ethanol Production Using Iron-Reducing Haloalkaliphilic Bacteria."

CHUAN-CHIN HUANG'S thesis was "Heavy Metals, Hematology, Plasma Chemistry and Parasites in Adult Hellbenders (*Cryptobranchus alleganiensis*)."

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Visiting Scholars Begin Studies at S&T

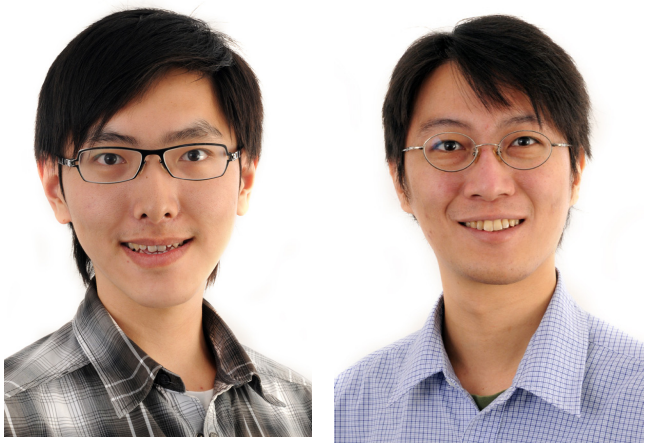
On June 27th 2009 the department welcomed three exchange students from National Taiwan Normal University (NTNU) and National Taiwan University (NTU), Taiwan. TSO-HAO TANG (a PhD candidate), TIEN-CHUN WANG (a master degree in science student), and CHIA-FANG LUE (an undergraduate senior) arrived in Rolla from Taipei. These students are participating in research activities in the Department of Biological Sciences.

TSO-HAO TANG is working in the Neurobiology lab under the direction of DR. ARONSTAM. He is studying the influence of oxidative stress of cellular responses to neurotransmitters, specifically the influence of nitric oxide on muscarinic receptor ligand binding and signal activation. He says "I have done many experiments in the lab, most I did not do before, like cell culture and receptor binding assay. I like the country life in Rolla, fresh air, friendly persons, and beautiful scenes. My friend will teach me how to hunt a deer in this winter, I think it will be an exciting experience."

TIEN-CHUN WANG is working in the Toxicology lab uder the direction of DR. HUANG. He is using protein transduction domains to deliver bioactive molecules to cells. Quantum dots, lysosome escape signals, and nuclear localization sequences are being used in concert to characterize and control the delivery system. He has completed some work on uptake mechanisms using RNAi techniques and subcellular transport mechanisms. He will soon test a sequence that has been inserted into the protein transduction domain to verify lysosomal escape. He says that "People here are so nice and passionate. Whenever you have a problem, they will volunteer to help you. Even when just walking by each other, people will say hello to each other with a smile. Although I still can't speak English fluently, it has helpd me learn a lot of English here."

CHIA-FANG LUE was here this summer working in the Cytokinesis lab under the direction of DR. SHANNON. She created new yeast strains to investigate the regulation of actomyosin ring formation. She has returned to Taiwan to continue her undergraduate studies.

The arrival of these scholars furthers solidifies the department's efforts to establish an international scholar exchange program. Another aspect of the international scholar exchange program is sending our undergraduate students to universities in Taiwan. In the summer of 2008, three S&T students went to National Dong Hwa University in Taiwan. We anticipate continuation and growth of this exchange program.



Tien-chun Wang (left) and Tso-hao Tang (right), visiting students from Taiwan