Missouri University of Science and Technology

14th Annual Undergraduate Research Conference

SAE International Collegiate Design Series

A celebration of experiential learning at Missouri S&T

April 17, 2018

Missouri S&T Havener Center

14th Annual
Undergraduate Research Conference
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Table of Contents

14th 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 and OURE Fellows Oral Sessions** **ENGINEERING --- FINAL REPORTS** *(Carver)* *(Turner)*
9:00am – 12:00pm	**Poster Sessions** **SCIENCES --- Social Sciences** *(Upper Atrium/Hallway)*
12:00pm – 1:00pm	**Luncheon & Keynote Address** ***Dr. Daniel B. Oerther, Ph.D.*** Professor of Environmental Health Engineering Civil, Architectural and Environmental Engineering Missouri University of Science and Technology ***Presents*** "Lessons from The Road Not Taken" *(St. Pat's C Ballroom)*
1:00pm – 3:00pm	**OURE Oral Sessions and OURE Fellows Oral Sessions** **ARTS & HUMANITIES --- Sciences --- FELLOW PROPOSALS** *(Carver)* *(Carver)* *(Turner)*
1:00pm – 3:00pm	**Poster Sessions** **ARTS & HUMANITIES --- ENGINEERING** *(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

Daniel B. Oerther

Ph.D., P.E., BCEE, CEng, CEHS, D.AAS, M.CIEH, CEP, CEnv, F.AAn, F.RSA, F.RSPH

Professor of Environmental Health Engineering

Department of Civil, Architectural and Environmental Engineering

Presents

"Lessons from The Road Not Taken"

Daniel B. Oerther is a professor of environmental health engineering at Missouri S&T, but he's always wished he could be a poet. Oerther joined S&T in 2010 as the John A. and Susan Mathes Chair of Civil Engineering after having worked at the University of Cincinnati for ten years. Online, Dan describes himself as a social entrepreneur, diplomat, and professor who's working at the nexus of food, water, and energy to solve sustainable development and eliminate poverty. He became an environmental engineer because his grandfather practiced sanitary health in the 50s, 60s, and 70s, which strongly influenced Dan's career choices. The Road Not Taken is a narrative poem by Robert Frost describing an early morning, forest scene in autumn with a journeyman struggling to answer the question, "do I take the path to the left or to the right?" The poem is often cited an an encouragement to "follow your own path", but as Dan will discuss in his presentation, the poem may be more appropriately understood as an admonishment to adopt an attitude of self confidence - irregardless of the path chosen. The message Dan will share - shedding regret - is important to the creation of new knowledge - that activity we call 'research' at S&T. As Dan will describe, self criticism is critical for a successful research career, but once self-satisfaction has been achieved, it is important for a researcher to move beyond any lingering notion of regret and embrace future opportunities to create additional new knowledge.

Oerther is a Fellow of the American Academy of Nursing, the Royal Society of Arts, and the Royal Society for Public Health. His recognitions include the S&T Service Learning Award, the Missouri System President's Award for Cross Cultural Engagement, the President's Excellence Award from the University of Cincinnati, the Fulbright-ALCOA Distinguished Chair in Environmental Science and Engineering, the NSF CAREER, and numerous national awards in the areas of engineering education and environmental health.

Conference Judges

The Office of Academic Support wishes to thank the faculty & staff for their valuable contributions to the 14th Annual Missouri S&T Undergraduate Research Conference.

Oral Presentations

Arts and Humanities

Name	Department	Time	Location
Donald Morard	History & Political Sciences	1:00 – 1:30pm	Carver Room

Engineering

Name	Department	Time	Location
Samuel Fayad	Mechanical & Aerospace Engineering	9:00 – 9:30 am	Carver Room
Connor Griffin	Chemical & Biochemical Engineering	9:30 – 10:00 am	Carver Room
Ryan Honerkamp	Civil, Architectural & Environmental Engineering	10:00 – 10:30 am	Carver Room
Alexandria Lore	Chemical & Biochemical Engineering	10:30 – 11:00 am	Carver Room
Lauren Tomanek	Mechanical & Aerospace Engineering	11:00 – 11:30 am	Carver Room
Patrick Toplikar	Electrical & Computer Engineering	11:30am – 12 pm	Carver Room

Sciences

Name	Department	Time	Location
C. Deeleepojananan	Chemistry	1:30pm – 2:00pm	Carver Room
Anton Sax	Civil, Architectural & Environmental Engineering	2:00pm – 2:30pm	Carver Room
Samantha Greaney Laura Murray	Biological Sciences	2:30pm – 3:00pm	Carver Room

Cholaphan Deeleepojananan

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

Funding Source: Opportunity for Undergraduate Research Experience (OURE) Program

Salt-Assisted Ultrasonic Deaggregation of Nanodiamond

Salt-assisted ultrasonic deaggregation of nanodiamond (SAUD) is a new facile, inexpensive, and contaminant-free technique used for reducing the size of nanodiamond into single-digit particles stable in aqueous colloidal solution in a wide pH range. The technique utilizes the energy of ultrasound to break apart nanodiamond aggregates in sodium chloride aqueous slurry. In contrast to current deaggregation techniques, which introduce zirconia contaminants into nanodiamond, the single-digit nanodiamond colloids produced by SAUD have no toxic or difficult-to-remove impurities and are therefore well-suited to produce nanodiamonds for numerous applications, including theranostics, composites, and lubrication, etc. Requiring only aqueous slurry of sodium chloride and standard horn sonicator, and yielding highly pure well-dispersed nanodiamond colloids, the technique is an attractive alternative to current nanodiamond deaggregation protocols and can be easily implemented in any laboratory or scaled up for industrial use.

Cholaphan is a senior majoring in Chemistry. She is originally from Nakhon Pathom, Thailand. Cholaphan joined Dr. Vadym Mochalin's research group in 2016 with an OURE funding. She published two research papers in ACS Nano and ACS Applied Materials & Interfaces journals within two years in the group. Her research is focusing mainly on nanodiamonds. Cholaphan will be graduating in May 2018 and intends to pursue a graduate degree in Inorganic Chemistry.

Samuel Fayad

Department: Mechanical and Aerospace Engineering
Major: Mechanical Engineering; Math Minor
Research Advisor(s): Dr. Edward Kinzel
Advisor's Department: Mechanical and Aerospace Engineering

Funding Source: NASA EPSCOR RID

DMD-Enabled Active Spatiotemporal Thermography

Thermographic techniques are well established in Non-Destructive Inspection (NDI) based environments for detection of material flaws normal to the inspected surface such as delamination and cracks parallel to the surface. However, these methods fail to detect cracks vertical to the surface. The heat flux must be tangential to the surface to detect these features. This can be done by focusing a frequency modulated radiation source on the surface (spatial confinement). However, the range of detection is limited by the natural attenuation of the thermal wave and requires scanning a target to locate features. In this work, the use of a Digital Micromirror Device (DMD) to modulate the heat source with respect to time and space is explored. The superposition of frequency multiplexed thermal waves is demonstrated and utilized to detect and locate defects without scanning a substrate. The use of a multiplexed spatially diverse thermal waves to resolve defects is demonstrated experimentally and compared to FEA and analytical models.

Samuel Fayad is a senior from Mexico, MO studying mechanical engineering with a research interest in advanced NDI methods, including thermographic inspection and x-ray CT-enabled digital imaging. He has industrial experience (Spartan Light Metal Products) and research experience (Sandia National Laboratories and Missouri S&T). Apart from academics, Sam has held executive positions and earned honors in the Beta Sigma Psi fraternity and the MST Wrestling Club. He plans to pursue a PhD in Mechanical Engineering following the completion of his BSME degree in Spring 2019.

Samantha Greaney

Joint project with… Laura Murray

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

Funding Source: Miner Tank, Spring 2018

The Use of Bioactive Glass in the Treatment and Prevention of Sexually Transmitted Infections

Sexually transmitted infections, STIs, have been a plague on mankind for thousands of years. Every promising STI treatment is soon followed by an increase in cases, as the bacteria gains resistant to the new drugs. Bioactive glass has been previously shown to both kill bacteria and heal wounds, making it an ideal candidate for STI treatment. By applying bioactive glass to the outside of a silicon tampon-like device, intervaginal wounds caused by the STI will heal and the bacteria will die, thus treating the infection. Since it is thought to be impossible for bacteria to gain resistance to bioactive glass, this device can also be used in preventative care.

Samantha is a senior in Biological Sciences and is graduating this May with minors in Chemistry and Biomedical Engineering. Samantha is an OURE student in Dr. Julie Semon's regenerative medicine lab, studying the effects of bioactive glass on mesenchymal stem cells. After graduation, Samantha is attending University of California, Davis to obtain her PhD in Biochemistry, Cellular, Molecular, and Developmental Biology. This project began with Lisa Gutgesell and Laura Murray in the fall of 2017 for the course of Biological Innovation and Design. After encouragement from professors, further development began in early 2018 and funding was secured to begin preliminary research.

Connor Griffin

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

Funding Source: OURE Program

My project was developing an inorganic structure into a greenhouse gas adsorbent. I started by 3D printing a monolith made up of primarily Kaolin. Once printed and calcinated, the monoliths were functionalized in an ammonia hydroxide solution. The monoliths were allowed to dry before the immobilization process. This process was a three-step technique. The monoliths were dipped in Torlon, transferred to a NiMOF-74 slurry, and allowed to dry. Three times this process was repeated before a trip to the vacuum oven. Tests then could be performed for adsorption capacity, BET surface area, and XRD peak consistency. Analysis verified this technique effective in adsorbent development.

Connor is a Junior in Chemical Engineering and pursuing minors in Chemistry and Engineering Management. This is Connor's third semester working in the lab on greenhouse gas capture. Outside of research, he is involved with Miner Rugby and mentoring at the local grade schools. Connor enjoys being outside, fishing, or playing sports in his free time.

Ryan Honerkamp

Department:	Department of Civil, Architectural, and Environmental Engineering
Major:	Civil Engineering
Research Advisor(s):	Dr. Grace Yan
Advisor's Department:	Department of Civil, Architectural, and Environmental Engineering
Funding Source:	National Science Foundation (NSF) Hazard Mitigation and Structural Engineering Program

Role of a Laboratory Tornado Simulator in Achieving Tornado-ready Communities

Tornado research is verified by using data from full-scale tornadoes, but this data is difficult and dangerous to obtain. In order to investigate the wind effects of tornadoes on buildings and communities, the use of tornado simulators in the laboratory setting has been employed. These simulators allow for the measurement of the pressures and forces on model versions of full-scale buildings and contribute to the knowledge base that wind engineers and structural engineers can draw on for designing safe homes and facilities. To these ends, a small-scale simulator was constructed in the Wind Hazard and Mitigation Laboratory on the university campus of the Missouri University of Science and Technology. Additionally, testing has been performed in this simulator, and the results compared to numerical simulation and full-scale radar-measurements, to determine the efficacy of the simulator. A large-scale simulator is planned for construction based on these results.

Ryan Honerkamp is from Farmington, MO. He graduated from the local high school, 4th in his class, in 2009. He attended Mineral Area College in Park Hills, MO for two years and attained an Associate's Degree in the Science of Nursing, in 2011, and practiced as a Registered Nurse from 2011 until 2015. He is currently in his final year of his Bachelor's Degree, at Missouri S&T, and has been working with his advisor, Dr. Grace Yan, since May 2016. After his graduation in May he plans to continue to pursue a PhD in Civil Engineering, under Dr. Yan's tutelage, in the science of Wind Engineering.

Alexandria Lore

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

Funding Source: PI's Start Up, Missouri S&T's Innovation Award (Miner Tank) 2018

Portable Biofiltration Kit

Endotoxin removal is an important but understudied process of purification. Endotoxins are released from gram-negative and gram-positive bacteria. The most common sources of infections are caused by endotoxins from gram-negative bacteria and can cause sepsis and toxic shock when a large amount of these infect the body. Endotoxins prove difficult to remove from solutions due to their size and physical and chemical properties. Current methods for endotoxin removal are often inefficient, expensive, or require a laboratory setting and a power source to operate. The proposed biofiltration kit would provide a portable membrane that could be used with gravity to filter endotoxins from water. Microparticles are present in the membrane which bind to endotoxins using electrostatic and hydrophobic properties. Water flux was taken with only the driving force of gravity over several hours, and endotoxin removal was measured using a fluorescent assay to determine overall effectiveness of the microparticle membrane.

Alexandria Lore is a Senior in Chemical Engineering at Missouri S&T where she works on Biopharmaceutical research with Dr. Sutapa Barua. She serves as a member of the executive board of the St. Pat's Board as secretary and is an alumna of Lambda Sigma Pi, service organization. She also graduated with a B.S. in Biological Sciences in 2013 from Missouri S&T.

Donald Morard

Department: History and Political Science
Major: History
Research Advisor(s): Dr Shannon Fogg
Advisor's Department: History and Political Science

Funding Source:

The Russian Revolution: A 100 years of Historiography

2017 marked the centennial of the February and October Revolutions, stirring up conversations about what happened in Russia during the revolution and why it happened. This paper evaluates the100 years of Russian Revolution historiography and the changes which took place over the years. The historiography of the revolution until the end of the Cold War was often defined by political bias and a focus on the political leadership of the various factions by both the Western point of view and the Soviet/socialist perspective. After the Soviet Union fell a new modern historiography emerged which drew from both traditional schools and focused on groups such as women and ethnic minorities. In this research traditional sources like books and journal articles are used along with propaganda posters and newspapers. Sources range from the early 1920's to 2017.

Donald Morard is a junior in the Missouri S&T History and Political Science department pursuing a Bachelor of Arts in History. His research primarily focuses on 19th and 20th century Baltic and Eastern Europe.

Laura Murray

Joint project with: Samantha Greaney

Department:	Biological Sciences
Major:	Biological Sciences
Research Advisor(s):	Dr. Julie Semon
Advisor's Department:	Biological Sciences
Funding Source:	Miner Tank

The Use of Bioactive Glass in the Treatment and Prevention of Sexually transmitted infections

With sexually transmitted infections (STIs) and antibiotic resistance on the rise, a new treatment is needed to combat these growing problems. We propose a novel way to not only treat STIs but also prevent them through the use of bioactive glass. In previous research it has been demonstrated that bioactive glass kills bacteria and heals wounds. The insertion of a silicon base tampon like device, coated in bioactive glass will target the bacteria. By targeting multiple pathways, our product will kill bacteria and heal wounds of the vagina. This process will not only treat current infection but can be applied to prevent them.

Laura and Samantha are seniors graduating this upcoming May. They began this project with friends in a course BioDesign and Innovation, taught by Dr. Julie Semon. Currently Laura is also researching cell cytokinesis in Dr. Katie Shannon's lab, and Samantha is currently researching regenerative medicine in Dr. Julie Semon's lab. After graduation Laura plans to attend Physicians Assistants School and Samantha plans to attend graduate school.

Anton Sax

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

Funding Source: National Science Foundation (NSF)

Computer Vision Techniques to Extract Data from Images of Plants

PlantCV is a collection of code, or a library, that enables scientists to manipulate image data in order to filter out and select for desired values. By writing Python scripts using PlantCV, it is possible to automate the process of finding the shape of plants in images, and then extract valuable information, such as leaf area, from those images. In this way, it can be determined whether plants are growing at an expected rate in order to facilitate and expedite the research of other projects.

Anton Sax is a junior majoring in computer science interested in pursuing a career in computer vision or machine learning. He has been working as a student research assistant since May 2017 and is a member of the Delta Sigma Phi fraternity and the Solar House Design Team. In his free time, he enjoys playing piano and hanging out with friends.

Lauren Tomanek

Department: Mechanical & Aerospace Engineering
Major: Mechanical Engineering
Research Advisor(s): Dr. Daniel S. Stutts
Advisor's Department: Mechanical & Aerospace Engineering

Funding Source: Dept. of Mechanical and Aerospace Engineering for ME4842 Lab

Parameter Estimation in a One-Dimensional Transient Convection Model of a Slender Cylindrical Fin with a Time-Dependent Boundary Temperature

This study describes one of the few transient convection models having a closed-form solution: that for a slender cylindrical metal rod (fin) with specified time-dependent boundary temperature on one boundary, and adiabatic on the other. The convection coefficient and thermal conductivity can be estimated using a modified Levenberg-Marquardt nonlinear least squares algorithm to minimize the difference between the model and experimentally measured temperatures under forced convection. Reasonable values for the convection coefficient were obtained, and the estimated thermal conduction coefficient compared well with published values for the rod materials used.

Lauren Tomanek is a first semester Ph.D. student working with Dr. Daniel Stutts. She graduated with her bachelor's in Mechanical Engineering in December 2017 from Missouri S&T and is now a graduate teaching assistant for the ME 4842 class.

Patrick Toplikar

Department: Electrical and Computer Engineering
Major: Electrical Engineering
Research Advisor(s): Dr. Tayo Obafemi-Ajayi
Advisor's Department: Electrical Engineering

Funding Source: Missouri State Cooperative Engineering Department
Self

Adaptive Learning for Raspberry Pi Controlled Smart Streetlights

For the project, a raspberry pi, and an Arduino control house lights in response to detecting cars with ultrasonic distance sensors. The project aims to demonstrate that street lights could save energy by adapting to traffic via neural networks in the raspberry pi, which would make the lights turn off when no cars are driving by at night, and flickering could be reduced. The project also investigates whether lights consume more energy when flickering, as compared to being powered constantly. In theory, neural networks reduce the energy consumed by smart-street lights, as well as flickering; ultrasonic distance sensors detect cars and send feedback to the neural networks, and the networks adapt the lights' behavior based off of the learned traffic patterns. The project has successfully detected a car and turned a house lamp on and off with an ultrasonic distance sensor.

Patrick Toplikar is enrolled in the cooperative engineering program in Springfield, Missouri. He is pursuing an Electrical Engineering undergraduate degree from Missouri University of Science and Technology, as well as an Applied Physics degree from Missouri State University.

Poster Presentations

Arts and Humanities

Poster #	Name	Department	Time	Location
1	Emily Beahm	Arts, Languages & Philosophy	1:00 – 4:00 pm	Upper Atrium
2	Randy Greeves	History & Political Science	1:00 – 4:00 pm	Upper Atrium
3	Arthur Schneider	History & Political Science	1:00 – 4:00 pm	Upper Atrium

Engineering

Poster #	Name	Department	Time	Location
4	Dalal Abduljaleel	Materials Sciences & Engineering	1:00 – 4:00 pm	Upper Atrium
5	Rakan Alali	Mining & Nuclear Engineering	1:00 – 4:00 pm	Upper Atrium
6	John Bequette	Chemical & Biochemical Engineering	1:00 – 4:00 pm	Upper Atrium
7	Derek Berndt	Mining & Nuclear Engineering	1:00 – 4:00 pm	Upper Atrium
8	Jonathan Duqum	Chemical & Biochemical Engineering	1:00 – 4:00 pm	Upper Atrium
9	Sarah Jemison	Civil, Architectural & Environmental Engineering	1:00 – 4:00 pm	Upper Atrium
10	Jonathan Kuchem	Civil, Architectural & Environmental Engineering	1:00 – 4:00 pm	Upper Atrium
11	Elizabeth Lemieux	Chemical & Biochemical Engineering	1:00 – 4:00 pm	Upper Atrium
12	Tiffany Lyche	Mining & Nuclear Engineering	1:00 – 4:00 pm	Upper Atrium
13	Christopher Mark	Mining & Nuclear Engineering	1:00 – 4:00 pm	Upper Atrium
14	Elizabeth Matejka	Chemical & Biochemical Engineering	1:00 – 4:00 pm	Upper Atrium
15	Devin Olds	Civil, Architectural & Environmental Engineering	1:00 – 4:00 pm	Upper Atrium
16	Frank Schott	Mining & Nuclear Engineering	1:00 – 4:00 pm	Upper Atrium
17	Thabiso Sechele	Mining & Nuclear Engineering	1:00 – 4:00 pm	Upper Atrium
18	Zhongqing Xiao	Mining & Nuclear Engineering	1:00 – 4:00 pm	Upper Atrium
19	Adam Gausmann Clay McGinnis Hannah Reinbolt Kevin Schoonover	Computer Science	1:00 – 4:00 pm	Upper Atrium
20	Meelap Coday Reagan Dugan	Mining & Nuclear Engineering	1:00 – 4:00 pm	Upper Atrium

Poster Presentations

Sciences

Poster #	Name	Department	Time	Location
21	Rachel Birchmier	Physics	9am – 12:00pm	Upper Atrium
22	Blake Bryant	Biological Sciences	9am – 12:00pm	Upper Atrium
23	Sarah Buckley	Biological Sciences	9am – 12:00pm	Upper Atrium
24	Katrina Compton	Physics	9am – 12:00pm	Upper Atrium
25	Osvaldino Contreiras	Geosciences & Geological & Petroleum Engineering	9am – 12:00pm	Upper Atrium
26	Zachary Driemeyer	Physics	9am – 12:00pm	Upper Atrium
27	Zachary Foulks	Chemistry	9am – 12:00pm	Upper Atrium
28	Maverick Gray	Chemistry	9am – 12:00pm	Upper Atrium
29	Scott Grier	Biological Sciences	9am – 12:00pm	Upper Atrium
30	Kayla Haneline	Geosciences & Geological & Petroleum Engineering	9am – 12:00pm	Upper Atrium
31	Matthew Healy	Mathematics & Statistics	9am – 12:00pm	Upper Atrium
32	Heather Hingst	Geosciences & Geological & Petroleum Engineering	9am – 12:00pm	Upper Atrium
33	Kaysi Lee	Chemistry	9am – 12:00pm	Upper Atrium
34	Rachel Nixon	Chemistry	9am – 12:00pm	Upper Atrium
35	Jennifer See	Chemistry	9am – 12:00pm	Upper Atrium
36	Ashley Segobiano	Biological Sciences	9am – 12:00pm	Upper Atrium
37	Jason Viehman	Mathematics & Statistics	9am – 12:00pm	Upper Atrium
38	Nicole Wheeler	Biological Sciences	9am – 12:00pm	Upper Atrium
39	Emma Young		9am – 12:00pm	Upper Atrium
40	Elliott France Tiffany Wysong	Geosciences & Geological & Petroleum Engineering	9am – 12:00pm	Upper Atrium

Social Sciences

Poster #	Name	Department	Time	Location
41	Cooper Broman	Business & Information Technology	9am – 12:00pm	Upper Atrium
42	Alexandra Emily	Economics	9am – 12:00pm	Upper Atrium
43	Sara Johnson	Psychological Science	9am – 12:00pm	Upper Atrium
44	Kaelyn Kacirek	Psychological Science	9am – 12:00pm	Upper Atrium
45	Luis E. Ocampo	Business & Information Technology	9am – 12:00pm	Upper Atrium
46	Lauren Tolan	Biological Sciences	9am – 12:00pm	Upper Atrium

Dalal Abduljaleel

Department: Materials Science & Engineering
Major: Biological Sciences
Research Advisor(s): Delbert Day & Richard Watters
Advisor's Department: Materials Science & Engineering

Funding Source: OURE

Corneal Abrasion Project

Regenerating the cornea using borate bioactive glass solution may solve the ever-existing obstacles with corneal transplantation. The cornea is the outermost layer of the eye that is responsible of refracting the light entering the eye. Corneal injuries are many and common among people and animals. There is a substantial lack of medicines when it comes to treating corneal ulcers in animals which leads to greater damages. In the minor cases of corneal abrasions, people recover without permeant problems. However, when the abrasion degree is deeper, infections and other complications may rise, causing long-term vision problems. This project was designed to test the effects of borate bioactive glass in vivo on corneal wound healing using the 1550 and the 1605 glass fibers. Thus, the hypothesis was that the solution of borate glass will have a beneficial effect and will result in faster re-epithelialization than the commercial optic drops (double antibiotic drops).

Dalal Abduljaleel is a college student who is working towards becoming a research scientist and who will be graduating with her BS in Biological Sciences in December of 2018 from Missouri University of Science and Technology. From there, she hopes to rise with her intellectual capabilities that she has been developing over the past two years and realize her professional ambition of starting her own company. Dalal has two outstanding research experiences in the biomedical field. Thus, both of her research projects are novel and potentially patentable. Dalal has served as the event coordinator at the International Student Club (ISC) and the African Student Association (ASA). Dalal who has been once a shy person and a non-English speaker, has managed to get out of her comfort zone to become someone that fearlessly pursue their dreams.

Rakan Alali

Joint project with Salman M. Alshehri (Ph.D. Candidate)

Department: Mining and Nuclear Engineering
Major: Nuclear Engineering
Research Advisor(s): Dr. Shoaib Usman and Dr Muthanna Al-dahhan
Advisor's Department: Mining and Nuclear Engineering
Chemical and Biochemical 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 Scaled Down Channels Facility

A Scaled Down Separate-Effects Dual Channel Facility has been constructed and designed by Multiphase Reactor Engineering Application Laboratory (mReal) team to investigate plenum to plenum natural circulation which is considered as a safety feature of the prismatic modular reactor (PMR) during accident scenarios. The natural circulation heat transfers through two different channels (heated and cooled channels) for coolant flow between lower and upper plenum. The heated channel was heated uniformly by electric heaters, while the cooled channel is cooled water chiller system to initiate the natural circulation by create a variation in temperature. At different axial locations were the heat transfer data collected, in terms of the local wall surface, local air centerline temperatures, heat flux, heat transfer coefficient and Nusselt number.

Rakan Alali is a Sophomore Student in the Nuclear Engineering program at Missouri University of Science and Technology, with passion for optimization and efficiency of Nuclear Engineering processes, especially the area of research in application to Nuclear Systems Design and Safety. He is also pursing a minor in Engineering Management.

Emily Beahm

Department: Biology
Major: Biological Sciences
Research Advisor(s): Dr. Terry Robertson
Advisor's Department: Communication

Funding Source: FYRE Program

It's not easy being green: The presence of greenwashing in commercial advertisements

Though advertising, at its core, aims to persuade consumers to buy a certain product, it has also developed a more subtle and manipulative agenda – greenwashing. Greenwashing is the practice of portraying, typically with a false portrayal, one's company or product as environmentally friendly. In a society which is facing the increasingly pressing threat of climate change, this kind of information is critical to the decision-making process of a consumer. This article examines the extent to which the practice of greenwashing is present in commercial advertisements. Typical consumers viewed a set of 25 advertisements which contained greenwashing and answered a series of questions about them. The information gathered from this study will aid future analysis of the issue, and hopefully facilitate the role of the consumer in the future.

Emily is a freshman pursuing a Bachelor's Degree in biological sciences. She currently is a part of two clubs on the S&T campus – the Water Environment Federation and the Spanish Club. Through the Water Environment Federation, as an extension of Stream Teams United, she monitors streams in the Rolla area and pursues her passion for the environment. Through the Spanish Club, she attends the Hispanic Film Festival, and works to maintain the cultural diversity of the campus through various activities. It is her goal to use the degree she earns on campus to become part of the ecological science community. She is passionate about the environment and the culture of enjoying it, so a career preserving the natural world is simply an extension of this.

John Bequette

Department: Chemical Engineering Department
Major: Chemical Engineering
Research Advisor(s): Dr. Ali Rownaghi
Advisor's Department: Chemical Engineering Department

Funding Source: Opportunities for Undergraduate Research Experience (OURE)
University of Missouri Research Board (UMRB)

SSZ-13 coated 3D-printed zeolite monolith for alcohol conversion

The production of light olefins from methanol provides a commercially feasible route to ethylene and propylene from non-petroleum sources, such as natural gas, coal, and biomass. Such significant process can be realized over microporous aluminosilicate (zeolite) solid acid catalysts. With CHA topology, SSZ-13 zeolite was characterized and tested as an important catalysts for this process due to its proper acid strength and small pore channels. However, it is also because of the size of the pores that the rapid deactivation of this catalyst was observed and can hardly be avoided even by changing Si/Al ratios.[1] As another optional catalyst for this alcohol conversion, HZSM-5 zeolite with larger pores are more often used despite of lower selectivity towards light olefins. Fabrication of monolithic catalyst is a considerable strategy to enhance its selectivity due to its advantages in configuration which leads to low pressure drop, high thermal stability, great mechanical integrity, good mass transfer and negligible contamination. Recent development of three-dimensional (3D) printing techniques also facilitate the application of monolith in catalytic reaction.[2]

In this research project, we will fabricate 3D-printed HZSM-5 monolith first by using an extrudable paste made from HZSM-5 zeolite, bentonite clay and methyl cellulose. Nano-sized SSZ-13 seeds will synthesized and evenly coated on HZSM-5 monolithic catalyst. Secondary growth of SSZ-13 layer will be carried out in an autoclave and the obtained SSZ-13 coated HZSM-5 monolith will be characterized and tested for alcohol conversion.

Derek Berndt

Joint project with Salman M. Alshehri (Ph.D. Candidate)

Department: Chemical and Biochemical Engineering
Major: Chemical Engineering
Research Advisor(s): Dr. Shoaib Usman and Dr Muthanna Al-dahhan
Advisor's Department: Mining and Nuclear Engineering
Chemical and Biochemical Engineering

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

Experimental Investigation of Influence of Heating Distribution Variation of Riser Channel on Heat Transfer in Two Channels Facility

This study investigated how heat transfer occurs during pressurized conduction cooldown accidents (PCC) to understand the passive safety features of natural convection in prismatic modular reactors (PMR). PCC is a loss of flow accident, meaning the flow of working fluid to the reactor is suspended. In contrast to DCC (depressurized conduction cooldown), during PCC, high working fluid pressure is maintained. Understanding how reactor properties affect natural convection during PCC is crucial to passive safety. To study this phenomenon, a scaled down PMR model was designed by multiphase reactors engineering and applications laboratory (mReal) team at Missouri University of Science and Technology (S&T), consisting of upper and lower plenum connected by a riser and downcomer channel. Non-uniform heat flux was applied to the riser channel, simulating axial temperature distribution of the nuclear fuel in PMR. Air was used as coolant to study the effect of non-uniform heating on natural convection.

Derek Berndt is a Sophomore Student in the Chemical Engineering program at S&T, with a passion for efficiency and optimization of Chemical Engineering Processes, especially in areas relating to heat transfer and thermodynamics. He is also pursuing minors in Mathematics and Chemistry, and is actively involved with Christian Campus Fellowship and Learning Enhancement Across Disciplines.

Rachel Birchmier

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

Funding Source: OURE Missouri S&T

The Hall Effect in Doped Bi_2Se_3 Superconductors

The topological insulator Bi_2Se_3 has been known to undergo a superconducting transition at t_c=3.8K when doped with copper or niobium. When doped with 0.25 moles of copper or niobium for each mole of Bi_2Se_3, the metal atoms are inserted in the van der Waals gaps between layers of Bi_2Se_3. These crystals are formed by combining raw materials stoichiometrically followed by a sequence of melting, cooling, and quenching. Their resistivity is tested approaching their critical temperature to check for superconductivity. If superconductivity is achieved the Hall voltage of the crystal is measured to check for unique magnetic properties. The results of this experiment are important for finding the optimum doping amount and growth technique for superconducting 3D topological insulators such as $Cu_{0.25}Bi_2Se_3$ and $Nb_{0.25}Bi_2Se_3$. The presence of the Hall Effect under a magnetic field and superconductivity suggests the presence of exotic particles and magnetic moments, making these materials of interest in quantum computing

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Rachel Birchmier is a senior majoring in Physics and minoring in Mathematics, Computer Science, and Spanish. She is interested in experimental physics research especially in the field of condensed matter physics research.

Cooper Broman

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

Funding Source: N/A

The Impact of Monetary Gains and Losses on Cybersecurity Behavior

This research examines users' computer security risk-taking behavior when presented with the possibility of monetary value gains and losses for their action. Since personal finance is easy to identify with, we believe that this research will help to increase our understanding on the risk-taking behavior of users in an information security context. While technology may provide protection from harmful programs or viruses on a device, how a user interacts with the system, such as disabling a firewall, may open 'holes' in the system that could ultimately cause harm to the device or risk the privacy of the user. The specific research question is: "Are users more willing to take greater risks in a cybersecurity context when gains and losses of monetary value for their risky behavior are involved?"

Cooper Broman is a freshman majoring in Information Science and Technology from Festus, Missouri. He works as an assistant lab manager for the Laboratory for Information Technology Evaluation (LITE). In addition, he is a member of the Future Business Leaders of America (FBLA) and the Missouri S&T Paintball team. His interests include sports such as running and biking, and other forms of physical activity.

Blake Bryant

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

Funding Source:

Physiological Biomarkers of Sleepiness

This experiments goal is to determine a way to tell how sleepy a person is through a set of physiological tests. If successful, there will be a quick, objective, and inexpensive way to test how sleepy a person is. Our main goal is to find a correlation between the cognitive and physiological data we gathered and the subject's sleepiness level to determine how sleepy a person is. We gather data from volunteers who take a subjective survey to get an estimated sleepiness level. After the survey they will take a series of different cognitive tests, for example we have a Psychomotor Vigilance Test (PVT) which will test the cognitive domains of vigilant attention, and psychomotor speed. Results from these tests will be correlated with sleepiness level. We use several statistical methods, such as mixed-model approaches to evaluate the individual, and the group at the same time from the data gathered.

Blake Bryant is a freshman at Missouri S&T, and he is a Biological Science major and pursuing a minor in chemistry as well. On this project he is a Research Assistant to Dr. Matthew Thimgan.

Sarah Buckley

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

Funding Source: UM Research Board, Missouri
Missouri S&T OURE

Hemolymph Extraction in *Drosophila Melanogaster*

Extraction of hemolymph from the fly is done by using a device composed of rubber tubbing, luer-locks, and pipet tips involving air pressure, as well. The air pressure guides the fly through the rubber tubbing and into the pipet tip, head first. The luer-locks are adjusted to apply the air pressure to only the pipet tip. One the fly is lodged into the end of the pipet tip, the antenna of the fly is removed and a little bit of air pressure is applied to push the hemolymph out of hole created by removing the antenna. This method will standardize the extraction of hemolymph by taking out the human factor of applying pressure and allowing air pressure to do the work. To record the amount of hemolymph extracted, the hemolymph drop gets transferred to hydrated paraffin oil. A picture is taken of the hemolymph drop in the oil and a volume calculation is performed.

Sarah is a junior from Richland, MO. She is studying Biological Sciences with an emphasis of Pre-Med and a minor in Chemistry. On campus, Sarah is a Student Ambassador for the Admissions office, the President of Scrubs Pre-Health Group, an Honors Academy student, and she is currently working in Dr. Thimgan's Lab.

Meelap Coday

Joint project with Reagan Dugan

Department: Mining & Nuclear Engineering
Major: Nuclear Engineering
Research Advisor(s): Dr. Joseph Graham
Advisor's Department: Nuclear Engineering

Funding Source: Opportunities for Undergraduate Research Experiences (OURE)

Radiation Transport Modeling of Gamma Ray Tomography System

New accident-tolerant nuclear fuel designs that incorporate advanced safety features and economy are being designed to advance the next generation of nuclear reactors. Experiments are being conducted at nuclear test reactors to determine the overall reliability and performance of the accident-tolerant fuel at both normal operating conditions and beyond-design conditions. This project was tasked with modeling a high-resolution submersible gamma computed tomography (CT) system that utilizes a strong gamma ray source and an array of radiation detectors to measure the transmission of gamma rays from the source through the fuel. The transport of radiation in the tomography system was modeled in the Monte Carlo N-Particle (MCNP) software, which was used to evaluate system performance at various design parameters.

Meelap Coday is a senior in Nuclear Engineering at Missouri University of Science and Technology. He will be graduating in May of 2018 with a B.S. in Nuclear Engineering with a Minor in Mathematics. He is a member of the Sigma Chi Fraternity and was also the vice president of the American Nuclear Society (ANS).

Katrina Compton

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

Funding Source: FYRE Project

Characterization of a laser-cooled atomic beam

In Dr. Fisher's lab, lithium ions are cooled near to absolute zero using laser radiation so that they may be manipulated and observed interacting with external fields. The atomic beam that is used to load a magneto-optical trap is currently the largest limiting factor in the efficiency of the overall experiment. In this research project, a measuring scheme is developed so that the atom flux, mean-velocity and temperature of the atomic beam can be accurately determined. Once these values and their dependence on the experimental parameters are fully analyzed, methods for optimization of the atom source performance can be developed and implemented.

Katrina Compton is completing her first year at Missouri University of Science and Technology after transferring from Ozarks Technical Community College. Currently a sophomore working towards her undergraduate degree in Physics, this is her first research opportunity and she is looking forward to working on more projects in the future.

Osvaldino Contreiras

Department: Geosciences, Geological and Petroleum Engineering
Major: Geology and Geophysics
Research Advisor(s): Dr. Marek Locmelis, Dr. David Wronkiewicz
Advisor's Department: Dr. Kelly Liu

Funding Source: Missouri S&T- Opportunity for Undergraduate Research Program

The Origin of Pennsylvanian Magnetic Shale from the Viper Pit Mine, Illinois

Highly magnetic rock samples of unknown origin were discovered in an underground Viper Pit coal mine near Springfield, Illinois. Low oxygen atmospheric conditions are known to have resulted in the deposition of significant iron; however, such conditions were no longer prevalent in the Pennsylvanian period. The magnetic shales are anomalous because the inferred magnetite content of the rocks is significantly higher than expected in contrast to similar sedimentary depositional environments. The aim of this study is to determine the chemical and mineral composition of the rocks to provide insight on factors that accumulate significant amounts of iron.

Magnetic surveys were conducted and failed to detect magnetism in the overlying and underlying strata. From petrographic analysis, the polished rock surface texture of the samples are observed to be relatively homogenous in comparison to banded iron formation rock samples. Furthermore, X-Ray diffraction results indicate the presence of magnetite, aluminum silicates and magnetoplumbite.

Osvaldino Contreiras is a senior student in the Geology and Geophysics program. He is currently participating in the Opportunity for Undergraduate Research (O.U.R.E) Program. His main academic interest areas are Geochemistry, Sedimentology and Stratigraphy, and Geomechanics with applications to hydrocarbon and mineral resource exploration. Osvaldino has participated on numerous on campus organizations but most noticeable is his position as a Peer Learning Assistant in Missouri S&T's Learning Enhancement Across the Disciplines (L.E.A.D) Organization where he has tutored Mineralogy and Petrology, Structural Geology, and Calculus.

Zachary Driemeyer

Department: Physics
Major: Physics
Research Advisor(s): Aleksandr Chernatinskiy
Advisor's Department: Physics

Funding Source: First Year Research Experience (FYRE) Program

Survey of the interatomic potentials for GaN and AlN for thermal properties.

Gallium Nitride and Aluminum Nitride are key materials for the future high-power electronics. Such devices are characterized by very large electric current which in turn generate enormous amount of heat. Removal of this heat from the device depends crucially on the thermal conductivity of GaN and AlN and thermal conductance through their interface with other components of the device. Elucidation of such boundary conductance requires high quality interatomic potentials that can adequately describe thermal transport properties. In this work, we identified available in the literature interatomic potentials for GaN and AlN and using General Utility Lattice Program (GULP), we surveyed their performance for the elucidation of the thermal transport properties. A recommendation is made for the best potential for the description of the thermal transport in these compounds which will be applied in the future studies.

Zachary Driemeyer is a Freshman Physics major at Missouri S&T with minors in Literature and Mathematics. He is from House Springs, MO, currently works at a dog care and training company, and plans on going into graduate school and eventually pursuing a PhD after graduation.

Reagan Dugan

Joint project with: Meelap Coday

Department:	Nuclear Engineering
Major:	Physics
Research Advisor(s):	Dr. Joseph Graham
Advisor's Department:	Nuclear Engineering
Funding Source:	None

Radiation Transport Modeling of Gamma Ray Tomography System

New accident-tolerant nuclear fuel designs that incorporate advanced safety features and economy are being designed to advance the next generation of nuclear reactors. Experiments are being conducted at nuclear test reactors to determine the overall reliability and performance of the accident-tolerant fuel at both normal operating conditions and beyond-design conditions. This project was tasked with modeling a high-resolution submersible gamma computed tomography (CT) system that utilizes a strong gamma ray source and an array of radiation detectors to measure the transmission of gamma rays from the source through the fuel. The transport of radiation in the tomography system was modeled in the Monte Carlo N-Particle (MCNP) software, which was used to evaluate system performance at various design parameters.

Reagan Dugan is a former Nuclear Engineering student and current Physics student. He graduated from David H. Hickman high school in 2015 and is currently a junior at Missouri S&T. Reagan has spent his undergraduate time focusing on medical applications of nuclear technology, such as medical imaging and radiation therapy. Upon graduation in the spring of 2019, he plans to begin a graduate program in medical physics and hopes to eventually work in a clinical setting in the radiation oncology unit of a hospital.

Jonathan Duqum

Department:	Chemical & Biomedical Engineering
Major:	Chemical Engineering
Research Advisor(s):	Joseph Smith
Advisor's Department:	Chemical & Biomedical Engineering
Funding Source:	Chemical Engineering Department

Flare System Design and Performance

The goal of this project is to find an effective way to increase the combustion efficiency industrial flares under low flow systems by using air. When fuel is combust, there is a release of hydrocarbons, which affects the environment known as global warming. However, engineers never found a way to keep combustion efficiency high without affecting the ozone layer. On the other side, if the flare is not producing at a high efficiency rate it cost lots of money for the company to run the system. The project's main objective is to air keep the flare combustion efficiency at maximum level while not populating the atmosphere. Currently, designing the flare's crown using C3d and getting ready set up the final product.

Jonathan Duqum is currently in his 3rd year at Missouri University of Science and Technology and plans to graduate with a Bachelor's in Chemical Engineering. For his second semester of his junior year, he has worked on research about increasing the combustion in a flare system. He is also currently working with another project involves identifying deposits when Urea is spayed a diesel truck helping the elimination of the emissions NOx. After graduating, he plans to get his Master's degree at Missouri S&T.

Alexandra Emily

Department: Economics
Major: Applied Mathematics and Economics
Research Advisor(s): Ana Ichim
Advisor's Department: Economics

Funding Source:

Bitcoin: A Study in Price Development and Volatility

Since its creation the economics of Bitcoin's price development and volatility has been a topic of great interest for economist, investors, and cryptocurrency enthusiast alike. This article investigates the potential contributors for Bitcoin's rapid price formation in recent years by analyzing the correlation between popular cryptocurrency news releases with major price fluctuations in addition to comparing Bitcoin's volatility and daily returns to that of well-established currencies and currencies commonly recognized as highly volatile. Using daily data for 2 years (2016-2017), we found that many of Bitcoin's most dramatic price spikes and plummets correspond with news releases in seven main news categories. Furthermore, using an exponentially weighted moving average model we developed a method of comparing Bitcoin's volatility and daily returns' behavior to that of other currencies. Our findings support that Bitcoin's behavior is not currently similar to the other currencies which we used for comparison in our analysis.

Alexandra Emily, a senior in Applied Mathematics and Economics, performed her research on Bitcoin price and volatility in conjunction with the American Institute for Economic Research and Professor Ana Ichim over the course of the last academic year.

Zachary Foulks

Department: Chemistry
Major: Chemistry and Biology
Research Advisor(s): Dr. Yinfa Ma
Advisor's Department: Chemistry

Funding Source: Missouri S&T OURE program, the Center for Single Cell, Single Particle, and Single Molecule Monitoring, and the Center for Biomedical Research

Investigation of Cytotoxicity of Nanodiamonds by using Human Lung Cancer Cells and Advanced Analytical Techniques

In recent years, nanodiamonds have been studied for their applications in biology and medicine due to their unique electronic, mechanical, and surface chemistry properties. Their uses have been explored in many different areas, such as bone tissue engineering and drug delivery, electronics, sensors, solar cells, and many others, and their applications appear promising. However, a full and complete understanding of their toxicity to human and ecological system is required before their applications become practical. In this project, we have investigated the cytotoxic effect of different types of nanodiamonds at different doses, and different exposure times by using adenocarcinomic human alveolar basal epithelial cells (A549 Cells). In our experiments, four differently functionalized nanodiamonds at 50 to 250 μg/mLhave been dosed to A549 human lung cancer cells with exposure times ranging from 6 to 72 hours. The study results will be very helpful to the researchers who use nanodiamonds for biomedical applications.

Zachary Foulks is a sophomore undergraduate at Missouri S&T double majoring in both chemistry and biology. He has been involved in research with Dr. Ma's group for over a year, and he has also been involved in the Schrenk Society for several months. He plans to pursue an MD/PhD degree once he graduates.

Elliott France

Joint project with Tiffany Wysong

Department: Geosciences and Geological and Petroleum Engineering
Major: Geology & Geophysics
Research Advisor(s): Dr. John P. Hogan
Advisor's Department: Geosciences and Geological and Petroleum Engineering

Funding Source: OURE

The Origin and Relationships Between Olivine and Phlogopite Phenocrysts of the Avon Diatreme

We investigated an analysis of the petrographic and compositional relationships between olivine, biotite, and phlogopite present within an alnöite of the Avon Alkaline Igneous Province located in Genevieve County, Missouri. The olivine may have been used in a reaction with feldspar to create phlogopite, given by the reaction: $3\ (Mg,Fe)_2SiO_4 + 2\ KAlSi_3O_8 + 2\ H_2O = 2\ K(Mg,Fe)_3AlSi_3O_{10}(OH)_2 + 3\ SiO_2$

This possible reaction implies assimilation of granitic crust into an intrusive mafic melt. Other possibilities for the observed textures include fractionation of a mafic melt to destabilize the olivine and/or the mixing of two seperate magmas.

Anhedral olivine grains are more heavily fractured than euhedral crystals, as they are surrounded and embayed by phlogopite crystals. Isotope geochemistry of the olivine crystals support that there is only one population of olivines. Alternatively, the avon diatreme magma source could have been metasomatized after crystallization.

Elliott France is a senior year Geology & Geophysics student with interests in both geophysics and igneous petrology. He will be graduating this May with a degree in Geology & Geophysics and a minor in Computer Science. Elliott is originally from Springfield, Missouri and his plans for the future after graduation are open-ended.

Adam Gausmann

Joint Project with Clay McGinnis, Hannah Reinbolt, and Kevin Schoonover

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

Funding Source: Los Alamos National Laboratory / S&T – Cyber Security Sciences Institute

Galaxy: A Network Emulation Framework for Cybersecurity

Modern society is increasingly threatened by cyber-attacks, ranging from organized crime to terrorists to adversarial foreign nation states. The asymmetric nature of cyber warfare puts cyber security practitioners at a great disadvantage; i.e., cyber attackers get to decide when and where to attack, without the need for a physical presence providing advance notice to the cyber defenders who must scramble to quickly determine that an attack is occurring, select an appropriate defense, and execute it. They would greatly benefit from the capability to model attacks and defense in order to prepare for a wide range of adversarial scenarios. Computer network emulations are required to create models with sufficient fidelity to usefully model the real-world. The existing publicly available network emulations do not provide sufficient low-level control for cyber security modeling. The goal of this project is creating a virtualized computer network emulation infrastructure with the required controllability, usability, and scalability.

Adam Gausmann is a sophomore in Computer Science and an Undergraduate Research Assistant in the Natural Computation Laboratory (NC-LAB) where he works on the Coevolving Attacker and Defender Strategies for Large Infrastructure Networks (CEADS-LIN) project and serves as the System Administrator for the Laboratory.

Maverick Gray

Department: Chemistry
Major: Biology
Research Advisor(s): Vadym Mochalin, Sanaz Yazdanparast
Advisor's Department: Chemistry

Funding Source: Missouri S&T

Etching MXene using Sulfuric Acid

A new group of two dimensional materials, MXenes, are produced by etching the A-group from MAX phase using Hydrofluoric acid. The purpose in our study is to find out the ideal concentration of sulfuric acid for etching MXenes.

Solutions with different concentrations of sulfuric acid were produced. These solutions were stirred for 7-10 days and then mixed with water and centrifuged. This step was repeated until the pH was 5-6. The solution was then centrifuged for 1 hour and the resulting colloidal solution was then collected.

Lower concentrations of sulfuric acid are too weak to etch MXene and higher concentrations are to strong and over-etch. The solution with the highest concentration of MXene in the colloidal solution was 40% sulfuric acid.

The advantage of these results is that we can now use sulfuric acid to etch MXene instead of hydrofluoric acid, because sulfuric acid is a safer acid to use.

Maverick Gray is a first year biology student at Missouri University of Science and technology. He received a high school diploma at Fort Zumwalt South High school in 2017. In high school he took his first job at a Papa Murphy's where he was promoted to supervisor, and from this experience he learned leadership skills and the value of hard work. In the future he is looking to use his degree for research.

Randy Greeves

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

Funding Source: First Year Research Experience (FYRE)

American Friends Service Committee In France During World War II

The American Friends Service Committee (AFSC) was a humanitarian organization that had a large role in helping French people in need during World War II. The AFSC's primary goal was to help children affected by the war, and the AFSC was the most successful aid organization at the time in helping those children. However, few people have heard of this organization. By researching newspaper articles from the early 1940's the effect of the AFSC can be ascertained and how they interacted with the public understood. This is useful for understanding how to best connect with the public for the goal of humanitarian aid.

Randy Greeves is a 3rd year student at Missouri S&T. He studies History and Political Science. He is from Oologah, Oklahoma where he first began to read about history and became interested in the lives of people during the 20th century. He works while attending school as a supervisor in the food court on campus, and was a member of the Residential Hall Association his Sophomore year.

Scott Grier

Department: Civil Architectural and Environmental Engineering
Major: Civil Engineering
Research Advisor(s): Dr. Katie Shannon
Advisor's Department: Biological Sciences

Funding Source: OURE

Regulation of Actin Binding Proteins During Cytokinesis

Cytokinesis is the process of cell separation that occurs at the end of mitosis and meiosis. Dr. Shannon's lab uses the budding yeast Saccharomyces cerevisiae as a model eukaryotic cell to study the coordination of cytokinesis with the end of chromosome segregation. This research focuses on the effect that mutations of the protein IQG1 have on actin binding during cytokinesis. Mutations that affect phosphorylation of IQG1 cause cytokinesis defects and change the timing of actin ring assembly. I have prepared yeast protein extracts and used immunoprecipitation to purify IQG1. I will perform actin binding and bundling assays to determine if the mutations affect the interaction of IQG1 with actin filaments. By conducting more research on IQG1 and the role it plays in cell division, we stand to gain a better understanding of how large of a role IQG1 has in cytokinesis.

Scott Grier is an undergraduate student dual majoring in Civil Engineering and Engineering Management at Missouri S&T. This is his first experience with biology research.

Matthew Healy

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

Funding Source: OURE

Links between Age, White Matter Microstructures, and the SOD2 Allele

Human brains' structures can change with age and differing health conditions. This study investigates the relationship between age and the presence of the superoxide dismutase 2(SOD2) allele in healthy individuals by using diffusion tensor imaging, or DTI, to measure five different aspects of white matter structural integrity in eight different brain regions. A multivariate analysis of covariance was used to test for differences in structures and SOD2 status while controlling for age. Other statistical methods were performed to test for demographic differences by SOD2 dominance. The results of this study will enable researchers to better understand the association between the SOD2 allele, age, and white matter structural differences in specific brain regions.

Matthew Healy is a junior in Computer Science and Applied Mathematics. Active on campus, he is the head of a research group for Dr. Markowsky in the Computer Science department, and is secretary of S&T's Underwater Robotics Team. He is also working on independent projects relating to robotics education and is an undergraduate researcher for the department of applied mathematics and statistics.

Madeline Hines

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

Funding Source:

Regulation of Actomyosin Ring Formation during Cytokinesis by Iqg1 and Phosphorylation

Cytokinesis is the division of a cell into two daughter cells. Budding yeast is a useful model organism because, like higher eukaryotes, it requires an actomyosin ring. My research focuses on Iqg1, which is required for cytokinesis and is related to IQGAP proteins in human cells. Phosphorylation of Iqg1 has been shown to regulate the proper timing of assembly of the actomyosin ring. One aim of my project was to investigate the function of Iqg1 phosphorylation at specific amino acids in cytokinesis. The second goal was to determine the effect of phosphorylation on binding of Iqg1 to formin proteins, Bnr1 and Bni1. This research is important for the understanding the regulation of cytokinesis and how this process can be perturbed in cancer cells.

Madeline, Maddie, Hines is a graduating senior from the chemistry department. She has an emphasis in Biochemistry. She choose to work in Dr. Shannon's research lab to gain biology lab skills which she hopes to use in the future for cancer research.

Heather Hingst

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

Funding Source:

A preliminary study of The Great Valley Microsite: collection and analysis of a microvertebrate fossil assemblage in the Hell Creek Formation of Eastern Montana

The Great Valley Microsite (hereafter referred to as the GVM) is a productive microvertebrate locality northeast of the town of Jordan in Garfield County, Montana. Microvertebrate fossil and lithostratigraphic data were collected in the summer of 2017. The data will be used as part of the Hell Creek Project; a collaborative effort to reconstruct the flora, fauna, and paleoenvironmental conditions of the Hell Creek Formation (HCF) during the latest Late Cretaceous (Maastrichtian). The preliminary results are constrained to fossils found in the eastern arm (the Runway) which were separated and identified based upon their morphological features. Based on the fossil evidence and the lithostratigraphy, the GVM locality was likely deposited in a fluvial, floodplain environment close to a levee. This river system was close to the boundary of the Western Interior Seaway. These preliminary results provide a foundation for further research into the microvertebrate paleontology of the Late Cretaceous in this region, more comprehensive interpretation of the paleoenvironment, and how it changed after the Cretaceous/Paleogene boundary.

Heather Hingst is a junior from Hermann, Missouri majoring in Geology and Geophysics in the Department of Geosciences and Geological and Petroleum Engineering. She has a deep passion for studying fossils and geophysics. Heather is a Coordinator for the Chancellor's Leadership Academy and is active in many other organizations on campus.

Sarah Jemison

Department:	Civil, Architectural, and Environmental Engineering
Major:	Civil Engineering and Architectural Engineering
Research Advisor(s):	Dr. Lesley Sneed
Advisor's Department:	Civil, Architectural, and Environmental Engineering
Funding Source:	Kerokoll

Compressive Behavior of Masonry Columns Confined with Fiber Reinforced Cementitious Matrix (FRCM) Composites

Fiber Reinforced Cementitious Matrix (FRCM) composites can be employed as a valid alternative to Fiber Reinforced Polymer (FRP) composites for strengthening existing reinforced concrete and masonry structures. In this study, the behavior of clay masonry columns confined by steel reinforced grout (SRG) composite with a natural hydraulic lime mortar is investigated. An experimental study was performed to understand the behavior of masonry prisms with varying cross-sections confined by SRG jackets subjected to a monotonic concentric compressive load. Test parameters considered in this study are the density of the steel fibers, column corner radius, number of SRG layers, and the overlap length of the composite. The effectiveness of the confinement is studied in terms of load-bearing capacity, ultimate strain, and energy absorption with respect to unconfined, square cross-sectioned columns.

Sarah Jemison is a senior Civil and Architectural Engineering duel major from Nixa, MO. She is part of the first generation of Greenberg Scholars of the Civil, Architectural, and Environmental Engineering Department who will be participating in the Missouri S&T Master Student Fellowship Programs pursuing BS+MS in an accelerated manner. She is a member of the Steel Bridge Design Team as well as Chi Epsilon and a Mechanics of Materials Teaching Assistant.

Sara Johnson

Department: Psychological Science
Major: Psychological Science
Research Advisor: Dr. Amber Henslee
Advisor's Department: Psychological Science

Funding Source: N/A

Project Title Predictors of Freshmen Engineering Students' Report of Cheating

Unethical behavior among students is a concern within all academic disciplines, including the STEM fields. The literature describes demographic variables of students who exhibit academically dishonest behaviors but is limited by specific samples. We investigated the probability of freshmen engineering students' report of cheating based upon individual predictor variables including perceptions, knowledge, and attitudes toward academic integrity. Participants rated themselves on five quantitative perception measures: self-perceived ethicalness (E), cheating prevalence (CP), plagiarism prevalence (PP), knowledge of consequences (KC), and how much they cared about academic integrity (C), as well as whether the participant had previous training or education about academic integrity (no training; NT). Eighty percent of participants reported that they had never cheated. Almost 93% had completed previous academic integrity training. Freshmen engineering students were more likely to report cheating with decreased self-perceived ethicalness and decreased perceived prevalence of plagiarism. These results could inform academic dishonesty prevention efforts aimed at challenging students' perceptions and behaviors.

Sara Johnson is a second-year psychology student at S&T. She began working with Dr. Henslee in 2017 and looks forward to pursuing a career in clinical psychology.

Kaelyn Kacirek

Department: Engineering Management
Major: Engineering Management
Research Advisor(s): Dr. Amy Belfi
Advisor's Department: Psychological Science

Funding Source: Psychological Science Department

The Famous Melodies Task: Design, development, and use in studies of category knowledge

Normalized stimuli are essential tools for cognitive neuroscience research. For example, the International Affective Picture System is a widely used set of visual images that have been rated on characteristics such as emotional valence and arousal. Such stimulus sets have been used to measure, for example, the ability of patients with brain damage to recognize and name visual objects. Similarly, musical melodies have been used to investigate processes such as naming abilities in patients with aphasia and memory in patients with Alzheimer's disease. However, there is no normed set of musical melody stimuli, preventing consistency across studies. With this in mind, this proposed research will create a normed set of musical stimuli for researchers to use in future studies. A range of famous musical melodies (N=100) will be rated and characterized on several variables (e.g., complexity, age of acquisition, valence) by large online sample (N=500) using Amazon's Mechanical Turk.

Kaelyn, an undergraduate student at Missouri S&T, has developed a great interest in both engineering and neuroscience. For her high school senior thesis project, she chose to study the effects of music on the brain in Alzheimer's and Dementia patients. Her fascination with the subject led her to become a research assistant at the university for Dr. Amy Belfi. Together, they are exploring the effects of music and the brain. While working to prepare the research for peer-reviewed scientific journals, Kaelyn will continue to pursue her Engineering Management degree with a minor in Cognitive Neuroscience with plans to graduate in the year 2020.

Jonathan Kuchem

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

Funding Source:

Mechanical Properties of Steel Fiber Reinforced Concrete made with recycled materials

A push for increasing the lifespan and sustainability of infrastructure has led to a need for more durable, strong, and environmental friendly construction materials. A concrete mix design using recycled steel fibers from rubber tires was chosen to enhance the mechanical properties, durability, and sustainability of the concrete. Concrete mixtures with different quantities of recycled and manufactured steel fibers were examined. Compression and flexural tests were performed in order to analyze these properties and used to compare the results with the industry standard steel fibers. The results show the flexural strength and toughness of fiber reinforced concrete has increased compared to reference mixtures and comparable results to manufactured steel fibers. It is found that the recycled fibers present an environmental friendly option to reduce tire waste in landfills and present a cheaper option than the industry used steel fibers.

Jonathan Kuchem is a senior in Civil Engineering from Augusta, Missouri. He is an active member of the school's Steel Bridge Team, American Society of Civil Engineers chapter (ASCE), Chi Epsilon Civil Honor Society, and Kappa Alpha Order Fraternity. Jonathan is a teaching assistant for Mechanics of Materials lab and has also helped with course development. Jonathan is a Greenberg Scholar in the Civil Engineering Department which will allow him to pursue an accelerated M.S. degree in Civil Engineering upon graduation this spring.

Kaysi Lee

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

Funding Source:

NMR pH Measurements using the ^{19}F Chemical Shift of 2-Fluoro-3-hydroxymethylpyridine

NMR chemical-shift information has long been used to determine the pH of aqueous solutions. Test molecules that qualify for conducting pH measurements must be sensitive to the solution's H^+ concentration and simultaneously change the electronic environment around the NMR-sensitive nuclei. Especially ^{19}F NMR has shown great potential because of the high NMR sensitivity of the ^{19}F nucleus, the wide chemical-shift range, and the large chemical-shift response to the solution's environment. Protonation of fluorinated molecules in acidic solutions or deprotonation in basic solution can alter the ^{19}F chemical shift far enough to accurately determine the pH from prerecorded calibration curves. Around the pK_a, fluoropyridines show a particularly large ^{19}F chemical-shift dependence on pH. However, because fluoropyridines are generally insoluble in aqueous solutions, only the water-soluble fluoro-hydroxypyridines or fluoro-hydroxymethylpyridines are suitable candidates for chemical-shift-dependent pH test molecules. For the molecule 2-fluoro-3-hydroxymethylpyridine we have measured a substantial ^{19}F chemical-shift dependence on pH.

Elizabeth Lemieux

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

Funding Source: University of Missouri Research Board

MP3: Microparticle-laden Protein Particles for Wound Healing

The objective of this research is to synthesize biodegradable microparticles (MP3s) to serve as a structural matrix for human cells, with the end goal of application for burn wound healing. The MP3s will be synthesized using poly(lactic-co-glycolic acid) (PLGA) polymer using the single emulsion solvent-evaporation technique while incorporating a proprietary flow-focusing device. Fibronectin will be immobilized on the surface of MP3s using 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide (EDC) and N-hydroxysuccinimide (NHS) conjugation and quantified using the bicinchoninic acid (BCA) assay. The conjugated MP3s will be seeded with human umbilical vein endothelial cells (HUVECs) and assessed for cell binding ability. The viable cell attachment and proliferation will be qualitatively analyzed using fluorescent microscopy. It is expected that fibronectin immobilization on the surface of MP3s will increase cell attachment compared to unmodified particles or particles coated with other proteins. The future of this project will be the study of effects of MP3s for tissue regeneration.

Elizabeth Lemieux is a sophomore in Chemical Engineering at Missouri S&T, pursuing minors in Chemistry and Nuclear Engineering. She is a member of Chi Omega Fraternity, Society of Women Engineers, and is on the executive board for Engineers Without Borders. Elizabeth hopes to graduate in May 2020.

Tiffany Lyche

Department: Mining and Nuclear Engineering
Major: Mining Engineering
Research Advisor(s): Dr. Kwame Awuah-Offei
Advisor's Department: Mining Engineering

Funding Source: Mining Department and OURE at MST

Evaluating the Effect of Text Message Prompts on Miners' Decision Making in a Disaster

The objective of this research is to determine if information provided to miners during an emergency will help an individual miner make safer decisions. The objective was achieved through surveys that obtained information from miners about what they will do in various circumstances. Respondents are presented with real-life scenarios of emergency and urgent situations during a disaster. In addition, respondents are provided text message options. The results show that miners are likely to use text message cues from an automated system to make decisions during a mine disaster. Also, the research found that workers did not heed warnings and only used breathing apparatus when giving a specific command to do so. Verbal cues from the human interaction increased the response rate when instructed to use a breathing apparatus. This research provides response patterns for endangered workers in emergency situations that can be used to make underground mining safer for miners.

Tiffany J. Lyche is a senior in mining engineering at Missouri S&T, graduating May 2018. She has an associate's degree in applied engineering from Wenatchee Valley College. She is married and has two children. She volunteers with her children's schools throughout the year as well as various student organizations. She holds elected positions with two MS&T's student chapters: NSSGA Vice-President (National Stone, Sand, and Gravel Association) and the ISEE Secretary (International Society of Explosive Engineers). She enjoys being with her family whether it is outdoors, crafting, home-improvement projects, or anything else leisurely. Tiffany plans to work in the aggregates industry after graduation, specifically mine planning and environmental.

Christopher Mark

Joint project with Salman M. Alshehri (Ph.D. Candidate)

Department: Chemical and Biochemical Engineering
Major: Chemical Engineering
Research Advisor(s): Dr. Shoaib Usman and Dr Muthanna Al-dahhan
Advisor's Department: Mining and Nuclear Engineering
Chemical and Biochemical Engineering

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

Investigation of the Circulation of Helium in the Prismatic Modular Reactor

The prismatic modular reactor (PMR) is one of the leading designs for the next generation of nuclear reactors because of its ability to passively remove heat by convection in an accident scenario. It is important to understand how the coolant, helium, circulates in order to design reactors that safely shutdown in the event of a loss of coolant flow accident. We studied the effect of the outer surface temperature of the reactor vessel on the circulation of the helium and the transfer of heat within the reactor. A scaled down duel-channel facility was used to study the plenum-to-plenum circulation. Data was taken with one channel heated, and the other channel and the upper plenum cooled to different temperatures. The temperature and heat flux was measured at several points along the channels.

Christopher Mark is a sophomore student majoring in Chemical Engineering from Manchester Missouri. He is currently doing undergraduate research with graduate student Salman Alshehri.

Elizabeth Matejka

Department:	Chemical & Biochemical Engineering
Major:	Chemical Engineering
Research Advisor(s):	Dr. Joontaek Park
Advisor's Department:	Chemical & Biochemical Engineering
Funding Source:	N/A

Spreadsheet-Based Simulator of a Flash Drum

A sample class project utilizing Excel spreadsheets to develop a flash drum simulator is demonstrated. In addition to solving equations for mole and enthalpy balances, students are trained to carry out vapor- liquid equilibrium calculations. More importantly, students gain a solid understanding of the link between hand calculations and simulator results and how it can be applied to any chemical engineering problems.

Elizabeth Matejka is a senior student studying chemical engineering at Missouri University of Science and Technology. Her industry work experience includes an internship at Sensient Colors LLC working in industrial colors and more recently she has completed a co-op with Anheuser Busch-InBev working in their research pilot brewery. She is participating in the undergraduate research program with the hopes to expand her knowledge and experience in the field of chemical engineering and to be able to apply the things she has learned in real-world scenarios when she graduates.

Clay McGinnis

Joint Project with Hannah Reinbolt, Adam Gausmann, and Kevin Schoonover

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

Funding Source: Los Alamos National Laboratory / S&T – Cyber Security Sciences Institute

Galaxy: A Network Emulation Framework for Cybersecurity

Modern society is increasingly threatened by cyber-attacks, ranging from organized crime to terrorists to adversarial foreign nation states. The asymmetric nature of cyber warfare puts cyber security practitioners at a great disadvantage; i.e., cyber attackers get to decide when and where to attack, without the need for a physical presence providing advance notice to the cyber defenders who must scramble to quickly determine that an attack is occurring, select an appropriate defense, and execute it. They would greatly benefit from the capability to model attacks and defense in order to prepare for a wide range of adversarial scenarios. Computer network emulations are required to create models with sufficient fidelity to usefully model the real-world. The existing publicly available network emulations do not provide sufficient low-level control for cyber security modeling. The goal of this project is creating a virtualized computer network emulation infrastructure with the required controllability, usability, and scalability.

Clay McGinnis is a Sophomore in Computer Science, and Undergraduate Research Assistant in the Natural Computation Laboratory working on the Coevolving Attacker and Defender Strategies for Large Infrastructure Networks (CEADS-LIN) project and Vice Chair of Missouri University of Science and Technology's (S&T's) Association for Computing and Machinery (ACM) Student Chapter Special Interest Group on Web Development.

Rachel Nixon

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

Funding Source: Department of Chemistry
OURE

DNA Decorated Multifunctional Gold Nanoparticles

Gold nanoparticles have attracted extensive research interests due to their unique optical, electrical, and physical properties. The hybridization of gold nanoparticles, along with other nanomaterials, has stimulated applications in biomedical imaging, plasmonic enhancement, and catalysts. However, the rational organization of gold nanoparticles with precisely controlled distance and orientation remains difficult in nanotechnology fields. This challenge can be overcome by using DNA origami scaffolding as templates. One such method of organization is by anchoring the nanoparticles, which are functionalized with single-stranded DNA, to a two-dimensional DNA origami tile surface via DNA hybridization. In this work, multi-functionalized gold nanoparticles were developed to determine the effect of nanoparticle coating composition on binding efficiency at two separate anchor sites of a DNA origami template. The ratio of coated DNA sequences as well as the functional strand length were varied to elucidate their influences on gold nanoparticle-conjugate functionality and stability.

Rachel Nixon is a sophomore pursuing a degree in Chemistry with a minor in Mathematics. She is an active member of the Honors Academy, the W. T. Schrenk student chapter of the American Chemical Society, and the Missouri S&T Symphonic Band. She has worked on projects investigating DNA nanotechnology under the direction of Dr. Risheng Wang since April 2017, and plans to continue her education in chemistry through graduate studies.

Luis Emmanuel Ocampo

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:	Laboratory for Information Technology Evaluation

Neuropsychological Assessment of Fatigue Utilizing Eye-Tracking Data

Fatigue is one of the leading causes of workplace incidents and car accidents and a rising safety issue for many industries. Many factors can be a source of fatigue, including sleep deprivation and prolonged mental and physical work. Negligence in effectively dealing with fatigue can have enormous consequences, ranging from economic loss due to a lack of productivity, to more extreme outcomes such as death. Therefore, it is essential to gain a better understanding on how to effectively detect fatigue.

The goal of this project is to isolate and determine how eye-tracking data can be used to assess fatigue in a person. Through this, we can better understand the neuropsychological signs of fatigue, and implement measures to improve safety and performance. The results of this research aim to minimize the risk of fatigue-related errors and accidents.

Luis Emmanuel Ocampo is a freshman in Information Science and Technology from Chesterfield, Missouri. He works as an assistant lab manager at the Laboratory for Information Technology Evaluation (LITE) and is webmaster for the Formula SAE design team. He is also a member of the Missouri S&T Chapter of the Association of Computing Machinery, the Thomas Jefferson Hall Association, and the Chancellor's Leadership Academy.

Devin Olds

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

Funding Source: N/A

Increasing Public Awareness in Regards to Antimicrobial Resistance

The goal of this project is to target the issue of lack of education and awareness in regards to antimicrobial resistance. Current messaging tactics and educational materials were analyzed in order to find what methods have been ineffective, as well as effective. Much of the messaging that was analyzed was in the form of infographics. After the analysis of these infographics was done, new infographics were made to essentially rebrand the message and target the general antibiotic user about the issue as well as educate them about proper use.

Devin Olds is a senior in civil engineering at Missouri S & T. During his time as an undergraduate, he has worked on several different projects such as antimicrobial resistance and applications 2D materials (graphene).

Hannah Reinbolt

Joint Project with Clay McGinnis, Adam Gausmann, and Kevin Schoonover

Department:	Computer Science
Major:	Computer Science
Research Advisor(s):	Dr. Daniel Tauritz
Advisor's Department:	Computer Science
Funding Source:	Los Alamos National Laboratory / S&T – Cyber Security Sciences Institute

Galaxy: A Network Emulation Framework for Cybersecurity

Modern society is increasingly threatened by cyber-attacks, ranging from organized crime to terrorists to adversarial foreign nation states. The asymmetric nature of cyber warfare puts cyber security practitioners at a great disadvantage; i.e., cyber attackers get to decide when and where to attack, without the need for a physical presence providing advance notice to the cyber defenders who must scramble to quickly determine that an attack is occurring, select an appropriate defense, and execute it. They would greatly benefit from the capability to model attacks and defense in order to prepare for a wide range of adversarial scenarios. Computer network emulations are required to create models with sufficient fidelity to usefully model the real-world. The existing publicly available network emulations do not provide sufficient low-level control for cyber security modeling. The goal of this project is creating a virtualized computer network emulation infrastructure with the required controllability, usability, and scalability.

Hannah Reinbolt is a Sophomore in Computer Science, and Undergraduate Research Assistant in the Natural Computation Laboratory working on the Coevolving Attacker and Defender Strategies for Large Infrastructure Networks (CEADS-LIN) project and Webmaster of Missouri University of Science and Technology's (S&T's) Association for Computing and Machinery (ACM) Student Chapter Special Interest Security Group.

Arthur Schneider

Department: History
Major: History
Research Advisor(s): Dr. Justin Pope
Advisor's Department: History

Funding Source: FYRE Research Program

Mapping Slave Uprisings Across the Eighteenth-Century British Atlantic

In one of the first projects of its kind, this study examines the influence of news of slave rebellions on the colonies of the British America during the eighteenth century. Using newspapers from both England and colonial America, this project traces the speed and direction of specific reports of insurrection across the British Empire. It also seeks to understand whether printers changed reports of slave unrest as they shared stories between colonies and to explore the impact of news upon specific towns and colonies. The poster will include the text of a specific newspaper report of slave rebellion, a map illustrating the movement of news reports between colonies, and evidence of the influence of the report on colonial slave codes. In addition to these graphics on the poster, there will be text included to provide insight to the results uncovered and to give some additional background information to the project as a whole.

Arthur Schneider is a History major that is interested in American history with an emphasis on colonial America. While growing up on a farm close to the Missouri River in Central Missouri, he developed as a grade school student an interest in not only early American history but also the very beginnings of America that includes its time as colonies of the British Empire. While being fascinated by the stories of Lewis and Clark traveling up the Missouri River, it led to learning about America at its earliest. These include the Boston Massacre, the American Revolution, and the War of 1812 that have had a lasting effect on him, which helped him in deciding to become a History major.

Kevin Schoonover

Joint Project with Clay McGinnis, Adam Gausmann, and Hannah Reinbolt

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

Funding Source:	Los Alamos National Laboratory / S&T – Cyber Security Sciences Institute

Galaxy: A Network Emulation Framework for Cybersecurity

Modern society is increasingly threatened by cyber-attacks, ranging from organized crime to terrorists to adversarial foreign nation states. The asymmetric nature of cyber warfare puts cyber security practitioners at a great disadvantage; i.e., cyber attackers get to decide when and where to attack, without the need for a physical presence providing advance notice to the cyber defenders who must scramble to quickly determine that an attack is occurring, select an appropriate defense, and execute it. They would greatly benefit from the capability to model attacks and defense in order to prepare for a wide range of adversarial scenarios. Computer network emulations are required to create models with sufficient fidelity to usefully model the real-world. The existing publicly available network emulations do not provide sufficient low-level control for cyber security modeling. The goal of this project is creating a virtualized computer network emulation infrastructure with the required controllability, usability, and scalability.

Kevin Schoonover is a Junior in Computer Science, an Undergraduate Research Assistant in the Natural Computation Laboratory working on the Coevolving Attacker and Defender Strategies for Large Infrastructure Networks (CEADS-LIN) project and Chair of S&T's Association for Computing Machinery (ACM) Student Chapter Special Interest Group on Web Development.

Frank Schott

Department: Mining & Nuclear Engineering
Major: Mining Engineering
Research Advisor(s): Dr. Lana Alagha
Advisor's Department: Mining & Nuclear Engineering

Funding Source: Mining & Nuclear Engineering Department, Missouri University of Science and Technology

EFFECT OF THE USE OF SEA WATER ON GRADE AND RECOVERY OF LEAD AND COPPER IN COMPLEX SULFIDE ORE FLOTATION

In Sulfide ore flotation, fresh water is normally used as the flotation medium. Due to increasing scarcity of fresh water resources, understanding the effect of use of recycled water/seawater in sulfide ore flotation is essential for its sustainability. The emphasis of this study is to test the possibility of replacement of fresh water with seawater as the flotation medium in sulfide ore flotation. During experiments an increase of 18.9 % and 12.89 % in recovery of Pb and Cu respectively was observed in case of sea water as flotation medium compared to fresh water flotation. However a decrease of 8.55 % and 0.93% in grades of Pb and Cu were observed in case of sea water flotation. It was concluded that seawater can be successfully used in bulk flotation of galena and chalcopyrite from complex sulfide ore by varying the reagents dosages and other flotation variables.

Frank Schott is currently in his 3rd year at Missouri University of Science and Technology and plans on graduating in December 2019 with a bachelor's degree in Mining Engineering. For the last two years, he has been working with Dr. Lana Alagha on different research projects involving processing of coal, sulfide and phosphate ores.

Thabiso Sechele

Department: Mining Engineering Department
Major: Mining Engineering
Research Advisor(s): Kwame Awuah-Offei
Advisor's Department: Mining Engineering Department

Funding Source: Immersive Technologies
Kwame Awuah-Offei

Investigating the correlation between spatial cognition and training on a cable shovel simulator

Spatial ability plays an importance role in the interaction of people with the environment. Skills related to spatial ability are applicable anywhere in the modern world including skills on virtual reality simulators. While simulators have become very important in the mining industry, the effect of a subject's spatial ability on simulator training effectiveness have not yet been studied. This study sought to find out if performance on a cable shovel simulator is correlated to one's spatial abilities or not. To assess that, participants with no experience on the shovel simulator were recruited to take a spatial ability test, the Purdue Spatial Visualization Test-Rotations, to measure their spatial cognition levels. The participants were then trained for about half an hour on the simulator and then assessed for their final performance on the simulator. The results indicate that age is negatively correlated to spatial abilities and simulator performance, education level has an influence only on the number of trucks loaded factor and both age and spatial abilities are correlated to fill factor. Despite that gaming experience has shown a huge impact on spatial cognition in other studies, for a cable shovel simulator gaming experience had no influence on spatial cognition nor performance.

Thabiso Sechele is a prospective May 2018 graduate of MS&T. She is currently doing a double major in Mining Engineering and Economics. Even though this was her first research ever, she hopes that its not her last as now she has a burning passion for Research Studies. Her other interests lie in Mining Economics. Having spent most of her life in Africa, she hopes that the skills she learnt in USA, in one of the most recognized mining university will be of great value in diversifying the economy back home.

Jennifer See

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

Funding Source: NSF

Transition Metal Chalcogenides and Surfaces for Energy Conversion Devices

In recent times electrocatalytic and photoelectrocatalytic water splitting has emerged as one of the most potent form of clean energy generation. This project is focused on designing efficient catalysts from earth-abundant resources based on transition metal chalcogenides for electrocatalytic water splitting and integrating these new catalysts with solar photoabsorber nanostructure arrays. Catalyst design follows a simple hypothesis which optimizes catalytic performance based on the material's properties, specifically anion electronegativity and degree of covalency in the structure. Rational design of the electrocatalyst will be achieved through combinatorial electrodeposition whereby, a phase diagram will be explored in a systematic way by varying relative amounts of respective precursor in the electrolyte. Along with new material synthesis, chemical identity of the active surface of the catalysts will be elucidated from various surface analytical techniques by carefully designing various surfaces and comparing their activities.

Jennifer's research experience includes working for Dr. Nath through the FYRE Program. She is interested in renewable energy and was drawn to Dr. Nath's work with clean energy alternatives. She also has hands on research experience with polymer formulation as an intern with the R&D group at Brewer Science. She graduated summa cum laude from Jefferson College in May 2017. She is currently a junior at Missouri S&T where she is pursuing a Bachelor of Science degree in Chemistry. She was on the Fall 2017 Dean's List and is also on a part time co-op with Brewer Science.

Ashley Segobiano

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

Funding Source: Biological Sciences Department

Isolation and Characterization of Halo-Acidophilic Microorganisms from Lake Gneiss, Western Australia

Lakes located in the Yilgron Craton, Western Australia may be the best terrestrial analogue to possible previous Martian conditions due to very similar geochemical features. Lake Gneiss is among the most extreme, possessing a pH of 1.4 and saturated salt conditions. The purpose of our study was to develop enrichments, isolate and characterize haloacidophiles, and gain an understanding of the organisms that reside in these harsh environments. Medium simulating lake conditions, microscopic observation, and molecular analyses were employed to achieve these goals. After six months of incubation, the initial enrichments of Lake Gneiss had turbidity and developed a pH of 0.5. DNA extraction was performed on this enrichment and a genomic library was generated. Our results support our hypothesis that bacteria can exist at extremely low pHs and salt saturation and provides hints of the kind of life that could have existed on Mars.

Ashley Segobiano is a junior undergraduate student pursuing a Bachelor of Science degree in Biological Sciences. She joined Dr. Mormile's lab the spring of her freshman year in 2016 and took over the L. Gneiss project. In her free time, she enjoys participating in her sorority, spending time reading about medical school admissions, and planning her future. She dreams of one day becoming a Physician and maybe - just maybe - becoming the first doctor on Mars.

Lauren Tolan

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

Funding Source: OURE

What is the function of the Iqg1 domain during Cytokinesis?

In this experiment, we are specifically looking at the final step in cell division which is cytokinesis. Cytokinesis is the final stage of cell division during which the two daughter cells separate completely. For this experiment, budding yeast is used to see multiple cell divisions in a short period of time due to the microbe being such a good model organism. After breaking down the budding yeast, the IQG1 protein has held an essential interest in the involvement of the actin-myosin ring assembly. The goal of this research was to enter a plasmid within the yeast genome of the IQG1-wt with deletion, making the mitosis of the division abnormal. Once the cells are abnormal, the cells are then starved to force sporulation, enabling tetrads within the cells to go through meiosis as spores until probable conditions arise. With more research on IQG1 and the role it plays in cell division, the more researchers can understand the effects of the gene protein and the functions that arrive when abnormal.

Lauren Tolan is a 20 year old Missouri S&T student who is studying to become an orthopedic surgeon with an emphasis in sports medicine. She is involved in numerous clubs and activities here on campus including Miner Club, Women's Soccer, Scrubs, and Phi Sigma Honors Society; just to name a few. When she has free time, she likes to spend time with her friends and family, sewing to a marvels or Disney movie, working as a student athletic trainer, and numerous other activities. Lauren is a passionate worker and an enthusiastic soul with a thirst for medicine. Seeing every aspect of medicine really makes her heart soar!

Jason Viehman

Department: Mathematics & Statistics
Major: Applied Mathematics
Research Advisor: Dr. Gayla R. Olbricht
Advisor's Department: Mathematics & Statistics

Funding Source: OURE

A Statistical Analysis of DNA Methylation In a Shift Work Study

DNA methylation occurs when methyl groups attach to cytosine nucleotides on DNA segments. Previous studies have established links between specific methylation patterns and certain lifestyles. In this research, statistical methods are employed to test for significant differences in methylation levels between females who work the night shift and females who work the day shift. DNA methylation levels are measured at cytosines across the genome with Illumina 450K methylation microarrays. After initial pre-processing to eliminate low-quality data, testing was performed at each cytosine site using t-tests and empirical Bayes tests to identify any statistically significant site level methylation differences between the different shifts. A region level statistical method known as Bumphunter was also applied to identify statistically significant regions of interest in the genome. Significant sites or regions that overlap with genes, CpG Islands, or other genomic annotations can help researchers better understand the molecular impact of DNA methylation and its connection to shift work.

Jason Viehman is a senior in applied mathematics. He is also getting a second bachelors in economics, and an emphasis area in actuarial science. He has been the historian, community service chair, and president of S&T's chapter of Kappa Mu Epsilon.

Nicole Wheeler

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

Funding Source: FYRE

Early Cancer Screening Using Urinary Biomarkers

Early detection of cancer is key for improving survival rates. The best way to detect cancer early is to have a non-invasive method of detection. This ensures that a test is more likely to be run as part of a regular check-up, rather than only after symptoms have appeared.

An excellent example of a non-invasive test is a urine test. This project investigated biomarkers in urine in order to determine if elevated levels of certain polypeptides could be detected and used to diagnose bladder cancer.

Nicole Wheeler is a first year student pursuing a Chemistry major. She hopes to continue to graduate school and pursue research as a career.

Tiffany Wysong

Joint project with Elliott France

Department: Geosciences and Geological and Petroleum Engineering
Major: Geology & Geophysics
Research Advisor(s): Dr. John P. Hogan
Advisor's Department: Geosciences and Geological and Petroleum Engineering

Funding Source: OURE

The Origin and Relationships Between Olivine and Phlogopite Phenocrysts of the Avon Diatreme

We investigated an analysis of the petrographic and compositional relationships between olivine, biotite, and phlogopite present within an alnöite of the Avon Alkaline Igneous Province located in Genevieve County, Missouri. The olivine may have been used in a reaction with feldspar to create phlogopite, given by the reaction: $3\ (Mg,Fe)_2SiO_4 + 2\ KAlSi_3O_8 + 2\ H_2O = 2\ K(Mg,Fe)_3AlSi_3O_{10}(OH)_2 + 3\ SiO_2$

This possible reaction implies assimilation of granitic crust into an intrusive mafic melt. Other possibilities for the observed textures include fractionation of a mafic melt to destabilize the olivine and/or the mixing of two seperate magmas.

Anhedral olivine grains are more heavily fractured than euhedral crystals, as they are surrounded and embayed by phlogopite crystals. Isotope geochemistry of the olivine crystals support that there is only one population of olivines. Alternatively, the avon diatreme magma source could have been metasomatized after crystallization.

Tiffany is originally from St. Louis, Missouri and is a senior in Geology & Geophysics. She was awarded the Bob Laudon Advanced Field Camp Award for exemplary field notes and maps in Utah under the teachings of Dr. John Hogan. Tiffany plans on attending graduate school to further her knowledge in igneous processes, magma chamber dynamics, and related geochemistry.

Zhongqing Xiao

Department:	Mining & Nuclear Engineering
Major:	Mining Engineering
Research Advisor(s):	Dr. Lana Alagha
Advisor's Department:	Mining & Nuclear Engineering
Funding Source:	Missouri University of Science and Technology, Mining & Nuclear Engineering Department

EFFECT OF NANOPARTICLES ON DYNAMIC FROTH STABILITY AND FLOTATION PERFORMANCE OF COMPLEX SULFIDE ORE

Froth stability is very important as it affects both grade and recovery in froth flotation. It is desirable to control forth stability in several industries. In this research we aim to investigate the possibility of controlling froth stability and flotation performance through nanomaterials in flotation of complex sulfide ores. Face centered central composite design was used for design of experiments. Flotation was carried out via D-12 Denver flotation cell of 1-liter capacity. Al_2O_3 and SiO_2 nanomaterials were used during the study. Addition of Al_2O_3 increased froth stability by about 20%.It also increased the grade and recovery of Pb by 40% and 4% respectively.SiO_2 was not helpful in increasing froth stability. It was concluded that it is important to select correct type of nanomaterials for a specific ore. Correct type of nanomaterials can help increase dynamic froth stability and flotation performance.

Zhongqing Xiao is currently in his 4th year at Missouri University of Science and Technology and plans on graduating in December 2018 with a bachelor's degree in Mining Engineering. For the last one year, he has been working with Dr. Lana Alagha on different research projects involving processing of coal, sulfide and phosphate ores.

Emma Young

Department: Geological Science and Engineering Department
Major: Geological Engineering
Research Advisor(s): Dr. Melanie Mormile
Advisor's Department: Biological Department

Funding Source: Biological Department

Halo-Acidophilic Microorganisms in Western Australia

The terrain and similar unusual mineral assemblages of Western Australia matches the aqueous environments that are likely to have occurred on early Mars. Specifically, acidic and saturated salt conditions were present in each of these environments. By isolating and characterizing microorganisms from evaporite minerals, it is possible to predict the possible lifeforms that could have occurred on Mars. The overall objective of our research has been to isolate microorganisms present in gypsum and halite salts originating from Lake Aerodrome in the Yilgarn Crater, Western Australia. Enrichments cultures, based upon the salt and pH conditions of this lake were developed. The resulting cultures will yield information that can be applied towards the understanding of possible previous life on Mars.

Emma Young is a Junior who started in Geology and Geochemistry then changed to Geological Engineering in Spring 2017. Her interests lies in planetary geology, relations between minerals and microbial life, and remote sensing.

OURE Fellows Final Oral Presentations 2017-2018

Name	Department	Time	Location
Jakeb Baldridge	Biological Sciences	9:00 – 9:30 am	Turner Room
Lisa Gutgesell	Biological Sciences	9:30 – 10:00 am	Turner Room
Andrew Hedlund	Mechanical & Aerospace Engineering	10:00 – 10:30 am	Turner Room
Erin Nischwitz	Biological Sciences	10:30 – 11:00 am	Turner Room
Nicholas O'Gorman	Electrical & Computer Engineering	11:00 – 11:30 am	Turner Room
Richard Snyder	Electrical & Computer Engineering	11:30 am – 12 pm	Turner Room

OURE Fellows Proposal Oral Applicants 2018-2019

Name	Department	Time	Location
Ryan Baumann	Biological Sciences	1:00 – 1:20 pm	Turner Room
Alexandre Cristea	Chemistry	1:20 – 1:40 pm	Turner Room
Erin Nischwitz	Biological Sciences	1:40 – 2:00 pm	Turner Room
William Ong	Electrical & Computer Engineering	2:00 – 2:20 pm	Turner Room
Nicholas Parris	Mathematics & Statistics	2:20 – 2:40 pm	Turner Room
Tristan Shatto	Electrical & Computer Engineering	2:40 – 3:00 pm	Turner Room
Mikayla Tessmer	Biological Sciences	3:00 – 3:20 pm	Turner Room
John Tubbesing	Chemistry	3:20 – 3:40 pm	Turner Room

OURE Fellows Program
Oral Abstracts
Final

Jakeb Baldridge

Department: Biological Sciences
Major: Chemical Engineering
Research Advisor(s): Dr. Julie Semon
Advisor's Department: Biological Sciences

Funding Source:

Solvent Based 3D Printing of Biopolymer/Bioactive Glass Composite and Hydrogel for Tissue Engineering Applications

Three-dimensional (3D) bioprinting is an emerging technology in which scaffolding materials and cell-laden hydrogels may be deposited in a pre-determined fashion to create 3D porous constructs. A major challenge in 3D bioprinting is the slow degradation of melt deposited biopolymer. In this research, we describe a new method for printing poly-caprolactone (PCL)/bioactive borate glass composite as a scaffolding material and Pluronic F127 hydrogel as a cell suspension medium. Bioactive borate glass was added to a mixture of PCL and organic solvent to make an extrudable paste using one syringe while hydrogel was extruded and deposited in between the PCL/borate glass filaments using a second syringe. The degradation of the PCL/borate glass composite scaffold with and without the presence of hydrogel was investigated by soaking the scaffold in minimum essential medium. The weight loss of the scaffold together with formation of a hydroxyapatite-like layer on the surface shows the excellent bioactivity of the scaffold.

Jakeb Baldridge is graduating in May of 2018 with a (bio)chemical engineering degree. He has done undergraduate research for two years under Dr. Semon, had an REU at Oklahoma State, and had an internship at Bayer CropScience.

Lisa Gutgesell

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

Funding Source: Seed Grant from Biomedical Science and Engineering

Mesenchymal Stem Cells and Bioactive Glass Fibers Increase Wound Healing

Mesenchymal stem cells (MSCs) have been shown to accelerate wound closure, improve epidermal/dermal architecture, and improve vascular dysregulation. Borate bioactive glass fibers has also successively treated chronic, nonhealing dermal wounds in the clinic. This study analyzes borate bioactive glass activated MSCs and phenotypic alterations. When co-cultured with bioactive glass, MSCs have also shown the ability to accelerate wound repair and improve cutaneous architecture while improving vascularity. MSCs in the presence of glass are evaluated for cell growth, differentiation, migration, and invasion. The hypothesis is borate bioactive glass triggers phenotypic changes in MSCs to increase wound healing.

Lisa Gutgesell is a senior majoring in Biological Science and minoring in Chemistry and Biomedical Engineering. She will be pursuing a PhD in cellular biology.

Andrew Hedlund

Department:	Mechanical and Aerospace Engineering
Major:	Aerospace Engineering
Research Advisor(s):	Dr. Charles S. Wojnar
Advisor's Department:	Mechanical and Aerospace Engineering

Funding Source: Office of Opportunity for Undergraduate Research Experience

Mechanical Property Characterization and Prediction of Additively Manufactured Polyvinylidene-Fluoride Microfibers

Additive manufacturing is one of the greatest advancements in manufacturing of the last century, however it has only been applied in a limited fashion to electroactive materials. One such material is the polymer, ployvinylidene-fluoride (PVDF). PVDF is capable of being additively manufactured into its piezoelectric form by extrusion through an electric field. Being able to predict the properties of additively manufactured PVDF by carefully tailoring the electric field-assisted extrusion process could lead to huge advancements in the sensing and actuation capabilities in aerospace, bio-medical, and other industries. This study shows the mechanical properties of the extruded fibers can be predicted by accounting for the size of the extruded fibers and the extrusion path used to create the fibers.

Andrew Hedlund is a graduating senior in Aerospace Engineering with a focus on mechanics and advanced materials. He was awarded the Opportunity for Undergraduate Research Experience Fellowship last year for his work on the precursor to the project described above. He is also a Distinguished Undergraduate Research Fellow in the Mechanical and Aerospace Engineering Department at MS&T. As such he has furthered his research on piezoelectric materials designing MEMS and integrated electromechanical systems for a corporate sponsor.

Erin Nischwitz

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

Funding Source: Student Activity Funding Board, Missouri S&T College of Arts, Science, and Business

Interchangeable Pollutant Detection in Arabidopsis

In many cases, testing plants for specific contaminants may require specialized lab equipment, which likely require significant experience and knowledge to operate and interpret. These tests can be time consuming and are only immediately useful to a small, specialized group of people. By genetically engineering *Arabidopsis thaliana*, in the presence of the common groundwater pollutant trichloroethylene (TCE), a periplasmic binding protein is bound and sets off a signal transduction pathway. The plant will then be prompted to degreen, meaning it will degrade and prevent further production of chlorophyll. The result is an obvious color change to clear. This biosensing technique is useful for a number of reasons. It benefits from the constant large source of groundwater that plants continually uptake, which allows for continuous testing with little intervention. It also is cost effective and does not require highly trained scientist to identify contaminated water. A further benefit of this system is that ideally the periplasmic binding protein can be modified to detect a variety of contaminants in the same way that it would be modified to bind TCE.

Erin Nischwitz is a junior Chemistry major from Wildwood, MO pursuing an emphasis in pre-med and minors in Biological Sciences and Biomedical Engineering. She has been involved in the iGEM Student Design Team for 3 years and has served as their president for two terms. She is also Vice President for Omega Sigma Service Organization. She intends to continue her education by attending medical school.

Nicholas O'Gorman

Department: Electrical Engineering
Major: Electrical Engineering & Mechanical Engineering
Research Advisor(s): Dr. Pommeranke
Advisor's Department: Electrical Engineering

Funding Source: OURE Fellowship

Controllable Plasma Array System to Manipulate Electromagnetic Waves

This research is to show the effects of plasma on varying frequencies of electromagnetic waves. This is to show the capability of using plasma to have a controllable effect on a specific wave frequency that is passing through it. A vacuum wave guild was designed and used to use the plasma at a lower voltage threshold. Different frequencies were then sent through this wave guild and the effects on magnitude and phase where then measured.

Nicholas O'Gorman has had a love of designing and building for since he was a child. he learned of the OURE program offered at Rolla and took it as an opportunity to work on innovative ideas. He worked on two different projects involving robotics, a controllable humanoid robot and a surveillance robot. However, during his time at S&T, he learned that his passions lied within the field of electromagnetics and energy flows. While helping Matt Paliwoda on his research for his masters with plasma, he found a field that possessed both. With a large interest in the plasma field, he began working to learn about how plasma works and what can be done in that field.

Richard Snyder

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

Funding Source: OURE Fellows Program

Monitoring and Detection of Network Anomalies

Networks face a variety of attacks from both interior and exterior sources. Timely detection and reaction to these attacks is important for the overall health and robustness of a network. While attack detection allows for damage minimization, a correct attack prediction can allow the system administrators to be prepared for the attack and take the appropriate actions to prevent it.

Richard has been conducting research with Dr. Cetinkaya since May 2015. In the past, he has analyzed network security through the application of graph theory and statistics. Richard graduates in May and plans to start his career then.

OURE Fellows Program Oral Abstracts Applicants

Ryan Baumann

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

Funding Source: Student Activity Finance Board

Analysis and Optimization of a Synthetic Biology Database

The International Genetically Engineered Machine (iGEM) Team competition brings together over 300 teams from 40 plus countries to present student led research projects in Synthetic Biology. Teams conduct research to solve real world issues with a goal to create and submit standardized genetic parts to the ever growing iGEM Registry of Standardized Parts. This database consists of over 20,000 documented and submitted genetic parts that have been used within projects. Through our 2017 project to create a plant based trichlorethylene biosensor in *Arabidopsis thaliana*, we identified issues with the limited quantity, characterization, and documentation of plant parts within the Registry of Standardized Parts. Our 2018 project aims to reduce this barrier of entry for future teams looking to dive into plant synthetic biology by addressing the various issues within the plant portion of the registry. My portion of this project will consist of analyzing the experimental data to develop a detailed characterization of these previously poorly documented plant related parts. In the end, this research will support future plant synthetic biology research for future generations of iGEM teams around the globe.

Ryan Baumann is a junior in Biological Sciences from Saint Louis, MO. This is his 6th semester as a member of the Missouri S&T International Genetically Engineered Machine (iGEM) student design team. In this time, he has worked in lab, assisted with public relations events, served as vice president, and currently serves as the team's lab manager. Outside of iGEM, He is a student ambassador in the Missouri S&T Admissions office, serves as Treasurer of the HELIX Life Sciences Club, , and in this past summer worked as an Intern at the City of Springfield, MO Southwest Clean Water Treatment Plant.

Alexandre Cristea

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

Funding Source: National Institutes of Health (NIH)

The Simultaneous Identification of Urinary Biomarkers for Early Detection of Traumatic Brain Injury

Over 2.5 million cases of traumatic brain injury (TBI) are reported each year in the United States and are involved in 30% of all injury-related deaths. TBI's can occur in a variety of ways and are thus difficult to diagnose. Current methods either include extensive imaging using expensive equipment or simple qualitative assessments that analyze a patient's verbal and motor skill. Due to the lack of an efficient method of TBI characterization, a metabolomics approach will be taken in order to design a biomarker profile for the complex injury. By utilizing high-performance liquid chromatography – tandem mass spectroscopy (HPLC – MS/MS) in addition to enzyme-linked immunosorbent assays (ELISA), a quantitative method will be designed to analyze the concentrations of 20 compounds found in urine. This method will then be used to analyze urine samples from 150 patients with severe TBIs, 150 patients with mild TBIs, and 150 matched controls. This data will then undergo statistical analysis in an attempt to link the relative concentrations of the 20 chemical panel with TBIs.

Alex is a junior biochemistry student who has been involved in Dr. Ma's group since December of 2015. His research has primarily focused on bioanalytical chemistry and biomedical chemistry, specifically biomarker discovery, cell migration patterns, and cytotoxicity of nanoparticles to human cells. In addition to undergraduate research, he is also involved in the Missouri S&T Student Council and is the current treasurer.

Erin Nischwitz

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

Funding Source: Student Activity Funding Board, College of Arts, Science & Business

Surveying of the Synthetic Biology Community and Improvement of the iGEM Plant Registry

International Genetically Engineered Machines, or iGEM, is an international community of synthetic biology scientists around the world. Teams strive to add to an ever expanding registry of standardized parts. Last year, our team completed a project in the model organism *Arabidposis thaliana*. We consistently struggled with utilizing the plant portion of the registry, as it is both limited and poorly documented. While at Jamboree last year, we spoke with teams around the world who had similar issues with the projects being limited by the scope of the plant registry. Our plan for the next year is to play a part in improving the documentation and content of the plant registry. My specific portion of this project will be to survey teams across the world and compile their responses on ways that the iGEM plant registry can be improved. This may entail increasing the number of promoters of varying strengths, having a larger variety of reporters that function well in plants, or just better documenting those that already exist. I will then design the parts that should be added to the registry by identifying them in plants or in existing research, while also compiling a list of parts which require data analytics and modeling completed.

Erin Nischwitz is a junior Chemistry major from Wildwood, MO pursuing an emphasis in pre-med and minors in Biological Sciences and Biomedical Engineering. She has been involved in the iGEM Student Design Team for 3 years, and has served as their president for two terms. She is also Vice President for Omega Sigma Service Organization. She intends to continue her education by attending medical school.

William Ong

Department: Electrical & Computer Engineering
Major: Electrical & Computer Engineering
Research Advisor(s): Dr. Joe R. Stanley
Advisor's Department: Electrical & Computer Engineering

Funding Source: Department of Electrical & Computer Engineering

Classification of Epithelium Regions for Cervical Intraepithelial Neoplasia using Deep Learning

The scope of this OURE Fellows project is to investigate deep learning and big data techniques to detect key features in the epithelium in digitized histology images and to classify epithelium regions for Cervical Intraepithelial Neoplasia (CIN) discrimination. William Ong will be asked to label key features in the epithelium region from a database of over 200 digitized histology images to be used as inputs for deep learning algorithms. William will use existing image annotation tools available in Dr. R. Joe Stanley's laboratory as well as baseline deep learning methods developed in Python for feature and CIN discrimination analysis. He will work with Dr. Stanley and also with Dr. William Van Stoecker for the image labeling process. William will apply and utilize these labeled features, including nuclei, cellular network and data fusion techniques to identify and characterize key features and to classify the epithelium region. All work will be done under the supervision of Dr. R. Joe Stanley, the faculty advisor for this project and will be mentored by two of Dr. Stanley's Ph.D. graduate students.

William Ong is currently a student at Missouri S&T studying electrical and computer engineering, emphasizing in deep learning and AI. This past year, William had participated in Dr. Donnell's Applied Microwave Thermography Nondestructive Testing lab. William also has participated in Formula SAE and the IEEE student branch. William's interests include biology and big data analytics. William is passionate in using AI and deep learning to aid people in meaningful ways.

Nicholas W. Parris

Department: Mathematics
Major: Math and Physics
Research Advisor(s): Jason Murphy
Advisor's Department: Mathematics

Funding Source:

Mathematical analysis of Nonlinear Schrödinger Equations for modeling of Bose-Einstein condensate

This project aims to bridge the gaps between the pure mathematical analysis, the applied mathematical modeling, and the physical experimentation associated with the NLS by: deriving an effective model for the dynamics of phenomena related to BECs using the NLS, rigorously analyze the model both theoretically and numerically, and explaining observed phenomena by comparing the mathematical results with real physical experiments. The analytic approach will allow the computational model to be robust and flexibility in the parameters of the NLS, providing a time evolution of the NLS.

Nicholas has worked at the MST physics Laboratory for Atomic Molecular and Optical Research (LAMOR) under the guidance of Dr. Daniel Fischer for over two years. This work has exposed Nicholas to the theory of Bose-Einstein condensates and cold atom systems and is where he completed an OURE for absorption imaging system of ultracold quantum gases. Further, Nicholas is a coauthor on a to-be-published LAMOR paper currently in review for the journal Physical Review A (arxiv number: 1712.01200.)

Some background in harmonic analysis and partial differential equations is required for the analysis of nonlinear partial differential. For physical application, knowledge of quantum mechanics and nonlinear dynamics is required. Nicholas will have completed the following key courses by the end of the 2018 fall semester: Partial Differential Equations, Intermediate Differential Equations, Quantum Mechanics 2, 'Chaos, Fractals and Nonlinear Dynamics' and Harmonic Analysis. This coursework should synergize with his study of Nonlinear Schrodinger Equations in the fall.

Tristan Shatto

Department: Electrical & Computer Engineering
Major: Computer Engineering & Electrical Engineering
Research Advisor(s): Dr. Egemen Çetinkaya
Advisor's Department: Electrical & Computer Engineering

Funding Source: Electrical & Computer Engineering Department

Modeling and Analysis of Software-Defined Networks using Graph Theory

To explore the real-world applications of graph-theoretic modeling and analysis on infrastructure networks, we can use software defined networks (SDNs) as a test bed for resilient networks and new analysis techniques. Using L1 and L3 data from large internet backbone networks, we have developed new techniques for measuring the resilience and reliability of these critical networks. To test these new techniques in real-world scenarios, we can use SDNs to dynamically create and operate networks with realistic loads, connection bandwidth, and variable size. To further explore the applications of SDNs, we will investigate the deployment of "smart" networks that utilize graph-theoretic metrics to construct resilient network structures, such as those for social networks and media streaming services. By scraping data from social sites, such as Twitter, we can construct real-world scenarios to test on our SDNs and develop techniques for improving the resilience of such networks against abnormal loads and network outages.

Tristan Shatto is a senior that is dual majoring in Computer Engineering and Electrical Engineering at Missouri S&T. Originally from the Kansas City area, he has been studying the graph-theoretic analysis of complex networks as a research assistant under Dr. Egemen Çetinkaya for the past 3 years. Tristan is a member of IEEE with several published conference papers, and wishes to pursue a career in the aerospace and defense industry after graduation.

Mikayla Tessmer

Department:	Chemical Engineering
Major:	Biochemical Engineering
Research Advisor(s):	Dr. David Westenberg
Advisor's Department:	Biological Sciences
Funding Source:	International Genetically Engineered Machines (iGEM) Design Team, Dr. Westenberg's Research Funding

Experimental Advancement of the International Biosynthetic Plant Registry

The 2018 International Genetically Engineered Machines (iGEM) Jamboree conference proved to show flaws in the international plant registry with only a small percentage of the total registry making up the plant components. The project focuses on testing tissue-specific promoters with the β-Glucuronidase (*Gus*) reporter. These methods would include many basic cell lab methods along with Agrobacterium-mediated transient transformation. By standardizing these promoters it would not only help iGEM teams but throughout the synthetic biology community around the world. This will then be presented and promoted at the November 2018 iGEM Jamboree.

Involved with the International Genetically Engineered Machines' design team on the Missouri S&T campus since her first semester as a freshman, Mikayla is a sophomore in Biochemical Engineering. Active in Omega Chi Epsilon, her involvement extends to the Chi Omega Sorority, the Society of Women Engineers, along with her job at the campus Registrar Office. Her dedication is apparent when one looks to last summer where she worked in the lab every day, including weekends, with Dr. Westenberg, continuing through the fall and spring semesters. During the summer session, Mikayla took the lead in mentoring a high school mentee in writing protocols and improving lab techniques. She created an E Coli biosensor for a modified homoserine lactone chemical made by the Bradyrhizobium japonicum. The experience has her excited to have another opportunity in the field to take a step forward in her life's pursuit in working with pharmaceuticals or genetic manipulation in to assist those with chronic illness.

John Tubbesing

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

Funding Source: OURE, DOE Office of Basic Energy Sciences DE-FG02-08ER46518.

Epitaxial Spin Coated Perovskites

Lead halide perovskites are a novel optoelectronic material which has received enormous attention, with over 6500 scientific articles on SciFinder since 2015. Lead halide perovskites have impressive optical and electrical properties, making fantastic LED's and Solar Cells. This project shows that spin coating, a commercially common as well as inexpensive process may be used to epitaxially deposit thin films of cesium lead bromide onto many diverse substrates. The Switzer Group has made single crystal gold foils, a promising substrate. Additionally, the Switzer group has shown that CsPbBr3 is epitaxial on epitaxial gold on silicon wafers. These two findings together lead to the prospect of epitaxially depositing Cesium Lead Bromide onto flexible gold foils. This leads to many applications in flexible LED's, flexible highly efficient solar panels, and wearable technology.

John Tubbesing is two years into his B.S. in Chemistry and hopes to graduate in December 2019 and then pursue graduate studies. He has been working in Dr. Switzer's lab since May 2017 and is helping to submit two papers in the very near future. His projects have included research with chiral surfaces and electrochemistry.

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