Apr 8th, 2009

5th Annual Undergraduate Research Conference Abstract Book

Missouri University of Science and Technology

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5th Annual
Undergraduate Research Conference

April 8, 2009
Missouri S&T - Havener Center

CONFERENCE AGENDA

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Chancellor John F. Carney
Vice Provost Harvest L. Collier
(St. Pat’s B)</td></tr>
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<tr><td>12:00 pm – 1:00 pm</td><td colspan="4">Luncheon & Keynote Address

Wayne Huebner, Ph.D., P.E.
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<tr><td rowspan="2">1:00 pm – 3:00 pm</td><td colspan="4">Concurrent Oral Sessions</td></tr>
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(St. Pat’s A & Miner Lounge)</td></tr>
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(St. Pat’s B)</td></tr>
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- **OURE Faculty Fellows Proposal Review:** 9:00 am – 12:00 pm, (Meramec room)
- **Judges Conference Rooms -** (Mark Twain conference room and Walnut room)

Oral Presentations

Engineering Oral Session		
Name	**Department**	**Time/Location**
Justin Aholt	Mechanical & Aerospace Engineering	9:00-9:30 AM – Ozark Room
Imowo Akpan	Geological Sciences & Engineering	9:30-10:00 AM – Ozark Room
Yezad Anklesaria	Mechanical & Aerospace Engineering	10:00-10:30 AM – Ozark Room
Ryan Arlitt	Interdisciplinary Engineering	10:30-11:00 AM – Ozark Room
Lisa Battern	Interdisciplinary Engineering	10:30-11:00 AM – Gasconade Room
Brandi Clark	Civil, Architectural & Environmental Engineering	9:00- 9:30 AM – Gasconade Room
David Erdos	Electrical & Computer Engineering	9:30-10:00 AM – Gasconade Room
Cory Gassner	Electrical & Computer Engineering	10:00-10:30 AM – Gasconade Room
Bryan Glass	Interdisciplinary Engineering	10:30-11:00 AM – Gasconade Room
Steven McDonald	Mechanical & Aerospace Engineering	10:00-10:30 AM – Ozark Room
Joe Schaefer	Interdisciplinary Engineering	10:30-11:00 AM – Gasconade Room

Sciences Oral Session		
Name	**Department**	**Time/Location**
Navarre Bartz	Chemistry	9:00-9:30 AM – Carver Room
Stuart Brune	Biological Sciences	9:30-10:00 AM – Carver Room
Brian Catron	Chemistry	10:00-10:30 AM – Carver Room
Beth Groenke	Interdisciplinary Engineering	9:00-9:30 AM – Turner Room
Matthew Mitchell	Computer Science	9:30-10:00 AM – Turner Room
Katherine Stockstill	Biological Sciences	10:00-10:30 AM – Turner Room

Social Sciences Oral Session		
Name	**Department**	**Time/Location**
Lindsey Coale	Psychology	1:00 – 1:30 PM – Carver Room

Arts and Humanities Oral Session		
Name	**Department**	**Time/Location**
Amanda Kamps	History & Political Science	1:30 – 2:00 PM – Carver Room
Jonathan Kampunzu	English & Technical Communication	2:00 – 2:30 PM – Carver Room
Adam Smith	History & Political Science	2:30 – 3:00 PM – Carver Room

Poster Presentations

Sciences Poster Session		
Name	**Department**	**Time/Location**
Jeffrey Bender	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Danielle Bowles-Martin	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Michelle Brosnahan	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Cassandra Browne	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Regina Callaway	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Nathan Carter	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Cory Cheatham	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Mark Dunseith	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Matthew Entrekin	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
Adam Farquhar	Physics	9:00 - 11:45 AM – Upper Atrium/Hallway
Spencer Garr	Physics	9:00 - 11:45 AM – Upper Atrium/Hallway
Brian Goldman	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
Casey Growcock	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Eric Hallstrom	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Marcus Hayer	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Thuydung Huynh	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Joseph Karas	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Rachel Klapper	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Jason Mast	Physics	9:00 - 11:45 AM – Upper Atrium/Hallway
Martin McPhail	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Megan Oldroyd	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Brian Pink	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
April Rocha	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Christopher Roush	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
Melinda Rushing	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Ashley Shockley	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Erin Sind	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Timothy Smiley	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Patrick Stanley	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Joseph Stansbery	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Michael Stockwell	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Patrick VerSteeg	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Barbara Wheelden	Biological Sciences	9:00 - 11:45 AM – Upper Atrium/Hallway
Alan Windhausen	Chemistry	9:00 - 11:45 AM – Upper Atrium/Hallway
Christopher Zacher	Geological Sciences & Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway

Poster Presentations (Cont.)

Arts and Humanities Poster Session		
Name	**Department**	**Time/Location**
Melissa Callan	Psychology	1:00 - 3:00 PM – Upper Atrium/Hallway

Engineering Poster Session		
Name	**Department**	**Time/Location**
John Bartow	Chemical & Biological Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Morgan Boresi	Chemical & Biological Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Kyle Borgmann	Materials Science & Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
William Cacheris	Mechanical & Aerospace Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Jesse Cross	Electrical & Computer Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Abbe Doering	Materials Science & Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Brandon Doherty	Mechanical & Aerospace Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Andrew Heckman	Mechanical & Aerospace Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Nick Jarnagin	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Shixiang Jia	Electrical & Computer Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Lucas McIntosh	Chemical & Biological Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Jonathan McKinney	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Ryan Miller	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Roger Rettig	Materials Science & Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Sarah Seigfreid	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Lucas Sudkamp	Civil, Architectural & Environmental Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Christopher White	Mechanical & Aerospace Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway

Poster Presentations (Cont.)

Research Proposal Poster Session		
Name	**Department**	**Time/Location**
Angela Hundt	Psychology	1:00 - 3:00 PM – Upper Atrium/Hallway
Kelly Walsh	Chemistry	1:00 - 3:00 PM – Upper Atrium/Hallway

Social Sciences Poster Session		
Name	**Department**	**Time/Location**
Adam Bussmann	History & Political Science	1:00 - 3:00 PM – Upper Atrium/Hallway
Jasmine Glaese	Computer Science	1:00 - 3:00 PM – Upper Atrium/Hallway
Janet Guntly	Computer Science	1:00 - 3:00 PM – Upper Atrium/Hallway
Charissa Mathis	Computer Science	1:00 - 3:00 PM – Upper Atrium/Hallway
Lindsay Roufa	Psychology	1:00 - 3:00 PM – Upper Atrium/Hallway

Keynote Speaker

Wayne Huebner
Ceramic Engineering ’82, ‘87

Chairman, Materials Science and Engineering
Missouri S&T

Dr. Wayne Huebner is a Professor of Ceramic Engineering, and the Chairman of the Materials Science and Engineering Department at the Missouri University of Science and Technology in Rolla, Missouri. He is an alumnus of UMR, having received his B.S. in 1982 and Ph.D. in 1987. He began his academic career as an Assistant Professor at the Pennsylvania State University, and moved back to UMR in 1991. The author of over 85 papers, monographs and book chapters, he has been actively involved in the preparation and characterization of electronic ceramics. Much of his research is focused on the use of dielectrics, ionic & mixed conductors, piezoelectrics, electrostrictive materials for multilayer capacitors, solid oxide fuel cells, gas separation membranes, and phased linear array transducers for intravascular imaging. He has graduated 9 Ph.D. students and 14 M.S. students. Huebner has received UMR's Faculty Excellence Award five times, the Outstanding Teacher Award four times, and was named the Outstanding Faculty Member in Ceramic Engineering five consecutive years. In 1994 he received the Karl Schwartzwalder Professional Achievement in Ceramic Engineering Award, given to the nation’s Outstanding Young Ceramic Engineer. He is a member of the Academy of the School of Mines and Metallurgy, and an Honorary Knight of St. Patrick. He has been a continuous member of the Electronics Division of American Ceramic Society since 1983, serving in many capacities including all offices of the Ceramic Educational Council, an organizer of various symposia, and Associate Editor of the Journal of the ACS.

Conference Judges

The Office of Undergraduate Studies wishes to thank the following faculty & staff for their valuable contributions to the 5th Annual Missouri S&T Undergraduate Research Conference.

Diana L. Ahmad
Ralph Alexander
Bonnie Bachman
Joel Burken
Harvest Collier
Nuran Ercal
Stephen Gao
Larry Gragg
David Henthorn
David Hoiness
Matt Insall
Irina Ivliyeva
Jonathan Kimball
Merilee Krueger
Ray Luechtefeld
Kelly Liu
Dee Montgomery
Prakash Reddy
Joshua Rovey
Jeff Schramm
Bijaya Shrestha
Bob Schwartz
Nancy Stone
Daniel Tauritz
Klaus Woelk

Thank You!

Engineering
Oral Session

Abstracts

Justin Aholt

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

Funding Source: NASA-Missouri Space Grant Consortium

Influence of Laminar Separation Bubbles on the Aerodynamic Characteristics of Elliptical Airfoils at Low Reynolds Numbers

This work was a computational study of the effects of laminar separation bubbles on a 16 percent thick elliptical airfoil at a 10 degree angle of attack and Reynolds numbers ranging from 60,000 to 2 million. In this study, computational fluid dynamics (CFD) was employed to characterize the effects of decreasing Reynolds numbers on bubble size, the airfoil's pressure coefficient plot, and the airfoil's lift, drag, and aerodynamic efficiency. The separation bubble was found to appear at Reynolds numbers less than or equal to 600,000. This bubble is capable of generating a marginal boost in lift at Reynolds numbers around 200,000, but at a large drag penalty. At Reynolds numbers below 200,000, the bubble has an adverse effect on the natural pressure peak of the airfoil, negating the bubble's positive effects. While the separation bubble produces a noticeable increase in lift, it does not improve aerodynamic efficiency.

Justin Aholt was born in Washington Missouri and is a graduate of St. Francis Borgia Regional High School. He is currently a junior majoring in Aerospace Engineering. Upon completion of his Bachelor's Degree, he intends to pursue an advanced degree in the field of Aerodynamics.

Imowo Celestine Akpan

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

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

Comparison of Rock Strength Predictions for Well Applications from Geological and Geophysical Information

Numerous correlations exist to determine rock strength of various lithologies. Rock strength information is used in the prediction of in-situ rock behavior and allows for proper determination of casing design, perforation zones and in the stability of formations. However, almost all of the correlations developed are site specific and applications in fields outside the sampled area are questionable and unguaranteed. As such, there is no field wide accepted correlation used to determine rock strength. This research focused on first identifying formation specific correlations and applying a statistical approach to determine expected rock strength. Effects of various lithological combinations were established. The methods were applied to an actual field case in the Mid-Alberta basin in an attempt to ascertain its accuracy.

Imowo Akpan is a post-baccalaureate student presently a senior in the Petroleum Engineering. He acquired his first degree in chemical engineering from the University of Port-Harcourt, Nigeria and worked in the Oil and Gas industry with ExxonMobil Nigeria over 5 years before deciding to advance his educational career.

Yezad Anklesaria

Joint project with Steve McDonald

Department: Mechanical & Aerospace Engineering
Major: Aerospace Engineering
Research Advisor: Dr. H. Pernicka
Advisor's Department: Mechanical & Aerospace Engineering

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

Design of the Docking System for the Missouri Satellite Project

The Missouri Satellite team (M-SAT) is working toward the design and launch of a microsatellite pair that explores the dynamics of autonomous close formation flight. The securing and release of the satellite pair is mission-critical, creating a need to design a dependable separation system. The objective of this research is to develop a low-cost separation system that is successful in securing and deploying the spacecraft, while meeting the many design and team constraints. A trade study was used in an interdisciplinary approach to facilitate the identification of a balanced selection of a release mechanism using numerical representations of the design criteria. A Separation Interface was then designed for the chosen mechanism. These results are a key milestone in the M-SAT design process and are an example of how careful selection of a release mechanism and robust structural analysis can yield a low-cost alternative to typical high-cost separation methods.

Yezad Anklesaria holds a degree in mechanical engineering with a two year experience in design and development of products in industry. His experiences are in shop floor management, forklift design & most recently unmanned aerial vehicle design.

Ryan Arlitt

Department: Interdisciplinary Engineering
Major: Interdisciplinary Engineering
Research Advisor: Dr. Katie Grantham-Lough
Advisor's Department: Interdisciplinary Engineering

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

Experimental Module Creation for Forensic Engineering Education

Experimental modules were researched and created for use in a future Applied Design of Experiments course in the Interdisciplinary Engineering Department's developing Forensic Engineering Track. Five modules were pursued, with three showing promise for use in a lecture/laboratory course. An experimental module testing cricket chirping rate as a predictor of temperature was developed, tested, and shows promise. A module for detecting residue on currency was pursued and discovered to exist in classroom-ready form at another university. Creation of a module for testing the feasibility and properties of an ice projectile was deemed unfeasible for this application in the face of cost and safety issues. A preexisting module involving solar panels was tested and refined, and a newly created earthquake engineering module succeeded in a middle school setting but fell short of suitability for college use.

Ryan Arlitt is a senior in the Interdisciplinary Engineering department. He is the son of Michael and Christine Arlitt from Houston, Texas. This is his second foray into research, with the first being population and analysis of the Design Repository. His future plans include the pursuit of a master's degree in Systems Engineering.

Lisa Battern

Joint project with Bryan Glass and Joseph Schaefer

Department:	Electrical and Computer Engineering
Major:	Electrical Engineering
Research Advisors:	Dr. Robert Stone, Dr. Katie Grantham Lough and Dr. Stuart Baur
Advisor's Department:	Interdisciplinary Engineering

Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Fellows Program Environmental Protection Agency, Department of Energy

Smart Building Systems in Residential Solar Applications

Chameleon is a residential automation system dedicated to the combination of energy efficiency and convenience. The system employs a series of automated applications including lighting, HVAC, home entertainment, appliance control, and phantom load reduction. The integration of these systems influences a net energy gain.

A network of sensors will be installed throughout the residence to provide pertinent information to the control system. Chameleon will then use this data to execute the desired actions in the most energy efficient manner. The system will include all conventional controls and will be seamlessly integrated, but will also feature a dedicated user interface. The interface will allow input of the resident's preferences; the system will also be controllable via the internet.

In addition to providing convenience to the resident, the system will save a significant amount of energy. While traditional systems expend energy to provide convenience, Chameleon will have a positive impact on both aspects.

Lisa Battern is a senior in Electrical Engineering and plans to graduate in May 2009. Throughout her time in college, she has become very involved in the campus. She is a member of Eta Kappa Nu, Tau Beta Pi, Kappa Mu Epsilon, Institute of Electrical and Electronic Engineers, and the Solar House Team. She has held officer positions in three of those five organizations. Originally from St. Louis, Lisa plans to return there to start a job with Anheuser-Busch Packaging Group in June.

Brandi Clark

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Jianmin Wang
Advisor's Department: Civil, Architectural, & Environmental Engineering

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

Determination of Mercury in Baby Formula Purchased from U.S. Supermarkets

The toxic effect of mercury (Hg) in high doses has been known since the first century A.D.; however, only in recent years has low-level mercury exposure been cited as a possible contributing factor for behavioral and developmental disorders such as autism and ADD. In light of this new evidence, all possible routes of mercury exposure for infants should be assessed. In this study, the concentration of mercury in twenty baby formula types, representing all four major US brands, was measured to determine the contribution of food consumption to infant mercury exposure. Mercury levels in all samples fell below the EPA drinking water limit when compared to prepared formula concentrations. Mercury concentration was found to be correlated to formula brand but not to formula type (milk-based versus soy-based).

Brandi Clark is a fourth year undergraduate student studying in the Chemistry department. This presentation marks the completion of her third year conducting undergraduate research in the OURE program. Her current research interests are environmental and analytical chemistry, and she plans to enter a graduate program in Environmental Engineering after completion of her undergraduate degree.

David Erdos

Department: Electrical and Computer Engineering
Major: Electrical Engineering
Research Advisor: Dr. Steve Watkins
Advisor's Department: Electrical and Computer Engineering

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
IEEE (Institute of Electrical and Electronics Engineers)
AESS (Aerospace and Electronic Systems Society)

Design of UAV System Architecture

The development and final system architecture of the Missouri S&T AESS UAV Team UAV is described. The project follows the guidelines for the 2008 UAV Challenge – Outback Rescue which is an international aerospace competition held in Kingaroy, Australia. The design of the electrical subsystems and the overall architecture of the UAV is described. The selected systems are integrated into a standard hobby remote control aircraft and configured for autonomous flight and navigation and image acquisition.

David Erdos is a senior undergraduate majoring in Electrical Engineering and plans to graduate in May 2009. He is the former President of the Missouri S&T Student Chapter of AESS and the Missouri S&T UAV Team.

Cory Gassner

Department: Electrical and Computer Engineering
Major: Computer Engineering
Research Advisor: Dr. Bijaya Shrestha
Advisor's Department: Electrical and Computer Engineering

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

Automating the Detection of Atypical Pigment Network Using Texture Segmentation

A software program called CVIPtools is used to calculate texture features in skin lesion images with the goal of finding atypical pigment networks in these images. The atypical pigment network is a critical feature in attempting to diagnose melanoma versus benign nevus from an image. Using CVIPtools is a long and arduous process. New software was developed to automate this laborious process. The software uses a map to segment an image for atypical pigment networks. The segmented image would mark the areas with and without atypical pigment networks. The results of the automated process are identical to CVIPtool's results when using grayscale images, and only 1-5% different when using a color image as the input.

Cory Gassner completed his primary and secondary education in Jefferson City, MO. He is currently working on his Bachelor's degree in Computer. He worked as an Undergraduate Research Assistant with the DERMVIS group of skin cancer research from August 2008 to April 2009.

Bryan Glass

Joint project with Lisa Battern and Joseph Schaefer

Department:	Electrical and Computer Engineering
Major:	Computer Engineering
Research Advisors:	Dr. Robert Stone, Dr. Katie Grantham Lough and Dr. Stuart Baur
Advisor's Department:	Interdisciplinary Engineering

Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Fellows Program Environmental Protection Agency, Department of Energy

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Bryan Glass is a third year student in Computer. He is a member of the Show-Me Solar House Team and is one of the leaders of the team's automation group. This is his second project through the OURE program at Missouri S&T. Bryan is also the founder of the Missouri S&T Racquetball Club, a member of Delta Sigma Phi Fraternity, a member of IEEE, and a voting member of the Student Activities Finance Board. He has spent the past two summers working for GE Transportation's Validation Engineering Group.

Steve McDonald

Joint project with Yezad Anklesaria

Department:	Mechanical & Aerospace Engineering
Major:	Aerospace Engineering
Research Advisor:	Dr. H. Pernicka
Advisor's Department:	Mechanical & Aerospace Engineering

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

Design of the Docking System for the Missouri Satellite Project

The Missouri Satellite team (M-SAT) is working toward the design and launch of a microsatellite pair that explores the dynamics of autonomous close formation flight. The securing and release of the satellite pair is mission-critical, creating a need to design a dependable separation system. The objective of this research is to develop a low-cost separation system that is successful in securing and deploying the spacecraft, while meeting the many design and team constraints. A trade study was used in an interdisciplinary approach to facilitate the identification of a balanced selection of a release mechanism using numerical representations of the design criteria. A Separation Interface was then designed for the chosen mechanism. These results are a key milestone in the M-SAT design process and are an example of how careful selection of a release mechanism and robust structural analysis can yield a low-cost alternative to typical high-cost separation methods.

Steve McDonald has experience from a research course taken during the spring of 2007 at Missouri State University. His research included, among others, a persuasive research paper regarding former president Bush's plan for space exploration, a research paper on the accuracy of the film Apollo 13, a research paper on the struggle in Darfur, and an annotated bibliography and bibliographical essay on Rocketdyne's linear aerospike engine.

Joseph Schaefer

Joint project with Lisa Battern and Bryan Glass

Department:	Electrical and Computer Engineering
Major:	Electrical Engineering
Research Advisors:	Dr. Robert Stone, Dr. Katie Grantham Lough and Dr. Stuart Baur
Advisor's Department:	Interdisciplinary Engineering

Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Fellows Program Environmental Protection Agency, Department of Energy

Smart Building Systems in Residential Solar Applications

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Joseph Schaefer is a senior in Electrical Engineering. Since 2004, he has been involved with the Solar House Design Team designing electrical and automation systems. As president of the Institute of Electrical and Electronics Engineers (IEEE) student branch, the branch received the Most Active Student Branch award from IEEE-St. Louis. He has also had co-op and intern experiences with Anheuser-Busch and General Electric. In June, Joseph plans to begin working for Kiewit Power Engineers in Lenexa, KS.

Sciences
Oral Session

Abstracts

Navarre Bartz

Department: Materials Science and Engineering
Major: Ceramic Engineering
Research Advisor: Dr. Jay Switzer
Advisor's Department: Chemistry

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

Electrodeposition of a Novel Cathode Material for Lithium-ion Batteries

The electrodeposition of monoclinic birnessite ($Na_{0.55}Mn_2O_4*1.5H_2O$) of space group C2/m was investigated as a possible route for production of a high charge and discharge rate battery material. Scanning electron microscopy, energy dispersive spectroscopy, and x-ray diffraction data were taken to determine the morphology and chemical nature of the deposited material. It was determined that electrodeposition was useful for making a uniform film of birnessite on a stainless steel substrate.

Navarre Bartz is currently a fourth year undergraduate student in the Department of Materials Science and Engineering. He has been interested in battery technology since he was introduced to it his first semester in Rolla by the Solar Car Team. Since then he has worked on numerous energy material research projects covering thermoelectrics, supercapacitors, and batteries. He hopes to obtain a Ph.D. in Materials Science, and become a professor with an emphasis in energy material research.

Stuart Brune

Department: Biological Sciences
Major: Biological Sciences
Research Advisors: Dr. Nathan Chen and Dr. Dev Niyogi
Advisor's Department: Biological Sciences

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

Algae for Biodiesel: Investigation of Enhanced Lipid Biosynthesis during Nitrogen Starvation

The limited productivity of algal cultures in the production of lipids for bio-fuel is the most significant bottleneck for the commercialization of this new alternative energy technology. In order to increase algal productivity, the effects of environmental conditions and nitrogen starvation on the accumulation of lipids and triglycerides in *Chlorella* cells was investigated. *Chlorella* was chosen because it produces lipids as food reserves that are ideal for bio-diesel production. Many *Chlorella* species can increase their lipid content from 20% of their dry weight when grown in nutrient-sufficient conditions to more than 40% after nitrogen depletion. The two strains chosen for this investigation were *Chlorella minutissima* and *Chlorella desiccata.* It was first found that Chlorella grew most effectively at 25°C and under high levels of light. Multiple methods of cell extraction and lipid extraction were employed due to significant losses. It was then found that there is an increase in lipid content in both *Chlorella* species when placed under nitrogen starvation. This was confirmed through the use of fluorescence microscopy and electron microscopy. The findings from this research will be used to further the bio-energy initiative at Missouri University of Science and Technology.

Stuart Brune is a senior pursuing a B.S. in Biological Sciences with a minor in Chemistry. He is a resident of Chesterfield, MO in St. Louis County and graduated in 2005 from Marquette High School. Stuart is a member of the MS&T's IGEM (International Genetically Engineered Machine) team, Helix biological science club, and is the current Vice-President of the Phi Sigma Biological Science Honors Society. He is also a Missouri "Bright Flight" scholarship recipient. After graduation Stuart is planning to attend graduate school to pursue a PhD in Molecular and Cellular Biology.

Brian Catron

Department: Missouri S&T Center of Excellence
Major: Aerospace Engineering
Research Advisors: Dr. Philip D. Whitefield, Dr. Donald E. Hagen and Dr.Nuran Ercal
Advisor's Department: Chemistry and Physics

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

Heath Impacts of Aviation Emissions
The Development of Lung Deposition Parameters for Aircraft Generated Particulate Matter

A first of its kind study to create a process for better understanding of the health impacts of aircraft generated particulate matter when doing airport impact studies using the IRCP model for particulate deposition in the human respiratory tract. With the affects of fuel type and engine operating condition along with atmospheric conditions have on the deposition of particulates in the human respiratory tract.

Brian Catron is pursuing a degree in Aerospace Engineering. Shortly after starting school at Missouri S&T, Brian got involved with the Center of Excellence for Aerospace Particulate Matter Reduction Research to get some experience in the aerospace industry and get some hands on experience with various propulsion systems.

Beth Groenke

Department: Interdisciplinary Engineering
Major: Interdisciplinary Engineering
Research Advisor: Dr. Douglas Carroll
Advisor's Department: Interdisciplinary Engineering

Funding Source: Private Contributions from Dr. Douglas Carroll and Dr. Bill Moorkamp

In Vitro Development of Dental Abfractions

Abfraction is a relatively new concept in dentistry, and there is still debate as to whether or not it even exists. What is accepted is that lesions can develop near the cervical areas of some teeth, broadly defined as non-carious cervical lesions (NCCLs). One possible cause of these lesions may be dental abfraction. Those that accept the theory of abfraction believe that tensile and compressive forces placed on the teeth from non-axial, cyclical loading over an individual's lifetime cause the breakdown of the microstructure of the teeth, which can lead to the NCCL, also sometimes known as an abfraction. In this study, non-axial, cyclical loading was applied to an intact permanent maxillary first premolar. SEM images from the control and experimental teeth indicate that the experimental tooth experienced more wear, from the compressive forces, at the microscopic level than the control tooth. This evidence supports the theory of dental abfraction.

Beth Groenke is a senior in Interdisciplinary Engineering with a biomedical emphasis. Beth is the daughter of David and Sharon Groenke of Gerald, MO. She will graduate with honors in May before beginning dental school at the University of Missouri – Kansas City in August. Beth has been an active member of the S&T campus community since her freshmen year, including a term as Student Body President from 2007-2008. This, however, is Beth's first venture into the world of research.

Matthew Mitchell

Department: Computer Science
Major: Computer Science
Research Advisor: Dr. Bruce McMillin
Advisor's Department: Computer Science

Funding Source: NSF Grant

FACTS Device Communication

This paper concerns the implementation of a communication protocol for reliable data transfer between an embedded computer (EPC) and a digital signal processor (DSP) included in a Flexible A/C Transmission System device. The purpose of this implementation is to mitigate gaps in communication between the EPC and DSP, which utilizes a control area network bus. The researcher implemented a verified communication protocol that was previously defined; this protocol used sequence numbers, which are cyclic, to uniquely identify groups of messages from one state to the next. This paper shows that the resulting code meets the previous specifications, and particulars for real-time timing and reliability. This paper also provides plans for further improvement of the protocol based upon these results.

Matthew Mitchell is a sophomore majoring in Computer Science. He began his research for Dr. McMillin at the end of his freshman year and has since been working in the FACTS Interaction Laboratory. He is currently the treasurer for a social fraternity, Delta Sigma Phi, and the Missouri S&T Rugby Club. For the 2008-2009 school year, Matthew has been a resident assistant at the Thomas Jefferson residential complex. He is also a DJ trainee at KMNR, a new member of the Blue Key Honor Society and a new member of the St. Pat's Celebration Committee.

Katherine Stockstill

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

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

Cytokinesis Defects in Budding Yeast

Budding yeast are a very good research organism, because they are similar to humans in many ways. One of the research opportunities with budding yeast is that there are many genes that are uncharacterized, and it is not known what their cellular function is or what their functional role is. There are also many genes that are affected by phosphorylation, one such gene is HOF1. Hof1 is phosphorylated during mitosis and results have shown that a Hof1 mutant without a PEST domain affects Hof1-GFP dynamics during cytokinesis. It has also been shown that deletion of the PEST domain may prevent phosphorylation of Hof1 (Blondel et al., 2005). Cytokinesis is the division of a cell into two daughter cells. Our research lab is interested in cytokinesis, because cytokinesis defects can lead to polyploidy in the cell. This defect can lead to cancer or cell death.

KatherineStockstill is a graduating senior majoring in Biological Sciences. On campus, Katherine is member Kappa Delta Sorority, Helix, and Phi Sigma. She also has an OURE for her research in the Cytokinesis Lab. Katherine is also a waitress at Applebee's. After graduation Katherine is planning on going onto graduate school, where she will pursue a master's degree.

Social Sciences
Oral Session

Abstracts

Lindsey Coale

Department: Psychology
Major: Psychology
Research Advisor: Dr. Julie Patock-Peckham
Advisor's Department: Psychology

Funding Source: Faculty Start-up Funds

Confirmatory factor analysis on the Perceived Parental Neglect Scale (PPNS)

Parental neglect denotes parents failing to provide physical or emotional needs for their children (Centers for Disease Control and Prevention [CDC], 2008). This study examined if there was a one factor solution to the remaining items on the Perceived Parental Neglect Scale (PPNS) utilizing a confirmatory factor analysis. Discriminate validity to other negative parenting scales (e.g. rejection, overprotection) was also examined. Questionnaires regarding parental bonding, alcohol-related problems, pathological reasons for drinking, control over-drinking, and parental neglect were administrated to 316 college students. Correlation coefficients explored the strengths of relationships among the variables. The findings revealed a one factor solution fit for the seven remaining items on the PPNS. Additional results revealed discriminate validity between PPNS and other negative parental bonds.

Lindsey Coale is a senior majoring in Psychology. She is the daughter of Dwayne and Darla Backer from Mokane, MO. Lindsey is currently serving as the Historian of Psi Chi (psychology honor society). She is also a member of Phi Kappa Phi. Lindsey has worked and participated in research at the Fulton State Hospital. In addition, she volunteers at the Tri-County Humane Society and the Phelps County Community Partnership. Lindsey plans on pursuing a career in Clinical Psychology.

Arts and Humanities
Oral Session

Abstracts

Amanda Kamps

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

Relationships? I've Had a Few: A Brief Look at Benjamin Siegel's Reputation in Las Vegas

Images of car chases, code words, and cold-hearted killers quickly spring to mind when discussing the mobsters of the 1930s and '40s. But, in looking at one particularly ruthless killer, Benjamin Siegel, the evidence suggests that perhaps these mobsters are mythologized into darker men then they really were. Focusing on the latter half of Siegel's life, when he spent his time in Las Vegas, one can evaluate his relationships with the community, and discern that perhaps the gambling town served as a respite, a place for once evil-men to start over. Legitimacy was, no doubt, difficult to obtain after a life of breaking the law, but in the case of Siegel, Las Vegas became a safe haven, where men could be judged for their actions while in the town, not their past.

Amanda Kamps is currently a senior and is completing her B.A. in History. She graduated from Waynesville High School in 2005 as Valedictorian. Her research at Missouri S&T has included primary source reviews of Moe Dalitz and Bugsy Siegel and their involvement in Las Vegas, as well as George Mivart's role in Darwinian Evolution. In the future she hopes to pursue a career in the military museums as a Collections Manager.

Jonathan Kampunzu

Department: Business and Information Technology
Major: Business and Management Systems
Research Advisor: Dr. Kate Drowne
Advisor's Department: English and Technical Communication

The 1920s Flapper in Public Opinion

Most of the results obtained during the research were newspaper articles from the 1920s concerning the flapper culture of that decade. The majority of the material comes from the New York Times archives, and the rest from archives of multiple other newspapers. As the title of this paper suggests, the flapper phenomenon was a rather polarizing one, and as such, research yielded articles both strongly in support of, and strongly condemning flapper lifestyle. However, findings obtained earlier on in the study suggested that the story of the Flapper is a much more layered one than has been suggested by the modern media.

Jonathan Kampunzu is a senior in Business and Management Systems. After graduating in May 09, he plans to take a year off, then attend law school. He is currently Vice-President of the Blue Key Honor Society, a Board Member of the Associated Students of the University of Missouri, and President of the Missouri S&T chapter of the Sigma Chi Fraternity.

Adam Smith

Department: History and Political Science
Major: History
Research Advisor: Dr. Michael Bruening
Advisor's Department: History and Political Science

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

Depictions of Aeneas in the Underworld during the Renaissance and Reformation

This study examines depictions of Aeneas, the legendary character from Virgil's *Aeneid*, in the Underworld during the Renaissance and Reformation. The analysis of these depictions focuses on the motivations of the authors for producing their works. Works of the authors are grouped into three main categories: fiction, translations of book VI of the *Aeneid* and artwork. Several motivational factors existed for these authors, but the mainly consisted of religion and politics. A brief summary of the surrounding circumstances in which the authors wrote is provided and shows how the authors factored them into their work.

Adam Smith is a junior History major and Economics minor from Buffalo, Minnesota. In addition to his research, he is involved with several campus organizations such as History Club, Lutheran Student Fellowship and the Show-Me Solar House Team. He has recently been invited to join the Missouri S&T section of Phi Alpha Theta, the history honor fraternity.

Sciences
Poster Session

Abstracts

Jeffrey Bender

Joint project with Melinda Rushing

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

Funding Source: Geo 401 Adv. Structural Geology

Mountain Building Processes: Insights from Analog Models

Strain distribution within the crust during continental collision can be visualized using "sandbox experiments". We investigated the affect of a weak ductile layer and variation in lithostatic load on crustal deformation during compression. The control experiment consisted of dry sand with horizontal marker layers subjected to compression by shortening the sandbox length. Thrust faults and folds developed beneath a thickening sand wedge. Successive experiments included weak ductile layers (all purpose-flour) and varied the lithostatic load to mimic conditions found in the Himalayas. Results suggest that faults in the rigid strata initially are steeper and more numerous than those in the ductile strata. As shortening increases dip angles become similar. Antithetic faulting occurs in experiments where a ductile layering was present. We suggest that mechanical strength properties and thickness of strata (e.g., weak/strong) has a significant impact on the number and dip angle of thrust faults formed during compressional "mountain-building" events.

Jeff Bender is currently an undergraduate student in Geophysics. His primary emphasis area is exploration geophysics/seismology. Anticipated graduation is May 2010.

Danielle Bowles-Martin

Department: Chemistry
Major: Chemical Engineering
Research Advisors: Dr. Rachadaporn Seemamahannop and Dr. Shubhender Kapila
Advisor's Department: Chemistry

Funding Source: Bureau of Mines- Center for Environmental Science and Technology

Jathropha Curcas: The New Bio-Diesel Source for the 21st Century

Developing alternatives to replace depleting fossil fuels has emerged as a pressing issue in the recent years. As a result attention is focused on non-food or feed crops, one potential crop is *Jatropha curcas*.

Jatropha curcas is a plant that grows in tropical regions and requires little water for growth thus conserving water and its beans are a good source of oil. The oil content of Jatropha bean is double the oil content of soybeans. Jatropha beans are not a suitable for food or feed because of the presence of toxins known as the phorbol esters. Biodiesel production can be made highly favorable if a process can be developed which render the protein rich Jatropha bean meal suitable as feed.

I am developing a process that would produce toxin free Jatropha meal and biodiesel. Results obtained show that a toxin free bio-diesel and Jatropha meal can be produced using a simple three step process that involve dehulling, sequential extraction and transesterification.

Danielle Bowles-Martin was born and raised in St. Louis, Mo. She grew up in the inner city and attended Gateway Institute of Gateway High School. Danielle is currently a sophomore where she is pursuing her undergraduate degrees in Chemical Engineering and Materials Engineering. Her future plans are to graduate from Missouri S&T and work with consumer goods or in the petroleum industry.

Michelle Brosnahan

Joint project with Marcus Hayer and Patrick VerSteeg

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

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

A Synthetic Biology Approach to Microbial Fuel Cell Development

Optimization of electron shuffle to external surfaces such as anodes was a primary goal. Geobacter sulfurreducens happened to be our model bacteria due to its ability in nature to efficiently export electrons extracelluarly. E. coli was the chassis for this experiment due to its genome already containing some key proteins in our preferred pathway. The proteins, such as extracellular pilin, MacA, and many other cytochromes, which E. coli does not have were isolated from Geobacter sulfurreducens and introduced into E. coli to formulate the most optimal pathway for generating electronmotive force in a microbial fuel cell apparatus.

Some problems were faced concerning plasmid engineering and the simple fact that Geobacter is anaerobic and E. coli is aerobic. The current work includes production and optimization of a microbial fuel cell into which our modified bacteria will be placed.

Michelle Brosnahan is a junior. While at the university she has served as a section editor for the RollaMo yearbook. She is in the Biology department and has been involved in the Honor Societies of Phi Sigma, and Alpha Chi Sigma. She has also been involved in Scrubs, Helix, Student Council, WISE, and various other campus activities.

Cassandra Browne

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

Funding Source: Geological Sciences & Engineering

Sandbox Experiments as Analogues for Continental Rifts: Investigation of the Impact of Rock Strength in Extensional Stress Regimes.

Experimental sandbox analogs are an effective method for researching incremental strain at the scale of the continental crust. We investigate the role of rock strength on the nascent stages of continental rifts, such as the East African Rift. The 1st experiment, using only sand, developed horst and grabens as a result of normal faulting. The 2nd experiment included a strong stiff layer and strain was localized along steeply dipping normal faults and by block rotation. The 3rd experiment included a weak layer that progressively thinned (ductile faulting). The 4th experiment modeled a stiffer upper crust overlying a deeper ductile layer. Deformation in the upper crust occurred through a combination of fracturing, faulting, and block rotation. These faults merged into the thinning ductile layer. The results demonstrate that rock strength variation within the crust impacts both the mechanisms and distribution of strain throughout continental crust undergoing extension.

Cassandra Browne is an undergraduate student in the department of Geology.

Gina Callaway

Joint project with Mark Dunseith

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

Funding Source: Geological Sciences and Engineering

Sandbox Modeling of Continent-Continent Type Collisions with Underlying Basement Structures

When continents collide, the earth's crust shortens and thickens by thrust faulting in a mountain building event. We investigated the effect of preexisting basement structures (old faults) on development of thrust faults in the cover rocks during collision using a "sandbox" with clear sides and a movable wall. Alternating beds of colored sand representing sedimentary cover rocks were layered over rigid wood blocks representing igneous/metamorphic basement rocks. The wooden blocks included 30˚ cuts to emulate preexisting basement faults. The moveable wall was used to horizontally shorten the model and imitate continent-continent collision. Reactivation of basement faults initiated faults in the cover that localized the strain in the growing wedge. The angles and spacing of pre-existing basement structures were seen to directly control thrust fault propagation in the "cover rocks" as well as the wedge thickness (i.e., height of the mountain range) of the system as it was compressed.

Gina Callaway is a Missouri native from Jefferson City. She transferred to Missouri S&T in the summer of 2006. She became a Geology and Geophysics major late in fall 2006. She will graduate in May 2009 with her bachelor of science and begin work in late summer with Southwest Energy in Fayetville, Arkansas.

Nathaniel J. Carter

Department: Chemical and Biological Engineering
Major: Chemical Engineering
Research Advisor: Dr. Klaus Woelk
Advisor's Department: Chemistry

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

Catalytic Effects on the Hydrothermal Conversion of Biomass

This project studied the effects different concentrations of deuterium chloride (DCl), deuterium iodide (DI) and sodium chloride (NaCl) catalysts on the yields of desirable 5-hydroxymethylfurfural (5-HMF) and undesirable levulinic acid (LA) in the hydrothermal carbonization of glucose. Solutions of catalyst, glucose, and heavy water (D_2O) were heated in a pressure vessel at 150°C for 24 hours, and every six hours samples were drawn from the solutions, filtered, and analyzed by H-NMR spectroscopy to determine the relative amounts of 5-HMF and LA present. The glucose in these experiments was a model for raw biomass.

Nathan Carter is a junior in the Chemical and Biological Engineering Department and is working toward a Bachelor's degree in Chemical Engineering. He joined Dr. Woelk's research group in January 2007, and his work has been included in several presentations at both national and international conferences. He delivered one such presentation himself at the National Collegiate Honors Council Conference in Denver, CO, in November 2007. He is also involved in a research project under Dr. David Henthorn in the Chemical and Biological Engineering Department. After graduating from Missouri S&T in May 2010 with a bachelor's degree in chemical engineering, Nathan plans to enroll in a doctoral graduate program in chemical engineering.

Cory Cheatham

Joint project with Rachel Klapper and Brian Pink

Department:	Biological Sciences
Major:	Biological Sciences and Chemistry
Research Advisors:	Dr. Katie Shannon and Dr. Dave Westenberg
Advisor's Department:	Biological Sciences

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

Constructing an Ethanol Sensor

In *Pichia pastoris*, alcohol oxidase (AOX) is the first enzyme in the methanol utilization pathway. This enzyme is encoded by the AOXI gene. If exposed to an environment containing both methanol and ethanol, *P. pastoris* preferentially metabolizes ethanol. The production of the AOX enzyme is subject to the concentration of ethanol. This diauxic metabolism may be utilized as an ethanol sensor. When the AOXI promoter is fused with a gene encoding a fluorescent protein, the activation of the AOXI promoter may be detected by direct observation of fluorescence. Our project is the development of a device containing the AOXI promoter fused with a fluorescent protein gene to create an inexpensive ethanol sensor for a variety of applications. The concentration of ethanol in the environment may be deduced from the time period between exposure of the microorganism carrying the device to ethanol and methanol, until the detection of fluorescence.

Cory Cheatham is a senior majoring in Biological Sciences and Chemistry. His current goal is to attend medical school in hopes of becoming a doctor one day.

Mark Dunseith

Joint project with Gina Callaway

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

Funding Source: Geological Sciences and Engineering

Sandbox Modeling of Continent-Continent Type Collisions with Underlying Basement Structures

When continents collide, the earth's crust shortens and thickens by thrust faulting in a mountain building event. We investigated the effect of preexisting basement structures (old faults) on development of thrust faults in the cover rocks during collision using a "sandbox" with clear sides and a movable wall. Alternating beds of colored sand representing sedimentary cover rocks were layered over rigid wood blocks representing igneous/metamorphic basement rocks. The wooden blocks included 30˚ cuts to emulate preexisting basement faults. The moveable wall was used to horizontally shorten the model and imitate continent-continent collision. Reactivation of basement faults initiated faults in the cover that localized the strain in the growing wedge. The angles and spacing of pre-existing basement structures were seen to directly control thrust fault propagation in the "cover rocks" as well as the wedge thickness (i.e., height of the mountain range) of the system as it was compressed.

Mark Dunseith is from Moberly, Missouri. He began attending Missouri S&T in the fall of 2004. He will graduate in May 2009 with his BS in Geology and Geophysics. He plans to begin working as soon as possible after graduation and is looking forward to a career with a lot of travel opportunities.

Matthew Entrekin

Joint project with Brian Goldman and Christopher Roush

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

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

Evolutionary Algorithm Software Factory

Evolutionary Algorithms (EAs) have shown great promise in solving complex real-world problems, such as typically found in manufacturing and transportation. There is a great lack of a standardized, thoroughly documented, and continuously maintained open-source research community resource containing industry quality implementations of the field's classic and state-of-the-art algorithms. This project takes the first steps in providing this resource by creating a web-based software factory for EAs which takes as input an algorithm specification, and provides as output the associated source code in multiple programming languages. Pseudo-code for all the included EAs as well as links to the seminal papers in which those algorithms were published. This project will benefit researchers, educators, as well as practitioners that use EAs by providing a single resource to obtain standardized EA implementations.

Matthew Entrekin is a junior studying Computer Science and Applied Mathematics. He grew up in Belleville, Illinois under his parents Steve and Jo Ann and his older sister Katie. In his spare time, he enjoys mentoring and teaching high school students at church, as well as playing racquetball and table tennis.

Adam Farquhar

Joint project with Jason Mast

Department: Physics
Major: Physics
Research Advisor: Dr. Thomas Vojta
Advisor's Department: Physics

Funding Source: NSF

Infinite-Randomness Critical Point in the Two-Dimensional Disordered Contact Process

We study the nonequilibrium phase transition in the two-dimensional contact process on a randomly diluted lattice by means of large-scale Monte Carlo simulations for times up to 10^{10} and system sizes up to 8000×8000 sites. Our data provide strong evidence for the transition being controlled by an exotic infinite-randomness critical point with activated (exponential) dynamical scaling. We calculate the critical exponents of the transition and find them to be universal, i.e., independent of disorder strength. The Griffiths region between the clean and the dirty critical points exhibits power-law dynamical scaling with continuously varying exponents. We discuss the generality of our findings and relate them to a broader theory of rare region effects at phase transitions with quenched disorder. Our results are of importance beyond absorbing state transitions because, according to a strong-disorder renormalization group analysis, our transition belongs to the universality class of the two-dimensional random transverse-field Ising model.

Adam Farquhar is a sophomore pursuing his B.S. in Physics. He is involved with the Society of Physics Students and is serving as president of the organization this semester. In addition to conducting research, he also works at RadioShack.

Spencer Garr

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

Funding Source: National Science Foundation

Guiding of Molecular Ions by a Capillary Insulator

An insulator charges up when exposed to charged particles. It has been shown that this can be used to guide beams of electrons and ions through micron and nanometer diameter capillaries in various insulators. Also, the direction of these beams can be changed by several degrees by rotating the capillary and millimeter diameter beams can be reduced to micron diameters by using tapered capillaries. This is because the beams are guided after they charge the inside surface of the capillary. This charge then repels the ions such that they follow the capillary direction. We are investigating this using molecular, rather than atomic, ions. Thus far we have transmitted beams through an insulating capillary, plus shown that they follow the capillary direction and the molecules don't break apart. The next step is to measure their energies after they exit plus the intensity change with degree of rotation.

Spencer Garr is currently a junior in the Aerospace Engineering department. He is working in a physics lab simply because he was interested and had an opportunity to do so. This is the first time he has ever worked in a lab of this kind. Most of the work he has done has been on a farm since that is where he grew up. Eventually he would like to work in research dealing with space travel, including the research into faster than light travel.

Brian Goldman

Joint project with Matthew Entrekin and Christopher Roush

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

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

Evolutionary Algorithm Software Factory

Evolutionary Algorithms (EAs) have shown great promise in solving complex real-world problems, such as typically found in manufacturing and transportation. There is a great lack of a standardized, thoroughly documented, and continuously maintained open-source research community resource containing industry quality implementations of the field's classic and state-of-the-art algorithms. This project takes the first steps in providing this resource by creating a web-based software factory for EAs which takes as input an algorithm specification, and provides as output the associated source code in multiple programming languages. Pseudo-code for all the included EAs as well as links to the seminal papers in which those algorithms were published. This project will benefit researchers, educators, as well as practitioners that use EAs by providing a single resource to obtain standardized EA implementations.

Brian Goldman was born and raised in an unincorporated suburb of St. Louis, Missouri. He is currently a student of Computer Science with junior credit standing. His main focus in schooling is in the field of artificial intelligence and machine learning. In the future he plans to continue schooling, most likely in the hopes of attaining a PHD.

C. Anna Growcock

Joint project with Barbara Wheelden

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

Funding Source: Missouri S&T cDNA Resource Center

Nitric Oxide Increases Calcium Oscillations in Response to Muscarinic Receptor Stimulation

The effect of NO on calcium oscillations elicited by low concentrations of a muscarinic agonist in CHO cells stably transfected with the gene for the human M3 receptor. Nitric oxide's targets include several synaptic receptor-mediated signaling processes. Agonist stimulation of M3 muscarinic acetylcholine receptors leads to release Ca^{2+} into the cytosol; this depletion of calcium stores stimulates calcium influx. At near threshold agonist concentrations, a cyclical release and re-uptake of calcium from intracellular stores (calcium oscillations) is the predominant response. Calcium influx was eliminated by the use of calcium-free medium; fura-2 fluorescence was used to quantify cytosolic calcium concentration; carbamylcholine was used to activate muscarinic receptors; nitric oxide was provided by varying concentrations of S-nitrosylglutathione (SNG) before measuring muscarinic responses. Calcium release from intracellular stores was characterized by carbamylcholine sensitivity, maximum initial response, and the presence, amplitude and decay of calcium oscillations. Pretreatment with nitric oxide donor decreased the amplitude of the initial Ca^{2+} peak by ≈15%, but increased the proportion of cells displaying oscillatory behavior from <10% to >90%. The threshold for the elicitation of Ca^{2+} responses by carbamylcholine increased, consistent with a NO-mediated subsensitivity. The average delay in the manifestation of the Ca^{2+} response increased markedly from 5.3 sec to 8.0 and 12.2 sec in the presence of 4.3 and 8.5 mM SNG, respectively. Nitric oxide modulates the ability of M3 muscarinic receptors to activate calcium signaling pathways as indicated by an enhanced development of calcium oscillations. These changes may reflect changes in the potency of the muscarinic ligand.

Anna Growcock plans on attending graduate school and pursue her doctorate in neurobiology. She participates in Scrubs, Joe's P.E.E.R.S. and coaches the local USA Swim team.

Eric Hallstrom

Department: Chemistry
Major: Ceramic Engineering
Research Advisor: Dr. Manashi Nath
Advisor's Department: Chemistry

Funding Source: MRC Student Support

Nanostructures of Functional Borides Made By Innovative Methods

Borides are important compounds in the materials chemistry world due to their interesting properties. Many boride compounds like LaB_6 are well-known for their high electron emissivity, while other compounds like MgB_2 exhibit superconductivity. Recently it has been suggested that binary borides like osmium boride or rhenium boride might be among the hardest materials known. As the dimensions of any solid are reduced to the nano scale, the surface to volume ratio is highly enhanced. The increased surface area in the nano-structured geometry makes them especially useful in devices where the functional surface area of the solid plays a critical role. The boride nano-structures are expected to show greatly enhanced properties and hence, the generation of boride nano-structures using simple and innovative routes is the current interest of this research. Some preliminary results obtained from synthesis routes involving solution-mediated hot-injection technique for the systems, LaB_6, MgB_2 and nickel boride would be presented.

Eric Hallstrom is currently in his second year of the Ceramic Engineering program. Involved in undergraduate research with Dr. Manashi Nath in the Chemistry Department, Eric is interested in nanomaterials chemistry and producing nano-structured morphologies of boride compounds.

Marcus Hayer

Joint project with Michelle Brosnahan and Patrick VerSteeg

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

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

A Synthetic Biology Approach to Microbial Fuel Cell Development

Optimization of electron shuffle to external surfaces such as anodes was a primary goal. Geobacter sulfurreducens happened to be our model bacteria due to its ability in nature to efficiently export electrons extracelluarly. E. coli was the chassis for this experiment due to its genome already containing some key proteins in our preferred pathway. The proteins, such as extracellular pilin, MacA, and many other cytochromes, which E. coli does not have were isolated from Geobacter sulfurreducens and introduced into E. coli to formulate the most optimal pathway for generating electronmotive force in a microbial fuel cell apparatus.

Some problems were faced concerning plasmid engineering and the simple fact that Geobacter is anaerobic and E. coli is aerobic. The current work includes production and optimization of a microbial fuel cell into which our modified bacteria will be placed.

Marcus Hayer is currently a junior. While at the university he has worked for the Office of Admissions and on formulating bioactive glass constructs. His department is Chemical and Biological Engineering and his honors include: Phi Kappa Phi, Tau Beta Pi, Omega Chi Epsilon, Kappa Mu Epsilon, Phi Sigma, and Phi Eta Sigma.

Thuydung Huynh

Department: Chemical Engineering
Major: Chemical Engineering
Research Advisor: Dr. Manashi Nath
Advisor's Department: Chemistry

Nanotubes and Nanowires of Metal Thiophosphates

Layered metal chalcophosphates with the empirical formula, MPQ_3 where, M is a main group element or transition metal, and Q is a chalcogen, forms a family of semiconductors, where the layers are held together by weak van der Waals forces. These materials have enjoyed considerable attention owing to their potential applications as cathode materials for secondary batteries, ion-exchange applications, ferroelectric materials, non-linear optically active materials, photomagnetic composite materials and so on. Li metal can be incorporated into these compounds very easily either by electrochemical Li intercalation or by ion-exchange reactions. $Li_xNi_{1-x}PS_3$ is already being used as cathode material in some room temperature batteries. The main goal of this project is to synthesize and characterize the growth of thiophosphate nanotubes and nanowires mainly by employing hydrothermal growth techniques. Some initial synthesis strategies for growing these thiophosphate nanowires and nanotubes would be discussed along with some preliminary data.

Thuydung Huynh came to the United States with her family in November 1995 and stayed in Kansas City, Missouri since. She has two sisters and one brother. She's a junior at Missouri S&T and is currently working toward majoring in Chemical Engineering.

Joseph Karas

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

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

Regulation of Actomyosin Ring Formation in Budding Yeast

Our research lab is interested in cytokinesis, the division of a cell into two daughter cells. Cytokinesis failure results in polyploidy, which may contribute to tumorigenesis or cause cell death.

My research project is focused on IQG1. IQG1 is a protein required for cytokinesis in budding yeast. IQG1 is necessary to recruit actin to the actomyosin ring at the division site during M phase. I have tested the hypothesis that overexpression of IQG1 can promote premature actin ring formation. Using a strain with IQG1 under control of the inducible GAL1 promoter, cells were synchronized using □ factor, fixed at numerous time points as cells progress through mitosis, and stained for actin to determine the timing of actin ring formation. My data does not show premature actin ring formation as a result of IQG1 overexpression. An alternative hypothesis is that actin ring formation is regulated by Mlc1. Mlc1 is a myosin light chain that binds IQG1 and is required for IQG1 localization. I am currently creating a strain overexpressing Mlc1 to test this hypothesis.

Joseph Karas is a senior Biological Sciences major from Chicago, IL. He has worked for a year in Dr. Shannon's cytokinesis lab. Joe has also worked during the summer as an industrial chemist. Joe was on the Missouri S&T Cross country team and worked for the school newspaper.

Rachel Klapper

Joint project with Cory Cheatham, Brian Pink and Jackie Schneider

Department:	Biological Sciences
Major:	Biological Sciences and Chemistry
Research Advisors:	Dr. Katie Shannon and Dr. Dave Westenberg
Advisor's Department:	Biological Sciences

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

Constructing an Ethanol Sensor

In *Pichia pastoris*, alcohol oxidase (AOX) is the first enzyme in the methanol utilization pathway. This enzyme is encoded by the AOXI gene. If exposed to an environment containing both methanol and ethanol, *P. pastoris* preferentially metabolizes ethanol. The production of the AOX enzyme is subject to the concentration of ethanol. This diauxic metabolism may be utilized as an ethanol sensor. When the AOXI promoter is fused with a gene encoding a fluorescent protein, the activation of the AOXI promoter may be detected by direct observation of fluorescence. Our project is the development of a device containing the AOXI promoter fused with a fluorescent protein gene to create an inexpensive ethanol sensor for a variety of applications. The concentration of ethanol in the environment may be deduced from the time period between exposure of the microorganism carrying the device to ethanol and methanol, until the detection of fluorescence.

Rachel Klapper is a senior majoring in Chemical Engineering. She plans on attending graduate school this fall in Biotechnology Engineering.

Jason Mast

Joint project with Adam Farquhar

Department: Physics
Major: Physics
Research Advisor: Dr. Thomas Vojta
Advisor's Department: Physics

Funding Source: NSF

Infinite-Randomness Critical Point in the Two-Dimensional Disordered Contact Process

We study nonequilibrium phase transition in the 2D contact process on a randomly diluted lattice by means of large-scale Monte-Carlo simulations for long times and system sizes up to 8000×8000 sites. Our data provide strong evidence for the transition being controlled by an infinite-randomness critical point with activated dynamical scaling. We calculate the critical exponents of the transition and find them to be universal, i.e., independent of disorder strength. The Griffiths region between the clean and the dirty critical points exhibits power-law dynamical scaling with continuously varying exponents. We discuss the generality of our findings and relate them to a broader theory of rare region effects at phase transitions with quenched disorder. Our results are of importance beyond absorbing state transitions because according to a strong disorder renormalization group analysis, our transition belongs to the universality class of the 2D random transverse-field Ising model.

Jason Mast is a fourth year physics student who is looking for graduate school. He worked for Dr. Vojta in the two-dimensional contract process; he was responsible for designing, implementing, and testing the correlation program. He was on the Missouri S&T Solar Car Team last year, and was responsible for writing software for the motor controller. Currently he works at Cloud and Aerosol Sciences testing and calibrating equipment.

Martin McPhail

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Charles Chusuei
Advisor's Department: Chemistry

Funding Source: University of Missouri Research Board

Nanowall Potentials: Effects of Covalent Functionalization on the Carbon Nanotube Point of Zero Charge

A working knowledge of the carbon nanotube isoelectric points is important for solution phase synthesis of precursors of nanoparticle surfaces for biosensor and catalyst applications. The effect of attaching moieties of various electron-withdrawing character was studied by functionalizing single-walled carbon nanotubes with carboxylic acid, maleic anhydride, and nitroso groups. Covalent functionalization was confirmed by X-ray photoelectron and attenuated total reflection infrared spectroscopies, and thermogravimetric analysis. Point of zero charge (PZC) measurements indicated that functionalization varied the PZC by as much as 6.3 pH units. UV-vis-NIR absorption in the E_{11} region and Raman D to G band ratios revealed changes in the semiconducting character of functionalized nanotubes, accompanying changes in the PZC. The results indicate that nanowall functionalization can play a major role in tuning the carbon nanotube isoelectric point, enabling fabrication of a variety of supports.

Martin McPhail is a senior studying Chemistry. He has worked in the Surface Chemistry Laboratory headed by Dr. Chusuei for the past two years. He has been a part of a number of student organizations, including performing with the Miner League Theatre Players. His professional areas of interest involve materials research with alternative energy applications. After completing his Bachelor's Degree in Chemistry at Missouri S&T, he plans to pursue his Chemistry Doctorate.

Megan Oldroyd

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

Funding Source: Pfizer Internship Program

Determining the Effect of Freeze-Drying above Collapse Temperature for a Model Protein

Traditional freeze-drying of amorphous formulations is carried out at product temperatures below the collapse temperature (Tc) of the frozen solution. This often results in long cycle times and increased cost of goods. In this study, freeze-drying cycles were conducted within three temperature regimes, to determine if freeze drying at product temperatures above, below and between the micro (Tcmicro) and macro (Tcmacro) collapse temperatures will affect the quality of the freeze-dried cake and the stability of the freeze-dried protein. Freeze dry microscopy was used to define the temperature regimes of interest, namely the regions of "microcollapse" and "macrocollapse". The freeze-dried material obtained from the aggressive (45°C, 35°C, and 25°C) drying cycles compared favorably with that obtained by traditional methods (-25°C), allowing significant reduction in cycle time from ~14 hours to 5 hours.

Megan Oldroyd is a junior majoring in Chemistry and Applied Mathematics with a minor in Biology. She currently works in Dr. Woelk's lab in the chemistry department doing an OURE concerning the effects of an acid catalyst on the hydrothermal degradation of biomass. For the past two summers, Megan has enjoyed being an intern at Pfizer in Chesterfield, MO doing research in the freeze-drying of proteins. In this presentation, Megan is presenting data from her first summer at Pfizer. After completing her degrees here at Missouri S&T, Megan hopes to attend graduate school at Wash-U in a biomedical related field.

Brian Pink

Joint project with Cory Cheatham and Rachel Klapper

Department: Biological Sciences
Major: Biological Sciences and Chemistry
Research Advisors: Dr. Katie Shannon and Dr. Dave Westenberg
Advisor's Department: Biological Sciences

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

Constructing an Ethanol Sensor

In *Pichia pastoris*, alcohol oxidase (AOX) is the first enzyme in the methanol utilization pathway. This enzyme is encoded by the AOXI gene. If exposed to an environment containing both methanol and ethanol, *P. pastoris* preferentially metabolizes ethanol. The production of the AOX enzyme is subject to the concentration of ethanol. This diauxic metabolism may be utilized as an ethanol sensor. When the AOXI promoter is fused with a gene encoding a fluorescent protein, the activation of the AOXI promoter may be detected by direct observation of fluorescence. Our project is the development of a device containing the AOXI promoter fused with a fluorescent protein gene to create an inexpensive ethanol sensor for a variety of applications. The concentration of ethanol in the environment may be deduced from the time period between exposure of the microorganism carrying the device to ethanol and methanol, until the detection of fluorescence.

Brian Pink is a senior majoring in Chemical Engineering.

April Rocha

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

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

Homo serine lactone signaling in *Bradyrhizobium japonicum*

Previous research completed in this laboratory indicated the presence of homo serine lactones (HSL) in *Bradyrhizobium japonicum*. This research showed that only some strains make HSLs. PCR techniques were used to detect the presence of the HSL synthase gene in all *B. japonicum* strains to determine if HSL production correlated with the HSL synthase gene. It was found that strains that do not make HSLs, contain the HSL synthase gene. The strains that do make HSL, do not contain the HSL synthase gene. Our hypothesis is that the strains that contain the HSL synthase gene are making HSL that is not detectable using the current method.

April Rocha is a senior in the Biological Sciences department. She is currently doing research under Dr. Westenberg. She is an active member of Helix and Phi Sigma.

Christopher Roush

Joint project with Matthew Entrekin and Brian Goldman

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

Evolutionary Algorithm Software Factory

Evolutionary Algorithms (EAs) have shown great promise in solving complex real-world problems, such as typically found in manufacturing and transportation. There is a great lack of a standardized, thoroughly documented, and continuously maintained open-source research community resource containing industry quality implementations of the field's classic and state-of-the-art algorithms. This project takes the first steps in providing this resource by creating a web-based software factory for EAs which takes as input an algorithm specification, and provides as output the associated source code in multiple programming languages. Pseudo-code for all the included EAs as well as links to the seminal papers in which those algorithms were published. This project will benefit researchers, educators, as well as practitioners that use EAs by providing a single resource to obtain standardized EA implementations.

Christopher Roush is currently interested in Computer Science and Software Engineering. He started pursuing his degree in Computer Science at Missouri S&T in 2006 with the hopes of becoming a Software Engineer after graduation. Christopher is getting ready to graduate with a BS in Computer Science in May, 2009. He will be working as a Software Engineer at Cerner Corporation in Kansas City, Missouri.

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Melinda Ann Rushing

Joint Project with Jeffrey Bender

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

Funding Source: Department of Geological Sciences and Engineering

Mountain Building Processes: Insights From Analog Models

Strain distribution within the crust during continental collision can be visualized using "sandbox experiments". We investigated the affect of a weak ductile layer and variation in lithostatic load on crustal deformation during compression. The control experiment consisted of dry sand with horizontal marker layers subjected to compression by shortening the sandbox length. Thrust faults and folds developed beneath a thickening sand wedge. Successive experiments included weak ductile layers (all purpose-flour) and varied the lithostatic load to mimic conditions found in the Himalayas. Results suggest that faults in the rigid strata initially are steeper and more numerous than those in the ductile strata. As shortening increases dip angles become similar. Antithetic faulting occurs in experiments where a ductile layering was present. We suggest that mechanical strength properties and thickness of strata (e.g., weak/strong) has a significant impact on the number and dip angle of thrust faults formed during compressional "mountain-building" events.

Melinda Rushing is seeking her second bachelor's degree in Geology and Geophysics. She previously attended Vanderbilt University in Nashville where she received a bachelor's degree in Psychology and minored in Religious Studies. Her geological interests include hydrogeology and petroleum exploration.

Ashley Shockley

Joint project with Christopher Zacher

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

Preliminary Palynology of the Hell Creek Formation in Garfield County, Montana

The Hell Creek Formation straddles the Cretaceous-Paleogene (K-Pg) boundary, which recorded the mass extinctions that affected dinosaurs and other organisms. An excavation expedition consisting of researchers from Washington University in St. Louis, St. Louis Community College – Meramec, and St. Louis Science Center extracted samples from the Hell Creek Formation in Garfield County, Montana in 2008 recovered fossil bones of the dinosaur *Triceratops* and sampled the sedimentary sequence for further study. Twenty-six samples are being studied for their dispersed organic matter components (palynofacies) and palynomorphs. Palynofacies results indicate that comminuted and degraded phytoclasts dominate the sediments, suggesting that the sediments were deposited in continental paleoenvironment. Additionally, preliminary assessment of palynomorphs shows an overwhelming abundance of terrestrially derived forms (mostly pollen), and support the palynofacies result. Integration of palynology with other techniques (sedimentology, vertebrate paleontology, etc.) will help further constrain the depositional environment.

Ashley Shockley is a junior majoring in Geology and Geophysics, with a minor in History and Political Science. She is a recipient of several scholarships Including the Missouri Bright Flight, V.H. McNutt Scholarship. Ashley is from Rosebud, MO, and plays the French horn and baritone Saxophone in the Missouri S&T University Band. She is a student member of the Geological Society of America.

Erin Sind

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

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

Isolation of Root Nodule Bacteria from Crotalaria Spectabilis Used to Detoxify Trichloroethylene

Trichloroethylene (TCE) is a chemical used in adhesives, paint removers, spot removers, and other commercial products. TCE can be very harmful not only to the environment but also to human health. Three different plants have been identified in TCE contaminated soil in South Carolina. One species, Crotalaria spectabilis, was shown to detoxify TCE while the other two do not. TCE detoxification was associated with the root nodules of the plant. The goal of this project is to isolate and identify the bacteria in the nodules of C. spectabilis and the other two species to determine if the bacteria in C. spectabilis are responsible for the plant's ability to detoxify TCE. We isolated bacteria from twelve different nodules and are sequencing the 16S rRNA genes to identify the bacteria.

Erin Sind is a junior in the Biological Sciences department. She is the daughter of Joseph and Joann Sind of St. Louis, Missouri. Erin graduated from Cor Jesu Academy. She is currently an active member of Chi Omega and various other organizations on campus. Erin plans on graduating in May 2010 with a Bachelors of Science Degree in Biology with a Pre Med focus.

Timothy Smiley

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Paul Nam
Advisor's Department: Chemistry

Funding Source: Missouri Life Sciences Research Board
USDA-CSREES

Supercritical Fluid Transesterification for the Catalyst-Free Production of Biodiesel

Non-catalytic supercritical transesterification reaction provides a new way of producing biodiesel fuel from bio-based oils (triglycerides). To find the supercritical reaction conditions that are best suited for the biodiesel production, experiments were conducted first with soybean oil. The soybean oil was treated with a supercritical mixture of methanol and carbon dioxide without the aid of traditional alkali or acid catalyst. The reaction parameters investigated were the reaction time and temperature at a constant pressure (24 MPa) and a molar ratio (41:1 alcohol to triglycerides), and their effect on the biodiesel formation. Addition of a co-solvent, supercritical carbon dioxide, increased the rate of the transesterification reaction, making it possible to obtain high yields at less harsh conditions.

Timothy Smiley is from Blacksburg, VA. He is a junior in the Chemistry department, and after college wants to work for a company that is involved in making chemical processes more environmentally friendly.

Patrick Stanley

Department: Chemical Engineering
Major: Chemical Engineering
Research Advisor: Dr. Amitava Choudhury
Advisor's Department: Chemistry

Funding Source: MRC (Missouri S&T) Student Support

Exploratory Synthesis of Potential Cathode Materials for Li-ion Batteries in the Iron Boro-phosphate Family

Lithium ion batteries are becoming a popular choice for battery materials in hybrid electric vehicles and plug-in hybrid electric vehicles. Its success will depend on safety, efficiency, and materials cost. Research is being done on ways to create more stable cathode materials which will not cause oxidation of the electrolyte through the release of oxygen from the oxide host of cathode. Lithium containing olivine-structure of iron phosphate, $LiFePO_4$, has already emerged as a safe and cheap cathode material. We are exploring the existence of new compositions and structures with the oxyanions (PO_4^{3-} and BO_3^{3-}) and transition metals. Currently, a ternary phase diagram is being explored using varying amount of BO_3^{3-}, Li^+, and PO_4^{3-}, with fixed amounts of F^-, H_2O, and Fe^{2+} using hydrothermal reaction conditions. Products are then analyzed using single-crystal or powder X-ray diffraction. Some preliminary results of our investigation will be presented.

Patrick Stanley is a sophomore dual majoring in Chemistry and Chemical Engineering. He currently holds the vice president position of the W. T. Schrenk Society (An American Chemical Society student affiliate chapter), and the national liaison position for the Missouri S&T student chapter of the American Institute of Chemical Engineers. Apart from his studies and research, Patrick spends time working out and teaching taekwondo, spending time at the Catholic Newman Center, and geocaching. Originally from Auxvasse, Missouri, Patrick has an acute interest in plants and all things agricultural, as evidenced by his involvement in the National FFA Organization and he desires to apply his knowledge to the field agriculture after graduation. This summer, Patrick has an internship in Kearney, Nebraska, with the University of Nebraska - Lincoln: Partners in Pollution Prevention.

Joseph Stansbery

Department: Chemical Engineering
Major: Chemical Engineering
Research Advisor: Dr. Amitava Choudhury
Advisor's Department: Chemistry

Funding Source: MRC (Missouri S&T) Student Support

Synthesis of Hybrid Porous Materials for Hydrogen Storage Application

The storage of hydrogen in a safe, viable manner is the greatest challenge towards the successful commercialization of hydrogen fuel cell cars. The use of metallo-organic frameworks (MOF's) seeks to make possible the storage of hydrogen gas at relatively low pressure and ambient temperature. MOF's consist of an organic compound as a ligand and metal ions which form a crystalline porous structure. However, they are not stable at high temperature. We attempt to introduce greater stability by introducing an inorganic tetrahedral moiety in the form phosphate, sulfate and other oxy-anion moieties. The metal polyhedral and the phosphate tetrahedral should form an inorganic layer, linked by the organic ligand creating a channel structure. Initial trials with terephthalic acid, the ligand and alumino-phosphate, the inorganic layer to produce what may be a more stable hybrid porous crystalline structure. The concept of hybrid strategy and initial results will be presented.

Joseph Stansbery is a sophomore majoring in Chemical Engineering. He is also a member of the Miner Lacrosse team and of Sigma Phi Epsilon Fraternity.

Michael Stockwell

Department: Freshman Engineering and Mechanical and Aerospace Engineering
Major: Aerospace Engineering
Research Advisor: Dr. David Westenberg
Advisor's Department: Biological Sciences

Funding Source: Copper Development Association and Missouri S&T Department of Biological Sciences

The Killing Game: Copper, A Possible Bactericide for Contact Surfaces

Antibiotic resistant bacteria are becoming more prevalent across the country. These infections are often spread by common contact surfaces such as door handles and push plates. Copper has been suggested to have antimicrobial properties and has been suggested as a replacement surface for stainless steel. In this study stainless steel, brass, and copper plates were tested for bacteria after a 24-hour exposure on the doors of school restrooms. In addition, a known quantity of E. coli and S. epidermidis were placed on each the different types of metal plates to determine the plates' antimicrobial properties over time..Based on this study, the following conclusions can be drawn: 1) Both the copper and brass demonstrated antimicrobial properties in the field study on public school restrooms. The results were significant ($p<.05$) 2) Brass was comparable to copper in its antimicrobial effectiveness 3) Over 99% of the E. coli and S. epidermidis were killed on the copper and brass plates within 30 minutes in the laboratory controlled experiment.

Michael Stockwell is an Aerospace Engineering major that has been doing research and is minoring in the Biological sciences.

Patrick VerSteeg

Joint project with Michelle Brosnahan and Marcus Hayer

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

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

A Synthetic Biology Approach to Microbial Fuel Cell Development

Optimization of electron shuffle to external surfaces such as anodes was a primary goal. Geobacter sulfurreducens happened to be our model bacteria due to its ability in nature to efficiently export electrons extracelluarly. E. coli was the chassis for this experiment due to its genome already containing some key proteins in our preferred pathway. The proteins, such as extracellular pilin, MacA, and many other cytochromes, which E. coli does not have were isolated from Geobacter sulfurreducens and introduced into E. coli to formulate the most optimal pathway for generating electronmotive force in a microbial fuel cell apparatus.

Some problems were faced concerning plasmid engineering and the simple fact that Geobacter is anaerobic and E. coli is aerobic. The current work includes production and optimization of a microbial fuel cell into which our modified bacteria will be placed.

Patrick VerSteeg is currently a junior in the Chemical and Biological Engineering department. While at the university he has assisted in founding and held office in multiple campus organization and been inducted into the Phi Eta Sigma and Phi Sigma honor societies.

Barbara Wheelden

Joint project with C. Anna Growcock

Department: Biological Sciences
Major: Chemical Engineering /Biochemical Emphasis
Research Advisor: Dr. Robert Aronstam
Advisor's Department: Biological Sciences

Funding Source: Missouri S&T cDNA Resource Center

Nitric Oxide Increases Calcium Oscillations in Response to Muscarinic Receptor Stimulation

The effect of NO on calcium oscillations elicited by low concentrations of a muscarinic agonist in CHO cells stably transfected with the gene for the human M3 receptor. Nitric oxide's targets include several synaptic receptor-mediated signaling processes. Agonist stimulation of M3 muscarinic acetylcholine receptors leads to release Ca^{2+} into the cytosol; this depletion of calcium stores stimulates calcium influx. At near threshold agonist concentrations, a cyclical release and re-uptake of calcium from intracellular stores (calcium oscillations) is the predominant response. Calcium influx was eliminated by the use of calcium-free medium; fura-2 fluorescence was used to quantify cytosolic calcium concentration; carbamylcholine was used to activate muscarinic receptors; nitric oxide was provided by varying concentrations of S-nitrosylglutathione (SNG) before measuring muscarinic responses. Calcium release from intracellular stores was characterized by carbamylcholine sensitivity, maximum initial response, and the presence, amplitude and decay of calcium oscillations. Pretreatment with nitric oxide donor decreased the amplitude of the initial Ca^{2+} peak by ≈15%, but increased the proportion of cells displaying oscillatory behavior from <10% to >90%. The threshold for the elicitation of Ca^{2+} responses by carbamylcholine increased, consistent with a NO-mediated subsensitivity. The average delay in the manifestation of the Ca^{2+} response increased markedly from 5.3 sec to 8.0 and 12.2 sec in the presence of 4.3 and 8.5 mM SNG, respectively. Nitric oxide modulates the ability of M3 muscarinic receptors to activate calcium signaling pathways as indicated by an enhanced development of calcium oscillations. These changes may reflect changes in the potency of the muscarinic ligand.

Barbara Wheelden plans on attending graduate school in BioMedical Engineering. She is active in Engineers Without Borders and the S&T Chapters of ISPE and Omega Chi Epsilon.

Alan Brandenburger Windhausen

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Jay A. Switzer
Advisor's Department: Chemistry

Funding Source: National Science Foundation grant #0504715, "Epitaxial Electrodeposition of Chiral Metal Oxide Films."

Electrodeposition of Calcium Oxalate Monohydrate

Because it is the primary mineral in kidney stones, the control of growth of calcium oxalate monohydrate (COM) is of great interest. In this study we use electrochemistry to deposit COM by electrochemically generating base at the electrode surface in a solution of calcium(II) and oxalic acid. Electrochemical deposition provides a convenient method to study the effects of the substrate and the solution pH, deposition current, and solution additives on the morphology of COM. The variable having the most significant effect on amount of COM deposited and its morphology was the deposition current. A future goal of this research is to deposit chiral morphologies of COM using amino acids to template the chirality of the electrodeposited COM.

Alan Windhausen is a pre-medical chemistry junior. Graduating from Niwot High School with a full International Baccalaureate degree in 2006, he has continued to strive for academic advancement by participating in undergraduate research under Dr. Jay Switzer for the past two years (operating with an OURE grant the first year) and staying active in numerous academic groups. He has participated in the undergraduate poster session at an American Chemical Society (ACS) National Meeting, and has organized / presented in over a dozen chemical outreach programs. Alan is a member of the Missouri S&T Honors Academy, the W.T. Schrenk Chemical society (a student affiliate chapter of the ACS), the $AX\Sigma$ chemical fraternity, and is also a DJ on KMNR 89.7 FM

Christopher Zacher

Joint project with Ashley Shockley

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

Preliminary Palynology of the Hell Creek Formation in Garfield County, Montana

The Hell Creek Formation straddles the Cretaceous-Paleogene (K-Pg) boundary, which recorded the mass extinctions that affected dinosaurs and other organisms. An excavation expedition consisting of researchers from Washington University in St. Louis, St. Louis Community College – Meramec, and St. Louis Science Center extracted samples from the Hell Creek Formation in Garfield County, Montana in 2008 recovered fossil bones of the dinosaur *Triceratops* and sampled the sedimentary sequence for further study. Twenty-six samples are being studied for their dispersed organic matter components (palynofacies) and palynomorphs. Palynofacies results indicate that comminuted and degraded phytoclasts dominate the sediments, suggesting that the sediments were deposited in continental paleoenvironment. Additionally, preliminary assessment of palynomorphs shows an overwhelming abundance of terrestrially derived forms (mostly pollen), and support the palynofacies result. Integration of palynology with other techniques (sedimentology, vertebrate paleontology, etc.) will help further constrain the depositional environment.

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Christopher Zacher is a senior majoring in Geology and Geophysics, with a minor in Biology. He is a member of The Missouri Academy of Science, and The Eastern Missouri Society for Paleontology. Chris has also done volunteer work for The St. Louis Science Center.

Arts and Humanities
Poster Session

Abstracts

Melissa Callan

Department: Business
Major: Psychology
Research Advisors: Dr. Morris Kalliny, Dr. Lance Gentry, and Dr. Julie Patock-Peckham
Advisor's Department: Business & Information Technology and Psychology

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

Parental Monitoring and Its Links with Alcohol Use and Alcohol-Related Problems

Impulsivity reflects acting on sudden urges, and has been correlated with alcohol-related problems (Sher & Trull, 1994). Individuals high in impulsivity experience difficulty inhibiting cravings, despite negative consequences. King and Chassin (2004) argue adolescents who are behaviorally undercontrolled (e.g. impulsivity, sensation-seeking) show particularly strong benefits from parental monitoring. This study examined the relationships between parental monitoring, impulsivity, drinking control and alcohol related problems. Questionnaires were administrated to 406 (178 male, 228 female) college students. Correlation coefficients were calculated to explore the strengths of relationships among variables. Findings revealed higher levels of father monitoring were linked to reduced levels of impulsivity among sons and daughters. However, higher levels of mother monitoring were linked to reduced levels of impulsivity only among males.

Melissa Callan is a sophomore majoring in Psychology. She first became involved in undergraduate research her second semester on campus in the Psychology department with Dr. Patock-Peckham, and has since begun other projects in the Business department as well. She plans to continue this research throughout the rest of her career at Missouri S&T, and will likely have a publication by the time of graduation. Melissa plans to continue her education in graduate school, where she would like to get her PhD in either clinical or forensic psychology.

Engineering
Poster Session

Abstracts

John Bartow

Joint project with Lucas McIntosh

Department: Chemical & Biological Engineering
Major: Chemical Engineering
Research Advisor: Dr. David Henthorn
Advisor's Department: Chemical & Biological Engineering

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

Development of Novel Polymer Membrane Fabrication Process for Intelligent Biosensors

In recent years, there has been an effort to develop self-calibrating electrochemical biosensors that require minimal human intervention. The overall goal of this project is to develop an implantable microchip capable of continuously monitoring blood glucose levels. Detection of glucose will be accomplished indirectly by measuring the fluorescence of europium tetracycline (EuTc) in the presence of hydrogen peroxide, a product of the reaction between glucose and glucose oxidase. One challenge of using EuTc arises from the fact that it is sensitive to phosphate ions, necessitating the use of a polymer-based charge-mosaic membrane to separate phosphate ions from the blood stream before reaching the EuTc detection matrix. Current methods for the fabrication of such membranes are time-consuming and expensive. This project demonstrates a novel, inexpensive method of fabricating a sealed-in charge-mosaic membrane using readily-available photolithographic techniques.

John Bartow is a junior pursuing a B.S. in Chemical Engineering with an emphasis in Biochemical Engineering. He is also working toward a minor in Business. This conference is John's first research conference and his second semester on the research project.

Morgan Boresi

Joint project with Christian Pick

Department:	Chemical & Biological Engineering
Major:	Chemical Engineering
Research Advisors:	Dr. David Henthorn and Dr. Chang-Soo Kim
Advisor's Department:	Chemical & Biological Engineering and Electrical & Computer Engineering

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

Photopatternable Hydrogel Membranes for Fluorescence Based Glucose Biosensors

With the increasing number of people succumbing to diabetes, a painless, implantable and continuous glucose sensor would be an asset in the measurement and correction cycle paramount to the management of this disease. In this work, a hydrogen peroxide sensitive fluorophore called europium tetracycline (EuTc) was incorporated into a photopatternable hydrogel matrix. EuTc can form a reversible complex with hydrogen peroxide making it suited for long term sensitivity. Hydrogen peroxide is a byproduct of the enzymatic oxidation of glucose in the presence of glucose oxidase. By utilizing the fluorescent intensity resulting from hydrogen peroxide production, glucose levels can be indirectly determined.

Morgan Boresi is a junior earning her degree in Chemical Engineering with an emphasis in Biology and minors in Biology and Psychology Neuroscience. She works in Dr. David Henthorn's laboratory as an OURE student. Outside of research she participates in several student organizations including Kappa Delta Sorority and Panhellenic Council.

Kyle R. Borgmann

Joint project with Abbe Deoring and Roger Rettig

Department: Materials Science and Engineering
Major: Metallurgical Engineering
Research Advisors: Dr. Wayne Huebner and Dr. Matthew O'Keefe
Advisor's Department: Materials Science and Engineering

Funding Source: Sandia/KCP Honeywell Plant

Development of Barium Titanate Single Layer Thin Film Capacitors

Discrete electrical components such as capacitors, resistors, resonators, and inductors are still soldered onto the surfaces. The next generation of technology will be to integrate these components into or onto a low temperature co-fired ceramic substrate (LTCC).

The objective of this work is to develop thin film sputtering techniques that will yield single layer capacitors directly on top of a LTCC substrate. It is desirable to minimize the size of the capacitor by increasing the K or decreasing the thickness. At the same time the dielectric must have a high insulation resistance.

The capacitors were made from 50 nm nickel electrodes and a 300nm $BaTiO_3$ dielectric. A physical mask of 74um x 74 um was used to increase the number of viable test points. The yield for positive test points was approximately 61%. A positive test point has a high resistance, approximately $10^{9\text{-}10}\Omega$.

Kyle Borgmann is a senior in the Metallurgical Engineering department and was born in Washington, MO. He attended East Central College for three years before transferring to Missouri S&T in 2006. He has had several internships ranging from working in a copper mine in Tucson, AZ to a stainless steel foundry in Pevely, MO. He will be graduating in May, 2009.

William Cacheris

Joint project with Jing Hu

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

Funding Source: NASA

Pseudospark Pulsed Plasma Discharges for a handheld X-ray Generation

Modern X-ray devices are far too large for portability today due to high energy requirements. They require a concentrated electron beam to be fired upon a target which requires massive amount of current. A new energy source such as a pseudospark induced plasma system can be compact enough to fit within a handheld device yet powerful enough to deliver a reliable and accurate x-ray. The basics of a pseudoplasma device consist of an anode and cathode connected to a capacitor and when triggered at high voltage, can form short lived plasma that emits a concentrated electron beam. Hopefully one day this technology can be refined and put to use to save lives.

William Cacheris is a double major in Aerospace and Mechanical Engineering. A junior here at Rolla, William is involved in Pi Kappa Alpha Fraternity, Intercollegiate knights, and the Phi Eta Sigma National Honors Society.

Jesse Cross

Department: Electrical and Computer Engineering
Major: Electrical Engineering
Research Advisor: Dr. Y Rosa Zheng
Advisor's Department: Electrical and Computer Engineering

Funding Source: Air Force of Scientific Research (AFOSR)

FlexRay Communications

As more features and functionalities are added to automobiles, the need for an improved communication bus becomes more apparent. The FlexRay protocol, currently under development by the FlexRay Consortium, is expected to be a comprehensive communication system for future automobiles, replacing the low-speed Control Area Networks (CAN) and providing speed, flexibility and scalability for complex networks of sensors and Electric Control Units (ECU) within a vehicle.

In this work, an interface capable of broadcasting the FlexRay protocol between two PCs is constructed. The features of FlexRay protocol are analyzed, including time and event triggered communication schemes, effects of Electromagnetic Interference (EMI) on fault-tolerant mechanism, error detection and error diagnosis capability, and power-down and wake up mechanisms.

Jesse Cross is a junior in the Electrical and Computer Engineering department. He will graduate in Fall 2010 with a B.S.EE.

Abbe Doering

Joint project with Kyle Borgmann and Roger Rettig

Department: Materials Science and Engineering
Major: Ceramic Engineering
Research Advisors: Dr. Wayne Huebner and Dr. Matthew O'Keefe
Advisor's Department: Materials Science and Engineering

Funding Source: Sandia/KCP Honeywell Plant

Development of Barium Titanate Single Layer Thin Film Capacitors

Discrete electrical components such as capacitors, resistors, resonators, and inductors are still soldered onto the surfaces. The next generation of technology will be to integrate these components into or onto a low temperature co-fired ceramic substrate (LTCC).

The objective of this work is to develop thin film sputtering techniques that will yield single layer capacitors directly on top of a LTCC substrate. It is desirable to minimize the size of the capacitor by increasing the K or decreasing the thickness. At the same time the dielectric must have a high insulation resistance.

The capacitors were made from 50 nm nickel electrodes and a 300nm $BaTiO_3$ dielectric. A physical mask of 74um x 74 um was used to increase the number of viable test points. The yield for positive test points was approximately 61%. A positive test point has a high resistance, approximately $10^{9\text{-}10}\Omega$.

Abbe Doering is a senior studying Ceramic Engineering with an anticipated graduation date of May 2009.

Brandon Doherty

Department: Mechanical and Aerospace Engineering
Major: Mechanical Engineering
Research Advisor: Dr. Hank Pernicka
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: University of Missouri National Instruments

Dynamic Load Acquisition for Ground Vehicle Handling Analysis

The necessity to understand the real world suspension loads in ground based vehicles has led to the creation of an electronic strain gage instrumentation system. A method developed to dynamically record the normal loads delivered by the tires of an open-wheel racecar were tested on track and discussed. The forces transmitted by each of the vehicle's four tires were recorded during a series of forward acceleration, braking, and skidpad exercises to determine the highest instantaneous lateral and longitudinal suspension loading. This data was used to verify the calculations and assumptions of a physics based analytical model that was concerned with the effects of lateral and longitudinal vehicular load transfer under acceleration.

Brandon Doherty is an undergraduate senior Mechanical Engineer focused on automotive research and development. He is heavily involved in the Missouri S&T FSAE race team and is currently responsible as for several design related projects as the S&T Racing Corners/Drivetrain Group Leader.

Andrew Heckman

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

Funding Source: NASA-Missouri Space Grant Consortium

Simulation of Overall Plasma Actuator Effects

Plasma actuators show a great deal of potential as enhancements for aerospace control surfaces, or even as control surfaces in of themselves for small platforms. The appeal of these as control surfaces is that plasma actuators can react far faster than normal mechanical control surfaces. However, in order for this potential to be fully realized, the effect of the plasma actuators must be known before hand in order to adjust the pressure flow over a surface, as there would not be enough time to do a complex fluid simulation in real time. To this effect this paper covers the simulation and then the generalization of the effects of the actuators on airflow over a surface at various initial flow speeds for eventual use in a surface control program.

Andrew Heckman went to Armstrong Elementary school and from there to Hazelwood West High School. He graduated in the top ten percent of the graduating class in May 2006. Andrew is currently a junior pursuing a bachelors degree in Mechanical Engineering. He has done a research project on the wall erosion in Hall thrusters and is currently doing research on plasma actuators. Further, has been involved in the Robotics club in the Computer Science portion of the team since sophomore year and has recently become involved in the Steel Bridge Building team.

Nick Jarnagin

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

Who's Going To Clean Up the Space Waste?

Over the last few decades, mankind has used the space around Earth as a landfill for any type of waste accumulated while traversing the great beyond. The trash dumped in space varies considerably, ranging from rocket stage parts to bits of insulation. Unfortunately, there were no official regulations on space waste, so the ring of trash orbiting Earth continued to grow larger until more serious issues arose. Today, the ring of space trash, or space debris, grows ever larger, posing a threat to current space launches, like satellites for example. Researchers and engineers alike are working together to find a solution. Countries have also begun to come together, in organizations such as the Inter-Agency Space Debris Coordination Committee (IADC), and discuss possible regulations and guidelines for space debris related issues. Preventative design and future possible regulations may help to deter the creation of future space debris related problems.

Nick Jarnagin is a senior majoring in Environmental Engineering. Nick works on campus as an undergraduate writing tutor. He also enjoys playing baseball and hiking. Nick hopes to one day work as an environmental consultant.

Shixiang Jia

Department: Electrical and Computer Engineering
Major: Electrical Engineering
Research Advisor: Dr. Y Rosa Zheng
Advisor's Department: Electrical and Computer Engineering

Funding Source: Air Force of Scientific Research

Statistical Analysis of IPIX Radar Clutter Signals

This research deals with the auto- and cross- correlations of radar clutter signals which consist of rich backscattering from sea surfaces at low-grazing angles in high resolution radar systems. High-resolution polarimetric data were recorded by the IPIX radar of McMaster University in Dartmouth, Nova Scotia, Canada. This research verified that the clutters are of compound K distribution, which is the product of a complex Gaussian speckle and a Gamma-distributed texture. A low-pass filter is designed to extract the texture component from the compound K clutter and then the speckle component is also separated. The temporal correlation functions of the texture and speckle components are analyzed. The cross-correlation of the real and imaginary parts of the speckle is also studied. These correlation properties will help to guide the design of adaptive space-time adaptive processing (STAP) filters for non-Gaussian clutter suppression.

Shixiang Steve Jia is a junior at the undergraduate department of Electrical and Computer Engineering. Steve has been working under Dr. Y Rosa Zheng since fall 2008. This is Steve's first undergraduate research project and this will be his first time attending the Undergraduate Research Conference. Steve has been a member of the Missouri S&T Solar Car team since spring 2008.

Lucas McIntosh

Joint project with John Bartow

Department: Chemical & Biological Engineering
Major: Chemical Engineering
Research Advisor: Dr. David Henthorn
Advisor's Department: Chemical & Biological Engineering

Development of Novel Polymer Membrane Fabrication Process for Intelligent Biosensors

In recent years, there has been an effort to develop self-calibrating electrochemical biosensors that require minimal human intervention. The overall goal of this project is to develop an implantable microchip capable of continuously monitoring blood glucose levels. Detection of glucose will be accomplished indirectly by measuring the fluorescence of europium tetracycline (EuTc) in the presence of hydrogen peroxide, a product of the reaction between glucose and glucose oxidase. One challenge of using EuTc arises from the fact that it is sensitive to phosphate ions, necessitating the use of a polymer-based charge-mosaic membrane to separate phosphate ions from the blood stream before reaching the EuTc detection matrix. Current methods for the fabrication of such membranes are time-consuming and expensive. This project demonstrates a novel, inexpensive method of fabricating a sealed-in charge-mosaic membrane using readily-available photolithographic techniques.

Lucas McIntosh was born in Jackson, MO. He is the son of Dr. Douglas and Joyce McIntosh. He is currently in his final semester at Missouri S&T, working toward a B.S. in Chemical Engineering.

Jonathan McKinney

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

Funding Source: EPA GRO Fellowship

Developing Methods to Measure Concentration Profiles in Solid Materials Using Solid Phase Micro Extraction (SPME)

Volatile organic compounds (VOCs) in indoor air have been correlated with numerous health problems by epidemiologists and toxicologists. However many of these health problems have not been linked to any particular pollutant since current methods for collecting exposure data are very limited. It is our goal to derive methods which provide health scientists with the historic exposure data needed for their studies by taking advantage of unique concentration profiles due to diffusion of air pollutants into and out of building materials. To date we have developed methods to measure chemicals activities in polyurethane foam (PUF; used in furniture cushions) using solid phase micro-extraction (SPME), measure the diffusion coefficient of toluene in PUF, create concentration profiles under conditions similar to indoor environments, and model the measured concentration profiles. For the PUF material tested, the toluene diffusion coefficient at room temperature was 0.00078 cm^2/s (± 0.00035). Uncertainty associated with measuring concentration profiles using SPME has also been quantified (±2.1%).

Jonathan McKinney is a junior in Environmental Engineering. He is pursuing a research project under the supervision of Dr. Glenn C. Morrison and plans to continue working on the project after his OURE fellowship. He has also received an EPA GRO fellowship for his research efforts. Jonathan has been interested in working in a lab for a long time, and really enjoys having the opportunity to do so now. When finished with his undergraduate degree, he plans to go on and get a masters degree.

Ryan J. Miller

Joint project with Lucas Sudkamp.

Department: Interdisciplinary Engineering
Major: Interdisciplinary Engineering
Research Advisor: Dr. Katie Grantham Lough
Advisor's Department: Interdisciplinary Engineering

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

LEED Certifying the 2009 Solar House

This paper is about unique challenges and successes of designing and constructing a home to fit the United States Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) for Homes criteria. This particular project took place in Rolla, MO; a small town of about 16,000 people, 100 miles southwest of St. Louis and the house is to be transported to Washington D.C. to compete in the US Department of Energy's Solar Decathlon. There were many challenges that were associated with the building of this project, as well as many unique solutions.

Ryan Miller is a senior in Interdisciplinary Engineering emphasizing in environmental and architectural. He has been a member of the Solar House Team since August 2008. He is a two year letterman of the university football team. Also, winner of the 2008 PACE competition sponsored by GM and Siemens.

Roger Rettig

Joint Project with Kyle Borgmann and Abbe Doering

Department: Materials Science and Engineering
Major: Metallurgical Engineering
Research Advisors: Dr. Wayne Huebner and Dr. Matthew O'Keefe
Advisor's Department: Materials Science and Engineering

Funding Source: Sandia/KCP Honeywell Plant

Development of Barium Titanate Single-Layer Thin Film Capacitors

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Roger Rettig is a junior studying Metallurgical Engineering. He was born and raised in St. Louis and graduated from Windsor High School in Imperial, MO.

Sarah Seigfreid

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

Carbon Credit Financial Markets and Feasibility Research

Carbon credit markets are an emerging financial tool for controlling the release of greenhouse gasses to the atmosphere. A major focus of this research is compiling information on the process to bring carbon credits to market, especially for small businesses, municipalities, and state agencies. Analysis of current carbon credit markets and pricing is an integral part of making GHG mitigation projects feasible, as is making this information available to smaller entities, particularly farmers and agribusineses. In general, 'Carbon Economics' or 'Greenhouse Gas Equivalents' are completely foreign to these smaller entities that are already over-whelmed with a myriad of legal requirements such as business permitting, tax law, and environmental regulation.

Sarah Seigfreid is a fourth-year student studying Environmental Engineering. She has interned with Peabody Energy for the past three summers. During the summer of 2008, she researched carbon credits especially as they applied to coal mine methane and attended a conference on emerging carbon markets.

Lucas Sudkamp

Joint project with Ryan Miller.

Department:	Civil, Architectural and Environmental Engineering
Major:	Architectural Engineering
Research Advisor:	Dr. Katie Grantham Lough
Advisor's Department:	Interdisciplinary Engineering

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

LEED Certifying the 2009 Solar House

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Lucas Sudkamp is a senior in Architectural and Civil Engineering. He has been a member of the Solar House Team since his freshman year in the fall of 2005. He held the position of Student Project Manager for the calendar year of 2008 and has also been acting as the Student Director of Design and Construction since August 2008.

Christopher K. White

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

Funding Source: Missouri NASA Space Grant Consortium

Plasma Properties & Diagnostics

The first objective of this project was to design and create a microwave plasma source utilizing a copper and glass waveguide. The second objective was to design and construct a retarding potential analyzer and double and single langmuir probes to measure plasma properties and diagnostics. The third objective was to analyze the data to see if there is a trend between ion number density, electron temperature, floating potential, kinetic energy, potential energy, and plasma potential for varying pressures and electromagnetic fields.

Results from the Langmuir probe data conclude that the plasma potential is greater than the floating potential and as the electromagnetic field is increased the plasma potential increases slightly and the floating potential decreased slightly. In addition, the ion number density decreases slightly and the electron temperature increases slightly with increasing electromagnetic field. Results from the retarding potential analyzer data conclude that the potential energy is centered on the plasma potential which for varying electromagnetic field turned out to be around 22-24 Volts. Furthermore, with varying pressure the potential energy was centered around 18-20 Volts.

Christopher White is a senior and plans to graduate in May 2009 with a double major in Aerospace and Electrical Engineering. Christopher is also getting a double minor in Chemistry and Mathematics. He is currently a founding father of a new fraternity on campus called Delta Sigma Phi, which he has played a big role in leadership for the Rolla chapter. Christopher is planning on continuing his education after graduation while working for Dynetics in Huntsville, Alabama.

Research Proposal
Poster Session

Abstracts

Angela Hundt

Department: Psychology
Major: Psychology
Research Advisor: Dr. James Martin
Advisor's Department: Psychology

Funding Source: Psychology Department

The Dark Side of Leadership Personality

This study will focus on the dark side of leaders by determining which traits make an awful leader and which personality traits will lead to a leader's failure. The Hogan Developmental Survey will be exceptionally helpful in determining which personality traits the subjects encompass that could lead to a derail in their careers. With the use of ROTC cadets on the Missouri S&T campus as subjects, this study will examine leaders in training to determine if dysfunctional leaders can be caught early on in their training.

Angela Hundt is a junior Psychology major, emphasizing in leadership psychology. Her primary interests in psychology are central to personality traits of leaders as well as contributing factors to developing leaders. Angela is a third year cadet in Air Force ROTC and will commission as a second lieutenant upon graduation in May 2010. She is actively involved in Zeta Tau Alpha fraternity and is president of the local Psi Chi chapter, which is the national psychology honor society.

Kelly Walsh

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Harvest Collier
Advisor's Department: Chemistry

Use of Carvacrol and Thymol as Anti-Bacterials and Anti-Parasitics

The significance of bacterial evolution and insect resistance is a major reason for the ongoing search of new chemical compounds that have the ability to eliminate unwanted organisms. Carvacrol and thymol, natural chemical compounds that have been shown to have anti-bacterial as well as anti-parasitic properties, are ideal candidates for eco-friendly pesticides and certain sanitizing agents. They exist naturally in varying amounts in a variety of oregano plants. As shown in, "Insecticidal and Genotox Activities of Oregano Essential Oils,"* Carvacrol, for most bacteria and insects, has better anti-bacterial and anti-parasitic properties than thymol. However, S. thymbra, in which the major active chemical is thymol, has better anti-bacterial and anti-parasitic properties than O. vulgare or C. capitatus. Thus, it is my proposed goal to learn whether low concentrations of Carvacrol, respectively, in solution with a high concentration of thymol, respectively, result in better anti-bacterial and anti-parasitic properties.

* Ioannis Karpouhtsis, Evagelia Pardali, Efi Feggou,, Stella Kokkini,, Zacharias G. Scouras, and, Penelope Mavragani-Tsipidou "Insecticidal and Genotoxic Activities of Oregano Essential Oils," Journal of Agricultural and Food Chemistry 46 (3), 1111-1115 (1998).

Kelly Walsh is currently a freshman Chemistry major who comes from Cassville, Missouri. In his free time, he relaxes with others or thumbs his guitar. It is his plan, one day, to operate his own pharmacy.

Social Sciences
Poster Session

Abstracts

Adam Bussmann

Department: History
Major: History
Research Advisor: Dr. Patrick Huber
Advisor's Department: History & Political Science

Prohibition in St. Louis

The content of this poster pertains to the subject of National Prohibition in the city of St. Louis, Missouri. It also compares the struggles of the citizens of St. Louis in comparison with the other major cities of the United States. To compare these cities, I have used statistical information that shows how many people were employed by the breweries in each city, how many breweries were in each city, and how much beer was produced by these breweries. These figures span from just before the ratification of the Eighteenth Amendment to the ratification of the Twenty-first Amendment. The final aspect of my poster will focus on the Anheuser-Busch brewery of St. Louis. This brewery is an important brewery to study because of its ties to the city of St. Louis and its brewing industry.

Adam Bussmann began his career at Missouri S&T on an Army ROTC scholarship. While in Rolla he has become a mentor at a local elementary school and also spends his time as a tutor in the Writing Center on campus. After graduating in May 2010, Adam will be commissioned as a 2nd LT in the United States Army and he looks forward to serving his country in the future.

Jasmine Glaese

Joint project with Janet Guntly and Charissa Mathis

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

Funding Source: Computing Research Association Committee on the Status of Women in Computing Research (CRA-W)
Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Computer Science Recruitment for the 21st Century

The goal of this project is to create recruitment software to aid in reversing the alarming trend of decreasing interest in Computer Science (CS) among American students, particularly females. The current generation of American students, especially females, tends to be attracted to fields with clear social relevancy. Third through sixth grade is a crucial time when students form their opinions about, and interests in, math and science. Misconceptions about what CS is and a lack of understanding regarding its many socially relevant applications creates negative associations during this crucial time. These negative associations can result later in many (female) students not picking the math and science classes that would prepare them for a CS career, ultimately lowering CS enrollment. Our recruitment software explains in an entertaining way what CS is and showcases its social relevancy through a series of highly visual, interactive games & puzzles, and illustrates CS alumni careers.

Jasmine Glaese went to Cuba High School and is currently a senior graduating in May of 2009. She is pursuing a minor in Mathematics and Spanish. She will be working as a Software Engineer at Cerner in Kansas City, MO as of August 2009. Her team, consisting of Lisa Guntly and Valerie Houseman, received fourth place at the 2007 ACM (Association for Computing Machinery) Mid-Central USA Programming Contest. Her hobbies are drawing, coloring, singing, writing, and playing and programming games.

Janet Guntly

Joint project with Jasmine Glaese and Charissa Mathis

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

Funding Source: Computing Research Association Committee on the Status of Women in Computing Research (CRA-W)
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Janet Guntly is a senior majoring in Computer Science. She will be working at Monsanto in St. Louis, Missouri this summer and fall as part of the cooperative education program. She intends to graduate in May 2010. In addition, she is a member of the ACM (Association for Computing Machinery) and Phi Kappa Phi, a national all-discipline honor society. This is her second undergraduate research project; the first was a multidisciplinary project with Environmental Engineering involving indoor air quality.

Charissa Mathis

Joint project with Jasmine Glaese and Janet Guntly

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

Funding Source: Computing Research Association Committee on the Status of Women in Computing Research (CRA-W)
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Charissa Mathis attended Rolla High School and is currently a junior, pursuing a Bachelor's degree in Computer Science and a minor in Psychology. She is the president and webmaster of Missouri S&T's ACM-W chapter. This summer she will be participating in an internship with Express Scripts as a Java programmer. During the school year, she works in the Computer Science office as an office assistant, and formerly she worked for the Rolla Public Schools Technology Department as a computer technician. Her hobbies include computers & technology, reading, sketching, and origami.

Lindsay Roufa

Department: Psychology
Major: Psychology
Research Advisor: Dr. James Martin
Advisor's Department: Psychology

Funding Source: St. Louis Metro

Importance Scores are Important When Examining Customer Satisfaction

Through recent years consumer research has extensively analyzed the psychological determinants of customer satisfaction attitudes. However, customer satisfaction with a particular service factor (e.g., "friendly service") does not necessarily reflect the customer's evaluation of the factor with respect to its importance. The hypothesis that "Importance" ratings contain valuable information about customer attitudes was explored with data collected over a four-year period with onboard patrons of a public transportation utility. The items were grouped into two sections: Service Factors (18 items) and Driver Behavior (9 items). Factor analysis suggests that Importance and Satisfaction load largely on separate factors, with a third factor representing "Driver Behaviors". Evidence to support that gender and sex differences significantly affect what customers determine to be important in service are commonly seen in factors of Safety (on the bus; at bus stops), Cleanliness, and Driver Courtesy. Implications of these findings are discussed.

Lindsay Roufa is pursuing her Bachelors of Science in Psychology and minoring in Military Science. In December 2009 she is commissioning into the United States Army as a Second Lieutenant where she hopes to pursue a career in Research Psychology. Lindsay is married and raising a six year-old stepdaughter, a Jack-Russell terrier, and her husband is currently deployed in Iraq. She enjoys school, traveling, reading, cooking, and the cinema.