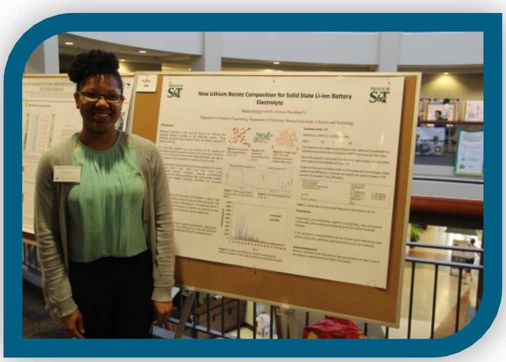
Apr 11th, 2016

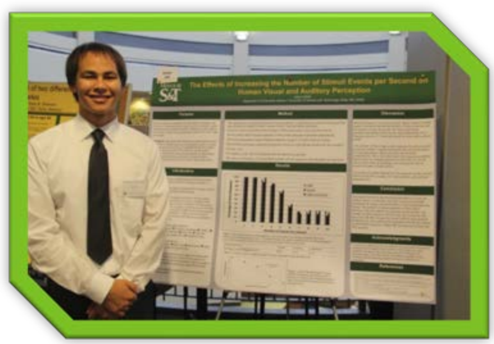
12th Annual Undergraduate Research Conference Abstract Book

Missouri University of Science and Technology

MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

12th Annual Undergraduate Research Conference



A celebration of experiential learning at Missouri S&T

April 11, 2016

Missouri S&T Havener Center

An equal opportunity institution

12th Annual
Undergraduate Research Conference
April 11, 2016

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11th Annual Undergraduate Research Conference

8:00am – 8:30am	**Registration and Poster Set-Up** *(Upper Atrium)*
8:30am – 9:00am	**Opening Address** Vice Provost Dr. Jeffrey Cawlfield *(St. Pat's C Ballroom)*
9:00am – 12:00pm	**OURE Oral Sessions** **ARTS & HUMANITIES --- ENGINEERING --- SCIENCE** *(Carver)* *(Turner)* *(Ozark)*
9:00am – 12:00pm	**Poster Sessions** **ARTS & HUMANITIES --- SCIENCES --- SOCIAL SCIENCES** *(Upper Atrium/Hallway)*
12:00pm – 1:00pm	**Luncheon & Keynote Address** ***Dr. Joel Gerard Burken, Ph.D., P.E., BCEE*** Interim Department Chair and Curators' Professor Civil, Architectural and Environmental Engineering Director, Environmental Research Center for Emerging Contaminants Past President, Association for Environmental Engineering and Science Professors ***Presents*** "Mother Nature as an Engineer: A Quest for Important Knowledge" *(St. Pat's C Ballroom)*
1:00pm – 3:00pm	**OURE Fellows Oral Sessions** Final Presentations *(Carver)* Proposal Applicants *(Turner)*
1:00pm – 3:00pm	**Poster Sessions** **ENGINEERING --- RESEARCH PROPOSALS** *(Upper Atrium/Hallway)*
3:00pm – 4:00pm	**Reception** *(St. Pat's C Ballroom)*
4:00pm – 5:00pm	**Awards Ceremony** *(St. Pat's C Ballroom)*

**Judges Conference Room – (Mark Twain)*

Keynote Speaker

Joel Gerard Burken, Ph.D., P.E., BCEE

Interim Department Chair and Curators' Professor, Civil, Architectural and Environmental Engineering
Director, Environmental Research Center for Emerging Contaminants
Past President, Association for Environmental Engineering and Science Professors

Presents

"Mother Nature as an Engineer: A Quest for Important Knowledge"

Dr. Burken received his PhD from the University of Iowa in 1996, where he conducted some of the initial research on phytoremediation. He has been at Missouri University of Science and Technology (formerly University of Missouri – Rolla) since 1997, now serving as Interim Chair and Curators' Professor. While at Missouri S&T Dr. Burken led the formation of the environmental engineering program as well as the green campus committee and the campus wide sustainability minor. He currently serves as Director of the campus-wide Environmental Research Center. Dr. Burken has also held temporary positions at: EAWAG in Zurich Switzerland (research intern), at the National Environment Research Institute (NERI) in Denmark (visiting researcher and OECD Fellow) and at the University of Canterbury, New Zealand as an Erskine Fellow.

Joel's research and service efforts have focused upon low impact and natural treatment systems since 1991. In that time, terms of sustainable-remediation, green infrastructure, and green-remediation have evolved and now promote the same fundamental aspects surrounding water quality and water resource management. His research in phytoremediation of organic contaminants and pioneering work in Phytoforensics have led to numerous publications, a patented environmental assessment method, and international recognition. This recognition includes twice winning the ASCE Rudolf Hering Medal and an NSF Career award. Dr. Burken has received Missouri S&T awards for teaching, service, advising and has received the Faculty Excellence award 7 times. In 2012 he was also awarded he Alumni Merit Award from the Miner Alumni Association, and in 2015 Dr. Burken received the President's Award for University Citizenship across the entire University of Missouri System. Dr. Burken was appointed as a Curator's professor at Missouri S&T.

Joel has been noted for his local, national and international service, serving on the board of directors for the Association of Environmental Engineering and Science Professors (AEESP) and elected as President of the board in 2011-12. Locally Joel is also active coaching youth sports and with the public school systems, Board of Directors for the Champions Of Rolla Education (CORE) a non-profit organization that supports the enrichment of the Rolla public schools, formerly serving as President of the CORE Board.

Conference Judges

The Office of Undergraduate Studies wishes to thank the following faculty & staff for their valuable contributions to the 12th Annual Missouri S&T Undergraduate Research Conference.

Aleksandr Chernatynskiy

Ana Ichim

Matt Insall

KM Isaac

Irina Ivliyeva

Amardeep Kaur

Jonathan Kimball

Dincer Konur

Merilee Krueger

Cihan Kurter

Rachel Morris

Paul Parris

Varun Paul

David Pommerenke

Parkash Reddy

Rateme Rezaei

Elizabeth Roberson

Ali Rownaghi

Chaman Sabharwal

Ibrahim Said

Bijaya Shrestha

Nancy Stone

Daniel Tauritz

David Westenberg

Jeff Winiarz

David Wright

Oral Presentations

Arts and Humanities

Name	Department	Time	Location
Chad McDaniel	History and Political Science	9:00-9:30 am	Carver Room
Joel Merz	History and Political Science	9:30-10:00 am	Carver Room
Keiler Swartz	History and Political Science	10:00-10:30am	Carver Room
Saki Urushidani	Arts, Languages and Philosophy	10:30-11:00am	Carver Room

Engineering

Name	Department	Time	Location
Timon Abraham	Chemical and Biochemical Engineering	9:00-9:20am	Turner Room
Yahya Abu-Hijleh	Mechanical and Aerospace Engineering	9:20-9:40am	Turner Room
Caitlin Brocker	Chemical and Biochemical Engineering	9:40-10:00am	Turner Room
Shirly Damti	Electrical and Computer Engineering	10:00-10:20am	Turner Room
Joseph Drury	Electrical and Computer Engineering	10:20-10:40am	Turner Room
Niklas Melton	Electrical and Computer Engineering	10:40-11:00am	Turner Room
Sean Tennyson	Chemical and Biochemical Engineering	11:00-11:20am	Turner Room
Melissa Vidal	Chemical and Biochemical Engineering	11:20-11:40am	Turner Room

Sciences

Name	Department	Time	Location
Caleb Holtmeyer	Chemistry	9:00-9:30am	Ozark Room
Ava Hughes	Biological Sciences	9:30-10:00am	Ozark Room
Madison Mara	Biological Sciences	10:00-10:30am	Ozark Room
Tyler Sundell	Geosciences & Geological & Petroleum Eng.	10:30-11:00am	Ozark Room

Arts and Humanities

Oral Abstracts

Chad McDaniel

Department:	Civil Engineering
Major:	Civil Engineering
Research Advisor(s):	Dr. Michael Bruening
Advisor’s Department:	History and Political Science
Funding Source:	N/A

Comparing the Water Distribution Systems Discussed by Vitruvius with Actual Roman Systems

Vitruvius Pollio in The 10 Books on Architecture discusses the construction, material specifications, dimensions, repairs and placement of water distribution systems. Vitruvius’s outline on Roman water distribution systems was then compared to systems throughout the empire particularly those mentioned by Sextus Julius Frontinus in The Strategems and Aqueducts of Rome. Specifications such as the slope of aqueducts was remarkably precise and largely agreed with actual aqueducts. Also, noteworthy is the discussion of health requirements such as the placement of detention basins, reservoirs, and even the health benefits of using clay instead of lead piping. In short this document is a comparison of Roman water resource engineering in theory and practice.

Chad McDaniel is a Senior in Civil Engineering major from Kansas City, MO. He works for the United States Navy Civil Engineering Corps and enjoys hiking, fishing, hunting, sports, and reading.

Joel Merz

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

Funding Source: None

Constantine the Great: His life through the accounts of Eusebius and the Origo Constantini

Constantine I was the emperor of Rome and the man who made Christianity legal. He will earn the title “the Great” and even later be called “Saint” by the Church he help build. We have two primary sources on his life; Eusebius's *Life of Constantine,* which focuses on the religious side, and the *Origo Constantini*, an anonymous source on the military life. By comparing these two sources will analyses already done on Constantine, we can put together who he really was. A Saint or a Secular Military Ruler?

Joel Merz is a undergraduate working on his Bachelor of Arts, History. He is also working on three minors, Foreign Language Russian, Political Science, and Pre-Law. Joel hope to continue his education by working for a Graduate degree.

Keiler Swartz

Department: History and Political Science
Major: History/Education
Research Advisor(s): Dr. Larry Gragg
Advisor's Department: History and Political Science

Funding Source: None

The Cost of Oversight: How the Continental Congress Almost Lost the American Revolution

The American Revolution was one of the most important events in both American and human histories. While this war is well known as being a war of defiance where a republican government attempted to break free from a monarchy, it should also be known as a war in which the legislative body of the new American states took a very active role in the control of the Continental Army. General Washington was an avid proponent of civilian control over the military so he allowed the Second Continental Congress to have a large say in how the American forces operated. Ultimately, due to a rapidly inflating currency and general fear of standing armies, they failed to adequately supply the troops. Despite the flaws of civilian control that were brought to light during the war, the sense of distrust between the government and the military remain today.

Keiler Swartz is a senior working towards a Bachelor of Arts in History and Secondary Teacher Certification. He is heavily involved with student government both at Missouri S&T and throughout the Midwest. Keiler is looking forward to teaching history and government in a high school setting.

Saki Urushidani

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

Funding Source: N/A

Overwhelming Culture: Environmental Concerns and Cultural Considerations in Guatemala

Guatemala is a country full of diversity, visible in its beautiful, varying landscapes, and also in the many people who make up its population—there are more than twenty ethnic groups within its borders. While each group has its own rich culture, many of their traditional ways of life are being challenged by 21st century technologies and other external influences. Rural Guatemala in particular faces many difficulties adjusting to cultural and environmental challenges such as changes in climate, polluted water sources, and accumulation of solid waste. This interdisciplinary study combines a cultural and historical perspective with environmental engineering and is based on both a literature review and first-hand observations and interviews of families in Antigua and the Izabal Region. I will demonstrate how these challenges will cause tensions within communities that are trying to maintain traditional ways of life.

Saki Urushidani is a senior in the Environmental Engineering Program at Missouri S&T graduating in December of 2016. On campus she is involved with Water Environment Federation, Zeta Tau Alpha, and Panhellenic Council.

Engineering
Oral Abstracts

Timon Abraham

Joint project with Nicholas Adolphsen

Department: Chemical and Biochemical Engineering
Major: Chemical Engineering
Research Advisor(s): Dr. Fateme Rezaei
Advisor's Department: Chemical and Biochemical Engineering

Funding Source: Opportunities for Undergraduate Research Experiences (OURE)

Preparation & Synthesis of Vanadium-Metal-Organic Frameworks (MIL-101) for Acid-Gas Adsorption and Separation

Carbon dioxide (CO_2) level in the air is increasing every day, due to continuous emissions of flue and greenhouse gases. CO_2 is the major contributor to global warming and oceans acidification. Recycling CO_2 and resupply fresh air is also critical and sensitive in closed areas like mining, submarines and diving. Our project goal is removing CO_2 from the air by developing and synthesizing novel porous materials, namely Metal-Organic frameworks (MOFs) that adsorb mixture of CO_2 and different gases and selectively and efficiently separate CO_2. Vanadium MOFs are one of the trinuclear transition metal clusters. MIL-101 has the biggest surface area among other MOFs. We successfully synthesized the first batch of MIL-101 after series of lab experiments. We were also able to determine the targeted parameters like concentration and temperature to develop MIL-101. We used vanadium tetrachloride and terphethalic acid dissolved in pure ethanol at 120C for two days to synthesis MIL-101. We are currently working on the characterization phase using SEM, BET, TGA and XRD.

Timon Abraham is a chemical engineering student at Missouri University of Science & Technology. Summer 2015, He received SULI award from DOE and worked as a Summer intern at Oak Ridge National Lab. Timon successfully achieved his Summer research project at ORNL and is coauthoring on publication. He participated in Chem-E-Car competition team in Fall 2015. Timon is hoping to graduate a professional chemical engineer and find a job in product and process development.

Yahya A. Abu-Hijleh

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

Funding Source: University of Missouri Research Board

Optimizing the Savonius Piezoelectric Turbine

A prototype of a highly efficient Savonius turbine that utilizes specifically designed guide vanes is tested, simulated, and analyzed. This turbine uses a polygon shaped gear that couples a rotating shaft to apply compressive and tensile forces on eight aluminum cantilever beams. Each beam has 2 piezoelectric strips that produce electrical power upon compression or tension. A hybrid procedure of wind tunnel testing, finite element analysis, and theoretical analysis was used when analyzing the Savonius turbine. This method enabled the coefficient of friction between the gear and beams to be calculated, and therefore the power efficiency for wind to mechanical, mechanical to electric, and wind to electric was calculated respectively. The wind power efficiency of the current turbine has the capability of exceeding the Betz limit of 0.593, which makes it ideal for power generation systems that utilize wind and water energy in remote locations.

Yahya was born in California on January 19th 1995, and he was raised in Abu Dhabi, United Arab Emirates. 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 Yahya got to work on in relevance to his major, and he views it as his first step towards achieving higher education.

Caitlin Brocker

Department: Chemical Engineering
Major: Chemical Engineering
Research Advisor(s): Dr. Sutapa Barua
Advisor's Department: Chemical Engineering

Funding Source: PI's Start-Up

Nanoparticle Shape Synergistically Inhibits Cancer

Interactions of nanoparticles with human cells have been the subject of intense research in the field of bioengineering due to their potential applications in imaging, gene delivery, drug delivery, and targeted cancer treatment. Nanoparticles, when modified with ligands, recognize specific cell membranes through binding with their complementray receptor proteins, and are internalized by cells *via* receptor-mediated endocytosis process. However, the ability of ligands-laden nanoparticles to target cells also depends on physical properties such as shape, among others. In spite of its high relevance, it is not known how the shape of nanoparticles can be engineered to enhance targeting abilities of nanoparticles. The objectives of this project are (i) generation of nanoparticles of various shapes (sphere, rod and disk); (ii) modification of nanoparticle surface with a US FDA-approved antibody, Herceptin for interacting with HER-2 proteins on breast cancer cells; and (iii) evaluation of therapeutic activity of drugs using the optimum shape.

Caitlin Brocker is a junior and plans to complete her B.S. in Chemical Engineering with a Biochemical Emphasis at Missouri University of Science and Technology in May of 2017. Caitlin is also on the Missouri S&T Women's Volleyball Team and the Love Your Melon Campus Crew. She has been working in Dr. Sutapa Barua's lab since April 2015, and her projects have involved drug delivery systems for breast cancer treatment.

Shirly Damti

Department: Electrical and Computer Engineering
Major: Electrical and Computer Engineering
Research Advisor(s): Dr. Steve Watkins, Dr. Joe Stanley
Advisors' Department: Electrical and Computer Engineering

Funding Source: Opportunities for Undergraduate Research Experience

Comparison of Binary and Multi-level Logic Electronics for Embedded Systems

Embedded systems are dependent on low-power, miniaturized instrumentation. Comparator circuits are common elements in applications for digital threshold detection. Target applications are dedicated control devices, sensor nodes, etc. in which hardware constraints may be most critical. Comparator circuits are selected to compare binary and multi-level logic implementations. A multi-level, memory-based logic approach is in development that offers potential benefits in power usage and size with respect to traditional binary logic systems. A multi-level digital system can reduce interconnect lines and processing components if implementation issues can be overcome. The multi-level, memory-based logic approach uses mature CMOS technology, but the transistors are used for multi-level operations and memory manipulation. Circuit layouts of quaternary and binary comparators are presented to compare the approaches. In particular, power characteristics and transistor count are examined. The potential for improved embedded systems based on the multi-level, memory-based logic is discussed.

Shirly Damti is a senior in Electrical and Computer Engineering at the Missouri University of Science and Technology. Shirly plans to obtain an M.S. and Ph.D. in Electrical Engineering degree with emphasis on optics, digital image processing, computer vision, robotics, etc. Then, she plans on conducting research in the field and contribute to the global effort in exploration and improvement of technology.

Joseph Drury

Department: Electrical and Computer Engineering
Major: Computer Engineering
Research Advisor(s): Dr. Choi
Advisor's Department: Electrical and Computer Engineering

Funding Source: NSF

FPQSC: FPGA-Based Parallel Quasi-Stochastic Computing

Integrated circuit scaling creates vulnerabilities in digital circuits; increasing errors make designs unreliable. Ultra-small and low-power designs are necessary but increasingly complex, solutions become highly sophisticated. Stochastic computation (SC) is a re-emerging technique used to deal with small, low-power circuitry. SC has proven advantageous for image processing and neural networks, but implementation has been hindered because random fluctuations in stochastic numbers cause exponentially increasing run times. Application of pseudo-random number generators (PRNG) tend to generate sequences with un-equilateral bit spacing. To mitigate this issue, implemented look-up tables (LUT) create stochastic number generators, influenced by quasi-random number sequences. The proposed design, stochastic bit matrix processing (SBM), was implemented on a Virtex-4 FPGA board to calculate probability values using the value of clock cycles ran. Parallel application of SNG was implemented using LUT, increasing throughput and decreasing execution time. Applying SBM to edge detection achieves better results than PRNG as SNGs.

Joseph is an undergraduate student studying Computer Engineering in the Electrical and Computer Engineering Department. He is a member of IEEE, Eta Kappa Nu, and Tau Beta Pi. He looks forward to a co-op with Nucor-Yamato Steel and will pursue a Masters Degree in Computer Engineering.

Niklas M. Melton

Department: Mechanical and Aerospace Engineering
Major: Aerospace Engineering
Research Advisor(s): Donald C. Wunsch
Advisor's Department: Electrical and Computer Engineering

Funding Source: None

Enhancing Supervisory Training Signals with Environmental Reinforcement Learning Using Adaptive Dynamic Programming

A method for hybridizing supervised learning with adaptive dynamic programming was developed to increase the speed, quality, and robustness of on-line neural network learning from an imperfect teacher. Reinforcement learning is used to modify and enhance the original supervisory signal before learning occurs. This research describes the method of hybridization and presents a model problem in which a human supervisor teaches a simulated car to drive around a race track. Simulation results show successful learning and improvements in convergence time, error rate, and stability over both component methods alone.

Niklas Melton is a senior aerospace engineering major from Kansas City, MO. Since coming to MS&T, he has continued to develop and refine his technical interests and skills with a focus on biologically inspired technologies. He is a Student Council representative for the iGEM student design team and is an active member of the Applied Computational Intelligence Lab, where he researches controls applications of neural networks.

Sean Tennyson

Department: Chemical and Biochemical Engineering
Major: Chemical Engineering
Research Advisor(s): Dr. 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 through a small modular reactor, 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 senior 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 undergraduates conducting research on the production of biodiesel. Sean plans to obtain a bachelor's degree in chemical engineering and then work for Phillips 66 at the Wood River Refinery.

Melissa Vidal

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

Funding Source: Seed Funding for 2016 by Center for Biomedical Science & Engineering

CFD SIMULATION STUDY OF INTERSTITIAL NANOPARTICLE FLOW IN TUMOR-ON-A-CHIP

We performed a computational fluid dynamics simulation to study the flow of nanoparticles in a microfluidic device, which mimics the cross section of a tumor tissue. A tumor is a complex phenomenon with vasculatures that have micro-sized gaps in their endothelial cells, also known as the enhanced permeability and retention effect (EPR). This allows the enhancement of transport of nutrients and oxygen. For the efficient study of drug delivery to tumor cells, and to also avoid complicated and costly animal studies, a tumor-on-a-chip device, which consists of a tumor tissue microchamber surrounded by porous microarrays, is under development. CFD simulation was performed to investigate the flow behavior of drug delivery nanoparticles in that device. More specifically, we estimated the permeability of nanoparticles from microchannel (mimicking blood stream) to the tumor chamber through the porous arrays. The outcome can be used in mathematical modeling of the system as well as validation of the performance of the tumor-on-a-chip device.

Melissa Vidal is currently a senior in Chemical Engineering at Missouri S&T. Melissa has worked with Dr. Joontaek Park on the CFD simulation project since January 2016. Her contributions include building a simpler geometry to perform the CFD, and running the simulation at different particle sizes. She has also worked with Dr. Smith on the biodiesel production project since August 2013. She will start graduate school in Fall 2016 to pursue her Ph.D. in Chemical Engineering.

Sciences

Oral Abstracts

Caleb Holtmeyer

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

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

Epitaxial $Co(OH)_2$ Deposited onto Au/n-type Si

$Co(OH)_2$ electrodeposited onto Au coated n-type Si is an effective catalyst for the oxygen evolution reaction(OER) in photoelectrochemical (PEC) water splitting. The n-type Si acts as a light absorber and the Au film prevents oxidation of Si from the basic PEC water splitting solution. $Co(OH)_2$ can be deposited using potentiostatically, where potential is controlled and current measured, or galvantostatically, where current is controlled and potential is measured. The $Co(OH)_2$ films are characterized using X-ray diffraction (XRD) and scanning electron microscopy (SEM). Measurements are made during PEC water splitting to determine the efficiency and stability of the cells.

Caleb Holtmeyer is a chemistry student pursuing a Bachelor's of Science at Missouri University of Science and Technology. This is his third year at Missouri S&T and plans to graduate in the spring of 2017. After graduation he hopes to attend graduate school. He is an active member of the Missouri S&T climbing club.

Ava Hughes

Department: Biological Sciences
Major: Biological Sciences
Research Advisor(s): Dr. 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 with ranges between 1.4-3.5 pH and 13-32% salt concentration. Halite and gypsum evaporites form a crustal layer within the sediment. Previously, microorganisms have been found to be acidophilic and halo-tolerant, but not halo-acidophilic. With this combination of extreme conditions, we expect novel halo-acidophilic microorganisms to be isolated. Matrices characterizing pH and salt concentration limits have been developed to determine the extent and preferential growth and to help with isolating novel bacteria. Growth results from matrices have led us to believe there are different communities in evaporite and sediment samples. Other analysis, scanning electron microscopy, indicates that diatoms are also present in these environments. Our results will lead to an understanding of this new category of extremophiles.

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, a Senior Resident Assistant, and currently Head Resident. She is also a general member of National Residence Hall Honorary and Phi Sigma, a biological honor society. She just recently presented, along with Katlyn Lonergan at the regional meeting of the American Society of Microbiology where they were awarded first in their session. She plans on going to graduate school and getting a doctorate in environmental sciences and conservation.

Madison Mara

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

Funding Source: OURE

Comparing Phenotypes of IQG1 Mutants

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 three 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 and a mutant (3T) that has 3 serines mutated to theronines. This 3T mutant is able to be phosphorylated but it unable to be dephosphorylated. The goal in doing this is to compare cytokinesis defects in the 3A mutant, 4A mutant, and 3T mutant and see if threonine has a unique function and determine the phenotype of permanent phosphorylation. To confirm mutant phenotype, morphological analysis will be performed via microscopy and immunofluorescence to indicate if actin ring formation has been disrupted.

Madison is a Junior at Missouri University of Science and Technology pursuing a degree in Biological Sciences with an emphasis in pre medicine. She is the Vice President of Scrubs Pre-Med Club, the Director of Philanthropy for Zeta Tau Alpha, and has been conducting research in Dr. Shannon's cytokinesis lab for two years. She plans on going to medical school once she graduates from Missouri S&T.

Tyler Sundell

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

Funding Source: Drs. Hogan and Chapman, 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 did give an age range, the range was about 250 million years. By using U/Th-He Apatite thermochronology, which looks at the decay of U/Th into He inside the apatite minerals. The purpose of this study is to: constrain the age range of the formation for Decaturville. One of the features of an impact site is an uplifted block at the center. This uplifted block was displaced nearly 300m at Decatureville. While these rocks where being displaced, the apatite minerals passed through their blocking temperature and started the isotopic 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 personal science interests are in: terrestrial impact events, analog environments, and Precambrian geology.

Poster Presentations

Arts and Humanities

Poster #	Name	Department	Time	Location
1	Carrie Levy	History and Political Science	9:00-11:45am	Upper Atrium/Hall
2	Madison Morris	History and Political Science	9:00-11:45am	Upper Atrium/Hall

Engineering

Poster #	Name	Department	Time	Location
3	Francisco das Chagas Silva Neto	Chemical and Biochemical Engineering	1:00-3:00 pm	Upper Atrium/Hall
4	Stephen Eastman	Chemical and Biochemical Engineering	1:00-3:00 pm	Upper Atrium/Hall
5	Chase Herman	Chemical and Biochemical Engineering	1:00-3:00 pm	Upper Atrium/Hall
6	Stiles Jackson	Chemical and Biochemical Engineering	1:00-3:00 pm	Upper Atrium/Hall
7	Scott Marchetti	Chemical and Biochemical Engineering	1:00-3:00 pm	Upper Atrium/Hall
8	Alex Mundahl	Mechanical and Aerospace Engineering	1:00-3:00 pm	Upper Atrium/Hall
9	Caleb Olson	Electrical and Computer Engineering	1:00-3:00 pm	Upper Atrium/Hall
10	Katherine Overend	Electrical and Computer Engineering	1:00-3:00 pm	Upper Atrium/Hall
11	Tim Victor	Mechanical and Aerospace Engineering	1:00-3:00 pm	Upper Atrium/Hall
12	Mitchell Wainwright	Mechanical and Aerospace Engineering	1:00-3:00 pm	Upper Atrium/Hall
13	Vanessa Reynolds Dylan Webb Yuchen Yang	Geosciences & Geological & Petroleum Eng.	1:00-3:00 pm	Upper Atrium/Hall
14	Tyler Johnson Adam Richter Jordan Sanders Trevor Sparks	Chemical & Biochemical Engineering	1:00-3:00 pm	Upper Atrium/Hall
15	Austin Fischer Cesar Ramirez	Chemical & Biochemical Engineering	1:00-3:00 pm	Upper Atrium/Hall
16	Joe Collum Scott Faulkner	Civil, Architectural & Environmental Engineering	1:00-3:00 pm	Upper Atrium/Hall

Research Proposals

Poster #	Name	Department	Time	Location
17	Alexander Ayres	Biological Sciences	1:00-3:00 pm	Upper Atrium/Hall
18	Damien Bizeau	Biological Sciences	1:00-3:00 pm	Upper Atrium/Hall
19	Justin Clinton	Geosciences & Geological & Petroleum Eng.	1:00-3:00 pm	Upper Atrium/Hall
20	Mason Donnell	Biological Science	1:00-3:00 pm	Upper Atrium/Hall
21	Joshua Herman	Computer Science	1:00-3:00 pm	Upper Atrium/Hall
22	Sierra Herndon	Biological Sciences	1:00-3:00 pm	Upper Atrium/Hall
23	Hannah Kim	Biological Sciences	1:00-3:00 pm	Upper Atrium/Hall
24	Brendan Beebe Daniel Sloan	Biological Sciences	1:00-3:00 pm	Upper Atrium/Hall
25	Justin Carollo Jordan Powell	Biological Sciences	1:00-3:00 pm	Upper Atrium/Hall
26	Delaney DeJanes Heather McCoy	Biological Sciences	1:00-3:00pm	Upper Atrium/Hall
27	Sonya Roberts Claire Wilmore	Biological Sciences	1:00-3:00pm	Upper Atrium/Hall

Sciences

Poster #	Name	Department	Time	Location
28	Arielle Bodine	Mathematics and Statistics	9:00-11:45 am	Upper Atrium/Hall
29	Kent Gorday	Chemistry	9:00-11:45 am	Upper Atrium/Hall
30	Ken Goss	Computer Science	9:00-11:45 am	Upper Atrium/Hall
31	Lisa Gutgesell	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
32	Darian Johnson	Chemistry	9:00-11:45 am	Upper Atrium/Hall
33	Kayln Jones	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
34	Parker Jones	Computer Science	9:00-11:45 am	Upper Atrium/Hall
35	Kirsten Kelly	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
36	Jonathan Kopel	Chemistry	9:00-11:45 am	Upper Atrium/Hall
37	Katlyn Lonergan	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
38	Daniel Park	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
39	Lindsey Pratt	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
40	Caitlin Siehr	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
41	Skye Tackkett	Physics	9:00-11:45 am	Upper Atrium/Hall
42	Victoria Grill Samantha Huckuntod Elizabeth Thoenen	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
43	Elsie Greenwood Abigail Haler	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
44	Kayla Haneline Katherine Herries	Geosciences & Geological & Petroleum Eng.	9:00-11:45 am	Upper Atrium/Hall
45	Austin Hall Margaret Pitzer	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall
46	Heather Pribil Jia Sun	Geosciences & Geological & Petroleum Eng.	9:00-11:45 am	Upper Atrium/Hall
47	Alexis Reece Allie Wilson	Biological Sciences	9:00-11:45 am	Upper Atrium/Hall

Social Sciences

Poster #	Name	Department	Time	Location
48	Samuel Smith	Business and Information Technology	9:00-11:45am	Upper Atrium/Hall
49	Lindsey Carlson Nick Rollins	Business and Information Technology	9:00-11:45am	Upper Atrium/Hall

Arts and Humanities

Poster Abstracts

Carrie Levy

Department: History
Major: Engineering Management
Research Advisor(s): Shannon Fogg
Advisor's Department: History

Funding Source: N/A

Holocaust Victims Forever

The purpose of this research is to highlight the mistreatment of Holocaust survivors after World War II. By examining survivor testimonies, programs created for survivors, and current media on relief, it becomes clear that humanity has failed to complete its obligation to the victims of the Holocaust. By shattering preconceived notions about post-war treatment of survivors, this research will highlights causes that led to the inadequate conditions currently faced by survivors. From this, we can evaluate where we went wrong in the past, and make changes starting today, to increase the quality of life for those effected by the Holocaust.

Carrie Levy is a senior in Engineering Management, originally from Columbia, Missouri. This spring she will receive her B.S. in Engineering Management with an emphasis in Industrial Engineering. During her time at Missouri S&T she actively been involved in the campus community playing on the Women's Soccer team and being a part of many organizations: Delta Omicron Lambda, M-Club, ASEM, and IIE. Carrie has always had a great appreciation for Humanities and Social Sciences throughout her academic career, and enjoys learning about the history of her ancestors from Southeast Missouri with her Uncle's genealogy work.

Madison Morris

Department: History
Major: Biology
Research Advisor(s): Dr. Bruening
Advisor's Department: History

Funding Source: N/A

Stitching the Way towards Modern Medicine: The Renaissance Advances of Ambroise Pare

The goal of this project is to study the medical advances of the French barber Surgeon Ambroise Pare, and discuss the innovative techniques and discoveries he introduced during the Renaissance. Pare's discoveries helped progress multiple fields including obstetrics and surgery, and this project will delve into his inventions such as ligatures, antiseptic, and artificial limbs. The practices introduced by Pare not only led to a decrease in the loss of soldiers' lives during the Renaissance period, but also helped to advance the medical field towards what todays generation perceives as modern medicine.

Madison Morris is a sophomore biology major at Missouri S&T. She plays college soccer for the Lady Miners, is a member of Zeta Tau Alpha, and plans on attending medical school after graduation.

Engineering
Poster Abstracts

Joe Collum

Joint project with Scott Faulkner and Lee Voth-Gaeddert

Department: Civil, Architectural, and Environmental Engineering
Major: Civil Engineering
Research Advisor(s): Dan Oerther
Advisor's Department: Civil, Architectural, and Environmental Engineering

Funding Source: Mathes Endowment

Creating Community-Driven Transparency in Local Government Water and Energy Sectors

Water and energy are inseparable: water is used to generate most forms of electricity, and energy is needed to obtain, treat, deliver, and dispose of water. We need to recognize and adjust our habits and expectations around the topic of water and energy in order to help ensure a more sustainable future. This research draws on the power of social awareness and crowd reporting to create an interactive, location-based app that allows users to identify, report, and discover water and energy efficient or inefficient points near them. This data can then be compiled and used to inform local governments to keep them accountable for the work they do. It can also be sent to lawmakers to inform the policies they propose and vote on.

Joe Collum is a senior studying Civil Engineering. He spent 3 years in Engineers without Borders, and helped lead his team to make clean water possible for the people of Tacachia, Bolivia. He plans to pursue a career in water resources, and has a strong interest in water and energy efficiency. In his spare time, he likes to play city-building games, make spreadsheets, and work on his car.

Francisco das Chagas Silva Neto

Department:	Chemical and Biochemical Engineering
Major:	Chemical Engineering
Research Advisor(s):	Dr. Muthanna H. Al-Dahhan
Advisor's Department:	Chemical and Biochemical Engineering

Funding Source: Molecular Filtration, Inc™

Treatment performance of oily wastewater using ceramic membranes

The purpose of this project is to evaluate the oily wastewater treatment performance of inorganic membranes. An inorganic membrane is a porous fine ceramic filter, which is sintered from Alumina or Titania, Zirconia oxide under ultra-high temperature. The macro porous support ensures the mechanical resistance while the active layer allows for the separation. Based on the pore size a category is set, ranging from microfiltration, ultrafiltration and even nanofiltration. To study its performance, we have investigated the effects of transmembrane pressure, cross flow velocity and feed temperature. This system could easily produce permeate with oil and grease content that meets the National Discharge Standard. However, the point of this research is to obtain the maximum permeate flow and the best effluent quality by high permeation flux at low operational costs.

Francisco das Chagas Silva Neto is an international transfer student from Brazil sponsored by the Brazilian Scientific Mobility Program to study two semesters at Missouri S&T for Chemical Engineering. He is a Petroleum and Gas technician graduated from the Federal Institute of Education, Science and Technology of Rio Grande do Norte. He evaluated the bioremediation of oil samples from Canto do Amaro Oil Field in Rio Grande do Norte – Brazil by isolation and identification of bacterial cultures from June 2013 to August 2014 and lately has been using oily wastewater samples to evaluate treatment performance of ceramic membranes.

Stephen Eastman

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

Funding Source: NASA-Missouri Space Grant Consortium

Development of CO_2 Removal Systems for NASA's Advanced Exploration Systems

In enclosed environments such as spacecraft cabins, CO_2 concentration is required to be below 0.5% because long term exposure to CO_2 higher than 0.5% can create severe health problems. Therefore, removal of CO_2 from the cabin atmosphere is a critical function of any spacecraft's life support system. We plan to investigate the use of materials with promising performance (high capacity and stability) for removing CO_2 from spacecraft cabins and space stations. The objective of this work is to test several metal-organic frameworks (MOFs) including MOF-74, MIL-101 and UiO-66 in a monolithic support in a CO_2 removal system that would be compact and lightweight, for use in space exploration. The adsorbent-support surface interactions play an important role in obtaining a well-defined, robust and uniform MOF distribution in the monolith; therefore, we aim to investigate this important parameter using various support and adsorbent materials.

Stephen Eastman is a Junior in Chemical Engineering. He is a member of the S&T chapter American Institute of Chemical Engineers as well as the Chemical Engineering car. His interests include: Outdoor Activities, Electronics, Video Games and Chemistry.

Scott Faulkner

Joint project with Joseph Collum and Lee Voth-Gaeddert

Department: Civil, Architectural, and Environmental Engineering
Major: Civil Engineering
Research Advisor(s): Dan Oerther
Advisor's Department: Civil, Architectural, and Environmental Engineering

Funding Source: Mathes Endowment

Creating Community-Driven Transparency in Local Government Water and Energy Sectors

Water and energy are inseparable: water is used to generate most forms of electricity, and energy is needed to obtain, treat, deliver, and dispose of water. We need to recognize and adjust our habits and expectations around the topic of water and energy in order to help ensure a more sustainable future. This research draws on the power of social awareness and crowd reporting to create an interactive, location-based app that allows users to identify, report, and discover water and energy efficient or inefficient points near them. This data can then be compiled and used to inform local governments to keep them accountable for the work they do. It can also be sent to lawmakers to inform the policies they propose and vote on.

Scott Faulkner is a freshman studying Environmental Engineering. He's currently in Engineers Without Borders and the Kappa Sigma Fraternity. He plans to pursue a career in water resources, has strong interest in water efficiency and advanced energy technology. In his spare time he likes to go hiking and camping.

Austin Fischer

Joint project with Cesar Ramerez, I.A.Said and M.M.Taha

Department: Chemical Engineering Department
Major: Chemical Engineering
Research Advisor(s): Dr. Muthanna H. Al-Dahhan
Advisor's Department: Chemical Engineering Department

Funding Source: U.S. Department of Energy-Nuclear Energy Research Initiative (DOE-NERI) project (NEUP 13-4953 (DENE0000744)

Natural Convection in Missouri S&T Prismatic Scaled Down Facility Subject to Constant Heat Flux

Previous findings suggest that natural circulation in simplified geometries cannot be directly extended to Prismatic Modular high temperature nuclear Reactor (PMR). Therefore, Missouri S&T constructed a prismatic scaled down dual channel facility and developed advanced fast response flash mounted heat transfer probes (HT) technique. Natural circulation is stimulated within the facility by electrically heating one channel and cooling the second one. The HT sophisticated technique is implemented to measure the local heat transfer coefficient (h) axially along the heated channel which is subjected to constant applied heat flux. Four values of heating intensity were investigated (i.e., 37, 40, 45, 50 watt). Results show that the local heat transfer coefficient (expressed in Nusselt number) is directly proportional to the heating intensity (expressed in Rayleigh number). Also, the results show that natural circulation behavior at channel ends is significantly influenced by the coolant mixing phenomena occurring in the reactor two plena.

After living his life in Highland Illinois, Austin Fischer moved to Rolla Missouri to pursue a degree in Chemical Engineering. As a junior, he currently holds the position as the president of the Sigma Chi Fraternity at Missouri University of Science and Technology. He plans to graduate in spring of 2017, and possibly pursue a career in Chemical Engineering consulting. He is also a member of AIChE, and has acquired skills in MATLAB, Aspen Plus, and various Microsoft Office Programs.

Chase Herman

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

Funding Source: Principal Investigator's Start-Up

CELLULAR HITCHHIKING ON MICROPARTICLES TO ALLEVIATE SKIN INJURY

Regenerative medicine holds great potential for the future treatment of acute burn injury. However, current skin graft technology does not provide any structural support to transplanted cells, and it also causes scar formation. To combat these challenges, the present study focuses on a rapidly developing field of research: engineering microparticles to provide structural support to cells while in suspension.

Microparticles have tremendous potential as scaffolding systems to carry multiple exogenous cells because of their high surface area to volume ratio. Microparticles can further be utilized as growth factor delivery systems to promote cell proliferation.

In this study, microparticles are synthesized from poly(lactic-co-glycolic acid) (PLGA), a biodegradable copolymer. Fibronectin, a glycoprotein involved in wound healing, is conjugated onto the surface of PLGA microparticles for seeding viable cells. Cells will be grown in suspension on the microparticles. We call it "*cellular hitchhiking*". This *de novo* technique has versatile applications including skin regeneration.

Chase Evan Herman is a 2nd-year undergraduate student from the Department of Chemical and Biochemical Engineering at the Missouri University of Science and Technology. Since his middle school days, Chase has enthusiastically participated in many research and design projects. During high school, he twice competed in the Intel International Science and Engineering Fair (ISEF), with projects firstly in civil engineering and then biochemistry. While in Los Angeles for ISEF, he was privileged to personally meet Robert Horvitz, a Nobel laureate. Listening to Dr. Horvitz and other laureates talk about their work set Chase's excitement for scientific research ablaze. Chase returned to this lab last summer. Furthermore, he served as a tutor for general chemistry during the fall 2015 semester. Currently, Chase is diligently progressing in his studies and is actively involved in Dr. Sutapa Barua's biomaterials lab.

Stiles Jackson

Joint project with Muhammed Al Ani (PhD)

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

Funding Source: N/A

Hydrodynamics of a two-phase concurrent trickle bed reactor

Many different parameters of a trickle bed reactor have been studied in an air-water cocurrent system. A trickle bed reactor with a fixed packed bed was used to produce the needed results. Parameters such has liquid holdup, pressure drop, flow regimes and flow regime transition were studied on a macroscale. The local liquid holdup in the particle pores are to be studied on a microscale as well as the gas-liquid interaction surrounding the particles. The performance of the reactor is directly related to these parameters as they will give insight to which conditions are most efficient to needed performance.

Stiles Jackson is a senior in the Chemical Engineering Major. He will graduate in December of 2016.

Tyler Johnson

Joint poster project with Adam Richter, Jordan Sanders, and Trevor Sparks

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

Funding Source: Energy Research and Development Center

Biodiesel Production Using a MSSR (Multi-tubular Supercritical Separative Reactor)

Biodiesel is an alternative fuel source for diesel engines. In comparison to traditional diesel fuels, it is renewable, has a comparatively lesser impact on the environment, and has a reduced amount of toxins in its emissions. Biodiesel can be made using supercritical methanol and waste cooking oil that is common in restaurant and household kitchens. Biodiesel is often produced in a batch process and then later undergoes time-consuming separation processes to retrieve the desired product from the undesired waste. However, the purpose of this research is to design, build, and test a novel reactor that will produce Biodiesel and separate the desired product from the undesired waste in a continuous process using supercritical methanol and waste cooking oil.

Tyler Johnson is a junior in Chemical Engineering from Union, Missouri. He is involved in the national society for chemical engineers (Omega Chi Epsilon) and also plays varsity baseball at the University of Missouri Science and Technology. Right now he is also involved with an undergrad research team that is working for Dr. Smith on developing a reactor to create biodiesel by using waste cooking oil and supercritical methanol transesterification through a Multi-tubular Supercritical Separative Reactor.

Scott G. Marchetti

Joint project with I.A.Said and M.M.Taha

Department: Chemical Engineering Department
Major: Chemical Engineering
Research Advisor(s): Dr. Muthanna H. Al-Dahhan
Advisor's Department: Chemical Engineering Department

Funding Source: U.S. Department of Energy-Nuclear Energy Research Initiative (DOE-NERI) project (NEUP 13-4953 (DENE0000744)

Development of Missouri S&T Prismatic Scaled Down Facility for Natural Circulation Thermal Hydraulics Investigations

The Prismatic Modular Nuclear Reactor (PMNR) is characterized by inherent passive safety systems to remove decay heat and prevent reactor core from reaching failure temperature. Natural circulation is one of the passive safety features stimulated during accident scenarios. Missouri S&T has developed a 1/4 prismatic scaled down facility with regards to the reference High Temperature Test Facility (HTTF) at Oregon State University. Advanced sophisticated techniques such as: the integrated fast response flash mounted heat transfer probes (HT) and the hot wire anemometry (HWA) will be integrated for the first time in such study. HT and HWA techniques will provide information of heat transfer coefficients and local velocity, respectively. Such a study will advance the knowledge and understanding of natural circulation phenomena occurs in prismatic blocks. Also, It will provide crucial benchmarking data for verification and validation of CFD codes.

Scott Marchetti is pursuing a B.S. in Chemical Engineering at the Missouri University of Science and Technology (FS '16). Originally, Scott is from Christopher, Il. He has worked a co-op and internship for Catalytic Innovations, LLC in Rolla, MO, and will have worked two internships at Westlake Chemical Corporation in Calverty City, KY. On campus, Scott works for Admissions as Student Ambassador Tour Trainer and is a member of Lambda Chi Alpha Fraternity, AIChE, and Students Today, Alumni Tomorrow.

Alex Mundahl

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

Funding Source: Opportunities for Undergraduate Research Experiences (OURE)

Linear Burn Rates of Monopropellants for Multi-Mode Micropropulsion

A linear strand burner setup was used to obtain linear burn rate characteristics for the mixture of 1-ethyl-3-methylimidazolium ethyl sulfate [Emim][EtSO4] and Hydroxyl Ammonium Nitrate (HAN) . A closed, pressurized system with an Argon atmosphere provided the environment to conductively heat a small cylinder of propellant within a length of quartz tubing through a length of nickel-chromium wire. The initial change and maximum pressure within the system were recorded to calculate the burn time of each test. This process occurred for varying pressures within the range 0-300psig. Open air testing occurred beforehand to obtain a visual proof of concept. Multiple data points were taken at each designated pressure to ensure consistency. The major conclusions that will come from this paper will be the working back pressures and mass flow rates of the [Emim][$EtSO_4$] and [HAN] monopropellant for the chemical mode of this propulsion system.

Alex Mundahl is a senior in Aerospace Engineering, and is currently performing undergraduate research for Dr. Rovey in the Aerospace Plasma Laboratory on a Multi-Mode Propulsion system for small spacecraft. He intends on pursuing a Ph.D. with an emphasis in space propulsion while continuing his research. Some of his previous experience includes being the Lead of the Aerodynamics and Propulsion subgroup for the AAVG rocket design team on campus, an active member of the M-SAT team, and a research assistant for the Center of Excellence for Aerospace Particulate Emission Reduction Research.

Caleb Olson

Department: Electrical and Computer Engineering
Major: Computer Engineering
Research Advisor(s): Dr. Minsu Choi
Advisor's Department: Electrical and Computer Engineering

Funding Source: National Science Foundation

Implementing Null Conventional Logic using Gate Diffusion Input

Asynchronous circuit designs have seen a resurgence in the research community lately as they promise higher energy efficiency and performance than similar clocked architectures. One way of implementing general purpose asynchronous circuits is using Null Conventional Logic (NCL). This project determined the feasibility and advantages of implementing NCL with Gate Diffusion Input (GDI) versus traditional CMOS implementations. GDI promises further reduced power consumption and reduced area when compared to CMOS. This is synergistic with NCL as NCL requires additional space when compared to traditional clocked logic. The benefits of this approach were tested by designing an optimized NCL implementation using GDI and comparing it in simulations against traditional systems.

Caleb Olson is a Junior undergraduate student in Computer Engineering at the Missouri University of Science and Technology. This year he has been working as an undergraduate research assistant to Dr. Minsu Choi, researching low power computing techniques. He has also worked as an undergraduate research assistant to Dr. Y. Rosa Zheng from May to November 2015. There he worked on her Multi-coil Magneto-Inductive Communications research. Caleb is currently in charge of the Missouri S&T Solar Car Team's electrical division. After receiving his Bachelor's Degree, he plans to pursue his Master's Degree in Computer Engineering.

Katherine Overend

Department: Electrical and Computer Engineering
Major: Electrical Engineering, Physics
Research Advisor(s): Dr. Watkins
Advisor's Department: Electrical and Computer Engineering

Funding Source: Applied Optics Laboratory
(Honors Project)

Biometric Identification using Infrared Imaging

Infrared (IR) imaging is used for analyzing vein structures for biometric identification. This could be applied in uses such as security scanners and identification (similar to finger print scanners). In this project, IR light (940 nm) is used to capture an image of the backs of hands and identify the vein structure. A camera with a modified filter to allow IR Light pass through is used along with IR LED's directed toward the focal point of the camera. An experimental setup is demonstrated that compares IR and visible images of hands. These images can be compared to visible light images from a non-modified camera with white light LED's. The hemoglobin in the veins has a different reflection coefficient than the surface of the skin. This difference is more noticeable with IR light than with visible light.

Katherine Overend is currently a senior from Lansing, Kansas, majoring in Electrical Engineering and Physics. Her emphasis in Electrical Engineering is Optics and Photonic Devices. She has been doing research with Dr. Watkins since the Fall of 2015. After she graduates, she plans to continue her exploration of optical engineering and image sciences in pursuit of a graduate degree.

Cesar Ramirez

Joint Project with Joe Collum

Department: Chemical Engineering Department
Major: Chemical Engineering
Research Advisor(s): Dr. Muthanna H. Al-Dahhan
Advisor's Department: Chemical Engineering

Funding Source: U.S. Department of Energy-Nuclear Energy Research Initiative (DOE-NERI) project (NEUP 13-4953 (DENE0000744)

Natural Convection in Missouri S&T Prismatic Scaled Down Facility Subject to Constant Heat Flux

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Born and raised in San Angelo, Texas, Cesar Ramirez is currently pursuing a B.S. in chemical engineering at Missouri University of Science and Technology. He plans on graduating in the spring semester of 2016. On campus, Cesar is involved in AIChE and has acquired skills in MATLAB, Aspen Plus and various programs in Microsoft Office.

Vanessa Reynolds

Department: Geology Geophysics and Petroleum Engineering
Major: Geology
Research Advisor(s): Dr. Kelly Liu
Advisor's Department: Geology and Geophysics

Funding Source: The National Science Foundation

2-D Seismic analysis of polygonal fault systems of Khoman Formation, Western Desert, Egypt

Throughout the Khoman Formation near the Farafra Oasis, Egypt, a series of basins called desert eyes are thought to be the result of a system of subsurface polygonal faults. The research area spans four specific locations in which seismic data was gathered using both forward and reverse 2-D refraction surveys. The area of interest consists predominantly of Cretaceous chalk deposits, in which extensive faulting and desert eye structures can be observed on the surface. The research aims at locating faults along with their respective vertical throw, and potentially recognizing desert eye structures in seismic section. Correlation of the subsurface data to visible faults on the surface and understanding seismic refraction techniques will allow accurate identification of desert eye structures that may no longer be visible due to eolian deposition.

Vanessa Reynolds is a senior studying Geology and Geophysics at the Missouri University of Science and Technology. She is interested in the relationship between geology and technology and plans to pursue a master's degree in Geographic Information Systems upon graduation in December 2016.

Adam Richter

Joint poster project with Trevor Sparks, Jordan Sanders, and Tyler Johnson

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

Funding Source:	Energy Research and Development Center

Biodiesel Production Using a MSSR (Multi-tubular Supercritical Separative Reactor)

Biodiesel is an alternative fuel source for diesel engines. In comparison to traditional diesel fuels, it is renewable, has a comparatively lesser impact on the environment, and has a reduced amount of toxins in its emissions. Biodiesel can be made using supercritical methanol and waste cooking oil that is common in restaurant and household kitchens. Biodiesel is often produced in a batch process and then later undergoes time-consuming separation processes to retrieve the desired product from the undesired waste. However, the purpose of this research is to design, build, and test a novel reactor that will produce Biodiesel and separate the desired product from the undesired waste in a continuous process using supercritical methanol and waste cooking oil.

Adam Richter is from Highland, Illinois, and is currently a third year chemical engineering student at Missouri S&T. He is researching, under the direction of Dr. Joseph Smith, how to create biodiesel fuel, as an alternative means of energy for diesel engines. He is also a third year varsity member of the baseball team at Missouri S&T. His anticipated graduation date is May 2017.

Jordan Sanders

Joint poster project with Tyler Johnson, Adam Richter, and Trevor Sparks

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

Funding Source: Energy Research and Development Center

Biodiesel Production Using a MSSR (Multi-tubular Supercritical Separative Reactor)

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Jordan Sanders is a Chemical Engineering student at the Missouri University of Science and Technology. He enjoys investing time into his design team, iGEM, and also is an active member of Beta Sigma Psi fraternity. He hopes to graduate in the December of 2016 and acquire a job doing chemical process safety or production management.

Trevor Sparks

Joint poster project with Adam Richter, Jordan Sanders, and Tyler Johnson

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

Funding Source: Energy Research and Development Center

Biodiesel Production Using a MSSR (Multi-tubular Supercritical Separative Reactor)

Biodiesel is an alternative fuel source for diesel engines. In comparison to traditional diesel fuels, it is renewable, has a comparatively lesser impact on the environment, and has a reduced amount of toxins in its emissions. Biodiesel can be made using supercritical methanol and waste cooking oil that is common in restaurant and household kitchens. Biodiesel is often produced in a batch process and then later undergoes time-consuming separation processes to retrieve the desired product from the undesired waste. However, the purpose of this research is to design, build, and test a novel reactor that will produce Biodiesel and separate the desired product from the undesired waste in a continuous process using supercritical methanol and waste cooking oil.

Trevor Sparks is senior in the Chemical Engineering department graduating in May. He is currently researching biodiesel for Dr. Smith. The goal of this research project is to build it as an easily transportable, modular reactor. He is involved in the student and national chapters of AIChE and a local mentoring program for Rolla schools.

Tim Victor

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

Funding Source: University of Missouri Research Board

Optimization of a Piezoelectric Cantilever-Based Windmill

Wireless sensor applications require that the power for the sensor and its networks be self-supplied. Previous technology demands that a single charge battery must be replaced once the energy is consumed. Since the sensor application can be in remote locations, the user must periodically retrieve the sensor and replace the power source to ensure consistent data output. A simple design for a piezoelectric cantilever-based windmill allows the sensor to harvest energy from a small amount of available wind power and can reduce the complexity of a self-powered system. The purpose of this research was to computationally and experimentally optimize a simple piezoelectric windmill to increase efficiency. The main goals are to reduce the wind speed required for startup, reduce friction within the cantilever-gear system, and increase the overall power efficiency.

Tim Victor is a Mechanical Engineering Senior at Missouri University of Science and Technology. He spends most of his time working on his car, staying in shape, and is an active member of Students Today Alumni Tomorrow (STAT) and Lambda Chi Alpha Fraternity. He will graduate in May of 2016 and hopes to work for an alternative energy company in research and development while also pursuing an MS in Mechanical Engineering.

Mitchell Wainwright

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

Funding Source: Missouri Space Grant

Missouri Plasmoid Experiment

Using emitted light to determine characteristics of a plasma provides a valuable tool for gaining insight into characteristics of a plasma including temperature and density. When using spectroscopic data to determine these characteristics within a plasma, it is sometimes necessary to refine some assumptions in order to improve on the precision of obtained values. Two specific topics of interest are effects of the relaxation of an optically thin assumption and effect of ionic cross sectional data on spectroscopic analysis of plasma characteristics. With the inclusion of these effects, more precise characteristics can be obtained with the goal of reducing analysis error to below that of the experiment.

Mitchell Wainwright is a graduating senior in Aerospace Engineering who has participated in many undergraduate activities including college athletics, design teams, volunteer work, and research. Mitchell plans on pursuing a graduate degree in Aerospace Engineering, researching characteristics of pulse induced plasma.

Dylan Webb

Joint Project with Vanessa Reynolds and Yuchen Yang

Department: Geology Geophysics and Petroleum Engineering
Major: Geology/Geophysics
Research Advisor(s): Dr. Kelly Liu
Advisor's Department: Geology and Geophysics

Funding Source: The National Science Foundation

2-D Seismic analysis of polygonal fault systems of Khoman Formation, Western Desert, Egypt

Throughout the Khoman Formation near the Farafra Oasis, Egypt, a series of basins called desert eyes are thought to be the result of a system of subsurface polygonal faults. The research area spans four specific locations in which seismic data was gathered using both forward and reverse 2-D refraction surveys. The area of interest consists predominantly of Cretaceous chalk deposits, in which extensive faulting and desert eye structures can be observed on the surface. The research aims at locating faults along with their respective vertical throw, and potentially recognizing desert eye structures in seismic section. Correlation of the subsurface data to visible faults on the surface and understanding seismic refraction techniques will allow accurate identification of desert eye structures that may no longer be visible due to eolian deposition.

Dylan Webb is a junior at Missouri S&T pursuing his bachelor's degree in geology and geophysics. He is currently working under Dr. Liu as an undergraduate research assistant and in the future plans to further his education as a graduate student. Dylan enjoys traveling and being outdoors.

Yuchen Yang

Joint Project with Vanessa Reynolds and Dylan Webb

Department: Geology Geophysics and Petroleum Engineering
Major: Geology
Research Advisor(s): Dr. Kelly Liu
Advisor's Department: Geology and Geophysics

Funding Source: The National Science Foundation

2-D Seismic analysis of polygonal fault systems of Khoman Formation, Western Desert, Egypt

Throughout the Khoman Formation near the Farafra Oasis, Egypt, a series of basins called desert eyes are thought to be the result of a system of subsurface polygonal faults. The research area spans four specific locations in which seismic data was gathered using both forward and reverse 2-D refraction surveys. The area of interest consists predominantly of Cretaceous chalk deposits, in which extensive faulting and desert eye structures can be observed on the surface. The research aims at locating faults along with their respective vertical throw, and potentially recognizing desert eye structures in seismic section. Correlation of the subsurface data to visible faults on the surface and understanding seismic refraction techniques will allow accurate identification of desert eye structures that may no longer be visible due to eolian deposition.

Yuchen Yang is an undergraduate student and majoring in Geology and Geophysics. His interest is Geophysics with emphasis on Seismic Interpretation. He plans to attend graduate school upon graduation in May 2017.

Research Proposals

Poster Abstracts

Alexander Ayres

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

Funding Source: None

Effect of Phosphorylation on Dbf2 in Cytokinesis

Cytokinesis is the physical process of cell division, which divides the cytoplasm between the two new daughter cells. One important pathway that regulates Cytokinesis is called the Mitotic Exit Network, or MEN for short. The MEN is signaling pathway that allow a dividing cell to complete cytokinesis and exit mitosis. Of the many proteins involved in the MEN, the particular protein being researched is a kinase called Dbf2. Of interest is the regulation of Dbf2 by phosphorylation. Mutant alleles of the dbf2 gene that prevent phosphorylation or dephosphorylation have been created on a plasmid. The plasmid is duplicated and purified from bacterial cells, then inserted in yeast cells, the model organism used for study of cytokinesis. After growth of the yeast colonies, the cells with Dbf2 mutations can be observed during mitosis through use of fluorescence microscopy to determine the effects of the mutations on cytokinesis.

Alexander Ayres is currently a junior in the Chemical Engineering Department, receiving a degree in Chemical Engineering with an emphasis in Biochemical Engineering. He is also striving for a minor in Biological Sciences. After finishing his undergraduate degree, he hopes to receive a Doctorates in pathogenic microbiology. In his spare time, he enjoys camping and climbing outdoors, and as such, holds a leadership position in the Missouri S&T Climbing club.

Brendan Beebe

Joint project with Daniel Sloan.

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

Funding Source: Biological Sciences Department

An Estrogen-Based BPA Detection Method

BPA is a synthetic Estradiol mimicking compound found in polymers and epoxy resins. Due to endocrine interrupting and estrogen simulating properties, BPA has side effects associated with reproductive and developmental health. To that the end, the team pursued the integration of a genetic device which detects BPA and estrogen on a parts per billion (ppb) basis. Ppb is the minimal level at which animal testing shows synthetic hormones to have detrimental effects. The device therefore consists of an Estrogen detection based promotor (the team hypothesizes shall also detect BPA due to chemical structural similarities beginning with the terminal alcohol group on each) and genes which code for blue fluorescence. The team will use *E. coli* in log and stationary phase to test the saturation of fluorescence using spectroscopy in cells grown in parts per trillion, parts per billion, and parts per trillion to determine if the device meets the requirements of effective detection.

My name is Brendan Beebe, a third year Biological Sciences major at Missouri University of Science and Technology. I have always loved biology and science from a young age, and decided to pursue a degree at Missouri S&T. It was here that I discovered the many interesting things that microbial agents can do, and what can be done to them. As such, I enrolled in Biological Design, and have embarked on a semester long project involving a Genetically Modified Organism.

Damien Bizeau

Joint project with Elizabeth Thoenen

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

Funding Source: None

Detection and Bioremediation: Polychlorinated Biphenyls

Polychlorinated Biphenyls (PCBs) are a group of toxic man-made compounds which resist most natural degradation processes. Originally produced for use in electrical components, adaptation for use in industry and construction enabled PCBs to find their way into the environment. PCB toxicity has resulted in the sickening of hundreds of people on multiple continents. To detect and degrade environmental PCBs, a PCB degrading operon cloned from the organism *Pseudomonas pseudoalcaligenes*, a PCB biosensor, and a kill switch will be designed and inserted into the model organism, *E. coli*. When this engineered bacteria takes up PCB molecules, gene for a red fluorescent protein as well as the enzymes for PCB degradation will be transcribed and translated, causing the visualization and breakdown of the PCB molecules. The kill switch gene will lyse the engineered bacteria following PCB degradation in order to ameliorate the bioburden of this project.

Damien Bizeau is a senior in Biological Sciences. Upon graduation, he plans to attend dental school to obtain a DDS.

Justin A. Carollo

Joint project with Jordan Powell

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

Funding Source: None

Regulating Cow Methane Production with Methane Monooxygenase Producing E. Coli

Research has shown strong evidence that greenhouse gases are accountable for the steady increase in temperatures around the world. Methane is among the most notable of the greenhouse gases and is heavily produced through the eructation of livestock, specifically cattle. Current research supports the approach of introducing methane monooxygenase producing E. coli, encapsulated in alginate beads, into the intestinal tract of cows to break down methane before it gets to the rumen. Our adaptation considers the negative effects of breaking down methane by which methanol is created as a byproduct. Methanol, in high enough quantity, can be toxic to the cow. By using a methanol sensitive promoter to limit production, the methane can be both broken down to help eliminate a portion of greenhouse gases, while the cow's health can be better ensured.

Justin Carollo is a junior in Biological Sciences with a minor in Military Science. He plans to graduate with a Bachelor of Sciences and commission in the United States Army as a Second Lieutenant. After Basic Officer Leadership Course, he plans to pursue a graduate's degree in Epidemiology.

Justin Clinton

Department: Geology and Geophysics
Major: Geology and Geophysics
Research Advisor(s): William Chandonia
Advisor's Department: Geology and Geophysics

Funding Source: none

Analog Modeling of "Thick-skin" Crustal Deformation During Continental Collision.

We use analog modeling to investigate the role of rigid basement rock in altering the architecture of fold and thrust belts that form in the overlying sedimentary "cover" rock during Plate Tectonic related continental collisions. The results will elucidate how "thick-skinned" deformation (basement-involvement) affects development of "structural traps" in the cover rocks. Such traps commonly are sites of prolific accumulation of hydrocarbons and are targets for energy industries. The model consists of layered colored sand (sedimentary cover) resting on a wooden block (rigid basement rocks). Saw cuts in the "basement" represent preexisting faults that reactivate during deformation. Shortening (e.g., horizontal compression) of the cover-rocks and basement-rocks during continental collision is accomplished by advancing a rigid wall (i.e., the colliding continent). Data to be collected includes thrust fault number, spacing, and geometry. Comparisons will be made to cross sections of thick-skinned deformation associated with the Appalachian fold and thrust belt.

Justin Clinton was born in Maryland Heights in St. Louis, Missouri. He moved to Rolla when he was 4 yrs old and graduated from Rolla High School in 2008 with an A+ scholarship. He took his core college classes at East Central College and then transferred to Missouri University of Science and Technology to pursue a degree in geology and geophysics. Justin became interested in geology and geophysics when he was about 8 yrs old. It started when he received box of all the minerals of every state and the interest in how they formed and why there were only found in certain areas and not everywhere. While growing up, he was fortunate enough to have several family friends who were geologists from the Missouri Department of Natural Resources, the US Geological Survey, and Conoco that he was able to talk to. Justin is interested in geophysics and plans to work in the engineering geophysics field after graduating.

Delaney DeJanes
Joint project with Heather McCoy

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

Funding Source: Imagination

Breaking Plaque

The purpose of the project is to create an E.coli strain with the ability to break down the plaque buildup around teeth. The main goal is to inhibit the bacteria from grouping together to form the biofilm. Therefore, the main target of the device will be the variety of gram-positive bacteria found in the mouth and the gooey, polysaccharide layer that they create. The biofilm is built through quorum sensing and our strain of E.coli will contain an enzyme that prohibits the peptides from working as sensors that signal other bacteria. Once the targets are unable to bind to each other, we will further the efficiency by breaking down the cell walls, and will attempt to lyse the cells. Lastly, the device will release a minty smell that allows the user to know their mouth cleaning has been completed for the time being.

Delaney DeJanes and Heather McCoy are seniors in Biological Sciences. They will graduate in December 2016 with their bachelor's degree from the Missouri University of Science and Technology. Delaney hopes to build on her interest in Biomedical Engineering by doing projects that improve the body and working with prosthetics to restore bodily functions. Heather will begin a career as an officer in the United States Army upon graduation.

Mason Donnell

Department: Biological Sciences
Major: Biological Sciences, minor in Biomedical Engineering & Chemistry
Research Advisor(s): Dr. Katie Shannon
Advisor's Department: Biological Sciences

Funding Source: OURE-Missouri S&T

Investigating Cytokinesis in Yeast may lead to Novel Cancer Treatments

Cytokinesis is the process of cytoplasmic division in a cell. One of the processes in cytokinesis is actomyosin ring (ARM) assembly. IQG1, a protein involved in ARM function, possess four domains with the C-terminal domain named Ras GAP C terminus (RGCT). This domain, when deleted, causes cell death. I will use DNA plasmids to introduce wild type IQG1 to yeast cells with a RGCT deletion allele. To confirm the proteins expression, SDS-PAGE will be used to isolate the protein and Western Blotting will confirm the IQG1 expression. Once the strain has been made, analysis of the RCGT domain will begin. Qualitative effects of IQG1 in cytokinesis will be achieved by fluorescent microscopy. The ability of the mutant IQG1 to bind to other proteins will be tested using a GST assay followed by Western Blotting. The merit of this project comes from understanding cytokinesis, which can lead to novel cancer treatments.

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 Biological Sciences while minoring in Chemistry and Biomedical 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.

Joshua James Herman

Department: Computer Science
Major: Computer Science
Research Advisor(s): Dr. Daniel Tauritz and Dr. Bruce McMillin
Advisor's Department: Computer Science

Funding Source: National Science Foundation's Scholarship for Service

eSHANCS: Evolving Simulated Human Activity on Networked Computer Systems

Emulated computer networks are commonly used in cyber security research to evaluate attacker and defender strategies, but it is often trivial to detect adversaries in the absence of complex human user interactions, because irregular activity can be attributed to an adversary. The research proposed is to create a custom hyper-heuristic employing genetic programming that evolves computer agents capable of simulating the complex behavioral patterns exhibited by human users on a diverse set of networks. Previous research has been mostly limited to replays of user traffic which does not generalize well to different networks. The proposed approach will use anonymized, enterprise scale network traffic data sets provided by Los Alamos National Laboratory to train and test the system. The goal will be to have the entire population of agents act as a multi-agent simulation of human users with sufficient fidelity to provide network emulations capable of representing the real world.

Joshua Herman is an undergraduate student expecting to graduate with his B.S. in Computer Science at Missouri University of Science and Technology in May 2016. After graduating he will pursue a Ph.D. in Computer Science with an emphasis on cyber security and evolutionary computing at Missouri University of Science and Technology through the National Science Foundation's Scholarship for Service. He is currently an undergraduate research assistant in the Natural Computation Laboratory supervised by Dr. Daniel Tauritz and Dr. Bruce McMillin. He has had two summer internships along with working year-round through telecommuting at Sandia National Laboratories.

Sierra Herndon

Department: Biological Sciences and Chemistry
Major: Biological Sciences
Research Advisor(s): Dr. Dev Niyogi and Dr. Klaus Woelk
Advisor's Department: Biological Sciences and Chemistry

Funding Source: Missouri S&T's Opportunities for Undergraduate Research Experiences

Identification of Phosphorus Species in the Mill Creek Watershed via Nuclear Magnetic Resonance

The Mill Creek area near Newburg, MO offers a complex hydrology due to several springs feeding into it, and as a result, is expected to provide information on the effects of land use on water quality. The presence of phosphorus in streams is important because it plays a significant role in the eutrophication of a water source. Nuclear Magnetic Resonance (NMR) will be used in an attempt to identify several organic and inorganic phosphorus species in the stream. Water and sediment samples from Mill Creek will be collected and analyzed. Stormflow samples, collected after rainstorms, will provide crucial information about the source of phosphorus in the watershed, as well as how it travels to streams.

Sierra Herndon is a Freshman in Biological Sciences, with minors in Chemistry and Biomedical Engineering. She has been with the NMR group for two years. She enjoys martial arts and writing.

Hannah Kim

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

Funding Source: N/A

Human Hair Clippings: Potential Energy of the Future

Human hair clippings can be utilized in various ways: wigs, plant fertilizer, hair boom, and clay reinforcement. However, majority of the human hair clippings are dumped without being used. Hair is a protein filament that are made of tough protein called Alpha-Keratin. Its toughness comes from the disulfide bonds created between cysteines, major amino acid composing Keratin. Due to its strong covalent disulfide bridges, Alpha-Keratin can take more than 100 years to break down, depending on what bacterial or chemical environment Keratin is exposed to. Research has been shown that some *Bacillus Subtilis* strain have the ability to hydrolyze Alpha-Keratin. Nonetheless, as Alpha-Keratin has numerous disulfide bonds, its hydrolysis efficiency is fairly low. Hence, to improve the Alpha-Keratin hydrolysis efficiency, I propose equipping Keratinase gene sequences into well-understood *B.Subtillis* chassis with a use of synthetic biology. Later, Keratin hydrolysate, amino acids, can be applied to run MFC for power generation.

Hannah is a senior majoring in Biological Science at Missouri University of Science and Technology. Her research interest includes genetics combined with microbiology and stem cell biology. She plans on going to graduate school to continue her education.

Heather McCoy

Joint project with Delaney DeJanes

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

Funding Source: Imagination

Breaking Plaque

The purpose of the project is to create an E.coli strain with the ability to break down the plaque buildup around teeth. The main goal is to inhibit the bacteria from grouping together to form the biofilm. Therefore, the main target of the device will be the variety of gram-positive bacteria found in the mouth and the gooey, polysaccharide layer that they create. The biofilm is built through quorum sensing and our strain of E.coli will contain an enzyme that prohibits the peptides from working as sensors that signal other bacteria. Once the targets are unable to bind to each other, we will further the efficiency by breaking down the cell walls, and will attempt to lyse the cells. Lastly, the device will release a minty smell that allows the user to know their mouth cleaning has been completed for the time being.

Delaney DeJanes and Heather McCoy are seniors in Biological Sciences. They will graduate in December 2016 with their bachelor's degree from the Missouri University of Science and Technology. Delaney hopes to build on her interest in Biomedical Engineering by doing projects that improve the body and working with prosthetics to restore bodily functions. Heather will begin a career as an officer in the United States Army upon graduation.

Jordan Powell

Joint Project with Justin Carollo.

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

Funding Source: None

Regulating Cow Methane Production with Methane Monooxygenase Producing E. Coli

Research has shown strong evidence that greenhouse gases are accountable for the steady increase in temperatures around the world. Methane is among the most notable of the greenhouse gases and is heavily produced through the eructation of livestock, specifically cattle. Current research supports the approach of introducing methane monooxygenase producing E. coli, encapsulated in alginate beads, into the intestinal tract of cows to break down methane before it gets to the rumen. Our adaptation considers the negative effects of breaking down methane by which methanol is created as a byproduct. Methanol, in high enough quantity, can be toxic to the cow, so we look to better control the reaction by having a limiting feature around levels of methanol. With the methanol better regulated, the methane can be both broken down to help eliminate a portion of greenhouse gases, and the cow's health can be better ensured.

Jordan Powell is a junior in Biological Sciences. She participates in various activities on campus including being a PRO-Leader, theater and a member of Christian Campus Fellowship. She plans to graduate with a Bachelor of Sciences and pursue a career in field biology.

Sonya Roberts

Joint project with Claire Wilmore

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

Funding Source: OURE

Inhibition of P. destructans

Pseudogymnoascus destructans is a fungus invading caves and drastically killing off bat populations across America. It causes a disease known as White Nose Syndrome, which affects hibernating bats. Agriculture costs have spiked due to the increase in insects caused by the dwindling bat populations. Our paper investigates ways to inhibit the growth of *P. destructans* by using naturally occurring antifungal agents. We explored the possibilities of using azoles and allylamines, chitin-degrading organisms, and bacteria with specific properties that hinder the growth of *P. destructans.* Our most promising finding was the bacteria *Rhodococcus rhodochrous*, which kills *P. destructans* with simple aromatic exposure. We propose to look into the compounds used in this aromatic exposure to determine if the bacteria's characteristic could be applied to caves affected by White Nose Syndrome.

Sonya Roberts is a Mechanical Engineering student with a Biological Sciences minor. She plans on attending graduate school after S&T and hopes to someday work in the field of biomedical engineering. She spends most evenings riding and training her two horses she owns here in Rolla. She competes in eventing, a discipline of English riding. Sonya is a member of the design team iGEM. She also enjoys playing the piano. She is a Miner Challenge participant and will be attending the volunteer trip to Colorado over spring break.

Daniel Sloan

Joint Project with Brendan Beebe.

Department: Biological Sciences
Major: Biology/Chemistry (Pre-Med)
Research Advisor(s): Dr. Katie Shannon and Dr. David Westenberg
Advisor's Department: Biological Sciences

Funding Source: Biological Sciences Department

An Estrogen-Based BPA Detection Method

BPA is a synthetic Estradiol mimicking compound found in polymers and epoxy resins. Due to endocrine interrupting and estrogen simulating properties, BPA has side effects associated with reproductive and developmental health. To that the end, the team pursued the integration of a genetic device which detects BPA and estrogen on a parts per billion (ppb) basis. Ppb is the minimal level at which animal testing shows synthetic hormones to have detrimental effects. The device therefore consists of an Estrogen detection based promotor (the team hypothesizes shall also detect BPA due to chemical structural similarities beginning with the terminal alcohol group on each) and genes which code for blue fluorescence. The team will use *E. coli* in log and stationary phase to test the saturation of fluorescence using spectroscopy in cells grown in parts per trillion, parts per billion, and parts per trillion to determine if the device meets the requirements of effective detection.

Daniel Sloan is a third year Biological Sciences Major. Daniel is involved in a variety of on and off-campus activities. Upon graduation, he plans on pursuing an M.D. at UMKC. Daniel believes that genetics has become and will continue to a developing tool in treatment options for outpatient therapies. Fortunately, a Bio Design class was offered this semester that allowed Daniel to pursue his interests in this area. Daniel thanks you for reading his biography and would like the reader to have a lovely and fulfilling day.

Claire Wilmore

Joint project with Sonya Roberts

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

Funding Source: Opportunity for Undergraduate Research Experience

Inhibition for P. destructans

Pseudogymnoascus destructans is a fungus invading caves and drastically killing off bat populations across America. It causes a disease known as White Nose Syndrome which affects hibernating bats. Agriculture costs have spiked due to the increase in insects caused by the dwindling bat populations. Our paper investigates ways to inhibit the growth of *P. destructans* by using naturally occurring antifungal agents. We explored the possibilities of using azoles and allylamines, chitin-degrading organisms, and bacteria with specific properties that hinder the growth of *P. destructans.* Our most promising finding was the bacteria *Rhodococcus rhodochrous*, which kills *P. destructans* with simple aromatic exposure. We propose to look into the compounds used in this aromatic exposure to determine if the bacteria's characteristic could be applied to caves affected by White Nose Syndrome.

Claire Wilmore is a sophomore at Missouri S&T working towards a degree in Chemical Engineering. She is involved on campus with IGEM and Greek Life. She is looking forward to getting her degree and new challenges ahead.

Sciences

Poster Abstracts

Arielle Bodine

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

Funding Source: Opportunities for Undergraduate Research Experience

Comparing Statistical Methods for Analyzing DNA Methylation Data

DNA Methylation occurs when a methyl group attaches to a cytosine base in the DNA strand. This methylation of cytosine bases plays a significant role in gene expression. It has also been shown that differences in DNA methylation patterns exist between healthy and diseased individuals. Because methylation patterns vary from person to person, this creates statistical challenges when trying to quantify differences between groups of individuals. In this project, we compare statistical methods for analyzing DNA Methylation microarray data with the goal of detecting methylation differences between low-grade and high-grade HIV patients.

Arielle Bodine is a senior in applied mathematics and economics. Active on campus, she is the recruitment chair for Delta Omicron Lambda service sorority, vice-president of S&T's chapter of Kappa Mu Epsilon math honor society and a Sue Shear fellow. She is also a student writer for the Missouri S&T marketing and communications department and an undergraduate researcher for the department of economics.

Kent Gorday

Department: Physics
Major: Physics
Research Advisor(s): Risheng Wang
Advisor's Department: Chemistry

Funding Source: Opportunities for Undergraduate Research Experience (OURE)

Self-Assembling Gold Nanorod Arrays Using DNA Origami

DNA origami uses many small, single-stranded oligonucleotides to fold a long single-stranded template into a predetermined shape. DNA origami has become a powerful technique for positioning different functional components on nanometer scales because of its programmable nature and ease of self-assembly. To extend these precise positioning capabilities over a larger scale, one- and two-dimensional arrays have been developed using the regular repetition of DNA origami tiles with complementary sticky ends. We assembled arrays of cross-over tiles, then functionalized the tiles with gold nanorods using thiolated linker strands. Methods of purification and incubation were explored for improved binding efficiency and larger ordered arrays as observed by atomic force microscopy. We expect our arrays of gold nanorods to exhibit exotic plasmonic properties based upon their designed orientation.

Kent Gorday is a sophomore in physics and a member of the International Genetically Engineered Machine design team. He also performs undergraduate research in DNA nanotechnology and participates in the Society of Physics Students as well as the Symphony Orchestra. In his free time, Kent enjoys playing horn, reading, and hiking. Kent intends to continue his education in biophysics after Missouri S&T.

Ken Goss

Department: Computer Science
Major: Computer Science and Computer Engineering
Research Advisor(s): Dr. Simone Silvestri
Advisor's Department: Computer Science

Funding Source: NSF, Missouri Transect

Autonomous Monitoring of Large Scale Agricultural Plants through Unmanned Aerial Vehicles

The importance of understanding how crops are impacted by climate change and drought cannot be overstated as the globe continues in both population growth and industrialization. This project seeks to use UAVs in an innovative framework to improve both the efficiency and efficacy of a wide array of agricultural pursuits. For the first time, a framework to optimize the tradeoff between the monitoring accuracy provided by a UAV network, and its cost, will be developed and proposed. The primary focus of this research is in the development of models to reliably and authentically represent a UAV swarm, from power, to coordination, and overall swarm performance in a wide array of sensing applications.

Ken is currently a senior in both Computer Science and Computer Engineering. He is an Undergraduate Research Assistant in the Networking Laboratory. He is the founder and current President of STARS (S&T Astronomical Research Society). He will graduate May 2017 and pursue graduate studies thereafter.

Elsie Greenwood
Joint project with Abby Haler

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

Funding Source: Center for Biomedical Science and 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 glass disk 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 junior in the biological sciences department. Her, Abby Haler, and Dr. Westenberg work on glass biomaterial. Elsie plans to attend nursing school after graduation. She is a member of the Missouri S&T Women's Basketball Team.

Victoria Grill

Joint project with Elizabeth Thoenen and Samantha Huckuntod

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

Funding Source: OURE

Quorum Sensing in *B. japonicum*

Quorum sensing is the ability of a cell to alter its gene expression in response to chemical stimuli produced by changes in population density. Homoserine lactones (HSLs) are the molecular stimuli responsible for quorum sensing in many nitrogen-fixing microbial species. This project aims to detect, identify, and characterize a novel HSL produced by *Bradyrhizobium japonicum*, a species thought to lack a detectable quorum sensing molecule. The *B. japonicum* quorum sensing gene promoter and regulatory element were inserted into a LacZ plasmid to create an HSL indicator *E. coli* strain. Simultaneously, the use of thin layer chromatography (TLC) was used to compare this novel HSL to known HSLs produced by other species. TLC was performed using an *Agrobacterium tumefaciens* indicator strain to observe the response to known *B. japonicum* HSLs. Understanding this quorum sensing provides practical applications specifically in the field of agriculture.

Victoria Grill a senior in the Biological Sciences department at Missouri University of Science and Technology. After graduating this spring, she hopes to attend graduate school where she will continue to do research in the field of biology. She aspires to one day work in the government sector conducting research. In addition to research, Victoria enjoys serving as a Peer Learning Assistant for the L.E.A.D. organization where she helps other students succeed in their chemistry and biology courses.

Lisa Gutgesell

Department: Biological Science
Major: Biological Science
Research Advisor(s): Dr. Julie Semon
Advisor's Department: Biological Science

Funding Source: Seed Grant from Center for Biomedical Sciences and Engineering

The Effects of Bioglass on Mesenchymal Stem Cells

Recently, mesenchymal stem cells (MSCs) have been demonstrated to accelerate wound closures, improve epidermal/dermal architecture, and improve vascular dysregulation. Borate-based bioglass has also successfully treated chronic, nonhealing dermal wounds in the clinic. This is due to the ability of bioglass to disintegrate in the body rapidly. This study analyzes bioglass activated MSCs and phenotype alterations to increase wound healing. Protein expression of inflammatory, angiogenic, proliferation, migration, and differentiation factors were compared between MSCs co-cultured with bioglass to MSCs grown under normal conditions. In addition, the type and amount of extracellular matrix deposition, differentiation capacity, angiogenic capacity, and cell proliferation were compared between MSCs co-cultured with bioglass to MSCs grown under normal conditions. This study presents a novel theory and mechanism for the ability of bioglass in wound healing.

Lisa Gutgesell is a sophomore majoring in Biological Science and minoring in Chemistry at Missouri University of Science and Technology. She spent last summer teaching children the wonders of life science at the Saint Louis Science Center and plans to spend next summer doing breast cancer research at the University of Illinois at Chicago. Lisa hopes to pursue a Ph.D. in cellular biology and continue research, as a professional, after acquiring a Ph.D.

Abigail Haler

Joint Project with Elsie Greenwood

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

Funding Source: Center for Biomedical Science and 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 glass disk 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.

Abigail is a sophomore in the biology department. Her, Elsie Greenwood, and Dr. Westenberg work on glass biomaterial. Abigail plans to attend vet school after graduation. She is a member of Sigma Alpha Pi, the National Society of Leadership and Success.

Austin Hall

Joint Project with Margaret Pitzer and Hannah Kim

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

Funding Source: OURE Program

Creation of an EnvZ-Tar chimera protein in Escherichia coli for use against White Nose Syndrome

The fungus, *Pseudogymnoascus destructans,* causes White Nose Syndrome which is devastating the North American bat population. More and more researchers are working toward combating the deadly disease and restoring the number of bats found in the wild. The bats affected by White Nose Syndrome are a viable asset to the United States Agricultural Industry, and so, a remedy needs to be found.. Our attempt at an answer uses a synthetic biology approach. It is expected that an E. coli strain able to move towards changes in salinity will move to the source of the fungal infection, and use this trait , along with a strain that produces a fungistatic compound, to slow or even stop the infection while the bat is in hibernation.

Austin Hall is a sophomore at Missouri University of Science and Technology. He is majoring in Biological Sciences while minoring in Chemistry and biomedical engineering. He is involved in Joe’s PEERS and iGEM.

Kayla R. Haneline
Joint Project with Katherine E. Herries

Department: Geosciences and Geological and Petroleum Engineering
Major: Geology and Geophysics
Research Advisor(s): David J. Wronkiewicz, Varun G. Paul
Advisor's Department: Geosciences and Geological and Petroleum Engineering

Funding Source: American Chemical Society – Petroleum Research Fund

An Investigation of the Genesis of Microbialite Communities in Storr's Lake, San Salvador Island, The Bahamas

Living microbial communities are found in the hypersaline and turbid waters of Storr's Lake, The Bahamas. The microbialite mats are composed of mixed communities of symbiotic bacteria and cyanobacteria that precipitate mixed calcium-magnesium carbonate minerals as a result of their biologic activity. These solid mineral strutures have coalesced into mound-shaped structures that initially began to form more than 2360 years ago in Storr's Lake. Growth patterns of the microbialite layers and their corresponding calcium and magnesium stable isotope chemistry are being used to determine both the growth process and sources of mineral components in the mounds. A better understanding of the modern mineralization process(es) will allow the researchers to use these isotopic patterns to reconstruct the carbon-cycle and paleoclimate history of Storr's Lake. Similar structures have been identified in Missouri's fossil record, and thus can provide glimpses into the evolution of the Earth's climate and atmosphere over geologic time.

Kayla R. Haneline is a sophomore in Geology and Geophysics. Upon graduation, she will attend graduate school to further her studies in the Geosciences. In her free time, she likes to play the clarinet, go hiking, and play tennis.

Katherine E. Herries

Joint Project with Kayla R. Haneline

Department: Geosciences and Geological and Petroleum Engineering
Major: Geology and Geophysics
Research Advisor(s): David J. Wronkiewicz, Varun G. Paul
Advisor's Department: Geosciences and Geological and Petroleum Engineering

Funding Source: American Chemical Society – Petroleum Research Fund

An Investigation of the Genesis of Microbialite Communities in Storr's Lake, San Salvador Island, The Bahamas

Living microbial communities are found in the hypersaline and turbid waters of Storr's Lake, The Bahamas. The microbialite mats are composed of mixed communities of symbiotic bacteria and cyanobacteria that precipitate mixed calcium-magnesium carbonate minerals as a result of their biologic activity. These solid mineral strutures have coalesced into mound-shaped structures that initially began to form more than 2360 years ago in Storr's Lake. Growth patterns of the microbialite layers and their corresponding calcium and magnesium stable isotope chemistry are being used to determine both the growth process and sources of mineral components in the mounds. A better understanding of the modern mineralization process(es) will allow the researchers to use these isotopic patterns to reconstruct the carbon-cycle and paleoclimate history of Storr's Lake. Similar structures have been identified in Missouri's fossil record, and thus can provide glimpses into the evolution of the Earth's climate and atmosphere over geologic time.

Katherine E. Herries is a senior in Geology and Geophysics. Upon graduation, she will attend graduate school to further her studies in the Geosciences. In her free time, she likes to play her guitar and banjo, play with her dog, and hike any trail she can find.

Samantha Huckuntod

Joint Project with Victoria Grill and Elizabeth Theonen

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

Funding Source: OURE

Quorum Sensing in *B. japonicum*

Quorum sensing is the ability of a cell to alter its gene expression in response to chemical stimuli produced by changes in population density. Homoserine lactones (HSLs) are the molecular stimuli responsible for quorum sensing in many nitrogen-fixing microbial species. This project aims to detect, identify, and characterize a novel HSL produced by *Bradyrhizobium japonicum*, a species thought to lack a detectable quorum sensing molecule. The *B. japonicum* quorum sensing gene promoter and regulatory element were inserted into a LacZ plasmid to create an HSL indicator *E. coli* strain. Simultaneously, the use of thin layer chromatography (TLC) was used to compare this novel HSL to known HSLs produced by other species. TLC was performed using an *Agrobacterium tumefaciens* indicator strain to observe the response to known *B. japonicum* HSLs. Understanding this quorum sensing provides practical applications specifically in the field of agriculture.

Samantha Huckuntod is a senior obtaining a B.S. in Biological Sciences in May.

Darian Johnson

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

Funding Source: Choudhury Start-up Package and OURE

Low-Cost Lithium Borate Compound for Solid State Lithium-ion Battery Electrolyte

Several research activities have been focused towards using lithium-ion batteries to act as an all solid-state battery. This requires a highly lithium-ion conducting solid to play the role of a solid electrolyte. This has been a major barrier towards the realization of a high efficiency all solid-state lithium-ion battery, which is why our research is focused on discovering new materials that can potentially serve as a solid state lithium electrolyte. We have synthesized a lithium-borate composition and solved the structure using single-crystal x-ray diffraction. The structure of this compound, $Li_3B_5O_8(OH)_2$, crystallizes in the Pnc2 space group, indicates good lithium-ion conduction and is built with BO_3 and BO_4 polyhedra and forms a layered topology. This project details the synthesis, structure, powder X-ray diffraction, and IR and NMR spectroscopic characterization as well as lithium-ion conduction measurements of the new composition.

Darian Johnson is a graduating senior in the Chemical Engineering department. She is involved in several student organizations and activities including, Miner Challenge Alternative Spring Break and Omega Chi Epsilon, as well as serving as the president of the Association for Black Students and co-chair of this year's Student Leadership Conference. In her free time she enjoys baking, running, and watching the Food Network. Darian has always been passionate about food and throughout college has been inspired to develop a healthier lifestyle. After graduation, Darian would like to pursue a career in the food and beverage industry, creating healthier food products.

Kayln Jones

Joint Project with Md Shahinuzzaman

Department: Biology and Chemical Engineering
Major: Biology
Research Advisor(s): Katie Shannon and Dipak Barua
Advisor's Department: Biology and Chemical Engineering

Funding Source: The Center for Statistical and Computational Modeling of Biological Complexity Collaborative Research Grant

Using Budding Yeast to Quantitate the Rate of Autophagy

Autophagy is a homeostatic process that functions in eliminating unwanted protein, damaged organelles, and intracellular microbial pathogens. Previous research has shown the importance of autophagy in maintaining physiological functions as well as its implications in severe human diseases. These implications have revealed an importance for quantitative measuring of autophagy. Rapamycin is a drug that induces autophagy through the inhibition of mTOR, a protein kinase that regulates cell growth and metabolism. The inhibition of mTOR mimics cellular starvation, causing cellular stress and thereby inducing autophagy. In budding yeast cells, autophagy causes an influx of proteins into the vacuole where they are then degraded. Measuring the degradation of these proteins is an accurate method to monitor and quantify autophagic activity. In this study, cells expressing Pgk1-GFP as a marker of autophagy were treated with various concentration of rapamycin. Imaging was performed after six hours of treatment with the various rapamycin concentrations. After data collection, image-processing software was used to quantitate fluorescence intensity of Pgk1-GFP in the yeast vacuole. This data will be used to create a computational model of autophagy induced by rapamycin.

Kayln is a senior majoring in Biological Sciences with a minor in Chemistry. She has been working in Katie Shannon's cytokinesis lab since June of 2015 and this represents her first project. She is currently president of Scrubs and a member of Phi Sigma Biological Honors Society. She will be graduating from S&T this December with plans to begin medical school in the fall of 2017.

Parker Jones

Department: Computer Science
Major: Computer Science
Research Advisor(s): Sajal Das, Vijay Shah, Shameek Bhattachargee
Advisor's Department: Computer Science

Funding Source: N/A

Application and Implementation of a Cognitive Radio Network in a Post Natural Disaster Scenario

The concept of cognitive radio networks, or CRN, was presented as a novel form of wireless communication in 1998 and has steadily been growing in popularity amongst researchers ever since. Cognitive radios are a software-defined radio platform that utilize a fully reconfigurable transceiver that adapts to the communication parameters set by the user and network. This inherently modular software based design allows for incredible versatility and robustness as a network. In a post disaster scenario where networks and traditional communications fail, it is paramount to restore communication as quickly and effectively as possible in order to provide aid to those affected. The added knowledge that this cognitive radio provides could potentially result in the saving of many lives that would have otherwise perished. To accomplish these goals I will simulate the implementation of a CRN that utilizes the vacant TV broadband spectrum channels to create basic ad hoc networks between cellular enabled smart devices. These ad hoc networks will be able to deliver messages to other nodes within the network based on an algorithm I have defined in order to notify first responders of potential victims in need of assistance.

Kirsten Kelly

Department: Chemistry
Major: Chemistry Pre-med
Research Advisor(s): Katie Shannon
Advisor's Department: Biological Sciences

Funding Source: N/A

Preparing a Halanaerobium Hydrogeniformans Vector

Halanaerobium Hydrogeniformans is an extremophile hydrogen producing bacteria. The ability to harness this hydrogen production would be extremely useful in the creation of a hydrogen biofuel. It would be most useful to study the hydrogen producing characteristics in inexpensive and easily grown bacteria, in this case yeast. *E. Coli* was used as an intermediate bacteria between the Hydrogen bug and yeast. Growth conditions were examined between *H. Hydrogeniformans* and *E. Coli*. A genetic sequence from the extremophile was chosen for removal, and an intermediate vector was in the process of development.

Kirsten Kelly is a Senior in Chemistry. She is planning on graduating in December 2016, and attending graduate school.

Jonathan Kopel

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

Funding Source: OURE Funds

The Under-investigated Antioxidant Potential of Thiolactic Acid

Free radicals have numerous physiological functions within the cell, ranging from cellular signaling to the immune response. However, a surge in free radicals has the potential to devastate biological macromolecules, structures, and cellular function. Current research aims to identify the mechanism, effects, and elimination of free radicals through the action of antioxidant compounds, such as vitamin C. In light of this trend, the antioxidant potential of a common industrial thiol, known as thiolactic acid (TLA), was investigated. TLA's scavenging capability was analyzed using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay and compared with known antioxidants, such as butylated hydroxytoluene (BHT), N-acetylcysteine (NAC), N-acetylcysteine amide (NACA), and uric acid, at various concentrations (200 µM-12.5 µM). The percent DPPH scavenged over time was plotted and the inhibitory concentration (IC_{50}) was calculated for each compound. TLA demonstrated the fastest and greatest overall scavenging of DPPH radicals among the antioxidants tested.

Jonathan Kopel is a senior undergraduate student at Missouri University of Science studying biochemistry. He has worked in Dr. Nuran Ercal's research laboratory investigating oxidative stress and antioxidant parameters of different compounds. In addition, Jonathan worked as intern at the Edward Doisy Research Center under the direction of Dr. Cho.

Katlyn Lonergan

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

Funding Source: NASA EPSCoR, MS&T Opportunities for Undergraduate Research Experience (OURE) Program

Isolation & Characterization of Novel Halo-Acidophillic Microorganisms from Evaporites in Western Australia

The microbial communities in the acidic hypersaline environments in Lake Magic, 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 evaporites 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 the halite, and in some cases, gypsum crystals from the various lakes mentioned above and are expected to be in this new category of 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 undergraduate student in Geology and Geophysics with an emphasis in Biological Sciences. In Rolla, Katlyn is an active member of the campus C.L. Dake Geological Society and a proud employee of the USGS, Cartography Division. After graduation, Katlyn will continue her education at University of Colorado-Boulder earning her Masters in Environmental Science.

Daniel Park

Department: Biological Sciences
Major: Biology
Research Advisor(s): Julie Semon
Advisor's Department: Biological Sciences

Funding Source: Seed Grant from Center for Biomedical Sciences and Engineering

Angiogenic Effects of Mesenchymal Stem Cells and Bioglass on Chick CAM Vasculature

New blood vessels are generated through a physiological process called angiogenesis. Formation of these blood vessels comes primarily from pre-existing vasculature. Using a chick chorioallantoic membrane (CAM), which provides a highly vascularized animal model, adipose- and bone marrow-derived mesenchymal stem cells and borate-based 13-93B3 bioglass were tested for angiogenic properties. The mesenchymal stem cells (MSC) and the borate bioglass were expected to accelerate angiogenesis within the CAM model. MSCs and bioglass were carefully placed between major blood vessels in the chick embryos seven days after their eggs were cracked. Angiogenesis was observed on a daily basis for three consecutive days before using a dissecting scope to capture images of vasculature in and around the plastic rings. Images were then analyzed and individual vasculature comparisons were made among: adipose derived-MSCs (AD-MSCs), bone marrow derived-MSCs (BM-MSCs), bioglass incorporated with AD-MSCs, and bioglass incorporated with BM-MSCs.

Daniel Park is a second bachelor's degree student majoring in biology. After completing his economics degree at Emory University in 2013, Daniel decided to study a subject that catered more to his interests and career goals. While working in Dr. Julie Semon's Regenerative Medicine Lab, Daniel has only become more enthusiastic about the biological sciences and the research being done in the field of stem cells.

Margaret Pitzer

Joint Project with Austin Hall and Hanna Kim

Department: Chemical Engineering Department
Major: Chemical Engineering
Research Advisor(s): Dr. David Westenberg
Advisor's Department: Biological SciencesDepartment

Funding Source: OURE Program

Creation of an EnvZ-Tar chimera protein in Escherichia coli for use against White Nose Syndrome

The fungus, *Pseudogymnoascus destructans,* causes White Nose Syndrome, which is devastating the North American bat population. More and more researchers are working toward combating the deadly disease and restoring the number of bats found in the wild. The bats affected by White Nose Syndrome are a viable asset to the United States Agricultural Industry, and so, a remedy needs to be found. Our attempt at an answer uses a synthetic biology approach. It is expected that an E. coli strain able to move towards changes in salinity will move to the source of the fungal infection, and use this trait, along with a strain tht produces a fungistatic compound, to slow or even stop the infection while the bat is in hibernation.

Margaret Pitzer is a sophomore at Missouri University of Science and Technology. She is majoring in Chemical Engineering while minoring in German, Business Management and biomedical engineering. She is involved in Residential Life, Miner Multi-Media, and iGEM.

Lindsey Pratt

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

Funding Source: OURE

Investigating the function of the IQG1 domain in yeast cytokinesis.

The budding yeast protein IQG1 is required for both actomyosin ring assembly and contraction during cytokinesis. Iqg1 interacts with two other proteins required for actin ring formation, the formins Bni1 and Bnr1. In order to further investigate the function of the interaction between Iqg1 and the formins, the first step is to identify which Iqg1 protein domain is required for the interaction. My project will be to investigate the binding using mutant strains lacking different Iqg1 domains. I will be preparing yeast protein extracts and performing protein binding analysis using GST pull down assays and Western blotting. Once the functional domain of Iqg1 is identified, we can further investigate the role of the Iqg1-formin interaction by doing a phenotypic analysis of Iqg1 mutants that cannot bind to formins.

Lindsey Pratt is a junior here at Missouri University of Science and Technology. She is majoring in biological sciences and minoring in chemistry. Lindsey belongs to several organizations including; Scrubs, National Society of Leadership and Success and the Honor Society. She works part time as a scribe for PhysAssist Scribes. She lives on a large cattle farm and enjoys spending most of her days outside. She hopes to be accepted to Mizzou's medical program so that she can return home and practice as a general physician.

Heather Pribil

Joint Project with Jia Sun

Department: Geosciences & Geological & Petroleum Engineering
Major: Geology & Geophysics
Research Advisor(s): Dr. David Wronkiewicz
Advisor's Department: Geosciences & Geological & Petroleum Engineering

Funding Source: Office of Undergraduate Research Experiences

Geochemical Analysis of Colloidal Particles During Flood Stages in the Maramec Spring System

The Maramec Spring system has a milky blue-white color due to colloidal matter in the system. Previous researchers have determined mechanisms for mineral formation and occurrence in the system, also identifying the mineral constituents of its colloidal matter. These minerals include low-Mg calcite ($CaCO_3$) and anglesite ($PbSO_4$). Previous studies focused on the system during low-flow, ignoring the system during flood stages. This project aims to understand how turbulent flow affects the mineralogy and the regional distribution of lead phases of the system. Water samples were collected at several sites along the system and centriguged. Particle morphology and elemental composition will be analyzed using optical light microscopy, X-Ray Diffraction, and Scanning Electron Microscopy-Energy Dispersive Spectroscopy. Preliminary results obtained from SEM-EDS of particles indicate that the composition of this colloidal matter is mainly kaolinite ($Al_2Si_2O_5(OH)_4$). High density phases include barite ($BaSO_4$), apatite ($Ca_{10}(PO_4)_6(OH,F,Cl)_2$), and iron-bearing constituents. No lead phases were found.

Heather Pribil is a junior in Geology & Geophysics at Missouri University of Science and Technology, and a writer and assistant news editor for the Missouri Miner. The round rocks around her hometown of Weaubleau, Missouri served as her introduction to geology, inspiring countless trips to nearby creeks and springs in pursuit of these so called "Weaubleau eggs."

Alexis Reece

Joint Project with Allie Wilson

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

Funding Source: NA

Antibacterial Properties of Biomedical Materials

Due to a high prevalence of hospital infections from implants, identification of appropriate biomedical materials with antibacterial properties to prevent infection is essential. Materials have variable surface composition with different bacterial growth results. This study tested three different materials-polycarbonate, silicon nitride, and poly-ether-ether-ketone (PEEK). The composition of each of the three materials is one factor to be considered when comparing the amount of bacterial growth seen. Due to the combination of morphology and composition of silicon nitride, less bacterial adhesion will be measured when compared to polycarbonate and PEEK. We are testing the survival of S. epidermidis on each of these three materials under different conditions.

Alexis Reece is a senior attending the Missouri University of Science and Technology graduating with a BS in Biological Sciences in May of 2016. This student is hoping to continue doing research in the field of Biomedical Sciences or crime scene investigation.

Caitlin Siehr

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

Funding Source: OURE

Cytokinesis and the effect of mutations on 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 is responsible for dividing the two cells. In previous studies, Iqg1 has been shown to interact with 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 with a preparation of yeast extracts from three different strains; a wild type, a mutant that prevents Iqg1 phosphorylation, and a mutant that mimics Iqg1 phosphorylation. I then used these extracts to perform GST-pull down experiments and conduct western blots to determine the results. By the end of my research, I will be able to determine if mutant Iqg1 alleles affect the binding of Iqg1 to Bnr1 and Bni1.

Caitlin Siehr is a sophomore at Missouri University of Science and Technology, pursuing a Bachelor's of Science in Biological Sciences. She has studied under Dr. Shannon since September of 2014 and is an avid member of Sigma Tau Delta, Missouri S&T's English Honor Society. After obtaining her Bachelor's degree, she plans to further her education with graduate studies.

Jia Sun
Joint project with Heather Pribil

Department: Geosciences & Geological & Petroleum Engineering
Major: Geology & Geophysics
Research Advisor(s): Dr. David Wronkiewicz
Advisor's Department: Geosciences & Geological & Petroleum Engineering

Funding Source: Office of Undergraduate Research Experience

Geochemical Analysis of Colloidal Particles During Flood Stages in the Maramec Spring System, St. James, Missouri

This project focus on the spring system during periods of turbulent flow. The researchers collected water samples of Maramec Spring on different days, at flood stage and normal situation. Also, they chose three different sites to make sure the result accurate. The particle analysis used X-ray diffraction, scanning electron microscopy, optical microscopy, light scattering meter, and centrifuge. The water chemistry analysis methods including Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES), Mass Spectroscopy (ICP-MS), Mass Spectroscopy-Particle Analyzer (ICP-MS-PA).

Skye Tackkett

Department: Physics
Major: Physics
Research Advisor(s): Cihan Kurter
Advisor's Department: Physics

Funding Source: UMRB Research Grant, OURE Grant

Magnetron Sputtering of Superconducting Niobium Thin Films

In the field of condensed matter physics, there has been an ongoing interest in superconducting thin films due to their novel properties. They can be employed in the designs of exotic mesoscopic devices such as metamaterials and superconducting quantum interference devices (SQUIDs). In this experimental work, we fabricate the niobium thin films with direct current (DC) magnetron sputtering technique and characterize them through resistance vs. temperature measurements. The deposition rate of the fabricated films is determined with atomic force microscopy (AFM) through thickness analysis. Niobium thin films are conducting at room temperature, but become superconducting at cryogenic temperatures with the transition temperature of 8.45 K.

Skye Tackkett is a second year student majoring in physics and minoring in German and mathematics. After completion of her undergraduate degree, she plans on attending graduate school to earn a Ph.D. in experimental condensed matter physics.

Elizabeth Thoenen

Joint Project with Samantha Huckuntod and Victoria Grill

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

Funding Source: OURE

Quorum Sensing in *B. japonicum*

Quorum sensing is the ability of a cell to alter its gene expression in response to chemical stimuli produced by changes in population density. Homoserine lactones (HSLs) are the molecular stimuli responsible for quorum sensing in many nitrogen-fixing microbial species. This project aims to detect, identify, and characterize a novel HSL produced by *Bradyrhizobium japonicum*, a species thought to lack a detectable quorum sensing molecule. The *B. japonicum* quorum sensing gene promoter and regulatory element were inserted into a LacZ plasmid to create an HSL indicator E. coli strain. Simultaneously, the use of thin layer chromatography (TLC) was used to compare this novel HSL to known HSLs produced by other species. TLC was performed using an *Agrobacterium tumefaciens* indicator strain to observe the response to known *B. japonicum* HSLs. Understanding this quorum sensing provides practical applications specifically in the field of agriculture.

Elizabeth Thoenen is a senior in Biological Sciences. Currently, Elizabeth does microbiology research with Dr. David Westenberg. She plans to obtain a PhD in a biomedical science following graduation.

Allie Wilson
Joint Project with Alexis Reece

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

Funding Source: N/A

Antibacterial Properties of Biomedical Materials

Due to a high prevalence of hospital infections from implants, identification of appropriate biomedical materials with antibacterial properties to prevent infection is essential. Materials have variable surface composition with different bacterial growth results. This study tested three different materials-polycarbonate, silicon nitride, and poly-ether-ether-ketone (PEEK). The composition of each of the three materials is one factor to be considered when comparing the amount of bacterial growth seen. Due to the combination of morphology and composition of silicon nitride, less bacterial adhesion will be measured when compared to polycarbonate and PEEK. We are testing the survival of S. epidermidis on each of these three materials under different conditions.

Allie Wilson is a senior student graduating with a BS in Biological Sciences in May 2016. Hoping to pursue a career in bacterial microbiology or research.

Social Sciences

Poster Abstracts

Lindsey Carlson

Joint project with Nick Rollins

Department: Business and Information Technology Evaluation
Major: Information Science and Technology
Research Advisor(s): Dr. Nathan Twyman
Advisor's Department: Business and Information Technology Evaluation

Funding Source: OURE, Laboratory for Information Technology Evaluation

Designing Reason Support Systems to Increase Satisfaction, Enjoyment, and Intention to Use

A Reason Support System (RSS) uses a web of interconnected logical statements that supports an overarching objective, goal, idea, or decision. Traditionally, groups or individuals have arrived at decisions using various methods such as brainstorming sessions, Post-it notes, whiteboards, or lengthy research. The result of these decisions can have negative consequences due to our tendencies to make biased decisions. Decision support systems (DSS) have been developed to help aid decision-making, some on an individual and some on a group scale. Although DSS have been shown to reduce error and improve decision quality overall, the adoption of these systems has been low. In this study, we evaluate the potential of a new type of DSS that focuses on the earliest process that affects the decision, namely, the reasoning that occurs when conceptualizing a problem space and work to implement certain design aspects to increase adoption among users.

Lindsey Carlson is a senior in Information Science and 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 an assistant lab manager and is an intern at Deloitte Services LP. She is also an ambassador for the Business and Information Technology department and a very active member of the S&T Climbing Club. Her hobbies include camping, climbing, canoeing, and photography. She hopes to work in user experience after she graduates.

Nick Rollins

Joint project with Lindsey Carlson

Department:	Business and Information Technology
Major:	Information Science and Technology
Research Advisor(s):	Dr. Nathan Twyman
Advisor’s Department:	Business and Information Technology

Funding Source:	Opportunities for Undergraduate Research Experience (OURE) Laboratory for Information Technology Evaluation (LITE)

Designing Reason Support Systems to Increase Satisfaction, Enjoyment, and Intention to Use

A Reason Support System (RSS) uses a web of interconnected logical statements that supports an overarching objective, goal, idea, or decision. Traditionally, groups or individuals have arrived at decisions using various methods such as brainstorming sessions, Post-it notes, whiteboards, or lengthy research. The result of these decisions can have negative consequences due to our tendencies to make biased decisions. Decision support systems (DSS) have been developed to help aid decision-making, some on an individual and some on a group scale. Although DSS have been shown to reduce error and improve decision quality overall, the adoption of these systems has been low. In this study, we evaluate the potential of a new type of DSS that focuses on the earliest process that affects the decision, namely, the reasoning that occurs when conceptualizing a problem space and work to implement certain design aspects to increase adoption among users.

Nick Rollins is an undergraduate student of Information Science and Technology (IST) at Missouri S&T. His academic focus is in Human-Computer Interaction (HCI) and is very involved with research in this area as the Lab Manager of the Laboratory for Information Technology Evaluation (LITE). He aspires to begin a career in User Experience (UX) Research and Design after graduating in May 2016.

Samuel Smith

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:	National Science Foundation, Laboratory for Information Technology Evaluation

User Assessment of E-Commerce Security Cues

When conducting online transactions, users must assess the e-commerce environment to evaluate its security. E-commerce security cues refer to elements of an e-commerce interface that are intended to signal information security. For instance, many web browsers display padlocks next to the address bar to signal to the user that the webpage is using a secured connection. However, some malicious designers create webpages that contain fabricated security cues, such as images of padlocks that have been inserted into the webpage. These cues create a false sense of security for the user, and may even lead to the user submitting sensitive information, such as a credit card number. Hence, users become vulnerable to fabricated websites designed to steal their information. In this research, we want to understand how users perceive and respond to various security cues in e-commerce.

Samuel Smith is a junior majoring in Information Science and Technology with a minor in Business Analytics and Data Science. He works for the Laboratory for Information Technology Evaluation as a research assistant and assistant lab manager, and as a teaching assistant for computer programming classes. Samuel is the secretary for Business and Information Technology's student ambassadors program. He is also a member of Beta Gamma Sigma, an honor society for business students.

OURE Fellows Final Oral Presentations

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

OURE Fellows Proposal Oral Applicants

Name	Department	Time	Location
Robert Block	Biological Sciences	1:00-1:20 pm	Turner Room
Patrick Brennan	Chemical and Biochemical Engineering	1:20-1:40 pm	Turner Room
Therese Galbraith	Mechanical and Aerospace Engineering	1:40-2:00pm	Turner Room
Natalie Holste	Biological Sciences	2:00-2:20pm	Turner Room
Samuel Holtmeier	Business and Information Technology	2:20-2:40pm	Turner Room
Morgan Hovis	Chemical and Biochemical Engineering	2:40-3:00pm	Turner Room
Aysen Malone	Electrical Engineering	3:00-3:20pm	Turner Room
Scott Neustadt	Business and Information Technology	3:20-3:40pm	Turner Room
Kyara Holloway Haley Neeter	Biological Sciences	3:40-4:00pm	Turner Room

OURE Fellows Program

Oral Abstracts

Final

Natalie M. Holste

Department: Biological Sciences
Major: Biological Sciences; Minor in Chemistry and Biomedical Engineering
Research Advisor(s): David Westenberg
Advisor's Department: Biological Sciences

Funding Source: Opportunities for Undergraduate Research Experiences Fellows

Synthetic Biology Approach to Making Drought Tolerant *Bradyrhizobium japonicum*

Droughts all across the globe are causing hardship to crops and creating food shortages. One complication for the soil in the regions with drought is high salt concentrations. Because of osmosis, plants' cells shrivel up, therefore 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.

Natalie Holste grew up in the southwest suburbs of Chicago and is now a Junior pursuing a degree in Biological Sciences. She is greatly involved on campus. Some involvement includes being a Lead of the Horticulture subteam of The Solar House Design Team, a euphonium player in the Missouri S&T Wind Symphony, and a new active member of Phi Sigma Rho. 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 for a PhD 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): Dr. 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 a love for learning about how things work including anything involving physics or engineering. As a duel major of mechanical engineering and electrical engineering he has dedicated lots of time and extra classes to learn more about how everything works. Having spent all of high school in Robotics and even becoming the captains of the robotics team there, he wished to continue working with robots in college. After finding out about the OURE program and seeing it as a great opportunity to be more creative with robot designs then the robotic teams at the school, he decided to take advantage of the opportunity and sign up.

OURE Fellows Program

Oral Abstracts

Applicants

Robert Block

Department: Biological Sciences
Major: Chemistry Pre-Medicine
Research Advisor(s): Dr. Matthew Thimgan
Advisor's Department: Biological Sciences

Funding Source: Missouri S&T OURE Program

Application of Voice Analysis Programs to Quantify Fatigue

Fatigue can have disastrous consequences in surgery, transportation, and monitoring tasks. It would be useful to quantitatively identify the fatigue level of an employee to predict if they are at risk for a catastrophic error. Previous efforts to quantify include subjective measures, cognitive ability and motor skills. These metrics are currently inadequate to assess sleepiness in a real-world situation. We will investigate if quantifiable speech patterns correlate with fatigue. Quantitative information on how sleepy a person is could help determine how fit they are for activities.
To test this hypothesis, subjects will record a test phrase in the morning and evening 2 times a week. Features of the voice will be quantified by voice analysis software and correlated with subjective sleepiness metrics, conventional cognitive and motor skills based fatigue tests. If a reliable correlation is found, a model will then be developed to predict fatigue using speech patterns.

Robert Block is a Junior studying Chemistry with an emphasis on Pre-Medicine and a minor in Biological Science. After graduating, he plans on attending medical school and becoming an anesthesiologist. His interests include robotics, martial arts, and video games.

Patrick Brennan

Department: Department of Chemical & Biochemical Engineering
Major: Chemical Engineering
Research Advisor(s): Dr. Ali Rownaghi/Dr. Fateme Rezaei
Advisor's Department: Department of Chemical & Biochemical Engineering

Funding Source: OURE

Coating of Metal-Organic Frameworks onto Polymeric Hollow Fibers for CO_2 Capture

Among the greenhouse gases, Carbon Dioxide (CO_2) is the leading contributor to global warming, with 90% coming from the burning of fossil fuels. In order to mitigate the effect of CO_2 emissions, we must capture the CO_2 from places that burn the most fossil fuels, such as power plants. Many studies are being carried out on metal-organic frameworks (MOFs) as novel adsorbents for removing CO_2 from flue gases. MOFs have great potential due to their tunable pore size, and astonishing surface area, and versatile applications. By grafting MOFs onto porous fibers, it will allow for easy use and quick mass transfer compared to MOF powders. This study will focus on two particular MOFs, MOF-74(Ni) and Mil-101(Cr) that will be grafted onto mesoporous silica/polymer hollow fibers using various techniques in order to find the best synthesis route to create a robust fiber capable of capturing CO_2 with high capacity and fast kinetics. With the financial support from OURE (2015-2016) on our previous work, we successfully submitted a manuscript to *ACS Materials & Interfaces* journal which is currently under review; and with the continued support, we will be able to continue working in this highly important research area.

Patrick Brennan is a junior in Chemical Engineering at Missouri S&T. He has been doing research on CO_2 capture under the supervision of Dr. Ali Rownaghi and Dr. Fateme Rezaei since January 2015. This upcoming summer, Patrick will be working an internship for Chemtura, a global specialty chemicals plant.

Therese Galbraith

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

Funding Source: University of Missouri Research Board

Micro Piezoelectric Windmill

The goal of this research is to develop a novel small-scale piezoelectric windmill that efficiently harvests energy from ambient wind flow by constructing and testing a model, combining computer FEA, wind-tunnel experiments, and field tests to analyze its performance. This windmill may be used to power various wireless sensors, including those widely used for monitoring structural health, border intrusion, weather conditions, and 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. Our invention is designed to overcome these drawbacks. It features simpler structures for the motion system and significantly higher power density compared with similar models. It also has the added advantage of operating on fluid flows from arbitrary directions, ideal for harvesting energy from natural random flows.

Therese Galbraith is a senior from Jefferson City studying Mechanical Engineering at Missouri University of Science and Technology. Interested in sustainability and renewable energy, she has enjoyed working as a research assistant on a wind energy project under Dr. Lian Duan since spring, 2015. Therese has completed a co-op at Pella Corporation, where she worked on developing their home automation line, and she will be returning to Pella where she will work with the Environmental Energy and Sustainability Team in the summer of 2016.

Kyara N. Holloway

Joint Project with… Haley Neeter

Department: Biological Sciences
Major: Biological Sciences
Research Advisor(s): Dr. Chen Hou
Advisor's Department: Biological Sciences

Funding Source: OURE Fellows, Crowd Funding

Energy Expenditure in Relation to Life History

In these experiments, we will be cross-disciplining the studies of biological sciences and biochemistry in relation to respirometry and life history/ behavior of invertebrate animals such as arts and cockroaches as well as fruit flies.
The animals mentioned will be put on a dietary restriction to see how it effects their reproduction and metabolic rates in relation to their aging. We will be looking into mechanisms for slowing the aging process while keeping quality of life.
CO2 will be our unit of measurement, as we measure the CO2 over time in our machinery, it will directly relate to their metabolic functions and how often and how much they reproduce (eggs or otherwise), and their overall life span and internal damage.
We will be examining the behavior of the animals and their energy expenditure while working in small, medium, and large groups, as well as solitary animals to see how it affects their metabolic functions. We will be examining social, eusocial, and non-social animals at this time and mark how their teamwork and communication, or lack thereof, affects them.

Kyara Holloway is a student at MS&T. She participates in Dance, Research, and often holds a job as well. She hopes to graduate and move on to a dual Graduate and Medical School in order to become a Tissue Engineer. She remains heavily interested in the human body, its workings, and finding a way to make body parts adjustable, replaceable, and affordable.

Natalie M. Holste

Department: Biological Sciences
Major: Biological Sciences; Minor in Chemistry and Biomedical Engineering
Research Advisor(s): David Westenberg
Advisor's Department: Biological Sciences

Funding Source: Opportunities for Undergraduate Research Experiences Fellows

Synthetic Biology Approach to Making Drought Tolerant *Bradyrhizobium japonicum*

Droughts all across the globe are causing hardship to crops and creating food shortages. One complication for the soil in the regions with drought is high salt concentrations. Because of osmosis, plants' cells shrivel up, therefore 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. Preliminary work has already been done on this project. The next steps would be insert the proper genes into the promoter in my chassis, test for salt tolerance, insert the plasmid into *B. japonicum*, and test for salt tolerance there too. The success of this project would bring about many positive changes to agriculture and the world.

Natalie Holste grew up in the southwest suburbs of Chicago and is now a Junior pursuing a degree in Biological Sciences. She is greatly involved on campus. Some involvement includes being a Lead of the Horticulture subteam of The Solar House Design Team, a euphonium player in the Missouri S&T Wind Symphony, and a new active member of Phi Sigma Rho. 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 for a PhD and settle down into a job doing research.

Samuel Holtmeier

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

Funding Source: Opportunities for Undergraduate Research Experiences (OURE)
Eastman Chemical
Center for Enterprise Resource Planning
Software grants from SAP

Influence of Prior Autism Spectrum Disorder (ASD) Knowledge on Teachers' Ability for Early ASD Diagnosis

Autism, or Autism Spectrum Disorder (ASD), is a genetic disability that causes communication, personality and/or social interaction deficiencies. Autism affects one in six children in U.S. and has caused increased family expenses, stressed the current health care system, and created many society problems as well as expenses in the education system. The findings from my previous research suggest that earlier diagnosis and subsequent treatment play a significant roll in reducing the negative impacts of autism on society.

One of my other findings suggests that school age children need to be diagnosed sooner to provide the proper education. With a more tailored educational program, children with autism have a tendency to follow more normal development cycle. Teachers play a major role in early recognition of autism. Therefore, I will use different IT tools to develop prototypes for testing purposes.

The overall goal of this research is to help further the field of evidence based medicine specifically with Autism. The results from the proposed research will also create higher awareness on the amount of training and preparation teachers should receive to improve early detection of children with Autism. Another deliverable of the proposed research is a fully functional interactive visualization decision dashboard on autism data to help educators.

Samuel Holtmeier is a 2nd year Junior at Missouri S&T. Sam is from Washington, Missouri and has been on the Dean's List every semester of his college career. He led an SAP ERP Simulation team to third place at Missouri S&T's 2015 annual competition. He works in the Center for Enterprise Resource Planning (ERP) in a few roles, from a grader to Research Assistant as well as an ERP Student Ambassador. Sam is an overall hardworking dedicated student and researcher.

Morgan Hovis

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

Funding Source: Opportunities for Undergraduate Research Experience (OURE)

The Separation of Ethane and Ethylene via Adsorbent Materials

Light olefins, such as ethylene and propylene, are important building blocks involved in many industrial processes, namely in the plastic and rubber industries. The process of producing pure olefins is complex and energy intensive because these olefin/paraffin pairs, such as ethane and ethylene, have similar physical properties. Studies have been performed to develop a more cost-effective olefin/paraffin separation processes. One alternative to separate these pairs is by using adsorbents. Adsorbents are porous materials and when a mixture of gasses is ran through these materials, one gas will continue to pass through the adsorbent, while the other gets trapped inside. Studying this method could lead to future implications of adsorbent separation in industry.

Morgan Hovis is a Junior studying Chemical Engineering. She is from Fredericktown, Missouri. Her student organizations include Kappa Delta Sorority, Phi Sigma Pi National Honor Fraternity, and Missouri S&T Ballet and Dance Club. She is looking forward to her internship with Missouri Department of Natural Resources in the summer.

Aysen Malone

Department: Electrical Engineering
Major: Electrical Engineering
Research Advisor(s): Yahong Zheng
Advisor's Department: Electrical Engineering

Funding Source: OURE Program

Super-capacitor Power Supply for wireless sensor networks

Smart rocks can form a wireless underwater sensor network and play an important role in monitoring bridges, levees, and river banks. Those applications require that the sensory smart rocks can work underwater for extended period of time without maintenance. Active smart rocks need power sources to run the best available rechargeable batteries and Super-capacitors fits these requirements. It is desired to develop a power supply that utilizes super-capacitors and energy harvesting to power the active smart rocks. Preliminary design of super-capacitor power supply is also available that provide limited power options and output power. This project is to improve the existing design to supply +-18 Volts, +-5 Volts, and +3.3 Volts outputs and triple the output power so that the main other boards can be powered by the super-capacitor power supply. The goal is to find out the practical constraints that can guide the design of a cost-effective energy harvester.

Aysen Malone, will be helping with the design and development of the super-capacitor power supply circuits and field tests. Aysen started working on this project in April with the OURE Program. She is a Undergraduate student at Missouri Science and Technology, majoring in Electrical Engineering.

Haley Neeter

Joint Project with Kyara Holloway

Department:	Biological Sciences and Chemistry
Major:	Chemistry Pre-Med Emphasis
Research Advisor(s):	Dr. Chen Hou
Advisor's Department:	Biological Sciences

Funding Source: University

Metabolism and Lifespans through Food Restriction of the Drosophila

In this experiment, we will be trying to identify the causation of metabolic rates and aging patterns in fruit flies (Drosophila). More importantly, we will be attempting to find a correlation between one's metabolism and their lifespan, as well as determining how lifespan effects bio synthesis such as reproductive rates. We will be using both biological applications, and chemical analysis to determine the factors of metabolic rates and carbon dioxide levels in flies. This experiment will include measuring CO2 levels, food preparation and creation, dissections, and biochemical analysis.

Haley Neater is a sophomore at the Missouri University of Science and technology. She is studding chemistry with a Pre-med emphasis and one day hopes to become a physician. She enjoys everything regarding chemistry and is a proud member of Kappa Delta sorority, currently being the assistant of finance for her chapter. Haley hopes that this research experience will help her gain insight on the aspects of research in her bio-chemical career.

Scott Neustadt

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

Funding Source:	Opportunities for Undergraduate Research Experiences Eastman Chemical Center for Enterprise Resource Planning Software grants from SAP

Visualizing Genetic Influence on Autism Spectrum Disorder (ASD) Diagnosis: The Roles of Colors and High Dimensional Graphs

As new discoveries of Autism Spectrum Disorder (ASD) become prevalent, a need for faster and more efficient diagnosis is essential. Results from my 2015-2016 OURE project suggest that color and high dimensional graphs have a large impact on data retention of genetic data and helps in the discovery of important information hidden within the data. My proposed project will develop an interactive visualization software prototype for Autism Spectrum Syndrome (ASD) genetic research data based on literature review and experiment design from my 2015-2016 OURE project.
My research will focus on educating people of different backgrounds (age, gender, race, etc.) on the genetic factors that have a direct influence on ASD through the roles of color and high dimensional graphs, particularly the chromosome locations of effected genes. I have collected and organized genetic data taken from SFARI Base and NDAR for my OURE research project that can be used to develop the proposed interactive visualization decision dashboard to conduct survey prototyping, analyze results and make recommendations. The proposed research will develop multiple high dimensional visualization models to allow effective and efficient ASD diagnosis. It is expected that results and prototypes from the proposed will contribute to the process that doctors and physicians diagnose autism, making for more efficient and earlier diagnosis.

Ever since Scott started school at Missouri S&T, he has been exceling at both academic and extracurricular activities. On top of doing his 2015-2016 OURE project, he works for the Center for Enterprise Resource Planning (ERP), New Student Programs, and is Safety Officer for the concrete canoe design team. He strives to make a lasting impact on his peers. Scott's hard work and dedication are proven through the results of his research projects.

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