Missouri University of Science and Technology

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Undergraduate Research Conference at Missouri S&T

2008 UGRC - Winners

Apr 9th, 2008 - 5:00 PM

4th Annual Undergraduate Research Conference Abstract Book

Missouri University of Science and Technology

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4th Annual
Undergraduate Research Conference

April 9, 2008
Missouri S&T - Havener Center

CONFERENCE AGENDA

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Vice President, Research & Development
Chief Technology Officer
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- **OURE Faculty Fellows Proposal Review:** 9:00 am – 12:00 pm, (Meramec & Walnut Rooms)
- **Judges Conference Room:** (Mark Twain Conference Room)

Oral Presentations

Engineering Oral Session		
Name	**Department**	**Time/Location**
Drews, Paul	Mechanical & Aerospace Engineering	10:30 - 11:00 AM - Ozark Room
Eads, Josh	Computer Science and Civil, Architectural & Environmental Engineering	9:00 - 9:30 AM - Ozark Room
Glass, Bryan	Electrical & Computer Engineering	9:30 - 10:00 AM - Ozark Room
Harms, Joel	Electrical & Computer Engineering	10:00 - 10:30 AM - Ozark Room
Lessley, Nick	Mechanical & Aerospace Engineering	10:30 - 11:00 AM - Ozark Room
Magaha, Brian	Mechanical & Aerospace Engineering	10:30 - 11:00 AM - Ozark Room
Robinette, Paul	Mechanical & Aerospace Engineering	10:30 - 11:00 AM - Ozark Room
Vaughan, Michelle	Electrical & Computer Engineering	9:30 - 10:00 AM - Ozark Room

Humanities/Social Sciences Oral Session		
Name	**Department**	**Time/Location**
Carr, Jennie	Arts, Languages & Philosophy	9:00 - 9:30 AM - Gasconade Room
Kamps, Amanda	History & Political Science	9:30 - 10:00 AM - Gasconade Room
Kampunzu, Jonathan	English & Technical Communication	10:00 - 10:30 AM - Gasconade Room
Kleeschulte, Mallary	Psychology	10:30 - 11:00 AM - Gasconade Room

Natural Sciences Oral Session		
Name	**Department**	**Time/Location**
Cheatham, Cory	Biological Sciences	9:00 - 9:30 AM - Turner Room
Clark, Brandi	Chemistry	9:00 - 9:30 AM - Carver Room
Garten, Lauren	Chemistry	9:30 - 10:00 AM - Carver Room
Rybacki, Kyle	Geological Sciences & Engineering	10:00 - 10:30 AM - Carver Room
Stockstill, Katherine	Biological Sciences	9:30 - 10:00 AM - Turner Room
Tune, Jenna	Biological Sciences	10:00 - 10:30 AM - Turner Room
Wright, Evan	Mathematics & Statistics	10:30 - 11:00 AM - Carver Room

Poster Presentations

Engineering Poster Session		
Name	**Department**	**Time/Location**
Adams, Robert	Mechanical & Aerospace Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Agbaje, Adedayo	Electrical & Computer Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Amdemichael, Leykun	Electrical & Computer Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Bartz, Navarre	Civil, Architectural & Environmental Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Ditch, Derek	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
Grelle, Stephen	Civil, Architectural & Environmental Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Guntly, Janet	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
Hassen, Yasmin	Civil, Architectural & Environmental Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Loftis, Amber	Computer Science	9:00 - 11:45 AM – Upper Atrium/Hallway
Markus, Samantha	Civil, Architectural & Environmental Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
McCouch, Ben	Mechanical & Aerospace Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
McKinney, Jonathan	Civil, Architectural & Environmental Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Nolte, Michael	Electrical & Computer Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Ponzer, Phillip	Electrical & Computer Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Probasco, Michael	Chemical & Biological Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Ralston, Bryan	Mechanical & Aerospace Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Rouse, Nathan	Mining & Nuclear Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Smedvig, Mark	Civil, Architectural & Environmental Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Warren, Alex	Mining & Nuclear Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway
Wilkins, Timothy Ryan	Electrical & Computer Engineering	9:00 - 11:45 AM – Upper Atrium/Hallway

Humanities/Social Sciences Poster Session		
Name	**Department**	**Time/Location**
Anderson, Brandi	History & Political Science	1:00 - 3:00 PM – Upper Atrium/Hallway
Coale, Lindsey	Psychology	1:00 - 3:00 PM – Upper Atrium/Hallway
Hecht, Jill	History & Political Science	1:00 - 3:00 PM – Upper Atrium/Hallway
Knocks, Kathryn	English & Technical Communication	1:00 - 3:00 PM – Upper Atrium/Hallway

Poster Presentations (Cont.)

Management & Information Systems Poster Session		
Name	**Department**	**Time/Location**
Coalson, Tim	Computer Science	1:00 - 3:00 PM – Upper Atrium/Hallway
Glaese, Jasmine	Computer Science	1:00 - 3:00 PM – Upper Atrium/Hallway
Guntly, Lisa	Computer Science	1:00 - 3:00 PM – Upper Atrium/Hallway
Williams, Jessica	Computer Science	1:00 - 3:00 PM – Upper Atrium/Hallway

Natural Sciences Poster Session		
Name	**Department**	**Time/Location**
Armstrong, Herman	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
Bollmann, Trevor	Geological Sciences & Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Brown, Cassandra	Geological Sciences & Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Burroughs, Brooke	Chemistry	1:00 - 3:00 PM – Upper Atrium/Hallway
Campbell, Christopher	Chemistry	1:00 - 3:00 PM – Upper Atrium/Hallway
Haring, Benjamin	Geological Sciences & Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Hoffman, Michael	Physics	1:00 - 3:00 PM – Upper Atrium/Hallway
Kaiser, Jason	Geological Sciences & Engineering	1:00 - 3:00 PM – Upper Atrium/Hallway
Klapper, Rachel	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
Modglin, Janelle	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
Oldroyd, Megan	Chemistry	1:00 - 3:00 PM – Upper Atrium/Hallway
Pink, Brian	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
Schiermeier, Morgan	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
Schneider, Jacqueline	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
Schwent, Daniel	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway
Stevens, Evan	Geology and Geophysics	1:00 - 3:00 PM – Upper Atrium/Hallway
Walker, Kevin	Biological Sciences	1:00 - 3:00 PM – Upper Atrium/Hallway

Keynote Speaker

Archus ORTHOPEDICS

Jorge A. Ochoa, Ph.D., P.E.

Vice President R&D and Chief Technology Officer
Archus Orthopedics, Inc.
Redmond, WA

B.S.M.E. 1985, Missouri S&T
M.S.M.E. 1987, Purdue
Ph.D.M.E. 1991, Purdue
Prof. Eng. 2005, Missouri S&T

Dr. Ochoa is currently Vice President for Research and Development and Chief Technology Officer of Archus Orthopedics, Inc., a privately held development stage medical device company he joined in 2004. Archus focuses on restoring motion to the human spine through novel surgical implant technology designed to replace the facet joints.

Previously, Dr. Ochoa was Vice President, Research and Development, at DePuy Orthopaedics, a Johnson & Johnson Company where he was responsible for R&D in the joint reconstruction business. His work experience also includes IBM and Chrysler Corporations. He has co-authored over 30 peer refereed journal articles and conference abstracts and has 11 US patents to his name. He is a member of the SHPE, MAES, ASME, ORS, the ISTA, SEM and the SFB. He also serves on advisory boards for various professional engineering societies and engineering schools.

Dr. Ochoa was raised in Guadalajara, Mexico, where his father was a physician, which along with being an oft-injured athlete, instilled in Dr. Ochoa an awe of the ultimate machine - the human body. His mother's side of the family is also from Mexico – Missouri, so it is only logic that he became a Miner, since he comes from a long line of Missouri S&T graduates and supporters. He has served on the Miner Alumni Association as Director-at-Large having lived all across the USA, is a member the Academy of Mechanical and Aerospace Engineers, and has also sponsored research projects at the School of Mechanical Engineering related to biomedical technology. In his free time he enjoys cooking regional Mexican dishes, traveling with his wife Heidi, playing a round of golf with his daughter Olivia, volunteering at St. Jude Church and The Bear Creek School, and is an avid college sports fan.

Conference Judges

The Office of Undergraduate Studies wishes to thank the following faculty & staff for their valuable contributions to the 4th Annual Missouri S&T Undergraduate Research Conference.

Diana L. Ahmad
Ralph Alexander
Carlos Castano
Nathan Chen
Stephen Gao
Larry Gragg
David Henthorn
David Hoiness
Matt Install
Irina Ivliyeva
Jonathan Kimball
Merilee Krueger
Kelly Liu
Scott Miller
Melanie Mormile
Seth Orsborn
Clayton Price
Josh Rovey
Chaman Sabharwal
BJ Shrestha
Bob Schwartz
Eric Smith
Cynthia Tharp

Thank You!

Engineering
Oral Session

Abstracts

Paul Drews

Joint Project with Nick Lessley , Brian Magaha and Paul Robinette,

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

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

Development of an Aerial Robot for Surveillance Missions around Buildings

A semi-autonomous helicopter has been created to fill both civilian and military rolls. In a civilian role, the aircraft is capable of assisting disaster relief personnel in surveying damaged structures and other hazardous areas. In a military role, the aircraft can provide valuable, time-sensitive intelligence in urban environments. A number of sensors and pieces of computer hardware have been mounted on a small remote control helicopter to allow for near autonomous operation. The helicopter is controlled from a portable, laptop computer based ground station that allows the operator to monitor the helicopter's position and video from an onboard camera. Image processing software station assists the operator in identifying windows and doorways of buildings. A fuzzy logic control system has been developed for the helicopter and has been tuned with partial success and tested using flight simulation. Additional work is needed to finish tuning and testing the control system.

Paul Drews is a senior double majoring in Computer Engineering and Electrical Engineering at Missouri S&T. He is currently a chief engineer for the Missouri S&T Robotics Team. He has experimented with microcontrollers and robotics sensors since high school and applied that experience to Missouri S&T's entries in the 2005, 2006, and 2007 IGVC. He was a primary designer of control systems for the 2006 robot as well as a researcher for the LAGR project (November 2005 to September 2006) and a team member on Project SAVER. He has experience developing software in both Linux and Windows for high and low level robotics systems. He has previous research experience in the OURE Ultrasonic Range Sensors and their applications in avoiding obstacles in IGVC. This OURE was conducted under the supervision of Dr. Steve Watkins during 2005. He also worked at Boeing during the summer of 2006 writing bus testing software for F-15 and F-18 avionics.

Joshua Eads

Department:	Computer Science
Major:	Computer Science
Research Advisors:	Dr. Daniel Tauritz and Dr. Glenn Morrison
Advisor's Department:	Computer Science Environmental Engineering

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

Deriving Gas-Phase Exposure History through Computationally Evolved Inverse Diffusion Analysis

Health risks due to indoor air are large and are ranked among the top five environmental health risks by the Environmental Protection Agency~\cite{EPA}. High indoor pollutant levels are a result of emissions from indoor sources, limited air exchange, high surface area to volume ratios, and indoor chemistry. This paper presents an ongoing project to find inverse diffusion differential equations employing advanced computational techniques. A technique known as Genetic Programming (GP) will be used to evolve candidate equation solutions. The final result will be validated by applying it to core samples from Dr. Morrison's laboratory exposure chamber for which the exposure histories are known. Beyond indoor human exposure, the validated method will be transferable to many environmental systems where diffusion records historic exposures in solid materials.

Joshua Eads is currently a Junior at the Missouri University of Science & Technology majoring in Computer Science. He has been involved in undergraduate research for the past three years, working on a variety of multi-disciplinary problems in optimization and evolutionary computation. Outside of course work, Josh is an active member in the local Association for Computing Machinery chapter and currently serving as President. He has worked to give students more opportunities to get involved with project groups on campus and to meet potential employers focused in computing.

Bryan Glass

Joint project with Michelle Vaughan

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

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

An Investigation of Automated Transportation

As drive-by-wire driving systems become more popular, the advent of completely automated vehicles will become a distinct possibility. This technology would eliminate the dangerous human factor of driving and provide many previously unheard of options.

In an effort to investigate the feasibility of automated transportation, a computer system with sensory inputs and a GPS receiver was constructed. It was able to detect lanes, the distance of objects in its proximity, their relative rates of change, and was capable of navigating from one location to another. Upon completion, the system was analyzed to determine its safety as well as its processing time. These numbers were compared to known information about current driving systems, and supported the development and introduction of such a technology.

Bryan Glass is a student of Computer Engineering, Computer Science, and Mathematics at the Missouri University of Science & Technology. He is a junior in his fourth semester of study. In addition to conducting undergraduate research, Bryan is a member of the solar house team, is the brotherhood chair for Delta Sigma Phi fraternity, and is the president and founder of the Missouri S&T club racquetball team. Outside of school, he works in the validation engineering group and the principle engineering group for General Electric Transportation.

Joel K. Harms

Department: Electrical & Computer Engineering
Major: Electrical & Computer Engineering
Research Advisor: Dr. Waleed Al-Assadi
Advisor's Department: Electrical & Computer Engineering

Funding Source: Vice Provost for Undergraduate Studies

Built-in Transient Current Monitor for Integrated Circuits Testing

The on-chip transient current monitor is used to detect transient currents in a circuit under test. Built-in current testing improves the defect coverage in chips. Transient power supply current testing is used to supplement the existing test methods to improve defect coverage. The proposed transient current monitor is used to measure transient currents for a wide range of amplitudes ranging from a very few micro amperes to a magnitude of milli Amperes and of pulse widths as small as few pico seconds. This monitor is built and tested using AMI 0.5μ and TSMC 0.18μ technologies.

Joel K. Harms is a senior studying Electrical Engineering and Computer Engineering from Missouri University of Science & Technology. Harms will graduate with a Bachelor of Science in both degrees in December of 2008. Harms has performed research in Wireless Sensor Networks Watershed Soil Monitoring and Built-In Transient Current Monitors.

Nick Lessley

Joint Project with Paul Drews, Brian Magaha, Paul Robinette

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

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

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Nick Lessley is a senior in Mechanical Engineering at Missouri S&T with an emphasis in design. He has been a member of the Missouri S&T Robotics Team since early 2006. As the chief engineer of the Stereo Opticon robot, he is responsible for coordinating an interdisciplinary team of engineers and scientists. He is also in charge of teaching and leading the mechanical engineers in design and construction, of the next generation robots. His research experience includes a project under Dr. Finaish for the SAVER team during the fall semester of 2006. The project was to build a dual collective helicopter transmission out of "off the shelf" parts. A dual collective transmission would have allowed the SAVER team to have more control than the helicopter's original capability. In the end, it was determined to be too difficult of a project for the time span and the cost.

Brian Magaha

Joint Project with Paul Drews, Nick Lessley, Paul Robinette

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

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

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Brian Magaha is a senior in Aerospace Engineering at Missouri S&T. He has research experience both on campus and in industry that qualify him for this project. From spring semester 2005 through spring semester 2006, he worked on the MRSAT project as a member of the thermal subsystem. He performed thermal modeling and analysis, as well as research in thermal protection systems under Dr. Pernicka. Also, he presented this work at a design review to engineers from the Air Force Research Laboratory during the spring of 2006. During the summer of 2006, Brian was an intern with Caterpillar. He worked to create a semi-autonomous control system for an implement on a D-10 tractor. This involved modeling the hydraulic system, designing a control system, and testing the control system using software rapid prototyping techniques.

Paul Robinette

Joint Project with Paul Drews, Nick Lessley, Brian Magaha

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

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

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Paul Robinette is a senior in the Computer Engineering and Physics at Missouri S&T. He is serving his second year as the Missouri S&T Robotics Team President. He has been active on the Robotics Team for over three years and has overseen the design, fabrication and testing of three robots for the Intelligent Ground Vehicle Competition (IGVC). He has spent the last year working on Missouri S&T's entry to the American Helicopter Society First Responder Competition. He has designed the ground station and assisted in the administration of the team. He has research experience with the Learning Applied to Ground Robotics (LAGR) program through Dr. Agarwal in the Intelligent Systems Center (November 2005 to September 2006). In this project, he helped to design a feature flow system for object recognition to allow a vision-based robot to navigate in unfamiliar terrain. He has worked as a software engineer for one year at the Rolla office of the US Geological Survey. He also has an amateur radio license.

Michelle Vaughan

Joint project with Bryan Glass

Department:	Computer Engineering
Major:	Computer Engineering, Computer Science
Research Advisor:	Dr. Steve E. Watkins
Advisor's Department:	Electrical and Computer Engineering
Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

An Investigation of Automated Transportation

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Michelle Vaughan is a junior at Missouri University of Science & Technology and is double majoring in computer engineering and computer science. She is currently in her fourth semester of classes and plans to graduate in May of 2010. Michelle is a member of the Society of Women Engineers (SWE) at Missouri S&T and is registered national member as well. She also holds the officer position as co-webmaster for SWE so she is currently working on setting up the SWE web page for Missouri S&T. As an extracurricular activity she is a member of the Missouri S&T Symphonic Winds Band in which she plays the flute and the piccolo. Michelle enjoys computer programming so she got involved in this project to enhance her skills in programming and overlook the programming of the project.

Humanities/Social Sciences
Oral Session

Abstracts

Jennie Ziverk Carr

Department: Arts, Languages & Philosophy
Major: Art History
Research Advisor: Dr. Adam Potthast
Advisor's Department: Philosophy

Autonomy and the Consequences of Criminalizing Prostitution

Sex sells, but in America the sex itself can not be sold. The women and men of the sex trade are being denied the right to reign sovereign over him/herself, and over his/her own body and mind. John Stuart Mill declared that the right to this kind of self governance is fundamental in any free society. In America today we are allowing the despotism of collective opinion to oppress the oldest profession is existence—prostitution. This system not only undermines the individual freedom of the prostitute to govern his/her own choices and action, but also permits legal moralism to replace concrete rights with tenuous moral biases. The current United States policy banning prostitution is inconsistence with other policies, harmful to the individuals currently practicing prostitution, and ultimately harmful to society as a whole.

Jennie Ziverk Carr received a B.A. in Art History from Missouri State University in December of 2007. Prior to graduating, Jennie accepted an internship at the Museum of Fine Arts in Houston, Texas and helped curate an exhibition of modern mexican prints. She began taking undergraduate courses at Missouri University of Science and Technology in the Fall of 2007 and has placed special emphasis on the study of philosophy. Jennie will begin her two year commitment with the non-profit organization Teach for America in June of 2008. She looks forward to teaching underprivileged children in low-income schools in Houston, Texas.

Amanda Kamps

Department: History & Political Science
Major: History
Research Advisors: Dr. Jeff Schramm and Professor Guise-Richardson
Advisor's Department: History & Political Science

The Struggle Within: A Brief Look at George Mivart and his Methods of Combining Science and Spirituality

During the late 1800s, science and religion clashed when Charles Darwin presented his arguments for evolution in *Origin of Species.* Opposing Darwin was George Mivart, a fellow scientist and religious man, who published his own book, *On the Genesis of Species,* in opposition to Darwin. While Darwin argued his new ideas on the perpetuation of species and natural selection Mivart tried to reconcile creation with evolution; leading to an intense feud between the two men. Mivart hoped to combine his deep religious beliefs with evolution, and this led to a crisis of conscience. While many historians look at the arguments of Mivart and Darwin to illustrate the complexities of the period, Mivart's attempts to relieve his inner struggle and find a satisfactory conclusion that allowed for both a spiritual realm and a scientific one are perhaps a better representation of the society of the late 18th and early 19th century.

Amanda Kamps is currently a junior at Missouri S&T and is completing her B.A. in History. She was born in Arizona, and raised in Germany, Virginia, Texas, Indiana, Japan, and then Missouri. She graduated from Waynesville High School in 2005 as Valedictorian. Her current research at Missouri S&T includes primary source review of Moe Dalitz and Bugsy Siegel and their involvement in Las Vegas, as well as George Mivart's role in Darwinian Evolution during the late 1800s. In the future she hopes to pursue a master's degree in Archival Studies with a focus on American history.

Jonathan Kampunzu

Department:	Business and IST
Major:	Business Management Systems
Research Advisor:	Dr. Kate Drowne
Advisor's Department:	English
Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

The 1920s Flapper in Public Opinion

Most of the results from the research came in the form of newspaper articles. Since most of the research was done via internet sources using historical databases, the articles have a variety of dates, but are limited to the late 1910s and early 1920s, because this is the time frame during which the subject of our research gained prominence. All the articles speak of people who were either in support of, or against the flapper lifestyle.

Jonathan Kampunzu was born in the Democratic Republic of Congo. A Business and Management Systems major, he has lived in France, South Africa and Botswana prior to his arrival in the United States. His involvement on campus contributes to preparing him for Law School.

Mallary Kleeschulte

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

Funding Source: Secondary Research Data Analysis
Graduate Student Research Award in prevention to Julie A. Patock-Peckham
Center Grant P30MH39346
National Research Service Award Training Grant 5T32MH18387
RTI's Health, Social and Economics Research Unit

Relationships with Parental Overprotection and Autonomy and Offspring Self-Esteem, Depression, and Problem Drinking

The stress-dampening model suggests some individuals expect alcohol consumption will reduce feelings of tension or stress (Sayette, 1999; Sher, 1987). It is also believed one's parental relationships have a prolonged impact on an individual's emotional functioning (Ainsworth, 1989) which may play a role in the development of alcohol use disorders. This study sought to examine the relationships with parental overprotection and autonomy and offspring self-esteem, depression, and drinking problems in offspring. Questionnaires regarding parental bonds, alcohol use, depression, and self-esteem were administered to 406 (199 female, 207 male) college students. Correlation coefficients were calculated to examine the strength of relationships among the variables. Results revealed parental autonomy was strongly correlated with high self-esteem in males, whereas depression and low self-esteem were strongly correlated with parental overprotection for both genders. Interestingly, father overprotection, for females, and mother overprotection, for males, was strongly correlated with problem drinking.

Mallary Kleeschulte is a senior attending Missouri University of Science and Technology majoring in psychology. She is the daughter of Michael and Marlene Kleeschulte and is from Rolla, MO. On campus she is actively involved in PSI CHI and working in Dr. Patock-Peckham's research lab. Off campus she is involved in the Mentoring Makes a Difference program, the Teen Outreach Program in St. James, and is a youth sponsor/ leader at her church. Mallary plans on pursuing a career in marriage and family therapy.

Natural Sciences
Oral Session

Abstracts

Cory Cheatham

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

Funding Source: MS&T Department of Biological Sciences, MS&T Department of Chemical and Biological Engineering, MS&T Materials Research Center, MS&T Center for Environmental Science and Technology, Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program, JE Dunn Construction, Morpholgoynet, Dr. Chang-Soo Kim, MidSci Scientific, Monsanto Corporation, Pizza Inn of Rolla

Constructing a Biological Breathalyzer

The goal of this research is the manipulation of yeast cells; granting them the capability of measuring the concentration of ethanol present. This project utilizes the metabolic pathways of the yeast *Pichia pastoris*, which are capable of metabolizing ethanol and methanol. The enzyme, alcohol oxidase (AO), encoded in the AOX gene appears to be the major enzyme involved in methanol metabolism. If both carbon sources are present, however, *P. pastoris* prefers to utilize ethanol first. Fusing the AOX promoter with a fluorescent protein gene will allow visible detection of the expression of AOX. In supplying the yeast with ethanol and methanol simultaneously, the cells should produce the fluorescent protein upon ethanol consumption; resulting in a visible color and fluorescent light. The concentration of ethanol can be determined by measuring the time before fluorescence and in doing so, will make plausible the development of a breathalyzer device and additional sensor systems.

Cory is a senior majoring in biological sciences and chemistry at Missouri S&T. He is actively involved in various organizations to include: Helix, Scrubs, Phi Sigma, and V.O.I. Presently, his interests are reading, participating in research projects and socializing with friends. Cory's future plans after undergraduate school is to attend medical school.

Brandi Clark

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

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

NSF grants CHE-0437346 and DMR-0504715

Unleaded Drinking Water: Equilibrium Potential Measurements for Monochloramine Disinfectant

The strength of monochloramine, NH_2Cl, as an oxidizing agent can be linked to its effect on Pb levels in drinking water. In this study, the equilibrium potential was measured as a function of pH from pH 8-12 and compared to a theoretical plot of formal potentials derived from the Nernst equation. The measured equilibrium potential was consistently 300 mV more negative than the calculated potential. When the measured potentials are plotted on a Pourbaix diagram, it is found that NH_2Cl can oxidize Pb to PbO_2 only above pH 9.5, while the theoretical values indicate that it can do so at a much lower pH. The validity of the values measured in this experiment is supported by the fact that NH_2Cl has been shown to oxidize Pb to Pb^{2+}, not PbO_2, at pH 8 (1). The work is important because it is known that PbO_2 acts to passivate lead-bearing plumbing materials.

Brandi Clark is a junior in the Chemistry Department at the Missouri University of Science and Technology. She has been involved in research in both chemistry and civil/environmental engineering and has worked on several research projects, including two for OURE. She is also actively involved in organizations in both departments including ASCE, WEF, the W. T. Schrenk Society, and AXΣ. Brandi plans to continue doing research and pursue a Ph.D. in chemistry, ideally with an emphasis on work in an environmental area.

Lauren Garten

Department: Material 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) Program

Electrodeposition of Pure and Doped ZnO

A study of the electrodeposition of pure and doped zinc oxide from a basic solution was completed using SEM, EDS, UV-Vis, and XRD analysis. The presence of a highly ordered zinc oxide film was confirmed. The doping of zinc oxide films with 3, 5, and 10 at wt% chromium was documented. Tests were run to insure the incorporation of chromium from solution and not the substrate which also contained chromium. Aluminum was doped into zinc oxide films at 3, 5, 10 and 20 at wt% but its presence could not be determined using these characterization techniques.

Lauren Garten is a senior in ceramic engineering at the Missouri University of Science and Technology. Previously she has worked in energy materials for Dr. Dogan.

Kyle Rybacki

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

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

Carbonate Phase Precipitation Within Missouri Springs

Colloidal white precipitates are observed in Missouri springs, as well as other regions. Chemical parameters of the spring water were measured in situ and colloidal precipitates were collected in order to determine their formation mechanism. Spring water pH and temperature both increase slightly downstream from the spring to the furthest downstream location approximately 1200 nautical meters from the conduit. Eh values decreased slightly while conductivity remained relatively consistent throughout the sampling reach. The pH increase occurs as a result of a decrease in pressure and a corresponding CO_2 loss from the spring system as it rises from a known depth of at least 200 feet. This pH increase lowers the solubility of Ca^{+2} and/or Mg^{+2} in solution with respect to carbonate phase(s). Colloidal spring precipitates were isolated and examined using a Scanning Electron Microscope and wet-chemical analysis following digestion. The particles were determined to be composed of low-Mg calcite ($CaCO_3$).

Kyle Rybacki is a senior at the Missouri University of Science & Technology studying geology. He is the son of Steven and Charlene Rybacki of Nasvhille, Illinois. Currently, he is the president of the MSM Spelunkers and vice president of geological sciences honor society, as well as member of other organizations on the Missouri S&T campus. Outside of school, Kyle is a member of the National Speleological Society, Cave Research Foundation, and Missouri Speleological Survey. Recently, Kyle has been accepted into the New Mexico Institute of Mining and Technology where he plans to pursue a M.S. in geochemistry before attempting a Ph.D. in carbonate geochemistry.

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. One way to study gene function is to knock out the gene. We focused on uncharacterized genes that have been identified in genomic screens as interacting with cytokinesis proteins. Another way to study gene function is to tag genes on the chromosomes. The purpose of tagging genes is to allow monitoring of protein localization in live cells without affecting the upstream regulatory regions. 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.

Katherine Stockstill is a junior at the Missouri University of Science and Technology where she is majoring in Biological Sciences. On campus, Katherine is the president of Kappa Delta Sorority; she is also a member of 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 she graduates, Katherine plans to peruse a career in research.

Jenna Tune

Department: Biological Sciences
Major: Biological Sciences
Research Advisors: Dr. A. Curt Elmore and Dr. Melanie Mormile
Advisor's Department: Geological Engineering, Biological Sciences

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Fellows Program
National Science Foundation Grant 0623091 – International Research Experiences for Students program

Field Analyses for the Detection and Enumeration of Coliform Bacteria in Drinking Water During a Public Health Assessment Study

The microbiological contaminant concentrations of drinking water are typically analyzed using a customary membrane filtration method approved by the U.S. Environmental Protection Agency (EPA) and the World Health Organization (WHO), as well as the European Economic Community (EEC). The membrane filtration method is well documented providing highly-reproducible water quality data at a relatively high cost in terms of preparation time, in situ procedure, and money. The commercially available Coliscan EasyGel method for the detection and enumeration of *Escherichia coli* and total coliforms costs much less. However, the usability of the field data may be uncertain when the results are qualitatively and quantitatively compared to duplicate membrane filtration results. Drinking water samples collected during a public health assessment study in Chichicastenago Guatemala will be analyzed using the Coliscan EasyGel method to measure concentrations of indicator coliform bacteria and the effect of the temperature stability on incubation time. A subset of the samples will be split for duplicate membrane filtration analysis. Linear regression analysis and relative percent difference analysis will be performed on the duplicate results to evaluate the comparability of the Coliscan EasyGel and membrane filtration data.

Jenna Tune is a first year graduate student pursuing a master's degree in Geological Engineering. Her research interests include: theoretical and practical applications of water treatment technologies and sustainable solutions in relation to water management, infrasture rehabilation, and industrial water processes. Her campus and community involvement include: Woman As Global Leaders, Engineers Without Borders, Sue Shear Leadership Academy, Hospice Volunteer, and West Coast Swing dancing enthusiast.

Evan Wright

Department: Mathematics
Major: Mathematics & Computer Science
Research Advisor: Dr. Wlodzimierz Charatonik
Advisor's Department: Mathematics

Monotone Maps on Dendrites

We investigate the class of monotone mappings (those with connected point-preimages) between dendrites (locally connected continua containing no simple closed curve). We develop the notion of *arc rank* of a dendrite using the Cantor-Bendixson rank of certain subsets of arcs, and show that this notion can be used to provide topological requirements for the existence of certain monotone maps.

As applications, we give an alternative proof for the characterization of monotone equivalence to a standard universal dendrite by containment of the Omiljanowski dendrite, an important fact in the study of dendrites whose original proof was recently found to be in error, and after more fully developing the concept of arc rank, we also apply the tool to prove a long-conjectured characterization of monotonely homogeneous dendrites, a proof which has resisted other methods.

Evan Wright is a senior double-majoring in mathematics and computer science. The above-mentioned work was undertaken as his Honors Academy senior thesis project. After graduation, he intends to pursue a Ph.D. in mathematics with an emphasis in topology.

Engineering
Poster Session

Abstracts

Robert Adams

Department:	Mechanical and Aerospace Engineering
Major:	Mechanical Engineering
Research Advisor:	Dr. Ashok Midha
Advisor's Department:	Mechanical Engineering

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

Energy Efficient Walking Mechanism with Genetic Algorithm Synthesis

This research covers the use of legs for transportation rather than wheels. Legged walking is potentially more efficient than wheels on deformable surfaces such as sand, where the required transportation energy is related to the amount of sand displaced. Available robotic walking devices use multiple motors per leg to control movement, which allows multiple degrees of freedom, but consumes excessive energy. Because the center of mass remains at a constant elevation, this new mechanism consumes no energy except for joint and sliding friction of the legs while traveling on level ground. Previously, no available mechanisms were efficient enough for a personal transport device based on size, weight, and energy consumption. Because no mechanism-synthesis programs were readily available to allow optimization of these criteria, a genetic algorithm was designed and written. The resulting mechanism appears to be superior to any previous designs, and will be tested with a full scale prototype.

Robert Adams is a dual major student in mechanical engineering and biological sciences, and is currently finishing up his junior year. He is very involved with his department and serves in leadership roles in the American Society of Mechanical Engineers as well as in Pi Tau Sigma, the mechanical engineering honors society. Beyond the department, Robert leads the mechanical group of the Robotics Competition Team, and is involved with Scrubs, the university pre-medical group. After Missouri S&T, he plans to work in the field of orthopedic prosthetics.

Adedayo Agbaje

Joint Project with Leykun Amdemichael, Michael Nolte and Timothy Ryan Wilkins

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

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

Detecting and Analyzing Milia-Like Cysts for Diagnosis of Malignant Melanoma

Malignant melanoma skin lesions contain several key characteristics that dermatologists search for in order to make a diagnosis. These include but are not limited to size, shape, color, and structures within the lesion. This research project focuses on one specific structure: small white dots within the lesion called milia-like cysts, which, when present, indicate that the lesion is benign, not malignant. Thus, the detection of milia-like cysts can help separate malignant melanoma from benign mimics. The group seeks to improve the reliability of detection of this characteristic as a means of diagnosis by analyzing high-quality images of skin lesions with image-processing tools. This is accomplished by first finding the milia-like cysts in the images by identifying them with the eye under the supervision of a dermatologist, then using the image-processing code to identify the dots, and comparing the results. These results then lead us to adjust the program by changing certain parameters to improve the accuracy and reliability of the code in identifying malignant melanoma.

Adedayo Agbaje is a junior majoring in electrical engineering at Missouri University of Science and Technology. He is originally from Nigeria, but he has been living in the United States for eight years. When Adedayo is not at school he enjoys lifting weight and playing soccer. Adedayo plans on graduating in the spring of 2009.

Leykun Amdemichael

Joint Project with Adedayo Agbaje, Michael Nolte and Timothy Ryan Wilkins

Department:	Electrical and Computer Engineering
Major:	Electrical 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

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Leykun Amdemichael was born in Hossana and was raised in Addis Ababa, Ethiopia. He came to the United States in 2003 as a permanent resident. Leykun is a senior majoring in electrical engineering with an emphasis in power engineering. He plans to graduate in December 2008.

Navarre R. Bartz

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

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

Evaluating the Solar Thermal Energy Recapture Capabilities of a Thermoelectric Tie-in Device

In this study, the energy conversion efficiency of a thermoelectric device was evaluated when paired with a solar thermal system. This application to a real-world solar hot water system was compared to a previously prepared mathematical model of the systems performance. The comparison between theoretical and real-world values is likely due to the small temperature gradient and the inefficiencies inherent in the system's design. It is hoped that this work can result in a less expensive hybrid roof system to further the adoption of alternative energy in the residential sector. Further work will attempt to minimize the effects of efficiency losses.

Navarre R. Bartz is a Junior in the Ceramic Engineering Department program at the Missouri University of Science and Technology. He is involved on campus with the W.T. Schrenk Society, Solar Car, and the Water and Environment Federation. He has a vested interest in energy storage, production, and sustainable design. He hopes to pursue a Ph.D. in materials science with an emphasis in energy materials.

Derek Ditch

Department:	Computer Science & Electrical Engineering
Major:	Computer Science
Research Advisors:	Dr. Bruce McMillin and Dr. Mariesa Crow
Advisor's Department:	Computer Science (McMillin) Electrical and Computer Engineering (Crow)

Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program NSF MRI (CNS—0420869) NSF CCF (CCF—0614633) Department of Energy

Security in Cyber Physical Systems

The need for protecting our nation's critical infrastructures is a pressing one that is undergoing much research. In the current approach for protecting our national power grid, assumptions are made that suggest that traditional approaches to cyber security may be applied without further analysis. However, systems involving information resources as well as physical resources present additional complexity in their protection needs. This research takes formal analysis of the proposed security architecture of a Cooperating Flexible Alternating Current Transmission System Device (CFD) and applies results of lab experiments to indicate weaknesses in the suggested architecture.

Derek Ditch is a senior in Computer Science and will be graduating in May 2008. He has been a member of the Army National Guard since graduating high school in 2000. When he began working as an undergraduate researcher for Dr. Bruce McMillin in 2006, he combined his experiences with securing classified military networks and academic theory learned at Missouri S&T, in order to provide a unique perspective on the security and vulnerability of software systems. Since working in the FACTS Interaction Laboratory, he has used this perspective to enhance both the physical and the cyber security of the experimental architecture, resulting in a more stable and robust test environment. Derek will be continuing his research in the fall as he begins his PhD program in Computer Science. Missouri S&T is one of the top candidates for his continued education.

Stephen Grelle

Department: Civil, Architectural, and Environmental Engineering
Major: Civil Engineering
Research Advisor: Dr. Genda Chen
Advisor's Department: Civil, Architectural, and Environmental Engineering

Funding Source: Center for Infrastructure Engineering Studies (CIES)

Corrosive Properties of Ceramic-Coated Steel Rebar

Enameled steel reinforcing bars were provided to CIES by a project consultant at Roesch, Inc. The gritty ceramic enamel was added to the surface of the rebar in an attempt to prevent steel corrosion in extreme environments, as well as to increase bonding between the rebar and cement. These bars were subjected to mechanical tests to gain an understanding of the tensile strain levels and load-displacement tendencies under which the coating experienced cracking or spalling. The bars were also subjected to a corrosion test which quantified corrosion levels by measuring the current in the bars after an electric potential was passed through them.

Stephen Grelle is a junior pursuing dual degrees in Architectural and Civil Engineering. In addition to being involved in the Opportunities for Undergraduate Research Program at Missouri S&T, he is also involved with many other campus organizations, such as Pi Kappa Alpha, Intercollegiate Knights, Architectural Engineering Institute, Order of Omega, and the Missouri S&T Lacrosse Team.

Janet Guntly

Joint project with Amber Loftis

Department:	Environmental Engineering and Computer Science
Major:	Computer Science
Research Advisors:	Dr. Glenn Morrison and Dr. Daniel Tauritz
Advisor's Department:	Environmental Engineering and Computer Science

Funding Source:	Multidisciplinary Research Opportunities for Women (MRO-W) grant from the Computing Research Association Committee on the Status of Women in Computing Research (CRA-W)

Indoor Air Quality Simulator with Lab and Interactive Consumer Interface

The Environmental Protection Agency ranks health risks due to indoor air among the top five environmental health risks. A research review estimates $160 billion could be saved every year in the United States by improving indoor air quality. High indoor pollutant levels are a result of emissions from indoor sources, limited air exchange, high surface area to volume ratios, and indoor chemistry. By observing the interactions between reagents, the project is aimed at helping (1) consumers, by allowing them to realize what pollution is in their home, and (2) researchers who would use the simulations to test new ideas. By creating a *cyberinfrastructure*, comprising consumers and researchers with feedback loops, we plan to improve consumer health and also provide researchers with a valuable research tool. At this time, we have performed lab tests on the reactions of alpha-pinene, discovered sets of equations, and produced programs that solve these equations.

Janet Guntly is the daughter of Michael and Maureen Guntly, and she is a junior in Computer Science. After graduating, she plans to pursue a career in St. Louis.

Yasmin Hassen

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

Funding Source: Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program
GeoMO 2007

Evaluation of Expansive and Problematic Compacted Clays in Missouri using 3D Swell Tests

Many clay soils in the Midwest region are susceptible to changes in water content that may result in swelling that can impact lightly loaded structures. In construction soils are often used for fill and compacted at specified water contents. Problematic clay soils are present in arid regions like in Texas and Colorado and it is well documented. However, less information is available on Missouri clay soils. Soil samples at shallow depth were collected and tested in the Missouri S&T geotechnical laboratories. The properties and characteristics of the compacted samples were determined. The swelling potential using a new testing protocol called the 3D Swell Test was determined for two samples from different locations in the state. Comparison and evaluation of the swelling results are made and recommendations for future research are also presented.

Yasmin Hassen is an undergraduate student in Civil Engineering. She is originally from California and came to Missouri S&T in search for fame, fortune, and knowledge. She found knowledge, which is endless, and therefore engaged in research. She has also found that learning can come in many different styles and has traveled to Guatemala in class projects that promote service learning. She plans to graduate in 2009.

Amber Loftis

Joint project with Janet Guntly

Department:	Environmental Engineering and Computer Science
Major:	Chemical Engineering
Research Advisors:	Dr. Glenn Morrison and Dr. Daniel Tauritz
Advisor's Department:	Environmental Engineering and Computer Science
Funding Source:	Multidisciplinary Research Opportunities for Women (MRO-W) grant from the Computing Research Association Committee on the Status of Women in Computing Research (CRA-W)

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Amber Loftis is the daughter of Ed and Tammy Loftis from Bartlesville, Oklahoma. She is a junior majoring in Chemical Engineering at Missouri University of Science and Technology.

Samantha Markus

Department:	Civil, Architectural, and Environmental Engineering
Major:	Environmental Engineering
Research Advisor:	Dr. Stuart Baur
Advisor's Department:	Civil, Architectural, and Environmental Engineering
Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Cost and Efficiency of Household Hot Water Systems

The Missouri S&T Solar House Team has competed in three Solar Decathlons and will be competing again in 2009. Each competition has ten components and one of these is hot water. In order to choose the best water heating system, the two solar powered water heaters used in past competitions as well as an electrical conventional hot water heater were studied and evaluated on various properties. These properties include cost, initial and ongoing; effectiveness, ability to quickly produce water above a certain temperature; and power efficiency, how much electricity each heater uses. It will also address the space taken by the heater and its aesthetics.

Samantha Markus was born in St. Louis, Missouri. She grew up in Fenton and attended Ursuline Academy in Kirkwood, Missouri until 2006. She is currently a sophomore in Environmental Engineering at the Missouri University of Science and Technology. She is an active member of the Cardinal Newman Catholic Campus Ministry Center and was part of the Missouri S&T Solar House Team for a year, including the 2007 competition.

Ben McCouch

Joint project with Bryan Ralston

Department:	Mechanical and Aerospace Engineering
Major:	Aerospace Engineering
Research Advisor:	Dr. K.M Isaac
Advisor's Department:	Mechanical and Aerospace Engineering

Micro Air Vehicle Aerodynamics

Computational Fluid Dynamics (CFD) can be applied to many problems involving aerodynamics. One particularly interesting area of research is low Reynolds number (Re) flows. In this research, CFD simulations of a rectangular planform wing at Re = 500 with aspect ratios of 4 and 6 were performed using a commercial CFD software package, Fluent 6.3, with a mesh of ~2.3 million tetrahedral cells. A drag polar was used to compare performance for angles of attack ranging from 0 to 20 Degrees. Tip vortices were observed but did not reveal a dead fluid region for the above angle-of-attack range. The results can be applied to moderately high aspect ratio wings subjected to low angles of attack, an important flow regime occurring during the gliding phase of micro air vehicle missions.

Ben McCouch is a senior in the Aerospace Engineering Department. In addition to his research, he takes pleasure in playing tennis and has been president of the Missouri S&T Tennis Club for the past 2 years. He is also a member of the American Institute of Aeronautics and Astronautics, Tau Beta Pi, and Phi Kappa Phi Honor Society. Ben will graduate in May 2008 and has accepted a job with Hawker Beechcraft in Wichita, KS. He hopes to eventually continue his education with Master's Degree in aerodynamics.

Jonathan McKinney

Department: Environmental Engineering
Major: Environmental Engineering
Research Advisor: Dr. Glenn C. Morrison
Advisor's Department: Environmental Engineering

Forensic Analysis of Contamination History using Solid Phase Microextraction (SPME)

Health professionals, epidemiologists and toxicologists need better ways to identify chemicals that cause disease. We have discovered that air contaminants diffuse into surrounding solids and leave behind unique concentration profiles. Even when contamination is no longer present in the surrounding air, a concentration profile still remains in the solid. By solving an "inverse diffusion problem" this profile can tell us a great deal about when, and how much, people were in contact with chemicals in the recent past. To date, we have been able to measure the diffusion coefficient of toluene in a foam material similar to furniture cushions. The diffusion coefficient is an important parameter, along with soon-to-be measured concentration profiles, necessary to solve the inverse problem. With these parameters in place, we will apply Evolutionary Algorithms to solve the inverse problem and to determine the history of contamination in homes and other microenvironments.

Jonathan McKinney is a sophomore in environmental engineering. He is pursuing a research project under the supervision of Dr. Glenn C. Morrison and plans to continue working after his OURE fellowship. 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.

Michael Nolte

Joint project with Adedayo Agbaje, Leykun Amdemichael and Ryan Wilkins

Department:	Electrical and Computer Engineering
Major:	Electrical Engineering and Applied Mathematics
Research Advisor:	Dr. Bijaya Shrestha
Advisor's Department:	Electrical and Computer Engineering
Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Detecting and Analyzing Milia-Like Cysts for Diagnosis of Malignant Melanoma

Malignant melanoma skin lesions contain several key characteristics that dermatologists search for in order to make a diagnosis. These include but are not limited to size, shape, color, and structures within the lesion. This research project focuses on one specific structure: small white dots within the lesion called milia-like cysts, which, when present, indicate that the lesion is benign, not malignant. Thus, the detection of milia-like cysts can help separate malignant melanoma from benign mimics. The group seeks to improve the reliability of detection of this characteristic as a means of diagnosis by analyzing high-quality images of skin lesions with image-processing tools. This is accomplished by first finding the milia-like cysts in the images by identifying them with the eye under the supervision of a dermatologist, then using the image-processing code to identify the dots, and comparing the results. These results then lead us to adjust the program by changing certain parameters to improve the accuracy and reliability of the code in identifying malignant melanoma.

Michael Nolte was born in Gladstone Missouri and graduated from North Kansas City High School in 2004, after which he came to Missouri S&T. He has participated in three research projects at Missouri S&T and plans to graduate with degrees in Electrical Engineering and Mathematics in December 2008. Michael plans on graduating with an emphasis in power engineering.

Phillip Ponzer

Department:	Electrical and Computer Engineering
Majors:	Computer Science and Computer Engineering
Research Advisor:	Dr. Sahra Sedigh
Advisor's Department:	Electrical and Computer Engineering
Funding Source:	University Transportation Center

Hydrological Monitoring of a Watershed Using Hybrid Sensor Networks

The objective of the project is to design and develop the next generation of research instrumentation for in situ hydrological monitoring of watersheds. More specifically, a system will be developed that autonomously measures various attributes of the watershed soil, including chemical composition, moisture, temperature, and resistivity. The measurements will be taken at several depths, and will be communicated to a processing server over the GSM cellular phone network. Several years of unattended field life are made possible through wireless data communication, solar power harvesting, and remote software maintenance and configuration.
Insert abstract text here

Phillip Ponzer, son of Robert and Penny Ponzer, is a senior majoring in Computer Science and Computer Engineering. He is set to graduate in May of 2009 with both degrees and, after graduation, plans to enter the work force as a software engineer.

M. Everett Probasco

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

The Synthesis of Biodegradable Microparticles for Pharmaceutical Use

Poly(lactic acid-co-glycolic acid) (PLAGA) is a commonly used polymer carrier in the controlled delivery of therapeutic agents because it degrades into naturally occurring compounds which the body easily metabolizes over a period of time. The goal of the research is to develop microparticles loaded with a drug of choice, in this case B-Estradiol, establish predictable time degradation of the drug in the body, and to be able to develop a process method that results in consistent production.

Michael Probasco, also known as Everett (his middle name), was born in Montgomery, Alabama to Michael and Denise Probasco. Everett's father was in the military and has traveled to more than 20 different countries. After his father's retirement, he went to high school at Francis Howell North in St. Charles, Missouri where he was in the marching band for four years and was the drum major for one. Everett has attending Missouri S&T since the fall of 2004 and is very active in school organizations; these include, KMNR college radio, Air Force ROTC, Kappa Sigma Fraternity, Military Aerospace Society, and Blue Sabres Drill Team & Color Guard, all of which he currently holds or has held a position in. Upon graduation in December of 2008, he will commission into the Air Force and begin pilot training.

Bryan Ralston

Joint project with Ben McCouch

Department:	Mechanical and Aerospace Engineering
Major:	Aerospace Engineering
Research Advisor:	Dr. K.M Isaac
Advisor's Department:	Mechanical and Aerospace Engineering

Micro Air Vehicle Aerodynamics

Computational Fluid Dynamics (CFD) can be applied to many problems involving aerodynamics. One particularly interesting area of research is low Reynolds number (Re) flows. In this research, CFD simulations of a rectangular planform wing at Re = 500 with aspect ratios of 4 and 6 were performed using a commercial CFD software package, Fluent 6.3, with a mesh of ~2.3 million tetrahedral cells. A drag polar was used to compare performance for angles of attack ranging from 0 to 20 Degrees. Tip vortices were observed but did not reveal a dead fluid region for the above angle-of-attack range. The results can be applied to moderately high aspect ratio wings subjected to low angles of attack, an important flow regime occurring during the gliding phase of micro air vehicle missions.

Bryan Ralston is an undergraduate in Aerospace Engineering. In addition to his research, he enjoys cycling and is a member of the 2008 Missouri S&T Collegiate and U.S Air Force Cycling Teams. Bryan is also a Senior Cadet Leader in Air Force ROTC and currently holds the position of Vice Wing Commander. In previous semesters, he has held the positions of Operations Group Commander and Flight Commander. While enrolled at Missouri S&T, he has also been a member of the Skydiving Club, Military Aerospace Society, Roller Hockey Team, and Advanced Aero Vehicle Group. He is also a student member of the American Institute of Aeronautics and Astronautics. After graduation in December 2008, Bryan will commission as a Second Lieutenant in the U.S Air Force and hopes to become a Flight Test Engineer, and eventually will pursue a master's degree in aerodynamics.

Nathan Rouse

Joint project with Alex Warren

Department:	Mining and Nuclear Engineering
Major:	Mining Engineering
Research Advisor:	Dr. Paul Worsey
Advisor's Department:	Mining and Nuclear Engineering
Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

The Effects of Powder Types and Applied Pressures on the Smoke Output of Proximal Fireworks

Past studies and research into the possibility of using Vulcanite 75 have shown that it appears not to be a suitable substitute of either black powder or Pyrodex, but in that research, confinement, an important variable of proximal fireworks, was omitted. Our research focuses on confinement, mass, and type of powder, which are three important variables to be taken into consideration. Powder is weighed, placed in cartridges, and confined. Then, the cartridges are contained in a regulated environment. Electric matches are used to initiate the cartridges and the smoke output of each cartridge is measured by a professional light meter. These results are analyzed to determine which powder emits the least amount of smoke on average.

Nathan Rouse is a Junior in Mining Engineering and is applying to begin a M.S. degree in Explosives Engineering. He is also an active member of several student organizations in the mining department, is the co-captain of the Missouri S&T mine rescue team, and competed in the NSSGA student design competition. Nathan is a member of the Missouri S&T explosives research team along with Alex Warren.

Mark Smedvig Jr.

Department:	Civil, Architectural and Environmental Engineering
Major:	Architectural Engineering
Research Advisor:	Dr. John J. Myers
Advisor's Department:	Civil, Architectural and Environmental Engineering

Funding Source:	Coreslab Structures Inc. of Marshall Mo National University Transportation Center at Missouri S&T National Science Foundation Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program CIES CAREE Department at Missouri S&T

Strength Properties and the Effects of Segregation on Self-Consolidating Concrete

Currently, the manufacturing and use of self-consolidating (or self-compacting) concrete (SCC) in the United States is very limited. It is mainly seen in pre-cast plants for architectural purposes due to its clean finish and its versatility. SCC was first seen in Japan after being developed in the late 1980's and is now used for bridges, tunnels and buildings. SCC has also been on the scene recently in Europe. The purpose of this research project is to gain a better understanding of the properties attained by SCC and the effects of segregation on a mix so SCC can be utilized in any concrete structure it would benefit. Six beams were made using different mix weight ratios. Some were made with a normal SCC mix design in mind and others were made to try to obtain segregation. These beams were tested using two point loads and the strength properties were monitored.

Mark Smedvig is a Senior undergraduate at Missouri University of Science & Technology studying Architectural engineering.

Alex Warren

Joint project with Nathan Rouse

Department:	Mining and Nuclear Engineering
Major:	Mining Engineering
Research Advisor:	Dr. Paul Worsey
Advisor's Department:	Mining and Nuclear Engineering

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

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Alex Warren is a Junior in Mining Engineering. He is a member and officer of several student organizations and competes on the Missouri S&T mine rescue team as first aid captain, mucking team, NSSGA student design team, and steel bridge team. Alex is also a member of the explosives research team headed by Dr. Jason Baird.

Timothy Ryan Wilkins

Joint project with Adedayo Agbaje, Leykun Amdemichael and Michael Nolte

Department:	Electrical and Computer Engineering
Major:	Electrical and 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

Detecting and Analyzing Milia-Like Cysts for Malignant Melanoma Diagnosis

Malignant melanoma skin lesions contain several key characteristics that dermatologists search for in order to make a diagnosis. These include but are not limited to size, shape, color, and structures within the lesion. This research project focuses on one specific structure: small white dots within the lesion called milia-like cysts, which, when present, indicate that the lesion is benign, not malignant. Thus, the detection of milia-like cysts can help separate malignant melanoma from benign mimics. The group seeks to improve the reliability of detection of this characteristic as a means of diagnosis by analyzing high-quality images of skin lesions with image-processing tools. This is accomplished by first finding the milia-like cysts in the images by identifying them with the eye under the supervision of a dermatologist, then using the image-processing code to identify the dots, and comparing the results. These results then lead us to adjust the program by changing certain parameters to improve the accuracy and reliability of the code in identifying malignant melanoma.

Timothy Wilkins was born in Illinois. He graduated from high school in 2005 on the High Honor roll. He was then accepted into the freshman engineering program at Missouri S&T where he is currently seeking a BS in Electrical Engineering and Computer Engineering. His main involvement outside of school is with his church and the Milia-Like Cysts research.

Humanities/Social Sciences
Poster Session

Abstracts

Brandi Andersen

Department:	History
Major:	Biochemical Engineering
Research Advisor:	Dr. Diana L. Ahmad
Advisor's Department:	History

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

The Music of the Second Great Awakening

During the late 1700's and early 1800's, a time of religious revival, called the Second Great Awakening, spread through the United States. Average Americans desired newer types of music, both sacred and secular. It was the interdependence of the new music and the Second Great Awakening's religious revivals that led to the success of the revival and the survival of this new type of music. Circuit riders would ride horses over the countryside recruiting new lay people to begin small congregations. These common people began to create their own religious music. These songs reflected some of the new beliefs that were stressed during this time such as free grace and believer's baptism. In summary, the revivals encouraged this new genre of music, but without the music, the revivals would not have been nearly as meaningful.

Brandi Andersen is a sophomore at Missouri University of Science and Technology in Biochemical Engineering. From Belleville, IL, Brandi participates on campus in many different organizations. Currently, she serves as Vice President of Phi Eta Sigma, the freshman honors society, and as a student leader with the Wesley Campus Ministry. Brandi is enjoying her second PRO season as a senior PRO Leader for Missouri S&T.

Lindsey Coale

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

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

Gender Specific Relationships between Antisocial Personality, Parental Bonds, and Alcohol Use

Antisocial Personality Disorder or ASPD reflects a general disregard for the rights of others (APA, 2000) and is one pathway to alcohol related problems. Sher's (1991) model of deviance proneness implies that alcohol use disorders (AUDs) are influenced by the union of inadequate parenting skills and innate factors. This study sought to examine the relationship between antisocial personality, parental bonds, and alcohol use. Questionnaires regarding ASPD, alcohol quantity, binge drinking, and parental bonding were administrated to 261 (150 male, 111 female) college students. This study constitutes secondary data analysis on data collected at Arizona State University. Correlation coefficients were calculated to explore the strengths of relationships among the variables. The findings revealed males who have poor relationships with their mothers are more prone to antisocial behavior. Interestingly, a positive relationship with one's father can compensate for a mother's uncaring/rejecting relationship. These patterns were not found among females.

Lindsey Coale is a junior attending the Missouri University of Science & Technology 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) and participates in the swing dance club and Christian Campus Fellowship on the Missouri S&T campus. During the summer, she works at the Fulton State Hospital as a Forensic Rehabilitation Specialist. Lindsey plans on pursuing a career in Clinical Psychology.

Jill A. Hecht

Department: Environmental Engineering
Major: Environmental Engineering
Research Advisor: Dr. Diana L. Ahmad
Advisor's Department: History and Political Science

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

The Cult of True Womanhood vs. the Cult of the Soccer Mom

Emerging in the 1830s, the Cult of True Womanhood emphasized four ideals for women. These ideals encouraged women to be pious, pure, submissive, and domestic. Above all else, this "cult" assiduously defined the position of women in society. The ideals of "True Womanhood" were propagated by numerous advice books and magazines. In my research, I show that although the message has changed slightly, elements of "The Cult" still exist today in publications geared toward the modern woman, creating a continuation of the Cult of True Womanhood in the Cult of the Soccer Mom.

Jill Hecht is a sophomore in environmental engineering at the Missouri University of Science and Technology. Jill also serves as the treasurer for the Society of Women Engineers. In addition, she is the recording secretary for Phi Eta Sigma, a freshman honor society. In addition to undergraduate research, Jill is involved in many school activities, including serving as the member enrichment coordinator for the Eta Theta chapter of Zeta Tau Alpha and a student leader in the Wesley Campus Ministry. Finally, Jill holds the position of Honors Ambassador and works closely with the Honors Academy at Missouri S&T.

Kathryn Knocke

Department: English
Major: English
Research Advisor: Mr. Dennis Wilson
Advisor's Department: Education

The Problem of English Language Learning and Equal Educational Opportunity - ESL: The Search for a Solution

As a result of civil rights legislation during the mid-20th century, court decisions and amendments have emphasized the need for equal educational opportunity. There is a widespread need for some sort of low English proficiency assistance demonstrated by the fact that since 1989 the population of linguistically diverse students has doubled. However, it would be difficult for a program like bilingual education to provide this assistance even only at state level given its costliness and impracticality. Over 2,000 languages need to be accounted for to achieve true equal educational opportunity. After thorough research was conducted, the solution reached was that English as a Second Language (ESL) programs, (programs using only the English language to teach English), fulfill the respective court decisions. These programs provide equal educational opportunity much better than any dual-language instruction could. It is therefore proposed that an ESL system be incorporated into our current K-12 school curriculum.

Kathryn Knocke is a junior majoring in English at the Missouri University of Science and Technology. She grew up in Wentzville, Missouri and is the oldest of Tamara and Glenn Duncan's three children. Currently, she is a member of Phi Kappa Phi and is also involved with Student Missouri State Teachers Association (SMSTA). Since October 2006 she has worked at The Zone skating rink in Rolla and values the friends she has made among staff and customers during her work there. In the future, Kathryn plans to teach Spanish and English at the high school level.

Management & Information Systems Poster Session

Abstracts

Tim Coalson

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

Identifying Appropriate Games for the Missouri S&T Introduction to Artificial Intelligence Course & Tournament

The CS 347: Introduction to Artificial Intelligence (AI) class and the following AI versus human tournaments have shown that some testing of a game should be done before it is used as an educational vehicle, such as whether it provides a fair and challenging contest in a tournament. Until now, very little work has been done to study how well a game would perform in a tournament with both human and AI players before holding the tournament itself.

This research identifies several possible ways a game can be ill-suited to this class and/or tournament from previous experience, and describes and utilizes a general test schema that can be applied to any turn-based two-player game to quantify a game's suitability in each of these respects.

Tim Coalson is a senior in Computer Science and is considering graduate studies on Artificial Intelligence (AI) or Evolutionary Algorithms. He grew up in St. Louis, Missouri and graduated from Parkway North High School in 2004. He placed third with his AI submission in the Fall 2007 AI Tournament which featured the game Mancala.

Jasmine Glaese

Joint project with Lisa Guntly and Jessica Williams

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
Collaborative Research Experience for Undergraduates in Computer Science and Engineering (CREU)
Grant from the Computing Research Association Committee on the Status of Women in Computing Research (CRA-W)

Computer Science Recruitment for the 21st Century (CSRecruit21)

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 women. The current generation of American students, especially women, 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 women 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 at Missouri University of Science and Technology. She is pursuing a minor in Mathematics and Spanish. 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. She is also a member of ACM-W (ACM for women), ACM, National ACM, and UPE (Upsilon Pi Epsilon), the International Honor Society for the Computing and Information Disciplines. Her hobbies are drawing, coloring, singing, writing, and playing and programming games.

Lisa Guntly

Joint project with Jasmine Glaese and Jessica Williams

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

Funding Source:	Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program Collaborative Research Experience for Undergraduates in Computer Science and Engineering (CREU) Grant from the Computing Research Association Committee on the Status of Women in Computing Research (CRA-W)

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Lisa Guntly is the daughter of Michael and Maureen Guntly from St. Louis. She is currently a senior at Missouri S&T and is double majoring in Computer Science and Biology. She is interested in research combining those two fields of study and is planning to continue attending Missouri S&T in the fall to get a Master's Degree in Computer Science. Her major research interests for the future include the areas of evolutionary algorithms and bioinformatics in Computer Science.

Jessica Williams

Joint project with Jasmine Glaese and Lisa Guntly

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 Collaborative Research Experience for Undergraduates in Computer Science and Engineering (CREU) Grant from the Computing Research Association Committee on the Status of Women in Computing Research (CRA-W)

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Jessica Williams went to Hazelwood West High School. She currently is a senior at Missouri University of Science and Technology where she is pursuing a Bachelor's in Computer Science and a minor in Mathematics. She is currently an intern at Reuters in St. Louis, MO and a member of INROADS, which is a non-profit organization that trains and develops talented minority youth for professional careers in business and industry. She mentors students on techniques they can use to successfully complete college, which includes Time Management and helping students to discover their learning style. She also attends training sessions for Learning Enhancement Across Disciplines (LEAD), in which she learns the most effective way to teach students, and INROADS, where she learns effective ways to improve in all job related areas. She participates in Bible Study, which is trying to become an official organization on campus.

Natural Sciences
Poster Session

Abstracts

Herman C. Armstrong

Joint project with Rachel Klapper, Brian Pink, Morgan Schiermeier and Jackie Schneider

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

Funding Source: Biological Sciences and Chemical Engineering

Synthesis of a Biological Breathalyzer

The aim of this research is the construction of a biological breathalyzer through the culturing of yeast cells that can be used to measure concentrations of ethanol. The project makes use of the metabolic pathways of species of the Pichia taxa that are able to metabolize both ethanol and methanol. The yeast prefers to metabolize ethanol when both methanol and ethanol are present and will therefore consume ethanol before methanol. The AO enzyme, from the AOX gene, appears to be the first enzyme produced by the metabolism of methanol. The AOX gene will not be expressed in the cell when ethanol is present since ethanol is being metabolized rather than methanol. Fusing the AOX gene promoter with the DNA sequence to a fluorescent protein will allow the expression of the AOX gene, and therefore the metabolism of methanol, to be visually detected. In supplying the yeast cells with ethanol and methanol simultaneously, the cells will produce the fluorescent protein once the ethanol is utilized. This will result in a visible fluorescent light. The concentration of ethanol can be determined by measuring the time before the fluorescent light is emitted. Determining the concentration of ethanol present will make plausible the construction of a breathalyzer device to detect the blood alcohol level in an individual and could lead to the development of additional sensor systems to detect the presence and concentration of solvents. The AOX gene promoter was cloned and the linking of the promoter to the red fluorescent protein gene is in progress.

Herman Armstrong, a native of St. Louis, is a senior in Biological Sciences graduating in May 2008. He really enjoys campus involvement and helping people. He spent a year as a dormitory resident assistant, and currently works for Missouri S&T police as a campus service officer. He is a member of the Missouri S&T Black Man's Think Tank, where he previously served as treasurer. In his spare time, he mentors youth through the Rolla Mentoring Makes a Difference Program. He plans to pursue a career in medicine.

Trevor Bollmann

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

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

Possible spatial-temporal variations in seismic activity in SE Asia after the Dec. 26, 2004, 9.0 Magnitude Sumatra Earthquake

The devastating earthquake near Sumatra, Indonesia was caused by plate slip along the megathrust between Indian plate and the Burma Microplate. This is a very active boundary and it is essential to find out where the next large earthquake will occur. Data was obtained from seismic catalogs from the Advanced National Seismic System. Then the data was organized using Fortran 77 programs to attain data such as the number of earthquakes (neq) per day, average earthquake depth (aed) per day, neq per latitude, aed per latitude, seismic moment per latitude. The same data was found for before and after the 9.0 earthquake and every subsequent year after. From interpreting the data it is apparent that the movement along the plate boundary is moving to the south. In conclusion the next large earthquake will occur south of the 9.0 Mw earthquake, as the plate slip propagates down the plate boundary.

Trevor Bollmann is a senior in Geological Sciences and Engineering at the Missouri University of Science and Technology. He is working towards his B.S. in Geology with an emphasis in Geophysics. He is also pursuing a minor in Geological Engineering and Mathematics.

Cassandra Browne

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

Funding Source: National Science Foundation

Palynofacies of the Bahariya and Abu Roash Formations (Mid – Cretaceous) in the North Western Desert of Egypt

The Bahariya and Abu Roash formations in the north Western Desert of Egypt contain organic-rich sediments and particulate organic matter (POM) which can yield important information about the age, paleoenvironment, and source rock potential of the formations. POM types include phytoclasts, marine and non–marine organic walled microfossils (palynomorphs), and amorphous organic matter (AOM). The different types and amounts of POM and spore/pollen color (which constitute palynofacies) will be used to assess source rock and petroleum generation potential for the sediments.

Cassandra Browne is from Cape Girardeau and is a junior majoring in Geology and Geophysics at Missouri University of Science and Technology.

Brooke Burroughs

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

Effects of Zinc Oxide Nanoparticles on Antigen-Antibody Binding

Antibodies, found in the blood of humans, are used to find and attack foreign objects such as bacteria. The antibody of interest is immunoglobulin G (IgG) which is the main antibody used by the immune system to invade pathogens. An antigen is a harmful molecule that triggers an antibody response. Once the antibody and antigen are bound, the antigen is tagged to be attacked by the immune system.

A person is routinely exposed to zinc oxide micro- or nanoparticles since they are additives in many personal care products including sunscreen. Little research has been done on the effects of zinc oxide nanoparticles on antigen-antibody binding after the introduction of zinc oxide nanoparticles into the body. This research project used capillary electrophoresis to determine the peak shifts when zinc oxide is exposed to the antigen-antibody bound system. The detailed experimental conditions and results will be presented at the undergraduate research conference.

Brooke Burroughs is a senior chemistry major and will be graduating December 2008. Her future goals are to work in research and development in the pharmaceutical industry.

Christopher Campbell

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

Funding Sources: USDA-CSREES Evans-Allen Program Fund
MO Life Science Research Grant

Controlled Production of Microalgae for Possible Use as the Biofuel Feedstock

As a part of the research directed at the production of biofuels from microalgae, we've been exploring algal strains and their growth conditions that yield the maximum amount of biomass and target biochemicals. Microalgal species were collected from local and non-local regions, and subjected to the isolation, identification, and cultivation. Lipid contents were monitored in order to evaluate their potential as a sustainable feedstock for producing biodiesel. Microalgae growth media containing various concentrations of essential nutrients were compared for the best algal biomass production. The optimum algal cultivation condition was determined by measuring the amount of biomass present during the log phase of growth through the measurement of optical density or dry weight. For the large-scale (65L) algae cultivation, an incremental volume was harvested daily for biomass yield determination. The harvesting and de-watering of algae culture were conducted via the chitosan-aided flocculation technique which allowed the treatment of large quantities.

Christopher Campbell is a senior undergraduate student at Missouri S&T who plans to enter graduate school in the fall. He enjoys music, reading and exercising.

Benjamin Haring

Department:	Geological Sciences and Engineering
Major:	Geological Engineering
Research Advisor:	Dr. David Wronkiewicz
Advisor's Department:	Geological Sciences and Engineering

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

Heavy Metal Contamination on the Black River, Missouri

The Black River is located in southeast Missouri and runs through the actively mined New Lead Belt. During the study *Fate and Transport of Contaminant Metals in the Big River and West Fork of the Black River, Southeastern Missouri*, Dr. Wronkiewicz obtained a sediment sample at Warner Bay Spring with a high copper concentration that was unexplained. The purpose of this study was to discover the source for the copper anomaly.

One hypothesis for the source of the copper was from brake dust washed off 4x4 vehicles as they drove through the river above Warner Bay Spring at a campground. Sediment samples were taken above and below the campground, including the original site of the copper anomaly. Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) data showed heavy metal contamination, including copper, at levels for below that of the anomaly. The most likely cause for the original copper anomaly was random error.

Benjamin Haring was born in St. Louis, Missouri. He grew up in St. Louis and attended St. Pius X High School in Festus, Missouri until 2005. He is currently a junior in Geological Engineering at the Missouri University of Science and Technology. He is emphasizing his studies in hydrology and environmental sciences. He is an active member in the C.L. Dake Geological Society.

Michael Hoffman

Department:	Physics
Major:	Physics and Nuclear Engineering
Research Advisors:	Dr. Darin Ernst and Dr. Ralph Alexander
Advisor's Department:	MIT Plasma Science and Fusion Center (Ernst) Missouri S&T Department of Physics (Alexander)
Funding Source:	DOE National Undergraduate Fellowship

Linear and nonlinear studies of trapped electron mode turbulence

Linear stability diagrams are presented to clarify the onset of toroidal drift modes, including ITG, and resonant and non-resonant TEMs, as a function of density and temperature gradients. Nearly two thousand linear gyrokinetic stability analyses were performed with the GS2 code to generate a stability diagram, varying density and temperature gradients around the "Cyclone Base Case." A series of nonlinear gyrokinetic simulations have been carried out to analyze the anisotropy of the turbulent eddies, and the role of zonal flows, as a function of drive. Stronger zonal flows should on average reduce the anisotropy in the radial and poloidal wavenumber spectra. Our results show that the anisotropy depends on the type and strength of the drive. Two separate studies have previously found that zonal flows play very different roles in TEM turbulence. The first [1], found that zonal flows play a strong role near threshold, where they produce a nonlinear upshift. The second [2], for a case well above threshold, found that zonal flows have little effect on the turbulent saturation level.

[1] D. R. Ernst et al., Phys. Plasmas 11(5) (2004) 2637. Also IAEA-CN-149/TH/1-3 (2006)
[2] T. Dannert et al., Phys. Plasmas 12 (2005) 072309

Michael Hoffman is a senior attending the Missouri University of Science and Technology majoring in Physics and Nuclear Engineering with a minor in Mathematics. He is the son of David Hoffman and Tonya Toebben and from Russellville, MO. He is an active member of the Society of Physics Students, American Nuclear Society and Missouri S&T Journal Club. Michael is currently involved in research and public outreach for science. Upon graduation, Michael is planning to pursue Ph.D. work in the area of plasma physics with application toward fusion energy.

Jason F. Kaiser

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

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

Using Laser Ablation ICP-MS to Constrain the Origin of the Rapakivi Texture of the Deer Isle Pluton, Maine

An Ovoid K-feldspar mantled by Na-feldspar is called rapakivi. Rapakivi may form either by (1) decompression during ascent of felsic magma through the crust to a shallow magma chamber or by (2) mixing of mafic- and felsic-magma within a magma chamber. We suggest that feldspar compositions may be used to distinguish between these two models. Rapakivi formed during decompression should have similar compositions. Conversely, if rapakivi have variable compositions this suggests variable interaction with compositionally unique magma at different times during crystallization. Cores and mantles of rapakivi feldspars from the Deer Isle Pluton, Maine were sampled using a 213 nm laser and analyzed using Inductively Coupled Plasma – Mass Spectrometry to determine differences (ppm) in trace element abundances, specifically barium. In a preliminary analysis of the data it seemed that the barium content varied little in each of the facies. Yet, patterns across the pluton were recognizable.

Jason Kaiser is a senior at the Missouri University of Science & Technology majoring in geology. He is the son of Alan and Darcy Kaiser of DeSoto. He is the president of the geological sciences honor society at Missouri S&T, as well as a member of other local and national geological organizations. Jason was recently accepted to the master's program at the University of Massachusetts, Amherst, where he plans to study igneous petrology before pursuing a Ph.D. in volcanology.

Rachel Klapper

Joint project with Herman Armstrong, Brian Pink, Morgan Schiermeier and Jackie Schneider

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

Construction and Testing of a Biological Breathalyzer

The ultimate goal of this research was the construction of a biological breathalyzer using methods of synthetic biology. The metabolic pathways of *Pichia taxa* were utilized for this research. This yeast is able to metabolize both ethanol and methanol present in the environment. The first known by-product of methanol metabolism is the AO enzyme from the AOX gene. When both ethanol and methanol are present, the yeast preferentially metabolizes ethanol and the AOX gene is not expressed. By fusing the AOX gene promoter with a fluorescence protein gene, the expression of the AOX gene may be visually detected. When the organism is supplied with both ethanol and methanol, the amount of time before fluorescence will correspond to the amount of ethanol fed to the cell. In this way, the concentration of ethanol can be determined.

Rachel Klapper is from Murray, Kentucky. She is a junior majoring in chemical engineering with a biological emphasis. She is a member of the International Genetically Engineered Machines team and also participates in campus organizations such as the American Institute of Chemical Engineers and the university bands and orchestras.

Janelle Modglin

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Anne Maglia
Advisor's Department: Biological Sciences

Funding Source: National Science Foundation Grant to Dr. Anne Maglia & Dr. Jennifer Leopold: The MorphologyNet Digital Library of 3D Reconstructions of Anatomy

Virtual Reality in Secondary Education; A New Approach to Educational Software

The project described herein is part of an existing effort to determine if: 1) virtual-reality software can be an effective supplement for secondary science education, and 2) virtual-reality educational software can be developed efficiently and cost effectively from an existing game engine. For my portion of the research, I will develop exercises and activities to be implemented in the game (currently in development), and associated lesson plans to aid teachers in integrating the software into classroom instruction. The educational tools I develop will be consistent with the Missouri State Education Standards. I also will conduct usability analyses to determine: 1) the usability of the software and virtual-reality environment, and 2) the effectiveness of the program in meeting the educational goals. If successful, this project could transform the expectations of, and strategies for creating, educational applications by providing a cost-effective model for developing realistic and engaging didactic software.

Janelle Modglin is a Freshman Biological Sciences student here at Missouri University of Science and Technology. Janelle is the oldest of four children and the first generation in her family to attend an institution of higher learning. She has been actively involved in Student Life on the Missouri S&T campus during her first year; serving as a member and committee chair of the Residential College Association and as a member of the Residential Hall Association. Janelle is working towards earning both her bachelor of arts degree in Biological Science and a certification in secondary education. Upon her graduation, Janelle hopes to acquire a position as a secondary educator and begin immediately working on her Master's Degree in Biological Sciences.

Megan Oldroyd

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

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

Effect of an Acid Catalyst on the Hydrothermal Conversion of Biomass to Coal

Cellulosic and lignocellulosic biomass from agricultural waste (wheat, rice, com and soy straw) as well as forestry (brushwood), industrial (sawmill dust and wood chips) and municipal (grass and yard clippings) waste is more and more viewed as a renewable and carbon-efficient energy source. Pyrolysis and hydrothermal degradation are procedures known to convert biomass to fuel. Compared with the pyrolysis at 700 °C, however, hydrothermal conversion is conducted in aqueous solution at only 180 °C. Thus, it is potentially the more energy efficient procedure, and may even convert very wet biomass such as pulp or mill sludge to fuel. The mechanism of hydrothermal degradation, which is largely unknown, has been investigated in this study by nuclear magnetic resonance (NMR) spectroscopy using D-glucose as a biomass model substrate. The chemical substances 5-hydroxymethylfurfural (5-HMF) and 4-oxopentanoic acid (levulinic acid) were identified as primary reaction products. Our studies also reveal a substantial influence of acid as a catalyst in the degradation reaction. Quantitative measurements of the 5-HMF and levulinic acid yields are presented as a function of reaction time and/or pH value of the reactive, hot compressed aqueous solution.

Megan Oldroyd is a sophomore majoring in chemistry and math, with minors in biology and cognitive neuroscience. She participated in the Opportunities for Undergraduate Research Program this past year, and is presenting her research here at the Undergraduate Research Conference. Megan is a recipient of the Chancellor's Scholarship here at Missouri S&T, and has also been presented scholarships from both the chemistry and math department. Megan was awarded chemistry student of the year both her freshman and sophomore years.

Brian Pink

Joint Project with Jacqueline Schneider

Department:	Biology
Major:	Biochemical Engineering
Research Advisor:	Dr. Dave Westenberg
Advisor's Department:	Biology

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

Biological Breathalyzer

The aim of this research is the construction of a biological breathalyzer through synthetic biology. The metabolic pathways of a species of the Pichia taxa are used. The yeast is able to metabolize both ethanol and methanol. The first known by-product of methanol metabolism is the AO enzyme from the AOX gene. When both ethanol and methanol are present, the yeast prefers to metabolize ethanol so the AOX gene is not expressed. The AOX gene promoter is fused with a fluorescence protein gene so expression of the AOX gene can be visually detected. When the cell is supplied with both ethanol and methanol, the amount of time before fluorescence will correspond to the amount of ethanol given to the cell. In this way, the concentration of ethanol can be determined.

Brian Pink is a junior pursuing a B.S. in BioChemical Engineering and a minor in Biology at Missouri University of Science and Technology. Brian is from Kansas City, Missouri where he graduated from Rockhurst High School. Brian is also a member of Phi Eta Sigma (freshman honor society), AIChE, Phi Sigma (Biological honor society),Omega Chi Epsilon (Chemical engineering honor society), Missouri S&T's iGEM team (International Genetically Engineered Machines Competition), and works in the cDNA neurobiology lab at Missouri S&T.

Morgan Schiermeier

Joint project with Herman Armstrong, Rachel Klapper, Brian Pink and Jackie Schneider

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

Biological Breathalyzer

The aim of this research is the construction of a biological breathalyzer through synthetic biology, specifically through use of the metabolic pathways of a species of the Pichia taxa. The yeast utilized is able to metabolize both ethanol and methanol. However, when both ethanol and methanol are present, the yeast prefers to metabolize ethanol such that an AOX gene is not expressed because the first known by-product of methanol metabolism is the AO enzyme from the AOX gene. The AOX gene promoter is fused with a fluorescence protein gene so expression of the AOX gene can be visually detected. When the cell is supplied with both ethanol and methanol, the amount of time before fluorescence will correspond to the amount of ethanol given to the cell. In this way, the concentration of ethanol can be determined.

Morgan Schiermeier is a senior at Missouri S&T majoring in biological sciences. He is from Vienna, Missouri and has been involved in the iGEM project for the last year.

Jacqueline Schneider

Joint project with Herman Armstrong, Rachel Klapper, Brian Pink, and Morgan Schiermeier

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

Funding Source:	Missouri S&T's Depts. of Biological Sciences, Chemical and Biological Engineering Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Design and Testing of a Biological Breathalyzer

The aim of this research is the construction of a biological breathalyzer through synthetic biology. The metabolic pathways of a species of the Pichia taxa are used. The yeast is able to metabolize both ethanol and methanol. The first known by-product of methanol metabolism is the AO enzyme from the AOX gene. When both ethanol and methanol are present, the yeast prefers to metabolize ethanol so the AOX gene is not expressed. The AOX gene promoter is fused with a fluorescence protein gene so expression of the AOX gene can be visually detected. When the cell is supplied with both ethanol and methanol, the amount of time before fluorescence will correspond to the amount of ethanol given to the cell. In this way, the concentration of ethanol can be determined.

Jackie Schneider is a junior in biochemical engineering from O'Fallon, Missouri. She is involved in the International Genetically Engineered Machines Team, the American Institute of Chemical Engineers, and Engineers Without Borders.

Daniel Schwent

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

Identifying Ribosomal Protein Gene Families in *Glycine max*

The database at NCBI is a vast resource of genetic information. The purpose of this project was to search through, acquire, compile and test that data in a way that would identify putative gene families of the proteins that make up the cytoplasmic ribosomes in *Glycine max*. The initial search criteria were sequences that had been submitted to NCBI as portions of these ribosomal protein genes in *Glycine* and were later expanded to include sequences from some of *Glycine*'s close relatives. The search results were assembled into contiguous sequences, searched for open reading frames and finally compared to each other for uniqueness. To date, contiguous sequences for over 20 cytoplasmic ribosomal protein gene families have been identified.

Daniel Schwent is a third-year undergraduate student of biology at Missouri S&T.

Evan Stevens

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

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

Investigation of jointing in the Roubidoux Formation, Rolla, Missouri

Jointing present at an outcrop of sandstone in the Roubidoux formation was examined in order to determine the principle stress direction(s) causing the joint formation. The investigation was accomplished with traditional mapping techniques (detailed field sketches, photographs, structural measurements). Seventy seven attitude measurements of joints and measurement of primary bedding were collected using a Brunton Compass. These measurements were analyzed using stereonets and rose diagrams. Two major joint sets were present. The more major joint set strikes along the 175° or 355° azimuth and it has an dip averaging from 75° to 80°. The minor joint set strikes along the 115° or 295° azimuth and has a dip averaging from 75° to 80° as well. This spatial pattern of these joints indicates the presence of a conjugate joint set. This indicates an orientation of 325° for s1 and 055° for s3 at the time of joint formation. Major joints from both sets exhibit secondary hematite cement in the sandstone adjacent to the joint, whereas hematite cementation is sparse along the minor joint sets indicating these joints controlled paleofluid flow. Understanding how joints in rock form can better constrain numerical computer models to further understand the effect joints may have on groundwater or petroleum reservoir characteristics like secondary permeability and direction of fluid flow. Understanding the conditions in which joints form can also aid exploration geologists in determining the genesis of specific ore bodies. Current spatial orientation of joints and bedding also affect rock face stability and highway safety.

Evan Stevens is a senior in the geological engineering department at Missouri S&T. He plans to find a job as a geological engineer with an emphasis in geology while working for a mining company. In his spare time, Evan likes to play guitar and spend time with his family and friends.

Kevin Walker

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

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

In Vitro Assessment of Porous Glass Scaffolds for Bone Tissue Engineering

Two types of glass scaffolds fabricated from silicate-based 13-93 glass were tested for possible use in bone tissue engineering. The two scaffold types included constructs prepared by a polymer foam infiltration procedure to simulate trabecular bone and sintered glass fiber construct. These scaffolds were seeded with mouse MLO-A5 cells, an established line of osteogenic cells used as a model of developing bone tissue. Assays were conducted to assess growth and function of the seeded cells over incubation times ranging from two to six days. Cell adhesion to the scaffolds was confirmed by scanning electron microscopy. Quantitative measurements of total cellular protein indicate that the rate of cell growth on the scaffolds is similar to that on standard tissue culture plates. MTT assays showed significant penetration and proliferation of cells within the interior of the scaffolds. Alkaline phosphatase, a marker enzyme of bone cell differentiation, was assayed to assess cell function of the scaffolds. Alkaline activity of this marker enzyme increased linearly during the six-day incubation on both scaffolds indicating they both support differentiation. The results obtained suggest that 13-93 sponge and fiber scaffolds are effective frameworks for bone tissue engineering.

Kevin Walker is a junior at the Missouri University of Science and Technology. He is majoring in Chemical Engineering with a minor in Biological Sciences. Kevin is a recipient of the Missouri S&T Chancellor's Scholarship. He serves as the president of the Christian Campus Fellowship and as a Resident Assistant at Missouri S&T. After graduation Kevin plans to pursue a Doctor of Medicine degree.