Undergraduate Research Conference at Missouri S&T

Apr 16th, 2014

10th Annual Undergraduate Research Conference Abstract Book

Missouri University of Science and Technology

Missouri University of Science and Technology

10th Annual Undergraduate Research Conference

A celebration of experiential learning at Missouri S&T

April 16, 2014

Missouri S&T Havener Center

MISSOURI S&T — MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

Formerly University of Missouri-Rolla

10th Annual
Undergraduate Research Conference
April 16, 2014

Table of Contents

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Undergraduate Research Conference

April 16, 2014
Missouri S&T - Havener Center

CONFERENCE AGENDA

8:00am – 8:30am	**Registration and Poster Set-Up** *(Upper Atrium)*
8:30am – 9:00am	**Opening Address** Provost Warren K. Wray Vice Provost Jeff Cawlfield *(St. Pat's B)*
9:00am – 11:45pm	**Oral Sessions** **ARTS & HUMANITIES** *(Ozark)* --- **ENGINEERING** *(Gasconade)* --- **SCIENCE** *(Carver)* --- **SOCIAL SCIENCES** *(Ozark)*
9:00am – 11:45am	**Poster Sessions** **SCIENCES** *(Upper Atrium/Hallway)*
12:00pm – 1:00pm	**Luncheon & Keynote Address** ***Dr. Delbert E. Day*** Curators' Professor Emeritus, Materials Science and Engineering *Presents* "Research --- Pathway to the Future" *(St. Pat's C)*
1:00pm – 3:00pm	**OURE Fellows Oral Sessions** **Engineering – Sciences – Social Sciences** Final Presentations *(Carver)* **Sciences – Social Sciences** Applicants Presentations *(Turner)*
1:00pm – 3:00pm	**Poster Sessions** **ARTS & HUMANITIES -- ENGINEERING -- RESEARCH PROPOSALS -- SOCIAL SCIENCES** *(Upper Atrium/Hallway)*
3:00pm – 4:00pm	**Missouri S&T Reception** *(St. Pat's A & Miner Lounge)*
4:00pm – 5:00pm	**Awards Ceremony** *(St. Pat's B)*

- **Judges Conference Rooms -** (Burgess Room and Mark Twain Room)

Keynote Speaker

Delbert E. Day

Curators' Professor Emeritus, Materials Science and Engineering

Senior Investigator, Graduate Center for Materials Research

Presents

"Research --- Pathway to the Future"

During Delbert's career, he has published more than 390 technical papers dealing with the structure, mass transport properties, and uses of glass, edited three books and been granted 61 US and foreign patents. His patents include glass microspheres for medical (radioembolization of malignant tumors) and dental applications, bioactive glasses for wound healing and bone repair, chemically durable iron phosphate glasses for vitrifying nuclear waste, optically transparent composites, and high temperature ceramics. He conducted the first US glass melting experiments in micro-gravity on NASA's Space Shuttle and is co-inventor of special purpose glass microspheres, TheraSphere^{TM}, which are now being used at more than 170 sites worldwide to treat patients with inoperable liver cancer. He is a co-inventor of "Glasphalt", where waste glass is recycled as part of the aggregate in asphalt paving.

His numerous honors and awards include election to the National Academy of Engineering, Distinguished Life Member (and past president) of the American Ceramic Society, The Presidential Award for Research and Creativity and the Presidential Citation for Alumni Service Award (University of Missouri), selection as the Nation's Outstanding Young Ceramic Engineer (Pace Award) by the National Institute of Ceramic Engineers, the Hosler Alumni Scholar Medal for Scientific Achievement (Pennsylvania State University), the Chancellor's Medal and Doctor of Science, Honoris Causa, (University of Missouri-Rolla/Missouri S&T), and the Outstanding Educator Award from the American Ceramic Society. He is a Fellow of the American Ceramic Society, the Society of Glass Technology (United Kingdom) and the National Institute of Ceramic Engineers. In 2009, he received the Toledo Glass & Ceramics award for his Achievements in Education and Industry and in 2010 he was awarded the Phoenix Award and named Glass Person of the Year for his technical achievements and contributions to the glass industry. In 2011 he received the Stookey Lecture of Discovery Award (American Ceramic Soc) which recognizes innovative work in developing new materials of significant commercial impact. He was also named one of only 28 Alumni of Influence by the Missouri University of Science and Technology from its 50,000 plus living alumni.

He is the former Chairman and President of MO-SCI Corp (Rolla MO), a company he co-founded to manufacture special purpose glasses for the healthcare, electronics, transportation, aerospace, chemical and sporting goods industries. He continues his work as an educator/researcher, entrepreneur, consultant and multi-engine commercial pilot/flight instructor.

Conference Judges

The Office of Undergraduate Studies wishes to thank the following faculty & staff for their valuable contributions to the 10th Annual Missouri S&T Undergraduate Research Conference.

Stuart Baur
Michael Bruening
Egemen Cetinkaya
Curt Elmore
Stephanie Fitch
Jie Gao
Stephen Gao
Greg Gelles
Larry Gragg
Amber Henslee
Greg Hilmas
Irina Ivliyeva
Wei Jiang
Dincer Konur
Merilee Krueger
Kelly Liu
Xin Liu
Scott Miller
Rachel Morris
Gayla Olbricht
Dana Rapier
Prakash Reddy
Josh Rovey
John Seiffertt
Katie Shannon
Joseph Smith
Nancy Stone
Dave Westenberg
Zhaozheng Yin
Vincent Yu
Rosa Zheng

Oral Presentations

Arts and Humanities

Name	Department	Time	Location
Anna Sakach	English & Technical Communication	9:00-9:30 am	Ozark Room
Nelson Shreve	Arts, Languages & Philosophy	9:30-10:00 am	Ozark Room
Sophia Vojta	Arts, Languages & Philosophy	10:00-10:30 am	Ozark Room

Engineering

Name	Department	Time	Location
Clayton Buback	Chemical & Biological Engineering	9:00-9:30 am	Gasconade Room
Katelyn Denby	Civil, Architectural & Environmental Engineering	9:30-10:00 am	Gasconade Room
Keith LeGrand	Mechanical & Aerospace Engineering	10:00-10:30 am	Gasconade Room
Alexandra Slimmer	Chemical & BioChemical Engineering	10:30-11:00 am	Gasconade Room

Sciences

Name	Department	Time	Location
Melissa Buechlein	Civil, Architectural & Environmental Engineering	9:00-9:30 am	Carver Room
Alan Landers	Chemistry	9:30-10:00 am	Carver Room
Katrina Ward	Computer Science	10:00-10:30 am	Carver Room
Clayton Craig Giannino Lusicic Alexander Mark	Physics	10:30-11:00 am	Carver Room

Social Sciences

Name	Department	Time	Location
Samantha Kempker	Psychological Science	10:30-11:00 am	Ozark Room

Poster Presentations

Arts and Humanities

Poster #	Name	Department	Time	Location
1	Ashley Koesterer	Business & Information Technology	1:00-3:00 pm	Upper Atrium/Hall
2	Brandon Noble	Arts, Languages & Philosophy	1:00-3:00 pm	Upper Atrium/Hall

Engineering

Poster #	Name	Department	Time	Location
3	Robert Block	Chemistry	1:00-3:00 pm	Upper Atrium/Hall
4	Brynne Coleman	Mechanical & Aerospace Engineering	1:00-3:00 pm	Upper Atrium/Hall
5	Melissa Elder	Civil, Architectural & Environmental Engineering	1:00-3:00 pm	Upper Atrium/Hall
6	Samuel Haberberger	Mechanical & Aerospace Engineering	1:00-3:00 pm	Upper Atrium/Hall
7	Amanda Holmes	Civil, Architectural & Environmental Engineering	1:00-3:00 pm	Upper Atrium/Hall
8	Michaela Kuzara	Materials Science & Engineering	1:00-3:00 pm	Upper Atrium/Hall
9	Chidiebere Onukogu	Geological Sciences & Engineering	1:00-3:00 pm	Upper Atrium/Hall
10	Derek Schnoebelen	Civil, Architectural & Environmental Engineering	1:00-3:00 pm	Upper Atrium/Hall
11	Kewei Shi	Geological Sciences & Engineering	1:00-3:00 pm	Upper Atrium/Hall
12	Logan Turk	Mining & Nuclear Engineering	1:00-3:00 pm	Upper Atrium/Hall
13	Yiwen Gong Qiang Guo	Geological Sciences & Engineering	1:00-3:00 pm	Upper Atrium/Hall
14	Jose Morales Jessica Randall Alyssa Steinert	Chemical & Biochemical Engineering	1:00-3:00 pm	Upper Atrium/Hall
15	Emily Dierkes John Schaefer	Mechanical & Aerospace Engineering	1:00-3:00 pm	Upper Atrium/Hall
16	Alex Carney Josh Heath Sean Tennyson Melissa Vidal	Chemical & Biochemical Engineering	1:00-3:00 pm	Upper Atrium/Hall

Research Proposals

Poster #	Name	Department	Time	Location
17	Lauren Anderson	Biological Sciences	1:00-3:00 pm	Upper Atrium/Hall
18	Alex Bertels	Computer Science	1:00-3:00 pm	Upper Atrium/Hall
19	Abagail Campbell	Biological Sciences	1:00-3:00 pm	Upper Atrium/Hall
20	Rebecca Curtis	Computer Science	1:00-3:00 pm	Upper Atrium/Hall
21	Olivia Fleming	Biological Sciences	1:00-3:00 pm	Upper Atrium/Hall
22	Joshua Neeter	Biological Sciences	1:00-3:00 pm	Upper Atrium/Hall

Sciences

Poster #	Name	Department	Time	Location
23	Mondae Atughonu	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
24	Carol Baker	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
25	Justin Beltz	Chemistry	9:00-11:45 am	Upper Atrium/Hall
26	Michael Bouchard	Geological Sciences & Engineering	9:00-11:45 am	Upper Atrium/Hall
27	Katherine Brinker	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
28	Jack Crewse	Physics	9:00-11:45 am	Upper Atrium/Hall
29	Kelsey Crossen	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
30	Andrew Cudd	Physics	9:00-11:45 am	Upper Atrium/Hall
31	Katie Czeschin	Chemical & Biochemical Engineering	9:00-11:45 am	Upper Atrium/Hall
32	Ariel Donovan	Chemistry	9:00-11:45 am	Upper Atrium/Hall
33	Brandon Drennen	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
34	David Gillcrist	Chemical & Biochemical Engineering	9:00-11:45 am	Upper Atrium/Hall
35	Timofey Golubev	Physics	9:00-11:45 am	Upper Atrium/Hall
36	Ethan Hamilton	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
37	Sabrina Hostler	Chemistry	9:00-11:45 am	Upper Atrium/Hall
38	Cassandra Hurley	Chemistry	9:00-11:45 am	Upper Atrium/Hall
39	Sahitya Injamuri	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
40	Nathaniel Kamrath	Computer Science	9:00-11:45 am	Upper Atrium/Hall
41	Scott Ketcherside	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
42	Michael Little	Geological Sciences & Engineering	9:00-11:45 am	Upper Atrium/Hall
43	Danielle Meyer	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
44	Katherine Nelson	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
45	Thanh Nguyen	Information Science & Technology	9:00-11:45 am	Upper Atrium/Hall
46	Nicholas Santoro	Materials Science & Engineering	9:00-11:45 am	Upper Atrium/Hall
47	Luke Simon	Computer Science	9:00-11:45 am	Upper Atrium/Hall
48	Samuel Turpin	Mathematics & Statistics	9:00-11:45 am	Upper Atrium/Hall
49	Qiqi Wang	Geological Sciences & Engineering	9:00-11:45 am	Upper Atrium/Hall
50	Wanying Wang	Geological Sciences & Engineering	9:00-11:45 am	Upper Atrium/Hall
51	Jing Zhang	Geological Sciences & Engineering	9:00-11:45 am	Upper Atrium/Hall
52	Matthew Zieger	Computer Science	9:00-11:45 am	Upper Atrium/Hall
57	Adrian Black Jeremiah Herbert	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
58	Brock Ebert Sheldon Harper Jaykob Maser	Physics	9:00-11:45 am	Upper Atrium/Hall
59	Yi Jiang Samantha Lucker	Geological Sciences Engineering	9:00-11:45 am	Upper Atrium/Hall
60	Ryan Gibbs Scott Ketcherside Nelson Shreve	Physics	9:00-11:45 am	Upper Atrium/Hall
61	Wang Dan Chunyu Liu Chenyi Mao	Geological Sciences Engineering	9:00-11:45 am	Upper Atrium/Hall
62	John Plihal Cera Thomason	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall

Social Sciences

Poster #	Name	Department	Time	Location
53	Kimberly Beck	Civil, Architectural & Environmental Engineering	1:00-3:00 pm	Upper Atrium/Hall
54	Nathan Dowd	Civil, Architectural & Environmental Engineering	1:00-3:00 pm	Upper Atrium/Hall
55	Natasha Stoneking	Psychological Science	1:00-3:00 pm	Upper Atrium/Hall
56	Darrell Wallace	Civil, Architectural & Environmental Engineering	1:00-3:00 pm	Upper Atrium/Hall

Arts and Humanities

Oral Abstracts

Anna Sakach

Department: Physics
Major: Physics
Research Advisor(s): Dr. Kate Drowne
Advisor's Department: English

Funding Source: N/A

Hamlet's Moral Double Bind

The play *Hamlet* is often used by psychologists to study the character Hamlet as they would study a patient in order to increase their understanding of people similarly disturbed. This makes the interpretation of the nature and causes of Hamlet's erratic behavior scientifically important. Through an understanding of the context of Hamlet's actions and a consideration of the entire play, it can be seen that Hamlet is a good example of a person suffering from trauma and from a double bind. It also becomes clear that Hamlet is not someone with an Oedipal complex and should not be used as a model for how this disorder can occur.

Anna Sakach is a freshman at Missouri University of Science and Technology. Her current major is physics, but her interest in English led her to peruse a research project in the humanities. She is also involved in Student Counsel and the Newman Center.

Nelson Shreve

Department: Arts, Languages & Philosophy
Major: Physics
Research Advisor(s): Dr. Joel Dittmer
Advisor's Department: Arts, Languages & Philosophy

Funding Source: N/A

Ivan's Children: Suffering for the Infinite?

In Dostoevsky's last novel, *The Brothers Karamazov*, he attempts to secure the existence of God. While writing a compelling story he also establishes a framework for his argument. He first tries to put an argument against God with a "rebellion", and then he immediately builds up an artistic argument for God. The discussion against God is look into the problem of evil with an interesting twist: the suffering of children. Dostoevsky goes on to reply to this argument, but does he succeed?

Nelson is a senior in Physics. He is a LEAD Peer Learning Assistant and tennis instructor. Following completion degree he plans to continue on to medical school.

Sophia Vojta

Department: Arts, Languages, and Philosophy
Major: Undeclared
Research Advisor(s): Dr. Audra Merfeld-Langston
Advisor's Department: Arts, Languages, and Philosophy

Funding Source: N/A

"What a Woman Is": Marianne and the Illusion of Representation in France

In France, liberty and justice have been personified for centuries in the image of a traditionally Caucasian woman called Marianne. She has come to represent the French Republic and the ideal French woman. Since the 1970s, French women have been chosen as visual and thematic models for sculptures and postage stamps featuring the image of Marianne. Although modern representations have become more ethnically diverse, women of non-Caucasian backgrounds who model as Marianne are still subsumed by the abstract ideals that she represents. Though Marianne herself seems more diverse, true inclusivity is only an illusion; this demonstrates the power structures that still shape Marianne's iconography.

Sophia Vojta is a dually enrolled student at Missouri S&T. She is a Peer Learning Assistant for Physics and a member of the Missouri S&T Chamber Choir. She plans to major in Physics and English.

Engineering

Oral Abstracts

Clayton Buback

Department: Department of Chemical and Biochemical Engineering
Major: Biochemical Engineering
Research Advisor(s): Dr. Daniel Forciniti
Advisor's Department: Department of Chemical and Biochemical Engineering

Funding Source: N/A

Precipitation of Porcine Hemoglobin by Nonionic Polymers

Protein precipitation is a commonly used unit operation in the process of isolating and purifying proteins. This project focused on the use of nonionic polymers to precipitate porcine hemoglobin. Elements of experimental design were used to select meaningful sets of experiments. The effects of various factors and two-factor interactions on the solubility of the protein were examined. The data indicated that higher weight polymers and higher concentrations of polymer both decrease porcine hemoglobin solubility, but the two-factor interaction between polymer concentration and molecular weight was an inconsistent interaction, resulting in higher solubility than would be independently expected. The role played by EO/PO fraction in solubility was also studied.

Clayton Buback was born in St. Charles, Missouri. At age 16, he enrolled in the Missouri Academy of Science, Mathematics, and Computing, and graduated at the top of his class, earning an Associate of Science Degree and High School Diploma simultaneously. He now attends the Missouri University of Science and Technology, and is working on two Bachelor's Degrees: one in Biology, and one in Biochemical Engineering. Clayton will graduate from Missouri S&T in May of 2014, and will start medical school at the University of Rochester the following fall.

Katelyn Denby

Department:	Civil, Architectural and Environmental Engineering
Major:	Environmental Engineering
Research Advisor(s):	Dr. Daniel Oerther
Advisor’s Department:	Civil, Architectura, and Environmental Engineering

Funding Source:	John A. and Susan Mathes Endowed Chair in Environmental Engineering

An Assessment of Rolla’s Food System and Nutrition Needs

The field of environmental engineering creates systems to improve public health and safety, yet it often ignores topics such as nutrition and obesity. These topics can affect human health and quality of life as much as air or water pollution and treatment. This project has explored the links between food, nutrition, hunger, and obesity in many ways, beginning with two honors experiences- work with a Kenyan food program and a molecular biology analysis of microbes involved in obesity. It also includes a survey of food systems in India. These experiences have culminated in the creation of a Rolla “food policy council” and several community awareness events. Through this group and public feedback, key factors in the nutrition and obesity issue have been identified, and programs will be discussed and evaluated for their ability to create a solution. The top programs will be implemented and tested for real-world success.

Katelyn Denby is a senior in environmental engineering and has conducted independent research with Dr. Oerther for several years, including a trip to India in 2012. Katelyn is involved in the Honor’s Academy, is a teacher’s assistant for EnvE 261, the president of Eco Miners, and an officer in Chi Epsilon and Wesley. She is also an active member of Tau Beta Pi.

Keith LeGrand

Department: Department of Mechanical and Aerospace Engineering
Major: Aerospace Engineering
Research Advisor(s): Dr. Kyle DeMars, Dr. Henry Pernicka
Advisor's Department: Aerospace Engineering

Funding Source: Opportunities for Undergraduate Research Experience

Initial Relative Orbit Determination Using Multiple LOS Measurements and Gaussian Mixture Models

Unobservability of space-based angles-only orbit determination can be mitigated by including angle measurements from a second optical sensor. Previous approaches have used stereoscopic angles to triangulate a second satellite's position. Due to triangulation nonlinearities, zero-mean Gaussian noise cannot be assumed. In this work, the uncertainty of both angle measurements is used to bound the possible positions of the second satellite. Uniform uncertainty is approximated over these bounded regions at two times using Gaussian mixtures. Linkage of the mixtures is performed using a Lambert solver to formulate a full state uncertainty for use in a Bayesian filter.

Keith LeGrand is currently an undergraduate student in Aerospace Engineering at the Missouri University of Science and Technology. His research interests are focused in the areas of astrodynamics and spacecraft embedded systems. Past internships have included positions at the Air Force Research Laboratory, Garmin International, and Sandia National Laboratories. Keith has accepted the invitation to participate in Sandia's Critical Skills Master's Program, in which he will earn his Master's in Aerospace Engineering before beginning full-time employment at Sandia National Laboratories in Albuquerque, NM.

Alexandra Slimmer

Department: Chemical Engineering
Major: Chemical Engineering
Research Advisor(s): Dr. Muthanna Al Dahhan, Dr. Gholamreza Zahedi
Advisor's Department: Chemical Engineering

Funding Source: Grant from AdaptiveARC

General Thermodynamic Modeling of Gasification of Diverse Biomasses

A thermodynamic equilibrium approach is used in a gasification process in order to create a model and program, via MATLAB, that calculates the composition of the product gas and the gasification temperature. The model is flexible, taking in diverse biomass feedstock, as well as a variety of gasification agents. Through equilibrium reactions and mass balances, the syngas composition is calculated. Then, energy balance calculates the gasification temperature using an iterative method. The model and program were created, and then the program was verified through convergence and validated with experimental data from other papers. Finally, a parametric study was run in order to examine the effects on syngas composition caused by gasification temperature, biomass moisture content, amount of air input, and carbon content of the feedstock. The model will be used to optimize converting municipal waste to energy and syngas, which is a prime example of converting waste to wealth.

Alexandra Slimmer is a junior in Chemical Engineering from Wildwood, MO. She works for the chemical engineering department as a research assistant and MATLAB programmer and for the Missouri S&T Yearbook as a photographer. Her research focuses on biomass gasification. Outside of class, she is the president of the campus chapter of Habitat for Humanity and is a member of Phi Eta Sigma and The National Society of Leadership and Success. Alexandra is currently in the process of being initiated into Tau Beta Pi and Kappa Mu Epsilon and hopes to continue working with biomass gasification and alternative energy in the future.

Sciences

Oral Abstracts

Melissa Buechlein

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

Funding Source: NONE

Skin Uptake of Gas Phase Methamphetamine: Effect of Clothing

A fluid-mechanical boundary layer that surrounds the human body acts as a resistance to skin uptake of chemicals from the air. Clothing has the potential to emit or absorb chemicals depending on the concentration difference between the material and the air. We hypothesized that clothing contaminated with a chemical reduces the effective boundary layer thickness which causes the skin to absorb chemicals at a higher rate. A cotton shirt material equilibrated with the concentration of a 10 L chamber at ~77 ppb methamphetamine was positioned at fixed distances (1 to 20 mm) from filters with ~5 mg of artificial skin oil. Each filter was immersed in 6.5 mL of 1% ethyl acetate in hexane then analyzed using a gas chromatography- mass spectrometry. These findings support the hypothesis that the flux from air-equilibrated clothing to skin is higher than from air to bare skin; suggesting that clothing-to-skin transfer may be an important vector for uptake of many chemicals.

Melissa Buechlein is a senior in environmental engineering with a minor in geological engineering. She is a member of the Eta Theta chapter of Zeta Tau Alpha, of Chi Epsilon (the civil engineering honors fraternity), of Tau Beta Pi (the engineering honor society), and EcoMiners (a Missouri S&T going-green club). Her interests include: outdoor activities, sports, drawing, and baking.

Alan Landers

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

Funding Source:	DOE project # DE-FG02-08ER46518 Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program

Sustainable Harvesting of Solar Energy Photoelectrochemical Water Splitting

Photoelectrochemical water splitting is a promising method for providing clean, renewable energy. Silicon is a very effective light absorber; however, silicon easily oxidizes to SiO_2. In this project, cobalt and a codeposit of cobalt, nickel, and iron are used to protect silicon from surface passivation. These materials provide long-term stability during photoelectrochemical water oxidation. Additionally, cobalt can be photo-oxidized to CoOOH, an effective water oxidation catalyst. The n-Si/Co/CoOOH thin film produced photocurrent of approximately 35 mA/cm^2 at 0.5 V vs. Ag/AgCl and showed a photocurrent onset potential of approximately 0.08 V vs. Ag/AgCl. The codeposit of cobalt, nickel, and iron has shown improved catalytic properties with a photocurrent onset potential of approximately 0 V vs. Ag/AgCl. While characterization of these films is ongoing, the use of metal/metal oxide thin films as a protective layer to prevent silicon oxidation shows great promise for use in photoelectrochemical water splitting.

Alan is a Junior in Chemistry from Gainesville, Missouri. Alan is involved in several organizations at Missouri S&T, including Christian Campus Fellowship, Toastmasters International, and Alpha Chi Sigma. Alan has also volunteered as an Opening Week Mentor. After receiving his Bachelor's Degree, Alan plans to attend graduate school to continue his studies in Chemistry.

Katrina Ward

Department: Computer Science
Major: Computer Science
Research Advisor(s): Dr. Dan Lin
Advisor's Department: Computer Science

Funding Source: National Science Foundation (NSF)

Publishing Big Trajectory Data with Privacy Preservation

One of the biggest trends in mobile technology is the collection of trajectory data for analysis and location prediction. While the collection of such data, through mobile phones and vehicle GPS systems, is not new, current research searches for better ways to preserve the privacy of the users, whose data is being collected. Over the past few years, several methods have been introduced including k-anonymity, data suppression, and data masking, however, all of these methods fail to address the huge amount of data being generated by an entire city of users. The amount of data being transmitted every month is in the order of exabytes. In this paper, we propose a new method, using Map Reduce technology, of anonymizing huge data so that individual users cannot be identified in published data while also keeping as much of the data as possible. With Map Reduce being easy to manage on multiple commodity machines and easy to configure to dynamically choose the number of machines for a given task, we believe this method has more scalability and will continue to outperform traditional methods even as the amount of data becomes even larger.

Katrina is a senior in computer science and has been accepted into the Computer Science PhD program with full scholarship. She has done prior research with Dr. Jennifer Leopold in 3D Spatial and Temporal Reasoning. Currently, she works under her PhD advisor in Big Data and Privacy Preservation and has been awarded an NSF Undergraduate Fellowship for her work.

Clayton Craig
Join project with Giannino Lusicic, Alexander Mark

Department: Physics
Major: Physics and Applied Mathematics
Research Advisor(s): Dr. John G. Story
Advisor's Department: Physics

Funding Source: Missouri S&T Advanced Physics Lab

The Production, Analysis, and Applications of Graphene

Graphene is a two-dimensional crystalline structure consisting of densely packed carbon atoms in a hexagonal pattern. Graphene is strong, nearly transparent, and is an excellent conductor of both heat and electricity. As such it has found many applications such as theoretical drug delivery systems and new transistors many times faster than modern silicone transistors. In 2010 Andre Geim and Konstantin Novoselov at the University of Manchester won the Nobel Prize in Physics for their work in graphene. Following their methods numerous samples of graphene were created using household sticky tape. In addition samples of reduced graphite oxide were created focusing intense light onto graphite oxide samples. This method produced large enough samples to create capacitors from.

Clayton is a Junior in Physics and Applied Mathematics with plans to graduate in May 2015. He intends to pursue a graduate degree in physics after graduation and perform research in the fields of nanomaterials and particle physics.

Giannino Lusicic

Joint project with Clayton Craig, Alexander Mark

Department: Physics
Major: Physics and Computer Science Double
Research Advisor(s): Dr. John Story
Advisor's Department: Physics

Funding Source: Physics department

The Production, Analysis, and Usage of Graphene

Graphene has been dubbed a "wonder material" in recent years due to its many remarkable physical traits including extremely high electron mobility and tensile strength. The 2010 Nobel Prize in physics was awarded to a pair of scientist who isolated a monoatomic layer of graphene utilizing little more than tape. This project sought to expand on methods of graphene production by investigating and testing different methods for its creation. Few-layer graphene was successfully created and tested via photo-reduction of a deposited layer of oxidized graphite, the aforementioned tape method, and variations on both.

Giannino is a second-year physics and computer science double major of senior standing in credit at Missouri S&T. After graduation, he will attend graduate school to further his education in physics. He seeks to use both his knowledge of physics and his skills as a programmer in harmony to advance humanity's understanding of the universe. He is an Eagle Scout and the head instructor of the fencing club.

Alexander Mark

Joint project with Giannino Lusicic, Clayton Craig

Department: Physics Department
Major: Physics/Electrical Engineering
Research Advisor(s): Dr. Story
Advisor's Department: Physics Department

Funding Source: Advanced lab class funds

The Production, Analysis, and Applications of Graphene

Graphene is a single atom thick sheet of carbon atoms with many interesting properties. Graphite is composed of multiple layers of graphene, so it can be mechanically separated into flakes of graphene. Graphene was separated from pure graphite samples using conventional scotch tape and analyzed optically to determine thickness. Graphite oxide was also reduced using a laser to form bans of graphene on various substrates. It was shown that the electrical properties of the graphite oxide differed after laser treatment, indicating varying levels of graphene present in the treated samples.

Alexander Mark is a sophomore at Missouri S&T majoring in Physics and Electrical Engineering. He is interested in materials research and plans on continuing his education, eventually going to graduate school for physics. Alexander is a member of the Missouri S&T fencing club and volunteers in Dr. Hor's laboratory in the physics department.

Social Sciences

Oral Abstracts

Samantha M. Kempker

Department: Psychological Sciences
Major: Psychology
Research Advisor(s): Dr. Amber Henslee
Advisor's Department: Psychological Sciences

Funding Source: N/A

College-student use of protective behavioral strategies on the Missouri S&T campus: A review of previous research and directions for future research

Event-specific drinking is associated with even riskier alcohol use among college students than drinking during typical occasions (Neighbors et al., 2011). The use of protective behavioral strategies (PBS; e.g., using a designated driver, limiting the number of drinks consumed) is associated with less risky alcohol use and fewer alcohol-related consequences (Benton et al, 2004; Delva et al, 2004; Martens et al, 2004). Previous research has investigated which college student demographics (i.e., gender, ethnicity; Lawrence, Abel, & Hall, 2010) predict use of protective behavioral strategies. The Missouri S&T campus provides a unique demographic population (i.e., mostly European American males) and campus culture (i.e., large celebratory event-specific drinking occasions) for studying use of protective behavioral strategies. These studies investigated various aspects of the use of protective behavioral strategies on the Missouri S&T campus. Results of these findings and directions for future research are discussed.

Samantha Kempker was born in the small town of Taos, MO. She grew up loving anything involving the outdoors and continues to love hunting, camping, and driving her four-wheeler. In high school, Samantha's school counselor instilled in her a love for psychology and she is now a senior psychology major at the Missouri University of Science and Technology. After graduating, Samantha intends to obtain her PhD in clinical psychology. Her long-term career goals include conducting research to improve therapy for juveniles and to instill a passion for psychology in the younger generation through a career as a professor.

Arts and Humanities Poster Abstracts

Poster 1

Ashley Koesterer

Department: Business Information Technology
Major: Business Management and Systems
Research Advisor(s): Dr. Sarah Stanley and Dr. Cassie Elrod
Advisor's Department: Business Information Technology

Funding Source: N/A

The Branding and Quality of Coffee

For many people it is hard to distinguish the difference between the branding and the quality of products. To determine the difference, there were two studies conducted focused on coffee products. The first study included a presentation that contained slides with different coffee products. The first slide displayed pictures of three different coffee brands, and students then ranked them based on the brand. Next, a slide showed the same coffee brands but with prices. The goal was to find out whether or not the students changed the order based off the prices, and they also were eye tracked. In our second study, there were two focus groups conducted that each included10-12 students. In the focus groups, several questions were asked regarding the branding and the quality of coffee to see why they purchased certain coffee products. Overall, students purchase coffee based on price.

Ashley Koesterer is a senior from Saint Louis who is dual majoring in Business Management and Systems and Economics, she is also minoring in Information Science and Technology. Currently, Ashley is a member of Zeta Tau Alpha, the Student Body President of Missouri University of Science and Technology, and is a Marketing Assistant for Career Opportunities and Employer Relations. Recently, she received the Woman Student of the Year Award for all of her involvement and work on our campus. Ashley is graduating this May and will be working with Junction Solutions in Saint Louis as a Consultant.

Poster 2

Brandon Noble

Department: Arts, Languages & Philosophy
Major: Mechanical Engineering
Research Advisor(s): Dr. Audra Merfeld-Langston
Advisor's Department: Arts, Languages, & Philosophy

Funding Source: NONE

The History of French Armor, from 1903-1993

This will be a study of French armor, from the Levasseur Project up to the AMX-56 Leclerc. In this study, it will be looked at how the initial philosophies for how a tank should be designed, and how its combat should be conducted, and then compare these philosophies to ones for the next generation of tanks, and then the next generation, and so on and so forth. This will be conducted by observing what makes up each tank, that is to say what is the balance between each tank of the three basics of armor: Firepower, Mobility, and Protection.

Brandon Noble is a student in the Freshman Engineering Program with an intended major in Mechanical Engineering. He is a part of the Air Force Reserve Officers Training Corps, and the Military Aerospace Society.

Engineering

Poster Abstracts

Poster 3

Robert Block

Department:	Chemistry
Major:	Chemistry-Premedicine
Research Advisor(s):	Rex Gerald, Klaus Woelk
Advisor's Department:	Chemistry
Funding Source:	Chemistry

Application of Automated Systems to Improve Data Quality of Long Durations Biomass-to-Fuel Reactions

The microcontroller-based pH auto-sampling apparatus is designed to improve the data quality of long term biomass to fuel reactions by using small sample sizes and operating autonomously. The apparatus is designed specifically to monitor the conversion of glucose to 5-Hydroxymethylfurfural. This reaction takes up to twelve hours and requires constant monitoring. If the pH falls outside an acceptable range, the intended reaction will be disrupted, giving a low yield. Reaction conditions prevent *in situ* pH measurements. Conventional pH measurement techniques require samples to be measured outside the reaction chamber. These samples represent non-negligible portions of the reaction mass. In the apparatus, a microcontroller reads a pH sensor that requires very little solution, allowing many pH readings to be taken without significantly affecting the amount of solution available for other types of analysis. The microcontroller operates autonomously, but alerts the operator if the reaction leaves acceptable bounds and action is required.

Robert Block is a freshman studying chemistry with a premedical emphasis. He has been working with Dr. Woelk's and Dr. Gerald's research group for a year and a half. During that time, he has worked with biofuels, solar cells, and nuclear magnetic resonance spectroscopy. Robert often designs systems for use with research projects and helps instruct researchers on the proper use and care for nuclear magnetic resonance spectrometers.

Poster 4

Brynne Coleman

Department:	Mechanical and Aerospace Engineering
Major:	Aerospace Engineering
Research Advisor(s):	Dr. Joshua Rovey
Advisor's Department:	Mechanical and Aerospace Engineering
Funding Source:	NASA-Missouri Space Grant Consortium

Imidazole-Based Ionic Liquid Ferrofluid Chemical Propellant Analysis

This project evaluated the potential of ionic liquids ferrofluids (ILFFs) as chemical propellants, since these liquids already indicate increased performance for electrospray thrusters. The NASA Chemical Equilibrium with Applications (CEA) code was used to predict specific impulses and combustion products of Bmim[NO3]-based and Emim[EtSO4]-based ionic liquids with varied amounts of iron oxide additions, assuming typical monopropellant spacecraft thruster values for the chamber pressure, 300 psi, and expansion ratio, 50. It was observed that as iron oxide was added to the mixtures, the specific impulses dropped significantly, proving to be an important consideration if the gains from hardware simplicity are not as significant as the propellant mass efficiency. However, the product species changed insignificantly, indicating that the iron oxide particles are not consumed in the reaction but act more as a catalyst, as predicted. Analysis of additional testing will be assessed further, pending results from the final experiments.

Brynne Coleman is a Senior in Aerospace Engineering at Missouri University of Science and Technology, and after graduating in December of 2014 with a minor in Mathematics, she will continue her studies as a graduate student at S&T.

Poster 5

Melissa Elder

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

Funding Source: Opportunities for Undergraduate Research Experiences

Evapotranspiration Determination and Modeling for Full Scale Phytoremediation

Volatile organic compounds (VOCs) such as perchloroethylene (PCE) and trichloroethylene (TCE) are contaminants found frequently in the environment. Due to their location in ground water, detection and remediation of VOCs are difficult but these steps are important in protecting human health. As plants have been shown to uptake VOCs, they have been increasingly used for site remediation and monitoring. Phytoremediation and phytoscreening have been found to be cost effective, easily implemented and more ecologically friendly when compared to traditional methods. Phytoscreening has been applied to seven sites in Missouri that are currently undergoing investigation for remediation.

This project utilizes thermal dissipation probes and evapotranspiration (ET) modeling based on daily climate input and is the key element in projecting the removal rate for pollutants at the site.The ET model and data are being integrated with in-planta pollutant assessment and 3-D groundwater pollution profiling.

Melissa Elder is a senior in Environmental Engineering minoring in psychology. She is secretary of the Society of Hispanic Professional Engineers, a mentor for the Student Diversity Mentoring Program, and a member of Eco Miners and Engineers Without Borders. She also lives with her sister in the Solar Village on campus. Her interests include American Indian history and culture, reading, traveling, skiing and skydiving.

Poster 6

Samuel J. Haberberger

Department: Mechanical/Aerospace Department
Major: Aerospace Engineering
Research Advisor(s): Dr. Kyle J. DeMars
Advisor's Department: Mechanical/Aerospace Department

Funding Source: Opportunities for Undergraduate Research Experiences

Inertial Navigation Using Dead-Reckoning and Distributed Sensing

This project will be focused on developing and testing algorithms for implementing a strap down (rigidly attached) inertial measurement unit (IMU) for obtaining a statistical quantification regarding the state of a vehicle. The algorithm to be studied propagates the spacecraft state's statistics by using a model of the gravitational acceleration and using the IMU to provide a measure of all non-gravitational accelerations and angular motions imparted to the spacecraft. This procedure is referred to as dead-reckoning. In addition to propagating the state of a vehicle using dead-reckoning, multiple sensors will be fused together to average their data in order to improve the accuracy of the sensor. This procedure is referred to as distributed sensing. The data will be averaged in multiple different ways algorithmically, in order to optimize computational power and accuracy.

Samuel Haberberger is a senior in the aerospace department at Missouri University of Science and Technology. He is involved with multiple on campus research groups; the Missouri S&T Satellite Team (MSAT) and a student research assistant of Dr. DeMars. For MSAT, he is the current lead of the Integration subsystem, which holds the responsibility of bringing all of the subsystems together and to test the system as a whole. He is also the support lead in the GN&C (Guidance Navigation and Control) which holds the responsibility of testing and interfacing the IMU with the satellite's system. His research area under Dr. DeMars lies in the area of distributed sensing, along with state propagation of aerospace vehicles using an IMU as data input.

Poster 7

Amanda Holmes

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

Funding Source: Opportunities for Undergraduate Research Experience (OURE)
US Environmental Protection Agency GRO Fellowship
NIEHS Superfund Research Program

Natural Systems to Treat Toxins: Mass Removal of Chlorinated Solvents

Volatile organic compounds (VOCs) such as perchloroethylene (PCE) and trichloroethylene (TCE) are contaminants found frequently in the environment, including sites across the state of Missouri. Due to their location in the groundwater, detection and remediation are difficult. As plants have been shown to uptake VOCs, they have been increasingly used for site remediation and monitoring. Phytoremediation and phytoscreening have been found to be cost-effective, easily implemented, and more ecologically friendly when compared to traditional methods.

In this work, a full scale phytoremediation plot located at Schuman Park in Rolla, MO will be monitored using in-planta, groundwater, and evapotranspiration techniques.

Amanda Holmes is a junior at Missouri S&T studying mathematics. She is thankful to have had the opportunity to participate in environmental research under Dr. Joel Burken since she was in high school. Her hobbies include trout fishing, hiking, watching movies, and cooking.

Poster 8

Michaela Kuzara

Department: Materials Science and Engineering
Major: Ceramic Engineering
Research Advisor(s): Dr. Richard K. Brow, Kathryn Goetschius
Advisor's Department: Materials Science and Engineering

Funding Source: Center for Biomedical Science and Engineering

The Effect of Composition and Structure on the Dissolution Rates in Water of Alkali- Alkaline Earth Borate Glasses

Fifteen different borate glasses with molar compositions $10X_2O{\cdot}10RO{\cdot}80B_2O_3$, $15X_2O{\cdot}15CaO{\cdot}70B_2O_3$, and $20X_2O{\cdot}20CaO{\cdot}60B_2O_3$ (where X =Li, Na or K and R =Mg, Ca or Sr) were characterized using NMR, FTIR, and Raman spectroscopies. The fractions of boron tetrahedra (B4) were determined; 0.45 of the borate units in glasses with 60 and 70 mole% B_2O_3 were tetrahedral, compared to 0.29 in glasses with 80 mole% B_2O_3. The dissolution rate in 37 °C water was determined from glass powders by measuring the boron release rate using ICP-OES. Dissolution rate constants were determined using a contracting volume model for spherical particles. Glasses with 80 mole% B_2O_3 (fewer B4 units) dissolved about an order of magnitude faster than glasses with more B4 units. Glasses with greater field strength alkali (Li<Na<K) and alkaline earth (Ca<Sr) ions dissolved 25-50% more slowly; Mg-containing glasses did not follow this field strength trend.

Michaela is a Senior in Ceramic Engineering from the St. Louis, Missouri area. She has been working with Dr. Brow's glass research group for about a year and a half, and will be graduating in December. She is involved with Keramos (professional Ceramic Engineering fraternity), the Water Environment Federation (WEF), and Lambda Sigma Pi (women's community service organization).

Poster 9

Chidiebere Onukogu

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

Funding Source: Opportunities for Undergraduate Experience Program

The Effects of In-Situ Condition Curing on Oil Well Cements Properties of CO2 Sequestration Injection Wells

CO_2 sequestration is a method to counteract the large amounts of CO_2 being produced into the atmosphere. It works by pumping CO_2 in super critical phase into the subsurface where it is stored in the same manner as hydrocarbons. Missouri has been working on CO_2 sequestration projects to help reduce the state's carbon emissions from power plants. CO_2 is injected through wellbores into the holding formation which are cased and cemented wellbores. Cement is one of the primary barriers of leakage and this integrity is based off the cement's physical properties. Many of the cement properties are known at atmospheric conditions, but the cement properties will vary once the cement is cured at in-situ conditions.

Curing is one of the most important steps in cement construction, because proper curing greatly increases cement strength and durability. Cement hardens as a result of hydration which is the chemical reaction between cement and water. Cement requires a moist, controlled environment to gain strength and harden fully. The cement paste hardens over time, initially setting and becoming rigid though very weak and gaining in strength in the weeks following. In around 4 weeks, typically over 90% of the final strength is reached, though strengthening may continue for decades. Properly curing concrete leads to increased strength and lower permeability and avoids cracking where the surface dries out prematurely.

A set of the same cement was prepared to conduct the lab experiment. The samples will be cured under simulated wellbore curing conditions for 7 days at 180 degrees Fahrenheit and 1500 psi initially. A measurement of each sample's physical properties was then conducted. These measurements include compressive strength, thermal conductivity, thermal expansion, Young's modulus, Poisson's ratio, permeability, volume changes (shrinkage or expansion), Rheology, and Settling. Then integrity will be checked using finite element analysis.

In conclusion, the physical properties of cement at atmospheric conditions differ from the physical properties of cement at in-situ conditions. These in-suit conditions must be known when considering the integrity of your cement for CO_2 sequestration. Otherwise, the integrity of the injection well cannot be predicted.

Chidiebere Onukogu is a senior studying Petroleum Engineering with a minor in Geology at Missouri S&T. He is the treasurer of the Pi Epsilon Tau Petroleum Honor Society, the event coordinator of the Society of Petroleum Engineers, and a member of the American Association of Drilling Engineers. After graduation, Chidiebere plans to further his education by pursuing a Masters' in Petroleum Engineering and eventually his PhD. His interests includes sports, working out, researching, and spending time with his family.

Poster 10

Derek Schnoebelen

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

Funding Source: John A. and Susan Mathes Endowed Chair in Environmental Engineering

Improving ability to transfer water effectively and inexpensively in African villages

According to the United Nations an estimated 40 billion man hours are lost per year collecting water in Sub-Saharan Africa. The job of gathering water is usually designated to the women of the household and can take up to 60% of the day. This leaves very little time for other possible income generating activities. This can in turn force them to forfeit valuable time for education and other activities, which contributes to the family's impoverished situation. Several options are available through aid organizations, but they are not easily accessible and costs can be prohibitive. The aim of this project is to offer a solution that can be made of locally obtained items, thus boosting local economies and creating greater access to water transportation aides.

Derek Schnoebelen is a sophomore at Missouri University of Science and Technology studying Civil Engineering. At school Derek is involved in Delta Sigma Phi Fraternity and Solar House Team. At home or in his free time he likes to mountain bike, run, and spend time outdoors.

Poster 11

Kewei Shi

Department: Geological Sciences and Engineering
Major: Petroleum Engineering
Research Advisor(s): Mingzhen Wei
Advisor's Department: Geological Sciences and Engineering

Funding Source: Opportunities for Undergraduate Research Experiences

Factors that Influence Gas Desorption in Unconventional Reservoirs

Unconventional gas reservoirs, which refer to coal bed methane and shale gas, are playing an increasingly important role in the energy supply in recent years. Gas in the unconventional reservoirs presents as free gas within the fractures and pores or as adsorbed gas in the rock matrix. During the production process, gas would be desorbed with the pressure depletion. This process has an obviously impact on the late time of gas production. Langmuir models are used in this report to simulate single component in the reservoir and 2D-EOS model is used to simulate high-pressure CO2 excess adsorption. There are several factors that influence gas desorption, such as permeability of fractures, components of the gas, reservoir pressures, etc. Although adsorbed gas makes up of a considerably amount of the gas-in-place, it is difficult to produce due to the ultra-tight rock matrix and relatively high bottom hole pressure. With the development technique so far, the economic values of desorption gas in moderate to deep shale gas plays may not be significant.

Kewei Shi is a senior of Petroleum Engineering and also a SPE member.

Poster 12

Logan Turk

Department: Mining & Nuclear Engineering
Major: Nuclear Engineering
Research Advisor(s): Dr. Joseph Smith, Dr. Shoaib Usman
Advisor's Department: Mining & Nuclear Engineering

Funding Source: SMR Research and Education Consortium

Sustainable Supply Chains for Small Modular Reactors

The long term goal of this project is to develop models for evaluating the sustainability of SMR supply chains. SMR supply chains are global and complex systems, which have environmental, social, and economic impacts. This ongoing project will test the hypothesis that life cycle sustainability assessment (LCSA) is suitable for the assessment of SMR supply chains. LCSA combines life cycle assessment (LCA), social life cycle assessment (S-LCA), and life cycle costing (LCC) to evaluate the environmental, social, and economic impacts, respectively, of the SMR. This project is approached by: (i) documenting the SMR supply chain product system, (ii) performing a gap analysis for local and regional growth, and (iii) selecting the relevant impact categories for environmental, social, and economic impacts. The impact of the SMR on Missouri's economy can be determined using this model.

Logan is a sophomore Nuclear Engineering major from Moberly, Missouri, who is also working toward a minor in Engineering Management. A member of the Energy Research and Development Center's research group, Logan aspires to contribute to solving the problem of supplying the world with clean, sustainable energy for decades to come. In his spare time, he can be found somewhere near water, either wakeboarding, fishing or boating.

Poster 13

Yiwen Gong

Joint project with Qiang Guo.

Department: Geological Sciences & Engineering
Major: Petroleum Engineering
Research Advisor(s): Bai Baojun
Advisor's Department: Geological Sciences & Engineering

Funding Source: Dr. Bai's office

The Application of Gel in Water Flooding of Unconsolidated Sands

With the worldwide production of hydrocarbon, an increasing challenging problem is how to get high oil recovery from the reservoir rather than drill more wells. Water flooding is the most significant way in secondary oil recovery by injecting water into the certain formation to displace oil. This experiment is a simulated situation to displace oil from ideally 100% oil saturation sand formation with water flooding. Usually the problem associated this technique is inefficient recovery due to variable permeability. Thus, we inject a certain amount of gel, after sufficient water injection until little oil could be swept anymore, to block the high permeable zone. As the pathway where water used more likely to go through is blocked, we could continue another set of experiment of water injection to displace the oil in low permeable zone. This experiment is focusing on how gel could affect the oil recovery during water flooding.

Yiwen Gong majors in Petroleum Engineering, Missouri University of Science and Technology. She has the Internship experiences at Halliburton (completion and management system) and simulation study in Antonoil. She has learned the water flooding methods to approach the oil recoveries from unconsolidated sands with varies water injection rates. And she has analyzed the gel plugging effect for water flooding at low permeable zone. She applied the secondary recovery knowledge to the experiments and arrived at the reasonable results.

Poster 13

Qiang Guo

Joint project with Yiwen Gong.

Department: Geological Sciences & Engineering
Major: Petroleum Engineering
Research Advisor(s): Bai Baojun
Advisor's Department: Geological Sciences & Engineering

Funding Source: Dr. Bai's office

The Application of Gel in Water Flooding of Unconsolidated Sands

With the worldwide production of hydrocarbon, an increasing challenging problem is how to get high oil recovery from the reservoir rather than drill more wells. Water flooding is the most significant way in secondary oil recovery by injecting water into the certain formation to displace oil. This experiment is a simulated situation to displace oil from ideally 100% oil saturation sand formation with water flooding. Usually the problem associated this technique is inefficient recovery due to variable permeability. Thus, we inject a certain amount of gel, after sufficient water injection until little oil could be swept anymore, to block the high permeable zone. As the pathway where water used more likely to go through is blocked, we could continue another set of experiment of water injection to displace the oil in low permeable zone. This experiment is focusing on how gel could affect the oil recovery during water flooding.

Qiang Guo is a senior in Petroleum Engineering, Missouri University of Science and Technology. He has been devoted to the study of unconventional reserve and oil recovery. His thought is to try best to exploit more from developed wells. This project is a result of GQ' idea combined with practice. Besides, GQ had intern experience in Halliburton for completion and management and stimulation in Antonoil.

Poster 14

Jose Morales

Joint project with: Jessica Randall, Alyssa Steinert

Department: Chemical Engineering
Major: Chemical Engineering
Research Advisor(s): Dr. Daniel Forciniti
Advisor's Department: Chemical Engineering

Funding Source: N/A

Fibrillation of Bovine and Human Insulin Fragments

Many diseases such as Alzheimer's and Parkinson's are linked to amyloid deposits, which are insoluble protein aggregates with a characteristic intermolecular beta-sheet structure. The buildup of these deposits is caused by the aggregation of the amyloid peptide that is found in the human body. It is known that aggregate formation damages tissue, but the kinetics of their formation is not well understood. One protein that also forms amyloid fibrils is insulin. It is known that bovine and human insulin have different fibrillation kinetics in spite of the fact of being almost identical molecules (they differ in four amino acids). In this work the fibrillation of bovine and human insulin fragments, which include the region lacking homology, was studied. Fourier Transform Infrared Spectroscopy, Transmission Electron Microscopy, and Thioflavin-T Fluorescent Spectroscopy (ThT) were used to explore the differences in kinetics of these two fragments.

Jose Morales is a senior chemical engineering student from Kansas City, MO with family roots tracing back to Mexico. Jose is interested in pursuing a career in the manufacturing industry upon his graduation this May. Jose partakes in several activities on campus besides schoolwork. He is the president of the society of Hispanic professional engineers, a member of Alpha Chi Sigma and also partakes in research. He was really interested in doing this kind of research because he felt it had real world application and it is an occurrence in his family. Jose believes that it is important to surround yourself with a variety of activities and things that interest you.

Poster 14

Jessica Randall

Joint project with Jose Morales, Alyssa Steinert

Department: Chemical Engineering
Major: Chemical Engineering
Research Advisor(s): Dr. Daniel Forciniti
Advisor's Department: Chemical and Biological Engineering

Funding Source: Opportunities for Undergraduate Research Experiences

Fibrillation of Bovine and Human Insulin Fragments

Many diseases such as Alzheimer's and Parkinson's are linked to amyloid deposits, which are insoluble protein aggregates with a characteristic intermolecular beta-sheet structure. The buildup of these deposits is caused by the aggregation of the amyloid peptide that is found in the human body. It is known that aggregate formation damages tissue, but the kinetics of their formation is not well understood. One protein that also forms amyloid fibrils is insulin. It is known that bovine and human insulin have different fibrillation kinetics in spite of the fact of being almost identical molecules (they differ in four amino acids). In this work the fibrillation of bovine and human insulin fragments, which include the region lacking homology, was studied. Fourier Transform Infrared Spectroscopy, Transmission Electron Microscopy, and Thioflavin-T Fluorescent Spectroscopy (ThT) were used to explore the differences in kinetics of these two fragments.

Jessica Randall is a student from Lee's Summit, MO pursuing a Bachelor's Degree in Chemical Engineering. She currently holds an undergraduate research assistant position working under the tutelage of Dr. Forciniti. Her areas of research specialty are in peptide synthesis and characterization using Fourier Transform Infrared Spectroscopy. She plans to graduate in May of 2014 and pursue a career in process chemical engineering.

Poster 14

Alyssa Steinert

Joint project with Jose Morales, Jessica Randall

Department:	Chemical Engineering
Major:	Biochemical Engineering
Research Advisor(s):	Dr. Daniel Forciniti
Advisor’s Department:	Chemical Engineering

Funding Source: Opportunities for Undergraduate Research Experiences

Fibrillation of Bovine and Human Insulin Fragments

Many diseases such as Alzheimer’s and Parkinson’s are linked to amyloid deposits, which are insoluble protein aggregates with a characteristic intermolecular beta-sheet structure. The buildup of these deposits is caused by the aggregation of the amyloid peptide that is found in the human body. It is known that aggregate formation damages tissue, but the kinetics of their formation is not well understood. One protein that also forms amyloid fibrils is insulin. It is known that bovine and human insulin have different fibrillation kinetics in spite of the fact of being almost identical molecules (they differ in four amino acids). In this work the fibrillation of bovine and human insulin fragments, which include the region lacking homology, was studied. Fourier Transform Infrared Spectroscopy, Transmission Electron Microscopy, and Thioflavin-T Fluorescent Spectroscopy (ThT) were used to explore the differences in kinetics of these two fragments.

Alyssa Steinert is a senior from Ozark, MO pursuing a degree in Chemical Engineering with an emphasis in Biochemical Engineering. Along with focusing on her studies, Alyssa also participates in many organizations on campus. She is currently a Certified Peer Educator for Joe's PEERS, a member of both Alpha Chi Sigma and American Institute of Chemical Engineers, and she partakes in research under the guidance of Dr. Forciniti. She plans to pursue a career in Chemical Engineering upon her graduation in May.

Poster 15

Emily Dierkes

Joint project with John Schaefer

Department: Mechanical & Aerospace Engineering
Major: Mechanical Engineering
Research Advisor(s): Dr. Kakkattukuzhy Isaac
Advisor's Department: Mechanical & Aerospace Engineering

Funding Source: Opportunities for Undergraduate Research Experiences

Applications of Active Aeroelastic Wing Technology

A new wing system has been developed using Active Aeroelastic Wing (AAW) Technology. This system uses an actuator made from two aluminum alignment rods that fit together to apply a vertical displacement. Camber is introduced into the wing by the displacement of the actuator. Beginning with a NACA 0012 airfoil, which has no lift at zero angle of attack, the displacement will increase the camber of the wing, providing lift at zero angle of attack. It is expected that wind tunnel testing will support this hypothesis, and that drag will be reduced when the actuators are not displaced. By utilizing the high life configuration for takeoff and a low lift configuration for cruise conditions, the design will require less fuel consumption.

Emily Dierkes is a senior studying Mechanical Engineering at Missouri S&T. In her time with the MAE department, she has become involved with numerous projects, including undergraduate research and the Advanced Aero Vehicle Group. After she completes her B.S. in Mechanical Engineering, Emily plans to work full time with Boeing assisting SLS design and analysis.

Poster 15

John Schaefer

Joint project with Emily Dierkes

Department:	Mechanical & Aerospace Engineering
Major:	Aerospace Engineering
Research Advisor(s):	Dr. Kakkattukuzhy Isaac
Advisor's Department:	Mechanical & Aerospace Engineering

Funding Source: Opportunities for Undergraduate Research Experiences

Applications of Active Aeroelastic Wing Technology

Active Aeroelastic Wing (AAW) Technology is an emerging technology in aerospace engineering which combines the fields of aerodynamics and structures. Aircraft featuring AAW Technology utilize wings or control surfaces which can actively deform in an effort to optimize aerodynamic performance. Examples of this technology include the X-29 and X-53. In this research, we designed, manufactured, and tested an active aeroelastic wing as a demonstration of the technology. The vortex lattice method was used to simulate results for comparison against wind tunnel data. The wing features a NACA 0012 airfoil section with a flexible skin and internal mechanical actuators which can be used to induce camber. The idea is that a high lift configuration could be used for a takeoff condition, and a low lift configuration could be used for a cruise condition.

John Schaefer is a senior studying Aerospace Engineering at Missouri S&T. In his time with the MAE department, he has become involved with numerous projects, including undergraduate research and the Advanced Aero Vehicle Group. After he completes his B.S. in Aerospace Engineering, John plans to stay at Missouri S&T for graduate school to obtain a M.S. in Aerospace Engineering. His primary interest is in aerodynamics, and he plans on studying aerodynamic shape optimization for his graduate research.

Poster 16

Alexander Carney

Joint project with Mellisa Vidal, Joshua Heath, Sean Tennyson

Department: Chemical Engineering
Major: Chemical Engineering
Research Advisor(s): Dr. Joseph Smith
Advisor's Department: Chemical Engineering

Funding Source: MST Energy and Research Development Center

Characterization of Biodiesel

With increased production of Biodiesel, the safety of the process takes on a greater importance. The major hazards of small scale biodiesel production are the reactants, and the products. Methanol is flammable and poisonous. Sodium hydroxide is highly corrosive. Biodiesel itself is highly flammable. Appropriate gloves and eyeware should be worn at all times. The production area should be well ventilated and have a fire suppression system. A flammable gas detector should also be used.

Alex Carney was born on April 18, 1990 in Springfield Missouri. He has spent the majority of his life there. Alex graduated From Glendale High School in 2008. Alex Carney is currently a senior at MS&T. His academic interests include green energy and nanotechnology.

Poster 16

Joshua Heath

Joint project with Shaun Tennyson, Alexander Carney, Melissa Vidal

Department:	Chemical and Biochemical Engineering
Major:	Chemical Engineering – Biochemical Engineering Emphasis
Research Advisor(s):	Dr. Joseph Smith
Advisor's Department:	Chemical and Biochemical Engineering
Funding Source:	MST Energy Research and Development Center

Characterization of Biodiesel Using Various Feedstocks

In recent years, there has been an increasing interest in biodiesel as a source of renewable energy. It burns cleaner than petroleum and can be produced fairly easily with the right equipment. Biodiesel can be used in many applications such as in motor vehicles, aircraft, and as heating oil. One of the benefits of biodiesel is the fact that it can be made from a variety of feedstocks. There are several feeds that have been chosen to be tested. Corn is the most abundant feed in the Midwest, soybean has been chosen since it has become a standard in biodiesel production, canola oil is the most prominent feed used in Europe leading to the question of the quality difference, and used cooking oil to see if the waste can be put to good use. This project compares the characteristics of different biodiesels made from different feedstocks and will provide valuable insight on the optimal feedstock for diesel.

Joshua Heath is currently a sophomore at Missouri University of Science and Technology pursuing a degree in chemical engineering. This is his first year participating in the OURE program at Missouri S&T. He is also a member of iGEM and the American Institute of Chemical Engineers. After graduation, he is hoping to go into a career in bioengineering.

Poster 16

Sean Tennyson

Joint project with Melissa Vidal, Josh Heath, Alex Carney

Department: Chemical and Biochemical Engineering
Major: Chemical Engineering
Research Advisor(s): Joseph Smith
Advisor's Department: Chemical and Biochemical Engineering

Funding Source: Missouri S&T Energy Research and Development Center

Characterization of Biodiesel Using Various Feedstocks

The recent demand for alternative energy and concern for the environment have led to the investigation of biodiesel as a feasible alternative to petroleum based liquid transportation fuels. One important factor in the production of biodiesel is the feedstock. Optimizing the biodiesel production process by selecting the most beneficial feedstock would greatly improve the feasibility of using biodiesel as an alternative fuel. The goal was to produce biodiesel using various feedstocks and then characterizing the resulting biodiesel. Biodiesel was produced using a base-catalyzed transesterification process and the same equipment, therefore ensuring uniformity in the process. This project compares the characteristics of the various biodiesels, and will provide valuable information on the optimal feedstock for biodiesel.

Sean Tennyson is a junior in chemical engineering. He has been the leader of the biodiesel research team for the past year. Sean's research interests include biodiesel production and optimization, and life-cycle analysis on carbon emissions.

Poster 16

Melissa Vidal

Joint project with Sean Tennyson, Joshua Heath, Alexander Carney

Department: Chemical and Biochemical Engineering
Major: Chemical Engineering
Research Advisor(s): Dr. Joseph D. Smith
Advisor's Department: Chemical and Biochemical Engineering

Funding Source: MST Energy Research and Development Center

Characterization of Biodiesel Using Various Feedstocks

Biodiesel has become a subject of great interest in renewable energy technologies, because of the high demand in clean sources of energy that have a much lower environmental impact than conventional energy technologies. A base-catalyzed transesterification was the first technique chosen for biodiesel production given that it is the predominant method for commercial-scale production, due to the low temperatures and pressures required during production. This approach reacts the triglycerides found in animal and plant fats and oils with alcohol and a catalyst to produce biodiesel and glycerol as the byproduct. Methanol and potassium hydroxide were used as the alcohol and catalyst, respectively. After characterizing the biodiesel from different feedstocks, this project will later compare the conversion rate into fuel and product purification, with other biodiesel production techniques such as using other alcohols, catalysts and enzymes.

Melissa Vidal is an undergraduate researcher for Dr. Joseph D. Smith who is the director of the Energy Research and Development Center in Rolla, Missouri. She is currently a junior pursuing a B.S in Chemical Engineering at Missouri University of Science and Technology. She joined the Biodiesel team in fall 2013 and was part of the HAZOP session for the overall process of biodiesel production with the BD65 machine. She was in charge of investigating the chemistry and reactions that take place during the base-catalyzed transesterification. She is now investigating for alternatives to this production process as well as on different techniques for product purification with a strong emphasis on glycerol separation.

Research Proposals

Poster Abstracts

Poster 17

Lauren Anderson

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

Funding Source: N/A

Serotonin Synthesis via Tryptophan-Producing E. coli

Some individuals who have had traumatic brain injury (TBI) are no longer able to produce enough serotonin (5-HT) which can affect learning, memory, emotional behavior, as well as a variety of other physiological functions. Tryptophan, which is required to produce Serotonin, is not produced in mammalian cells. My proposal uses E. coli to synthetically produce tryptophan. These genes will be cut out of E. coli and cloned into stem cells so that the mammalian cells will be capable of producing tryptophan, and subsequently 5-HT, on their own. These stem cells, which would only be used in patients who have had a TBI, will, I hypothesize, produce tryptophan which interacts with tryptophan hydroxylase-2 (Tph2) to form 5-HTP. 5-HTP will then interact with naturally occurring 5-HTP decarboxylase to synthesize the needed Serotonin. When there is enough Serotonin, it will be degraded by naturally occurring Monoamine oxidase (MAO).

Lauren is a junior majoring in Biological Sciences and minoring in Chemistry and Cognitive Neuroscience. Besides working on this project proposal, Lauren has recently gotten involved in iGEM, and is currently being trained to work in the lab. In addition to her work with biology, Lauren is an active member of Zeta Tau Alpha and works part-time in the Development office on campus. In her free time, she enjoys volunteering on and off campus, hiking, and painting. When she graduates in December 2015, Lauren will have a Bachelor's of Sciences degree. She intends on getting her Master's degree in Biochemistry and would like to continue doing research in Neurology.

Poster 18

Alex Bertels

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

Funding Source: Opportunities for Undergraduate Research Experiences (OURE)

Automated Red Teaming and Remediation Tool

The Automated Red Teaming and REmediation Tool (ARTRET) will take a completely novel approach to red teaming by applying state-of-the-art computational intelligence in the form of coevolution to simultaneously evolve cyber-attacks and corresponding remedial defenses. ARTRET will employ the automated software testing and correction system developed at Missouri University of Science and Technology (Missouri S&T) as its engine. The availability of the envisioned automated red teaming tool will increase efficiency and effectiveness in 1) identifying flaws in target software systems (those under red team assessment), 2) developing exploits to facilitate penetration testing exercises, and 3) identifying patches to correct identified flaws.

Alex is currently a senior in Computer Science, an Undergraduate Research Assistant in the Natural Computation Laboratory, the Public Relations Officer for the Missouri S&T Student Chapter of the Association for Computing Machinery (ACM) Special Interest Group - Security (SIG-Security), and will be returning to Sandia National Laboratories this summer as an intern in the Center for Cyber Defenders and Center for Analysis Systems and Applications. He was previously a tutor for the Introduction to C++ labs (CompSci 54), the Secretary for ACM SIG-Security and the Missouri S&T ACM Student Chapter, and the grader for Evolutionary Computing (CompSci 348). Alex will continue his research as a Master's student in Computer Science at S&T in Fall Semester 2014.

Poster 19

Abagail Campbell

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

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

Characterization of Biomass-Degrading Acidophilic Microorganisms in Red Lake

Red Lake, located approximately 8 miles north of Columbia, Missouri, at the Rocky Fork/Finger Lakes Conservation Area, possesses many different types of extremophile microorganisms, primarily acidophilic ones. The lake maintains an average pH of 3.7 throughout the year due to the influx of acidic mine drainage from a number of seeps. Trees and other biomass enter the lake and decompose, signifying that there are biomass-degrading microorganisms working and living in the lake. My project goals are to isolate and characterize microorganisms responsible for biomass degradation from Red Lake, through the use of biochemical assays, microscopy techniques, and DNA analysis. The overall goal of this project is to find the enzymes that work in this acidic environment to break down the ligno-cellulose in biomass. Ultimately, these enzymes can be used to make the process of biofuel production more efficient and economical.

Abagail is a first year student in the Biological Sciences department. She has been working in Dr. Melanie Mormile's Environmental Microbiology Lab for two semesters under the guidance of Tiffany Edwards. On campus, Abagail is a Biological Sciences Department Ambassador, an active member of Miner Mentors, and sits on the Women's History Month committee. Off campus, she works part-time and volunteers without her community. Abagail plans to matriculate in a graduate school of her choice to study medical microbiology.

Poster 20

Rebecca Curtis

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

Funding Source: Sandia National Laboratories

Automated Program Understanding Validation

This proposed research is concerned with automating the validation process for binary analysis program understanding tools. These tools are employed to identify the semantic functionalities of computer programs based on static analysis of their binary code without actually executing them. Program understanding is of vital importance to gain situational awareness in computing networks, which in turn is crucial to obtaining security of cyber space. Currently, there is no available means to perform automated validation of the accuracy of program understanding tools, requiring extremely labor intensive manual validation employing necessarily very limited program test sets. This research aims to fill the void by creating an automated validation approach for program understanding tool accuracy.

Rebecca is currently a senior in Computer Engineering, an Undergraduate Research Assistant in the Natural Computation Laboratory, and will be interning at Sandia National Laboratories this summer in the Center for Cyber Defenders. She was previously a grader for Discrete Mathematics for Computer Science (CompSci 128). Rebecca hopes to continue her research as a Master's student in Computer Science at S&T in Fall Semester 2014.

Poster 21

Olivia Fleming

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

Funding Source: N/A

Commodity Chemical Production Using Extremophillic Bacteria

In our changing world, it is becoming more and more important to be able to create things in an environmentally benign way. Currently, a majority of commodity chemicals come from fossil fuels, not an environmental-friendly option. An alternative to some chemical production is to use microorganisms to produce industrially relevant compounds. In addition, it would be beneficial to produce these compounds from waste materials. Currently, glycerol is a waste product from biodiesel production. Enrichments will be prepared from sediment from Red Lake, located at the Rocky Fork/Finger Lakes Conservation Area, just north of Columbia, Missouri, to obtain microorganisms that can ferment glycerol under acidophilic conditions. The use of extremophilic bacteria provides numerous benefits, such as a lack of contamination. Ideally, this process will give us the ability to created commodity chemicals in an efficient and environmentally benign manner.

Olivia Fleming is a sophomore in biological sciences.

Poster 22

Joshua Neeter

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

Funding Source: NONE

Advances in Lichen Research through Synthetic Manipulation of Cyanobacteria

Lichens represent a diverse and poorly understood taxon. Though they have known metabolites whose potential has yet to be realized, discovering the exact mechanisms of chemical production is difficult due to the symbiosis of fungus and photobiont. My project proposes to take chitinase-forming genetic material from bacterial detritivores and apply it to cyanobacteria for insertion into a lichen symbiote. Given the chitinous nature of fungal cell walls, I believe that a locally created enzyme would break down the connection between the two species and allow for quick separation of fungus and bacterium in the presence of internally generated chemicals. This will allow for more focused examination of the physiology of the conjugate organism and its parts.

Joshua is currently a junior studying Biological Sciences. Currently this project is his main area of extra-curricular study, although he has had light experience with genetic research in the past. Upon graduation, Joshua plans to attend graduate school in the hopes of entering a research-based career.

Sciences

Poster Abstracts

Poster 23

Mondae Atughonu

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

Funding Source: N/A

Reversing the Effects of Vitiligo using a Synthetic Biology Approach

Vitiligo is a condition that causes depigmentation of parts of the skin. It occurs when melanocytes, the cells responsible for skin pigmentation, die or are unable to function. It is hypothesized that this device will reverse the effects of vitiligo by targeting dying melanocytes and releasing the peptide hormone a-MSH. Through the binding of a-MSH to the MC1R G-protein coupled receptor, melanin production will be induced through the maturation or switching of melanin type. Melanocyte pH, governed by the P-protein, will determine tyrosinase enzyme activity to control the initial step in melanin production, or TYRP complex formation to begin melanogenesis and melanosomal maturation.

Mondae is a senior majoring in Biological Sciences, with minors in Chemistry and Studio Art. In addition, Mondae is the current president of the Association for Black Students, and the Corresponding Secretary/Editor to the Sphinx for the Epsilon Psi Chapter of Alpha Phi Alpha Fraternity, Inc., both here on the Missouri University of Science and Technology campus. As an inclusive, creative, and determined person all his academic career, Mondae has earned the respects of those around him, and now uses his knowledge of his degree path and leadership experience to be a leader at his school and in his community.

Poster 24

Carol Baker

Joint project with Alex Evans, Sarah Moeller

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

Funding Source: OURE

Microbial Art

This research project was focused on using bacteria to create art. This included researching their growth rates and diameter in which they grow by the hour, how they interacted with each other, and different application techniques. There were also transformations that were done in order to get new colors that are not natural for that bacteria type. Different equipment was used to maximize the effects of the bacteria. There was UV light, a plastic needle (used for application), and a 12 by 17 acrylic box petri dish used for displays.

Carol Baker is a Junior in Biological Sciences at MS&T. After she graduates in May of 2015, she plans on going on to get a Masters in Marine Microbiology somewhere on the East Coast. Besides doing undergraduate research, she is also a Senior Resident Assistant for the Department of Residential life. She hopes to one day do research into how the climate is effecting the microbial life in the ocean and how that effects the animals that live there.

Poster 25

Justin Beltz

Department: Chemistry
Major: Chemistry – Biochemistry Emphasis
Research Advisor(s): Dr. Nuran Ercal
Advisor's Department: Chemistry

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

The Neuroprotective Effects of the Novel Thiol Antioxidant, N-acetylcysteineamide (NACA), on SH-SY5Y Neuroblastoma Cells.

This study investigated the antioxidant and neuroprotective efficacy of N-acetylcysteineamide (NACA) in comparison to the well-known antioxidant, N-acetylcysteine (NAC) on SH-SY5Y neuroblastoma cells which are prominent *in vitro* models for studies of neurodegenerative diseases such as Parkinson's and Alzheimer's. Cell viability testing determined that exposure to 750 μM doses of NAC and NACA for 4 hours were optimum. Oxidative stress was induced using *tert*-butyl hydroperoxide (*t*BHP), a membrane-permeant oxidant compound that enters the cells and generates *tert*-butoxy radicals resulting in lipid peroxidation, depletion of cellular antioxidant defenses, and cell death. The cells were divided into six groups: control, *t*BHP alone, pre-treatment with NAC, pre-treatment with NACA, and controls for NAC and NACA. The levels of ROS and the extent of cytotoxicity were measured via fluorescence spectroscopy. Both NAC and NACA reduced the cytotoxicity and the levels of ROS from exposure to *t*BHP, but NACA out-performed NAC by a noteworthy margin.

Married to chemistry from the age of seven, Justin was a founding member of the ACS affiliated chemistry club at Francis Howell North High School and has held multiple officer positions in the American Chemical Society – W.T. Schrenk Chapter. He has used his positions in these organizations to lead and design chemistry magic shows and demonstrations to generate interest in the sciences for both children and adults. After completing his degree at Missouri S&T, Justin plans to attend graduate school and use his interest in chemistry to combat diseases and improve the quality of living.

Poster 26

Michael Bouchard

Department: Geologic Sciences and Engineering
Major: Geology and Geophysics
Research Advisor(s): John Hogan
Advisor's Department: Geologic Sciences and Engineering

Funding Source: Joint University NSF Grant

Fault Terrain Analysis, Farafra Egypt: Investigating the Potential for Polygonal Faulting

Regional stress genesis faulting is a recognized and ubiquitous process, whereas polygonal faulting only occurs under uniquely constrained conditions. One of the most distinct characteristics of polygonal faulting is the lack of preferential strike direction. Generally regional stress induced faulting aligns to one or two preferred strike azimuths. The region of interest presents a complicated fault regime. Visual inspection of panchromatic imagery provides no evident preferential strike direction. By digitizing hundreds of these fault traces over a two kilometer square region a quantitative analysis of these fault azimuths has been reached. By comparing this dataset to the regional geologic tectonic setting as well as known regions of polygonal faulting, a case can be built that the Farafra region of the Western Desert of Egypt exhibits characteristics unique to polygonal fault geometry. This conclusion can help interpret the regions tectonic and kinematic history.

Michael Bouchard will be graduating with his Bachelors of Science in Geology and Geophysics this May. A hard working student he has been recognized by both his department and the Academy of Mines and Metallurgy with academic/leadership awards. Bouchard is passionate about space exploration and is the Chief Executive Officer and founder of the Mars Rover Design Team. In the fall he will begin a PhD program in Planetary Science at Washington University, St. Louis. He wants to thank Dr. John P. Hogan for all of his support and guidance these last four years.

Poster 27

Katherine Brinker

Department: Biology
Major: Psychology
Research Advisor(s): Dr. Aronstam
Advisor's Department: Biology

Funding Source: N/A

Direct activation of M1 muscarinic receptors by the positive allosteric modulator, BQCA

BQCA (Benzyl quinolone carboxylic acid) was recently identified as a positive allosteric modulator of the M1 muscarinic receptor. We studied the nature of this effect on muscarinic signaling at the single cell level in Chinese Hamster Ovary (CHO) cells stably transfected with cDNA clones for muscarinic receptors (M1, M3, and M5). BQCA was found to potentiate response of CHO cells expressing M1, but not M3, receptors for a low concentration (10 nM) of the agonist carbamylcholine, while a small potentiating effect on M5 was observed. Unexpectedly, BQCA activated M1 receptors in the absence of an allosteric agonist. The orthostatic antagonist atropine completely blocked allosteric receptor activation. There was no relation between direct allosteric activation by BQCA and subsequent allosteric potentiation, i.e., cells that BQCA did not activate were still subject to allosteric potentiation. Moreover, activation by BQCA did not predict the pattern of the response to agonist activation.

Katherine Brinker is a senior in psychology, is minoring in both physics and mathematics, and is pursuing research in the biology department. She will be graduating in May, and will be pursuing a Masters of Science in Business Analytics at Arizona State University in the fall.

Poster 28

Jack Crewse

Department: Physics
Major: Physics
Research Advisor(s): Dr. J. Greg Story
Advisor's Department: Physics

Funding Source: Physics Department

Chaotic Behavior in a Damped Driven Pendulum

Chaotic behavior of a physical system is characterized by its unpredictability and extreme sensitivity to initial conditions. This type of behavior is prevalent throughout the universe, yet we likely don't expect it of simple systems like a pendulum. We show here that solutions to the theoretical model of a damped driven pendulum produce transcendental functions that are easily understood in small angle approximations, yet provide chaotic solutions if the angle is allowed to take all values. We then recreated this system physically to show that a system as simple as the damped driven pendulum would indeed produce unpredictable behavior, strongly dependent on initial conditions.

Jack Crewse, a physics major in his third year here at Missouri S&T, has always had a passionate curiosity for strange and unusual properties of the world. Currently investing research interest in the budding fields of topological insulating materials and fractional calculus, Mr. Crewse has spent his time at S&T working hard to meet his goal of someday becoming a full time research professor.

Poster 29

Kelsey Crossen

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

Funding Source: Opportunities for Undergraduate Research Experience

Determining the Function of the RGCt Domain of IQG1 in Budding Yeast

Cytokinesis is the final step in cell division, when the mother cell divides into two daughter cells. In budding yeast, IQG1 is an extracellular scaffolding protein that is required for formation and contraction of the actin ring during cytokinesis. The Ras GAP C-terminus domain (RGCt) is one of the four domains found in IQG1. This domain is highly conserved in IQGAP family members, but the function of this domain in budding yeast is currently unknown. Based on data from the human homolog, we suspected that this domain would be required for binding to actin-nucleating proteins called formins; however, our preliminary data shows that this is not the case. Deletion of the RGCt domain is lethal to yeast cells, so its function is essential. To determine binding partners for this domain, we will purify a His-tagged RGCt protein from bacteria, incubate with yeast extracts, and identify candidate interacting proteins by western blotting and novel interactions using mass spectrometry.

Kelsey Crossen is a junior majoring in Biological Sciences with minors in Chemistry and Psychology. She has been an undergraduate researcher in Dr. Katie Shannon's Cytokinesis Lab since February 2013. Kelsey is the secretary and a lab instructor for S&T's International Genetically Engineered Machine Team, a member of Phi Sigma Biological Sciences Honors Fraternity, and works for the Bio Sci department as a grader and as the BioConnection writer. After graduating from S&T next year, she plans to enter graduate school to study Microbiology or Cell Biology.

Andrew Cudd

Department: Physics
Major: Physics
Research Advisor(s): Carl Gagliardi (Texas A&M)
Advisor's Department: Physics

Funding Source: DOE, NSF-REU

Exploring Gluon Polarization in the Proton with STAR Jet Data and the NNPDF Polarized Parton Distributions

The NNPDF Polarized Parton Distribution Functions (PDF) are a PDF set made using a neural network technique rather than using traditional functional forms. The NNPDF polarized parton distribution includes one hundred different fits, or replicas, that are all considered equally probable. The NNPDF replicas were used to calculate the longitudinal double-spin asymmetry, A_{LL}, for inclusive jet production at $\sqrt{s} = \text{200 GeV}$. The calculations were compared to STAR inclusive jet A_{LL} results from 2006 and 2009, and the χ^{2} was determined for each replica. The χ^{2} values were used in a reweighting procedure, which the NNPDF group developed, for the inclusion of new data into an existing PDF fit. After the reweighting, the polarization of the gluon is examined. The STAR data provide significant constraining power on the gluon polarization, compared to the unweighted NNPDF set.

Andrew Cudd is a senior in Physics, graduating this May with his B.S. in Physics with Minors in Mathematics and Computer Engineering. He is planning on going to graduate school in physics to earn his doctorate in physics, most likely nuclear or high energy physics. The work being presented was performed at the Texas A&M Cyclotron Institute during the summer of 2013 through the NSF Research Experience for Undergraduates program.

Poster 31

Katie Czeschin

Department: Chemistry
Major: Biochemistry
Research Advisor(s): Dr. Daniel Forciniti
Advisor's Department: Chemical Engineering

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

Contribution of GSK3 Phosphorylation towards Tau Protein Aggregation

Tau microtubule associated protein is one of the many factors responsible for neuronal structure. When the failure of tau compromises structural integrity, the conditions are referred to as "tauopathies," resulting in neurodegeneration. This is caused by the hyperphosphorylation and subsequent aggregation of tau, which collapses the scaffold required for microtubule assembly. This research investigated a potential cause of Alzheimer's disease, a widely recognized tauopathy. Afflicted individuals have been shown to have an overabundance of GSK3 phosphorylating kinase in cerebrospinal fluid, and so it was devised to test the contribution of this kinase activity towards tau aggregation. This would be done by varying environmental factors *in vitro,* such as oxidation and acetylation. For this OURE, the focus was on isolating tau protein for further study. Tau was extracted from bovine brain, and centrifuged in varying cocktails of microtubule-forming stimulants. Further fractionation was performed on microtubule samples, monitored via BCA assay. The presence of tau could be confirmed by SDS-PAGE, and research continues for final purification.

Katie is currently a senior in the Chemistry/Biochemistry emphasis program at Missouri S&T. She splits her free time between the research lab, Cycling Club, and her position as Music Director and DJ at KMNR. After harboring the idea for Alzheimer's research since her freshmen year, she is grateful for the continuing opportunities provided by Missouri S&T and Dr. Daniel Forciniti.

Poster 32

Ariel Donovan

Department: Chemistry
Major: Bachelors of Science in Chemistry
Research Advisor(s): Honglan Shi
Advisor's Department: Chemistry

Funding Source: Opportunities for Undergraduate Research (OURE) Project Funding

Heavy Metal Elements Pre-concentration by Solid Phase Extraction and Rapid Detection

Analyses of trace metal elements are generally performed by expensive instrumental methods, such as inductively coupled plasma-mass spectrometry (ICP-MS) and graphite furnace atomic absorption spectrometry (GFAA). In addition to the high cost, the instruments are not always available. These methods are also not suitable for in field detection. This study developed a novel method to pre-concentrate the heavy metal elements in environmental samples by solid phase extraction. A large volume of water sample was extracted with a cartridge that packed with specific adsorbent, and then the metal elements were eluted with a small volume of solvent. The metal elements in the extracted samples can be analyzed by using HACH test kits or other rapid and less expensive methods. ICP-MS method was used to detect the metal elements concentrations and validate the newly developed method. The optimized experimental conditions and the method suitability for water samples analysis were studied.

Ariel Donovan is a senior at Missouri S&T pursuing a Bachelors of Science in Chemistry. She is currently working on water treatment research with Dr. Honglan Shi. After completing her degree at Missouri S&T, she plans to continue her education through graduate school with a focus on Analytical Chemistry.

Poster 33

Brandon Drennen

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

Funding Source: Opportunities for Undergraduate Research Experience

Determining which Domain of Iqg1 Binds to Formins during Cytokinesis

The final step in cell division is cytokinesis. Cytokinesis must be coordinated with mitosis in order to prevent aneuploidy. Budding yeast are a good model organism for studying cytokinesis due to genetic and molecular tools and inexpensive growth medium. Iqg1 is a protein that has been shown to regulate cytokinesis in budding yeast cells. The Iqg1 protein contains four domains: IQ motifs that are needed for localization of Iqg1 to the contractile ring, a CHD domain required for actin recruitment, a GAP domain essential for contraction, and a RGCT domain that was predicted to interact with formins Bni1 and Bnr1. However, we found that a deletion of the RGCT domain of the protein is still able to interact with the formins and is required for cell viability. Our current goal is to determine domain of the protein that is responsible for formin binding using different mutant strains.

Brandon Drennen is from the small town of Freeburg in Missouri. He has been attending the Missouri University of Science and Technology for 4 years now and will graduate this May. After graduation he will be moving to Baltimore, MD to attend grad school and work on his PhD in Pharmaceutical Sciences.

Poster 34

David Gillcrist

Department: Physics
Major: Physics
Research Advisor(s): Garry Grubbs II
Advisor's Department: Chemistry

Funding Source: MS&T Startup Funds

Design and Construction of a Novel Chirped Pulse Fourier Transform Microwave (CP-FTMW) Spectrometer

Microwave spectroscopy is a technique utilized to elucidate the structure of molecules via their rotational transitions. Traditionally, the Fourier transform microwave (FTMW) variety of this technique has been narrowband in nature resulting in long spectral acquisition times and large sample consumption. Pioneered by the work of Pate and coworkers, a new technique was created to allow for the broadband acquisition of the rotational spectra named the chirped pulse Fourier transform microwave (CP-FTMW) spectrometer.[1] Recent technological advancements in the field of radiofrequency/microwave engineering, however, have allowed for a new, simpler circuit design across the entire range of the typical spectrometer, 6-18 GHz. Tests of the new circuit design and viability of the spectrometer will be presented.

David Gillcrist is from Kansas City, Missouri and is 19 years old. He is a second semester freshman at Missouri University of Science & Technology, and is majoring in Physics. David is involved in Student Council and is a member of the Theta Xi fraternity on campus. His projected graduation is in May 2017.

Poster 35

Timofey Golubev

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

Funding Source: Opportunities for Undergraduate Research Experiences

Manipulation of Diffusion of Light via Wave Interference Effects

The concept of diffusion is fundamental to our understanding of light transport phenomena. Diffusion has been widely used to describe the motion of particles and waves, and it requires only one parameter – the diffusion coefficient. However, for waves, diffusion does not take into account the possibility of interference. Corrections to diffusion theory of waves have been predicted to depend on the distance to the boundaries where the waves can escape the medium. Thus, it is possible to affect the diffusion of light by varying the geometry of the system. The commercial package COMSOL Multiphysics, along with Matlab have been used to model the diffusion of light through a waveguide.

Tim Golubev is a senior at Missouri S&T and majoring in physics. He has been a member of the METIS research group advised by Dr. Alexey Yamilov since summer of 2012. His role in the research has been concentrated in studying the optical properties of various systems using COMSOL Multiphysics and Matlab. After receiving his bachelor's degree, Tim plans to attend graduate school specializing in condensed matter physics and pursue a career in research physics.

Poster 36

Ethan Hamilton

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

Funding Source: Dr. Melanie Mormile

Antibiotic Resistance in Alkaline Thriving Organisms

Soap Lake, in Washington State, is a meromictic, soda lake. Previously, it was noted that many bacterial isolates from the lake possessed resistance to multiple antibiotics. One possible explanation for the wide range of antibacterial resistance exhibited by these isolates is due to the impact of high alkalinity on the antibiotics themselves and not necessarily due to the presence of antibiotic resistance conferring genes. The aim of our study is to determine the effects antibiotics have on bacterial cultures capable of growth over a wide range of pH values, 7-11, to investigate the influence of pH on antibiotic activity. Five pure cultures capable of growing over a wide range of pH values were isolated from Soap Lake sediment. These strains were inoculated on agar plates with a pH set at 9. Fifteen selected antibiotics were placed individually on a plate in disk form. The zone of inhibition was recorded for each antibiotic tested. The zone of inhibition for several antibiotics was found to remain rather constant across the five isolates. Several antibiotics were ineffective against the isolates. Some antibiotics that were very effective against the isolates. The observable zones of inhibition in alkaline conditions seem to indicate that the high number of antibiotic resistances seen in Soap Lake may be the cause of resistance genes rather to the effects of alkalinity on the antibiotics.

Ethan Hamilton is a junior at Missouri University of Science and Technology and is working on a major in Biology. He is currently doing undergraduate research in Melanie Mormile's lab. In his free time Ethan likes playing video games as well as reading and hiking. Ethan plans on attending graduate school to pursue a degree in Microbial Genetics.

Poster 37

Sabrina Hostler

Department: Chemistry
Major: Chemical Engineering
Research Advisor(s): Dr. Woelk and Dr. Ludlow

Funding Source: Office of Undergraduate Research

Production of 5-HMF from Glucose

5-Hydroxymethylfufural, referred to as 5-HMF, is an important source of biofuel which can be formed from simple carbohydrates such as glucose. 5-HMF is hard to acquire in such reactions, however, because of the many side reactions that contribute to the decomposition of 5-HMF and the carbon carbon bonds that would be used as an energy source for fuel. In the research conducted, the focus was to maintain a steady pH between 3 and 5 to maximize the yield of 5-HMF.

Sabrina Hostler is a junior level student at Missouri S&T majoring in chemical engineering. She participates in many extracurricular activities on campus including the varsity soccer team for which she is captain, M-club, Delta Omicron Lambda, Fellowship of Christian Athletes, and more. Sabrina first got involved in research through the Chemistry department sophomore year, where Dr. Woelk first introduced her to the project she is currently working on.

Poster 38

Cassandra C. Hurley

Department: Ceramic Engineering
Major: Ceramic Engineering
Research Advisor(s): Garry Grubbs II
Advisor's Department: Chemistry

Funding Source: MS&T Startup Funds

Construction and Implementation of a Fourier Transform Microwave (FTMW) Spectrometer

Microwave spectroscopy is a technique utilized to elucidate the structure of molecules via their rotational transitions. As of 1981, the standard for this technique has been the Balle-Flygare cavity FTMW spectrometer.[1] A version of this type of spectrometer has been purchased from Oxford University and reconstructed in the Microwave Spectroscopy group at MS&T. Recent tests of this spectrometer on the calibration molecule carbonyl sulfide will be detailed and presented for demonstration of sensitivity. Furthermore, preliminary explorations into the structure of the molecule bromoperfluoroacetone will be presented.

Cassandra C. Hurley is a freshman in the ceramics engineering department. Originally from Arkansas, she enrolled in Missouri S&T to not only study, but to become involved on campus. She currently is involved in student organizations, residential life, as well as undergraduate research within the Chemistry department. As well as her involvement on campus, Cassandra has also been placed on the Academic Scholar's List and the Honor Role.

Poster 39

Sahitya Injamuri

Department: Biological Sciences
Major: Biological Sciences
Research Advisor(s): Matthew Thimgan
Advisor's Department: Biological Sciences

Funding Source: NONE

Mathematical Modeling of Sleep and Wake in *Drosophila Melanogaster*

The regulation of how and why we fall asleep and wake up are not yet understood. We used mathematical modeling of sleep to uncover underlying patterns that may help to understand how and why sleep transitions occur in normal flies. We recorded activity from male and female wild-type flies and circadian rhythm mutants, *cycle* (cyc^{01}). Flies were allowed to adapt to constant darkness (DD) for two days and activity was recorded for four days. After sleep and wake was determined, we applied exponential and linear models to determine the relationships between prior bouts to the current bout lengths. We found that exponential models better described this relationship compared to linear models. Importantly, we determined that a fly's bout duration data needed to be standardized by its own average bout length to correct for individual differences in bout length. Our initial results suggest a more complicated relationship between sleep and wake bouts.

Sahitya Injamuri was born in India and moved to the United States when she was four. She is a junior in Biological Sciences at Missouri University of Science and Technology. She is also the president of Helix, the university's chapter of the American Society of Microbiology. She is also a member of the Phi Sigma society, the biological sciences honors society. After graduation, Sahitya plans to go to graduate school.

Poster 40

Nathaniel Kamrath

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

Funding Source: Opportunities for Undergraduate Research Experiences (OURE)

Adaptive Selection Operators in Evolutionary Algorithms

Selection is a core genetic operator in many evolutionary algorithms (EAs). The performance of EAs on a given problem is dependent on properly configuring selection. A small set of common selection operators is used in the vast majority of EAs, typically fixed for the entire evolutionary run. Selecting which crossover operator to use and tuning its associated parameters to obtain acceptable performance on a specific problem is often a time consuming, manual process. Even then a custom selection operator may be required to achieve optimal performance. Finally, the best crossover configuration may be dependent on the state of the evolutionary run.

This work introduces Adaptive Selection Operators which address these shortcomings while relieving the user from the burden of selection operator configuration. Results are presented showing it to outperform the traditional selection operators k-tournament, truncation, and fitness proportionate selection on the Rosenbrock benchmark problem.

Nathaniel is currently a senior in Computer Science and an Undergraduate Research Assistant in the Natural Computation Laboratory.

Poster 41

Scott Ketcherside

Department: Biology
Major: Physics
Research Advisor(s): Dr. Chen Hou
Advisor's Department: Biology

Funding Source: N/A

Modeling Human Brain Growth from Energy Conservation Principles

A general model for human brain growth over ontogeny is created, starting from principles of energy conservation. From basic energy conservation laws, an equation giving the total metabolic rate of an animal in terms of the energy required to grow and maintain cells is created, allowing energetic data to yield a growth curve for a given organisms. Successful in describing non-human animals' growth, this model may also be successful in describing human growth, given consideration of the brain's abnormally high energy cost. This is demonstrated by modeling the brain's growth using such a model, and then analyzing the nature of its impact on human whole-body growth.

Scott is a senior in Physics, focusing in Computational Physics.

Poster 42

Michael Little

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

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

Quantitative Characterization of Sieyal Fault in the Aswan Area, Egypt

The Sieyal fault is in the western desert of Egypt about 100 kilometers southwest of Aswan. The remote location of this fault system makes field study very difficult and expensive. With little to no vegetation cover, geologic units and structures related to this fault are visible in satellite imagery. Using remote sensing techniques and imagery from Google Earth, data regarding fault segment length, orientation, linkage style, and density can be quantified in order to characterize the fault system. Through the analysis of this data, information about the tectonic history of the Egyptian desert may be obtained. Two distinct regions were identified in this study, a western region and an eastern region. The data collected from these two regions showed key differences with respect to linkage style and orientation. These differences are due to a change in stratigraphic units.

Michael is currently a Geology and Geophysics student graduating in May 2014. While at Missouri S&T, Michael has served as a member of Sigma Gamma Epsilon and President of Sigma Pi Fraternity. In fall 2014, Michael will begin work on a Master's degree in Geological Engineering at either UC – Berkeley, Colorado School of Mines, or UW- Madison.

Poster 43

Danielle Meyer

Department: Biological Sciences
Major: Biology
Research Advisor(s): Dr. Matthew Thimgan
Advisor's Department: Biology

Funding Source: Opportunities for Undergraduate Research Experiences

The Effect of Starvation on Glucose Levels in Wild Type Drosophila and Circadian Rhythm Mutants

Individuals with Night Eating Syndrome wake up in the middle of the night and can't fall asleep until they've eaten something. We hypothesized that metabolic state may underlie this change in sleep and wake. Starvation results in waking in Drosophila and likely affects glucose levels in Drosophila, and those effects may be different in flies with normal circadian rhythms versus flies without. We investigated this relationship by starving each type of fly for different periods of time between 4 and 29 hours and then measuring all sources of glucose, including trehalose and glycogen. The results have shown that in wild type flies, glucose levels decrease with starvation until about 24 hours, where they increase due to utilization of glycogen. In the mutants, glucose levels stay constant throughout starvation. Therefore, we concluded that there is a clear relationship in wild type flies, and that the circadian rhythm mutation disrupts this relationship.

Danielle Meyer is an undergraduate student at Missouri University of Science and Technology. She is majoring in biology and minoring in chemistry and psychology. Danielle is primarily interested in research that involves aspects of both biology and psychology, such as sleep. She has been working in Dr. Thimgan's Sleep Biology lab for approximately nine months.

Poster 44

Katie Nelson

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

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

Does a Hof1 mutation that prevents phosphorylation in the PEST domain affect both haploid and diploid yeast cell?

Cytokinesis is the last stage in cellular division when the cell splits into two daughter cells, which must be regulated to ensure that cell separation occurs at the right place and time. Budding yeast are a good model organism to study since they use similar processes and proteins as higher eukaryotes use in cytokinesis. The Hof1 protein in *S. cerevisiae* is a member of a conserved protein family; it is localized at the bud neck and is required for efficient cytokinesis. Previously our lab showed that a Hof1 allele that prevents phosphorylation of the PEST motif causes a smaller bud neck and slower rate of actomyosin ring contraction during cytokinesis in haploid cells. Because Hof1 interacts with a protein that is required in haploid, but not diploid cells, we are examining the bud neck and cytokinesis phenotype of the Hof1 mutation in diploid cells using live cell time-lapse microscopy.

Katie is currently a junior majoring in Biological Sciences with a minor in Chemistry and Psychology. She is a member of the biological honors society Phi sigma, is a certified Joe's Peer educator, and is the Public Relations Officer of the International Genetically Engineered Machines design team. After graduation she plans on attending graduate school for Genetic Counseling.

Poster 45

Thanh Nguyen

Department: Business & Information Technology
Major: Information Science & Technology
Research Advisor(s): Dr. Nick Lockwood
Advisor's Department: Business & Information Technology

Funding Source: Opportunities for Undergraduate Research Experience (OURE)

Environmental Presence in Virtual Environments: *Antecedents and Impacts*

Presence is a multi-dimensional construct that is profoundly important towards the development of life-like experiences in a virtual environment. It is often characterized by a user's sense of "being there" within an environment. This paper seeks to explain what presence is, and as well the different elements of a virtual n environment that can contribute to a user's experience of presence. In this study we developed a conceptual model to explain the relational links of environment design with user perception, and their resulting impact and effect on establishing user presence. Additionally, results gathered from a survey provide a framework of reference by which an experimental model of presence by environmental factors can be established. The goal and purpose of this research study is to examine the impact and effect environmental design constructs on user presence as influenced by user perceptions constructs.

Thanh Nguyen is a Missouri S&T senior in Information Science & Technology with a minor in Business. He is the lab manager for Laboratory for Information Technology Evaluation (LITE), and specializes in Human-Computer Interaction (HCI) studies. His interests include tennis, travelling, foreign languages, virtual- and augmented reality, and game design.

Poster 46

Nick Santoro

Department: Materials Science and Engineering
Major: Ceramic Engineering
Research Advisor(s): Dr. Mohamed Rahaman
Advisor's Department: Materials Science and Engineering

Funding Source: Center for Biomedical Science and Engineering

Conversion of Borate Glass to Bioactive Micro-tubes.

Fibers of a calcium-lithium-borate glass were converted to hydroxyapatite (HA) in a KH_2PO_4 solution. Hollow HA micro tubes were obtained by removing the unreacted glass cores. The conversion behavior was studied with varying KH_2PO_4 concentrations (0.01 M, 0.02 M, and 0.10 M). For the KH_2PO_4 concentrations of 0.01 M and 0.02 M, glass fibers had similar conversion rates, and had a weight loss of approximately 12% and 14% respectively after 3 days. When the KH_2PO_4 concentration was increased to 0.10 M, glass fibers showed a much faster conversion rate and had a weight loss of approximately 60% after 3 days. The effects of heat treatments (500 °C, 700 °C, and 900 °C) on the strength of the HA tubes is currently being studied. The in vivo performance of the HA tubes is also being studied by using a rat calvarial defect model.

Nick Santoro is a senior in Ceramic Engineering and has been working as an undergraduate research assistant for Dr. Rahaman's biomaterials group for the last year and worked for Dr. Brows' glass research group for a year. He is a member of Keramos and Kappa Kappa Psi.

Poster 47

Luke Simon

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

Funding Source: Sandia National Laboratories

Visualization for Program Understanding

Program understanding is of vital importance to gain situational awareness in computing networks, which in turn is crucial to obtaining security of cyber space. Automating program understanding is a current hot topic of research, but for the foreseeable future, human practitioners will have to rely on their human intellect to interpret the ever increasing amounts of data generated by binary analysis program understanding tools. Visualization is one of the most effective methods to enhance their interpretation ability.

This research project has created a web-based binary analysis program understanding visualization interface. Rather than merely replicating single program analysis in visual form, the power of this interface lies in its ability to visualize the commonalities and differences between sets of programs based on criteria which the user can change on the fly. By providing human-centric comparison visualization work-flows, this interface enables discovery of complex insights by human practitioners.

Luke is currently a Senior in Computer Science, an Undergraduate Research Assistant in the Natural Computation Laboratory, and will be returning to Sandia National Laboratories this summer as an intern in the Center for Cyber Defenders. He is currently a tutor for the Introduction to C++ courses (CompSci 53/54 and 74/78). Likely, Luke will continue his research as a Master's student in Computer Science at S&T in Fall Semester 2015.

Poster 48

Samuel Turpin

Department: Department of Mathematics and Statistics
Major: Applied Mathematics
Research Advisor(s): Dr. Gayla Olbricht
Advisor's Department: Department of Mathematics and Statistics

Funding Source: Missouri University of Science and Technology OURE Program

Statistical Methods for Detection of Differential Methylation in Human Disease Studies

DNA methylation is an epigenetic modification that occurs when a methyl group is added to cytosine sites on the DNA sequence. Altered DNA methylation patterns have been shown to be characteristic of various human diseases, including many types of cancer. With the advent of next-generation sequencing, DNA methylation can be measured in ways not possible just ten years ago. High-throughput sequencing technology such as Illumina's HiSeq 2000 enables the quantification of the percent methylation at millions of cytosine locations. Statistical analysis of data from such studies allows researchers to determine which sites exhibit significant differences in their average methylation levels between normal and diseased groups. Using R, an open-source statistical analysis software package, each site can be tested to determine if a relationship exists between methylation level and disease status. Several statistical methods exist to test for differences between independent samples, such as the two-sample *t* test, which measures the likelihood that the true means of the two groups are the same. Other methods include Fisher's exact test and the Wilcoxon rank-sum test. Sites in which the sample results indicate this likelihood is very small provide evidence for a significant difference in average methylation level between disease status groups. In this project, we examine and apply these three statistical methods to methylation data in a study comparing of senescent cells to normal cells with the goal of investigating the differences in these three analyses and ultimately obtaining a list of significant sites to test for methylation as an indicator of disease. Furthermore, these statistical methods are highly replicable and can be applied to the plethora of current data sets available on various archives to test for differentially methylated sites with any number of diseases and conditions. This is the first step to using methylation as a predictor for an innumerable set of characteristics.

Samuel is a senior majoring in applied mathematics. He is particularly interested in statistical studies and biological statistics. Sam is engaged to be married to Sarah Padgett in June and plans to continue studying statistics at KU in August. His hobbies include reading, card games, and video games.

Poster 49

Qiqi Wang

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

Funding Source: Alfred Spreng Undergraduate Research Award; OURE

PRELIMINARY LITHOLOGICAL AND PALYNOLOGICAL INVESTIGATION OF MESOZOIC-CENOZOIC STRATA IN THE GORGE OF THE NILE, ETHIOPIA

Samples from the Gohasion Formation, Antalo Formation, and lignite and chert interbedded with flood basalts were studied for their palynological contents. Palynology has been integrated with lithologic data to make preliminary interpretations about depositional conditions. Five distinct lithofacies associations based on rock types, their association with one another, their textural characteristics, sedimentary structures. Organic components were point counted and analyzed to recognize four palynofacies assemblages. The absence of marine palynomorphs, abundant phytoclasts and moderate amounts of AOM coupled with lithological data suggest marine depositional conditions with high input of terrestrial material into the basin. Kerogen data also yield information on source rock potential in the study area. Sixteen out of the 21 samples plot in the gas-prone, phytoclast-rich type 3 kerogen field, indicating a moderate to high potential for gas production.

Qiqi Wang transferred to the Geology and Geophysics program at Missouri University of Science and Technology in 2012 fall. Her first two years of undergraduate study were at China University of Petroleum as a Geophysics major. Her research interest mainly lies in Sedimentology and Paleontology. The study of fossils in sediments has never felt like unwarranted labor for her, but an opportunity to learn about the story behind the rock. Her undergraduate research project is about conducting a preliminary investigation of the Mesozoic palynology (study of organic-walled microfossils) of the Gorge of the Nile in Ethiopia. She is the recipient of two awards awarded by Geological Science and Engineer Department, the Alfred Spreng Undergraduate Research Award and the S. K . Grant Field Trip Award.

Her favorite extracurricular activity is sports. She played basketball and is obsessed with hiking. She also worked as the assistant instructor of the Paleontology session of the Expanding Your Horizon event and is the volunteer at the Mineral Auction held by on C.L. Dake Geological Society in department.

Poster 50

Wanying Wang

Department: Geological Sciences and Engineering
Major: Geology and Geophysics
Research Advisor(s): Stephen Gao
Advisor's Department: Geological Sciences and Engineering

Funding Source: OURE program

The anisotropy beneath the Southeastern United States: influences of mantle flow and tectonic events

The main purpose of the research is to investigate the interior structure beneath the southeastern United States (90°W~75°W, 37°N~24°N) by using the shear-wave-splitting technique, which provides constraints to characterize the mantle flow direction and strength of anisotropy. At most stations, the detected polarization directions of the fast wave are approximately parallel to the absolute plate motion (APM) direction of the North American plate, suggesting a coupling between the asthenosphere and the lithosphere. The similarity between the Appalachian Mountain's strike and the fast directions, and the significant differences between APM direction and the fast directions at the eastern margin indicate a contribution of anisotropy from lithospheric deformational processes. The splitting time between the fast and slow shear waves, which can be utilized to characterize the strength of anisotropy, shows systematical distribution through the study area. The study confirm the contribution of both fossil fabrics in the lithosphere and present mantle flow in the asthenosphere to the pbserved seismic anisotropy.

Wanying Wang is a senior majoring in Geology and Geophysics. She is a transfer student who finished the former two years of study in China University of Geosciences. With strong enthusiasm, she found her value in learning to use geophysical techniques to explore the Earth. Wanying gained experiences in projects and presentations focusing on seismology and geodynamics. She is currently a member of Society of Exploration Geophysicists (SEG) and has a published abstract submitted to Geological Society of America (GSA), 2014.

Poster 51

Jing Zhang

Department: Geological Science and Engineering
Major: Geology and Geophysics
Research Advisor(s): Kelly Liu
Advisor's Department: Geology and Geophysics

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

3-D Seismic Interpretation of the Boonsville Field, TX Using the SMT Kingdom Suite

This research study interpreted the underground structure and specific horizon layers, which have significant meaning for oil and gas production in the Boonsville field, TX by using the Kingdom Suite software. The underground zone in this area was characterized by carbonate collapse. Overall there were seven major cylindrical faults with average scale of 1km were captured and five horizon layers were located. Carbonate collapse can be observed obviously either from time slice or 3-D view of horizon layer. Major reservoir layer were the Runaway Formation and the Vineyard formation, those near vertical faults played an important role in reservoir migration from The Barnett Shale to the upper group.

Jing Zhang, a senior student of the Geological Science and Engineering department, is a transfer student from the China University of Petroleum Beijing. Having great interest in combining geology and geophysics knowledge to pursue reservoir interpretation and characterization research, she applied the OURE project under the guidance of Dr Kelly Liu last April. During this one-year project, she did her research along with overcoming technique problems of the software, which cannot be encountered at the common Lab session and solving the academic problems with the help of graduate students at B40 and her research advisor, Dr Liu. After this research experience, she not only gained the understanding of the research subject, but also got familiar with the general routine of pursuing a scientific research, which is quite important to the further research study.

Poster 52

Matthew Zieger

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

Funding Source: Sandia National Laboratories and Opportunities for Undergraduate Research Experiences (OURE)

Automated Program Understanding Employing Assembly Templates

Modern society increasingly relies on the correct functioning of networked computer systems, while at the same time the threat of cyber-attacks is precipitously growing. There is a critical need to build our capabilities to understand the semantic functionality of the software running those systems.

This research aims to create not only a valid methodology to identify what a computer program does without executing it on a computer, but to also combine underlying features that are discovered in order to identify functional classes for programs. In particular, this research is concerned with developing assembly code templates to identify algorithms indicating the presence, or lack of presence, of specific semantic functionality. The templates that are developed have two layers, the first defines assembly instructions that must be included, while the second layer defines the pattern in which they need to occur in order for there to be a match.

Matthew is currently a senior in Computer Science, an Undergraduate Research Assistant in the Natural Computation Laboratory, and Cadet Vice Wing Commander in S&T's AFROTC Detachment. He is also a 4 time All-American and 3 year Varsity letterman for S&T Men's Swim Team.

Poster 57

Adrian Black

Joint project with Jeremiah Herbert

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

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

Quorum Sensing in *Bradyrhizobium Japonicum*

Bradyrhizobium japonicum is a soil dwelling bacterium that is known to nodulate soybean roots and conduct nitrogen fixation for the plant. We hypothesize that for this to happen, a process known as quorum sensing is important. Quorum sensing is a density dependent process, and it is the way the way that *B. japonicum* communicate with each other. We predict that *B. japonicum* must have a gene that controls production of the quorum sensing molecule. By finding this gene, it may be possible to use this information to better use *B. japonicum* as a natural fertilizer. Companies currently sell pre-inoculated seedlings that grow and nodulate correctly in the lab, but in real world application the plants do not nodulate correctly. We believe that this may be because the plants are pre-inoculated at high concentrations, which allows quorum sensing molecules to be released at high concentrations. This high concentration of quorum sensing molecules may hinder the ability of the bacteria to nodulate properly.

Adrian is from Corydon, IA and is a junior majoring in Biological Sciences at Missouri S&T. She will graduate in May 2015, and plans to continue on to graduate school for biomedical research. She is a member of Helix and works for the Missouri S&T Police as a Campus Service Officer, along with doing research in Dr. Westenberg's lab. She would like to thank Dr. Westenberg for the opportunity to conduct research in his lab.

Poster 57

Jeremiah Herbert

Joint project with Adrian Black

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

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

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Jeremiah is from Belleville, IL, and is a senior in Biological Sciences set to graduate in May of 2014. He is the Vice President of Fellowship for the Christian Campus Fellowship and is actively involved with Helix. He plans to return to school for his Master's degree after working in the biotechnology/biology industry, and eventually getting his Ph.D before moving to biomedical research.

Poster 58

Brock Ebert

Joint project with Sheldon Harper, Jaykob Maser

Department: Physics
Major: Physics
Research Advisor(s): Dr. John Story
Advisor's Department: Physics

Funding Source: Department of Physics

Evaluation of Electrostatic Confinement Fusion as an Energy Source

Fusion is highly sought after for its ability to efficiently provide abundant energy with minimal waste. There are currently multiple competing designs, the most successful of which have operated by the confinement of high energy plasma via electro-magnetic means. In this project an Inertial Electrostatic Confinement (IEC) fusion device was constructed to gauge its potential to achieve a net positive energy yield. The characteristics of the plasma were measured prior to an investigation of the fusion properties via Langmuir Probe and spectroscopic techniques. Data on neutron emissivity for several operation regimes of the IEC device were examined including; variations of the acceleration grid, reversed polarity (false anode), and resonant wave modes.

Brock Ebert is currently an undergraduate Physics Student at Missouri's University of Science and Technology. When he was sixteen, he left his high school to attend the Missouri Academy of Science, Mathematics, and Computing; during said program he attended college courses on the campus of Northwest Missouri State University, and he received an Associate's Degree in Science while simultaneously graduating high school. From there Brock began pursuing a Bachelor's Degree in Physics; after which he plans to go on to receive his Ph.D. in the same subject.

Poster 58

Sheldon Harper

Joint project with Brock Ebert, and Jaykob Maser

Department: Physics
Major: Physics
Research Advisor(s): Dr. John Story
Advisor's Department: Physics

Funding Source: Department of Physics

Evaluation of Electrostatic Confinement Fusion as an Energy Source

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Sheldon is a junior majoring in Physics and Mechanical engineering at Missouri University of Science and Technology. At 16 he enrolled in the Missouri Academy of Science, Mathematics, and Computing, earning an Associate of Science Degree and High School Diploma Simultaneously. Sheldon is highly active in the Missouri S&T Robotics design team and currently holds the position of Vice President. He intends to pursue a graduate degree in mechatronics following graduation.

Poster 58

Jaykob Maser

Joint project with Brock Ebert, and Sheldon Harper

Department: Physics
Major: Physics
Research Advisor(s): Dr. John G. Story
Advisor's Department: Physics

Funding Source: Department of Physics

Evaluation of Electrostatic Confinement Fusion as an Energy Source

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Jaykob Maser is currently studying physics at the Missouri University of Science and Technology. He holds an associate's degree in math and science from Northwest Missouri State University. Jaykob also works as a teaching assistant in the physics department, overseeing a section of the Kinematics and Energy Lab. He will be going to graduate school soon, seeking a master's degree at Missouri S&T before proceeding to work on a doctorate elsewhere. His field of interests are plasma and nuclear physics.

Poster 59

Yi Jiang

Joint project with Samantha Lucker

Department:	Geology/Geophysics
Major:	Geology/Geophysics
Research Advisor(s):	Dr. Stephen Gao
Advisor's Department:	Geology/Geophysics

Funding Source: Missouri University of Science and Technology Office of Undergraduate Studies

The thickness and Poisson's ratio of the Earth's crust beneath the North Central US

The crustal thickness, structure, and composition have been disputed for decades. Major geological structures in the area include the Mid-Continent Rift (MCR) and the Black Hills batholiths. In this project, we largely improved the spatial resolution of the crustal thickness and Poisson's ratio measurements in the region between N41 and N50 latitudes, and W90 and W110 longitudes by using receiver function method. The data we used is the broadband seismic data recorded by the USArray. In the region of the MCR we have established evidence for the original thinning of the crust and have provided evidence for the intrusion of mafic rocks and deposition of clastic sedimentary rocks which were responsible for the later crustal thickening. To the east a mid-crustal reflector can be identified at a depth of 20-30km. The Paleozoic sediments occur in most regions of the Superior Craton, Trans-Hudson Orogeny and Yavapai province.

Yi Jiang is a senior graduating in May 2014 with a degree in Geology/Geophysics. His emphasis has been in seismology and after graduation he plans to study the micro seismic in the hydraulic fracturing and earthquake trigger.

Poster 59

Samantha Lucker
Joint project with Yi Jiang

Department: Geology/Geophysics
Major: Geology/Geophysics
Research Advisor(s): Dr. Stephen Gao
Advisor's Department: Geology/Geophysics

Funding Source: Opportunities for Undergraduate Research Experiences

The thickness and Poisson's ratio of the Earth's crust beneath the North Central US

The crustal thickness, structure, and composition (as reflected by the Poisson's ratio) have been disputed for decades. Major geological structures in the area include the Mid-Continent Rift (MCR) and the Black Hills batholiths. In this project, we improved the spatial resolution of the H (crustal thickness) and PR (Poisson's ratio) measurements in the region between N41 and N50 latitudes, and W90 and W110 longitudes by using broadband seismic data recorded by the USArray. In the region of the MCR we have established evidence for the original thinning of the crust by the receiver functions study and have provided evidence for the intrusion of mafic rocks and deposition of clastic sedimentary rocks which were responsible for the later crustal thickening. To the east a mid-crustal reflector can be identified at a depth of 20-30km. The Paleozoic sediments occur in most regions of the Superior Craton, Trans-Hudson Orogeny, Yavapai province and MCR.

Samantha Lucker is a senior graduating in May 2014 with a degree in Geology/Geophysics and a minor in communications. Her emphasis has been in geophysics and after graduation she plans to study gas hydrates in the Gulf of Mexico.

Poster 60

Ryan Gibbs

Joint Project with Scott Ketcherside, Shreve Nelson

Department: Physics
Major: Physics
Research Advisor(s): Dr. John Story
Advisor's Department: Physics

Funding Source: Physics Department

Analysis of Magnetic Dipole Fixed Lattice Structure

For most materials, electron spin coupling plays the dominant role in determining the arrangement of atoms or molecules in a lattice. For some, the magnetic dipole-dipole interaction may play a role as well. By fixing macroscopic magnetic dipoles in position and allowing them to rotate freely in three dimensions, the ground state characteristics of lattices for which the magnetic dipole-dipole interaction is dominant may be analyzed. The behavior observed here is thus useful for studying the behavior of lattices for which some combination of the magnetic dipole-dipole interaction and spin coupling determine the orientation of particles in a lattice. This behavior is observed both experimentally and computational for two-dimensional lattices of various structure and size.

Ryan Gibbs is studying physics with an emphasis on particle physics and applied mathematics. He is in his fourth year at Missouri S&T and plans to attend graduate school to study particle physics following his undergraduate degree. Ryan is a member of the Kappa Mu Epsilon mathematics honor society and was involved in undergraduate research with Dr. Schulz in the accelerator lab.

Poster 60

Scott Ketcherside

Joint project with Nelson Shrev, Ryan Gibbs

Department: Physics
Major: Physics
Research Advisor(s): Dr. John Story
Advisor's Department: Physics

Funding Source: Physics Department

Analysis of Magnetic Dipole Fixed Lattice Structure

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Scott is a senior in Physics, focusing in Computational Physics.

Poster 60

Nelson Shreve
Joint project with Ryan Gibbs, Scott Ketcherside

Department: Physics
Major: Physics
Research Advisor(s): Dr. John Story
Advisor's Department: Physics

Funding Source: Physics Department

Analysis of Magnetic Dipole Fixed Lattice Structure

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Nelson is a senior in Physics. He is a LEAD Peer Learning Assistant and tennis instructor. Following completion degree he plans to continue on to medical school.

Poster 61

Dan Wang

Joint project with Chunyu Liu, Chenyi Mao

Department: Geological Science & Engineering Department
Major: Geology & Geophysics
Research Advisor(s): Dr. Stephen S. Gao
Advisor's Department: Geological Science & Engineering Department

Funding Source: Opportunities for Undergraduate Research Experiences

Imaging the mantle flow field beneath the Atlantic Ocean using seismic waves

The mid-ocean ridge in the Atlantic Ocean, which is also called Mid-Atlantic Ridge (MAR), is a divergent tectonic plate boundary and part of the longest mountain range in the world. It separates the Eurasian Plate and North American Plate in the North Atlantic, and the African Plate from the South American Plate in the South Atlantic. MAR is caused by sea floor spreading and can also be an indication of plate motion. Studying the mechanism of plate motion in this area is meaningful for giving an idea of continental drift which is being discussed for a long time. We studied the mechanism of plate motion in the Atlantic Ocean by imaging the mantle flow field using seismic waves, which is called "shear wave splitting"(SWS). SWS is a robust tool to infer the direction and strength of seismic anisotropy in the lithosphere and underlying asthenosphere. Measurements of the splitting or birefringence of seismic shear waves that have passed through the Earth's mantle yield constraints on the strength and geometry of elastic anisotropy in various regions. In turn, information about the occurrence and character of seismic anisotropy allows us to make inferences about the style and geometry of mantle flow because anisotropy is a direct consequence of deformational processes. Splitting of P-to-S converted phases at the core-mantle boundary (XKS, including SKS, PKS, and SKKS) is a direct manifestation of seismic anisotropy, which is mostly the result of deformational processes in the Earth's lithosphere and asthenosphere. As demonstrated by hundreds of XKS splitting studies, spatial distribution of two splitting parameters (ϕ, which is the polarization direction of the fast shear wave, and δt which is the splitting delay time between the fast and slow shear waves) has played an essential role in the investigation of anisotropic structure and associated mantle dynamic processes of the Earth. We required and processed the broadband XKS data recorded in the Atlantic Ocean area at the Incorporated Research Institutions for Seismology (IRIS) Data Management Center (DMC).

He has been a lab/research assistant of geophysics lab for almost three years. In fall 2012, he was involved in a large project to measure seismic anisotropy beneath 700 broadband stations in Asia and Australia, and mastered the complicated codes and procedures. At the present time the manuscript is being written. He is also a teaching assistant for seismic interpretation and physical mineralogy & Petrology courses. He is the former vice president of Chinese Student and Scholar Association.

Poster 61

Chunyu Liu

Joint project with Dan Wang, Chenyi Mao

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

Funding Source: Opportunities for Undergraduate Research Experiences

Imaging the Mantle Flow Field beneath the Atlantic Ocean Using Seismic Waves

Shear wave splitting (SWS) is an unambiguous indicator of anisotropy and a robust tool to help understanding the structure and dynamics of the Earth's deep interior. In this project, I relate the splitting measurements to mantle flow covering the major tectonic provinces in Southeast Brazil on the Atlantic Shield, mid-ocean ridge and middle of the West Africa to study and image the mantle flow field. The previous studies indicate that the fast-polarization direction of most of the continents tends to be close to the absolute plate motion direction. The relatively stable measurements on the Africa do manifest the correlation. However, our data on the Atlantic Shield of South America shows that the SKS fast-polarization directions does not correlate well with the flow models of the upper mantle and the results presented indicates that the relatively coarse lithospheric thickness could be one of the reasons for the low correlation.

Chunyu Liu is a senior international transfer student majored in Geology and Geophysics. He is graduating on May and will have his geophysics further education. During the four-year undergraduate study, he is good at Fortran programming, loves structure interpretation, does great on building math model and solving problems . What's more, he always puts his geology knowledge into practice, especially seismic interpretation.

Poster 61

Chenyi Mao

Joint project with Dan Wang, Chunyu Liu.

Department:	Geological Sciences and Engineering
Major:	Geology & Geophysics
Research Advisor(s):	Dr. Stephen Gao
Advisor's Department:	Geological Sciences and Engineering
Funding Source:	Opportunities for Undergraduate Research Experiences

Imaging the Mantle Flow Field beneath the Atlantic Ocean Using Seismic Waves

Shear wave splitting (SWS) is an unambiguous indicator of anisotropy and a robust tool to help understanding the structure and dynamics of the Earth's deep interior. In this project, I relate the splitting measurements to mantle flow covering the major tectonic provinces in Southeast Brazil on the Atlantic Shield, mid-ocean ridge and middle of the West Africa to study and image the mantle flow field. The previous studies indicate that the fast-polarization direction of most of the continents tends to be close to the absolute plate motion direction. The relatively stable measurements on the Africa do manifest the correlation. However, our data on the Atlantic Shield of South America shows that the SKS fast-polarization directions does not correlate well with the flow models of the upper mantle and the results presented indicates that the relatively coarse lithospheric thickness could be one of the reasons for the low correlation.

Chenyi Mao is a senior international transfer student majored in Geology and Geophysics. She is set to graduate in May 2014 and hopes to continue her further education in Geophysics. During the four-year undergraduate study, she is now familiar with the Linux system, GMT, and Fortran Programming Language. Besides, after taking the specialized courses of geology and experiencing the advanced field camp, she has a deeper comprehension of geological structure and mineralogy. In addition, she is open-minded and active in integrating the local life.

Poster 62

John Plihal

Joint project with Cera Thomason

Department: Chemical Engineering
Major: Chemical Engineering with an emphasis in Biochemical Engineering
Research Advisor(s): Dr. David Westenberg
Advisor's Department: Biological Sciences

Funding Source: Dow Chemical Company

The Role of Soil Bacteria in Phytoremediation of Contaminated Soils

Bioremediation/phytoremediation are among many methods used to clean up sites contaminated with toxic chemicals. These methods of biodegradation refer to the use of microorganisms/plants to breakdown compounds into smaller molecules that can be volatilized or used by other organisms. Contaminants such as benzene, toluene and catechol are of particular interest in this project. Gram Positive(GP) and Gram negative(GN) bacteria have been identified to excrete enzymes which aid in the degradation of catechol (CAT) and polycyclic aromatic hydrocarbons (PAH).. More specifically, the biodegradation of benzene, toluene and catechol, among many other compounds, have been linked to the catechol dioxygenase-specific enzymes and PAH-degradation pathways. The enzymes for CAT and PAH degradation have been show to contain a specific DNA sequence which can be amplified by PCR. In this project we used PCR assays dioxygenase to amplify target sequences to quantify the presence of DNA sequences that code for CAT and PAH genes.

John Plihal is currently a senior in the chemical engineering department at Missouri Science and Technology. He has continued interest in biochemistry, cellular, tissue and enzymatic engineering. At Missouri S&T, John participates in on campus activities such as Student Union Board, intramural soccer along with continued work in ceramics, filtration, and biochemical engineering processes. John started his undergraduate research by participating in the OURE program and intends to further his education in fields related to biochemistry and biochemical engineering.

Poster 62

Cera Thomason

Joint project with John Plihal

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

Funding Source: Dow Chemical Company

The role of soil bacteria in phytoremediation of contaminated soils

Bioremediation/phytoremediation are among many methods used to clean up sites contaminated with toxic chemicals. These methods of biodegradation refer to the use of microorganisms/plants to breakdown compounds into smaller molecules that can be volatilized or used by other organisms. Contaminants such as benzene, toluene and catechol are of particular interest in this project. Gram Positive(GP) and Gram negative(GN) bacteria have been identified to excrete enzymes which aid in the degradation of catechol (CAT) and polycyclic aromatic hydrocarbons (PAH).. More specifically, the biodegradation of benzene, toluene and catechol, among many other compounds, have been linked to the catechol dioxygenase-specific enzymes and PAH-degradation pathways. The enzymes for CAT and PAH degradation have been show to contain a specific DNA sequence which can be amplified by PCR. In this project we used PCR assays dioxygenase to amplify target sequences to quantify the presence of DNA sequences that code for CAT and PAH genes.

Cera is a current senior at Missouri University of Science and Technology. She plans to graduate in December 2014 with an undergrad in biological sciences. She is a member of the sorority Phi Sigma Rho and also on the Greek Independent Board.

Social Sciences
Poster Abstracts

Poster 53

Kimberly Beck

Department: Civil, Architectural, & Environmental Engineering
Major: Civil Engineering
Research Advisor(s): Dr. Daniel Oerther and Lee Voth-Gaeddert
Advisor's Department: Environmental Engineering

Funding Source: N/A

Improving the Standard of Living for Indian Women by Creating a Sustainable Option for Water Transport

Potable drinking water is a basic necessity to life, yet every day nearly a billion people in developing countries struggle to find access to it. In many cases within Indian villages, the responsibility of fetching water for the household falls on the mothers or young daughters. This requires spending a large portion of their day walking long distances, carrying heavy loads of water, which may prevent them from being able to provide the household with an additional source of income, and for the young girls being able to attend school, as well as exposing them to additional health risks. The overall goal of this research is to design a means of transporting water using only materials that can be found locally within these Indian villages. Creating a sustainable option for water transport will allow for an improved standard of living.

Kimberly Beck is a sophomore at Missouri S&T currently pursuing a bachelor's degree in Civil Engineering. Kimberly is originally from Marshall, Missouri. She does not expect to graduate until May of 2016, but hopes to continue participating in research during her remaining time at Missouri S&T.

Poster 54

Nathan Dowd

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

Funding Source: John A. and Susan Mathes Endowed Chair in Environmental Engineering

Affective Domain Knowledge relating to Biosand Filters

Approximately one billion people lack safe drinking water and are unable to live fully functional lives due to the dangers of the water they drink. Biosand filters are proven to be a successful, cost effective form of water treatment that have been implemented in over seventy countries around the world. Even with the level of success seen from biosand filters, many areas are still not utilizing filters. The study revolves around researching why the need for clean water is not becoming a response that leads to action. Previously acquired data from different areas in Central and South America will be used to find relations to learning with affective domain knowledge. The decision to use a biosand filter includes seeing a need, valuing a solution, and making those values turn into action.

Nathan Dowd is a senior at Missouri University of Science and Technology studying Civil Engineering. While on campus Nathan is involved with Delta Sigma Phi Fraternity, Student Council, Blue Key Honor Society, Christian Campus Fellowship, and Miner Challenge. In Nathan's spare time he enjoys running, playing soccer, reading and spending time with friends and family.

Poster 55

Natasha Stoneking

Department: Psychological Science
Major: Psychology
Research Advisor(s): Dr. Brandi Klein
Advisor's Department: Psychological Science

Funding Source: N/A

Generalization of Stereotype Threat Interventions in Women

Stereotype threat refers to a situation in which a stereotype about a person might be confirmed, and performance decreases as a result. Interventions designed to combat stereotype threat can narrow or close the gap between stereotyped groups and their peers.

The current study examines whether an informative intervention tailored to one threat ("women underperform at math") will later protect against a different threat ("women underperform at mental rotation") and vice versa. Data collection is in progress. We expect that those exposed to stereotype threat without the intervention will have the lowest scores, and those who receive the intervention will score as well as those not exposed to stereotype threat. This would indicate that an intervention for one threat generalized to a second threat, and that stereotype threat interventions need not be tailored to specific threats.

Natasha Stoneking is a senior in psychology at Missouri S&T. Since Fall 2011, she has been the president of the Free Thinkers Society, a philosophical discussion group. She currently works as a peer tutor at Missouri S&T's Writing Center. Her interests include dogs, hiking, and traveling. Natasha hopes to pursue a career in cognitive neuroscience research.

Poster 56

Darrell Wallace

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

Funding Source:	John A. and Susan Mathes Endowed Chair in Environmental Engineering

Teaching Kids to Give a Crap

Diarrheal disease kills an estimated 1.8 million people each year, the majority of whom are under five years of age - accounting for approximately 20% of all deaths for children under five. The majority of these deaths are occurring between the ages of six months and three years of age. Lack of safe water contributes significantly to the high incidence of diarrheal disease and chronic malnutrition in Guatemala. Parasites, transferred by waterborne contamination, consume nutrients, aggravate malnutrition, retard children's physical development and result in poor school attendance and performance. Our goal through this research is to educate children in Guatemala, mainly villages that do not have proper water filtration, on the importance for clean water and how safe water keeps them healthy. Teaching these children the basics of how a Bio Sand filter works and the proper way to use the filter. We expect that our approach will improve the knowledge of wellness, ultimately improving health and possibly saving lives.

Darrell Wallace is a senior at Missouri University of Science and Technology studying Civil Engineering. While on campus Darrell is involved with Delta Sigma Phi Fraternity, Steel Bridge Design Team, Intramural Manager's Association, and Blue Key Honor Society. In Darrell's spare time he enjoys rock climbing, playing golf, and spending time with his family.

OURE Fellows Final Oral Presentations

Engineering

Name	Department	Time	Location
Mathew Glascock	Mechanical & Aerospace Engineering	1:00-1:30 pm	Carver Room

Sciences

Name	Department	Time	Location
Dylan Courtney	Biological Sciences	1:30-2:00 pm	Carver Room

Social Sciences

Name	Department	Time	Location
Brittney Able Daykin Schnell Rachel Stancil-Bacon Jordan Versules	Psychological Sciences	2:00-2:30 pm	Carver Room

OURE Fellows Oral Applications

Sciences

Name	Department	Time	Location
Adrian Black	Biological Sciences	1:00-1:20 pm	Turner Room
Valentine Hollingsworth	Chemistry	1:20-1:40 pm	Turner Room
Rachel Connell Justin Lovelady	Biological Sciences	1:40-2:00 pm	Turner Room
Anthony Bitar Caleb Trecazzi	Material Sciences & Engineering	2:00-2:20 pm	Turner Room

Social Sciences

Name	Department	Time	Location
Sean Howell	Business & Information Technology	2:20-2:40 pm	Turner Room
Montana Long	Business & Information Technology	2:40-3:00 pm	Turner Room

OURE Fellows Program

Oral Abstracts

Final

Matthew Glascock

Department: Mechanical & Aerospace Engineering
Major: Aerospace Engineering
Research Advisor(s): Dr. Joshua Rovey and Dr. Xiaodong Yang
Advisor's Department: Mechanical & Aerospace Engineering

Funding Source: OURE Fellows Program

Plasmonic Force Propulsion for Small Spacecraft

Plasmonic force propulsion is a revolutionary concept that can overcome one of the biggest obstacles to unlocking the full potential of small spacecraft: mobility. Fundamentally, the concept relies on the rapidly expanding field of plasmonics, which is focused on optical interactions with deep sub-wavelength scale metallic nanostructures. Specially designed lenses are able to focus incident light, such as sunlight, into very precise and powerful optical force fields. A plasmonic propulsion thruster device uses engineered metallic nanostructures that harness raw sunlight to expel nanoparticles at a high speed. By studying the various design characteristics of this device, the performance and impact of a plasmonic force propulsion system for small spacecraft is examined.

Matt Glascock is a Senior student currently in pursuit of an Aerospace Engineering Bachelor's degree, with a minor in Physics. He has enjoyed a very successful academic career thus far. Outside of the curriculum, he is involved in the Missouri Satellite Project student research team on campus at Missouri S&T, developing a micro satellite for the University Nanosat Program. He is also conducting undergraduate research in the space propulsion field in the Aerospace Plasma Laboratory on campus. Matt has plans to attend graduate school for an academic doctorate degree in the Aerospace Engineering field following graduation in May 2014. His research interests lie mainly in the field of electric space propulsion, and its application to small satellites.

Dylan Courtney

Department: Department of Chemical and Biochemical Engineering
Major: Chemical Engineering with an Emphasis in Biochemical Engineering
Research Advisor(s): Dr. Melanie Mormile and Dr. Oliver Sitton
Advisor's Department: Department of Biological Sciences
Department of Chemical and Biochemical Engineering

Funding Source: OURE Fellows Program

1, 3-Propanediol Production from Glycerol Under Haloalkaline Conditions

1,3-Propanediol serves as a precursor to several polymers and is used as a solvent many consumer products. *Halanaerobium hydrogeniformans* is a haloalkaliphilic bacterium that shows potential in the production of 1,3-propanediol at 7% (w/v) NaCl and a fermentative pH of 10. Experiments are being run in small-scale bioreactors over a range of glycerol concentrations up to 2M and a B_{12} cofactor range of 0ug/L – 100ug/L to determine optimal conditions for potential industrial applications and to gather production rate information. When analyzed by using HPLC, samples were shown to have significant levels of 1,3-propanediol production, with B_{12} significantly enhancing the level of production. A conversion ratio of 0.6mol/mol was found with the potential to increase this yield as optimal conditions are determined. *H. hydrogeniformans* is an example of an extremophilic bacterium that holds great promise in increasing the range of conditions and applications of microbial processes in the industrial setting.

Dylan Courtney is a junior in Chemical Engineering with an emphasis in Biochemical Engineering. He has conducted research in Dr. Mormile's lab for the past year and a half, first working with Daniel Roush and later on his own project. Dylan hopes to have a future career in research based Chemical Engineering and plans to graduate in December of 2015.

Brittney Abel
Joint project with Rachel Stancil-Bacon, Reinhold Schnell, Jordan Verslues

Department: Psychological Science & Mining Engineering
Major: Psychological Science
Research Advisor(s): Dr. Brandi Klein & Dr. Kwame Awuah-Offei
Advisor's Department: Psychological Science and Mining Engineering, respectively

Funding Source: OURE Fellows Program

Optimal Number of Factors for Choice Experiments in Mining Community Consultation/Surveying

This study used choice experiments of different variable ranges to investigate the optimal number of variables that should be used in choice experiments. Too many variables to consider on a choice experiment can increase participants' cognitive load to the point that it becomes a burden, and they begin to make choices that aren't in line with their actual beliefs. Choice experiments allow researchers to assess participants' preferences regarding mining projects in their community. An online-based tool called Qualtrics was used to collect data (i.e., demographic information, choice experiment preferences, effort ratings, and difficulty ratings). Results indicate that participants exerted more mental effort as the number of variables increased from three to six, and they rated each level as significantly more difficult than the previous level. There is also some evidence that four variables is the optimal number of variables to use in choice experiments. These results suggest that mining communities that use choice experiments for community consultation should be aware of the demands of cognitive load and limit the number of variables they use to four.

Brittney Abel is a senior in the Psychological Science Department. She helped found the first psychology club of Missouri S&T history, PsyCo. While she's not club activities, she spends her time volunteering in the Rolla Community. In her spare time she enjoys playing softball, racquetball, video games, and walking her dog. "Working with engineering students was quite an interesting experience and I am thankful to get the opportunity. They contributed such a different perspective than what I'm used to. Our group was really balanced out in intellect, skills, and views."

Reinhold Daykin J. Schnell

Joint Project with Rachel Stancil-Bacon, Brittney Abel, Jordan Verslues.

Department: Social Sciences
Major: Mining Engineering
Research Advisor(s): Dr. Brandi Klein and Dr. Kwame Awuah-Offei
Advisor's Department: Psychology, Mining Engineering

Funding Source: OURE Fellows Program

Optimal Number of Factors for Choice Experiments in Mining Community Consultation

This study used choice experiments of different variable ranges to investigate the optimal number of variables to be used in choice experiments. Too many variables for a choice experiment can increase participants' cognitive load to the point that it becomes a burden, leading them to make choices that aren't in line with their actual beliefs. Choice experiments allow researchers to assess participants' preferences regarding mining projects in their community. An online-based tool called Qualtrics was used to collect data. Results indicate that participants exerted more mental effort as the number of variables increased. They rated each level as significantly more difficult than the previous level. There is evidence that four variables is the optimal number of variables to use in choice experiments. These results suggest that mining communities using choice experiments for community consultation should be aware of the demands of cognitive load and limit choice experiments to four variables.

Reinhold Daykin J. Schnell is a junior in Mining Engineering at the Missouri University of Science and Technology. As a recent member of the Student Mine Design Team, he has experience and knowledge in mine planning and knows the major factors that play roles in the interaction between mining companies and communities. The mine design competition requires independent research by the team to complete the design tasks during the competition. Daykin is also a member of the Missouri University of Science and Technology Mine Rescue Team and is knowledgeable in the hazards and inner workings of mining operations.

Rachel Stancil-Bacon

Joint project with Brittney Abel, Daykin Schnell, Jordan Versules

Department: Psychological Sciences and Mining Engineering

Major: Psychology

Research Advisor(s): Dr. Brandi Klein and Dr. Kwame Awuah-Offei

Advisor's Department: Psychological Sciences and Mining Engineering

Funding Source: OURE Fellows Program

Optimal Number of Variables for Choice Experiments in Mining Community Consultation

This study used choice experiments of different variable ranges to investigate the optimal number of variables that should be used in choice experiments. Too many variables to consider on a choice experiment can increase participants' cognitive load, and they begin to make choices that aren't their actual beliefs. Choice experiments allow researchers to assess participants' preferences regarding future mining projects. Qualtrics, an online-based tool was used to collect data. Results indicate participants exerted more mental effort as the number of variables increased from three to six, and rated each level as significantly more difficult than the previous level. There is also some evidence that four variables is the optimal number of variables to use in choice experiments. These results suggest that mining communities that use choice experiments for community consultation should be aware of the demands of cognitive load and limit the number of variables they use to four.

Rachel is senior psychology student at Missouri University of Science and Technology. She is the treasurer of PsyCo, the Psychology Club on campus which discusses research on various topics during meetings. Also, she is an active member of Phi Sigma Rho. Philanthropy holds great value to Rachel, and she has participated in events on campus and in the St. Louis community. Rachel has assisted Dr. Klein with her spatial ability and math anxiety research. She works for Center for Learning and Autism Support Services (CLASS) as a behavioral therapist doing applied behavior analysis (ABA) therapy with autistic children. Rachel hopes to attend graduate school focusing on Industrial and Organizational Psychology. Ethics and corporate social responsibility interest her most in this field.

Jordan Verslues

Joint project with Reinhold Schnell, Brittney Abel, Rachel Stancil-Bacon

Department: Social Science
Major: Mining Engineering
Research Advisor(s): Dr. Brandi Klein, Dr. Kwame Awuah-Offei
Advisor's Department: Psychology, Mining Engineering

Funding Source: OURE Fellows Program

Optimal Number of Factors for Choice Experiments in Mining Community Consultation

This study used choice experiments of different variable ranges to investigate the optimal number of variables to be used in choice experiments. Too many variables for a choice experiment can increase participants' cognitive load to the point that it becomes a burden, leading them to make choices that aren't in line with their actual beliefs. Choice experiments allow researchers to assess participants' preferences regarding mining projects in their community. An online-based tool called Qualtrics was used to collect data. Results indicate that participants exerted more mental effort as the number of variables increased. They rated each level as significantly more difficult than the previous level. There is evidence that four variables is the optimal number of variables to use in choice experiments. These results suggest that mining communities using choice experiments for community consultation should be aware of the demands of cognitive load and limit choice experiments to four variables.

Jordan Verslues is a senior in Mining Engineering at Missouri University of Science and Technology. As a current member of the Missouri University of Science and Technology Mine Rescue Team, he is knowledgeable of the hazards and inner workings of mining operations. The mine rescue competitions require team members to collaboratively research and solve the simulated mine disaster problems during the competition. He is also enrolled in the Army ROTC program and understands the importance of healthy interactions between people.

OURE Fellows Program

Oral Abstracts

Applicants

Adrian Black

Joint project with Jeremiah Herbert

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

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

Quorum Sensing in *Bradyrhizobium japonicum*

Bradyrhizobium japonicum is a soil dwelling bacterium that is known to nodulate soybean roots and conduct nitrogen fixation for the plant. We hypothesize that for this to happen, a process known as quorum sensing is important. Quorum sensing is a density dependent process, and it is the way the way that B. japonicum communicate with each other. We predict that B. japonicum must have a gene that controls production of the quorum sensing molecule. By finding this gene, it may be possible to use this information to better use B. japonicum as a natural fertilizer. Companies currently sell pre-inoculated seedlings that grow and nodulate correctly in the lab, but in real world application the plants do not nodulate correctly. We believe that this may be because the plants are pre-inoculated at high concentrations, which allows quorum sensing molecules to be released at high concentrations. This high concentration of quorum sensing molecules may hinder the ability of the bacteria to nodulate properly.

Adrian is from Corydon, IA and is a junior majoring in Biological Sciences at Missouri S&T. She will graduate in May 2015, and plans to continue on to graduate school for biomedical research. She is a member of Helix and works for the Missouri S&T Police as a Campus Service Officer, along with doing research in Dr. Westenberg's lab. She would like to thank Dr. Westenberg for the opportunity to conduct research in his lab.

Valentine Hollingsworth

Department:	Chemical Engineering
Major:	Chemical Engineering; Biochemical Engineering Emphasis
Research Advisor(s):	Dr. Philip D. Whitefield
Advisor's Department:	Chemistry

Funding Source: Center of Excellence for Aerospace Particulate Emissions Reduction Research

Thermodenuder Penetration and Volatile Component Removal Study: Investigation of Improvements and Their Implementation

The Missouri S&T Thermodenuder was redesigned to analyze hybrid soot particles with volatile coatings by heating, then cooling an aerosol stream; this allows for measuring the change in size of the denuded particles. The original design carried with it practical limitations and it was found that the device had a less than satisfactory ability to allow particulates to penetrate through the sampling line. Through a combined thermodynamic interpretation of the design along with the use of the Aerosol Calculator Program, ideal design parameters were found to maximize the penetration of particles through the apparatus while maintaining its ability to drive off the volatile fraction on hybrid particles. These parameters were implemented in a new design which is to be tested for penetration and its denuding ability.

Graduating from Rolla High School in 2010, Valentine Hollingsworth has a strong interest in flow processes, particularly those associated with manufacturing. In pursuit this interest, he studies Chemical Engineering at Missouri University of Science and Technology. When not studying, he works with the Missouri S&T Center of Excellence for Aerospace Particulate Emissions Reduction Research to apply concepts adapted from chemical engineering courses to ongoing research in aerosol chemistry.

Rachel Connell

Department: Biological Sciences
Major: Biological Sciences
Research Advisor(s): Dr. Dave Westenberg
Advisor's Department: Biological Sciences

Funding Source: Center for Biomedical Science and Engineering
Department of Biological Sciences

Antibacterial Properties of Metal Doped Glass

The proposed research project is intended to measure the antibacterial properties of novel bioactive glass formulations. Enhancing the antibacterial properties of the glass will improve the effectiveness of the glass and minimize infections. Some of these glasses are being used for bone and tissue repair and have proven effective in stimulating cell growth and repair. The various glasses were tested using well diffusion and water suspension methods. Our research has shown that glass enhanced with different metals is effective at killing diverse bacteria. The doped glass seems to be more effective against Gram-positive compared to Gram-negative bacteria.

Rachel is a junior in the biological sciences department. She works with Dr. Westenberg working on glass biomaterial. Rachel has been a teaching assistant for Professor Terry Wilson in the Project Lead the Way training program. She plans on attending medical school. She is actively involved in Phi Sigma Biological Honor Society and Scrubs. She also is actively involved in the community volunteer coaching Upward Basketball and tutoring homeschool children.

Justin Lovelady

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

Funding Source: Amedica

Biofilm Formation and the Antibacterial Properties of Silicon Nitride and Other Biomaterials

The medical applications of antibacterial biomaterials have made great strides since the field's beginning. With new material being produced for surgical implantation, questions of bodily reactions to these biomaterials arise. As a foreign substance is placed into the body a biofilm may accumulate on the surface, which can then lead to severe infections and become difficult to treat. One such material is an antibacterial silicon nitride polymer designed for orthopedic and spinal implants. Using a CDC Biofilm Reactor the testing of these new materials has been accomplished to accurately predict the antibacterial properties of each material. After the reactor is inoculated, samples are taken after 4, 24, 48 and 72 hours and tested for growth of biofilms. Our preliminary data indicates an initial reduction in biofilm formation with some material. With the successful completion of this project, a more effective biomaterial could be found and made readily available for safe and practical use in the human body.

Justin Lovelady is in his fourth year at Missouri University of Science and Technology. He is studying Biology with emphasis in Pre-Med and pursuing a minor in Chemistry. He is a member of Delta Tau Delta Fraternity, a member of the Missouri S&T Jazz Band, and a Photographer for RollaMo Yearbook. He plans to attend Graduate School at Missouri S&T and later plans on going to Medical School in Chicago at Midwestern University.

Anthony Bitar

Joint project with Caleb Trecazzi

Department: Biological Sciences
Major: Pre-medical Biology
Research Advisor(s): Dr. Delbert Day, Ali Mohammadkhah
Advisor's Department: Materials Science and Engineering

Funding Source: OURE Fellows Program

Effects of B3 Bioactive Glass Length on in Vivo Angiogenesis

Borate-based 13-93 B3 bioactive glass scaffolds have been shown to promote angiogenesis in vivo and have been used successfully in clinical trials for wound healing. This study will investigate various scaffold lengths in order to determine the maximum length that a glass scaffold may be before angiogenesis is no longer present within the scaffold. Two separate 13-93 B3 bioactive glass compositions will be compared in this experiment—one with the inclusion of copper and one without—while using the same experimental design of varying scaffold length in order to determine the effects that the addition of copper may have on angiogenic promotion. Toxicological analysis will be conducted per each bioactive glass composition in order to determine the effects that each composition has in vivo.

Anthony Bitar is a freshman who is pursuing a pre-medical bachelor's degree in the biological sciences department. He has worked alongside Ali Mohammadkhah, a graduate student in the Materials Sciences and Engineering department, since September 2013 and has learned cell culturing techniques as well as how to prepare and produce bioactive glass and fibers. He has assisted in implanting scaffolds in Sprague Dawley laboratory rats in order to study angiogenesis with different bioactive glass compositions. He is currently learning about tissue processing.

Caleb Trecazzi

Joint project with Anthony Bitar

Department: Chemistry, Biological Sciences
Major: Pre-medical Chemistry and Biology
Research Advisor(s): Dr. Delbert Day and Ali Mohammadkhah
Advisor's Department: Materials Science and Engineering

Funding Source: OURE Fellows

Effects of B3 Bioactive Glass Length on in Vivo Angiogenesis

Borate-based 13-93 B3 bioactive glass scaffolds have been shown to promote angiogenesis in vivo and have been used successfully in clinical trials for wound healing. This study will investigate various scaffold lengths in order to determine the maximum length that a glass scaffold may be before angiogenesis is no longer present within the scaffold. Two separate 13-93 B3 bioactive glass compositions will be compared in this experiment—one with the inclusion of copper and one without—while using the same experimental design of varying scaffold length in order to determine the effects that the addition of copper may have on angiogenic promotion. Toxicological analysis will be conducted per each bioactive glass composition in order to determine the effects that each composition has in vivo.

Caleb Trecazzi is a junior who is pursuing a dual bachelor's degree in pre-medical chemistry and biology. He has assisted in the iGEM laboratory under the supervision of Levi Palmer, the current iGEM Laboratory Manager, in performing gel electrophoresis, cell culture preparation and plating, and briefly in the creation of competent cells. He has taken and successfully completed a research course (Math 390, Summer 2010) with Dr. Matt Insall in the mathematics department. Together their research team studied lattice theory, nonstandard analysis, and did minor work with a project titled "The Book of Squares."

Sean Howell

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

Funding Source: Opportunity for Undergraduate Research (OURE)
Center for Enterprise Resource Planning (ERP)

Factors that Influence Usability and Effectiveness of a Performance Dashboard: A Case Study

The intent of this research is to extend my current findings from my OURE research, Usability Framework of a Performance Dashboard: A Case Study. My first proposed task is to investigate influential factors in visualization of Big Data. Big Data is a term used to describe the current and expanding trend of large and complex data sets. My second proposed task is to compare these factors to the variables identified by my current OURE research, to derive a framework for data visualization modeling. These factors will be the main focus of my third task, which is to design and implement a prototype based on the framework developed in task 2. This prototype will be designed using large and complex data sets, known as big data. The next task is to implement a survey to analyze user data from the prototype. This will allow me to assess the framework developed in task 2. The final task is to perform statistical analysis and test hypotheses to derive a decision support framework.

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Enterprise Mobility Strategy: How Marketing Factors Improve Customer Relationship Management

The purpose of this research is to utilize the findings from the researcher's previous OURE research project, Influential Factors in an Enterprise Mobility Strategy, to create actionable decision models and strategies in the area of customer relationship management. The model that will be formed over the course of this project should help a company create or improve their enterprise mobile strategy. An Enterprise Mobile Strategy is the application of mobile devices and wireless technology to enable communication, information access, and business transaction from any device, from anyone, from anywhere, at any time. The overall plan for this project will be to craft strategies and decision models in the areas of customer relationship management. Those strategies with then be used to create and deploy mobile prototypes that can be analyzed. Finally, the findings will be compared those from the researcher's initial research findings.

Montana Long is a sophomore in Information Science and Technology. She plans to graduate from Missouri University of Science and Technology with minors in Business Management, Marketing, and Enterprise Resource Planning. Montana works with New Student Programs as a Student Success Coach, and for the Center for Enterprise Resource Planning as a Student Research Assistant. She is an active participant in Residential Hall Government, intramurals, and Christian Campus Fellowship.

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