Program and Abstracts

**Wichita State University**

Nineteenth Annual

Undergraduate Research and Creative Activity Forum—URCAF



April 19, 2019 Rhatigan Student Center

2019 URCAF

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**Wichita State University**

Nineteenth Annual Forum

**Undergraduate Research and Creative Activity Forum—URCAF**

SCHEDULE

**9:00 am – 9:30 am**: Registration, *Second Floor*

**9:30 am – 1:00 pm:** Oral Presentations

* Social Sciences and Humanities, *RSC, Rm 258*
* Natural Sciences and Engineering, *RSC, Rm 256*

**9:30 am – 1:00 pm:** Poster Presentations

* Natural Sciences and Engineering, *RSC, First Floor*
* Social Sciences and Humanities, *RSC, First Floor*

**1:00 – 2:00 pm:** Lunch, *RSC, First Floor*

**2:00 – 2:30 pm**: Awards Ceremony, *Pike Room 266*

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**Lucy Cook Apartment** Faculty Mentor: Dr. Heidi Bell College of Health Professions Applied Learning Poster

# EFFECTIVENESS OF ANTI-SLIP PATCH TO ASSESS LINGUAL PERFORMANCE IN USE WITH THE IOPI DEVICE

**Abstract:** The Iowa Oral Performance Instrument (IOPI) is known as the standardized instrument used to measure tongue strength and endurance. A common complaint, however, is that the bulb may move from its intended tongue placement during the measurement. Movement of the bulb may reduce reliability of the recorded measurement; thereby, potentially having a negative impact on diagnostic and rehabilitative practices. This study sought to determine whether an oral-safe biomaterial anti-slip patch is effective in reducing IOPI bulb movement on the tongue while measuring tongue strength and endurance. Additionally, the study sought to identify a participant’s overall perception and preference between IOPI bulb conditions. Methods: 40 healthy adults (19- 40 years) were randomly counterbalanced and grouped, 1) Anterior Tongue (n = 22) and 2) Posterior Tongue (n = 18). There were 3 IOPI conditions (IOPI bulb, IOPI bulb-Patch 1, IOPI bulb-Patch 2). Each participant performed five tongue strength measures and three tongue endurance measures for each of the 3 IOPI bulb conditions. Each condition was then rated using the Comfort Level Survey. Results: Analysis is currently being conducted. A Cronbach’s Alpha will determine ICC (95%) of the Comfort Level Survey.

Multivariate ANOVA will determine overall preference amongst the 3 conditions, and Repeated Measures analyses will verify the integrity of tongue muscle performance measures were maintained (p = .05).

Conclusion: Results may have important implications by introducing a more reliable application of assessing tongue muscle performance while maintaining normative values of IOPI. Such findings may bolster current diagnostic and rehabilitative practices.

**Mahreen Ahsan**

Faculty Mentor: Dennis

Fairmount College of Liberal Arts & Sciences Natural Sciences & Engineering Poster Presentation

# Synthesis of Phosphatidylglycerol Receptor: Precursor Preparation

**Abstract:** With the emergence of an alarming amount of multidrug resistant bacteria, there has been a growing interest in antimicrobial peptides as potential antibiotics to combat this issue in the medical community.

Antimicrobial peptides target the bacterial plasma membrane by first binding to phosphatidylglycerol (PG) via Columbic interaction, followed by insertion into the membrane and killing the bacterial cell. However, antimicrobial peptides can be toxic, difficult expensive to make, and exhibit low bioavailability. Our focus will be directed toward the development of small molecules that specifically bind to (PG), the major anionic phospholipid found in bacterial membranes. In doing so, the membrane is disrupted. Currently, precursors for a family of cyclophanes whose structure is proprietary are being developed. Previously prepared small molecules that bind to the PG head groups have displayed high bacteriostatic properties at low concentrations (1-4 Î¼M). Therefore, this privileged structure is expected to similarly bind to PG that will cause the antimicrobial effect due to its commonality in binding pocket. The antimicrobial effect makes plasma membrane more permeable which depolarizes the membrane with the aim to stop replication. The precursors developed so far consist of the

synthesis of bis-phenol from bis-anisole via demethylation and the synthesis of an allylic mesylate from the transformation of pentane-1,5-diol into 5-(methoxy methoxy) pentyl-4-methylbenzene sulfonate.

**Irfan Ansari**

Co-Author: Robin Cesur Mark Schneegurt Faculty Mentor: Mark Schneegurt

Fairmount College of Liberal Arts & Sciences Natural Sciences & Engineering Poster Presentation

# Demonstration of Bacterial Growth in Brines Formed by the Deliquescence of Salts Relevant to Mars

**Abstract:** Hygroscopic salts can absorb moisture from the atmosphere to form saturated brines through the process of deliquescence. The surface of Mars has abundant sulfate and (per)chlorate salts that may at times form saturated brines through deliquescence. The brines formed from the deliquescence of these salts freeze at very low temperatures and may provide the liquid water necessary for life on Mars. We have studied the growth of salinotolerant microbes (Halomonas and Marinococcus) under deliquescing conditions. Bacterial cultures were grown in medium containing 2 M MgSO4 and appeared to survive multiple drying and rewetting cycles. While there was cell death with each cycle (usually less than 50%), many of the cells were able to survive during dry storage. When water or salt solution was added directly to dried cultures, the cells were revived and grew, reaching high culture densities. Deliquescence conditions also were tested, in which dried cultures were not directly rewetted but immediately exposed to a humid environment. After drying, the cultures were kept in a sealed jar above a layer of water or salt solution, allowing the MgSO4 to create a saturated brine within a day through moisture absorption from the headspace. Surviving cells were revived and were able to grow, reaching high culture densities. Our experiments are the first laboratory demonstration of microbial growth in any deliquescent brine. The survival of microbes, which may contaminate spacecraft, after drying and subsequent growth in deliquescent brines is relevant to planetary protection protocols for missions to Mars and to guidelines for habitable regions on Mars. Bacterial growth in saturated brines after direct rewetting also is pertinent beyond Mars, to the oceans and ices of satellites in the outer solar system, such as Europa and Enceladus.

Supported by NASA ROSES PPR and KINBR

**Mason Bivens**

Faculty Mentor: Dr. Linda Kliment College of Engineering

Natural Sciences & Engineering Poster Presentation

# A Summary of Usage Data for CL-415 Aircraft in Service with USFS Abstract:

United States Forest Service (USFS) uses a variety of aircraft for firefighting operations. In this study, flight data is analyzed for CL-415 aircraft, which were specifically designed for firefighting. A major operational and design difference between other airtankers and the CL-415 is that, being an amphibious aircraft, it does not need to land to fill with water; therefore, it performs multiple fills and drops per flight. Data is available for firefighting missions as well as maintenance and ferry flights for analysis. In total, 1,069 flights files,

consisting of 380,903 nautical miles, are analyzed for four CL-415 airframes. The flight data, recorded at 32 Hz, contains channels of navigational, inertial, and air data. Usage data is extracted from each ground-air- ground (GAG) cycle using a FORTRAN code developed specifically for the aircraft. Some results of interest are flight duration and distance, altitudes at which the aircraft is flown, maximum airspeeds and load factors, number of fills and drops per flight, and flap usage. The usage results are then compared against published operational limits as given by the airframe manufacturer in the flight manual. The comparison of the results with operational limitations set by the manufacturer is used to determine if the aircraft are being operated as they were designed. This data could be used by the FAA to recommend possible design limits for future aircraft in a similar role. Finally, the operators can use results of this nature to fine-tune their maintenance and inspection periods.

**Mckyla Chavez**

Faculty Mentor: David McDonald

Fairmount College of Liberal Arts & Sciences Natural Sciences & Engineering Poster Presentation

# USING CHECKBOARD ASSAY TO EXPLORE POSSIBLE SYNERGY BETWEEN TWO NATURALLY DERIVED ANTIMICROBIAL PRODUCTS

**Abstract:** Dental caries, or tooth decay, is a prevalent problem in today’s world and can be exacerbated by lack of oral healthcare. Streptococcus mutans is one of the first colonizers of the tooth surface and thus helps to facilitate biofilm, or plaque, formation on teeth. Tooth decay, due to the metabolic activities of aggregated dental bacteria, is typically controlled by frequent brushing and visiting a dentist regularly. However, for those without access to dental care, the removal of bacteria from teeth is challenging. There are many natural substances that have been proven to exhibit antimicrobial effects on the bacteria responsible for dental caries.

Identifying potential synergistic pairings of these natural agents, which are easily accessible, would allow for more effective treatment. The purpose of this experiment is to explore whether the two substances: cinnamon and methylglyoxal (MGO), the latter of which is derived from honey, are synergistic. This experiment was conducted using a checkerboard assay, where serial dilutions of each product were applied as a gradient on a 96-well plate. Results were obtained by determining the presence or absence of Streptococcus mutans and analyzing patterns of growth using well-established methods. This experiment showed that the pairing of MGO and cinnamon was additive, not synergistic. However, previous studies have suggested repeating assays in triplicate for accurate results, so further experiments would need to be conducted.

**Ethan Fulghum**

Faculty Mentor: Dr. Nicholas A. Smith College of Engineering

Natural Sciences & Engineering Poster Presentation

# Carbon Fiber-Reinforced 3D-Printed Specimens

**Abstract:** The objective we completed was to characterize the properties of carbon fiber reinforced filaments in 3D-printed specimens. Carbon fiber, in general, increases the strength and stiffness of materials, but its properties are highly direction-dependent. Four different materials were 3D-printed; PLA, carbon-filled PLA, ABS, and carbon-filled ABS. The materials were each printed in four different directional lays, those being vertically, 0-degree, 45-degree, and 90-degree. The use of carbon fiber has become very widely used in industry

and for hobbyists, through our tests we have acquired useable data to show how both material and print direction will affect the strength. From our data it is quite clear that carbon-filled ABS increased the strength of material in all directions except when printed vertically. While it can be noted that the carbon-fiber increased the strength of the ABS material, it also caused the material to be more brittle. This property was much more prominently shown in the vertically printed specimen, hence how the carbon fiber had a negative impact on this print direction. Contrary to the ABS the strength derived from the PLA specimens is very similar to each other. The only clear change is for the 90-degree and vertical specimens. The carbon-filled PLA yielded less strength in both these directions. To conclude the carbon-filled ABS specimens clearly showed an increase in strength in all directions except vertically. Yet the PLA and carbon-filled PLA didn’t show much improvement in strength but proved to be weaker in both the 90-degree and vertical directions.

**Sreenavya Gandikota**

Faculty Mentor: Dr. Mark Schneegurt Fairmount College of Liberal Arts & Sciences

Natural Sciences & Engineering Poster Presentation

# Presence of Halotolerant Bacteria in Oligohaline Environments

**Abstract:** We are investigating the prevalence of culturable halotolerant aerobic heterotrophic bacteria in various inland oligohaline soils near Wichita, KS. As the selected soils have low salt concentrations, it is unclear whether halotolerant bacteria will be present. Samples from agricultural and turf soils were used to inoculate liquid SP media supplemented with 10% or 20% Sodium Chloride. We are performing most probable number counts to statistically determine the abundance of bacteria exhibiting tolerance to 10 or 20% salinity.

The data we have obtained displays considerable microbial growth at 10% Sodium Chloride ranging from 1.07 x 105 to 5.3 x 106 cells per gram soil. Most probable number counts will also be performed on soils nearby, and wipes from, spacecraft assembly cleanrooms at the Jet Propulsion Laboratory (JPL) to determine the potential for forward contamination to Mars. Soils and other particulate matter surrounding the JPL facility can easily be deposited into the assembly rooms via adhering to the hair and clothes of JPL personnel. Although these assembly rooms are extensively cleaned, minor levels of bacterial contamination can persist. As Chlorate and Perchlorate salts are widespread in Martian soil, we are interested in determining whether bacteria present in oligohaline soils around the JPL site are culturable in high Chlorate and Perchlorate conditions. These samples will be used as inoculate in liquid SP media supplemented with 1% or 5% Sodium Chlorate and 1% or 5% Sodium Perchlorate. This study is supported by NASA ROSES PPR and NIH KINBRE.

**Wyel Halimeh**

Faculty Mentor: Dr. Douglas English Fairmount College of Liberal Arts & Sciences

Natural Sciences & Engineering Poster Presentation

# Surfactant-Based Colloidal Systems to Promote Photo Induced Synthesis of Silver Nanoparticles

**Abstract:** This research focuses on the synthesis of silver nanoparticles by the photoreduction of silver ions in colloidal aqueous solution. This method provides a green approach to silver nanoparticle production, since there is no need for organic solvents and the photoreduction reaction occurs at room temperature. This study investigates the effect of surfactant mixture composition on the silver nanoparticle's yield, stability, uniformity,

and size. This gives the ability to produce silver nanoparticles at different yields and sizes according to the required use or experiment. The silver nanoparticle solutions are monitored through UV/Vis absorption spectroscopy by monitoring a unique optical property of metal nanoparticles known as surface plasmon resonance band. Differences in these spectra are used to evaluate reaction yield and nanoparticle size and homogeneity.

**Jerod Horsch**

Faculty Mentor: Dr. Elizabeth Behrman and Dr. James Steck

Fairmount College of Liberal Arts & Sciences Natural Sciences & Engineering Poster Presentation

# Encoding Optimization Problems on D-Wave Systems Via Quantum Neural Networking

**Abstract:** Quantum computing is a promising new field with the expectation of being able to solve certain problems much more quickly than their classical counterparts through the use of superposition and entanglement. However, creating entanglement is a difficult task, without which a quantum computer has zero advantage over a classical one. This research seeks to demonstrate that W-state entanglement can be created on D-Wave annealing machines via quantum neural network training. Not only that, but the parameters for any N-qubit W-state can be ‘bootstrapped’ onto any other M W-state with minimal error.

**MD Joad**

Faculty Mentor: Mark Schneegurt

Fairmount College of Liberal Arts & Sciences Natural Sciences & Engineering Poster Presentation

# Growth of Bacterial Isolates in Iterative Matrix of Salts at High Concentrations Relevant to Mars

**Abstract:** We have been testing bacterial isolates collected from the Great Salt Plains in Oklahoma and Hot Lake in WA. We have chosen 18 salinotolerant bacterial isolates for testing. Mars is rich in salts beyond NaCl, especially MgSO4. We have been using an iterative matrix of salts relevant to Mars in order to test the growth of these select bacterial isolates in the presence of various mixtures of ions at concentrations high enough to lower water activities. Liquid broth media was made for each salt at different concentrations and inoculated with each of the 18 bacterial isolates. Growth was recorded over a 12-day period using A600 measurements of turbidity. The shake-tube cultures were incubated in the dark at room temperature. The matrix includes the cations Ca, Fe, Mg, K and Na, while the anions include chlorate, chloride, nitrate, perchlorate, phosphate, and sulfate. We will continue to increase the concentrations of the media until the bacteria show no growth. Certain salts appear more inhibitory and it will be interesting to determine whether the inhibition can be attributed to single ions in the matrix. The completion of this research project will give us an idea of the chances of bacterial growth on Mars and will determine qualities of the life forms that can potentially inhabit the planet.

Our work on bacterial growth will assist in developing planetary protection protocols for the Red Planet and limits to habitable regions to explore for evidence of extant life.

Supported by NASA ROSES PPR and K-INBRE

**Betty Mathias**

Faculty Mentor: Bin Shuai

Fairmount College of Liberal Arts & Sciences Natural Sciences & Engineering Poster Presentation

# Amplification and Analysis of Genes for hFSH Glycoform-Specific Antibodies in Hybridoma Cell Lines

**Abstract:** Human follicle stimulating hormone (hFSH) plays a role in female and male fertility. FSH has Î± and Î² subunits, which can be N-glycosylated to produce different glycoforms with varied bioactivities. Dr.

Bousfield’s laboratory discovered that the Î² subunit could be differentially N-glycosylated, creating hFSH21 and hFSH24 glycoforms. Intriguingly, as women age, the more potent and active hFSH21 becomes less abundant, whereas the less active hFSH24’s abundancy increases. Because hFSH is important for follicle maturation in females, the ratio of the glycoforms may carry indications of fertility and reproductive age. The characteristics of hFSH21 and hFSH24 has the potential to revolutionize fertility assessments and IVF treatment. To characterize these glycoforms and develop effective assays for clinical diagnosis, pure forms of hFSH21 and hFSH24 are needed. To solve the bottleneck in glycoform purification, glycoform-specific antibodies were generated. Because the expression level of these antibodies in hybridoma lines was low, we proposed to clone the antibody genes from various hybridoma cell lines and use recombinant DNA technology to produce recombinant antibodies. The research focus is to amplify the variable regions of antibody genes and obtain their sequences. We began this process by isolating RNA from the hybridoma cells and using RT-PCR to amplify our targets. The amplified DNA fragments were then cloned, sequenced, and analyzed using BLAST. Up to date, seven cell lines have been characterized. We hope to use the obtained sequences for engineering antibody genes in the future.

**Jared McNeil**

Faculty Mentor: Dr. David Eichhorn Fairmount College of Liberal Arts & Sciences

Natural Sciences & Engineering Poster Presentation

# Synthesis and Characterization of Zinc and Cobalt Pyrazole Complexes

**Abstract:** Pyrazoles are cyclic molecules which have been shown to display antibacterial properties. A new class of pyrazoles are being developed in the Eichhorn research group at WSU which contain a cyano group bound to a carbon in the 4-position of the ring. One of the pyrazoles in this class contains an additional cyclohexyl group bound to the 3-position of the ring. I have utilized this pyrazole to make two new metal complexes containing zinc and cobalt. The synthesis and characterization of these molecules are reported.

**Austin Nelsen**

Faculty Mentor: Nickolas Solomey Fairmount College of Liberal Arts & Sciences

Natural Sciences & Engineering Poster Presentation

# Investigations of a Space-Based Solar Neutrino Detector

**Abstract:** The solar neutrino carries with its detailed information about its origins deep within the sun. The elusive particle travels through the sun nearly unimpeded, allowing for a real-time glimpse into the fusion that powers the sun. However, this feature is a double-edged sword as the solar neutrino often escapes any detection. On Earth, massive detectors are built and buried deep beneath ground in an attempt to study the neutrino.

Instead of growing larger, NuSol aims to go closer to the source. At a mere seven solar radii (3 million miles) from the sun, the flux of neutrinos increases by a factor of 1,000. If a detector of manageable size can be put in such a position, scientists from a wide array of fields can reap the benefits of viewing neutrinos from this unique perspective, chief among them being details about the life and health of the sun. The greatest obstacle of such a device is managing a proper signal. With a constant flood of galactic particles and gamma-rays, discerning a neutrino detection signal becomes incredibly difficult. The goal of this study is to simulate the background and optimize the material and detection method of the spacecraft to demonstrate the effectiveness and practicality of such a detector. Initial results indicate that a dual-layer shielding design can effectively protect the spacecraft from extreme heat, filter out most background noise, and ascertain a characteristic double-pulse signal. Further studies include constructing a crude prototype to simulate and demonstrate the physical feasibility of the design.

**Linh Nguyen**

Co-Author: Abby Jurgensmeier Moriah Beck Faculty Mentor: Moriah Beck

College of Engineering

Natural Sciences & Engineering Poster Presentation

# REVEALING INTERACTIONS BETWEEN PALLADIN AND ACTIN WITH FLORESCENT TAGS AND TIRF MICROSCOPY

**Abstract:** Prior research shows that the protein, palladin, is overexpressed in metastatic cancer cells. Palladin is an actin binding protein and actin is a protein involved in cell motility through actin polymerization into filaments and bundles which then push the cell forward. Thus, the Beck lab hypothesizes that palladin plays a major role in the motility of cancer cells through its interactions with actin. This research focuses on the minimal actin binding domain of palladin, Ig3. Our aim is to monitor the interactions between Ig3 and fluorescently labeled actin and Total Internal Reflection Fluorescence (TIRF) microscopy so we can witness both the dynamics of actin polymerization and what structures it forms. In the absence of Ig3, actin polymerizes into long unbranched chains, but upon the addition of Ig3 the actin filaments are noticeably thicker and branch out into a meshwork. Cosedimentation assays were conducted to ensure that the attachment of the fluorescent tag to Ig3 does not hinder the ability of Ig3 to bind or bundle actin filaments. Our results have shown that our initial florescent SNAP-tag does decrease actin binding and eliminates bundling. Thus, we are working on protein engineering to add a fluorescent tag to Ig3 using a disulfide linkage to cysteine residues, which we hope will allow us to more accurately monitor interactions between palladin and actin. Once we observe the interactions through TIRF microscopy we could potentially understand how palladin contributes to the mobility of metastatic cancer cells.

**Ricky Oshakuade**

Co-Author: Dr. David McDonald Dr. Alisha Prince Faculty Mentor: Dr. David McDonald

Fairmount College of Liberal Arts & Sciences Natural Sciences & Engineering Poster Presentation

# Exploring the Antimicrobial Effects of Neem and Cranberry in a Liquid-Based Assay System

**Abstract:** This study was conducted to explore the antimicrobial effects of neem, an extract from an evergreen tree native to India, and cranberry in preventing the formation of biofilm on the surface of the tooth that leads to the development of dental caries or tooth decay. These naturally occurring products are ideal considering their availability, particularly in developing regions of the world that lack access to consistent dental care. The goal of this project is to explore the combined effect of two naturally-occurring antimicrobial agents to see whether they display synergy. A synergistic combination is revealed with the display of an inhibitory effect such that 1+1 > 2. Synergy was assessed using a Checkerboard Assay system, which measures the Minimum Inhibitory Concentration (MIC) of the compounds. The MIC is visualized by applying varying concentrations of neem and cranberry along with bacteria and broth in each well of a 96-well plate. The wells that appear to lack any bacterial growth indicate that they are at or above the MIC. These findings were then quantified to assess synergy using the Lowest Fractional Inhibitory Concentration Index (FIC), Mean FIC, and the Two Well Method. Results were not supportive for synergy using the Lowest FIC. Results in the Mean FIC and Two Well method were inconclusive. These results are preliminary and more experimentation will be necessary for definitive conclusions.

**Casey Palmer**

Faculty Mentor: Dr. Moriah Beck

Fairmount College of Liberal Arts & Sciences Natural Sciences & Engineering Poster Presentation

# Examining LDH Function and Stability in Extremophile Hypsibius dujardini Through Protein Engineering

**Abstract:** Tardigrades are renowned for their ability to survive extreme conditions, their abundance and isolation from almost every environment on earth. Previous tardigrade research has been primarily focused on their unique ability to survive radiation damage via tardigrade’s unique DNA-associating protein, which facilitates the protection and repair of DNA that has been exposed to high instances of radical oxygen species induced by radiation. However, little research has been focused on understanding how tardigrade proteins, in general, may diverge from non-extreme tolerant species. Thus, my research will focus on lactate dehydrogenase (LDH), a heterotetrametric enzyme responsible for the reversible conversion of lactate to pyruvate, which is found in nearly all living cells, to gain more insight into extremophile protein structure. Tardigrade LDH protein sequence from Hypsibius dujardini was compared to non-extremophile barracuda species to identify non- conserved regions. Site-directed mutagenesis was then conducted on both the barracuda and tardigrade LDH and purified mutant proteins was then used to determine the effect the mutation has on enzyme function and stability. Protein stability can be measured by heat-denaturing the protein and monitoring the unfolding by circular dichroism where we can observe secondary structure deformation. While the functionality is observed using an enzymatic assay that employs spectroscopic observations of the conversion of NAD+ to NADH which is coupled to the turnover of lactate to pyruvate. This research will afford greater insight into protein structure of extreme species and how structure variation to the non-conserved regions allow proteins to remain viable in harsh conditions.

**Harshil Patel**

Faculty Mentor: Kandatege Wimalasena Fairmount College of Liberal Arts & Sciences

Natural Sciences & Engineering Poster Presentation

# Cellular Toxicity of MPP+ with Inhibition of Antioxidant Enzymes in Hepatocytes.

**Abstract:** Parkinson’s Disease (PD) is a leading neurodegenerative disease, resulting in the degradation of dopaminergic neurons within the substantia nigra of humans. The disease is linked to both environmental and genetic factors. The model compound 1-methyl-4-phenylpyridinium (MPP+) serves as an important tool in studying environmental causes of PD. The proposed mechanism of action for MPP+ is the inhibition of mitochondrial complex 1, leading to increases in the level of reactive oxygen species (ROS) and the subsequent activation of an apoptotic pathway. The production of ROS and the initiation of the apoptotic pathway is more prevalent in dopamine neurons than other cells. This difference in their susceptibility could be explained by the amount of antioxidant enzymes expressed in various cell lineages. This study analyzed the inhibition of the antioxidant enzymes catalase & glutathione peroxidase within hepatic cell lineages and its effects on the toxicity of MPP+. It was concluded that the inhibition of these enzymes influences the toxicity of MPP+. Future experiments will include the implementation of these studies in an in vivo model such as C. elegans. These findings will hopefully pave the way for future treatment and prevention options for patients with PD.

**Alia Qasem**

Faculty Mentor: Ramazan Asmatulu College of Engineering

Natural Sciences & Engineering Poster Presentation

**ELECTROSPINNING MACHINE FOR CREATING FIBER Abstract:** ELECTROSPINNING MACHINE FOR CREATING FIBER

Introduction:

I performed an undergraduate research under Dr. Ramazan, working with a PD student. The goal of this experiment was how to make fiber. Polyvinyl alcohol (PVA) is a water- soluble synthetic resin. PVA is a colorless polymer, and it is mainly used for preparing textiles, papers and coatings.

Procedure and Results:

* The final mixture has to be homogenous (liquid) with a mass of 20 grams filled in a 10 ml syringe.
* Adjust the syringe in the electrospinning pump inside the machine.
* The shape of the drum is basically a flat sheet or cylindrical covered with an Aluminum foil.
* The tip needle must be a metal because metals are considered to be conductors.
* Set the initial Auto Feeding to 1.00 ml/hr.
* Have the distance between the tip needle and the drum was about 25 cm.
* Connect the pump to the positive wire (red) with a 15 KV. Then connecting the black wire to the to the drum with 10 KV.
* Adjust the temperature and the auto feeding to 0.3 ml/hr, noticing that increasing the feeding rate, fibers become thick and uniform and vice versa.
* Set up the PAV and DMF solvent at a temperature of 55 degrees Celsius and the drum to 350 rpm with a magnetic power.
* The time it took to produce fiber of 45 to 60 min.
* Finally, the fiber will be produced on the aluminum foil which was covered on the drum. Conclusion:

After all, we have found out a way to generate fiber using the electrospinning machine. We have used a 10%

PVA polymer into account for this process. After 60 minutes or less, fiber will be generated inside the machine and specially over the drum.

**Elmer Romero**

Faculty Mentor: Kandatege Wimalasena Fairmount College of Liberal Arts & Sciences

Natural Sciences & Engineering Poster Presentation

# Measurement of potential Parkinsonian Toxin uptake in C. elegans using HPLC and microscopy techniques.

**Abstract:** Parkinson’s is a neurodegenerative disease that is prevalent in older generations and currently has no cure. Parkinson’s is correlated to cell death in specific dopaminergic neurons in the substantia nigra of humans. The death of these cells causes a decrease or even complete absence of dopamine in the brain which leads to impaired motor movement, rigidity, and tremors, which are defining characteristic symptoms of Parkinson’s.

This illness has been known to have a genetic component that makes people more prone to developing it, however, it has been found that environmental factors may play a greater role in development of the disease.

One compound, 1-methyl-4-phenylpyridinium (MPP+), has been studied because it inhibits complex 1 in mitochondria, and has been found to cause oxidative damage in dopaminergic cells. MPP+ has since been used as a model for the environmental causes of PD and its mechanism of action hosts a variety of mysteries. Our research consists of studying the chemical uptake of MPP+ and its derivatives in the model organism Caenorhabditis elegans and how they lead to further degeneration of these dopaminergic neurons. In addition to uptake measurements via HPLC, microscopy is used to attest for uptake and neurological damage. The nematodes are assessed under the microscope and their axons are checked for blebbing, a bulge/protrusion in the plasma membrane indicating neuronal degeneration.

**Ashlie Salinas**

Co-Author: Alisha Prince

Faculty Mentor: David J. McDonald Fairmount College of Liberal Arts & Sciences

Natural Sciences & Engineering Poster Presentation

# EVALUATING SYNERGISTIC PROPERTIES BETWEEN NEEM AND METHYLGLYOXAL AGAINST STREPTOCOCCUS MUTANS

**Abstract:** A common method for controlling troublesome bacteria is through the use of antimicrobial substances. A frequent human problem, dental caries, or tooth decay, results when oral bacteria adhere to the tooth surface. They pose a significant problem where, if left untreated, they may cause severe damage to teeth and surrounding areas. The use of natural substances for their antimicrobial activity is beneficial because they are easily accessible and provide affordability plus fewer side effects compared to synthetic substances.

Additionally, natural substances used in combination may equate to greater antimicrobial activity than when used alone. Both Azadirachta indica, also known as Neem, and methylglyoxal, a major component in Manuka honey, have been shown to have antibacterial properties, however, there is not much information on their properties when used together. This experiment was done to evaluate whether these two natural substances possess synergistic antimicrobial action against Streptococcus mutans, the primary culprit of dental caries. A synergy testing method was performed via a checkerboard assay as a means of visualizing the combined antimicrobial effects of these two substances. Multiple methods exist for interpreting checkerboard synergy testing, and in the case of this experiment, three common methods were explored. Results indicate that two of the three methods show synergistic action, while the third method was inconclusive. Natural substances possessing synergistic activities against Streptococcus mutans could be a notable step forward in targeting and treating dental caries worldwide. However, further testing will be needed for an accurate understanding of Neem and methylglyoxal’s combined antimicrobial effects.

**Christopher Seirer**

Faculty Mentor: Dr. John Watkins College of Engineering

Natural Sciences & Engineering Poster Presentation

# Automated Altitude Control Via a Raspberry Pi

**Abstract:** AUTOMATED ALTITUDE CONTROL VIA A RASPBERRY PI

Participant: Christopher Seirer

Department and College: EECS, College of Engineering

For this research project, I wanted to learn how to implement a closed loop control system for the altitude portion of an autopilot system. I began by researching how closed loop control systems worked and the mathematics required to model them. For part of my research, I studied how control systems could be implemented using code. This helped me gain a better understanding of the complexity of control systems.

From this research, I found that a Proportional Integral Derivative (PID) controller would be appropriate for my project. I decided to implement the PID controller in Python on a Raspberry Pi single-board computer so that It would be light enough to be attached to a drone. An accelerometer, gyroscope and a barometer where chosen to measure that attitude and altitude of the drone. These sensors provided very accurate readings for both attitude and altitude. Through this research, I learned about autopilots, in general, and, more specifically, what is required to implement a closed loop control system. I have developed a greater understanding of the field and believe that I have met the goals set out for this research.

**Connor Shannon**

Faculty Mentor: David Long College of Engineering

Natural Sciences & Engineering Poster Presentation

# Comparison of Fluid Shear Patterns on HMEC-1 Morphology

**Abstract:** Mechanobiology is an emerging field of study that focuses on how mechanical forces affect cellular structure, function, and signaling. The purpose of this study is to investigate the role of mechanobiology, specifically shear stress, on the morphological changes of human dermal microvascular endothelial cells.

HMECs will be subjected to two distinct flow patterns and compared to a static control group. Image and data processing are currently being conducted. Many studies suggest that in areas of low shear stress in arteries, plaque tends to build up. These diseased areas have a disturbed flow pattern. Healthier areas have a steady laminar flow rate. Comparison of the diseased state with the healthy state will be the goal of this research.

**Minh Tran-Nguyen**

Co-Author: Weslin Camden

Faculty Mentor: Mark A. Schneegurt, PhD Fairmount College of Liberal Arts & Sciences Natural Sciences & Engineering Poster Presentation

# Bacterial Keratinase Enzyme for the Treatment of Nail and Skin Disease

**Abstract:** Nail and skin tissues, rich in keratin, can be impermeable to the drugs needed to treat fungal infections or underlying lesions. A variety of dermatological conditions are characterized by hypertrophy of keratotic tissues resulting in discomfort or aesthetic impairment of the afflicted, including onychomycoses, actinic keratoses, keratosis pilaris, and onychogryphosis. In nail fungal infections, fungi often embed themselves within the nail matrix, making it challenging to eradicate the infection with topical treatment.

Keratinase enzymes have the potential to loosen nail (and keratotic) tissue, such that topical antifungal drugs can penetrate. A collection of ~ 100 bacterial we isolated from wild bird feathers produce extracellular proteases. The most well-studied keratinolytic organism, Bacillus lichenformis PW1, is used as a positive control for keratinase production. Feather microorganisms have been screened for their ability to degrade whole delipidized feathers in culture, for caseinolytic affinity of extracellular proteases on milk agar, and for keratolytic affinity of extracellular proteases on feather powder agar. The results of these tests have identified 5 novel isolates that display an encouraging ability to degrade keratotic material. We are currently refining a ninhydrin assay to quantify free-amino acid release from degraded whole feathers as a measure of keratinase activity for each promising organism to select the most potent enzymes extracts. Our goal for this period is to advance assay development, identify the most productive microbes and active enzymes, as well as move toward testing treatments on model nail infections using keratinases and antifungal drugs. We will test nail mechanical properties and porosity in collaboration with WSU engineering and a dermatologist.

**Zaid Alashqar**

Faculty Mentor: ANIL MAHAPATRO College of Engineering

Natural Sciences and Engineering Oral Presentation

# INVESTIGATING THE EFFECTIVENESS OF DLP STEREOLITHOGRAPHY AS COMPARED TO TRADITIONAL LASER STEREOLITHOGRAPHY 3D PRINTING

**Abstract:** INVESTIGATING THE EFFECTIVENESS OF DLP STEREOLITHOGRAPHY AS COMPARED TO TRADITIONAL LASER STEREOLITHOGRAPHY 3D PRINTING

Zaid Alashqar1, Anil Mahapatro1

Department of Biomedical Engineering, Wichita State University, Wichita, KS.

Background: 3D printing is an additive manufacturing (AM) technique that constructs a solid object from a CAD design. The aim of the study is to investigate the effect of different process parameters i.e. number of layers, post curing conditions, and building orientation between UV laser 3D printer and digital light 3D printer on printed specimen properties and to create new biocompatible resin material that has curing capabilities comparable to commercial resins.

Methods: ISO (527-2 5A) samples were printed using both manufacturing techniques at different layer thickness, 0.1, 0.05, and 0.025 mm. Swelling measurements were recorded. Then, Fourier-Transform Infrared Spectroscopy (FTIR) was obtained from 64 scans at 4cm-1 resolution to determine the conversion effectiveness of C=C after UV light exposure by the two 3D printers. Specimens were then post cured at 10, 20, and 30 minutes and studied using swelling measurements and FTIR. New methacrylate-based resins are being created and its curing degree will be compared to the commercial resin.

Results: Commercial specimens showed optimal curing. FTIR results indicated increased curing with increasing the number of layers and post curing time. Novel methacrylate-based resins formulations were successfully constructed and cured using a UV chamber at 405nm.

Summary/Conclusion: Failure of the samples to swell indicates optimal curing of the specimens. In addition, the decrease in the 1635 cm-1 C=C peak as compared to the uncured resin indicated higher curing of the resin at lower layer thickness and higher post curing times.

**Nathan Albu**

Co-Author: Jacob Keese

Faculty Mentor: Dr. Gisuk Hwang College of Engineering

Natural Sciences and Engineering Oral Presentation

# Bimodal, Thin Wick Structures for High Heat Flux Two-Phase Thermal Control Systems

**Abstract:** Modern electronic devices and power systems in space technologies dissipate large amounts of heat through small surface areas, which requires advanced thermal control systems with high heat flux capabilities. Two-phase thermal control systems, such as heat pipes and vapor chambers, offer reliable high heat flux cooling capabilities. The thin wick structures inside these devices are key to their effective operation. This is because the wick structures supply liquid to the heated surface through capillary action, preventing surface dry out and overheating. The objective of this study was to optimize the capillary pumping ability of micro-scale wick structures. More specifically, the effect of changing particle size, thickness, and bi-modal particle size distribution was measured experimentally. These factors were chosen since very little research has been done on them in the scientific literature.

To perform this study, the wicks were manufactured in-house, then tested using a custom experiment setup. The wick structures are made of sintered spherical copper particles. Wicking ability is measured using the rate-of- rise test, which involves partially submerging the sample in liquid and recording the spontaneous liquid rise due

to capillary suction. The results showed that increased particle size and wick thickness improve wicking ability. In addition, the most important result was wicks with two particle sizes mixed (bi-modal distribution) show drastically improved performance as compared to uniform wicks. This knowledge will provide insight into optimal designs of thermal management systems by showing how particle size, wick thickness, and particle size distribution affect wicking performance.

**Evan Boutz**

Faculty Mentor: Gisuk Hwang College of Engineering

Natural Sciences and Engineering Oral Presentation

# Understanding of Adsorption-Capillary Transition in Heterogeneous Nanoporous Structures

**Abstract:** Fundamental understandings of adsorption-capillary transitions in nanoporous structures are crucial to optimal material design and operations in energy and environmental systems. A main technical challenge lies in a significant hysteresis on adsorption-capillary transition between capillary condensation and evaporation.

The previous study has shown that the structural/material heterogeneity minimizes the hysteresis in Argon-filled Platinum-based nanogap. However, the experimental demonstration of such a mechanism is challenging due to limited manufacturability for the Pt-based nanostructures. To overcome this challenge, adsorption-capillary transitions in Ar-filled Silicon-based heterogeneous nanoporous structures are performed using Grand Canonical Monte Carlo (GCMC) simulation. The adsorption-capillary transition is predicted, by controlling Argon molecules for desired chemical potential (temperature and pressure). This study shows that the adsorption-capillary transition, with a nanogap size of 10nm, occurs at 80K and 115K, respectively. When a single nanopillar, with dimensions of 5.4nm by 5.4nm by 10.8nm, was added to the bottom surface, the capillary transition occurs at 75K and 120K, respectively, which is an even larger amount of difference than the two bare surfaces. However, when a second nanopillar is added, i.e., a pillar on each surface, the transition occurs at 75K without the hysteresis. The extended surface area with the pillar promotes the capillary evaporation and condensation, which in turn results in the minimal hysteresis. The simulation results provide a deep insight into the tailored adsorption-capillary transition using heterogeneous nanoporous structures.

**Chimuka Cheepa**

Faculty Mentor: Atri Dutta College of Engineering

Natural Sciences and Engineering Oral Presentation

# Performance Characterization of a Reaction-Wheel-Actuated Air-Bearing Platform

**Abstract:** An Attitude Determination and Control System (ADCS) is an important subsystem onboard a spacecraft, with the specific function of ensuring that a spacecraft meets its orientation requirements. The ability of an ADCS to correct a spacecraft’s attitude perturbation is accomplished by actuators. The most commonly utilized actuator onboard a spacecraft is the reaction wheel, which stabilizes a spacecraft’s attitude through angular momentum storage by maintaining a specific spin rate. However, this characteristic of momentum storage has its drawback in that reaction wheels get saturated after reaching the maximum spin rate determined by the electric motor. The spacecraft then needs to desaturate or de-spin the wheel by using thrusters, resulting in fuel consumption. In this presentation, an air-bearing platform to understand spacecraft attitude dynamics is

presented, along with the performance characterization of a reaction-wheel. The platform was designed to test, examine and validate ADCS capabilities as part of ongoing research. The ADCS discussed here is part of a three degree of freedom air-bearing testbed capable of attitude measurement through sensors and allows for control through feedback. However, since sensors are susceptible to noise measurements resulting in distorted attitude data, a filtering technique of the Kalman type is introduced in the feedback loop to estimate the attitude by considering noisy measurement data. With a single reaction wheel about one axis and with the use of microcontroller devices, the testbed can be used to identify reaction wheel saturation limits and can also be used to test and validate ADCS data.

**Ethen Dixon**

Faculty Mentor: Hyuck Kwon College of Engineering

Natural Sciences and Engineering Oral Presentation

# Simulation of Channel Statistics-Dependent Frequency Hopping

**Abstract:** For wireless communication systems in hostile environments (i.e. in the presence of a jammer), one method for security and improved reception is the utilization of “frequency hopping” - in which the carrier frequency of the receiver and transmitter are shifted synchronously within the system’s bandwidth. This lowers the probability of a jammer interfering with a transmitted message. Traditionally, the frequency hopping pattern is cyclical (going through a list of carrier frequencies iteratively) or random. Dr. Hyuck Kwon from the Electrical Engineering department at WSU developed an algorithm (covered by US Patent no. 9,819,387 B2) that changes the frequency hopping pattern to reflect the performance of the transmitter and receiver at different carrier frequencies.

In this research project, Dr. Kwon’s algorithm is implemented using the simulation software NI LabVIEW coupled with two NI USRP-2392 transceiver modules. The Modulation scheme is FM M-ary phase shift keying (FM MPSK). In this simulation, the performance of the communication system at different frequencies was measured by instantaneous frequency offset at the receiver. The implementation of Dr. Kwon’s method is then compared to the use of a cyclical frequency hopping pattern. After at least 2 iterations of altering the frequency hopping pattern with respect to the frequency offset, Kwon’s method generates patterns that out- perform the traditional frequency hopping patterns. This research therefore supports Dr. Kwon’s patented technology by showing its successful implementation in a laboratory environment.

**Anne Dowling**

Faculty Mentor: Dr. Jaydip Desai College of Engineering

Natural Sciences and Engineering Oral Presentation

# Implementation of Artificial Neural Networks to Classify Human Forearm Muscle Signals for Individual Finger Movement of a Robotic Hand

**Abstract:** Implementation of Artificial Neural Networks to Classify Human Forearm Muscle Signals for Individual Finger Movement of a Robotic Hand

By: Anne Dowling and Dr. Jaydip Desai

Artificial Neural Networks (ANNs) have been utilized in the engineering field to identify patterns from a given dataset. Powered prosthetics have specifically implemented them to detect muscle patterns; however, this has been achieved only for two patterns (open and closing). The objectives of this study were to acquire surface electromyography (sEMG) signals from human forearm muscles on fifteen participants, train Scaled Conjugate Gradient (SCG), Levenberg-Marquardt (LM), and Bayesian Regularization (BR) ANNs to extract eight features (six for fingers, hand close and hand open), and implement real-time control algorithms to individual finger movement of the YouBionic robotic hand using Arduino Mega 2560 microcontroller and Simulink. An Institutional Review Board approval was acquired prior to human subject testing. Each participant sat at a computer desk and performed individual finger movements while wearing a Myoband; a wireless noninvasive band of eight sEMG sensors. Results shows that the BR training algorithm outperforms the SCG and the LM training algorithms for accuracy in identifying the individual finger movements. The lowest and highest percentages in the confusion matrix were 70.4%, 89.9%, 69.2%, 89.3%, 64.3%, and 84.6% for BR, LM, and SCG training algorithms respectively. Future work includes testing these algorithms on persons with disabilities and integration of deep convolutional neural networks for higher accuracy.

**Erica Lill**

Faculty Mentor: Donna Robinson College of Health Professions

Natural Sciences and Engineering Oral Presentation

# Effects of Dietary Fiber on Colorectal Cancer

**Abstract:** The purpose of this literature review is to determine whether increasing daily fiber intake to 25 grams per day reduces risk for colon cancer in American Women compared to their usual fiber intake of 15 grams per day. Eight research articles were analyzed in this literature review that consist of meta-analyzes and prospective studies to determine if American women should increase their dietary fiber intake to 25 grams per day. These research articles were found using NCBI, PubMed, and CINAHL databases. Seven out of the eight research articles reviewed suggest that increasing daily dietary fiber intake is inversely associated with a reduced risk of colorectal cancer. While many of the articles reviewed were vague about how many grams of daily dietary fiber is needed to reduce colorectal cancer (CRC), two research articles suggested an increase of ten grams of dietary fiber per day is associated with a reduced risk of CRC. In conclusion, research provides evidence to support a reduced risk of colorectal cancer in women who increase their dietary fiber intake from 15 grams to 25 grams per day.

**Hunter Picard**

Faculty Mentor: William C. Groutas Fairmount College of Liberal Arts & Sciences

Natural Sciences and Engineering Oral Presentation

**Synthesis of a Key Intermediate for Inhibitors of Norovirus 3CL Protease Abstract:** Synthesis of a Key Intermediate from Inhibitors of Norovirus 3CL Protease

Picard, Hunter, [1] Athri D. Rathnayake1, Yunjeong Kim2, Chamandi S. Dampalla1, Nhat Nguyen1, Anusha C. Galasiti Kankanamalage1, Nurjahan Mehzabeen3, Kevin P. Battaille4, Scott Lovell3, Kyeong-Ok Chang2, and William C. Groutas1

1Department of Chemistry, Wichita State University, Wichita, KS; 2College of Veterinary Medicine, Kansas State University, Manhattan, KS;3 IMCA-CAT, APS Argonne National Laboratory, Argonne, IL; 4Protein Structure Laboratory, The University of Kansas, KS.

Human noroviruses are the leading cause of acute gastroenteritis (‘stomach flu’) in the United States, resulting in greater than 20 million reported cases annually. The symptoms associated with norovirus infection (vomiting, diarrhea, and generalized gastrointestinal discomfort) are especially dangerous for young children, immunocompromised patients, and the elderly. The impact of norovirus on public health worldwide is significant and further exacerbated by the current lack of therapeutics or prophylactics. Targeting norovirus 3CL protease (3CLpro), an enzyme essential for virus replication, may lead to the emergence of effective anti- norovirus therapeutics. A novel series of dipeptidyl transition-state inhibitors of 3CLpro was designed and shown to have efficacy in a small animal model of norovirus infection. A key intermediate, the “glutamine surrogate,” is present in all norovirus and Coronavirus inhibitors synthesized by the Groutas laboratory and is the focus of this undergraduate research. The synthesis of this intermediate and integration into different molecular structures affords many potential inhibitors, with our overall goal being to obtain a suitable clinical candidate for a norovirus therapeutic.

**Richard Sandefur**

Co-Author: Ashley DeBrot Li Yao Faculty Mentor: Li Yao

Fairmount College of Liberal Arts & Sciences Natural Sciences and Engineering Oral Presentation

# The interaction of nanofibers and oligodendrocyte progenitor cells derived from induced pluripotent stem cells

**Abstract:** The interaction of nanofibers and oligodendrocyte progenitor cells derived from induced pluripotent stem cells

Richard Sandefur, Ashley DeBrot, Li Yao

Department of Biological Sciences, Wichita State University

Induced pluripotent stem cells (iPSCs) are generated from somatic cells and could provide a new source of patient-specific stem cells for replacement therapies. Though human iPSC-derived stem cell therapies have been used in various in vivo models of neurodegenerative disorders, few studies have evaluated efficacy of iPSC- derived neural stem cells (NSC) transplantation in models of spinal cord injury (SCI). Additionally, the application of human iPSCs in SCI research of preclinical animal model has been limited by the immune- response to xenografts. The nanofibers and continuous porous structure generated by electrospinning enhance neural regeneration because the nanofibers mimic the extracellular matrix and provide guidance for axonal growth at nanolevels. Nanofiber-based scaffolds may simultaneously provide immediate contact guidance for neural regeneration and act as a vehicle for therapeutic cell delivery. Additionally, nanofibers can serve as a neuron-free model to study myelination of oligodendrocytes. In our preliminary study, nanofibers that were fabricated using a polycaprolactone and gelatin copolymer provided a scaffold for the growth of oligodendrocyte progenitor cell (OPC) derived from iPSCs-NSC. This study showed that the nanofibers can support OPC growth. OPCs maintained their phenotype and viability on nanofibers. Cells were positively labeled with OPC markers A2B5 and MBP.

**Amanda Scroggins**

Co-Author: Brittany Wojciechowski Trenton Sample Faculty Mentor: Dr. Bhisham Sharma

College of Engineering

Natural Sciences and Engineering Oral Presentation

# Acoustical Properties of 3D Printed Functionally-Graded Porous Structures with Triply Periodic Minimal Surfaces

**Abstract:** Structures with triply periodic minimal surfaces (TPMS) have recently been shown to possess attractive mechanical properties such as high stiffness-to-density and strength-to-density ratios. In this study, we investigate the absorption coefficient of porous TPMS structures with a view towards their possible use as acoustic liners for reducing aircraft engine noise. Porous structures with controlled microstructures were fabricated for experimental testing using MATLAB and a Form 2 stereolithographic 3D printer. The sound absorption coefficient of the fabricated structures was measured using a two-microphone impedance tube setup and in accordance with ASTM E1050-12. The effect of surface topology on the acoustic properties was characterized by testing four different TPMS geometries. The gyroid geometry was then selected to study the effect of relative density on its acoustic properties. Finally, the effect of functionally-graded through-thickness relative density variation was studied. The obtained results show that TPMS structures offer a novel path towards the design of multifunctional structures with good mechanical and acoustical properties.

**Jing Wei Tan**

Faculty Mentor: Dr. Yimesker Yihun College of Engineering

Natural Sciences and Engineering Oral Presentation

# FMG Driven Sensory Feedback to Prosthetic Hand Users

**Abstract:** In the United States, it is estimated that nearly one in every 300 people will undergo an amputation with 23% of those being on the arm down to the hand. After the limb amputation, performing used-to-be simple tasks becomes challenging and time consuming. Even with the assistance of prosthetic limbs, amputees are still unable to perform simple tasks with ease, this is partly due to the lack of touch sensations/feedback. Sensory feedback is a critical component that makes it possible for human extremities to perform various daily activities. Without feedback, simple tasks like holding a cup or picking up a piece of food become very challenging. The purpose of this research is to explore a technology that can use the human physiological information, such as Force Myography (FMG) signals to provide sensory feedback to prosthetic hand users. The study is established based on the principle that during the user’s intent to move the hand, the remaining limbs in the arm move by recruiting a specific group of muscles. These muscles will show a change in the cross-sectional area; and as the muscle cross-sectional area varies, FMG signals are generated which can be captured through the bending of piezoelectric sensors. The correlation between the amplitude of the FMG signals and intensity of pressure on the prosthetic fingertips are then computed; and a dynamic relation/model is established through system identification in MATLAB. The model is then programmed into the Arduino microcontroller so that a real-time and proportional force feedback is channeled to amputees through a micro actuator. The preliminary results have shown promises for the concept and opens the door for future research. Applying advanced signal processing and classification techniques will refine the findings to better capture and correlate the force

sensitivities with the sensory feedback. Relating touch sensations with human intents through physiological parameters helps amputees to control the amount of force to be exerted during a grasping task.

**Derek Vonarx**

Faculty Mentor: David Eichhorn

Fairmount College of Liberal Arts & Sciences Natural Sciences and Engineering Oral Presentation

# Modeling of Enzymatic Active Sites using Pyrazole-Containing Metal Complexes

**Abstract:** A chemical compound containing a metal is called a metal complex and consists of the metal ion and organic molecules called ligands. These interacting ligands vary widely in structure. One such ligand is called pyrazole. It is comprised of a 5-membered ring of three carbon atoms and two adjacent nitrogen atoms. The significance of this compound is that it can easily interact with the metal ion to form a bond through the nitrogen atom. Furthermore, the pyrazole ligand has a similar structure to the amino acid histidine. Therefore, metal complexes that contain pyrazole can serve as models for those involved in biological processes. In addition, the pyrazole ligand can be substituted, meaning that different elements can replace others. These substitutions can have unique and defining characteristics that will significantly alter the resulting metal complex. One such substitution is a cyano group, carbon triply bound to a nitrogen (C≡N). In my research project, I successfully synthesized 3-ethyl-4-cyanopyrazole. This is a disubstituted pyrazole in which an ethyl group (CH2CH¬3) and a cyano group (C≡N) are directly attached to the ring. This ligand was characterized by infrared and mass spectroscopy. This ligand was reacted with two metal salts, copper chloride and cobalt chloride, to produce metal complexes. The cobalt complex was successfully synthesized and characterized by mass spectroscopy and x-ray crystallography. The copper complex will be explored and characterized to further understanding its properties.

**Samadini Weerasekara Arachchilage**

Faculty Mentor: Dr. Atri Dutta College of Engineering

Natural Sciences and Engineering Oral Presentation

# A Cube- satellite propulsion experimental test bed

**Abstract:** Cube satellite is a miniaturized satellite which typically in 3U form factor, for which the volume is 10x10x30 cm^3 with a weight of 1-10 kg and widely applied for validation of science and technology concepts in space and for communication purposes. The propulsion system plays a very important role for any satellite, hence understanding miniaturized propulsion systems are crucial for further Cube-satellite missions. This talk presents a cold gas propulsion system that involves flow of compressed gas through a nozzle and one that has been tested using readily available gases such as air, Nitrogen and Carbon-dioxide. Two important properties for a propulsion system are thrust generated and specific impulse. In addition, propulsion generates shock waves as a result of thrusting, which can be photographed using Schlieren technique. The talk will provide an overview of the integrated propulsion system, thrust and imaging system. These observations will help us to determine the Specific impulse of the corresponding propellant, which identifies the efficiency of the propulsion system. This test bed will be helpful for us to understand the efficiency of different propellants for certain cube-satellite missions and characterization of any Cube-Sat propulsion system development at WSU.

**Sophie Bachman**

Co-Author: Alyssa Scott Faculty Mentor: Margaret Dawe

Fairmount College of Liberal Arts & Sciences Social Sciences & Humanities Oral Presentation

# Examination of the Creative Writing Process

**Abstract:** This study of the creative writing process, specifically of poetry, aims to understand whether the preliminary processes behind creative writing are vital to the success of the final draft and if so, how they affect the writer and their skills. To conduct this study in a classroom setting we read from the textbook, practiced with writing prompts, wrote handwritten rough drafts, did peer review sessions, and revised to create the final draft. Through practice with writing prompts and making multiple rough drafts we became more comfortable with the processes of writing. We were also able to explore more of our creativity through these exercises.

Whereas through doing peer reviews and revisions we were better able to understand how our readers interpreted our writing. Their critiques allowed us to adapt our writing to better connect emotionally with our readers and to improve the overall understanding of the poem. We found that the more we wrote, the better we wrote. Over approximately a seven-week period we saw significant development in both our writing techniques and writing skills. We also found that we became better at connecting with the readers through our use of language. The ability of a writer to draft, edit, and revise significantly increases their ability to write work which connects emotionally to their readers and comments in a powerful way on the human condition.

**Holly Herda**

Co-Author:

Faculty Mentor: Rannfrid Thelle

Fairmount College of Liberal Arts & Sciences Social Sciences & Humanities Oral Presentation

# Female Tricksters in the Old Testament

**Abstract:** The trickster is a character found in stories from virtually all cultures. The trickster can be male or female, malevolent, humorous, or both. They exist on the fringes of society, being different or disenfranchised in some way, and often possess secret knowledge that enables them to “get ahead.”

The Hebrew Bible (Old Testament) is no different. Tricksters abound, both male and female, but particularly female. So, I ask: why are female tricksters so prevalent in the Old Testament? How do they differ from the male tricksters? How do they compare to the general trickster archetype?

To explore this, I survey each book of the Old Testament, cataloging every character that engages in trickery or deceit. I compare their circumstances and motives and demonstrate that while the male tricksters stick closely to the traditional trickster archetype, utilizing trickery for self-preservation, personal gain, or amusement, the female tricksters defy norms. As opposed to the men, their actions are never malevolent or humorous, but often desperate, last-ditch attempts to protect their husbands, families, and communities.

**Bryant Nguyen**

Co-Author:

Faculty Mentor: Dr. Soon Lee College of Applied Studies

Social Sciences & Humanities Oral Presentation

# Rewinding Back to Paper

**Abstract:** Within a classroom, there are various methods of teaching styles that teachers can implement for their students. Primarily, depending on the school, teachers are allowed to use a wide variety of resources, including various technologies like iPads or Chromebooks. However, there are many classrooms that are dependent on the technologies. What if suddenly the classroom was unable to handle the technologies and the teachers must improvise by providing paper assignments? What would become of the students’ learning? The study is conducted within a classroom that provides sufficient technologies for the students to use during weekly assignments and lessons. Without informing the students, one experimental class period will begin learning through primarily paper lessons and assignments, while another similar class period, in terms of grades, are the control group and continue to learn through technologies. Through careful observation through this research, the experimental group performed with much enthusiasm due to the sudden change in the classroom, giving a spark of motivation to learn while the control group did not change. In the end, a formal summative assessment was given to the two groups to measure the percentage growth from the starting point (pre- assessment) to end point. In conclusion, the experimental paper group performed with a higher-class average on the summative assessment and a larger percent increase from the pre-assessment than the control group.

Although there are various factors that can affect the outcome of the results, the paper-based group outperformed the technology-based group.

**Blake Overman**

Co-Author:

Faculty Mentor: Dr. Katie Lanning College of Applied Studies

Social Sciences & Humanities Oral Presentation

# Concealing the Beast Inside: Medieval Queerness and Monstrosity in Marie de France's Bisclavret

**Abstract:** Marie de France’s werewolf poem, Bisclavret, provides an opportunity to examine medieval sentiment towards homosexuality. Reading the titular character, Bisclavret, in a queer way reveals the complexities of both homosexuality and monstrosity, as well as how these discussions overlapped in the period. How does Bisclavret depict a monster with dual-identity of man and beast to symbolize a queer man and his salvation in a homosexual relationship? Queer theorists have identified the innate queerness of monstrosity in appearance and circumstance, which supports an understanding of Bisclavret as a queer character. Primary sources reveal a divided time period that both justified and condemned homosexuality through the study of beasts. Documents that examine the duality of man and beast, monsters that blur this duality, and homosexuality in the context of the medieval times conceptualize Bisclavret’s role in answering these questions concerning medieval queerness. The dual nature of Bisclavret’s character conveys both a genuine and superficial identity that coincides with the relationships in the poem. His identity shifts depending on whether he is clothed or undressed. The bareness of the beast exhibits both personal authenticity and queer sexuality in contrast to the

covered man he is otherwise. In hiding his bestial persona from his wife, he is able to exhibit control over the conflicting identities. The superficial relationship to his wife leads to Bisclavret’s downfall, betrayal, and loss of agency over his bestial nature. Only the queenless king is able to accept and appreciate this bestial identity and provides salvation in the restoration of Bisclavret’s humanity and agency. The positive treatment of the monstrous character precedes a modern understanding of queerness in literature as not innately evil. Bisclavret holds immense value in scholarship on medieval British culture and insights into transitory understandings of queerness that signal a lasting impact on queer and monstrous literature.

**Elayne Rye**

Faculty Mentor: Dr. Crystal Dozier Fairmount College of Liberal Arts & Sciences

Social Sciences & Humanities Oral Presentation

# Ethnobotany of the Southern Plains

**Abstract:** The purpose of this research was to discover the ethnobotany of the Southern Plains Indians, specifically the Wichita tribe(s). The study of the plants native to the Southern Plains is important to add to our understanding of the Wichita culture, and to compare current vegetation to the botanic diversity of the past.

Knowing the plants found in archaeological sites, as well as which plants are edible or medicinal, can lead to speculating and understanding how these plants have been used by indigenous peoples. The use of electronic databases and hardcopy sources were used to research the plants and their uses in the Kansas and Oklahoma areas. A number of sources were consulted but not much data was found that tied to the Wichita tribe(s) specifically, however a substantial amount of plants and their uses were found for the Southern Plains area. Due to the difficulty of associating the botanical history with the Wichita, my research focused more on the Kansas and Oklahoma regions.

Keywords: Southern Plains, ethnobotany, Wichita, Kansas, Oklahoma, botanical

**Christian Saldana**

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Social Sciences & Humanities Oral Presentation

# Effectiveness of Foreign Aid Channels in Boosting Economic Growth in Developing Economies

**Abstract:** This study analyzes the impact of Net Official Development Assistance (ODA), Multilateral ODA, and Bilateral ODA has on developing economies growth. It includes 68 countries from 1990 to 2015. With trillions of dollars being used for foreign aid throughout the decades, it is important to analyze whether it is creating the intended goal of economic growth. The independent variables analyzed were capital formation from 1990 to 2015, GDP per capita in 1990, average secondary education attainment in 1990, population growth from 1990 to 2015, and average Net ODA, Multilateral ODA, and Bilateral ODA as a fraction of GNI from 1990 to 2015. The dependent variable was GDP per capita growth from 1990 to 2015. The data collected from the World Bank Open Data was measured with a least squares regression. Net, Multilateral, and Bilateral ODA all had negative coefficients and were significant at the 10% level. Capital formation was positive and significant at the 5% level. Population growth and initial GDP per capita were both negative and significant.

Secondary education level was also negative and significant. This study supports the idea that foreign aid is

ineffective and possibly detrimental to developing economies. The result suggests that foreign aid keeps developing economies from growing by removing incentives that drive economic growth and by their susceptibility to be funneled out by corrupt government workers. Further research needs to be done to confirm this finding by analyzing the role of corruption in recipient countries government and remove the possibility of endogeneity.

**Ereymi Crystal Santana Morales** Co-Author: Violet Nguyen Li Wang Faculty Mentor: Kyoung Hag Lee

Fairmount College of Liberal Arts & Sciences Social Sciences & Humanities Oral Presentation

# Limited English Proficiency, Health Literacy, and Depression among Asian Immigrant Elders

**Abstract:** Purpose: Barriers to the use of mental health services may contribute to the increased level of mental health disparities. Among Asian immigrant elders, there is a lack of research examining how barriers, such as limited English proficiency and low health literacy are associated with depressive symptoms. This study explored this topic.

Methods: This study surveyed 60 older adults from three Kansas Asian communities in Spring, 2019. Its dependent variable is depressive symptoms. The independent variables are limited English language proficiency (speaking, writing, reading, and listening skills) and low health literacy (medical forms, written information, and medical materials). It employed descriptive statistics and correlation methods.

Results: Participant ages ranged from 50 to 95 years old, with a mean of 68.65 years. A high percentage of participants answered poor speaking (42.4%), poor reading (38.6%), poor writing (39%), and poor listening (35.4%). Additionally, a high percentage of participants indicated no confidence to fill out medical forms (44.1%), difficulty understanding written information (44.3%), and difficulty reading medical materials (63.6%). Also, 11.4% had moderate depressive symptoms and 2.3% had severe depressive symptoms. The correlation results revealed that poor reading, poor writing, and poor listening skills were significantly associated with an increase in depressive symptoms. Difficulty understanding written information was significantly associated with an increase in depressive symptoms.

Conclusion: The study is significant in that its results will provide important insights for social work practitioners or health care providers to minimize language barriers, improve depression literacy, and reduce depressive symptoms among Asian immigrant elders.

**Jeromiah Taylor**

Faculty Mentor: Dr. Rannfrid I. Thelle Fairmount College of Liberal Arts & Sciences Social Sciences & Humanities Oral Presentation

# Jesus and the Syro-Phoenecian Woman: Hegemonic Masculinity, Heteroglossia, and the Power of Resistance.

**Abstract:** In this presentation I will be discussing the story of Jesus and the Syrophoenecian woman in Mar 7: 24-30. My analysis focuses on gender and power in the text. I explore to what extent Jesus’s masculinity is

hegemonic. In addition, I use the concept of heteroglossia to evaluate the woman’s speech as a form of linguistically diverse self-advocacy. My reading of the text is supplemented by secondary sources. I place my analysis squarely in the Womanist context, while adding to the developing body of literature that focuses on biblical masculinity. In addition to gender and language in the selected text, I identify an interesting Markan theme: a unique power found in people’s interaction with Jesus independent of Jesus’s own power. I call this theme of spiritual autonomy in Mark the “Power of Resistance.”

**Inneke Vargas**

Faculty Mentor: Dr. Amy Chesser

Fairmount College of Liberal Arts & Sciences Social Sciences & Humanities Oral Presentation

# Women Invilved Network (WIN for Kansas): Community Collaboration to Create Health Equity

**Abstract:** Community need and research illustrate a deprivation of equitable women’s healthcare initiatives in America. Patients should be capable of making informed health decisions, yet there exists a chasm in women’s healthcare between health literacy and the utilization of programs which support informed patient choices. This project is being conducted to identify and deconstruct the barriers women in the Sedgwick County area experience when seeking appropriate healthcare options. In conjunction with the Patient-Centered Outcomes Research Institute (PCORI) researchers are exploring the feasibility of creating a Women Involved Network in a Midwestern state whose purpose will be joining patients and community stakeholders to improve access and assess if educational interventions positively affect health disparities. Short term outcomes will be multifaceted to include accurately identifying priority health disparities, building community trust, and breaking down the identified community and institutional impediments. Long term outcomes include conclusively reducing health disparities, promoting health equity in perpetuity, and developing and sustaining a healthcare network to serve women. The enhancement of this network will serve as an unparalleled benefit to the urban and rural areas in Sedgwick County and will result in a net positive for both patients and providers.

**Elizabeth Vest**

Faculty Mentor: Dr. Mythili Menon College of Applied Studies

Social Sciences & Humanities Oral Presentation

# A Linguistic Approach to Religion and Sexuality

**Abstract:** Because there is a limited assessment of the linguistic inquiry within the context of religion and sexuality, this research project looks at the portrayal of sexuality within the Bible. Looking at both the Old and New Testaments, I assess the morphology, inter-language translations, and context of some instances of sexuality within the Bible using what are referred to as “clobber passages” used as homophobic religious rhetoric against the LGBT community. Specifically looking at the terms including sodomy and sodomite, Greek and Hebrew translations (or mistranslations) are analyzed on the basis of linguistic reasoning rather than a biased theological approach. Using different biblical translations to outline the skew of meaning within certain passages, the specific language and word order application within those contexts are also assessed, while also emphasizing the geographical location of biblical cities including Sodom, Kadesh, and Moloch, and the biblical and cultural practices traditional for each location.

**Karen Abshire-Gordon**

Faculty Mentor: Mercedes Lubbers-Payne Fairmount College of Liberal Arts & Sciences Social Sciences & Humanities Poster Presentation

# PAST AND PRESENT ELECTROSHOCK THERAPY: INHUMANE?

**Abstract:** This investigation explores the use of electroshock therapy (ECT) throughout history, the purposes for using ECT, the benefits and detriments in long-term effects, and the ramifications of using ECT, specifically in cognitive function and memory. Invented in the late 1930s in Italy, ECT has evolved through the years to become more humane and more focused. This study will seek to identify how ECT has improved and why it has become an effective treatment for certain psychiatric disorders. The research will evaluate supportive and opposing views in the continued use of ECT and will look into individual case studies as well as journal articles concerning the use and effects of ECT on patients for varying psychiatric disorders. This research will seek to follow a correlational design using quantitative data, using an abductive research approach to understand data analysis since the beginning of ECT.

**Katie Carley**

Faculty Mentor: Dr. Douglas Parham College of Health Professions

Social Sciences & Humanities Poster Presentation

# Patterns and Levels of Intensity in Young Children with Autism Spectrum Disorder

**Abstract:** This study explored how young children with Autism Spectrum Disorder (ASD) use speech intensity (perceived as loudness) when they produce words and sounds during communication with clinicians and the children’s parents. Children with ASD often have atypical prosody when compared to children without ASD. One area of prosody is intensity, which is perceived by listeners as loudness (sounds are considered “softer” or “louder”). There has been little research that investigates the intensity levels of children with ASD and how this contributes to their atypical prosody. We looked at differences in this acoustic measure

(a) among children diagnosed with ASD, and (b) between children with ASD and a control group of children without ASD. When looking at acoustic measurements of children with ASD, we predicted that there would be significant differences in speech intensity and the patterns of intensity compared to those of typically developing children. This is because children with ASD often have abrupt, unpredictable intonation that can be clinically described as louder, idiosyncratic bursts of speech sounds compared to those of typical developing children. Understanding intensity patterns could help speech-language pathologists develop practices that can help children with ASD achieve the desired intensity variability to produce speech sounds similar to those of typically developing children.

**Raven Hodges**

Faculty Mentor: Dr. Kyoung Lee

Fairmount College of Liberal Arts & Sciences Social Sciences & Humanities Poster Presentation

# The Effects of Mental Illness and Substance Abuse Amongst Homeless Veterans

**Abstract:** This paper explores how mental illness and substance abuse correlate, to cause an increase in the homeless veteran population. The specific mental illnesses that will be explored is posttraumatic stress disorder (PTSD); alcohol and drug abuse are the two forms of substance abuse that will be used within the research. This paper examines several articles, that explain comorbidity and how it has a significant effect on veterans. The information gathered is combined with reports from Veteran Affairs (VA), the Annual Homeless Assessment Report (AHAR) and the U.S. Conference Mayors’ Report to support the data that homelessness among the veteran populations is an area of concern for the united states government.

Keywords: alcohol abuse, drug abuse, homelessness, Kansas, mental illness, PTSD, posttraumatic stress disorder, substance abuse, veteran affairs, veterans

**William Kirby**

Faculty Mentor: Dr. Dozier

Fairmount College of Liberal Arts & Sciences Social Sciences & Humanities Poster Presentation

# THE IMPORTANCE OF DIGITAL COLLECTIONS

**Abstract:** The work conducted here is digitizing the collection of artifacts found at Shabbona Grove, Illinois. The procedure requires scanning type collection forms, field notes and other such documents filled during the excavation process. Photographing the discoveries was the next step in this process. The types of artifacts found at Shabbona Grove range from; children’s toys, glass, ceramics, shotgun shells/bullet casings, bone (animal), metal/ machinery, and cloth. Open access and the digitization of archaeological collections allows more individuals the ability to access and view a collection. This is important because it will greatly smooth research for future projects. Another reason why this is important is because it allows people the opportunity to observe the artifacts without having to be in person; further protecting and prolonging the preservation of important discoveries. Due to this reason it is important that all archaeological sites move towards digitizing records and finds and allowing open access to these newly digitized collections.