RESEARCH AND CREATIVE ACTIVITIES FORUM

APRIL 15, 2021

2021 SIU Carbondale

Student Research and Creative Activities

Virtual Forum

Program and Abstract Guide

Undergraduate and Graduate Research and Creative Activities

Virtual Forum

April 15, 2021

Sponsored by the Office of the Vice Chancellor for Research, Graduate School, and Graduate and Professional Student Council

Program

Poster Judging Sessions: 10:30 AM − 2:00 PM

Session 1 10:30 AM – 12:00 PM

Session 2 12:30 PM –   2:00 PM

Public Viewing Session: 2:00 PM − 3:30 PM

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Closing Ceremony: 3:30 PM −   4:30 PM

YouTube Broadcast

- Welcome by Dr. Gary Kinsel, Vice Chancellor for Research

- Graduate School Remarks and Awards presented by Dr. Stephen Shih, Director of Graduate School

- Sigma Xi Remarks and Awards

- Forum Awards, New REACH Awards and Closing Remarks by Dr. Gary Kinsel, Vice Chancellor for Research

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Blake Uchitjil**

Authors: Faith M. Still; Kemaly S. Parr; Blake A. Uchitjil; Steven M. Still - Faculty Advisor: Dr. Steven Still

Major/Field of Study: Ag Systems and Education

Identifying the Concerns of Early, Mid, and Late Career Agriculture Teachers in Illinois

Concerns of teachers must be identified to provide quality teacher education programs and professional development. The theoretical framework of this study was the Teacher Career Cycle (Fessler and Christensen 1992). The theory explains that as teachers move through the cycle, their characteristics and professional needs change. The purpose of this study was to identify the concerns of Illinois agriculture teachers of different experience levels. A Likert-type scale of concerns was administered. The sample was divided into three experience groups: early career, mid-career, and late career. The results indicate that certain concerns do change with the level of experience and that mid-career teachers in this sample have the most concerns. We recommend that these results be shared with the Illinois Association of Vocational Agriculture Teachers, universities, state agricultural education staff, and other stakeholders. Those leading professional development should consider years of experience when planning for workshops. Professional development topics on student motivation, balancing personal and professional responsibilities, recruiting and retaining students, and time management should be explored.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Amanda Weidhuner M.S.**

Authors: Amanda Weidhuner, M.S.; Ron Krausz; Stephen Crittenden, Ph.D; Amir Sadeghpour, Ph.D - Faculty Advisor: Dr. Amir Sadeghpour

Major/Field of Study: Agricultural Sciences

How does 50 years of no-tillage and periodic tillage effect earthworm populations and subsequent soil physical characteristics?

Earthworm populations are generally improved with a lack of disturbance and improve soil physical properties. However, some earthworm populations are more beneficial to soil improvements than others. The objective of this study was to determine the influence of contrasting tillage systems after 49 and 50 years on earthworm communities and their subsequent effects on soil physical properties in a long-term corn (Zea mays L.)-soybean (Glycine max L.) rotation in Southern Illinois. The experimental design was replicated four times, with four tillage treatments, in a randomized complete block design. Tillage treatments included moldboard plow (CT), chisel-disk (RT), 2-yr no till and 1-yr CT (AT), and no-tillage (NT). Tillage treatments received N-P-K fertilization at 196, 24, and 140 kg ha-1, respectively. Lack of disturbance (NT) resulted in the highest earthworm populations, biomass, diversity (H'), and percentage of Epigeic ecotype. However, some disturbance increased species evenness (E) and percentage of Anecic and Endogeic ecotypes. It seems that although tillage is an extreme form of disturbance when discussing the soil ecosystem, the intermediate disturbance hypothesis (IDH) could be applied to earthworm populations, stating that local earthworm species richness is maximized when ecological disturbance is neither too rare nor too frequent (yearly tillage).

Graduate   Poster Number: A003

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Kendall Hyde B.S.**

Authors: Kendall A. Hyde; Benner G. Alves; Kele A. Alves; Francisco L. N. Aguiar; Samara S. Souza; Fabiana A. S. Brandão; Emília C. Garcia; Yago Pinto; Melba O. Gastal; José R. Figueriedo; Dárcio I. A. Teixeira; Eduardo L. Gastal - Faculty Advisor: Eduardo Gastal

Major/Field of Study: Animal Science

Authors' Affiliations: Animal Science, Food and Nutrition Department, Southern Illinois University, Carbondale, Illinois, USA, Postgraduate Program in Animal Bioscience, Federal University of Goiás, Jataí, GO, Brazil, 3Laboratory of Manipulation of Oocytes and Preantral Follicles and Laboratory of Diagnostic Imaging Applied to Animal Reproduction, School of Veterinary Medicine, Ceará State University, Fortaleza, CE, Brazil, Department of Veterinary Medicine, Federal Institute of Education, Science and Technology of Paraíba, Sousa Campus, Sousa, Paraíba, Brazil

Heterotopic autotransplantation of equine ovarian tissue: Efficiency of intramuscular and subvulvar grafting sites

Ovarian tissue transplantation (OTT) is a technique well established and successfully applied in humans using mainly orthotopic or heterotopic transplantation sites. In livestock, OTT is still in its infancy and, therefore, different aspects of the technique, including the efficiency of different heterotopic OTT sites as well as the potential effect of age (i.e., young vs. old mares) in the ovarian graft quality, need to be investigated. The present study investigated the efficacy of the intramuscular (IM) or the novel subvulvar mucosa (SV) heterotopic autotransplantation sites to maintain the survivability of the grafts for 3 and 7 days post-OTT. Ovarian biopsy fragments were obtained in vivo and distributed to the following treatments: Fresh control group (ovarian fragments immediately fixed), SV-3, IM-3, SV-7, and IM-7. During and after graft harvesting, the macroscopic characteristics of the grafts (i.e., adherence, morphology, and bleeding) were scored, and the percentages of morphologically normal and developing follicles, as well as the follicular and stromal cell densities of the grafts were evaluated. The results were that similar (P > 0.05) macroscopic scores were observed between both transplantation sites 7 days post-OTT, with positive correlations (P < 0.01) found among adherence, morphology, and bleeding of the grafts. A lower (P < 0.05) percentage of morphologically normal follicles was found 7 days post-OTT in the SV site (82%) compared with the Fresh control group (99%) and

IM site (95%); however, the percentages of developing follicles were similar ($P > 0.05$) between both transplantation sites 7 days post-OTT (30-43%). Although similar ($P > 0.05$) follicular densities were found in both transplantation sites in young and old mares at 3- and 7-days post-OTT, large individual variation in the follicular depletion rate was observed regardless of transplantation site. The Fresh control group and SV-7 treatments had higher ($P < 0.05$) stromal cell densities in young and old mares compared with the IM-7 treatments. When comparing transplant sites between young and old mares, the follicular density in old mares and the stromal cell density in young mares were greater ($P < 0.05$) in the SV than in the IM site. In conclusion, even though the transplantation sites differentially affected some end points, an overall similar efficiency of the OTT technique using both heterotopic autotransplantation sites (i.e., IM and SV) for equine ovarian tissue was observed.

Agricultural, Life and Physical Sciences

Presenting Author: **Lee Elliott B.S.**

Authors: Lee Elliott; Dr. Mary G. Kinsel; Dr. Gary R. Kinsel - Faculty Advisor: Dr. Gary R. Kinsel

Major/Field of Study: Chemistry

Influence of Matrix Crystal Size on the Plume Effective Temperature in MALDI

Sample preparation has been shown to influence analyte ion signals observed in MALDI mass spectra. Methods to reduce matrix crystal size, control morphology, and improve sample homogeneity have yielded higher, more reproducible analyte ion yields. The influence of crystal size on plume effective temperature is not fully understood. The plume effective temperature (T_{eff}) is a measure of internal vibrational energies of reacting matrix and analyte partners. Here we report studies that compare the T_{eff} for MALDI samples prepared using the conventional dried-droplet method to T_{eff} measured after crystal size is reduced with on target grinding. Amino acids Ala, Val, Ile, and Phe were co-crystallized with sinapic acid using the dried-droplet method to achieve 10:1 and 20:1 matrix-to-analyte ratios. The samples were imaged at 250x magnification. MALDI mass spectra were acquired at 2.19 mJ/cm2 and at reduced laser fluences. After irradiation, dried-droplet sample spots were ground down and re-imaged. Natural logs of the ratios of the protonated amino acids to the matrix ion signals were plotted as a function of the amino acid gas phase basicities for each sample preparation. Plume T_{eff} values were calculated from the plots' slopes and compared for each sample preparation method. The dried-droplet method for 10:1 and 20:1 (mole: mole) were determined to be 853 and 755 K, respectively. Reduction of matrix crystal size caused the measured plume T_{eff} values to decrease. The plume T_{eff} value for the ground dried-droplet sample at 10:1 was 681 K and at 20:1 was 407 K. Lowering the laser fluence reduced but did not eliminate the observed fragmentation. This observation suggests that heat dissipation was limited in the small matrix crystals and led to analyte degradation. The plume T_{eff} values measured at 1.69 mJ/cm2 were still lower than that measured at 2.19 mJ/cm2. The plume T_{eff} value was 458 K for 10:1 and 346 K for 20:1 (mole: mole) matrix-to-analyte ratios.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Afeez Olisa**

Authors: Afeez Olisa - Faculty Advisor: Dr. Gary Kinsel

Major/Field of Study: Chemistry

GCMS, LCMS and HS-SPME GC-MS Methods To Detect Adulteration of Argan Oil

Agricultural, Life and Physical Sciences

Presenting Author: **Andrew Peters**

Authors: Andrew Peters; James Garvey, PhD; David Coulter, PhD; David Glover, PhD
- Faculty Advisor: Dr. James Garvey

Major/Field of Study: Fisheries Ecology/Zoology

Acoustic Split-Beam Sampling to Quantify Target Strengths of Bigheaded Carps (HYPOPHTHALMICHTHYS SPP.)

Invasive bigheaded carp (Silver Carp Hypophthalmichthys molitrix and Bighead Carp H. nobilis) are a major nuisance throughout the Midwest and threaten the Great Lakes, in particular Lake Michigan through the Illinois River Waterway System. Horizontally oriented hydroacoustic sampling is used throughout this system to quantify the density of bigheaded carp, where fish are beamed on the side aspect. To accurately estimate the density in an area using target strength (TS) return, orientation of the fish can be an important factor. Fish swimming alongside a transducer may generate a stronger TS return than one swimming towards or away from it. To determine how fish orientation affects total length estimates, silver carp were suspended in a research pond on a carousel at orientations from three orientation categories (lateral, oblique and head/tail) using a horizontally facing split-beam transducer. Initial results suggest that there is an impact of orientation on TS return (mean TS return for lateral, oblique and head/tail categories were -22.34 decibel (dB), -26.06dB, -28.17dB respectively). This information will allow orientation to be incorporated into size estimates of free-swimming fish of known lengths.

Graduate   Poster Number: A008

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Lakshika Dissanayake**

Authors: Lakshika Dissanayake; Sandipty Kayastha; Juling Zefo; Peter Langridge; Isaac Shaw; Danielle Neal; Ryaan R. Ligon; Lahiru Jayakody, PhD. - Faculty Advisor: Lahiru Jayakody, PhD

Major/Field of Study: Molecular Biology, Microbiology and Biochemistry

Engineering Erwinia aphidicola enables the End-of-Life of polyethylene terephthalate.

Polyethylene Terephthalate (PET) is one of the widely used synthetic polymers due to its versatile material properties. The annual production of PET exceeds 73.39 million metric tons, out of which only 30% is recycled, leading to pollution of terrestrial and aquatic ecosystems. Indeed, current mechanical or chemical recycling techniques are not techno-economically feasible to recycle PET. Hence, our goal is to develop an efficient whole microbial system using Erwinia aphidicola LJJL-01, a novel robust catabolic powerhouse, as the microbial catalysts that selectively degrade PET into monomers ethylene glycol (EG) and terephthalic acid (TPA). We successfully heterologously expressed PET hydrolyzing enzymes, namely PETase and MHETase enzymes from Ideonella sakaiensis, along with their secretion signal peptides in E. aphidicola LJJL-01. We demonstrated the PET hydrolysis activity using intermediate compound Bis(2-Hydroxyethyl) terephthalate (BHET) as the model substrate. Co-expression of PETase and MHETase in E. aphidicola LJJL-01 enables complete conversion of BHET into TPA monomer within 36 hours, with a yield of 0.88±0.10mol of TPA/mol of BHET, which is slightly higher than when the enzymes are expressed in Pseudomonas putida KT2440, commonly used platform organism for PET degradation studies. We are currently exploring these pathways to produce ß-ketoadipate from TPA, a platform chemical that can be chemo-catalytically upgraded into novel material such as PET alternative and nylon analogs. Diverse metabolic pathways in E. aphidicola LJJL-01 paves the opportunity to engineer these pathways to funnel PET degradation products' monomers into value-added compounds, and enable the End-of-Life to PET and PET upcycling.

Agricultural, Life and Physical Sciences

Presenting Author: **Waseem Hussain Ph.D**

Authors: Waseem A. Hussain; Kyle N. Plunkett* - Faculty Advisor: Kyle N. Plunkett

Major/Field of Study: Organic Materials

Thiophene Fused Contorted Aromatics via a Palladium catalyzed Cyclopentannulation and Scholl Cyclodehydrogenation strategy

We report the synthesis of a new class of contorted cyclopenta-fused polyaromatic hydrocarbon (CP-PAH) incorporating thiophene rings. These contorted CP-PAHs were prepared utilizing a two-step process involving a palladium catalyzed cyclopentannulation followed by a Scholl cyclodehydrogenation. This work broadens the scope of annulation chemistry by employing 1,2-bis(5-hexylthiophen-3-yl)ethyne and dibromoaryl derivatives based on anthracene, pyrene and perylene to give 4,4',4'',4'''-(cyclopenta[hi]aceanthrylene-1,2,6,7-tetrayl)tetrakis(2-hexylthiophene) , 4,4',4'',4'''-(dicyclopenta[cd,jk]pyrene-1,2,6,7-tetrayl)tetrakis(2-hexylthiophene) and 1,2,7,8-tetrakis(5-hexylthiophen-3-yl)-1,2,7,8-tetrahydrodicyclopenta[cd,lm]perylene . Scholl cyclodehydrogenation of the pendant thiophene units provided access to the ?-extended polyaromatic systems 2,5,11,14-tetrahexylrubiceno[5,4-b:6,7-b':12,11-b'':13,14-b''']tetrathiophene, 2,5,11,14-tetrahexyldithieno-[4,5:6,7]indeno[1,2,3-cd]dithieno[4,5:6,7]indeno-[1,2,3-jk]pyrenes, and 2,9,12,19-tetrahexyldithieno[4,5:6,7]indaceno[1,2,3-cd]dithieno[4,5:6,7]indaceno[1,2,3-lm]perylene that possess helicene-like fragments . The fully conjugated small molecules give low optical gaps (1.7 - 2.1 eV)with broad light absorption. The HOMO and LUMO energies of these CP-PAHs were found to be in the range of -5.48 to -5.05 eV and -3.48 to -3.14 eV, respectively. Finally, the anthracene based CP-PAH was found to be a p-type semiconductor when tested in an organic field effect transistor.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Oladapo Adeyemi**

Authors: Oladapo Adeyemi, MS; Madhabi Tiwari, MS; Amir Sadeghpour, PhD - Faculty Advisor: Dr. Amir Sadeghpour

Major/Field of Study: Environmental Resource and Policy/Agricultural Science

Managing wheat as a cover crop impacts corn yield and nitrous oxide emission

Winter cereal cover crops, including wheat (Triticum aestivum L.), are recommended as the best in-field management strategy by the Illinois Nutrient Loss Reduction Strategy (INLRS) to minimize nitrate-N leaching to the Mississippi River Basin and the Gulf of Mexico. However, reduction in nitrate-N leaching could result in increased nitrous oxide (N_2O) emissions in the following corn (Zea mays L.) crop in rotation. The objectives of this study were to evaluate the effect of wheat cover crop management on (i) soil N (nitrate-N, ammonium-N, and total N); (ii) soil volumetric water content (VWC) and temperature; (iii) soil N_2O emission, (iv) corn leaf area index (LAI); (v) corn yield; and (vi) yield-scaled N_2O emissions. Treatments included three wheat termination methods [early, late, and residue removal (RR)] plus a no-cover crop control (Fallow). Treatments were laid out in a randomized complete block design with four replicates. Nitrogen fertilizer (Urea Ammonium Nitrate; UAN) rate was 224 kg ha-1 which was split between planting time and at sidedressing time (V4 -V5 growth stage). Our results indicated similar soil N among all treatments. Soil N_2O emissions were higher in early and late terminated wheat compared to the Fallow treatment. Majority of N_2O emission occurred before the V10 growth stage of corn indicating a need for future studies with focus on practices that reduce early season N_2O losses. Maximum LAI values indicated greater photosynthetic capacity in the Fallow treatment. While corn yield was more than 2 Mg ha-1 higher in Fallow than other treatments reflecting on higher LAI values, statistically, there were no differences among treatments. Yield-scaled N_2O emission were lowest in the Fallow and RR treatments. Principle component analysis revealed that when N is available in the soil, soil VWC, which was higher in early and late terminated cover crops, can drive N_2O emissions.

Graduate   Poster Number: A011

Agricultural, Life and Physical Sciences

Presenting Author: **Prasanna D. Patil NULL**

Authors: Prasanna D. Patil; Milinda Wasala; Sujoy Ghosh; Rana Alkhaldi; Lincoln Weber; Sidong Lei; Andrew Nolander; Poopalasingam Sivakumar; Robert Vajtai; Pulickel M. Ajayan; Saikat Talapatra - Faculty Advisor: Prof. Saikat Talapatra

Major/Field of Study: Physics

Gate Tunable Optoelectronic Properties of Selenide-based Two-Dimensional (2D) Materials

Recently selenide based layered materials have attracted attention due to their exciting optical properties. Here we will report optoelectronic properties of phototransistors fabricated using multilayers of InSe and $CuIn_7Se_{11}$. Room temperature photoconductivity measurements on InSe FETs exhibits responsivity (R) of $\sim 5 \times 10^{-2}$ AW^{-1}, external quantum efficiency > 10 % and response time of $\sim$ 20 µs when illuminated with a laser of wavelength λ = 658 nm and at a power of $\sim$ 23 nW. However, our investigations suggest that these figures of merits in InSe can be further improved by alloying InSe with other dopant materials such as copper. For example; we show that $CuIn_7Se_{11}$ FETs exhibit response times of $\sim$ 8 µs with responsivity (R) values > 10 AW^{-1} and with external quantum efficiencies reaching beyond 10^3 % when excited with a 658 nm wavelength laser at an effective power of $\sim$ 63 nW. The properties of the phototransistor can be further tuned and enhanced by applying a back gate voltage. Dominant mechanisms leading to such photo-responsive behavior will be presented and discussed.

Graduate   Poster Number: A013

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **David Barfknecht M.S.**

Authors: David Barfknecht; Saroj Thapa; David Gibson - Faculty Advisor: David Gibson

Major/Field of Study: Plant Biology

Changes in taxonomic and phylogenetic diversity, community composition, and spatial structure of sapling and tree communities following an inland super derecho

Disturbances are events which can lead to drastic changes in the community composition on forested ecosystems. These compositional shifts can occur based on both taxonomic designations of species as well as the evolutionary relationships between taxa. In 2009, a super derecho occurred in areas throughout the Midwest, including southern Illinois. Plant surveys were conducted at LaRue Pine Hills Nature Preserve during both before and after the derecho for sapling and tree communities, to assess taxonomic-based community shifts. The objectives of this research were to expand upon previous research and include perspectives of compositional shifts based on evolutionary and spatial relationships. Phylogenies and multivariate analyses were used to assess shifts in community composition before and after the derecho, and global Moran's I and spatial interpolation based on inverse distance weighting and ordinary kriging were used to evaluate spatial relationships. Ordination analyses showed that sapling communities significantly shifted in taxonomic composition and dispersion, but only phylogenetic composition (not dispersion) after the derecho. Tree communities did not significantly change based on species or phylogenetic composition or dispersion after the derecho. Moran I analysis indicated that taxonomic species richness of saplings was dispersed spatially for before and after the derecho, whereas phylogenetic species richness was clustered before the derecho and dispersed after the derecho. Similarly, taxonomic and phylogenetic species richness for trees was clustered before the derecho but spatially dispersed in after the derecho. Both inverse distance weighting and ordinary kriging spatial interpolation predicted that the higher species richness occurred towards the edges of the preserve both taxonomically and phylogenetically. In addition, Inverse distance weighting performed better than ordinary kriging in predicting taxonomic and phylogenetic species richness.

Agricultural, Life and Physical Sciences

Presenting Author: **Sandipty Kayastha**

Authors: Sandipty Kayastha; Lakshika Dissanayake; Laxmi Sagwan-Barkdoll; Poopalasingam Sivakumar; Aldwin M. Anterola; Lahiru N. Jayakody - Faculty Advisor: Lahiru N. Jayakody, PhD

Major/Field of Study: Plant Biology/Molecular Biology

Microbial production of water-soluble Indirubin-derivatives using novel P450 enzymes

Indirubin is naturally synthesized by medicinal plants such as Indigofera tinctoria L. and Isatis tinctoria L (Woad) as a byproduct of indigo. Indirubin and its derivatives exhibit multifaceted interactions with cell cycle regulation, glycogen metabolism, and Stat signaling. Indeed, indirubin derivatives showed antiproliferative and antitumor effects, and are currently being developed as potential agents for treating psoriasis or maintaining stem cell pluripotency. The main obstacle for indirubin medical application is purity, very low aqueous solubility, poor absorption, and low cellular activity. Researchers synthesized water-soluble indirubin-derivatives via in vitro process or chemical catalytic process and demonstrated pharmaceutical applications. We demonstrated the heterologous expression of ItB24, a novel Cytochrome P450 enzyme, and reductase AtR2 (Arabidopsis thaliana) in E. coli enables the production of pink color compound(s) using tryptophan. We identified this compound(s) as an Indirubin derivative using comprehensive analytical techniques. The strain produced 0.16 g/L of compounds at the yield of 0.4 g of compounds/1 g of tryptophan in Luria-Bertani (LB) after 72 h incubation. The product could be extracted using water without disrupting the cells. Next, we revealed the novel-Indirubin derivative inhibits the growth of E. coli, S. cerevisiae, and pathogenic strains such as Salmonella. We are currently working on generating in vitro biochemical data of purified ItB24 enzyme, constructing the genome engineered strain for efficient production of novel Indirubin compounds, and characterizing the molecular targets of the novel Indirubin derivatives.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Madhabi Tiwari M.S.**

Authors: Madhabi Tiwari; Ashani Thilakarathne; Pawan Kumar, PhD; Amanda Weidhuner; Oladapo Adeyemi; Gurbir Singh, PhD; Jon E. Schoonover, PhD; Karl W.J. Williard, PhD; Amir Sadeghpour, PhD - Faculty Advisor: Dr. Amir Sadeghpour

Major/Field of Study: Soil management and integrated cropping system

Nitrous oxide emission from terminated hairy vetch in tillage systems

Shifting from reduced tillage (RT) to no-till (NT) often improves soil structure and sequesters soil C but may increase nitrous oxide (N_2O) emissions. Including a legume cover crop such as hairy vetch (Vicia villosa L.) before corn (Zea mays L.) is more preferred than winter cereal cover crops (WCCCs) to avoid yield penalty in corn and ensure high grain production. The objective of this study was to evaluate the influence of cover crop (hairy vetch vs. no-CC control) and tillage systems (NT vs. RT) on (i) corn yield, nitrogen (N) uptake, and N removal; (ii) N_2O-N emissions; and yield-scaled, grain N yield-scaled, and total aboveground N yield-scaled N_2O-N emissions in a corn season on a medium-term (six years) tillage × cover cropping system. The highest corn dry matter (DM) yields were observed in hairy vetch rotation with RT practices (8.84 Mg DM ha-1). Reduced tillage increased the corn yield by 2.88 Mg DM ha-1 compared to NT. Greater yield in RT resulted in greater N removal and lower N_2O-N emissions. The greatest N_2O-N losses were recorded from NT with hairy vetch as a cover crop during the corn growing season (22.49 kg ha-1). We concluded that including hairy vetch after soybean can increase the following corn yield due to supplemental N from vetch in a wet growing season. However, supplied N from hairy vetch could further increase N_2O-N emissions in a wet growing season due to increased soil N.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **William Browning**

Authors: William Browning; Amelia Merced, PhD; Karen Renzaglia, PhD

Major/Field of Study: Plant Biology

Stomata have been lost over 60 times during moss diversification

Because stomata in bryophytes are uniquely located on sporangia, the physiological and evolutionary constraints placed on bryophyte stomata are fundamentally different from those on leaves of tracheophytes. Although losses of stomata have been documented in mosses, the extent to which this evolutionary process occurred remains relatively unexplored. We initiated this study by plotting the known occurrences of stomata loss and numbers per capsule on the most recent moss phylogeny. From this, we identified 40 families and 74 genera that lack stomata, of which at least 63 are independent losses. No trends in stomata losses or numbers are evident in any direction across moss diversity. Extant taxa in early divergent moss lineages either lack stomata or produce pseudostomata that do not form pores. The earliest land plant macrofossils from 400 ma exhibit similar sporangial morphologies and stomatal distribution to extant mosses, suggesting that the earliest mosses may have possessed and lost stomata as is common in the group. To understand why stomata are expendable in mosses, we conducted comparative anatomical studies on a range of mosses with and without stomata. We compared the anatomy of stomate and astomate taxa and the development of intercellular spaces, including substomatal cavities, across mosses. Two types of intercellular spaces that develop differently are seen in peristomate mosses, those associated with stomata and those that surround the spore sac. Capsule architecture in astomate mosses ranges from solid in the taxa in early divergent lineages to containing an internal space that is directly connected to the conducing tissue and is involved in capsule expansion and the nourishment, hydration and development of spores. This anatomy reveals there are different architectural arrangements of tissues within moss capsules that are equally effective in accomplishing the essential processes of sporogenesis and spore dispersal. Stomata are not foundational to these processes.

Agricultural, Life and Physical Sciences

Presenting Author: **Madison Decker**

Authors: Madison R. Decker; Ronald F. Krausz; Karla L. Gage - Faculty Advisor: Dr. Karla Gage

Major/Field of Study: Weed Science

An Integrated Approach to Southern Illinois Weed Control: Wheat Against Weeds

Due to the selection of herbicide resistant weed biotypes, there is an urgent need to progress towards more sustainable weed management practices that increase biodiversity, crop productivity, and reduce reliance on chemical weed control. Therefore, field studies were conducted in 2019 and 2020 at the Southern Illinois University Agronomy Research Center in Carbondale, Illinois and at the Belleville Research Center in Belleville, Illinois to determine the effect of inter-seeding winter wheat in soybean on weed suppression and soybean development. A weed-free winter wheat termination date study and a winter wheat planting date-by-herbicide program study were conducted. The purpose of these studies was to identify the most practical and effective implementation practices for southern Illinois soybean growers. Results from the 2019 termination date study indicated no significant differences in soybean yield among inter-seeded treatments where winter wheat was terminated by soybean growth stage V2 or V3. In 2020, no significant soybean yield differences were detected in any treatment where the inter-seeded winter wheat was terminated. In the planting date study, at both locations, common waterhemp biomass was significantly reduced when compared to the soybean-only non-treated treatment when winter wheat was planted prior to soybean at the fall, April, and early May planting dates. Soybean yield from the ARC planting date study indicated that planting winter wheat concurrent with soybean resulted in no yield reduction compared to the standard soybean-only plots. In the BRC planting date study, inter-seeding winter wheat at any of the planting dates with an herbicide program yielded the same as the standard soybean-only program. These data suggest that inter-seeding winter wheat in soybean in combination with an herbicide program could provide further non-chemical integrated weed management for the suppression of common waterhemp. These studies will be repeated in the 2021 growing season.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Caleb Crawford**

Authors: Caleb Crawford; Michael Eichholz, PhD - Faculty Advisor: Michael Eiccholz

Major/Field of Study: Zoology

Influence of Landcover on Northern Bobwhite (Colinus virginianus) Annual Home Range in Southern Illinois

Northern bobwhite (Colinus virginianus) populations have continually declined across much of their native range due to changes in land use and habitat. Bobwhites are dependent upon a suite of specific habitat requirements that must be found within the landscape to satisfy the needs of different components of the annual cycle. I evaluated the influence of landcover type and characteristics on bobwhite annual home-range area at two scales, home-range and landscape. I radio-marked 113 individuals from May 2018 to August 2020 at Burning Star State Fish and Wildlife Area. Out of the 113 radio-marked individuals, 50 bobwhites (31 males and 19 females) were used in my analyses that had =25 independent tracking locations. I manually mapped landcover using UAS imagery and 2019 NAIP imagery to estimate landcover composition at the two scales of investigation. I compared models incorporating landcover classifications hypothesized to be influenced by bobwhite habitat selection, habitat avoidance, foraging habitat, and protective cover at two scales to identify how landcover use influences bobwhite home-range area. At the home-range scale, the proportion of foraging habitat had the greatest influence on home-range area when compared to all other models, including the proportion of protective cover. Additionally, the avoidance model had a greater influence on home-range area when compared to the habitat selection model. At the landscape scale, the habitat selection model had the greatest influence on home-range area. The habitat selection model outcompeted the habitat avoidance model, and the foraging habitat model outcompeted protective cover on the influence of home-range area. As expected, landcover classifications that are thought to be beneficial to bobwhite survival and reproduction reduce home-range area, while landcover classifications thought to be detrimental to bobwhite fitness increased home-range area. My study also demonstrates differential landcover influences on bobwhite home-range area based on the scale of observations.

Agricultural, Life and Physical Sciences

Presenting Author: **Ashani Thilakarathne**

Authors: Ashani M. Thilakarathne; Karl W.J. Williard; Gurbir Singh; Jon E Schoonover - Faculty Advisor: Dr Karl Williard

Major/Field of Study: Watershed Science

Impact of Cover Crops on Nitrate Leaching in a Corn-Soybean Rotation

Winter fallow season and spring are critical times for nutrient management as precipitation has great potential to flush available nutrients from the soil profile in row-crop agricultural fields. Cover Crops (CC) are a promising strategy to reduce nutrient leaching during these time periods. In 2014, a replicated plot study was established to monitor nutrient leaching with pan lysimeters at the Southern Illinois University Carbondale Research Farm. The research layout includes a complete randomized design with two tillage practices [conventional tillage (CT) and no tillage (NT)] and three different crop rotation treatments [corn-noCC-soybean-noCC (CncSnc), corn-cereal rye-soybean-hairy vetch (CcrShv), and corn-cereal rye-soybean-oats+radish (CcrSor)]. Pan lysimeters were installed below the A horizon (~22-30 cm in depth) in each plot. Soil solution was sampled weekly or biweekly depending on precipitation and analyzed for nitrate-N and dissolved reactive phosphate (DRP). During the CC season in spring 2018, cereal rye in CcrShv and CcrSor significantly reduced nitrate-N leaching by 82% and 68% compared to noCC treatment. However, cereal rye season 2020 did not show any significant difference in nitrate-N leaching between treatments. The CC season in spring 2019, CcrShv and CcrSor cover crop rotations had 75% and 68% higher nitrate-N leaching respectively compared to noCC treatment. In spring 2019, significant rainfall delayed cash crop planting creating too long of a window between cover crop termination and subsequent nutrient demands by the cash crop. DRP leaching was reduced 66% in CncSnc under NT compared to CncSnc under CT after cash crop harvesting. This study highlights the role of different cover crop species in limiting nutrient losses in different seasons as well as the importance of timing the release of nitrogen from cover crop biomass to meet the N demands of subsequent cash crops.

Agricultural, Life and Physical Sciences

Presenting Author: **Dipty Poudel**

Authors: Dipty Poudel; Harpreet Kaur; Karl W.J Williard; Jon Schoonover - Faculty Advisor: Dr. Karl W.J Williard

Major/Field of Study: Watershed Sciences

Impacts of Flue Gas Desulfurization Gypsum Application on Water Quality and Crop Production

Agricultural, Life and Physical Sciences

Presenting Author: **Hannah Holmquist**

Authors: Hannah Holmquist; James Garvey, PhD; Gregory Whitledge, PhD - Faculty Advisor: Dr. Gregory Whitledge

Major/Field of Study: Zoology

Fish Community Responses To Water Level Fluctuations In Buttonland Swamp, Illinois

Human alterations to the Lower Cache River have shifted the hydrologic dynamics in Buttonland Swamp where the swamp is inundated year around by dams to keep it from drying out, disrupting the natural floodpulse. This study evaluates how water level dynamics effect the fish community structure, abundance, and year-class strength in Buttonland Swamp by conducting electrofishing and fyke/mini-fyke net fish surveys. This study began in June 2020 with monthly fish surveys until October, with sampling every other month in the winter; this sampling scheme will continue until 2022. Four macrohabitats (Cache River, Main Swamp, Eagle Pond, Side Channels) are surveyed every month with 4 electrofishing runs, 3 fyke, and 3 mini-fyke nets. Water level and other habitat characteristics are being recorded at each site. Otoliths are being analyzed from bluegill, gizzard shad, and silver carp to estimate age to determine year-class strength. Analysis of the data is ongoing and not complete, but non-metric multidimensional scaling (NMDS) and analysis of similarities (ANOSIM) are going to be used to evaluate changes in assemblage structure of juvenile and adult fishes across seasons, years (including historical fish data), and habitat conditions. The residual method will be used to calculate year-class strength indices using the collected age structure data from a subsample of bluegill, gizzard shad, and silver carp. Year-class strength will be determined by the magnitude of residuals from the catch curve regression.

Graduate

Poster Number: A022

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Justin Kowalski**

Authors: Justin Kowalski[1]; Alison Coulter, PhD[2]; David Coulter, PhD[1]; James Garvey, PhD[1] - Faculty Advisor: James Garvey, PhD

Major/Field of Study: Zoology/Fisheries Ecology

[1]Southern Illinois University – Carbondale; Center for Fisheries, Aquaculture, and Aquatic Sciences; [2]South Dakota State University

Examining the effect of Silver Carp invasion on native species body condition

Silver Carp (Hypophthalmichthys molitrix) are an invasive species found in a large portion of the Mississippi River basin and are threatening to expand their range. Understanding how Silver Carp affect the communities they invade could help managers mitigate their impact and predict how uninvaded communities may be affected. Most existing research on the impacts of Silver Carp has analyzed ecosystem dynamics before and after invasion or focused only on native species that may directly compete with Silver Carp. We determined how Silver Carp affect the body condition of native fish at varying trophic levels along an invasion gradient consisting of high abundance, invasion front, presence front, and absence of Silver Carp in Ohio River tributaries. Three tributaries were selected per invasion category. Silver Carp abundance was compared with Largemouth Bass, Bluegill, Gizzard Shad, and Smallmouth Buffalo body conditions using linear models. Significant relationships among Silver Carp abundance and native fish condition would indicate possible competition for food resources. Both Largemouth Bass and Gizzard Shad had significantly reduced body condition under higher abundances of Silver Carp. The body conditions of Bluegill and Smallmouth Buffalo did not significantly differ under any Silver Carp abundance. The results indicate that native fish feeding ecology may be negatively impacted by Silver Carp, but whether reduced body condition is related to competition for food resources remains unsolved.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Jensen Cloe B.S.**

Authors: Jensen Cloe; Lydia Arbogast, PhD - Faculty Advisor: Lydia Arbogast, PhD

Major/Field of Study: Molecular, Cellular & Systemic Physiology

Effects of progesterone and androgens on gene expression in hypothalamic neurons of the female rat

Androgens and progesterone show distinct cyclic changes during the female reproductive cycle and provide hormonal feedback to tuberoinfundibular dopaminergic (TIDA) and kisspeptin/neurokinin B/dynorphin (KNDy) neurons within the arcuate nucleus. The aims of this study were to: 1) examine progesterone receptor B (PRB) and androgen receptor (AR) co-localization within TIDA neurons, 2) determine the effect of progesterone (P4) and/or dihydrotestosterone (DHT) on gene and protein expression of enzymes in dopamine biosynthesis and 3) evaluate the effect of P4 and/or DHT on gene expression of neuropeptides in KNDy neurons. Ovariectomized female Sprague-Dawley rats were estradiol primed for 5 days prior to injections once daily for two days with DHT (50 µg/rat) and/or P4 (5 mg/rat). Rats were sacrificed on the third day. For tyrosine hydroxylase (TH) immunopositive cells within the arcuate nucleus, 93.5 ± 5.1% colocalized nuclear PRB and 44.9 ± 0.6% colocalized nuclear AR. P4 increased Th gene expression 1.9-fold and decreased Ddc 0.93-fold, whereas DHT had no effect. TH protein was unaltered by hormonal treatment. P4, DHT, and combined treatment decreased Kiss1 gene expression to 0.63-, 0.75-, and 0.52-fold, respectively. Tac3 gene expression was suppressed to 0.66-, 0.75-, and 0.63-fold by P4, DHT, and combined treatment, respectively. Pdyn gene expression was unchanged with all treatments. There were no changes in Ar, Pgr, and Esr1 gene expression, except for a modest reduction in Esr1 expression with P4 treatment. Localization of PRB/AR with TH provides an anatomical basis for direct steroid hormone actions within TIDA neurons. P4 increased the gene expression of Th, the rate-limiting enzyme in dopamine biosynthesis suggesting the greatest impact of P4 occurs at the regulatory step in this pathway. P4 and DHT independently suppress Kiss1 and Tac3 gene expression indicating that both hormones are inhibitory to the components in KNDy neurons that are stimulatory to LH secretion.

Graduate   Poster Number: A025

Business and Analytics

Presenting Author: **Sai Vishal Babburi NULL**

Authors: Sai Vishal Goud Babburi, MS; Nick Rahimi, PhD - Faculty Advisor: Nick Rahimi, PhD

Major/Field of Study: Computer Science

LDE based P2P-fog

To outsource their computational tasks several Internet-of-Things(IoT) devices bank on Cloud computing architecture. As there is massive growth in the usage of IoT devices, Cloud computing architecture is unable to meet the requirements of bandwidth, real-time response and latency. To overcome these limitations, Fog computing architecture is introduced which responds to requests from IoT devices and only if necessary forward requests to cloud. Nonetheless there are still some requests that needs to go to the cloud and gets effected with the shortcomings of the Cloud. Then there is a peer-to-peer (p2p) fog model that enhances the fog computing architecture by adding a peer to peer mechanism to the fog layer so that the fog nodes can collaborate with each other to fulfill the client requests. This helped in fulfilling the client requests by fog nodes in the fog layer at the proximity of clients(users) which ultimately decreases overhead on the Cloud. In this research we Implement P2P fog model by using LDE based P2P Two-level Hierarchical network structure(LDEPTH) as a P2P for the fog nodes in fog layer . We also provided a security protocol for our LDE based peer to peer fog model.

Graduate

Engineering

Presenting Author: **Qilun Luo**

Authors: Qilun Luo - Faculty Advisor: Dr. Mingqing Xiao

Major/Field of Study: Computational Mathematics - Tensor Decomposition

Non-negative Multi-dimensional Data Decomposition: A New Approach

The increasing popularity of low-rank tensor decomposition in recent years demonstrates that tensor as an extension of the matrix is an efficient tool for real-world problems. In this paper, we introduce a novel tensor decomposition method by defining the matrix outer product. The alternating least square (ALS) method and rank-one residue iteration (RRI) method are developed to solve the giving model and tensor completion problem. Numerical experiments on synthetic data and real-world datasets demonstrate the effectiveness of the new approach which gains higher accuracy with lower rank.

Graduate   Poster Number: A031

<u>Engineering</u>

Presenting Author: **Subash Kharel**

Authors: Subash Kharel; Khaled R Ahmed - Faculty Advisor: Khaled R Ahmed

Major/Field of Study: Computer Science

Potholes detection for autonomous vehicles using deep learning

Roads make a huge contribution to the economy of a territory. As a platform for transportation, roads are widely used by every countries in the world. Potholes in road are one of themajor concerns in the transportation infrastructure. A lot of research works have been pro-posed using Computer Vision to detect potholes that include wide range of image processingand object detection algorithms. There is a need for potholes detection with adequate accuracyand speed, and that can be implemented with ease and low setup cost. In this paper, we havedeveloped efficient deep learning Convolution Neural Networks (CNNs) to detect potholes inreal-time with adequate accuracy. This paper compares the performance of YOLOv5 Large(Yl),YOLOv5 Medium (Ym) and YOLOv5 Small (Ys) with ResNet101 backbone and Faster R-CNNwith ResNet50(FPN), VGG16 and MobileNetV2 backbone. The experiments results show thatYOLOv5s is more applicable for real-time potholes detection because of its speed. With the useof Inverse Perspective Mapping with YOLOv5 to estimate area, we concluded that the detectioncan still be done in real time with area estimation.

Graduate

Engineering

Presenting Author: **Md. Jawad Siddique**

Authors: Md. Jawad Siddique; Dr. Khaled Ahmed - Faculty Advisor: Dr. Khaled Ahmed

Major/Field of Study: Computer Science

Deep Learning Technologies to mitigate Deer-Vehicle Collisions

Deer Vehicle Collisions (DVCs) are a growing problem across the world. DVCs are not only resulting in serious injuries to humans but also result in loss of human lives, properties, and deer lives. Several strategies have been employed to mitigate DVCs and include fences, underpasses and overpasses, animal detection systems (ADS), vegetation management, population reduction and warning signs. The main aim of this research is to mitigate deer-vehicle collisions. It proposes an intelligent deer detection system using computer vision and deep learning techniques. It warns the driver to avoid collision with deer. The rate of detection of deer on the road by the proposed system reached 99.4%.

Graduate   Poster Number: A033

<u>Engineering</u>

Presenting Author: **Liping Deng**

Authors: Liping Deng; MingQing Xiao - Faculty Advisor: Prof. MingQing Xiao

Major/Field of Study: Machine learning

Automatic Classification Configuration Recommendation via Sparse Denoising Autoencoder and Meta-learning

The Combined Algorithm Selection and Hyperparameter Optimization problem, known as CASH, aims to simultaneously choose the optimal classifier and the involved hyperparameters for a new classification problem. In this work, we propose a novel method that solves CASH via meta-learning (MtL) and Sparse Denoising Autoencoders (SDAEs). Specifically, we first define the configuration space of CASH, i.e., the candidate classifiers together with their hyperparameters, and obtain the meta-data by evaluating their classification performance on a set of collected historical problems. Then a SDAE is learnt with the corrupted meta-data as inputs and the clean meta-data as labels, where the trained encoder and decoder are respectively leveraged to extract the latent variables of meta-data and recover the original inputs. When some evaluations on a new problem is known, we can estimate its performance over the entire configuration space by denoising principle. Besides, A multivariate ridge regression (MRR) between the latent variables and meta-features of problems is built such that the performance can be estimated directly through MRR and the decoder of SDAE for new classification problems.

Graduate

<u>Health and Human Sciences</u>

Presenting Author: **Megan Moore B.S.**

Authors: Erin Connelly M.A. CCC-SLP; Megan Moore B.S. - Faculty Advisor: Erin Connelly

Major/Field of Study: Communication Disorders and Sciences

Perceived self-competency of second-year graduate students for clinical fellowship

Externships play an important role in developing clinical competency, allowing speech-language pathology students to apply basic skills, theory, and didactic knowledge learned in year one of graduate school. The primary aim of this study is to identify if there is a difference in second-year graduate students' self-perceptions of clinical competency at the eight- and sixteen-week marks of a 16-week full time externship. A comprehensive literature review, using the most relevant academic search methods, highlights both the research confirming the importance of externship in building clinical competency and uncovers the research gap concerning duration required to build sufficient clinical competency. To identify optimal time frames for clinical externships, it is important to survey student perceived self-competency for clinical fellowship.

Graduate   Poster Number: A041

<u>Health and Human Sciences</u>

Presenting Author: **Shauna Tomblinson**

Authors: Shauna Tomblinson - Faculty Advisor: Dr. Diane Muzio

Major/Field of Study: Communication Disorders and Sciences

Speech Language Pathologists as Expert Witnesses

The purpose of this study was to discover if as an expert witness, an SLP can make a significant impact on the decision made by juries in the cases of defendants with a traumatic brain injury compared to no expert witness testimony. Participants were recruited from a pool of individuals who met the requirements to be a potential juror in the state of Illinois. Participants completed a survey regarding their opinions on defendants with TBI in court cases. The survey was created with the online survey generator software, "Google Forms" in order to determine if individuals would judge a defendant differently when informed of the expert witness testimony of an SLP. Results suggest a positive correlation between exposure to SLP testimony and greater leniency or rehabilitative tendencies in legal judgment. The implications of these results shine a very important light on the issue of individuals with TBI inside the criminal justice system. If cases continue to be held in a court of law without the input of specialized SLP expert knowledge, it would be difficult to say if true justice is served for each individual. With SLP expert testimony, the number of individuals with TBI who are behind bars as a result of ill-informed jury sentencing could be significantly reduced.

<u>Health and Human Sciences</u>

Presenting Author: **Benjamin Mosko MPA**

Authors: Benjamin Mosko - Faculty Advisor: Lyndsay Laycoax

Major/Field of Study: Public Safety Administration and Homeland Security

COVID – 19: Emergence and Evolution of the Pandemic in the Media

An unknown virus originating in Wuhan, a city in the province of Hubei, China became the newest pandemic facing humanity. The virus could have been mitigated, contained, and diffused at various points in time, however, world leaders did not take the correct actions and now citizens worldwide, especially in the United States, feel the repercussions. This paper explores the virus from its inception in China to its spread to a pandemic level covering vast amount of the earth and infecting over a million people. This paper examines the virus and its spread from the lens of the media as the warning signs were all present. Either leadership was unaware, or normalcy bias prevented a stop to what the world now knows as COVID-19.

Health and Human Sciences

Presenting Author: **Scott Motisi**

Authors: Brian Ondrako; Scott W. Motisi - Faculty Advisor: Lindsay Laycoax, Andrew Wienckowski

Major/Field of Study: Public Safety Management

Fixed Fire Training Facility Proposal For The Barrington Countryside Fire Protection District

The Barrington Countryside Fire Protection District is looking to build a training facility to enhance the level of service it delivers to its residents. The training facility will provide a realistic hands-on learning environment suitable for today's era where electronic training and pandemics are prevailing. This Practicum will discuss the entire process of building a facility. It will give a background of the Barrington Countryside Fire Protection District and the Countryside Fire Protection District. The Countryside Fire Protection District, a neighboring fire district, actively uses a five story training tower. This Practicum will also discuss the organizational value the five story tower provides to the Countryside Fire Protection District and any changes that could have made the training tower more effective and efficient. Furthermore, it will describe the process of building a training tower, including the construction and administration phases. It will conclude with a written proposal and a presentation to the Barrington Countryside Fire Protection District Board of Trustees. The goal of this Practicum has two parts. The first goal is to get approval from the Board of Trustees to build a facility. The second goal is for the Practicum format to be used as a template for other students that would like to succeed in the SIU Master's PSHSA Practicum.

Liberal Arts

Presenting Author: **Maggie Ruswick**

Authors: Maggie Ruswick - Faculty Advisor: Rebekah Frumkin

Major/Field of Study: Creative Writing

Visitations, A Novel

Visitations is a novel that explores the innate trauma of legacy, and how we move forward when our identity is in jeopardy. The novel features two protagonists. Agnes is a young psychic traveling through the American Midwest, earning her coin and making a name for herself while in the shadow of her fabilized father. Bennet is a disembodied demon, left directionless when his only friend passes away. Together, the pair navigate their growing pains as the narrative weaves between past and present, revealing an interconnectedness that spans generations and histories.

<u>Liberal Arts</u>

Presenting Author: **Amina Naliaka**

Authors: Amina Naliaka - Faculty Advisor: Dr. Ruopu Li

Major/Field of Study: Environmental Resources and Policy

Evaluation of Agricultural Footprints under the Scenarios of Conservation Practices and Climate Change: A Case Study in Central Nebraska

Climate change is one of the greatest challenges to water availability for crop production in different agricultural regions. Future projections suggest that increasing climate variability and change, such as long periods of drought and a shift of seasonal precipitation patterns, is likely to occur in the next decades. Thus, it is critical to make water resources management and agricultural production compatible with the challenges of climate change. Conservation practices have shown many soil and water conservation benefits, such as improving soil water retention and reducing runoff and erosion. For example, winter cover crops in annual cropping systems (e.g., maize and soybeans) have emerged as one of the important conservation approaches. Despite a plethora of research on the conservation benefits of cover crops, it is unclear whether a regional installation of cover crops is a viable option to counteract the negative impacts of climate change on water resources. This study aims to evaluate the long-term effects of cover crops on soil water dynamics and evapotranspiration in a semiarid agricultural region in Central Nebraska. A combination of cover crop practices and climate change scenarios are examined using a SWAT-based water footprint assessment. This study will help understand if conservation schemes and policies will help address climate change impacts on water resources for sustaining crop production.

Mass Communication & Media Arts

Presenting Author: **Khara Lukancic**

Authors: Khara Lukancic - Faculty Advisor: Walter Metz

Major/Field of Study: Department of Cinema and Photography

"We Call It Zombieland": Reframing Benghazi as Horror in 13 Hours

In American popular culture we often talk about the horrors of war. This phrase is used without much thought or analysis of what it means: What are the horrors of war? What does it mean to interrogate war through the lens of the horror genre?

Graduate   Poster Number: A057

<u>Mass Communication & Media Arts</u>

Presenting Author: **Zahedur Arman M.A.**

Authors: Zahedur Arman - Faculty Advisor: Scott McClurg

Major/Field of Study: Public Relations

Networked agendas of Huawei during the US-China Trade War: Interrelationships between Huawei, news media, and public tweets

This study examines interrelationships between the networked Huawei agendas, the U.S. and Chinese news media agendas, and Twitter users' issue agendas on Twitter during the US-China Trade War. Social network analysis is used as a theory and method to analyze Huawei's public relations activities on Twitter, news media, and Twitter users' network. This study found that Huawei's direct networked agenda setting to Twitter users is more successful than the news media's networked agenda-setting to the Twitter users. This study is among the first to explore cross-nation networked agenda building and networked agenda setting effects on Twitter. It also found that the US media did not follow Huawei's networked agendas, but the Chinese media followed the corporation's issue agendas during the US-China trade war. The theoretical and practical implications of the findings are discussed.

School of Education

Presenting Author: **Yutao Yan**

Authors: Yutao Yan - Faculty Advisor: Dr. Heidi Bacon

Major/Field of Study: Curriculum and Instruction

From the Most Spoken Mandarin to the Most Chosen English: Stories of International Chinese Students' Language Investment at SIUC

This on-going study aims at a group of international Chinese students (ICS) at SIUC, who are seeking to strengthen their symbolic capital via their ambitious study-abroad projects. I intend to explore how they adjust to an English-dominant learning environment, and how their identities, (re)constructed in the local context, influence their investment in learning English as a second language. Using narrative inquiry as the research approach, I am revealing their transnational lives in the US. Their transnational lives consist of their formation of pro-English language ideologies in China, language barriers and academic struggle they experienced in the US, the challenges to their literacy identities, their acculturative strategies of synergizing Western and Eastern thoughts, and their final transformation of identities as legitimate English users.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Tanner Werts**

Authors: Tanner Werts; Avery Shikanai; Dr. Karla Gage - Faculty Advisor: Karla Gage

Major/Field of Study: Agribusiness Economics

Effects of Exogenously Applied Methyl-jasmonate on Tricome Development in Industrial Hemp

Glandular trichomes are secretory hairs that produce and store cannabidiol (CBD) in industrial hemp (Cannabis sativa L.) stems, leaves, and floral bracts. CBD is valued for its medicinal and nutraceutical purposes. Methyl-jasmonate (MeJa) is a plant hormone involved in herbivore defense and is known to induce formation of protective trichomes in other species. We hypothesized that exogenously applied MeJa would act similarly to increase trichome density in C. sativa. Therefore, the goals of the present study are to 1) determine if exogenously applied MeJa increases trichome density and to 2) determine the optimal application timing of MeJa. MeJa treatments were applied at three different times (early flowering, mid-flowering, and late flowering) in a carrier solution and compared to control applications of carrier solution alone. At harvest, leaves were collected and analyzed to determine trichome density. The presence of herbivorous insects and resulting plant damage was also quantified at harvest. Although the late application of MeJa resulted in the greatest mean density of trichomes, there was no significant change in trichome density by application timing. The trichome density of the leaves in the late application treatment was marginally greater than the paired late application control plants. However, there was a significant difference in insect damage. Applications of MeJa at all timings resulted in increased herbivorous insect presence and damage at harvest, where insect damage was recorded on 91% of plants treated with MeJa at any timing. Insect damage was recorded on only 43% of the control plants. There is weak evidence that MeJa treatments during late flowering may increase trichome density in C. sativa; since CBD is produced and stored in trichomes, MeJa may also increase CBD content by weight in tissue. However, it is possible that any increase in crop value from increased CBD content could be negated by increased occurrence of herbivore damage.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Joseph Hindi**

Authors: Joseph Hindi BA; Avery Shikanai BS; Karla Gage Ph.D - Faculty Advisor: Dr. Karla Gage

Major/Field of Study: Agricultural Sciences

Efficiency of Silver Thiosulfate Applications on Sexual Development of Dicamba Sprayed Hemp

Hemp (Cannabis sativa L.) plants are dioecious and, therefore, may be male or female. Female plants have significantly greater cannabidiol content than males. With increased consumer demand for cannabidiol, there has been increased interest in producing female-only hemp crops, which can be accomplished through using 'feminized seeds' in cultivation. Feminized seeds are obtained by chemically-inducing masculinization of female hemp. Chemical treatment of female plants causes production of pollen-bearing genes for femaleness, which leads to self-pollination of female hemp plants and subsequent production of female seeds. The regulatory sex determining mechanism of hemp is not fully understood, however, there is consensus that auxin and ethylene, plant hormones, play significant regulatory roles. Silver Thiosulfate (STS) is an ethylene antagonist and can be used to induce formation of male flowers on genetically female plants. Dicamba, a widely used auxinic herbicide, acts as an ethylene agonist. Given the opposing mechanisms of action, it is plausible that STS and dicamba could have polarizing effects on sexual development, threatening efforts to generate feminized seed. Therefore, the goals of the present study are to understand the effects that dicamba and STS have on hemp sexual development. Hemp was sprayed with dicamba at 0.0025x, 0.0125x and 0.0625x of the full use rate of 560 g ae/ha, then treated with foliar sprays of 3mM of STS. Applications of STS occurred weekly for three weeks, and dicamba visual injury ratings were takin on a weekly basis. The presence of male, female and mixed flowers per terminal inflorescences was assessed and given objective ratings on the fourth week. Higher rates of dicamba both caused increased injury ratings as well as reduced the effectiveness of STS in inducing male flowers.

Undergraduate   Poster Number: A103

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Madison Hebert**

Authors: Madison M. Hebert; Adrian A. Pater; Sunit K. Jana; Christopher L. Barkau; Eman A. Ageely; Elise Malek-Adamian; Zachary J. Kartje; Daniel O'Reilly; Masad J. Damha; Keith T. Gagnon - Faculty Advisor: Keith Gagnon

Major/Field of Study: Biochemistry

Designation: REACH 2020-2021

Characterizing Guide RNA 2'-Hydroxyl Ribose Requirements for CRISPR-Cas9 Gene Editing

There are six unmodified positions in the RNA that need to be chemically modified to become more stable. They remain unmodified because enzyme activity was turned off when they were modified, thus an alternative is needed to modify the six positions and still have Cas9 activity. We will chemically modify the 2'-NH2, 2'-SH, and individual 2'-F in six critical positions because these modifications are likely to mimic 2'-OH and not effect Cas9 activity. 2'-NH2 and 2'-SH replacements have yet to be tested by anyone, so the potential outcomes are unknown. We will explore if the removal of hydrogen bonds will destabilize the Cas9 protein and in what ways RNA can be attached. This will be done by exchanging the OH group in the 2' position for a NH2 group, SH group, or a fluorine in the same 2' position and determine which groups maintain function of the Cas9 protein. Most of these modifications are custom, and will be synthesized by a collaborator, a nucleic acid chemist at McGill University, Dr. Masad Damha.

Undergraduate   Poster Number: A105

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Katalina Kuzanga**

Authors: Katalina R. Kuzanga; Sharvath Kathi; Besmir Hyseni; Vjollca Konjufca - Faculty Advisor: Vjollca Konjufca

Major/Field of Study: Biological Science, Microbiology

Designation: REACH 2020-2021

The role of immune cells in Chlamydia pathogenesis

Chlamydia trachomatis is a gram-negative bacterium that causes sexually transmitted disease and preventable blindness. Women infected with C. trachomatis are susceptible to pelvic inflammatory diseases, ectopic pregnancy, chronic pelvic pain, and infertility. C. trachomatis infects the female reproductive tract (FRT) and has been found in the gastrointestinal tract as a place for habituation, which can lead to reinfection of the FRT. Ongoing research is focused in outlining the mechanisms by which a C. muridarum, a commonly used mouse pathogen disseminates from the FRT to the GI tract via bodily internal routes. Using the mouse model of FRT infection it was shown that C. muridarum disseminates is stepwise fashion, first infecting the FRT-draining iliac lymph nodes, then spleen, then the gastrointestinal tract (GIT). Furthermore, it was shown that the CD11c+ dendritic cells mediate the first step in Chlamydia dissemination. Our project is focused on identifying the immune cells that mediate the transport of Chlamydia from the iliac lymph nodes, to the spleen, and then to the gastrointestinal tract. Our findings indicate that CD8 T cells and monocytes play an important role in Chlamydia transport to the spleen and a significant role in transportation to GIT. By identifying the effector cells involved in Chlamydia transport and protection against infection, we can gain a better understanding of C. trachomatis pathogenesis in humans. This knowledge will lead to design of vaccines and therapies against this pathogen.

Undergraduate

Poster Number: A106

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Grace DuRocher**

Authors: Narges Asefifeyzabadi; Mohtashim Shamsi, PhD; Grace DuRocher - Faculty Advisor: Mohtashim Shamsi

Major/Field of Study: Chemistry

Designation: REACH 2020-2021

Novel Peptide Nucleic Acid Probe for Label-Free Detection of Neurodegenerative DNA Repeat Sequence

DNA repeat expansion sequences cause a variety of genetic diseases when they expand beyond a critical threshold. Electrochemical DNA biosensors have been proven to have great potential in DNA sensor technology to detect these disease-causing repeats because of their simplicity and easy miniaturization. Here, we have optimized probe and target concentrations, repeat lengths, and incubation time of a PNA probe and gold biosensors to identify DNA repeat sequences for genetic disease detection. Using electrochemical techniques, such as EIS and CV, we tested for hybridization of our PNA probe and target DNA sequence. We found that our probe can distinguish between complementary and non-complementary sequences and has shown high sensitivity. This label-free strategy using this PNA probe has potential to detect a variety of genetic diseases, such as Huntington's disease, caused by repeat sequences.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Orion Fiorino-Matthews**

Authors: Orion Fiorino-Matthews; Avery Shikanai; Karla Gage, PhD; Mary Kinsel, PhD - Faculty Advisor: Dr Mary Kinsel

Major/Field of Study: Chemistry

Detection of pesticides S-metolachlor and glyphosate in Industrial Hemp/Cannabis using Liquid Chromatography Mass spectrometry with implementation using field grown samples.

Cannabis, including medical and recreational marijuana, and industrial hemp for fiber and CBD production are all growing industries. The recent legalization of recreational marijuana in the state of Illinois and establishment of the Cannabis Science Center at Southern Illinois University are key examples of the progressing demographics. With the increase in popularity of cannabis of all types, there is the need for proper regulation to protect the consumer. This regulation includes testing for the presence of pesticide residues. S-Metolachlor and glyphosate are the active ingredients in the popular pesticides Dual Magnum® and Roundup®, respectively. The purpose of this research is to develop extraction, detection, and quantification methods to detect these active ingredients on all types of cannabis. S-Metolachlor is a non-polar compound, and glyphosate is a polar compound. Extraction of these compounds from samples is based on a modified QuEChERS method, and detection is performed using liquid chromatography mass spectrometry (LCMS). The area between rows of field grown industrial hemp plants were treated with Dual Magnum® and Roundup® at a known application rate. These cannabis plants were used for method development, including determination of limits of detection and limits of quantitation. The difference in S-metolachlor and glyphosate polarity has proven challenging for the development of a single extraction and detection method, the details of which will be discussed in this presentation.

Agricultural, Life and Physical Sciences

Presenting Author: **Kaitlyn Wiegand**

Authors: Kaitlyn Wiegand; Ruitao Wu - Faculty Advisor: Dr. Lichang Wang

Major/Field of Study: Chemistry

Designation: REACH 2020-2021

Computational Studies of Catalytic Dehydrogenation of Ethanol

The initial dehydrogenation of ethanol (CH_3CH_2OH) is important in the development of sustainable energy processes that are both economically and realistically feasible for the fulfillment of today's energy demands. Transition metals, especially the less expensive and more abundant 3d metals, are appealing as catalysts for ethanol dehydrogenation. As a single atom adsorbed to ethanol, these metals are likely to have enhanced selectivity and activity, in addition to maximized utilization efficiency. To investigate these ideas, DFT calculations were performed using Gaussian16. The presented work explores the use of 18 different single metal atoms as catalysts in the first dehydrogenation of ethanol. All of the 3d metals, as well as eight 4d and 5d metals, were tested as catalysts for this reaction. For each metal tested, three ethanol dehydrogenation pathways were modeled: Ha, Hß, and Ho cleavage. Analysis of adsorption energy, activation energy, and the reaction energy of each pathway allowed for a determination of the dehydrogenation pathway most favored by each metal catalyst. Comparison of these energies between the different metals yielded a top catalyst for each dehydrogenation pathway. Out of the metals tested, the best catalyst for Ho cleavage was scandium, for Hß cleavage was rhodium, and for Ha cleavage was palladium. This work will serve as a benchmark for heterogenous catalysis of the ethanol dehydrogenation reaction.

Agricultural, Life and Physical Sciences

Presenting Author: **Scott Benzinger**

Authors: Scott Benzinger; Christopher L. Barkau; Seth B. Eddington; Keith T. Gagnon, PhD - Faculty Advisor: Keith T. Gagnon, PhD

Major/Field of Study: Chemistry & Plant Biology

Designation: REACH 2020-2021

Cis-SNuBs, a Self-Repressing CRISPR System

Over the past decade Clustered Regularly Interspersed Short Palindromic Repeats (CRISPR) and their associated (Cas) proteins, especially CRISPR-Cas9, have been studied intensely as a gene editing technology. This bacterial and archaeal adaptive immune system has the function of cutting foreign double-stranded nucleic acids, and has been co-opted by researchers to modify the genomes of plants, animals, and even humans in various ways. With this powerful tool being used more frequently, careful control of CRISPR-Cas9 is vital. Context-specific editing by Cas9 would be a major step toward reigning in Cas9 as it is delivered systemically to a patient or study organism. Cis-SNuBs (Cis Short Nucleic acid-Base inhibitors) may be a simple avenue to making Cas9 function in a context-specific manner. These rationally designed oligonucleotide extensions of the guide RNA inhibit Cas9 in the absence of an antisense sequence which would bind a toehold and unwind their inhibitory module. Competition by the cis-SNuB for binding to the Protospacer Adjacent Motif (PAM) prevents recognition and cleavage of the target, inhibiting editing. Cis-SNuBs were demonstrated to reduce activity by the most commonly used DNA-editing Cas complex, Streptococcus pyogenes (SpCas9) relative to a normal crRNA in vitro and in cells. Two sets of Cis-SNuBs were designed and tested; each set contained variations in key regions of interest to determine how they impacted their cSpCas9 suppressing capabilities. The second set was based around the best-performing oligonucleotide from the first generation. These data provide a preliminary proof-of-concept for Cis-SNuBs as a tool for controlling CRISPR gene editing.

Undergraduate   Poster Number: A110

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Claire Fettig**

Authors: Claire Fettig - Faculty Advisor: Diana K. Sarko

Major/Field of Study: Computer Science

Designation: REACH 2020-2021

Developing a Novel Behavioral Multisensory Testing Chamber

Undergraduate

Agricultural, Life and Physical Sciences

Presenting Author: **Justin Berberich**

Authors: Justin Berberich B.S.; Andrew Margenot Ph.D.; Rosa Ibarra López M.S.; John Pike M.S.; Amir Sadeghpour Ph.D. - Faculty Advisors: Drs. Andrew Margenot and Amir Sadeghpour

Major/Field of Study: Crop, Soil and Environmental Management

Designation: REACH 2020-2021

Does Precision Planting of Cover Crop Mixtures Provide Zonal Soil Benefits?

Growing winter cereal cover crops (WCCCs) has been identified as an effective in-field practice to reduce nitrate-N and phosphorus (P) losses to Upper Mississippi River Basin, USA. In the Midwestern USA, growers are reluctant to plant WCCCs prior to corn (Zea mays L.) due to N immobilization and establishment issues. Two tactics to minimize these issues are (i) incorporating legumes and brassicas into WCCCs as mixtures and (ii) precision planting of cover crops. The objective of this study was to (i) evaluate the effect of cover crop mixtures vs a no-cover crop control on soil chemical and biological properties and (ii) assess whether precision planting increase or decrease soil nutrients, soil matter (SOM) and carbon (SOC) stocks "on" and "off" the corn row over three depths (0-5, 5-20, and 20-90 cm) after five years. Treatments were (i) a no-cover crop control (NCC); (ii) no cover on corn row, hairy vetch (V) on middle row, and winter cereal rye (WCR) on the outside row of corn (NOVR); and (iii) oats and radishes on the corn row, V on the middle row, and WCR on the outside row (ORVR). Our results indicated NCC had lower SOM and SOC stocks than the NOVR and ORVR only at 0-5 cm depth. At 0-5 cm depth, cover cropping increased soil test P (STP). Soil test P declined over depth reflecting its immobility in the soil. Soil test K (STK) was higher in cover crop treatments than the no-cover crop control at 0-5 cm depth. Soil test K was higher on corn row indicating both cover crops (oats plus radishes) and corn decomposition and release of K increases STK. Soil test sulfur was similar among treatments but higher at 20-90 cm depth reflecting S leaching. These results indicate cover cropping can benefit soil after five years.

Agricultural, Life and Physical Sciences

Presenting Author: **Garrett Williams**

Authors: Garrett Williams; Lindsey McKinzie, PhD Candidate - Faculty Advisor: Dr. Ahmad Fakhoury, Dr. Jason Bond

Major/Field of Study: Crop, Soil, and Environmental Management

Designation: REACH 2020-2021

Using a multi-spectral tool to assess incidence and severity of Heterodera glycines in soybean

In this research project, I am using a spectroradiometer to measure spectral reflectance on soybeans as influenced by parasitism by soybean cyst nematode (SCN). In the literature, there are many documented cases where symptoms caused by plant pathogens alter the solar reflectance values of plants. Soybean cyst nematode is a devastating soilborne, plant pathogen that infects soybean roots, acquires nutrients from the plant, and robs soybean yield potential. At present, the primary mechanism to manage SCN is nematicide seed treatments. Population detection and quantification are made possible with soil/plant sampling, soil elutriation, and enumeration with microscopy. With further development and implementation, plant pathologists, crop consultants, and producers may detect SCN population densities across soybean fields using such spectral tools rather than labor and time-intensive strategies such as root digs.

Undergraduate   Poster Number: A113

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Francesca Burkett**

Authors: Francesca Burkett; Dr. James A. Conder - Faculty Advisor: James A. Conder

Major/Field of Study: Geology and History

Designation: REACH 2020-2021

Magma production beneath subduction zones: Using numerical models to evaluate melt production

Melt production at subduction zones depends on mineral composition, water content, age of the plate, dip angle of the plate subducting, rate of convergence, age of the slab, and length of the forearc. It has proven challenging to understand how melting changes when any single factor, or combination of these factors, changes. This project examines differences in subduction melting resulting from the changes of several different variables. These variables include initial modal clinopyroxene (cpx), and its exhaustion, mantle hydration, dip angle, rate of convergence, plate and slab age, and forearc cold corner depth. To do this, we constructed 2D numerical models of temperature, mantle flow, and melt production at subduction zones. We ran a variety of models that tracked changes in the total melt as the combination of parameters was altered in each trial. The dip angle of the subducting slab is varied from 30 to 75 degrees, rate of the slab between 20 and 90 km/Myr, age of the plate between 20 and 90 Myr, forearc depth between 40-50 km, and hydration set at 0.1%, 0.5%, and 0.01 wt%. The slab age and initial modal cpx levels are held constant throughout all the trials at 60 Myr and 15%, respectively. Each of these parameters affect the overall melt production, with melting seeming to peak for models set with hydration content at 0.1%, the dip angle at 60 degrees, the highest convergence rates, and the youngest ages. Changes in forearc length, in addition to each combination of the other parameters, also effect amount of overall total melt with longer forearcs resulting in less melt than shorter forearcs.

Undergraduate   Poster Number: A114

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Ashley Bryant**

Authors: Ashley Bryant; Pratyusa Das; Buffy S. Ellsworth - Faculty Advisor: Dr. Buffy S. Ellsworth

Major/Field of Study: Microbiology

Utilizing Genetic Mouse Models to Observe Forkhead Transcription Factors, FOXO1 and FOXO3, in Pituitary Gland Development and Function

Mus musculus genetic engineering advancement has enabled scientists to explore genetic mutations at a genomic level, as opposed to only being able to observe phenotypic differences in earlier years. This innovative approach allows us to generate "knockout mice" which entails that a gene has either been deleted or inactivated. In this study, genetically modified mouse models are used for observing the role of forkhead box transcription factors in pituitary gland development and function. FOXO1 and FOXO3 are closely related forkhead transcription factors that aid in the role of somatotroph differentiation. Foxo1 is expressed in the pituitary gland, heart, and placenta. Cre-lox mediated technology is used to promote tissue specific-deletion of Foxo1 in the pituitary gland. Expression is then analyzed and measured at various embryonic stages using immunohistochemistry (IHC) under fluorescent microscopy. Foxo1(f/f) is an indication that the Foxo1 gene was "floxed" by inserting loxP sites. Foxo3 is similarly floxed (Foxo3f/f). The use of cre deletes the floxed Foxo1 and Foxo3 genes. Mice are mated based on their genotype, which is determined through genotyping analysis performed via PCR and gel electrophoresis. Foxg1-cre stimulates pituitary specific deletion, because Foxg1 is expressed in the pituitary gland causing cre to be present in the pituitary gland. This method prevents the demise of mice, if Foxo1 deletion were to occur everywhere, this causes early embryonic lethality. Each mouse has genotype that is either homologous or heterozygous for Foxo1 and; Foxo3, and Foxg1 with or without the presence of cre. For example, a mouse model could have the following genotype: Foxo1+/f, Foxo3f/f Foxg1+cre. IHC for FOXO1 was performed on an e18.5 pituitary tissue sample with Tyramide SuperBoost kit with Alexa Fluor Tyramides; confirming successful deletion of Foxo1. Further exploration initializing an IHC procedure utilized glucocorticoid receptor NR3C1, and growth hormone (GH) protein was analyzed at e18.5- and 6-week Foxo1 pituitary tissue samples. These studies show that NR3C1 is not obviously different in mice lacking Foxo1 and Foxo3.

Presenting Author: **Morgan Burmeister**

Authors: Morgan Burmeister; Matthew Blalock - Faculty Advisor: Vjollca Konjufca PhD

Major/Field of Study: Microbiology

Designation: REACH 2020-2021

The Use of Nanoparticles for the Development of Mucosal Vaccines Against Chlamydia

Chlamydia trachomatis is an obligate intracellular pathogen that causes sexually transmitted infection (STI). Chlamydia is the most common reported STI worldwide, causing harmful etiology such as ectopic pregnancy, infertility, blindness, and pelvic inflammatory disease. Although treatments are available for Chlamydia an effective vaccine is not available. Antibodies play a large role in the protection of infections yet the antibodies' roles responsible for Chlamydia are unclear. It was shown that per-oral (p.o.) immunization with Chlamydia allows for protection against per-vaginal (p.v.) infection, lowering the burden of bacteria present in the female reproductive tract (FRT). These finds show that mucosal antibody responses in the FRT are induced in the gut-associated lymphoid tissues (GALT). Mice immunized with Chlamydia p.o. cleared the infection significantly faster than mice that were immunized subcutaneously (s.c.). Additionally, in p.o. immunized mice hydrosalpinx pathology was significantly reduced. The major outer membrane protein (MOMP) of Chlamydia is an immunodominant surface antigen. Antibodies that are triggered by MOMP help to understand the role of MOMP in the pathogenesis of Chlamydial related diseases. A combination of prime-boost immunization strategies was used to examine humoral immune responses in animals immunized with MOMP antigen conjugated to nanoparticles or nanoparticles alone. These different routes of immunization will assess the protective efficacy of locally secreted antibodies against p.v. challenge with Chlamydia.

Undergraduate   Poster Number: A116

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Jessica Grygus**

Authors: Jessica Grygus - Faculty Advisor: Bethany Rader, PhD

Major/Field of Study: Microbiology

Designation: REACH 2020-2021

In vitro characterization of the Euprymna scolopes microbiome tolerance protein Alkaline Phosphatase

Most animals enter a life-long symbiotic relationship with bacteria. The partnership between Euprymna scolopes and Vibrio fischeri gives incite into the interactions of alkaline phosphatase (AP) and lipopolysaccharide (LPS) that can be used to design effective AP therapies for LPS-associated chronic inflammatory diseases. To better characterize AP activity for detoxifying LPS, we aimed to use site-directed mutagenesis to substitute an essential serine active site with various other amino acids and observe the activity of mutant AP isoforms by an LPS toxicity assay. It was expected that the alteration of the key activity site of EsAP1 would hinder LPS specific AP activity. Various complications were present during polymerase chain reactions (PCR), digestions, ligations, and expressions of mutant EsAP1; however, eight possible mutants have been formed by site-directed mutagenesis. The resulting mutants could play a key role in characterizing AP activity specific to LPS detoxification.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Cassidy Lounsbury**

Authors: Cassidy Lounsbury; Derek Fisher, PhD - Faculty Advisor: Derek Fisher

Major/Field of Study: Microbiology

Development of an EcI5 Group IIB Intron Mutagenesis System for Use in Chlamydia

Background: The sexually transmitted infection, chlamydia, is the world's most reported bacterial infection causing 1.75 million cases in the United States in 2018. Improved measures of prevention, such as vaccination, are required to address this significant public health threat. Vaccine development requires an in-depth understanding of pathogenesis at the molecular level. Genetically altering bacteria through gene inactivation is a classical approach for defining pathogenic mechanisms. For Chlamydia trachomatis, only a limited genetic tool kit exists, hindering our ability to study pathogenesis. We hypothesize that the EcI5 intron from Escherichia coli can be used to generate chlamydial gene insertion mutants in a more efficient manner than the current Ll.LtrB intron from Lactococcus lactis. Increasing insertion efficiency will facilitate faster mutant construction and allow for the generation of random mutant libraries.

Methods: The EcI5 intron was modified to carry various antibiotic resistance genes using standard cloning methods. The modified introns were tested for functionality by targeting the lacZ gene in E. coli and assessing production of white (mutant) or blue (wild type) colonies on LB agar plates containing the chromogenic substrate Xgal. Insertion location was confirmed using polymerase chain reaction.

Results: The EcI5 intron represents an ~106-fold improvement in efficiency over the Ll.LtrB intron in E. coli. The addition of resistance genes within the intron significantly reduced efficiency compared to the wild type intron. Removing the resistance gene promoter or RBS increased efficiency, approaching wild type insertion levels.

Conclusions: The improved efficiency of the EcI5 intron at 37°C compared to Ll.LtrB supports that EcI5 will be more efficient in C. trachomatis. The reduced insertion rate in the presence of additional gene "activity" elements suggest that alternative promoter/RBS combinations may be needed to optimize insertion. We will next transition into experiments comparing efficiency of Ll.LtrB to ECI5 in C. trachomatis.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Katherine Mazdra**

Authors: Katherine Mazdra; Scott Hamilton-Brehm, PhD - Faculty Advisor: Dr. Scott Hamilton-Brehm

Major/Field of Study: Microbiology

Designation: REACH 2020-2021

Development and Optimization of a Continuous Flow Bioreactor for the Culturing of Bio-diesel Producing Bacteria

Biodiesel is a fuel that is commonly created from oils derived from plant crops, such as corn or soybeans. Although biodiesel is considered eco-friendly, issues arise when not enough land is available to maintain the amount of feedstock needed to produce the fuel. The process of harvesting and extraction is costly which leads expenses to be passed on to the consumer. By creating an inexpensive way to manufacture the fatty acids needed for biofuels, land use for fuel will decrease and biofuel use will rise, increasing the positive environmental effect biodiesels have.

Presenting Author: **Bilal Sawar**

Authors: Bilal Sawar; Lana Sawar; Kinan Sawar - Faculty Advisor: Pre-Approved for Non-faculty advised project

Major/Field of Study: Microbiology

New Frontier of Autoimmune and Viral Disease Diagnosis via Immune Receptor Profiling and Principal Component Analysis

Diagnosis of autoimmune and viral diseases is a difficult task that for most diseases has no one specific test to confirm a particular diagnosis. However, the interplay of immune receptor sequencing and statistical analysis can make this an issue of the past. Recent advancements in the last decade have allowed us to sequence immune receptors from a patient's blood sample, giving us an approximate count of each type of immune receptor (T-cell receptors and B-cell receptors) in that patient's immune system. Analyzing the distribution of this data to extract functional information to help diagnose a patient has been difficult. In this paper, I will make a case for the use of a methodology that is gaining traction that can help clinicians use this data to provide "immune profiles" associated with particular disease states. This data analysis technique is called principal component analysis. Principal component analysis (PCA) is a mathematical technique that can be used to reduce a high-dimensional data set into a lower-dimensional data set with fewer dimensions, also known as "components," while still accounting for the majority of the variance seen with a particular set of data. An issue when looking at immune receptor data is that there is almost always no single unique receptor sequence responsible for mounting an immune response associated with a particular disease state. We're oftentimes looking at thousands of sequences. So, this PCA technique reduces the number of receptors we have to account for in a data set in a way where we can calculate how much variance in the data is accounted for by changes in the immune receptor count of a normal patient population against patients with a particular disease state. This technique will be beneficial in helping diagnose various diseases that are associated with different "immunoreceptor profiles."

Agricultural, Life and Physical Sciences

Presenting Author: **Tyler Sons**

Authors: Tyler Sons - Faculty Advisor: Dr. Scott Hamilton-Brehm

Major/Field of Study: Microbiology

Designation: REACH 2020-2021

Developing Electron Microscopy Fixation Techniques for Novel Subsurface Bacteria

Characterization of prokaryotic microorganisms requires a scanning electron micrograph for a full publication to be submitted. Bacteria are found in many environments with different unique metabolisms and morphologies for survival. This can cause problems when obtaining images for many microorganisms. This study focuses on improving or maximizing the techniques used to prepare prokaryotic cells for electron microscopy. By altering incubation times, centrifugation forces, and drying methods it is possible to optimize the procedure for increased image quality. In this study experiments were performed on using bacterial cells from anaerobic, subsurface, thermophilic, and aerobic, mesophilic environments. Cell wall features were also explored which included Gram positive and negative cell types. Different solid support surfaces were tested to challenge porosity features that may affect the procedural design. The following images portray the results of our conducted experiments.

Agricultural, Life and Physical Sciences

Presenting Author: **Avinash Khatri**

Authors: Avinash Khatri; Yub Raj Sapkota; Dipanjan Mazumdar, PhD;Faculty Advisor: Dr. Dipanjan Mazumdar

Major/Field of Study: Physics

Designation: REACH 2020-2021

Fabrication of non-collinear antiferromagnetic Mn3Sn thin films using magnetron co-sputtering

Antiferromagnets (AFMs) have zero or nearly zero net magnetic moment even though one of the host atoms is magnetic. MnO and NiO are probably the most well-studied AFMs. Typically, the zero-moment arises because magnetic moments are aligned perfectly anti-parallel to each and are called collinear AFMs. Recently, there is a growing interest in investigating a novel class of AFMs, called non-collinear AFMs, that are not aligned anti-parallel to each other. Such materials are thought to be useful for applications in areas such as spintronics. One such family is the Mn3X (X=Sn,Ge,Ga). Non-collinear AFMs develop a very weak magnetic moment and show exotic properties such as the Anomalous Hall effect. In this work, we have successfully fabricated Mn3Sn thin films which are reported to be non-collinear AFM films. We employed magnetron co-sputtering of Mn and Sn targets to synthesize the films and annealed at 500-600 oC for 2 hours to promote crystallization. After confirming the desired 3:1 ratio for Mn3Sn, we confirmed the hexagonal structure of these thin films. We studied substrate dependence of these thin films and did not find any significant difference among the thin films. We also studied the preliminary transport properties of these thin films which are in accordance with the literature.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Kurtis Sanders**

Authors: Kurtis Sanders; Thushari Jayasekera; Lakshika Dissanayake; Lahiru Jayakody - Faculty Advisor: Thushari Jayasekera

Major/Field of Study: Physics, Biology

In silico-guided engineering of efficient PET depolymerizing enzymes

Reducing plastic waste production is a critical step to develop towards a sustainable future, and conventional disposal methods, involving recycling, incineration, and landfills, are insufficient. Recycling, for example, is often commercially uneconomical compared to producing plastic. Upcycling, one of several alternative solutions, converts plastics into new, better quality materials with a mitigated production of waste and enables a circular material economy. Polyethylene Terephthalate (PET) is one of the largest contributors to single-use plastic waste produced in the form of food and drink containers. The discovery of two-enzyme assisted PET depolymerization has made bio-upcycling this plastic more viable. Joint activation of the enzymes, PETase and MHETase, is a critical characteristic of successful selective depolymerization of PET into original monomers terephthalic and ethylene glycol. Researchers leverage computational approaches to further enhance PETase and MHETase by understanding molecular mechanisms and target mutations to improve enzymes' activities. In the same vein, we will present our recent results from molecular dynamics simulations on understanding the depolymerization activity of the recently characterized leaf-branch compost cutinase (LCC) enzyme. We will discuss how our results can be further advanced to engineer more effective PET degrading enzymes in concert with synthetic biology for PET upcycling .

Undergraduate   Poster Number: A126

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Drew Brittin**

Authors: Drew O. Brittin; Md Shahabuddin Alam; Max E. Gemeinhardt; Thomas R. Gebhardt; Boyd M. Goodson - Faculty Advisor: Boyd Goodson

Major/Field of Study: Physiology

Designation: REACH 2020-2021

1H Hyperpolarization and Optimization of Biological Agents using ParaHydrogen Induced Polarization (PHIP)

Magnetic Resonance Imaging (MRI) is a technique in the medical field to visualize a variety of structures and tissues throughout the body. MRI uses a magnet to align the nuclear spins of atoms in the body, which are then interrogated with radio wave pulses to create an image. This technique is non-invasive, and it does not use ionizing radiation unlike X-rays or (CT). However, MRI is normally much less sensitive, requiring that high-concentration species like water are used for imaging. Through hyperpolarization, the signals obtained for MRI can be enormously increased for better detection and accuracy, potentially allowing other molecules (besides water) to be imaged that can provide more information. For example, the ParaHydrogen Induced Polarization (PHIP) technique allows us to hyperpolarize biologically relevant molecules, potentially allowing the resulting anatomical MRI images to be encoded with molecularly-specific--e.g. metabolic or disease-related--information. PHIP is a relatively cheap and fast approach to achieve hyperpolarization with large signal enhancements; it works by using a catalyst and parahydrogen gas (p-H2, an easily-created source of nuclear spin order) to hydrogenate double or triple bonds in an unsaturated molecular substrate. In particular, the reactions studied here uses a rhodium catalyst in an organic solvent containing a substrate of interest with an unsaturated ester group, like vinyl acetate. The reaction begins by using a parahydrogen generator to "bubble" p-H2 into the solution to activate the catalyst. PHIP is performed at a weak magnetic field using the ALTADENA method before being quickly placed into the NMR magnet for detection (using both a high-field 9.4 T NMR spectrometer and benchtop NMR spectrometers in our lab). I will report on our efforts to optimize the PHIP signal from different substrates of interest, as well as to develop methods to purify the hyperpolarized PHIP products by rapidly removing the catalyst.

Agricultural, Life and Physical Sciences

Presenting Author: **Alana Campbell**

Authors: Alana Campbell - Faculty Advisor: Phil Jensik, PhD

Major/Field of Study: Physiology

Designation: REACH 2020-2021

Characterizing DEAF1-PARP1 Protein Interactions

Deformed Epidermal Autoregulatory Factor 1 (DEAF1) is a transcription factor important in regulating the expression of various genes responsible for early embryonic and cognitive neurodevelopment. Mutations in DEAF1 lead to various neurodevelopmental disorders including intellectual disability and autism spectrum disorder which are referred to as DEAF1-Associated Neurodevelopmental Disorders (DAND). Recent publications have shown that conditional Deaf1 deletion in the brain of mice leads to decreased learning and memory and hippocampal area. Further, it is suggested that the proapoptotic activity of DEAF1 may be occurring through interactions with PARP1. The objectives of this project were to determine if DEAF1 variants alter DEAF1-PARP1 protein interactions and to characterize how changes in this interaction may affect DEAF1 function. Co-immunoprecipitation followed by western blot analysis revealed that heritable R226W and de novo Q264P DEAF1 variants have decreased interactions with PARP1. Further study using Caspase- Glo 3 Assay to analyze staurosporine induced apoptosis revealed that the rate of apoptosis was not altered between wildtype and DEAF1 variant cell lines. Quantitative PCR, using complementary DNA isolated from scramble expressing HEK cells and PARP1 shRNA expressing HEK cells, revealed that UBE2M expression was decreased as a result of decreased PARP1 expression, while CASZ1 expression was not affected. These results indicate that PARP1 interaction does not influence putative proapoptotic activity of DEAF1 or DEAF1 transcriptional repression activity, but does regulate DEAF1 transcriptional activation activity on genes such as UBE2M. The data obtained from this project provides insights into the effects of patient-identified mutations on DEAF1 function and DAND.

Agricultural, Life and Physical Sciences

Presenting Author: **Omar Khader**

Authors: Omar Khader; Emily Rantz; Gregory Hockerman; Amber Pond - Faculty
Advisor: Amber Pond

Major/Field of Study: Physiology

*Investigation of the Mechanism by which the ERG1 Potassium Channel Increases
Intracellular Calcium Concentration*

Skeletal muscle atrophy occurs with injury, disease and starvation, and with natural aging, contributing to human morbidity and mortality. Muscle atrophy can be caused by imbalances or defects in pathways modulating intracellular calcium level, which plays a crucial role in signaling and the excitation-contraction process in muscle fibers which cause movement. Because we have shown that the ERG1a potassium channel contributes to muscular atrophy, we hypothesized that it would also contribute to imbalances of intracellular calcium levels which are known to modulate protein degradation in atrophic muscle. In order to test this, we transduced cultured C2C12 myotubes with either ERG1-encoded adenovirus or an appropriate control adenovirus and determined that indeed intracellular calcium concentration is higher in ERG1-expressing myotubes than in control cells. We need to determine the source of this calcium increase. To test for the source of the calcium concentration increase, we treated the control and ERG1-expressing myotubes with nifedipine, an L-type calcium channel blocking agent, and found no difference in intracellular calcium concentration, demonstrating that L-type channels do not contribute to this increase in calcium. Further, we treated the transduced myotubes with thapsigargin, a reagent which blocks SERCA and thus calcium reuptake into intracellular stores, and found that the intracellular calcium levels were not increased in the ERG1 expressing myotubes (relative to control cells), strongly suggesting that the source of the calcium increase is indeed intracellular stores. At this point, we hypothesized that the intracellular source is likely release of calcium from endoplasmic reticulum stores through IP3 receptors. However, IP1 assays reveal that IP3 does not increase in response to ERG1, suggesting that this signaling pathway is not involved. Further research is necessary to determine if the increase in intracellular calcium concentration is a result of modulation of IP3 or ryanodine receptors or potentially other ion channels. It is the hope of the researchers that investigation of this pathway will produce basic information which may lead to discovery of a more efficient therapy for skeletal muscle atrophy.

Agricultural, Life and Physical Sciences

Presenting Author: **Samantha Park**

Authors: Samantha Park; Amanda K Rothert; Dale B. Hales, Ph. D. - Faculty Advisor: Dale B. Hales, Ph. D.

Major/Field of Study: Physiology

Designation: REACH 2020-2021

The Production of Short Chain Fatty Acids in The Microbiota of the Ceca from the Integration of Fibrous Supplementation and its Effect on the Metabolic Development of Ovarian Cancer

With nearly 22,000 new cases each year, and 14,000 of those cases leading to death, epithelial ovarian cancer (EOC) is the most lethal among all other gynecologic malignancies. Research has shown that the incorporation of a flaxseed supplemented diet decreases the severity and prevalence of epithelial ovarian cancer. This could potentially be due to the increase in the concentration of short chained fatty acids (SCFA). An investigation on the role of short chain fatty acids (SCFA) and its relationship with the gut microbiota in the laying hen model of ovarian cancer was performed in order to study if metabolic health is influenced by bacterial synthesis of metabolites. The goal of this study is to observe and quantify acetic acid (C:2), butyric acid (C:4), hexanoic acid (C:6), and octanoic acid (C:8) in the ceca contents and determine if diet impacted the concentration of short chain fatty acids. Solid phase microextraction headspace gas chromatography (SPME-HS-GC) was preformed to determine the abundance of short chain fatty acids (SCFA) in an in vitro fermentation model. Preliminary data suggest that hens on a flaxseed supplemented diet displayed a preliminary increase of acetic acid compared to hens given the control diet. More analyses are needed to provide evidence that the incorporation of flaxseed could decreases the severity and prevalence of epithelial ovarian cancer by acting as a histone modulator and anti-inflammatory molecule.

Presenting Author: **Savanna Staley**

Authors: Savanna Staley; Diana Sarko, PhD; Mikaela Thurber; Karen Renzaglia, PhD

Major/Field of Study: Physiology

Designation: REACH 2020-2021

Determining Whether the Ability to Move Incisors Independently is Linked to Increased Innervation in Naked Mole-Rats

The goal of this research was to analyze the degree of innervation dedicated to the upper and lower incisors in naked mole-rats by performing careful postmortem dissections, excising the left and right superior and inferior alveolar nerves, embedding nerve samples in resin, imaging nerve cross-sections, and quantifying the number of axons present in each nerve sample. The naked mole-rat is a good animal model for studying tooth sensation because of the unusually large representation of the incisors in its central nervous system, including the somatosensory (tactile) cortex and the cerebellum. Although the large cortical representation of the incisors implies that they are well-innervated, this has not yet been quantified and proven. In addition, naked mole-rats are unusual in that they can move their lower – but not their upper – incisors independently. This independent movement very likely generates greater proprioceptive and tactile cues, which would require increased innervation compared to the upper incisors that do not receive these cues. The major finding of this research was the sampled inferior alveolar nerve contained over three times the number of axons than the sampled superior alveolar nerves. However, more data are needed to definitively support this conclusion.

Presenting Author: **Emily Duran**

Authors: Emily Duran; Jason Henry; Karen Renzaglia, PhD - Faculty Advisor: Karen Renzaglia, PhD

Major/Field of Study: Plant Biology

How does dehydration effect cell wall composition in food conduction cells of the moss Polytrichum?

Botanists have widely used herbaria for taxonomic studies and to catalogue plant diversity based on geography. The use of biological collections has expanded largely due to the increased digitalization of collections. The utilization of plant collections in ultrastructure studies has not yet been explored. Using 100-year-old herbarium specimens compared to freshly prepared field specimens of the moss Polytrichum commune, this study assesses the integrity of epitopes targeted by four monoclonal antibodies commonly used in cell wall research. Immuno-gold labelling was conducted in the transmission electron microscope using the JIM7, LM19, LM15, and LM25 antibodies to pectin and hemicellulose. The abundance of labels was scored in stereid cell walls, cortex cell walls, and the middle lamella of parenchyma cells. The concentration of cell wall polymers between herbarium and field-collected moss was similar in all three regions, suggesting that polymer integrity is not affected by drying or extended storage in the herbarium. This work opens the door to the use of herbaria for future research on cell wall composition in a wide range of plants that are archived in natural collections around the globe.

Undergraduate   Poster Number: A132

Agricultural, Life and Physical Sciences

Presenting Author: **Clarice Gonzales**

Authors: Clarice Gonzales; Matthew Geisler, PhD - Faculty Advisor: Matthew Geisler

Major/Field of Study: Plant Biology

Zinc Tolerance in Brassicaceae Members

Phytoremediation is the process of using plants to remove heavy metal from soil by harvesting the vegetative tissue from plants grown in contaminated soil. The plants used are called hyperaccumulators. While considered more a cost-effective method, some hyperaccumulators are troublesome to ship and difficult to germinate. Noccaea caerulescens is one such plant, but N. caerulescens has a hardier, more accessible cousin: Thlaspi arvense. While not a hyperaccumulator, T. arvense is a zinc-resistant plant would kill zinc-sensitive members of the same family.

Agricultural, Life and Physical Sciences

Presenting Author: **Jonathan Henson**

Authors: Jonathan Henson - Faculty Advisor: Dr. Matthew Geisler

Major/Field of Study: Plant Biology

Is the LYSM Interacting Kinase 1 Gene Responsible for Intraspecific Competition?

When plants of the same species are planted in proximity, they recognize each other and grow more vertically to compete. What remains to be discovered is the mechanism for this response including the genes involved in the process. We have previously obtained a mutated line of the model organism Arabidopsis thaliana in which the LYSM Interacting Kinase 1 (LIK1) gene has been knocked out. When tested, individuals from this line have been unresponsive to competition. While these were remarkable results, there may have been other mutations present in the genome. This semester we have been testing both DNA extraction and PCR so we can demonstrate that the competition insensitive plants truly contain the LIK1 mutation and that mutation only. Data from both spectrophotometry and gel electrophoresis indicate that our extractions were successful. Gel electrophoresis of the PCR product, however, showed only primer DNA. We suspect that the Taq polymerase used was deteriorated and have plans to repeat PCR with a fresh enzyme. Another aspect of the experiment involved eliminating a second mutation we found in an ancestor to our current mutant lines. When this mutation was homozygous, it caused increased anthocyanin production in the plants. To eliminate it, we planted 16 seeds from each of our two mutant lines and found that the purple phenotype had already segregated out of both lines.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Isaac Shaw**

Authors: Isaac Shaw; Peter R. Langridge; Juling Zefo; Ryaan R. Ligon; Lakshika Dissanayake; Sandipty Kayastha; Scott D. Hamilton-Brehm; Lahiru N. Jayakody - Faculty Advisor: Lahiru Jayakody

Major/Field of Study: Political Science/Classical Studies

Mining subsurface microbial genetic traits to develop robust microbial cell factories

Synthetic microbial cell factories are designed to produce renewable-based fuels, chemicals, and materials from biomass and unconventional substrates such as synthetic polymers. During the microbial production process, microbial cells encounter diverse abiotic and biotic stresses, including chemical stressors. Developing robust microbial cell factories to tolerate chemical stressors is vital to enhance the desire product titer, rate, and yield to enable an economically viable process. Subsurface microbes' deal with multiple extreme environmental conditions, including heat, pressure, nutrient starvation, radiation, and chemical stressors. Consequently, these microbes have developed genetic stress tolerances that are useful to syntheric biology. We explore the genetic traits from the novel strict anaerobic, thermophilic, subsurface bacterium, Caldiatribacterium inferamans strain SUIC1, which is one of the first cultured members from the candidate phylum Atribacteria OP9. Here we demonstrated successful heterologous expression of SIUC1, gene L-iditol 2-dehydrogenase in the domesticated industrial workhorse Pseudomonas putida KT2440. We discovered that expression C. inferamans SIUC1, L-iditol 2-dehydrogenase in P. putida KT2440 remarkably enhances its resistance to several high-toxic compounds, including alcohol such as methanol, ethanol, and catechol, and aldehydes such as glycolaldehyde and furfural. The biochemical characterization of the substrate specificity of the enzymes is underway. Additionally, we are currently exploring C. inferamans SIUC1 chaperone machinery in P. putida KT2440 to enhance thermophilic enzymes' expression, such as plastic degrading enzymes. In summary, we demonstrated the synthetic expression of genes from the extreme subsurface bacterium C. inferamans, SIUC1 in industrial cell factories for the first time.

Keywords: SIUC1, L-iditol 2-dehydrogenase, chemical stress, P. putida KT2440

Undergraduate   Poster Number: A136

Agricultural, Life and Physical Sciences

Presenting Author: **Cassidy Brunson and Morgan Brown**

Authors: Cassidy Brunson; Morgan Brown; Avery Vestal; Kara Huff Hartz; Michael J. Lydy - Faculty Advisor: Dr. Michael J. Lydy

Major/Field of Study: Zoology

Designation: REACH 2020-2021

Photosensitivity and predator avoidance in pyrethroid-resistant Hyalella azteca

Hyalella azteca is a species of freshwater invertebrate and a vital component to many aquatic ecosystems, serving as a primary food source and indicator species that highlights environmental issues. One such ecological problem, and the central focus of our research, is pesticide exposure. Increased pesticide use in agricultural and urban landscapes has caused certain H. azteca populations to develop resistance to pyrethroid pesticides, which may have adverse effects on H. azteca's chemosensory and photic reflexes. In addition, a genetic bottleneck can be created due to these elevated exposures that decrease the population's diversity and stability. Our research explores how resistance mutations in H. azteca alter their responses to certain stimuli by comparing how resistant and non-resistant populations react to light, chemical predator cues, physical/chemical hybrid stimuli, and a live chemical predator cue. Tests were conducted in dishes containing 1000 mL of water and 10 H. azteca in each trial. A total of 10 trials per physical stimuli were conducted. A lightbox was used for the physical stimuli, while L-histidine, L-serine, and fish water were used as chemical stimuli. Additionally, H. azteca were exposed to 30 ng/L permethrin for 48 hours and then tested on the light table. Each test was paired with a respective control trial to account for random behaviors unassociated with the experimental element. Our preliminary data suggest that non-resistant populations have much stronger and faster reactions compared to the resistant populations. We have especially seen these results in our light stimuli trials. As we continue to collect data and draw our final conclusions, we are focused on how the changes in behaviors caused by resistance mutations can affect H. azteca populations and their ability to respond to threatening stimuli.

Agricultural, Life and Physical Sciences

Presenting Author: **Daniel Fernandez**

Authors: Daniel M. Fernandez[1]; Richard Flamio Jr.[1]; Aaron J. DeLonay[2]; Kimberly A. Chojnacki[2]; Amy C. Buhman[3]; Edward J. Heist[1,3] - Faculty Advisor: Richard Flamio Jr. and Dr. Edward J. Heist

Major/Field of Study: Zoology

Designation: REACH 2020-2021

Are spring and summer spawning shovelnose sturgeon (Scaphirhynchus platorynchus) in the Lower Missouri River distinct genetic stocks?

Sturgeon spawn in freshwater with most species spawning in spring. Some sturgeon species have populations that have also demonstrated the ability to spawn in late summer or fall. Studies of several anadromous sturgeon have found distinct genetic differences between seasonal spawning pulses. Effective management of sturgeon populations require managers to accurately characterize the population status and composition of reproductive stocks. Little is known about the genetic structure of seasonal spawning pulses in river sturgeons, such as the shovelnose sturgeon (Scaphirhynchus platorynchus). This information is particularly important for the shovelnose sturgeon, which is often used as a surrogate in studies to assess management actions for the closely-related, endangered pallid sturgeon (S. albus). The goal of this study was to determine if genetic structure between the spring and summer spawning shovelnose sturgeon in the Missouri River can be detected using existing microsatellite markers. We performed genetic analyses using 19 microsatellite loci on sturgeon free embryos collected from the Lower Missouri River in 2014. A total of 49 shovelnose sturgeon free embryos collected during a spring spawning pulse and 50 free embryos from a late summer pulse was analyzed. Using the computer program GENEPOP, we found no genetic differentiation between spring and summer pulses (Fst = -0.0016, p = 0.108194). Results from this study indicate that sturgeon free embryos collected from the two different spawning pulses are genetically similar and from one spawning population, rather than distinct stocks. The absence of a genetic basis for extended spawning of shovelnose sturgeon in the Lower Missouri River suggests that this species shows a substantial degree of temporal variability in spawning behavior compared to pallid sturgeon. Shovelnose sturgeon are likely a poor surrogate for pallid sturgeon in basin-wide studies of timing of reproduction.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Tyler Bennett**

Authors: Tyler R. Bennett; Shaley A. Valentine, MS; Gregory W. Whitledge, PhD - Faculty Advisor: Dr. Gregory W. Whitledge

Major/Field of Study: Zoology specialization in fisheries and aquatic biology

Designation: REACH 2020-2021

Habitat Use of Prey Fish in White Bass Diet Across Large Illinois Rivers

Connectivity in large river systems is important as fish use different habitats including tributaries, backwaters, and main channel rivers for movement, foraging, spawning, and refuge from predators. Understanding what habitats are used and prey is consumed across riverine food-webs is necessary to make informed management decisions. In 2019, White Bass were collected from four geologically distinct rivers: the Mississippi, Ohio, Illinois, and Wabash. Stomach contents of White Bass were identified to the lowest taxonomic rank, otoliths were extracted from prey fish, and dry weights of prey were recorded. Gizzard Shad was the most frequently consumed prey fish and yielded the highest percentage of dry weight across all prey items. We used nonmetric multidimensional scaling (NMDS) to describe variability in White Bass diets across rivers. Diet data showed that the White Bass collected in the Upper Mississippi and Illinois rivers had variable diets and those collected in the Middle Mississippi, Ohio, and Wabash rivers had similar diets to one another. These data suggest that White Bass are more generalist predators in some rivers but may have some diet specificity in other rivers. Additionally, this study will determine the natal origins of prey fish consumed using otolith microchemistry. Analysis of processed otoliths concentration of Ca:Sr and Ca:Ba using a Laser Ablation Inductively Coupled Mass Spectrometer (LA-ICPMS) is ongoing. To determine the natal origin, the average chemistry profile from the otolith core of each prey fish and the average and 95% confidence intervals of water chemistry of the main rivers and tributaries will be developed using regressions for each prey fish species. The proportions of prey fish species originating in tributaries or mainstem rivers will be compared using Chi-Square tests for each river basin and across river basins. Combining diet data and prey origin will help determine what prey species and habitats are important for supporting predator populations among these rivers

Undergraduate   Poster Number: A139

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Christian Gonzalez**

Authors: Christian Gonzalez; Guillaume Bastille-Roussaue - Faculty Advisor: Guillaume Bastille-Roussaue

Major/Field of Study: Zoology Wildlife Biology and Conservation

Designation: REACH 2020-2021

Spatial Analysis on Albino White Tailed Deer

After discovering and collaring a wild albino white-tailed deer, we decided to test if albinism affects a white-tailed deer's space use relative to conspecifics. We used GIS in order to gather the locational data from the albino and 19 normal white-tailed deer, all wearing GPS collars. We created home range estimate for each deer using their GPS data. We mapped the spatial data gathered from the deer in ARCGIS to extract l landcover proportions of developed, forest, and agricultural land using NLCD. Finally, we compared each individual deer's home range and the proportions of the landcovers they roamed. We focused on developed, forest, and agricultural landcovers and found that there were significant differences between the albino and normal deer when it came to the developed and forested areas. The albino was more active in those areas than others, which allows us to better understand how albino white-tailed deer, and perhaps other albino species move around.

<u>Agricultural, Life and Physical Sciences</u>

Presenting Author: **Alexandra Apgar**

Authors: Alexandra Apgar; Harvey Henson; Zachariah Seaman; Kailey Seaman; Angela Hanson - Faculty Advisor: Dr. Harvey Henson

Major/Field of Study: Geology

Subsurface Detection of Camarasaurus Bone Beds Using Ground-Penetrating Radar.

The field of paleontology was founded on the discovery, excavation, and display of prehistoric specimens. However, modern paleontologists must often rely on erosion or chance exposure via construction efforts to uncover fossilized vertebrate remains. Once uncovered, it also remains difficult to estimate a fossil's size or extent underground without expensive and time-consuming excavation efforts. In response, some paleontological studies have investigated ground-penetrating radar (GPR) as a tool for subsurface exploration. GPR is a geophysical technique that uses electromagnetic energy to image the subsurface and solve problems within multiple fields (i.e. engineering, archaeology and geophysics). Previous studies showed some success in identifying underground mammalian fossils, but attempts focused on fossilized dinosaur remains produced very limited results. With vast improvement of GPR technology in recent years, new methods and techniques are available for testing that could improve the efforts of paleontologists. This study explored the capability of GPR hyper-stacking technology to identify fossiliferous strata and to determine the extent of a known and unknown bone bed in the subsurface. Additionally, the proficiency of micro-georadar to locate and delineate exposed and near-surface buried dinosaur remains was investigated. Noninvasive, high-resolution GPR data were collected from multiple field sites containing dinosaur remains, including a large ichnofossil trackway with interbedded Camarasaurus bones. This method successfully mapped site stratigraphy, delineated exposed fossils from surrounding limestone, and imaged potential subsurface ichnofossils. An abundance of reflective anomalies within the collected data were interpreted as previously undetected dinosaur remains. Results from this study suggest GPR is an important tool for small-scale, noninvasive identification of Mesozoic fossiliferous strata.

Agricultural, Life and Physical Sciences

Presenting Author: **Samantha Dennis**

Authors: Samantha Dennis; Zachariah Seaman; Harvey Henson

Major/Field of Study: Zoology with a specialization in wildlife biology and conservation

Collaborative Study of Burrowing Crayfish Using Zoological and Geophysical Methods

This multidisciplinary research combines applied geophysics and invertebrate zoology to study important ecological problems involving burrowing crayfish. Burrowing crayfish are particularly under investigated and invasively excavated during normal research studies. While crayfish being a keystone species in some environments, it is important when handling the crayfish to not destroy or impose on their habitat. More research is needed to better understand the nature/species of burrowing crayfish and to provide information to help stem the encroachment and endangerment of native species in southern Illinois and elsewhere. My proposal is to develop ground penetrating radar (GPR) techniques to image the subsurface burrows of crayfish in southern Illinois. Subsequently, I will trap crayfish safely by using the string and bait method and luring them out of the channel, describing their phenology and species, and then releasing the crayfishes unharmed. The research question I will investigate is: Can subsurface GPR imaging of crayfish habitats provide unique burrow signatures to sufficiently identify crayfish taxonomically?

Undergraduate

<u>Engineering</u>

Presenting Author: **Simon Markus NULL**

Authors: Simon Markus; Tyler Bishop - Faculty Advisor: Abdullah Aydeger

Major/Field of Study: Computer science

CovidCaution

The COVID-19 pandemic continues to be a major disruptor in the United States. As a response to this unprecedented crisis, the CDC has made publicly available daily data on the number of cases and death count by county and date. The goal of this project will be to create a visualization and data export tool for historical data on the number of casts and deaths related to COVID-19. Machine learning may also be included.

Presenting Author: **Grace Lafo**

Authors: Grace Lafo - Faculty Advisor: Valerie Boyer, PhD, CCC-SLP

Major/Field of Study: Communication Disorders and Sciences

Designation: REACH 2020-2021

Parents' Experiences Navigating the Diagnostic Process for Children with Autism Spectrum Disorder

The diagnostic process for autism spectrum disorder (ASD) can pose many barriers for families, especially within rural communities where there is a lack of adequate diagnostic and therapy services available. Factors such as cultural stigma, medical professionals, financial constraints, and travel have previously been reported as barriers for pursuing a diagnosis within rural geographic regions. The current study was conducted to find obstacles that parents face within rural southern Illinois while on the path to receive an accurate diagnosis of ASD for their child. This study also aimed to determine what resources were being provided to parents at the time of diagnosis and what supports assisted families throughout the diagnostic process. Participants included eleven families of children with ASD residing in southern Illinois who had been diagnosed between 2013 and 2019, with one outlier diagnosed during the early 2000s. A qualitative research design was used with a semi-structured interview of eight open-ended questions regarding experiences with the diagnostic process. The interviews were analyzed using Qualitative Data Analysis Miner Lite to find common themes across parent responses. The current study's results were consistent with existing research, and experiences and perspectives varied significantly across families. The findings from this study will be used to improve the diagnostic process within southern Illinois by better informing service, teaching, and research at Southern Illinois University Carbondale's Center for Autism Spectrum Disorders (CASD).

Undergraduate

<u>Health and Human Sciences</u>

Presenting Author: **Lauren Troutt**

Authors: Lauren Troutt; Ryan Campbell, PhD - Faculty Advisor: Ryan Campbell, PhD

Major/Field of Study: Criminology & Criminal Justice

Burial Variation in Pope County, Illinois: A Preliminary Examination of Historic Cemeteries

Undocumented graveyards occur throughout the vast forest of Southern Illinois. These burial sites provide valuable historical and anthropological data regarding the people who settled in this region from the early nineteenth to twentieth centuries. The goal of the project was to gather valuable data from each undocumented site and map each site so that these areas can be better preserved. Data were collected from September to December 2020 from a series of cemeteries in the southern Illinois area (Figure 1). These cemeteries are located throughout the Shawnee National Forest and were located using Universal Transverse Mercator, or UTM, coordinates. When the cemeteries were located, they were thoroughly documented photographs of each headstone/footstone, any plants that may have been planted there by someone, and archival work on individuals buried there.

<u>Health and Human Sciences</u>

Presenting Author: **Lindsey Leatherman**

Authors: Lindsey Leatherman - Faculty Advisor: Julie Partridge, PhD

Major/Field of Study: Exercise Science and Psychology

Designation: REACH 2020-2021

An Exploration of the influence of Demographic and Psychosocial Variables on Rehabilitation and Overadherence

The first purpose of this study was to investigate the impact of athletic identity, self-presentational concerns, guilt/shame proneness, sport type, and gender on over adherence to injury rehabilitation. The second purpose was to explore perceptions of invisible injury in athletes. The sample consisted of college students who have competed in competitive athletics at least through the high school level. Participants were given a series of questionnaires including Athletic Identity Measurement Scale (AIMS), Self-Presentation in Sport Questionnaire (SPSQ), the Test of Self-Conscious Affect (TOSCA), Rehabilitation Overadherence Questionnaire (ROAQ), and open-ended questions on invisible injuries. A linear multiple regression indicated that athletic identity, self-presentational concerns, shame proneness, and gender were all significant in predicting scores on the Rehabilitation Overadherence Questionnaire (ROAQ). Results from the qualitative analysis also showed that there were significant recurring themes in the qualitative open-ended questions regarding experiences with invisible injuries. Overall, this study showed that future studies should continue to examine the effects of invisible injuries on the rehabilitation process.

<u>Health and Human Sciences</u>

Presenting Author: **Gabriella Agius**

Authors: Gabriella Agius; Dr. Seung-Hee Lee - Faculty Advisor: Dr. Seung-Hee Lee

Major/Field of Study: Fashion Merchandising

Designation: REACH 2020-2021

Female Consumers' Brand Attitudes toward Fashion Socially Responsible Marketing

The average American woman is a size 16 (Christel & Dunn, 2016). However, most women shown in fashion advertising are significantly less than that. This disparity has led to negative body image and body dissatisfaction in women. Not only this, but this often unattainable beauty standard leads to an internalization of the thin ideal, which can lead to disordered eating behaviors. This standard was not often questioned until around 2014 when lingerie brand Aerie started their Aerie Real campaign (Mabry-Flynn & Champlin 2018). However, despite the positive feedback on social media, it would be interesting to see how this campaign reflects in terms of stock data and consumer preference. The purpose of this study is to analyze female consumers' preferences regarding socially responsible marketing in fashion.

Undergraduate

<u>Health and Human Sciences</u>

Presenting Author: **Tamara Keene**

Authors: Tamara Keene; Bristi Poudel - Faculty Advisor: Joseph Cheatwood

Major/Field of Study: Nutrition and Dietetics

The Expression of Central GLP-1 in Rats Given the Chemotherapy Drug Doxorubicin

A common result of chemotherapy treatment is chemotherapy induced nausea and vomiting. While many medications have been successful in remedying this side effect for a small period of time, there is little known about the physiological mechanism behind this subset of nausea and vomiting. Our study investigates the involvement of Glucagon-Like Peptide 1 Receptors within this process.

Presenting Author: **Katlyn Helton**

Authors: Katlyn Helton; Natalie Hite; Diana Sarko, PhD - Faculty Advisor: Diana Sarko, PhD

Major/Field of Study: Physiology

Designation: REACH 2020-2021

Characterization of cytochrome oxidase staining in the naked mole-rat brain

The naked mole-rat (NMR) is becoming of greater interest in the research world due to a large part of their brain being devoted to the somatosensory cortex. However, the NMR brain has not been thoroughly mapped. Therefore, the goals of this research project are to characterize the naked mole rat brain by using cytochrome oxidase (CO) stain to highlight the primary sensory dense areas in the brain and cresyl violet (CV) stain to locate landmark structures, to help identify structures in the CO stained sections. One adult naked mole-rat was given an overdose of pentobarbital and perfused with 4% paraformaldehyde. The brain was extracted and sectioned on a cryostat microtome. Cresyl violet stain and CO stain were alternated between every other brain section. The slides were then mounted, scanned and observed. Dense CO staining was observed in the following brain regions: the striatum (caudate/putamen), nucleus accumbens, globus pallidus, nucleus of the vertical limb of the diagonal band, piriform cortex (layer 1, anteriorly), islands of Cajella, primary somatosensory cortex (S1, layer 4) and presumptive primary auditory and visual cortices (A1 and V1, layer 4), intermediate division of the lateral septal nuclei, some divisions of the thalamus (anterodorsal, laterodorsal, reticular, lateral habenular nucleus, medial extent of medial habenular nucleus, ventral posterior lateral and medial nuclei), the hippocampus (particularly the dentate gyrus). These results serve as one component of a larger effort to comprehensively characterize the naked mole-rat brain using a wide range of immunohistochemical and histological methods.

Health and Human Sciences

Presenting Author: **Audrey Ambrosio**

Authors: Audrey Ambrosio; Kristen Boog, MA; Kayla Cooper - Faculty Advisor: Karla Fehr, PhD

Major/Field of Study: Psychology

Designation: REACH 2020-2021

Daily Number of Steps and Sleep Quality in Children during the COVID-19 Pandemic: Preliminary Results

Background: The relationship between sleep quality and physical activity in school-aged children has been previously exclaimed and has shown a relationship between the two. Increased daily number of steps and decreased sleep onset latency has also been examined in adults. The COVID-19 pandemic has impacted daily walking behaviors, sleep behaviors, and screen usage. The present study examined daily walking behaviors, sleep, and screen time in children aged 4-9 during the COVID-19 pandemic.

Methods: Participants (n = 5) wore an Actigraph watch and Garmin Vivofit Jr. Watch for a 48-hour period, in addition to demographics forms and questionnaires being filled out by a parent. Actigraph watch data from night two of the 48-hour period was used to examine sleep duration, as Actigraphy has shown to have high accuracy for sleep. Garmin Vivofit Jr. step data from day two of the 48-hour period was used to calculate daily step count because Actigraphy does not report step count. Parents were also asked to report the number of hours of current/pre-pandemic screen use for their child.

Results and Conclusion: While no conclusions can be made due to the small sample size, the results of the current study suggest that children aged 4-9 are not often meeting recommendations for daily step count or sleep duration during the COVID-19 pandemic. There has also been a reported increase in screen time during the COVID-19 pandemic. Future research and continuation of the current study is needed to make further conclusions.

Health and Human Sciences

Presenting Author: **Audrey Ambrosio**

Authors: Audrey Ambrosio; Kristen Boog, MA - Faculty Advisor: Karla Fehr, PhD

Major/Field of Study: Psychology

Designation: REACH 2020-2021

Differences in Sleep Quality in College Students with and without Chronic Illness

Background: College students are vulnerable to struggling with sleep due to several factors like stress and homework. Additionally, those with various chronic illnesses have shown imparments in varying areas of cognition due to poor sleep quality. The present study examined sleep quality, defined by number of night wakings, perceived and objective sleep onset latency, sleep duration, and daytime sleepiness, in college students with and without a chronic illness.

Methods: Particpants (n = 191) wore an Actigraph watch for 48 hours and were given a sleep diary to fill out. Actigraph watch data from night two was used to calculate night wakings, sleep duration and objective SOL. Sleep diary responses were used to calculate perceived SOL. Participants also completed the Epworth Sleepiness Scale (ESS) to measure daytime sleepiness.

Results and Conclusion: The results of the current study suggest that there is no difference between quality of sleep in a college student population for those with or without a chronic illness. Future research is needed to continue to examine the possibility of this relationship.

Undergraduate

Poster Number: A169

Health and Human Sciences

Presenting Author: **Caleb Hoffman**

Authors: Caleb Hoffman; Aleceya Davis; Elliot Gray; Monica Murray - Faculty
Advisor: Joe Narusis

Major/Field of Study: Psychology

Effect of Quantity and Quality of Mental Health Services on Students

Mental health resources are essential tools for students at university during Covid-19 as students struggle to adapt (Liu et al., 2020; Son et al., 2020). However, not all universities have the same quality or quantity of mental health resources (Mowbray, 2007). During this time of increased student need, it is even more important to know if students prefer a higher quantity or a higher quality of mental health resources. It was hypothesized that students would show a preference for situations where they had high quality mental health resources, even at the detriment of the quantity of resources available. To test this hypothesis, a randomized experiment using survey data was created. One of three scenarios of differing mental health resources at a university were presented to the students of a mid-western university: resources with low quantity but high quality, resources with average quantity and average quality, and resources with high quantity but low quality. It was found that, regardless of the quantity and quality of the services, students felt that they would be able to find help if they required it, as the results showed no significant change between the hypothetical scenarios. Even though these results were insignificant between groups, it should be noted that there was a significant trend with another outcome variable related to the importance of quality of mental health services. When a participant viewed the low-quality scenario, quality was significantly more important to them than participants that viewed the medium or high quality scenarios. This shows the importance of highlighting the quality of mental health care to university students. It is believed that this study, unfortunately, was under-powered, as a trend could be seen throughout the data, but with only 81 usable responses, there is not enough of a trend to make the results significant.

Health and Human Sciences

Presenting Author: **Tehya Payne**

Authors: Tehya Payne; Matthew Jamnik - Faculty Advisor: Lisabeth DiLalla, Ph. D

Major/Field of Study: Psychology

Designation: Sigma Xi

The Influence of Perinatal Stressors on Activity Levels in Preschool-Aged Twins

This project examined whether prenatal stressors, as well as sex differences, influenced temperamental activity levels in preschool-aged twins. Theories of childhood temperament suggest that some children are born with a predisposition for higher activity levels than others (Thomas & Chess, 1977). Perinatal stressors (e.g., low birth weight) have been associated with decreased motor abilities in late adolescence (Rogers et al., 2005). Additionally, some but not all studies find that boys have higher activity levels than girls (Strelau & Zawadzki, 2012). It was hypothesized that preschoolers who experience perinatal stressors (i.e., birth complications, small birth weight for age) would be rated lower   on temperamental activity than without prenatal stressors and that boys would be rated higher in activity than girls. Children were tested as part of the Southern Illinois Twins/Triplets and Siblings Study (SITSS). At ages 4 and 5 years, parents reported child temperament, including activity levels (the level, tempo, and frequency of motor behavior), and birth information, including birth weight, gestational age, and perinatal birth complications. Per globally-recommended guidelines (World Health Organization, 2006), birth weight and gestational age were used to calculate size-at-birth (small, appropriate, or large for gestational age). One twin from each family was randomly selected for analyses. Regression analyses indicated that age 4 temperamental activity was predicted by child sex and size-at-birth, but not birth complications, $F(3, 102) = 7.72$, $p < .001$. At age 5, temperamental activity was significantly predicted only by child sex, $F(3, 221) = 4.54$, $p = .004$. Thus, boys were rated by parents as higher in activity level at ages 4 and 5. Furthermore, findings suggest that prenatal stressors, specifically size-at-birth, influence children's temperamental activity at age 4, but not at age 5. Perhaps children who are small-for-size at birth 'catch up' by age 5 to children who are appropriate- or large-for-size.

Undergraduate

Poster Number: A171

<u>Health and Human Sciences</u>

Presenting Author: **Kailee Henderson**

Authors: Kailee Henderson; Laxmi Sagwan-Barkdoll, PhD - Faculty Advisor: Laxmi Sagwan-Barkdoll, PhD

Major/Field of Study: Radiologic Sciences

Large-Scale SARS-CoV-2 Mutation Study

The United States has the highest global deaths with approximately 158,263 total deaths due to COVID-19 caused by the virus SARS-CoV2. The five states with the highest deaths in the US were New York (39,118), Texas (29,498), California (28,579), Florida (22,481), and New Jersey (19,646). We investigated the mutational patterns of the S protein of the SARS-CoV2 in these five US states and if the mutations correlated with the high number of deaths in these states. We downloaded 5,967 S protein sequences from the 5 US states from NCBI virus database. Multiple sequence alignment showed prevalent single mutations of SARS-CoV2 at position 13, 152 221, 402, 494, 614, 677, and 681. From these sequences, a phylogenetic tree was constructed to study the evolution of these mutations. The tree showed two clades –Clade I which consists of the original SARS-CoV2 sequence from Wuhan, China with D614 and Clade II consists of different strains of the virus including mutation at D614G, Q677H, P681H positions and would explain the high number of deaths in these 5 US states.

Presenting Author: **Roshni Choudhary**

Authors: Roshni Choudhary; Renee Davis; Trenton Spencer - Faculty Advisor: Aaron Scott

Major/Field of Study: Communication Design, Computer Science

Designation: REACH 2020-2021

*Designing A Future Application for Assisting
Pre-Alzheimer's (Mild Cognitive Impairment) Patients with Facial Recognition
and Object Detection*

People with mild cognitive impairments (MCI) struggle to identify faces and safely navigate environments in their everyday lives. This prototype of a phone application utilizes augmented reality technology to help pre-Alzheimer's recognize faces or objects in their environment and create virtual notes about them. Our team tested the limits of facial recognition and obstacle detection on consumer-grade mobile devices by building on pre-existing computer vision software. We created design personas and referenced accessibility conventions to create a comprehensible user interface for MCI users. It was possible to create a software that detects obstacles on a single-camera device through coding algorithms (set of rules a computer follows to achieve a particular goal) that could detect contrasting colors and shapes. We developed real-time facial recognition by producing eigenfaces (matrices of vectors representing facial features) of people. This helps to store and compare people's facial features. The team paid close attention to web accessibility standards to provide a proper user experience for the elderly. To further enhance the performance of the prototype, we integrated edge computing devices such as a neural computer stick to parallelize the computer vision algorithms, allowing for lower tier consumer grade hardware (such as mobile devices) to be viable. Allowing the code to be run on a mobile device makes the prototype more accessible. This research strives to improve independence and confidence for MCI patients and increase the accessibility of assistive technology for everyday users. After conducting human-research testing with MCI patients at the Center for Alzheimer's and Related Disorders in Springfield, Illinois this app prototype will improve and eventually be converted into an application for augmented reality headsets.

Undergraduate

Poster Number: A181

<u>Liberal Arts</u>

Presenting Author: **Xante Cutroni A.A.**

Authors: Xante Cutroni; David Gilbert, Ph.D - Faculty Advisor: David Gilbert, PhD

Major/Field of Study: Psychology

Evaluation of Potential Differences Between African American and Caucasian Marijuana Use Cessation

While there have been many studies done involving marijuana, there is currently a lack of research in motivations for marijuana use and its cessation. Especially lacking is research on the subtopic of marijuana use and cessation in different ethnic groups, particularly for heavy users (at least five times a week for the past year or more). This study aims to evaluate differences in motivation of marijuana cessation in African American and Caucasian individuals classified as having cannabis use disorder (CUD) using ANOVA. Concurrent tobacco use as a function of ethnic group will also be assessed in follow-up chi-square analyses. Data for the present study was collected as part of an earlier published research study on marijuana use. Findings from this study may be important in the development of treatment interventions better tailored to individuals seeking help.

Presenting Author: **Tra'Deidra Davis**

Authors: Tra'Deidra Davis; Dr. Tamara Kang; Adam Green - Faculty Advisor: Tamara Kang

Major/Field of Study: Psychology

Designation: McNair Scholars Program

Aggravating factors of abuse: How do they impact the futures of youth who have sexually offended?

Childhood sexual abuse can have lasting devasting impact, but little is known regarding how the youth's relationship to their sexual abuse perpetrator impacts adjustment later in life. This research paper will (1) examine how a youth's relationship to their perpetrator of sexual abuse affects global adjustment outcomes later in life for male and female youth who were sexually abused and offended sexually; (2) examine if the gender difference of the caretaker affects global adjustment outcomes; and (3) look at the interaction between the gender of the caretaker and the gender of the youth to see if it affects global adjustment outcomes. Global adjustment outcomes look at general self-regulation, school behavior, interpersonal behavior, and sexual self-regulation for youth who have offended sexually. For this paper, relationship to perpetrator was defined in terms of a male caretaker, female caretaker, or a non-caretaker. I evaluated youth who were sexually abused and sexually offended out of a dataset of youth who were enrolled in the child welfare system. The final sample analyzed consisted of 456 youth, with 347 males and 109 females. The analysis showed statistical significance for gender on global adjustment outcomes, $F(1, 450) = 6.504$, $p = .011$. There was statistical significance for relationship to perpetrator on global adjustment outcomes, $F(2,450)=5.357$, $p = .005$. No statistical significance was found for the interaction between gender and the relationship to perpetrator on global adjustment outcomes, $F(2,450)=1.1.916$, $p = .148$. These findings are supported by previous research that look at mental health outcomes for youth who were abused by caretakers (Kiser et al, 1993) and gendered difference in sexual offending (Glasser et al, 2018). This research expands on what previous research found by looking at global adjustment outcome. This provides a fuller picture so research can better understand why certain youth have different outcomes.

<u>Liberal Arts</u>

Presenting Author: **Megan Myers**

Authors: Megan Myers; Maria Garcia; Tori McNary; Riley Marshall - Faculty Advisor: Dr. Lisabeth DiLalla

Major/Field of Study: Psychology

Designation: Sigma Xi

Mediation of the Relationship Between Effortful Control and Externalizing Behavior by Family Conflict

This study examined the correlations between the temperament dimension effortful control, family climate, and externalizing behaviors. We hypothesized that effortful control would be negatively related to family conflict, which would be positively related to externalizing behaviors; thus, family conflict would serve as a mediator between effortful control and externalizing behaviors. Prior studies have found that difficult temperament moderates the relationship between family conflict and externalizing behaviors. However, no previous research looks at specifically effortful control. Our sample consisted of 116 twin pairs tested at ages 4 and 5 years. In sample 1, the indirect effect of effortful control on externalizing was significant. The direct effect of effortful control on externalizing was no longer significant with the mediator included. Similarly, in sample 2, the indirect effect of effortful control on externalizing was significant. The direct effect was no longer significant with the mediator included. Our findings suggest home conflict completely mediates the relationship between effortful control and externalizing behaviors.

<u>Liberal Arts</u>

Presenting Author: **Amy Rogers**

Authors: Amy Rogers; Dr. Jane Nichols - Faculty Advisor: Dr. Jane Nichols

Major/Field of Study: Psychology

Therapeutic Alliance: Therapist's Perceptions on Strength in Remote Psychotherapy

With the recent shift to social distancing caused by the COVID-19 pandemic, we are forced to do many things we are used to doing in person in a virtual way. Virtual psychotherapy has been studied before, but little information is available on the outcomes of it in relations to the therapeutic alliance. Therapeutic alliance is the agreed upon goals and tasks made by the therapist and client and the relationship that forms between the therapist and client. Our study measured the strength of the therapeutic alliance in the context of virtual psychotherapy. We used the Working Alliance Inventory for therapists (WAI-T) to measure the therapist's therapeutic alliance strength. It is our hope to better understand this relationship and recommend advancements in this area.

<u>Liberal Arts</u>

Presenting Author: **Margaret Schlotter**

Authors: Margaret Schlotter - Faculty Advisor: Dr. Lisabeth DiLalla

Major/Field of Study: Psychology

Designation: McNair Scholars Program

The Impact of Socioeconomic Status, Parental Negative Talk, and Gender on Child Internalizing and Externalizing Behaviors

Mental and behavioral problems in young children can lead to anxiety, depression, impaired academic performance, or substance abuse in adolescence and adulthood. Negative parenting practices and economic stressors have been associated with increased mental and behavioral problems in children. Boys typically display more aggressive-type behaviors while girls display more depressive behaviors. Data from 147 4- and 5-year-old children were used to test the effects of parental verbal negative talk and socioeconomic status (SES) at age 4 on internalizing and externalizing behaviors at age 5. Regression analyses showed a significant main effect of SES on girls' externalizing behaviors and a trending interaction effect for boys' internalizing behaviors, showing that boys with high negative parent talk and low SES show the highest internalizing, as expected, but boys with low negative parent talk and high SES also show high internalizing. Several post-hoc exploratory analyses were conducted. Aggression during a parent-child interaction at age 4 was used as a measure of age 4 externalizing. Age 4 aggression was significantly correlated with the age 5 externalizing measure. Therefore, regression analyses were conducted with age 4 aggression as the outcome variable. Results found that higher negative talk and lower SES at age 4 significantly predicted age 4 aggression in boys only. The developmental pathway for internalizing and externalizing behaviors may differ for boys and girls. Negative parenting practices and lower SES are particularly important to examine as risk factors when creating treatment plans for externalizing behaviors in preschool-aged boys.

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