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7th Annual
Undergraduate Research Conference

April 6, 2011
Missouri S&T - Havener Center

CONFERENCE AGENDA

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Chancellor John F. Carney
Vice Provost Harvest L. Collier
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<tr><td>12:00 pm – 1:00 pm</td><td colspan="3">Luncheon & Keynote Address

Yinfa Ma, Ph.D.
Curators Professor of Chemistry, Missouri S&T
Presents
"Undergraduate Research: A Valuable Learning Experience"
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<tr><td rowspan="2">1:00 pm – 3:30 pm</td><td colspan="3">Concurrent Oral Sessions</td></tr>
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<tr><td>3:00 pm – 4:00 pm</td><td colspan="3">Missouri S&T Reception
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(St. Pat's B)</td></tr>
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- **OURE Faculty Fellows Proposal Review:** 9:00 am – 12:00 pm, (Meramec room)
- **Judges Conference Rooms -** (Mark Twain conference room and Walnut room)

Oral Presentations

Engineering Oral Session		
Name	**Department**	**Time/Location**
Emily Briggs	Mechanical & Aerospace Engineering	9:00-9:30 AM – Ozark Room
Andrew Brune	Mechanical & Aerospace Engineering	9:30-10:00 AM – Ozark Room
Tamas Erdos	Mechanical & Aerospace Engineering	10:00-10:30 AM – Ozark Room
Mariana Escalona Diaz	Mechanical & Aerospace Engineering	10:30-11:00 AM – Ozark Room
Luke Jones	Mechanical & Aerospace Engineering	9:00-9:30 AM – Ozark Room
David Madsen	Electrical & Computer Engineering	11:00- 11:30 AM – Ozark Room
Matthew Ortel	Mechanical & Aerospace Engineering	9:00-9:30 AM – Ozark Room
Anan Takroori	Mechanical & Aerospace Engineering	11:30- 12:00 PM – Ozark Room

Sciences Oral Session		
Name	**Department**	**Time/Location**
Nichole Hurd	Biological Sciences	9:00-9:30 AM – Carver Room
Kristin Kelly	Biological Sciences	9:30-10:00 AM – Carver Room
Tiffany Ramsey	Chemistry	10:00-10:30 AM – Carver Room
Meghan Ray	Biological Sciences	9:00-9:30 AM – Carver Room
Daniel Roush	Biological Sciences	9:00-9:30 AM – Carver Room
Erica Shannon	Biological Sciences	9:00-9:30 AM – Turner Room
Jared Simon	Computer Science	9:30-10:00 AM – Turner Room
Jill Wildhaber	Biological Sciences	10:00-10:30 AM – Turner Room

Social Sciences Oral Session		
Name	**Department**	**Time/Location**
Frank Keehn	Psychology	1:00 – 1:30 PM – Carver Room
Joseph Pieczynski	Information Sciences & Technology	1:30 – 2:00 PM – Carver Room
Lauren Summerville	Psychology	2:00 – 2:30 PM – Carver Room

Oral Presentations (Cont.)

Arts and Humanities Oral Session		
Name	**Department**	**Time/Location**
Ashley Grace	History & Political Sciences	1:00 – 1:30 PM – Turner Room
Samantha Lucker	English & Technical Communication	1:30 – 2:00 PM – Turner Room
Evan Mobley	History & Political Science	2:00 – 2:30 PM – Turner Room
Stephen Taul	Humanities	2:30 – 3:00 PM – Turner Room
Kyle Visnapuu	History & Political Science	3:00 – 3:30 PM – Turner Room

Poster Presentations

Sciences Poster Session		
Name	**Department**	**Time/Location**
Casey Burton	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Ashley Byerley	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Brice Curtin	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Joshua Erickson	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Robert Haselwander	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Megan Koerner	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Amber Kreps	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Alexis Martin	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Ariel Mollhagen	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Dominique Nocito	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Jennifer Page	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Austin Ramsey	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Kate Schlarman	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Jeffery Shelburg	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
Laura Sisken	Physics	9:00 - 11:45 AM – Upper Atrium/Hallway
Marissa Spencer	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Crystal Twenter	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Alexander White	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
Rachel Wille	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway

Research Proposal Poster Session		
Name	**Department**	**Time/Location**
Andrew Brown	Computer Science	1:00 - 3:00 PM – Upper Atrium/Hallway
Amber Foster	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
Daniel Hillis	Electrical & Computer Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Joseph Kurtz	Computer Science	1:00 - 3:00 PM – Upper Atrium/Hallway
April Pummill	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
Logan Sauerbrei	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
Margret Steele	Computer Science	1:00 - 3:00 PM – Upper Atrium/Hallway
Michael Virag	Computer Science	1:00 - 3:00 PM – Upper Atrium/Hallway
Michael Wisely	Computer Science	1:00 - 3:00 PM – Upper Atrium/Hallway

Poster Presentations (Cont.)

Engineering Poster Session		
Name	**Department**	**Time/Location**
Rachel Bartz	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Luke Brekke	Mechanical & Aerospace Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Cailie Carlile	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Allen Ernst	Mechanical & Aerospace Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Julie Ezzell	Mechanical & Aerospace Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Emily Kackley	Electrical & Computer Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Alfred Massey Jr.	Geological Sciences & Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Scott Melby	Geological Sciences & Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Adam Morgan	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Dong Pan	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Justin Schlechte	Electrical & Computer Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Tyler Thompson	Mechanical & Aerospace Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Benjamin Weideman	Geological Sciences & Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Jordan Wilson	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway

Keynote Speaker

Yinfa Ma

Curators' Professor, Chemistry
Missouri S&T

Presents

"Undergraduate Research: A Valuable Learning Experience"

Dr. Yinfa Ma received his BS degree in chemistry at December 1981 at Zhengzhou University in China. Ma received his Ph.D. in analytical chemistry and minor Ph.D. in biochemistry in December 1990 from Iowa State University. Ma has serviced as chemistry faculty at both Truman State University (1990-2000) and Missouri University of Science and Technology (2000-present). During his professorship at both universities, he has co-chaired two international conferences: the APCE international conference (Asian-Pacific Capillary Electrophoresis and Related Microscale Separation Techniches) in 1998 at Dalian, China (656 participants) and in 2002 at Shanghai, China (over 750 participants). He serves on the scientific committee since APCE was first initiated in 1996. He also serves on the science committee for Chinese Capillary Electrophoresis (CCE) since 1993. Ma has received over 30 prestige awards for his teaching and research, including Missouri Professor of the Year (1996), Governor's Award (1996, 2008), and Outstanding Scientist Accomplishment Award (1998), Educator of the Year (1996), Researcher of the Year (1995), Wilbur Tappmeyer Outstanding Teaching award, John W. Claypool Award for Medical Research, and J. Calvin Giddings Award for Excellence in Education from American Chemical Society (2008). He was named as an Honored Professor of Zhengzhou University (1994), Zhongyuan University (2008), and Dalian Institute of Chemical Physics, Chinese Academy of Science (2000). He was named Curator's Teaching Professor in December 15, 2007. He is currently associate editor for *Global Journal of Analytical Chemistry.* He has served as a guest editor for *Electrophoresis* journal in 1998 and 2002. Ma has published 96 peer-reviewed journal papers and 17 book chapters, gave 202 presentations at national and international conferences, delivered 55 invited seminars, and filled 10 patents.

Conference Judges

The Office of Undergraduate Studies wishes to thank the following faculty & staff for their valuable contributions to the 7th Annual Missouri S&T Undergraduate Research Conference.

Ayodeji Alajo
Ralph Alexander
Jacqueline Bichsel
Bonnie Bachman
Stuart Baur
Stephen Gao
Anna Gaw
Larry Gragg
Irina Ivliyeva
Jonathan Kimball
Merilee Krueger
Kelly Liu
Jana Neiss
Daniel Oerther
Prakash Reddy
Joshua Rovey
Jeff Schramm
Bijaya Shrestha
Lia Sotiriou-Leventis
Andy Stewart
Nancy Stone
Daniel Tauritz
David Westenberg

Thank You!

Engineering
Oral Session

Abstracts

Emily Briggs

Joint project with Luke Jones and Matthew Ortel

Department:	Mechanical and Aerospace Engineering
Major:	Mechanical Engineering
Research Advisors:	Dr. Douglas Bristow and Dr. Kwame Awuah-Offei
Advisor's Departments:	Mechanical and Aerospace Engineering/Mining Engineering

Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Fellows Program

Robotic Exploration Unit for Exploration of Abandoned Mine Wildlife

To protect and understand the endangered species of bat, Myotis sodalist commonly known as the Indiana bat, accurate population counts must be obtained. Current population counts require humans to enter dangerous environments like abandoned and collapsing mines. This research works to develop a method to robotically explore abandoned mines and count the endangered bat populations in these dangerous areas. Specifically, efforts were made to further knowledge within the areas of robotic communication, transport, and data management. A method to communicate wirelessly with a robotic platform was developed. Analysis was performed to find the optimal method of transportation. Proofs of concepts were performed to prove ideas presented. In providing analysis and preliminary designs, this research provides the basis and recommendations for the development of a final robotic platform.

Emily is currently a Mechanical Engineering Senior from Mission Kansas. Emily has done previous research with 'Process Modeling for Dip Pen Nanolithography' and 'High Resolution Atomic Force Microscope Imaging of Membrane Proteins in Biological Settings'.

Andrew Brune

Department: Mechanical and Aerospace Engineering
Major: Aerospace Engineering
Research Advisor: Dr. Serhat Hosder
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: NASA-Missouri Space Grant Consortium

Aerodynamic Heating Analysis of Hypersonic Cruise Vehicles in Conceptual Design

NASA has placed great importance on space exploration including the development of innovative spacecraft configurations for affordable access to space, i.e. hypersonic cruise vehicles that utilize hypersonic air-breathing propulsion such as the X-43. The development of these aerospace vehicles requires effective, accurate, and computationally efficient design methodologies. The present paper will discuss the research that aims to address this requirement with the study and evaluation of computationally efficient physics-based models for aerodynamic heating analysis of hypersonic cruise vehicles in conceptual design phase. The Hyper X-43 model and the Orbiter shuttle will be examined in the Hypersonic Engineering Aerothermodynamic Trajectory Tool Kit (HEAT-TK) program to predict the aerodynamic heating capabilities from a hypersonic standpoint and thoroughly justify its significance from the heat flux and skin friction distributions. The hypersonic cruise vehicles are mainly determined to have dominant aeroheating features based on its design conditions compared to the reentry of the Orbiter shuttle.

Andrew, from St. Charles, Missouri, is currently an undergraduate senior upon completion of his Bachelor of Science degree in Aerospace Engineering in the department of Mechanical and Aerospace Engineering at the Missouri University of Science and Technology. Andrew plans to attend graduate school at Missouri S&T with emphasis in hypersonic flow and hopes to complete graduate work under direction of NASA fellowships. He has been actively involved in Sigma Gamma Tau and American Institute of Aeronautics and Astronautics as a student member.

Tamas Erdos

Department: Mechanical and Aerospace Engineering
Major: Mechanical Engineering
Research Advisor: Dr. Ryan Hutcheson
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: N/A

Thermal Magic Formula Based Tire Model for Simulation use in Racing Applications

A new addition to the Magic Formula tire model is presented that will take thermal effects into account. A thermodynamic model is used to calculate the heat generation from the tire forces and hysteresis. An approximation of the tire surface temperature and force relationship is made with a non-linear function. Indoor tire testing data is used to fit the thermodynamic and grip modifying parameters.

The proposed model has the advantage of using a temperature/grip coupling function that accounts for the initial rise and eventual fall off of grip with rising temperature that is typical for racing tires. This feature can make it especially useful for tuning a race car and training a driver for short, highly tire temperature dependent events like qualifying or autocross.

Tamas is currently a senior in the department of Mechanical and Aerospace Engineering at Missouri S&T. He has been an active member of the Formula SAE team for the past four years and is the 2010-11 Chief Engineer. He intends to graduate with a Bachelor's degree in Mechanical Engineering in December 2011.

Mariana Escalona Diaz

Department: Mechanical and Aerospace Engineering
Major: Mechanical and Aerospace Engineering
Research Advisor: Dr. Fathi Finaish
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Vortex Induced Lift Augmentation: Case Study

Optimizing the aerodynamic characteristics of an aerospace vehicle has always been of great importance. For instance, improving the lift-to-drag ratio could represent savings in fuel consumption, an increment in the range & endurance of the aircraft and a shorter take-off and landing distances. Therefore, this study explores the possibility of enhancing the aerodynamic performance by introducing a single step configuration in any given airfoil. The results presented here, use a computational fluid dynamics approach to simulate the development of flow around four different airfoils (NACA 0006, NACA 0009, NACA 1408, and NACA 1410) which utilize a single backward facing step configuration on either the upper or lower curve of the airfoil. All the cases studied, were simulated for two different angles of attack (0^o and 5^o). It was found that the lower step configuration yielded to an increment in lift at lower angles of attacks that enhanced aerodynamic performance of a propeller driven aircraft up to a 130%.

Mariana is a senior at the Missouri University of Science and Technology. She hopes to graduate in May 2012 with a BS in both Mechanical and Aerospace Engineering. Currently, she is a peer learning assistant in the Physics Department for the Learning Enhancement Across Disciplines (LEAD) program.

Luke Jones

Joint project with Emily Briggs and Matt Ortel

Department:	Mechanical and Aerospace Engineering
Major:	Mechanical Engineering
Research Advisors:	Dr. Douglas Bristow and Dr. Kwame Awuah-Offei
Advisor's Departments:	Mechanical and Aerospace Engineering/Mining Engineering

Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Fellows Program

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Luke is a senior in Mechanical Engineering at Missouri University of Science and Technology. He worked as a production engineer for TEMA (Toyota Motor Engineering and Manufacturing North America, Inc). He also worked as a product development engineer for Springfield Remanufacturing Company. He is currently involved in research for the Department of Defense in the Systems Engineering department at Missouri S&T for the design of a haptic feedback simulation vest.

David Madsen

Department: Electrical & Computer Engineering
Major: Computer Engineering
Research Advisor: Dr. Joe Stanley
Advisor's Department: Electrical & Computer Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Fellows Program
DERMVIS Research Group

Web Accessible Pharmaceutical Database

Currently, drug reactions account for at least seven percent of all hospital admissions worldwide (1). Additionally, potential adverse drug reactions occur in at least 3.7% of all hospitalized patients (2). Post-marketing drug surveillance data is the main source of safety data worldwide. It was post-marketing data that led to withdrawal of a number of drugs that were associated with severe and fatal drug reactions. This information can be found in the Adverse Events Reporting System (AERS) and MedWatch, which are difficult to access and quickly understand by physicians. Creating a website accessible from a computer or mobile device will display the data on adverse drug interaction trends using visual information, such as graphs, and would assist with drug surveillance. Using methods like rolling averages will help identify the adverse effect for a particular drug. Since this database is maintained voluntarily the quality of information is poor. This is the main obstacle in obtaining results.

David is a junior at Missouri S&T majoring in Computer Engineering with a minor in Physics. This is Madsen's first year in the OURE and DERMVIS and has assisted in PhD research. Madsen has had clinic and intern/co-op experience with small and large companies. He has participated with Missouri S&T Robotics Competition Team. Madsen will graduate in May, 2012 and will peruse a Masters.

Matthew Ortel

Joint project with Emily Briggs and Luke Jones

Department:	Mechanical and Aerospace Engineering
Major:	Mining Engineering
Research Advisors:	Dr. Douglas Bristow and Dr. Kwame Awuah-Offei
Advisor's Departments:	Mechanical and Aerospace Engineering/Mining Engineering

Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Fellows Program

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Matthew is a junior in Mining Engineering at the Missouri University of Science and Technology who is currently working on defense research and fragmentation analysis of sandstone under the advisement of Dr. Jason Baird. Matthew has worked in underground mines and is part of the Missouri University of Science and Technology's black mine rescue team. These experiences have made him familiar with the hazards and conditions of underground mining operations.

Anan Takroori

Department: Mechanical and Aerospace Engineering
Major: Aerospace Engineering
Research Advisor: Dr. Fathi Finaish
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Influence of Flow Baffles On Flow Mixing of Two Air Streams with Dissimilar Temperatures: Experimental Study

Thermal Stratification is one of the major problems that occur inside the Heating, Venting and Air-Conditioning systems "*HVAC*". One of the many suggested solutions for this problem is using flow baffles. In this study, the effect of flow baffles on the mixing of two air streams with temperature difference of 55°F has been investigated. A baffle is installed at different angles and different sizes for each test. An array of thermocouples is employed and connected to data acquisition system to collect the flow temperature distribution at three different stations inside the mixing chamber. Using Tecplot 360, graphs of the temperature distributions inside the mixing chamber are produced. Mixing effectiveness of each test is calculated and minimum and maximum temperatures are also found. Results show that mixing effectiveness is at best when 20"x10" baffle is installed at 90°. As expected, the results also show that the mixing effectiveness of the two flow streams is increased as the downstream distance increased.

Anan is in the Mechanical & Aerospace Engineering department at Missouri S&T. He graduated from St. Louis Community College and transferred to Missouri S&T in 2010. Anan served as an educational assistant for six semesters at St. Louis Community College, helping with mathematics, physics and basic engineering courses. He participated in multiple research projects involving mathematics and thermodynamics. Currently he is employed by the Undergraduate Advising Office as a student mentor & also employed by the department of Mechanical & Aerospace Engineering as a research assistant. Anan volunteers as a recruiter for community service projects for Habitat for Humanity and the Catholic Charities of New Orleans. Anan currently is an officer at the Advanced Aero Vehicle Group and a president and a member of many organizations at Missouri S&T.

Sciences
Oral Session

Abstracts

Nichole Hurd

Joint project with Meghan Ray and Daniel Roush

Department:	Biological Sciences
Major:	Chemical Engineering
Research Advisor:	Dr. David Westenberg
Advisor's Department:	Biological Sciences

Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program Missouri S&T Department of Biological Sciences and Department of Chemical and Biological Engineering, Energy Research and Development Center, and the Materials Research Center

Isolation and Implementation of the Electron Shuttling Pathway from *Geobacter* into *Escherichia coli*

Certain bacteria, like *Geobacter sulfurreducens*, are naturally exoelectrogenic. In these organisms, electrons are shuttled outside of the cell during metabolism to reduce metals in the environment. This requires the use of c-type cytochromes; electron carrying proteins located on the periplasmic side of the cytoplasmic membrane. For c-type cytochromes to work properly, they must be transported to the correct location within the cell and covalently bound to a heme. In previous work, we theoretically isolated four outer membrane cytochrome genes and two combinations of those genes into plasmids. In this work, we confirm the presence of the cytochrome gene sequences in our plasmid set and worked to characterize the expression of the gene set in *Escherichia coli*.

Nichole is a senior in biochemical engineering. She has been involved in several organizations over her undergraduate career, including leadership positions in the International Genetically Engineered Machines student design team and Habitat for Humanity. She plans on entering industry after graduating this May.

Kristin Kelly

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Ronald Frank
Advisor's Department: Biological Sciences

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Genomic analysis of an unknown gene family in *Glycine max*

The gene models were analyzed to find their function and evolutionary pathway. These gene models were found to form a gene family that contains a Phospholipase A2 domain. The Phospholipase A2 domain is thought to control the release of fatty acids from glycerol. The gene models are now thought to have gone through a gene duplication on chromosome one and then a genome duplication, giving the similar gene models on chromosome one and chromosome seven. This was found by using multiple bioinformatic resources to analyze both protein and nucleic acid sequences.

Kristin is a sophomore in Biological Sciences. She is the Open Lab Chair for Helix, the Life Sciences club. She is also a member of the pre-health society, Scrubs and was elected as the secretary for the upcoming year. After graduation, Kristin plans on attending a combined medical and graduate school to complete a MD/PhD program. Eventually, Kristin plans on working as Forensic Pathologist.

Tiffany Ramsey

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Yinfa Ma
Advisor's Department: Chemistry

Funding Source: Missouri Department of Natural Resources
Department of Chemistry and Environmental Research Center at Missouri University of Science and Technology

Removal of Sulfamethoxazole in Water Samples using Nano-materials and Activated Carbon

The presence of pharmaceuticals and personal care products (PPCPs) in natural and drinking water supplies has raised concern because of their potential adverse ecological effects on aquatic organism and human health. The study of pharmaceutical elimination is crucial in providing information for the disinfection strategy in water treatment facilities. This research project was conducted to investigate which nano-material would best remove sulfamethoxazole from drinking water. Four different nano-materials (Zinc Oxide, Iron Oxide, Silicon Oxide, and activated Carbon) at four different time increments (30 minutes, 2 hours, 3 hours, and 24 hours) have been studied and an HPLC (High Performance Liquid Chromatography) system was used to evaluate the removal efficiency of sulfamethoxazole in natural and drinking water. Duplicate data for each condition was obtained for accuracy and statistical data analysis. The results show that iron oxide nanoparticles at a time increment of 3 hours provide best sulfamethoxazole removal from water.

Tiffany is a senior at Missouri S&T. She is majoring in Chemistry with a minor in Industrial Psychology. Tiffany attended Ash Grove high school here in Missouri and is expecting to graduate from MS&T in the fall of 2012. Tiffany has been involved in club volleyball and local horse show judging.

Meghan Ray

Joint project with Nichole Hurd and Daniel Roush

Department:	Biological Sciences
Major:	Chemical Engineering
Research Advisor:	Dr. David Westenberg
Advisor's Department:	Biological Sciences

Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program Missouri S&T Department of Biological Sciences and Department of Chemical and Biological Engineering, Energy Research and Development Center, and the Materials Research Center

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Meghan is a senior in biochemical engineering. She has been involved in several organizations over her undergraduate career, including leadership positions in the International Genetically Engineered Machines student design team, Kappa Delta Sorority, and the W.T. Schrenk Society. She will be entering industry after graduating this May.

Daniel Roush

Joint project with Meghan Ray and Nichole Hurd

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. David Westenberg
Advisor's Department: Biological Sciences

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
Missouri S&T Department of Biological Sciences and Department of Chemical and Biological Engineering, Energy Research and Development Center, and the Materials Research Center

Isolation and Implementation of the Electron Shuttling Pathway from *Geobacter* into *Escherichia coli*

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Daniel is a senior in Biological Sciences. He has held various leadership positions within the International Genetically Engineered Machines student design team. Throughout his undergraduate career he has participated in various research projects under the guidance of faculty. After graduation he plans on continuing education and pursuing an M.D./Ph. D. with emphasis in clinical microbiology.

Erica Shannon

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Robert Aronstam
Advisor's Department: Biological Sciences

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
Biological Sciences Department
Missouri S&T cDNA Resource Center

Changes in Gene Expression of Muscarinic Acetylcholine Receptors Mediated by a Constitutively Active Phenotype

Muscarinic acetylcholine receptors are involved in multiple processes of the central and autonomic nervous system. They play an integral role in learning, memory, mood, attention, arousal, rest, and digestion. Acetylcholine, the native agonist for muscarinic receptors, initiates a signal transduction pathway that begins in the extracellular matrix and culminates with altered gene expression in the nucleus of the cell. These changes in gene expression can be measured using reporter plasmid comprised of specific response elements coupled to the gene coding for firefly luciferase. In these assays, the amount of light emitted directly correlates with the concentration of luciferase, a measure of response element activation. In the present study I demonstrate that each of the five muscarinic receptors subtypes with the constitutively active phenotype increase unstimulated gene expression and a potentiation of the induced reporter gene expression.

Erica is a junior in the Biological Sciences department at Missouri S&T. She is pursuing a BS in Biological Sciences and minors in Chemistry, Psychology of Leadership, and Organizational Psychology. Since her freshman year Erica has been actively involved in student organizations and held many leadership roles. Erica is currently the Webmaster of the National Residence Hall Honorary (NRHH) Shamrock Chapter and President of the international Genetically Engineered Machines (iGEM) Student Design Team. In addition to participating in student organizations, Erica is a student researcher in the biological sciences neurobiology lab and a student worker in the cDNA Resource Center. In her free time Erica likes to paint and read Michael Crichton novels.

Jared Simon

Department: Computer Science
Major: Computer Science
Research Advisor: Dr. Daniel Tauritz
Advisor's Department: Computer Science

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Fellows Program

Run-time Fitness Monitor for Automated Fault Localization

From a simplified perspective, software development involves programming software, and then testing and correcting it. Because software developers are not perfect, software often needs to go through a series of fault localization and correction iterations. Software fault localization is an essential and expensive process in software correction, which motivates the design of analysis tools that automate this process as much as possible. This paper presents the run-time fitness monitor, a novel approach to fault localization which uses a fitness function to monitor the performance of specified buggy software in real time and to determine the likelihood of the location of a bug. To show the strengths and weakness of the run-time fitness monitor and to demonstrate a proof of concept, the run-time fitness monitor is tested against a series of programs with seeded errors.

Jared is a senior majoring in Computer Science. He will be graduating in May with a B.S., and he plans on going to graduate school to get his masters. With his degree he plans on programming music software.

Jill Wildhaber

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Melanie Mormile
Advisor's Department: Biological Sciences

Funding Source: N/A

Data Mining of Bacterial Genes for Enzymes to Use for Biofuel Production: Determining Pathways of Interest in *Halanaerobium* strain *sapolanicus*

Halanaerobium strain *sapolanicus* is an alkaliphilic bacterium that shows promise in producing biofuel. The presence of hydrogenases and dehydrogenases in its genome offers a potential mechanism from which biohydrogen can be obtained. Alcohol forming enzymes, producing alcohols such as propane-1,3-diol, 1-propanol, propane-1,2-diol and ethanol, are also apparent in its genome and can be of essential industrial use. In addition to these renewable energy-producing enzymes, the carbohydrate metabolism of this bacterium indicates the presence of xylanase, capable of converting xylan into xylose. Xylose is the precursor to hemicellulose, a component of biomass. The findings in this genome have not, however, been tested in a laboratory setting; they have only been discovered when analyzing the annotation of its genome. If this bacterium carries out the functions that are present in its genome, *Halanaerobium* strain *sapolanicus* will be very beneficial in the shift from fossil fuels to biofuels.

Jill is a senior at Missouri S&T, majoring in Biology with a premed emphasis. She will be attending Kansas City University of Medicine and Biosciences in the fall of 2011. She is currently the secretary of Phi Sigma Honor Society and has been the pianist for several Missouri S&T musicals.

Social Sciences
Oral Session

Abstracts

Frank Keehn

Department: Psychological Sciences
Major: Psychology
Research Advisor: Dr. Nancy Stone
Advisor's Department: Psychological Sciences

Funding Source: UM Research Board

Collective Efficacy and Group Performance in Computer-mediated Settings

Student groups of 3 worked a maze problem to determine if types of planning methods (control, random, and guided) or planning medium (computer-mediated or face-to-face) could differentially develop collective efficacy and lead to different performance levels. Contrary to expectations, levels of collective efficacy were not significantly different across communication medium, planning type, or amount of time spent planning. The interaction between planning medium and type on collective efficacy was significant, but not as hypothesized, supporting a difference in the development of collective efficacy between media. Specifically, controlled planning led to higher pre-efficacy scores for computer-mediated compared to face-to-face planning whereas groups that planned face-to-face compared to computer-mediated had higher pre-efficacy when planning was random or guided. Post-task, but not pre-task, collective efficacy evinced predicted correlations with performance in the first two maze quadrants. Limitations and possible improvements on the current experiment are discussed in the context of future research directions.

Frank is a Psychology major with an emphasis in Personnel and Human Resources and a minor in music. He will be graduating in May 2011 and then entering a PhD program in IO Psychology.

Joseph Pieczynski

Department: Business and Information Technology
Major: Information Science and Technology
Research Advisor: Dr. Bih-Ru Lea
Advisor's Department: Business and Information Technology

Funding Source: N/A

Virtual Communities in an Enterprise Portal and the Effect on Corporate Governance for Generation Y

With Generation Y entering the workforce, virtual communities may prove to be a worthwhile investment for enterprises because Generation Y uses similar tools. The objective of this research study is to identify if virtual communities in a corporate environment increase corporate governance in Generation Y.

This research was carried out in a St. Louis based fortune 500 multinational enterprise. A prototype virtual community was implemented with collaboration and social features including team rooms, community calendars, user profiles and micro blogging.

The analysis of the surveys and server usage supports that users felt the system helps with corporate governance. However in some aspects views of how much the system helped declined. These results illuminated barriers to successful implementation of a virtual community including change management, inclusion of relevant business content, amount of content, amount of users, type of users and culture of the company.

Joseph is an undergraduate senior majoring in Information Science and Technology and minoring in Business and Management Systems where he is learning how to manage business needs through the use of information technology. He is an officer in Phi Beta Lambda-Future Business Leaders of America, Technical Innovators and Entrepreneurs Society, student event coordinator for the Center for Enterprise Resource Planning and will be working for Accenture after he graduates.

Lauren Summerville

Department: Psychological Science
Major: Psychology
Research Advisor: Dr. Jacqueline Bichsel
Advisor's Department: Psychological Science

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Second to fourth digit ratio: A measure related to intelligence

Androgens influence individual differences in a conventional way: They increase the masculinity of the individual. The ratio of the index finger length to ring finger length, otherwise known as 2D:4D, is a known reflection of prenatal androgen exposure. Smaller digit ratios can be inferred as higher prenatal androgen exposure, a more masculine trait, while larger digit ratios can be inferred as weaker prenatal androgen exposure, a more feminine trait. This ratio of digit lengths has been used to study the effects of prenatal androgenization on human cognition. I correlated this digit ratio with an intelligence measure in 19 men and women. I found a relation between 2D:4D and long-term memory (r = .28, p = .01). 2D:4D may be a beneficial tool in accounting for individual differences in intelligence.

Lauren is to graduate May 2011 with her Bachelor's of Science in Psychology with an emphasis in Cognitive Neuroscience. She also has successfully completed a minor in History at S&T. She is the current president of the Psychological Science department's honor society, Psi Chi and also the president of the social, informational, and service organization PsyCo. She is concluding her second year as a Research Assistant in Dr. Bichsel's Cognitive Studies Lab and hopes to continue research while she pursues a Masters in Experimental Psychology. Eventually, she hopes to obtain a doctorate in Psychology, with an emphasis in Evolutionary Psychology. This will be her second appearance at Missouri S&T's Undergraduate Research Conference.

Arts and Humanities
Oral Session

Abstracts

Ashley Grace

Department: History & Political Science
Major: History/Secondary Education
Research Advisor: Dr. Larry Gragg
Advisor's Department: History & Political Science

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Public Policy on Pathological Gambling: An Examination of Federal Recommendations and the Gaming Industry's Response

This paper examines the federal government's recommendations concerning pathological and problem gambling and the gaming industry's response to those recommendations. The research for this paper comes primarily from two national studies: the 1976 *Commission on the Review of the National Policy toward Gambling Final Report* and the 1999 *National Gambling Impact Study Commission Final Report*. In 1999 the American Gaming Association released its own review of the casino industry. These reports reveal the difficulties of government at the state and federal level in addressing the problem of pathological gambling.

Ashley is a senior studying history and secondary education. She is currently president of Phi Alpha Theta and a member of Phi Kappa Phi, History Club, and Student-Missouri State Teachers' Association. She is the daughter of Chris and Deborah Grace and is from Lebanon, Missouri.

Samantha Lucker

Department: Geology and Geophysics
Major: Geophysics
Research Advisor: Dr. Lindgren H. Johnson
Advisor's Department: English

Funding Source: N/A

When Nature is Not Enough: Frederick Douglass' Desire to Enter Human Society in Narrative of the Life of Frederick Douglass, An American Slave

Recently many literary scholars, such as Jeffery Myers, have been researching the connection between slaves and nature in slave narratives. Scholars claim that there is a liberating quality in nature that provided comfort to African American slaves. What they fail to realize it the concept that the connection does not have to be a positive one. This report examines Frederick Douglass' narrative and other secondary sources to prove that this connection exists as a negative correlation and how Douglass managed to free himself from it.

Samantha is currently a freshman majoring in Geophysics. In addition to English research, she is involved in numerous campus activities and organizations such as treasurer of the C.L. Dake Society, member of SEG, and member of the Missouri S&T fencing club. She plans to graduate in the spring semester of 2014 and continue on to graduate school.

Evan Mobley

Department: History and Political Science
Major: History
Research Advisor: Dr. Larry Gragg
Advisor's Department: History and Political Science

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Know When to Fold 'Em: Portrayal of Compulsive Gambling and Gamblers Anonymous in News Articles, 1956-1997

This paper examines Gamblers Anonymous and compulsive gambling in newspaper articles from the 1950s to the 1990s. It is an analysis of what readers of major newspapers could have learned about compulsive gambling through Gamblers Anonymous. It includes how Gamblers Anonymous used newspapers for publicity and to inform readers about compulsive gambling. Gamblers Anonymous presented newspaper readers with an image of the compulsive gambler, the difficulties associated with being and living with a compulsive gambler, various statistics on compulsive gamblers, and attempted to reach out to prospective compulsive gamblers in order to help them.

Evan is a senior majoring in History with a minor in Pre-law. He is currently vice-president of Phi Alpha Theta and a member of Phi Kappa Phi and History Club. He is the son of Scott and Rhonda Jordan and is from Peculiar, Missouri.

Stephen Taul

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Lindgren Johnson
Advisor's Department: English & Technical Communications

Funding Source: N/A

An Imminent Path of Destruction: The Perfect Formula for Rebirth?

Before I began this project, I was very interested in alternative healing methods and global consciousness awakening. I wrote this paper, in essence, to save us from ourselves. In America, it is really easy to become comfortable and complacent, to witness devastation happen in other countries, and just brush it off like it will never happen to us. However, in this paper, I attempt to expose the fact that there is a hidden danger lurking within every part of our American society that is actually detrimental to the survival of most living things on this planet, including us, that most people just don't know about. I hope this paper's intent shines clear, I hope you can see where I'm coming from, and I pray together we can create a Peaceful, Loving, Global Humanity, safe for our children's children.

Stephen is a junior studying Biological Science, intent on studying biophysics and the nature of consciousness later in my career. He intends on studying human electromagnetic fields and biophoton emissions, studying how these fields interact with one another, how they can be used for medicine and psychology. Stephen wants to study alternative healing methods, such as acupressure and Reiki, and discover why they are so effective in healing. His ultimate goal is to assist in the merging of Western scientific wisdom with Eastern spiritual wisdom.

Kyle Visnapuu

Department: History
Major: History
Research Advisor: Dr. Petra Dewitt
Advisor's Department: History

Funding Source: N/A

A Study of the Historical Interpretations of the Emancipation Proclamation

This paper attempts to study the historical interpretations and perspectives of the Emancipation Proclamation, mainly through secondary sources, and to find a unifying theme throughout sources that differ over the reasons for the proclamation's issuance; the paper, in addition, attempts to account for these differences. The numerous sources used span from the issuance of the document in 1863 to the twenty-first century, and take the form of newspaper and magazine articles, journal essays, and books. Moreover, a deliberate attempt was made when researching for this paper to include authors with wide differences of opinion regarding the reasons for issuing the proclamation.

Kyle has been a part-time student majoring in history at the Missouri University of Science and Technology since fall 2007. He enjoys American History, specifically the social and political history of the Civil War era, including the study and impact of the Emancipation Proclamation on the war and American History. In addition to enjoying history, Kyle has also enjoyed his writing and literature courses.

Sciences
Poster Session

Abstracts

Casey Burton

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Yinfa Ma
Advisor's Department: Chemistry

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
Department of Chemistry, Environmental Research Center

Sarcosine Detection by Dichlorofluorescein as a Hydrogen Peroxide Probe

Metabolites impart a significant importance to the understanding of biological reactions, and consequently, to the research of diagnostic and therapeutic techniques. Furthermore, there has been recent interest in metabolic levels present in urine. The detection of specific metabolites, however, presents certain analytical difficulties such as low or ambiguous specificity of the probe. This study proposes a new technique, utilizing oxidative, enzymatic production of hydrogen peroxide from the metabolite accompanied by dichlorodihydrofluorescein (DCFH). This probe displays high selectivity towards hydrogen peroxide, and coupled with high enzymatic specificity, forms an accurate method to measure metabolite levels. Sarcosine was used as a paradigm, by treatment of sarcosine oxidase to generate hydrogen peroxide, which was exposed to DCFH. Changes in fluorescence between initial and enzyme-exposed hydrogen peroxide levels were used to construct a standard curve from which actual urine samples were measured using this technique.

Casey was raised in the Lake of the Ozarks, MO where he attended the School of the Osage. In that time, he participated in his high school research class, putting out several papers, most notably that concerning the development of a computerized training method to demonstrate that the skill of absolute pitch could indeed be taught, earning him a chance to speak at many professional symposiums. He has taken these experiences with him to college, where he is currently participating in undergraduate research in Chemistry, and plans to make a career of it.

Ashley Byerley

Department: Geological Sciences and Engineering
Major: Geology
Research Advisor: Dr. John P. Hogan
Advisor's Department: Geological Sciences and Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Characterization of Folds in the Roubidoux Fm. Near Licking, MO

The Roubidoux Formation, near Licking, Missouri is folded into anticline-syncline pairs, which contrasts with horizontal sedimentary strata typical for the state. This folding reflects either 1) sagging of the strata (i.e., folding) due to karsting (cave collapse) in the underlying layers, or 2) a period of compressional plate tectonic activity leading to shortening of the strata by folding. To test these hypotheses I used detailed geologic mapping of an 80 meter road cut using a digital photomosaic, collection of orientation data of the bedding planes with a Brunton compass, and stereographic analysis to determine fold type and fold orientation. Ten separate folds form three coherent groups with each group having distinct orientations for the fold axial surfaces. Similarity of the fold axis orientations within each group suggests a common tectonic origin for these folds. However, the deflection of fold orientations from one group to the next suggests subsequent deformation event(s) leading to the rotation of fold axes. The younger event(s) may also have been tectonic, followed by late karsting.

Ashley graduate from St. Clair High School in 2007. She participated in the marching band, scholar bowl, and National Honor Society. In August 2007, Ashley attended University of Missouri-Rolla, now Missouri S&T.

Brice Curtin

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Chariklia Sotiriou-Leventis
Advisor's Department: Chemistry

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
ARO and NSF

Aerogels as Drug Delivery Systems: Silica and Dysprosia Aerogels as Drug Carriers for Indomethacin and Paracetamol

The use of aerogels as drug delivery systems is fast growing as an attractive field of research because of their high surface area and low density. This project is on the feasibility of a system of aerogels and pharmaceutical drugs combined in a novel way. Two drugs were investigated: paracetamol and indomethacin; and two biocompatible aerogels (silica and dysprosia based) were loaded with the aforementioned drugs. We found that silica aerogels could be loaded with 13.6% paracetamol and 12.1% indomethacin, while polymer crosslinked dysprosium oxide (X-DyOx) aerogels could be loaded with 35.1% paracetamol and 32.2% indomethacin. We then time-released the drugs from each aerogel in two buffer systems (0.1 N HCl and phosphate pH = 7.4). The silica aerogels showed a total drug release in 0.5 h in each system. However, X-DyOx completely released paracetamol in 60 h in 0.1 N HCl and 65 h in the phosphate buffer.

Brice is a current junior in Chemistry at Missouri University of Science and Technology in Rolla, MO. He has worked under the guidance of Dr. Chariklia Sotiriou-Leventis on aerogel systems and pharmaceutical applications since January 2010. He plans on attending graduate school and pursuing further research opportunities after graduation.

Joshua Erickson

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Robert S. Aronstam
Advisor's Department: Biological Sciences

Funding Source: Missouri S&T cDNA Resource Center

Disruption of Muscarinic Receptor Mediated Signal Transduction by Oxidative Stress

The ability of a series of metal oxide nanoparticles (20 - 60 nm) to alter muscarinic receptor signaling was studied in cells with the human M3 muscarinic acetylcholine receptor. Activation of M3 receptors induced a biphasic increase in $[Ca^{2+}]_i$: an initial, IP3-mediated release of Ca^{2+} from endoplasmic reticulum (ER) stores followed by a sustained phase of Ca^{2+} entry (i.e., store operated calcium entry, SOCE). The different particles had multiple effects on calcium metabolism and muscarinic signaling: resting calcium concentration was increased and SOCE entry was decreased among other effects. Only ZnO and CuO particles consistently increased resting $[Ca^{2+}]_i$. SOCE was depressed by several metal oxide particles in disparate degrees. ZnO depressed most aspects of calcium signaling in response to muscarinic stimulation. The effect of SOCE depression did not correlate highly with cytotoxicity. The present findings raise the possibility that nanoparticle-induced cytotoxicity and nanoparticle-induced SOCE depression have different mechanisms of action.

Joshua is a current senior at the Missouri University of Science and Technology. He has worked under the tutelage of Dr. Robert Aronstam on the subject of muscarinic receptors and how different toxins affect their signaling properties since August 2009. He is planning on attending medical school in the upcoming academic year and has already been accepted to the Saint Louis School of Medicine.

Robert Haselwander

Department: Geology
Major: Geological Sciences and Engineering
Research Advisor: Dr. Francisca Oboh-Ikuenobe
Advisor's Department: Geology and Geophysics

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Signs of Change: Evidence for Ecological Disturbances in the Micro-Fossils of a Local Lake

Analysis of dispersed organic matter (palynofacies) and palynomorph data for the Bray Conservation Area Lake show low levels of pollen, high levels of spores and fungal matter, and increased opaque content from a depth of ~10-18cm. This suggests that some kind of major disturbance occurred in the recent past. This event may be related to the clearing of Missouri forests in the late 19th and early 20th centuries. The results of this analysis will be used to try to understand the nature of the disturbance and ascertain whether or not the disturbance is related to the clearing of forest. If possible, it will also be compared to Carbon-14 dates obtained from the core to establish the true time relationship.

Robert is a senior in Geology and Geological Engineering. He looks forward to completing his degree and moving on to graduate work in the fall.

Megan Koerner

Joint project with Alexis Martin

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Robert Aronstam
Advisor's Department: Biological Sciences

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Honokiol Blocks Store Operated Calcium Entry in CHO Cells Expressing the M3 Muscarinic Receptor

Honokiol, a cell-permeable phenolic compound derived from the bark of magnolia trees, inhibits multiple autonomic responses. We determined the effects of honokiol on calcium signaling underlying transmission mediated by M3 muscarinic receptors expressed in Chinese hamster ovary (CHO) cells. Honokiol had a potent (EC50 ≈ 5 μM) inhibitory effect on store operated calcium entry (SOCE) that was induced by activation of the M3 receptors. This effect was specific, rapid and reversible, and was seen at concentrations not associated with cytotoxicity, inhibition of IP3 receptor-mediated calcium release, depletion of ER calcium stores, or disruption of M3 receptor binding. It is likely that an inhibition of SOCE contributes to honokiol disruption of parasympathetic motor functions, as well as many of its beneficial pharmacological properties.

Megan is in her third year at Missouri S&T. She is from Eldon, MO, and plans to attend medical school after receiving her undergraduate degree in Biological Sciences. She will receive a minor in Cognitive Neuroscience and Chemistry. Megan is an active member in the Biological Sciences Honor Society. Other campus organizations she is involved in include Scrubs, Helix, and Engineers Without Borders. Megan is employed as a department recruiter for the Biological Sciences Department. She also volunteers in Dr. Aronstam's laboratory, conducting research on cellular signal transduction. Megan has been awarded the Access Missouri Scholarship and SMART Grant all three years of academic study.

Amber Rose Kreps

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Dev Niyogi
Advisor's Department: Biological Sciences

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
Freshwater Ecology Lab

Assessment of Fungal Diversity in an Acidic Lake through Use of Traditional and Molecular Techniques

In this project I compared traditional and molecular approaches to assess diversity of aquatic fungi in an acidic lake. Leaves were deployed for colonization at four sites in Finger Lake State Park, located near Columbia, Missouri. The land once housed a coal mine, and one small lake, "Red Lake," remains acidic. Sites included an extremely acidic seep (pH 3), a site in Red Lake (pH 3.5), a site downstream from Red Lake (pH 3.5), and a nearby neutral lake (pH 7). For the traditional approach, I examined fungal spores microscopically, and grew fungi from leaves in an attempt to isolate pure cultures. For the molecular approach, DGGE analysis was done using DNA extracted and amplified from leaves and pure cultures grown in the lab. Traditional and molecular analyses yielded different results, due in part to biases in the traditional methods. Based on the molecular analysis, diversity decreased as acidity increased.

Amber is a junior in the Biology department. She participates in undergraduate research in the Freshwater Ecology Lab and is a work study student for the Microbiology Lab. Amber is a member of Phi Sigma and the iGEM design team.

Alexis Martin

Joint project with Megan Koerner

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Robert Aronstam
Advisor's Department: Biological Sciences

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Honokiol Blocks Store Operated Calcium Entry in CHO Cells Expressing the M3 Muscarinic Receptor

Honokiol, a cell-permeable phenolic compound derived from the bark of magnolia trees, inhibits multiple autonomic responses. We determined the effects of honokiol on calcium signaling underlying transmission mediated by M3 muscarinic receptors expressed in Chinese hamster ovary (CHO) cells. Honokiol had a potent (EC50 ≈ 5 μM) inhibitory effect on store operated calcium entry (SOCE) that was induced by activation of the M3 receptors. This effect was specific, rapid and reversible, and was seen at concentrations not associated with cytotoxicity, inhibition of IP3 receptor-mediated calcium release, depletion of ER calcium stores, or disruption of M3 receptor binding. It is likely that an inhibition of SOCE contributes to honokiol disruption of parasympathetic motor functions, as well as many of its beneficial pharmacological properties.

Alexis is a junior from Rogersville, MO, planning to attend medical school after receiving her bachelor's degree in Biological Sciences. Alexis is an active member in Phi Sigma, the Biological Sciences honor society, as well as the other Biological Sciences organizations, Scrubs and Helix. Alexis is employed as a research assistant in Dr. Aronstam's laboratory, conducting research on signal transduction in cells. Alexis has been awarded the Academic Scholar's certification for all three years of undergraduate studies. In her free time, she mentors elementary children, and volunteers at St. John's Free Clinic, as well as other various local charities. At the end of March, Alexis will be presenting additional research at the American Society for Neurochemistry conference in St. Louis, MO.

Ariel Mollhagen

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Klaus Woelk
Advisor's Department: Chemistry

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
MS&T Energy Research and Development Center
Missouri Research Board

Kinetic and Mechanistic Investigations into the Degradation of Glucose in Hot Compressed Water as a Model for Hydrothermal Biomass-to-Fuel Conversions

To find renewable, more sustainable, and environmentally benign techniques for the production of synthetic fuel, we studied the hydrothermal conversion of D-glucose (a model substrate for cellulosic and starch-based biomaterial) to liquid fuel precursor chemicals such as 5-hydroxymethyl furfural (5-HMF). The project was aimed at the elucidation of reaction mechanisms and kinetics involved in the conversion. Model substrates such as D-glucose and several known intermediates of the reaction were reacted in inert glass pressure vessels under hydrothermal conditions (120-170 °C, 3-10 atm). The acidity of the reactive solutions were adjusted from ph = 1 to 6. Quantitative results derived from ^{1}H-NMR spectra were used to determine activation barriers of individual steps in the reaction.

Ariel is a third year undergraduate majoring in Chemistry at MS&T. She is also working on a minor in Geology. Ariel is the current president and a prior officer in the WT Schrenk Society and has been the recipient of several Chemistry Outstanding Student awards.

Dominique V. Nocito

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Yinfa Ma
Advisor's Department: Chemistry

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Study of the adsorption kinetics of 17α-ethinylestradiol(EE2) onto Al_2O_3, SiO_2, and CeO_2 nanoparticles

Adsorption of 17 alpha-ethinylestradiol onto nanoparticles shows promise as a possible step in water treatment. In order to better understand the process a kinetic study of adsorption onto Al_2O_3, SiO_2, and CeO_2 nanoparticles was done with a constant temperature of 25 °C and pH of 7.0. In the study the specific surface area was kept the same for all three nanoparticle doses($30m^2$/ml). The Al_2O_3, SiO_2, and CeO_2 nanoparticles all showed very similar removal percentages of 76.19%, 72.01%, and 78.43% respectively. The pseudo-second-order kinetic model was found to be the best fit for all three nanoparticles' adsorption behavior. Based on the pseudo second order kinetic model being the best fit and the very similar percent removals, we can assume that under these experimental conditions that the rate of adsorption of EE2 is primarily dependent on the surface area available, and has little to do with the intrinsic properties of the nanoparticles.

Dominique is currently a sophomore majoring in Chemistry with a minor in Mathematics at Missouri S&T. There he continued to excel at his studies, earning departmental awards for leadership and outstanding achievement. He is involved in the Baduk(Go) club and is a member of Delta Sigma Phi fraternity where he serves as fundraising chair. At the 6th annual undergraduate research conference he received third place in the research proposal section for his poster "Measurement of the Production of Beta-1,4-Endoglucanase by Genetically Engineered Bacteria". He plans to pursue graduate education in biochemistry.

Jennifer Page

Department: Geological Sciences & Engineering
Major: Geological Engineering
Research Advisor: Dr. Mohamed Abdelsalam
Advisor's Department: Geological Sciences

Funding Source: NSF
Missouri S&T Geological Sciences & Engineering

Stratigraphic Controls on the Morpho-Tectonic Elements of the Gorge of the Nile, Ethiopia

This work presents new results from remote sensing and field studies aimed at understanding the morpho-tectonic evolution of the Gorge of the Nile (which is carved by the Blue Nile in the Ethiopian Plateau since ~30 Ma ago) and possible stratigraphic controls on its incision history. The Gorge of the Nile is similar to the Grand Canyon of Arizona and it exposes over 700 Ma of geological history. From its headwaters at Lake Tana, the Blue Nile traverses a ~150 km semi-circular, structurally-controlled bend, carves a ~1.6 km-deep gorge, and exposes Miocene- Quaternary--volcanics and a ~1100 m-thick Mesozoic sedimentary section, all underlain by a Neoproterozoic Precambrian crystalline rocks.. Results from examining the Dejen-Gohatsion segment indicate that the development of the Gorge of the Nile width and symmetry are influenced by stratigraphy, especially when the Blue Nile was incising through the Mesozoic sedimentary section.

Jennifer is a junior in the Geological Engineering undergraduate program at MS&T. She is the Public Relations Director of KMNR 89.7 FM, and is a practicing student pilot. Upon graduation, Jennifer plans to pursue a MS in Planetary Geology and eventually work in lunar mining.

Austin Ramsey

Department: Chemistry
Major: Architectural Engineering
Research Advisor: Dr. Klaus Woelk
Advisor's Department: Chemistry

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Dehumidifying Capabilities of Ionic Liquids

This was an OURE project conducted by Austin Ramsey under the supervision of Dr. Klaus Woelk (advisor) and Dr. Rex Gerald (Senior Research Scientist, Chemistry Department). The purpose of the project was to investigate the usage of ionic liquids for dehumidifying air. The ionic liquid that was tested was 1-ethyl-3-methylimidazolium ethyl sulfate produced by BASF. A sample was placed in a custom built humidity control chamber which was run autonomously by a microcontroller. The ionic liquid was shown to adsorb large quantities of water from the atmosphere and then to release water when placed in an environment with less than twenty percent relative humidity.

Austin is a sophomore Architectural Engineering student and member of the Missouri S&T solar house team. He was awarded an OURE research grant for the 2010-201 academic year and is the 2nd place winner of the 2010 Missouri S&T elevator pitch competition.

Kate Schlarman

Department: Geological Sciences and Engineering
Major: Geology and Geophysics
Research Advisor: Dr. Francisca Oboh-Ikuenobe
Advisor's Department: Geological Sciences and Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
National Science Foundation
Dr. Al Spreng Undergraduate Research Award

Western Australia Extreme Environments

Studies of hypersaline lakes on Earth provide insights into extreme conditions in which life may arise on other planets. We present palynological analysis of cores from three hypersaline lakes in Western Australia (Cowan Basin, Oldenberg Farm, Twin Lake West) that constrain environmental conditions during the Holocene. Dispersed organic matter preserved in the sediments includes structured phytoclasts (wood, cuticles, etc.), degraded and comminuted phytoclasts, and fungal remains. Identified pollen grains blown in from the surrounding areas include Myrtaceae (*Eucalyptus* pollen), Chenopodiaceae (saltbush pollen), and Poaceae (grass pollen). The discovery of *Dunaliella* (algae that lived within the lakes) demonstrates that such organisms can survive and thrive in hypersaline extreme environments that are analogous to those on Mars.

Key words: Western Australia, Hypersaline Lakes, Palynology, *Dunaliella*

Kate Schlarman is a junior Geology and Geophysics major interested in connections between biological and earth sciences.

Jeffery Shelburg

Department: Computer Science
Major: Computer Science
Research Advisor: Dr. Daniel Tauritz
Advisor's Department: Computer Science

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Virtual Facilitation of Human Group Interactions Employing a State-based Learning Classifier System

Natural human group dynamics sometimes can lead a group down unproductive pathways. A human expert group facilitator may need to intervene to return the group to a productive workflow. Unfortunately, human expert group facilitators are scarce and prohibitively expensive. The circumstances that lead a group astray can be translated into a state-based decision graph with sets of matching rules along with an appropriate intervention for each situation. The goal of this project is to successfully develop a Virtual Facilitator software system that employs a state-based learning classifier system to evolve increasingly higher quality matching rules and conversation models based on crowd sourced feedback. By doing so, ubiquitous access to a low cost, high quality means of group facilitation will become a feasible reality.

Jeffery will be receiving a Bachelor of Computer Science in the spring 2011 after spending three years as an undergraduate. During the summer of 2010, he interned at Sandia National Laboratories in the Center for Cyber Defenders. His current research project was previously presented at the Undergraduate Research Day at the Capitol in Jefferson City. In the spring of 2011, Jeffery plans on pursuing a Masters of Computer Science degree with funding from the Sandia National Laboratories Critical Skills Master's Program.

Laura Sisken

Department: Physics
Major: Physics
Research Advisor: Dr. Alexey Yamilov
Advisor's Department: Physics

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Electromagnetic Wavefront Shaping

It is well known that electromagnetic waves can be superimposed and thus create interference effects. By applying this fact one can focus light by superimposing a specific combination of electromagnetic wave fronts. Using numerical simulations, I demonstrated a possibility of such focusing through a random medium. These simulations were done in COMSOL Multiphysics in conjunction with Matlab to launch certain combinations of plane waves through a substrate with metallic scatterers placed on top of it. I have shown that one can focus light in a specific place, and by tuning the phases of the waves one can translate the focused light across the sample. One application for this setup is scanning biological molecules that are attached to metallic nanoparticles without using moving parts.

Laura is currently a junior in Physics. She is involved in the Society of Physics Students, the MSM Spelunkers and Christian Campus Fellowship.

Marissa Spencer

Department: Geological Sciences and Engineering
Major: Geology and Geophysics
Research Advisor: Dr. Francisca Oboh-Ikuenobe
Advisor's Department: Geological Sciences and Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Palynology of the Hell Creek Formation in Montana

Sediments were collected from the Hell Creek Formation and surrounding areas in Garfield County, Montana in 2008 and 2009 during the recovery of fossil bones of a *Triceratops* (a dinosaur), and the Snow Creek Microstratigraphy Project as part of a collaborative study with researchers from Washington University, St. Louis Community College, the St. Louis Science Center, and Missouri S&T. The Hell Creek spans the Cretaceous-Paleogene (K-Pg) boundary, known for one of the largest Phanerozoic mass extinctions. The palynofacies and palynomorphs of these samples were analyzed utilizing transmitted light microscopy to interpret paleoenvironmental conditions and age of the sediments. The 69 samples studied contain abundant dispersed organic matter and pollen. Dispersed organic matter components are mainly comminuted and degraded phytoclasts, and structured phytoclasts (wood, cuticles, parenchyma), although palynomorphs (primarily pollen, spores, fungal remains), and opaque matter are also commonly preserved. Palynology is being integrated with sedimentology and vertebrate paleontology for interpretation.

Marissa is a senior at Missouri University of Science and Technology studying Geology and Geophysics. Marissa is a member of the C.L. Dake Geological Society, Geological Society of America, Eastern Missouri Paleonotological Society, American Association of Petroleum Geologists, and is Treasurer for Sigma Gamma Epsilon, the Earth Science Honor Society. While studying the palynology of the Hell Creek Formation in Montana, Marissa also co-authored another scientific publication on the palynology of Southeast Missouri. In addition to classroom and research experience, Marissa has spent several summers in the field excavating dinosaur bones in Montana, leading geological tours of Onondaga and Cathedral Caves, as well as educational programs and geological presentations. Marissa plans to continue her education at Missouri S&T as a graduate student of geological sciences.

Crystal Twenter

Department: Geology and Geophysics
Major: Geology
Research Advisor: Dr. John Hogan
Advisor's Department: Geology and Geophysics

Funding Source: National Science Foundation

The Origin of Minor Folds Associated with a Structural Dome along the Seiyal Fault in the Western Desert of Egypt

The Sinn el-Kaddab Plateau and surrounding Nubian Plain of the Western Desert of Egypt is characterized by the presence of numerous elongate domes and basins or "Desert Eyes" (Tewksbury et al., 2009) that range from several hundred meters to several kilometers in length. These Desert Eyes are commonly associated with dominantly E-W fault zones (e.g., Kalabsha Fault Zones). One such Desert Eye occurs as a structural dome cross-cut by fault splays associated with the trace of the Seiyal Fault Zone. Reconnaissance field studies of this dome suggested the presence of localized minor folding within a sandstone unit near the trace of one of the splays of the Seiyal Fault. Two models were proposed for the origin of these folds: 1) the folds were the result of localized soft-sediment deformation and 2) the folds were tectonic in origin. Outcrop geologic mapping immediately revealed consistent and inconsistent orientations suggesting both origins possibly developed out of the motion along the Seiyal Fault.

Crystal, daughter of Larry and Beverly Twenter of Sedalia, is a senior and will be graduating this May with her Bachelor's in Geology. After graduating she plans to work as an open pit or underground geologist for a major mining corporation. During her time here at MS&T she has been involved with many campus groups such as Swing Dance Club, Ballet Club, Theater. SGE, SEG, C.L.Dake, Residential Life, CCF, BSU, and SME. She also has had opportunities for a couple of different internships one with Barrick Gold of North America and another with Cliffs Natural Resources. Her greatest award is the honor of being inducted into the Academy as one of the scholars of 2011.

Alexander White

Department: Computer Science
Major: Computer Science & Computer Engineering
Research Advisor: Dr. Daniel Tauritz
Advisor's Department: Computer Science

Funding Source: Self-Funded

Self-Adaptive Website User Interface Optimization Framework

Billions of people worldwide use the internet. Unfortunately, many of these people struggle in finding the information they seek in a timely fashion. Oftentimes, website users struggle with information overload — they are overwhelmed with so much material that it is difficult to know where to go next. Additionally, it is common that frequently used items are hard to navigate to within a layout.

To overcome these struggles, this framework uses Fitts' Law as a metric for optimizing website user interfaces so that users can use a layout customized to their needs. Optimization is achieved through both local and global optimum to ensure adaptations are clear and concise so there is no user confusion. In addition, this framework does not rely on any explicit user input or feedback minimally effecting the user experience.

Alexander is a senior in Computer Science and Computer Engineering with a minor in Mathematics. His related interests are in web development and artificial intelligence having both maintained a web development business for nearly three years and taken two classes in AI while at Missouri S&T. Alexander is also involved in the music program at Missouri S&T having performed in marching band, jazz ensemble, pep band, trumpet choir, brass choir, and a brass quintet. He has also served the marching band as assistant drum major. Additionally, Alexander is part of the honorary music fraternity, Kappa Kappa Psi, in which he has held several positions. Upon graduating in May 2011, Alexander is slated to work as a software engineer for Stauder Technologies in Saint Peters, Missouri where he will work on military contracted software projects in the growing company.

Rachel Wille

Department: Biological Science
Major: Biological Science
Research Advisor: Dr. Katie Shannon
Advisor's Department: Biological Science

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Determining the interaction between IQG1 and formin proteins.

Our lab focuses on the study of cytokinesis in ***Saccharomyces cerevisiae*** (budding yeast). Cytokinesis is the separation of a cell into two daughter cells. My current research focuses on the interaction between two protein formins, Bni1 and Bnr1, and the IQG1 protein. It is believed that there is an interaction between these formins and the IQG1 complex because in *C.albicans*, another yeast species, the IQG1 homolog interacted with formins. In budding yeast, IQG1 and the formins are required for actin ring formation. At this time I am still trying to determine the interaction between the protein formins and IQG1. Co-immunoprecipitation experiments did not show an interaction. However, it is likely that the interaction occurs, but is regulated. Currently, we are working with new plasmid that contains a domain that possibly regulates this potential interaction. Using this DAD domain, we hope to detect the interaction between the formins and IQG1.

Rachel is a graduating senior at Missouri University of Science and Technology. She is a Biological Science major and a member of the Women's Soccer team and Phi Sigma. Rachel also has an OURE in the cytokinesis lab this year. Upon graduation Rachel plans to apply to graduate schools and obtain her Ph.D.

Research Proposal
Poster Session

Abstracts

Andrew Brown

Department: Computer Science
Major: Computer Science
Research Advisor: Dr. Daniel Tauritz
Advisor's Department: Computer Science

Funding Source: N/A

Creating Intuitive Graphical User Interfaces for Managing the Virtual Facilitator

The Virtual Facilitator project is aimed at mediating human conflict in real-time by replacing scarce and prohibitively expensive human facilitation experts with inexpensive and ubiquitously available intelligent software. As the Virtual Facilitator has evolved, the management interface has been clogged down from an endless progression of ad hoc additions. A major revision of the administrative graphical user interface will not only benefit the performance of those in charge of creating and managing sets of facilitative guidelines, but also implicitly improve the experience of the end user by creating more intuitive conversation interventions. Additionally, many more modifications are needed in order to maintain the project, such as providing a system of grouping users and assigning permissions, creating administrative editors, and designing a system for manipulating states in our learning classifier system.

Andrew plans to graduate with a Bachelor in Computer Science from Missouri University of Science & Technology in 2013. He will be an intern at Rapportive in San Francisco during the summer of 2011, and will return for the 2011 school year to work on the Virtual Facilitator through undergraduate research.

Amanda Foster

Joint project with April Pummill

Department: Biological Sciences
Major: Chemical Engineering and Biological Sciences
Research Advisor: Dr. Westenberg
Advisor's Department: Biological Sciences and Chemical Engineering

Possible Funding Sources: The International Genetically Engineered Machines Team (iGEM), American Beekeeping Federation, Missouri State Beekeepers Association, United States Department of Agriculture, Almond Board of California, National Science Foundation, Monsanto, Bayer

Saving the Honeybees: A Synthetic Biology Approach

Since 2006-2007, beekeepers in the US have seen dramatic losses in honeybees, which could potentially cost billions of dollars in agriculture. The phenomenon has been termed Colony Collapse Disorder (CCD), and is characterized by rapid losses of adult honeybees that do not return to the hive to die. Even more puzzling is that damaging levels of normal bee parasites are not present at the time of collapse. Researchers have yet to determine a specific cause of the disorder, although most agree that CCD is caused by multiple factors that either work individually or in combination. A newly suspected cause of CCD is the fungus-virus combination of *Nosema* and invertebrate iridescent virus. This research project will focus on solving this possible cause of CCD using a synthetic biology approach. The use of genetically engineered microorganisms to test the theory could be an important step in solving the mystery of CCD.

Amanda is a second-year student at Missouri S&T. She is currently majoring in Biological Sciences and Chemical Engineering with a Biochemical Engineering emphasis. She is and has been involved in a number of research projects through the International Genetically Engineered Machines Team (iGEM) and through the Office of Undergraduate Studies and the Department of Biological Sciences. She is also the vice-president of iGEM. Amanda enjoys reading, playing ultimate frisbee, playing disc golf, skiing, and scuba diving.

Daniel Hillis

Department: Mechanical & Aerospace Engineering
Major: Aerospace Engineering
Research Advisor: Dr. Reza Zoughi
Advisor's Department: Electrical & Computer Engineering

Funding Source: N/A

Inspection Methods for Porosity and Disbonds of Polyaniline (PANI) Coating on Aluminum Alloy 6061

This presentation is a trade study of methods of Nondestructive Evaluation (NDE) that would be "best" to check polyaniline (PANI) coating on a sheet of AA 6061 for porosity and disbonding. The criteria defined for a "best" method are field capability of the test, the testing method is safe, and the testing method can be used on a large scale. PANI is primarily used to prevent corrosion. Porosity and disbonding in a coating can and will trap contaminates that increase the rate of corrosion, completely negating the intended effect of the coating. The unique properties of this polymer restrict which methods can be applied to investigate its consistency. The results of this trade study suggest that a preferred method for checking the effectiveness, presence of porosity or disbonds, of a polyaniline coating is Ultrasonic Testing. Further research with experimental testing may suggest a better method that will meet the criteria.

Daniel is a senior in Aerospace Engineering at Missouri University of Science and Technology. He will graduate with a B.S. in Aerospace Engineering in May 2011. Daniel is involved in Missouri S&T's satellite design team. The team is competing in a university small sat competition sponsored by the Air Force Research Lab. He is currently working on the Structures subsystem and working to develop a RSO (Resident Space Object) sensor for the satellite. Daniel looks forward to graduating in May and becoming a productive member of the aerospace industry.

Joseph Kurtz

Department: Computer Science
Major: Computer Science
Research Advisor: Daniel Tauritz
Advisor's Department: Computer Science

Funding Source: N/A

Balancing Limited Resources for Speech Transcription on Mobile Devices

Recently there has been an increase in decentralized teams due to globalization and advances in mobile technology. Distributed teams communicating via a mobile platform cause a tremendous increase in wireless communication, and in order for this to be managed it is critical to avoid unnecessary bandwidth use. However, mobile clients often lack in processing power and battery life when handling speech data. Thus it is crucial to carefully balance client side processing versus server side processing. One option is sending a feed of the user's voice to a server where it is converted to text. Alternatively the mobile device can convert the user's speech to text and send that text to a server. Virtual facilitation software for distributed teams requires real time transcription of conversations and thus would tremendously benefit from optimal balancing of client-server side processing.

Joseph is a first year undergraduate in Computer Science at Missouri S&T. Prior to his career at Missouri S&T he was a student of the Missouri Academy of Science, Mathematics, and Computing where he graduated with an Associate in Science and Mathematics. He will be interning at NISC in St. Louis this summer.

April Pummill

Joint project with Amanda Foster

Department: Biological Sciences
Major: Chemical Engineering
Research Advisor: Dr. Westenberg
Advisor's Department: Biological Sciences and Chemical Engineering

Possible Funding Sources: The International Genetically Engineered Machines Team (iGEM), American Beekeeping Federation, Missouri State Beekeepers Association, United States Department of Agriculture, Almond Board of California, National Science Foundation, Monsanto, Bayer

Saving the Honeybees: A Synthetic Biology Approach

Since 2006-2007, beekeepers in the US have seen dramatic losses in honeybees, which could potentially cost billions of dollars in agriculture. The phenomenon has been termed Colony Collapse Disorder (CCD), and is characterized by rapid losses of adult honeybees that do not return to the hive to die. Even more puzzling is that damaging levels of normal bee parasites are not present at the time of collapse. Researchers have yet to determine a specific cause of the disorder, although most agree that CCD is caused by multiple factors that either work individually or in combination. A newly suspected cause of CCD is the fungus-virus combination of *Nosema* and invertebrate iridescent virus. This research project will focus on solving this possible cause of CCD using a synthetic biology approach. The use of genetically engineered microorganisms to test the theory could be an important step in solving the mystery of CCD.

April grew up in Columbia, Missouri. She is currently a sophomore at Missouri S&T studying Chemical Engineering with a minor in Spanish. She is interested in pursuing a career performing biomedical research and engineering. April is the Public Relations officer for iGEM and a DJ in KMNR. She enjoys swimming and biking in her free time.

Logan Sauerbrei

Department: Biological Science
Major: Biology
Research Advisor: Dr. David Westenberg
Advisor's Department: Biological Science

Funding Source: N/A

Evaluation of a Biological Glucose Concentration-sengings iGEM Part

In the bodies of people with type one diabetes, the body has lost the ability *recognize* and *respond* to glucose concentration in the blood. This leads to an accumulation of glucose is the blood stream. High blood glucose concentrations damage the body in many ways. One theoretical solution to these issues would be to use microbes to replace both of these functions. The ability to recognize glucose concentration is the first part that needs to be developed. Once a part can successfully recognize different glucose concentrations, it can be used in coordination with other parts. Contained in the iGEM registry is such a glucose-concentration sensing part. However, the concentration needed for its activation is unknown. This specific concentration should be discovered, and mutants of the part that respond to different concentrations of glucose should be produced.

Logan is a junior studying biological science. He was diagnosed with type one diabetes in high school, and wants to see it cured.

Margret Steele

Department: Computer Science
Major: Computer Science
Research Advisor: Dr. Daniel Tauritz
Advisor's Department: Computer Science

Funding Source: N/A

Developing a Platform-Independent Server for the Virtual Facilitator Project

While human expert group facilitators are known to significantly improve work flow, they are scarce and prohibitively expensive. The Virtual Facilitator (VF) project mediates the communications between multiple parties instead of a human facilitator. Over time, VF has grown in size and complexity. The project has outgrown its experimental roots on a custom platform. Platform independence is desirable because it improves manageability and portability in order to adapt to fast-changing technologies. It is important to maintain a system capable of handling cutting-edge research requirements. VF must migrate to a robust server architecture, minimizing ties to any particular host architecture. This effort will ensure the continued development and longevity of the VF project.

Margret plans to graduate in 2013 with a Bachelor of Science degree in Computer Science from Missouri University of Science and Technology. She graduated in 2010 from Northwest Missouri State University with an Associates degree of Science and Mathematics. Over the next few years, she plans to pursue research in software engineering at Missouri S&T.

Michael Virag

Joint project with Michael Wisely

Department: Computer Science
Major: Computer Science
Research Advisors: Dr. Daniel Tauritz and Dr. Matthew Insall
Advisor Departments: Computer Science/Mathematics & Statistics

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Automated Partial Credit Grading Software System

Education in the 21st century is quickly moving away from the traditional classroom lecture structure. A new generation of computer savvy students is accustomed to working at their own pace and receiving continuous feedback. The current financial situation is actually reducing the number of grader hours, overwhelming instructors and leading to less feedback. Educational companies have responded by offering automated training and test tools. However, these tools are very rudimentary, providing full credit for exact matches to model answers and no credit for any other answer. There is a clear and urgent need for a far more sophisticated system which can analyze student error, assign partial credit, and provide detailed feedback to the student.

Michael moved to Missouri in 1999 and attended Blue Springs South High School in Blue Springs, Missouri. He joined Missouri S&T in 2007 pursuing a bachelor's degree in Computer Science. He is currently a senior in Computer Science with a minor in Business on track to graduate in May 2011.

Michael Wisely

Joint project with Michael Virag

Department:	Computer Science
Major:	Computer Science and Computer Engineering
Research Advisors:	Dr. Daniel Tauritz and Dr. Matthew Insall
Advisor Departments:	Computer Science/Mathematics & Statistics

Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Automated Partial Credit Grading Software System

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Michael is a native of Saint Louis, Missouri and is a junior at Missouri S&T studying computer science and computer engineering. He is actively involved in ACM SIG-Security, a computer security special interest group, and ACM SIG-Game, a software development special interest group. Michael is also a Peer Learning Assistant for Missouri S&T's Learning Enhancements Across Disciplines program.

Engineering
Poster Session

Abstracts

Rachel Bartz

Joint project with Jordan Wilson

Department: Civil, Architectural and Environmental Engineering
Major: Environmental Engineering
Research Advisor: Dr. Joel Burken
Advisor's Department: Civil, Architectural and Environmental Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
The Ministry of the Environment, Ontario, Canada

Effect of Groundwater Depth on Aerobic Biodegradation of BTEX using *In-planta* Measurements

Lab studies confirm that trees extract and translocate moderately hydrophobic contaminants and sampling trees for BTEX can help delineate plumes in field studies. However, when BTEX is detected in the groundwater, detection in nearby trees is not as reliable as for other compounds. Aerobic rhizosphere and bulk soil degradation is a potential explanation for the variability of BTEX in trees. This experiments aim was to determine the effect of groundwater level on BTEX concentration in tree tissue, hypothesizing that low water levels promote degradation of BTEX and lower concentrations in trees. Planted reactors with variable water levels and methods for measuring BTEX concentrations in trees were designed and developed. Variable water level was found to significantly affect BTEX concentrations in trees indicating that the influx of oxygen coupled with the presence of the tree facilitates aerobic biodegradation of BTEX in the vadose zone.

Rachel is a sophomore studying Environmental Engineering at Missouri University of Science and Technology. She is currently working on an undergraduate research project in the Environmental Engineering Department. The goal of the research project is to determine how the level of groundwater affects the contaminant (BTEX) concentration in the tree tissue and the efficacy of using trees as bio-indicators of pollution. Aside from working on her research project, she is also a dedicated member and Secretary of the Engineers Without Borders organization at Missouri S&T, working to develop a potable water system for the Nahualate community in Guatemala.

Luke Brekke

Joint project with Allen Ernst

Department: Mechanical and Aerospace Engineering
Major: Mechanical Engineering
Research Advisor: Dr. Robert Landers
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Development of a Flexible Fluid Modeling and Control Platform with Course Projects

The purpose of this research is to design and implement a flexible fluids control platform for use in the Mechanical Engineering curriculum. An existing course project was used as a starting point for the development of a system consisting of a pump, tubing, tanks, and various pressure and flow rate transducers. The system is instrumented and interfaces with Matlab/Simulink allowing students to model a real world system design and compare the experimental results with the calculated expectations. The discussion covers the background of the system, the selection of additional hardware, implementation of hardware, and troubleshooting. Modeling of the system and creation of two course projects is also considered.

Luke is a senior in Mechanical Engineering, and will graduate in May with an emphasis in Manufacturing Processes. Luke is active in the MST student chapter of the Society of Manufacturing Engineers.

Cailie Carlile

Department: Civil, Architectural & Environmental Engineering
Major: Environmental Engineering
Research Advisors: Dr. Joel Burken, Dr. Dave Westenberg and Dr. Snehalata Nadiger
Advisor's Departments: Civil, Architectural & Environmental Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
EPA GRO Fellowship
Fullbright-Nehru Research Fellowship (Dr. Snehalata Nadiger)

Effect of Fly Ash on Growth of Mustard and Corn

Fly ash is generated as a by-product of coal combustion and contains nutrients, such as Ca, K, Na, and Mg, as well as toxic metals such as As, B, Cr, Hg, and Pb. The goal of this research is to optimize a phytoremediation technique to stabilize the toxic metals and produce biomass which could have benefit for example as biofuel. Flyash was combined with leaf mulch, wood mulch, and soil in varying concentrations and distributed into "cone-tainers." Water holding capacity was determined, and leachates from the cone-tainers were analyzed to determine pH, EC, and TDS. Zea mays, Brassica juncea, and poplar were planted and germination times were recorded. Plants were harvested at 7 weeks for Brassica and 8 weeks for Zea mays, and biomass and height were recorded. For Brassica juncea and Zea mays, plants grew best in soil amendments. Analysis of plants for metal content using ICP-MS is planned.

Cailie is a senior in Environmental Engineering at Missouri University of Science and Technology. She is a member of Chi Epsilon, Tau Beta Pi, Kappa Mu Epsilon, and Phi Kappa Phi honor societies as well as the United States Parachute Association. Her current research in phytoremediation is being done under Dr. Joel Burken. Cailie is the recipient of an EPA GRO Fellowship and will be working with the EPA this summer.

Allen Ernst

Joint project with Luke Brekke

Department: Mechanical and Aerospace Engineering
Major: Mechanical Engineering
Research Advisor: Dr. Robert Landers
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Development of a Flexible Fluid Modeling and Control Platform with Course Projects

The purpose of this research is to design and implement a flexible fluids control platform for use in the Mechanical Engineering curriculum. An existing course project was used as a starting point for the development of a system consisting of a pump, tubing, tanks, and various pressure and flow rate transducers. The system is instrumented and interfaces with Matlab/Simulink allowing students to model a real world system design and compare the experimental results with the calculated expectations. The discussion covers the background of the system, the selection of additional hardware, implementation of hardware, and troubleshooting. Modeling of the system and creation of two course projects is also considered.

Allen is a senior in Mechanical Engineering and will graduate in May with a Bachelors of Science. In the fall he will continue his education at Missouri S&T through the pursuit of his MS in Mechanical Engineering. Allen is captain of the Missouri S&T Cross Country and Track and Field Teams and is a member of the Student Athletic Advisory Committee.

Julie Ezzell

Joint project with Tyler Thompson

Department: Mechanical Engineering
Major: Mechanical Engineering
Research Advisor: Dr. Ming Leu
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: National Science Foundation

Fab@Home

The intended goal of the Fab@Home was to offer hobbyists with a way to make custom items that would satisfy their own personal interests through three dimensional printing. The three dimensional printing the Fab@Home is outputting is called Solid freeform fabrication (SFF). The Solid Freeform Fabrication (SFF) has the capability of transforming and modernizing manufacturing, because it allows individuals to invent and customize goods in their own homes. Even though commercial fabrication systems are successful, they are very costly. Our research goal is to use the Fab@Home machine to experiment with using two different materials to fabricate parts.

Julie is a senior in Mechanical Engineering. She was working at the Missouri S&T Bookstore, but is currently working on undergraduate research and a member of the Advanced Aero Vehicle Group. Julie has accepted an internship with Alcoa for summer 2011, and will be graduating in December 2011.

Emily Kackley

Department: Electrical and Computer Engineering
Major: Electrical Engineering
Research Advisor: Dr. Randy Moss
Advisor's Department: Electrical and Computer Engineering\

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Spectral Analysis of Basal Cell Carcinoma

This project deals with analysis of the visible and infrared light spectrum measured on a lesion of basal cell carcinoma, the most common type of skin cancer. The reflectance spectrum of basal cell carcinoma lesions and that of normal skin will be measured with a spectrometer (ASD, Inc; Boulder, CO). The results from the spectrometer measurements will be used to find the difference between reflectance spectra of basal cell carcinoma and normal skin regions.

A similar project has been studied previously, comparing infrared images of malignant melanoma and benign lesion regions. Some of the results of the previous project were promising, yielding over 70% melanoma/benign discrimination. In this project we will be comparing the visual and infrared light spectrum results of basal cell carcinoma and normal skin to find the edges of the basal cell tumors.

This work will be used to design a system similar to a Mohs light to be used prior to surgery to determine lesion boundaries, intra-operatively to enable detection of any residual lesion at that point in the surgery, and after treatment to check for any residual tumor. It is hoped this system will be ready for use by clinicians within the next 18 months.

Emily is attending Missouri University of Science and Technology and is a junior majoring in Electrical Engineering. She is 20 years old and from Blue Springs Missouri outside of Kansas City. Emily participated in the Undergraduate Research day at the Capitol this spring. This is her first year participating in Undergraduate Research.

Alfred Massey Jr

Joint project with Ahmed Elshiekh

Department: Geological Sciences and Engineering
Major: Geological Engineering
Research Advisor: Dr. Mohamed Abdelsalam
Advisor's Department: Geological Sciences

Funding Source: NSF
Missouri S&T Geological Sciences and Engineering

Slope Stability as a Function of Lithology in the Gorge of the Nile, Ethiopia

The purpose of this study is to examine slope stability in relation to lithology in a segment of the Gorge of the Nile in Ethiopia. This ~1.4 km gorge exposes ~1.1 km thick Mesozoic sedimentary rocks at the base followed by ~0.3 km thick Cenozoic basaltic rocks. The base of the sedimentary section is dominated by sandstone exposures, its central part is characterized by exposures of shale and gypsum units, and its upper part is where limestone units are found. Analysis of Digital Elevation Model (DEM) extracted from the Shuttle Radar Topography Mission (SRTM) data shows that the basaltic rocks are characterized by 0 to10 degrees slope and most of the sedimentary rocks have 10-20 degrees slope with the exception of the upper and lower parts of the limestone where slopes ranging between 60 and 70 degrees are found. These steep slopes are characterized by rockslides and debris slides whereas the gentle slopes are dominated by frequent occurrence of earth flow. The nearly flat tops of the basaltic rocks are the most stable parts of the Gorge of the Nile.

Alfred is a junior majoring in Geological Engineering at Missouri University of Science and Technology. He transferred from Metropolitan Community College in Kansas City Missouri where he was born and raised with an emphasis in engineering basics and plans to become a professional geotechnical engineer.

Scott A. Melby

Department: Geological Sciences and Engineering
Major: Geology
Research Advisor: Dr. Mohamed Abdel Salam
Advisor's Department: Geological Sciences and Engineering

Funding Source: Statoil ASA, Norway

Reuniting the Red Sea Shores - Evidencing Complete Pre-rift Terrestrial Integrity Via Satellite Imagery

Landsat Thematic Mapper (TM) imaging shows clear lithological, structural and geomorphological correlation for shore-to-shore reconstruction of the Red Sea. Building upon previous regional scale studies, this work presents results of detail-scale correlation of geological features such as individual volcanic belts and geological structures across this rift system. Results of this work provide geometrical constraints on the reconstruction of the Red Sea and the geological history of its opening suggestive of lithospheric rupture without significant attenuation.

Scott is a senior majoring in geology at Missouri S&T. He has been involved with the Remote Sensing lab within the geology department for three years, participating in a number of projects centered around the East Africa region, including an NSF-funded research trip to Egypt in 2009. A father of three, Scott has included his children in many university activities, and looks forward to his son, Sawyer, following in his footsteps in just a few short years. Looking ahead, Scott plans to begin work on his Master's degree in 2012, and is considering a career in academia.

Adam Morgan

Department: Civil, Architectural and Environmental Engineering
Major: Civil and Architectural Engineering
Research Advisor: Dr. Lesley Sneed
Advisor's Department: Civil, Architectural and Environmental Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Effects of Pressure During Curing of Fiber-Reinforced Polymers On the Properties of the Resulting Cured Lamina Relating to Structural Reinforcement

This experiment is being conducted to explore the results of applied pressure, during curing, on the material properties of a fiber reinforced polymer (FRP) matrix. Specifically it will be investigating those properties that are most relevant to structural rehabilitation and strengthening through externally-bonded FRP wraps.

FRP samples were cured under various environmental conditions, including both applied pressure and vacuums. These samples were instrumented with strain gauges and tested to rupture in uniaxial tension in the direction of the strong axis of the fiber.

Adam is an undergraduate senior pursuing his degrees in Civil and Architectural Engineering, and expects to graduate in May 2011. He currently acts as the aerodynamics group leader for the Missouri S&T Formula SAE team.

Dong Pan

Department: Civil, Architectural & Environmental Engineering
Major: Environmental Engineering
Research Advisor: Dr. Glenn Morrison
Advisor's Department: Civil, Architectural & Environmental Engineering

Funding Source: National Institute for Standards and Technology

Chemical Activity of VOCs in Indoor Air Compared with Activity Polyurethane Foam Cushions

There is a need for better measurements of long-term indoor exposure to volatile organic compounds (VOCs) in indoor environments due to chronic health effects. Existing measurements capture a narrow time period and neglect concentrations that change over time. In this research, I am studying how the polyurethane foam material, found in furniture cushions, can act as a reservoir and long-term sampler for VOCs. I use solid-phase micro-extraction (SPME), which has been shown to be suitable for sampling organic compounds in indoor, to measure the chemical activity of VOCs in the foam (in my home) and the surrounding air. By analyzing the SPME using gas-chromatography mass spectrometry (GCMS) I find that the chemical activities of toluene, dichlorobenzene and limonene in foam are nearly identical to that in air. I conclude that foam, and perhaps other materials in buildings, are suitable air pollution samplers.

Dong is from Canton, China. Junior student in Environmental Engineering and doing research on indoor air pollution for Dr. Morrison since Nov.2009.

Justin Schlechte

Department: Electrical and Computer Engineering
Major: Electrical Engineering
Research Advisor: Dr. Jonathan Kimball
Advisor's Department: Electrical and Computer Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

VHF dc-dc Conversion

This poster covers a study into the possibility of a very high frequency power convertor designed to be controlled digitally by quickly switching smaller converters on and off. Attempts have made previously and as such, this research picks up where they left off while giving ample background. The topics of component selection and testing are all addressed alongside a discussion of the difficulty of populating boards with components smaller than 1 millimeter. An introduction to some issues that arose is included and possible experiments for the future are suggested.

Justin is a senior in the department of Electrical and Computer Engineering, working toward his B.S. in Electrical Engineering. He is involved on campus as an executive board member of Eta Kappa Nu (electrical engineering honor society) and with NRHH(residential hall leadership honor society)as both their Promotion Chair and Leadership Trip Chair. He enjoys playing guitar and solving logic puzzles and hopes to one day live in the mountains.

Tyler Thompson

Joint project with Julie Ezzell

Department: Mechanical Engineering
Major: Mechanical Engineering
Research Advisor: Dr. Ming Leu
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: National Science Foundation

Fab@Home

The intended goal of the Fab@Home was to offer hobbyists with a way to make custom items that would satisfy their own personal interests through three dimensional printing. The three dimensional printing the Fab@Home is outputting is called Solid freeform fabrication (SFF). The Solid Freeform Fabrication (SFF) has the capability of transforming and modernizing manufacturing, because it allows individuals to invent and customize goods in their own homes. Even though commercial fabrication systems are successful, they are very costly. Our research goal is to use the Fab@Home machine to experiment with using two different materials to fabricate parts.

Tyler is a senior in Mechanical Engineering. He was a member of the Chancellor's Leadership Academy and is currently a member of Pi Tau Sigma. Tyler was accepted on a co-op with The Boeing Company is St. Louis MO Spring Semester 2009, and has been on summer internships ever since. Tyler will be graduating next semester fall 2011.

Benjamin Weideman

Department: Geology and Geological Sciences
Major: Petroleum Engineering
Research Advisor: Dr. Runar Nygaard
Advisor's Department: Geology and Geological Sciences

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
Department of Energy

Effects of Thermal Loading on Oil Well Cement

During the process of CO_2 sequestration the wellbore undergoes under a variety of temperature changes, from the high temperatures of the subsurface to the low temperatures of supercritical CO_2. These large changes in temperature will cause a change in the mechanical properties of near wellbore materials, such as the steel casing and the oil well cement. While the properties of steel are quite well known, the properties of oil well cement are not, especially with changing temperature. To understand the effects that CO_2 sequestration has on the near wellbore environment, the properties of cement must be obtained at a variety of different temperatures. Obtaining mechanical properties, such as Poisson's Ratio, Bulk Modulus, Young's Modulus, and Shear Modulus, can be base on P and S wave velocities through the specimens. In addition when the temperature changes the cement will expand and contract causing a difference in length determined by the linear thermal expansion coefficient which could cause complications in the wellbore, this too must be obtained to completely understand the effects that CO_2 sequestration will have on the near wellbore environment.

Benjamin is a junior in petroleum engineering at Missouri University of Science and Technology. He has been studying the effects of thermal loading on cement for two years. His first year was part of an OURE and his second year was as a research assistant. He is also a member of Tau Beta Pi, Sigma Gamma Epsilon, and the Society of Petroleum Engineers

Jordan Wilson

Joint project with Rachel Bartz

Department: Civil, Architectural and Environmental Engineering
Major: Environmental Engineering
Research Advisor: Dr. Joel Burken
Advisor's Department: Civil, Architectural and Environmental Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
The Ministry of the Environment, Ontario, Canada

Effect of Groundwater Depth on Aerobic Biodegradation of BTEX using *In-planta* Measurements

Lab studies confirm that trees extract and translocate moderately hydrophobic contaminants and sampling trees for BTEX can help delineate plumes in field studies. However, when BTEX is detected in the groundwater, detection in nearby trees is not as reliable as for other compounds. Aerobic rhizosphere and bulk soil degradation is a potential explanation for the variability of BTEX in trees. This experiments aim was to determine the effect of groundwater level on BTEX concentration in tree tissue, hypothesizing that low water levels promote degradation of BTEX and lower concentrations in trees. Planted reactors with variable water levels and methods for measuring BTEX concentrations in trees were designed and developed. Variable water level was found to significantly affect BTEX concentrations in trees indicating that the influx of oxygen coupled with the presence of the tree facilitates aerobic biodegradation of BTEX in the vadose zone.

Jordan, a senior studying Environmental Engineering, studies plants as a tool to delineate contaminated plumes. His research has been mainly focused on BTEX (gasoline constituents) contamination from leaking underground storage tanks. His interests are focused in remediation, bioremediation and humanitarian work. His plans include obtaining a master's degree in Environmental Engineering and working in the remediation field.

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