Apr 11th, 2007 - 5:00 PM

3rd Annual Undergraduate Research Conference Abstract Book

Missouri University of Science and Technology

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3rd Annual
Undergraduate Research Conference

April 11, 2007
UMR Havener Center

CONFERENCE AGENDA

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Chancellor John F. Carney III, and Vice Provost Harvest L. Collier
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<tr><td>12:00 pm – 1:00 pm</td><td colspan="4">Luncheon & Keynote Address-
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McCormick Scientific and Coretech Holdings
(St. Pat's C)</td></tr>
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<tr><td>3:00 pm – 4:00 pm</td><td colspan="4">Experiential Learning Showcase & Reception
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(St. Pat's B)</td></tr>
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- OURE Faculty Fellows Proposal Review: 9:00 am–12:00 pm (Walnut Room/Shamrock Room)
- Judges Conference Room- (Mark Twain Room)

Oral Presentations

Engineering Oral Session		
Name	**Department**	**Time/Location**
Cooper, Cary	Mining & Nuclear Engineering	9:00-9:30 AM-Missouri Room
Dornajafi, Mahsa	Electrical & Computer Engineering	9:30-10:00 AM-Missouri Room
Lininger, Adam	Computer Science	10:00-10:30 AM-Missouri Room
Moore, Phillip	Electrical & Computer Engineering	9:00-9:30 AM-Ozark Room
Smith, Lisa	Electrical & Computer Engineering	9:30-10:00 AM-Ozark Room
Yu, Terry	Mining & Nuclear Engineering	10:00-10:30 AM-Ozark Room

Humanities/Social Sciences Oral Session		
Name	**Department**	**Time/Location**
Huerta, Rob	Psychology	9:00-9:30 AM- Gasconade Room

Management & Information Systems Oral Session		
Name	**Department**	**Time/Location**
Stauffer, Benjamin	Computer Science	10:00-10:30 AM-Gasconade Room

Natural Sciences Oral Session		
Name	**Department**	**Time/Location**
Austin, Matthew	Computer Science	9:00-9:30 AM-Meramec Room
Hoffman, Michael	Physics	9:30-10:00 AM-Meramec Room
Stockstill, Katherine	Biological Sciences	10:00-10:30 PM-Meramec Room

Poster Presentations

Engineering Poster Session		
Name	**Department**	**Time/Location**
Abbott, Ashlee	Materials Science & Engineering	9:00-11:45 AM-Carver-Turner Room
Bartz, Navarre	Civil, Architectural & Environmental Engineering	9:00-11:45 AM-Carver-Turner Room
Dasani, Devang	Chemical & Biological Engineering	9:00-11:45 AM-Carver-Turner Room
Doering, Kenneth	Materials Science & Engineering	9:00-11:45 AM-Carver-Turner Room
Eads, Josh	Computer Science	9:00-11:45 AM-Carver-Turner Room
Granich, Will	Civil, Architectural & Environmental Engineering	9:00-11:45 AM-Carver-Turner Room
Holloway, Phillip	Electrical & Computer Engineering	9:00-11:45 AM-Carver-Turner Room
Hrenak, Lara	Materials Science & Engineering	9:00-11:45 AM-Carver-Turner Room
Hudson, Thomas	Mechanical & Aerospace Engineering	9:00-11:45 AM-Carver-Turner Room
Loesch, Kristen	Computer Science	9:00-11:45 AM-Carver-Turner Room
McGrath, Meghan	Materials Science & Engineering	9:00-11:45 AM-Carver-Turner Room
Mullen, David	Computer Science	9:00-11:45 AM-Carver-Turner Room
Rasnic, Ashley	Engineering Management & Systems Engineering	9:00-11:45 AM-Carver-Turner Room
Tullock, Charles	Computer Science	9:00-11:45 AM-Carver-Turner Room
Wilke, Nathaniel	Mechanical & Aerospace Engineering	9:00-11:45 AM-Carver-Turner Room
Wright, Evan	Computer Science	9:00-11:45 AM-Carver-Turner Room

Humanities/Social Sciences Poster Session		
Name	**Department**	**Time/Location**
Mueller, Don	Psychology	9:00-11:45 AM-Carver-Turner Room
Salvador, Stuart	History & Political Science	9:00-11:45 AM-Carver-Turner Room
Shanklin, Natalie	Psychology	9:00-11:45 AM-Carver-Turner Room

Management & Information Systems Poster Session		
Name	**Department**	**Time/Location**
Andrews, Ryan	Computer Science	9:00-11:45 AM-Carver-Turner Room
Duvall, Kristen	Business Administration	9:00-11:45 AM-Carver-Turner Room
Nieters, Dan	Electrical & Computer Engineering	9:00-11:45 AM-Carver-Turner Room

Poster Presentations (Cont.)

Natural Sciences Poster Session		
Name	**Department**	**Time/Location**
Bahr, Leah	Geological Sciences & Engineering	1:00-3:00 PM-Carver-Turner Room
Calcara, David	Biological Sciences	1:00-3:00 PM-Carver-Turner Room
Elmer, Jacob	Biological Sciences	1:00-3:00 PM-Carver-Turner Room
Fears, Tyler	Chemistry	1:00-3:00 PM-Carver-Turner Room
Glick, Wesley	Biological Sciences	1:00-3:00 PM-Carver-Turner Room
Herrera, Mark	Physics	1:00-3:00 PM-Carver-Turner Room
Hunt, Amy	Biological Sciences	1:00-3:00 PM-Carver-Turner Room
Jaleel, Shamim	Biological Sciences	1:00-3:00 PM-Carver-Turner Room
McDaniel, Marshall	Biological Sciences	1:00-3:00 PM-Carver-Turner Room
Oakley, Audry	Biological Sciences	1:00-3:00 PM-Carver-Turner Room
Rich, Lauren	Physics	1:00-3:00 PM-Carver-Turner Room
Sutterer, Amanda	Biological Sciences	1:00-3:00 PM-Carver-Turner Room

Research Proposals Poster Session		
Name	**Department**	**Time/Location**
Kaiser, Jason	Geological Sciences & Engineering	1:00-3:00 PM-Carver-Turner Room
Stevens, Evans	Geological Sciences & Engineering	1:00-3:00 PM-Carver-Turner Room

Keynote Speaker

James G. Unnerstall - *Chief Operating Officer, McCormick Scientific and Coretech Holdings*

Mr. Unnerstall, Chief Operating Officer, has led Coretech's efforts to evaluate and operate new business units, while providing solid leadership for the company's dramatic operational growth.

Under Mr. Unnerstall's direction, Coretech re-engineered its manufacturing and R&D operations, leading to the development of more than 100 new products in 48 months.

Mr. Unnerstall has guided the company's transformation from acompletely outsourced manufacturing operation, to one that now manufactures a multitude of products. This accomplishment required the skillful establishment of a complete manufacturing system, an entire manufacturing team and the tripling of the company's manufacturing space.

Prior to founding Coretech, Mr. Unnerstall held engineering, sales and management positions for several Fortune 500 companies.

As a sales engineer for Rockwell Automation's Reliance Electric brand of products, he grew an undeveloped sales territory to $4 million in sales in just three years, becoming the top salesman in company's St. Louis office.

Mr. Unnerstall honed his operations management skills while employed by Anheuser-Busch Companies' packaging division. While serving as a project engineer for the division, he had responsibilities for project scope development, capital appropriation, design management, budget management, project scheduling, procurement, implementation and asset utilization for major construction projects, including the startup of three new $50 million-plus facilities.

Promoted to engineering manager at the company's Arnold packaging center, Mr. Unnerstall later oversaw 25 professionals in plant engineering, maintenance and production. There he implemented Total Quality Commitment, Total Quality Management and Continuous Process Improvement teams. Through process improvement contributions, material reductions, multi-skilled labor capabilities and variable cost control, he helped reduce facility costs by 30 percent in two years.

Mr. Unnerstall holds a bachelor of science degree in electrical engineering and a master's degree in engineering management from the University of Missouri-Rolla.

Conference Judges

The Office of Undergraduate & Graduate Studies wishes to thank the following faculty & staff for their valuable contributions to the 3rd Annual UMR Undergraduate Research Conference.

Diana L. Ahmad
Waleed Al-Assadi
Ralph Alexander
DJ Belarbi
Kate Drowne
Ralph Flori
Leslie Gertsch
Katie Grantham-Lough
David Hubbard
Irina Ivliyeva
Ray Luechtefeld
Bruce McMillin
Don Miller
F. Scott Miller
Dee Montgomery
Melanie Mormile
Mike Nelson
Prakash Reddy
David Roberston
Bijaya Shrestha
Eric Smith
Andy Stewart
Scott Volner
Barry White
Pushpa Wijesinghe
Dennis Wilson
Jeff Winiarz

Thank You!

Engineering
Oral Session

Abstracts

Cary Cooper

Department: Mining & Nuclear Engineering
Major: Mining Engineering
Faculty Advisor(s): Dr. R. Larry Grayson
Advisor's Department: Mining Engineering

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Identifying Trends in Underground Coal Mine Incidents Caused by Roof Falls

Current technology and safety practices generally provide today's underground coal miner with a safe workplace in an unpredictable environment. However, incidents still occur and until the number of incidents resulting in injury or loss of life reaches zero, there will always be room for improving methods and technology used by the modern coal miner. This study analyzes underground coal mine incidents caused by roof falls. Information provided by the Mine Safety and Health Administration (MSHA) was analyzed for trends in factors that contribute to roof fall fatalities in underground coal mines. Identification of major contributing factors will allow for a focused approach to selecting new technology and practices as interventions to keep the underground coal mining workplace free of injury.

Cary is a sophomore attending the University of Missouri-Rolla majoring in Mining Engineering. He is the son of Tom and Susan Cooper and is from Ponchatoula, Louisiana. On campus he is the active president of the International Society of Explosives Engineers (ISEE), a member of the Society of Mining and Metallurgical Engineers (SME), and a member of Kappa Sigma. After graduation, Cary plans on pursuing a career in the mining industry.

Mahsa Dornajafi

Department: Electrical and Computer Engineering
Major: Electrical Engineering
Faculty Advisor(s): Dr. Steve E. Watkins
Advisor's Department: Electrical and Computer Engineering

Funding Source: Core Memory Circuits LLC

Performance of a Quaternary Logic Design

This paper analyzes the performance of a quaternary core memory circuit and its components. The multi-valued logic design consisting of two drivers and a transistor matrix is simulated using Mentor Graphic software. Functional operation of the circuit is shown and propagation delay and power consumption are determined. The design is dependent on the voltage values for the multi-valued logic. Three logic cases are investigated. The performance of the core memory as a quaternary difference calculator and its application in preprocessors is described.

Mahsa is a senior in Electrical Engineering at University of Missouri-Rolla. She is a member of Eta Kappa Nu and of IEEE. She is going to start her master's degree in University of Missouri-Rolla next semester.

Adam Lininger

Department: Computer Science
Major: Computer Science
Faculty Advisor(s): Dr. Bruce McMillin
Advisor's Department: Computer Science

Funding Source: NSF MRI award CNS-0420869,
NSF CSR award CCF-0614633,
UMR Intelligent Systems Center,
UMR Opportunities for Undergraduate Research Experience (OURE) Program

Analysis of Max-Flow values for setting FACTS devices.

With all the work finding effective placements for FACTS devices in power grids, there is some question as to how many of the cascading outage scenarios can actually be solved. We discuss fourteen outage scenarios on the IEEE 118 bus system. We determine whether each scenario can be solved using the Max-Flow algorithm. If it can be solved, we determine what placement and setting will solve the scenario. We also discuss the use of the max-flow algorithm both in determining the solvability of each scenario and in finding FACTS settings that will solve a scenario.

Adam Lininger is a senior at the University of Missouri – Rolla majoring in Computer Science. Adam plans on perusing a career in academic research.

Phillip Winston Moore

Department: Electrical and Computer Engineering
Major: Computer Engineering
Faculty Advisor(s): Dr. Ganesh K. Venayagamoorthy
Advisor's Department: Electrical and Computer Engineering

Funding Source: N/A

Evolving Combinational Logic Circuits Using a Hybrid Quantum Evolution and Particle Swarm Inspired Algorithm

An algorithm inspired from quantum evolution and particle swarm optimization is used to evolve combinational logic circuits. This algorithm uses the framework of the local version of particle swarm optimizations with quantum evolutionary algorithms, and integer encoding. A multi-objective fitness function is used to evolve the digital circuits in order to obtain a variety of feasible circuits with minimal number of gates in the design. A comparative study indicates the superior performance of the hybrid quantum evolution-particle swarm inspired algorithm over the particle swarm and other evolutionary algorithms (such as genetic algorithms) independently.

Phillip is a senior attending at the University of Missouri-Rolla majoring in Computer Engineering. He is the son of Mark and Beverly Moore and is from High Ridge, Missouri. On campus he is actively involved in the Real-Time Power and Intelligent Systems (RTPIS) Laboratory and has been involved in the solar house team. Off campus, he works at SMMJ Legal Auditing firm as a web developer to develop web applications and sites dictated by outside clients. Phillip plans on furthering his education to graduate studies at the University of Missouri-Rolla.

Lisa L. Smith

Department: Electrical & Computer Engineering
Major: Electrical Engineering
Faculty Advisor(s): Dr. G. K. Venayagamoorthy
Advisor's Department: Electrical & Computer Engineering

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Comparison of Particle Swarm Optimization and Greedy Search for Collective Robotic Search in a Complex Environment

Collective Robotic Search (CRS) is useful in applications such as radioactive source detection where little to no human intervention is desired. In CRS, a group of intelligent mobile robots collectively explores a dangerous environment in order to locate and converge on a specified target. This project applies two search algorithms, Particle Swarm Optimization (PSO) and greedy search, to a CRS problem containing an environment with multiple targets and obstacles where the entire swarm of robots is needed to complete the desired task. The simulation results for both methods are compared on the following: simulated run time, number of evaluations, distance traveled by the robots, resilience against communication and robot loss, and target convergence percentage. Simulation results show that PSO performs better than greedy search in terms of convergence time, distance traveled, and adaptability, for CRS problems requiring the entire swarm of robots for collective mission completion.

Lisa Lorena Smith is a senior undergraduate student at the University of Missouri-Rolla, majoring in Electrical Engineering. Lisa is a member of the Real-Time Power and Intelligent Systems Laboratory at UMR.

Terry Yu

Department: Mining & Nuclear Engineering
Major: Nuclear Engineering
Faculty Advisor(s): Dr. Shoaib Usman
Advisor's Department: Mining & Nuclear Engineering

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Prototype Computer Based Procedure Implementation at University of Missouri-Rolla Reactor

Paper-Based Procedures systems (PBPS) currently used by major part of the nuclear power industry are rapidly becoming obsolete, inefficient and costly[i]. These inefficiencies will continue to grow as younger individuals, less tuned to paper-based procedures and more comfortable with computer consoles, continue to join the nuclear engineering workforce. Therefore, there is a strong desire to modernize the operation system of existing nuclear plants by utilizing the advances in computer and information management technologies. We have taken the initiative to implement a prototype computer based procedures system at the research reactor, which will provide basic answers to some questions useful for the effort of procedure modernization. Involvement in this project either as the tester of the system or as a builder, experience gained will assist them to shape of the future computerization for the nuclear industry

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Terry (Shung) is a junior attending the University of Missouri- Rolla majoring in Nuclear Engineering. He is the son of Dennis and Katie Yu and is from Kansas City, Missouri. On campus he is involved in the American Nuclear Society. Terry plans on pursuing a career in the nuclear power industry

Humanities/Social Sciences
Oral Session

Abstracts

Adam Helton

Joint project with Rob Huerta

Department:	Psychology
Major:	Psychology, Economics
Faculty Advisor(s):	Dr. James Martin
Advisor's Department:	Psychology
Funding Source:	UMR Psychology Department

Non-cognitive Predictors of Students' Achievement

The purpose of this study was to examine the predictive value of ACT scores and personality characteristics as they pertain to college GPA and quiz scores on three upper level psychology classes. Male and female college students (N=82) from three upper level psychology classes at the University of Missouri-Rolla were asked to fill out a questionnaire surveying, among other demographic information, ACT score and college GPA, and a personality survey to measure levels of the Big Five personality traits. Our results support our hypothesis that ACT scores will be positively correlated with GPA and quiz performance, as well as our hypotheses that the personality traits Conscientiousness is positively correlated with college GPA and quiz performance and that Neuroticism is negatively correlated with college GPA and quiz performance.

Adam Helton is a sophomore at UMR. He grew up in a small town in central Illinois and now lives in Savoy, IL. He plays offensive line for the varsity football team at UMR. Adam is involved in Christian Campus Fellowship and intramural sports. He is the third of four children. His older sister, Kristi, and her husband have three boys, Simeon, Elias and Isaiah and live in Normal, IL. His older brother Ben lives in St. Louis and his younger sister Caroline is a senior in high school this year and is planning on enrolling at Lincoln Christian College in the fall.

Rob Huerta

Joint project with Adam Helton

Department: Psychology
Major: Psychology
Faculty Advisor(s): Dr. James Martin
Advisor's Department: Psychology

Funding Source: UMR Psychology Department

Non-cognitive Predictors of Students' Achievement

The purpose of this study was to examine the predictive value of ACT scores and personality characteristics as they pertain to college GPA and quiz scores on three upper level psychology classes. Male and female college students (N=82) from three upper level psychology classes at the University of Missouri-Rolla were asked to fill out a questionnaire surveying, among other demographic information, ACT score and college GPA, and a personality survey to measure levels of the Big Five personality traits. Our results support our hypothesis that ACT scores will be positively correlated with GPA and quiz performance, as well as our hypotheses that the personality traits Conscientiousness is positively correlated with college GPA and quiz performance and that Neuroticism is negatively correlated with college GPA and quiz performance.

Rob R. Huerta is a senior majoring in Psychology at UMR. He was born in Fort Hood Texas. He is from a family of five with 18 aunts and uncles and 70+ cousins. He is married to wife Tammi and has three children Isaac, Brandon and Alana. He plans to attain the education needed to teach at the college level.

Management & Information Systems
Oral Session

Abstracts

Benjamin Stauffer

Department: Computer Science
Major: Computer Science
Faculty Advisor(s): Dr. Bruce McMillin, Mr. Joseph A. Counsil
Advisor's Department: Computer Science, Chemistry

Funding Source: N/A

SonicData: An Open-Source Instrument Data Acquisition Program

A low-cost voltage-to-frequency interface can be used to collect and process data from instrumentation by means of a sound-card input to a personal computer. A program was designed to read, analyze, process, and generate reports from the resulting data stream. The program design was based upon a list of requirements from the user, including parameters specifying data rate and range, real-time presentation, data analysis, report generation, and the user interface. The program was written in C++ using open source libraries. Program operation is adaptable through use of a configuration file. The source code was designed to be easily adapted for other applications. Users can save the data in a graphical, plain text, or spreadsheet format.

Benjamin Stauffer is a student at the University of Missouri-Rolla and is working to receive a bachelor's degree in Computer Science. He is currently employed as a tutor for UMR's C++ Data Structures class and has served as president of the W0EEE UMR Amateur Radio Club since January 2007. He served a religious mission in Porto Alegre, Rio Grande do Sul, Brazil from 2003-2005 and speaks fluent Portuguese. While not at school, he lives with his family in Dardenne Prairie, Missouri.

Natural Sciences
Oral Session

Abstracts

Matthew Austin

Department: Computer Science
Major: Applied Mathematics
Faculty Advisor(s): Dr. Mayur Thakur
Advisor's Department: Department of Computer Science

Funding Source: N/A

Stochastic Sequential Dynamical Systems

We introduce models for stochastic sequential dynamical systems (SSDS), an extension of sequential dynamical systems. We introduce the Random Value and Random Update models of SSDS, as well as defining the *p*-PROBABLE-PREDECESSOR-EXISTENCE problem (*p*-PPRE problem), which is a generalization of the PREDECESSOR-EXISTENCE problem to the stochastic realm. The *p*-PPRE problem asks, given a configuration C and SSDS S, whether or not there exists a configuration C' such that $\Pr[S(C')=C] \geq p$. We show that, given specific restrictions on the underlying graph of S and its local transition functions, we can apply methods used in the non-stochastic case to solve this problem in polynomial time with respect to the number of nodes in S.

Matthew Austin is a graduating senior in Applied Mathematics who is also pursuing minors in Computer Science and Physics.

Michael D. Hoffman

Department: Physics
Major: Physics and Nuclear Engineering
Faculty Advisor(s): Dr. Massimo Bertino and Dr. Ralph Alexander
Advisor's Department: Physics

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Detecting Gamma-rays with Quantum Dots

The purpose of this experiment is to demonstrate the ability of CdSe quantum dots to detect gamma radiation. Current methods for the detection of gamma radiation require large voltages and possess only semi-portability; moreover, detection of gamma radiation while accurate is plagued by material inefficiencies. Hence, there is need for small portable and efficient gamma-ray detectors. The ability of quantum dots to detect radiation has been predicted but not thoroughly examined in the laboratory. Here we prove that semiconductor quantum dots can be used to detect gamma radiation. Exposure of CdSe quantum dots to gamma rays causes a notable increase in their fluorescence. The increase of luminescence is probably due to photocorrosion of defects, and was found to be linear in the range 20-200 kRad. Quantum dot detectors might represent a simple, rugged, solid state device capable of providing portable and accurate gamma-ray detection.

Michael is a junior attending the University of Missouri-Rolla majoring in Physics and Nuclear Engineering with a minor in Mathematics. He is the son of David Hoffman and Tonya Toebben and is from Russellville, MO. On campus he is an active participant in the American Nuclear Society, the Society of Physics Students, and the Dean's Academy. Michael is currently involved with multiple research projects and tutors students in the Physics Leaming Center. Michael plans to attend graduate school and begin a career in research and development at an advanced laboratory or university with the intention of becoming a professor of physics.

Katherine Stockstill

Department: Biological Sciences
Major: Biological Sciences
Faculty Advisor(s): Dr. Katie Shannon
Advisor's Department: Biological Sciences

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Cytokinesis Defects in Budding Yeast

Budding yeast are a very good research organism, because they are very similar to humans in many ways. One of the problems 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. The purpose of knocking genes out is because they are uncharacterized genes that have been identified in genomic screens as interacting with cytokinesis proteins. 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. So far, are data shows that we have knocked out the genes, but we do not have enough data to say if we have gotten a cytokinesis defect.

Katherine is a sophomore at the University of Missouri-Rolla, majoring in Biological Sciences. On campus she is a member of Kappa Delta Sorority and Helix. She is a participant in the UMR Opportunities for Undergraduate Research Experiences (OURE) Program. Off of campus she is a waitress at Applebee's. Katherine plans on pursuing a career in research after she graduates.

Engineering
Poster Session

Abstracts

Ashlee Abbott

Department: Materials Science and Engineering
Major: Ceramic Engineering
Faculty Advisor(s): Dr. Fatih Dogan
Advisor's Department: Materials Science and Engineering

Funding Source: CAMT Project 4.1

Rapid Freeze Spraying of Graded Laminar Composites

Laminar composites are needed for many applications ranging from structural materials to aerospace engine components to biomedical implants. Unfortunately, different expansion coefficients of materials cause them to separate during sintering which can lead to failure of the composite samples. This project optimizes and employs rapid freeze spraying technology to fabricate prototypes with *graded* alumina and zirconia structures in order to form gradual transitions between coefficients of thermal expansion.

Rapid freeze spraying significantly decreases costs for manufacturing because sample fabrication time decreases and expensive dies are no longer required. The process is also environmentally friendly because the materials used possess a low organic content. In addition, our research has shown that graded composites with gradual transitions between coefficients of thermal expansion are less susceptible to crack formation during sintering. This can lead to tougher materials for use in biomedical applications, structural materials, and aerospace engine components.

Ashlee Abbott is from Rolla, Missouri and is currently a sophomore enrolled in the Ceramic Engineering program at the University of Missouri – Rolla. She is the daughter of Gary and Joyce Abbott. She has been researching composites since May 2005.

Navarre Bartz

Department: Materials Science and Engineering
Major: Ceramic Engineering
Faculty Advisor(s): Dr. Stuart Baur
Advisor's Department: Civil, Environmental, and Architectural Engineering

Funding Source: Environmental Protection Agency - P3 Grant

The Use of Thermoelectric Peltiers to Recapture Waste Heat

Peltier devices are a method of converting differences in temperature into electrical energy. Using data from a supplier of these devices, calculations were made to determine the efficiency of these devices in conjunction with a residential solar hybrid electric system. The initial calculations show efficiencies less than 2% with the temperature differences experienced during the springtime. While this efficiency doesn't sound stellar, taking into account the current efficiency of residential solar cells, this would be an appreciable addition to the power output of a residential solar system.

Navarre Bartz is a sophomore in Ceramic engineering. He is a member of Solar Car, Solar House, and the Vehicle Design Summit. His interests lie in the area of alternative energy.

Brandon Brinkmeyer

Joint project with Ken Doering

Department:	Material Science and Engineering
Major:	Metallurgical Engineering
Faculty Advisor(s):	Dr. Matthew J. O'Keefe
Advisor's Department:	Material Science and Engineering

Funding Source:	Center for Aerospace Manufacturing Technologies (CAMT) through the Air Force Research Laboratory (AFRL)

Investigation of Lead-Free Solder for Military Applications

Due to international environmental regulations that took effect in July 2006, the replacement of lead-tin solder with lead-free solder is occurring globally in the electronics industry. Although aerospace and military applications are exempt from the regulations, the shift to lead-free solder for high volume consumer products, such as cell phones, is impacting aerospace and military electronic assemblies as suppliers abandon lead-tin solder and ship only lead-free components. The switch to lead-free alloys is already being seen by defense contractors and military installations in Missouri and throughout the United States. The reliability of lead-free solder joints in military and aerospace applications is not known, resulting in new research opportunities in this area. To investigate the use and impact of lead-free solder on military applications, the University of Missouri – Rolla (UMR) has teamed with Boeing Integrated Defense Systems in St. Louis and Northrop Grumman Interconnect Technologies in Springfield to research the reliability of repaired and reworked lead-tin, lead-free, and mixed lead-tin/lead-free solder joints for military and aerospace applications. Evaluations have been performed on components soldered to test boards, including the effect of thermal cycling between -55°C and 150°C, vibration testing up to 5 g's, and measuring the melting point of the various solder alloys. Results indicate a dramatic change in microstructure before and after thermal cycling that may impact long term reliability. Vibration testing indicated that the type of component and location on the test board affects reliability more than the type of solder. The melting temperature of lead-free solder with varying amounts of lead-tin contamination can change significantly, up to 30°C, making rework and repair operations difficult to control. The implication of these results on the use of lead-free solder for military applications will be summarized.

Brandon is a senior in Metallurgical Engineering. He plans on continuing with his education by obtaining an M.S.degree after graduation in May. In his free time he enjoys golfing, fishing, and anything outdoors.

Devang Dasani

Department: Chemical & Biological Engineering
Major: Chemical Engineering
Faculty Advisor(s): Dr. Xing
Advisor's Department: Chemical & Biological Engineering

Funding Source: General Motors Foundation

Nanocomposite Materials for Hydrogen storage

Hydrogen fuels have been studied as a potential alternative energy source though the storage of hydrogen has not been an easy task. One answer to increase storage capacity is to introduce well dispersed metal nanoparticles onto the surface of the nanotubes to alter the surface chemistry of the nanotubes. It was shown that plain sonochemically treated nanotubes had an ambient (25ºC) hydrogen uptake of 0.75%, while nanotubes doped with 5.3 nm diameter Pd particles gave an ambient uptake of 3.5%. Initially a broad range of pH between 4 and 10 was used to determine the effect, if any, of pH on the Pd deposition on the CNTs. Once an initial pH had been determined, a smaller range around a pH of 6 was used to narrow the results down to a more specific pH. For this study, a range between 5.3 and 7.3 was studied. Again, the general effects were seen as before, and an optimal value was determined to be 6.3.

Located on the west coast of India, Bombay is one of the biggest cities of the world with a population of about eighteen million. I come from this city of dreams, where I was born and brought up. My childish dreams were often of being a scientist, at other times an actor while there were still other times when all I wanted to be was a pilot and yet at others I wanted to be someone who could have it all. Well having grown up in to a mature and sensitive individual, I am surprised at how far-fetched my young aspirations were! For long now I have nurtured a dream to attain the power to 'Engineer' my life in a productive and progressive way. Studying properties of particles of minute sizes, as small as in the range on nanometers, has continually interested me in pursuing Chemical Engineering. It was this interest that forced me to come all the way on the other side of the world to get the best education and research work. Though it's been just a little more than six months in a completely new country, it still feels like a lot of years. UMR has been a wonderful experience so far. Not only is UMR one of the finest Engineering schools, but also a great place to live. Within six months it has given my life directions to its destiny.

Kenneth Doering

Joint project with Brandon Brinkmeyer

Department:	Material Science and Engineering
Major:	Metallurgical Engineering
Faculty Advisor(s):	Dr. Matthew J. O'Keefe
Advisor's Department:	Material Science and Engineering

Funding Source:	Center for Aerospace Manufacturing Technologies (CAMT) through the Air Force Research Laboratory (AFRL)

Investigation of Lead-Free Solder for Military Applications

Due to international environmental regulations that took effect in July 2006, the replacement of lead-tin solder with lead-free solder is occurring globally in the electronics industry. Although aerospace and military applications are exempt from the regulations, the shift to lead-free solder for high volume consumer products, such as cell phones, is impacting aerospace and military electronic assemblies as suppliers abandon lead-tin solder and ship only lead-free components. The switch to lead-free alloys is already being seen by defense contractors and military installations in Missouri and throughout the United States. The reliability of lead-free solder joints in military and aerospace applications is not known, resulting in new research opportunities in this area. To investigate the use and impact of lead-free solder on military applications, the University of Missouri – Rolla (UMR) has teamed with Boeing Integrated Defense Systems in St. Louis and Northrop Grumman Interconnect Technologies in Springfield to research the reliability of repaired and reworked lead-tin, lead-free, and mixed lead-tin/lead-free solder joints for military and aerospace applications. Evaluations have been performed on components soldered to test boards, including the effect of thermal cycling between -55°C and 150°C, vibration testing up to 5 g's, and measuring the melting point of the various solder alloys. Results indicate a dramatic change in microstructure before and after thermal cycling that may impact long term reliability. Vibration testing indicated that the type of component and location on the test board affects reliability more than the type of solder. The melting temperature of lead-free solder with varying amounts of lead-tin contamination can change significantly, up to 30°C, making rework and repair operations difficult to control. The implication of these results on the use of lead-free solder for military applications will be summarized.

Kenneth is a senior at UMR studying metallurgical engineering. He is the officer of worship music for the Christian Campus Fellowship. He plans on attending graduate school and acquiring an M.S. in metallurgical engineering.

Josh Eads

Department: Computer Science
Major: Computer Science
Faculty Advisor(s): Dr. Daniel Tauritz
Advisor's Department: Computer Science

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Self-Adaptive Semi-Autonomous Democratic Parent Selection

One of the primary obstacles to Evolutionary Algorithms (EAs) fulfilling their promise as easy to use general-purpose problem solvers is the difficulty of correctly configuring them for specific problems such as to obtain satisfactory performance. This paper introduces the concept of democratic, semi-autonomous parent selection by encoding and evolving population rating operators as in Genetic Programming and shows the potential of extending self-adaptation by pairing mates using an adaptation of the Stable Roommates problem. Replacing the typical general parent selection algorithm with autonomously evolved individual selection parameters has the prospective to bring EAs a step closer to their promise as easy to use general-purpose problem solvers.

Josh M. Eads is a junior at the University of Missouri – Rolla majoring in Computer Science and Applied Mathematics. He is actively involved with Rolla's ACM chapter and currently working on research involving Genetic Programming and Evolutionary Algorithms. Josh plans to continue his education and research as a graduate student after completing his degrees in Computer Science and Math.

Will Granich

Department:	Civil, Architectural & Environmental Engineering
Major:	Environmental Engineering
Faculty Advisor(s):	Dr. Mark Fitch and Dr. Dev Niyogi
Advisors' Department:	Civil, Architectural & Environmental Engineering and Biological Sciences

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Phosphorus Uptake Mechanisms in Missouri Streams

Excess nutrients affect many natural ecosystems and lead to imperilment of ecosystem integrity. Although nutrient uptake in streams has received growing attention in recent years, we still have little quantitative information on the specific characteristics of streams that affect uptake rates. My research included combining experimental (using artificial streams) and observational (measuring uptake in whole streams) approaches to understand specific controls on phosphorus uptake in streams. Phosphorus was chosen because it is one of the primary nutrients that enter water systems through agricultural runoff. This research attempted to quantify the response of nutrient uptake from the addition of limestone and to varying amounts of algal biomass. Experimental channels were set up simulating natural streams where biological and geological characteristics were manipulated. Results from the experimental channels allowed predictions of uptake rates for whole streams given their biological and geological characteristics. This project will help guide the management of streams to protect downstream systems from eutrophication

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Will is a senior attending the University of Missouri-Rolla. He is the son of Rose and James Granich and is from Russellville, MO. He is majoring in Environmental Engineering and minoring in Geological Engineering. He will be graduating in December 2007 and is undecided if he will pursue a Master's Degree or a full-time position.

Phillip Holloway

Department: Electrical & Computer Engineering
Major: Electrical & Computer Engineering, Physics
Faculty Advisor(s): Dr. G Kumar Venayagamoorthy
Advisor's Department: Electrical & Computer Engineering

Funding Source: Real-Time Power and Intelligent Systems Laboratory & UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Road Junction Optimization

We experience traffic congestion as a part of our daily activities. Decisions made at the junction as the traffic flow increases impacts the delay and the number of stopped vehicles the junction will experience.

A four phase traffic controller has been simulated. The average delay and the number of stopped vehicles were reduced by employing a dynamic programming algorithm. A hierarchical fuzzy logic controller as an offline learning process is being developed to instantly make decisions affecting the green signal allocation. Its rule base will be comparatively trained between particle swarm optimization and a genetic algorithm.

The proposed research involves modeling a series of interconnected two-way street road junctions that have four traffic phases for protected left turning. Each junction will have a fuzzy logic controller producing actions locally, with an approximate dynamic programming network to adapt signalization providing optimal traffic flow between the junctions.

Phillip Holloway is a senior undergraduate student attending the University of Missouri at Rolla. He is currently on a co-op with Honeywell as a software engineer and seeks majors in Physics, Electrical, and Computer Engineering. He is a talented musician and enjoys writing music.

Lara Hrenak

Department: Materials Science and Engineering
Major: Ceramic Engineering
Faculty Advisor(s): Dr. Richard Brow
Advisor's Department: Materials Science and Engineering

Funding Source: National Science Foundation

Exploration of the Aventurine Effect Mechanism in Chromium Aventurine Glass

Similar to the details of the discovery of aventurine glass, the mechanism that allow aventurine glass formation are not well understood. Mechanisms ranging from supersaturation with transition metal ions to the physical addition of iron or brass filings have been suggested. Because the amount of technical knowledge is extremely limited, the goal of this research is to better understand the melt conditions and formation mechanisms that produce aventurine glasses.

A composition, based on an artesian aventurine glass, was modified so that the effect of each batch material could be understood with regard to the aventurine effect. The specimens were analyzed using XRD, ASEM, DTA, and optical microscopy for comparison. The base glass was then modified as to vary the transition metal, transition metal ion concentration, and glass basicity. The specimens were analyzed similarly so that a better understanding of the conditions and mechanisms that lead to the formation of aventurine glass could be understood.

Lara Hrenak is a freshman attending the University of Missouri – Rolla, majoring in ceramic engineering. On campus she is actively involved in Keramos and Omega Sigma. She works on campus doing undergraduate research under the guidance of graduate student Nate Wyckoff.

Thomas Charles Hudson

Department: Mechanical and Aerospace Engineering
Major: Mechanical Engineering
Faculty Advisor(s): Dr. Ming Leu
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: The United States Air Force and Boeing

Selective Laser Sintering of Coated Ceramics

With advances in technology the aerospace industry has developed a greater demand for high temperature parts and has increased the use of ceramics. Since ceramic parts are very limited in how they are manufactured, it is difficult to integrate parts into areas requiring complex geometries. With the use of a rapid prototyping machine, coated ceramic powder can be formed into parts using the selective laser sintering process. Once formed, the part goes through a binder burnout stage and is then sintered. Build parameters and the types of binders and ceramics used will play a large role in how well parts are formed in the process.

Thomas Hudson is a senior attending the University of Missouri–Rolla majoring in mechanical engineering. He is currently a member of both the Lambda Chi Alpha fraternity and Pi Tau Sigma, a mechanical engineering honor society. Once graduated in May, Tom will begin work as a stress analysis engineer for Black and Veatch in Kansas City.

Kristen Loesch

Joint project with Laura Woodard

Department:	Computer Science
Major:	Computer Science
Faculty Advisor(s):	Dr. Daniel Tauritz
Advisor's Department:	Computer Science

Funding Source:	UMR Opportunities in Undergraduate Research Experiences (OURE) Program , Computing Research Association Committee on the Status of Women in Computing Research, Collaborative Research Experience for Undergraduates

Computer Science Recruitment in the 21st Century: Improving the Image of Computer Science with 4th-7th Graders, Especially Females

The goal of this project is to create a tool to aid in reversing the alarming trend of decreasing interest in Computer Science (CS) among American students, particularly females. The current generation of American female students tends to be attracted to fields with clear social relevancy. Middle school is a crucial time when students form their opinions about math and science; this is also the time when they begin picking elective classes and, in the case of female students, all too often not picking the math and science classes that would prepare them for a Computer Science career. Our tool will be software aimed at middle school students, with emphasis on female appeal, showcasing the social relevancy of CS through a series of highly visual games and puzzles, illustrating the careers of CS alumni. They will be connected in a manner inspired by "Where in the World is Carmen Sandiego?"

Kristen is the daughter of Janet and Terry Loesch of St. Louis, Missouri. She is a senior in the computer science department at UMR. Kristen is an active member of organizations and honor societies such as Omicron Delta Kappa, Chi Omega Fraternity, Order of Omega and others. Kristen also volunteers her time to recruiting within the department. Outside of school, Kristen enjoys reading, line dancing, and ballroom dancing.

Meghan McGrath

Department: Materials Science and Engineering
Major: Metallurgical Engineering
Faculty Advisor(s): Dr. Von Richards
Advisor's Department: Materials Science and Engineering

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Trace elements effects on gray cast iron microstructure

Trace elements found in gray cast iron affect graphite morphology, and thus mechanical properties. Even though there is existing research on the effects of trace elements, this paper will specifically discuss the outcomes of adding the trace elements, boron, nitrogen, and titanium in ranges suggested by a committee of participating foundries, to gray cast iron on the microstructure. The compositions of the samples were varied according to a factorial experimental array in ranges recommended by a committee of foundries providing technical oversight. Using metallographic techniques, graphite length and type of graphite were determined and then compared with their tensile strengths. Correlations between composition and graphite length were compared to correlations between composition and strength.

Meghan McGrath is the daughter of Kevin and Mary McGrath of St. Louis. She is a junior in Metallurgical Engineering. She is the President of the Alpha Sigma Mu (Materials Science and Engineering Honor Fraternity), the Secretary/Treasurer of the American Foundry Society, and a member of Material Advantage.

David Mullen

Department: Computer Science
Major: Computer Science
Faculty Advisor(s): Dr. Sanjay Madria
Advisor's Department: Computer Science

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Security of Data Collection and Sensor Group Management in Wireless Networks

Because of their practical applications in monitoring the physical environment and collecting the data for further analysis, sensor networks have become an important area of research within computer science and engineering. Security, in many circumstances, may be a primary concern due to the confidential nature of the data. Since in sensor networks, communication between motes is done via a radio frequency channel (RF), which is not a secure channel, an adversarial node attaching itself to the network could potentially eavesdrop on sensitive data, by listening to any signals which are transmitted. The research shows that a key management protocol, in combination with efficient group management and cryptographic techniques appropriate to energy- and memory-limited sensor networks, such as elliptic curves (ECC), provide a scalable approach for acquiring and maintaining the freshness of keys in large, dynamic groups.

David Mullen is a senior attending the University of Missouri-Rolla, majoring in Computer Science and minoring in Russian. David's interests lie particularly in distributed data processing and databases, such as on the Web, and he seeks a career in research.

Ashley Rasnic

Department:	Engineering Management & Systems Engineering
Major:	Engineering Management
Faculty Advisor(s):	Dr. Scott Grasman, Dr. Bill Daughton
Advisor's Department:	Engineering Management & Systems Engineering

Funding Source:	UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Engineering Management and Industrial Engineering: Similarities and Differences

Engineering Management is a broad and diverse field of engineering, thereby making it difficult to define exactly what the degree encompasses; whereas, the somewhat related degree of Industrial Engineering is better understood. Some universities offer a Bachelor of Science degree in Engineering Management with an emphasis in Industrial Engineering, while others offer a Bachelor of Science degree in Industrial Engineering with an emphasis in Engineering Management. In today's world of competitive academia, many wonder if these degree fields are similar enough to be used interchangeably or if there is a distinct difference separating the two degrees, making it mandatory that they stay clearly separate. To be able to offer insight into these concerns, a study of academic departments will be conducted to determine how both fields are defined and what real similarities and differences exist. As part of this study, curricula from departments in both fields will also be compared to better understand the similarities and differences in these degree programs in regard to course requirements. The results of this study will be provide insight into differentiating characteristics of the engineering management degree as an aid to successfully marketing it to prospective students.

Ashley is a senior attending the University of Missouri-Rolla majoring in Engineering Management. She is the daughter of Jeff and Suzanne Rasnic and is from Bonne Terre, Missouri. On campus she is actively involved in Phi Sigma Rho, Epsilon Mu Eta, Order of Omega, and Tau Beta Pi. Ashley plans on pursuing graduate study in Engineering Management.

Charles Tullock

Department: Computer Science
Major: Computer Science and Computer Engineering
Faculty Advisor(s): Dr. Daniel Tauritz
Advisor's Department: Computer Science

Funding Source: N/A

AI Robotic Soccer Development Platform

This project was designed with two purposes. One was to help in the recruitment of high school students into the Computer Science discipline, and the other was to create a useful tool for the development and research of artificially intelligent systems in a competitive and dynamic environment. The project includes an operating system and programming language independent soccer simulator, a set of table top soccer playing robots, a vision tracking and analysis system, and an interface system easy enough for high school students but useful enough for academic research.

As a recruitment tool, this project was designed to have a "wow" factor via robotics. Games are a tool for holding the interest of young minds and soccer is globally known.

As a research tool the project was designed to be useful and reliable for testing A.I.'s in real-time dynamic environments.

Charles is a senior in Computer Science and Computer Engineering with a minor in Mathematics. He plans to enroll as a graduate student in the CS department this fall and pursue research into the development of intelligent systems.

Nathaniel Wilke

Department: Mechanical and Aerospace Engineering
Major: Mechanical Engineering
Faculty Advisor(s): Dr. James Drallmeier
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: National Science Foundation

Dynamic thin film measurement data analysis method

The characteristics of how a moving thin film travels over a corner, interacting with the surrounding air, material edge surface and gravitational effects, are not well known. Challenges are encountered while attempting to measure transient fluid flow thickness at a point near the corner due to the small physical size and dynamic nature of the system. Images generated using an optical interference technique and high-speed photography are taken of the moving fluid. Due to the large quantity of images, a numerical analysis method using a discrete Fourier transform is used to filter valid signals in the images and calculate the film thickness at a point in time. The result is measurement of changes in the thickness of the moving fluid over some time period. The measurements are used to gain understanding of the dynamic fluid's behavior and instabilities in a corner separation system.

Nathaniel is a senior in Mechanical Engineering from Columbus, NE. He has worked as an undergraduate research assistant in the Combustion and Spray Dynamics laboratory in Mechanical Engineering for over two years. During his time working for Dr. Drallmeier, he has assisted in the research, purchasing, setup and operation of experiments pertaining to the graduate students that Drallmeier advises. He has been working with Mark Friedrich on thin film measurement data analysis since September of 2006. Nathaniel will graduate in May with a bachelor's degree in mechanical engineering.

Laura Woodard

Joint project with Kristen Loesch

Department:	Computer Science
Major:	Computer Science
Faculty Advisor(s):	Dr. Daniel Tauritz
Advisor's Department:	Computer Science

Funding Source:	UMR Opportunities in Undergraduate Research Experience , Computing Research Association Committee on the Status of Women in Computing Research, Collaborative Research Experience for Undergraduates

Computer Science Recruitment in the 21st Century: Improving the Image of Computer Science with 4th-7th Graders, Especially Females

The goal of this project is to create a tool to aid in reversing the alarming trend of decreasing interest in Computer Science (CS) among American students, particularly females. The current generation of American female students tends to be attracted to fields with clear social relevancy. Middle school is a crucial time when students form their opinions about math and science; this is also the time when they begin picking elective classes and, in the case of female students, all too often not picking the math and science classes that would prepare them for a Computer Science career. Our tool will be software aimed at middle school students, with emphasis on female appeal, showcasing the social relevancy of CS through a series of highly visual games and puzzles, illustrating the careers of CS alumni. They will be connected in a manner inspired by "Where in the World is Carmen Sandiego?"

Laura is the daughter of Karen and Jeff Woodard of Rockton, Illinois. She is a senior at UMR majoring in computer science with a double minor in mathematics and psychology. Laura plans to graduate from UMR in May 2007. Laura is an officer in the Association for Computing Machinery Special Interest Group: Security. She assists with activities at the local middle school and high school such as Expanding Your Horizons and the Science Olympiad, and participates in a law enforcement internship program. In addition, Laura enjoys reading, cooking, and watching movies.

Evan Wright

Department: Computer Science
Major: Computer Science
Faculty Advisor(s): Dr. Daniel Tauritz
Advisor's Department: Computer Science

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

A Multicommodity Flow Approach to FACTS Device Control

One solution to the problem of preventing cascading failures in the electrical power system is the use of power electronics, such as Flexible AC Transmission System (FACTS) devices. In order to effectively use these devices, we must be able to calculate control settings quickly enough to mitigate a cascading failure. In this research, we abstract away the complexity of the power grid by modeling it as a directed graph, which allows us to use standard network flow algorithms to determine control settings. In particular, we investigate the use of so-called multicommodity flow algorithms, which model networks that carry more than one "type" of flow, in this case real and reactive power.

Evan Wright is a junior attending the University of Missouri-Rolla, and is pursuing a dual major in Mathematics and Computer Science.

Humanities/Social Sciences Poster Session

Abstracts

Erin Rae Long

Joint project with Donald Joseph Mueller

Department:	Psychology
Major:	Psychology/Engineering Management
Faculty Advisor(s):	Dr. James Martin
Advisor's Department:	Psychology

Funding Source:	UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Using Personality Scores to Predict GPA

The purpose of this study was to determine whether conscientiousness was a good predictor of academic performance in college. It was predicted that conscientiousness was indeed an effective measure of success in a college setting. A survey was administered to University of Missouri-Rolla students taking certain psychology courses. Conscientiousness, GPA, and Academic Adjustment of the students were acquired using self-report. The results showed that there was a high positive correlation between conscientiousness and the GPA reported. However, we also found that academic adjustment mediates the relationship between conscientiousness and GPA. The study does have limitations worth considering, such as the reliability of self-report, and the sample is not representative of the entire college population. Future research may be able to improve the predictability of the conscientiousness on academic success in a college setting.

Erin is a senior attending the University of Missouri-Rolla majoring in Psychology and Business & Management Systems. On campus, she was heavily involved in numerous student organizations and is now a research assistant for Dr. James Martin. Erin plans to pursue a career in social psychology.

Donald Joseph Mueller

Joint project with Erin-Rae Long

Department:	Psychology
Major:	Psychology/Engineering Management
Faculty Advisor(s):	Dr. James Martin
Advisor's Department:	Psychology

Funding Source:	UMR Opportunities for Undergraduate Research Experiences (OURE) Program

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Don is a senior attending the University of Missouri-Rolla majoring in Psychology and Engineering Management. He is the son of Michael and Giselle Mueller and is from Hermann, Missouri. On campus, he is currently involved in a research class under the advisory of Dr. James Martin. Off campus, he holds a part time job. Don plans to pursue a career in business consulting.

Stuart Salvador

Department: Mechanical & Aerospace Engineering
Major: Mechanical Engineering
Faculty Advisor(s): Dr. Diana L. Ahmad
Advisor's Department: History & Political Science

Funding Source: UMR Department of History & Political Science

The Sutro Tunnel: An engineering feat in the West, a global legacy

The Sutro Tunnel was a revolutionary concept in mining engineering. Numerous mining locations world-wide, including locales in Missouri, have benefited from the tunnel's technology. The Sutro Tunnel's legacy includes the elimination of diseases common for miners, such as pneumonia and "miner's consumption," the hazards posed by extremely hot air and lethal gases for those in the mines, and the lack of fresh air. For the first time in history, it also provided mining companies with a practical means to mine a fissure vein and drain water from flooded mines. Finally, Sutro's innovations quartered the death rate of miners at the Comstock Lode that benefited from the Sutro Tunnel and increased the output of the entire load by nearly one-third. Thus, it is not a surprise that mining became significantly more productive after the Sutro Tunnel's construction when others began implementing Sutro's ideas in their own mines.

Stuart Salvador, son of Joseph and Anita Salvador, is a senior currently attending both UMSL and UMR, where he is majoring in mechanical engineering and minoring in history. Aside from his extracurricular activities, Stuart actively pursues his interest in robotics, programs video games, and works as a part-time design engineer in Springfield, MO.

Natalie Shanklin

Department: Psychology
Major: Psychology
Faculty Advisor(s): Dr. Julie A. Patock-Peckham
Advisor's Department: Psychology

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Parental Trust and Links to Adult Relationships

Rempel's (1985) theoretical model of interpersonal trust in close relationships was examined in conjunction with communication styles and perceptions of parental trust. The model consists of three dimensions of trust: Dependability, Predictability, and Faith. Questionnaires regarding feelings of trust of one's own parents, communication styles, and one's own romantic relationships were administered to (184 female, 269 male) University of Missouri – Rolla students. Correlations coefficients were calculated to examine the strength of the relationships among the variables. Findings revealed that lack of trust with parents was linked to poorer quality romantic relationships.

Natalie is a junior majoring in Psychology with an emphasis in Human Resources. This is her second year participating in the Undergraduate Research Conference. Natalie has been actively participating in research in the Psychology department for the past three semesters. She plans to graduate in December and pursue her career in Human Resources in the Nashville, TN area.

Management & Information Systems
Poster Session

Abstracts

Duane Alexander

Joint project with Ryan Andrews; Mitchell Diebold and Ariel Hernandez, et al.

Department:	Computer Science
Major:	Computer Science
Faculty Advisor(s):	Dr. Tom Sager, Dr. Waleed Al-Assadi, Matt Buechler
Advisor's Department:	Computer Science, Computer Engineering, Computer Science
Funding Source:	Computer Science Department

Innovative Secure eVoting System

Recent elections have highlighted the need for a more robust and error proof method of counting votes. An increasing number of studies find that the currently available commercial electronic voting machines have multiple security flaws. The lax security and lack of redundancy can, and possibly has, illegally disenfranchised voters by the dropping or mis-recording of votes. This project attempts to build an electronic balloting system that corrects the shortcomings of competing systems. An open and redundant project would solve many of the problems. The eVoting project is based on a client-server network architecture comprised of multiple ballot machines networked to a server machine. System authentication security prevents the unauthorized addition of rogue systems into the network before or during the vote. Vote data are encrypted during transmission from machines to prevent network sniffing. Many current systems have no paper trail; the proposed system features physical vote printouts as a backup in addition to the separate encrypted databases. The proposed system is currently being constructed with the intent of deployment into an actual voting environment.

Duane Alexander is a senior undergraduate at the University of Missouri-Rolla majoring in Computer Science.

Ryan Andrews

Joint project with Duane Alexander, Mitchell Diebold, Ariel Hernandez, et al.

Department:	Computer Science
Major:	Computer Science, Economics
Faculty Advisor(s):	Dr. Tom Sager, Dr. Waleed Al-Assadi, Matt Buechler
Advisor's Department:	Computer Science, Computer Engineering, Computer Science
Funding Source:	Computer Science Department

Innovative Secure eVoting System

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Ryan Andrews is a senior undergraduate at the University of Missouri-Rolla majoring in Computer Science and Economics.

Mitchell Diebold

Joint project with Ryan Andrews, Duane Alexander, Ariel Hernandez, et al.

Department:	Computer Science
Major:	Computer Science, Computer Engineering
Faculty Advisor(s):	Dr. Tom Sager, Dr. Waleed Al-Assadi, Matt Buechler
Advisor's Department:	Computer Science, Computer Engineering, Computer Science
Funding Source:	Computer Science Department

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Mitchell Diebold is a senior undergraduate at the University of Missouri-Rolla majoring in Computer Science and Computer Engineering.

Kristen Duvall

Department:	Management and Information Systems
Major:	Business and Management Systems
Faculty Advisor(s):	Dr. Bih-Ru Lea
Advisor's Department:	Business Administration
Funding Source:	UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Feasibility of Opening a Coffee and Tea House in Rolla, Missouri

The purpose of this research is to determine the feasibility of operating a specialty coffee and tea house in Rolla, Missouri. The proposed research is important as many students and faculty have expressed interests and a need of a specialty coffee and tea shop in the past. Following research questions are investigated in the proposed research:

1) Would a specialty coffee and tea house in Rolla, MO be able to sustain itself financially?
2) Would the hours of operation affect the success of the proposed coffee and tea house?
3) Does the societal/general environment have an influence on the success of the proposed specialty coffee and tea house?

Methodologies used in this research include literature review and data collected from a survey. I expect the results will show that a coffee and tea shop may be popular with the UMR community; it may not be financially sustainable in the Rolla area.

Kristen Duvall is a senior at the University of Missouri-Rolla. She is majoring in Business and Management Systems, with a minor in Economics and Finance. At UMR, she is a member of Kappa Delta Sorority. Kristen was recently accepted into Clemson University in South Carolina for the Masters in Real Estate Development program.

Ariel Hernandez

Joint project with Ryan Andrews, Duane Alexander, Mitchell Diebold, et al.

Department:	Computer Science
Major:	Computer Science
Faculty Advisor(s):	Dr. Tom Sager, Dr. Waleed Al-Assadi, Matt Buechler
Advisor's Department:	Computer Science, Computer Engineering, Computer Science
Funding Source:	Computer Science Department

Innovative Secure eVoting System

Recent elections have highlighted the need for a more robust and error proof method of counting votes. An increasing number of studies find that the currently available commercial electronic voting machines have multiple security flaws. The lax security and lack of redundancy can, and possibly has, illegally disenfranchised voters by the dropping or mis-recording of votes. This project attempts to build an electronic balloting system that corrects the shortcomings of competing systems. An open and redundant project would solve many of the problems. The eVoting project is based on a client-server network architecture comprised of multiple ballot machines networked to a server machine. System authentication security prevents the unauthorized addition of rogue systems into the network before or during the vote. Vote data are encrypted during transmission from machines to prevent network sniffing. Many current systems have no paper trail; the proposed system features physical vote printouts as a backup in addition to the separate encrypted databases. The proposed system is currently being constructed with the intent of deployment into an actual voting environment.

Ariel Hernandez is a senior undergraduate at the University of Missouri-Rolla majoring in Computer Science.

Daniel Nieters

Joint project with David Trupiano

Department:	Electrical and Computer Engineering
Major:	Information Science & Technology
Faculty Advisor(s):	Dr. Ann Miller
Advisor's Department:	Electrical and Computer Engineering
Funding Source:	N/A

Computer Network Attack, Defense, and Forensics in Two Scenarios

Many different methods exist for infiltrating a PC locally or over the internet. This can be done though the use of malicious software such as viruses, worms, malicious applets, spammers, keyloggers, rootkits, and the like. The purpose of our study was to, first off, study the effects of malicious software downloaded and installed onto a PC running Windows XP Professional, and the ways the software hijacks the machine and spreads from the user's PC. The second half of our project utilized everything we learned from analyzing this malicious software and applying it to a real-life scenario. For our scenario, we coded a specific kind of virus (aptly named a "cryptovirus"), and attacked from one machine over the network to another machine. After the attack was carried out, forensics were applied, and ways of defending against the attack in the future were determined. The victim machine then assumed the role of the attacker PC, and a stronger cryptovirus was created to attack the other PC. Forensics and a defense strategy were also applied to this attack.

Daniel is a junior attending the University of Missouri-Rolla, majoring in Information Science & Technology with an emphasis in Computer Science. He is the son of Jay and Patricia Nieters and is from St. Louis, Missouri. On campus, he is actively involved in UMR's music department and is one of the founding fathers of UMR's newest fraternity, Delta Sigma Phi. Off campus, he became an Eagle Scout under Boy Scout troop 169, and enjoys playing music in his spare time.

David Trupiano

Joint project with Daniel Nieters

Department:	Electrical and Computer Engineering
Major:	Information Science & Technology
Faculty Advisor(s):	Dr. Ann Miller
Advisor's Department:	Electrical and Computer Engineering
Funding Source:	N/A

Computer Network Attack, Defense, and Forensics in Two Scenarios

Many different methods exist for infiltrating a PC locally or over the internet. This can be done though the use of malicious software such as viruses, worms, malicious applets, spammers, keyloggers, rootkits, and the like. The purpose of our study was to, first off, study the effects of malicious software downloaded and installed onto a PC running Windows XP Professional, and the ways the software hijacks the machine and spreads from the user's PC. The second half of our project utilized everything we learned from analyzing this malicious software and applying it to a real-life scenario. For our scenario, we coded a specific kind of virus (aptly named a "cryptovirus"), and attacked from one machine over the network to another machine. After the attack was carried out, forensics were applied, and ways of defending against the attack in the future were determined. The victim machine then assumed the role of the attacker PC, and a stronger cryptovirus was created to attack the other PC. Forensics and a defense strategy were also applied to this attack.

David is a sophomore undergraduate student attending the University of Missouri-Rolla. He is majoring in Information Science & Technology with a minor in Business. He is the son of Jerome and Penny Trupiano and is from St. Charles, MO. He was a member of the Beta Sigma Psi fraternity and was Athletic Chairman of the fraternity for a semester. He plans to pursue a career in Information Technology.

Natural Sciences
Poster Session

Abstracts

Leah Bahr

Department: Geological Sciences & Engineering
Major: Geology
Faculty Advisor(s): Dr. John P. Hogan
Advisor's Department: Geological Sciences & Engineering

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Model for Stalactite Growth

A stalactite collected from a concrete structure near Gweru Zimbabwe, South Africa was investigated to better understand growth mechanisms for stalactites. The sample is composed of relatively concentric rings, alternating between light brown and dark brown in color. These differences have been attributed to reflect growth during the "wet" and "dry" seasons in Gweru. The petrographic microscope was used to characterize the nature of the rings and to count the rings in an attempt to determine the stalactite's age. Physical characteristics of individual layers, such as crystal form, indicate these layers preserve a more complex growth history than simply recording seasonal changes. It is suggested that each ring is related to separate significant rainfall events during the wet season with no deposition during the dry season. Stalactite rings thus provide a good record of past rainfall activity and will require other methods to establish the calendar age of rings.

Leah Bahr is a senior undergraduate student at the University of Missouri-Rolla, majoring in Geology.

Ashley Boudria

Joint project with Shamim Jaleel

Department: Chemical and Biological Engineering
Major: Chemical Engineering
Faculty Advisor(s): Dr. David Westenberg
Advisor's Department: Biological Sciences

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Characterization of Autoinducer Production in *Bradyrhizobium japonicum*

Quorum sensing allows bacteria to communicate with each other and coordinate their behavior with their surroundings. This communication uses autoinducers, such as Acyl-homoserine lactones (AHLs), which is produced and secreted by several strains of *Bradyrhizobium japonicum.* This study characterizes the production of AHL in specific strains of *B. japonicum* and describes the relationship between AHL production and a supposed AHL synthase gene in the *B. japonicum* genome. Polymerase Chain Reaction (PCR) was performed on various bacterium strains to amplify the synthase gene. Extraction of AHLs from *B. japonicum* culture supernatants were used to analyze AHL production using thin-layer chromatography (TLC). The results indicate that some strains of *B. japonicum* produce detectable AHLs of different sizes while other strains do not produce as much AHLs. Surprisingly, AHL production does not appear to correspond precisely with the presence of an AHL synthase gene, indicating more than one pathway for AHL synthesis.

Ashley is a senior attending the University of Missouri-Rolla majoring in chemical engineering. She is the daughter of Russell and Joyce Boudria and is from Jefferson City, Missouri. On campus she is actively involved in Chi Omega, Tau Beta Pi, Omega Chi Epsilon and the American Institute of Chemical Engineers. Ashley plans to pursue a master's degree in Chemical Engineering after she graduates from UMR in December.

David Calcara

Department: Biological Sciences
Major: Biological Sciences
Faculty Advisor(s): Dr. Ron Frank
Advisor's Department: Biological Sciences

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

FtSH Gene Family Identification

Gene family research is an important area of genetics which can help to identify evolutionary lines. Starting with the FtSH gene family in *Arabidopsis*, a well studied relative of a well studied relative of *Glycine max*, with the ultimate goal of finding members of the gene family in *G. max,* computer programs were used to compare the genes in *Arabidopsis* to more closely related plants. These were then compared to *G. max* ESTs, which were assembled into contigs where ORFs were identified. The contigs were compared and the EST sources for the best contigs were identified. Overall, five members of the FtSH gene family were identified. Once these are identified, the next stage is possible, where the ESTs are ordered in vector form, transformed into bacteria, cultured and isolated. This allows them to be sequenced and compared to the contigs to see if a gene family was identified.

David is a junior at the university of Missouri-Rolla majoring in biological sciences. He is the son of Rick and Phoebe Calcara from Olympia, WA. On campus he is a member of the swim team, where he is both an All-American and an Academic All-American. He is still undecided as to his future career.

Jacob Elmer

Joint project with Scott Spychala

Department:	Biological Sciences
Major:	BioChemical Engineering
Faculty Advisor(s):	Dr. Melanie Mormile
Advisor's Department:	Biological Sciences

Funding Source:	UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Radiotolerance of Microorganisms Isolated from the UMR Reactor

The surface of Mars is exposed to high levels of solar and galactic cosmic ray irradiation. Thus, microorganisms that could possibly survive in the shallow subsurface of Mars would likely be radiotolerant. To better understand microorganisms that might reside in this environment of Mars, a number of isolates were obtained from a gamma-radiation source (^{137}Cs) located on the UMR campus. Radiation sensitivity assays were performed on the isolates as well as on the common bacterium, *E. coli*. The *E. coli* did not survive exposures of 100 to 200 Gy while the isolate designated 1B-1 survived. Another isolate, Cont-1, that can withstand the highest exposures tested, is able to degrade agar. Further study of these isolates and similar organisms will enhance our knowledge of these unique extremophilic bacteria and might provide insight into the microorganisms that could be present on Mars.

Jacob is a senior attending the University of Missouri-Rolla majoring in Biochemical Engineering and Biological Sciences. He is the son of Jake Elmer and Valerie Rivera and is from Cocoa Beach, FL. On campus he is involved in Omega Chi Sigma, Phi Sigma, and the Helix Biological Society. He is currently employed as a LEAD PLA for Calc I and II and enjoys fishing. Jacob will pursue a career in Biomolecular Engineering.

Tyler Martin Fears

Department: Chemistry
Major: Physics and Chemistry
Faculty Advisor(s): Dr. Jerry Peacher and Dr. Prakash Reddy
Advisor's Department: Chemistry

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Photorefractivity of Organic-Inorganic Hybrid Composites Photosensitized with Nickel-Sulfide Nanocrystals

The photorefractivity of organic-inorganic hybrid composites doped with nickel sulfide (NiS) nanocrystals is described. The nanocrystals were characterized using visible-absorption spectroscopy, energy-dispersive X-ray spectroscopy, and transmission electron microscopy. The nanocrystals were further modified by ligand exchange, lowering the over-modulation voltage without sacrificing diffraction efficiency as well as increasing the two-beam coupling gain coefficient. Photoconductivity measurements were used to determine the overall quantum efficiency of the photorefractive samples. The measurements represent a significant increase in photorefractivity when compared to other organic-inorganic hybrid photorefractive composites.

Tyler Martin Fears is a student of Physics and Chemistry at the University of Missouri at Rolla.

Wesley Glick

Department: Biological Sciences
Major: Biological Sciences
Faculty Advisor(s): Dr. Roger Brown
Advisor's Department: Biological Sciences

Funding Source: UMR Biological Sciences Department

Assessment of in vivo bone formation using porous, glass scaffolds seeded with mesenchymal stem cells

The purpose of this investigation was to compare two different porous scaffolds composed of silica based bioactive glass in their ability to facilitate bone growth *in vivo* when seeded with mesenchymal stem cells. Companion scaffolds were also used without seeding as a control. One scaffold was constructed entirely of 45S5, while the other was a 70/30 blend of 45S5 and 13-93. These scaffolds were implanted underneath the skin on the backs of young, healthy rats. After recovery, the scaffolds were fixed and processed for analysis. The samples were infiltrated with methyl methacrylate, which was polymerized. Sections were made, ground, polished, and stained. Light microscopy was used to visualize the samples for the presence of new bone growth. Analysis revealed evidence of soft tissue such as blood vessels and connective tissues as well as new bone formation incorporated into both of the scaffolds and the formation of a reactive layer.

Wesley Glick is a senior in the UMR Biological Sciences Department with a pre-med emphasis. He is the current co-President of UMR's pre-health organization Scrubs, Vice-President of the chemistry honor fraternity Alpha Chi Sigma, and an active member in a number of other campus organizations. He has been involved in research for two years. His future plans are to attend medical school and then return to the area to practice medicine.

Mark Herrera

Department: Physics
Major: Physics
Faculty Advisor(s): Dr. Alexey Yamilov
Advisor's Department: Physics

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

The Slow Light Effect in Dual-Periodic Photonic Crystals

Photonic crystal structures are a light analog of electronic semi-conductors. The electromagnetic spectrum of these crystals exhibits photonic band gaps where light propagation is forbidden. This attribute has led to an increased interest in photonic crystals as well as numerous optical applications. Further, the anomalous dispersion properties of these crystals allow for the tailoring of materials in which light propagates at very slow speeds. The system can be considered as a coupled-resonator optical waveguide (CROW): photonic bands with abnormally small dispersion are created due to the interaction of long-lived states in the cavity regions via weak coupling across tunneling barriers. Unlike previous CROW implementations, the proposed structures can be fabricated with interference photolithography (holography) sidestepping the issue of resonator-to-resonator fluctuation of the system parameters. These structures can also be implemented in photonic crystal slab waveguides.

Mark Herrera is an undergraduate student majoring in Physics.

Amy Hunt

Department: Biological Sciences
Major: Biology
Faculty Advisor(s): Dr. Katie Shannon
Advisor's Department: Biological Sciences

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Identification of an Uncharacterized RNA-binding protein that affects Cytokinesis in *Saccharomyces cerevisiae*

Cytokinesis is the physical separation of the cytoplasm after mitosis that results in two daughter cells. This is accomplished by the use of a contractile ring composed primarily of actin and myosin. This project used gene knockout techniques in *S. cerevisiae* to determine the effect a gene has on cytokinesis. We used one-step PCR-mediated gene replacement to delete an uncharacterized open reading frame (ORF) that has been identified in a genomic screen as interacting with the cytokinesis protein Hof1. Deletion of this ORF, YGR250C, resulted in a cytokinesis defect. The gene deletion resulted in 12% of the cells exhibiting a cytokinesis defect compared to a wild type strain that exhibited a 2% cytokinesis defect. The protein encoded by YGR250C ORF has homology to RNA-binding proteins. Further studies will determine if Hof1 mRNA or protein levels are affected by deletion of YGR250C.

Amy is a senior at the University of Missouri-Rolla majoring in biology. On campus she is the president of the biology organization Helix and involved in Phi Sigma.

Shamim Jaleel

Joint Project with Ashley Boudria

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

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) program.

Characterization of Autoinducer Production in *Bradyrhizobium japonicum*

Quorum sensing allows bacteria to communicate with each other and coordinate their behavior with their surroundings. This communication uses autoinducers, such as Acyl-homoserine lactones (AHLs), which is produced and secreted by several strains of *Bradyrhizobium japonicum*. This study characterizes the production of AHL in specific strains of *B. japonicum* and describes the relationship between AHL production and a supposed AHL synthase gene in the *B. japonicum* genome. Polymerase Chain Reaction (PCR) was performed on various bacterium strains to amplify the synthase gene. Extraction of AHLs from *B. japonicum* culture supernatants were used to analyze AHL production using thin-layer chromatography (TLC). The results indicate that some strains of *B. japonicum* produce detectable AHLs of different sizes while other strains do not produce as much AHLs. Surprisingly, AHL production does not appear to correspond precisely with the presence of an AHL synthase gene, indicating more than one pathway for AHL synthesis.

Shamim is a senior attending the University of Missouri-Rolla majoring in biological sciences (with pre-medicine emphasis) with a minor in cognitive neuroscience. Shamim is the daughter of Mohammad and Noorjehan Jaleel and is from Potosi, Missouri. On campus she is actively involved in Scrubs, Helix and is a work-study student for the Biological Sciences department. Off campus, she is a mentor/tutor at Harry S. Truman Elementary School and a volunteer for Hospice in Rolla, Missouri. Shamim plans to pursue a career in medicine.

Heather Lavezzi

Joint project with Amanda Sutterer

Department: Biological Sciences
Major: Biology
Faculty Advisor(s): Dr. Robert Aronstam
Advisor's Department: Biological Sciences

Funding Source: UMR cDNA Resource Center

Novel Method to Express Functional Epitope-Tagged GPCRs

Epitope tagging of G-protein coupled receptors (GPCRs) typically involves the addition of a specific antigenic amino acid sequence (e.g., hemagglutinin) to the N-terminus, a region not involved in receptor ligand binding or signal transduction functions. However, with certain GPCRs this method fails due to post-translational cleavage of the N-terminal tag or inhibition of membrane isertion. To overcome this, we modified a cloning vector so that it would insert an artificial cleavage site at the N-terminus of the protein before the epitope. This ensures that a functional receptor will be expressed and properly inserted into the membrane. Clones of a □ opiod and calcitonin-like receptor (the tagged versions of which are subject to improper post-translational processing) were tagged using this new vector. The modified clones were expressed in a mammalian cell line and visualized using immunoflorescence. This method offers an efficient means to create immunologically identifiable constructs of human GPCRs.

Heather Lavezzi is a sophomore in Biological Sciences from Moberly, Missouri. Heather plays violin in the UMR Chamber Orchestra and she plans to attend medical school.

Marshall McDaniel

Department: Biological Sciences
Major: Biological Sciences
Faculty Advisor(s): Dr. Anne Maglia
Advisor's Department: Biological Sciences

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

A Protocol for 3D Reconstructions from Reduced-quality Serial Histological Sections

Computer-generated 3D reconstructions of anatomy allow the examination of minute and internal structures that cannot be visualized using traditional methods. Digital reconstructions are generated from many sources, including magnetic resonance imaging, computed tomography, and histological serial sections. Of these, serial sections provide the most information, but are difficult to generate because of deformation and misalignment. Protocols to eliminate inconsistencies in a serial section stack could result in informative reconstructions generated efficiently and inexpensively. I describe a protocol I developed to construct 3D visualizations from reduced-quality serial sections. Using this technique, I created a reconstruction of the vertebral column of the spadefoot toad (*Spea bombifrons*), a species for which the vertebral column has unique morphology and developmental patterns. Results presented here should: 1) provide better methods for creating 3D reconstructions from serial sections, and 2) offer new insights for future studies of the development of the spinal column of *S. bombifrons.*

Marshall McDaniel is a senior pursuing his Bachelor's of Arts in Biological Sciences. He has conducted research with Dr. Maglia since his freshman year in college. He has also been involved in Opportunities of Undergraduate Research Experiences (OURE) for the past two years. Marshall enjoys being a part of this program, because it provides an easy way for students and professors to learn from one another and have fun doing it.

Audrey Oakley

Department: Biological Sciences
Major: Biology
Faculty Advisor(s): Dr. Melanie Mormile
Advisor's Department: Biological Sciences

Funding Source: UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Isolation of Haloalkaliphilic Bacteriophages from Soap Lake, Washington

Soap Lake, a meromictic haloalkaline lake located in central Washington State, provides a habitat for many unique types of microbiota. Due to its meromictic quality, the layers of the lake do not mix, instead separating to produce distinct environments within the lake, causing a variance in microbiota from layer to layer. Though viral studies have been conducted on haloalkaline lakes, only a few viruses have been isolated and studied. The focus of this study was to investigate the types of viruses found in Soap Lake. Haloalkaliphilic bacteriophages were found to be present in Soap Lake. This viral community may act as an ecological control for the bacterial community in this unique ecosystem.

Audrey is a senior attending the University of Missouri-Rolla, majoring in Biology, and minoring in philosophy. She is from Custer, South Dakota. On campus she is an officer in Phi Sigma, the Biological Sciences Honor Society, and Scrubs, the pre-health professions organization. Off campus she shadows physicians via Mid-Missouri AHEC. Audrey plans on becoming a physician, and pursuing her PhD in microbiology.

Lauren Rich

Department: Physics
Major: Physics
Faculty Advisor(s): Dr. Massimo Bertino
Advisor's Department: Physics

Funding Source: National Science Foundation

Quantum Dot Photolithography

Quantum dots are semiconductor nanocrystals that have entered the quantum confinement regime and thus exhibit unique optical properties. Quantum dot photolithography (QDPL) has the potential to serve as an effective method of integrating quantum dot technology into mainstream industry. Though several types of radiation can be used for QDPL, multiphoton ionization is among the most promising. Patterns are constructed inside a porous silica matrix by focusing laser light to induce multiphoton ionization, initiating a chemical reaction which results in the precise and controlled writing of quantum dots. This method efficiently yields high-resolution patterns of quantum dots, making it a feasible process for the production of optical-digital interfacing circuitry and quantum dot laser arrays.

Lauren Rich is a third year student at UMR, majoring in Physics. She is the daughter of Joseph and Darlene Rich from St. Louis, Missouri. Her research interests include experimental physics: primarily solid state, condensed matter, laser and optical physics. Lauren plans to attend graduate school upon completion of her Bachelor's degree and pursue a PhD in Physics.

Scott Spychala

Joint project with Jacob Elmer

Department:	Mining & Nuclear Engineering
Major:	Nuclear Engineering
Faculty Advisor(s):	Dr. Gary Mueller
Advisor's Department:	Mining & Nuclear Engineering

Funding Source:	UMR Opportunities for Undergraduate Research Experiences (OURE) Program

Radiotolerance of Microorganisms Isolated from the UMR Reactor

The surface of Mars is exposed to high levels of solar and galactic cosmic ray irradiation. Thus, microorganisms that could possibly survive in the shallow subsurface of Mars would likely be radiotolerant. To better understand microorganisms that might reside in this environment of Mars, a number of isolates were obtained from a gamma-radiation source (^{137}Cs) located on the UMR campus. Radiation sensitivity assays were performed on the isolates as well as on the common bacterium, *E. coli*. The *E. coli* did not survive exposures of 100 to 200 Gy while the isolate designated 1B-1 survived. Another isolate, Cont-1, that can withstand the highest exposures tested, is able to degrade agar. Further study of these isolates and similar organisms will enhance our knowledge of these unique extremophilic bacteria and might provide insight into the microorganisms that could be present on Mars.

Scott is a senior attending the University of Missouri-Rolla majoring in Nuclear Engineering. He is the son of Wayne and Paula Spychala. On campus he is involved in the American Nuclear Society. He is currently employed as an engineer at LEMetrix Solutions LLC. Scott will pursue a career in Nuclear Engineering as a design engineer.

Amanda Sutterer

Joint project with Heather Lavezzi

Department: Biological Sciences
Major: BioChemical Engineering
Faculty Advisor(s): Dr. Robert Aronstam
Advisor's Department: Biological Sciences

Funding Source: UMR cDNA Resource Center

Novel Method to Express Functional Epitope-Tagged GPCRs

Epitope tagging of G-protein coupled receptors (GPCRs) typically involves the addition of a specific antigenic amino acid sequence (e.g., hemagglutinin) to the N-terminus, a region not involved in receptor ligand binding or signal transduction functions. However, with certain GPCRs this method fails due to post-translational cleavage of the N-terminal tag or inhibition of membrane isertion. To overcome this, we modified a cloning vector so that it would insert an artificial cleavage site at the N-terminus of the protein before the epitope. This ensures that a functional receptor will be expressed and properly inserted into the membrane. Clones of a □ opiod and calcitonin-like receptor (the tagged versions of which are subject to improper post-translational processing) were tagged using this new vector. The modified clones were expressed in a mammalian cell line and visualized using immunoflorescence. This method offers an efficient means to create immunologically identifiable constructs of human GPCRs.

Amanda Sutterer is a sophomore in BioChemical Engineering from Jackson Missouri who is active in RHA and plans to either go to graduate school or enter the field of research and development.

Research Proposals
Poster Session

Abstracts

Jason Kaiser

Department: Geological Sciences and Engineering
Major: Geology
Faculty Advisor(s): Dr. John Hogan
Advisor's Department: Geological Sciences and Engineering

Funding Source: N/A

Formation of Rapakivi Textures in Granite of the Deer Isle Pluton, Maine

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 feldspars 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 will be drilled out and analyzed using Inductively Coupled Plasma – Mass Spectrometry and Optical Emission Spectrometry to determine subtle differences (ppm) in trace and Rare Earth Element abundances. These data will be used to resolve between the two models of formation.

Jason is a senior attending the University of Missouri-Rolla majoring in Geology. He is the son of Alan and Darcy Kaiser and is from St. Louis, Missouri. He is actively involved in the CL Dake society (American Association of Petroleum Geologists), and is Vice President of Sigma Gamma Epsilon. Jason plans on attending graduate school.

Evan J. Stevens

Department: Geological Sciences & Engineering
Major: Geological Engineering
Faculty Advisor(s): Dr. John Hogan & Dr. Derek Apel
Advisor's Department: Geology & Mining Engineering

Funding Source: N/A

Investigation of Jointing and Joint Formation in the Roubidoux Sandstone, Rolla, Missouri

Jointed outcrops of Roubidoux Sandstone are exposed along the north outer road of Interstate 44 in Rolla, Missouri. I will determine if the jointing present in the outcrop is systematically or randomly oriented. Furthermore, I will investigate whether or not hematite cementation present along some joint surfaces is related to mineralization as a result of fluid flow along these joints. Finally, the strength properties of the sandstone will be determined to constrain the conditions of joint formation. Geologic field methods will be used to map the outcrop. Thin sections will be examined in order to observe cementation and pore cavities. The mechanical properties of rock cylinders of Roubidoux Sandstone will be tested using the UMR Rock Mechanics Facility.

Evan is a junior attending the University of Missouri-Rolla majoring in Geological Engineering. He is the son of Terry and Marcie Stevens and is from St. Charles, Missouri. On campus he is involved in the Pi Kappa Alpha Fraternity and also works for the Interdisciplinary Engineering Department as a professor's assistant. Evan plans on pursuing his career as a Geological Engineer in the mining industry.