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MINERS OF THE CARIBBEAN 2010

We enjoyed beautiful weather, cotton candy, BBQ, and games at the Departmental Picnic on Friday, October 1.

Unfortunately, the Miners lost the Homecoming game to Northwestern Oklahoma State.

Development of Materials for Bone Tissue Engineering and Repair

Development of new materials that help the body heal itself is the research goal of Professor of Biological Sciences **DR. ROGER BROWN** and his students and engineering colleagues in the Center for Bone and Tissue Repair & Regeneration (CBTRR), a new research center on the Missouri S&T campus. This interaction of biologists and engineers reflects the interdisciplinary nature of CBTRR as well as the biomaterials research field. The projects underway in the CBTRR are supported by grants from the Department of Defense and National Institutes of Health.

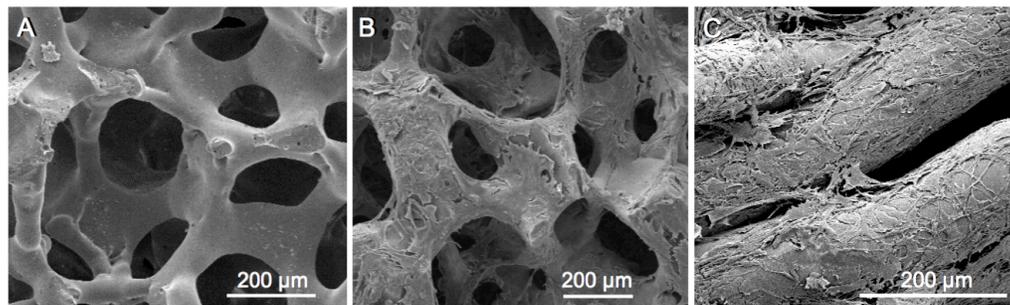
The primary focus of this interdisciplinary research center is the development and testing of new materials for the repair of diseased and damaged tissues with particular emphasis on bone. The two main options currently used for treatment of bone defects, autologous and allogenic bone grafts, each have serious limitations or health risks. A potential solution involves the use of cell support scaffolds for engineering of new bone tissue in the lab and assisting repair of skeletal defects in the body.

Collaborations between **DR. BROWN** and two other CBTRR investigators, Dr. Mohamed Rahaman and Dr. Delbert Day, have resulted in the development of two new types of porous constructs of silicate glass for use as scaffolds to support the growth of bone cells. The glass is a 'bioactive' silicate material designated type 13-93 glass. One type of construct is fabricated using a polymer foam infiltration procedure to form a porous structure with a micro-architecture similar to trabecular bone (panel A).

The second type of construct is a fibrous three-dimensional scaffold prepared by sintering a cluster of short length 13-93 fibers. Dr. Brown and his students have conducted multiple tests to assess the ability of these two scaffold types to support the attachment, growth, and differentiation of two different lines of mouse-derived osteogenic (bone-forming) cells (the MC3T3-E1 line of pre-osteoblasts and the MLO-A5 line of late osteoblasts).

The results obtained with MC3T3-E1 and MLO-A5 cells seeded onto these scaffolds are very promising. Examples are shown in the scanning electron microscopy (SEM) images in panels B and C of the figure below, which show cell-seeded scaffolds cultured for 4 days. These SEM images show well-adhered, 'happy' cells on both types of scaffolds. Other analyses confirm that both types of scaffolds support bone cell growth as determined by measurements of total cellular protein and total DNA. The scaffolds support differentiated cell function as shown by the formation of alkaline phosphatase by MC3T3-E1 pre-osteoblasts and by the formation of mineralized nodules by MLO-A5 late osteoblasts seeded onto the prototype scaffolds. Overall, the in vitro results obtained thus far indicate the fibrous and trabecular constructs could be effective as cell support scaffolds for the bone repair and regeneration. Additional follow-up work is underway to assess various modifications for possible enhanced performance of the scaffolds.

SEM image of: (A) as-made trabecular scaffold; (B) MLO-A5 cell-seeded trabecular scaffold after a culture interval of 4 days; and (C) MC3T3-E1 cell-seeded fibrous scaffold after 4 days.



Biological Sciences Hosted PLTW Summer Workshops

TERRY WILSON of Biological Sciences hosted seven Project Lead the Way (PLTW) Biomedical Core Training Workshops for eighty-nine high school teachers during June and July. The secondary teachers were trained to teach at least one course in a series of four in the PLTW Biomedical Sciences curriculum. The intensive two week courses included Principles of Biology (PBS), Human Body Systems (HBS) and Medical Interventions (MI). The program focuses on activity-based, project-based and problem-based learning. PLTW is a national, not-for-profit education 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." Missouri S&T is one of only three universities nationwide that provides teacher training for these biomedical courses. Thirty-five Missouri teachers across twenty districts have been through the rigorous training since it began in 2007. The Biological Sciences department looks forward to hosting future summer PLTW core training workshops.



A Project Lead The Way participant loads a gel as others observe.

Dr. Mormile Promoted to Full Professor

DR. MELANIE MORMILE has been promoted to the academic rank of Professor in the Department of Biological Sciences. This rank denotes a consistent record of productivity and creativity in research, teaching and service, as well as attainment of international recognition for scholarly contributions.

DR. MORMILE joined the S&T faculty as an Assistant Professor in September 1999 following doctoral training at the University of Oklahoma and postdoctoral training at Battelle Northwest National Laboratories. **DR. MORMILE** was promoted to Associate Professor and awarded tenure in 2004.

DR. MORMILE has been a consistently effective instructor. She introduced several new courses at S&T, including Environmental Microbiology, Bioremediation, Astrobiology, and Advanced Microbial Metabolism with Dr. Westenberg. She has earned 5 Faculty Excellence Awards as well as the Woman of the Year Award.

DR. MORMILE'S research program has been focused on 1) environmental microbiology, especially extremophiles and 2) microbial degradation of organic contaminants. More recently, her research interests have expanded to include the development of microbial fuel cells for energy production. **DR. MORMILE** has published about 30 research articles, in addition to book chapters, an encyclopedia article, and refereed conference proceedings. Congratulations to **DR. MORMILE** on her promotion!



Dr. Mormile, Professor of Biological Sciences

NTNU Scholar Exchange Program Completes First Year

A Visiting Scholar Exchange Program between Missouri S & T and National Taiwan Normal University was initiated in 2009 with the arrival of two graduate student scholars from NTNU, **TSAO-HAO TANG** and **TIEN-CHUN WANG**. In February, 3 new scholars arrived, **TIEN-CHUN TANG**, **HSIANG-YU WANG**, and **CHIA-YI HU**. The students worked in the Department of Biological Sciences and participated in departmental seminars and weekly laboratory meetings.

CHIA-YI HU worked in the Freshwater Ecology Laboratory with **DR. DEV NIYOGI**, focusing on the use of molecular tools to describe fungal communities in streams. One of her projects involved the study of drying stress on fungal community composition and function. Another project was on the effects of acid mine drainage on fungal communities involved in the decomposition of leaves and wood.

TIEN-CHUN WANG and **HSIANG-YU WANG** worked in the emerging field of nanobioscience with **DR. YUE-WERN HUANG** (Laboratory of Molecular Toxicology). These scholars established a system to deliver and monitor biologically active molecules. The system utilizes a fluorescent nanocrystal semiconductor in conjunction with a cell-penetrating peptide to deliver biomolecules.

TSAO-HAO TANG and **TIEN-CHUN TANG** worked with **DR. ROBERT ARONSTAM** in the Laboratory of Neurobiology on synaptic signaling. These scholars used ligand binding techniques on CHO cells to determine the effects of nanoparticles and oxidative stress on receptor expression, binding affinity, allosteric regulation, and receptor-G protein coupling. They also used calcium imaging to measure physiological responses of cells to muscarinic stimulation.



From left to right: Chi-heng Wu (Martin), Tien-chun Wang (Daniel), Tso-hao Tang (Joe), Hsiang-Yu Wang, Chia-yi Hu, Chung-Tan Chang, Hsiu-Jen Wang (Sharen)

Department Update

The S&T BioSci community strives to provide a supportive, collegial, challenging and rewarding environment for its faculty, students and staff. We have a lot on our plate this year, but our primary challenge remains maintaining our quality and unique approach in a time of extremely limited resources. Still, good things continue to happen.

Faculty: We celebrated the promotion of Dr. Melanie Mormile to the academic rank of professor of biological sciences. Dr. Mormile just returned from a research sabbatical at the University of Missouri – Columbia with a patent application and a new grant in tow. Dr. Anne Maglia, associate professor of biological sciences, resigned to assume the position of Program Director for Advanced Biological Informatics at the National Science Foundation. We will sorely miss Dr. Maglia's creativity, enthusiasm and expertise; a search committee has been formed to fill this open position.

Students: Degrees were awarded to 13 undergraduates and 3 graduate students at our May commencement ceremony. This brings the number of BioSci graduates to 483 since the department was formed in 1978. Prior to 1978, biology at S&T was embodied as a Life Sciences section in the department of Chemistry; from 1978 through 1998, we were called as the Department of Life Sciences. More than 50% of all biology majors (245) have graduated since 2000, reflecting the strong recent growth of the department.

Over 45 new (first year and transfer) students matriculated in BioSci for the fall 2010 semester. The BioSci community now includes 179 undergraduates (compared to 161 last year). In terms of enrollment, we are now the 8th largest department on campus.

Facilities: It was close, but we finished the renovation of our 3 teaching laboratories in Schrenk Hall (G7, 111, and 313) before the beginning of the fall semester. These renovations were funded by the Caring for Missourians initiative that is designed to increase training of students entering the health professions in Missouri. The new labs have a more flexible layout that supports group projects. To make maximal use of our physical space, we have redesigned G-9 to serve as a common histology laboratory, reserved room G-7 for use of the iGEM student design team, and expanded the Laboratory of Freshwater Ecology by incorporating Schrenk Hall room 210.

Project Lead the Way: We had a busy summer hosting 7 training sessions for master high school teachers involved in the Project Lead The Way – Biomedical Sciences curriculum. This went exceptionally well. Naturally, we took full advantage of the opportunity to inform our guests about the unique training programs in biological sciences at Missouri S&T. We are exploring ways to offer academic credit to both the students and teachers in this remarkable program.

Strategic Plan: The faculty further refined the departmental Strategic Plan at our annual planning retreat. Our 5 year (2010-2014) rolling plan embodies our best strategies for realizing our mission to “promote learning and discovery in the biological sciences while functioning as an inclusive academic community that is supportive, collegial, challenging and rewarding...”. Despite our diverse backgrounds, approaches and interests, there was remarkable agreement with regard to our most pressing needs. Among our immediate goals are: 1) adoption of a continuous curriculum improvement plan; 2) development of an advising handbook; 3) engaging >90% of our students in lifelong learning activities; 4) growing the BioSci academic community to include 200 undergraduate students; 5) formalizing graduate training policies; 6) assessing implementation of an interdisciplinary Ph.D. training program; 7) funding faculty development and research accounts; 8) updating departmental protocols for supporting the career development of new faculty members; and 9) improving our research infrastructure through establishment of core facilities.

I am pleased to report to you. Your comments and suggestions are 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

MELANIE MORMILE-was on sabbatical for Spring semester 2010 at the University of Missouri-Columbia in the lab of Dr. Gary Stacey. Dr. Mormile returned with a patent application and a research grant.

ANNE MAGLIA-is now Program Director for Advanced Biological Informatics at the National Science Foundation.

DEV NIYOGI-taught a class on Lake and Stream ecology at the Mountain Research Station of the University of Colorado.



Biological Sciences Announces 2010 Bio Star Award Winners

The winners of the second annual Bio Star awards were announced at the end of semester picnic in April. The awards recognize outstanding achievements by Biological Sciences undergraduates and Masters students. Winners received 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. Congratulations to all the winners!

The 2010 Bio Star Winners are:

Graduating senior - **BRANDON TUCKER**
Graduate TA - **APRIL ROCHA**
First year student (freshman) - **SHELBY EMMETT**
Graduate research - **KATIE STOCKSTILL**
Undergraduate research - **CRYSTAL HALLORAN**
Undergraduate research - **ASHLEY MUEHLER**
Student service - **RICHARD CAMPOS**
Student leader - **KAREN SCHILLI**
First year student (transfer) - **HEATHER BRANSTETTER**



From left to right, Bio Star award winners Richard Campos, Ashley Muehler, Crystal Halloran, Karen Schilli, Katie Stockstill, Heather Branstetter, April Rocha, Brandon Tucker, and Shelby Emmett

Biological Sciences students win in Annual Undergraduate Research Symposium



Daniel Roush, Nichole Hurd, and Meghan Ray with their winning poster

The 6th Annual Missouri S&T Undergraduate Research Symposium was held in April 2010. 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.

KAREN SCHILLI won 2nd place for her oral presentation "Genomic Analysis of the BCA Sequence 3 Gene Family in Glycine Max."

Our students swept the Natural Sciences Poster Session.

3rd Place - **DREW MENKE** - "Phosphorus Dynamics in an Ozark Stream and a Hyper-Eutrophic Lake in East Central Missouri"

2nd Place - **DANIEL ROUSH** with Chemical Engineering students Nichole Hurd and Meghan Ray - "Isolation and Implementation of the Electron Shuttling Pathway from Geobacter into Escherichia coli"

1st Place - **ASHLEY MUEHLER** and **CRYSTAL HALLORAN** - "Use of Endophytic Bacteria for Growth Promotion and Toxicity Resistance in Leachate Treated Poplar Trees"

Caring for Missourians funds Teaching Lab Renovations

The Department received funds from the state Caring for Missourians fund to renovate teaching labs. The money is designated for increasing the number of health professionals to care for patients in Missouri.



Above, the microbiology lab renovation shows new lab bench. Left, Room 111 showing new benches and shelves. Labs were renovated over the summer, and students began using the improved labs this fall semester.

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.

MICHELLE BROSNAHAN- "I did a summer internship with Cargill in Memphis. I was a quality assurance chemist for high fructose corn syrup. At the plant in Memphis they made high fructose corn syrup, corn oil, and a number of other things. During the first part of the internship I was doing a project about the affect of steep time and temperatures on the bacteria lactobacillus used on the corn for the first part of the steeping process. I was in charge of collecting samples, measuring the temperatures, measuring the pH, analyzing the dextrose, fructose, and other sugars in the corn, and running other tests on the samples. From that I organized the data, drew some conclusions and presented my work. I found several instances where the company could save a lot of money by making a few minor changes. The temperature probes were off and needed to be calibrated, because of that the lactobacillus were dying and not helping soften the corn for steeping. I was given pretty free reign over the plant and got to talk to the chemist, specialist, and mill workers and learned a lot about the overall process. I really enjoyed it."



Michelle in gear at Cargill

KAREN SCHILLI- "This past summer I worked on campus with with **SHELBY EMMETT** on Project Lead the Way, which is a preparatory program for high school students that are interested in biology, and possibly receiving college credit for the course. High school teachers from across the country traveled to take these biomedical courses in order to be certified to teach Project Lead the Way Courses in their home towns. I served as a Teaching Assistant under **TERRY WILSON**, where I daily set up several labs for the instruction of these high school teachers. I am very thankful to have had the opportunity to meet and interact with such a diverse and enjoyable group of people. The experience I gained from helping these teachers is something I will never forget."



Karen and Shelby helped with project Lead the Way

RHETT REICHARD - "Working in the cDNA lab this summer with **ALEXIS MARTIN** and **JOSH ERICKSON** provided an invaluable educational experience. Interacting with faculty and graduate students developed an insightful perspective in regards to conducting research. Acquiring and refining techniques such as tissue cultures, protein assays, and calcium imaging, to name a few, developed skills required to participate in a research laboratory. Performing literary reviews, developing hypotheses and structuring experiments culminated in an enhanced understanding of the scientific approach to research. The opportunities to prepare for and interact in weekly lab meetings developed sound communication and presentation skills. The experience of working in the cDNA lab resulted in a sound foundation on which a successful career in scientific research could be built."



Josh, Rhett, and Alexis from cDNA lab

2010 BioSci Graduates

Thirteen Missouri S&T students received a B.A. or B.S. in Biological Sciences during the spring and summer of 2010.



BioSci graduates at the May 2010 commencement ceremony pictured with Dr. Aronstam.

Graduate Student News

FOUR new graduate thesis students joined the department: **ERIN SIND**, **CHI-HENG (MARTIN) WU**, **YINAN LIN** and **KELE THRAILKILL**.

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

BARBARA FEARS' thesis was "Laryngeal Apparatus and Call Structure in North American Hylids."

BONNIE BEASLEY'S thesis was "Analysis of *Eurycea* Hybrid Zone in Eastern Missouri."

SARAH HAVENS' thesis was "The Role of Skeletal Development in Body Size Evolution of Two North American Frogs."



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Advanced Biodiversity Trip to Hawaii

While most students dream of spending spring break on a tropical island, for the students of the BIO 358: Advanced Biodiversity class that dream came true...with a price. They spent their break in Hawaii studying the impact of tourism, hurricanes, and introduced species on the variation seen in living organisms, also known as biodiversity.

“As a remote island chain, Hawaii is an ideal environment to study the processes that influence biodiversity. In addition to many different types of ecosystems in a small area, many of its plant and animal communities are unlike those anywhere else on the planet,” said **ANNE MAGLIA**, Associate Professor of Biological Sciences and course instructor.

“Life varies at the genetic, species, and ecosystem level, and a loss of that variation reduces an ecosystem’s ability to recover from natural and man-made disruptions. Understanding how and why biodiversity is where it is, and learning how to protect it, is one of the most critical endeavors of our time”, said **MAGLIA**.

Throughout the semester, students met to discuss the importance of biodiversity, and learn how it is enhanced, reduced, measured, and monitored. During break, they spent their days studying and comparing life among the different Hawaiian ecosystems and contrasting it to that of the more familiar ecosystems of Missouri.

“I was expecting Hawaii to be mainly tropical plants. I was surprised at the variety of types of plants. One of our hikes felt like we could have been in a temperate forest in Missouri. I would have never expected to hike through a forest similar to what we have here,” said **ASHLEY MUEHLER**, a junior in Biological Sciences.

MUEHLER added that “visiting Hawaii helped me to better understand what we studied in class because I could see all the contributing factors of biodiversity we had discussed. I could look at a specific habitat and determine why the plants and animals were found there and how they were interacting.”



Students in the BIO 358: Advanced Biodiversity class study life in the small tidal pools east of Coco Crater (background).