Oral presentations, Category A: primarily Sciences and Technology, Graduate

Oral presentations

Oral presentations, Category A: primarily Sciences and Technology, Graduate

Presenter: Shiva Bhardwaj

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Material Science

Title: Bimetallic Mix-phased Co-Fe Sulfide and Phosphide as Efficient Electrode Materials for Overall Water Splitting and Supercapacitor

Abstract: The major center of attraction in renewable energy technology is the designing of an efficient material for both electrocatalytic and supercapacitor (SC) applications. Herein, we report the simple hydrothermal method to synthesize cobalt-iron-based nanocomposites followed by sulfurization and phosphorization. The crystallinity of nanocomposites has been confirmed using X-ray diffraction, where crystalline nature improves from as-prepared to sulfurized to phosphorized. The as-synthesized CoFe-nanocomposite requires 263 mV overpotential for oxygen evolution reaction (OER) to reach a current density of 10 mA/cm^2, whereas the phosphorized requires 240 mV to reach 10 mA/cm^2. The hydrogen evolution reaction (HER) for CoFe-nanocomposite exhibits 208 mV overpotential at 10 mA/cm^2. Moreover, the results improved after phosphorization showing 186 mV to reach 10 mA/cm^2. The specific capacitance (C_{sp}) of as-synthesized nanocomposite is 120 F/g at 1 A/g, with a power density of 3752 W/kg and a maximum energy density of 4.3 Wh/kg. Furthermore, the phosphorized nanocomposite performs best by exhibiting 252 F/g at 1 A/g and the highest power and energy density of 4183 W/kg, 10.1 Wh/kg. This shows that the results get improved more than twice. The 97% capacitance retention after 5000 cycles shows cyclic stability of phosphorized CoFe. Our research thus offers cost-effective and highly efficient material for energy production and storage applications.

Presenter & First author: K.A.U. Madhushani

Co-authors: A.A.P.R. Perera, Wang Lin, and Ram K. Gupta

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: A low-cost KOH-activated carbon derived from polyaniline for symmetric supercapacitors with high energy density and power density.

Abstract: Supercapacitors have attracted great attention as electrochemical energy storage devices. To achieve a high electrochemical performance of supercapacitors, this research focuses on producing porous activated carbon from polyaniline (PANI) as an efficient electrode material for supercapacitors. Here, chemical oxidative polymerization was used for the synthesis of PANI. Consequently, the electrochemical window of the porous activated carbon was enhanced through the combination process of carbonization

and activation of PANI nanotubes with KOH. Moreover, the changes in surface area and porosity were examined via BET analysis for the samples having polyaniline to KOH ratios 1:0.5, 1:1, and 1:2. It was observed that the surface area and pore volume from as-synthesized PANI to chemically treated samples were significantly improved from 18 to 3525 m^2/g. All materials' electrochemical performance was tested using a three-electrode cell system and a symmetrical coin-cell device (SCCD). Electrodes made from PANI to KOH, 1:1 wt. ratio showed better electrochemical performances in an aqueous electrolyte (6M KOH) in both systems. This material exhibited the highest capacitance of 378 F/g (at 0.5 A/g) and 143 F/g (at 0.5 A/g) in the three-electrode system and SCCD, respectively. The SCCD achieved a maximum energy density of 23 Wh/kg and a maximum power density of 12 KW/kg. Further, this material has a higher stability, showing a good coulombic efficiency of about 99% with capacitance retention of 97% at 7 A/g current density after 10000 charge-discharge cycles. These results suggest the possibility of producing low-cost high-performance supercapacitors for commercial applications.

Presenter: Bobbi Monroe

Co-authors: Haley Price, Alexis Paynter, Andrew George, and Anuradha Ghosh

Faculty sponsor: Anuradha Ghosh

Student Status: Graduate

Major: Biology

Title: CHARACTERIZATION OF CULTURABLE BACTERIAL ISOLATES OBTAINED FROM GUANO OF GRAY BATS IN SOUTHEAST KANSAS FOLLOWING BIOCHEMICAL AND GENOMIC APPROACHES

Abstract: Humans have historically had an ambivalent relationship with bats. Bats perform important services by reducing populations of insect pests. They also act as reservoirs of diseases, as highlighted by the recent Coronavirus pandemic. This study aims to characterize the bacterial diversity associated with the Gray Bat (*Myotis grisescens*) in Southeast Kansas. A total of 32 bacterial isolates with different colony morphology were recovered from guano samples on tryptic soy agar media after enrichment. The majority (21/32, 65%) of isolates were Gram positive. All isolates were tested for growth on selective and differential media. Sugar fermentation profiles showed that 78% (25/32) fermented all four sugars, 9% (3/32) fermented three sugars, another 9% (3/32) fermented two sugars, and one isolate (3%) fermented only one sugar. Urea was hydrolyzed by seven (21%) isolates while one isolate (3%) was positive for indole production. Pooled isolates were sequenced using an Illumina miniSequencer. A total of 2,909,555 reads were completed. The most common genus being *Serratia* (26.36%) followed by *Achromobacter* (20.17%),

Lysinibacillus (19.93%), and *Bacillus* (17.01%). Currently, sequencing experiments are underway to determine the microbiota of male and female bats GI tract. Identification of known and novel bacteria/fungi in bats is important for prevention of disease spread and long-term preservation of bat populations.

Presenter: Rishabh Srivastava
Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Material Science

Title: Facile synthesis of metallic-P_2O_7 embedded on Nickel sheet for better trifunctional electrocatalyst and supercapacitor application

Abstract: NiP_2O_7, CoP_2O_7, and FeP_2O_7-based nano-composites are grown on conductive nickel sheets of definite size which can effectively enhance the electrical transport of charges and storage. Herein, Metal-based P_2O_7 nanoparticles are successfully synthesized on nickel foam by using a hydrothermal route. The synergistic effect between metal and P corroborates significant improvement in the catalytic activity as well as the electrochemical charge-storing ability of the material. Therefore, NiP_2O_7 exhibits outstanding oxygen evolution reaction, urea oxidation reaction, and hydrogen evolution reaction with the least overpotential of 220, 76, and 241 mV to draw a current density of 10 mA/cm^2. The nanocomposite was further examined under the prelims of the supercapacitor and found that the NiP_2O_7 outcast the highest specific capacitance with the optimized cyclic stability. Such a strategy for fabricating nanocomposite is efficient to produce and store energy economically and feasibly. Therefore, this work could be extended to construct electrodes for electrolyzers and asymmetric supercapacitors.

Oral presentations, Category A: primarily Sciences and Technology, Undergraduate

Presenter: James Loomis

Faculty sponsors: Andrew George, Christine Brodsky

Student Status: Undergraduate

Major: Biology

Title: Evaluating Effectiveness of AHDriFT System for Surveying Small Mammal and Herpetofauna Communities on Reclaimed Mined Lands

Abstract: Current methods for surveying herpetofauna and small mammals include drift fence arrays with funnel traps or pitfalls traps, visual encounter surveys, and other live-trapping Techniques. These methods can be labor intensive and often result in mortality of captured animals. While game cameras have become an efficient method for passively surveying medium and large mammals, attempts to survey herpetofauna and small mammals with camera traps have had limited success. We used the recently developed AHDriFT surveying method to monitor herpetofauna on reclaimed mined lands in southeast Kansas. Using 18 game cameras suspended in buckets deployed across 6 sites, we detected 14 reptile, 12 mammal, 5 amphibian, and 4 avian species. We assessed species richness (R), evenness (J), and the Shannon diversity index (H) for each site, providing information to better understand community structure. The use of cameras dramatically reduced time spent sampling in the field and prevented mortality of organisms recorded, while still obtaining data necessary to determine diversity measures. Initial results suggest that the AHDriFT system is an effective alternative or addition to pitfall/funnel trapping and visual encounter surveys. Further research is needed to identify strengths and limitations of this system and expand its use in various habitats.

Presenter: Taylor Michael

Faculty sponsor: Andrew George, Christine Brodsky, Anuradha Ghosh

Student Status: Undergraduate

Major: Biology

Title: Exploring range boundaries of chorus frogs using morphometric measurements and genetic techniques

Abstract: A north-south clinal gradient has long been recognized in the body proportions of North American trilling chorus frogs (*Pseudacris* spp). Current identification keys and field guides suggest that morphometrics can be used to separate *P. maculata* and *P. fouquettei*, which occur north and south of Kansas's southern border, respectively. However, these sources are based on the most recent taxonomic revision of *Pseudacris*, which reports averages of morphometric measurements across the entire geographic range of each species. Prior to the reclassification, *P. maculata* and P. *fouquettei* in Kansas and Oklahoma were considered the same species based on similarity of morphometric measurements. We took morphometric measurements from 40 *P. maculata* specimens that were collected in and around southeast Kansas and compared them to values reported by Lemmon et al. (2008). While results varied, tibia length and head size of southeast Kansas specimens were intermediate between published values for the two

species. Morphometric measurements alone may be insufficient to distinguish between trilling chorus frogs near the periphery of their range. Ongoing work includes the use of DNA analysis to assess phylogenetic relationships of local populations. We suggest that additional specimens be measured to better quantify clinal gradients that may confound species identification.

Presenters: Madison Reese and Niamh Dixon
Co-authors: Monika Jirak, Rebekah Elliott and Anuradha Ghosh
Faculty sponsor: Anuradha Ghosh

Student Status: Undergraduate

Major: Biology with Pre-Med Emphasis, Biology

Title: Prevalence and characterization of antibiotic resistant strains of *Enterococcus* spp. and *Acinetobacter* spp. in community household environment

Abstract: With increasing prevalence of antibiotic resistance threats, there is an upsurge in the occurrence of community-acquired infections. The purpose of this study was to assess the prevalence of *Enterococcus* spp. and *Acinetobacter* spp. (that are well-known antibiotic resistant nosocomial pathogens) in the household environment. A total of 30 kits, each containing five swabs for each of shoe bottom, restroom, cleaning supply, kitchen top, and door step/handle (n=150) were processed using enrichment technique. Twenty-two out of 30 (73%) and 28/30 (93%) kits were positive for the growth of *Enterococcus* spp. and *Acinetobacter* spp., respectively. Door steps, cleaning supplies, and shoe soles (13-20%) were less frequently contaminated with enterococci compared to that of kitchen tops (53%) and restrooms (40%). Majority of the locations swabbed were contaminated with *Acinetobacter* spp. except for door step/handles. Overall, 102/150 (68%) of the swabbed surfaces were contaminated with *Acinetobacter* spp. in contrast to 43/150 (28%) with enterococci. Biochemical tests confirmed identity of 34% (140 out of 408) *Acinetobacter* and 71% (123/172) *Enterococcus* isolates at the genus level. Disk-diffusion antibiotic susceptibility testing revealed 41 of each of *Acinetobacter* and enterococcal isolates were resistant to 3-6 antibiotics. Multi-drug resistant isolates are being further identified using species-specific PCR and are also being tested for biofilm formation, presence of amylase and protease. These isolates will be genotyped and compared to nosocomial strains. The community will be outreached with recommended cleaning protocol and antimicrobial stewardship program. The outcome of this study may help facilitate effective and appropriate antibiotic treatment against community-acquired infections.

Presenter: Bryce Scholze
Faculty sponsor: Russ Rosmait

Student Status: Undergraduate

Major: Manufacturing Engineering Technology

Title: Mini Foundry: A Research Project for Makers, Creators and Innovators

Abstract: Firefighters are tough and astronauts are cool, but manufacturing jobs are great, too. Good wages, opportunities for advancement and high levels of job security are just the beginning. Manufacturing is also a very rewarding industry, offering opportunities to flex creative, logical and managerial muscles on a daily basis. It's also very much a part of the future, especially in high-tech careers. The goal of Mini Foundry is to introduce metal casting early on as a potential career. At the end of the activity a student might not be

ready to bump "rock star" off the list just yet, but at least metal casting is on the radar. Objectives of the Project include: to develop a working Mini Foundry portable casting system, advance PSU student skill set in tooling design through CAD hands-on applications**,** advance PSU student skills in additive manufacturing hands-on applications, use hands-on casting applications as a Pathway to PSU and use the Mini Foundry Experience as a recruitment tool to attract more Engineering Technology students. The research deliverables will dictate methods. The students have worked their deliverable to develop a workable time line for completion of the final end result. The real-world application here (Mini Foundry) is that the main deliverable will be a working system able to produce high quality parts for the customer. Part of this semester's work will include using the Mini Foundry to demonstrate the metal casting process. This project will also include extensive part design, digital analysis and manufacturing.

Presenter: Sydney Walkup

Faculty sponsors: Jeremey Wolfe, Gary Wilson, and Marjorie Donovan

Student Status: Undergraduate

Major: Psychology & Sociology

Title: How has Social Media Affected Mental Health

Abstract: The question regarding how social media has affected mental health can be interpreted in two ways. Either positive or negative. This project includes a survey given to 261 first-year college students who are asked about their demographics, use of social media, and mental health. Throughout conducting research, there have been noticeable debates on social media and mental health. Because such debates and analyses exist, it is important to understand how social media can affect mental health. Important notice of the data include that more than half the respondents said they began to use social media at ages 10 to 13 years old. The notability of this question and answer is the youthful age that the respondents began to use social media. It is important in understanding how that can contribute to exposure at an early age. The implications for future research include the future changes of social media and how those changes will correlate with effects on mental health. The answers to one of the questions uncovered an unexpected insight. The question was, "What social media apps do you use? Select all that apply," the answers to select include, Snapchat, Instagram, Twitter, Facebook, and other option. The "other" option was used by 25.6% of the respondents, where 20% of the respondents said they used TikTok as a social media app. This goes on to show how social media can change in a year. After all the results were collected, it suggested that the hypothesis, social media can negatively affect mental health, to be correct.

Presenter: Paul Worsley

Faculty sponsor: Dr. Santimukul Santra

Student Status: Undergraduate

Major: Biology (Premed) and History

Title: Synthesis and Characterization of Antioxidant Nanoceria for the Targeted Treatment of Lung Cancer

Abstract: Nanoceria, or cerium oxide nanoparticles, have many properties that make them excellent therapeutic agents. Nanoceria are radio protective, radio sensitive, and have antiangiogenic properties. Within this study we determined if nanoceria could be used as a targeted drug delivery system to treat lung

cancer. For this study we synthesized a nanoceria coated with a polyacrylic acid polymer using the solvent precipitation method. The selected lung cancer, non-small cell lung cancer (NSCLC), over-expresses folate receptors. To target these over-expressed receptors, folic acid was conjugated to the surface of our nanoceria using “click” chemistry. The solvent diffusion method was used to encapsulate two chemotherapy drugs, Taxol and Fingolimod, as well as an optical imaging dye, DiI. The nanoceria system was evaluated on model NSCLC cells, to determine efficacy of treatment. Cytotoxicity (MTT) assays, reactive oxygen species (ROS) studies, apoptosis and necrosis assays, and fluorescence microscopy were performed and will be discussed in this presentation.

Oral presentations, Category B: primarily Business, Education, and Humanities, Graduate

Presenters: Isaac Lewis and Himika Akram

Faculty sponsors: Alicia Mason, Ph.D.

Status: Graduate

Major: Communication

Title: Analyzing Medical Aid in Dying (MAiD) discourse on #TikTok: Advocacy for Agency in Dying

Abstract: The Medical Aid in Dying (MAiD) movement has grown in notoriety in recent years as policy regarding the practice has been moving through various governments, discourse amongst the general public has arisen as a result, and now we see opinion leaders, like palliative care professionals, utilizing social media spaces to discuss the practice. This discourse analysis utilizes #TikTok as a message-sharing space to understand the media artifacts being produced and their impact on broader society in terms of either promoting or disapproving the practice. Our multimodal content analysis was formative in nature as this discourse is rather new to the mediasphere, therefore, our team focused on collecting data useful in forming a foundational catalog of themes and narratives surrounding MAiD on #TikTok. We found that major themes of interest included (1) source credibility; (2) framing of content (i.e. multimodal effects such as graphics); and (3) nature of the content (i.e. patient talking about their MAiD process via #TikTok, or a surrogate using the space to talk about the experience). This study aims to aid in growing the body of scholarship associated with discourse and End of Life decisions. The results provide us with a look into how the public perceives this topic and how the conversations surrounding MAiD are framed.

Oral presentations, Category B: primarily Business, Education, and Humanities, Undergraduate, Economics

Oral presentations, Category B: primarily Business, Education, and Humanities, Undergraduate, Economics

Presenter: Carson Cowan
Faculty sponsor: Dr. Michael Davidsson

Student Status: Undergraduate

Major: Business Economics and Finance

Title: Determinants of the Average Annual Value of Players' Contracts in the NBA

Abstract: The increases in NBA players' salaries since the 1990s have put more pressure on NBA General Managers and team offices to ensure that they are paying a player what he is worth based on his performance on the court. The purpose of this study is to determine the significance of players' individual statistics in determining the average annual value of their new contracts in the following season. The results of this study will be particularly relevant to players and team administration, as it can be used to estimate a player's average annual value given past performance which can give a baseline for contract negotiations, ensuring players aren't underpaid and that teams aren't overpaying for a player on the court abilities. This study differs from past literature, as previous studies focusing on NBA players' salaries as a function of individual players' statistics have focused on discrimination issues. These models include the values of players' new contracts and previous year statistics in 2019-2022 to derive a model for each year. Variables included in the linear regression models are age, games played, points per game, and much more player statistics. Based on past literature, it can be anticipated that points per game, rebounds, and personal fouls will be significant to a player's average annual value. With salaries of NBA players continuing to increase, the implications of this study are particularly relevant to ensuring that continued research in this topic is current and the usefulness of the model is significant.

Presenter: Samuel Holman
Faculty sponsor: Dr. Michael Davidsson

Student Status: Undergraduate

Major: Computer Information Systems, Business Economics, Finance

Title: The Population of Cities

Abstract: There are many reasons as to why certain cities gain population and some cities lose their populations. The purpose of this research project is to find out what factors are causing cities in the United States to gain and lose their populations by using the sum of least squares regression approach. The independent variables being used are the latitude, longitude, crime rates, economic conditions, age of city, and importance of each city. These variables can be used to find out why some of the geographic locations in the United States are booming and some are drying up. This model could be used to bring populations to a location that would increase economic growth or stop a city from drying up when it suffers from a dwindling population.

Oral presentations, Category B: primarily Business, Education, and Humanities, Undergraduate, Economics

Presenter: Zach Kunkler

Faculty sponsor: Dr. Michael Davidsson

Student Status: Undergraduate

Major: Economics

Title: Climate Change Explained by Pollution

Abstract: This paper provides a reasonable perspective of pollution and the impact on climate change. The data sample will be based in the United States from the year of 2002 to 2022. The goal of this paper is to understand if there is a positive correlation between pollution and climate change. The adopted research method of combining the theory and empirical research will be the linear regression model to analyze the true effect of pollution on climate change. The variables that will be included in the study are Carbon Dioxide *(CO2)*, fuel emission *(car),* and greenhouse gas emissions *(green)*. The paper shows that the confidence level of all variables has a positive correlation to the study and weighs a heavy significance in influencing the effects of climate change. The limitations to the study were the area of data gathered. If I were to gather data from every well populated country, then I am sure we would have a better understanding of the influence of pollution and climate change. However, I took the mindset that most variables will be held constant and proven significant regardless of the location of the data. I hope this paper can help provide an idea to support and help the future economic growth of decreasing pollution and climate change.

Presenter: Jessica Leininger

Faculty sponsor: Dr. Michael Davidsson

Student Status: Undergraduate

Major: Finance and Business Economics

Title: Determinants of Economic Growth Across the Globe

Abstract: Throughout history, there have been numerous studies about what determines economic growth around the world, as measured by the growth of Gross Domestic Product (GDP). This study investigates the effect of unemployment, foreign direct investment (FDI) inflows, and inflation on GDP through a process known as regression analysis. The data used in this study is collected using 10 countries that have the highest GDPs (as of 2022) over a period of 20 years, between 2002 and 2021. The observations used are on an annual basis and the data is organized in a panel - data that contains observations about different cross sections across time. The results show that there is a positive relationship between FDI inflows and GDP, and a negative relationship between unemployment and GDP, as well as inflation and GDP. In other words, a low unemployment and inflation rate will correlate with higher economic growth. The more FDI inflows there are in a country, the higher the economic growth will be. This is an important topic of study, as economic growth is an indicator of the general health on the economy, including welfare and quality of living standard.

Presenter: Devon Nugent

Faculty Sponsor: Dr. Michael Davidsson

Student Status: Undergraduate

Major: Business Economics

Title: Determinants of Population Growth in Micropolitan Areas

Abstract: What causes individuals to make the important and substantial decision to move from huge cities to small communities? Many factors could be at play that affect this decision and this question has garnered increasing attention recently as micropolitan areas were officially recognized at the end of the 20th century. A micropolitan area is defined as "an urban cluster consisting of at least 10,000 people and no more than 50,000 people" (United States Census Bureau, 2019). At the start of the 21st century, the United States Census Bureau began tracking data for micropolitan areas and comparing them to metropolitan cities. Over the years, there has been an increase of individuals that are moving to these small communities from large cities. Small towns have started to see an increase in individuals moving to their area. In turn, they began construction plans to alter their communities to be more desirable for individuals looking to move and in turn hopefully boost their local economy. This study will collect data from hundreds of micropolitan areas across the United States for the years 2000-2010, perform a regression analysis using population growth as the dependent variable and relating it to different independent variables. The purpose of this study is to identify variables causing migration from big cities to micropolitan areas and to recommend possible changes to make mico areas, more attractive.

Presenter: Ayelen Pecci

Faculty sponsor: Dr. Michael Davidsson
Student Status: Undergraduate
Major: Economics

Title: Determinants of the US Poverty Level: A Time-Series Analysis

Abstract: The level of poverty and income inequality in the United States remains the highest among the country members of the Organization for Economic Co-operation and Development (OECD). Additionally, Human Rights Watch has declared that poverty and economic inequality in the US are a "pressing human rights problem." Prior researchers have investigated the determinants of poverty in the US and in several other countries, finding that the main factors that influence one's probability of living in poverty are an individual's level of educational attainment, race, employment status, and household composition (female headed or male headed), among others. This investigation examines the role played by income inequality and the factors named above (the independent variables) in determining the poverty level in the United States. The dependent variable for this research is the proportion of the population living below the poverty line. For this purpose, the statistical software EViews was used to perform a Time-Series analysis using Ordinary Least Square estimation to construct an empirical model with data collected on a national level from the Bureau of Labor Statistics, the Federal Reserve Bank, and the US Census Bureau covering the time period from the year 2000 to 2020.

Oral presentations, Category B: primarily Business, Education, and Humanities, Undergraduate, Economics

Presenter: Jake Reynoldson
Faculty sponsor: Dr. Michael Davidsson

Student Status: Undergraduate

Major: Business Economics

Title: Determinants of Housing Prices in the United States Midwest

Abstract: One significant indication of economic growth is housing prices. Rising prices tend to lead to more robust economic growth, while a decline in prices signals weak growth. What determines home prices is therefore crucial. While many things influence the complexity that is the housing market, this study aims to identify which of those specific determinants are significant, and which ones are not. This research paper will be analyzing the twelve states of the United States Midwest region, from the years 2000 to 2021. A multivariate regression model will be applied to the question of determinates, with the Home Price Index (HPI) acting as the dependent variable. HPI proves to be the best dependent variable as oppose to average house prices, or median house prices for all intents and purposes. A metric such as average house prices treats all homes in the market as equal and cannot adjust for composition. Additionally, using average or median home prices as the dependent variable would skew the data due to outlier prices. Therefore the home price index is the premier measure of true price changes and fluctuations in the market. This paper will dissect the results of said regression, and look at each independent variable that plays a part in determining housing market prices.

Presenter: Cooper Schettler
Faculty sponsor: Dr. Michael Davidsson

Student Status: Undergraduate

Major: Finance & Business Economics

Title: NFL Ticket Pricing: Understanding the determinants behind fluctuation in game by game ticket prices

Abstract: The National Football League (NFL) has historically sold tickets at a fixed price throughout the season, regardless of demand for individual games. However, resellers have taken advantage of undervalued tickets and used online secondary markets to increase prices in proportion to consumer demand. To address this, several professional sports leagues have adopted a dynamic pricing model to capture profits that were previously lost to ticket brokers. While the NFL has been slower to adopt this approach, some teams have begun using dynamic pricing in the past decade. To achieve an equilibrium ticket price, it is crucial to understand the factors that drive consumer demand. This study uses data collected from Seatdata.io to explore the fluctuations in ticket prices throughout the 2022 NFL season. Team strength and game timing are identified as key factors that influence consumer demand and correlate with changes in ticket prices. Specifically, it was found that the opposing team's winning percentage has the largest impact on ticket prices, with almost a 50 percent increase in price when the winning percentage rises. It is also observed that the timing of the game has an increasing effect on ticket prices, although games played later in the week and further into the season have a decreasing effect on

prices. As seen in other entertainment industries, dynamic pricing can effectively capture lost revenue, but competing with ticket brokers may be a challenge. Therefore, understanding the drivers of consumer demand is critical for NFL franchises looking to adopt a variable pricing model.

Presenter: Matthew Teel

Faculty sponsor: Dr. Michael Davidsson

Student Status: Undergraduate

Major: Business Economics

Title: The Determinants of House Pricing in Micropolitan Areas

Abstract: The differences in house prices have been a major discussion in recent times with house prices rising greatly over the past few years. These differences have led to much discussion and research over what determines and affects house prices. One of the reasons that have been argued for rising housing costs is restrictive land use regulations limiting the construction of new housing. Other reasons such as the impact of Covid 19 or the credit tightening of the great recession could also be blamed. Blame has even been thrown on the corruptness of politicians and real estate developers as well. To find the exact reason for this increase, many different factors and variables must be analyzed and studied. Many studies on this subject have been done in more developed metropolitan areas. This study will analyze the effect of 77 different social, economic, and fixed determinants on a weighted average of growth in the median gross rent, which represents the growth in housing costs, with this study focusing on 554 different micropolitan counties across the United States. This study will question the importance of each of these determinants in determining the reason for the growth in the prices of houses. This study will be conducted through the use of cross-section analysis, with the method of evaluation being an ordinary least squares regression. Its goal is to increase the amount of knowledge regarding the determinants of house pricing and how it can be used to satisfy inquiries regarding the subject and be applied in future real estate or business endeavors.

Oral presentations, Category B: primarily Business, Education, and Humanities, Undergraduate, History

Presenter: Josh Ghering

Faculty sponsor: Kyle Thompson

Student Status: Undergraduate

Major: History

Title:

Abstract:

Presenter: William Kruse

Faculty sponsor: Kyle Thompson

Student Status: Undergraduate

Major: History

Title: Alexander the Great

Abstract: The topic that I will be researching is Alexander the Great. Alexander the Great's leadership has been argued by historians for hundreds even thousands of years. Many historians such as Ian Worthington and Paul Cartledge have argued that Alexander the Great's leadership was unmatched during his time, with Alexander fully conquering the great Persian Empire that stretched as far Baktria, modern day India. Most historians have agreed with Worthington's argument, but not all of them. For example, Pierre Briant argues that Alexander was not that great, as four of Alexander's generals conspired against him, and even attempted to assassinate him during the military conquest of the Persian Empire. The research shows that Alexander had made political enemies back home in Macedonia who founded local rebellions, such as the Spartan and Athens uprising. The research also argues that Alexander had villainized himself in the eyes of his generals and soldiers due to his arrogance. He took on the customs of the Persian Empire, such as the dress and the Persian ritual of Proskynesis. The conclusion of this research has shown that Alexander the Great was really 'great'. The sources that cover Alexander the Great's life and conquest have been found to be mostly trustworthy but not entirely truthful in its recordings.

Presenter: Kody Westerhaus

Faculty sponsor: Kyle Thompson

Student Status: Undergraduate

Major: History

Minor: Military Science

Title: A reassessment of the Fall of France: 1940

Abstract: On 10 May 1940, Nazi Germany began its invasion of France and the low counties, under the operational name Fall Gelb (Sichelschnitt). Within six weeks France and the low countries capitulated, and the British Expeditionary Force (BEF) was ejected from the continent, Nazi Germany had managed to achieve a stunning and swift military victory. In the immediate aftermath of this event, an explanation was required to explain how such an event might have occurred. The initial explanation provided was of the French Republic facing internal social decadence and its Military was inadequately prepared, equipped, and not willing to fight. This explanation also subscribed to a belief in overwhelming German Military superiority. This idea has continued to survive by decades of post-war writing that managed to capture the popular imagination of readers. This paper aims to disprove that explanation and argues that the battle of France in 1940 was in reality a much closer military encounter, with just a few critical factors dictating the outcome.

Presenter: Karl Wittenburg

Faculty sponsor: Kyle Thompson
Student Status: Undergraduate
Major: History

Title: The Sibling Systems of Medieval England

Abstract: Feudalism is a concept and system that has long since been done away with, but the traces of it remain to this day, most notably in England. But England has had multiple bouts with a feudal system, with one unceremoniously replacing the other. This came about the time of William the Conqueror, as he and his army from Normandy supplanted the existing system by the Anglo-Saxons. Being from France, the new system under William was much more like his southern neighbor across the Channel. His feudal government went on to survive through some of the hardest periods of English history, while the Anglo-Saxon system failed. I will be exploring feudalism in England under both the Anglo-Saxon kings and the Norman kings and see how and why the former of them failed, and what the Normans did differently to succeed in their place. There are sources documenting how each system worked, most notably the Domesday book, commissioned by William, and the Burghal Hidage, commissioned by King Alfred the Great to keep track of his own governance system. The Normans were more successful in keeping the country stable thanks to the barony system that was more effective than the Anglo-Saxon Earldoms, as well as through a less complex bureaucracy and administration system to manage taxes.

Oral presentations, Category C: Creative Works, Graduate

Presenter: Elizabeth Hayes

Faculty sponsor: Janice Jewett

Student Status: Graduate

Major: Health, Human Performance and Recreation

Title: Choreographic Process and Presentation at the American College Dance Conference

Abstract: I, Elizabeth Hayes, am creating a choreographic piece titled, “It Needed To Be Said.” I have selected six dancers that I believe to be well developed in their craft and artistry. The piece is about standing up for oneself when it is not the popular choice. The dance should force the audience members to reflect on their values as well as the challenges of standing firm in the face of adversity. To create the piece, I am using my own experiences, techniques from modern, contemporary, jazz, and improvisational dance, spatially intriguing forms, and gestural qualities that I observe in everyday life. I am researching these elements to craft a dance that further exemplifies the story that I am trying to tell. I am also researching music selection, choosing costumes, and creating the lighting design for the piece. The piece will be performed and presented for adjudication for a panel of professional dancers and choreographers at the American College Dance Conference in Edmond, Oklahoma from March 29th-April 1st. The adjudicators will provide feedback on the choreography. The six performers, as well as four additional students and our sponsor, will participate in multiple classes at the conference as well. Our research presentation will include the creative process for the piece, the professional feedback received, and the overall experience and learning outcomes from the students involved. After the conference, the piece will also be performed at the Bicknell Center at the PSU Dance Program’s Dance Research Symposium and Performance on April 12th.

Oral presentations, Category C: Creative Works, Undergraduate

Oral presentations, Category C: Creative Works, Undergraduate

[NONE]

Oral presentations, Category D: Topical Literature Review, Graduate

[NONE]

Oral presentations, Category D: Topical Literature Review, Undergraduate

Presenter: Tricia Combs
Faculty sponsor: Ken Ward

Student Status: Undergraduate

Major: Communication and Criminology

Title: Symbolic Interactionism: A Modern Analysis

Abstract: When analyzing literature on communication theories that have been around for decades, it is important to find the overlap and impact they have on theories that are increasingly prevalent in a more modern day and age. Understanding current effects of symbolic interactionism can allow us to better understand how we view ourselves in relation to the imagined opinions of others. This study explores and explains the theory of symbolic interactionism, and particularly the role of the looking-glass self within it. Coined by George Herbert Mead in the 1930s, symbolic interactionism has long been studied in both a sociological and communicative sense. Recent studies show how symbolic interactionism is still relevant in newer theories today, such as in Taylor, Houghton, and Bednall's study with face negotiation; Low and Thompson's proposed structural implications; and Northrop's examination of the looking-glass self and social media. From the 1930's to present day, literature has vouched for the idea that symbolic interactionism is inherently at the base of a variety of theories, yet it is only with careful consideration that we can see the impact it has today.

Poster presentations, Category A: primarily Sciences and Technology, Graduate

Poster presentations

Poster presentations, Category A: primarily Sciences and Technology, Graduate

Presenter: Mansi Ahir

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: Improved lignin polyurethane properties with Lewis acid treatment

Abstract: Chemical modification strategies to improve the mechanical properties of lignin-based polyurethanes are presented. We hypothesized that treatment of lignin with Lewis acids would increase the concentration of hydroxyl groups available to react with diisocyanate monomers. Under the conditions used, hydrogen bromide-catalyzed modification resulted in a 28% increase in hydroxyl group content. Associated increases in hydrophilicity of solvent-cast thin films were also recorded as evidenced by decreases in water contact angle. Polyurethanes were then prepared by first preparing a prepolymer based on mixtures of toluene-2,4-diisocyanate (TDI) and unmodified or modified lignin, then polymerization was completed through the addition of polyethylene glycol (PEG), resulting in mass ratios of TDI:lignin:PEG of 43:17:40 in the compositions investigated here. The mixture of TDI and unmodified lignin resulted in a lignin powder at the bottom of the liquid, suggesting it did not react directly with TDI. However, a homogeneous solution resulted when TDI and the hydrogen bromide-treated lignin were mixed, suggesting demethylation indeed increased reactivity and resulted in better integration of lignin into the urethane network. Significant improvements in mechanical properties of modified lignin polyurethanes were observed, with a 6.5-fold increase in modulus, which was attributed to better integration of the modified lignin into the covalent polymer network due to the higher concentration of hydroxyl groups. This research indicates that chemical modification strategies can significantly improve the properties of lignin-based polymeric materials using a higher fraction of an inexpensive lignin monomer from renewable resources and a lower fraction of an expensive, petroleum-derived isocyanate monomer to achieve the required material properties.

Presenter: Bassam Alshammari

Faculty sponsor: Erik Mayer

Student Status: Graduate

Major: Engineering Technology

Title: Assessing the Effectiveness of Teaching Deep Learning for Microcontrollers Using a Line Follower Robot

Abstract: Deep learning applications, a type of artificial intelligence, have increased significantly in the last decade. This research assessed a hands-on approach to teaching deep learning in an undergraduate microcontroller course in the Electronics Engineering Technology program at Pittsburg State University. Microcontrollers are small computers that fit into a single integrated circuit and are used for specific purposes, such as smart devices for the home. In the course, students learned the fundamentals of deep learning and built a line-follower robot. The line follower robot project used a TI-RSLK MAX robot based on an ARM-based MSP432 microcontroller and was utilized in the Spring 2022 semester. To prepare the

students for the line follower robot project, a new concept of deep learning was introduced each week and included hands-on activities.

Assessment results demonstrated that 66.7% of the line follower robots developed by students consistently followed the line, 16.7% occasionally left the line, and 16.7% did not work. This showed that, overall, students acquired practical knowledge and could develop deep learning models and deploy them into a microcontroller. Furthermore, even though students used deep learning for an uncomplicated line follower robot, many applications can be built based on the techniques that the students have learned in the project.

Research is currently being pursued on identifying the best methods to teach deep learning utilizing microcontrollers for voice and image recognition. Multiple types of microcontrollers and software are being investigated to establish the most effective teaching method.

Presenter: Eniola Arogunyo

Co-authors: Sahithi Kondaveeti, Kristos Baffour, and Tuhina Banerjee

Student Status: Graduate (MSc)

Major: Chemistry

Title: Fabrication of Plasmonic Nanosensor for the Rapid Detection of Food-Borne Pathogens

Faculty sponsor: Santimukul Santra

Abstract: Increasing foodborne illnesses have led to global health and economic burdens. *E. coli* O157:H7 is one of the most common disease-provoking pathogens and is known to be lethal Shiga toxin-producing *E. coli* (STEC) strains. With a low infection dose in addition to person-to-person transmission, STEC infections are easily spread. Conventional FDA-BAM procedure exhibits high sensitivity and specificity, however, limited by lengthy readout time. Although popular methods such as PCR, ELISA, SERS, and electrochemical detections are time efficient, they require extensive sample preparation and operating protocols. Hence, there is a critical need for a sensitive detection nanosensors platform for *E. coli* O157:H7 that is user-friendly, specific, rapid, cost-effective, and can be used in the field for food-safety applications. In this study, we will be presenting an innovative concept of integrating plasmonic and magnetic properties for fabricating plasmonic nanoceria nanosensors (PNC) and its application as a colorimetric label in lateral flow immunoassay format for detection of *E. coli* O157:H7. The facile synthesis protocol of PNC involves assembling several embedded nanoceria nanoparticles as colorimetric labels within the polymeric coating of gold nanocrystals. In addition, introducing plasmonic properties in PNC is further expected to enhance detection sensitivity. Preliminary experiments from this study have shown visual detection limit of PNC-based LFA for *E. coli* O157:H7 is 10^3 CFU/mL with a broad quantitative range between 10^3-10^8 CFU/mL.

Presenter: Akshay Kumar Chaudhari

Faculty Sponsor: Ram K. Gupta

Student Status: Graduate

Major: Material Science

Title: Spray-deposited Aluminum-doped Zinc oxide as an efficient electron transport layer for inverted organic solar cells

Abstract: Spray-deposited thin films of zinc oxide (ZnO) and aluminum-doped zinc oxide (Al-ZnO) are characterized in detail to get insight into the role of a dopant in the matrix. ZnO and Al-ZnO are implemented as electron transport layers (ETLs) in inverted organic solar cells (IOSCs) with PTB7-Th as a donor and IEICO-4F as a norfullerene acceptor, forming the bulk heterojunction (BHJ) photoactive layer. Organic solar cells (OSCs) based on the ZnO ETL exhibit a short-circuit current density (J_{SC}) of 24.46 mA/cm^2 and an open-circuit voltage (V_{OC}) of 0.68 V, yielding a power conversion efficiency (PCE) of 9.3%. A solar cell based on the Al-ZnO ETL yields a higher J_{SC} of 25.16 mA/cm^2 and a V_{OC} of 0.71 V, resulting in a PCE of 10.5%, which indicates that Al doping improves the device's performance. Time-delayed collection field (TDCF) measurements yielded field-independent charge generation for both devices. Furthermore, steady-state photoluminescence (PL), time-resolved PL, and transient absorption measurements confirm a reduction in the number of defect states in Al-ZnO thin films compared to ZnO thin films and efficient charge transfer, yielding an overall improved IOSC device performance.

Presenter: Arjun Chaudhary

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: Role of Renewable Resources in the Preparation of Wood Adhesives

Abstract: Petroleum-based compounds are generally utilized in industries for getting higher mechanical properties for the wood application, where the process of synthesis release toxicity in the environment and causes health issues. Because of this reason, scientists are trying to make biobased compounds and products. In this research, a bio-based polymer (sunflower polyol) was used to make polyurethane (PU) resin. During the synthesis of polyol, an epoxidation reaction was done, followed by a ring-opening reaction. The presence of hydroxyl groups was confirmed with Fourier transform infrared spectroscopy (FT-IR) and hydroxyl value determination test to confirm the polyol formulation. After that, hydroxyl groups of polyol were reacted with a diisocyanate to make crosslinked polyurethane. After synthesizing the polyol, two different curing techniques were used to cure the adhesive for wood samples. With the hot-press technique, variation in time and temperature was done to find the ideal situation and highest tensile results. Where, without the addition of any filler, the highest tensile result was observed at 5.66 MPa. Furthermore, silicon dioxide (SiO_2), cellulose microcrystalline (MCC), and titanium dioxide (TiO_2) were introduced as a filler to improve bonding strength. With the introduction of SiO_2 filler, 86.25% improvement was observed with 10.49 MPa in bonding strength. Adhesion properties were observed with tensile strength testing, and other characterizations were also done with the help of thermogravimetric analysis, FTIR, and gel permeation chromatography.

Presenter: Janvi Chaudhari

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: Ultraviolet curable coating of modified lignin

Abstract: In ultraviolet curable coating introducing the bio-based product lignin is a main compound. Methacrylic anhydride was used in an esterification process to modify kraft lignin (KL) into methacrylated lignin. Up to 70% hydroxyl group of the kraft lignin was converted into methacrylate. The methacrylated lignin (ML) was incorporated into the ultraviolet (UV)-curable formulations and add photo initiator reactive diluent and cross-linker for UV curing. To create a durable, lignin-rich coating, the solution was then applied on a glass slide and cured under UV light. Among all four coatings of different WT% of methacrylate lignin, they achieve the best result of curing in 31 WT%.

Presenter: Mahesh Chaudhari

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: Valorization of Lignin from Biorefinery: Colloidal Lignin MicroNanospheres as Multifunctional Bio-Based Fillers for Waterborne Wood Coating Enhancement

Abstract: Lignocellulose is one of the major components which possess a high proportion of lignin, considered the third most abundant component of it that can be valorized and expected to enhance the proficiency and feasibility of biorefinery. In that sense, the Organosolv pre-treatment method was employed, an environmentally friendly way to produce colloidal lignin mico-nanospheres, and used as a bio-oriented filler for waterborne wood coating. Further, various characterization techniques and testing measures were adopted to analyze the efficiency of the obtained material. The average approximate diameter of lignin micro-nanospheres was observed as 260 nm. It was noticed that the aggregation of the particles started as per increasing the concentration of lignin. The polymer matrix of the wood coating enhanced the toughness, indicating 55% niches in the tensile property and 40% in elongation. A significant improvement had seen in wear resistance, adhesion, and other traits. Moreover, it was subjected to UV radiation and provided improved protection against color alteration in wood. To recapitulate, the incorporation of nano-microspheres and particles uplifted the color and texture of wood, protecting against the valuable parameters of considerations under this study and coming out to be the best alternative and a better revolution to the development of the waterborne wood coating industry.

Presenter: Niyati Chaudhary

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: Safely dissolvable Healable active packaging based on alginate and pectin

Abstract: Extensive usage of long-lasting petroleum-based plastics for short-lived applications such as packaging has raised concerns regarding their role in environmental pollution. In this research, we have developed active, healable, and safely dissolvable alginate-pectin-based bio composites that have potential applications in food packaging. The morphological study revealed the rough surface of these bio composite films. Tensile properties indicated that the fabricated samples have mechanical properties in the range of commercially available packaging films while possessing excellent healing efficiency. Bio

composite films exhibited higher hydrophobicity properties compared to neat alginate films. Thermal analysis indicated that crosslinked bio-composite samples possess higher thermal stability in temperatures below 120 °C, while antibacterial analysis against E. coli and S. aureus revealed the antibacterial properties of the prepared samples against different bacteria. The fabricated biodegradable multi-functional bio composite films possess various imperative properties, making them ideal for utilization as packaging material.

Presenter: Allen Davis

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: The Design and Synthesis of Metal Doped Carbon Aerogels for Electrochemical Applications

Abstract: Carbon based materials exist as an immensely popular option for electrocatalyst design. Additionally, high surface area is shown to be conducive to improved electrocatalytic activity. Herein, carbon based aerogels were created with the above properties in mind. These aerogels were first synthesized from a resorcinol-formaldehyde hydrogel that was converted to an aerogel (RF gel) through the freeze drying method. The RF-gels were later calcined to create the desired carbon aerogels (RF-C gel). To further improve electrocatalytic activity, the carbon aerogels were doped with cobalt oxide (RF-CCo gel), nickel oxide (RF-CNi gel), and a 50/50 mix of the two (RF-CCoNi gel). Furthermore, each of the carbon based gels were tested for supercapacitor and HER-OER water splitting capability. Additionally, structural characterization tests were performed to observe the material's pore structure and elemental makeup.

Presenters: Jenell de la Peña and Daniel Benson

Faculty sponsor: Dr. Christine Rega-Brodsky

Student Status: Graduate

Major: Biology

Title: Intensive camera trap survey for the Plains Spotted Skunk (*Spilogale interrupta*) in Kansas

Abstract: The plains spotted skunk (*Spilogale interrupta*) once commonly occurred across the Great Plains, but has suffered severe declines across its historical range since the 1940s. Population declines in Kansas prompted the closure of the trapping season in the 1970s. Declines have continued to present day with the last confirmed sighting of the species occurring in 2020 in western Kansas. In order to determine the current abundance and distribution of the plains spotted skunk, we are conducting a camera trap study at 600 locations across 18 counties in Kansas. As of March 2022, we have sampled approximately 550 camera locations and have yet to detect a spotted skunk. However, we successfully detected three mammal species of conservation concern listed under the Kansas State Wildlife Action Plan (SWAP): gray fox (*Urocyon cinereoargenteus*), swift fox (*Vulpes velox*), and the Southern flying squirrel (*Glaucomys volans*). We will complete winter sampling efforts in mid-April, with camera trapping efforts continuing this summer 2023.

Poster presentations, Category A: primarily Sciences and Technology, Graduate

Presenter: Yash Nilesh Desai

Co-authors: Sagar Jariwala, Ram K. Gupta

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: Epoxidized castor oil-based bio-thermoset coating incorporating synthetic hardeners for enhanced thermal and chemical stability

Abstract: It has been very crucial to find alternatives to petroleum-based epoxy thermoset resins. So, to tackle this problem novel castor oil-based epoxy resin was synthesized, which offered fast curing reaction with several hardeners and gave out exceptional chemical and thermal stability which made them best to be used as coatings and adhesives. On the successful synthesis of the resin, it was incorporated with polyetheramine and polyamineamide, which offered a spectrum of thermal and mechanical properties identical to commercial epoxy thermoset resins. Even though castor-oil-based epoxy has a high molecular weight, it was still possible to create a coating out of it without the need for solvents or VOC's which could be irritants or hazardous, this attested that it was a solvent-free formulation and a successful replacement to the commercial petroleum-based resins up to some extent.

Presenter: Sagar Jariwala

Co-authors: Yash Desai, Ram K. Gupta

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: Acrylic Acid from Soyabean Oil for UV coatings and 3D Printing

Abstract: Bio-based UV curable coatings are nowadays a new focal point for the researcher exploring alternate routes for replacing petro-synthetic products. To use bio-based compounds, epoxidized soybean oil (ESO) was chosen due to the presence of epoxy groups. To synthesize UV curable formulation, epoxy groups further reacted with acrylic acid to form an acrylic double bond which is reactive under UV radiation. The reaction was propagated until the acid value became less than 15 mg KOH/g for the resulting product of acylated epoxy soybean oil (AESO). Pre- and post-curing the resin, FTIR peak for C=C were analyzed for confirmed curing by calculating the cure percentage which was observed above 86%. With and without the DMPA photo initiator curing time was 6 min and 2.5 hours, respectively which is a significant improvement for the sake of reducing the curing time of the material. MEK rub tests were performed to see coating properties to understand crosslinking in the polymer matrix. To enhance mechanical and thermal properties, SiO_2 filler was added to the curing formulation. The coated materials were characterized by TGA, tensile, flexural, gel content, water contact angle, and under different chemical environments. UV-curable epoxy-acrylates were successfully synthesized in one step reaction without any solvent and separation process.

Poster presentations, Category A: primarily Sciences and Technology, Graduate

Presenter: Kajal K

Co-authors: Caleb Worsley, Carissa Sutton, Tuhina Banerjee

Faculty sponsor: Santimukul Santra

Student Status: Graduate

Major: Chemistry

Title: Polymer-Coated Recyclable Gold Nanocatalysts for Efficient Hydrogenation Reactions

Abstract: Catalytic reduction of 4-nitrophenol by a novel polymer-coated gold nanoparticle (GNPs) was performed. For their more sustained catalytic activity and improved recyclability, polymer-coated metallic catalysts are of great interest. Diethanolamine was used to create the hydrophilic hyperbranched polyester poly-hydroxyl (HBPH) polymer, which was characterized using a number of spectroscopic techniques, including ^{1}H, ^{13}C NMR, TGA, and FT-IR. The HBPH-stabilized GNPs were formulated using conventional Zerkovich method. This water dispersed functional GNPs were characterized using DLS, and UV-Vis spectroscopic methods. The reduction of 4-nitrophenol and formation of 4-amino phenol was monitored using in UV−Vis spectrometer. Using a UV-Vis spectrometer, the synthesis of 4-amino phenol and reduction of 4-nitrophenol were observed. To estimate the rate of these reduction processes, time-dependent kinetic experiments were carried out. The HBPH polymer stabilized GNPs catalyst when formulated showed higher reaction rate. The high molecular weight (Mw 36,400) HBPH polymer-coated GNPs indicated for the higher degree recovery and recyclability. In addition, the use of aliphatic hydrophilic HBPH polymer in the formulating GNPs catalyst makes it biocompatible and greener in nature.

Presenter: Neelima Koti

Co-authors: Adam Worsley, Tuhina Banerjee

Faculty sponsor: Santimukul Santra

Student Status: Graduate

Major: Chemistry

Title: New dendritic polymer-based drug delivery system for the targeted imaging and treatment of lung cancer

Abstract: Herein, we report on the synthesis of a new hydrophobic hyperbranched polymer using 1,6-hexanediol and a proprietary malonic acid-based A_2B monomer. The polymer synthesis was carried out using the melt polymerization technique in the presence of para-toluene sulfonic acid as a catalyst. The resulting polymer material was purified by the solvent precipitation method and characterized by various spectroscopic methods such as NMR, DSC, TGA, and FT-IR. The obtained pure polymer was found to be soluble in organic solvents such as DMSO, $CHCl_3$, and higher molecular weight as confirmed by GPC results, which is suitable for drug delivery. BQU57 is a hydrophobic, Ral inhibitor (related to Ras) that reduces tumor growth, selected for the delivery along with doxorubicin for a combination treatment. We co-encapsulated both drugs while formulating polymeric nanoparticles using the solvent diffusion method. To demonstrate the ability to deliver drugs specifically to a tumor, lung cancer A549 cells were selected as a model cancer line. The surface of the nanoparticles was conjugated with folic acid using EDC/NHS chemistry to target folate receptors expressed on A549 cells. These functional polymer-based nanomedicines were characterized using DLS, UV-Vis, and TEM techniques. Various cell-based *in vitro* experiments were carried out including MTT, comet, migration, ROS, apoptosis, and necrosis assays, to demonstrate the efficacy of these drug-loaded nanomedicines. Results showed the ability to inhibit

migration and over 80% cell death within 48 h of treatment, and these results will be summarized in this presentation.

Presenter and First author: K.A.U. Madhushani

Co-author(s): A.A.P.R. Perera, Wang Lin, and Ram K. Gupta

Faculty sponsor: Ram K. Gupta

Student Status.: Graduate

Major.: Polymer Chemistry

Title: Improving energy density of polyaniline-derived activated carbon-based supercapacitors using ionic liquid electrolytes

Abstract: As a clean energy storage device, supercapacitors have attracted remarkable attention in recent research and commercial activities due to their excellent electrochemical properties of high specific capacitance, fast charge-discharge rate, high power density, etc. The only issue related to supercapacitors is their low energy density. Several strategies can be performed to overcome this problem. In that sense, widening the working voltage effectively enhances the energy density without disturbing the specific capacitance and power density. This research work mainly focuses on finding a suitable electrolyte to fabricate a supercapacitor with high electrochemical performance. In previous studies, the electrochemical performance of activated porous carbon material derived from polyaniline to KOH ratios 1:0.5, 1:1, and 1:2 was studied. From those, it was discovered that electrodes derived from polyaniline to KOH in a 1:1 ratio showed better capacitive performances in an aqueous electrolyte. In this study, symmetrical coin-cell supercapacitors based on this 1:1 ratio electrode were further tested on an aqueous electrolyte (6M KOH), organic electrolyte ($TEATFB_4$ in acetonitrile) and ionic liquid (PMPyrr TFSI) separately. The supercapacitor based on aqueous electrolyte exhibited a high specific capacitance of 143 F/g at 0.5 A/g, which is much higher than that of 89 F/g and 93 F/g at 0.5 A/g from $TEATFB_4$-AN and PMPyrr TFSI, respectively. However, these organic and ionic liquid electrolyte systems' energy density and power density illustrated superior values compared to those of the aqueous electrolyte system. The maximum energy density and power density were owned by PMPyrr TFSI, which were 202 Wh/kg and 26 KW/kg, respectively. This research proposes the development of a supercapacitor using a low-cost electrode and ionic liquid electrolyte that can be applied for cutting-edge applications.

Presenter: Niharika Maley

Co-authors: Rishabh Srivastava and Ram K. Gupta

Faculty sponsor: Ram K. Gupta

Student Status.: Graduate

Major: Chemistry

Title: Zn and Co Loaded Porous C Decorated Electrospun Nanofibers as Efficient Oxygen Evolution Reaction for Water Splitting

Abstract: To decrease the usage of energy fuels, and to increase the water-splitting green energy conversion, a clean and efficient noble metal-free electrocatalyst for oxygen evolution reaction (OER) is

crucially required. The design of a noble metal-free electrocatalyst build on Zn and Co loaded porous C-decorated cellulose acetate-polyaniline (ZnCo-C/CA-PANI) electrospun nanofibers on the surface of highly conductive sponge-like nickel foam (NF). The smooth coating of CA-PANI electrospun nanofibers on the surface of the NF assist in exposing the highest proportion of the ZnCo-C-based electrocatalyst and uniform ion flow over the entire surface, resulting in strong OH adsorption capacity. The ZnCo-C/CA-PANI@NF electrode was intended to be an effective electrocatalyst for oxygen evolution reaction (OER) in an alkaline medium, with a reduced onset potential (134 mV vs RHE), a trifling Tafel slope of approximately 42 mV/dec, and excellent stability because PANI shows high conductivity, high surface area, and high binding affinity. Additionally, CA provides better solubility, rigidity, and charge density. Finally, the predesigned electrode shows high electrocatalytic activity, thus resulting in good steadiness and prolonged activity for 15h by chronoamperometric measurement. These findings imply that new noble metal-free hybrid materials should be investigated in order to induce effective electrocatalytic water splitting for long-term energy conversion.

Presenter: Jimmy “Tony” Milano

Faculty Sponsors: Dr. Cheryl Giefer, Dr. Jeffrey Waddell, and James Oliver

Student Status: Graduate

Major: Doctor of Nursing Practice Advanced Practice Nursing Family Nurse Practitioner

Title: Promoting Safety Through Advocacy and Practice: Nurse Input and Beliefs Regarding Hospital Fall Prevention Policies in the Inpatient Setting

Abstract: Throughout the evolving healthcare system, many issues in the hospital setting pose significant risk to patient safety and outcomes. Falls occur at detrimental rates that inevitably impact both the patient and the nurse. Of the several reasons one would choose to join the profession, nurses often seek the satisfaction of knowing the care they have provided impacted a patient, physically and spiritually. The healthcare system has allotted for variables in patient safety to promote safe outcomes and the reduction of fall risk, such as evidence-based practices and tools like cameras and assessments. However, the lack of nursing involvement in these processes often leaves them a step behind the pattern they wish to follow. Collecting baseline data regarding nursing staff knowledge of policies and procedures via survey allows both the researcher and nursing leadership team to determine staff demographics and direct opportunity for change in process. The purpose of the study is to highlight current nursing staff understanding regarding hospital fall prevention policies, implement an increased frequency of current assessments, and review whether these changes made an impact on staff’s beliefs about their involvement in practice. Recreating this in other areas of patient safety concerns may potentially impact nursing practice at the organizational level and lead to better patient outcomes.

Presenter: Joseph Okwe

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Physics

Title: Three-dimensional ZnCo-MOF modified graphene sponge: Flexible electrode material for symmetric supercapacitor

Abstract: Developing flexible, lightweight, and portable energy storage systems have become a necessity with the advent of wearable electronic devices in modern society. We report a novel, easy, and low-cost way to fabricate flexible bimetallic metal−organic framework (MOF) doped graphene sponge (GS) free-standing materials (ZnCo-MOF/ GS). The electrochemical behavior of the flexible ZnCo-MOF/GS was probed via galvanostatic charge−discharge, electrochemical impedance spectroscopy, and cyclic voltammetry. The morphological and structural studies of this material were performed by scanning electron microscopy, energy-dispersive X-ray spectroscopy, X-ray photoelectron spectroscopy, X-ray diffraction, and Raman spectrometry. ZnCo-MOF/GS exhibited a high specific capacitance of 695 F/g at 1.0 A/g and excellent cyclic stability with 78% retention after a 7500 cycle test in 3.0 M KOH. Furthermore, a ZnCo-MOF/GS-based symmetric supercapacitor (SC) was fabricated, and this flexible device displayed a specific capacitance of 302 F/g at 1.0 A/g, an energy density of 108 W h/kg, and a power density of 5037 W/kg. Moreover, this flexible SC kept its excellent performance at severe bending conditions. We believe that our electrode with its outstanding electrochemical performance has great potential in energy storage applications, especially for lightweight and flexible electronics.

Presenter: Sonu Parekh

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: Impact of ferroelectric polarization on different semiconductors for photoelectrochemical application

Abstract: Introducing a built-in electric field into the photoelectrochemical system is considered an effective strategy for tuning interfacial energy band bending and manipulating charge transport direction. Here, we design the hybrid ferroelectric semiconductor structure photoanodes for water oxidation, and the $BaTiO_3$ (BTO) is used for ferroelectric while monoclinic WO_3, tetragonal TiO_2, and triclinic $CuWO_4$ for the semiconductors, respectively. After the positive poling, 3 wt % BTO−WO_3 and 3 wt % BTO−$CuWO_4$ hybrid photoanodes perform a significantly enhanced photocurrent of 68.5 and 62.9% compared with the pristine semiconductors. The charge separation and oxidation kinetics efficiencies of these hybrid photoanodes increase by 14−19% and 1.38−1.42 fold, and the electron transport time decreases by 16%. Further, the structure morphologies of these semiconductors were investigated by FE-SEM and TEM. The space charge region near the semiconductor surface has been changed, and the positive polarized ferroelectric induces an outside built-in electric field. This electric field helps to band banding of the interface, especially on the semiconductor with fermi level also it enhances the upward banding to photogenerated holes to migrate to the surface where the water oxidation takes place.

Presenter: Janu Patel

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: Green Synthesis of Biobased Soft Foams by the Aza-Michael Reaction

Abstract: The world has been facing a major resource crisis in the last few decades. In order to tackle such environmental issues, new solutions must be found in order to replace fossil resources by more sustainable, biobased resources. One of the most promising biobased resources are vegetable oils, which are used as building blocks for renewable polymer synthesis. Industrial productions and the corresponding chemical structures make oleo-chemistry very attractive. Nevertheless, such building blocks must compete with usual petrol-based monomers. Hence, this work focuses on the development of new foams in order to replace toxic isocyanate-based polyurethanes foams. Different efficient soft foams were obtained for the first time by Aza-Michael reactions, using acylated soybean oils and biobased amines, with an original chemical blowing system. Properties of the foams have been studied in order to determine the influence of the different structures in terms of morphologies, glass transition, hardness or deformation, etc. Homogeneous open-cell foams with a pore size from 0.1 to 0.5 mm were obtained. Flexible foams were obtained with glass transition from −20 to −7 °C. These soft foams demonstrated a time recovery of about a few seconds and exhibited similar properties to equivalent commercial fossil-polyurethane foams, without the use of highly toxic chemicals.

Presenter: Meet Patel

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: Fabrication of Nanometer-Sized Nickel-Based Metal Organic Frameworks on Carbon Nanotubes for Electro-Catalytic Oxidation of Urea and Arsenic Removal

Abstract: Even though metal organic frameworks (MOFs) have rapidly emerged as useful materials in many applications, their inherent low conductivity necessitate hybridizing them with conductive carbon nanostructures like graphene or carbon nanotubes (CNTs) or carbon black especially in energy storage and energy generation applications like batteries, super capacitors, and electro-catalysts in oxygen reduction reaction (ORR). However, to date the synthesis of MOF/CNT is carried out by mixing pre-synthesized MOFs with oxidized or chemically modified CNTs. In this article, we report synthesis of nano-meter-sized Ni-MOF/CNT by the reaction of nickelocene-derived nickel oxide-decorated CNTs with terephthalic acid synthesize from waste polyethylene terephthalate (PET). Morphological studies by scanning electron microscopy and transmission electron microscopy shows nanometer-sized Ni-MOF particles anchored on defect-rich carbon nanotubes, whereas the chemical changes associated with transformation of NiO@CNT into nanometer-sized Ni-MOF/CNT were evaluated by X-ray photoelectron spectroscopy and energy-dispersive X-ray spectroscopy analysis. The utility of nanometeric Ni-MOF/CNT as an electro-catalyst in urea oxidation reactions and removal of arsenic from contaminated water is reported. The applicability of our developed technique to synthesize nanometer Fe-MOF/CNT is also demonstrated.

Presenter: Pratik Patel

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Chemistry

Title: Core-Shell Structured MXene@Carbon Nanodots as Bifunctional Catalysts for Solar Assisted Water Splitting

Abstract: To produce green energy, the synthesis of inexpensive bifunctional catalysts with excellent catalytic activity, durability, and stability across a wide range of pH is an urgent requirement for the extremely effective, reasonably priced, and streamlined overall water-splitting. In this article, core-shell structured MXene@carbon (MX@C) nanodot hybrid with efficient hydrogen evolution reaction (HER)/ oxygen evolution reaction (OER), in which N-doped carbon shells are formed in a heteroepitaxial manner and strongly interact with MXene active side. As a result, MX@C nanodot hybrids reflect good catalytic activity in different pH settings ranging from 0 to 14. At the acidic and neutral medium, MX@C showed significant onset overpotential as compared to the alkaline medium. The Tafel slope of MX@C is 32 mV/dec in contrast with Pt/C because of the enhanced charge transfer and recombination reactions. Molybdenum doped bismuth vanadate (Mo:BiVO4) is used as a cocatalyst of the photoanode in the oxygen evolution reaction (OER), and MX@C nanodots are added to its surface. Due to more light absorption and charge transfer frequency, this results in 1.5 times more photocurrent density than pure Mo:BiVO4 at 1.23 V (vs. reversible hydrogen electrode). The advantages of this hybrid catalyst are demonstrated using solar-assisted overall water-splitting cells with an MX@C cathode and an MX@C/Mo: BiVO4 photoanode. These cells show the enhancement of current density from 0.78 to 1.23 mA/cm^2 with prolonged durability over 8 h. These outcomes are ascribed to the facile surface catalytic kinetics at the heterointerface for both OER and HER of the chemically and electrically coupled MX@C hybrid.

Presenter: Vivek Patel

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: Bio-based flexible polyurethane foam synthesized from palm oil and natural rubber.

Abstract: As environment friendly polymers are required to reduce the green-house gas emissions and global warming, bio-based polyurethane foam (PUF) is attracting interest from the industrial sector and researchers. Bio-based polyols for PUF have been synthesized from various renewable resources, mostly plant oils. The present study explored a novel bio-based PUF produced from a mixture of bio-based polyols synthesized from palm oil and natural rubber. Palm oil-based polyol (POP) was synthesized via an epoxidation reaction of double bonds of palm oil followed by complete oxirane ring-opening. Hydroxy telechelic natural rubber (HTNR) was synthesized by oxidative degradation using periodic acid and sodium borohydride. For comparison, two diisocyanates were used: toluene-2,4-diisocyanate and polymeric methylene diphenyl diisocyanate. POP and HTNR were miscible and all PUFs showed polyhedral semi-closed cells and hardness was in the flexible foam range. One possible application of the novel PUF could be thermal insulation.

Presenter: A.A.P.R. Perera

Co-authors: K.A.U. Madhushani, Felipe M. de Souza, Tim Dawsey

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Chemistry

Title: Animal Fat for Polymer Industries

Abstract: The trend of recycling waste materials into valuable resources has grown in this era. Particularly, the polyurethane industry has a strong desire to utilize low-cost, bio-renewable resources for the creation of value-added products. Chicken fat is a valuable byproduct of chicken waste and is currently used for a variety of useful purposes. The amount of chicken waste produced from chicken rendering and processing industries in the United States is staggering annually. Therefore, chicken fat is a less-expensive substitute for manufacturing processes. In this study, we converted chicken fat into chicken fat polyol via epoxidation following a ring-opening approach to form polyurethane foam (PUF). The high unsaturated fatty acids content in chicken fat makes it a prospective alternative source for greener polyurethane formation. The high flammability of PUF is one of the major concerns due to its inherent chemical and physical nature. A P-based flame retardant (FR), namely, Dimethyl methyl phosphonate (DMMP), was introduced to suppress PUF's flammability. The density, closed-cell content, cell distribution, thermal stability, and horizontal burning were carried out to examine the mechanical and thermal properties of PUFs. PUFs retained their structural integrity despite the addition of DMMP, indicating that the active FR component and the biobased PUF matrix interact properly. Moreover, 25% (w/w) chicken fat polyol blended PUF was shown to be a viable material for producing FR- rigid PUF as it provided satisfactory properties for its mechanical and thermal behavior. The incorporation of this type of waste material into PUF synthesis showed novel possibilities for using animal waste as a sustainable option for polyurethane industries such as flexible PUFs, adhesives and coatings.

Presenter: Jay Prajapati
Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Physics

Title: Rational dispersion of $Co_2P_2O_7$ fine particles on N, P-codoped reduced graphene oxide aerogels leading to enhanced reversible oxygen reduction ability for Zn−Air Batteries.

Abstract: Developing low-cost and highly efficient non-precious-metal-based bi-functional electrocatalysts for both oxygen reduction and evolution reactions concerns the key steps for the fabrication of rechargeable metal−air batteries. Herein, a rationally designed strategy is developed to join the merits of metal phosphate and carbonaceous materials for the fabrication of novel hybrid electrocatalysts. Through the self-polymerization of organophosphorus acid and cobalt salts on graphene oxide (GO) under a hydrothermal process to form cobalt phosphonate, and subsequently, high-temperature pyrolysis, the N, P-co-doped three-dimensional (3D) reduced-graphene-oxide-aerogel-supported (rGOA-supported) Co2P2O7 (CoPi) fine particles (CoPi/NPGA) are obtained. The pyrolysis of cobalt phosphonate introduces abundant heteroatom defects and the in situ formed CoPi particles on rGOA, wherein the rGOA permits enhanced electric conductivity and corrosion resistance. Thereby, these two aspects possess different abilities and together endow the obtained hybrid material with enhanced electrocatalytic performance. In 0.1 M KOH, CoPi/NPGA affords a positive onset and half-wave potential in catalyzing oxygen reduction, close to that of the Pt/C benchmark, along with impressive durability. In addition, it also exhibits considerable oxygen evolution electrochemical performance and renders a potential of 1.57 V to achieve a current density of 10 mA cm−2 in 1.0 M KOH. Impressively, employed as the air cathode of the assembled Zn−air battery, this synthesized bi-functional catalyst enables high open-circuit potential, large

powder density, and impressive cycling durability, holding great potential in practical rechargeable batteries.

Presenter: Libby Rohr
Authors: Libby Rohr, Zoey Harvey, Jessica Jones, Chandler Wortman, and Madie Steed

Faculty sponsor: Dr. Covert-Miller
Student Status: Graduate
Major: Sport and Leisure Service Management
Title: Therapeutic Recreation-Based Leisure Education Interventions in Adolescents with Intellectual Disabilities

Abstract: Individuals with intellectual disabilities display a lack of social skills and self-awareness compared to their typically developed peers. Leisure education is useful in teaching individuals with intellectual disabilities appropriate social skills and self-awareness. **Purpose:** To examine the effects of therapeutic recreation-based leisure education interventions on social skills and self-awareness in adolescents diagnosed with an intellectual disability. **Methods:** Adolescents (n=5) who are in a high school Career and Life Skills class participated in a 45-minute therapeutic recreation-based leisure education intervention two days per week for five weeks. Pre-and post-assessments were completed using the Social Empowerment and Trust assessment. Demographics were assessed using mean. **Results:** Data is currently being analyzed. **Conclusion:** Based on preliminary data, it can be suggested that participation in therapeutic recreation-based interventions are beneficial for adolescents with intellectual disabilities. Professionals who encourage leisure education in individuals with intellectual disabilities may see improved outcomes in social skills and self-awareness.

Presenter: Lav Sharma

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: Bio-based wood adhesive from Camelina protein (a biodiesel residue) and depolymerized lignin with improved water resistance

Abstract: The aim of this study was to improve the water-resistance of camelina protein (CP) for wood adhesives with depolymerized lignin. Kraft lignin was depolymerized by H_2O_2-induced oxidation in the presence of ultrasound (US) irradiation to reduce lignin's particle size and thermal stability and increase the hydroxyl group. Coupling with depolymerized lignin camelina protein exhibited increased hydrophobicity. Fluorescence spectroscopy analysis revealed that the oxidation treatment of lignin further stimulated the hydrophilization effect of the protein–lignin copolymer due to the increased reactivity of depolymerized lignin to camelina protein. Accordingly, the water resistance of CP–lignin adhesives was significantly improved. When copolymerized with US-induced oxidized lignin, the camelina protein had increased wet shear adhesion strength from 0.28 to 1.43 MPa, with wood panels passing the three-cycle water-soaking test. The CP resin, with depolymerized lignin as an economical, green, and bio-based hydrophobic enhancer, provided an alternative to petroleum-based and other edible protein-based adhesives, such as soy protein.

Presenter: Rishabh Srivastava

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Material Science

Title: In situ influenced facile synthesis of Nickel phosphide nanocomposite on the Ni foam as optimized electronic configuration for bifunctional electrocatalysts and highly encouraged supercapacitor electrode

Abstract: The rising scrutiny of the environment and increased usage of conventional energy sources affected the availability of fossil fuels. The concerns reinforced the situation and increase the challenges to accessing reliable, sustainable, eco-friendly, and cost-effective energy production resources. Furthermore, the produced energy is required to store for sustainable use. Water-splitting and supercapacitors are the best representatives among the various energy production and storage devices. Herein, we report a binder-free, single-step facile electrochemical deposition of nickel phosphide nanosheet-type structure on the Ni foam. The potentiodynamic records illustrated improved overpotential for nickel phosphide of about 231 and 323 mV than as prepared $Ni(OH)_2$ (239 and 335 mV) and NiO (337 and 366 mV) for HER and OER to deliver a current density of 10 mA/cm^2. Nickel phosphide showed robust performance because of the presence of phosphorous, considered negatively charged so it acts as an effective active site for H_2 dissociation. On the other hand, electropositive metal prefers lone pair-containing species to trap. Furthermore, stability testing was conducted over electropositive metal between the first polarization curve and polarization curve after 10,000 cyclic voltammetry cycles indicating no deviation and showing excellent nickel phosphide stability. Further, the same material electrodes were subjected to supercapacitor application. The nickel phosphide exhibited good performance for electrochemical energy storage with a specific capacity (C_{sp}) increased by 145 % than the C_{sp} acquired by $Ni(OH)_2$ (413 mF/cm^2) and NiO, NiO showed inferior capacitance and power density. However, due to low charge transfer resistance in Ni-P-(OH) delineated good conductivity, higher energy density, and more than 98.9% retention capacity after 5000 cycles. Hence, the results outcast that low-cost, single-step synthesis routes, binder-free, sustainable electrocatalysts hold significant attributes toward electrocatalytic activity for energy storage devices.

Presenter: Rishabh Srivastava

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Material Science

Title: Self-supported 3D rose and 2D flowers like $Mn(OH)_2$ and bimetallic heterostructure of $Mn_xNi_{2x}O$, respectively: in situ synthesis on Ni-mesh for highly efficient electrolyzer and supercapacitor application

Abstract: The constantly growing interest in the production of low-cost and highly abundant transition metal-based electrocatalysts for sustainable assembly to fasten the clean energy technology by electrolytic water-splitting to generate hydrogen (H_2) fuel with low overpotential and high durability. The sluggish kinetics could be further improved with the synthesized catalyst possessing microstructure. In this work, binder-free, electrodeposition-assisted manganese hydroxide ($Mn(OH)_2$) and manganese nickel hydroxide ($MnNi_2(OH)_x$) nanoparticles were developed on Ni-foam using *in situ* mechanism with a three-dimensional cross-linking. Further, the synthesized materials were calcined to obtain the oxide form of

the original composites. Various characterization strategies were employed to study its elemental phases and morphology. The optimum catalytic performance of electrodes was recorded in 1.0 M KOH solution. Thus, the potentiodynamic studies showed improved overpotential value for the oxygen evolution reaction (OER) and hydrogen evolution reaction (HER) at 10 mA/cm^2 current density for $MnNi_2(OH)_x$ was 231 mV and 327 mV, respectively. In addition, high turnover frequency and extensive exposure of comparable active sites facilitated the manganese-nickel composite best candidate for H_2 evolution. Furthermore, the composite material was investigated for electrochemical energy storage ability under the parameters of the supercapacitor module. The capacitance experiment showed a significant increase in specific capacitance (C_{sp}). The $MnNi_2(OH)_x$ (C_{sp} = 308.3 mF/cm^2 @ 1 mA/cm^2) delivered approximately 200% an improved capacitance than $Mn(OH)_2$ and 1300 % niched than oxides. Moreover, $MnNi_2(OH)_x$ showed more than 98.9% retention capacity after 5000 cycles. Hence, the outcomes delineate that low-cost, one-step electrodeposited, binder-free electrocatalysts hold excellent attributes toward electrocatalytic activity for OER and HER and energy storage applications.

Presenter: Vishwa Suthar

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: Polyurethane composite coating from a renewable resource: route and characterizations

Abstract: Polyurethanes (PUs) are durable and mechanically strong material which is suitable for various sectors like furniture, and construction. Using different starting materials to produce PU - is the only approach that makes PU unique among all common polymers. This approach enriches the PU with a wide selection of properties to develop a variety of forms such as, - coatings, adhesives, and foams. In that, petroleum-based polyol,- the main component of PU, is delivering a harmful environmental impact. Also, petroleum sources are non-renewable resources and are expensive in the market. As a solution to that, researchers are taking advantage of renewable resources such as, - linseed, and limonene to use as raw materials in the preparation of polyols. As a green synthesis route, sunflower oil was used in this work to make polyol by using epoxidation and ring-opening reaction mechanisms. The synthesized polyol was further confirmed by standard techniques of FT-IR, GPC, and OH value. After the confirmation of polyol synthesis, polyurethane films were prepared with the addition of isocyanate and a graphene-based composite. Graphene nanoribbons (GNRs), fabricated by chemical unzipping from a multi-walled carbon nanotube (MWCNT), were dispersed into the polyol as composites. The samples were prepared by dispersing 0.01%wt., 0.02%wt., and 0.05%wt. of GNRs concentration. After curing at a certain temperature, various mechanical and thermal tests (TGA) were performed to examine the properties of PU films. As a result, the thermal stability was increased slightly. In terms of mechanical strength, the tensile stress applied to the sample was increased from neat PU (9 MPa) to PU/GNR (11 MPa). The hardness was roughly increased from shore D hardness 53 to 65 for PU/GNR film. This work examined the effect of GNRs with renewable resource-based PUs, in terms of thermal stability and mechanical strength.

Presenter: Priyesh Zalavadiya

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Plastic Engineering Technology

Title: Environmental assessment of the recycling process for polyamides - Polyethylene multilayer packaging films

Abstract: Plastic packaging, and in particular multilayer flexible packaging, has several characteristics that make it essential in everyday life. However, the sustainability of used materials is undermined by the difficulties encountered in their recycling. The purpose of this study is to assess both the technical feasibility and above all the environmental sustainability of an effective process enabling the recycling of polyamides-polyethylene multilayer packaging films. The technique used for the separation of the polymers is based on a selective dissolution, carried out using mono-ethylene glycol. The experimental tests made it possible to identify the best conditions for treating the films and for maximizing yields and final product quality. The Life Cycle Assessment of the recycling process modeled at an industrial level first allowed us to determine the main process hotspots (i. e. the energy consumption). The LCA analysis was then extended, examining the life cycle of polyamides-polyethylene films with different end-of-life treatments, i.e., incineration, energy recovery, and recycling. The results showed that the recycling process, carried out through the selective dissolution of the films, allows for to reduction of the overall environmental impacts of these materials along their life cycle. Therefore, the recycling process analyzed here can be considered an effective approach to increase environmental sustainability and recovery of raw materials.

Poster presentations, Category A: primarily Sciences and Technology, Undergraduate

Poster presentations, Category A: primarily Sciences and Technology, Undergraduate

Presenter: Annika Anzjon

Faculty sponsor: Christine Brodsky

Student Status: Undergraduate

Major: Biology

Title: Urban Transportation Noise Does Not Influence Sea Turtle Nesting Densities Along Florida Coastlines

Abstract: Novel environments resulting from urbanization can have wide ranging impacts on native wildlife. Specifically, light pollution due to urbanization is known to negatively impact sea turtle nesting behaviors; however, little is known regarding the impacts of urban noise on sea turtles. Prior studies have found that nesting sea turtles were more abundant in areas with less urbanization, suggesting that these species may prefer quieter beaches. Not only does urban noise mask other sounds surrounding a nesting turtle, but prolonged exposure can hinder the frequencies that these species can hear at; preventing them from picking up on faint sounds. We hypothesized that noise and sea turtle nesting density were correlated, resulting in decreasing densities of sea turtle nests in areas with increased transportation noise. We investigated this hypothesis by analyzing loggerhead sea turtle (*Caretta caretta*) nest data collected along Florida coastlines by the Florida Statewide Nesting Beach Survey Program. We ran correlation analyses to determine how human population and the sum of all transportation noise impacted sea turtle nesting density, at the county level. The results of this study have the potential to inform marine conservationists as to the influence of noise on these protected species, which will influence future urban planning and design in coastal areas.

Presenters: Braden Baker and Clayton Moore

Faculty sponsor: Clark Shaver

Student Status: Undergraduate

Major: Electronics Engineering Technology

Title: Pet Tracker

Abstract: The Pet Tracker is an electronic tracker that will allow the user to be able to track their pet and observe data based on where they spend most of their time at. The Pet Tracker will have a central hub linked to a collar attachment that will keep track of the animal's movements. The collar attachment will be user friendly, small enough to not interfere with the animal, and be rechargeable. The collar attachment will track the GPS location of the pet and relay that data via Bluetooth to the central hub to then upload to a server.

Presenters: Kevin Birk and Trenton Allison

Faculty sponsor: Erik Mayer

Student Status: Undergraduate

Major: Electronics Engineering Technology

Title: Development of a LunaSat for the Great Lunar Expedition For Everyone

Abstract: The goal of the Great Lunar Expedition For Everyone (GLEE) is to develop hundreds of tiny LunaSats that will be programmed by college and high school teams and deployed on the Moon. The GLEE teams are currently from 22 countries. The PSU team is the only GLEE team in the state of Kansas.

Presenters: Kevin Birk and Trenton Allison

Faculty sponsor: Clark Shaver

Student Status: Undergraduate

Major: Electronics Engineering Technology

Title: Presentation Tool

Abstract: The presentation tool will allow control of presentations with the motion of one's hands. The tool will sense hand gestures and motion to manage a presentation. Different gestures would send commands to the computer to change slides, zoom in/out, scroll up/down, and many other uses for presenting. The gestures would be sensed by an accelerometer. The accelerometer would sense the movement of the presenter and relate the movement to a scan code(s). The tool has two distinct parts, a wrist band and the tool box. The wrist band would be located on the hand and would be use for making gestures. The wrist band will have a Bluetooth module to communicate to the tool box. The tool box would connect directly to the computer via USB. The motion detected from wrist band would send via Bluetooth, information to the tool box. The tool box then would interpret what the gesture was, creating a packet (data) to forward to the computer for certain control commands.

Presenters: Garrett Burghart, Cole Cooper, Kristopher Light, Kasey Reynolds, Timothy Waisner, and Matthew Long

Faculty sponsor: Jeanne H. Norton

Student Status: Undergraduate

Major: Plastics Engineering Technology

Title: Characterization of Immiscible Polymer Blends Manufactured by Twin-Screw Extrusion and Injection Molding

Abstract: 3D printing has become common for prototyping and performing small productions in the plastics industry, as it is faster and cheaper than traditional manufacturing. 3D printing often utilizes filament: a continuous plastic strand on a spool. The goal of our project is to design filament from optimized ratios of polylactic acid (PLA) and thermoplastic polyurethane (TPU). PLA is strong, but brittle while TPU is flexible but lacks strength. By blending them, we will improve the filaments' overall properties. PLA and TPU are immiscible, meaning they do not mix on the molecular level. Extrusion blending will force mixing of PLA and TPU on the nanoscale. PLA/TPU blends were blended in the following ratios (weight percent PLA: weight percent TPU): 90:10, 70:30, 50:50, 30:70, and 10:90. Pure PLA (100:0) and pure TPU (0:100) filaments were also extruded. All filaments were processed to meet a target diameter of 1.75mm (±0.05). The following filaments were also pelletized and injection molded after extrusion blending: 100:0, 70:30, 30:70, and 0:100. Tensile testing, melt flow indexing (MFI), thermogravimetric analysis, differential scanning calorimetry, and scanning electron microscopy (SEM) was performed on all PLA/TPU filaments. Izod impact testing and test bar tensile testing was performed

on injection-molded PLA/TPU. 70:30 and 50:50 blends had the most consistent filament diameter compared to other blends. As TPU incorporation increased, thermal stability and tensile modulus decreased while MFI increased. SEM images indicated TPU domains surrounded by PLA in all blends, indicating that immiscible polymers can be successfully blended into viable 3D printer filament.

Presenters: Gentry Cole, Daniel Castillejos, Trey Leonard, Makyn Wade, and Ian Watts

Faculty sponsors: Paul Herring, Jeanne H. Norton

Student Status: Undergraduate

Major: Plastics Engineering Technology

Title: Scientific Injection Molding Study Utilizing In-Mold Pressure Sensors and the iMFLUX Process Control and Monitoring System

Abstract: Injection molding is a plastics processing method most typically used in mass-production where the same part is being created thousands or even millions of times in succession. Two major industries that use injection molding are single-use medical supplies, like syringes, and consumer products, like food packaging. Over 80% of the plastics items we encounter daily are injection-molded products. Injection molding is advantageous for many reasons: high production volumes, consistent parts, ease of producing parts with complicated geometry, and ease of automation. Despite the advantages, injection molding does have drawbacks: high machine and tool costs, downtime associated with mold changes, and restrictive material requirements. In this project, we will utilize the iMFLUX Process Control and Monitoring System attached to the Arburg All-Rounder 320S 500-150 Injection Molder. The iMFLUX system is more advantageous than conventional injection molding by using constant pressure during the molding process and automatically adjusting to melt viscosity and the injection-molding environment. By observing the graph produced by the iMFLUX system, the pressure will remain consistent throughout the fill and pack/hold process stages. The iMFLUX system will also assist in eliminating hesitation lines, utilize recycled material more efficiently, and function on any mold or with any material. We will be able to compare high-density polyethylene, weathered polypropylene, and non-weathered polypropylene using recycled material from the old Carnie Smith cupholders. We will demonstrate how parts made using the iMFLUX Process Control and Monitoring System compare to parts made via conventional injection molding process control.

Presenter: Josh Evans

Faculty sponsor: Professor Clark Shaver

Student Status: Undergraduate

Major: Electronics Engineering Technology

Title: The Warlock's Chess Set

Abstract: The Warlock's Chess Set is a voice-controlled chess board and mobile app inspired by the chess set in the Wizarding World of Harry Potter. Paired via a Bluetooth connection to a cell phone, the board can move the chess pieces automatically based on the verbal commands given to the Bluetooth device. These commands are then interpreted and sent to a microcontroller within the board. An electromagnet mounted below the playing surface attracts the magnetics in the base of the chess pieces to move them across the board. This automatic chess board is a fun addition to any game night or Wizarding themed party.

Presenters: Zoey Harvey, Jessica Jones, Madie Steed, and Chandler Wortman

Faculty sponsor: Dr. Laura Covert Miller

Student Status: Undergraduate

Major: Recreation Services, Sport, and Hospitality Management

Emphasis: Therapeutic Recreation

Title: Effects of Peer Fitness Activity Programming on Individuals with Intellectual Disabilities

Abstract: People with intellectual disabilities (ID) have low levels of physical activity and greater multi-morbidity than those without ID. Those with ID specifically have low physical activity levels or are known to have very abnormal levels of sedentary lifestyles. **Purpose:** To examine the effects of a therapeutic recreation-based peer fitness physical activity program on adults with intellectual disabilities. **Methods:** Adults with intellectual disabilities receiving day services from a local program will be participating in a six-week, 45-minute peer fitness program. Pre- and post-assessments include: blood pressure, heart rate, weight, height, waist circumference, balance (Berg Balance assessments), aerobic endurance (15-meter Pacer), flexibility (sit and reach), upper body strength (hand grip), and lower body strength (chair stands). **Results:** Project is currently in progress. **Conclusion:** Once the program is completed, it is hoped peer fitness physical activity programs are shown to be beneficial to physical health in adults with intellectual disabilities.

Presenters: Elyjah Helm, Collin Carlson, Preston Estep, Seth Lindsey, and Thinh Tran

Faculty sponsors: Dan Spielbusch, Jeanne H. Norton

Student Status: Undergraduate

Major: Plastics Engineering Technology

Title: Injection Mold Tool Prove-Out: Clothes Hanger Tool Build and Process Set-Up

Abstract: The Department of Engineering Technology at Pittsburg State University continues to stand out among other universities through the increased level of hands-on learning experiences incorporated into the curriculum. Plastics Engineering Technology (PET) students are required to use injection molding machines as they are a prominent manufacturing process in the plastics industry. This project focused on manufacturing a unique clothes hanger injection molding tool using a 3D printer to print prototypes, producing packaging for the hangers, and performing various studies to determine what material would be best suited to the product. The hanger packaging assembly was achieved by purchasing a glue dot dispenser and working with the Department of Graphics and Imaging Technology to design and produce packaging. A previously donated mold base was machined through collaboration with ETECH. While the mold was in the manufacturing process, we printed hanger prototypes and a fixture for the package assembly process. Once the mold was complete, we began conducting material tests using three materials: high density polyethylene (HDPE), polystyrene (PS), and polypropylene (PP). Material tests were performed to find the optimal time for producing a hanger. We determined that PS was the best material because PS had optimal production time while retaining required mechanical properties. We successfully produced a unique clothes hanger with customized packaging. Now, Pittsburg State University's Admissions Department will have an additional useful promotional item to provide to

prospective students. We have also demonstrated the capability of the College of Technology through inter-departmental collaboration across the College of Technology.

Presenters: Trevor Hertel and Tristen Williamson

Faculty sponsor: Clark Shaver

Student Status: Undergraduate

Major: Electrical Engineering Technology

Title: The Smart Aquarium

Abstract: TNT Aquariums has designed "The Smart Aquarium". This aquarium will allow aquarium enthusiasts to enjoy their aquarium without having to worry about routine maintenance. The Smart Aquarium entails a cabinet with a twenty-gallon aquarium built in that is equipped with an LCD touchscreen to control all features of the tank. One of the biggest hassles of owning an aquarium is water changes, replacing the dirty water in the tank with clean water is now just a button push away. The Smart Aquarium is also equipped with programmable lights to best meet the owners desire, an automatic feeder that can be set to dispense food at certain times of the day, and numerous warning systems that alert the owner of filter blockages, unacceptable Ph levels in the tank, if the automatic food dispenser needs refilled, and many more. The idea behind The Smart Aquarium is to take most of the busy work out of owning an aquarium to allow the enthusiast more time to enjoy their hobby while also taking some uncertainty out of owning an aquarium for beginners.

Presenters: Grant Howard, Mark Arnce, Kennan Guilfoyle, Colton Vlach, and Drew Wiggins

Faculty sponsor: Jeanne H. Norton

Student Status: Undergraduate

Major: Plastics Engineering Technology

Title: Mechanical and Thermal Properties of Polypropylene/Fly-ash Blends

Abstract: Fly-ash is a combustion product of coal-fired power plants. The use of fly-ash as a filler in thermoplastics offers a valuable opportunity to recycle one of the largest waste streams in the US. Fly-ash contains heavy metals, and this waste has the potential to endanger ground water resources. This study investigated the use of fly-ash as a viable filler in polypropylene (PP). We used extrusion compounding followed by injection molding to incorporate fly-ash fillers into PP test samples at 20 weight percent. We utilized calcium carbonate as control filler. We first determined optimum compounding and injection molding process parameters. When samples were produced, we analyzed unfilled PP, calcium carbonate-filled PP, and PP samples compounded with three different fly-ash types: C-type, F-type, and surface-modified fly-ash. We conducted tensile and flexural mechanical testing, Izod impact testing, and thermogravimetric analysis (TGA) on all samples. We determined that fly-ash increased the tensile and flexural modulus, similar to calcium carbonate, when compared to unfilled polypropylene. F-type filler reduced impact strength, while C-type and calcium carbonate were similar to unfilled PP. TGA analysis indicated filler loading levels near 20 weight percent, and thermal stability was similar to that of unfilled PP. Fly-ash can be used as an inexpensive filler that enhances mechanical properties without a significant reduction in impact properties or thermal stability. Use of fly-ash fillers in polyolefins, such as PP, has the

potential to keep a potentially hazardous waste product from entering landfills and providing a viable commercial filler to the plastics industry.

Presenter: Braidy Hunt

Faculty sponsors: Andrew D. George and Mary C. Marine

Student Status: Undergraduate

Major: Biology: Wildlife Ecology & Conservation

Title: Introducing MOFEP: A 100-year Ecological Experiment to Protect Forest Songbirds

Abstract: The Missouri Ozark Forest Ecosystem Project (MOFEP) was created to be a long-term, large-scale experiment to understand the effects of different forest management types on songbird communities and their reproductive success. Initiated in 1991, the project compares bird responses to three silvicultural systems: uneven-aged management, even-aged management, and no-harvest management. Nine 400-ha sites in the Missouri Ozark region were randomly selected to be harvested on a 15-year re-entry interval over a 100-year rotation. A team of researchers has monitored birds on the sites every year between harvests using point counts, spot mapping, and nest monitoring. Thus far, MOFEP has produced many important discoveries that inform bird conservation. In even-aged and uneven-aged management areas, mature forest species such as Ovenbird and Worm-eating Warbler showed a decrease in density following harvest. In contrast, densities of shrubland species such as Indigo Bunting and Yellow-breasted Chat temporarily increased before declining by 10 years post-harvest. Analyses of other MOFEP findings are ongoing, including a comparison of resident bird abundance among management types. MOFEP will continue to provide relevant data to guide sustainable management decisions that promote bird conservation.

Presenter: John Jameson

Co-authors: Dakota Herman, Austin Abrams, Sara Scholes, and Hermann Nonnenmacher, Ph.D.

Faculty sponsor: Hermann Nonnenmacher, Ph.D.

Student Status: Undergraduate

Major: Biology

Title: Eclosion, and pupation mortality, of Antheraea polyphemus Cramer, in an urban setting in Crawford County, Kansas

Abstract: Antheraea polyphemus is a species of giant silk moth native to Kansas, Missouri, Arkansas, and Oklahoma, and it reproduces two times per year. The species pupates in silk cocoons that do not employ a pre-formed escape valve for adults to emerge from. Signs of successful eclosion (exit) are obvious, as are many indicators that the pupa was killed and no moth emerged for reproduction. From March, 2019 to March 2023, 159 cocoons were collected, and then analyzed. Of the 159 cocoons collected and analyzed, 83 (52%) produced reproductive moths, and 76 (48%) showed evidence of pupa mortality by various causes. Mortality was caused by biotic influence (parasitoid insects: Diptera, and Hymenoptera) and squirrels. Mortality caused by abiotic influence included falling from foliage onto hard surfaces, lawn mower blades, and being crushed by automobile drive-over.

Presenters: Jessica Jones, Zoey Harvey, Madie Steed, and Chandler Wortman

Faculty sponsor: Dr. Laura Covert Miller

Student Status: Undergraduate

Major: Therapeutic Recreation

Title: Evaluating the Health and Fitness of Kansas Special Olympic Athletes

Abstract: It has been found that individuals with intellectual disabilities are living a more sedentary lifestyle leading to a lack of physical activity and are known to have an increase in several health concerns later in life. Health concerns for these individuals include obesity, hypertension, coronary disease, and premature mortality. Purpose: The purpose of this project was to evaluate the health and fitness of Special Olympic athletes in the state of Kansas. Methods: Special Olympics Athletes (n=134) participated in a 16-week fitness evaluation. Athletes were separated into three groups. Group A were USA Games athletes, Group B and C were not USA games athletes. Group A and B participated in a Special Olympics fitness challenge while Group C did not participate in a fitness challenge. Pre, mid and post assessments included: aerobic endurance (three-minute step test), balance (one-legged stand), abdominal strength (curl-ups), upper body strength (push-ups), blood pressure, height, weight, and waist circumference. Means were completed using SPSS 27. Results: Timed balance for Group A increased (pre: 26.6 ± 23 seconds; post: 39 ± 87 seconds). Group B had an increase in push-ups (pre: 3.38 ± 6; post: 6.25 ± 7.14). Group C increased push-ups (pre: 1.79 ± 5.10 ; post: 5.87 ± 6.91). Conclusion: Based on the evidence, the Special Olympics fitness challenge could be beneficial for athletes, but additional programs could be recommended for individuals with intellectual disabilities.

Presenter: Brayden Letterman

Co-authors: Sydney Nippoldt, Ayushee Dasgupta, Levi Carrico, Hallee Belgum, and Anuradha Ghosh

Faculty sponsor: Anuradha Ghosh

Student status: Undergraduate

Major: Biology

Title: Prevalence of ticks and tick-borne pathogens in mined land areas of southeast Kansas

Abstract: Ticks serve as vectors for many disease-causing pathogens, particularly bacterial and rickettsial pathogens. Diseases such as Lyme, Anaplasmosis, Ehrlichiosis, Rickettsiosis, Rocky Mountain Spotted Fever, and Tularemia can result after bitten by ticks. These tick-borne diseases are more common in the Great Plains region than is recognized. The present study aimed to conduct a three-year long surveillance on various tick species in the mined land area in Cherokee County (KS) using dry ice bait as well as flag-drag technique. Over several visits (June 2020 – Aug 2022) to the collection site, ticks were collected using both trapping methods. Detailed environmental data was also collected during each visit on-site. Collected ticks were brought to the lab in vials kept in ice-cooler and differentiated by species, sex, and life stage in the laboratory using a dissectoscope. A total of 1880 adults and nymphs as well as 280 larvae were collected from both woodland and grassland areas. The majority of which were identified as *Amblyomma americanum* (90.1%; Males-384, Females-433, Nymphs-877) followed by *Dermacentor variabilis* (9.9%; Males-65, Females-79, Nymphs-42). Pathogen testing on these ticks are being carried out by our collaborator at Oklahoma State University. This long-term ecological study will help better understand the variations in tick-pathogen prevalence influenced by various environmental

parameters and thus appropriate management programs can be implemented to reduce the risk for human/animal diseases.

Presenter: Brock Marquardt

Faculty sponsor: Dr. Charles J. Neef

Student Status: Undergraduate

Major: Biology

Title: Flame retardant properties of ferrocenium salts in polyurethanes

Abstract: Polyurethanes are widely used for many commercial and industrial applications such as foams for bedding or furniture, coatings, and insulation. However, they are highly combustible and produce a dense smoke and potentially toxic off gases upon ignition. To reduce the flammability of polyurethanes flame retardants are included as an additive or incorporated into the polymer backbone. One class of flame retardants that is often used is brominated flame retardants (BFR). BFRs significantly reduce the flammability of polyurethanes but their use is under increased scrutiny due to their environmental and safety issues. BFRs are environmentally persistent and bioaccumlative in addition to being suspected of causing neurological problems in humans and animals. To circumvent the problems with BFRs, novel flame retardants are needed and research within our lab has shown ferrocene to be a promising candidate. Ferrocene polyols are easily synthesized and incorporated into the polymer backbone. However, little research has been reported on ferrocenium salts. Ferrocenium toluene sulfonate was synthesized by oxidizing ferrocene with quinone using PTSA as the acid. The ferrocenium salt was then blended into polyol at various amounts prior to the addition of the isocyanate to determine its flame retardancy. The results of the horizontal flame testing and TGA will be presented along with possible synergistic effects with halloysite.

Presenter: Mariah Monsour

Faculty sponsor: Dr. Laurent *Prétôt*

Student Status: Undergraduate

Major: Psychology

Title: Performance of the dottyback fish on the biological market task

Abstract: Despite their small brains, adult cleaner fish from the species *Labroides dimidiatus* outperform juvenile fish and several non-human primates on the *biological market task* (also called ephemeral reward task), a dichotomous choice task derived from the cleaner-client fish mutualistic interaction (Salwiczek, Prétôt, et al., 2012). This finding suggests that ecology and experience rather than brain size efficiently equips species to be sensitive to particular cues when solving ecological problems. Consistent with this idea, when the task is modified to be more relevant to primates than fish, monkeys improve their performance (Prétôt et al., 2016a&b). An important remaining question concerns the extent to which the cleaner fish results generalize to fish species that do not face the same ecological dilemma. In the current study, we addressed this question by testing dottybacks (*Pseudochromis aldabraensis*, n = 5; *P. flavivertex*, n = 3; *P. fridmani*, n = 6)—an understudied group of non-cleaner fish that inhabit crevices and small caves of coral reef—in the biological market task. The results indicated that, as a group, dottyback fish performed worse than the cleaner fish (two-tailed Fisher's exact test, $p < 0.01$), further supporting that the cleaner

fish's ability to solve the task is linked to specific environmental conditions which are not met anywhere in and beyond the fish taxon. This finding contributes to the growing literature on the biological market task and, more broadly, emphasizes the importance of studying species' ecologies to enhance our understanding of their behavior and cognition.

Presenter: Kamryn Odell

Faculty sponsor: David Boffey

Student Status: Undergraduate

Major:

Title: TBA

Abstract: TBA

Presenters: Alexandra N. Robinson and Wang Lin

Faculty Sponsor: Dr. Ram K. Gupta

Student Status: Undergraduate

Majors: Biology and Chemistry

Title: One-Step Synthesis of Fe-MOF: An Efficient Catalyst in Water-Splitting

Abstract: While the world continues to progress, new inventions and innovations develop, demand of products increases, and mass production of outputs expands. Unfortunately, these advancements result in a surging need for fuels, leading to the current energy crisis. Many scientists are searching for clean alternatives to fossil fuels, such as hydrogen gas. Currently, water splitting appears to be the optimal method of attaining it, since the products are hydrogen and oxygen gas. However, there is a downside to this reaction: the rate is slow and requires a high energy input. Due to this, an effective, stable, and abundant catalyst must be determined. Many scientists have directed their attention to transition metals, since they tend to have strong catalytic activity, are cheap and abundant, and do not release as many harmful byproducts. MOF structured materials have unique properties that allow them to have a synergistic effect. Additionally, MOF structures increase the porosity of materials, which increases efficiency. Therefore, the single-step microwave method was used to synthesize Cu-MOF, Fe-MOF, and CuFe-MOF, since iron and copper are both abundant and stable in both alkaline and acidic environments. The characteristics of these materials were studied using X-RAY Diffraction (XRD). Their catalytic activity, as illustrated by the Three-Electrode Testing system, demonstrates that Fe-MOF has good catalytic activity in OER, with a low overpotential of 313mV to reach a current density of 10mA/cm^2, low Tafel slope of 81mV/dec, and good electrochemical stability.

Presenters: Christian Staecker and Phil Hail

Faculty sponsor: Dr. Erik Mayer and Professor Shaver

Student Status: Undergraduate

Major: Electronics Engineering Technology

Poster presentations, Category A: primarily Sciences and Technology, Undergraduate

Title: An apparatus to detect drowsiness through the use of EEG

Abstract: The Snooze-O-Meter will monitor the alertness of its user and wake them when it detects that they are dozing off. It will work by reading and interpreting brain waves using probes attached to the user's head and ears. Wet cup electrodes attacked to the scalp by conductive gel will be used as the primary spot where biopotential measurement will be taken, and tiptrodes will serve as a secondary data acquisition used in the ears. The Snooze-O-Meter will collect and interpret the EEG data that it receives from the probes as well as save the data for later analyses. Once the device determines that the user is in a certain state of sleep, it will then sound an alarm.

Presenters: Khloey Stringer, Daniel Benson, and Jenell de la Peña

Faculty sponsor: Christine Brodsky

Student Status: Undergraduate

Major: Biology

Title: The Cat's Out of the Bag: Comparing the Presence of Bobcats and Domestic Cats in Three Habitat Types Across Kansas

Abstract: Bobcats (*Lynx rufus*) are the most widespread feline in North America and one of the top predators of the Great Plains. With bobcat populations of the Midwest experiencing declines since the mid-1900s, other species may start to fill the niche of this highly carnivorous predator, such as domestic cats (*Felis catus*). In our study, we compared the presence of bobcats and domestic cats in grasslands, agriculture, and temperate forests in Kansas. We hypothesized that bobcats would be more abundant in temperate forests, specifically those in close proximity to agricultural land uses, due to bobcat's habitat associations with woody cover and their diet of small rodents. We also hypothesized that bobcats and domestic cats would not be present at the same areas due to interspecific competition. To address our research objective, we used camera trap data collected across Kansas as a part of a spotted skunk study. We focused on camera trap data with bobcat and domestic cat detections for our analysis. Each camera was deployed with a sardine can as bait for a 1-month period. We are currently in the process of downloading camera images and analyzing collected data. We plan to determine habitat associations for bobcats across the three habitat types, and describe any relationships between bobcat and domestic cat presence. Understanding the presence and absence of these two mesocarnivore species can provide insight about the overall health and stability of ecosystems across Kansas.

Presenters: Banner Updike, Andy Bryant, Josh DeRosa, Jason Holt

Faculty sponsors: Paul Herring, Jeanne H. Norton

Student Status: Undergraduate

Major: Plastics Engineering Technology

Title: Material Characterization and Recycling of PSU Waste Plastic

Abstract: Plastic waste is a major environmental and societal concern; only 20% of plastic waste is recycled. The current challenge faced by the plastics industry is how to use waste plastic and produce quality plastic parts. In this project, waste material was polypropylene (PP) cup holders from the renovation of Carnie Smith Stadium that experienced different exposure to weathering over time. Some cupholders were exposed to Kansas weather, while others were stored. All waste material was chopped into processable

pellets. Material was analyzed by melt flow indexing (MFI), differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), and infrared spectroscopy (FT-IR) to confirm the base polymer and determine effects of weathering on physical properties. TGA analysis did not indicate significant differences between both weathered and non-weathered material. DSC analysis showed a 10% reduction in crystallinity in the weathered samples. FT-IR indicated the presence of aldehyde carbonyls, an indication of chain scission as a result of oxidation. Weathered material had an MFI more than three times higher than the non-weathered material, indicating molecular weight reduction. Test bars were injection molded for the purpose of mechanical testing of weathered and non-weathered material. Mechanical properties were characterized using tensile, flexural, and Izod impact testing. Non-weathered material demonstrated higher tensile and flexural strength than weathered material. Izod impact testing showed similar results for weathered versus non-weathered material. Promotional items (keychains and frisbees) were successfully injection molded, indicating that, despite differences in material properties, both weathered and non-weathered material could be processed by conventional plastics processing methods.

Presenter: Adam Worsley

Faculty sponsor: Dr. Santimukul Santra

Student Status: Undergraduate

Major: Chemistry

Title: Using Magneto-Plasmonic Nanosensors for the Sensitive Detection of Foodborne Pathogens

Abstract: With a growing global population comes a greater risk for foodborne illnesses to spread because of the international trade of food products, and the amount of food required to feed the population. *E. coli* O157:H7 is a common foodborne pathogen, that has a very low minimal infective dose. For this reason, a simple, effective, and timely method must be employed to test for the presence of *E. coli* on a large scale. To achieve this, we propose a novel magneto-plasmonic nanosensor (MPnS) by integrating surface plasmon resonance (SPR) property with spin-spin magnetic relaxation (T2 MR) technology. The MPnS has gold nanoparticles encapsulated in the polymer-coating of iron oxide nanoparticles. This MPnS shows MR relaxation properties with optical properties better than conventional gold nanoparticles, allowing for rapid and ultrasensitive detection of *E. coli* O157:H7 by SPR, T2 MR, and colorimetric readout. The MPnS based assay could detect low CFU counts of *E. coli* O157:H7 in minutes with no cross-reactivity, in experiments that took place in a simple buffer and complex media. Overall, the formulated MPnS holds great potential for the ultrasensitive detection of *E. coli* O157:H7 in a simple and timely fashion. The MPnS nanoparticle can be used for the detection of other foodborne pathogens, and is highly customizable.

Presenter: Caleb Worsley

Faculty sponsor: Dr. Santimukul Santra

Student Status: Undergraduate

Major: Biology (Cellular and Molecular)

Title: Polymer-Derived Personalized Nanomedicine for Targeted Drug Delivery and Treatment of Prostate Cancer

Abstract: Aliphatic polyester polymers are suitable for delivering cancer therapeutics for targeted treatment. Herein, we synthesized a linear, biodegradable polyester polymer using polyethylene glycol-300, sorbitol, glutaric acid and 4-pentynoic acid as monomers. The synthesis was carried out using

standard melt polymerization technique and catalyzed by Novozyme-435, an enzyme that is more environmentally friendly than traditional organic catalysts. Therapeutic agents and optical imaging dyes were encapsulated by the polymer during the formulation of water-dispersible nanoparticles via solvent diffusion method. The surface functional alkyne groups were used to conjugate folic acid using "click" chemistry for targeted delivery to tumors over-expressing folate receptors. The efficacy of this nanomedicine delivery system was gauged by targeting prostate cancer cells. The results were analyzed by cytotoxicity (MTT) assays, drug release studies, and fluorescence microscopy and the results will be summarized in this presentation.

Presenter: Victoria Yoakam

Faculty Sponsor: Laurent *Prétôt*

Student Status: Undergraduate

Major: Psychology with an emphasis on legal issues

Title: Assessment of inhibitory control in the dottyback fish

Abstract: Inhibitory control—the ability to modulate a prepotent response in favor of one that is more appropriate—helps organisms survive in fluctuating environments and is often considered to be highly correlated with intelligence. Among the paradigms used to test inhibitory control in animals, the *detour task* consists of presenting individuals with a situation where a direct route to a food reward is blocked and a detour must be made to reach it. In one version of the task, the food is placed behind a semi-transparent barrier and the subject needs to inhibit its motor impulses to reach for the food directly by moving away from it, thus avoiding to bump or touch the obstacle. Previous work indicates that the cleaner fish *Labroides dimidiatus*, who engage in complex cleaning interactions with other coral reef species, shows effective inhibitory control in the task (Triki & Bshary, 2021). In the current study, we tested nine dottyback fish from the genus *Pseudochromis* (*P. aldabraensis*, *P. flavivertex*, *P. fridmani*), an understudied group of non-cleaner fish that inhabit crevices and small caves of coral reefs. As a group, dottybacks showed a success rate of 10% (18/180 trials), which was significantly lower than the performance of the cleaner fish in the same paradigm (two-tailed Fisher's exact test, $p < 0.01$). Taken together, our findings add to the growing literature on inhibitory control in the fish taxon and, more broadly, emphasize the importance of studying species' ecologies and natural histories to better understand their behavior and cognition.

Poster presentations, Category A: primarily Sciences and Technology, Undergraduate

Poster presentations, Category B: primarily Business, Education, and Humanities, Graduate

[NONE]

Poster presentations, Category B: primarily Business, Education, and Humanities, Undergraduate

Poster presentations, Category B: primarily Business, Education, and Humanities, Undergraduate

Presenter: Keegan Dawkins

Faculty sponsor: Kyle Thompson

Student Status: Undergraduate

Major: History

Title: Why the Military college programs were not effective

Abstract: The V training programs were designed to get the United States in fighting shape to take on Axis forces before deploying men on the battlefield. The programs enlisted men for the Army and the Navy for mobilization and training for the battlefield. Despite minor setbacks, these Programs were effective in mobilization, but claimed that battle-ready training was established, which was different. Research suggests that these programs threw men onto the battlefield without proper training while making bold claims of their effectiveness. Soldiers paid dearly for these mishaps in the Pacific and European campaigns, demonstrating that these programs were ineffective. The purpose of evaluating the V programs is to discover if troops were ready for war by attending these training programs, but evidence points out that this is not the case. Navy and Army men paid dearly for their mistakes that should have been avoided if they had been adequately briefed on battlefield operations. However, they paid dearly for these mishaps in the Pacific and European campaigns, which will be examined and presented with sound evidence that these programs were ineffective. Furthermore, the combat engagements also reflect this ideology in the argument presented with aftermath battle results. Therefore, the United States unintentionally deployed its men, who needed to be more knowledgeable about the battlefield.

Presenter: Madeline Owen

Faculty sponsor: Kyle Thompson

Student Status: Undergraduate

Major: History

Title: Women's Transformation in the Gilded Age

Abstract: This paper explores the role women in American society during the Gilded Age, which was transformational for American women. They improved their education to better apply their work skills to a more public life, gain freedoms within their marriages and sexual lives, and seek overall equality to their male counterparts while still meeting the societal expectations of the Victorian Age era. The long-term trends being made through industrialization, immigration, and urbanization throughout the Gilded Age provoked responses from the women of the time to make their own changes to social roles. This paper uses a variety of primary and secondary sources; such as historical documents, scholarly articles, and textbooks; to examine the ways in which women were affect by these changes and their response. My analysis reveals that the Gilded Age was a time of great change and transformation for women as they gained an increasingly important social roles. Women gained new opportunities in both education and the workforce, and they also began to participate more actively in political and social reform movements. However, these gains were not without their challenges, and women still faced significant barriers to equality. Understanding this transformation is crucial to understanding the history of women in America and their continuing struggle for equal rights and opportunities.

Presenter: Paul Worsley

Faculty sponsor: Kyle Thompson

Student Status: Undergraduate

Major: History and Biology (Premed)

Title: British Formal Rule in India: The Fall of the British East India Company

Abstract: Imperialism is an area of British history that has received increased study since the Empire's decline in the twentieth century. Historians have spent much time debating how economic interests in London determined imperialistic goals in peripheral edges of the British sphere of influence. One entity synchronous with British Imperialism is the British East India Company; originally chartered in 1600 by Queen Elizabeth I, the Company shaped British influence overseas for more than three centuries. Until 1858, India was informally ruled through the British East India Company. This presentation will explore why the British government decided to take formal control of India in 1858 and what role the East India Company played in the takeover. Unlike most research on the subject, this presentation will focus on socio-economic aspects of India rather than economic interests in London. While the main drivers of imperialism were economic interests in the mainland, there was a shift towards formal control that began in India. Formal rule was initiated in India through corruption, poor wages, and oppression that led to full scale revolt. The decision to formally rule India was thus a reaction to the socio-economic upheaval originating in India.

Poster presentations, Category B: primarily Business, Education, and Humanities, Undergraduate

Poster presentations, Category C: Creative Works, Graduate

Poster presentations, Category C: Creative Works, Graduate

[NONE]

Poster presentations, Category D: Topical Literature Review, Graduate

Poster presentations, Category C: Creative Works, Undergraduate

[NONE]

Poster presentations, Category D: Topical Literature Review, Graduate

Presenter: A.A.P.R. Perera

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Chemistry

Title: Tin selenide-based anode materials for lithium-ion batteries

Abstract: Tin-selenide (SnSe) based anodes have attracted considerable attention in recent years as a promising alternative to conventional graphite anodes in lithium-ion batteries due to their outstanding properties such as high energy density, fast charging, long cyclic stability, and environmental benefits. The theoretical capacity of SnSe-based anode materials is larger than that of graphite (372 mAh/g), at roughly 790 mAh/g. Hence, research has demonstrated that lithium-ion batteries using SnSe-based anodes can store more energy in the same amount of volume. SnSe based anode materials has a higher electronic conductivity than graphite, allowing more efficient transfer of lithium ions. As such, SnSe anode materials can be charged faster than conventional graphite anodes. The high cyclic stability of SnSe indicates that they can be charged and discharged more times without degrading. All these characteristics make them ideal candidates for high-performance lithium-ion batteries. Compared to the conventional materials used in lithium-ion batteries, SnSe is an Earth-abundant non-toxic material. Consequently, it can be termed as a more environmentally friendly option. This literature review summarizes the properties of potential applications of SnSe-based anodes in lithium-ion batteries for the development of energy storage applications.

Presenter: Vatsal Chaudhari

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Polymer Chemistry

Title: Soybean oil-based non-isocyanate polyurethane adhesive for wood application with high mechanical strength

Abstract: The rapid expansion of the polyurethane (PU) market requires a facile synthesis route as the world is proceeding toward sustainability. PU has multiple applications for both flexible and rigid forms such as bedding and construction, respectively. Previously, this class of polymer had a high dependency on petrochemical resources which can be solved by replacing them with renewable sources. These include vegetable oils like soybean oil, which was already used for the preparation of PUs. However, this conventional method contains isocyanate, which is harmful to the environment as well as human health. Therefore, researchers are continuously attempting experiments on non-isocyanate polyurethane (NIPU). Herein, epoxide soybean oil (ESBO) was treated with carbon dioxide (CO_2) and a catalyst in the presence of heat. The synthesized carbonated soybean oil (CSBO) was blended with ethylenediamine to produce a NIPU adhesive network. This network showed thermal stability till 180 °C temperature which was determined by thermogravimetric analysis (TGA). Furthermore, to study the tensile strength of the NIPU adhesive, a single lap joint sample was tested with a tensile testing machine. To strengthen the

thermal and mechanical properties of the polyurethane adhesive, silicon (Si) nanopowders were added as a filler with various particle size (100 nm, 200∼300 nm, and 500 nm). With the control NIPU sample, 8.81 MPa of tensile strength was recorded. As expected, the addition of the filler to the NIPU adhesive resulted in high thermal stability (up to 220 °C) and tensile strength 9.85 MPa. This increment in the mechanical property was likely due to the rigid silica particles which prevented the crack from spreading and increased the toughness of the overall material. So, the observed phenomenon indicated that the improved mechanical strength agreed with the crack pinning mechanism. The hydrophobicity was detected by the water contact angle (WCA) test. This work brought a facile path to produce NIPU adhesive from soybean oil which could be further used as a wood adhesive.

Presenter: Himanshu Chaudhary

Faculty sponsor: Ram K. Gupta

Student Status: Graduate

Major: Engineering Technology - Plastics Technical

Title: Redox Additive-Improved Electrochemically and Structurally Robust Binder-Free Nickel Pyrophosphate Nanorods as Superior Cathode for Hybrid Supercapacitors

Abstract: For several decades, one of the great challenges for constructing a high-energy supercapacitor has been designing electrode materials with high performance. Herein, we report for the first time to our knowledge a novel hybrid supercapacitor composed of battery-type nickel pyrophosphate one-dimensional (1D) nanorods and capacitive-type N-doped reduced graphene oxide as the cathode and anode, respectively, in an aqueous redox-added electrolyte. More importantly, ex-situ microscopic images of the nickel pyrophosphate 1D nanorods revealed that the presence of the battery-type redox additive enhanced the charge storage capacity and cycling life because of the microstructure stability. The nickel pyrophosphate 1D nanorods exhibited their maximum specific capacitance (8120 mF/cm^2 at 5 mV/s) and energy density (0.22 mWh/cm^2 at a power density of 1.375 mW/cm^2) in 1 M KOH + 75 mg K_3[Fe (CN)$_6$] electrolyte. On the other side, the N-doped reduced graphene oxide delivered an excellent electrochemical performance, demonstrating that it was an appropriate anode. Our results suggested that the materials and redox additive in this novel design hold great promise for potential applications in a next-generation hybrid supercapacitor.

Poster presentations, Category D: Topical Literature Review, Undergraduate

Presenter: Charis Trusty
Faculty sponsor: Barb McClaskey

Student Status: Undergraduate

Major: Nursing

Title: Stem Cell Regenerative Therapy

Abstract: Injury is a natural part of life and aging but the human body has been designed in such a way as to "self-renew" in response. Stem cells can differentiate into any kind of cell and compensate for the damaged ones. This means that broken skin, joints, organs, etc. can regenerate in the same way that they generated in utero. However, the number of stem cells we have are established in development and, consequently, decline in number with use. Through stem cell regenerative therapy, the body is given the ingredients necessary to grow and replace severed tissue, such as cartilage in osteoarthritis. Conventional therapy provides a temporary solution by removing tissue or replacing it with external material. Stem cell therapy is a non-pharmacological, minimally invasive therapy that uniquely promotes autologous tissue renewal and offers a long-term solution with fewer risks and a higher quality of life. A combination of stem cell injections, plasma rich protein, and laser therapy over the course of several months has produced successful results and should, therefore, be included in patient education regarding options for relevant injury treatment.

Poster presentations, Category E: High School

Presenter: Anna Barnhart, Joplin High School

Faculty sponsors: Karissa Boyer, Joplin High School, and Dr. Christopher Lupfer, Missouri State University

Title: The Effects of Various Diet Consumption on Simulated Alzheimer's Disease Responses

Abstract: Alzheimer's disease kills 1 in 3 senior citizens every year (Alzheimer's Disease Facts and Figures, 2020). This disease has no cure and doctors are unsure of its cause. Many wonder if certain life changes such as diet could help prevent the onset of Alzheimer's disease. One common trait among Alzheimer's disease patients is a higher level in cortisol (Daniilidou, 2021). Linking the rise in cortisol levels to these lifestyle changes, this experiment studied the link between diet and cortisol using fecal sample analysis with a microplate reader. The Novel Object Recognition test was then used to analyze the effect of diet on cognitive memory function. In this experiment, diet was not a key factor in cortisol levels. However, the Novel Object Recognition test results showed that diet could affect other areas such as memory and behavior.

Presenter: Elizabeth Cornish, Joplin High School

Faculty sponsor: Karisa Boyer, Joplin High School

Title: The Effect of Garlic Oil on *Escherichia coli* Living on Lettuce

Abstract: Romaine lettuce (Lactuca sativa var. longifolia) is commonly recalled due to outbreaks of Escherichia coli (E. coli). E. coli contamination can prove fatal with an average of 100 deaths yearly (Branch, 2019). Garlic (Allium sativum) has been shown to be an effective treatment against E. coli (Kumar and Berwal, 1998) but has not been tested on E. coli in lettuce. This project tested the effectiveness of different applications of garlic oil in eliminating E. coli by applying garlic oil to lettuce plants and observing whether or not E. coli was still present by using Eosin-Methylene Blue agar plates. The three application methods for the garlic oil onto the plants were adding to water, adding to soil, and adding topically to plants. The results of the experiment came back inconclusive, with none of the plates, including the control group, having observable signs of E. coli. This project aimed to provide an alternative way of lettuce decontamination.

Presenter: Payton Erickson

High School: Joplin High School

Faculty sponsor(s): Karisa Boyer

Title: The Effect of Different Biochars on the Filtration of Phosphates and Nitrates

Abstract: This research plan was conducted to study different biochars and how they can filter phosphates and nitrates from water to reduce eutrophication in bodies of water. Preventing eutrophication is vital for protecting aquatic biomes, due to the killing of marine life, depletion of oxygen, and damage to the environment. This experiment utilized a flow table and berm-like structures filled with different biochars. One experimental group involved pine biochar while the other experimental group involved coconut husk-derived biochar. Turkey litter served as the source of phosphates and nitrates and a control table was

constructed (no biochar). A real-life ratio of turkey litter to water from an agriculture farm was used. The water was poured at the top of the table, traveled through the berm structure, and gathered at the bottom for analysis. The coconut husk samples were unable to be analyzed due to their dark color. The samples that were processed through the pine biochar did show a significant difference between the initial and final levels of phosphates (p-value of 0.0003). However, the samples that were processed through the pine biochar did show a significant difference between the initial and final levels of nitrates (p-value of 0.015).

Presenter: Vivian Farber

Joplin High School

Karisa Boyer

The Effects of Polyethelyne Microplastics on Generations Using Daphnia magna

Microplastics are a pollution concern for the environment as they are causing health issues in aquatic organisms and transferring diseases (Plastic Planet, 2018). With an increase in plastic production, how will the amount of plastic/microplastics affect future generations? Daphnia magna, great aquatic bioindicators, were used as model organisms. Two chronic tests were conducted observing survival rate, reproduction rate, and organism body size. In the first test, half of the organisms were exposed to polyethylene microplastics. The babies reproduced in the first test were then used in the second test with multiple treatments. The survival rate of organisms exposed to microplastics had no significant difference throughout generations but had negative trends. Reproduction was affected only in the first generation, leaving little data to determine effect. Microplastics significantly decreased the size of the organisms. Plastic-exposed organisms were significantly smaller and suggested a trend to decrease over each generation. If this trend were to continue across multiple generations, there is the potential of the organisms becoming so small they can no longer reproduce efficiently due to the lack of size and maturity

Presenter: Brooklyn Hiller

Joplin High School

Karisa Boyer, Joplin High School, and Dr. Lynell Gilbert-Saunders

The Effected of Benzalkonium Chloride on Elodea canadensis and Medicago sativa

Benzalkonium chloride, which is used in disinfectants, detergents and some soaps, is a chemical used widely to kill bacteria, viruses, and fungi. Due to its structure, benzalkonium chloride belongs to a class of Quaternary Ammonium Compounds (QACs). Unfortunately, 75% of the QACs commonly used are later detected in wastewater treatment systems, with benzalkonium chloride making up the majority (Zhang, et. al, 2010). These chemicals can be extremely toxic to aquatic wildlife and plants by causing genetic damage to both and low fertility among wildlife (Ferk, et. al, 2007). Elodea (Elodea canadensis) and Alfalfa (Medicago sativa) were used to study the absorption of benzalkonium chloride. Analysis was performed on the growth of the Elodea sprigs and both plants were studied to quantify the weight/volume % (wt/vol%) of benzalkonium chloride absorbed into the living plant tissue. Results showed the presence of benzalkonium chloride in water uptake at various concentrations did affect plant growth for Elodea with a p-value of 0.00136. However, the results for the absorbed benzalkonium chloride analyzed by gas chromatography were varied according to species and concentrations introduced (in wt/vol%). The p-value of the Elodea was 0.2706 which demonstrates there was not a statistical significance in the

concentrations used. With Alfalfa, the absorption of benzalkonium chloride was unique for each concentration, with a p-value of 1.17 x 10 -16, indicating statistical significance. Thus, the Alfalfa samples had an increase in benzalkonium chloride absorption when exposed to higher concentrations with up-take water exposure. Funding by the Whitmire Foundation

Presenter: Joseph Ipsen

High School: Joplin High School

Faculty sponsor: Karisa Boyer

Title: Organic Treatments Options for Moraxella catarrhalis (Pink Eye) Infections in Cattle

Abstract: Moraxella bovis is the leading cause of pink eye in cattle (Peek, 2017). Organic beef farmers cannot use antibiotics or they will lose their organic certification ("Pink Eye in Organic Cattle", 2020). This project investigated natural treatments (honey, hydrogen peroxide, and silver nitrate) as alternatives for organic farmers. These were chosen because of their previous benefits in treating open wound injuries and their antibacterial properties (Mandal and Mandal, 2011). Moraxella catarrhalis, a BSL-1 bacterium that is similar to Moraxella bovis, was cultivated and lawns of growth were created on BHI agar plates, then the treatments were impregnated into discs and added to the lawn of growth. Then every 24 hours the zone of inhibition was measured. Penicillin-impregnated disks, water with blank discs, and just blank discs served as control treatments. All of the treatment options produced a zone of inhibition. Hydrogen peroxide produced the largest zones while honey produced the smallest. All natural treatments were more effective than water. Both dilutions of hydrogen peroxide were more effective than penicillin. There was a statistically significant difference between the average size of the zones of inhibition created by each group on the last day of measurement (p- value of $3.54x10^{-16}$).

Presenter: Isabella Yust

High School: Joplin High School

Faculty sponsor(s): Karisa Boyer

Title: The Effect of Probiotic Brands and Costs on True Microorganism Content

Abstract: Probiotics are currently not regulated as a drug by the U.S. Food and Drug Administration (FDA). For this reason, there may be different microorganisms within probiotics than was advertised ("Probiotics: What You Need To Know", 2019). To test this, in Phase I bacteria were cultured from three different brands of probiotics, and their genomic sequences were tested. In Phase 2, bacteria were quantified and colonies were counted. This study investigated the questions: does the label on probiotics contain what is advertised and does cost affect the integrity of ingredients? Due to the low concentration of DNA, genomic sequences were not analyzed. There was a statistically significant difference between observed and advertised colony-forming units (CFU's).

Virtual presentations, Category A: primarily Sciences and Technology, Graduate

Virtual presentations

Virtual presentations, Category A: primarily Sciences and Technology, Graduate

Presenter: Aaron Bigando

Faculty sponsors: Dr. Janis Schiefelbein, Dr. Jennifer Harris, Dr. Greg Belcher

Student Status: Graduate

Major: Nursing – BSN to DNP Program at Irene Ransom Bradley School of Nursing

Title: THE IMPACT OF PERSONAL BARRIERS TO INCORPORATING THE AMERICAN HEART ASSOCIATION DIET

Abstract: The leading cause of death worldwide is cardiovascular disease. Diet is the most influential, modifiable factor related to the development and progression of cardiovascular disease. For a patient to be able to optimize their cardiovascular health through diet, they must understand the barriers to incorporating the most appropriate diet. The American Heart Association developed a diet which delivers standardized guidelines for diet. Therefore, identifying the most significant factors that hinder the effectiveness of the diet was necessary. These hinderances can be categorized as physical, psychosocial, and socioeconomic barriers. Demographic differences can also impact dietary choices. A survey was developed to identify and account for the most common dietary barriers. The Barriers to Healthy Eating scale addressed different circumstances which impact diet. By using this scale, providers can understand the individualized barriers for each patient. After meeting the inclusion criteria, 152 research participants completed the scale. Once the surveys were completed, a factor analysis was conducted to identify trends in barriers which allows for more effective education and interventions related to diet. Psychosocial factors, including motivation and environmental circumstances, were determined to be the most significant reported barriers to adopting the American Heart Association diet. This study emphasized the understanding that everyone must deal with unique life circumstances, and they directly impact their diet. With improvements to the quality of diet for patients, cardiovascular deterioration can be reduced.

Presenter: Lyndsay Camper

Faculty sponsor: Jennifer Harris

Student Status: Graduate

Major: Doctor of Nursing Practice

Title: Enhancing Provider Knowledge on the Benefits of LARC use in Teens

Abstract: The present study will be investigating the effects of introducing an educational intervention to enhance the knowledge of family and obstetric providers in the rural area on the benefits of Long-Acting Reversible Contraceptive (LARCs) use in teens. Teen pregnancy is associated with many different health risks including eclampsia, endometritis, and systemic infections. These mothers are also at risk of poverty, lower education levels, reduced employment, and dependence on government assistance programs. Apart from their lack of knowledge on the different types of contraceptives available, many teens do not take their oral contraceptives appropriately. LARCs can include IUDs or implants that prevent unwanted pregnancy up to 20 times better than pills, patches, or vaginal rings. However, it has been found that the majority (97%) of female teenagers aged 15-19 who had sexual intercourse used condoms followed by 65% of them using the withdrawal method and 53% using a pill form of birth control and only 20% of these

females had ever used LARCs. This quasi-experimental research project will be posted to a social media website for providers in the rural Northeast Oklahoma area who are currently providing care to teens in a family or obstetric practice. This post will contain an educational intervention followed by a post-test that will be generated through the Qualtrics website. The data collected will then be evaluated to assess whether an increase in the providers knowledge of the most recent research on the benefits of LARCS in teens will occur after education on this topic is provided.

Presenter: Renee Roth

Faculty sponsors: Dr. Tracy Stahl, Dr. Amanda Alonzo, & Dr. Gregory Belcher

Student Status: Graduate

Major: Doctor of Nursing Practice

Title: A Pre and Post Survey of How Teaching Interventions of Anticoagulant/Antiplatelet Medications Affect Patient Outcomes in the Primary Care Setting

Abstract: With the elderly population expanding in the United States, primary care providers are having to place more emphasis on managing multiple disease etiologies and medication modalities in the outpatient clinic setting. Patients and providers struggle to overcome educational communication barriers that facilitate proper medication adherence and monitoring. The specific aim of this study was to evaluate whether anticoagulant/antiplatelet education increases the patients' knowledge of medication understanding and possible adverse outcomes. Evaluation of antiplatelet knowledge was conducted in a rural health clinic in Columbus, Kansas. The study utilized an individual pre-test post-test design to patients receiving self-management and monitoring education in a Southeast Kansas rural primary care clinic. A paired t-test was run on a sample of 22 education participants to determine whether there was a statistically significant difference between pre-test and post-test scores of knowledge and confidence before and after educational intervention. Analysis of the data demonstrated that the participants' antiplatelet therapy knowledge levels were significantly higher upon completion of the educational session. The educational intervention video presented between the pretest and posttest surveys increased antiplatelet therapy knowledge in participants of this study. By increasing patient knowledge and involving them in their care, patients will experience better therapeutic outcomes and a decrease in adverse effects and consequences related to their antiplatelet medications. Educational interventions for medication teaching in different patient populations should be examined further, this study provides data that supports institution and nationwide implementations of patient teaching on anticoagulant and antiplatelet medications.

Presenter: Jodi Weber

Faculty sponsor: Kristi Frisbee

Student Status: Graduate

Major: Doctor of Nursing Practice

Title: Registered Nurse Education on Prevention of Ventilator Associated Pneumonia in an Urban Midwestern Intensive Care Unit

Abstract: Ventilator associated pneumonia (VAP) is a preventable health condition causing increased hospital stays, over 35,000 deaths each year, and one of the costliest healthcare associated infections. VAP occurs when a patient develops pneumonia after being intubated and mechanically ventilated.

Preventative measures are commonly in place amongst facilities, despite these measures VAPs still are occurring. Poor compliance with preventative measures have been observed in regards to oral care. Staff nurses in an intensive care unit (ICU) at a midwestern urban hospital were provided education on VAPs and preventative measures, with a focus on proper oral care. Staff nurses were given a survey before the educational intervention and seven months after to assess perceptions of importance as well as barriers to providing oral care. Data was collected from the ICU seven months before and after the educational intervention including oral care kit usage, ventilator days, and VAP occurrence. Education was found to increase compliance with oral care the month directly following the educational intervention. No significant change was found after the following months. Education did not impact VAP occurrence. Nurses had high perceived importance and confidence of performing oral care both before and after the educational intervention. Two main barriers to oral care compliance were time constraints due to patient acuity, which was significantly increased, and understaffing. These barriers to proper VAP preventative measures need to be addressed as findings indicate that nurses know and perceive preventative measures to be important but do not have the time to properly implement them.

Virtual presentations, Category A: primarily Sciences and Technology, Undergraduate

Presenter: Leann Trout

Faculty sponsor: Dr. Christine Brodsky

Student Status: Undergraduate

Major: Biology

Title: Interspecific competition and the geographic relationship of the red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), and kit fox (*Vulpes macrotis*)

Abstract: The distribution of a species across a landscape is the result of a multitude of factors, ranging from resource availability, climate, to competition from similar species that share habitat needs. While closely related, the influence of interspecific competition on the geographic distribution of the red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), and kit fox (*Vulpes macrotis*) is not well documented. Our research objective was to examine how the geographic distribution of the red fox, gray fox, and kit fox overlap and the climate features driving these relationships. For data on fox distribution, we utilized camera trap data collected in the fall of 2019 from a nationwide mammal survey (i.e., Snapshot USA). We analyzed the species relationships between average temperature and precipitation with an ANOVA and the presence of each species across the contiguous USA with ArcGIS. Red fox was the most commonly detected fox species across the United States (13% camera sites), while the gray and kit fox were rare (7% and 0.3%, respectively). While these three fox species overlapped in their geographic range, they were rarely captured at the same camera sites. Temperature and precipitation significantly differed across the three species' habitats, with red fox detections occurring at cooler and wetter locations. Therefore, a follow up experiment targeting red, gray, and kit fox could elucidate the relationship between their preferred climate and effects of interspecific competition on their distribution. Understanding these relationships are particularly valuable as climates nationwide are shifting and mammals will need to respond.

Presenter: Renee Trout

Faculty sponsor: Dr. Christine Brodsky

Student Status: Undergraduate

Major: Biology

Title: Red fox (*Vulpes vulpes*) distribution in relation to two prey species: eastern fox squirrel (*Sciurus niger*) and eastern gray squirrel (*Sciurus carolinensis*)

Abstract: Following its introduction for hunting purposes to the United States in the 1800s, the red fox (*Vulpes vulpes*) has expanded its range throughout North America. The expansion of agriculture and associated increases in rodent prey since the fox's initial introduction has allowed this species to proliferate. Eastern fox squirrels (*Sciurus niger*) and eastern gray squirrels (*Sciurus carolinensis*) are two common prey species of the red fox that occupy similar habitats. Our research objective was to determine if the distribution of red fox was the result of the presence of either squirrel species by using data collected via a nationwide camera trap survey (i.e., Snapshot USA). We downloaded data collected in 2019 to analyze camera trap locations at which the fox or either squirrel species were detected. Red foxes were detected at 12% of the 1,502 surveyed locations, with most prey overlap occurring with eastern gray squirrels (co-occurring at 5.8% of sites) compared to fox squirrels (1.3% sites). Our observations revealed a weak pattern between the distributions of red fox and prey species; however, the strength and reasoning behind this

pattern would require further research. The use of camera surveys to evaluate predator distribution in relation to prey species is effective in providing data which reveals spatial patterns. Projects like Snapshot USA help detect wildlife across ecoregions, but can also serve as a baseline for research exploring ecological and geographical trends.

Virtual presentations, Category B: primarily Business, Education, and Humanities, Graduate

Virtual presentations, Category B: primarily Business, Education, and Humanities, Graduate

[NONE]

Virtual presentations, Category B: primarily Business, Education, and Humanities, Undergraduate

Virtual presentations, Category B: primarily Business, Education, and Humanities, Undergraduate

[NONE]

Virtual presentations, Category C: Creative Works, Graduate

Virtual presentations, Category C: Creative Works, Graduate

[NONE]

Virtual presentations, Category C: Creative Works, Undergraduate

[NONE]

Virtual presentations, Category D: Topical Literature Review, Graduate

Presenter: Charla Furing

Faculty Sponsors: Jennifer Harris, Karen Johnson, Julie Dainty

Student Status: Graduate

Major: Doctorate of Nursing Practice

Title: Utilization of a Heart Failure Clinic in Rural Missouri

Abstract: To assess the utilization of the heart failure clinic at one health system, an evaluation will be conducted of the primary patient management of heart failure by the clinic, cardiologist, or primary care provider. Heart failure clinics have been instituted to provide quality education to patients which require in depth teaching to care for themselves appropriately at home. The education that patients receive regarding heart failure allows a patient to provide self-efficacious self-care. Patients' subjective treatment outcomes will be assessed with the Minnesota Living with Heart Failure Questionnaire and identification of their primary source of education and treatment. Patients to be included will be selected from a cohort scheduled for a left heart catheterization with a previous diagnosis of heart failure. Primary care and cardiologists will be provided a questionnaire identifying their management of heart failure and propensity to refer to the heart failure clinic. Comparisons will be made regarding the patient's subjective assessment within each provider category, as well as including data for 30-day readmission related to heart failure within the last year. Results will attempt to identify strengths and weaknesses in education provided in each setting and patient subjective assessment related to the management of heart failure. Should patients' subjective assessments provide data identifying a singular source of management as superior, recommendations will be made to incorporate this into the standard of care for this system when managing heart failure.

Virtual presentations, Category D: Topical Literature Review, Undergraduate

[NONE]