MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

11th Annual Undergraduate Research Conference

A celebration of experiential learning at Missouri S&T

April 15, 2015

Missouri S&T Havener Center

11th Annual
Undergraduate Research Conference
April 15, 2015

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11th Annual
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April 15, 2015
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CONFERENCE AGENDA

8:00am – 8:30am	**Registration and Poster Set-Up** *(Upper Atrium)*
8:30am – 9:00am	**Opening Address** Vice Provost Jeff Cawlfield *(St. Pat's A Ballroom)*
9:00am – 12:00pm	**OURE Oral Sessions** **ARTS & HUMANITIES --- ENGINEERING --- SCIENCE --- SOCIAL SCIENCES** *(Meramec) (St. Pat's B) (Gasconade) (Meramec)*
9:00am – 11:45am	**Poster Sessions** **SCIENCES** *(Upper Atrium/Hallway)*
12:00pm – 1:00pm	**Luncheon & Keynote Address** *Dr. Ronald J. O'Malley* F. Kenneth Iverson Chair Professor of Steelmaking Technologies, Materials Science & Engineering Director, Kent D. Peaslee Steelmaking Manufacturing Research Center ***Presents*** "Undergraduate Research – An Experience Worth Pursuing" *(St. Pat's C Ballroom)*
1:00pm – 3:00pm	**OURE Fellows Oral Sessions** Final Presentations *(Gasconade)* Proposal Applicants *(Meramec)* **OURE Oral Sessions** **Engineering** *(St. Pat's B)*
1:00pm – 3:00pm	**Poster Sessions** **ARTS & HUMANITIES -- ENGINEERING -- RESEARCH PROPOSALS -- SOCIAL SCIENCES** *(Upper Atrium/Hallway)*
3:00pm – 4:00pm	**Reception** *(St. Pat's A Ballroom)*
4:00pm – 5:00pm	**Awards Ceremony** *(St. Pat's A Ballroom)*

- **Judges Conference Room -** (Mark Twain Room)

Keynote Speaker

Ronald J. O'Malley

F. Kenneth Iverson Chair Professor of Steelmaking Technologies, Materials Science & Engineering
Director, Kent D. Peaslee Steelmaking Manufacturing Research Center
Senior Investigator, Graduate Center for Materials Research
Distinguished Member and Fellow, AIST

Presents

"Undergraduate Research – An Experience Worth Pursuing"

Ronald J. O'Malley received B.S. and M.S. degrees in materials engineering from Drexel University in 1978, and a Ph.D. in metallurgy from the Massachusetts Institute of Technology in 1983. In 1984, he joined Alcoa's research center to work on casting and refining technologies in aluminum. In 1988, he joined Armco Inc.'s Technology Center in Middletown, Ohio, which later became part of AK Steel, where he conducted steelmaking and casting research and development for a diverse mix of flat rolled specialty steels, including developments in the thin-slab casting of stainless steels at AK Steel Mansfield Works. He later served as chief metallurgist at Nucor Steel–Decatur LLC, where he was responsible for metallurgical development and for steelmaking and casting process support within Nucor.

In January 2014, after a 30 year career in the metals industry, Dr. O'Malley joined the faculty at the Missouri University of Science and Technology as the F. Kenneth Iverson Chair Professor of Steelmaking Technologies and director of the Kent D. Peaslee Steelmaking Manufacturing Research Center. Dr. O'Malley has published many papers in the fields of continuous casting and steel processing and has taught numerous short courses on the continuous casting of carbon and specialty steels for the Association of Iron and Steel Technologies (AIST). He received the Charles H. Herty Jr. Award in 1999, was awarded AIST Distinguished Member and Fellow status in 2012, and received an AIST Presidential Citation in 2013. He is currently serving on the executive board of directors of AIST and has served previously as the conference planning committee chair for AISTech 2013, papers chair for the continuous Casting technology committee (CCTC) for AISTech 2012 and is currently a lecturer for the AIST short courses "Continuous Casting — A Practical Training Seminar" and "The Making, Shaping and Treating of Steel". He has also served on the selection committee for the FeMET and StEEL student scholarships and continues to serve on the selection committee for the Elliott Lectureship Award.

Dr. O'Malley has a broad range of interests that include: steelmaking, continuous casting, solidification & heat transfer, interfacial phenomena, thin slab & strip casting, mold fluxes & slags, steel manufacture, and quality defects & causes. He is currently teaching classes in Metals Deformation Processing, Kinetics and Steelmaking in the Department of Materials Science and Engineering.

Conference Judges

The Office of Undergraduate Studies wishes to thank the following faculty & staff for their valuable contributions to the 11th Annual Missouri S&T Undergraduate Research Conference.

Ayodeji Alajo

Baojun Bai

Stuart Baur

Michael Bruening

Carlos Castano

Mihail Cutitaru

Petra DeWitt

Stephanie Fitch

Stephen Gao

Greg Gelles

Larry Gragg

Diane Hagni

John Hogan

Matt Insall

Irina Ivliyeva

Amardeep Kaur

K. Krishna

Xin Liu

Christi Luks

Rachel Morris

Gayla Olbricht

Prakash Reddy

Fateme Rezaei

Joshua Rovey

Ali Rownaghi

Chaman Sabharwal

Julie Semon

Nancy Stone

Shakila Tobwala

Jeffrey Winiarz

Oral Presentations

Arts and Humanities

Name	Department	Time	Location
Nikki Breeland	History and Political Science	9:00-9:30 am	Meramec Room
Nelson Shreve	Arts, Languages, and Philosophy	9:30-10:00 am	Meramec Room
Emily Weigel	Arts, Languages, and Philosophy	10:00-10:30 am	Meramec Room

Engineering

Name	Department	Time	Location
Patrick Brennan	Chemical and Biochemical Engineering	9:00-9:30 am	St. Pat's B
Daniel Grooms	Computer Science	9:30-10:00 am	St. Pat's B
George Holmes	Mechanical and Aerospace Engineering	10:00-10:30 am	St. Pat's B
Shayan Sazdar	Materials Science and Engineering	10:30-11:00 am	St. Pat's B
Allysa Standeven	Mechanical and Aerospace Engineering	11:00-11:30 am	St. Pat's B
Sean Tennyson	Chemical and Biochemical Engineering	1:00-1:30 pm	St. Pat's B
Ziyan Zhang	Mechanical and Aerospace Engineering	1:30-2:00pm	St. Pat's B
Elizabeth Robinson Shannah Withrow	Mechanical and Aerospace Engineering	2:00-2:30pm	St. Pat's B
Tong Mou Cody Spratt	Chemical and Biochemical Engineering	2:30-3:00pm	St. Pat's B

Sciences

Name	Department	Time	Location
Ashley Demster	Chemistry	9:00-9:30 am	Gasconade Room
Adam Evans	Sajal Das	9:30-10:00 am	Gasconade Room
Reid Herndon	Geosciences & Geological & Petroleum Engr.	10:00-10:30 am	Gasconade Room
Caleb Holtmeyer	Chemistry	10:30-11:00 am	Gasconade Room
Michael Steurer	Biological Sciences	11:00-11:30 am	Gasconade Room

Social Sciences

Name	Department	Time	Location
Arielle Bodine	Economics	10:30-11:00 am	Meramec Room
Kelly Payton	Psychological Science	11:00-11:30 am	Meramec Room
Joseph Volpe	Economics	11:30-12:00 am	Meramec Room

Arts and Humanities

Oral Abstracts

Nikki Breeland

Department: History
Major: History
Research Advisor(s): Petra DeWitt, Shannon Fogg
Advisor's Department: History

Funding Source: None

A Case Study on the Depiction of Female Revolutionary Figures in French Revolutionary Media and the Concept of Equality

During the French Revolution, media incited action against the monarch and called for retribution for the suffering of the people. However, the French Revolution media also altered the images of women close to the Revolution. The impact of the media on the images of women like Marie Antoinette, Madame Roland and Charlotte Corday was incredible. Portraits, news articles, pamphlets, and governmental decrees among other primary sources are just some of the evidence of the depiction of women during this time. These women were scolded for being in the public sphere, attempting to gain power, and altogether acting in a masculine fashion. This resulted in them being reverted to mere objects of beauty, stripped of their gender entirely, and denied their own identities. French Revolution media shaped public opinion about the role of women, especially the attitude toward active women in France.

Nikki Breeland holds a Bachelor of Arts in Political Science and is pursuing a Bachelor of Arts in History. She looks forward to a promising career as an attorney.

Nelson Shreve

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

Funding Source: None

Causation: Hume's Concern and Kant's Response

If event A occurs then event B will follow. Is causation really that simple? Causation exists only if it is the case that certain events *actually* cause others. David Hume questioned the assumption of causation in his work *A Treatise of Human Nature.* This rocked the world of philosophy from its core teachings. Of course, a great question deserves a great response. Immanuel Kant attempted such an answer. Kant argued that a cause *necessarily* leads to the effect. This is in direct opposition to Hume's argument that cause *probably* leads to the effect observed. An example would be of a child jumping into a still pool of water. One would expect that there would be some sort of disturbance of the water. Is this presumption a valid conclusion given the initial conditions? Kant argues that not only does the surface become disturbed, but that it *must.*

Nelson is a senior in physics and philosophy. Upon completion of his degree, he plans to attend medical school. In his spare time, he is a tennis instructor.

Emily Weigel

Joint project with Rachel Miller.

Department: Chemistry
Major: Chemistry
Research Advisor(s): Audra Merfeld-Langston
Advisor's Department: Arts, Languages & Philosophy

Funding Source: OURE

Marcel Aymé's Wartime Journalism

During World War II, the Germans occupied approximately half of France. This meant many new rules for French citizens, including the rationing of food and censorship of the media. Marcel Aymé was a writer before and during the Occupation of France. His decision to continue writing under German censors caused some people at the time to label him as a collaborator, but after reading Aymé's original newspaper articles published from 1939-1944, it is clear he was in no way pro-German. His articles contain many harsh truths about France's downfall, along with a defense of freedom of speech for writers. After the war, many people condemned Aymé's defense of collaborators' rights to free expression. On the surface, Aymé's works are very critical of the French government and its citizens, but he did this because he wanted to spark discussion and better his country.

Emily Weigel is a fifth year Chemistry student also studying for her minor in French. She has been an active member of the campus radio station KMNR since her third semester, holding executive board and appointed positions in addition to her regular radio show. When not studying or doing homework, she enjoys reading science fiction and fantasy novels.

Engineering

Oral Abstracts

Patrick Brennan

Department: Chemical Engineering
Major: Chemical Engineering
Research Advisor(s): Ali Rownaghi, Fateme Rezaei
Advisor's Department: Chemical Engineering

Funding Source: Advisor's start-up packages

Composite Aminosilica/Polymer Hollow Fiber Sorbents for Co_2 Capture from Flue Gas

Amine-loaded silica/poly(amide-imide) hollow fiber sorbents are created and used for CO_2 capture under simulated post-combustion flue gas conditions. Amine is infused into the mesoporous silica/ poly(amide-imide) hollow fiber sorbents during fiber solvent exchange steps after fiber spinning. The amine loaded fibers are tested by exposure to simulated flue gas at 1 atm and 35 °C The amine functionalized mesoporous silica / poly(amide-imide) hollow fibers comprising ~5 wt% silica with a high CO_2 equilibrium capacity of 1.8 mmol/g-fiber which is significantly higher than previously reported for fiber sorbents.

Patrick Brennan is a sophomore studying Chemical Engineering at Missouri S&T. He went to Duchesne High School in St. Charles, Missouri. This semester, he has started doing research under the guidance of Dr. Ali Rownaghi.

Daniel Grooms

Department: Computer Science
Major: Computer Science
Research Advisor(s): Bruce McMillin
Advisor's Department: Computer Science

Funding Source: NSF FREEDM Systems Center

Invariant Function Objects in FREEDM Distributed Grid Intelligence

To ensure security and stability of the FREEDM system, it is necessary to develop invariants for the cyber, physical, and network areas of the distributed grid. This paper addresses the use of a function object implementation for invariants, for use in the Load Balance algorithm of the DGI. This will allow the Load Balance algorithm to communicate with external algorithms by exchanging any invariants it uses with said algorithm. It will also aid in development, as invariant code need not be updated with the Load Balance algorithm; current or previous versions of invariants will be able to be used in the Load Balance algorithm interchangeably.

Daniel Grooms is an undergraduate student and researcher expecting to complete his B.S. Computer Science degree with a minor in Mathematics at the Missouri University of Science and Technology in December 2015. His research interest is in the application of mathematical principles to the study of Computer Science.

George L. Holmes Jr.

Department: Department of Mechanical and Aerospace Engineering
Major: Mechanical Engineering
Research Advisor(s): Dr. Frank Liou, Todd Sparks
Advisor's Department: Mechanical Engineering

Funding Source: Opportunities for Undergraduate Research Experience

Laser Disposition – Mass Flow Sensor

3D printing has been able to capture the imagination of many, turning science fiction into reality. A more precocious element of 3D printing enables infinitesimal amounts of metal powder and a high powered laser to fabricate a part. This project is concerned with the designing, optimization and signal analysis of an optical systems to measure the flow rate of the metal powder involved with printing such a part. Implications include increased control during fabrication and a more complex, diverse range of manufacturing capabilities.

George Holmes is a diverse student that has become engaged on all levels of the undergraduate experience. He is the President of Black Man's Think Tank, Membership Intake Chair for Kappa Alpha Psi Fraternity Inc., and student representative for the Chancellor's Advisory Committee. After graduating in December of 2015 George will pursue a Ph.D. at Missouri S&T. He has ambitions of one day starting his own business in engineering related industries and fostering a passion for engineering in future generations.

Tong Mou

Joint project with Cody Spratt.

Department: Chemical and Biochemical Engineering
Major: Chemical Engineering
Research Advisor(s): Joontaek Park
Advisor's Department: Chemical and Biochemical Engineering

Funding Source: None

DYNAMIC SIMULATION OF ENTANGLED POLYMERS UNDERGOING DEFORMATION

Polymeric liquids possess complex properties that significantly deviate from Newtonian fluids. Therefore, understanding such abnormal flow behaviors is important in industrial applications. This study implements the stochastic-tube model to dynamically simulate polymer chains. These were placed under a constant shear rate for a certain amount of time and analyzed to ascertain whether the polymer chains undergo a "tumbling" motion and determine how the extent of linearity changes with time for different shear rates. The tumbling is also quantified in terms of a newly introduced variable. The simulation results indicate that the polymer chains exhibit a significant tendency to elongate at higher shear rates and occasionally experience tumbling, while lower shear rates tend to exhibit very infrequent tumbling and slight elongation. These results may help explain the inverse sigmoidal behavior of polymer viscosity vs. shear rate. Comparison of dynamic behaviors under shear and extension is also made.

Tong Mou is a senior undergraduate student of Chemical Engineering at the Missouri University of Science and Technology. Tong has worked with Dr. Joontaek Park on the polymer deformation simulation project from January 2015 to April 2015. Her contribution is using the developed code to visualize the simulation data under different shear rates from the new model.

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Elizabeth Robinson

Joint project with Shannah Withrow and Jaykob Maser

Department: Aerospace Engineering
Major: Ceramic Engineering
Research Advisor(s): Hank Pernicka
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: AMAE Grant, STUCO

Testing of Active Compressions- Decompression Cardiopulmonary Resuscitation

An Active-Compression-Decompression (ACD) device was tested to assess the benefits of ACD-CPR during cardiac arrest. The first portion of the experiment illustrated the feasibility of an average person performing ACD-CPR in microgravity. The second portion of the experiment used a fluids model of the human chest to compare the flow rate of the heart in both 1g and microgravity using ACD-CPR and traditional CPR. The results of this experiment showed that ACD-CPR through a behind-the-back application could be initiated within 25 seconds and that an average rate of 96 compressions per minute could be achieved in microgravity. It was shown that ACD-CPR improved cardiac output by 23% during microgravity as compared to 44% in a 1g environment. Data showed that both ACD-CPR and traditional CPR were more effective in microgravity as compared to a 1g environment.

Elizabeth is a sophomore studying Ceramic Engineering in the Material Sciences and Engineering department. She is the vice president of Miners in Space, a Missouri S&T design team that partners with NASA to perform microgravity research on the Weightless Wonder, aka the Vomit Comet. She is also involved in Keramos, the ceramic engineering professional fraternity, and will be Herald for the organization in the upcoming school year. Elizabeth is also a member of the S&T Women's Track and Field Team, receiving an All-Academic honor for the 2013-2014 season. She is looking forward to an internship with GE Aviation this summer.

Shayan Sazdar

Department: Department of Chemical and Biochemical Engineering
Major: Chemical Engineering
Research Advisor(s): Delbert Day, Ali Mohammadkhah (Ph.D. student of Dr. Day)
Advisor's Department: Department of Materials Science and Engineering

Funding Source: Missouri University of Science and Technology

Fabrication and evaluation of polylactide/bioactive glass composites for tissue engineering applications

Recent research in the field of bioactive glasses has shown that bioactive borate glasses hold strong potential as materials for tissue engineering in the areas of angiogenesis and potentially even nerve repair. The focus of the present work was to develop and evaluate flexible polymer/bioactive glass composite films for tissue engineering applications such as repairing peripheral nerves. Polylactide (PLA) composites containing up to 50 weight percent of bioactive borate and/or silicate glass particles (approximately 20 μm in diameter) were fabricated by solvent casting. The dried composites were then immersed in static simulated body fluid (SBF) at 37^{o}C for 23 days during which time the degradation of the different composites was analyzed based on the amount of ions released from the bioactive glass. The favorable degradation characteristics of the composites indicated that the PLA/bioactive glass composites have potential to act as conduits for repairing damaged nerves.

Shayan Sazdar is currently a sophomore in chemical engineering from Chesterfield, Missouri. He has been working with Dr. Delbert Day's research group at the Missouri S&T Materials Research Center since the fall of 2013 and worked with Dr. Susan Stagg-Williams and Dr. Michael Detamore at the University of Kansas Department of Chemical and Petroleum Engineering on biofuels and tissue engineering research during the summer of 2014. Shayan is also a member and a former officer of the Missouri S&T Chem-E-Car Design Team and the Missouri S&T Student Chapter of the American Institute of Chemical Engineers.

Cody Spratt

Joint project with Tong Mou

Department: Chemical and Biochemical Engineering
Major: Chemical Engineering
Research Advisor(s): Joontaek Park
Advisor's Department: Chemical and Biochemical Engineering

Funding Source: Not applicable

DYNAMIC SIMULATION OF ENTANGLED POLYMERS UNDERGOING DEFORMATION

Polymeric liquids possess complex properties that significantly deviate from Newtonian fluids. Therefore, understanding such abnormal flow behaviors is important in industrial applications. This study implements the stochastic-tube model to dynamically simulate polymer chains. These were placed under a constant shear rate for a certain amount of time and analyzed to ascertain whether the polymer chains undergo a "tumbling" motion and determine how the extent of linearity changes with time for different shear rates. The tumbling is also quantified in terms of a newly introduced variable. The simulation results indicate that the polymer chains exhibit a significant tendency to elongate at higher shear rates and occasionally experience tumbling, while lower shear rates tend to exhibit very infrequent tumbling and slight elongation. These results may help explain the inverse sigmoidal behavior of polymer viscosity vs. shear rate. Comparison of dynamic behaviors under shear and extension is also made.

Cody Spratt is a senior undergraduate chemical engineering student at the Missouri University of Science and Technology. Cody has worked with Dr. Joontaek Park on the polymer deformation simulation project from August 2013 to December 2013 and from January 2015 to April 2015. His contributions include writing/editing Matlab code to display polymer configurations in three-dimensional graphs, developing calculation methods to quantify polymer tumbling and extension, and generating organized displays of data that directly reflect the simulated polymer behavior.

Allysa Standeven

Department: Mechanical Engineering
Major: Mechanical Engineering
Research Advisor(s): Ryan Hutcheson
Advisor's Department: Mechanical Engineering

Funding Source: OURE

Axial Flux Motor

Motors are very commonly used as electrical energy to mechanical energy converters. This project focuses on innovative ways to design and manufacture an electric motor for small vehicle use. The design stage had to take electrical, material, and mechanical factors into consideration. The particular application for this project would be a hub motor that had to fit within 10" rims. Some other constraints were voltage and revolution per minute limitations (under 300V and 1400 rpm), bolt patterns, and cost-effectiveness. The main components are the rotor, stator, bobbins, windings, and structural mounts for assembly and mounting purposes. Analysis and math modeling were used for the design and material selection. Varieties of manufacturing processes were taken into consideration for the parts and were decided by certain criterion.

Allysa Standeven was born in St. Peters, Missouri. She graduated Orchard Farm High School in spring 2011. She attends Missouri University of Science and Technology and plans to earn a Bachelor's Degree in Mechanical Engineering. Allysa will graduate from Missouri University of Science and Technology in May 2015. She will start her full time position with General Motors in June 2015.

Sean Tennyson

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

Funding Source: Opportunities for Undergraduate Research Program
Energy Research and Development Center

Process Intensification of Biodiesel Production via Supercritical Transesterification

Biofuels have gained lots of attention due to the rising interest in clean energy. Biodiesel is considered one of the most promising biofuels used in industry. Typically, biodiesel is produced using a base-catalyzed transesterification reaction with a feedstock of some vegetable oil or waste cooking oil (WCO). In this study, a more efficient and economical biodiesel production process is discussed. The process uses supercritical methanol and WCO as reagents in a transesterification reaction with no catalyst. To further improve the process, areas of opportunity for process intensification were investigated. From the process intensification study it was found that a membrane reactor combined with a purification step in the biodiesel production process will not only save space, but also time and money. This membrane reactor will greatly enhance the biodiesel production process and must be designed and put into practice to determine the effects it will have on the process.

Sean Tennyson is currently a junior in chemical engineering at Missouri University of Science and Technology. Sean's research interests include hybrid energy systems, biofuels, and life-cycle analyses. Sean leads a team of eight undergraduates conducting research on the production of biodiesel using supercritical methanol. Sean plans to obtain a bachelor's degree in chemical engineering and then work in industry or attend graduate school.

Shannah Withrow

Joint project with Elizabeth Robinson and Jaykob Maser

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

Funding Source:	Student Council Phelps County Regional Medical Center Veterans of Foreign Wars-Rolla Branch Academy of Mechanical and Aerospace Engineers (AMAE)- Rolla Branch

Testing of Active Compression-Decompression Cardiopulmonary Resuscitation(ACD-CPR) in Microgravity

In collaboration with NASA's Reduced Gravity Education Flight Program, the effectiveness of ACD-CPR was compared to traditional CPR in a microgravity environment. Elements compared included fluid flow output in a simulated chest cavity, depth and rate of compressions achieved, time required for implementation, and feasibility to perform compressions. ACD-CPR varies from traditional CPR in that it uses a small, mechanical device, similar to a suction cup, to raise the chest wall after compression, allowing decompression of the chest. Testing showed that rate and compression standards established by the American Heart Association could be reached doing ACD-CPR in microgravity. Flow data showed that the fluid flows similarly in a 0g environment as in a 1g environment. Average time required for implementation was reduced from two minutes, at which point brain damage is likely, to twenty-five seconds. Greater efficiency in medical emergency procedures will be crucial for long-term missions.

Shannah Withrow is a junior in Aerospace Engineering at the Missouri University of Science and Technology. She has served as the President of Miners in Space since the Fall of 2013. She has had the privilege of performing research with NASA through the Reduced Gravity Education Flight Program for two years and through an internship with NASA Ames Research Center. She was honored to present at the Gateway to Space Conference in Fall 2014. She is also active in Sigma Gamma Tau Aerospace Honor Society and Kappa Mu Epsilon Mathematics Honor Society.

Ziyan Zhang

Department: Mechanical and Aerospace
Major: Mechanical
Research Advisor(s): Cheng Wang
Advisor's Department: Mechanical and Aerospace

Funding Source: Microscale Transport Laboratory

A low-cost rapid prototyping system for microfluidic devices

Microfluidics devices deal with volumes of fluid on the order of nanoliters or picoliters (10-12 liter). The devices have dimensions ranging from millimeters down to micrometers. They have made significant impact on various science and engineering disciplines, including biology, chemistry, and biomedical engineering, due to its many advantages, such as low sample consumption, precise control of micro-environments, and a high degree of integration and automation. We developed a low-cost and high-resolution micro-fabrication system that enables quick and inexpensive manufacturing of master molds for fabricating microfluidic devices via soft-lithography. The system utilizes ultraviolet LED as a light source and dry film photoresist as patterning materials. It achieves feature resolution down to 30μm, aspect ratio≈1, and sidewall angle>80◦, which meet the requirements of typical microfluidic applications.

Ziyan Zhang is a senior at Missouri S&T, majoring in Mechanical Engineering. He is also a transfer student from Harbin Institute of Technology, China. After graduation, he will attend graduate school to further his education in Mechanical Engineering. He participated in Missouri S&T Opportunities for Undergraduate Research Experiences (OURE) Program from May 2014 to January 2015 with Dr. Cheng Wang.

Sciences

Oral Abstracts

Ashley Demster

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

Funding Source: Missouri S&T Opportunity for Undergraduate Research Experiences (OURE) Program
U. S. Department of Energy Grant DE-FG02-08ER46518
National Science Foundation Grant DMR-1104801

Epitaxial Methylammonium Lead Iodide Perovskites for Inexpensive and Efficient Solar Harvesting

Our planet's ever-increasing energy consumption drives a search for inexpensive and efficient renewable energy sources, and the sun could be the answer. Emerging inorganic-organic solar cell technology utilizing methylammonium metal halides with the perovskite structure experienced five-fold increase in power conversion efficiency since its introduction, from 3.8 % in 2009 to 20.1 % in 2014. These solar cells show potential to greatly cut costs of solar energy harvesting: however epitaxial films remain unexplored.

I will present a novel method to electrochemically synthesize epitaxial $CH_3NH_3PbI_3$ films with the perovskite structure. Epitaxial PbO_2 is converted to epitaxial $CH_3NH_3PbI_3$ perovskite of tunable morphology and crystal orientation by simple dip conversion. Solar cells constructed with epitaxial $CH_3NH_3PbI_3$ should exhibit increased efficiencies because the density of bulk and interface defects is minimized. This method could be integrated into cells to provide a clean and more cost-effective alternative to traditional silicon single crystal technology.

Ashley is a junior in the chemistry department from Springfield, Missouri. She is a member of the American Chemical Society and works as a research assistant in the Materials Research Center. Upon graduation in May 2016, she plans to enroll in graduate studies to continue her education in chemistry.

Adam Evans

Department: Computer Science
Major: Computer Science
Research Advisor(s): Debraj De, Sajal Das
Advisor's Department: Computer Science

Funding Source: NSF Research Experience for Undergraduates

Indoor Localization with Bluetooth Beacons

The importance of the problem of Indoor Localization has grown tremendously as smartphones have become more ubiquitous and robots more intelligent. Solutions to this problem will greatly help users with location-based services indoors, and allow robots to become more autonomous in movement and navigation. Previous attempts have used a multitude of strategies, including signal fingerprinting, online and offline simultaneous localization and mapping (SLAM), and estimating user location change using phone sensors, commonly the accelerometer, gyroscope, and compass. In our research, we have: (i) characterized various properties of communication between Bluetooth beacons and smartphones (including effects of orientation, distance and environmental condition); (ii) performed user daily activity behavior analysis with Bluetooth beacons (placed in key locations around the Computer Science building); (iii) applied a variation of signal mapping to the collected data for location estimation.

Adam Evans is a sophomore majoring in Computer Science at Missouri S&T. He has been programming since eighth grade and is a member of ACM SIG-Competition on campus.

Reid Herndon

Department: Geology & Geophysics
Major: Geology
Research Advisor(s): John Hogan
Advisor's Department: Geology & Geophysics

Funding Source: None

The Characterization of Soft Sediment Deformation in Hawkesbury Sandstone shale lenses South of Maroubra Beach

The sediment sequence occurring the Hawkesbury Sandstone on the Sydney coast would be relatively mundane were it not for the profound way in which it has been deformed. Other deposits of like origin and similar age are relatively untouched while one deposit in question has now been irrevocably changed. This location represents an as yet unknown type of deformation and will be characterized. The deformation experience in this location seems to be linked to both pore fluid pressure and lithological variation. In the event of deformation these variations allowed the rocks to take shape in various fabrics including "Flotsam" and Sheath Folds. Structures like these may be advantageous to people of interests in understanding anisotropies in potentially economic media.

Reid Hernon love of rocks began early when his dad took him on a cave tour. Several rock collections and mineral digs later Reid decided Geology was for him. His four years studying Geology have taken him on two field camps to Utah and New Mexico which includes locations as visually and geologically spectacular as the Grand Canyon and Meteor Crater. In the early 2014 calendar year he went to Sydney, Australia and took his love of rocks with him. He will be presenting his findings at this year's conference. After graduation in May he will be pursuing a career applying his skills and expertice to the rocks he loves.

Caleb Holtmeyer

Department: Chemistry
Major: Chemistry
Research Advisor(s): Manashi Nath
Advisor's Department: Chemistry

Funding Source: OURE Program

Electrodeposition of Mercury Cadmium Telluride Nanorods

Nanorod arrays of Mercury cadmium telluride (HgCdTe) have potential uses in photovoltaics, infrared detectors, and electro-optical modulators. HgCdTe has semiconductor properties like CdTe, but has the advantage of having a tunable bandgap which is dependent on the amount of Hg incorporated into the structure. Electrodeposition of HgCdTe on lithographically patterned nanoelectrodes, is a low-cost, simple method of producing these nanorod arrays. Nanoelectrodes were defined on indium tin oxide (ITO) coated glass through e-beam lithography, which was then subjected to confined electrodeposition. The nanorod arrays were characterized using powder X-ray diffraction (PXRD), scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy. Photoelectrochemical measurements were performed to determine the photoconductivity of the nanorod arrays.

Caleb Holtmeyer is a chemistry student pursuing a Bachelor's of Science at Missouri University of Science and Technology. This is his second year at Missouri S&T and plans to graduate in the spring of 2016. After graduation he hopes to attend graduate school at University of Colorado in Boulder. He has a wide interest in environmental issues and is particularly focused on sustainable energy. By working with Dr. Nath, he has been able to make use of his knowledge in chemistry to develop photoactive nanorods, which have applications in photovoltaics.

Michael A. Steurer

Department: Chemistry
Major: Chemistry, Biochemistry Emphasis Area
Research Advisor(s): Adam Martin, Robert Aronstam
Advisor's Department: Chemistry and Biology, respectively

Funding Source: Biological Sciences Department

Constitutive Activity in Orphan G-Protein Coupled Receptors

The G-protein coupled receptor type is the most diversely expressed in our genome, and their characterization is an important avenue of ongoing pharmacological research. GPCRs are most commonly identified by the endogenous ligand with which they interact. For many of those identified, however, an endogenous ligand is not known. Sequence relationship methods have identified families based on similarity in their ligand-binding site, but require more information before the endogenous ligand can be inferred. This research classifies several of these orphan GPCRs through the analysis of their constitutive activity on the adenylyl cyclase pathway. Signaling was monitored by transfecting cells with a reporter gene construct under control of the CRE promoter in conjunction with a particular orphan receptor vector plasmid. Results of this analysis reveal the potential role of the selected orphan receptors, and provides direction for further research in determining their endogenous ligand.

Michael A. Steurer, informally known as Abe, has been an involved member of the cDNA resource center of the Missouri S&T biology department for over two years. Guided by his interest in neuroscience, he has sought to apply his biochemical studies to the understanding of this system. In the long term, he hopes to pursue a career in pharmacological research. He was fortunate in that the opportunity for undergraduate research in which he has participated in aligns closely with his long term research goals.

Social Sciences

Oral Abstracts

Arielle Bodine

Department: Economics
Major: Applied Mathematics and Economics
Research Advisor(s): Michael Davis
Advisor's Department: Economics

Funding Source: Opportunities for Undergraduate Research Experiences

Putt for Show, Drive for Off-Course Dough?

A significant portion of a professional golfer's income does not come from tournament purses. In a given year, a professional golfer may make millions of dollars in off-course earnings that include everything from endorsement deals to appearance fees. Though past research has monetized the value of skill sets to the golfer in relation to their on-course earnings, it is of interest to determine the effect of a certain skill level on a golfer's off-course earnings. Thus, this study attempts to determine the effects of power, short game, putting, accuracy and scoring on a golfer's off-course earnings. The results suggest that scoring most effects a player's off-course earnings.

Arielle is an undergraduate at Missouri University of Science and Technology in applied mathematics and economics. In addition to her work on this OURE project, she is a member of Delta Omicron Lambda service sorority, historian of Kappa Mu Epsilon, a member of the Missouri S&T Honors Academy and a student writer in the S&T Marketing and Communications department.

Kelly Payton

Department: Psychological Sciences
Major: Psychology
Research Advisor(s): Nathan Weidner
Advisor's Department: Psychological Sciences

Funding Source: None

The Trouble with Lying: An Empirical Study of the Interaction Between Agreeableness, Lie Type, and Counterproductive Workplace Behaviors.

Research has shown that people will be dishonest until they reach the point where they must update their self-concept (Mazar, Amir, & Ariely, 2008). People justify behaviors (e.g. lying) in their minds to avoid having to think of themselves as dishonest (Mazar et al., 2008).Doing this creates a range of acceptability for dishonest behaviors, like lying. The present study was designed to develop two measures, the Range of Acceptability (ROA) scale and the Propensity for Lying Scale (PLS) in order to better understand how this range of acceptability, with regards to lying, impacts counterproductive workplace behaviors (CWBs). An online questionnaire was administered to examine the relationships between ROA, PLS, Agreeableness, lie type, and CWBs. Range of acceptability, lie type, and propensity for lying were all found to relate to CWBs.

Kelly Payton is a senior at Missouri S&T. She will be graduating in May with a BS in Psychology. She is a wife, mother of six, and grandmother or two. She is currently working as a Group Facilitator for Southeast Missouri Behavioral Health, and plans to put her psychology degree to use helping people fight their addictions and get their lives back on track.

Joseph Louis Volpe

Department: Mechanical and Aerospace Engineering
Major: Mechanical Engineering
Research Advisor: Michael C. Davis
Advisor's Department: Economics and Finance

Funding Source: None

The Impact of Mid-season Super-Star Trades on NBA Attendance

The instinctive response that comes from teams trading away their superstar is agony and displeasure from fans of the team, the NBA is no exception. Since fans are furious about teams trading away a star player, seeing this as an act of tanking for a better draft pick and preparing for the next season, it is intuitive to think that the fan attendance after the trade would diminish because of the trade. However, through linear regression analysis of four NBA teams using common independent variables associated with fan attendance, the effect of trading away their superstar player showed too small of a significance to have any effect on fan attendance, which would suggest the drop in attendance after a team trades away their superstar is not necessarily because of the trade.

Joseph Louis Volpe is a student majoring in Mechanical Engineering and Economics at Missouri S&T.

Poster Presentations

Arts and Humanities

Poster #	Name	Department	Time	Location
1	Thomas Cooper	Business and Information Technology	1:00-3:00 pm	Upper Atrium/Hall
2	Kelly Dunlap	Arts, Languages, and Philosophy	1:00-3:00 pm	Upper Atrium/Hall
3	Rebekah Harrah	English and Technical Communication	1:00-3:00 pm	Upper Atrium/Hall
4	Rachel Miller	Arts, Languages, and Philosophy	1:00-3:00 pm	Upper Atrium/Hall

Engineering

Poster #	Name	Department	Time	Location
5	Katherine Bartels	Civil, Architectural & Environmental Engineering	1:00-3:00 pm	Upper Atrium/Hall
6	Kristin Bier	Chemical and Biochemical Engineering	1:00-3:00 pm	Upper Atrium/Hall
7	Eric Carlson	Mining and Nuclear Engineering	1:00-3:00 pm	Upper Atrium/Hall
8	Devin Cornell	Electrical and Computer Engineering	1:00-3:00 pm	Upper Atrium/Hall
9	Mason Donnell	Chemical and Biochemical Engineering	1:00-3:00 pm	Upper Atrium/Hall
10	Angela Grueninger	Materials Science and Engineering	1:00-3:00 pm	Upper Atrium/Hall
11	Joseph Hakanson	Mechanical and Aerospace Engineering	1:00-3:00 pm	Upper Atrium/Hall
12	Nathan Hargrave	Chemical and Biochemical Engineering	1:00-3:00 pm	Upper Atrium/Hall
13	Joshua Heath	Chemical and Biochemical Engineering	1:00-3:00 pm	Upper Atrium/Hall
14	Justin Hoyt	Electrical and Computer Engineering	1:00-3:00 pm	Upper Atrium/Hall
15	Thomas Knight	Mechanical and Aerospace Engineering	1:00-3:00 pm	Upper Atrium/Hall
16	Alyssa McCarthy	Engineering Management & Systems Engr.	1:00-3:00 pm	Upper Atrium/Hall
17	Ashley Painter	Computer Science	1:00-3:00 pm	Upper Atrium/Hall
18	Thomas Roth	Electrical and Computer Engineering	1:00-3:00 pm	Upper Atrium/Hall
19	Mitchell Smith	Mining and Nuclear Engineering	1:00-3:00 pm	Upper Atrium/Hall
20	Johnathan Sumpter	Mechanical and Aerospace Engineering	1:00-3:00 pm	Upper Atrium/Hall
21	John Tegtmeyer	Civil, Architectural U Environmental Engineering	1:00-3:00 pm	Upper Atrium/Hall
22	Amer Al-Lozi Amy Snyder	Chemical and Biochemical Engineering	1:00-3:00 pm	Upper Atrium/Hall

Research Proposals

Poster #	Name	Department	Time	Location
23	Robert Block	Chemistry	1:00-3:00 pm	Upper Atrium/Hall
24	Sierra Herndon	Chemistry	1:00-3:00 pm	Upper Atrium/Hall
25	Matthew Howerton	Biological Sciences	1:00-3:00 pm	Upper Atrium/Hall
26	Samantha Huckuntod	Biological Sciences	1:00-3:00 pm	Upper Atrium/Hall
27	Tyler Knobbe	Business and Information Technology	1:00-3:00 pm	Upper Atrium/Hall
28	Harriet Lumula	Biological Sciences	1:00-3:00 pm	Upper Atrium/Hall
29	Michelle Mild	Geosciences & Geological & Petroleum Engr.	1:00-3:00 pm	Upper Atrium/Hall
30	Conner Sprague	Engineering Management & Systems Engr.	1:00-3:00 pm	Upper Atrium/Hall
31	Tyler Sundell	Geosciences & Geological & Petroleum Engr.	1:00-3:00 pm	Upper Atrium/Hall
32	Therese Galbraith Yahya Abu Hijleh	Mechanical and Aerospace Engineering	1:00-3:00 pm	Upper Atrium/Hall

Sciences

Poster #	Name	Department	Time	Location
33	Alec Bayliff	Computer Science	9:00-11:45 am	Upper Atrium/Hall
34	Melissa Cambre	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
35	Sunghee Choi	Chemistry	9:00-11:45 am	Upper Atrium/Hall
36	Jack Crewse	Physics	9:00-11:45 am	Upper Atrium/Hall
37	Kelsey Crossen	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
38	Isaac DiGennaro	Chemistry	9:00-11:45 am	Upper Atrium/Hall
39	Corinna Edwards	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
40	Sonia Franz	Chemistry	9:00-11:45 am	Upper Atrium/Hall
41	Hannah Frye	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
42	Monica Gehrig	Mining and Nuclear Engineering	9:00-11:45 am	Upper Atrium/Hall
43	Elsie Greenwood	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
44	Rachel Hendrix	Chemistry	9:00-11:45 am	Upper Atrium/Hall
45	Jing Hua	Geosciences & Geological & Petroleum Engr.	9:00-11:45 am	Upper Atrium/Hall
46	Darian Johnson	Chemistry	9:00-11:45 am	Upper Atrium/Hall
47	Kristen Kelly	Chemistry	9:00-11:45 am	Upper Atrium/Hall
48	Seth Kitchen	Mathematics and Statistics	9:00-11:45 am	Upper Atrium/Hall
49	Stephanie Kroger	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
50	Alan Landers	Chemistry	9:00-11:45 am	Upper Atrium/Hall
51	Dana Lawson	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
52	Matt Liberson	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
53	Madison Mara	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
54	Joshua Miller	Chemistry	9:00-11:45 am	Upper Atrium/Hall
55	Nocona Sanders	Physics	9:00-11:45 am	Upper Atrium/Hall
56	Caitlin Siehr	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
57	Arthur Southard	Chemistry	9:00-11:45 am	Upper Atrium/Hall
58	Josey Stevens	Physics	9:00-11:45 am	Upper Atrium/Hall
59	Daniel Townzen	Chemistry	9:00-11:45 am	Upper Atrium/Hall
60	Shuoyu Yao	Geosciences & Geological & Petroleum Engr.	9:00-11:45 am	Upper Atrium/Hall
61	Travis Bueter Sean Harris	Computer Science	9:00-11:45 am	Upper Atrium/Hall
62	Sahitya Injamuri Shelby McNeil	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
63	Edna Armstrong Morgann Kleeschulte	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
64	Lauren Kroenung Luke Simon	Computer Science	9:00-11:45 am	Upper Atrium/Hall
65	Adam Evans El Hadji Ndiaye Ashley Painter	Computer Science	9:00-11:45 am	Upper Atrium/Hall
66	Ava Hughes Katlyn Lonergan	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall

Social Sciences

Poster #	Name	Department	Time	Location
67	Lindsey Carlson	Business and Information Technology	1:00-3:00 pm	Upper Atrium/Hall
68	Thomas Gremminger	Chemistry	1:00-3:00 pm	Upper Atrium/Hall
69	Emily Puleo	Chemistry	1:00-3:00 pm	Upper Atrium/Hall

Arts and Humanities

Poster Abstracts

Thomas Cooper

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

Funding Source: Opportunity for Undergraduate Research (OURE)
Center for Enterprise Resource Planning (ERP)
CIO Innovation Project
Accenture

Application of In-Memory Technology to Support Data Visualization in Big Data Context: ERP Simulation Case

The goal of this research is to utilize the in-memory technology in implementing a data warehouse using the SAP ERP Simulation data. Operational data currently play an important role in running the simulation as part of making critical decisions or adjusting company's strategy. Those data are getting bigger in size as the simulation progresses, so it is essential to have a more reliable data warehouse. The adoption of in-memory technology in data warehouse design and data modeling would not only solve the problem, but could provide numerous benefits. At the end of this research, major components in data warehouse are expected to be created including data mart schema (star schema), tables, and various views needed for data visualization. Furthermore, the data warehouse is expected to connect to and work seamlessly with other different visualization tools, such as SAP Predictive Analysis and SAP BusinessObjects Design Studio.

Thomas Cooper is a senior majoring in Information Science and Technology and minoring in Business, Enterprise Resource Planning, and Digital Supply Chain Management. Currently, Thomas works as a Research Assistant for the Center for Enterprise Resource Planning and as a Teaching Assistant for the Department of Business and Information Technology. He is also an active participant in Miner Challenge. After graduation in May, Thomas is joining Deloitte Consulting as a Business Technology Analyst.

Kelly Dunlap

Department: Arts, Languages, and Philosophy
Major: Chemical Engineering
Research Advisor(s): Audra Merfeld-Langston
Advisor's Department: Arts, Languages, and Philosophy

Funding Source: OURE

Translating Knowledge: Bees, Migraines, and More from Diderot and d'Alembert's *Encyclopédie*

The *Encylopédie* presented a compendium of knowledge of eighteenth-century France. Editors Denis Diderot and Jean-Baptiste le Rond d'Alembert spearheaded the effort to not only gather, but redefine knowledge in many disciplines. With more than 70,000 articles, the *Encyclopédie* was meant to "change the common way of thinking," according to Diderot.

More than two centuries later, another collaborative effort is underway: the translation into English of these articles. "The Encyclopedia of Diderot and d'Alembert Collaborative Translation Project" reflects many of Diderot and d'Alembert's aims and involves volunteer translators from around the world—students, scholars, and subject experts—coming together to form a new type of "society of men of letters" whose aim is to increase access to these to the *Encyclopédie*.

This poster will demonstrate some of the challenges of translating articles on topics as diverse as bees, migraines, Argonauts, and the Iron Age.

Kelly is a sophomore currently studying for her bachelor's degree in chemical engineering. She works in a chemical engineering laboratory on campus and is involved in other school organizations. She very much enjoyed working with Dr. Merfeld-Langston and looks forward to future OURE projects.

Rebekah Harrah

Department: English and Technical Communication
Major: English Education
Research Advisor(s): Daniel Reardon
Advisor's Department: English and Technical Communication

Funding Source: None

Reading Comprehension Strategies in Chemistry I

In this project, Rebekah studied exam questions for a college-level introduction to Chemistry course and aligned the questions with the Webb Depth of Knowledge (DOK) levels developed by Norman L. Webb of the Wisconsin Research Center. Webb's DOK is used by Missouri K-12 schools and the MO Department of Elementary and Secondary Education to chart learning outcomes. By aligning Chemistry I questions with Webb's DOK levels, the intellectual ability needed by students to correctly answer questions on each test were determined.

Chemistry I instructors may, therefore, use the alignment matrix created to assess course content rigor and student's intellectual progression. This alignment study can then potentially be used across the curriculum. Additionally, this alignment tool can assist instructors and administrators with student, course and program assessment. This alignment study can also potentially assess if Missouri state college readiness standards are transferable to courses during a student's first year in college.

Rebekah Harrah is a senior in English Education at Missouri University of Science and Technology. She is a member of the Baptist Student Union, Phi Kappa Phi, and Student Missouri State Teacher's Association. She enjoys reading, writing, photography, and sharing her passion for English with students.

Rachel Miller

Department: Electrical and Computer Engineering
Major: Computer Engineering
Research Advisor(s): Audra Merfeld-Langston
Advisor's Department: Arts, Languages, and Philosophy

Funding Source: None

Marcel Ayme's Wartime Journalism

World War II created an abundance of chaos in France for many people. The German Occupation meant rationing, sacrifices, and censorship. It was a particularly trying time for writers who relied on their publications for salary, because everything in France had to pass through German censorship. Like some other writers, Marcel Aymé chose to contribute to collaborationist newspapers for money to provide for his household. Although none of Aymé's articles indicate pro-German or anti-Semitism attitudes, Aymé was harshly criticised after the war for having published in collaborationist journals. Marcel Aymé used varying tactics in his wartime publications, including fantasy, fiction, sarcasm, and satire to challenge the French mindsets during the Occupation and as a call to action against their destructive habits, herd mentality, and hypocrisy.

Rachel Miller is a senior in Computer Engineering and graduates in December of 2015. She anticipates completing both a Mathematics and French minor. Her interests in the French Language led her to pursue French Research and she is the current President of French Club.

Engineering

Poster Abstracts

Amer Al-Lozi

Joint project with Amy Snyder

Department: Chemical and Biological Engineering
Major: Chemical Engineering (Biology emphasis)
Research Advisor(s): Daniel Forciniti
Advisor's Department: Chemical and Biological Engineering

Funding Source: None

The Fibrillation Kinetics of Human and Bovine Insulin Fragments and Tailored Peptides

Amyloid deposits are insoluble proteinaceous fibrils that are responsible for diseases such as Alzheimer's disease, type 2 diabetes and Parkinson's disease. These proteins form clumps, due to misfolding, known as amyloid plaques that interfere with neuronal function. This study was focused on the monitoring of the kinetics of the insoluble proteins, starting from oligomers to mature fibrils. An experimental design was made to determine the main factors that contribute to fibrillation. A Thioflavin T fluorescence assay was performed to determine the presence of amyloid deposits. Afterwards, FT-IR (Fourier Transform Infrared Spectroscopy) was used to determine concentration of amyloid deposits.

Amer Al-Lozi is a Chemical Engineering student researching under Dr. Forciniti.

Katherine Bartels

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

Funding Source: Opportunity for Undergraduate Research Experience

Green Roof Leachate Water Quality

Green roofs provide many environmental benefits such as peak flow attenuation, runoff reduction, and increased roof life expectancy. However, green roofs need media capable of sustaining vegetation, requiring nutrients (nitrogen and phosphorus). Water leaching from green roof media carries nutrients from the rooftop and enters nearby water bodies. In addition to nutrients in green roof runoff, organic carbon and suspended solids are a concern. Prolonged leaching over time leads to eutrophic and anoxic conditions, inhibiting aquatic life.

Three cylinders filled 3" deep with green roof media: GAF, Arkalyte, and one control of Thermoplastic Polyolefin (TPO), performed in triplicate, were used in an *in-vitro* study simulating 1-year 30-minute precipitation events for Rolla, Missouri. Results demonstrated a decrease in suspended solids, organic carbon and nutrients in green roof leachate over time for the media tested. Assessing water quality is imperative to fully understanding the implications of green roof implementation.

Katherine Bartels is a sophomore in environmental engineering and is also planning on minoring in sustainability. On campus she is a member of the Water Environment Federation, Society of Women Engineers, and Eco Miners Students for a Sustainable Future. Her interests include playing tennis, photography, and crocheting.

Kirstin Bier

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

The use of dynamic light scattering to follow the aggregation of bovine insulin

Insulin forms fibrils rich in beta sheets at extreme pHs and temperatures. The fibrils may be identified by a couple of fluorescence assays and visualized by SEM. Dynamic light scattering is a powerful technique that can be used to monitor in situ the change in size over time of the fibrils. Moreover, information may be obtained about the size distribution and about the shape of the aggregates. In this work, human and bovine insulin were incubated at pH 1.8 in the presence of NaCl and at a temperature of 60 C. The samples were periodically monitored using a dynamic light scattering instrument working at 800 nm and at an angle of 155^{o}. Deconvolution of the signals was done to identify the main populations and how they evolve over time. The results were compared with theoretical calculations. Differences between the insulins from both species are highlighted.

Kirstin Bier is a senior in biochemical engineering researching under Dr. Forciniti.

Carlson, Eric D

Department: Mining and Nuclear Engineering
Major: Nuclear Engineering
Research Advisor(s): Carlos Castano and Xin Liu
Advisor's Department: Mining and Nuclear Engineering

Funding Source: OURE Research Fund
New Professor Research Fund (Dr. Xin Liu)

Synergetic Health Effects of Radon with Electronic Cigarette Vapor

The two leading causes of lung cancer in the US are from smoke inhalation (particularly cigarette smoke) and the inhalation of radon gas. Already known from pre-existing research is that there is a synergetic effect between cigarette smoke and radon, causing an increased rate of radon being absorbed by the lungs. This research project deals with determining whether there is a similar synergetic effect between electronic cigarette vapor and radon gas. Results have found no statistically significant synergy between electronic cigarette vapor and radon, while by the same methodology finding a synergy between classical cigarette smoke and radon (62.12 cpm, s = 24.86 cmp).

Eric D. Carlson is a senior at Missouri S&T pursuing a BS in Nuclear Engineering. He is involved in several on-campus organizations, such as the American Nuclear Society (for which he is the Outreach Chair) and Women in Nuclear. He is actively performing undergraduate research for NE professors Dr. Xin Liu and Dr. Carlos Castano on the radiological health effects of e-cigs, as well as performing research on the effects of thermal aging on friction stir welded copper. He is as well the criticality subgroup lead for his senior design team, responsible for the design of the group's reactor, team TRUCKERS.

Devin Cornell

Department: Electrical and Computer Engineering
Major: Electrical Engineering
Research Advisor(s): Donald Wunsch
Advisor's Department: Electrical and Computer Engineering

Funding Source: OURE

Convolution and Wavelet Neural Networks Applied to EEG Brain-Control Interface

This project determined the feasibility of applying convolutional and wavelet neural networks to mental imagery classification based EEG Brain Control Interfaces. While statistical techniques like Common Spatial Patterns and Independent Component Analysis have been combined with neural network preprocessing successfully in the past, only recently have EEG researchers begun to take advantage of the flexibility that convolutional neural networks offer for feature extraction and classification. The popularity of these tools for problems such as image recognition has been increasing due to their ability to take advantage of multi-core GPU based computation. Wavelet neural networks offer the potential for reduced training data requirements while maintaining the flexibility for feature extraction and classification across multiple humans.

Devin Cornell is an undergraduate student in Electrical Engineering. He currently serves as the IEEE Region 5 Student Representative, and has served in several other positions in the IEEE Student Branch at Missouri S&T. He has worked on a microgravity flight research team studying methods of CPR in a space environment for three years and is currently involved with research on methods of using EEG as a Brain-Control Interface in the Missouri S&T Applied Computational Intelligence Laboratory. He has completed two summer internships at Sandia National Labs in Electrical Engineering R&D, and was an exchange student at Universiti Teknologi Petronas in Malaysia. After graduation, he hopes to pursue a PhD in Computational Sociology.

Mason Donnell

Department: Chemical and Biochemical Engineering
Major: Biochemical Engineering
Research Advisor(s): Sutapa Barua
Advisor's Department: Chemical and Biochemical Engineering

Funding Source: OURE Program-Missouri University of Science and Technology

Endotoxin Purification using Cationic Nanoparticles

Endotoxin is a lipopolysaccharide found on the membrane of gram-negative bacteria and is extremely toxic to humans. The endotoxin contamination has long been a serious problem in the lakes and rivers of Midwestern United States including Kansas, Missouri and Ohio. The water is difficult to disinfect once endotoxin is present. Although several methods such as filtration, irradiation, distillation and ethylene oxide treatments have been employed to remove endotoxin from contaminated water samples, the reduction efficiency is still low, and remains a challenge. We propose a cheap, reliable and simple method to remove endotoxin from water using cationic polymers that demonstrate high binding efficacies to negatively charged endotoxin *via* electrostatic interactions facilitating water purification. The intellectual merit of this proposal is the design and synthesis of polymers using an easy, one step and scalable synthesis method, and its efficiency in removing endotoxin.

Mason Donnell grew up in rural Willard, MO before he made his journey to Missouri S&T. Within his hometown, Mason was actively involved in his high school and community. Being the creator of the school's first science club and volunteering at the local hospital for three years, his love for science and innovation was pronounced. While looking for the right university, he saw Missouri S&T as a good challenge for his academic abilities and decided to pursue a degree in Biochemical Engineering. Mason's activity didn't stop at home, but continued here on campus and in the local community. He has taken leadership roles in organizations such as Society of Women Engineers, Spectrum, and volunteers at Rolla Publics Schools to tutor students. Mason Donnell is excited about the applications of his research, and hopes you enjoy his presentation.

Angela Grueninger

Department: Materials Science and Engineering
Major: Ceramic Engineering
Research Advisor(s): Richard Brow, Jaime George
Advisor's Department: Materials Science and Engineering

Funding Source: National Science Foundation (DMR-1207520)

Dissolution Rates of a Bio-active Borate Glass in Water

Borate glasses have been developed at Missouri S&T for biomedical applications, but less is known about how these glasses react in aqueous environments than more common silicate bioactive glasses. This research used the Single Pass Flow Through (SPFT) test to study the dissolution rates of a borate bioactive glass with a composition ofc53B_2O_3-20CaO-12K_2O-6Na_2O-5MgO-4P_2O_5 (wt%) in deionized water at °C. The SPFT flow rate was kept constant at 15 ml per day and the amount of glass particles in a reaction cell was varied by a factor of 20. Increasing sample size increases the concentration of ions in a reaction cell which in turn influences the dissolution rate. Solution samples were collected throughout the testing period and analyzed by inductively coupled plasma optical emission spectroscopy (ICP-OES) to determine the concentrations of boron, calcium, sodium, magnesium, phosphorus, and potassium in each sample at the different time periods. The smallest sample (0.05 grams) dissolved completely in 4 days whereas only 71% of the largest sample (1.00 grams) dissolved after 13 days. The slower dissolution rates for larger sample sizes are consistent with the greater ionic strengths of solutions measured by ICP-OES. The ICP-OES data was also used to calculate changes in average particle sizes which decreased with dissolution time for all experimental conditions.

Angela Grueninger is a senior in Ceramic Engineering. She has been working with Dr. Brow and his research group for one year assisting in and conducting various research experiments on bio-active glass and other glass applications. Angela looks forward to doing more research in the area of bio-active glass and working in this area upon her graduation from Missouri S&T in December 2015.

Joseph Hakanson

Department: Mechanical and Aerospace Engineering
Major: Aerospace Engineering
Research Advisor(s): Joshua Rovey
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: Missouri Space Grant

Plasma Theory for Undergraduate Education

These instructions will discuss both DC plasma theory as well as describe experiments that can be used for undergraduate instruction of DC plasma diagnostics. Experimental breakdown curves and Langmuir Probe curves will be obtained and studied with the use of a DC glow test article. Through the development of these experiments, the Missouri S&T Aerospace Plasma Laboratory (AP Lab) have experimentally achieved data that resembles theoretical models. From this, useful quantities can be obtained, such as breakdown voltage region (lower limit: p*d = 0.2 Torr*cm), electron temperature (Te = 3eV), etc. The results of the AP Lab have been included in this document for reference.

Joseph (Joe) Hakanson is an undergraduate junior dual majoring in Aerospace and Mechanical Engineering. He hopes to one day work for a company that produces space transportation vehicles. He enjoys attending church activities and rock climbing in his free time.

Nathan Hargrave

Department: Chemical & Biological Engineering
Major: Chemical Engineering
Research Advisor(s): Joontaek Park
Advisor's Department: Chemical and Biochemical Engineering

Funding Source: None

Computational Simulation of Cement Fluid in Rotational Flows

We simulated cement fluid in rotational flows of a rheometer. A commercial software COMSOL Multiphysics was used to describe the non-Newtonian behaviors of the cement fluid using a single phase yield stress model. We investigated the effects of the stirrer of the rheometer and the fluid properties (yield stress and plastic viscosity) on both the flow pattern and the total torque required at given rotational speeds. The efficient geometry of the stirrer at given fluid properties is discussed.

Nathan Hargrave is a senor in the chemical engineering department. He is graduating this Spring Semester.

Joshua Heath

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

Funding Source: None

Modeling of a New Waste-to-Energy Plant Design

Over the course of the last few decades, there has been an increasing demand for clean renewable energy. The typical sources that come to mind are hydroelectric, solar, wind, and biomass. Another potent source of power comes from burning municipal waste. Every year, billions of tons of waste are recycled or put into landfills and left to decompose. This same waste holds billions of joules of potential energy which could be used to power communities and industry. This project will focus on designing an Aspen model of waste to energy (WTE) plant designed by Tony Hughey of UKON which could prove to be far more efficient than current WTE plants available. The model will be used to analyze the energetics and the material balances of the plant and potentially be used to refine the design even more.

Joshua Heath is a junior majoring in Chemical Engineering with a Biochemical emphasis at the Missouri University of Science and Technology. He is interested in renewable energy along with agriculture and medicine. He currently does research under Dr. Smith by working in the biodiesel subgroup of his research. In addition, he is an Eagle Scout and a member of Omega Chi Epsilon, the chemical engineering honor society.

Justin Hoyt

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

Funding Source: National Science Foundation (NSF) REU

Multi-Coil Magneto-Inductive Communications for Wireless Sensor Networks

This paper presents the design and field tests of a Magneto-Inductive (MI) communication system for wireless sensor network applications. The proposed MI communication system utilizes three coils in a 3D spherical structure to improve the spatial sensitivity patterns and communication range. The sensor nodes equipped with a multi-coil MI system are designed to communicate at 125 kHz carrier frequency with 1 – 5 kbps data rate. Field tests in air and underwater demonstrate that the proposed sensor nodes can achieve reliable, low power communication at a range of 50 – 60 meters with a data rate up to 4 kbps.

Justin Hoyt is a senior undergraduate student in Electrical Engineering at the University of Missouri Science and Technology. He has been working as an undergraduate research assistant for Dr. Y. Rosa Zheng since April 2014. Through this research opportunity, he was given the distinguished task of presenting a paper related to this topic at the Underwater Communications Conference 2014 in Italy. Previously, he had a co-op with Ameren Missouri and has accepted an internship with Dynetics for the coming summer. He is currently a member of Tau Beta Pi, Eta Kappa Nu, and IEEE. After receiving his Bachelor's Degree, he plans to pursue his Master's Degree in Electrical Engineering.

Thomas Knight

Department: Aerospace Engineering
Major: Aerospace Engineering
Research Advisor(s): Lian Duan
Advisor's Department: Aerospace Engineering

Funding Source: Joint USAF & NASA Research Grant, OURE Supplies Stipend

Boundary-Layer Transition for High Speed, Hypersonic Flight:

This project is based on Dr. Duan's proposal, titled "Numerical Simulation of Freestream Acoustic Disturbances in Hypersonic Ground Facilities and Their Effect on Boundary Layer Transition".
Our research involves the effects of 'noise' created by the tunnel environment when subjected to hypersonic flow testing. This acoustic interference inhibits accurate prediction of boundary layer transition in the wind tunnel. Prediction of boundary-layer transition is a critical part of hypersonic vehicle design because of the large increase in surface heating associated with the transition during flight. Working closely with NASA and USAF supercomputers, Dr. Duan's team conducts large scale simulations of noise at the tunnel wall in order to gain further understanding and develop prediction algorithms for future wind tunnel testing and design. Advances in the prediction of wind tunnel noise will allow for the development of lighter, more aerodynamically efficient thermal protection systems for hypersonic vehicles.

Thomas Knight is a junior in the Aerospace Engineering Department at Missouri S&T, he has recently begun an undergraduate research position under the direction of Dr. Lian Duan. His work in the acoustic disturbance analysis for hypersonic flight involves constructing three dimensional visual simulations of transition in the laminar to turbulent flow transition. In addition to his undergraduate research he is the president of the S&T chapter of AIAA (American Institute of Aeronautics and Astronautics) and a member of S&T's unmanned mobile systems interest group.

Alyssa McCarthy

Department: Engineering Management and Systems Engineering
Major: Engineering Management
Research Advisor(s): Brian K. Smith
Advisor's Department: Engineering Management and Systems Engineering

Funding Source: O.U.R.E.

Therapy and Workload Analysis in Public Schools

Each year, hundreds of Speech Language Pathologists (SLPs) in the state of Missouri undergo the challenge of providing therapy to thousands of students with limited time constraints and varying degrees of therapy need. Demand exceeds supply in many school districts resulting in heavy caseloads or workloads for the SLPs. By presenting the analysis of an extensive survey, we can better discover the exact problems presented to therapists and some ways to solve these problems.

Alyssa McCarthy is a sophomore majoring in Engineering Management. She is involved in the Mars Rover Design Team, Joe's P.E.E.R.S. and is also a Student Ambassador in the Office of Admissions. She became involved with Dr. Smith's research due to the humanitarian nature of the project and her desire to help others.

Ashley Painter

Department: Computer Science
Major: Computer Science
Research Advisor(s): Sanjal Das, Debraj De
Advisor's Department: Computer Science

Funding Source: Smart Living Project

Using Pressure Sensors in Ubiquitous Sensing

Pressure sensors are a valuable tool in ubiquitous sensing able to detect everything from movement to mood to vital signs. Since fall of last year I have been researching several types of pressure sensors and various methods of integrating them into the every day. To begin with I attempted to use Velostat to create a mat that would sense the direction of someone walking over it. Most recently I have been working on using an RFDuino to send real time pressure data via Low Energy Bluetooth to a phone. So that pressure sensor data can be collected and analyzed in different locations without a wire connection between sensor and computer. I am also currently helping with the smart chair pressure sensors research and study for breathing rate detection which will benefit from the ability to send the data collected wirelessly.

Ashley is originally from Verona, Mo. She's interested in problems that involve integrating sensors and computing into the everyday environment whether that be homes, offices, or outdoors. She plans to work in the field of robotics when she graduates, preferably starting her own company. When not working on research or homework she fences with her husband Zach Kreuer.

Thomas Roth

Department: Electrical and Computer Engineering
Major: Electrical Engineering and Computer Engineering
Research Advisor(s): Kristen Donnell, Mohammad Ghasr, Reza Zoughi
Advisor's Department: Electrical and Computer Engineering

Funding Source: United States Army (A14A-T003 STTR Phase I)

Implementation of Robust Data Reduction Techniques to Rapid Millimeter Wave Imaging

Millimeter wave imaging systems have found use in many applications related to structural health monitoring in industries including space, aerospace, civil infrastructure, security, and many others. The focus of this project is to design an innovative millimeter wave imaging system capable of real-time and high-resolution (3D) imaging. To achieve the high resolution of these systems, synthetic aperture radar imaging algorithms are employed. This requires a substantial amount of data to be collected which can greatly increase the measurement time. This project will develop a novel millimeter wave (100 GHz or higher) imaging system capable of implementing data reduction techniques such as compressed sensing to reduce measurement time. This requires that portions of the imaging array be randomly and electronically activated. To support these capabilities, specialized antennas (including the imaging array) and supporting circuitry must be designed.

Thomas Roth is a senior pursuing degrees in electrical engineering and computer engineering. He conducts his research at the Applied Microwave Nondestructive Testing Laboratory. His research is aimed at applying electromagnetic theory to make important measurements for interdisciplinary problems. Thomas has also participated in two internships at Honeywell FM&T in Kansas City, where he worked in the RF Test Equipment and Radar Engineering departments. After graduation, Thomas will work at Sandia National Laboratories before beginning graduate school to continue his studies and research in electrical engineering.

Mitchell Smith

Department: Mining and Nuclear Engineering
Major: Nuclear Engineering
Research Advisor(s): Carlos H. Castaño
Advisor's Department: Mining and Nuclear Engineering

Funding Source: OURE

Friction Stir Welding

This project studies the effects of welding similar alloys together and comparing those welds to the original metals. Trial welds were made to understand the programming and mechanics of the friction-stir-weld machine. Welds were made on a single aluminum sample and then butt welds were created by welding two samples of aluminum together. For this project, one welding pin was used and the metal samples were kept to a thickness of 0.25 inches. The largest problem encountered was the separation of the metal samples when attempting a butt-joint weld. When the rotating bit was forced into the metal, the two pieces would separate if not clamped well enough. Welds were visually inspected to verify that they were properly made. Further tests, both destructive and non-destructive, are needed to quantify what is happening to the metal in the weld.

Mitchell Smith is a non-traditional student with a family of four. He graduated from Brownstown High School in Brownstown, Illinois in 2006. He previously studied automotive collision repair and refinishing at Lincoln College of Technology in Indianapolis, Indiana and graduated from there in 2007. He is in his second semester at MS&T after transferring from a community college in mid-central Illinois. He is earning a bachelor's degree in nuclear engineering. After graduation, he plans to pursue a master's degree in nuclear engineering with an emphasis on fluid flow and heat transfer.

Amy Snyder

Joint project with Amer Al-Lozi

Department: Chemical and Biological Engineering
Major: Chemical Engineering (Biology emphasis)
Research Advisor(s): Daniel Forciniti
Advisor's Department: Chemical and Biological Engineering

Funding Source: None

The Fibrillation Kinetics of Human and Bovine Insulin Fragments and Tailored Peptides

Amyloid deposits are insoluble proteinaceous fibrils that are responsible for diseases such as Alzheimer's disease, type 2 diabetes and Parkinson's disease. These proteins form clumps, due to misfolding, known as amyloid plaques that interfere with neuronal function. This study was focused on the monitoring of the kinetics of the insoluble proteins, starting from oligomers to mature fibrils. An experimental design was made to determine the main factors that contribute to fibrillation. A Thioflavin T fluorescence assay was performed to determine the presence of amyloid deposits. Afterwards, FT-IR (Fourier Transform Infrared Spectroscopy) was used to determine concentration of amyloid deposits.

Amy Snyder is a Chemical Engineering student researching under Dr. Forciniti.

Johnathan Sumpter

Department: Department of Mechanical and Aerospace Engineering
Major: Aerospace and Mechanical Engineering
Research Advisor(s): Joshua Rovey
Advisor's Department: Aerospace Engineering

Funding Source: Opportunities for Undergraduate Research Experience (OURE)

Plume Characterization of a Novel Electrically Ignited Solid Propellant

Electric propulsion is a current mainstay within the aerospace engineering field used for satellites and deep-space spacecraft. For a newly developed propellant, it is extremely important to understand and quantify the plasma plume behavior exhibited during thruster firing. This work researches and develops significant plasma diagnostics to characterize the plume of an innovative electrically ignited solid propellant. Diagnostics developed include a Triple Langmuir Probe, Faraday Cup, and Single Langmuir Probe Rake. These tools allow the quantification of chief plasma parameters such as electron number density and the electron-fluid temperature. Results from the application of these diagnostics will be presented to show successful plasma characterization.

Johnathan Sumpter is currently an undergraduate student double majoring in Aerospace and Mechanical Engineering at the Missouri University of Science and Technology. His research interests include: plasma applications within spacecraft, astrodynamics, and spacecraft/launch vehicle propulsion. Extra-curricular activities have included the Advanced Aero-Vehicle Group, M-SAT, and Sigma Gamma Tau. Past internship experience was gained at Space Exploration Technologies in Hawthorne, CA. Upon graduation in December 2015, John expects to attend graduate school internationally for spacecraft propulsion.

John Tegtmeyer

Department: Architectural Engineering
Major: Computer Science
Research Advisor(s): Stuart W. Baur
Advisor's Department: Architectural Engineering

Funding Source: OURE

Climate-Response Adaptive Control for Use with Natural Ventilation

A system for climate-response control has been researched, theorized, and is being implemented into the Missouri University of Science and Technology's 2009 Solar House. The system intends to control the window functionality and monitor the temperature, relative humidity, and mean radiant temperature. The information gathered from indoor and outdoor sensors determined that a correctly functioning adaptive control system would result in a 6-8% annual energy reduction. A model has been developed using Ecotect software to analyze the thermal performance of the house. The current system utilizes an exterior weather station (Netatmo), motorized windows controlled by a microcontroller (Arduino), and a touch screen interface programmed by 4D Systems software. A network of sensors has been setup in the house that feeds into a computer, which distributes commands to the microcontroller. Through these devices, windows can be raised and lowered, utilizing what would theoretically be the cool, low humid, natural ventilation.

John is a senior in Computer Science graduating in May of 2015. He was the Solar House Home Automation Team Lead during the 2013 competition to Irvine, California and is active in research in both the Architectural Engineering and Computer Science Departments at Missouri S&T.

Research Proposals

Poster Abstracts

Yahya Anwar Abu-Hijleh

Joint project with Therese Galbraith

Department: Aerospace Engineering
Major: Aerospace Engineering
Research Advisor(s): Lian Duan
Advisor's Department: Aerospace Engineering

Funding Source: Applied for OURE, Dr. Duan's grant

Micro Piezoelectric Windmill design and optimization

The project aims at developing a small micro piezoelectric windmill that aims to harvest natural energy efficiently in order to power small scale sensors and various other devices

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Yahya was born in california on january 19th 1995, and he was raised in Abu Dhabi, United Arab Emarites. He attended an international school and became fluent in both english and arabic. After that he got accepted into the Missouri University of Science and Technology where he is pursuing a bachelors degree in Aerospace Engineering. This is the first job/project yahya has ever worked on in relation to his major, and he is hoping that this will be his first step towards higher research and a brighter future.

Robert Block

Department: Chemistry
Major: Chemistry
Research Advisor(s): Klaus Woelk
Advisor's Department: Chemistry

Funding Source: Missouri S&T OURE Program, Missouri S&T Chemistry Department

Application of in vivo Nuclear Magnetic Resonance Toroid Cavity Detectors to Improve Quality and Availability of Medical Magnetic Resonance Imaging

Magnetic Resonance Imaging (MRI) is a common technique in medicine, providing accurate data for medical diagnosis. Though MRI is a powerful diagnostic tool, it has drawbacks, such as using pulsed magnetic gradients and radio-frequency pulses that interfere with electronic implants, like pacemakers, preventing many patients from undergoing MRI's. Toroid Cavity Detector Nuclear Magnetic Resonance Imaging (TCD-MRI) probes could be modified into acupuncture needle probes that in part could solve these problems. TCD-MRI probes utilize static magnetic field gradients, and radio-frequency pulses can be weaker allowing patients with implants to safely undergo medical MRI procedures. The acupuncture needle of the probe would be inserted directly into the tissue in question, increasing sensitivity and resolution. An acupuncture TCD-MRI probe was constructed and tested on tissue analogs to determine effectiveness. Acupuncture TCD-MRI probes are expected to provide doctors with MRI data for patients that normally could not undergo such procedures, improving public health.

Robert Block is a sophomore majoring in Chemistry with a Premedicine emphasis, and minoring in Biological Sciences. He has been involved with multiple research projects since he started working with Dr. Woelk's research group in June 2012, and helps manage and maintain the university's Nuclear Magnetic Resonance Spectrometers, as well as training researchers on the proper use and care of the spectrometers. Robert plans on attending medical school after graduating from MS&T.

Therese Galbraith

Joint Project with Yahya Abu Hijleh

Department: Mechanical and Aerospace Engineering
Major: Mechanical Engineering
Research Advisor(s): Lian Duan
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source:

Micro Piezoelectric Windmill

The research aims at developing a novel small-scale piezoelectric windmill that can efficiently harvest energy from natural wind flows by combining computer simulations, wind-tunnel experiments, and field tests. The windmill holds the potential for powering various wireless sensors, including but not limited to those widely used for monitoring structural health, border intrusion, weather conditions, food security. Existing small-scale piezoelectric windmill designs typically have complicated structural motion systems and low output electric power densities (power per PZT volume), and cannot be used for random wind flows coming from arbitrary direction. Our invention is designed to overcome the aforementioned drawbacks of existing windmills. It features simpler structures for the motion system and significantly higher power density compared with the state-of-the-art model in literature. It also has the advantage of being operational with fluid flows coming from arbitrary directions, ideal for harvesting energy from natural random flows.

Therese Galbraith is a Junior studying Mechanical Engineering at Missouri University of Science and Technology. She plans to co-op with Pella Corporation this summer and next semester working on developing Insynctive technology.

Sierra Herndon

Department: Chemistry Department
Major: Biological Sciences
Research Advisor(s): Klaus Woelk, Rex Gerald
Advisor's Department: Chemistry Department

Funding Source: Missouri S&T's Opportunities for Undergraduate Research Experiences (OURE) Program

Analysis of Cellular Secretion via NMR and Toroid Cavity Probes

Yeast cells, such as *Saccharomyces Cerevisiae,* provide information for medical diagnostics, genetics, biochemical and microbiological applications. Due to structural, functional, and genetic similarities with higher level eukaryotic and human cells, yeast cells are common model cells. Yeast cells (3-4 μm in size) and their enzyme secretions should offer spectroscopic and spatial signatures via NMR and MRI. Initial experiment designs required the central conductor of a toroid cavity device (TCD) probe to be dip-coated in agar, exposed to yeast cells, and placed in incubation. After subsequent incubation periods, the central conductor was placed in a cylindrical TCD modified for insertion of the central conductor. Analysis utilized high field NMR spectrometers, and provided spectral information about the growth medium, secretions, and cells. The development of these new spectroscopic and imaging techniques for studies of cell secretion could be translated to the analysis of cancer cells.

Sierra Herndon is an incoming Freshman studying Biological Sciences at the University of Missouri Science and Technology. She has been working with Dr. Woelk's and Dr. Gerald's research group since August 2014 with the Nuclear Magnetic Resonance spectrometers and electronics.

Matthew Howerton

Department: Chemical Engineering
Major: Chemical Engineering with Biochemical Engineering Emphasis
Research Advisor(s): David Westenberg and Katie Shannon
Advisor's Department: Biological Sciences

Funding Source: None

Utilizing Cas9 (Clustered Regularly Interspaced Short Palindromic Repeats Associated Protein 9) as a Genetic Engineering Method to Treat Pulmonary Epithelial Cells from Individuals with Cystic Fibrosis

Cystic fibrosis is a genetic disorder primarily caused by deletion of three nucleotides within the gene encoding for the ion channel protein CFTR which allows for the passage of chloride ions across epithelial cell membranes classified as delta-F508. Individuals with CF have shorter life expectancies predominantly due to complications in the respiratory system by the thinning of airway surface liquid (ASL) where chronic infections occur along with cardiopulmonary structural damage. Recently genetic engineering has leaped forward with the advancement of Cas9, a prokaryotic immune defense mechanism against bacteriophages, an RNA-guided DNA endonuclease enzyme. My project goal is to produce and embed CFTR within the membranes of cultured CF respiratory epithelial cells. This requires genetically engineering a guide RNA for Cas9 to target and remove delta-F508 while simultaneously inserting a functional CFTR DNA sequence. Optimistically, pulmonary CFTR expression by Cas9 will be used as a medical treatment for CF patients.

Matthew Howerton is a sophomore with the goal of entering graduate school to obtain his Ph.D. in Biomedical Engineering. His motivation to treat cystic fibrosis originates from the memory of his unforgettable and loving cousin, Rebecca Shively.

Samantha Huckuntod

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

Funding Source: none

Building Better Soybeans with *B. japonicum*

Glycine max, otherwise known as soybean, is the second largest crop in the United States in growing area and sales. It is second only to maize, which is deemed more hardy in drought affected environments than soybean. In order to have higher soybean yields in drought conditions, researchers have suggested manipulating transpiration rates, lateral root length, and nitrogen fixation. Of these, manipulation of soybean nitrogen fixation through its bacterial symbionts show much promise. Because the natural soybean symbionts are not equipped with the proper "tools" for high drought scenarios, synthetic biologists look towards halotolerant bacteria for solutions to low water concentrations. For future research, I propose equipping soybean symbionts with the means to produce ectoine through use of synthetic biology. Ectoine is a compatible solute that aids halotolerant and halophillic bacteria combat stresses in osmolarity. By producing ectoine, I predict soybean symbionts (*B. japonicum*) will become more drought tolerant.

Samantha Huckuntod is a junior in Biological Sciences. Her research interests include quorum sensing and signal transduction. She hopes to continue her research interests as a career in the future.

Tyler Knobbe

Department: Business and Information Technology
Major: IST
Research Advisor(s): Ralph Hanke
Advisor's Department: Business and Information Technology

Funding Source: None

Temporal Development of Interpersonal Trust in Dyadic Negotiations

Recent work shows that the relationship between trust and negotiation outcomes is integral to organizational functioning. However, the study of this relationship is largely incomplete, and strikingly little research considers how interpersonal trust develops within and across negotiation events. Particularly, little is known about how trust dynamics change over time as the focus of negotiations move between integrative and distributive outcomes. We present a model for the temporal development of trust in dyadic negotiations and propose further empirical exploration of the development of trust within and across multiple rounds of temporally separated negotiation events. Finally, we outline a method for further investigation into how the development or the disintegration of interpersonal trust affects negotiation outcomes, outcome satisfaction, and trust reciprocity. This work is aimed for submission in January 2016 to a special issue on Trust in Negotiations and Repeated Bargaining in the Journal of Trust Research.

Tyler Knobbe is a senior in Information Science & Technology. He will be joining Deloitte Technology Consulting as a Business Technology Analyst in July. His prior work experiences include an internship in software engineering with Boeing, a co-op in user experience with Monsanto, and an internship in new business development with PG Shocks. Tyler has been working with Dr. Hanke since the beginning of the Spring 2015 semester. In addition to his work with Dr. Hanke, Tyler serves as an assistant manager for the LITE lab and works as an independent web consultant.

Harriet Lumula

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

Funding Source: None

ANTIBIOTIC RESISTANT BACTERIA

Antibiotic resistance bacteria has emerged as an important determinant of outcome for patients all over the world. In addition, the escalating problem of antimicrobial resistance has substantially increased overall health care costs. This increase is a result of prolonged hospitalizations and convalescence associated with antibiotic treatment failures, the need to develop new antimicrobial agents, and the implementation of broader infection control and public health interventions aimed at curbing the spread of antibiotic-resistant pathogens. Quorum sensing is a system of stimulus and response used by bacteria to communicate with each other. This problem however, can be solved by designing a device or molecule that will lead to quorum quenching hence effective use of antibiotics to target the bacteria.

Miss Harriet Lumula is an International Student from Kenya currently pursuing her degree in Biological Sciences at Missouri University of Science and Technology. Her great interests in science and research led her to major in Biology. Her long term plans are to work in a research department and help solve current or arising human related health conditions. Currently she works under Dr. Matthew Thimgan using the model system Drosophila Melanogaster to research sleep biology.

Michelle Mild

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

Funding Source: OURE; Dr. Hogan

Origin of Quartz Clusters in the Rhyolite Dike at Medicine Park, Oklahoma

The Rhyolite Dike at Medicine Park contain quartz clusters which currently have two proposed models for their origin: Synneusis, which occurs while the quartz is crystallizing, or resorption which occurs while the crystals are dissolving. Each of these models predict a different scenario for the character of the quartz clusters. The Synneusis model requires quartz crystals to show clean, sharp boundaries between the shared faces of the crystals while the resorption model would likely show disordered clusters. In order to test these models, qualitative observations with a petrographic microscope using thin sections will be used to describe the quartz crystals. Cathodoluminescene (CL) on the scanning electron microscope (SEM) will also be used to determine zoning due to Ti variations. Lastly, the crystallographic orientations of these quartz crystals will be determined using both the EBSD on the SEM scope, and a universal stage with a petrographic microscope.

Michelle Mild is a senior at Missouri S&T and is working toward a B.S. in Geology and geophysics. She is expected to graduate in May 2016, at which point she'd like to go onto graduate school to pursue a Master's Degree. In her free time, Michelle likes to read, rollerblade, and play video games.

Connor Sprague

Department: Engineering Management & Systems Engineering
Major: Aerospace and Engineering Management
Research Advisor(s): Elizabeth Cudney, Susan Murray
Advisor's Department: Engineering Management and Systems Engineering

Funding Source: Coffee

Evaluation of Gamification Techniques in Social Media Environments

The purpose of this study is to evaluate and discern the attributes of a Social Media Website that lead to its overall User Satisfaction, utilizing Gamification Theory. This will be accomplished through the use of popular social media website *reddit.com* and Google Chrome Extension *Sylish* and some CSS coding. With the elimination of targeted aspects of the *reddit.com* main page theme, we can discern which "Game" aspects promote a higher user satisfaction within a sample pool of users. Users will be given a questionnaire upon completing a use of the modified theme that measures the user's satisfaction.

Connor Sprague is an undergraduate at Missouri University of Science and Technology as well as an Entrepreneur.

Tyler Sundell

Department: Geosciences and Geological and Petroleum Engineering
Major: Geology and Geophysics
Research Advisor(s): John Hogan, Alan Chapman
Advisor's Department: Geosciences and Geological and Petroleum Engineering

Funding Source: OURE

Confining the Date of the Decaturville Structure

The Decaturville Structure on Highway 5 in Missouri was established as a meteor impact site in 1979 by a USGS study funded by NASA. While this report di give an age range, the range was about 250 million years. By using Apatite-He thermochronology, which looks at the decay of U/Th into He inside the apatite minerals. The purpose of this study is to: find a new age range, add more evidence to the theory of Decaturville being an impact site, and to test the above method for dating craters. One of the features of an impact site is an uplifted block at the center, similar to rain drops hitting a still surface. This uplifted block was displaced nearly 300m at Decatureville and exposed tourmaline schist and pegmatitic granite. While these rocks where being displaced, the apatite minerals passed through their blocking temperature and started the clock by trapping He.

Tyler Sundell is a senior in Geology and Geophysics at Missouri S&T whom is interested in planetary geology. He attended High School in Waynesville Missouri, graduating in May 2012. His extracurricular activities include: volunteering at Truman Elementary's Outdoor Classroom, Rolla Apartments retirement home, hiking, and reading.

Sciences

Poster Abstracts

Edna Armstrong

Joint project with Morgann Kleeschulte

Department: Biological Sciences
Major: Biological Sciences
Research Advisor(s): Dev Niyogi
Advisor's Department: Biological Sciences

Funding Source: Opportunities for Undergraduate Research Experiences (OURE)

E. Coli Contamination of a Recreational Watershed in the Ozarks: Field Monitoring and a Mesocosm Experiment

Water quality of the Mill Creek recreation area has been a recent topic of concern with local residents and the Mark Twain National Forest in regard to potential water quality degradation caused by recreation along the trails used for hiking, cycling, and horseback riding. An *Escherichia coli* survey included water and suspended sediment samples throughout the watershed, and sediment samples from experimental mesocosms to measure long term viability. Results from the water sample survey indicated that the Natural Bridge site contained higher *E. coli* concentrations than its headwaters or downstream sites. Results from suspended sediment samples from this site indicate that *E. coli* concentration increase with recreational use. A rainfall event of about 2 cm created an increase of *E. coli* concentrations in the Mill Creek area. Results from the mesocosm study indicated that *E. coli* can survive outside of the gastrointestinal system in the sediment for over a month.

Edna Armstrong is a junior at Missouri University of Science and Technology. She is iGEM's treasurer and fundraising chair. She is schedule to graduate in the Fall of 2015. She plans to continue her education in medical school.

Alec Bayliff

Department: Electrical and Computer Engineering
Major: Computer Engineering
Research Advisor(s): Sajal Das
Advisor's Department: Computer Science

Funding Source: National Science Foundation

Biologically Inspired Wireless Sensor Networking

Gene regulatory networks (GRNs) involve the interactions of proteins in collections of DNA segments. Understanding GRNs has many applications in both biological and computational sciences, ranging from a potential cure for cancer to solving problems incurred by maintaining large scale sensor networks. The study of the GRNs has boomed over the past several years, as DNA sequencing technology has progressed, unlocking the potential of understanding the GRN by analyzing the regulatory process more in-depth. The objective of this research is to analyze the graph representations of E. coli and yeast GRNs for the purpose of creating similar scale-free networks able to be used for robust, efficient wireless sensor networking.

Alec Bayliff is a senior in computer engineering at the Missouri University of Science and Technology. He is the robotic arm team lead for the Telemetry and Controls division of the Missouri S&T Mars Rover Design Team. Alec also participates as an officer of the Institute of Electrical and Electronics Engineers as well as Miners in Space. Alec recently completed an REU with CReWMaN labs in the computer science department at Missouri S&T.

Travis Bueter

Joint project with Sean Harris

Department: Department of Computer Science
Major: Computer Science
Research Advisor(s): Daniel Tauritz
Advisor's Department: Department of Computer Science

Funding Source: Research contract from Sandia National Laboratories

Matching Hyper-heuristics and Genetic Programming

Modern society is faced with ever more complex problems, many of which can be formulated as generate-and-test optimization problems. General-purpose optimization algorithms are not well suited for real-world scenarios where many instances of the same problem class need to be repeatedly and efficiently solved, such as routing vehicles over highways with constantly changing traffic flows, because they are not targeted to a particular scenario. Hyper-heuristics automate the design of algorithms to create a custom algorithm for a particular scenario.

Hyper-heuristics typically employ Genetic Programming (GP) and this project has investigated the relationship between the choice of GP and performance in Hyper-heuristics. Results are presented demonstrating the existence of problems for which there is a statistically significant performance differential between the use of different types of GP. Also, some preliminary findings are presented on how to match the type of GP employed in a hyper-heuristic with the problem being addressed.

Travis is currently a senior in both Computer Science and Computer Engineering. He is an Undergraduate Research Assistant in the Natural Computation Laboratory. He will graduate May 2015 and begin working at Deere & Company as a Software Engineer Summer 2015.

Melissa Cambre

Department: Sciences and Computing
Major: Biological Sciences
Research Advisor(s): Robert Aronstam
Advisor's Department: Biological Sciences

Funding Source: Funded by the Missouri S&T cDNA Resource Center (www.cdna.org)

Subtype-specific Interactions of Oxotremorine-M with Muscarinic Acetylcholine Receptors

There are five subtypes of muscarinic acetylcholine receptors, the product of separate genes. M1, M3 and M5 muscarinic receptors respond to agonists by activating phospholipase C activity, thereby releasing inositol trisphosphate and releasing calcium from the endoplasmic reticulum. Most agonists have very similar affinities and efficacies for these receptors. In order to identify an agonist which might affect these receptors differentially, we evaluated the effect of oxotremorine-M (oxo-M) on calcium responses mediated by these receptors expressed in CHO cells. Cytosolic calcium levels were measured by ratiometric measurements of a calcium-sensitive fluorescent dye, fura-2, by single cell imaging. Threshold responses were determined for each receptor subtype. M1 were 10 fold more sensitive to oxo-M than M5 receptors, and M5 receptors were 10 times more sensitive than M3 receptors. These findings demonstrate that oxo-M is the most receptor-selective agonist identified to date, and suggests that it may be possible to selectively stimulate muscarinic responses associated with specific physiological responses with appropriate pharmacological agents.

Melissa Cambre is a Senior Biological Sciences major. She intends on getting a Masters in Toxicology after she graduates.

Sunghee Briana Choi

Department: Chemistry
Major: Chemistry
Research Advisor(s): Yinfa Ma
Advisor's Department: Chemistry

Funding Source: OURE- Opportunities for Undergraduate Research Experiences

A Rapid, High-Performance Capillary Electrophoresis Method for Urinary Modified Nucleosides for Early Prostate Cancer Detection

This project will expand on a recent paper (Jiang, Ma, 2009) in which a novel method (High-Performance Capillary Electrophoresis) was developed that separated and quantified nucleosides with high resolution. HPCE was used to target ten nucleosides previously implicated in prostate cancer (adenosine, xanthosine, guanosine, N_2-methylguanosine, uridine, inosine, cytidine, 5-methylcytidine, 5-methyluridine, and 5-bromouridine). Various conditions in determining the appropriate buffer and concentration, separation voltage, and pH was identified to produce optimum separation of the analytes. Following the method development, reproducibility and sensitivity will be validated to substantiate any essential data relating to prostate cancer. Once optimal resolution and separation of the ten analytes are achieve, ~20 urine samples will be analyzed with the newly developed HPCE method.

Briana Choi is in her third year at Missouri S&T majoring in Chemistry with a Pre-Med emphasis. She was interested in getting a hands-on, learning experience with a research field she found interest in and get into research that could help her future career. She joined Dr. Ma's research group last year and is hoping to further her learning experience at Missouri S&T.

Jack Crewse

Department: Physics
Major: Physics
Research Advisor(s): Yew San Hor
Advisor's Department: Physics

Funding Source: None

Chromium Doping of the Topological Insulator Antimony Telluride

Topological insulators (TI's) are recently discovered quantum states of matter characterized by an insulating bulk paired with conducting surface states such that electronic conduction occurs only across edges and surfaces. In these experiments we investigate the effect of chromium doping on the TI antimony telluride. The interesting applications involved with TI's rely on the presence of the anomalous quantum hall effect (AQHE) in the sample. Previous experiments demonstrate that chromium-doping of antimony telluride can produce this effect in thin film samples. Here, we expand on the previous experiments to a.) determine if the effect can be produced in bulk samples and b.) more precisely determine the effects of the doping on the host material. Results indicated that the AQHE could likely be observed with further tuning of doping ratios; our samples exhibiting an anomalous hall effect that is "nearly quantized".

Jack Crewse is a senior undergraduate in physics who has worked with Dr. Hor and his team since 2013.

Kelsey Crossen

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

Funding Source: OURE

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 a 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 its function 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, preliminary data shows that this is not the case. Deletion of the RGCt domain is lethal to yeast cells, so its function is essential. Identifying binding partners for this domain will help determine its function. To do this, we planned to 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 senior 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 heavily involved in S&T's International Genetically Engineered Machine (iGEM) Team: she was the 2014 secretary and is currently a lab instructor for iGEM's Lab Training Program. She is also a member of Phi Sigma Biological Sciences Honors Fraternity and and works for the Bio Sci department as a grader. Kelsey also conducted research during summer 2014 at Washington University in St. Louis through the Amgen Scholars program. She will be graduating from S&T this May and plans to enter graduate school in the fall for a doctorate in microbiology.

Isaac DiGennaro

Department: Chemistry
Major: Chemistry
Research Advisor(s): Rex Gerald
Advisor's Department: Chemistry

Funding Source: Physical Chemistry Lab

Simple Method to Measure Ion Association in Strong Electrolyte Solutions

Debye-Hückel-Onsager theory (DHO) models molar conductivity as a function of ion concentration correcting for ionic effects. By Arrhenius theory, the ratio of predicted and measured molar conductivities shows the degree of association of the ions in solution. This experiment used deviation in molar conductivity from that predicted by DHO to calculate the dissociation constant for cupric sulfate solutions with concentrations < 0.01 M. A potential was applied to a cell with a DC power supply, and the potential difference was measured for various concentrations of electrolyte to obtain molar conductivities to compare to those predicted by DHO. Data showed a linear decrease in molar conductivity and dissociation with the square root of concentration. Near complete dissociation (91.6%) was observed at .3 mM ± 0.057%, decreasing to 57% at 6.9 mM ± 0.011%. Using a simple and inexpensive apparatus it was possible to demonstrate complex solution properties.

Isaac DiGennaro is a senior in chemistry, aiming to graduate in December 2015. The research presented here was performed as part of Chem 3429 Physical Chemistry Lab, as directed by Dr. Rex Gerald – NMR Technician. Isaac is interested in the overlap of biological and chemical processes, and hopes to pursue graduate studies to further his understanding of the field by participation in nutrition research.

Corinna Edwards

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

Funding Source: Funded by the Missouri S&T cDNA Resource Center (www.cdna.org).

Endoplasmic Reticulum Calcium Measurements using Intracellular Fluorescent Dyes

Many cellular processes are regulated by changes in the concentration of calcium in the cytosol. The immediate source of cytosolic calcium is release from the endoplasmic reticulum (ER), while depletion of ER calcium leads to a secondary entry of calcium from the extracellular medium (this delayed influx is termed store-operated calcium entry; SOCE). We sought to validate an assay for ER calcium in CHO cells expressing human M1 muscarinic receptors. We loaded the cells with a Mag-fura-2 calcium sensitive dye. The large cytosolic signal was then depleted using a weak detergent (saponin). This revealed a large ER calcium concentration that could be quantified using a ratiometric single cell analysis. Our study found that pretreating the cells with 2.1 μM thapsigargin caused a 10-60% decrease in ER calcium content, further emphasizing that we successfully measured ER calcium with this method.

Corinna Edwards is a senior in Biological Sciences from Lebanon, TN. She has been doing research for Dr. Aronstam in the Neurobiology Lab since she transferred to Missouri S&T in the spring of 2014. She plans to graduate in December of 2015 and to pursue a master's degree in nursing.

Adam Evans

Department: Computer Science
Major: Computer Science
Research Advisor(s): Debraj De, Sajal Das
Advisor's Department: Computer Science

Funding Source: NSF Research Experience for Undergraduates

Indoor Localization with Bluetooth Beacons

The importance of the problem of Indoor Localization has grown tremendously as smartphones have become more ubiquitous and robots more intelligent. Solutions to this problem will greatly help users with location-based services indoors, and allow robots to become more autonomous in movement and navigation. Previous attempts have used a multitude of strategies, including signal fingerprinting, online and offline simultaneous localization and mapping (SLAM), and estimating user location change using phone sensors, commonly the accelerometer, gyroscope, and compass. In our research, we have: (i) characterized various properties of communication between Bluetooth beacons and smartphones (including effects of orientation, distance and environmental condition); (ii) performed user daily activity behavior analysis with Bluetooth beacons (placed in key locations around the Computer Science building); (iii) applied a variation of signal mapping to the collected data for location estimation.

Adam Evans is a sophomore majoring in Computer Science at Missouri S&T. He has been programming since eighth grade and is a member of ACM SIG-Competition on campus.

Sonia Franz

Department: Chemistry
Major: Chemistry
Research Advisor(s): Rex Gerald
Advisor's Department: Chemistry

Funding Source: None

Maximum Recollected of Random Sequences in Humans, Utilizing a Microcontroller with Light and Sound Sequences

Immediate memory recall is assessed through a two part test, sequences of lights and then sequences of lights and sound. Sound is added to each color of light to determine if it has an effect on the maximum sequence recalled. For the test population as a whole, the addition of sound to each color of light did not increase the maximum sequence of lights recalled. While audio cues do help long term retention, they do not appear to be ass affective for immediate memory recall. The average maximum sequence of light and of light and sound recalled was six, resulting in a 14% error. The experimental data supports the theory of 7 ± 2 as the maximum average sequence recalled.

Sonia Franz is senior at Missouri S&T majoring in Chemistry. She was able to perform this study in her physical chemistry laboratory.

Hannah Frye

Department: Chemistry
Major: B. S. Chemistry, Biochemistry Emphasis
Research Advisor(s): Robert Aronstam
Advisor's Department: Biological Sciences

Funding Source: OURE, cDNA Resource Center

The Dependence of M2 Muscarinic Receptor Signaling on the Formation of a Disulfide Bridge

Muscarinic receptors are G-protein coupled acetylcholine receptors made up of seven transmembrane loops. On the M2 receptor, the second and the third extracellular domain are linked by two cysteine residues forming an intramolecular disulfide bridge. Little is known of the disulfide bridge's role in receptor signaling and this project aims to explore how elimination of the disulfide bridge affects M2 receptor signaling. First this was performed through co-transfection of a modified M2 receptor (hM2 aaC96A mutant) where alanine replaces cysteine residues with a chimeric G protein ($G_{\alpha qi}$) that binds the M2 receptor but produces a measurable calcium signal (atypical of M2 signaling). Second, cells with a wild-type M2 receptor were dosed with dithiothreitol (DTT) which reduces disulfide bonds. Elimination of the disulfide bridge through point mutation disrupts receptor function by reducing or eliminating receptor signaling, whereas signal was maintained with chemical reduction of the disulfide bridge with DTT.

Hannah Frye is a senior in Chemistry with a Biochemistry emphasis and a minor in Biological Sciences. She has worked in Dr. Robert Aronstam's lab for over three years and has presented her work at both the 2013 American Society for Cell Biology Meeting in New Orleans and the 2013 Undergraduate Research Conference, at which she won third place in the Sciences Poster Division. Upon graduation she will be continuing her education towards a doctorate in Neuroscience. On the Missouri S&T campus she is involved with the International Genetically Engineered Machines Team, the National Residence Hall Honorary, and Alpha Chi Sigma.

Monica Gehrig

Department: Mining and Nuclear Department
Major: Nuclear Engineering
Research Advisor(s): Carlos Castaño
Advisor's Department: Mining and Nuclear Department

Funding Source: Department funds, OURE Stipend

Making a Plasma Laboratory for Missouri S&T Students

Plasma is a quasi-neutral gas consisting of both charged and neutral particles that exhibit collective behavior. This unique fluid can be used in many applications, including but not limited to space propulsion, gaseous electronics, and fusion projects. One method to produce plasma is to apply a high voltage to a gas in a vacuum chamber. If the plasma is produced in a transparent vacuum chamber, it can be analyzed with the assistance of concepts that are offered at the Missouri University of Science and Technology in the Plasma I course available annually.

This project aims to create a counterpart to the Plasma I course; it provides an introduction to physical interaction and understanding of the fluid. This is being tested via the use of placed electrodes applying variable voltage to Argon at variable pressures. Results will be graphed with respect to pressure and voltage holding electrode distance constant.

Monica Gehrig is a sophomore in Missouri S&T's nuclear department. She is interested in pursuing a future in research in development of nuclear energy, which inspired the research she is presenting in this conference.

Elsie Greenwood

Joint project with Rachel Connell

Department: Biological Sciences
Major: Biological Sciences
Research Advisor(s): 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 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.

Elsie is a sophomore in the biological sciences department. Her, Rachel Connell, and Dr. Westenberg work on glass biomaterial. Elsie plans to attend nursing school after graduation. She is actively involved in SAAC. She is also a member of the Missouri S&T Women's Basketball Team.

Sean Harris

Joint project with Travis Bueter

Department: Department of Computer Science
Major: Computer Science
Research Advisor(s): Daniel Tauritz
Advisor's Department: Computer Science

Funding Source: OURE & research contract from Los Alamos National Laboratory

Matching Hyper-heuristics and Genetic Programming

Modern society is faced with ever more complex problems, many of which can be formulated as generate-and-test optimization problems. General-purpose optimization algorithms are not well suited for real-world scenarios where many instances of the same problem class need to be repeatedly and efficiently solved, such as routing vehicles over highways with constantly changing traffic flows, because they are not targeted to a particular scenario. Hyper-heuristics automate the design of algorithms to create a custom algorithm for a particular scenario.

Hyper-heuristics typically employ Genetic Programming (GP) and this project has investigated the relationship between the choice of GP and performance in Hyper-heuristics. Results are presented demonstrating the existence of problems for which there is a statistically significant performance differential between the use of different types of GP. Also, some preliminary findings are presented on how to match the type of GP employed in a hyper-heuristic with the problem being addressed.

Sean is currently a senior in both Computer Science and Applied Mathematics. He is an Undergraduate Research Assistant in the Natural Computation Laboratory. He will be starting his Ph.D. in Computer Science at S&T effective Fall Semester 2015.

Rachel Hendrix

Department: Chemistry
Major: Chemistry
Research Advisor(s): Rex Gerald III
Advisor's Department: Chemistry

Funding Source: None

Variability of MEGA Brands U.S.A. Gold #2 Pencil Lead Resistivity

The purpose of this study was to determine if a relationship exists between resistivity and quality control methods of MEGA Brands Inc. for USA Gold #2 pencils. Voltage of eight sample pencils was initially determined by using a direct current electric circuit and 5 increasing distances along the length of the pencil. Resistance was calculated and graphed against the distance measurements. Linear graphs were produced from this data, with R-squared values between 0.9855 and 1.000, which indicated the data had a high goodness of fit to the linear model. The resistivity values were determined to be between 3.1485x10-4 and 4.8729x10-4Ω·m, with an average of 3.88x10-4 Ω·m ± 2.7805%. The resistivity of each sample pencil was very similar compared the other sample pencils tested which indicates a positive relationship is present with quality control of MEGA Brands Inc. MEGA Brands Inc. can potentially use resistivity determination of pencil core lead to analyze their composition and ensure that the pencils they make are similar and of the same high standard MEGA Brands Inc. expects.

Rachel Hendrix is a junior Chemistry major, Biological Sciences minor. Rachel is from St. Louis, MO and expects to graduate in December of 2016. She is an active club member of Women as Leaders and Habitat for Humanity.

Jing Hua

Department: Geosciences and geological and petroleum engineering
Major: Geology & Geophysics
Research Advisor(s): Alan D. Chapman
Advisor's Department: Geosciences and geological and petroleum engineering

Funding Source: Dr. Chapman's startup funding

Detrital zircon geochronology of Paleozoic to Late Cretaceous siliciclastic strata of the Ozark Dome, Southern Missouri

Siliciclastic strata exposed in the Ozark Dome provide Late Cambrian to Late Cretaceous snapshots of an evolving paleogeography and regional to far-field tectonic events. Detrital zircon geochronology in the Ozark Dome reflects an evolving depositional environment involving two significant provenance shifts:

1) a Cambrian–Ordovician shift from local basement- to Superior Province-derived detritus, attributed to the rise in base level associated with the Sauk transgression and/or the inversion of Proterozoic basins perched on Superior Province and midcontinent rift basement at the onset of the Taconic orogeny.
2) an Ordovician–Devonian shift to detritus sourced from the emerging Appalachian Mountains to the east. Westward transport of clastic sediment originating from the Appalachian highlands continued sporadically until at least Late Cretaceous time.

Additionally, the originally assigned "Pennsylvanian sink fill" in the Ordovician Gasconade Dolomite is reinterpreted here as Ordovician in age on the basis of petrographic and detrital zircon age similarities between this unit and the St. Peter Sandstone and cross cutting relationship with the surrounding strata.

Jing Hua is a senior student who is interested in detrital zircon geochronology. She won the Spreng research award last semester which supports her to attend 2015 GSA section meeting. Jing's abstract has just been accepted by GSA and is published in GSA Abstracts with Programs Vol. 47, No. 1.

Ava Hughes

Department: Biological Sciences
Major: Biological Sciences and Geology and Geophysics
Research Advisor(s): Melanie Morilme
Advisor's Department: Biological Sciences

Funding Source: NASA-EPSCoR

Isolation and Characterization of Novel Halo-Acidophilic Microorganisms Present in Hypersaline Lakes from Western Australia

The microbial communities in the acidic hypersaline environments in Lake Magic, Lake Gounter, Lake Gneiss, and Lake Aerodrome in Western Australia are currently unknown. These lakes are of interest due to their pH and salt concentrations, recorded to be between 1.4-3.5 pH and 13-32% salt concentration. The lakes are also ephemeral, which effects the salt concentration based on how much water is in the lake. With these extreme conditions, it is likely that novel species of microorganisms will be isolated from the sediments taken from the lakes. There have been microorganisms found to be acidophilic and halo-tolerant but not halo-acidophilic. Retrieved isolates are expected to be in this new category extremophiles, leading us to a new understanding of extremophiles while pushing the envelope of where life can thrive.

Ava Hughes is a junior in Biological Sciences and has been performing research in Dr. Mormile's lab since August 2013. She is involved in Residential Life, being a Resident Assistant and Senior Resident Assistant. She is also the secretary/treasurer of National Residence Hall Honorary and a member of Phi Sigma, a biological honor society. She plans on going to graduate school and getting a doctorate in environmental sciences and conservation.

Sahitya Injamuri

Joint project with Shelby McNeil

Department: Biological Sciences
Major: Biological Sciences
Research Advisor(s): Matthew Thimgan, Gayla Olbricht
Advisor's Department: Biological Sciences, Mathematics and Statistics

Funding Source: None

Sleep Responses to Starvation and Sleep Deprivation in Drosophila melanogaster

Sleep deprivation and starvation both produce increased waking in *Drosophila* during the period of treatment, but both produced a different post-treatment response. After flies undergo sleep deprivation an increase in sleep is observed compared to sleep baseline. However, in flies that experience starvation conditions sleep tends to return to the pretreatment level. We will use mathematical modeling of sleep to determine any subtle differences in sleep patterns pre and post treatment. Males and females of three different genotypes will be used. These mutant genotypes include *tim 01*, *cyc 01*, which lack a circadian rhythm. The wild type, *CS Skeath*, will be used as a control. These flies will be placed in complete darkness for 48 hours and then are sleep deprived by either sleep deprivation or starvation for 12 hours. Post treatment sleep is measured for 48 hours, and analysis is done to detect a difference.

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

Darian Johnson

Department: Chemistry Department
Major: Chemical Engineering
Research Advisor(s): Amitava Choudhury
Advisor's Department: Chemistry

Funding Source: Choudhury-startup package

New Lithium borate composition for solid state Li-ion battery electrolyte

In the area of Li-ion battery lot of research activities are focused towards building an all solid-state battery. This means that a highly Li-ion conducting solid is required to play the role of a solid electrolyte. This has been a major barrier towards the realization of a high efficiency all solid-state Li-ion battery. For this reason we focused our research to discover new materials that can potentially play the role of solid state Li-electrolyte. In this direction we have synthesized a new Li-borate composition and solved the structure using single-crystal X-ray diffraction. The compound, $Li_3B_5O_8(OH)_2$, crystallizes in the orthorhombic space group of $Pnc2_1$ and have the following cell parameters: a = 8.499(5), b = 26.520(10), c = 9.308(3) α = β = γ = 90°, Vol = 2097.96. The structure of this compound is built with BO_3 and BO_4 polyhedra and forms a layered topology. The Li-ions are located in between the layers. In this presentation we will focus on the synthesis, structure, powder X-ray diffraction and IR-spectroscopic characterization of the new composition.

Darian graduared from Center High School in 2012. She is a current junior in the Chemical Engineering department and hopes to obtain a minor in Chemistry. Aside from doing research, she also works as a Success Coach in the Student Success Center and as a MASH Mentor for Math 1120. Darian is very passionate about food and wants to one day work as a product developer, creating new food products.

Kirsten Kelly

Department: Chemistry
Major: Chemistry Pre-med
Research Advisor(s): Rex Gerald
Advisor's Department: Chemistry

Funding Source: None

Flashing Light Patterns and the Resulting Effect on Heart Rate

Heart rate was thought to increase while watching a series of flashing lights. Fourteen different peoples' heart rates were individually observed in after being given a Vernier Labpro heart rate monitor. Their heart rates were observed and recorded while the people stared at several different light patterns. The light patterns included a yellow flashing pattern, a red flashing pattern, and an alternating red and yellow flashing pattern. The flashing patterns were controlled by a BS2 Stamp microcontroller. A statistical analysis was done comparing the heart rates within each flashing light pattern set. The data suggests that focusing on a singular task decreased heart rate.

Kirsten Kelly is a Junior in the Chemistry Pre-med program at Missouri University of Science and Technology. She will be graduating in May 2016.

Seth Kitchen

Department: Mechanical and Aerospace Engineering
Major: Aerospace Engineering
Research Advisor(s): Matt Insall
Advisor's Department: Mathematics and Statistics

Funding Source: None

On the Existence of Perfect Cuboids

An Euler brick is a rectangular prism with integer sides and integer face diagonals. A perfect cuboid is an Euler brick with an integer space diagonal. An infinite amount of Euler bricks exist, but before this research, it was an unanswered whether a perfect cuboid existed. We show an exponential and logarithmic equation which could be used to prove the existence or nonexistence of a perfect cuboid (PC). We then continue the computer search for a PC and finish a proof of nonexistence.

Seth Kitchen is a first year sophomore at Missouri S&T. He was born and raised in Saint Peters, Missouri and graduated from Fort Zumwalt South High School in 2014. At Missouri University of Science and Technology, Seth is involved with the cross country and track teams, AAVG design team, business incubator, and is an advanced mathematics tutor for Project MEGSSS. He is currently managing the thermocouple bay for the electronics subgroup of the campus rocket team. He has also worked on a high school senior research project, The Determination of an Effective Parafoil for Human-Powered Bicycle Aircraft, with a mentor from Boeing. Seth was captain of the Missouri team at the US Department of Energy National Science Bowl in 2014.

Morgann Kleeschulte

Joint project with Edna Armstrong

Department: Biological Sciences
Major: Biological Sciences
Research Advisor(s): Dev Niyogi
Advisor's Department: Biological Sciences

Funding Source: Opportunities for Undergraduate Research Experiences (OURE)

E. Coli Contamination of a Recreational Watershed in the Ozarks: Field Monitoring and a Mesocosm Experiment

Water quality of the Mill Creek recreation area has been a recent topic of concern with local residents and the Mark Twain National Forest in regard to potential water quality degradation caused by recreation along the trails used for hiking, cycling, and horseback riding. An *Escherichia coli* survey included water and suspended sediment samples throughout the watershed, and sediment samples from experimental mesocosms to measure long term viability. Results from the water sample survey indicated that the Natural Bridge site contained higher *E. coli* concentrations than its headwaters or downstream sites. Results from suspended sediment samples from this site indicate that *E. coli* concentration increase with recreational use. A rainfall event of about 2 cm created an increase of *E. coli* concentrations in the Mill Creek area. Results from the mesocosm study indicated that *E. coli* can survive outside of the gastrointestinal system in the sediment for over a month.

Morgann Kleeschulte is a senior at Missouri University of Science and Technology set to graduate in May 2015. Morgann plans to continue her education with a completion of a master's degree in biological science. Living in a rural area for her entire life Morgann has developed a respect for the environment and its streams, springs, river-ways, and other natural wonders. She plans on using her degree in biological science to work outdoors to conduct research on forestry and hydrology topics. Recreational activities include: fishing, archery hunting, trapping, and outdoor sports.

Lauren Kroenung

Joint project with Luke Simon

Department: Department of Computer Science
Major: Computer Science
Research Advisor(s): Daniel Tauritz
Advisor's Department: Computer Science

Funding Source: OURE & research contract from Sandia National Laboratories

Visualization for hyper-heuristics

Modern society is faced with ever more complex problems, many of which can be formulated as generate-and-test optimization problems. General-purpose optimization algorithms are not well suited for real-world scenarios where many instances of the same problem class need to be repeatedly and efficiently solved, such as routing vehicles over highways with constantly changing traffic flows, because they are not targeted to a particular scenario. Hyper-heuristics automate the design of algorithms to create a custom algorithm for a particular scenario. While such automated design has great advantages, it can often be hard to apply to real-world problems and difficult to understand exactly how a design was derived and why it should be trusted. This project aims to address these issues of usability and understandability, by creating an easy-to-use graphical user interface for hyper-heuristics to support practitioners, as well as easy-to-understand scientific visualization of the produced automated designs for practitioners and researchers.

Lauren is currently a senior in Computer Science, an Undergraduate Research Assistant in the Natural Computation Laboratory, the Publicity Officer for the Missouri S&T Student Chapter of ACM SIG-Security, and the Webmaster for the Missouri S&T Student Chapter of ACM-W. She will be graduating from Missouri University of Science and Technology in May 2015.

Stephanie Kroger

Department: Biological Sciences
Major: Chemical Engineering
Research Advisor(s): Katie Shannon

Advisor's Department: Biological Sciences

Transfer of Bacterial Genome into Yeast

The transfer of a genome from bacteria to budding yeast enables genomic engineering for those bacteria that are difficult to culture in the lab and lack tools and protocols for genetic manipulation. Budding yeast *Saccharomyces cerevisiae* provide the advantage of simple and effective genetic tools for transfer and manipulation of DNA. This project's goal is to transfer the genome from the *Halanaerobium hydrogeniformans* into a yeast cell in order to allow for genetic manipulation of the bacterial genome. For this to be possible, a plasmid needs to be created that contains a sequence that allows for the transfer of the DNA into bacteria, a selectable marker for yeast, a yeast centromere sequence, and a yeast replication origin. Then, the plasmid can be added to the bacteria, and integrated into its genome. If the plasmid is successfully incorporated into the bacterial genome, the resulting genome can be transferred to yeast cells. This will later allow for engineering of the bacterial genome using mutations.

Stephanie Kroger is a currently a sophomore at Missouri University of Science and Technology. She has always been interested in biology, and after taking a Cell Biology class in the fall, she joined Dr. Shannon's lab in the spring semester of 2015. She has learned a lot in the short time that she has been working in the lab, and enjoys learning more each day. She will continue her education and follow her love of biology to earn a degree in Biomedical Engineering. She hopes to be a part of the forefront to develop new technologies and advancements in the medical field.

Alan Landers

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

Funding Source: DOE project # DE-FG02-08ER46518

Sustainable Harvesting of Solar Energy via Photoelectrochemical Water Splitting

Photoelectrochemical water splitting represents a promising method for providing clean, renewable energy. Effective cells for photoelectrochemical water oxidation pair low band gap semiconductors with efficient oxygen evolution catalysts. In this study, earth-abundant transition metal catalysts are electrochemically synthesized and compared based on their catalytic activity toward the oxygen evolution reaction. These low overpotential catalysts are paired with a metal-semiconductor (MS) junction to create a photoelectrochemical cell. The MS Schottky barrier, created by electrodeposition of gold on the surface of silicon, protects the silicon from being corroded by the basic electrolyte without significantly attenuating the light reaching the semiconductor. Combining the transition metal oxide catalyst with the MS junction created an electrochemical cell in series with a photovoltaic cell which allows independent analysis and optimization of each layer. This creates a stable, efficient n-Si/Au/catalyst cell for photoelectrochemical water splitting.

Alan is a senior studying chemistry from Gainesville, Missouri. Alan has been an undergraduate research assistant in the Materials Research Center since 2013. After receiving his Bachelor's Degree, Alan plans to attend graduate school to continue his studies in chemistry.

Dana Lawson

Department: Biological Sciences
Major: Biological Sciences
Research Advisor(s): Robert Aronstam
Advisor's Department: Biological Sciences

Funding Source: OURE program

Modulation of Allosteric Regulation of Muscarinic Signaling by Chemical Modification of the Receptor

M1 muscarinic acetylcholine receptors are G protein-coupled receptors involved with functions such as learning and memory. Learning about these receptors is beneficial so that pathways involved with diseases such as Alzheimer's can be better understood. Deep within the receptor is the active site where acetylcholine binds, while the allosteric site is above it. Between two loops on this allosteric site is a disulfide bond. Using CHO cells expressing M1 receptors, we explored the role that this disulfide bond has on the acetylcholine response by breaking it with dithiothreitol (DTT). The acetylcholine response (which triggers a Ca^{2+} release from the endoplasmic reticulum into the cytosol) of this experimental group was compared to that of unmodified cells. This response was measured as a function of cytosolic Ca^{2+} concentrations using a Ca^{2+} imaging assay. In preliminary experiments, DTT increased this response, suggesting that the disulfide bond may block access to the active site.

Dana has enjoyed her research experience working in Dr. Aronstam's Laboratory of Neurobiology, and is excited to participate in this year's Undergraduate Research Conference. Her training in calcium imaging, CHO cell culture, and the Ca^{2+} signaling pathway has been very rewarding. She also enjoys participating in the Phi Sigma Biological Honor Society as well as the Alpha Chi Sigma Professional Chemistry Fraternity. She will be graduating in December 2015 with minors in Chemistry and Psychology, and plans to pursue a career in biological research.

Matthew Liberson

Department: Biological Sciences
Major: Biological Science with Chemistry Minor
Research Advisor(s): Dr. Katie Shannon
Advisor's Department: Biological Science

Funding Source: Missouri University of Science and Technology

Cell Cycle Regulation

The major reason for the undertaking of this research is to understand how cytokinesis is regulated by the cell cycle. The interesting thing is that it only occurs after mitosis, but how is that so well-controlled and maintained? For this segment of research, we focused on a specific budding yeast gene called slk19. This gene is a component of spindle dynamics and the FEAR (Cdc **F**ourteen **E**arly **A**naphase **R**elease) pathway. We looked at a mutated version of slk19, and compared the timing of actin ring formation in mutants compared to control yeast cells. Based on preliminary results, we found that cells with the mutated version prematurely undergo the process of cytokinesis. This kind of research is helpful because it helps us understand the cell cycle of the human body.

Matt Liberson is a junior at Missouri University of Science and Technology. His current major is biological science, and his interest in that field led him to pursue research in the biological sciences. He is an active member of Alpha Chi Sigma Honor Fraternity and Phi Sigma Biological Honor Society.

Katlyn Lonergan

Department: Biological Sciences
Major: Geology and Geophysics, Biological Sciences (Minor)
Research Advisor(s): Melanie Mormile
Advisor's Department: Biological Sciences

Funding Source: NASA-EPSCoR

Isolation and Characterization of Novel Halo-Acidophilic Microorganisms Present in Hypersaline Lakes from Western Australia

The microbial communities in the acidic hypersaline environments in Lake Magic, Lake Gounter, Lake Gneiss, and Lake Aerodrome in Western Australia are currently unknown. These lakes are of interest due to their pH and salt concentrations, recorded to be between 1.4-3.5 pH and 13-32% salt concentration. Halite and gypsum crystals form as evaporates as a crustal layer on the sediment. With these extreme conditions, it is likely that novel species of microorganisms will be isolated. There have been microorganisms found to be acidophilic and halo-tolerant but not halo-acidophilic. Retrieved isolates will be isolated from halite and in some cases gypsum crystals from the various lakes mentioned above and are expected to be in this new category extremophiles. This will lead us to a new understanding of extremophiles while pushing the envelope of where life can thrive.

Katlyn Lonergan is a senior in Geology and Geophysics pursuing a minor in Biological Sciences. She is taking on her first research project with Dr. Mormile to incorporate biology and geology as one science. Currently she serves as President of AAPG/C.L. Dake Geological Society and a member of Sigma Gamma Epsilon, an honors geological society. After graduation, Katlyn plans to pursue a Master's degree in Geomicrobiology with a focus on environmental protection.

Madison Mara

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

Funding Source: None

Phenotype Comparison of two Different IQG1 Mutant Alleles

During cytokinesis, many mutations can arise that affect formation of the actomyosin ring. Iqg1 is a protein that is required for assembly and contraction of the actomyosin ring in budding yeast. This project is designed to compare the phenotypes of two separate IQG1 mutant alleles to examine any problems that arise during cytokinesis. In this research, a mutant (3A) that has three serines dephosphorylated via CDC14 mutated to alanine is compared to a mutant (4A) that has three serines and one threonine mutated to alanine. The goal in doing this is to compare cytokinesis defects in the 3A mutant and the 4A mutant and see if threonine has a unique function. To confirm mutant phenotype, morphological analysis will be performed via microscopy and immunofluorescence to indicate if actin ring formation has been disrupted.

Madison Mara is a freshman majoring in biological sciences and plans to enter medical school at the end of her undergrad. She has been working in Dr.Shannon's cytokinesis lab since June 2014 and this represents her first project. She is currently the Community Chair on the Executive Committee for Scrubs and a member of Helix.

Shelby McNeil

Joint project with Sahitya Injamuri

Department: Mathematics and Statistics
Major: Applied Mathematics, Emphasis in Statistics
Research Advisor(s): Gayla Olbricht, Matthew Thimgan
Advisor's Department: Mathematics and Statistics, Biological Sciences

Funding Source: None

Sleep Responses to Starvation and Sleep Deprivation in Drosophila Melanogaster

Sleep deprivation and starvation both produce increased waking in *Drosophila* during the period of treatment, but both produce a different post-treatment response. After flies undergo sleep deprivation, an increase in sleep is observed compared to sleep baseline. However, in flies that experience starvation, sleep tends to return to the pretreatment level. We will use mathematical modeling of sleep to determine any subtle differences in sleep patterns pre and post treatment. Males and females of three difference genotypes will be used. The mutant genotypes include tim 01, cyc 01, which lack a circadian rhythm. The wild type, CS Skeath, will be used as a control. These flies will be placed in complete darkness for 48 hours and then are sleep deprived by either sleep deprivation or starvation for 12 hours. Post treatment sleep is measured for 48 hours, and statistical analysis is done to detect differences from baseline.

Shelby McNeil is a senior in Applied Mathematics with an Emphasis in Statistics at Missouri University of Science and Technology. She is the Peer Involvement Advisor for Missouri S&T's alternative spring break program, Miner Challenge. She has also been on the dance team for her four years in attendance. After graduation, Shelby plans on attending graduate school for Statistics.

Joshua Miller

Department: Chemistry
Major: Chemistry
Research Advisor(s): Rex Gerald II
Advisor's Department: Chemistry

Funding Source: Self-Funded

The Effects of Increasing the Number of Stimuli Events per Second on Human Visual and Auditory Perception

In this experiment, the abilities of human visual and auditory perception were studied with the use of a Parallax Basic Stamp 2 Microcontroller by measuring 30 test subject's correct responses when counting the number of flashes of a LED, and/or the number of beeps from a piezoelectric speaker that occur within one second. It was found that humans more accurately perceive sounds and light stimuli simultaneously that then when individually exposed to 1-10 stimuli within the one second time period. The overall average percentage of correct answers for the combined visual and perception test was 61.3% while the subjects of visual perception test gave 60.3% of the correct answers. The least perceived stimulus was the auditory stimulus which resulted in an average 57.4% of the correct responses. A majority of the test subjects were able to perceive the number of events per second with a deviation of plus or minus 1 from the correct number of event per second. Test subjects could perceive 5 events per second with more than 50% accuracy for all perception tests. A highly negative correlation was found between correct responses and the number of stimuli per second.

Joshua Miller, a Rolla native, is a senior a Missouri S&T majoring in chemistry. His studies in chemistry have had an emphasis in biochemistry. Joshua's interest in biochemical pathways has also led to research in the physiology of perception pathways. Joshua plans to continue his research in biochemistry after graduation in May of 2015.

El Hadji Malick Ndiaye

Joint project with Adam Evans, Ashley Painter

Department: Computer Science
Major: Computer Science
Research Advisor(s): Sajal Das
Advisor's Department: Computer Science

Funding Source: National Science Foundation (NSF)

Smart Living: Cyber-Human Smart Environments Design

Smart environments are systems in which both the environment and the user are in contact through several means, such as sensors, wearables, and mobile devices among others. The goal is to establish an environment in which, all the changes and conditions are not only based on the user's preferences, but they also adapt and learn about the user as he/ she uses such system. Among several others, some of the main aspects of this project are the collection of the heterogeneous sensor data, storage, computation for intelligence, and visualization. Using a new open-source project called the Global Sensor Network (GSN), we aim to collect data from live sensors that are deployed in the user's environment. Using such data and combining it with the powerful tool that is GSN, it is possible to harness information about the surroundings and also identify more efficient ways to constantly make the environment smarter.

Malick is a junior in computer Science and is currently working as an REU at the Crewman Lab at Missouri S&T. The Smart Living Project, which he is currently working on, is part of the National Science Foundation initiative for Undergraduate Research. He is working under the supervision of Dr. Sajal Das and Dr. Debraj De.

Ashley Painter

Department: Computer Science
Major: Computer Science
Research Advisor(s): Sanjal Das, Debraj De
Advisor's Department: Computer Science

Funding Source: Smart Living Project

Using Pressure Sensors in Ubiquitous Sensing

Pressure sensors are a valuable tool in ubiquitous sensing able to detect everything from movement to mood to vital signs. Since fall of last year I have been researching several types of pressure sensors and various methods of integrating them into the every day. To begin with I attempted to use Velostat to create a mat that would sense the direction of someone walking over it. Most recently I have been working on using an RFDuino to send real time pressure data via Low Energy Bluetooth to a phone. So that pressure sensor data can be collected and analyzed in different locations without a wire connection between sensor and computer. I am also currently helping with the smart chair pressure sensors research and study for breathing rate detection which will benefit from the ability to send the data collected wirelessly.

Ashley is originally from Verona, Mo. She's interested in problems that involve integrating sensors and computing into the everyday environment whether that be homes, offices, or outdoors. She plans to work in the field of robotics when she graduates, preferably starting her own company. When not working on research or homework she fences with her husband Zach Kreuer.

Nocona Sanders

Department: Physics
Major: Physics & Applied Mathematics
Research Advisor(s): Julia Medvedeva
Advisor's Department: Physics

Funding Source: None

Role of stoichiometry and chemical composition in the properties of amorphous indium-based oxides

The main objective of this research is to understand how oxygen stoichiometry and chemical composition affect the structural and electrical properties of amorphous transparent indium-based oxides, obtained via first-principles molecular dynamics liquid quench approach. A detailed comparison of the structural properties (distribution of the metal-O and metal-metal distances, bond angles, and coordination) of crystalline oxides of post-transition metals and several amorphous In-X-O structures where 20% of indium atoms are replaced by specific metal X (Ga, Sc, La, or Y) and the number of oxygen atoms is adjusted to maintain or vary the stoichiometry and density in the sample was performed. In particular, in multicomponent amorphous In-X-O, the presence of X may alter the number of octahedrally coordinated In atoms and result in the appearance structural defects responsible for carrier generation. The results may help explain the observed intriguing behavior in the carrier concentration as a function of the substitution level in amorphous In-X-O.

Nocona Sanders is currently a junior in physics and applied math. He has plans of going to graduate school where he will pursue a PhD in condensed matter physics.

Caitlin Siehr

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

Funding Source: Opportunities for Undergraduate Research Experience

How do mutations affecting Iqg1 phosphorylation alter protein-protein interactions?

Iqg1 is a protein involved in cytokinesis in budding yeast. It is required for the assembly and contraction of the actin ring, which then divides the two cells. In previous studies, Iqg1 has been shown to interact with a myosin light chain, Mlc1, and the formin proteins Bni1 and Bnr1. The overall objective of my research is to determine how mutations affecting Iqg1 phosphorylation alter protein-protein interactions. My research began last semester as I prepared yeast extracts from three different strains; wild type, a mutant that prevents Iqg1 phosphorylation, and a mutant that mimics Iqg1 phosphorylation. I used these extracts to perform GST-pull down experiments and conducted western blots to determine the results. I found that the mutant IQG1 alleles do not affect the binding of Iqg1 to Mlc1. I am currently performing similar experiments with formin fragments. The eukaryotic yeast cell is very similar to human cells, including the conserved interaction between human IQGAP1 and formin proteins. By studying cytokinesis in yeast cells, the results could yield a better understanding of cytokinesis in other cells.

Caitlin Siehr is a freshman at Missouri University of Science and Technology pursuing a Bachelor's of Science in Biological Sciences. She is a member of iGEM, SCRUBS, and Helix. She also works at a local grocery store in her free time. Upon graduating, she plans to continue her education in graduate school.

Luke Simon

Joint project with Lauren Kroenung

Department: Department of Computer Science
Major: Computer Science
Research Advisor(s): Daniel Tauritz
Advisor's Department: Computer Science

Funding Source: OURE & research contract from Sandia National Laboratories

Visualization for hyper-heuristics

Modern society is faced with ever more complex problems, many of which can be formulated as generate-and-test optimization problems. General-purpose optimization algorithms are not well suited for real-world scenarios where many instances of the same problem class need to be repeatedly and efficiently solved, such as routing vehicles over highways with constantly changing traffic flows, because they are not targeted to a particular scenario. Hyper-heuristics automate the design of algorithms to create a custom algorithm for a particular scenario. While such automated design has great advantages, it can often be hard to apply to real-world problems and difficult to understand exactly how a design was derived and why it should be trusted. This project aims to address these issues of usability and understandability, by creating an easy-to-use graphical user interface for hyper-heuristics to support practitioners, as well as easy-to-understand scientific visualization of the produced automated designs for practitioners and researchers.

Luke is currently a senior in Computer Science, an Undergraduate Research Assistant in the Natural Computation Laboratory, and heavily involved with Christian Campus Fellowship. When he's not doing things related to Computer Science, he enjoys traveling, the outdoors, and combining the two with photography. Luke will be pursuing a Master of Science in Human-Computer Interaction at Carnegie Mellon University starting in Fall Semester 2015 followed by a full time position at Sandia National Laboratories through the Critical Skills Master's Program.

Arthur Southard

Department: Chemistry
Major: Chemistry
Research Advisor(s): Rex Gerald
Advisor's Department: Chemistry

Funding Source: None

Effects of Temperature on Resistivity of Copper Sulfate Solutions

This experiment used a direct current circuit to send potential through a copper II sulfate solution. The temperature of the solution was changed to five different temperatures, one of them being room temperature as a control. The other temperatures used were 5°C, 11°C, 54°C, and 84°C. This temperature variation gave a look into the linear trend of copper II sulfate solutions dependence on temperature. From the data obtained in this experiment it was determined that there is a relationship between temperature and resistivity. The DC circuit set up varied current (I) and held voltage at 14.9A. This experiment could be improved so that the exact temperature is known and by adding multiple trials.

Arthur Southard is senior in the Chemistry Department emphasizing in pre-med. He currently has been interning at Brewer Science since May 2013.

Josey Stevens

Department: Physics
Major: Physics
Research Advisor(s): Peet Hickman
Advisor's Department: Physics- Lehigh University

Funding Source: NSF

Rotationally inelastic collisions of He and Ar with NaK: Theory and Experiment

Rotationally inelastic collisions of NaK ($A\ ^1\Sigma^+$) molecules with He and Ar have been studied. In the experiments at Lehigh, we use a pump-probe scheme (the probe is scanned over transitions to the $3\ ^1\Pi$ state) with either polarization labeling (PL) or laser-induced fluorescence (LIF) spectroscopy. The pump laser excites a particular ro-vibrational level $A\ ^1\Sigma^+$ (v, J). We observe strong direct lines corresponding to transitions from the (v, J) level pumped, and weak satellite lines corresponding to transitions from collisionally-populated levels (v, $J'=J + \Delta J$). The ratios of satellite to direct line intensities in LIF and PL yield information about population and orientation transfer. A strong propensity for $\Delta J=$ even transitions is observed for both He and Ar perturbs. Theoretical calculations are also underway for collisions in both the $A\ ^1\Sigma^+$ and $X\ ^1\Sigma^+$ states. For He-NaK we have calculated potential surfaces using GAMESS and carried out coupled channel scattering calculations of transfer of population, orientation, and alignment.

Josey Stevens is a junior in Physics at the Missouri University of Science and Technology. He has done research on Quantum Phase Transitions of Highly Disordered Solid State Systems and Atom Molecule Collision Theory. He is the president of the local Society of Physics Student and will be working at Los Alamos National Labs in the Summer of 2015.

Daniel Townzen

Department: Chemistry
Major: Chemistry with Pre-Medical Emphasis
Research Advisor(s): Gerald Rex
Advisor's Department: Chemistry

Funding Source: Self-Funded

Effect of Temperature and Cost on Pencil Resistivity

In this experiment resistivities of five different brands of pencils were measured using a circuit and a digital multimeter. These resistivities were obtained in order to assess whether or not the cost of a pencil can be used to estimate its resistivity and graphite composition. Experimental data suggests that there is little to no correlation between the cost of different brands of pencils and their resistivities even if resistivities did vary between brands. Temperature was also analyzed in order to assess whether or not it had an effect on the pencil's resistivity. One pencil was kept at 294.26K, 334.15K, and 77.2K. Resistivity was calculated from resistance gathered through the direct use of a digital multimeter. Resistivity did weakly negatively correlate to the pencil's resistivity.

Daniel Townzen is a Junior Chemistry Pre-Medical emphasis Student.

Shuoyu Yao

Department: Geosciences and Geological and Petroleum Engineering
Major: Geology and Geophysics
Research Advisor(s): Stephen S. Gao
Advisor's Department: Geosciences and Geological and Petroleum Engineering

Funding Source: Missouri University of Science and Technology

Crustal Anisotropy beneath South-Central Tibet revealed by P-to-S conversions from the Moho

We investigate crustal anisotropy along the Hi-CLIMB seismic array, an approximately N-S oriented broadband seismic profile of about 800-km long along the longitudinal line of 85° E, by using P-to-S converted phases from the Moho. Using the approach of fitting moveout times of the Pms arrivals on the receiver-functions under the assumption of a flat and sharp Moho, the fast polarization orientation and splitting time at 148 stations have been measured. Our results suggest eastward crustal extrusion occurring in central Tibet and southward crustal flow in southern Tibet. Based on the significant changes of the splitting parameters, we propose the following key elements regarding the Himalayan-Tibetan collision configuration: (1) the onset of mid-crustal low velocity zone at north of the Main Boundary Thrust; (2) the potential termination of the Indian upper crust at the Main Central Thrust; (3) the northern limit of the Indian crust at approximate 31° N in central Lhasa Terrain.

Shuoyu Yao grew up in Shandong province, China. Before transferring to Missouri University of Science and Technology in 2013 fall semester, he had studied at China University of Petroleum (East China) for his freshman and sophomore years. He is currently a graduating senior student majoring in Geology and Geophysics. Shuoyu Yao has conducted his undergraduate research under the supervision of Dr. Stephen Gao for several semesters since 2014 spring. His research focuses on the geodynamics in Tibetan Plateau by using seismological approaches. After graduation, he will continue his graduate education at New Mexico Institute of Mining and *Technology. Shuoyu Yao's career goal is to become a geophysical expert serving in petroleum industry.*

Social Sciences

Poster Abstracts

Lindsey Carlson

Department: Business and Information Technology
Major: Information Science and Technology
Research Advisor(s): Fiona Fui-Hoon Nah
Advisor's Department: Business and Information Technology

Funding Source: None

User Interfaces in a Collaborative Online Shopping Context

Collaborative e-commerce is a fairly new line of research with many very useful applications in the online shopping marketplace. To determine what users expect from a collaborative online shopping experience, a study will be conducted to gather these users' requirements. A short demographics questionnaire and an interview script have been created, and the script will be followed as I interview potential users. The interviewees will then be asked to articulate the features and functionality they expect from a collaborative e-commerce interface. They will be encouraged to illustrate their ideas about the interface using paper prototyping methods including drawings. These gathered requirements will lead to further research and possibly the development of a new user interface for collaborative online shopping.

Lindsey Carlson is a junior in Information Science in Technology from Republic, Missouri. She is minoring in Business as well as Human-Computer Interaction. Lindsey works at the Laboratory for Information Technology Evaluation as a research assistant and the Missouri S&T Writing Center as a tutor. She is also involved in Phi Eta Sigma, an honor society, and the S&T Climbing Club. Her hobbies include camping, climbing, canoeing, and photography. She hopes to work in user experience after she graduates.

Thomas Gremminger

Department: Chemistry
Major: Chemistry
Research Advisor(s): Rex Gerald
Advisor's Department: Chemistry

Funding Source: No funding

The Effect of Sound Sequence Length on Short Term Memory Retention

Humans have trying to unlock the mysteries of the brain for thousands of years. One aspect of the brain, memory, is a very hot research topic. According to current research there are three types of memory, short term memory, long term memory, and working memory. This experiment attempts to examine the effect of increasing auditory sequence length on short term memory retention.

To do this a sound sequence was played of long and short beeps. This sound sequence varied from one to nine beeps. A participant was tasked with remembered and repeating the correct sequence of beeps. Results showed that as sound sequence length increased the number of successful remembrances stayed steady from 1-5 beeps then decreased from 5-8 beeps with a small increase at nine beeps. Results also showed that the average amount of auditory objects that could be remembered was 6 ± 1 objects.

Thomas Gremminger is a third year Chemistry student at Missouri S&T. Thomas would like to go into the food science field after he receives his chemistry degree. In his spare time Thomas works for the L.E.A.D program as a Chemistry and Physics Peer Learning Assistant.

Emily Puleo

Department: Chemistry
Major: Chemistry – Biochemistry emphasis
Research Advisor(s): Rex Gerald
Advisor's Department: Chemistry

Funding Source: None

A microcontroller-facilitated complex span task for examining the effects of background music on working memory capacity

Participants memorized sequences of colors while listening to background music varying in likeability, type of lyrics, and degree of stimulation. The sequences were randomized and transmitted using a microcontroller with LEDs. It was found that songs that are liked achieved the lowest average serial recall percent accuracy (57.9% ± 6), and songs that participants disliked achieved a higher average (64.4% ± 9) than did those toward which they were apathetic (62.1% ± 11). For three pop songs, a song with English lyrics produced the worst results (57.5% ± 20) while music with no lyrics produced the best (64.6% ± 10). A song in Mandarin achieved intermediate results of 62.7% ± 11. While listening to stimulating music, people achieved an only 59.8% ± 5 in comparison to 65.7% ± 7 for relaxing music. Ongoing efforts to increase the sample size from 14 are expected to improve statistical significance.

Emily Puleo is a senior at Missouri University of Science and Technology, working on a major in Chemistry with a Biochemistry emphasis and a minor in Communication Studies. She has served as Vice President and President of the iGEM design team and currently works as a tutor at the Writing Center. In her free time, she provides companionship to hospice patients and also volunteers as a pet therapy handler. After graduating in May 2015, Emily plans on pursuing a medical degree.

OURE Fellows Final Oral Presentations

Name	Department	Time	Location
Adrian Black	Biological Sciences	1:00-1:20 pm	Gasconade Room
Rachel Connell	Biological Sciences	1:20-1:40 pm	Gasconade Room
Valentine Hollingsworth	Chemistry	1:40-2:00 pm	Gasconade Room
Sean Howell	Business and Information Technology	2:00-2:20 pm	Gasconade Room
Montana Long	Business and Information Technology	2:20-2:40 pm	Gasconade Room
Anthony Bitar Caleb Trecazzi	Materials Science and Engineering	2:40-3:00 pm	Gasconade Room

OURE Fellows Proposal Oral Applicants

Name	Department	Time	Location
Natalie Holste	Biological Sciences	1:00-1:30 pm	Meramec Room
Nicholas O'Gorman	Electrical and Computer Engineering	1:30-2:00 pm	Meramec Room

OURE Fellows Program

Oral Abstracts

Final

Anthony Bitar

Joint project with Caleb Trecazzi

Department: Biological Sciences
Major: Pre-medical Biology
Research Advisor(s): Delbert Day, Mohamed Rahaman
Advisor's Department: Materials Science and Engineering

Funding Source: OURE Fellows

Angiogenic Effects of Variant Lengths of Borate Glass Scaffolds Prepared via Robocasting

Borate-based 13-93B3 bioactive glass scaffolds have been used successfully in clinical trials to treat chronic wounds and have been shown to be both safe and effective in promoting angiogenesis both in vivo and in vitro. The objective of this research was to determine the degree of capillary and blood vessel growth present within bioactive glass scaffolds between five and twenty millimeters in length when constructed via robocasting. The scaffolds were implanted subcutaneously in rats using aseptic surgery techniques. The reacted bioactive scaffolds were extracted and prepared for histological analysis through paraffin embedding and tissue sectioning followed by hematoxylin and eosin (H&E) and periodic acid-Schiff (PAS) staining for sample evaluation.

Anthony Bitar is a sophomore who is pursuing a Pre-Medical Bachelor's degree in the Biological Sciences department, and minoring in Chemistry and Biomedical Engineering. He has worked under the supervision of Dr. Mohamed Rahaman and Dr. Yue-Wern Huang since February 2014. Anthony has worked in making Hydroxyapatite hollow microscpheres as well as bioactive glass scaffolds via robocasting. He has learned cell culturing techniques which enables him to conduct in vitro experiments. Additionally, Anthony has experience in conducting in vivo studies related to bone regeneration and angiogenesis using Sprague Dawley laboratory rats. He also gained the skills of performing histological analysis of implants.

Adrian Black

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

Funding Source: Missouri S&T OURE Fellows 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 efficiently in the lab, but in real world application the plants do not nodulate efficiently. 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 efficiently.

Adrian is from Corydon, IA and is a senior majoring in Biological Sciences at Missouri S&T. She will graduate in May 2015, and will be attending the School of Clinical Laboratory Science at Mercy Hospital in St. Louis. She 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.

Rachel Connell

Department: Biological Sciences
Major: Biological Sciences
Research Advisor(s): 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 senior in the biological sciences department. Her and Dr. Westenberg work 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 is on the University's basketball team, and she also is involved in the community by volunteer coaching Upward Basketball, refereeing basketball, and tutoring homeschooled children.

Valentine Hollingsworth

Department: Chemical and Biochemical Engineering
Major: Chemical Engineering
Research Advisor(s): Prem Lobo
Advisor's Department: Environmental Research Center

Funding Source: Missouri S&T Center of Excellence for Aerospace Particulate Emissions Reduction Research, Missouri S&T Cloud and Aerosol Science Laboratory

A Comparative Study of Volatile Particulate Matter Removal Efficiency: Catalytic versus Thermal Denuding of Aerosols

The Missouri S&T Thermodenuder was compared to the Catalytic Instruments CS08 Catalytic Stripper. The performance of both devices was analyzed using a propane soot aerosol generated by a laminar flame burner (miniCAST). High organic carbon and high elemental carbon flow settings on the miniCAST gave effectiveness over two regimes of aerosol hydrophobicity. Soot samples were coated with vaporized H_2SO_4 which was then allowed to equilibrate and condense before being sent through each denuder. The effectiveness of both devices at removing sulfuric acid was compared for both the total size distribution and that of a selected size using a Tandem Differential Mobility Analyzer and condensation particle counter system. At operating temperatures of 375 and 370°C, both devices had similar penetrations of 80% at 30nm using NaCl. Preliminary results from performance experiments show slight downshifting of particle size after passing though both devices along with possible artifacts after the Thermodenuder.

Valentine Hollingsworth is a Chemical Engineering student and an AICHE member working with the MS&T COE on analysis of aerosol chemistry and atmospheric interactions.

Sean Howell

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

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

In-Memory Database Design and Modeling to Support Guided- and Self-Service Visual Discovery in Big-Data Context: An Autism Spectrum Disorder (ASD) Application Case

This research identifies how in-memory technology can be leveraged to understand big data in a case study using Autism Spectrum Disorder (ASD) data from Simons Foundation Autism Research Initiative (SFARI) database. Literature review was first conducted to compare and contrast different In-memory database design architectures, to define the role of in-memory computing in Big-Data Analytics, and to address the role of different types of Self-Service Business Intelligence (BI) in visual discovery. A data warehouse schema and related data modeling framework (i.e., attribute views, analytical views, and calculation views) were proposed and implemented to support guided- and self-service visual discovery at the data discovery stage utilizing SAP HANA In-memory Appliance. Finally, experiments were conducted to test the proposed models and framework with users ranging from novice to computer savvy. The data were analyzed and recommendations were provided for future research improvement.

Sean Howell is a senior in Information Science and Technology. He plans to graduate from Missouri University of Science and Technology in Dec. 2015, with minors in Business and Enterprise Resource Planning. Sean works for the Center for Enterprise Resource Planning as a Student Research Assistant.

Montana Long

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

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

Impact of Mobile Device Types on the Visualization of Enterprise Data

The purpose of this research is to identify how mobility effects the visualization of enterprise data. The first phase of this project involved the creation of a dashboard using a new tool called SAP Design Studio. After that, data was collected through a series of test involving students of different knowledge sets. The responses received from the test was then turned into a data set that could be analyzed to decide how factors such as screen size, and device effect the ability to make enterprise decisions. The final phase of my research project involved literature review to compare the findings of this research project to those done previously. By identifying these factors and knowing their impact, we can help Chief Information Officers (CIOs) and IT management predict the most effective way to implement a mobile strategy within their company.

Montana Long is a junior 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, for the Center for Enterprise Resource Planning as a Student Research Assistant, and for the LEAD Center as a Peer Leading Advisor. She is an active participant in intramurals, and Christian Campus Fellowship.

Caleb Trecazzi

Joint project with Anthony Bitar

Department: Chemistry, Biological Sciences
Major: Chemistry (Emphasis in Pre-med) and Biology
Research Advisor(s): Delbert Day, Mohamed Rahaman
Advisor's Department: Materials Science and Engineering

Funding Source: OURE Fellows

Angiogenic Effects of Variant Lengths of Borate Glass Scaffolds Prepared via Robocasting

Borate-based 13-93B3 bioactive glass scaffolds have been used successfully in clinical trials to treat chronic wounds and have been shown to be both safe and effective in promoting angiogenesis both in vivo and in vitro. The objective of this research was to determine the degree of capillary and blood vessel growth present within bioactive glass scaffolds between five and twenty millimeters in length when constructed via robocasting. The scaffolds were implanted subcutaneously in rats using aseptic surgery techniques. The reacted bioactive scaffolds were extracted and prepared for histological analysis through paraffin embedding and tissue sectioning followed by hematoxylin and eosin (H&E) and periodic acid-Schiff (PAS) staining for sample evaluation.

Caleb Trecazzi is a senior undergraduate student pursuing a dual bachelor's degree in pre-medical chemistry and biology with a minor in applied mathematics. He is a member of Phi Sigma, the biology honor society, and Kappa Mu Epsilon, the mathematics honor society. Caleb has experience with molecular genetics techniques from his work in the iGEM laboratory and microbiology techniques from his brief work under graduate student Tiffany Edwards in the environmental microbiology laboratory. He has worked with Dr. Matt Insall in the mathematics department on lattice theory and nonstandard analysis during a previous summer research project in mathematics.

OURE Fellows Program

Oral Abstracts

Applicants

Natalie Holste

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

Funding Source: Opportunities for Undergraduate Research Experiences and possibly the American Society of Microbiology

Synthetic Biology Approach to Making Drought Tolerant *Bradyrhizobium japonicum*

Droughts all across the globe are causing hardship to crops and food shortages in parts of the world. One complication for the soil in the regions with drought is high salt concentrations. Due to osmosis, this can cause the plants' cells to shrivel up, thereby becoming useless and killing the plants. Drought also affects the bacteria that associate with plant roots, particularly nitrogen-fixing symbionts of legume plants. The project would let agriculture be introduced to drier areas of the planet. This will allow more crops to be grown and food to be made because they can survive in high salt conditions. The goal of my project is to develop successful salt tolerant strains of Bradyrhizobium japonicum that would protect crops. The success of this project would bring about many positive changes to agriculture and the world.

Growing up in the southwest suburbs of Chicago, Natalie Holste attends Missouri S&T as a Sophomore pursuing a degree in Biological Sciences. She is greatly involved on campus. Some involvement includes being the Assistant Health and Safety Officer of The Solar House Team, the Secretary of Eco Miners, a member of the Society of Women Engineers and several other organizations. In her free time, Ms. Holste loves to play badminton and the piano. After receiving her Bachelor of Science, she plans to attend graduate school and settle down into a job doing research.

Nicholas O'Gorman

Department: Electrical and Computer Engineering
Major: Electrical Engineering and Mechanical Engineering
Research Advisor(s): Theresa Swift
Advisor's Department: Electrical and Computer Engineering

Funding Source: OURE Fellowship

Robotic Surveillance Spider

There are many places where we need to search but the environment is too dangerous or inaccessible to people for it to be worth having a person enter it. Surveillance and search and rescue robotics have been designed in order to rectify this issue. These robots however, are primarily based on two general designs. A vehicle consisting of wheels that is able to drive around on relatively level terrain and a plain/helicopter design that is able to view locations using an aerial view. With these two types of robots there still remains many locations where searching remains very challenging. This includes locations such as collapsed buildings, forests and swamps. The purpose of this Research project is to create a robot with the capability to traverse challenging terrains such as these. This robot will have the capability to travel through water, forest and even vertical terrain while retaining the dexterity to slip through small spaces that could be found in collapsed structures. This design will show the possibility of maneuvering around harsh terrains without the need of an extremely expensive machine and still be able to collect information and save lives.

Nicholas O'Gorman has spent most of his life creating things. Even before starting in grade school he was being taught carpentry by his father and grandfather. He also had a love for music and was an avid participant in his schools chorus and orchestra and even entering the advanced course for both of them. Upon entering middle school He joined the Lego league robotics team that was there, introducing him to the world of engineering. The challenges and achievements faced through this activity taught him a love of learning that carries on to this day.

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