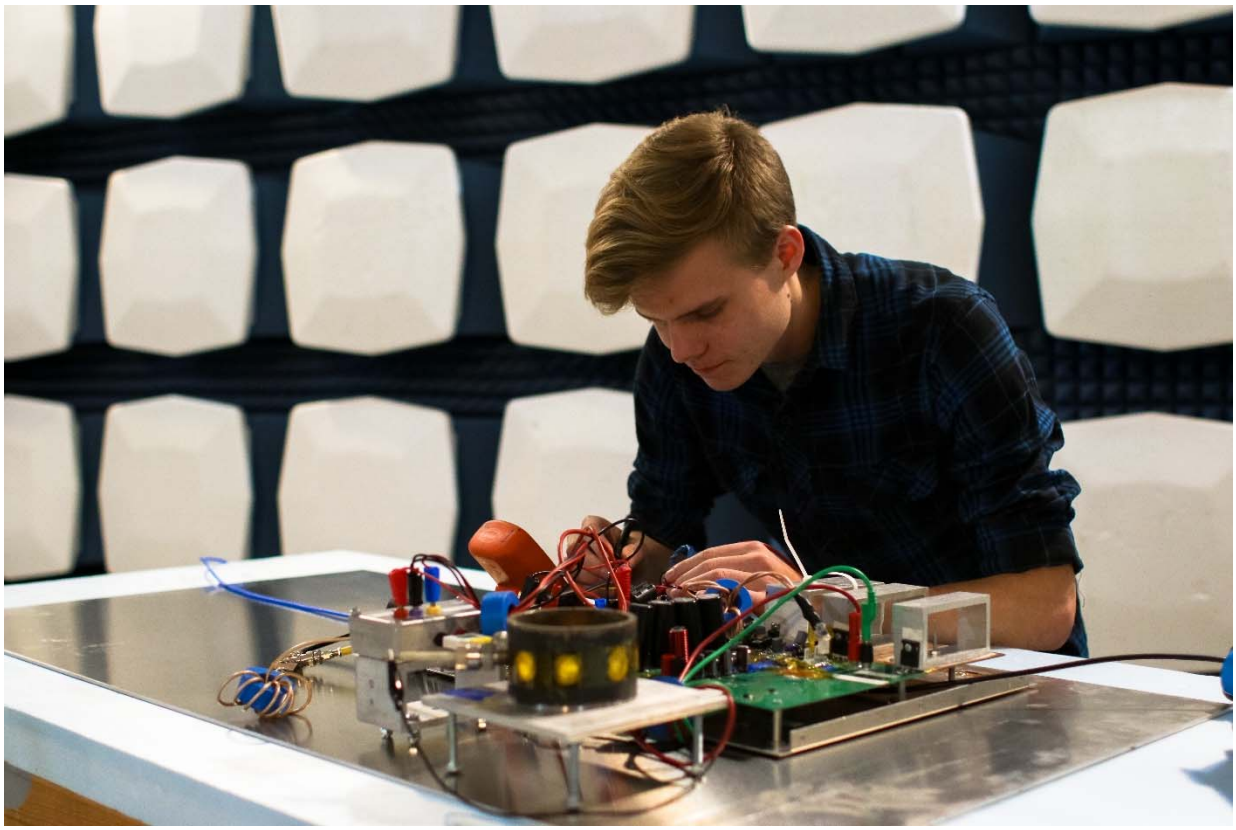
Apr 16th, 2019 - 5:00 PM

15th Annual Undergraduate Research Conference Abstract Book

Missouri University of Science and Technology

MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

15th Annual Undergraduate Research Conference



Electromagnetic Compatibility Lab

The Electromagnetic Compatibility Lab supports electromagnetic compatibility, power integrity, and signal integrity research and education projects. Researchers work on a wide range of topics for government and industry; the goal of developing the knowledge base, people and tools is to solve today's EMC problems and address the EMC problems of the future.

A celebration of experiential learning at Missouri S&T

April 16, 2019

Missouri S&T Havener Center

15th Annual
Undergraduate Research Conference
April 16, 2019

Table of Contents

	Pages
Conference Agenda	3
Keynote Speaker	5
Conference Judges	7
Oral Presentation Schedule	9
Poster Presentation Schedule	23-24
OURE Fellows Presentation Schedule	71

15th 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 A Ballroom)*
9:00am – 12:00pm	**Conference Oral Sessions and OURE Fellows Oral Sessions**
	Arts & Humanities --- Sciences --- Fellows Final Reports *(Ozark Room)* *(Ozark Room)* *(Missouri Room)*
9:00am – 12:00pm	**Poster Sessions** **Arts & Humanities --- Engineering** *(Upper Atrium/Hallway)*
12:00pm – 1:00pm	**Luncheon & Keynote Address** ***Dr. Steven B. Jung, Ph.D.*** Chief Technology Officer MO-SCI Corporation ***Presents*** "The Transition of Research to Development" *(St. Pat's A Ballroom)*
1:00pm – 3:00pm	**Conference Oral Sessions and OURE Fellows Oral Sessions**
	Engineering --- Fellow Proposals *(Ozark Room)* *(Missouri Room)*
1:00pm – 3:00pm	**Poster Sessions** **Research Proposals --- Sciences --- Social Sciences** *(Upper Atrium/Hallway)*
3:00pm – 4:00pm	**Reception** *(St. Pat's A Ballroom)*
4:00pm – 5:00pm	**Awards Ceremony** *(St. Pat's A Ballroom)*

**Judges Conference Room – (Mark Twain)*

Keynote Speaker

Steven B. Jung PhD.

Chief Technology Officer of MO-SCI Corporation

Presents

"The Transition of Research to Development"

Steven B. Jung is the CTO of Mo-Sci Corporation, a specialty glass company located in Rolla MO. Jung joined Mo-Sci Corporation in 2010 after completing his BS, MS, and PhD in Ceramic Engineering at S&T. Since beginning at Mo-Sci, Jung has focused his efforts on commercializing cutting edge research in areas such as healthcare, energy, and information technology. Fundamental or basic science research is very important, but ultimately in industry we want this work to develop into something that solves a problem, and become a product or service that a customer is willing to purchase. Steve will discuss a few examples of basic science research that began in research labs on the S&T campus and had significant contributions by undergraduate and graduate students and has since been developed into commercial products that solve real world problems.

Jung currently serves as the CTO to Mo-Sci Corporation, CTO to Engineered Tissue Solutions, as an Adjunct faculty member in Materials Science and Engineering at S&T, and as a Rolla City Council Member. He is also a member of the Academy of Mines and Metallurgy at S&T and a member of the S&T Athletic Hall of Fame for Swimming. He has won numerous societal and university awards but is most proud of the civic work he has been able to accomplish in his home of Rolla MO.

Conference Judges

The Office of Academic Support wishes to thank the faculty & staff for their valuable contributions to the 15th Annual Missouri S&T Undergraduate Research Conference.

Oral Presentations

Arts and Humanities

Name	Department	Time	Location
Mark Allison	History & Political Science	9:00 – 9:30 am	Ozark
Clinton Lawrence	History & Political Science	9:30 – 10:00 am	Ozark
Donald Morard III	History & Political Science	10:00 – 10:30 am	Ozark

Engineering

Name	Department	Time	Location
Jack Fletcher	Mining & Nuclear Engineering	1:00 – 1:30 pm	Ozark
Tyler Huff	Civil, Architectural & Environmental Engineering	1:30 – 2:00 pm	Ozark
Kaitlyne Powers	Chemical & Biochemical Engineering	2:00 – 2:30 pm	Ozark
Nicole Aldridge Daniel Ellerbrook Chris Rowan	Electrical & Computer Engineering	2:30 – 3:00 pm	Ozark

Sciences

Name	Department	Time	Location
Kelsey Brakensiek	Chemistry	10:30 – 11:00 am	Ozark
Kaysi Lee	Chemistry	11:00 – 11:30 am	Ozark

Nicole Aldridge
Joint project with Daniel Ellerbrock and Chris Rowan

Department: Electrical and Computer Engineering
Major: Computer Engineering & Computer Science
Research Advisor: Dr. Donald Wunsch
Advisor Department: Electrical and Computer Engineering

Funding Source: OURE

Non-Volatile Memory and Associative Learning

Neuromorphic computing is a critical tool in modern problem solving, and non-volatile memory devices like memristors mitigate massive power consumption by transistor-based implementations. Memristors retain a set conductance level even with power off, enabling many practical applications. However, most research studies use idealized simulations, ignoring hardware implementations and non-ideal traits. This project investigates the use of commercially available hardware memristors and their non-ideal properties, to analyze associative learning applications. It demonstrates that non-ideal memristor components are not only feasible for use in machine learning applications, but can actually provide beneficial results when employed in associative memory algorithms.

Nicole Aldridge is a senior student studying both Computer Engineering and Computer Science. She is originally from Bloomington, Illinois, and will be graduating in May 2019 before starting full time at Intel Corporation. Her undergraduate research is coordinated with fellow students Daniel Ellerbrock and Chris Rowan, as well as Dr. Donald Wunsch in the ECE department at S&T and Yi Huang at Huazhong University of Science and Technology. On campus, she is involved in the Varsity Track and Field Team, Chi Omega Fraternity, and holds positions as Vice President of Internal Affairs in Society of Women Engineers, and Head Ambassador within the Admissions office.

Mark Allison

Department: History & Political Science
Major: History
Research Advisor: Dr. Michael Bruening
Advisor Department: History & Political Science

Funding Source: N/A

KINGS, OLD IRONSIDES, LEVELERS, & A RUMP

The Interregnum Period of English history (1649-1660) has often been described as a failed attempt to create a true republic in England; however, the period had a lasting impact on the development of modern England. This paper highlights the permanent changes the Interregnum had on both Parliamentary and citizen rights in England, the overhaul of England's military doctrine, and England's growing influence throughout the British Isles. In order to highlight the changes brought during the Interregnum Period, this paper breaks down the immediate and lasting impact of the period by analyzing primary and secondary source documents, as well as providing a detailed look into the life of George Monck. A prominent figure in the Interregnum, who commanded forces in most of the major English conflicts of the period and served as military governor, Monck both witnessed and took part in the rise and fall of the English Commonwealth.

Mark Allison is a sophomore in the Missouri S&T History & Political Science Department, and is pursuing a Bachelor's Degree in History with an emphasis on Secondary Education. He is from Cuba, Missouri, where he developed an interest for history and the importance of educating the next generations of students the historic lessons of the past. His research is primarily focused on the history of Britain.

Kelsey E. Brakensiek

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Klaus Woelk
Advisor Department: Chemistry

Funding Source: Materials Research Foundation & CASB FYRE Program

Nuclear spin relaxation in NMR spectroscopy

Several hyperpolarization techniques are known to enhance the intrinsically low sensitivity of NMR spectroscopy. The enhanced sensitivity allows users to record spectra from very low sample concentrations, or improve the spatial resolution and imaging contrast in medical MRI. The relaxation of hyperpolarization to thermodynamic equilibrium is often viewed as the limiting factor for NMR and MRI enhancements. When hyperpolarization techniques are used, relaxation may not follow a mono-exponential but a multi-exponential decay. To accurately describe relaxation of hyperpolarization, a numerical algorithm is introduced which uses relaxation-matrix calculations that apply to both hyperpolarized and regular spin arrangements. For two-spin systems, the algorithm provides four eigenvectors with their respective eigenvalues, which are then used to model the relaxation of both regular and hyperpolarized spin-state distribution. An extension to three-spin systems leads to six Eigenvectors. Standard inversion-recovery and hyperpolarized spin-state experiments are used to provide evidence for the validity of the new algorithm.

Kelsey Brakensiek is a junior in Chemistry from O'Fallon, Missouri. She transferred to Missouri University of Science and Technology in the Fall of 2018 after receiving her Associate of Science degree in Chemistry from St Charles Community College, where she combined her passions for chemistry and helping others by tutoring chemistry for two years. She joined Dr. Woelk's team in the spring of 2019 under the FYRE program, where she plans to continue her undergraduate research until graduation. She also serves as safety officer for the research team on Chem E Car. She hopes to receive her PhD in chemistry, and to work in industry, focusing on renewable energy and green chemistry.

Daniel Ellerbrock
Joint project with Nicole Aldridge and Chris Rowan

Department: Electrical and Computer Engineering
Major: Computer Engineering & Computer Science
Research Advisor: Dr. Donald Wunsch
Advisor Department: Electrical and Computer Engineering

Funding Source: OURE

Non-Volatile Memory and Associative Learning

Neuromorphic computing is a critical tool in modern problem solving, and non-volatile memory devices like memristors mitigate massive power consumption by transistor-based implementations. Memristors retain a set conductance level even with power off, enabling many practical applications. However, most research studies use idealized simulations, ignoring hardware implementations and non-ideal traits. This project investigates the use of commercially available hardware memristors and their non-ideal properties, to analyze associative learning applications. It demonstrates that non-ideal memristor components are not only feasible for use in machine learning applications, but can actually provide beneficial results when employed in associative memory algorithms.

Daniel Ellerbrock is a senior in Electrical and Computer Engineering graduating in May 2019. He has interests in non-volatile memory devices, computer architecture, and neuromorphic computing.When he graduates he will be working in the non-volatile memory systems group at Intel in California. On campus he has been involved in Kappa Alpha Order, Missouri S&T Jazz Band, and the Missouri S&T Chem E Car team. His undergraduate research is advised by Dr Donald Wunsch and is being conducted with fellow teammates Chris Rowan, Nicole Aldridge, and Yi Huang from Huazhong University of Science & Technology.

Jack Fletcher

Department: Mining and Nuclear Engineering
Major: Nuclear Engineering B.S.
Research Advisor: Dr. Gary Mueller
Advisor Department: Mining and Nuclear Engineering

Funding Source: Department

CFD Modeling of Flow through Twisted Tape

Sustained nuclear fusion subjects components to extremely high heat fluxes. Heat transfer enhancement techniques are necessary to ensure the survival of these components in such conditions; one enhancement mechanism currently proposed for use in toroidal fusion devices such as Wendelstein 7-X (W7-X) is a twisted tape swirltube inserted in a monoblock. Swirl flow induced by the twisted tape is expected to increase the critical heat flux and localized boiling by sweeping the hottest part of the fluid in contact with the tube into the bulk flow. This study uses STAR-CCM+ 13.06.011-R8 computational fluid dynamics (CFD) simulations to examine the flow from twisted tape and how modifications to geometry, physics models, meshing models, and flow conditions affect the results. The simulations visualize radial and axial transport of the fluid and determine pressure drop due to the geometry, and will later be compared to positron emission particle tracking (PEPT) experiments.

Jack Fletcher is a freshman pursuing his degree in Nuclear Engineering. He is an active member in the Nuclear Science Design Team and the American Nuclear Society, through which he gained the opportunity to conduct research in the fields of heat transfer and fluid dynamics under the direction of Ph.D. candidates Mr. Ryan Steere and Ms. Monica Gehrig, respectively. Through both organizations he enjoys the ability to create strong connections in his degree field and make tangible contributions to the scientific community, even as a first-year student at the University. He plans to continue conducting, guiding, and teaming from research well into his graduate studies and professional career.

Tyler Huff

Department: Civil, Architectural, and Environmental Engineering
Major: Environmental Engineering
Research Advisor: Dr. Dan Oerther
Advisor Department: Civil, Architectural, and Environmental Engineering

Funding Source: N/A

Causes of Migration from Guatemala

The American Dream of wealth and prosperity has been a beacon for generations. As a country of immigrants, people have long been migrating to the USA for socioeconomic advancements. While most have taken legal routes to enter the United States, illegal migration has always been common especially through Mexico. Recently a more extreme migration in the form of a 2000 km walk, has been occurring. Guatemalans are making this journey, even with having a high chance of being turned away at the border. The question stands of how does this attempt at getting to America full of unknowns offer better opportunities than staying in Guatemala? Throughout this paper, a structured review will be utilized to answer this question using the information gathered from issues stemming from environmental and technological shortcomings to find what the United States can do to help promote the Guatemalan farmers in staying on their farms.

Tyler Huff is currently a Junior in Environmental Engineering. Other than his current research, Tyler can be seen on campus as the President of the National Residence Hall Honorary Shamrock Chapter. Thank you for your time.

Clinton Lawrence

Department: History
Major: History
Research Advisor: Dr. Shannon Fogg
Advisor Department: History

Funding Source:

Missouri Naval Veterans in World War II

This presentation covers how World War II naval veterans, Missouri naval veterans specifically, viewed their enemy and their time at war. Their enemy largely being the people of Japan. Through this analysis people can see that the Missouri veterans in the Navy did not view the Japanese people with reckless hate as it has come to be believed. Rather, some viewed their enemy with a sense of caution and respect. Their are references to their honor and tenacity, as well as suspicion and distrust. By looking at the lives of sailors, crewmen, and marines on a more individual basis people can get a better since of how the war was viewed from their perspective.

Clinton Lawrence is a senior history major at the Missouri University of Science & Technology. His area of interest is the history of the Far East such as China, Japan, Korea, and the South Pacific. Clinton's grandfather, from Missouri served in the U.S. Navy during World War II on several vessels as a fire crewman. Clinton is an Eagle Scout and avid supporter of his community, where he has performed several public service projects.

Kaysi M. Lee

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Klaus Woelk
Advisor Department: Chemistry

Funding Source: Missouri S&T OURE Program

Optimizing D2O/H2O Ratio for NMR pH Measurements

Solvents with 2H isotopes (deuterium) are frequently used in NMR spectroscopy to avoid large solvent signals and to lock the external magnetic field of the spectrometer to the deuterium resonance frequency. In this research, deuterated water (D2O) was used in investigations of the NMR chemical-shift dependency on the pH of the solution. It was found that 2-fluoro-3-hydroxymethylpyridine shows a large 19F chemical-shift dependency on pH; however, in subsequent studies, we realized that the chemical shift of 2-fluoro-3-hydroxymethylpyridine also depends on the 2H/1H composition of the solvent water. Several D2O/H2O compositions were tested, and their influence on the relationship between 19F chemical-shift and pH was evaluated. While the chemical shift dependency is relatively small for aqueous solutions with high amounts of D2O (e.g., 90%), it increased substantially if the D2O portion in the solvent is reduced. The highest chemical-shift dependency was found for an about equal mixture of D2O and H2O.

Kaysi M. Lee is a sophomore of chemistry at Missouri S&T. She began her research career as a freshman in the 2018 FYRE program of the College of Arts, Science and Business (CASB). Her work included several poster presentations at regional and international conferences as well as a talk at the Missouri Academy of Science annual meeting and the Southeastern Undergraduate Research Conference (SURC 2019). Her passion for research was featured in October/November 2018 on the S&T web portal and portrayed in the newspaper St. Louis American. Kaysi continues her research on NMR pH measurements as an OURE student for Dr. Woelk working together with graduate student Ming Huang.

Donald Morard

Department: History and Political Science
Major: History
Research Advisor: Dr. Shannon Fogg
Advisor Department: Dr. Shannon Fogg

Funding Source: OURE

The Anti-Soviet Forest Brother's Movement

In 1940 the nations of Latvia, Lithuania, and Estonia were occupied by the Soviet Union, signaling the start of the "Forest Brother" insurgency that saw nationalist partisans fighting to free their occupied nations. This research looks how influence from the German Reich, and later the United States and other Western countries played an important in this insurgency, providing important material support and intelligence services to these partisans to further their foreign policy goals. This research is based on Soviet and Western security documents along with eye witness accounts.

Donald Morard is a graduating senior in the Missouri S&T History and Political Science department pursuing a Bachelor of Arts in History. His research primarily focuses on 19 th and 20th century Baltic and Eastern Europe. He will be attending the Higher School of Economics- Saint Petersburg for a master's in Applied History starting Fall 2019.

Kaitlyne Powers

Department: Chemical Engineering
Major: B.S. Chemical Engineering
Research Advisor: Dr. Sutapa Barua
Advisor Department: Chemical Engineering

Funding Source: PI's Start Up and Ozark Biomedical Initiative

Cellular Hitchhiking of Nanoparticles

The overall goal of the research is to explore a combinatorial approach in exploiting the specificity of antibody conjugated drug Nano rods with the direction of polyclonal T cells for breast cancer therapy. Nanoparticles are increasingly appearing as a promising tool for non-invasive and targeted delivery of therapeutic agents to breast tumor tissues. Most applications of nanotechnology in drug delivery have focused on improving blood circulation half-lives, or targeting the cancer tissue. However there are challenges to deliver nanoparticles and their payloads into a tumor parenchyma even after they reach the tumor sites. To address this issue, the research will target the drug nanoparticles for an efficient delivery of therapeutic payloads to the breast cancer site, and expand therapeutic benefits. We hypothesize that the attachment of Trastuzumab-conjugated paclitaxel drug Nano rods to natural T cells will enhance their circulation time and substantially alter their anti-tumoral efficacy.

Kaitlyne Powers is a senior at Missouri University of Science and Technology pursuing a B.S. in Chemical Engineering. She transferred from the University of Missouri St Louis to Missouri S&T in the fall of 2017 to obtain a chemical engineering degree. She wants to work for the pharmaceutical field once she graduates in May 2020 and the undergraduate research Kaitlyne is in is preparing her for that field. The research is giving Kaitlyne hands on experience that she can utilize before graduating to apply to her field of work.

Chris Rowan
Joint project with Nicole Aldridge and Daniel Ellerbrock

Department: Electrical and Computer Engineering
Major: Computer Engineering
Research Advisor: Dr. Donald Wunsch
Advisor Department: Electrical and Computer Engineering

Funding Source: OURE

Non-Volatile Memory and Associative Learning

Neuromorphic computing is a critical tool in modern problem solving, and non-volatile memory devices like memristors mitigate massive power consumption by transistor-based implementations. Memristors retain a set conductance level even with power off, enabling many practical applications. However, most research studies use idealized simulations, ignoring hardware implementations and non-ideal traits. This project investigates the use of commercially available hardware memristors and their non-ideal properties, to analyze associative learning applications. It demonstrates that non-ideal memristor components are not only feasible for use in machine learning applications, but can actually provide beneficial results when employed in associative memory algorithms.

Chris is a senior in the Computer Engineering program at MST, and plans to graduate with his bachelor's degree in spring 2019. While attending MST, he specialized in process automation, taking courses focusing on manufacturing automation. After graduation, he will be working for MAVERICK Technologies, a PLC/HMI automation company. He has been working under his research advisor, Dr. Wunsch, and alongside his team members Daniel Ellerbrock and Nicole Aldridge, as well as with the groups counterpart at Huazhong University of Science & Technology, Yi Huang, in the OURE program for the past year.

Poster Presentations

Arts and Humanities

Poster #	Name	Department	Time	Location
1	Lillian Adams	English & Technical Communication	9:00am – 12:00pm	Upper Atrium
2	Paige Berg	Arts, Languages & Philosophy	9:00am – 12:00pm	Upper Atrium
3	Austin Coulon	History & Political Science	9:00am – 12:00pm	Upper Atrium
4	Sophia Longwell	Arts, Languages & Philosophy	9:00am – 12:00pm	Upper Atrium
5	Auburn Meister	History & Political Science	9:00am – 12:00pm	Upper Atrium
6	Mackenzie Shields	Arts, Languages & Philosophy	9:00am – 12:00pm	Upper Atrium
7	Wesley Vaught	Arts, Languages & Philosophy	9:00am – 12:00pm	Upper Atrium
8	Andrew Warner	Arts, Languages & Philosophy	9:00am – 12:00pm	Upper Atrium
9	Michele White	History & Political Science	9:00am – 12:00pm	Upper Atrium

Engineering

Poster #	Name	Department	Time	Location
10	Abdulrahman Bani	Civil, Architectural & Environmental Engineering	9:00am – 12:00pm	Upper Atrium
11	Dibbya Barua	Chemical & Biochemical Engineering	9:00am – 12:00pm	Upper Atrium
12	Kayla Bruemmer	Chemical & Biochemical Engineering	9:00am – 12:00pm	Upper Atrium
13	Michael Khayat	Materials Science & Engineering	9:00am – 12:00pm	Upper Atrium
14	Zihao Meng	Chemical & Biochemical Engineering	9:00am – 12:00pm	Upper Atrium
15	Dane Nguyen	Civil, Architectural & Environmental Engineering	9:00am – 12:00pm	Upper Atrium
16	Nicholas Timme	Materials Science & Engineering	9:00am – 12:00pm	Upper Atrium
17	Andrew Woode	Electrical & Computer Engineering	9:00am – 12:00pm	Upper Atrium
18	Alex Daues Steven Gibbons Zaid Haha Jasmine Monroe	Chemical & Biochemical Engineering	9:00am – 12:00pm	Upper Atrium

Research Proposal

19	Luke Andrews	Engineering Management & Systems Engineering	1:00 – 4:00pm	Upper Atrium
20	Madison Oostendorp	Engineering Management & Systems Engineering	1:00 – 4:00pm	Upper Atrium
21	Raelynn Twohy	Psychological Science	1:00 – 4:00pm	Upper Atrium
22	Devin Wood	Biological Sciences	1:00 – 4:00pm	Upper Atrium
23	Kaelyn Yarbrough	Chemical 7 Biochemical Engineering	1:00 – 4:00pm	Upper Atrium

Poster Presentations

Sciences

Poster #	Name	Department	Time	Location
24	Lucas Albrecht	Chemistry	1:00 – 4:00pm	Upper Atrium
25	Brett Ballard	Physics	1:00 – 4:00pm	Upper Atrium
26	Sarah Buckley	Biological Sciences	1:00 – 4:00pm	Upper Atrium
27	Anzumaan Chakraborty	Physics	1:00 – 4:00pm	Upper Atrium
28	Katrina Compton	Physics	1:00 – 4:00pm	Upper Atrium
29	Sarah Darknell	Biological Sciences	1:00 – 4:00pm	Upper Atrium
30	Zachary Driemeyer	Physics	1:00 – 4:00pm	Upper Atrium
31	Zachary Foulks	Chemistry	1:00 – 4:00pm	Upper Atrium
32	Madison Hogan	Biological Sciences	1:00 – 4:00pm	Upper Atrium
33	Kirsten Schwandtner	Biological Sciences	1:00 – 4:00pm	Upper Atrium
34	Sarah Skinner	Physics	1:00 – 4:00pm	Upper Atrium
35	Alex Warhover	Physics	1:00 – 4:00pm	Upper Atrium
36	Frankie Wilson	Biological Sciences	1:00 – 4:00pm	Upper Atrium
37	Lilly Germeroth Justine Hinson Brittan McLaughlin	Biological Sciences	1:00 – 4:00pm	Upper Atrium

Social Sciences

Poster #	Name	Department	Time	Location
38	Sara Johnson	Psychological Science	1:00 – 4:00pm	Upper Atrium
39	Kaelyn Kacirek	Psychological Science	1:00 – 4:00pm	Upper Atrium
40	Ava Stroud	Psychological Science	1:00 – 4:00pm	Upper Atrium

Lillian Adams

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Kathryn Dolan
Advisor Department: English & Technical Communication

Funding Source: First Year Research Experience Program

Cold Cereal: America's Favorite Breakfast Food

From the beginning of agriculture, humanity has engaged with the cultivation and cooking of grains. Until the 19th Century, people could only eat their cereals hot. Today, cold cereals have spread throughout the world, and they maintain their place as one of the United States' top breakfast foods. This research project investigated the history and significance of one of today's most popular breakfast foods. Sources ranging from compilations of the history of breakfast cereal to the actual invention patents were used to create an annotated bibliography for Dr. Dolan to write a book covering the history of cold cereals. Cold breakfast cereals began with Dr. James Jackson; improved upon by Dr. John Kellogg, influenced heavily by the Seventh Day Adventist Church; and popularized by Charles Post, Kellogg's eventual rival. The rise of cold cereals helped shape American households and revolutionized the way companies marketed towards the public.

Lillian Adams is a freshman pursuing a Bachelor of Science degree in Chemistry with the intent of pursuing a Ph.D. in Chemistry and later working in chemical research. She is an active member of the W. T. Schrenk Society, the student chapter of the American Chemical Society. Lillian wanted to explore opportunities outside of her major by participating in research with Dr. Kathryn Dolan in the English department as a part of the First Year Research Experience program.

Lucas J. Albrecht

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Klaus Woelk
Advisor Department: Chemistry

Funding Source: Ozark Biomedical Institute & Materials Research Foundation

Low-Cost Solution for Optical NMR Hyperpolarization

Hyperpolarization can boost the low sensitivity of NMR spectroscopy and medical MRI, making it possible to record spectra of samples too dilute for standard NMR analyses. A laser excitation system for optical hyperpolarization is introduced, where the beam of a low-cost 350-nm laser, controlled by a homebuilt shutter, is coupled into the sample by a multimode fiber. A modified 5-mm Shigemi tube accommodates the sample at the end of the fiber. The NMR pulse program sends a signal to a microcontroller that then operates the shutter. Irradiation and spectrum acquisition are synchronized, which also minimizes undesirable photobleaching. The new hyperpolarization system is smaller and less expensive than previously reported systems. A standard shutter costs over $2,000 while the microcontroller and fiber coupler sleeve total $85.35 (cost reduction of 96%). Spectra obtained with the new shutter setup provide an attractive solution for enhancing NMR signals in optical hyperpolarization experiments.

Lucas Albrecht is from St. Louis, Missouri. He has a passion for chemistry and has a background in chemical engineering. He joined Dr. Woelk's research team in March 2019 and has contributed to the design of the NMR apparatus and to the oral presentation on the apparatus. His goal is to enter into a chemical industry, and design a controllable, multi-purpose nanostructure. He is currently participating as an officer in the student led chapter of the ACS, the W.T. Schrenk Society, which is active in community outreach, solving global chemical problems, and inspiring an interest in chemistry to young Americans.

Luke Andrews

Department: Engineering Management
Major: Engineering Management with an industrial emphasis
Research Advisor: Casey Canfield
Advisor Department: Engineering Management

Funding Source: No Funding at this Time

Communicating Deep Learning Results For Healthcare

There is a rising interest in the use of artificial intelligence (AI), such as “deep learning,” in the healthcare industry. AI techniques aim to identify patterns in healthcare data to improve diagnosis and prognosis. This proposal focuses on a large data set that includes health outcomes, treatments, medications, and Medicare/Medicaid costs for patients who have received a liver or kidney transplant. In this project, we will (1) perform a literature review on the use of AI in healthcare and health communications, (2) collect qualitative data on the implications of using data from an AI to make health decisions, and (3) develop an experiment to test approaches for communicating the uncertainty associated with AI findings. Ultimately, this work may lead to the development of a decision tool, such as an app. or web-page, for transplant patients and/ or doctors.

Luke Andrews was adopted at the age of three and a half from Mogilovo, Belarus and then moved to the United States where he grew up in St. Charles Missouri. Luke is now a junior at the Missouri University of Science and Technology where he is pursuing a B.S in Engineering Management. When Luke is not busy with school work or activities he enjoys spending his time outdoor hiking, cycling, and hunting.

Brett Ballard

Department: Physics
Major: Physics and Applied Mathematics
Research Advisor: Dr. Aleksandr Chernatynskiy
Advisor Department: Physics

Funding Source: Dr. Chernatynskiy

Individual Phonon-Phonon Processes in GaAs

Experimental data on individual phonon-phonon interaction processes is rare and permits detailed experimental confirmation of the recently developed computational methods. Here, we present the theoretical explanation of the recent laboratory experiments using computer simulations. The experiment studied the longitudinal acoustic phonons at low temperature and high frequency for GaAs superlattices. The experimental data found deviation from the Herring process contribution estimations at 50 K which we verified computationally. We further explore individual phonon processes looking for possible explanations to this apparent breakdown of Herring processes in order to gain a better understanding of longitudinal acoustic phonon propagation in GaAs.

Brett Ballard is a junior from Warrensburg, MO pursuing a dual major in physics and applied mathematics. Aside from having a 4.0 gpa, he has been serving as SPS(Society of Physics Students) President for Fall 2018 and Spring 2019. Brett plans to pursue a Ph.D. in physics upon completion of both of his bachelor's in the spring of 2020. He has been researching phonon propagation and interactions with Dr. Chernatynskiy of the physics department since May 2018.

Abdulrahman Bani

Department: Civil Architectural and Environmental Engineering
Major: Environmental Engineering
Research Advisor: Dr. Daniel Oerther
Advisor Department: Civil Architectural and Environmental Engineering

Funding Source: N/A

Modeling biofouling in aerobic submerged membranes

Solids separation is an important and often used process in Environmental engineering, membranes are a technology that works based on the solids separation. Membranes are useful in because of the excellent effluent quality, and the high concentrated biomass that would lead to a small footprint. One of the issues that faces membrane bioreactors is the biofouling of the membrane pores, Biofouling is the clogging that occurs to membranes due to various microbes.

The purpose of this research is to create a mathematical model that describes the biofouling of the submerged aerobic membranes.

Abdulrahman Bani is a senior in Environmental engineering at MST. During his time there he went from mechanical engineering to environmental engineering where he found what he loves to do. This is his first foray in research.

Dibbya Barua

Department: Electrical and Computer Engineering
Major: Computer Engineering
Research Advisor: Sutapa Barua
Advisor Department: Chemical and Biochemical Engineering

Funding Source: start-up, technology acceleration grant and S&T innovation

PolyBall– a new adsorbent for the removal of endotoxin

In biotechnology industries, gram-negative bacteria are widely used for the production of therapeutic biomolecules including proteins, peptides, and nucleic acids. These biomolecules are recovered by cellular rupturing that leads to the release of a large quantity of bacterial cell-wall components containing endotoxins, also known as lipopolysaccharides (LPS). When the LPS contaminated products are administered to animals or humans even in small quantities (0.05–0.1 ng/ml), a systemic inflammatory reaction can occur, leading to multiple pathophysiological effects, such as septic shock, tissue injury, and lethality. Removing undesirable endotoxins from solutions is thus an important aim in the pharmaceutical industry and in clinical practice. Conventional treatments such as coagulation and membrane filtration are adequate for removing bacteria cells and debris but not effective for removing dissolved endotoxins to a significant extent. Therefore, it is highly desirable and also the focus of this project to develop a biodegradable and inexpensive means that can tackle both aspects of endotoxin removal.

Dibbya Barua is a Freshman Engineering student who would like to gain research experience in data analysis. His research interests include computational programming by virtual visualization of a specific research problem. Through this OURE project, he will develop software programs to understand the mechanisms of endotoxin binding with polymer nanoparticles. He is a recipient of several awards that include S&T's opening week car design, Regional Math Olympiads and 1st place in High School Science Fair.

Paige Berg

Department: Arts. Languages. and Philosophy
Major: Aerospace Engineering
Research Advisor: Dr. Audra Merfeld-Langston
Advisor Department: Arts, Languages, and Philosophy

Funding Source: Arts, Languages, and Philosophy

Empress Josephine's Beheaded Statue

Empress Josephine's beheaded statue in Fort-de-France, Martinique symbolizes Martinican culture both politically and socially. Through research about the statue's creation and significant events surrounding the statue, how Empress Josephine's statue represents social and political contradictions in Martinique was explored. It was discovered the symbolism of Empress Josephine's statue has changed through history from a symbol of white supremacy to a site of political protest of departmentalization and assimilation, and refusal to forget complexities of Martinique's history.

Paige Berg is a junior majoring in Aerospace Engineering with a minor in French. She is the Vice-President of French Club, Resource Manager for Missouri S& T Satellite Research Team, and Secretary of Society of Women Engineers, as well as being a member of Phi Sigma Rho, Sigma Gamma Tau, Student Union Board and Honors Academy. In her free time, she loves to read, watch movies, embroider, and sew.

Kayla Bruemmer

Department: Chemical and Biochemical Engineering
Major: Biochemical Engineering
Research Advisor: Humayun Shariff
Advisor Department: Chemical Engineering

Funding Source: NONE

Resident-Time Distributions for Trickle Bed Reactors

Trickle Bed Reactor (TBR) is one of the common types of reactor used in the chemical industry. For this project, the Residence Time Distributions (RTD) for a lab scale packed bed reactor with trickling flow (downflow) were studied using liquid tracer experiments for two shapes of commercial catalysts, spherical and cylindrical. The reactor was packed with porous catalyst particles in the center with inert glass beads packed on top and bottom. The RTD was then found from conductivity measurements using pulse-input liquid-tracer injection. Different liquid and gas velocities were used to compare the data. From these, the mean residence time and standard deviation were determined from the C-curve. The liquid hold-up of the reactor was evaluated using the mean residence time to compare between the catylysts.

Kayla Bruemmer is a Junior in the Department of Chemical and Biochemical Engineering. Her home town is Fair Grove, MO, just north of Springfield, MO. She loves Running, Hunting, and Fishing. For the summer of 2019, she will be interning at Mother's Brewery in Springfield, MO and working on her farm.

Sarah Buckley

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Thimgan
Advisor Department: Biological Sciences

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

Quantification of Hydration in Drosphila Melanogaster

In research labs using Drosophila, most commonly the source of food and water is the same. This could pose problems in that if the fly is not hungry, it may become dehydrated or vice versa in that the fly may become oversaturated. To combat this problem, a variety of 3D printed caps were placed over the fly rearing vial and a humidity and temperature sensor was used to evaluate the efficacy of the cap. Hemolymph provides the most information on the hydration of flies, but there currently is no standardized collection method. Trying to solve this problem led to the construction of a device that uses airflow and pressure to manipulate adult flies and extract hemolymph samples. To record the amount of hemolymph extracted, the hemolymph drop gets transferred to hydrated paraffin oil. A picture is taken of the hemolymph droplet in the oil and a volume calculation is performed.

Sarah is a senior 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, a member of Scrubs Pre-Health Group, an Honors Academy student, and she is currently working in Dr. Thimgan's Fly Lab.

Anzumaan Chakraborty

Department: Physics
Major: Physics
Research Advisor: Thomas Vojta
Advisor Department: Physics

Funding Source: National Science Foundation

Phase Transitions of an Anisotropy Ising-O(3) Model

The two-dimensional anisotropic Ising-O(3) model is an effective Hamiltonian for the square-lattice J1-J2 Heisenberg model, with nearest-neighbor coupling J1 along with frustrated and dominant next-nearest-neighbor coupling J2. We employ Monte Carlo simulation of the Ising-O(3) model to determine its phase diagram as a function of the anisotropy of the O(3) spins and the temperature. For sufficiently large anisotropy, there is a direct transition from the paramagnetic high-temperature phase to the low-temperature phase that breaks both spin and nematic (Ising) symmetries. This transition splits into two separate transitions as the anisotropy is lowered, leading to the appearance of an Ising-ordered intermediate phase. We also determine the orders of the phase transitions. These results can be related to the experimental observations of the orders and sequences of magnetic and structural transitions in quasi-2D ferropnictide materials.

Anzumaan is a junior with a major in both physics and mathematics. Anzumaan worked with Dr. Vojta on this project for three semesters as well as during the summer of 2018. He is currently interested in pursuing a PhD in theoretical physics after graduating to become a professor and researcher. Outside of academics, Anzumaan has an active role in Society of Physics Students, College Democrats, and the Missouri S&T Math Team.

Katrina Compton

Department: Physics
Major: Physics
Research Advisor: Daniel Fischer
Advisor Department: Physics

Funding Source: OURE

Characterization of Laser-Cooled Atomic Samples

Laser cooling techniques, developed in the 1980s, are routinely used in labs and allow scientists to trap and cool atoms to near absolute-zero temperatures. This research project aims to understand the characteristics of ultra-cooled lithium-7 samples in three different trapping schemes. First, a Magneto-Optical Trap (MOT) is the most common type of atom trap which utilizes a magnetic field and three pairs of mutually perpendicular, counter-propagating laser beams. Second, an All-Optical Trap (AOT), developed over the last two years by the MST team, is an advanced trapping scheme that does not rely on a magnetic field. Last, an Optical Dipole Trap (ODT) which allows for temperatures several magnitudes lower than what can be achieved with the other two trapping schemes. Characterization methods are based primarily on fluorescence and absorption imaging to obtain information about temperature, particle density and polarization.

Katrina Compton is currently earning her undergraduate degree in physics from MST. This is her second research project in the physics department and in 2018, she worked in Dr. Fischer's lab as a First Year Research Opportunity (FYRE) program participant.

Austin Coulon

Department: History and Political Science
Major: History
Research Advisor: Dr. Petra DeWitt
Advisor Department: History and Political Science

Funding Source: Self-funded

Tanks in World War I: An Experiment in Military Strateg

The tank in World War I was an experiment in military strategy. As the fight for inches was a battle of attrition, there was an attempt to change the tide of battle by creating a mobile platform that could cross "No Man's Land." Unfortunately, like most new technologies in World War I, nobody was able to utilize it to its fullest potential. The poster takes a look into some of the different ways tanks were utilized during World War I.

Austin Coulon is a student in the History department and the Technical Communication department. He is interested in World War I and World War II history. He likes to play video games and watch JoJo's Bizarre Adventure. His future plans are to move to Phoenix, Arizona and work as a technical writer.

Sarah Darknell

Department: Biology
Major: Biological Sciences
Research Advisor: Dr. Katie Shannon
Advisor Department: Biology

Funding Source: FYRE

Effects of mutant Dbf2 alleles on cytokinesis

Cytokinesis is the division of one cell into two daughter cells. Budding yeast, like other eukaryotic cells, uses an actomyosin contractile ring (AMR) to accomplish cytokinesis. The coordination of cytokinesis with chromosome separation in mitosis is essential to prevent aneuploidy. In budding yeast, the Mitotic Exit Network (MEN) is responsible for completing cytokinesis and linking it to the end of mitosis. Dbf2 is a protein kinase of the MEN that regulates AMR function through phosphorylation. Dbf2 activity is itself regulated by phosphorylation and dephosphorylation by other MEN proteins. In my project, mutant dbf2 alleles that prevent regulation are incorporated into the yeast genome. The effects of the mutations on protein localization and myosin contraction will be observed by fluorescence microscopy. As Dbf2 has a human homolog that is a tumor suppressor gene, learning about the function of this gene could help to illuminate its role in cancer development.

Sarah Darknell is a sophomore majoring in Biological Sciences and minoring in Psychology and Chemistry. She is a participant of First Year Research Experience (FYRE) and is being mentored by Dr. Katie Shannon while working in the cytokinesis laboratory. She is also the Outreach Chair for SCRUBs pre-health society, and an active volunteer at Phelps Health. She hopes to get into Medical School and pursue a career as a physician.

Alex Daues

Joint project with Steven Gibbons, Zaid Haha and Jasmine Monroe

Department: Chemical and Bochemical Engineering
Major: Chemical Engineering
Research Advisor: Dr. Al-Dahhan
Advisor Department: Chemical and Biochemical Engineering

Funding Source: Dr. Al-Dahhan

Extractive Metallurgy & Industrial Waste

The presence manuscript conducted on lead removal from industrial wastewater using an emulsion liquid membrane method (ELM). The developed ELM consisted of ionic liquid 1-Methyl-3-octylimidazolium hexafluorophosphate ([OMIM]PF6) in membrane phase is used as a stabilizer to provide sufficient stability of emulsion. Other ingredients for emulsion preparation are solvents (kerosene), surfactant (Span 80), extractant [di-2-ethylhexyl phosphoric acid (D2EHPA)], and sulfuric acid (H2SO4) as an internal receiving phase. Recently, experiments investigated the parameters' effects on % removal of lead(II) and ELM techniques such as homogenous speed, surfactant and extractant concentrations, internal to membrane phase ratios, agitation speed, treated ratios, pH of external phase, and ([OMIM]PF6) concentrations. At the best conditions, results showed the stabilizing effect of ionic liquid and nanoparticles was sufficient enough for % removal of lead(II) during the first five minutes of the extraction process of therapeutic studies with low turbidity and swelling at the end of experiment.

Alex Daues is a junior chemical engineer from Saint Louis, Missouri. He has been a part of this research project since January. On campus, he is a member of Omega Chi Epsilon and S&T's Water Polo team.

Zachary Driemeyer

Department: Physics
Major: Physics
Research Advisor: Aleksandr Chernatynskiy
Advisor Department: Physics

Funding Source: OURE

Thermal Transport Properties of GaN via MD

Gallium Nitride is a key material for the future of high-power electronics. Such devices are characterized by very large electric current which in turn generates enormous amounts of heat. Removal of this heat from the device depends crucially on the thermal conductivity of GaN and thermal conductance through its interface with other components of the device. The goal of this project is to determine the thermal transport properties of GaN both internally and across a resistant grain boundary. In this work, we are determined these properties using Non-Equilibrium Molecular Dynamics technique via community code LAMMPS. Results of the simulations are compared to experimental measurements and ab-initio caculations.

Zach is a sophomore physics major with a minor in mathematics from House Springs, Missouri. He tutors low-level classes in the Toomey Student Success Center and works at a dog boarding and day camp facility in Valley Park, Missouri. In his free time he enjoys reading and long walks.

Zachary Foulks

Department: Chemistry
Major: Chemistry and Biological Sciences
Research Advisor: Dr. Honglan Shi
Advisor Department: Chemistry

Funding Source: Ozark Biomedical Initiative (OBI), OURE

New Pheromone Bioassay and Spider Trap Testing

Brown recluse spider (BRS) bites can lead to deep wounds persisting for months, blood loss that can be severe enough to need treatment in intensive care units, and can be life-threatening for children. Our research team has been investigating the sexual pheromones of BRS in order to develop enhanced spider traps capable of more effectively targeting BRS. We have applied ultra-sensitive solid-phase microextraction (SPME) sampling techniques to sample the headspace of BRS containers. These samples were then analyzed using GC-MS to identify the chemicals which were emitted by BRS. Dozens of BRS have been tested, including juveniles, adult males, adult females that do not attract males, and adult females that do attract males, to develop a thorough understanding of the chemicals and semiochemicals emitted by the various types of spiders. Several potential semiochemicals have been identified via this method. A new testing chamber was also developed to allow a more accurate biological assay in order to better observe the effects of these specific chemicals, as well as future potential semiochemicals, on the behavior of the spiders.

Zachary Foulks is a junior undergraduate at Missouri S&T majoring in both Chemistry and Biological Sciences. He has been involved in research with Dr. Honglan Shi's research group for 2 years, and he plans to pursue an MD/PhD degree once he graduates.

Lilly Germeroth
Joint project withJustin Hinson and Brittan McLaughlin

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Robin Verble
Advisor Department: Biological Sciences

Funding Source: Biological Sciences

Thermal profile of varying depths of Ozark leaf litter

We examined the thermal environment of oak-hickory leaf litter at varying depths in the Mill Creek Watershed to better understand the regulation of the structure, diversity, and composition of soil surface-active arthropod communities. We predicted that deep leaf litter would result in cooler, more insulated soil surface temperatures then shallow leaf litter. Leaf litter depth was measured among 100 0.25 m2 quadrats, and we selected plots that represented the median, 10th and 90th percentiles of that range. iButton data loggers were placed on the soil surface of each plot, and left in place for five days, taking temperature recordings hourly on a 24-hour cycle. We plotted our data against ambient temperatures as recorded by an iButton data logger placed on bare soil. Data suggest that thermal environments differ among sites, but this relationship is likely influenced by other environmental factors.

Lilly Germeroth is a Junior pursuing a B.S. in Biological Sciences, and a minor in Sustainability at Missouri S&T. She has been involved in Dr. Robin Verble's Fire Ecology Lab since fall of 2018, and has completed an Opportunity for Undergraduate Research Experience (OURE) project in her lab. She hopes to continue her education after graduation by enrolling in a masters program focusing in ecological studies.

Steven Gibbons

Joint project with Alex Daues, Jasmine Monroe and Zaid Haha

Department: Chemical Engineering
Major: Chemical Engineering
Research Advisor: Dr. Muthanna Al-Dahhan and Qusay Al-Obaidi
Advisor Department: Chemical Engineering

Funding Source: Dr.Muthanna Al-Dahhan

Extractive Metallurgy and Industrial Waste

The presence manuscript conducted on lead removal from industrial wastewater using an emulsion liquid membrane method (ELM). The developed ELM consisted of ionic liquid 1-Methyl-3-octylimidazolium hexafluorophosphate ([OMIM]PF6) in membrane phase is used as a stabilizer to provide sufficient stability of emulsion. Other ingredients for emulsion preparation are solvents (kerosene), surfactant (Span 80), extractant [di-2-ethylhexyl phosphoric acid (D2EHPA)], and sulfuric acid (H2SO4) as an internal receiving phase. Recently, experiments investigated the parameters' effects on % removal of lead (II) and ELM techniques, such as homogenous speed, surfactant and extractant concentrations, internal to membrane phase ratios, agitation speed, treated ratios, pH of external phase, and ([OMIM]PF6) concentrations. At the best conditions, results showed the stabilizing effect of ionic liquid and nanoparticles was sufficient enough for % removal of lead (II) during the first five minutes of the extraction process of therapeutic studies with low turbidity and swelling at the end of experiment.

Steven Gibbons is a junior at Missouri S&T and is currently taking up a bachelor's degree in Chemical Engineering. When not studying for school he can usually be caught working or playing tennis.

Zaid Haha

Joint project with Steven Gibbson, Alex Daues and Jasmine Monroe

Department: Chemical Engineering
Major: Chemical Engineering
Research Advisor: Dr.Muthanna Al-Dahhan & Qusay Al-Obaidi
Advisor Department: Chemical Engineering

Funding Source: Dr.Muthanna Al-Dahhan

Extractive Metallurgy & Industrial Waste

The presence manuscript conducted on lead removal from industrial wastewater using an emulsion liquid membrane method (ELM). The developed ELM consisted of ionic liquid 1-Methyl-3-octylimidazolium hexafluorophosphate ([OMIM]PF6) in membrane phase is used as a stabilizer to provide sufficient stability of emulsion. Other ingredients for emulsion preparation are solvents (kerosene), surfactant (Span 80), extractant [di-2-ethylhexyl phosphoric acid (D2EHPA)], and sulfuric acid (H2SO4) as an internal receiving phase. Recently, experiments investigated the parameters' effects on % removal of lead (II) and ELM techniques, such as homogenous speed, surfactant and extractant concentrations, internal to membrane phase ratios, agitation speed, treated ratios, pH of external phase, and ([OMIM]PF6) concentrations. At the best conditions, results showed the stabilizing effect of ionic liquid and nanoparticles was sufficient enough for ~70% removal of lead (II) during the first five minutes of the extraction process of therapeutic studies with low turbidity and swelling at the end of experiment.

Traveled from the East to West to create and help innovate todays world. Everyday is a new challenge, everyday a new door for opportunity to lead the way. As a chemical Engineering student i learned that humans can enhanse their learning ability by surrounding themselves with the smartest people in the room. Good and bad habits are contagious.

Justin Hinson
Joint project with Lillian Germeroth and Brittan McLaughlin

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Robin Verble
Advisor Department: Biological Sciences

Funding Source: Biological Sciences

Thermal Profile of Varying Depths of Ozark Leaf Litter

We examined the thermal environment of oak-hickory leaf litter at varying depths in the Mill Creek Watershed to better understand the regulation of the structure, diversity, and composition of soil surface-active arthropod communities. We predicted that deep leaf litter would result in cooler, more insulated soil surface temperatures then shallow leaf litter. Leaf litter depth was measured among 100 0.25 m2 quadrats, and we selected plots that represented the median, 10th and 90th percentiles of that range. iButton data loggers were placed on the soil surface of each plot, and left in place for five days, taking temperature recordings hourly on a 24-hour cycle. We plotted our data against ambient temperatures as recorded by an iButton data logger placed on bare soil. Data suggest that thermal environments differ among sites, but this relationship is likely influenced by other environmental factors.

Justin Hinson is a junior majoring in Biological Sciences at Missouri S&T. He has been involved with Dr. Verble's Fire Ecology lab since the Spring 2019 semester, and intends to continue working under her. Following the completion of his B.S. in Biological Science, Justin intends to pursue a Master's degree in Ecology.

Madison Hogan

Department: Biology
Major: Biology
Research Advisor: Ronald Frank
Advisor Department: Biology

Funding Source: OURE

Transposable Elements in Soap Lake's Halomonas #7

Transposable elements are DNA sequences that can move or copy themselves within a genome. As a result insertional mutations can be reversed,gained, and genomes expanded. Bacterial genomes consist mainly of protein-coding regions and therefore bacterial transposable elements can have a significant impact on these small genomes. The transposable elements of Soap Lake s Halomonas # 7 were examined in this research. Our analysis started with an algorithmic annotation of the genome to locate transposable elements. We used BLAST (Basic Local Alignment Search Tool) at NCBI (National Center for Biotechnology Information) to search the genome for matches to the initial sequence. Once the left and right ends of each element were approximated we identified inverted repeats for each element that are characteristic of these families. Using the inverted repeats we identified target site duplications and identified the start and stop codons of the open reading frames that encode the transposase enzyme required for copying elements. We were able to locate, identify, and characterize four different transposable element families with multiple copies in the genome.

Madison Hogan is a junior in the Biology department at Missouri University of Science and Technology. She attended classes for two years at East Central College with the assistance of the A+ Program from tutoring the special education classes at Rolla Senior Highschool. Some of her notable position including working as a natural resource specialist as Onondaga Cave State Park and holding the position of vice President and President of Phi Theta Kappa's beta omicorn phi chapter at East Central College's Rolla location. Madison is using this research opportunity to further her experience with different aspects of the genetics field

Sara Johnson

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

Funding Source: N/A

Drinking and Sex Motives during Spring Break

Undergraduate alcohol use and related consequences vary during events such as Spring Break (SB) (Neighbors et al., 2007). Students who vacation with friends drink more alcohol compared to students that travel with their parents or stay home (Grekin et al., 2007). Greek members are an at-risk group for heavy drinking, which is associated with sexual behaviors and related consequences. Despite the research documenting risky drinking in fraternities or sororities (Caudill et al., 2006), no studies have specifically investigated SB drinking and sex behaviors among Greeks. We investigated Greek vs non-Greek drinking and sex behaviors and motives during SB. Data suggest drinking and sexual motives differed for daily life compared to SB among Greeks (N=106). Specifically, Greek students demonstrated higher drinking motives for daily life and SB whereas non-Greek members reported higher sexual motives for SB. These data could inform efforts targeted at reducing risky behaviors among Greeks during SB.

Sara Johnson is a graduating senior in the Pyschological Science department. Upon graduation, she will be attending graduate school to study Clinical Psychology.

Kaelyn Kacirek

Department: Engineering Management
Major: Engineering Management
Research Advisor: Dr. Amy Belfi
Advisor Department: Psychological Science

Funding Source: Psychological Science Department

The Famous Melodies Task

Famous 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. The goal of the present work was to create a standardized stimulus set of famous musical melodies. This research has resulted in a normed set of musical stimuli for researchers to use in future studies. A range of famous musical melodies (N=109) were rated and characterized on naming ability, familiarity, age of acquisition, valence and arousal by a large online sample (N=206). In addition to providing normative ratings for each stimulus, we investigated the relationships between these variables: Valence and arousal were positively correlated, while age of acquisition was negatively correlated with both familiarity and naming. Overall, these results will provide researchers with a standardized and openly available set of musical stimuli to be used in future work.

Kaelyn, an undergraduate student at Missouri S&T, has 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 interest 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.

Michael Khayat

Department: Material Science
Major: Ceramic Engineering
Research Advisor: Dr. Anthony Convertine
Advisor Department: Material Science

Funding Source: IAM

3D Bioprinting Polymer Bioactive Glass Composite

In traditional tissue engineering, 3D-printed scaffolds are prepared, and then cells are seeded on them. However, these cells typically proliferate on the outer surface of the scaffold, making it difficult for them to grow. However, in bioprinting, both materials and cells are printed together to form a 3D environment. Bioglass polymer composite scaffolds (biodegradable) are printed alongside hydrogels containing stem cells using solvent-based extrusion printing. These scaffolds are tested in vivo and in vitro to observe osteoconductive, angiogenic, and mechanical properties, to be used for drug-testing protocols.

Michael Khayat is a Junior studying ceramic engineering with a minor in biomedical engineering at Missouri S&T. He is the standing Longboard Club President, the Programming chair for Material Advantage, a member a Keramos, a Transfer Transitions mentor, teaches music lessons at the Kaleidoscope Learning Center, and is heavily involved in multiple research projects on campus. He has been conducting research at S&T since his freshman year.

Sophia Longwell

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Michelle Schwartze
Advisor Department: Teacher Education and Certification

Funding Source: FYRE Project

The Impact of Classroom Design on Active Learning

Education in the twenty-first century has been moving towards a STEM focus. Active learning classrooms incorporated within them create an environment in which collaboration and critical thinking come alive. These benefits can be restricted if the setting is not easily adaptable to make such changes. While many elementary and secondary classrooms have created more flexible seating options to accomocate for active learning, many higher education classrooms remain more traditional and are not easily adaptable for active learning. This study will explore how the seup of a classroom impacts active learning in a college classroom. In order to explore this, student surveys will be evaluated in order to address themes that appear throughout. The qualitative survey data will be used to create a table in order to address the themes involved. The results from this study will help teachers and students alike understand the impacts of learning based on classroom
setup.

Sophia Longwell is a freshman at Missouri S&T studying biological sciences with an emphasis in pre-medicine. She is from Wentzville, Missouri and has plans to attend medical school after graduating. Additionally, her involvement in organizations such as Kappa Delta Sorority, Chancellor's Leadership Academy, and SCRUBS, has grown her ability to realize the sky has no limit. This is her first research opportunity on campus and she aspires to work on others in the near future.

Brittan McLaughlin
Joint project with Justin Hinson and Lilly Germeroth

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. Robin Verble
Advisor Department: Biological Sciences

Funding Source: Biological Sciences

Thermal profile of varying depths of Ozark leaf litter

We examined the thermal environment of oak-hickory leaf litter at varying depths in the Mill Creek Watershed to better understand the regulation of the structure, diversity, and composition of soil surface-active arthropod communities. We predicted that deep leaf litter would result in cooler, more insulated soil surface temperatures then shallow leaf litter. Leaf litter depth was measured among 100 0.25 m2 quadrats, and we selected plots that represented the median, 10th and 90th percentiles of that range. iButton data loggers were placed on the soil surface of each plot, and left in place for five days, taking temperature recordings hourly on a 24-hour cycle. We plotted our data against ambient temperatures as recorded by an iButton data logger placed on bare soil. Data suggest that thermal environments differ among sites, but this relationship is likely influenced by other environmental factors.

Brittan McLaughlin is a Senior pursuing a B.S. in Biological Sciences at Missouri S&T. He has been involved in an Opportunity for Undergraduate Research Experience (OURE) project in psychology developing a yogic breathing device that will assist in treatment of pulmonological pathologies. He plans to attain a job perform prescribed burns as well as joining the woodland firefighters.

Auburn Meister

Department: History & Politcal Science
Major: Psychology
Research Advisor: Shannon Fogg
Advisor Department: History & Political Science

Funding Source: FYRE

Quaker Aid in France during WWII

The American Quakers provided aid and relief in France during WWII. They helped Jewish refugees in the Holocaust, mainly women and children, by raising money, collecting items, and even traveling over to France to help directly. The items they collected were clothing, food, and even medical supplies, while the direct help they provided included establishing schools, employment offices, and running children's homes for the refugees. The Quakers created fundraisers and advertised their cause in the New York Times for all of the US to see.

Auburn Meister is a 3rd year student working on a BS in Psychology with a Minor in History. She has always enjoyed learning about history and Dr. Fogg's work relating to WWII captured her interest. Auburn's curiosity was peaked by the topic of Quakers in WWII since she did not know that Quakers played a part in helping refugees in the Holocaust. She plans on either going to graduate school after receiving her degree to become a therapist or becoming a middle or high school teacher.

Zihao Meng

Department: Chemical and Biochemical Engineering
Major: Chemical Engineering
Research Advisor: Xinhua Liang
Advisor Department: Chemical and Biochemical Engineering

Funding Source: Opportunities for Undergraduate Research Experiences

Preparation of ZSM-5 for DME Synthesis

The most commonly used catalyst for the synthesis of DME through methanol dehydration is γ-Al2O3, due to its low cost, and high selectivity towards DME. However, γ-Al2O3 tends to adsorb water produced during the reaction, which makes it an unreliable catalyst because of deactivation. On the other hand, zeolite, such as ZSM-5, has huge catalytic potential as dehydration components in DME synthesis, because of its high resistance toward water adsorption, tunable acidity, and high activity. In this study, we explored the effect of pressing and grinding on the catalytic performance of DME catalyst granules. Besides, through both literature survey and experiment, influences of temperature, acidity & structure of zeolite, and surface modification on ZSM-5 catalytic performance, were evaluated by selectivity and yield of DME as well as methanol conversion. At last, the possible changes of zeolite crystal structure during the synthesis process and their influences on catalytic activity were investigated through literature research.

Zihao Meng is a senior majoring in Chemical Engineering in the department of Chemical and Biochemical Engineering. He has strong interests in studying catalysts and nanomaterial. As a participant of OURE program, he has been working in Dr. Liang's lab since Fall 2018. He is also a member of American Institute of Chemical Engineers (AIChE), Tau Beta Pi and a design team at Missouri S&T.

Jasmine Monroe
Joint project with Alex Daues, Steven Gibbons and Zaid Haha

Department: Chemical Engineering
Major: Chemical Engineering
Research Advisor: Dr. Muthanna Al-Dahhan & Qusay Al-Obaidi
Advisor Department: Chemical Engineering

Funding Source: Dr. Muthanna Al-Dahhan

Extractive Metallurgy from Industrial Wastewater

The presence manuscript conducted on lead removal from industrial wastewater using an emulsion liquid membrane method (ELM). The developed ELM consisted of ionic liquid 1-Methyl-3-octylimidazolium hexafluorophosphate ([OMIM]PF6) in membrane phase is used as a stabilizer to provide sufficient stability of emulsion. Other ingredients for emulsion preparation are solvents (kerosene), surfactant (Span 80), extractant [di-2-ethylhexyl phosphoric acid (D2EHPA)], and sulfuric acid (H2SO4) as an internal receiving phase. Recently, experiments investigated the parameters' effects on % removal of lead (II) and ELM techniques, such as homogenous speed, surfactant and extractant concentrations, internal to membrane phase ratios, agitation speed, treated ratios, pH of external phase, and ([OMIM]PF6) concentrations. At the best conditions, results showed the stabilizing effect of ionic liquid and nanoparticles was sufficient enough for % removal of lead (II) during the first five minutes of the extraction process of therapeutic studies with low turbidity and swelling at the end of experiment.

Jasmine is a junior majoring in Chemical Engineering from Barry, IL. While attending S&T, she has gained experience from internships at BASF as a production engineering intern and various part-time jobs held while at school. These experiences have strengthened several skills including those in VBA, Matlab, communication, and leadership. Her goal with undergraduate research is to gain useful experience with wastewater extraction methods, while applying content learned in the classroom.

Dane Nguyen

Department: Civil, Architectural, and Environmental Engineering
Major: Environmental Engineering
Research Advisor: Dr. Daniel Oerther
Advisor Department: Civil, Architectural, and Environmental Engineering

Funding Source: N/A

Modeling Antibacterial Resistance in The Environment

Antibiotic resistance is an emerging threat to our health security. To maintain the current benefits of antibiotics, a steady development of new drugs needs to be developed. However, the high use of antibiotics in humans and animals is leading to increased pressure on bacteria to develop and spread resistant phenotypes. The goal of this research is to develop a model that models the selective pressure of bacteria to develop resistant phenotypes given a variety of emission sources and antibiotics. The data generated will have a possible use for policy-makers, businesses, and the public.

Dane Nguyen is a senior in environmental engineering at Missouri S&T. During his time as an undergraduate, he has worked on several projects such as antibacterial resistance modeling, and EQ Student Accelerator for plant phenotyping.

Madison Oostendorp

Department: Engineering Management
Major: Engineering Management
Research Advisor: Casey Canfield
Advisor Department: Engineering Management

Funding Source: N/A

Confronting Systemic Barriers to Solar Adoption

This project aims to identify barriers to solar deployment and estimate the impact of addressing them. One potential strategy for addressing barriers is the SolSmart Program. SolSmart is a national community designation program, funded by the U.S. Department of Energy, designed to recognize communities that take steps to make it easier for businesses and residents to go solar. Steps range from providing information on solar permitting online to implementing streamlined permitting processes. We will be performing a literature review and tracking which barriers to going solar are addressed by SolSmart. We will help SolSmart by making recommendation to target these additional barriers to maximize the impact of the program in terms of solar adoption. The results will bring a quantitative and qualitative lens to direct and indirect barriers that affect the SolSmart program and ultimately the solar movement in general.

Madison is a junior attending Missouri University of Science and Technology. She is currently working to obtain her B.S. in Engineering Management with an emphasis in Management of Technology. In her free time she currently performs undergraduate research pertaining to barriers in solar adoption as well as participating in a few other extracurricular activities. She is the Marketing Director of Chi Omega and oversees multiple positions within the sorority.

Kristen Schwandtner

Department: Biological Sciences
Major: Biological Sciences; Chemistry Minor
Research Advisor: Katie Shannon
Advisor Department: Biological Sciences

Funding Source: None

The Effect of IQG1 Phosphorylation

After a cell goes through mitosis or meiosis, a process called cytokinesis takes place. During cytokinesis the cytoplasm of the cell is divided between two daughter cells. Cytokinesis is a vital cellular process as it physically splits the components of the cell into two daughter cells. Budding yeast, like other eukaryotic cells, divides the cell membrane using an actomyosin contractile ring. In yeast cells, a protein known as IQG1 is required for the contraction of the actomyosin ring that divides the daughter cells. Phosphorylation mutations of IQG1 cause the actomyosin ring to form incorrectly. With IQG1 being essential to actomyosin, formation mutations cause defects in cytokinesis of yeast cells. My research will focus on the study of different phosphorylation mutations of IQG1 and their effects on binding to actin.

Kirsten Schwandtner is from Tebbetts, MO. She is a sophomore in Biological Sciences and is minoring in Chemistry. On campus she is involved in Phi Sigma Pi, Phi Sigma, and Scrubs. She is currently volunteering in Dr. Shannon's lab.

Mackenzie Shields

Department: History & Political Science
Major: History
Research Advisor: Dr. Andrew Tohline
Advisor Department: Arts, Language, & Philosophy

Funding Source: First Year Research Experience Program

Tracking Mass Ideology through IMDb's Top 250

In 1947, film scholar Siegfried Kracauer famously argued in his book "From Caligari to Hitler" that the films of Weimar Germany provided clues as to the “inner life” of a culture undergoing seismic ideological changes. Now in 2019, an era of mass data collection, there is a more concrete way to quantify the relationship between a culture’s art and beliefs beyond looking at films being released.

The IMDb Top 250 movies, a list compiled with ratings collected from users, tracks attitudes towards the movies even after their release. For this project, we collected snapshots of Top 250 lists preserved on the Wayback Machine to examine changes in users’ opinions between 2004 and 2019. Most films’ rankings rose or fell according to identifiable patterns. However, films that behave atypically may indicate underlying ideological shifts, and preliminary data analysis suggests trends relating to fantasy and wish fulfillment.

Mackenzie Shields is a freshman pursing a Bachelor of Arts in History and a Bachelor of Science in Technical Communication. She intends to attend graduate school and aspires to work in museum archiving and curation. Mackenzie serves as the Traditions Committee Chair of the Thomas Jefferson Hall Association, Member-At-Large of the Residence Hall Association, and Secretary of History Club.

Sarah Skinner

Department: Physics
Major: Physics
Research Advisor: Thomas Vojta
Advisor Department: Physics

Funding Source: NSF under Grant No. DMR-1506152 and DMR-1828489

Fractional Langevin equation with a reflecting barrier

The Fractional Langevin equation describes the motion of a particle under the influence of a random force with long-time correlations. This stochastic differential equation is a common model for anomalous diffusion. We investigate the fractional Langevin equation in the presence of a reflecting wall using Monte Carlo simulations. The mean-square displacement shows the expected anomalous diffusion behavior, < xA2 > - tA(2-alpha) , as in the unconfined case. However, the probability density close to the wall shows highly non-Gaussian behavior. For reference, we compare our results to reflected fractional Brownian motion for which the probability density shows a power law singularity at the barrier [1].

[1] A.H.O. Wada and T. Vojta, Physics Review E 97, 0201012 (2018)

Sarah's entire life has been dedicated to the development of a navigation app for flat earthers and pastafarianism.

Ava Stroud

Department: Psychological Sciences
Major: Psychology/Pre-medicine
Research Advisor: Amy Belfi
Advisor Department: Psychology/Pre-medicine

Funding Source: University of Missouri Research Board

Age-Related Differences in Voluntary Remembering

The ability to recall specific autobiographical memories (AMs) declines with age; however, such age-related differences in AM have only been found using tests of voluntary memory. We investigated whether involuntary AMs are more resistant to age-related decline. Involuntary AMs are memories that come to mind without any effort and are often evoked by sensory cues. We predicted that involuntary AMs would show a decreased age-related decline in episodic richness. Participants were shown three stimuli: music, pictures, and verbal prompts. After each stimulus, participants stated whether the stimulus evoked an involuntary memory. If so, they verbally described the memory. If not, they were asked to retrieve a voluntary memory. We found that older adults showed poorer performance for voluntary memories, but not involuntary memories. Our results will apply to fields like music therapy, which use music to evoke memories in individuals. Our results can also inform theories about age-related memory decline.

Ava Stroud is a senior majoring in psychology/cognitive neuroscience. She will attend A.T. Still University in Kirksville, MO in 2020 to pursue her career goal of practicing medicine. Ava is a member of the PsiChi National Honor Society and was awarded a $1500 research grant for this particular project. She is interested in memory and its function across the lifespan and will continue to do research with Dr. Belfi until she graduates.

Nicholas Timme

Department: Materials Science and Engineering
Major: Ceramic Engineering
Research Advisor: Dr. Hilmas
Advisor Department: Materials Science and Engineering

Funding Source: Honeywell

Wet Processing of Granular Nickel for On-Demand Extr

On-demand extrusion is a direct-write additive manufacturing process in which paste is extruded through fine nozzles to produce a geometry, layer by layer, using a 3D gantry system. A manufactured paste is suitable for printing if it has an appropriate low shear viscosity, shear thinning behavior, and the particles are properly dispersed. This allows for easy extrusion and prevents agglomeration while maintaining shape retention after extrusion. While suitable nickel pastes for printing have been found, the characterization of nickel during the paste production process and optimization of paste formulation has not been explored. This study examined how the ball milling of granular nickel powder modifies the oxygen content, particle size distribution, and surface area of the starting powder. The effectiveness of ionic and nonionic dispersants were evaluated with rheology for different milling times. Preferred nickel milling times and dispersants were determined and used to make pastes for on-demand extrusion.

Nick Timme is a junior majoring in Ceramic Engineering from St. Charles, MO. His research involves the processing of nickel for additive manufacturing. He is on the executive board of Material Advantage as the Historian and is a general member of the Keramos Honors Fraternity. This is Nick's first research project, but he hopes to pursue more in the coming semesters.

Raelynn Twohy

Department: Psychological Sciences
Major: Biological Sceinces & Psychology
Research Advisor: Dr. Amy Belfi
Advisor Department: Psychological Sciences

Funding Source:

Investigating the Effects of Concussion on Athletes

In recent years, concussions have become a critical public health issue for athletes at all levels. The cognitive, behavioral, and emotional effects of concussions have received increasing attention from the general public, scientific researchers, as well as sports organizations including the NFL, NCAA, and youth sporting leagues. However, despite these growing concerns, concussion effects are still poorly understood. Our goal is to investigate whether TBI symptoms differ based on the sport played. The goal of this exploratory study to look for trends in college athlete concussions including sport played, cognitive testing results, and self-reported symptoms. For the study, we will analyze previously collected data from the ImPACT (Immediate Post-Concussion Assessment and Cognitive Testing) collected by the Student Health Center at a public research university with NCAA Division II athletics. It is hypothesized that symptoms will be able to be associated as the outcomes of TBI of the particular sport played.

Raelynn Twohy is a sophomore student majoring in biological sciences and psychology. She is interested in studying the effects of brain trauma and how they effect cognition, behavior, and emotion. She currently works in Dr. Amy Belfi's lab studying memory and music.

Wes Vaught

Department:	Arts, Languages, & Philosophy
Major:	Computer Engineering
Research Advisor:	Dr. Audra Merfeld-Langston
Advisor Department:	Arts, Languages, & Philosophy
Funding Source:	Arts, Languages, & Philosophy

Paul Gauguin's Decisive Time In Martinique

Paul Gauguin is best known for his post-impressionist works. Some of his greatest achievements in post-impressionism are co-founding the synthetism movement and creating many notable primitivist pieces. But how did he transition from his impressionist roots to the unique style for which he became famous? Gauguin states, "I had a decisive experience in Martinique. It was only there that I felt like my self, and one must look for me in the works I brought back from there[...] if one wants to know who I am." Though he spent a relatively short amount of time in Martinique, and his work from that period is less known than his later work, his stay there was an influential and pivotal experience for him as an artist.

Wesley Vaught is a senior attending Missouri University of Science and Technology pursuing a B.S. in Computer Engineering and is on track to graduate in May 2019. He is seeking a career in the field of computer hardware engineering. He is involved in multiple projects within the discipline of his major. In addition to these projects he is also working as a part time tutor in the Bums & McDonnell Student Success Center and as a TA for Dr. Erickson's Basic PLCs lab course.

Alex Warhover

Department: Physics
Major: Physics, Computer Science
Research Advisor: Thomas Vojta
Advisor Department: Physics

Funding Source: National Science Foundation

Fractional Brownian Motion with an Absorbing Wall

Fractional Brownian motion, a random walk with long-time power-law correlations between its steps, is a prototypical model for anomalous diffusion. We employ large scale Monte Carlo simulations to investigate fractional Brownian motion in the presence of an absorbing wall. In the limit of vanishing correlations, our findings reproduce the well-known results for normal diffusion. In contrast, the interplay between the absorbing wall and the long-range power correlations leads to a singular probability density close to the wall. We compare our results to those of Brownian Motion in the presence of a reflecting wall [1], and we discuss implications of our results.

[1] A.H.O Wada and T. Vojta, Phys. Rev. E 97, 020102 (2018)

Alex Warhover is a Physics and Computer Science Dual Major. Alex is interested in looking for ways where knowledge from one field can aid work in the other, namely in the field of computational methods for Physics research or Physics problem solving techniques for Computer Science. Alex hopes to go to go on doing work in computational physics or making computational tools for science research. Alex is also an active member of the Society of the Society of Physics Students.

Andrew Warner

Department: History and Political Science
Major: History with emphasis on secondary education
Research Advisor: Jeanne Stanley
Advisor Department: Arts, Languages, & Philosophy

Funding Source:

Research, Editing, and Publishing a Play

Researching a play is the beginning of this project, starting with a survey sent to all those involved in the last production of the play and then compiling the answers to give insight to the features that the actors and other participants felt unnecessary and complicated. Then the editing part of the project will commise with the information provided by the survey and research through books, reviews, and online resources the play will be edited to strive to be cleaner and more enjoyable for both audience and participant. Then the final act of the project will be publishing the play in its new form. This will also be defined and the process explained to make it less complicated for the next time a play must be published. This project's purpose is to improve the one play and to provide a detailed account of the processes carried out during this project for later examination and use.

Andrew Warner is a history major with an emphasis on secondary education that enjoys Theatre but never found himself good enough or had enough time for practice. While this project might seem contradictory to this time problem, Andrew found that a project like this is needed for graduation and will provide a great experience in the field of Theatre without a speaking part. Beginning his life on October of 1998, Andrew enjoys the outdoors, the intricacies of computers, learning German, playing the ukulele, and blacksmithing. History is no longer a hobby for Andrew now that it is his major.

Michele White

Department: History and Political Science
Major: Electrical Engineering
Research Advisor: Dr. Diana L. Ahmad
Advisor Department: History and Political Science

Funding Source: Dr. Diana L. Ahmad

Then vs. Now

Journalists' depictions of Latino immigrants in the contemporary United States mimics the portrayal of Chinese immigrants during the late 19th century. The media stresses drugs, employment competition, and crime for both groups. Sources for this poster came from Nevada Newspapers from 1870 to 1900 as well as online newspapers articles from 2017 to the present day. The astonishing similarities between these two time periods illustrates that immigration has long been a controversial topic in America. Essentially, many of the same arguments about immigrants have been used to influence public opinion for over 145 years.

Michele White is in her last semester of her undergraduate degree in Electrical Engineering at Missouri University of Science & Technology, and will begin work towards her Master's degree this Summer. When Michele is not in class, she can be heard over the airwaves as a DJ for KMNR 89.7 FM, or she can be found tutoring in the Burns & McDonnell Student Success Center.

Frankie Wilson

Department: Biological Sciences
Major: Biology
Research Advisor: Dr. Katie Shannon
Advisor Department: Biological Sciences

Funding Source: None

Protein Interactions of Iqg1 and Mutants with Formins

Cytokinesis is a biological mechanism essential for both types of cell division. In mitosis, cytokinesis is required for the production of two identical daughter cells from a parent cell, and in telophase I and telophase II of meiosis, which produces four genetically distinct haploid gametes, cytokinesis plays a key role in the final separation of the cells.

Using the budding yeast Saccharomyces cerevisiae as a model organism, ongoing research will test the effect of mutations in an essential protein (Iqg1) involved in forming the actomyosin contractile ring during cytokinesis. Techniques to examine protein-protein interactions are used to explore the relationship of wild-type Iqg1 and two of its mutants with the formins Brn1, and Bni1 (actin nucleators). Learning more about the binding of Iqg1 to formins and their role in the process of cytokinesis is important, as this interaction is conserved from yeast to human cells.

Frank is an undergraduate student in the Biological Sciences program seeking a Bachelor's degree. As a non-traditional student he is looking forward to doing research in the academic field after graduating and pursuing a higher degree. Frank retired after thirty years working as a portrait photographer in December 2016. He took part-time online college courses in the spring and fall of 2016 at Moberly Area Community College while still working, then one full semester in the spring of 2017 after retiring, to acquire an Associates' Degree in STEM studies. Frank is currently in his fourth semester at MS&T, graduating in the fall of 2019. Frank has been doing research in Dr. Katie Shannon's cytokinesis laboratory, and will continue to do so until graduation.

Devin Wood

Department: Chemistry
Major: Chemistry (with an emphasis in Biochemistry)
Research Advisor: Dr. Katie Shannon
Advisor Department: Biological Sciences

Funding Source:

Investigating Phosphorylation During Cytokinesis

Cytokinesis is the final step of the cell cycle, where the cell divides its cytoplasm between two daughter cells and separates to form two new cells. The mechanism that facilitates this separation is known as the actomyosin ring. Without the contraction of this ring, the yeast cell will not separate and continues to form buds. The purpose of my experiment is to investigate the effects of phosphorylation of Iqg1, an essential protein required for the actomyosin ring to function properly. Previously, it was shown that preventing phosphorylation of Iqg1 affects the timing of actomyosin ring formation and prevents contraction. I will use a mutant Iqg1 that cannot be dephosphorylated to determine the importance of this regulation on cytokinesis. After first introducing the mutant allele into yeast cells, I will then determine if yeast cells can assemble and contract actomyosin rings normally using microscopy.

Devin Wood is a Sophomore student at the Missouri University of Science and Technology and is pursuing a bachelors of science in Chemistry with an emphasis in Biochemistry. After transferring to MST in fall of 2018, he joined the Honors Academy. He also picked up a leadership position in the Scrubs Pre-Health Society. When he isn't working at school, his extracurriculars include shadowing at the Phelps Health hospital, chess club, volunteering, and playing music. He is currently working with Dr. Katie Shannon in her cytokinesis laboratory, and is planning on attending a MD/PhD program after earning his bachelors degree. He is interested in pursuing research in neurocritical care and neuromuscular disorders during his time in medical school.

Andrew Woode

Department: Electrical and Computer Engineering
Major: Computer Engineering
Research Advisor: Dr. Ferguson
Advisor Department: Electrical and Computer Engineering

Funding Source:

Measurement and Analysis of GaAs Solar Cells

III-V compound semiconductor have been receiving increasing research interest due to their unique optical, electrical, and magnetic properties. In this report, we investigate the photovoltaic properties of GaAs metal-semiconductor (M-S) Schottky junction solar cells, such as open-circuit voltage (Voc), short-circuit current (Isc), and fill factor (FF). A home-made solar simulator setup is used in order to test the solar cells with different top electrode structures under industry lighting standards of AM1.5g 1000 W/cm2. The characteristics of Schottky junction diodes, such as Schottky barrier height, ideality factor, series resistance, are also extracted using the I-V curves plotted with OriginLab data analysis software.

Andrew Woode is a senior year Computer Engineering student, with an emphasis on computer networks. He is also an undergraduate research assistant in Dr. Ian Ferguson's POETS research lab, working with other graduate students in order to measure and characterize III-V based solar cells.

Kaelyn Yarbrough

Department: Chemical and Biochemical Engineering
Major: Chemical Engineering
Research Advisor: Dr. Joontaek Park
Advisor Department: Chemical and Biochemical Engineering

Funding Source:

Modeling of Structure-Controllable Optical Nanofluids

A mathematical model was developed to predict the orientation of nanoparticles in a nanofluid when exposed to solar energy through a photovoltaic cell. Shear rate and relative position in the nanofluid channel were combined with Peclet number data to relate incident sunlight angle with absorbance efficiency. The patterns of shear rate, nanorod tilt angle, and absorption efficiency varied with relative vertical position in the channel are discussed. A combination of these parameters was proposed. This data was used to develop a model to optimize heat transfer by the photovoltaic cell.

Kaelyn Yarbrough is a senior in Chemical Engineering graduating in May 2019. She is the secretary of Phi Sigma Rho Sorority and the president of the Residence Hall Association. Throughout her collegiate career, she has enjoyed conducting research through OURE and Honors Academy. After graduation, she will be employed in the oil field services industry.

OURE Fellows Final Oral Presentations 2018-2019

Name	Department	Time	Location
Ryan Baumann	Biological Sciences	9:00 – 9:30 am	Missouri
Alexandre Cristea	Chemistry	9:30 – 10:00 am	Missouri
Nicholas Parris	Mathematics & Statistics	10:00 – 10:30 am	Missouri
Mikayla Tessmer	Biological Sciences	10:30 – 11:00 am	Missouri
John Tubbesing	Chemistry	11:00 – 11:30 am	Missouri

OURE Fellows Proposal Oral Applicants 2019-2020

Name	Department	Time	Location
Rhys Martin	Psychology	1:00 – 1:30 pm	Missouri
Jeremy Mesa	Biological Sciences	1:30 – 2:00 pm	Missouri
Jessica Newbury	Biological Sciences	2:00 – 2:30 pm	Missouri
William KY Ong	Computer Engineering	2:30 – 3:00 pm	Missouri
David Rogers	Geosciences & Geological & Petroleum Engineering	3:00 – 3:30 pm	Missouri

OURE Fellows Program

Oral Abstracts

Final

Ryan Baumann
Joint Project in conjunction with the Missouri S&T iGEM Team

Department: Biological Sciences
Major: Bilogical Sciences
Research Advisor: Dr. David Westenberg
Advisor Department: Biological Sciences

Funding Source: Missouri S&T Biology, Chemical Engineering and SDELC

BTree: A Bacillus Thuringiensis Toxin Targeting EABs

Since the year 2002, North American ash trees have been infected with and killed by an invasive beetle species known as Emerald Ash Borers (EAB). Current methods for prevention and treatment of EAB's are expensive and inadequate. Our proposed long term solution is to develop Ash trees that are genetically resistant to EAB's. From a known Bacillus thuringiensis Cry8Da protein, we hope to induce mutations in the protein's receptor binding regions to create a Bt toxin specific for EAB's. After screening modified proteins, we will utilize leaf-specific expression of the Cry Toxin in Arabidopsis thaliana as our model system for Ash trees. We hope to present this system for future development as a safe and effective alternative to current treatment methods used in affected areas.

Ryan Baumann is a Senior in Biological Sciences from Saint Louis, MO. He has spent all 8 semesters a member of the Missouri S&T International Genetically Engineered Machine (iGEM) Team. He has served as the Vice President, Lab Manager, and has assisted in the design and lab work of three individual year long projects. He is a Student Ambassador in the Missouri S&T Admissions Office, has worked two summer internships, and has served positions in the Helix Life Sciences Club.

Alexandre Cristea

Department: Chemistry
Major: Biochemistry
Research Advisor: Dr. Honglan Shi
Advisor Department: Chemistry

Funding Source: OURE Fellows Program, Leanard Wood Institute

Traumatic Brain Injury Diagnosis Via HPLC-MS/MS

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), a quantitative method was designed to analyze the concentrations of eight compounds in urine that have been previously linked with traumatic brain injury. This method was then used to analyze the urine of students, to prove method efficacy in real urine samples and establish the average concentrations of these metabolites in urine.

Alex is a senior chemistry student and has been conducting research in the chemistry department since his freshman year. Throughout his time at S& T, he has been an active member of the chemistry department and has been involved in numerous projects across several disciplines of chemistry. Alex will graduate this May and is currently seeking work in analytical chemistry in St. Louis.

Nicholas Parris

Department: Mathematics
Major: Physics
Research Advisor: Dr. Jason Murphy
Advisor Department: Mathematics

Funding Source:

Analysis of the Nonlinear Schrodinger Equation

We analyze the nonlinear Schrodinger equation for application to Bose-Einstine condensates. First, we devise a rigorous mathematical model for the underlying physics. We then prove well-posedness and establish sharp bounds for solutions to the equation. Deriving a rigorous model for the dynamics of a general condensate, we then analyse several other physically interesting solutions, particularly radially symmetric and solitary wave solutions. We finally compare these results to experimental Bose-Einstein condensate results, discussing physically interesting details.

Nicholas Parris is a senior of Physics and Mathematics who has done research in Atomic physics for three years as a apart of the I.AMOR group under Dr. Daniel Fischer, an assistant professor in the MST Physics Department studying quantum gas collisions. Nicholas' research advisor for this project, Dr. Jason Murphy, is an assistant professor of the MST Mathematics Department who is an expert in the analysis of nonlinear partial differential equations.

Mikayla Tessmer

Department: Chemical Engineering
Major: Chemical Engineering (Biochemical Engineering Emphasis
Research Advisor: Dr. David Westenberg
Advisor Department: Biological Sciences

Funding Source: Dr. David Westerberg and MS&T IGEM Design Team

Advancement of the Biosynthetic Plant Registry

The 2018 International Genetically Engineered Machines (iGEM) Jamboree conference proved to show flaws in the international plant registry. Although the iGEM registry has over twenty thousand documented parts, only a small percentage make up the plant registry section. This research focused on adding known promoters to the registry to improve future use and documentation. The AT5G54000 promoter is a seed-specific promoter, therefore any gene put after the promoter will affect only the seed. The GmPRP2 promoter is a root-specific promoter. To test the promoters activity, it was combined with the GUS reporter which produces a blue coloration in the specific tissue when given X-gluc. Each promoter's effects can be properly documented. By putting the combination into the specific iGEM backbone, it can be added to the iGEM plant registry to make future projects less time consuming.

Mikayla is a junior in Chemical Engineering that has done undergraduate research in the past with Dr. Westenberg at MS&T and the National Science Foundation at the University of Houston. She is involved on campus as the secretary of Omega Chi Epsilon, the chemical engineering honor society. Additionally, she participates with the iGEM design team and Chi Omega greek sorority.This upcoming summer (2019) she will be interning with Bayer to do research on plant pathogens.

John Tubbesing

Department: Chemistry
Major: Chemistry
Research Advisor: Dr. Switzer
Advisor Department: Chemistry

Funding Source: Department of Energy (grant N. DE-FG02-08ER46518)

Epitaxial Spin Coated Films

Spin coating is a simple technique for applying thin films to flat substrates, most commonly used as a method of applying photoresists to silicon wafers for lithography. Here, single crystal substrates were used and produced single crystal-like films of cesium lead bromide perovskite, lead iodide, zinc oxide, and sodium chloride. Single crystal-like gold films electrodepositied on silicon wafers were used as the substrate for cesium lead bromide perovskite as a preliminary semiconductor device. Insights were gained into the nature of how spin coating works: That a supersaturated layer immediately next to the surface propagates, which allows for nucleation on the single crystal surface in such a way that the resulting crystals are oriented both in plane and out of plane. Such crystals can serve as semiconductors or as templates for other deposition techniques.

John is a 3rd year undergraduate in the chemistry department with plans to graduate in December of this year. John has been involved on campus with the W. T. Schrenk Society as well as CCF and the Aerial Swing Dance Club. He has been with the Dr. Switzer research group since May of 2017 where he completed one DURE and is published in the Journal of the American Chemical Society. John plans to continue with the group after graduation to pursue a doctorate in chemistry.

OURE Fellows Program

Oral Abstracts

Applicants

Rhys Martin

Department: Psychology
Major: Biology/Psychology
Research Advisor: Devin Burns
Advisor Department: Psychology

Funding Source: Cognitive Science Lab Startup Funds, OURE, Out of Pocket

Breathing Measurement Improvements & Investigation

Our team has built a breathing measurement device similar to a spirometer, but with special considerations for measuring breathing maneuvers at lower flow rates. It improves upon current tools with inexpensive and fully digital components, including a thermistor, microphone, and gas sensor. Currently, we are doing simple tests of instrument functionality in the experimental environment and will soon be using it to measure the effect of a controlled breathing session on a subject's ability to steady the flow rate of their breath.

We would like expand our research and improve the prototype materials. Further experiments will include more generalized breath training in experimental groups, and invite subjects to return to the lab at repeat intervals for short term longitudinal studies. We may also pursue integration with posture sensors developed previously in the cognitive science lab. This will help us further investigate the effects of yoga and other Ayurvedic breathing disciplines. Improved materials may include metal, ceramic, or plastic castings; sealants and lubricants; and possibly new sensors.

Rhys Martin is an undergraduate student, finishing his Bachelor's of Science degrees in Biology and Psychology. He is an personal trainer and a KMNR DJ, and a private tutor. He enjoys crosswords and card games.

Jeremy Mesa

Department: Biological Sciences
Major: B.S. in BioSci
Research Advisor: Dev Niyogi and Mark Fitch
Advisor Department: Biological Sciences and Environmental Engineering

Funding Source: Missouri Water Resources Research Center

Stormwater Delivery and Remediation in Rolla Ponds

This project will examine nutrient pollution and remediation in two urban ponds in Rolla. The OURE Fellow, Jeremy Mesa, will conduct lab and field trials on management strategies for limiting urban stormwater pollution. The project will focus on two urban watersheds in Rolla: the Schuman Park and Ber Juan Park watersheds, which both have small ponds. Stormwater nutrients lead to significant water quality problems in the ponds, impairing human uses for recreation such as fishing. The project will focus on the use of “floating treatment wetlands” to limit the effects of nutrients on water quality in these ponds. Plants and algae will be examined for effective nutrient sequestration in microcosm studies. The best taxa will be grown in the treatment wetlands and periodically harvested to remove nutrients from the ponds. Additional research will help determine optimal harvesting strategies. The goal of the research is to help establish an inexpensive, bio-inspired strategy to protect the urban ponds of Rolla.

Jeremy Mesa is from Kansas City, Missouri, and is a student of biological sciences. He is a member of the S&T synthetic biology design team, iGEM, and is an undergraduate researcher under Dr. Dev Niyogi. He takes interest in biochemistry as well as ecology. Jeremy aspires to be an environmental scientist focused on bioremediation, but, if he weren’t a student at Missouri S&T, he would be training as a luthier.

Jessica Newburry

Department: Biological Sciences
Major: Biological Sciences
Research Advisor: Dr. David Duvernell
Advisor Department: Biological Sciences

Funding Source: Professor funded

Biodiversity Assessment in Ozark Streams Using eDNA

Environmental DNA (eDNA) methods of biodiversity sampling have become well documented, utilized and depended upon as a source of data, using DNA generated by epithelial cell deposition and then using PCR restriction fragment length polymorphism markers to distinguish between species. Despite the surge of research data generated via sampling eDNA, technical challenges still facing the usage of eDNA today include verifying that eDNA samples recovered accurately represent the biotic community and exploring the extent that technical errors can affect sampling results, acknowledging the power of PCR sampling and the challenge it poses to eliminating contamination. In this project, we aspire to validate this (eDNA) technique by: (1) collecting eDNA data by sampling three different stream sites and comparing the results to traditional biodiversity samples collected previously and extensively by the regional Missouri Department of Conservation office for our specific local stream habitats and (2) devising positive and negative controls that can be applied to monitor for contamination issues.

Jessica Newburry is currently a junior at S&T. She has been a part of three reasearch teams, including a Neuroscience research team, a water Ecology research team, and a Population Genetics team currently. In her spare time, she enjoys reading, painting, and working with animals, including her dog, Shadow. She also enjoys spending time with her fiancé, Chandler Mossman, a fellow Biological Sciences major. She aspires to achieve a PhD, hoping to secure a career in conservation in Alaska.

William Ong

Department: Electrical & Computer Engineering
Major: Electrical & Computer Engineering
Research Advisor: Dr. Ronald J. Stanley
Advisor Department: Electrical & Computer Engineering

Funding Source: Electrical & Computer Engineering

Classification of Epithelium Regions for CIN

The scope of this OURE Fellows project is to continue investigating 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 lesion 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 Dr. William Van Stoecker for the image labeling process. William will apply utilize these labeled features, including nuclei, cellular and acellular features, for the development and extension of deep learning convolutional neural 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. 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. Stanley's CIN lab. William also has participated in Dr. Donnell's Applied Microwave Thermography Nondestructive Testing Lab. William's interests include biology, statics, and big data analytics. William is passionate in using AI and deep learning to aid people in meaningful ways.

D. Brian Rogers

Department:	Geological Sciences and Geological and Petroleum Engineering
Major:	Geological Engineering
Research Advisor:	Katherine Grote
Advisor Department:	Geological Sciences and Geological and Petroleum Engineering

Funding Source: GGPE Department, Geological Society of America

Heavy metal contamination in the tri-state district

Heavy metal release from historic mines and abandoned mine waste has caused major water quality issues in Missouri. However, these contaminants can also occur naturally in bedrock layers, and it is not always clear whether high levels of these contaminants in the groundwater are the result of historic mining or dissolution through undisturbed strata. This project will investigate whether heavy metal contamination observed in the historic tri-state mining district is derived primarily from anthropogenic or geogenic causes. To determine this, groundwater monitoring wells will be installed near streams that are impaired by heavy metals. Some wells will be placed down-gradient of historic mining areas, while others will be placed in unmined areas. Water samples will be collected from all wells, and elemental concentrations and ratios will be determined using an ICP-MS. The water quality data will be analyzed using groundwater mixing models and other statistical techniques to determine the source of the contaminant. This project is expected to advance the use of elemental isotopes to determine contaminant sources and aid in groundwater remediation efforts.

Brian is a senior in geological engineering and has actively pursued research opportunities throughout his undergraduate career. He has research experience at Vanderbilt University, University of Pennsylvania, Argonne National Laboratory, and Missouri S&T. He plans to attend graduate school to pursue a PhD in environmental engineering. Brian hopes to create an established career in research, investigating demanding environmental issues.

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