Apr 10th, 2012

8th Annual Undergraduate Research Conference Abstract Book

Missouri University of Science and Technology

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8th Annual
Undergraduate Research Conference

April 10, 2012
Missouri S&T - Havener Center

CONFERENCE AGENDA

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Chancellor Cheryl B. Schrader
Vice Provost Harvest L. Collier
(St. Pat's B)</td></tr>
<tr><td rowspan="2">9:00 am – 11:45 am</td><td rowspan="10">Poster Exhibits Open</td><td colspan="3">Concurrent Oral Sessions</td></tr>
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(Carver)</td><td colspan="2">Sciences (Turner)</td></tr>
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(Upper Atrium)</td></tr>
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<tr><td>12:00 pm – 1:00 pm</td><td colspan="3">Luncheon & Keynote Address

Mr. Richard C. Smith
Manager – Research & Development, Ameren Services Company
Presents
"Energy Research of the Future"
(St. Pat's C)</td></tr>
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<tr><td>3:00 pm – 4:00 pm</td><td colspan="3">Missouri S&T Reception
(St. Pat's A & Miner Lounge)</td></tr>
<tr><td>4:00 pm – 5:00 pm</td><td colspan="3">Awards Ceremony
(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**
Timothy Collard	Mechanical & Aerospace Engineering	9:00-9:30 AM – Carver Room
Emily Kackley	Electrical & Computer Engineering	9:30-10:00 AM – Carver Room
Levi Malott	Computer Science	10:00-10:30 AM – Carver Room
Jacob Mueller	Electrical & Computer Engineering	9:30-10:00 AM – Carver Room
Samuel Pomeroy	Mechanical & Aerospace Engineering	10:30-11:00 AM – Carver Room
Abhinav Saxena	Computer Science	10:00-10:30 AM – Carver Room
Anan Takroori	Mechanical & Aerospace Engineering	11:00-11:30 AM – Carver Room

Sciences Oral Session		
Name	**Department**	**Time/Location**
Casey Burton	Chemistry	9:00-9:30 AM – Turner Room
Kristin Kelly	Biological Sciences	9:30-10:00 AM – Turner Room
Daniel Miller	Biological Sciences	10:00-10:30 AM – Turner Room
Austin Ramsey	Chemistry	10:30-11:00 AM – Turner Room
Matthew Willmering	Chemistry	11:00-11:30 AM – Turner Room

Social Sciences Oral Session		
Name	**Department**	**Time/Location**
Amanda Foster	Biological Sciences	1:00 – 1:30 PM – Carver Room
Justin Levy	English & Technical Communication	1:30 – 2:00 PM – Carver Room
Erica Shannon	Biological Sciences	1:00 – 1:30 PM – Carver Room

Arts and Humanities Oral Session		
Name	**Department**	**Time/Location**
Trista Bruning	History & Political Sciences	1:00 – 1:30 PM – Turner Room
Thomas Insall	English & Technical Communication	1:30 – 2:00 PM – Turner Room
Nathan Jarus	English & Technical Communication	2:00 – 2:30 PM – Turner Room
Kevin Kranz	English & Technical Communication	2:30 – 3:00 PM – Turner Room
Evan Menkes	English & Technical Communication	3:00 – 3:30 PM – Turner Room

Poster Presentations

Sciences Poster Session			
Poster #	**Name**	**Department**	**Time/Location**
1	**Alie Abele**	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
2	**Vincent Allen**	Electrical & Computer Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
3	**Lara Applegate**	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
4	**Kelsey Bass**	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
5	**Alex Bertels**	Computer Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
6	**Katherine Bey**	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
7	**Brandon Boies**	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
6	**Brittany Brand**	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
8	**James Bridges**	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
9	**Andrew Brown**	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
10	**Clayton Buback**	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
11	**Mydah Choudhry**	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
12	**Tiffany Edwards**	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
13	**Brittany Ford**	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
14	**Peter Haw**	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
15	**Thomas Herbst**	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
16	**Bin Hou**	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
2	**Kathryn Isbell**	Electrical & Computer Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
17	**Avery Joseph**	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
18	**Megan Koerner**	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
19	**Katie Kuehn**	Civil, Architectural & Environmental Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
20	**Joseph Kurtz**	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
21	**Alexis Martin**	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
10	**Patrick McCarver**	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
18	**Katie Payne**	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
22	**Cory Reed**	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
23	**Thomas Reese**	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
24	**Krista Rybacki**	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
25	**Chelsea Sanders**	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
26	**Megan Schuller**	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
27	**Matthew Simon**	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway

Poster Presentations (Cont.)

Sciences Poster Session			
Poster #	**Name**	**Department**	**Time/Location**
28	**Marissa Spencer**	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
29	**Margret Steele**	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
30	**Junzhe Sun**	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
25	**Kathleen Venhaus**	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
25	**Tiffany Werckmann**	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
31	**Patricia Williams**	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
32	**Alex Willis**	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
2	**Wenyu Zhou**	Electrical & Computer Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
16	**Lu Zhu**	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway

Research Proposal Poster Session			
Poster #	**Name**	**Department**	**Time/Location**
33	**Heather Branstetter**	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
34	**Melissa Buechlein**	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
35	**Jacob Gardner**	Computer Science	1:00 - 3:00 PM – Upper Atrium/Hallway
36	**Chester Gregg**	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
37	**Tavia Hall**	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
38	**Amber Kreps**	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
39	**David Pohlman**	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
40	**Logan Sauerbrei**	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
41	**Zackary Stone**	Mining & Nuclear Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
42	**Larry Tolliver**	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway

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Engineering Poster Session			
Poster #	**Name**	**Department**	**Time/Location**
43	**Sarah Bey**	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
44	**Andrea Els**	Materials Science & Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
45	**Tommy Goodwin**	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
46	**Nevan Himmelberg**	Geological Sciences & Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
47	**Amanda Holmes**	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
51	**Gerald Holt**	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
51	**Sean Klover**	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
48	**Alexander Korff**	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
51	**Lucas Laughery**	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
54	**Samuel Murphy**	Mining & Nuclear Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
49	**Charlene Ruwwe**	Chemical & Biological Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
50	**Husain Shekhani**	Mechanical & Aerospace Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
51	**Annelise Smith**	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
52	**Jason Stumfoll**	Mechanical & Aerospace Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
53	**Albrion Symonette**	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
54	**James Weeks**	Mining & Nuclear Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
54	**Robert Zedric**	Mining & Nuclear Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway

Poster Presentations (Cont.)

Social Sciences Poster Session			
Poster #	**Name**	**Department**	**Time/Location**
55	**Amber Julien**	Psychology	1:00 - 3:00 PM – Upper Atrium/Hallway
56	**Montana Puckett**	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
56	**Lee Voth-Gaeddert**	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway

Keynote Speaker

Richard C. Smith

Manager – Research & Development
Ameren Services Company, St. Louis, MO

Presents

"Energy Research of the Future"

Mr. Smith currently manages Ameren's corporate Research & Development program. He has over thirty years of experience in engineering and construction projects supporting coal-fueled and natural gas-fueled power plants and combustion turbines, and he has been involved in development and demonstration of new technologies for power generation for over twenty years. Early in his career he gained manufacturing experience with military products at Texas Instruments, in Dallas, Texas. At Ameren companies, Mr. Smith was responsible for project management and engineering related to coal, hydro, and combustion turbine capital and maintenance projects, including development and implementation of a variety of environmental control systems for particulates, combustion modifications, and flue gas desulfurization projects. Mr. Smith is currently responsible for R&D and advanced technology management related to electricity generation, energy delivery, and customer systems. Mr. Smith has served on a variety of U.S. utility industry committees including the Research Advisory Committee, Generation Council and environmental control committees of the Electric Power Research Institute, and the Research Management Committee of the Edison Electric Institute as well as advisory roles with the University of Missouri campuses and Washington University in St. Louis. Mr. Smith is a Fellow of the American Society of Mechanical Engineers and is a registered Project Management Professional. Mr. Smith is licensed as a Professional Engineer in the States of Missouri and Illinois. He earned Bachelor and Master of Science degrees in mechanical engineering from the University of Missouri – Rolla.

Conference Judges

The Office of Undergraduate Studies wishes to thank the following faculty & staff for their valuable contributions to the 8th Annual Missouri S&T Undergraduate Research Conference.

Akim Adekpedjou
Ayodeji Alajo
Bonnie Bachman
Stuart Baur
Sriram Chellappan
David Enke
Larry Gragg
Xiaoming He
Wayne Huebner
Irina Ivliyeva
Jonathan Kimball
K. Krishnamurthy
Merilee Krueger
F. Scott Miller
Melanie Mormile
Daniel Oerther
Jana Neiss
Daniel Reardon
Joshua Rovey
Bijaya Shrestha
Nancy Stone
David Westenberg
Phillip Whitefield
Henry Wiebe
David Wright
Donald Wunsch
Zhaozheng Yin

Thank You!

Engineering
Oral Session

Abstracts

Timothy A. Collard

Department: Mechanical and Aerospace Engineering
Major: Aerospace/Mechanical Engineering
Research Advisor: Dr. Joshua L. Rovey
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
NASA-Missouri Space Grant Consortium

A Novel Enzymatic Technique for Determination of Sarcosine in Urine Samples

The theoretical chemical and electrospray performance of [Bmim][dca], [Bmim][NO_3], or [Emim][$EtSO_4$] mixed with HAN in aqueous solution for dual mode chemical monopropellant/bipropellant and electrical electrospray rocket propulsion have been investigated. A ternary mixture comprised of 80 percent HAN, 20 percent of each ionic liquid fuel, and no water yielded the maximum specific impulse and chamber temperature: 290 seconds and 2700 Kelvin, respectively. The specific impulse was computed for a 1000 V accelerating voltage. For a binary mixture of [Bmim][dca] and HAN the upper limit on the specific impulse performance was 4655 to 6683 seconds and the lower bound was 2567 to 3745 seconds. For [Bmim][NO_3] and Han the limits were 4743 to 6683 seconds and 2595 to 3745 seconds, respectively. For [Emim][$EtSO_4$] and HAN the bounds were 4128 to 6683 seconds and 2380 to 3745 seconds, respectively.

Timothy is currently pursuing a Bachelor's of Science at Missouri S&T in both Aerospace Engineering and Mechanical Engineering. Originally from Olathe, KS, he expects to graduate in December 2013.

Emily Kackley

Joint project with Jacob Mueller

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) Fellows Program

Spectral Analysis of Basal and Squamous Cell Carcinoma

The primary objectives of this project were to gain an understanding of the spectral properties of basal cell and squamous cell carcinomas and develop a method or technique based on those properties to aid in the cancer diagnosis and removal processes. To aid the diagnostic process, the spectra of malignant lesions were compared to the spectra of normal skin. To aid in assessment of the completeness of removal, the spectra of partially removed lesions were compared to the spectra of tumor-free bloody fields. Three comparison methods were used for both the pre-surgical vs. normal and mid-surgical vs. bloody field sets. It was found that at the wavelengths 483 nm, 546 nm, and 593 nm tumorous material has the highest relative reflectance.

Emily is a senior in Electrical Engineering at Missouri University of Science and Technology. This is her second year working on this project in this research group, as well as her second year in OURE.

Levi Malott

Joint project with Abhinav Saxena

Department:	Computer Science
Major:	Computer Science
Research Advisors:	Dr. Akim Adekpedjou, Dr. Sriram Chellappan and Dr. Maclej Jan Zawodniok
Advisor's Department:	Math and Statistics, Computer Science, and Electrical and Computer Engineering

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

Mobile Camera Sensor Networks for Structural Health Monitoring

Structural health monitoring is a very actively researched field for structural engineers. Structural health monitoring (SHM) is performed by constantly monitoring structure related parameters. The constantly monitored data can be analyzed statistically to build models which would be used to predict structural failures. The aim of this research is to make similar predictions on structural health using a mobile agent with a variety of sensors mounted. The core idea is to reduce the number of sensors by using mobility. Two prototypes have been design and tested using LabRats, Gumstix, Logitech video cameras and Xbee radio modules. Future work includes optimizing routing protocols for multi-hop video transmission and adding more autonomy.

Levi graduated from Pilot Grove High School and is now attending Missouri University of Science and Technology. He is majoring in Computer Science and wants to work in Computer Security.

Jacob Mueller

Joint project with Emily Kackley

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

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

Spectral Analysis of Basal and Squamous Cell Carcinoma

The primary objectives of this project were to gain an understanding of the spectral properties of basal cell and squamous cell carcinomas and develop a method or technique based on those properties to aid in the cancer diagnosis and removal processes. To aid the diagnostic process, the spectra of malignant lesions were compared to the spectra of normal skin. To aid in assessment of the completeness of removal, the spectra of partially removed lesions were compared to the spectra of tumor-free bloody fields. Three comparison methods were used for both the pre-surgical vs. normal and mid-surgical vs. bloody field sets. It was found that at the wavelengths 483 nm, 546 nm, and 593 nm tumorous material has the highest relative reflectance.

Jacob is a senior Electrical and Computer Engineering major at Missouri University of Science and Technology. This is his first year with OURE. Before coming to Missouri S&T, he attended St. Louis University High School and studied Music Production at Loyola University New Orleans.

Samuel Pomeroy

Department: Mechanical & Aerospace Engineering
Major: Aerospace Engineering
Research Advisor: Dr. Joshua Rovey
Advisor's Department: Mechanical & Aerospace Engineering

Funding Source: Missouri Space Grant

Electromagnetism surrounding Plasmoid Formation in an FRC Test Article

Modern spaceflight technology is inhibited by current propulsion limitations, specifically low impulse, low exit velocity propulsion systems. Field reversed configuration plasmoid formation devices offer a high impulse, high exit velocity electric propulsion solution to future spaceflight requirements. The purpose of this study is to investigate plasmoid formation within a test article of such configuration, determine plasma characteristics via the quantification of magnetic flux vs time within the test article, and nullify electromagnetic pulse issues associated with the discharge of the test article.

Samuel is majoring in Aerospace Engineering with a M.N. in Mathematics, He is currently conducting undergraduate research at the Missouri S&T Aerospace Plasma Laboratory. He is a member of Sigma Gamma Tau and Tau Beta Pi and is the President of the Missouri S&T Mathematical Association.

Abhinav Saxena

Joint project with Levi Malott

Department:	Computer Science
Major:	Computer Science
Research Advisors:	Dr. Akim Adekpedjou, Dr. Sriram Chellappan and Dr. Maclej Jan Zawodniok
Advisor's Department:	Math and Statistics, Computer Science, and Electrical and Computer Engineering

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

Mobile Camera Sensor Networks for Structural Health Monitoring

Structural Health Monitoring is an actively researched field. It is closely related to structural and civil engineering and usually is treated as a core discipline. The health monitoring involves deploying a certain fixed position strategically placed relevant data collecting sensors. These sensors then transmit the data back to a base station which either then transmits it or stores it as per requirements. This data is used to build statistical models which are in turn used to assess structural health. This research involves computer science and civil engineering. The aim of his research is to reduce the number of sensors used by actively using sensors mounted on a mobile platform. The mobile platforms are then moved strategically to collect appropriate data and predict structural health. The incoming data is at a very low resolution and hence requires reassessing already collected data to build low resolution models.

Abhinav graduated from Sunflag High School India in 2008 and started college at Missouri University of Science and Technology in 2009. His intended majors are Computer Science, Computer Engineering, Electrical Engineering and Applied Mathematics.

Anan Takroori

Department: Mechanical & Aerospace Engineering
Major: Aerospace Engineering
Research Advisor: Dr. Fathi Finaish
Advisor's Department: Mechanical & 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 40°F has been investigated. A baffle with different shapes, angles and sizes is installed for each test. An array of thermocouples is employed and connected to data acquisition system to collect the flow temperature distribution at six 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 with holes is installed at 20°. As expected, the results also show that the mixing effectiveness of the two flow streams is increased as the downstream distance increased.

Anan is a graduating senior in the Department of Mechanical & Aerospace Engineering at Missouri S&T. He Graduated from St. Louis Community College and transferred to MS&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 Orbital Decay, Mathematics, Aerodynamics 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 multiple community service projects including 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. Anan received multiple awards during his years at Missouri S&T including the first place for the engineering category during the 7th Annual Undergraduate Research Conference at Missouri S&T.

Sciences
Oral 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
Environmental Research Center
Chemistry Department

A Novel Enzymatic Technique for Determination of Sarcosine in Urine Samples

There has been recent interest in metabolite concentrations present in urine for noninvasive disease diagnosis. The detection of specific metabolites, however, presents certain analytical difficulties such as low or ambiguous specificity. This study developed a new technique, utilizing oxidative, enzymatic production of formaldehyde from the metabolite to produce a pH-induced change observed by fluorescein in acetone. This probe displays high sensitivity towards pH imbalances, and coupled with high enzymatic specificity, forms an accurate method to measure metabolite concentrations. Sarcosine was used as a model analyte in this study due to its potential for serving as a prostate cancer biomarker. A good linearity was revealed with a correlation coefficient of 0.9961 and a detection limit of 20 $nmol \cdot L^{-1}$. This method was applied to sarcosine analysis in nine urine samples. The results suggest that this is a viable, cost-effective technique for determination of sarcosine in urine samples without interferences such as alanine.

Casey graduated from School of the Osage High School in Kaiser, MO. In high school, he was engaged with scientific research attending numerous symposia and authoring three papers involving the modeling of absolute pitch using a software paradigm. While attending Missouri University of Science and Technology, Casey has been working with Dr. Ma of the Department of Chemistry to develop analytical techniques for potential urinary biomarkers for prostate cancer as well as other environmental analytical applications including kinetics of oxidation of nitrosamine precursors. His university work has garnered the attention of various agencies and has culminated in a high-impact publication as well as attendance at various conferences. Casey plans to continue his studies by obtaining a Ph.D. in Bioanalytical Chemistry from Missouri University of Science and Technology.

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

Computational identification and analysis of the PLA_2 gene family in *Glycine max*

Six similar 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. These genes have also been shown to be expressed more in both roots and embryos. The gene models are now thought to have gone through a gene duplication on chromosome one and then a whole 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 junior in Biological Sciences. She is the President for Scrubs, Pre-Health Society, Vice President for Helix, Life Sciences Club, and Secretary for Phi Sigma, Biological Honors Society. She is also a member of Phi Kappa Phi. After graduation, Kristin plans on attending a combined medical and graduate school to complete a MD/PhD program. Eventually, Kristin plans on working as a Forensic Pathologist.

Daniel Miller

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

Funding Source: N/A

Phosphorylation of Iqg1 by Cyclin Dependent Kinase (Cdc28) Temporally Regulates Actin Ring Formation

Cytokinesis is the final step in mitosis when the cell separates the cytoplasm by contracting a ring composed of filamentous actin (F-actin) and type II myosin. Iqg1, an IQGAP1 homolog, is an essential scaffolding protein in budding yeast (S. cerevisiae) required for actin recruitment, and contraction of the actomyosin ring. Actin is recruited by the calponin homology domain (CHD) late in anaphase after Iqg1 is localized to the bud neck. Four perfect consensus sites for the cyclin-dependent kinase Cdc28 were identified flanking the CHD, which lead to the model that Cdc28 phosphorylation of Iqg1 negatively regulates F-actin binding until it is further modified during late anaphase. To test this model the four consensus sites were mutated into a non-phosphorylatable form (A4) and a phosphomimetic form (E4). Our hypothesis is that mutants that cannot be phosphorylated will form actin rings early and disassemble them late, while the phosphomimetic mutant will form actin rings late or not at all. The A4 mutant shows a significant cytokinesis defect, and preliminary immunofluorescences data indicates actin ring formation occurs 20 minutes early, in cells that have not yet completed mitosis.

Daniel is a graduating senior in the Biological Sciences department. He has been a member of Phi Sigma for two years and a member of Sigma Pi for four years. He was a member of IGEM for a year and left to research in Dr. Katie Shannon's lab. He has researched in her lab for a year and plans on staying at Missouri S&T for graduate studies.

Austin Ramsey

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

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

Ionic Liquids as the Working Fluid in a Cooling System

This project is a continuation of the project conducted by Austin Ramsey under the supervision of Dr. Klaus Woelk (Advisor) and Dr. Rex Gerald during the 2010-2011 academic year. This project was conducted by the aforementioned persons in order to test the possibility of using ionic liquids as the working fluid in a cooling system. The experiments conducted were designed to test ionic liquids in an absorption desorption cycle. The ionic liquid once again chosen was 1-ethyl-3-methylimidazolium ethyl sulfate.

Austin is a junior majoring in Architectural Engineering. He has been a member of the Missouri S&T Solar House Team for three years and is in charge of the lighting design for the upcoming 2013 solar house. His interests include green building technology and embedded electronics.

Matthew M. Willmering

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Jay A. Switzer
Advisor's Department: Chemistry; Materials Science & Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
Department of Energy - Grant No. DE-FG02-08ER46518

Template-Free Electrodeposition of Freestanding MnO_2 Nanowires and Their Pseudo-Capacitive Properties

Freestanding MnO_2 nanowires were synthesized via a novel, template-free galvanostatic deposition from an aqueous Mn(II)(acetate) electrolyte at elevated temperatures. The influence of the deposition parameters on the morphology, crystal structure and specific capacity was investigated. The crystal structure was unaffected by the deposition parameters. The wire size and morphology strongly depend on the deposition parameters. The substrate significantly affects the nanowire size. The current density has a predominant influence on the morphology and porosity. The electrolyte temperature has a profound influence on the nucleation and early stages of growth phenomena. The specific capacity of the nanowires was investigated in 1 M Na_2SO_4 solution and the specific capacity of 309 F g^{-1} was reached. Although, this method requires further optimization of synthesis parameters, it shows a great potential of manufacturing large scale MnO_2 based positive electrodes for super-capacitors.

Matthew graduated as Valedictorian from Mehlville High School in St. Louis in May 2008. He continued his education at Missouri University of Science and Technology in order to obtain a B.S. in Chemistry. He will be graduating in May 2012 from Missouri S&T and will be attending graduate school in order to obtain a Ph.D.

Social Sciences
Oral Session

Abstracts

Amanda Foster

Joint project with Erica Shannon

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

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

The Effect of Education on the Public Opinion of Synthetic Biology

The field of synthetic biology is rapidly growing. The applications have great potential, but they also present new risks and dangers. Future progress in this field substantially depends on public support; therefore, it is important to have quantitative measures of the public opinion of synthetic biology. Using statistical sampling in the form of surveys, we have collected data from an unprecedented religious standpoint. Qualitative data collected from group discussions was used to design the surveys. Findings show that subjects with a religious affiliation were more likely to disapprove of synthetic biology. Findings also reveal a significant difference between educational treatments. A "hands on" approach designed to simultaneously entertain and educate subjects was more effective at increasing positive perceptions of synthetic biology than a formal presentation. The data collected from this research provides significant insights into public opinion and the design of educational tools.

Amanda is a third-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 president of iGEM. Amanda enjoys reading, playing ultimate frisbee, playing disc golf, skiing, and scuba diving.

Justin Levy

Department: English & Technical Communication
Major: Geology & Geophysics
Research Advisor: Dr. Lindgren Johnson
Advisor's Department: English & Technical Communication

Funding Source: N/A

The Color Blind Leading the Blind: The Ascension to Self-Actualization through a Furry Guide

In 1943, Abraham Maslow released his hierarchy of needs, and ever since people have been judged as to whether they are "self-actualized" or not. This method, though, has long left out the non fully functioning humans, such as those suffering from blindness. People afflicted with blindness though can now ascend through the hierarchy all the way to the peak at self-actualization, with the help of a guide dog, more commonly referred to as a seeing-eye dog. The guide dog allows the blind to pass the level of the hierarchy they used to be stuck on and leads them to the next all the way to the fifth and final stage of self-actualization.

Justin is a sophomore in Geology & Geophysics at Missouri University of Science and Technology. Justin is active in many endeavors across campus. He works in Student Assistance Services for the Department of Residential Life. Justin is a member of Engineers Without Borders, as a member of the Tacachia, Bolivia Team. In fact, Justin is in charge of the Distribution and Settling Tank Project in Tacachia, Bolivia, and is also on the executive board of Engineers Without Borders as the Fundraising Chair for the entire chapter. He is also a member of the C.L. Dake Geological Society, the American Association of Petroleum Geologists, and the Missouri S&T Lacrosse Club.

Erica Shannon

Joint project with Amanda Foster

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) Fellows Program

The Effect of Education on the Public Opinion of Synthetic Biology

The field of synthetic biology is rapidly growing. The applications have great potential, but they also present new risks and dangers. Future progress in this field substantially depends on public support; therefore, it is important to have quantitative measures of the public opinion of synthetic biology. Using statistical sampling in the form of surveys, we have collected data from an unprecedented religious standpoint. Qualitative data collected from group discussions was used to design the surveys. Findings show that subjects with a religious affiliation were more likely to disapprove of synthetic biology. Findings also reveal a significant difference between educational treatments. A "hands on" approach designed to simultaneously entertain and educate subjects was more effective at increasing positive perceptions of synthetic biology than a formal presentation. The data collected from this research provides significant insights into public opinion and the design of educational tools.

Erica is a senior at Missouri University of Science and Technology. She majors in Biological Sciences and is pursuing minors in Chemistry and the Psychology of Leadership. Erica is the former President of iGEM, S&T's new Synthetic Biology Design team. She has been involved with the organization since she was a freshman. Currently, Erica is the Vice President of Phi Sigma, the biological honors society. She is also active in the Residential Life department as a member of the National Residence Hall Honorary. As well as her work through the OURE Fellows program, Erica is a group leader in the S&T Neurobiology Lab and cDNA Resource Center. Next year Erica will attend medical school at Vanderbilt University to pursue a PhD in Biomedical Sciences.

Arts and Humanities
Oral Session

Abstracts

Trista Bruning

Department: History
Major: English
Research Advisor: Ms Jeanine Bruening
Advisor's Department: History

Funding Source: N/A

The Need for Uniformity in St. Benedict's Rule for Monasteries

The essay is a literary analysis of the fifth century text *Rule for the Monasteries* by St. Benedict. This analysis explores the attitudes of the western European church regarding monks and abbots during a critical time in Christendom. Using support from a leading source in historiography, Peter Brown, the analysis concludes that St. Benedict himself was prodded by a need which was shared by the western European church: to protect the church by eliminated the individual and creating a protective uniformity.

Trista is an English major in her senior year at Missouri S&T. She is from Leasburg, Missouri. Trista has published in Missouri S&T's literary magazine, Southwinds, and will be moving to Los Angeles, California to pursue a career in creative writing.

Thomas Insall

Department: Communication Arts / English
Major: English & Secondary Education
Research Advisor: Dr. Eric Bryan
Advisor's Department: Communication Arts / English

Funding Source: N/A

Misfires: A Look at SMS Conversations and Clarity

This paper hopes to make an argument for the introduction of the term misfire to denote moments in SMS conversations where a recipient is unsure of the implicature of the message received. By taking a closer look at how and why misfires occur, it may be possible to predict responses to them. Defining a set method to determine the correct implicature of a misfire could pave the way for designing more efficient methods to determine the implicature of other forms of communication where meaning is unclear.

Thomas is an English and Secondary Education student at Missouri S&T. He plans to graduate in the fall of 2013.

Nathan Jarus

Department: English
Major: Computer Science
Research Advisor: Dr. Lindgren Johnson
Advisor's Department: English

Funding Source: N/A

Old Ideas in a New Age: Descartes' Influence on Modern Animal Farming

Descartes' philosophy has had a profound influence on modern science and technology. This paper explores his ideas about animals and their influence on modern farming. It then discusses modern scientific advances, particularly those of Temple Grandin, and how they have cast a shadow of doubt on Descartes' approach to the animal. In light of these errors in Descartes' views, modern farming methods must be re-evaluated.

Nathan is a junior in Computer Science here at Missouri S&T. He has been a LEAD Peer Learning Assistant, and is involved in the local ACM chapter. Along with Computer Science, Nathan has an intense interest in philosophy: ideas about ideas. He plans to continue into graduate school after completing his Bachelors' degree.

Kevin Kranz

Department: Computer Science
Major: Computer Science
Research Advisor: Dr. Lindgren Johnson
Advisor's Department: English

Funding Source: N/A

Humans: The Animal Lost in Words

Humans rely heavily on language as a means of explaining and understanding the world around them as well as a means of conveying ideas. In trying to convey an idea, a problem arises when humans focus so much on finding the right words to accurately convey their thoughts that they distort the original idea itself. Another problem arises when humans, in the attempt to interpret an idea, focus too much on the specific words used, as they lose sight of the meaning behind them. These problems and their consequences can be seen in the words that humans use when talking about living creatures (including themselves) – and more specifically in the words that humans use to categorize these creatures. Some humans use words to try to hide from the fact that they are also animals, and some humans use words to desensitize or justify their treatment of other creatures.

Kevin is a junior studying Computer Science as well as pursuing a minor in Psychology. He plans to go into the field of Artificial Intelligence. He is the Pledge Educator for Delta Lambda Phi and is also a member of the DaVinci Society. He is the son of Sharon and George Kranz and is from Saint Louis, Missouri.

Evan Menkes

Department: Humanities
Major: Geological Engineering & Mining Engineering
Research Advisor: Dr. Lindgren Johnson
Advisor's Department: English

Funding Source: N/A

Savages and Pig-men: the Role of Dehumanization in Torture

At the dawn of humanity, there was torture. While public opinion of torture has changed quite drastically since humanities humble beginnings, it still is a common practice. The fact that this abhorrent action continues to flourish in modern society, hints at some underlying connection between the idea of humanity, and the practice of torture. This paper examines that connection and how it has changed as humanity has evolved, and along the way explores the effects of torture on the victim, torturer, and society at large.

Evan is a sophomore in Geological Engineering and Mining Engineering. When he is not working in the lab our out in the field he enjoys spelunking, mountain biking, running, pruning shrubberies, interpretive dance, and hiking.

Sciences
Poster Session

Abstracts

Alie Abele

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

Funding Source: N/A

The Optimization of Anabaena Variabilis for the Removal of Nitrogen Oxide Gases from Coal Plant Emissions

Nitrogen oxides (NO and NO2) emitted by industrial coal plants are among the most important environmental pollutants. They directly contribute to acid rain, which causes damage to terrestrial as well as marine environments, and the formation of photochemical smog and ozone. Furthermore, CO2, another bi-product of burning coal, is a major contributor to global warming. CO2 is naturally fixed by photosynthetic organisms and N2 can be fixed by nitrogen fixing bacteria. The cyanobacteria species *Anabaena variabilis* can fix both CO2 and N2. It may be possible to use *Anabaena* to filter CO2 and NOx from coal plant emissions. To do this, I plan to identify and isolate the pathways responsible for nitrate reduction from a species of denitrifying bacteria and integrate the genetic pathway into the *Anabaena* sp. This should allow *Anabaena* to fix nitrogen from both NOx sources and N2.

Alie is a sophomore in Missouri S&T's Biology department, and the lab manager of the International Genetically Engineered Machines (iGEM) design team. Her academic interests include forensics, synthetic biology and bioinformatics.

Vincent Allen

Joint project with Kathryn Isbell and Wenyu Zhou

Department: Electrical and Computer Engineering
Major: Electrical Engineering
Research Advisors: Dr. Bijaya Shrestha, Dr. Randy Moss and Dr. Joe Stanley
Advisor's Department: Electrical and Computer Engineering

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

Inference Engine for Skin Cancer Diagnosis

The first task our group completed was designing a search engine. We queried a database of patient data using SQLite and created a graphical user interface using open-source code, wxWidgets. My personal portion of the search engine was to query the database, and I also contributed to the graphical user interface coding. Everything was coded in C++, and this portion of the project was designed to be used as the foundation for the Inference Engine.

The group's current method for skin cancer diagnosis is to look at all the features an image has and evaluate them simultaneously to reach a diagnosis. However, finding and measuring each feature is very time consuming. The purpose of the inference Engine is to make this process more efficient by finding which features are necessary or useful and which ones are not.

Vincent is pursuing a degree in Electrical Engineering. He is a member of Tau Beta Pi, Kappa Mu Epsilon, and is currently the president of the Gamma Theta chapter of Eta Kappa Nu. All three organizations are Greek honors societies. Of course, he is also a member of the Dermatology Vision research group. Through one programming class and his experiences in this research group he has learned to program in C++, also using wxWidgets for designing a graphical user interface and SQLite for Database Querying. He has several hobbies, including playing pool, Texas Hold 'Em poker, running, bike riding, drawing (and any other art), designing things and playing Minecraft.

Lara Applegate

Department: Biology
Major: Biology
Research Advisor: Dr. Dev Niyogi
Advisor's Department: Biology

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

Comparing the Diversity of Fungi on Leaves Submerged in Different Amounts of Stream Water

In this research project I looked at the different types of fungi that inhabit leaves placed in different parts of a stream. Four sites were compared along the same stream, one being completely submerged in the stream, one on the bank, and two further from the stream. The site chosen was the Audubon stream located on the north side of Rolla, Missouri. This site is considerably secluded and surrounded by native Missouri flora. Maple leaf cores were used in mesh leaf litterbags because maple trees are very common in the Midwest. The methods used in this study included dissolved oxygen measurements, conidia slides, PCR gels and most importantly DGGE gels. Although the results were slightly variable, I found that the leaves more submerged in water had a fungal community that was both more active and more diverse.

Lara is an undergraduate student majoring in biology. She is interested in the field of ecology and hopes to one day obtain a graduate degree in conservation biology.

Kelsey Bass

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Jeffrey Winiarz
Advisor's Department: Chemistry

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

Functional Image Restoration Using a Photorefractive Polymeric Composite

For applications involving the transmission of optical data through media such as air or water, a dynamic correction scheme must be employed. Many image restoration experiments using photorefractive polymeric composites have been described in literature, although the previously available materials resulted in the use of impractical experimental geometries. We have focused our attention on the formulation and characterization of high-performance photorefractive composites based on N,N'-Bis(3-methylphenyl)-N,N'-bis(phenyl)benzidine. The experiment has been modified to distinguish between sender and receiver locations, so a clean reference beam is required at the receiver. We demonstrate the ability of our group's composite to function in the practical geometry. The proposed geometry is a combination of two-beam-coupling and four-wave-mixing layouts, and the data indicating the efficiency of the composite in the geometry without scattering of optical radiation is presented. The effect of rotating the polarization of the object beam relative to *p*-polarization has also been quantified.

Kelsey is a junior majoring in Chemistry. She has participated in undergraduate research since her freshman year. Kelsey is active in Alpha Chi Sigma and the W. T. Schrenk Society. She plans to attend graduate school after receiving her B. S. in Chemistry.

Alex Bertels

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

Automated Fitness Guided Fault Localization

For a given computer program, logical flaws produce invalid results which can be difficult, and thus costly, to correct. Finding software errors is a significant step towards fixing them. Given this, having a tool to automatically identify the most likely parts of the program containing these faults would be a huge advantage. Classical fault localization tools require an "oracle," typically a human expert, to determine if the program is working as intended. The research presented here novelly employs a fitness function which automates the process by computationally enforcing the program specifications. The current Fitness Guided Fault Localization (FGFL) system combines two techniques: (1) trace comparison, and (2) trend-based line suspicion. Two additional techniques are under investigation, but require additional research to overcome their limitations, called: (1) run-time fitness monitor, and (2) critical slicing. Empirical comparisons are statistically analyzed for significance.

Alex is from Dorsey, Illinois. He is currently a sophomore in Computer Science, an Undergraduate Research Assistant in the Natural Computation Laboratory, a tutor for theIntroduction to C++ labs (CS54), the Secretary for the Missouri S&T Association for ComputingMachinery (ACM) Student Chapter, and will be interning this summer in the Center for Cyber Defenders at Sandia National Laboratories.

Katie Bey

Joint project with Brittany Brand

Department: Biological Sciences
Major: Biology
Research Advisor: Robert Aronstam
Advisor's Department: Biological Sciences

Funding Source: cDNA resource lab

Effects of Chlorothiazide on Muscarinic Receptors

Chlorothiazide (6-chloro-2H-1,2,4-benzothiadiazine-7-sulfonamide 1,1-dioxide) is diuretic drug normally used within a hospital setting to manage excess fluid associated with congestive heart failure and as an antihypertensive drug. The goal of this experiment was to define the effects of Chlorothiazide on muscarinic receptors. We determined the effects of Chlorothiazide on calcium signaling by using ratiometric fluorescent dye on Chinese hamster ovary (CHO) cells, which have the human M3 muscarinic receptors, and imaging the amounts of intracellular calcium concentrations released. Based on the results of the experiment conducted, Chlorothiazide has no legitimate inhibitory effect on store operated calcium entry (SOCE) that was induced by activation of the M3 receptors. Chlorothiazide most likely acts as a stimulant to the uptake of calcium.

Katie is a sophomore biological sciences student at Missouri University of Science and Technology. Katie has volunteered as a student researcher for eleven months in the cDNA research center and greatly enjoyed the research opportunities introduced to her by volunteering in the lab.

Brandon Boies

Department: Biological Sciences
Major: Biological Science
Research Advisors: Dr. David Westenberg and Dr. Melanie Mormile
Advisor's Department: Biological Sciences

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

Biotechnological Use of Bacteriorhodopsin as Memory Storage

Rhodopsins are pigment proteins in retinal tissues that make up photoreceptive cells. Various forms of rhodopsins, such as bacteriorhodopsin, which acts as a proton pump in many halophilic Archaea, channel-rhodopsin, and halorhodopsin can be used to create a binary system capable of storing data as temporary and longterm memory. When illuminated with various wavelengths of light, bacteriorhodopsin undergoes a conformational change from ground state to excited state.

Bacteriorhodopsin can be cultivated industrially from Archaea such as *Halobacterium salinarum* and bacteria such as *Escherichia coli*. It can effectively be extracted via dialysis and centrifugation. Alternating wavelengths of light can be used to induce an excited state (M state, 460nm) from its ground state (B state, 500-650nm), establishing a functional binary system.

The exploration of a biological memory system would ease the global dependence on silicon based memory systems and devices.

Brandon is a graduating senior at the Missouri University of Science and Technology. He joined the Biological Sciences department as a freshman in August 2008. Brandon has been involved in several research projects, including analyzing gene families of Glycine max and characterizing the halophile, Halorubrum salsolis.

Brittany Brand

Joint project with Katherine Bey

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

Funding Source: cDNA resource lab

Effects of Chlorothiazide on Muscarinic Receptors

Chlorothiazide (6-chloro-2H-1,2,4-benzothiadiazine-7-sulfonamide 1,1-dioxide) is diuretic drug normally used within a hospital setting to manage excess fluid associated with congestive heart failure and as an antihypertensive drug. The goal of this experiment was to define the effects of Chlorothiazide on muscarinic receptors. We determined the effects of Chlorothiazide on calcium signaling by using ratiometric fluorescent dye on Chinese hamster ovary (CHO) cells, which have the human M3 muscarinic receptors, and imaging the amounts of intracellular calcium concentrations released. Based on the results of the experiment conducted, Chlorothiazide has no legitimate inhibitory effect on store operated calcium entry (SOCE) that was induced by activation of the M3 receptors. Chlorothiazide most likely acts as a stimulant to the uptake of calcium.

Brittany is a senior biological sciences student at Missouri University of Science and Technology. Brittany has volunteered as a student researcher for eleven months in the cDNA research center and greatly enjoys the research opportunities introduced to her by volunteering in the lab.

James Bridges

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

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

Multi-Objective Coevolutionary Automated Software Correction

For a given program, testing, locating the errors identified, and correcting those errors is a critical, yet expensive process. The field of Search Based Software Engineering (SBSE) addresses these phases by formulating them as search problems. The Coevolutionary Automated Software Correction (CASC) system targets the correction and testing phases by coevolving test cases and programs at the source code level. Programs and tests are evaluated by objectives defined by the user, and each population is optimized for these objectives. Results presented demonstrate CASC's ability to successfully correct five seeded bugs in two non-trivial programs from the Siemens test suite. Additionally, empirical evidence is provided substantiating the hypothesis that multi-objective optimization is beneficial to SBSE as compared to traditional single-objective approaches.

James is a Senior at Missouri University of Science and Technology majoring in both Computer Science and Applied Mathematics with an emphasis in Computational Mathematics; graduating in the spring of 2012. His research interests include evolutionary algorithms, multi-objective optimization, artificial intelligence, and search based software engineering.

Andrew Brown

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

Funding Source: N/A

Intuitive Graphical User Interfaces for Virtual Facilitation

The Virtual Facilitator project is aimed at mediating human conflict and facilitating human interaction 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 did not only improve the work flow of those in charge of creating and managing sets of facilitative guidelines, but also implicitly benefited the experience of the end user by creating more intuitive conversation interventions in a more intuitive environment. Additionally, many more modifications were needed in order to maintain the project, such as providing a system of grouping users and assigning permissions, creating administrative editors, and designing an interface 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 2014. Last summer he was an intern at Rapportive in San Francisco during the summer of 2011, and returned for the 2011 school year to work on the Virtual Facilitator through undergraduate research.

Clayton Buback

Joint Project with Patrick McCarver

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

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
United States Army Research Office (W911NF-10-1-0476)

Flexible Aerogels

Aerogels are open-pore, ultra-low density solids with very high surface areas, low thermal conductivities, high acoustic impedance, and low dielectric constants [1,2]. Because of these properties, aerogels are attractive multifunctional materials for applications in aerospace, automotive, chemical, and construction industries. However, aerogels are often rigid and fragile. That is addressed herein with two different types of polyurethane aerogels, where flexibility is imparted by varying the chemical structure and concentration of the monomers.

These flexible aerogels may find use in highly insulating clothing for divers, astronauts, and mountain climbers [3]. Their high surface area may find applications as catalyst supports, in microfluidic devices used in biotechnology, and in fuel cells [4]. Importantly, the impressive strength-to-weight ratio of higher-density polyurethane aerogels renders them attractive as energy absorbers for defense applications [5].

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Clayton was born in St. Charles, Missouri. At age 16, he enrolled in the Missouri Academy of Science, Mathematics, and Computing, and graduated at the top of his class, earning an Associate of Science Degree and High School Diploma simultaneously. He now attends the Missouri University of Science and Technology, and is working on a Bachelor's Degree in Biochemical Engineering. After completing this, he will attend Medical School, and hopes to make meaningful contributions to the field of oncology.

Mydah Choudhry

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

Funding Source: N/A

Is IQG1 required for the localization of Bni1?

Saccharomyces cerevisiae, budding yeast, is our model organism to study cytokinesis. Cytokinesis is an important and essential step of cell division. During cytokinesis, the cell separates the cytoplasm through the contraction of F-actin and non muscle type II myosin.

udding yeast contain two formins, Bni1 and Bnr1. These are essential for cytokinesis. My hypothesis focuses on IQG1 and Bni1. My project focuses on if IQG1 is required for the localization Bni1 at the site of cytokinesis.

n order to determine if Iqg1 is required for the localization of Bni1, I must observe the bud neck localization of Bni1 using GFP. My goal is to compare the Bni1 neck localization with and without Iqgl. Bni1-GFP is observed in mitotic cells. Galactose media allows expression of Iqg1, while glucose represses Iqg1 expression. Data indicate that Bni1-GFP does localize without Iqg1; quantification will be performed to measure Bni1-GFP at the bud neck.

Mydah is a senior in Biological Sciences at the Missouri University of Science and Technology. She started working with Dr. Katie Shannon in August 2011. Mydah is an officer in SCRUBS Pre Health Club as well as an active member in Phi Sigma Biological Sciences Honors Society and Helix Life Sciences Club. Mydah plans to attend medical school post graduation from Missouri University of Science and Technology.

Tiffany Edwards

Department: Chemistry
Major: Biology
Research Advisor: Dr. Nuran Ercal
Advisor's Department: Chemistry

Funding Source: Ercal Vitek Endowment and NIH

The Therapeutic Effects of the Novel Thiol Antioxidant, N-acetylcysteine Amide (NACA), on Treating Rats with Grade I and Grade II Cataracts

The effect of the antioxidant N-acetylcysteine amide (NACA) on the reversal of grades I and II cataracts in Wistar rat pups was evaluated. Cataract formation was induced via a glutathione inhibitor, l-buthionine-(S,R)-sulfoximine (BSO). The lens of each pup was tested for a number of oxidative stress related parameters, including the observation of glutathione and cysteine levels. After the pups opened their eyes, the grades of cataracts were evaluated in each lens. These pups were then divided into three groups; BSO only, grade I cataracts and grade II cataracts. The two groups that were treated with NACA eye drops showed a significant reduction of the cataracts. Our findings indicate that NACA is able to reverse BSO-induced cataracts (Grades I&II) by acting as a substrate donor for the synthesis of glutathione. In addition, NACA can also function as a scavenger for dangerous free radicals in the cells.

Tiffany is a junior majoring in Biology. She has been working in the laboratory of Dr. Ercal for two years. She plans on attending graduate school in Stockholm, Sweden. She has an avid interest in working biology and chemistry.

Brittany Ford

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

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

Preserved Palynomorphs in Ephemeral Hypersaline Lakes

Surface sediments were sampled from Prado Lake (7 samples) and Salty Lake (5 samples) in southern Western Australia for palynological analyses. Light microscopy was utilized in examining the samples for dispersed organic matter (palynofacies) and organic-walled microfossils (palynomorphs). The most abundant dispersed organic components were comminuted and structured phytoclasts; amorphous organic matter was also common. Pollen and spore were more commonly preserved in the Prado Lake samples, as opposed to the Salty Lake samples. An overview of the types of palynomorphs preserved in the samples suggests vegetation comprising mainly arid-loving floras. Statistical analysis of the data yields useful information about the paleoenvironmental conditions and overall lake history.

Brittany is a senior in the Geological Science and Engineering Department, with a minor in Nuclear Engineering. Aside from undergraduate research in palynology, she is also active in Student Union Board as the Promotions Director for the Concert Committee and is a board operator for the KMST station on campus. After graduation, she will be continuing on with geology into graduate school.

Peter Haw

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

Funding Source: N/A

The Cure to Skin Cancer: A Metabolic Approach

Mycosporines are naturally synthesized metabolites found in bacteria that are constantly exposed to sunlight. The mycosporines help to absorb UV radiation and therefore, keep the UV radiation from disrupting the DNA of the cell. Although our skin is host to many different bacteria, none of them produce mycosporines. There are three genes responsible for producing the mycosporine in the cyanobacterium, *Nostoc punctiforme.* Using a plasmid as a vector, these genes will be transferred to *Staphylococcus epidermidis,* a natural inhabitant of human skin. The *S. epidermidis* will then be able to produce their own mycosporine. Applying the *S. epidermidis* to our skin via a lotion, we will be protected from harmful UV radiation. Horizontal gene transfer on our skin could lead to more bacteria producing the mycosporines and thus, a greater UV protection.

Peter is a junior at Missouri S&T. His fascination with microbiology lies in the application of microbes in our daily life. He is a captain of the men's varsity soccer team here at school and spends much of his time playing the sport. Peter maintains a high GPA while also being involved in extracurriculars.

Thomas Herbst

Department: Geological Sciences & Engineering Department
Major: Geology & Geophysics / Applied Mathematics
Research Advisor: Dr. David Wronkiewicz
Advisor's Department: Geological Sciences & Engineering Department

Funding Source: U.S. Department of Energy

Investigation of Mineral Weathering Products Following CO_2 Injection and High Pressure Tests

Successful carbon sequestration is predominantly controlled by host rock minerals, their alteration products, and the rate of their formation following exposure to a CO_2 injected environment with high pressure/temperature conditions. By reproducing these conditions in a lab setting utilizing mineral species originally tested in Goldich's (1938) classic weathering series, it was concluded the minerals that reacted more rapidly, ergo were more susceptible to weathering, had a higher capacity for promoting carbonate mineral formation. A Hitachi S570 Scanning Electron Microscope was used in conjunction with X-Ray Microanalysis (EDS), to locate and identify newly precipitated mineral phases and their chemical composition. The most notable comparisons contrary to the Goldich series are the amphibole (hornblende) tests, which yielded faster reactions and greater alteration results than pyroxene (augite) samples. It was confirmed via SEM-EDS analysis that a concentrated region of white precipitate material contained microcrystalline particles with a rhombohedral morphology, called magnesite ($MgCO_3$).

Thomas is a senior about to complete his studies and earn dual Bachelors of Science degrees in both Geology & Geophysics and Applied Mathematics. His background includes numerous awards and leadership positions within the Geological Sciences & Engineering Department, including the American Mineralogist Undergraduate Award, the Undergraduate Student Award for Service, and the Clifford Wade Bishop Scholarship "for Outstanding Senior in Geophysics," as well as Presidency and Vice Presidency of the C.L. Dake Geological Society and Sigma Gamma Epsilon – The Earth Science Honor Society. Following graduation in May, 2012, he will attend graduate school.

Bin Hou

Joint project with Lu Zhu

Department:	Geology & Geophysics Program Geological Sciences and Engineering
Major:	Geology
Research Advisor:	Dr. Wan Yang
Advisor's Department:	Geology & Geophysics Program Geological Sciences and Engineering

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

Petrographic Characteristics of Transgressive and Regressive Limestone of Upper-Pennsylvanian (Virgilian) Oread Cyclothem, NE Oklahoma and SE Kansas

Limestone composition and texture indicate environmental conditions during landward (transgressive) and seaward (regressive) shoreline migrations. We studied six thick regressive Plattsmouth Limestone samples and five thin transgressive Leavenworth Limestone samples at two localities ~50 km apart. Microscopically, Leavenworth samples are dominantly biomicrites with crinoid and fusulinid fragments and coated grains, 1.3 mm in size, poorly-moderately sorted, and variably skewed. Plattsmouth samples are dominantly biomicrites with phylloidal algal and brachiopod fragments and coated grains, 3.6 mm in size, poorly to very poorly sorted, and variably skewed. Leavenworth samples become coarser and more poorly-sorted upward. Plattsmouth samples become finer and better sorted upward at inner shelf, but coarsen upward at algal mound. Plattsmouth is coarser and more poorly-sorted and has less fusulinid but more algae than Leavenworth. The differences conform with a giving-up mode of deposition during Leavenworth sea-level rise and a keeping-up mode during Plattsmouth slow sea-level fall.

Bin is a senior majoring in Geology. He is an international student from China. He received a scholarship from WAAIME in 2011.

Kathryn Isbell

Joint project with Vincent Allen and Wenyu Zhou

Department:	Electrical and Computer Engineering
Major:	Computer Engineering and Computer Science
Research Advisors:	Dr. Bijaya Shrestha, Dr. Randy Moss and Dr. Joe Stanley
Advisor's Department:	Electrical and Computer Engineering

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

Inference Engine for Skin Cancer Diagnosis

The development of our inference engine began by creating a search engine that would draw information from our knowledge base. It was designed such that when a user provides a description of a skin lesion, corresponding images from our database will be displayed. The search engine was programmed in C++ and the GUI was constructed by using the wxWidgets library. The knowledge gained from this portion of the project was essential for creating our inference engine.

The inference engine determines a diagnosis for a skin lesion by using image processing techniques to search for all features in a given image before comparing them with the dataset. Although accurate results can be obtained from this method, it is often time consuming and unnecessary to search for every feature. We have developed a decision tree algorithm to limit the amount of features searched based on trends in the database.

Kathryn is a senior at Missouri S&T majoring in computer science and computer engineering. She was born and raised in Mobile, Alabama. After graduating from the Alabama School of Math and Science in 2008, she attended Samford University in Birmingham, Alabama to study trumpet performance, piano performance, and computer science. In 2009, Katie transferred to Missouri S&T so that she could concentrate on computer engineering and computer science. While she was there, she conducted undergraduate research under Dr. Jonathan Kimble, worked with Power and Command and Data Handling on the Missouri S&T Satellite Team, and joined IEEE and ACM. In the future, she wants to continue her research and other personal programming projects, move towards a career involving the development of new technology, and eventually become a successful entrepreneur.

Avery Joseph

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

Funding Source: Grants acquired by Dr. Shannon

Investigating the Negative Regulation of Iqg1 in Budding Yeast Cytokinesis

Cytokinesis is the separation of cells and is the final step involved in division of the cell. In budding yeast (*S. cerevisiae)* the protein Iqg1 helps regulate the actin cytoskeleton involved in the contraction ring necessary for cytokinesis. Iqg1 is similar to the IQGAP1 found in humans, which can be more active in tumor cells. The experiment being conducted involves the negatively regulated interaction of Iqg1 with GTPase Tem1 necessary for contraction of the myosin ring. It is hypothesized that the proteins Bfa1 and Bub2 required for the spindle checkpoint regulates the Iqg1-Tem1 interaction. To test this, cells without Bfa1and Bub2 or overexpression of these proteins will be studied to establish what effects occur on the Iqg1-Tem1 co-immunoprecipitation.

Avery is a junior in the Biology department. She has been a member of SCRUBS, iGEM, and is currently the Awards Chair for Order of Omega and the Ritual Chair in Zeta Tau Alpha. Avery plans on pursuing a degree in Medicine post-graduation.

Megan Koerner

Joint project with Katie Payne

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

Effects of Nitric Oxide on Store Operated Calcium Entry

S-nitrosoglutathion (SNG) is a well known smooth muscle relaxant and a nitric oxide donor when introduced into a cell. SNG has a very short half life so it must be synthesized before every experiment. It was made by using Glutathione (GSH) and Sodium Nitrate ($NaNO_2$). We determined the effects of nitric oxide on calcium signaling by utilizing M3 muscarinic receptors expressed in Chinese hamster ovary (CHO) cells. Cytotoxicity was determined using a dye reduction assay. Nitric oxide was found to have an EC50 at 10mM, and had an inhibitory effect on store operated calcium entry (SOCE). Cytosolic calcium concentrations were measured using a calcium sensitive fluorescent dye (fura-2AM) and a ratiometric imaging program.

Megan is a senior from Eldon, MO. She plans to attend medical school after receiving her bachelor's degree in Biological Sciences. Megan is an active member in the Biological Sciences honor society. 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 four years of academic study.

Katie Kuehn

Department: Civil, Architectural and Environmental Engineering
Major: Environmental Engineering
Research Advisor: Dr. Daniel Oerther
Advisor's Department: Environmental Engineering

Funding Source: Mathes Endowed Chair

Linking the Obese Phenotype with the Microbial Composition of the Animal Gut

Obesity in the United States has become the number one cause of morbidity and mortality with 33% of the adult population and 17% of children demonstrating an obese phenotype. Traditional approaches to combat obesity suggest that improved diet and exercise will result in weight loss. Growing evidence points to an alternative hypothesis, namely that environmental determinants interact with the microbial populations in the human gut resulting in chronic low level inflammation that produces fatty tissues. To explore this hypothesis, this study documents the correlation among the Western diet, the obese phenotype, and the composition of the microbial communities in samples removed from the guts of experimental animals. Sequencing of 16S rRNA genes was used as a measure of microbial community composition. The preliminary results of this study support the hypothesis that environmental determinants play a role in the obesity epidemic.

Katie was raised in St. Louis Missouri and received a first B.S. degree in Biology in 2009 from Saint Louis University. She came to Rolla in 2011 to complete a second B.S. degree in Environmental Engineering. Her expected graduation date is May 2013.

Joseph Kurtz

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

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. Results will be presented in regards to optimization of client versus server side transcription.

Joe transferred to the Missouri Academy of Science, Mathematics, and Computing after his sophomore year of high school. This program impacted his life immensely because it was the first time he was introduced to the discipline of computer science. When his professor showed the class how to make a very basic instant messaging program, he was hooked. After completing the Missouri Academy program, he enrolled at Missouri S&T, and joined the Kappa Sigma fraternity. He used this opportunity to advance his knowledge of computers by becoming the fraternity's website chair. He is now working for the Natural Computation Lab doing mobile development research.

Alexis Martin

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

Funding Source: cDNA Resource Center

Comparison of Potency of SOCE Inhibition by Naturally Occurring Biphenolic Compounds

Asian herbal medicine has used plants to treat many diseases for years. Two main compounds derived from Magnolia trees, honokiol and magnolol, have become accepted in their treatment of mental disorders such as anxiety and depression. These compounds have more recently been studied for their unique abilities to induce apoptosis and cytotoxicity in cancer cell lines. The purpose of this study was to determine and compare how honokiol, its sister compound, magnolol, and two other isomers, compound 24 and 27, affect intracellular calcium concentrations in cells expressing muscarinic receptors. Calcium concentrations were determined using a Fura-2 ratiometric imaging protocol. It was determined that all four compounds inhibit SOCE, an ER calcium-replenishing mechanism, known to play a crucial role in apoptosis and cell cycle regulation. Of this, compound 27 was found to be the most potent. It is recommended that the isomers of honokiol be specifically looked at for their anti-tumorigenic properties.

Alexis is a senior of the Biological Science's department. She has been a research assistant in the cDNA Resource Center for two and a half years. Alexis is an active member of the Biological Honor's society, Phi Sigma, and secretary of a women's service organization, Lambda Sigma Pi. She will be attending medical school at Kansas City University of Medicine and Biosciences in the fall.

Patrick McCarver

Joint project with Clayton Buback

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

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
United States Army Research Office (W911NF-10-1-0476)

Flexible Aerogels

Aerogels are open-pore, ultra-low density solids with very high surface areas, low thermal conductivities, high acoustic impedance, and low dielectric constants [1,2]. Because of these properties aerogels are attractive multifunctional materials for applications in aerospace, automotive, chemical, and construction industries. However, aerogels are often rigid and fragile. That is addressed herein with two different types of polyurethane aerogels, where flexibility is imparted by varying the chemical structure and concentration of the monomers.

These flexible aerogels may find use in highly insulating clothing for divers, astronauts, and mountain climbers [3]. Their high surface area may find applications as catalyst supports, in microfluidic devices used in biotechnology, and in fuel cells [4]. Importantly, the impressive strength-to-weight ratio of higher-density polyurethane aerogels renders them attractive as energy absorbers for defense applications [5].

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Patrick is a Junior in Chemical Engineering at Missouri University of Science and Technology. In his spare time he enjoys reading and writing science fiction, playing board games, and browsing Wikipedia endlessly. Patrick is also President of the campus chapter of Toastmasters International.

Katie Payne

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

Effects of Nitric Oxide on Store Operated Calcium Entry

S-nitrosoglutathion (SNG) is a well known smooth muscle relaxant and a nitric oxide donor when introduced into a cell. SNG has a very short half life so it must be synthesized before every experiment. It was made by using Glutathione (GSH) and Sodium Nitrate ($NaNO_2$). We determined the effects of nitric oxide on calcium signaling by utilizing M3 muscarinic receptors expressed in Chinese hamster ovary (CHO) cells. Cytotoxicity was determined using a dye reduction assay. Nitric oxide was found to have an EC50 at 10mM, and had an inhibitory effect on store operated calcium entry (SOCE). Cytosolic calcium concentrations were measured using a calcium sensitive fluorescent dye (fura-2AM) and a ratiometric imaging program.

Katie is in her second year at Missouri S&T. She is from Steelville, MO and plans to attend a medical school after receiving her undergraduate degree in Biological Sciences with a minor in Chemistry and Theatre. Katie Payne is active in Alpha Psi Omega, the National Theatre Honors society. Katie Payne works as a research assistant at Dr. Aronstam's cDNA lab and she volunteers at the PCRMC Emergency Department in her free time.

Cory Reed

Department: Geological Sciences and Engineering
Major: Geology and Geophysics
Research Advisors: Dr. Kelly Liu, Dr. David Bridges, Dr. Stephen Gao, and Dr. John Hogan
Advisor's Department: Geological Sciences and Engineering

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

Geomagnetic Investigations of a Desert Eye Structure, Egypt

Circular and elongate structural basins and domes known as "Desert Eyes" and their associated faults are prominent bedrock features of the Western Desert of Egypt. This study reports preliminary results of a high-resolution magnetic survey of the El Kasr structure, a well exposed Desert Eye southwest of Aswan, Egypt. Magnetic surveys were conducted with an east-west azimuth to constrain the subsurface geometry of possible faults. The absolute regional variation in the geomagnetic field is a sparse 40 nT even though survey lines cross distinct formation contacts. Slight along strike variations in the induced magnetism are detected as the surveys progress northward, parallel to the structure. However, there is little evidence in the pre-processed data to suggest any significant north-south trending subsurface structures. Forward modeling of the data provides better constraints on the subsurface geometry of the El Kasr Desert Eye structure and its potential relationship to local faults.

Cory is a graduating senior in Geology and Geophysics with an Associate's Degree in Pre-Engineering. He possesses coursework in both applied and theoretical geophysics, has a working knowledge of multiple software platforms concerned with a diverse range of uses (namely seismic interpretation, statistical analysis, and design and documentation), and has field experience with both seismic and magnetic methods. He has been awarded both the Sheldon Kerry Grant Award for Outstanding Field Work and the Clifford Bishop Memorial Scholarship for Outstanding Geophysics Students, and is a member of the American Geophysical Union as well as multiple honor societies: Sigma Gamma Epsilon for Earth Sciences, Kappa Mu Epsilon for Mathematics, and Phi Kappa Phi. His interests are chiefly affiliated with predictability and statistical analysis of seismic phenomenon, and intends on pursuing a doctoral degree in Theoretical Seismology with advisors Dr. Stephen Gao and Dr. Kelly Liu at Missouri S&T beginning in the Fall of 2012.

Thomas Reese

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

Automated Generation of Benchmarks with High Discriminatory Power for Specific Sets of Black Box Search Algorithms

Black box search algorithms (BBSAs) vary widely in their effectiveness at solving particular classes of problems. It is paramount to be able to identify the most effective BBSA for a real-world problem. There exists a sizable set of standard benchmarks, but only for very narrow problem classes. Any such limited set is inherently unable to identify the general differences in effectiveness between particular BBSAs and practically infeasible for a sufficiently comprehensive comparison to differentiate between arbitrary BBSAs. Thus it is necessary to create custom benchmarks for given BBSAs to obtain benchmarks with high discriminatory power, utilizing a meta evolutionary algorithm approach in this case. By sampling the search space of a real-world problem and identifying the most similar custom benchmark, the previously identified BBSA with the best performance may be expected to be the most effective for solving that real-world problem. Results are presented showing the effectiveness of this approach.

Thomas is a junior in Computer Science at Missouri S&T. He is also pursuing minors in both bioinformatics and mathematics. He is an undergraduate research assistant in the Natural Computation Laboratory. His on-campus positions include Collegiate Eagle Scout Association president, Aerial Swing Dance Club instructor, and Student Council web administrator. In his free time, Thomas participates in many physical activities such as biking, Ultimate, and Frisbee golf. His future plans include graduate school and a career in computational science research.

Krista N. Rybacki

Department: Geological Sciences and Engineering
Major: Geology and Geophysics
Research Advisors: Dr. David J. Wronkiewicz, Dr. Cheryl M. Seeger and Dr. J. David Rogers
Advisor's Department: Geological Sciences and Engineering

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

Analysis of Flood Sediment Deposits Following the Taum Sauk Reservoir Failure, Reynolds County, Missouri

Many types of sediments are contained within the scour valley of the Taum Sauk failure site. To effectively identify the processes of deposition and source of the sediments of the middle and lower valley, point count tests are administered. This type of test will help explain the reverse grading present in the valley as well as proportionate the types of sediments present, where they are present, and the distribution of sizes throughout the valley. We will also look at the weathering processes that have occurred on those rocks, as well as the amount of rounding. This can provide a small piece of information about the environment during the flooding event. This study can also help prevent future incidents like this one from occurring elsewhere around the reservoir.

Krista is originally from the small town of Nashville, Illinois. She is currently a senior at Missouri University of Science and Technology working towards a Bachelor of Science degree in Geology and Geophysics. She is actively involved in the department and campus as a member of the C.L. Dake Geological Society, Society of Exploration of Geophysicists, Sigma Gamma Epsilon Honor Society, and the Phi Kappa Phi Honor Society. In February of 2012, Krista was named the Mines and Metallurgy Academy Scholar for the Geology and Geophysics program. Krista plans on attending graduate school after graduation in May 2012 to further her studies in environmental geology/geochemistry/atmospheric sciences.

Chelsea Sanders

Joint project with Kathleen Venhaus and Tiffany Werckmann

Department:	Computer Science
Major:	Computer Science
Research Advisor:	Dr. Daniel Tauritz and Dr. Matt Insall
Advisor's Department:	Computer Science and Mathematics

Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program Computer Research Association's Committee on the Status of Women in Computing Research

APCG: The Automated Partial Credit Grader

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. Few, if any, institutions have the resources to offer around-the-clock human graders to provide the desired level of feedback. Educational companies have responded by increasingly offering automated training and assessment tools. However, these tools are typically very rudimentary, providing full credit for exact matches to model answers and no credit otherwise. There is a clear and urgent need for a far more sophisticated system which can analyze what went wrong, assign partial credit, and provide detailed feedback to the student. The Automated Partial Credit Grader (APCG) project is specifically addressing this problem through the creation of such a sophisticated system.

Chelsea is a senior at Missouri University of Science and Technology. She will be graduating with a bachelor's degree in Computer Science and a minor in Technical Theater this coming May. After graduation she plans to use her degree to go work for a theater company developing the software for light boards and other theater products.

Megan Schuller

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
Chemistry Department and Environmental Research Center

Early Breast Cancer Detection by Quantitative Determination of Potential Biomarkers in Urine Samples Using Capillary Electrophoresis

Breast cancer is a disease that impacts the majority of the female population in the world. Unfortunately, the most reliable way of detecting this cancer is through tissue samples. This means of testing is very invasive and painful to the patient; therefore it is used as a last resort. Due to the fact that symptoms are often not noticeable until the later stages of progression, tissue samples are generally taken too late. The goal of this research project is to develop a capillary electrophoresis (CE) technique and apply the technique to detect the presence of breast cancer by using urinary biomarkers. After identifying potential biomarkers, we aim to validate this technique as a means of early detection. The experimental conditions, the current stage of the project, and future experimental designs will be presented at the conference.

Megan is currently a junior at Missouri S&T. She is majoring in chemistry with an emphasis in biochemistry and planning on picking up a biology minor. Megan has attended Fort Zumwalt High School here in Missouri and she is expected to graduate from Missouri S&T in the summer of 2013. She has been involved with chemistry orientated organizations such as W.T. Schrenk Society, associated with the American Chemical Society, and Alpha Chi Sigma, a professional fraternity. Megan has also been active with Scrubs, the campus's premedical organization as well as fencing.

Matthew Simon

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

Funding Source: National Science Foundation
Office of International Science and Engineering
International Research Experience for Students

Outcrop-scale Investigation of Faulting in the Gorge of the Nile, Ethiopia

This work investigates normal faulting in the sedimentary rocks of the Gorge of the Nile, Ethiopia. It focuses on an outcrop at the middle of the Triassic Gohatsion Formation. The outcrop is dominated by wavy-bedded and nodular gypsum alternated with dolomite, limestone, and shale. This formation is part of 1.1 km thick Mesozoic sedimentary section of clastic and carbonate rocks exposed along the Gorge of the Nile carved by the Blue Nile River. This work shows that the normal faulting is the form of NW-trending, SW-dipping listric fault. The hanging wall is characterized by a long wavelength syncline whereas the footwall is characterized by comparable wavelength anticline. The fault is accompanied by mezoscopic scale bookshelf faulting with detachment dipping in the same direction, but shallows down to become layer-parallel displacement plane. The examined fault is likely of the same orientation and style as map-scale faults in the region.

Matthew is a junior at Missouri University of Science and Technology studying Geological Engineering. He is a member of Engineers Without Borders, Christian Campus Fellowship and Tau Beta Pi, National Engineering Honors Society. Matthew plans on finishing his undergraduate degree here at Missouri S&T and then pursuing Graduate School.

Marissa Spencer

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

Funding Source: Missouri S&T, NSF-OISE-IRES (National Science Foundation, Office of International Science and Engineering, International Research Opportunity for Students)

If Rocks Could Talk, Oh What Tales Tekeze Could Tell

As part of the International Research Experience for Students funded by the National Science Foundation's Office of International Science and Engineering, students and researchers were given the opportunity to study rock outcrops within Tekeze Gorge, located in eastern Ethiopia. Tekeze Gorge is similar in size and geologic wonder to the Grand Canyon. The geologic history of the area of Tekeze Gorge can be reconstructed by combining field studies with the acquisition of data through remote sensing. The observation of small scale features within outcrops in the area including crenulation lineation, tensional gashes, and other metamorphic alteration were compared with enhanced remote sensing images on a regional scale. By applying principles of structural geology and the behavior of rock in rigid body shearing, interpretations were made of the evolution of the study area. Features within the metasedimentary rocks indicate tectonics in the Tekeze Gorge occurred regionally in two pulses. Folding in two directions implies a change in the direction of tectonic transport and may expose structures not previously discovered by other field methods.

Marissa is a senior at Missouri S&T studying Geology and Geophysics. Marissa is a member of the C.L. Dake Geological Society, AAPG- Chapter Representative, the Geological Society of America, the Eastern Missouri Paleonotological Society, as well as Sigma Gamma Epsilon, Earth Science Honor Society-Vice President. While studying the palynology of the Hell Creek Formation in Montana, Marissa also co-authored another scientific publication on the palynology of Southeast Missouri. Marissa is currently researching the palynology of Florida. 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 is currently employed at the Missouri DNR, Division of Geological and Land Survey as a student intern. Marissa plans to continue her education at Missouri S&T as a student of geological science.

Margret Steele

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

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 has migrated to a robust server architecture, minimizing ties to any particular host architecture. This effort has ensured 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. She is currently working on the Virtual Facilitator project in S&T's Natural Computation Laboratory. Over the next few years, she plans to pursue research in software engineering at Missouri S&T.

Junzhe Sun

Department: Geological Sciences and Engineering
Major: Geology and Geophysics
Research Advisor: Dr. Stephen Gao
Advisor's Department: Geological Sciences and Engineering

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

Seismic Anisotropy Beneath Alaska from Shear Wave Splitting Study

Abstract: Seismic azimuthal anisotropy beneath the Aleutian-Alaska Trench is studied using all teleseismic shear wave records archived at the IRIS Data Management Center. We have obtained approximately 2400 high-quality splitting measurements, selected by visual inspection of over 12,000 records of SKS, SKKS and PKS phases. Wave traveling northwest of the 100km slab contour shows overall uniform fast polarization direction parallel to the strike of the trench, suggesting along strike flow in the thicker part of mantle wedge possibly caused by North America Plate motion to the southwest. Wave traveling southeast of the 100km contour with their piercing point falling between 100-50 km contours shows fast polarization directions orthogonal to the strike of the trench. A gradual turning in fast direction around the slab edge is also observed. The splitting pattern confirms a numerical model which involves a 3D toroidal mantle flow around the north-eastern edge of the subducting Aleutian slab.

Junzhe is a senior student studying Geophysics advised by Dr. Stephen Gao. He grew up in the second largest oil field of China, Shengli Oil Field. He found seismology intriguing since his childhood, thanks to his father, a petroleum engineer, who first introduced him to exploration geophysics. Junzhe was admitted to China University of Petroleum-East China (hereinafter referred to as "CUP") as a EE major in 2007, one year after which he switched his major to Geophysics due to the influence of the devastating 2008 Sichuan Earthquake. He transferred from CUP to Missouri S&T in 2010 and will be graduating in May 2012 with a BS degree in Geophysics. Junzhe has worked as a research assistant in Geophysics and a teaching assistant in Structural Geology as well as Physical Mineralogy and Petrology. He has also served as the president of Chinese Students and Scholars Association at Missouri S&T from 2011 to 2012. After graduation, he will go to Stanford University to pursue Ph.D degree in Geophysics.

Kathleen Venhaus

Joint project with Chelsea Sanders and Tiffany Werckmann

Department:	Computer Science
Major:	Computer Science and Computer Engineering
Research Advisors:	Dr. Daniel Tauritz and Dr. Matt Insall
Advisor's Department:	Computer Science and Mathematics

Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program Computer Research Association's Committee on the Status of Women in Computing Research

APCG: Automated Partial Credit Grader

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. Few, if any, institutions have the resources to offer around-the-clock human graders to provide the desired level of feedback. Educational companies have responded by increasingly offering automated training and assessment tools. However, these tools are typically very rudimentary, providing full credit for exact matches to model answers and no credit otherwise. There is a clear and urgent need for a far more sophisticated system which can analyze what went wrong, assign partial credit, and provide detailed feedback to the student. The Automated Partial Credit Grader (APCG) project is specifically addressing this problem through the creation of such a sophisticated system.

Kathleen is from St. Louis, Missouri and is currently a junior at Missouri University of Science and Technology. She plans to graduate with a bachelor's degree in Computer Science and a bachelor's degree in Computer Engineering.

Tiffany Werckmann

Joint project with Chelsea Sanders and Kathleen Venhaus

Department:	Computer Science
Major:	Computer Science and Computer Engineering
Research Advisors:	Dr. Daniel Tauritz and Dr. Matt Insall
Advisor's Department:	Computer Science and Mathematics

Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program Computer Research Association's Committee on the Status of Women in Computing Research

APCG: Automated Partial Credit Grader

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. Few, if any, institutions have the resources to offer around-the-clock human graders to provide the desired level of feedback. Educational companies have responded by increasingly offering automated training and assessment tools. However, these tools are typically very rudimentary, providing full credit for exact matches to model answers and no credit otherwise. There is a clear and urgent need for a far more sophisticated system which can analyze what went wrong, assign partial credit, and provide detailed feedback to the student. The Automated Partial Credit Grader (APCG) project is specifically addressing this problem through the creation of such a sophisticated system.

Tiffany is a senior at Missouri University of Science & Technology, majoring in Computer Science and Computer Engineering. She has been actively involved in both the department and extracurricular organizations, especially Engineers Without Borders. This coming summer she will be interning with the Boeing Company as a software engineer for her third summer. She plans on graduating in December 2012 with her dual degree and a minor in Spanish Language.

Patricia S. Williams

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

Funding Source: National Science Foundation

The Nature of the Contact of the Khoman Chalk Formation and Dahkla Formation at Gebel Gunna near Farafra, Egypt

The contact between the Khoman Chalk and the Dahkla formations has been reported as a sharp depositional contact. The contact is well exposed on Gebel Gunna (Farafra, Egypt) where a recent field investigation identified six different cycles of inter-fingering between the Khoman and the Dahkla Formation, indicative of a gradational contact. To better understand this transition, samples collected across this zone will be investigated using X-ray Diffraction (XRD). This will quantify the variation in clay content of the rock types as a function of stratigraphic sequence. This information will be used to better constrain the inter-fingering depositional nature of the contact and help construct more accurate model for the change in the environment of deposition.

Patricia is a senior in Geology and Geophysics. She worked as a student teaching assistant in Structural Geology and as an interpretive guide at Onondaga Cave State Park. She plans to attend graduate school focusing in sedimentology and stratigraphy.

Alex Willis

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

Funding Source: cDNA Resource Center

The Effects of Gallein on M3 Muscarinic Receptors

Gallein is a large cyclic carbon molecule with multiple functional groups. With no known medical use and few research articles, the only known action is that the drug has been found to effect G-protein subunits, specifically the GBγ subunit expressed in native rat olfactory receptors. I determined the effects of Gallein on calcium signaling underlying transmission mediated by human M3 muscarinic receptors expressed in Chinese hamster ovary (CHO) cells. Receptor binding was determined in radiolabelled ligand binding assays; changes in intracellular calcium concentrations were determined using a fura-2 ratiometric imaging protocol. Gallein had a distinct inhibitory effect on store operated calcium (SOCE) that was induced by activation of the M3 receptors. No inhibition of IP3 receptor mediated calcium release was seen. With more testing, Gallein might prove to have a pharmacological benefit.

Alex is a junior in Biology. While getting his B.A., he is also pursuing a minor in Chemistry and Spanish. He is the Public Relations Officer for the pre-health organization, Scrubs. He has hopes to go to medical school after his senior year and become a M.D. in Ophthalmology.

Wenyu Zhou

Joint project with Vincent Allen and Kathryn Isbell

Department:	Electrical and Computer Engineering
Major:	[Electrical Engineering]
Research Advisors:	Dr. Bijaya Shrestha, Dr. Randy Moss and Dr. Joe Stanley
Advisor's Department:	Electrical and Computer Engineering

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

Inference Engine for Skin Cancer Diagnosis

Our team is to develop a rule-based inference engine aimed at efficiency enhancement. For the first part of our inference engine, we have already developed a search engine which will let you search any picture limiting by certain conditions, such as age, gender, location, and so on. In the search engine, I finish the list-ctrl part, which will display a thumbnail list at the lift bottom of the program. In this part, I need to read in the search result passed by Vincent , look into the data base to find out the images matching the searching result, and display them as thumbnail list. It is coded in C++ with wxWidgets. Now we are still working on the algorithm part of the inference engine so that we can detect the unknown diagnosis accurately and efficiently.

Wenyu is a Chinese undergraduate student in Electrical Engineering. He has been in United States for almost four years. However, this is his first year involved in research. After graduation, he plans to attend graduate school.

Lu Zhu

Department: Geological Science and Engineering
Major: Geology
Research Advisor: Dr. Wan Yang
Advisor's Department: Geological Science and Engineering

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

Petrographic Characteristics of Maximium-Transgressive and Regressive Deltaic Sandstones of Upper-Pennsylvanian (Virgilian) Oread Cyclothem, NE Oklahoma

Deltaic sandstones deposited during maximum-transgression and regression are expected to differ compositionally and texturally, because of different environmental conditions associated with sea-level changes. This hypothesis is tested by petrographic study of two sandstones from maximum-trangressive delta and two from regressive delta in NE Oklahoma. Data are compared to display their similarities by interpreting the controlling processes. All sandstones are feldspathic arenite. The lower maximum-trangressive sandstone is K-feldspar rich, less sorted, finer, less rounded, more symmetrical than the upper one. These characteristics conform with the stratigraphic stacking of the lower distal and upper proximal delta lobes, where upward coarsening trend and increased maturity are common during deltaic progradation. The lower regressive sandstone is finer, better sorted, better rounded, near symmetrical than the upper one. Field evidence indicates that the lower sandstone is wave dominated, whereas the upper river dominated, conforming to the overall progradational pattern. The differences in wave and river processes and energy regime are probably the causes of an upward-decreasing textural maturity between the two sandstones. Maximum-trangressive sandstones are more texturally heterogeneous than regressive sandstones, indicating more variable environmental conditions in regressive-deltaic environment. Overall the deltaic sandstones of Oread Cyclothem are feldspar-rich, texturally submature. The petrographic characteristics suggest that the lithology and location of provenance, transport distance, and deltaic sedimentary processes are the dominant controls, rather than sea-level changes.

Lu, a geology student at Missouri S&T, was transferred to Rolla from China University of Petroleum (East China) in 2010. She is a member of Epsilon Sigma Gamma honor society.

Research Proposal
Poster Session

Abstracts

Heather Branstetter

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

Funding Source: Boudin Bakery San Francisco, California
National Institute of Health
U.S. Department of Health and Human Services

Lactic Acid Bacteria from Sourdough and Impact on Gluten Sensitivity

With Celiac disease and gluten sensitivity diagnoses rising fermentation of bread starter, typically termed sourdough, has shown promising potential to play a critical role in providing a safe, highly nutritious and flavorful addition to a strict gluten-free diet. During extensive, spontaneous, fermentation of whole wheat products microorganisms establish themselves degrading gluten/gliadin. Focusing on isolating and identifying a variety of bacteria, especially lactic acid bacteria, the ability to degrade gluten will be tested using a variety of standardized assays including SDS-PAGE, ELISA, Western blot, and 16s RNA gene sequence for identifying bacteria. In addition a new enzyme activity test developed by the University of Washington International Genetically Engineered Machine Team will be used. This work will determine which lactic acid bacterium degrades gluten/gliadin best.

Heather is a full-time student pursuing undergraduate studies in Biological Sciences at the Missouri University of Science and Technology in Rolla. She has enjoyed working in the lab of Dr. David Westenberg since summer 2011 more recently focusing on extensive fermentation of gluten breads and the lactic acid bacteria that make it possible. Heather loves wheat and has been making baked goods using home-ground whole wheat a hobby for many years. As mother to a newly diagnosed gluten-sensitive daughter she has ramped up efforts to study gluten grains and cereals and traditional fermentation practices. In her free-time she watches "Ben-10", Disney's "Phineas and Ferb", and old westerns with her children and when school is not in session spends as much time as possible outside riding her bike, camping and hiking with her family. Outside of school and research Heather is an avid reader of great books, looks forward to graduate school and dreams of giving the world great whole wheat sour dough bread safe for Celiacs.

Melissa Buechlein

Department: Environmental Engineering
Major: Environmental Engineering
Research Advisor: Dr. Daniel Oerther
Advisor's Department: Environmental Engineering

Funding Source: Mathes Chair of Environmental Engineering

Validating Developed Microbial Source Tracking Methods for Missouri Waterways

Approximately ten percent of Missouri waterways are contaminated by biological pollution. As required by Clean Water Act, all waterways must be tested for Escherichia coli contamination because this bacterium indicates the potential for fecal contamination. The methods currently used yield results that require a significant amount of time for processing and lack accuracy in the results. Few researchers have devoted funding necessary for developing better methods for discovering biological contamination. However, previous members of our research team developed 16S rRNA-targeted methods to evaluate bacterium from humans, wildlife, and live stock to better this field of study. Our current objective is establishing the validity for these new methods in order to incorporate them into the field. This is the next crucial step in gaining acceptance of these methods.

Melissa is a second year student at Missouri University of Science and Technology. She is majoring in Environmental engineering with a minor in both Geological Engineering and Geology. With her degree she hopes to work in remediation of contaminated sites. With this as her goal, the research opportunity in Microbial Source Tracking instantly excited her. Melissa is a member of several organizations on campus, including: Zeta Tau Alpha, EcoMiners, Alpha Phi Omega, and Aerial Swing Dancing.

Jacob Gardner

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

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

Automating Prior Work Replication Through Experiment Configuration Evolution

Replicating prior work to validate claims and perform comparisons is a critical but arduous task in many research fields. This project surveyed a large set of papers published at the prestigious 2011 ACM Genetic and Evolutionary Computation Conference and found that this task is particularly onerous in the field of Evolutionary Computing due to ambiguity in terminology, a lack of commonly accepted standard algorithms, and a pervasive tendency in literature to not fully specify algorithmic configurations nor provide source code. In response, a system is being proposed to automatically replicate configurations for Evolutionary Algorithms (EAs) based on published experimental data, with accelerations possible if partial configuration information is available. The proposed system will employ a meta-EA to evolve various configurations for a base EA, including the operators used and parameter values, to most accurately match the published results of a given EA.

Jacob is a senior in Computer Science at Missouri S&T. He is an undergraduate research assistant in S&T's Natural Computation Laboratory. Jacob spends most of his free time in theatre or working with ACM SIG-Game to develop the next MegaMinerAI competition. MegaMinerAI is a 24 hour AI programming competition held twice a year welcoming programmers and strategists of all skill levels to come and compete.

Chester Gregg

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

Funding Sources: iGEM, National Science Foundation, Missouri Department of Conservation, U.S. Department of Energy, U.S. Department of Agriculture, Environmental Protection Agency

Revolutionizing Industry with Microbial Cellulose

Cellulose is a polysaccharide used in a plethora of products ranging from paper and clothing to food and medical supplies. Cellulose harvested from wood pulp is typically used in these products, but *Gluconacetobacter xylinus*, formerly known as *Acetobacter xylinum*, is one of many microbes which produce microbial cellulose. The cellulose produced by microbes such as *G. xylinus* is far superior to plant cellulose. To name just a few benefits, it is finer, being less than 1000 times smaller than the width of a human hair and able to hold 1000 percent of its weight in water; there are fewer byproducts, so it is purer; and it has strength comparable to steel. The proposed experiments aim to genetically modify *E. coli* to include the genes for cellulose production from *G. xylinus*, perhaps making it possible to provide a cheaper, ecologically clean alternative to the methods currently used.

Chester is a senior majoring in Computer Science at Missouri S&T. He is the webmaster of iGEM and has been involved in the design team's research. He is also an MAL in the Residence Hall Association, a governor in the Thomas Jefferson Hall Association and involved in several special interest groups for the Association for Computing Machinery. He enjoys programming software, listening to music, playing video games, discussing politics and learning.

Tavia Hall

Department: Biology
Major: Biological Sciences
Research Advisor: David Westenberg
Advisor's Department: Biology/ Microbiology

Funding Source: iGem

Asaia: Preventing Malaria

Malaria is a disease that affects between 300 and 500 million people a year with over 1 million cases resulting in death. Efforts to prevent the spread of the disease find Asaia to have properties that make it a candidate for preventing the spread of Malaria because it can thrive in the midgut of mosquitos and also move horizontally and vertically through mosquito populations. Asaia has been transformed to contain an immunotoxin that will prevent the *Plasmodium falciparum* from being able to spread through the mosquitos by stopping it from being able to move through the wall of the mosquitos' midgut. Therefore, it cannot move to the mosquitos' salivary glands. The immunotoxin, however, has not been tested in mosquitos nor has the transformed bacteria been implemented in a mosquito. If the transformed bacteria will thrive in E. coli, then, if implemented into a mosquito, it will prevent plasmodium from spreading.

Tavia is a freshman at Missouri S&T. This is her first experience with research, but she is very excited to see where it will take her. She is currently studying Biological Sciences with an emphasis in Microbiology, and plans on going to medical school; she would like to go into preventative medicine. She is also studying French and hopes to study abroad someday as well as teach English in Southern France. Hopefully, the experience gained through her undergraduate research will help her to achieve these goals.

Amber Kreps

Department: Biological Sciences
Major: Biology
Research Advisors: Dr. David Westenberg and Dr. Melanie Mormile
Advisor's Department: Biological Sciences

Funding Source: N/A

Examining the potential for antibiotic biosynthesis with fungal cultures extracted from Red Lake

Fungal biotechnology is an economically important industry encompassing fermentation, isolation of secondary metabolites such as antibiotics, vitamins and immunosuppressants, and DNA recombination technology. Little research has been conducted using aquatic species of fungi, which compete with bacteria during leaf decomposition in streams and lakes. This study would examine fungal cultures already extracted from a small, highly acidic and metal polluted lake that have been shown to inhibit bacterial growth. Standard disk assays with common disease causing bacteria would be used to further assess the antibiotic biosynthesis capabilities. DNA of any potential antibiotic producing species would be extracted and sequenced. Fungal genes which produce antibiotics like Penicillin have already been mapped and many of the proteins involved in the biosynthesis pathways are known. Known and potential antibiotic producing species could be compared using genomic databases such as BLAST to find similar genes for the precursors in antibiotic biosynthesis pathways. The production of other secondary metabolites could be examined in similar fashion, using HPLC as the beginning screen for potential species.

Amber Kreps is a senior in Biological Sciences. She performs research in the Stream Ecology Lab and is a member of Phi Sigma.

David Pohlman

Department: Biological Sciences
Major: Biochemical Engineering
Research Advisors: Dr. David Westenberg and Dr. Katie Shannon
Advisor's Department: Biological Sciences

Funding Source: iGEM

Synthetic Biology Approach to Create a Hybrid Extracellular Supramolecular Machine to Breakdown Free Mycolic Fatty Acids and a Feedback System to Produce a TB Inhibitory Peptide

With the advancement of modern medicine tuberculosis is still causing many deaths around the world. Tuberculosis is caused by a *Mycobacteria tuberculosis* infection that can arise from ingesting or inhaling *M. tuberculosis* tubercle bacilli. The bacteria then take residence within the body, mainly the lungs, causing painful lesions. The body's natural defense to *M. tuberculosis* infections is to ingest the cells by means of endocytes, but all Mycobacterium produce a waxy coating made up of free mycolic fatty acids and the endocytes cannot breakdown the bacteria. I propose to use synthetic biology to create a hybrid protein of the *Clostridium cellulovorans'* cellulosome and the peroxisomal multifunctional – protein 2 to be able to breakdown extracellular free fatty acids that will allow anti – TB drugs and endocytes to stop/kill the infectious bacteria. A feedback system that responds to the degradation of mycolic fatty acids will also be made by synthetic biology. This will was the production and secretion of a stem and loop peptide structure, called lariatins, which have been studied to inhibit mycobacterial growth.

David is a junior in Biochemical Engineering and is the Vice President of the new student design team the International Genetically Engineered Machines team, iGEM.

Logan Sauerbrei

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

Funding Source: N/A

Using Host Microbiota to Study the Development of Diabetes

Investigate the relationship between host microbiota and type one and type two diabetes. Do certain members inside of a microbiota increase the likelihood of developing diabetes? Are similar bacteria in a microbiota responsible for the development of type one and type two diabetes? How do type one diabetes and type two diabetes impact the microbiota? Can we alter the microbiota to influence the severity of diabetes, or to lessen the need for insulin and medication?

Logan is a junior in biological science who has had type one diabetes for five years. He is very interested in the study of the genetics behind autoimmune disorders, and hopes to one day cure type one diabetes.

Zackary Stone

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

Funding Source: N/A

Phytoforensic-Dendrochemistry using NAA Techniques

Plants and trees can tell us the history of a geographic area through their intake from their environment. There have been significant developments in techniques to identify the history of contaminants in plant materials to map out potential pollutant sites. So far, the traditional methods, though successful, are limited in the minimum detection level, MDL, particularly for inorganic or elemental analysis. Neutron Activation Analysis technique has the potential to reduce the MDLs of certain environmental contaminants (inorganic material, metals, etc.) to new levels to assess the extent of present contamination and document pollution history with greater analytic accuracy. NAA is a non-destructive technique where the sample is bombarded with neutrons, transmuting the nucleus of a target atom. The transmuted atom subsequently produces signature emission of gamma radiation. Based upon the spectrum analysis, the elemental composition can be obtained and with proper calibration, quantitative analysis of the elemental composition of the specimen can be calculated. Utilizing Missouri S&T nuclear reactor, we are developing and refining NAA based phytoforensic techniques for several environmentally significant elements like, As, V, Cr, Ni, Zn, and Mo.

Zackary is a senior in Nuclear Engineering at Missouri University of Science and Technology and expects to receive his degree in May 2012. He has already been accepted into the master's program for Nuclear Engineering at MS&T and plans on beginning in the summer of 2012.

Larry Tolliver

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

Funding Source: N/A

The Use of Microbes in the Processing of Radionuclides

The process of bioremediation, using microbes (altered or otherwise) to clean up toxic industrial products or pollutants, is already used for processing of plastics, heavy metals or even radioactive waste. It is known that some microbes can convert soluble radionuclides into insoluble radionuclides, such as the reduction of hexavalent uranium to tetravalent uranium by *Desulfosporosinus spp*. This ability to convert one into another could be useful in cleaning up the waste and pollution from nuclear incidents, like last year's Fukushima disaster. If the genes for these radionuclide-reducing enzymes along with the genes necessary for radiation resistance could be isolated, they could be introduced into another appropriate microbe to create a bacteria specialized for a certain environment. These microbes could also potentially be used to clean up radionuclides other than uranium.

Larry is a senior in Biological Sciences. After graduation he plans to pursue graduate school. In his spare time he enjoys playing baseball and bird watching.

Engineering
Poster Session

Abstracts

Sarah Bey

Department: Civil Environmental and Architectural Engineering
Major: Civil Engineering
Research Advisor: Dr. Ronaldo Luna
Advisor's Department: Civil Environmental and Architectural Engineering

Funding Source: Missouri Society of Professional Engineers (MSPE)

Micropile Load Transfer Monitoring During Construction of Bridge No. 2, Foothills Parkway, TN

The Tennessee Central Foothills Parkway is a 16-mile span of scenic highway that winds around the Smokey Mountains. The project was approved by congress in 1944 and remains incomplete, making it the nation's longest undergoing construction project. Its original approval was tied to the WPA program and was recently restarted as a shovel ready project under the 2009 ARRA initiative. The goal of this research project is to monitor the load transfer and moment distribution in the micro piles used to support the two largest piers of Bridge No. 2 on this steep terrain. The piers are supported on 20-micropiles of (~95-ft length) and tied together by a five-ft thick pile cap. In addition to the superstructure load transfer on the bond zone into rock, the effects of grout hydration on the instrumentation installed in the micro piles were studied. A laboratory sample of the micro pile's cross section was prepared and monitored to observe possible stresses induced during the hydration of the grout. Results are currently being analyzed.

Sarah is currently a senior in the Civil Architectural and Environmental Department, and has been working closely with the Geotechnical Division for two years. Her on-campus activities include Chi Epsilon, ASCE, and KMNR 89.7FM. She is also the Co-founder of the Missouri S&T Women's Ultimate Team.

Andrea Els

Department: Material Science & Engineering
Major: Ceramic Engineering
Research Advisors: Dr. Greg Hilmas & Dr. Bill Fahrenholtz
Advisor's Department: Material Science & Engineering

Funding Source: National Science Foundation under DMR

Effects of Atmosphere on the Pressureless Sintering Behavior of ZrB_2 Ceramics

The effects of atmosphere on the pressureless sintering behavior, microstructure development, and thermal properties of ZrB_2 ceramics were studied. ZrB_2 powders were sintered in a carbon free, refractory metal furnace under controlled atmospheres including helium, hydrogen, nitrogen, mild vacuum (~ 5 Pa) and high vacuum (~5×10^{-3} Pa). The sintering temperatures were varied from 1900°C to 2400°C with hold times ranging from 1 to 4 hours. Sintering in hydrogen resulted in higher weight loss than sintering in helium. Thermodynamic equilibrium calculations indicated that formation of $ZrO_{(g)}$ and $H_2O_{(g)}$ were favorable in the presence of excess $H_{2(g)}$ at temperatures above 1800°C. These vapor species increased in concentration above 2000°C and were removed by the flowing $H_{2(g)}$, which resulted in the observed mass loss increase. No increase in density was observed between the mild vacuum and the high vacuum. Other effects of atmospheric conditions will be discussed such as those on thermal conductivity and microstructure development.

Andrea is a senior in Ceramic Engineering, graduating in May 2012. She will be attending Graduate School at Missouri S&T in Aerospace Engineering in the fall of 2012. Currently she is President and Treasurer of Material Advantage, Co-chair of the Keramos History Committee and planning a trip to Southeast Asia after graduation.

Tommy Goodwin

Joint project with Melissa Buechlein

Department: Environmental Engineering
Major: Environmental Engineering / Biological Sciences
Research Advisor: Dr. Daniel Oerther
Advisor's Department: Environmental Engineering

Funding Source: Mathes Chair of Environmental Engineering

Employing Microbial Source Tracking Tools to Determine the Origin of Fecal Pollution in Missouri Waterways

Abstract: According to the 305(b) report released by the Missouri Department of Natural Resources in 2010, approximately 8% of the total or nearly 2,000 miles of classified streams in the State of Missouri are impaired with bacterial contamination. Approximately 100 miles are impaired due to point source wastewater discharge, and the remaining stream miles are impaired by a combination of non-point sources including agricultural runoff and animal husbandry operations. To determine the origin of bacterial contamination in streams, microbial source tracking tools can be employed. Building upon the prior results of our research team, this study is using 16S rRNA-targeted methods to identify sequence signatures corresponding to likely human fecal contamination as compared to wild life and livestock. These methods are being used to evaluate putative threats to human and environmental health due to bacterial contamination of Missouri streams.

Tommy is a third year student at Missouri University of Science and Technology dual majoring in Environmental Engineering and Biological Sciences with a minor in Chemistry. Tommy wishes to continue with Missouri S&T research and the process of biological remediation with his degree from Missouri S&T. His interests are in the biologically relevant areas of environmental engineering. Tommy is currently a member of Helix (an academic/social biological sciences organization).

Nevan Himmelberg

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

Funding Source: United States Department of Energy

Optimal Wellbore Trajectory and Mud Weight Window Design for Generic Anticline Reservoirs

In this study we investigate the state of stress of a generic anticline reservoir and analyze a variety of parameters such as reservoir geometry, in situ stress regime, and the coefficient of friction between rock layers. We utilize 2D and 3D finite element analysis to map stress magnitudes and orientations in the reservoir and then apply analytical solutions to study conditions for safe and optimized drilling.

We investigate three proposed drilling locations; the crest, limb, and trough of the anticline. The modeled state of stress and associated rock strength parameters then determine the conditions for the safe mud weight window. Based on these windows the optimal well placement and well trajectory can be determined. From the study of the 2D model the stress regime is the biggest factor in determining the optimal wellbore location for vertical wellbores. The viability of deviated and horizontal wellbores is currently being investigated.

Nevan graduated as valedictorian from Glasgow High School in 2008. In the same year he began his undergraduate studies at Missouri University of Science and Technology as a petroleum engineering major. He will graduate in May 2012 with his undergraduate, and will begin graduate school at S&T in the fall of 2012. In April 2010 Nevan began working part time for the United States Geological Survey (USGS) as a hydrologic technician. During his time with the USGS he traveled all across Missouri collecting and recording groundwater data. In March 2011 he resigned from the USGS in order to spend more of his time as an undergraduate research assistant for Dr. Andreas Eckert, where is still currently employed. Nevan spent the summer of 2011 in North Dakota with Continental Resources Inc. as a petroleum engineering intern.

Amanda Holmes

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

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

Seasonal Variation of Contaminant Concentrations *In Planta*

Chlorinated solvents are carcinogens found frequently in the environment. Due to their location in the groundwater, detection and remediation are difficult. As plants have been shown to uptake chlorinated solvents, they have been increasingly used for site remediation and monitoring. Phytoremediation has been found to be cost-effective, easily implemented, and more ecologically friendly when compared to traditional remediation methods. In order to use trees as an effective monitoring and remediation tool, seasonal variations of chlorinated solvent concentrations in trees must be understood. In this research, sampling tools were developed to monitor chlorinated solvents in trees at Schuman Park in Rolla, MO. The proximity to the S&T labs offers a unique testing opportunity. Concentrations in the trees were found to fluctuate seasonally, with higher concentrations observed in the summer when trees were actively transpiring groundwater. Groundwater monitoring using trees holds promise as an ecological solution that is non-invasive. Compared to traditional methods, less water, electricity and equipment are required while less hazardous waste is generated.

Amanda is a freshman at Missouri S&T studying environmental engineering. She is thankful to have had the opportunity to participate in research under Dr. Joel Burken since she was in high school. In addition to research, Amanda is involved in the Chancellor's Leadership Academy, Honors Academy, Global Bridges Club, International Conversation Partners, and is a pre-school Sunday school teacher at her local church. Participating in research at Missouri S&T has been an invaluable experience for Amanda. The chance to apply concepts learned in the classroom to real-world situations has helped her understand science and the world around her on a deeper level.

Gerald Holt

Joint project with Sean Klover, Lucas Laughery and Annelise Smith

Department: Civil, Architectural, and Environmental Engineering
Major: Architectural, Civil, Electrical Engineering, Computer Science
Research Advisor: Dr. Joon-Ho Choi
Advisor's Department: Civil, Architectural, and Environmental Engineering

Funding Source: Environmental Protection Agency

Climate-Responsive Adaptive Control for Natural Ventilation

According to the U.S. Green Building Council and the U.S. Energy Information Administration, 21% of all energy used in the U.S. is for building mechanical systems that provide heating, cooling, and ventilation. On the other hand, building occupants are significantly affected by ambient thermal conditions, as their work productivity and health depend on their thermal satisfaction. Therefore, it is important to use passive strategies for natural cooling and heating to enhance the thermal comfort and minimize the use of mechanical systems. The Climate-Responsive Adaptive Control for Natural Ventilation is a predictive control system that is able to forecast an indoor climate based on real-time data of outdoor conditions, and controls window actuators to use cross ventilation for cooling. Using the Missouri S&T Solar Decathlon House as a testbed, indoor and outdoor conditions are measured and evaluated in order to develop an adaptive control model for actuating operable windows.

Gerald is majoring in Computer Science and Computer Engineering and hopes to work as a software developer after graduation. He is active in the Missouri S&T Miner Marching band, Concert band, and the national honorary band co-ed sorority, Tau Beta Sigma.

Sean Klover

Joint project with Gerald Holt, Lucas Laughery and Annelise Smith

Department:	Civil, Architectural, and Environmental Engineering
Major:	Architectural, Civil, Electrical Engineering, Computer Science
Research Advisor:	Dr. Joon-Ho Choi
Advisor's Department:	Civil, Architectural, and Environmental Engineering
Funding Source:	Environmental Protection Agency

Climate-Responsive Adaptive Control for Natural Ventilation

According to the U.S. Green Building Council and the U.S. Energy Information Administration, 21% of all energy used in the U.S. is for building mechanical systems that provide heating, cooling, and ventilation. On the other hand, building occupants are significantly affected by ambient thermal conditions, as their work productivity and health depend on their thermal satisfaction. Therefore, it is important to use passive strategies for natural cooling and heating to enhance the thermal comfort and minimize the use of mechanical systems. The Climate-Responsive Adaptive Control for Natural Ventilation is a predictive control system that is able to forecast an indoor climate based on real-time data of outdoor conditions, and controls window actuators to use cross ventilation for cooling. Using the Missouri S&T Solar Decathlon House as a testbed, indoor and outdoor conditions are measured and evaluated in order to develop an adaptive control model for actuating operable windows.

Sean is majoring in Computer Engineering. His interests include computer systems, VLSI chip design, and neural networks. He will attend the University of Central Florida in August 2012 to pursue a Master of Science degree in Computer Engineering.

Alexander Korff

Department: Civil, Architectural & Environmental Engineering
Major: Environmental Engineering
Research Advisor: Dr. Daniel Oerther
Advisor's Department: Civil, Architectural & Environmental Engineering

Funding Source: John A. and Susan Mathes Chair

Improving the Performance of Drinking Water Filters for Developing Countries

According to the United Nations, approximately 1/6th of the worlds population lacks access to adequate drinking water supplies resulting in 2.2 million deaths annually. Biosand filtration has been shown in laboratory and field studies to be a cost effective means of improving the microbiological quality of drinking water in developing countries. Unfortunately, in the poorest regions the costs to construct biosand filters remains prohibitive due to the lack of appropriate building materials needed to construct a sand bed with a minimum height of 46 cm. The purpose of this project is to explore alternative designs for biosand filters that effectively utilize the available resources in the poorest regions to improve access to safe drinking water. Fluid modeling was used to analyze potential modifications and experimental models were used to test concepts.

Alexander is an Environmental Engineering junior at Missouri S&T. He attended Fulton High School and is expecting to graduate from Missouri S&T in spring of 2014. Alex has been involved in several organizations, including leadership positions in Kappa Mu Epsilon, Phi Eta Sigma, and Kappa Sigma Fraternity. He plans on attending graduate school after obtaining his Bachelor's degree.

Lucas Laughery

Joint project with Gerald Holt, Sean Klover and Annelise Smith

Department:	Civil, Architectural, and Environmental Engineering
Major:	Architectural, Civil, Electrical Engineering, Computer Science
Research Advisor:	Dr. Joon-Ho Choi
Advisor's Department:	Civil, Architectural, and Environmental Engineering
Funding Source:	Environmental Protection Agency

Climate-Responsive Adaptive Control for Natural Ventilation

According to the U.S. Green Building Council and the U.S. Energy Information Administration, 21% of all energy used in the U.S. is for building mechanical systems that provide heating, cooling, and ventilation. On the other hand, building occupants are significantly affected by ambient thermal conditions, as their work productivity and health depend on their thermal satisfaction. Therefore, it is important to use passive strategies for natural cooling and heating to enhance the thermal comfort and minimize the use of mechanical systems. The Climate-Responsive Adaptive Control for Natural Ventilation is a predictive control system that is able to forecast an indoor climate based on real-time data of outdoor conditions, and controls window actuators to use cross ventilation for cooling. Using the Missouri S&T Solar Decathlon House as a testbed, indoor and outdoor conditions are measured and evaluated in order to develop an adaptive control model for actuating operable windows.

Lucas is majoring in Civil and Architectural Engineering. His interests include smart building systems, passive solar design, and FRP reinforced concrete. Lucas expects to graduate in May 2012 before attending graduate school.

Samuel Murphy

Joint project with James Weeks and Robert Zedric

Department: Mining and Nuclear Engineering
Major: Nuclear Engineering
Research Advisor: Dr. Carlos H Castano
Advisor's Department: Mining and Nuclear Engineering

Funding Sources: Nuclear Regulatory Commission grant NRC-38-10-966
Mining and Nuclear Engineering Department

Production of Samarium Nanoparticles by Gamma Irradiation

Samarium nanoparticles were created in a solution of water and isopropyl alcohol using an intense radiation source. A cobalt-60 source irradiated samples containing Sm^{3+} ions with a 10 kGy/hr dose rate. Radicals formed reduced the Sm^{3+} ions to neutral atoms. These coalesced into spherical clusters. A polymer surfactant called polyvinylpyrrolidone (PVP) was added to regulate nanoparticle growth.

Nanoparticles were observed on a scanning transmission electron microscope. Using a solution irradiated to 40 kGy consisting of 0.15 mM PVP and 0.10 mM Sm^{3+}, the average diameter was 201.9 nm, the mode was 149.3 nm, and the standard deviation was 83.7. 230 particles were observed and particles smaller than 50 nm were not included. Energy-dispersive X-ray spectroscopy confirmed the particles were samarium.

Solutions of nanoparticles that had received radiation doses ranging from 10 kGy to 40 kGy were measured. Higher doses produce smaller, spherical particles. Lower doses produce larger, jagged particles.

Samuel is a senior at Missouri S&T majoring in Nuclear Engineering. He graduates in December 2012.

Charlene Ruwwe

Department: Chemical and Biological Engineering
Major: Chemical Engineering: Bio-emphasis
Research Advisor: Dr. Muthanna Al-Dahhan
Advisor's Department: Chemical and Biological Engineering

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

Optimization of Growth Parameters in a Tubular Photobioreactor

In this project, a tubular photobioreactor was constructed following the guidelines and modeling equations found in the thesis "Mathematical Modeling for Photobioreactor Design" by Xiaoxi Wu. This reactor and theory were used to map and understand the growth rates, and consequently, oil and/or desired gene production of the algae in relation to incident light. Some factors were altered in the processes for finding the optimum growth parameters and for achieving proper fluid flow, structural support, and lighting. These factors include, but are not limited to, light to dark ratio, Carbon dioxide concentration, lighting type, and flow direction. The initial testing was performed with the freshwater algae species, *Scenedesmus quadricauda*. Moreover, this process can also be applied to any single-celled or micro- algae species in such a way as to reduce the time and effort needed to learn how to efficiently grow each species in any type of desired photobioreactor.

Charlene is a non-traditional senior majoring in both the Chemical Engineering: Bio-emphasis and the Biological Sciences programs. She is a married mother of one that aspires to attain a PhD in Chemical Engineering with an emphasis in pharmaceutical delivery systems. Charlene would like to run a research and development lab for a large-scale pharmaceutical company. She hopes to find a solution for the treatment of viruses and to serve as an inspiration and a role model for her son.

Husain Shekhani

Department: Mechanical Engineering
Major: Mechanical Engineering
Research Advisor: Dr. Daniel Stutts
Advisor's Department: Mechanical Engineering

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

The Effect of a Localized Mass Non-Uniformity on a Longitudinally Vibrating Piezoelectric Rod

This paper describes the effects of a localized (point)-mass non-uniformity located arbitrarily on a longitudinally vibrating piezoelectric rod. The point-mass non-uniformity is accounted for using the receptance method. Expressions for the natural frequencies, modes, and the forced solution for the non-uniform rod and corresponding impedance are developed in closed form. The model is experimentally verified using impedance data from piezoelectric rods with attached concentrated masses. Methods for back-calculating the location of the point-mass using the experimental impedance trace are also described. The modeling approach detailed in this paper is potentially useful in the design of piezoelectric transformers and health monitoring of piezoelectric sensors and devices, as well as other piezoelectric devices.

Husain was born in Karachi, Pakistan and soon after moved to the United States with his parents. He currently resides in the St. Louis area. This May he will be graduating with a B.S. degree in Mechanical Engineering from Missouri S&T with emphasis in mechanical vibration. After graduation, he will pursue a doctorate degree in Electrical Engineering at Penn State. He serves a volunteer leader at the university's local mosque.

Annelise Smith

Joint project with Gerald Holt, Sean Klover and Lucas Laughery

Department: Civil, Architectural, and Environmental Engineering
Major: Architectural, Civil, Electrical Engineering, Computer Science
Research Advisor: Dr. Joon-Ho Choi
Advisor's Department: Civil, Architectural, and Environmental Engineering

Funding Source: Environmental Protection Agency

Climate-Responsive Adaptive Control for Natural Ventilation

According to the U.S. Green Building Council and the U.S. Energy Information Administration, 21% of all energy used in the U.S. is for building mechanical systems that provide heating, cooling, and ventilation. On the other hand, building occupants are significantly affected by ambient thermal conditions, as their work productivity and health depend on their thermal satisfaction. Therefore, it is important to use passive strategies for natural cooling and heating to enhance the thermal comfort and minimize the use of mechanical systems. The Climate-Responsive Adaptive Control for Natural Ventilation is a predictive control system that is able to forecast an indoor climate based on real-time data of outdoor conditions, and controls window actuators to use cross ventilation for cooling. Using the Missouri S&T Solar Decathlon House as a testbed, indoor and outdoor conditions are measured and evaluated in order to develop an adaptive control model for actuating operable windows.

Annelise is majoring in Civil and Architectural Engineering. Her interests include HVAC, passive solar design, LEED, and economic analysis. Annelise expects to graduate in May 2012 before beginning mechanical consulting work in St. Louis.

Jason Stumfoll

Department: Mechanical and Aerospace Engineering
Major: Aerospace Engineering
Research Advisor: Dr. Joshua Rovey
Advisor's Department: Mechanical and Aerospace Engineering

Funding Sources: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
Mechanical and Aerospace Engineering Department

Demonstration of Plasma Actuators as Active Flow Control Devices

Active flow control is an area of intense research in the aerospace community. Single Dielectric Barrier Discharge (SDBD) plasma actuators are a recent development that shows potential as a solution to replace large mechanical systems with low power electrical systems. Plasma actuators have been shown to improve the efficiency and reduce noise on aircraft systems, eliminate flow separation, and increase the stall angle of attack, both experimentally and computationally. Computer simulations previously performed by S&T students were experimentally tested by constructing a wind tunnel model capable of demonstrating various Teflon and Kapton based plasma actuators at differing model locations. Lift and drag characteristics were measured and shown to improve with the introduction of plasma, and flow reattachment was demonstrated using smoke flow visualization in the Subsonic Wind Tunnel at S&T. This experiment will be used in future aerospace class demonstrations as an undergraduate laboratory exercise.

Jason, from Springfield, Missouri, will graduate in May 2012 with his Bachelor of Science degree in Aerospace Engineering. Jason has been an active member on the Missouri Satellite Team, helping to complete the design of the team's nano-satellite for the Air Force Research Lab's Nanosat-7 program, and is a member of the Advanced Aero Vehicle Group, serving as the team's design lead for the NASA University Student Launch Initiative competition for the 2011-2012 year. He will be continuing his education at S&T in the coming fall, pursuing a Master of Science degree in Aerospace Engineering, with a focus on Aerodynamics and Propulsion.

Albrion Symonette

Department: Civil, Architectural and Environmental Engineering
Major: Civil Engineering
Research Advisor: Dr. Stuart Baur
Advisor's Department: Civil, Architectural and Environmental Engineering

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

Thermal Optimization by Energy Modeling of a Passively Solar Residential Design System –Trombe Wall Using Water Barrel

Aspects of the building passive solar design such as the placement, sizing and type of fenestration, thermal massing and shading are influential in the performance of Missouri S&T's Solar House at the 2013 Solar Decathlon. This research focused on the use of trombe wall design using water barrels as a thermal mass. Using computer generated models the trombe wall design was analyzed to provide an estimated performance analysis in terms of energy savings.

Based on preliminary analysis and review of other similar case studies the energy savings generated from this type of system was approximately 5-10% for our regional climate. Other case studies yielded higher energy savings. It is anticipated that this research will aid the Missouri S&T solar house team in finalizing their building design and additionally provide information about passive strategies that would help engineers, architects and consumers.

Albrion grew up in the Bahamas. His interest in engineering was the result of seeing the design of structures that were resilient to al various weather conditions especially hurricanes. With his involvement in the solar house project he particular grew more interested in designing and building structures that not only withstood hurricanes but are also energy-efficient. He is planning to take his experiences from Missouri University of Science and Technology back to his home.

James Weeks

Joint project with Samuel Murphy and Robert Zedric

Department: Mining and Nuclear Engineering
Major: Nuclear Engineering
Research Advisor: Dr. Carlos H Castano
Advisor's Department: Mining and Nuclear Engineering

Funding Sources: Nuclear Regulatory Commission grant NRC-38-10-966
Mining and Nuclear Engineering Department

Production of Samarium Nanoparticles by Gamma Irradiation

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Solutions of nanoparticles that had received radiation doses ranging from 10 kGy to 40 kGy were measured. Higher doses produce smaller, spherical particles. Lower doses produce larger, jagged particles.

James is a senior at Missouri S&T majoring in Nuclear Engineering with minors in Business and Mathematics. He is actively involved in several groups on campus including Student Activity Finance Board and as a leader with the Wesley Campus Ministry. He graduates in May 2012 and will pursue a Masters in Explosives Engineering.

Robert Zedric

Joint project with Samuel Murphy and James Weeks

Department: Mining and Nuclear Engineering
Major: Nuclear Engineering
Research Advisor: Dr. Carlos H Castano
Advisor's Department: Mining and Nuclear Engineering

Funding Sources: Nuclear Regulatory Commission grant NRC-38-10-966
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Robert is a senior at Missouri S&T majoring in Nuclear Engineering with a minor in Mathematics. He is actively involved in several societies on campus including the national engineering honor society Tau Beta Pi. He graduates in May 2012 and will pursue a Ph.D. in nuclear science.

Social Sciences
Poster Session

Abstracts

Amber Julien

Department: Psychological Science
Major: Psychology
Research Advisor: Dr. Dee Montgomery
Advisor's Department: Psychological Science

Funding Source: Curator's Teaching Professorship Funds

S&T Male and Female STEM majors: Experiences with Discrimination and Adjustment

This predictive study assessed experiences of discrimination reported by undergraduate STEM majors at S&T (with a 4:1 male to female ratio) and possible relationships with academic, social and personal adjustment as well as academic performance. Participants provided information about their sex, age, year in school, and GPA, and completed widely used measures of discrimination and adaptation to college. For females, significant relationships were found between experiences of Degradation and poorer Personal-Emotional Adjustment *(r* = -.55*, p* < .0001); and between discrimination in School/Work Settings and lower Academic Adjustment *(r* = -.62, *p* < .0001) as well as lower GPA's *(r* = -.69, *p* < .0001). For males, experiences of discrimination in Relationships was negatively associated with poorer Social Adjustment *(r* = -.46, *p* < .001). These results found that students who thought they had been treated unfairly showed power adjustment to areas most directly related to their experiences.

Amber is a sophomore at the Missouri University of Science and Technology. She is a Psychology major with a minor in Writing. Amber is from a military family and has grown up moving around the country. Her future career goal is to become a Licensed Clinical Social Worker and to go to back to school for her PhD in Clinical Psychology. Amber is currently a Research Assistant for Dr. Henslee and studies college student drinking. She also researched male and female STEM majors and how they dealt with discrimination and adjustment. Amber is currently the Secretary of PsyCo, which is a club for Psychology majors and other individuals wanting to learn about Psychology and be involved on campus. Her hobbies include writing, painting, and listening to music. Amber enjoys working with people and wants to continue doing so in her future career.

Montana J. Puckett

Department: Environmental Engineering
Major: Civil Engineering
Research Advisor: Dr. Daniel Oerther
Advisor's Department: Environmental Engineering

Funding Source: Mathes Chair of Environmental Engineering

PulaCloud Research

The PulaCloud platform as a business model abstract: the purpose of PulaCloud is to alleviate poverty worldwide. According to the World Bank, international poverty is defined as a daily income below $1.25. In 2010, studies confirmed that there are over 1.4 billion people living in poverty. While direct aid can be a beneficial approach to alleviate poverty, our research team is pursing the alternative hypothesis that poverty alleviation is best achieved through the creation of high paying jobs that provide income and dignity. PulaCloud provides income through jobs performing microtask via the internet. A microtask is the smallest uniquely separable computational task that can be completed by any human being but are difficult for computers to process efficiently. An example of a microtask is transcribing a hand written survey to a standard digital format. Estimates indicate that mirotasking produces $10 billion of income annually. This research project is developing PulaCloud as an information technology platform to complete microtasks in rural Missouri and villages in developing countries as a practical solution for those in poverty.

Montana moved to Missouri at the age of 10 and started his college career at Missouri S&T in 2008. Montana is a senior in the Civil engineering department graduating in December of 2012. He has also been an Air Force ROTC cadet his entire college career. Through AFROTC he will graduate as a 2nd Lieutenant in the USAF.

Lee Voth-Gaeddert

Joint project with Montana Puckett

Department: Civil, Geotechnical and Environmental Engineering
Major: Civil Engineering
Research Advisor: Dr. Daniel Oerther
Advisor's Department: Environmental Engineering

Funding Source: Mathes Chair of Environmental Engineering

Growing the Crowd of Users for Microtask Platforms With the Goal of Alleviating Poverty

Microtasks are short simple tasks that almost any human being can perform but a computer program cannot. These types of tasks are available online through several different mediums. The objective of this research project is to grow the crowd of users engaged in microtasks in rural Missouri and in villages in developing countries. An initial step in this process has been the creation of MSTWorks.org, a website and marketing campaign designed to specifically grow the number of microtask workers in Phelps County region. Current microtask platforms provide opportunities to earn minimum wage, and linking unemployed and underemployed individuals with self-paced, work-from-anywhere jobs through the internet promises to improve access to income with the additional anticipated benefits of improved wellness and reduced criminal tendencies.

Lee is a senior Civil Engineering major who will graduate next December. His focus will most likely be in environmental engineering. After graduating Lee wants to focus on helping people in third world countries. This will most likely include missionary work hopefully based in Africa. He also wants to pursue his Emergency Medical Technician license and possibly a paramedic degree. Although the first thing on his plate is seeing how far his baseball career can take him. He will be playing for a Professional Independent baseball team this summer in hopes of getting a chance to play for an affiliated team. Lee grew up in Hesston, KS and attended Hesston High School where he played football, basketball, and ran track. He signed to play football for Bethel College and did that in the fall of 2008 before transferring at semester to Hesston College to play baseball. This was then repeated for the next year transferring again. Finally, after his sophomore year he signed to play baseball with Missouri University of Science and Technology. Both of his first two colleges where Mennonite Colleges and he is deeply rooted in his faith. His goal in life is to help people no matter what the cost and a degree in Civil Engineering and doing research for Dr. Oerther has him right where he wants to be.