28TH ANNUAL

RESEARCH DAY
AT THE CAPITOL

TUESDAY, MARCH 28, 2023 * STATE CAPITOL OF OKLAHOMA * OKLAHOMA CITY, OK

Recognizing Exceptional Oklahoma Undergraduate Research

OK NSF EPSCoR is funded through National Science Foundation Grant No. OIA-1946093 & Oklahoma State Regents for Higher Education.

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TUESDAY, MARCH 28, 2023 * STATE CAPITOL OF OKLAHOMA * OKLAHOMA CITY, OK

AGENDA

CAPITOL POSTER PRESENTATIONS & AWARDS CEREMONY

7:30 a.m.	**Student Researchers Check In** (*State Capitol, Rotunda, 2nd Floor*)
8:30 a.m. - 11:15 a.m.	**Scientific Posters on Exhibit** (*State Capitol, Rotunda, 2nd Floor*)
11:30 a.m.	**Awards Ceremony** (*State Capitol, MultiPurpose Room 100, 1st Floor*) Dr. Kevin Wagner, OK NSF EPSCoR Project Director Dr. Raman P. Singh, OK EPSCoR State Director Dr. Allison D. Garrett, Chancellor of Higher Education
Noon	**Adjourn**

Special thanks to our esteemed poster competition judges:

Jennifer Chain, OBI; Jason Lewis, USGS; Sherry Marshall, Science Museum Oklahoma; & Brian O'Dell, Teledyne FLIR

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OKLAHOMA STATE REGENTS FOR HIGHER EDUCATION
Improving our future by degrees

Tuesday, March 28, 2023

28th Annual

RESEARCH DAY *at the* CAPITOL

Student Participant List & Poster Guide

#	Student Researcher	University Represented	Research Topic	Hometown
1	Bethany Bengs	East Central University	Native American COVID Analysis	Wister
2	Kelsey A. Dobson	Rogers State University	Caffeine & Alcohol	Nowata
3	Victoria M. Fairchild	Northeastern State University	DNA Replication	Tulsa
4	Nicholas Harwood	University of Science & Arts of Oklahoma	Orbital Dynamics Simulations	Norman
5	J'Taelii N.E. Heath	Langston University	Multiple Sclerosis Pathology	Oklahoma City
6	Yulianis Pagan	University of Central Oklahoma	Oil Spills & Bird Heart Defects	Edmond
7	Emma Quintana	Southeastern Oklahoma State University	Native American Suicide Statistics	McAlester
8	Ally Riley	Northwestern Oklahoma State University	Hospital Stay Length & Readmission	Alva
9	Cally A. Ruiz	Cameron University	Elk Population	Lawton
10	Milena Rundine	Rose State College	Adolescent Development	Warr Acres
11	Alison Tock	Redlands Community College	Hops via Greenhouse	Watonga
12	Uzziah Urquiza	Southwestern Oklahoma State University	Pancreatic Cancer	Guymon
13	~~Bryce D. Whetstine~~ (withdrew)	College of the Muscogee Nation	Forestry & Agriculture	Glenpool
14	Omar I. Abouzahr	Oklahoma State University	UAVs	Stillwater
15	Maria Bustamante Molina	OU Health Sciences Center	Cancer Disparities	Claremore
16	Stephen Kooker	University of Oklahoma	Water Remediation	Norman
17	Jacob A. Lieberman	Oklahoma State University	Antifungal Therapies	Tulsa
18	Lane McCoy	University of Oklahoma	Antibiotic Tolerance	Tulsa
19	Ella A. Moffet	Oklahoma State University	Ultra-Processed Food	Woodward
20	Rabeca D. Richardson	Oklahoma State University	Invasive Species Management	Yukon
21	Kaylee Tatum	University of Oklahoma	Conservation Biology	Broken Arrow
22	Anna Troxell	University of Oklahoma	Emotional Regulation	Edmond

Presented by:

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OKLAHOMA STATE REGENTS FOR HIGHER EDUCATION

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Poster #1

Student Name: Bethany Bengs
Research Topic: Native American COVID Analysis
University: East Central University
Hometown: Wister

Researcher(s): Bethany Bengs and J.D. Brumley
Dept. of Biology & Environmental Science
East Central University, Ada, OK
Faculty Advisor: Dr. Jessica D. Brumley, East Central University, Ada, OK

AN ANALYSIS OF COVID-19 INFECTION RATES AMONG NATIVE AMERICAN TRIBAL NATIONS IN OKLAHOMA

Introduction: In the United States, coronavirus disease 2019, or COVID-19, has significantly impacted every demographic group. However, research indicates that Native Americans are one of the most severely affected demographic groups, with a death rate of at least double that of Caucasian Americans. Despite these alarming statistics, the data used in these studies were primarily aggregated and did not analyze rates in individual native populations. This study utilized the Supreme Court case *McGirt v. Oklahoma* to analyze daily COVID-19 cases and deaths among seven tribal nations in Oklahoma. The goal was to determine how areas in tribal nations have been affected by COVID-19 compared to the general population of Oklahoma.

Methods: Oklahoma COVID-19 county data was gathered for analysis from March 1, 2020, to May 1, 2021. Counties within the seven tribal nations were assigned as "tribal," while all other counties were designated "nontribal." First, incidence and case-fatality rates were calculated for each tribal-assigned area and compared to those for Oklahoma. Time series plots were created to illustrate the rates of daily new cases in each tribal nation. Finally, multiple linear regression models were created to determine the association between a county's population, tribal status, and case and death totals.

Results: Overall, tribal nation-assigned areas did not experience significantly higher incidence and case-fatality rates than Oklahoma. Furthermore, the time series plots suggested similar trends of new cases for each tribal-assigned area compared to Oklahoma during this period. Tribal-assigned counties did not have significantly different case and death totals compared to nontribal-assigned counties.

Conclusion: The results indicate that areas within tribal nations did not have significantly different COVID-19 case and death rates from Oklahoma, which contradicts previous studies.

Relevance of Study: This analysis demonstrates the need for more research on COVID-19 among Native Americans. However, it also indicates the importance of disaggregated data in research and analysis. Ultimately, disaggregating data to examine individual native populations will help us make more informed decisions toward mitigating the effects of COVID-19 in those most impacted.

Poster #2

Student Name: **Kelsey A. Dobson**
Research Topic: **Caffeine & Alcohol**
University: **Rogers State University**
Hometown: **Nowata**

Researcher(s): **Kelsey A. Dobson**
Dept. of Biology
Rogers State University, Claremore, OK
Faculty Advisor: **Prof. Cheyanne Olson, Rogers State University, Claremore, OK**

EFFECTS OF CAFFEINE AND ALCOHOL ON ZEBRAFISH BEHAVIOR

Pollution of drugs and pharmaceuticals into waterways can come from water discharged from wastewater treatment plants, since these chemicals are not filtered out in the treatment process. The presence of drugs and pharmaceuticals in water can pose environmental and human health risks. Zebrafish are used commonly to understand the effects drugs and other chemicals have on the brain and central nervous system, due to their similarities of neurological structure and function to humans. Two common drugs of interest, whose combined effects have been understudied, are caffeine and alcohol. The purpose of this research was to determine what the combined effects of caffeine and alcohol at different dosages were on zebrafish behavior. Experimental groups of zebrafish underwent exposure to different concentrations of the two drugs, a low and high dose, and their behavior was examined using the novel tank test. Tracking software (ToxTrac) was used to track fish speed, exploration, movement, and frozen events during testing. Statistical analyses were performed to differentiate between these behaviors of the experimental groups. Low doses of both drugs led to increased speed and exploratory behaviors. Further analyses with Toxtrac revealed spatial differences and intensity of movement between experimental groups during the novel tank test. In low doses observed behavioral aspects were significantly higher, while in high doses an increase was observed, but not significant. This research confirms previous studies that found high doses of alcohol counteract high doses of caffeine and reinforces the use of zebrafish as a study model. Further research is needed on the combined effects of caffeine and alcohol to understand their interaction and the implications for human health.

Poster #3

Student Name: Victoria M. Fairchild
Research Topic: DNA Replication
University: Northeastern State University
Hometown: Tulsa

Researcher(s): Victoria M. Fairchild and Carlos Cuza
Dept. of Natural Sciences
Northeastern State University, Broken Arrow, OK
Faculty Advisor: Dr. Sapna Das-Bradoo, Northeastern State University, Broken Arrow, OK

STUDY OF Pol 2 MUTANTS TO EXAMINE THE ROLE OF POLYMERASE EPSILON IN DNA REPLICATION INITIATION AND ELONGATION

In eukaryotes, genome duplication starts at many replication initiation sites termed replication origins. The proper functioning of origins is essential for the sound onset of replication. Malfunctions in origin firing can cause chromosomal aberrations, chromosome loss and rearrangement. DNA Polymerase Epsilon (Pol ε) has a known role in synthesizing the leading strand of DNA. In yeast, the subunits of Pol ε are referred to as Pol2, dpb2, dbp3, and dpb4. Impairment of Pol ε functions is associated with cancers and other diseases and thus prompts investigation into its role in origin activation. To this end, we studied origin activation and replication elongation in budding yeast using Pol2 mutants. Previous lab work has shown that the pol2-GE1425,1428AA mutant disrupts interactions with Mcm10 while pol2-W1272A interferes with a stable Pol ε complex formation. In this project, DNA sequences bound to Pol2 were pulled down by chromatin immunoprecipitation and purified. Early and late origin sequences were amplified by PCR and results were observed by agarose gel electrophoresis. Non-template samples were used as negative controls and genomic DNA served as the positive control. The non-origin sequence was twelve kilobase pairs away from the early origin to establish the Pol ε function during elongation. Our results indicate that pol2-GE1425,1428AA mutants show an earlier pattern of binding but dissociate during replication elongation. This result is in accordance with Pol2's inability to bind to Mcm10, which functions in replication elongation. The pol2-W1272A mutant weakly binds the other two Pol ε subunits (Dpb 3 and 4) and exhibits an unstable association with both early and late origins. Results with the Pol2 mutants are in stark contrast to the wild-type Pol2 cells that associate with origins in the S phase and maintain a strong association with DNA through elongation. In conclusion, loss of functionality in the Pol2 mutants have established the importance of the Pol ε complex in origin activation and elongation. In the future, we plan to investigate other Pol2 mutant strains that exhibit defects in DNA damage checkpoint activation.

Poster #4

Student Name: Nicholas Harwood
Research Topic: Orbital Dynamics Simulations
University: University of Science & Arts of Oklahoma
Hometown: Norman

Researcher(s): Nicholas Harwood and J.C. Sanders
School of Science & Physical Education
University of Science & Arts of Oklahoma, Chickasha, OK
Faculty Advisor: Prof. J.C. Sanders, University of Science & Arts of Oklahoma, Chickasha, OK

FROM EARTH TO THE MOON: ORBITAL TRANSFER SIMULATIONS

Orbital dynamics calculations are vital to satellite placement, exploration of our solar system, and planetary defense against asteroids. Sending satellites, rovers, or interceptors into space is expensive. It costs several thousand dollars per kilogram just to send a payload into low earth orbit, the starting point for distant trajectories. Accurate orbital transfer models are essential to minimize costs and ensure the success of future missions.
Using the computer program Mathematica, we created an n-body numerical model to simulate the launch of a spacecraft from earth to the moon. Beginning with the initial conditions, we determined the motion of the objects utilizing gravitational forces, kinematic equations, and a midpoint method approximation scheme over a variable time interval.

The Lunar Reconnaissance Orbiter (LRO), launched in 2009, was chosen as a sample mission based on its recent success gathering lunar data. NASA's JPL Horizons system provided the initial conditions to begin our simulation and final conditions to compare with our results. By utilizing a variable time step, we found the rate of error convergence to determine a suitable timestep. The simulation runs with an error of less than 1% for the planetary and spacecraft positions prior to lunar insertion. These results indicate that our numerical model effectively simulates the LRO's trans-lunar injection. Additional historical missions may now be used to further validate the simulation.

The total cost of the LRO mission was over $500 million dollars. An investment of this size requires various simulations beginning in the planning process and continuing through the launch of the spacecraft. Our simulation requires minimal computational resources, is conceptually straightforward, and can be adapted for other missions. It provides a quick check on more complex and expensive models utilized by NASA, SpaceX, Virgin Galactic, and other space programs.

Poster #5

Student Name: J'Taelii N.E. Heath
Research Topic: Multiple Sclerosis Pathology
University: Langston University
Hometown: Oklahoma City

Researcher(s): J'Taelii N.E. Heath[1], A. Nguyen[2] & R.C. Axtell[2]
[1]Dept. of Biology, Langston University, Langston, OK;
[2]Arthritis & Clinical Immunology Research Program, Oklahoma Medical Research Foundation, Oklahoma City, OK
Faculty Advisor: Dr. Byron Quinn, Langston University, Langston, OK

PIPERINE REDUCES THE INFLAMMATORY EFFECTS OF CIGARETTE SMOKE ON IMMUNE CELLS: IMPLICATIONS OF MULTIPLE SCLEROSIS PATHOLOGY

Introduction: Multiple sclerosis (MS) is a chronic inflammatory disease that affects the central nervous system (CNS). Inflammation causes demyelination of the nerves leading to neuronal damage and disability in patients. Inflammation, demyelination, glial activation, and oxidative damage are authenticated markers for MS. Smoking cigarettes is a lifestyle factor with severe health consequences. Smoking increases the susceptibility to developing MS and worsens the disease prognosis with severe health consequences for the general population. Cigarette smoke has over 4,000 chemicals that cause abnormal cell responses and tissue damage in the lungs, which drives pathology in MS. Our lab has shown that MS patients who smoke have elevated levels of S100 proteins in the blood. S100s are damage-associated molecular pattern proteins (DAMP), which drive severe inflammation in the central nervous system of MS patients. Black pepper (Piper nigrum) contains 5%-9% of the bioactive alkaloid, piperine, which may have neuroprotective, anti-inflammatory, and antioxidant properties.

Aims: The goal of this project was to determine if piperine reverses the inflammatory effects of cigarette smoke.

Methods: To test this hypothesis, we assessed piperine's *in vitro* effects on human peripheral blood mononuclear cells (PBMCs) cultured in cigarette smoke extract (CSE). Specifically, we cultured PBMCs with either 0%, 20%, or 40% CSE in the presence or absence of increasing concentrations of piperine. In the absence of piperine, CSE induced PBMCs to secrete the inflammatory DAMP, S100A9.

Results: We found a dose-dependent reduction of S100A9 by piperine in PBMCs cultured with either 20% or 40% CSE. This data provides evidence of a novel anti-inflammatory mechanism of piperine that inhibits DAMP release by immune cells induced by CSE.

Conclusion: CSE is directly linked to the production of DAMPs which worsen CNS-inflammation MS patients. We now show that black pepper components can mitigate the detrimental inflammatory effects of smoking by reducing DAMP release.

Relevance of Study: Our study provides evidence that piperine can treat the exacerbated pathology observed in MS patients who smoke.

Poster #6

Student Name: Yulianis Pagan
Research Topic: Oil Spills & Bird Heart Defects
University: University of Central Oklahoma
Hometown: Edmond

Researcher(s): Yulianis Pagan, H. Ewbank & C. Goodchild
Dept. of Biology
University of Central Oklahoma, Edmond, OK
Faculty Advisor: Dr. Christopher Goodchild, University of Central Oklahoma, Edmond, OK

GETTING TO THE HEART OF THE MATTER: EVIDENCE OF CARDIOTOXICITY FROM PRENATAL EXPOSURE TO TOXIC COMPONENTS OF CRUDE OIL

While it is often apparent that large marine oil spills cause extensive ecological damage, accurately quantifying the magnitude of damage is a considerable challenge. For instance, following oil spills, avian mortality estimates are based on beach surveys of visibly oiled birds. However, this approach does not include potential adverse developmental outcomes for avian embryos exposed to crude oil transferred from oiled nesting material or oiled feathers of brooding parents to the eggshell surface. Polycyclic aromatic hydrocarbons (PAHs) are naturally occurring toxic chemicals found in crude oil and are known to transfer from the external eggshell surface to the embryonic environment. In this study, we investigated the effects of sublethal exposure to two PAHs (phenanthrene, chrysene) at four different concentrations (100, 200, 400, and 800 ng PAH / g egg mass), on avian embryonic heart mass, heart rate, metabolic rate, and cardiac mRNA expression of detoxification enzymes. For both PAHs, we observed a decrease in embryonic heart rate, increased heart mass, and shifts in metabolic rate and mRNA expression of detoxification enzymes. However, there was no difference among treatments on embryonic growth or morphology. Collectively, these data suggest prenatal exposure to PAHs can lead to congenital heart defects, which may have long-term implications for hatchling survival. Based on these findings, it is critical to consider sublethal eggshell surface oiling to accurately quantify the adverse effects of crude oil spills on avian populations.

Poster #7

Student Name: **Emma Quintana**
Research Topic: **Native American Suicide Statistics**
University: **Southeastern Oklahoma State University**
Hometown: **McAlester**

Researcher(s): **Emma Quintana**
Dept. of Biological Sciences
Southeastern Oklahoma State University, Durant, OK
Faculty Advisor: **Dr. Ning Wu, Southeastern Oklahoma State, Durant, OK**

COMPARISON STUDY OF 1999-2019 NATIVE AMERICAN SUICIDE RATE PER 100,000 POPULATION IN THE UNITED STATES OF AMERICA

The suicide rate in the USA has been on the rise. Native American (NA) has been known on a higher level than other minorities. This study is focused on the NA suicide rate across 50 states from 1999 to 2020. The data were retrieved from the CDC Wonder database. Microsoft Excel and t-tests were employed for data processing and statistical analysis. The suicide rate was represented as the suicide number per 100,000 population. The USA's total suicide rate during the same time was also included. Each state was placed in a region outlined by the American Indian Science and Engineering Society including regions 1 (AK, ID, MT, OR, WA, WY), 2 (CA, HI, NV), 3 (AZ, CO, NM, UT), 4 (AR, KS, LA, MO, OK, TX), 5 (IA, IL, MI, MN, NE, ND, SD, WI), 6 (CT, IN, MA, ME, NH, NJ, NY, OH, PA, RI, VT), 7 (AL, DE, FL, GA, KY, MD, MS, NC, SC, TN, VA, WV). The results showed that the suicide rate of total NA was lower than that of USA total ($P < 0.01$). There were 4 regions with suicide rates higher than that of USA total (region 1 and 5 > 3 > 4 > USA total > 2 and 7 > 6). 9 states showed their NA suicide rates higher than that of USA total (AK > SD > MT and ND > AZ, NM, WA, and MN > OK > USA total). There were 15 states whose suicide rates of NA males were larger than that of USA total males, while 18 states whose suicide rates of NA females were larger than that of USA total females. However, the suicide rate of NA males was significantly higher than that of NA females ($P < 0.01$). The results supported previous studies that the male gender was impacted by suicide at a higher rate. In addition, NA in the west was more affected than those in the east. This study provided information on NA population being impacted most and in need of resources for suicide prevention, which would positively impact the NA population.

Poster #8

Student Name: Ally Riley
Research Topic: Hospital Stay Length & Readmission
University: Northwestern Oklahoma State University
Hometown: Alva

Researcher(s): Ally Riley and K. Lian
Division of Nursing
Northwestern Oklahoma State University, Alva, OK
Faculty Advisor: Dr. Leslie Collins, Northwestern Oklahoma State University, Alva, OK

READMISSION RATES AND LENGTH OF HOSPITAL STAY

Length of stay and readmission rates are common statistics used to determine patients' outcomes and hospital performance. These are important to the healthcare field in order to continue striving towards improved quality care and patient satisfaction. Both length of stay and readmission rate are seen as a preventable failure in the hospital setting and are needed to be continually challenged and tested. This project set forth to answer the question of: In hospitalized patients above the age of 18, what is the effect of a long length of stay on readmission rates compared with a short length of stay within 4 days. For the purpose of this research project, length of hospital stay is defined as the amount of days the patient stayed in the hospital. Readmission rate is defined as the rate of patients being readmitted after staying in the hospital for an x amount of time. A short length of stay is defined as a stay in the hospital shorter than 4 days. A long length of stay is defined as a stay in the hospital exceeding 4 days. Research states that there is no correlation between readmission rates and length of hospital stay. There are many factors to consider in determining an average length of stay in the hospital including but not excluded to: acute/chronic primary health condition, age, pre-existing conditions, allergies, gender, and religious preference. This research project found no relationship between length of hospital stay and readmission rates.

Poster #9

Student Name: **Cally A. Ruiz**
Research Topic: **Elk Population**
University: **Cameron University**
Hometown: **Lawton**

Researcher(s): **Cally A. Ruiz**
Dept. of Agriculture, Biology & Health Sciences
Cameron University, Lawton, OK
Faculty Advisor: **Dr. Dana Lee, Cameron University, Lawton, OK**

GENETIC VARIATION IN AN ISOLATED ELK POPULATION IN THE WICHITA MOUNTAINS WILDLIFE REFUGE, OKLAHOMA: A 20 YEAR COMPARISON

Elk *(Cervus canadensis)* were traditionally distributed across most of the continental U.S. but were extirpated from most of the U.S. by the 1920's. In effort to protect the species, 21 individuals from the Greater Yellowstone Ecosystem were translocated to the Wichita Mountains Wildlife Refuge (WMWR) in 1908-1912. This population has been protected but also isolated from other populations of elk. Slow population growth was further hindered by a 70% decrease in population size throughout the 1960's-1970's. Population size was estimated to be 500 individuals in 2001 when a previous study used microsatellites to examine the genetic variation in this slow growing introduced population. Researchers found the WMWR population to have zero unique alleles and the second lowest level of heterozygosity when compared to 4 other reintroduced populations (Hicks et al 2007). It was suggested the population suffered from a founder effect and later genetic bottleneck that could have negative effects on the population. Therefore our objective was to reexamine this population 20 years later and assess if genetic variation levels have improved as the population has grown to a size of 1,300. This is a unique opportunity to inform WMWR biologists about the genetics of the elk population and provide insight into potential refinements of future reintroduction methods.

We obtained 56 muscle samples from harvested specimens in 2021 and analyzed genetic variation using 10 of the 12 microsatellite loci used in Hicks et al (2007). The loci examined were not in linkage disequilibrium but 9 significantly departed from Hardy Weinberg Equilibrium expectations. This could be from null alleles, genetic drift in the form of a bottleneck, inbreeding, or sampling of subpopulations. We investigated further the possible sources for heterozygote deficiencies and found evidence for null alleles in 6 of the 10 loci. We also discovered evidence for a genetic bottleneck, inbreeding coefficient of 26%, and 3 distinct genetic subpopulations. Further investigation is warranted to tease apart these effects but it appears the elk on the WMWR are still experiencing consequences of a small founding population and minimal mixing of subpopulations despite the recent increase in population size.

Poster #10
Student Name: Milena Rundine
Research Topic: Adolescent Development
University: Rose State College
Hometown: Warr Acres

Researcher(s): Milena Rundine[1] and S. Jewell-Fleming[2]
Dept. of Social Science[1], Div. of Liberal Arts & Sciences[2]
Rose State College, Midwest City, OK
Faculty Advisor: Dr. Sheri Jewell-Fleming, Rose State College, Midwest City, OK

THE EFFECTS OF CANNABIS ON ADOLESCENTS' BRAIN DEVELOPMENT

Cannabis and marijuana are the most used illicit drugs in the United States and, while cannabis and marijuana consumption has significantly increased in the past decade, concern about its potential harm seems to have decreased, especially between adolescents. Tetrahydrocannabinol, best known as THC, is one of the major psychoactive components of cannabis, and recent increases of its levels in commercial cannabis products have raised concerns on its neurocognitive effects. Several studies conducted on adult THC consumption have shown impairments in both cognitive functioning and brain structure. However, there is a lack of research in determining the effects of cannabis and THC consumption on the adolescent brain. The aim of this meta-analysis is to detect any potential effect of THC on adolescent brain development, as research has identified adolescence as being critical for brain development and cognitive functioning. Therefore, 62 abstracts were analyzed, and 8 studies met the criteria established. Significant impairments between cognitive functioning and brain development variables were identified. Memory, attention, learning, and executive functioning were identified as the variables most affected by cannabis and THC consumption. Moreover, several studies found that THC use represents a risk factor for psychotic symptoms in initially psychosis free individuals. Possible results confounders include environmental factors, such as socioeconomic, educational, and psychological background, as well as nicotine and alcohol comorbidity. Future studies should focus on the duration of the effects of heavy cannabis and THC consumption after a period of abstinence. This meta-analysis aims at explaining the negative effects of cannabis and THC consumption on the development of the adolescent brain and highlights the importance of regulating the availability of the drug on commerce.

Poster #11

Student Name: Alison Tock
Research Topic: Hops via Greenhouse
University: Redlands Community College
Hometown: Watonga

Researcher(s): Alison Tock
Dept. of Agriculture
Redlands Community College, El Reno, OK
Faculty Advisor: Dr. Julie Flegal-Smallwood, Redlands Community College, El Reno, OK

VIABILITY OF HOPS PRODUCTION IN A GREENHOUSE ENVIRONMENT

Introduction: Hops are the flowers of the *Humulus lupulus* plant, and are considered a perennial vine/bine plant. Female plants produce pine cone shaped flowers, while male plants produce pollinating flowers. The majority of US production is in the Pacific Northwest, in part due to cooler/moderate temperatures with high rainfall. With preferred temperature ranges between 40°F and 71°F, both heat and cold extremes inhibit successful outdoor growth in Oklahoma.

Primary Research Questions:

- Can hops rhizomes be brought out of dormancy in a controlled greenhouse environment?
- Can hops be grown in multiple modalities in a controlled greenhouse environment?

Methods: One hundred plant rhizomes representing two cultivars were introduced a controlled greenhouse environment using multispectrum LED lights on an 18:6 light cycle. Once plants were out of dormancy, they were divided between a media-bed aquaponic system and containers with a minimum diameter of 20". Trellis structures were in place to accommodate the vining tendency and peak growth rate of 2ft/week. Plants were pruned/topped as need to accommodate height limitations.

Results: Both cultivars were successfully brought out of dormancy in the controlled environment. Once transplanted, both varieties grew in both modalities. Aquaponic hops showed slightly faster growth rates and maturation. Vine management was a key factor for both varieties in both modalities.

Conclusion: Indoor production of hops in Oklahoma is viable utilizing multiple growing techniques. The ability to move out of a dormant state quickly in a controlled environment, suggests the capacity to have more generation cycles per year, increasing the consistency and availability of small-batch hops. The ability to grow indoors also allows more flexibility and capacity to compensate for weather extremes inhibiting tradition field-growth.

Relevance: The microbrewery and craft beer industry has continued an upward trend for the past decade, outpacing traditional large-scale commercial breweries. The surge has, in part, been attributed to consumers under 40 desiring a variety of beverages in a more social setting. Successful growth of hops in a controlled environment allows small-batch brewers to focus on desired flavor profiles and have a more consistent supply of preferred varieties.

Poster #12

Student Name: Uzziah Urquiza
Research Topic: Pancreatic Cancer
University: Southwestern Oklahoma State University
Hometown: Guymon

Researcher(s): Uzziah Urquiza, C. Ezparza, H. Sharma & P. Sharma
Dept. of Biological Sciences
Southwestern Oklahoma State University, Weatherford, OK
Faculty Advisor: Dr. Pragya Sharma, Southwestern Oklahoma State University, Weatherford, OK

EXPLORING THE METABOLIC VULNERABILITIES OF PANCREATIC CANCER

Pancreatic cancer is one of the most lethal cancers, with a 5-year survival rate of ~10% and median survival of fewer than six months. It is projected to become the second most common cause of cancer deaths by 2030. Oklahoma suffers from a heavy burden of cancer and has the 7th highest average cancer incidence rate, with pancreatic cancer being the second-highest cause of cancer-related mortality. The current trend highlights the urgent need to identify novel therapeutic strategies against pancreatic cancer. Cancer cells differ from normal cells in their altered cellular metabolism. Cancer cells reprogram their metabolism to support their growth and proliferation. Although both cancer and normal cells need glucose, cancer cells have a "sweet tooth" where they metabolize sugar differently from normal cells. Unlike normal cells, most glucose consumed by cancer is fermented to lactate rather than oxidized in pathways that require respiration. This phenotype is referred to as "aerobic glycolysis." In addition to their dependency on glucose, cancer cells display metabolic plasticity driven by their tumor microenvironment. The study aims to understand the metabolic dependencies of pancreatic cancer cells and explore metabolic plasticity in cancer. Using the pancreatic cancer cell line as a model, we are studying cancer cells' metabolic energy needs using nutritional starvation approaches and pharmacological inhibitors. We carried out the ATP rate assay to explore the bioenergetic status of pancreatic cancer cells. Changes in the expression of genes essential for mitochondrial functioning and glucose metabolism are currently being studied using the Real time-PCR and Western Blotting. Our preliminary data indicate that pancreatic cancer cells do not depend solely on glycolysis for energy needs. Real-Time ATP Rate assay demonstrated that the cancer cells used both oxidative phosphorylation and glycolysis for energy production. Glycolytically suppressed cells upregulated mitochondrial function and exhibited metabolic flexibility to obtain the ATP necessary for survival. Further studies will explore the metabolic pathways that may lead to energy production or provide for building blocks needed for cancer cell growth when glycolysis is suppressed. These studies will provide insights into cancer cell vulnerability for designing therapies against pancreatic cancer.

Poster #13

Student Name: ~~**Bryce D. Whetstine**~~ *Student has withdrawn from event*
Research Topic: **Forestry & Agriculture**
University: **College of the Muscogee Nation**
Hometown: **Glenpool**

Researcher(s): **Bryce D. Whetstine, B. Whetstine, A. Tanyan, J. Adams, J. Knight, K. Postoak & M. Robinson**
Dept. of General Education & Dept. of Natural Resources
College of the Muscogee Nation, Okmulgee, OK
Faculty Advisor: **Ms. Cynthia Sanders, College of the Muscogee Nation, Okmulgee, OK**

ORKO AND CVSE (PAWPAW AND PUMPKIN)

Introduction: Pawpaw trees (*Asimina* triloba) and Mvskoke pumpkins (*Cucurbita* moschata) have been harvested as an indigenous food source. Pawpaw trees are native Oklahoma trees found in Alabama and Georgia (Mvskoke homelands). Pawpaw trees grow near well-drained sandy soil riparian.

Methods:

- Soil and water testing (nutrient and mineral) for each site
- Soil moisture and precipitation data to determine phenology changes and varying trees and plant needs
- Nutrient density of fruits and pumpkins will be analyzed for potential mineral content after seasonal harvests.
- Biomass of plants and trees (nutrient concentration)-chemical testing.
- Plant pawpaw grove of trees and pumpkin plots near riparian areas within the Mvskoke tribal area.
- Establish a pawpaw tree stand that utilizes water conservation techniques in areas where groundwater access is not available.
- Data obtainment for plant growth, fruit, and pumpkin circumference measurements.
- Develop an indigenous cultural recipe guide for community outreach talk to encourage local indigenous agricultural producers to consider growing pawpaws and Mvskoke pumpkins.

Results: The study is currently ongoing and has initiated soil and water testing. Sites were evaluated for sandy soil content. Depletions of nitrate, phosphate, calcium, and potassium have identified the need for soil amendments. Biomass chemical testing assists in determining health. The gathering of traditional food preparation will continue until 2023 for pawpaw fruit analysis and the initial indigenous outreach workshop.

Conclusion: Soil and water testing have identified inadequate levels of nutrients. Biomass will continue to be evaluated. Fruit and pumpkin growth will be initiated in spring 2023. With best-managed practices for the pawpaws and pumpkins, harvesting should yield more significant outputs with nutrient-dense crops.

Relevance of the study: Heritage agricultural crops have suffered significant losses in the last hundred years. Heirloom species are identified as plants of genetic integrity and have been shared as community food security. Mvskoke pumpkins (*Cucurbita* moschata) or cvse are important heirloom plants. Pawpaw trees (Asimina triloba) are also heirloom crops and can be grown to maintain an edible food forest. Growing these indigenous heritage plants can indirectly determine ecosystem health.

Poster #14

Student Name: Omar I. Abouzahr
Research Topic: UAVs
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Hometown: Stillwater

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IMPROVING THE SAFETY OF UNMANNED AERIAL SYSTEMS FOR COMMERCIAL OPERATIONS

Unmanned Aerial Systems (UASs) are becoming a greater part of everyday life. They have unlimited applications, including assessing crop and livestock health, collecting weather data, providing surveillance of critical infrastructure, supporting first responders, and transporting goods. As their usage increases, more rules by the FAA are required to ensure UAS operations remain safe. This is critical in regards to operating around people, as a collision with a person can cause serious damage.

Frangible UASs could address the issue of safety in direct collisions. Upon impact with an object at a certain force, the UAS would break apart easily to divert the full force of the collision. This would ensure that the object the UAS is colliding with would not obtain nearly as much damage if the UAS did not break apart, subsequently decreasing injury risk.

A quantifiable analysis was conducted by using Flite Test foam board aircraft to mimic collisions on structures. An OptiTrack Motion Capturing System was implemented to track the position of the UASs during the tests with cameras triangulating the 3D position of fiducial markers placed on the aircraft, resulting in a position and time array. Additionally, a Vernier force probe measured the direct impact force during the collision. Magnets of varying strength were the primary factor affecting frangibility in the wings.

The results of this investigation indicated a trend with strength of frangibility and force transferred across different impact velocities. Overall, lower strength and a lower quantity of magnets correlated to less force being absorbed by the object at collision; higher strength and more magnets behaved somewhat close to a completely rigid UAS, which had the most force transferred on impact.

Based on these results, it is clear that the easier a UAS breaks apart on impact, the less damage it causes to humans and structures. This is critical as UASs are more commonly used in urban applications benefiting society as a whole.

Poster #15

Student Name: Maria Bustamante Molina
Research Topic: Cancer Disparities
University: OU Health Sciences Center
Hometown: Claremore

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RACIAL AND ETHNIC DIFFERENCES AND DISPARITIES IN THE INCIDENCE OF IN SITU AND INVASIVE BREAST CANCER AMONG WOMEN IN OKLAHOMA

Introduction: Carcinoma in situ (CIS) is a benign breast condition accounting for 20% of all breast neoplasm diagnoses. While CIS outcomes are generally favorable, up to 40% of women with CIS will develop second breast cancers (SBCs), with 28% of those diagnosed with invasive breast cancer (IBC). The incidence of CIS and IBC varies among racial and ethnic groups, and the incidence of CIS is strongly associated with access to mammographic screening. We sought to determine the incidence of CIS and IBC and evaluate whether observed differences are related to race/ethnicity, and/or health disparities among Oklahoma women. We hypothesized that race/ethnicity, healthcare access, socioeconomic factors, and high-risk behaviors may contribute to differences in the incidence of CIS and IBC.

Methods: Crude and age-adjusted incidence rates between 1999-2018 were extracted from the CDC WONDER Cancer Statistic Database and were stratified by race, ethnicity, and age at diagnosis. Behavioral Risk Factor Surveillance System data were extracted from the Oklahoma State Department of Health database (OK2Share). CIS and IBC incidence rates by county were mapped to compare with the Social Vulnerability Index (Center for Disease Control; CDC) to measure socioeconomic impact.

Results: IBC and CIS rates were highest among American Indian (AI) women relative to other racial/ethnic groups. Potential socioeconomic, and behavioral risk factors, and health disparities were observed that could contribute to differences in the observed incidence rates.

Conclusion: We observed disparities in CIS rates among AI women, which could be due to increased mammographic screening rates relative to national-level screening rates. We also observed disparities in IBC rates among AI, Hispanic and Black women in Oklahoma. Future studies will evaluate the impact of health disparities on the high breast cancer burden among AI women and the rates of SBC among women diagnosed with CIS.

Relevance of the Study: By evaluating the disparities across different racial and ethnic groups in Oklahoma, we will better understand the impact of disease incidence among differing populations. As such, we hope to evaluate the disparities that exist in the development of primary CIS and IBC and SBCs following the initial CIS diagnosis.

Funding: Cancer Undergraduate Research Experience, Stephenson Cancer Center

Poster #16

Student Name: Stephen Kooker
Research Topic: Water Remediation
University: University of Oklahoma
Hometown: Norman

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FOAMING PROPERTIES OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) FOR REMEDIATION PURPOSES

Per- and polyfluoroalkyl substances (PFAS) are a collection of over 6,000 manmade substances, which exhibit high chemical and thermal stability. PFAS are surface-active compounds due to a hydrophobic, fluorinated tail and a hydrophilic head group. Given their unique chemical properties, PFAS have been commonly used in several consumer products, including aqueous film-forming foams (AFFFs), nonstick coatings, packaging, and cleaners. As a result of their broad applications, PFAS have leeched through the air-water interface into natural reservoirs including water sources. In addition, long-chain PFAS, those with more than seven carbons in the fluorinated chain, tend to accumulate in the human body. Consequently, there is substantial concern as PFAS are carcinogenic and have adverse impacts on human and environmental health. Therefore, addressing the presence of PFAS molecules in water resources is a serious concern.

Remediation using solid surfaces for adsorption, such as activated carbon and ion exchange resins, may remove PFAS contaminants, but regenerating the adsorbent and removing the surface-active PFAS involves complex and expensive difficulties. Remediation using gas injection, like in foam flotation, can address these setbacks by making the PFAS adsorbate more accessible downstream, whilst utilizing gas as a sustainable and available solvent. However, current foam floatation processes are not viable for PFAS removal. Critically, the present project shapes a framework for foamability of PFAS systems, establishing foaming evolution diagrams based upon PFAS length, aeration period, air flowrate, and ionic strength. Evaluation of the foam stability (FS) and foaming capacity (FC) are analyzed through dynamic foaming volume, mean bubble area (MBA), bubble count (BC), and liquid content (LC) utilizing the Kruss DFA100FSM dynamic foam analyzer.

The results of the interfacial foaming studies, performed in quadruplicate, are then applied to fabrication of a novel, bench-scale foaming column system. It is found that mean bubble area, bubble geometry, liquid content, and foam height are reliable indicators for predicting foamability and foam stability of PFAS systems. Further, the optimization of these parameters is necessary for implementing cost and energy efficient foam fractionation systems for PFAS removal and scale up of laboratory to the bench and industrial, pilot scales.

Poster #17

Student Name: Jacob A. Lieberman
Research Topic: Antifungal Therapies
University: Oklahoma State University
Hometown: Tulsa

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ANTIFUNGAL ACTIVITY OF NOVEL MACROCYCLE DERIVATIVES ON *Cryptococcus neoformans*

Introduction. *Cryptococcus neoformans* is an opportunistic fungal pathogen that causes cryptococcosis. After being inhaled, the fungal organism disseminates to the brain, where it causes cryptococcal meningitis. Meningitis occurs in approximately 225,000 immunocompromised individuals annually, resulting in over 181,000 deaths. Currently, there are only four classes of antifungal drugs available. These medications are ineffective, highly toxic to humans, and many fungal organisms are developing resistance. As a result of these issues, new antifungal therapies are desperately needed to continue fighting fungal infections. Our collaborator has developed macrocycle derivatives that have shown activity against several pathogenic microorganisms, so we were interested in testing these compounds against *C. neoformans* strain H99. Based on the activity of the compounds on other fungal strains, we hypothesized that the compounds would show antifungal activity against H99. **Methods.** For these studies, 12 novel macrocycle compounds that had previously shown antifungal activity were provided by our collaborator. These compounds were grown with H99 and evaluated using minimum inhibitory concentration (MIC) assays. Following MIC, compounds that exhibited antifungal activity were grown at the MIC concentration with mouse macrophage cell line J774.A in order to determine cytotoxicity against mammalian cells. **Results.** Several of the tested compounds exhibited antifungal activity at low concentrations. Of the compounds that showed antifungal activity, six were also non-toxic. **Conclusion.** The majority of the 12 tested compounds showed antifungal activity against H99. Of these compounds, six were proven to be non-toxic to mammalian cells. In the future, RNA sequencing of H99 treated with the non-toxic compounds will be performed in order to understand how the compounds affect fungal gene expression. The compounds will also be incubated with strains of H99 from a mutant strain library to determine genes the compounds interact with. **Relevance of the study.** These results and future studies will determine if these compounds could possibly be developed as a therapy against *C. neoformans*.

Poster #18

Student Name: Lane McCoy
Research Topic: Antibiotic Tolerance
University: University of Oklahoma
Hometown: Tulsa

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ELUCIDATING THE MECHANISMS WHICH *Staphylococcus aureus* AND *Streptococcus agalactiae* USE TO ESTABLISH ANTIBIOTIC TOLERANCE IN CHRONIC INFECTION

Polymicrobial infections are some of the most financially demanding issues in the healthcare system, requiring over $25 billion in treatment annually in the United States alone. This results from their increased virulence, infectivity, and tolerance of common antimicrobial treatments, part of a process termed synergy. Communities of pathogenic bacteria often lead to more severe disease in chronic wounds, and while bacteria interrelate with each other in a variety of ways, we do not completely understand the exact mechanisms for how these organisms interact within the infection itself. Furthermore, we are not completely sure how these interactions depend on local microbes, on the environment of their host, or on spatial arrangement in the wound. Here, we sought to identify and understand novel interactions between *Staphylococcus aureus* and *Streptococcus agalactiae* (Group B Streptococcus, GBS) in a chronic wound environment. To accomplish this, we assessed tolerance to various antibiotics of each organism individually and in co-culture in our *in vitro* wound models. Each condition was grown until it reached the log phase of bacterial growth, where the antibiotic was then added. Dilution and spot-plating techniques allowed us to measure growth rates, quantify the cells, and analyze how survivability of each organism was impacted. Furthermore, we sought to understand how *diabetes mellitus* type II impacted interactions between these microbes and assessed how a hyperglycemic environment changed these interactions in a chronic wound environment. Our preliminary results suggest that *S. aureus* has increased tolerance to specific antibiotics when co-cultured *in vitro* with *S. agalactiae* but saw a decline in tolerance when grown in our wound models. Our data also shows that *S. agalactiae* has increased tolerance to specific antibiotics when co-cultured *in vivo* with *S. aureus* and decreased tolerance when *in vitro*. These results suggest a heightened importance of the environment on the role of antibiotic tolerance development in microorganisms when grown together, and further tests are needed to determine the exact mechanisms in which the environment alters the physiology of these two species. These investigations could be essential in producing more effective treatment strategies and hindering the progression of chronic wounds.

Poster #19

Student Name: Ella A. Moffet
Research Topic: Ultra-Processed Food
University: Oklahoma State University
Hometown: Woodward

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ULTRA-PROCESSED FOOD CONSUMPTION IN OKLAHOMA EXCEEDS THE NATIONAL AVERAGE

Introduction: Diet contributes to obesity and chronic disease, both of which are high in Oklahoma. Data indicates ultra-processed food (UPF) consumption worsens these outcomes. The NOVA Food Classification System was created to operationalize foods based on the type and extent of processing, with four categories: Category 1 (*unprocessed/minimally processed*) (e.g., fresh fruits/vegetables, meat); Category 2 (*processed culinary ingredients*) (e.g., butter, salt); Category 3 (*processed foods*) (e.g., canned vegetables, salted meats); and Category 4 (*UPF*) (e.g., packaged snacks, frozen meals). The purpose of this study was to examine UPF consumption in Oklahoma adults and compare this to the national average. **Methods:** A secondary data analysis was conducted using dietary data collected via 24-hour recalls done by Oklahoma Cooperative Extension per evaluations of the Extended Food and Nutrition Program (EFNEP); this method captures all foods and beverage consumed in a 24-hour period. Each item consumed was assigned a NOVA Category. Calories from each food were used to calculate percent of calories from each NOVA Category; descriptive statistics were computed. Data from Juul et al (2022) were used to compare data to the national average. **Results:** In this subset of Oklahoma adults (n=13,475), percent of calories consumed from Categories 1-4 were as follows: 16.6%, 0.9%, 13.2%, and 69.4%, respectively. Among the general U.S. population, averages were 27.4%, 5.4%, 10.2%, and 57.0%, respectively. The most consumed Category 1 foods were fruits and/or fruit juices, the most consumed Category 4 foods were sweet foods; sugar-sweetened beverages; and ready-to-eat/heat mixed dishes. **Conclusion:** Oklahoman adults consume fewer minimally processed foods and more UPF than the general population, which may contribute to diet-related chronic diseases plaguing Oklahomans. Future work should examine both individual interventions (e.g., diet counseling) and policy-level change to modify the built food environment. **Relevance of the Study:** Given high rates of obesity and diet-related chronic illness in Oklahoma, it is critical to examine dietary factors driving these trends. From existing data regarding diet-related factors driving chronic disease nationally, this study documents that UPF consumption is a key priority in tackling this issue in Oklahoma.

Poster #20

Student Name: Rabeca D. Richardson
Research Topic: Invasive Species Management
University: Oklahoma State University
Hometown: Yukon

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Faculty Advisor: Dr. Bo Zhang Oklahoma State University, Stillwater, OK

PROJECTING MECHANICAL TREATMENT OUTCOMES ON INVASIVE GRASS TO IMPROVE CONTROL EFFICIENCY

Background. With the increasing impacts of climate change, species invasions are expected to worsen, especially by drought. Meanwhile, drought could decrease the efficiency of invasion control. Given the worsened invasion and decreased control efficiency under drought, there is an urgent need to improve control methods, e.g., changing the treatment timing, to sustain the control efficiency. However, the variation in efficiency of mechanical control (e.g., clipping, mowing) by treatment timing is largely unknown. **Methods.** To address the knowledge gap, we conducted modeling analyses and greenhouse experiments to compare efficiency of mechanical control early-applied and evenly-applied during a growing season under two drought levels. We hypothesized that the efficiency of early applied mechanical treatments will decrease under drought conditions, making even-applied treatments more efficient in the presence of drought. The modeling analyses are based on a spatial-specific logistic equation model to capture the dynamics of an invasive species under the different treatment timings and drought levels. To validate the model, we conducted a greenhouse experiment focusing on the interactions of drought and treatment timing on the growth and functionality of *Sorghum halpense*. **Results.** Our model results indicated that applying early-season (short) interval treatments is a more efficient approach without the presence of drought, while late-season (long) interval treatments have a higher efficiency under drought. Our modeling results were further supported by preliminary observations of the ongoing greenhouse study. Under drought absence, the early and late season interval clippings showed a large difference in biomass, but under drought, this difference was much less, indicating that the efficiency of early season interval clippings decreased under drought. **Conclusion.** Thus, our study suggests that widely proposed early treatment could be modified to sustain the control efficiency under increasing drought. The model we developed here can potentially be extended and inform field managers in their efforts to control invasions more efficiently.

Poster #21

Student Name: Kaylee Tatum
Research Topic: Conservation Biology
University: University of Oklahoma
Hometown: Broken Arrow

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AN INVESTIGATION OF MID-HOLOCENE BERING SEA BEAR BONES TO PROVIDE INSIGHT INTO MODERN-DAY POLAR BEAR POPULATION CHANGES IN RESPONSE TO CLIMATE CHANGE

Polar bears are one of the most vulnerable species to climate change due to their heavy reliance on sea ice. The amount of sea ice in the arctic has rapidly decreased each year, forcing these bears to travel further in search of food. Conservation efforts begin with monitoring current populations including demographic trends and changes in behavior. We can try to predict the response of polar bear populations to modern anthropogenic climate change by investigating historical bear populations during the environmental shifts of the Neoglacial era roughly five thousand years ago. This project examines thirty-three ancient bear bones found at the Margaret Bay archaeological site on Unalaska Island dated to the Neoglacial period. These bones provide information about the ancient Bering Sea bear populations as well as the history of the Indigenous Unangan peoples. The Unangan people have been impacted by a history of colonization and forced internment during World War II. Today, they have no known history of interaction with bears. By identifying the species of bear represented in the remains, we can better understand who the Unangan ancestors traded with and what kinds of animals they were hunting. To determine species, we took measurements from the Margaret Bay bones as well as comparative measurements from museum specimens housed at the Smithsonian's National Museum of Natural History (NMNH) and the Sam Noble museum. We performed statistical analysis on these data using R software to visually represent clusters between species. 3D scans were taken using a DAVID 3D scanner at the Laboratories of Molecular Anthropology and Microbiome Research (LMAMR). The 3D models were used to supplement an educational outreach activity created for elementary school students. This activity was used in Tulsa, Oklahoma and was uploaded to Thingiverse as an open access resource. Due to high sexual dimorphism and intraspecific variability between individuals, the results of the measurement analysis were inconclusive. However, preliminary results of isotopic analysis suggest the sample contains both polar bear and brown bear bones. Further genetic testing is currently in progress to determine the number of unique individuals and their relationships with modern-day bears.

Poster #22

Student Name: **Anna Troxell**
Research Topic: **Emotional Regulation**
University: **University of Oklahoma**
Hometown: **Edmond**

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Special acknowledgement to Maddison North (GRA) & Ashlyn Carter (URA)

PERCEIVED HELPFULNESS BETWEEN AROUSING AND SOOTHING POSITIVE EMOTIONS

Emotions help individuals navigate and bring meaning to the world. However, with the extensive range of emotions available and expressed through social, physical, and mental interaction, it is sometimes difficult to control and regulate the intended outcomes of emotions (e.g., emotional influence over action). Therefore, self-regulating processes guide these targeted outcomes over time and throughout changing circumstances. One essential self-regulating process is emotional regulation. My research replicated and extended previous experimental data from the Complex Skill Acquisition Lab in the University of Oklahoma Department of Psychology, which explored the beneficial and detrimental effects of specific emotions when learning a new and complex task. I concentrated on extending the qualitative analysis of open-ended data collected from a recent series of experiments. Forty-three undergraduate students participated in an experimental study during the Spring of 2022. The study consisted of 28 game trials where participants learned to perform a complex and dynamic computer game. Participants were randomly assigned to either a positive-arousing emotion condition (happy, excited, enthusiastic) or a positive-soothing emotion condition (calm, relaxed, at ease). Participants in both experimental conditions answered open-ended survey questions and received repeated reminders throughout the study, prompting the awareness of their respective emotion conditions. The results from my research extended the prior study's findings by comparing the similarities and differences between emotion conditions and their perceived helpfulness. The results indicated that positive-arousing emotions are perceived to be more helpful than positive-soothing emotions for motivation, whereas positive-soothing emotions are more helpful for regulating emotions and improving task focus. Furthermore, the results showed that repeated recognition of positive-arousing emotions can be helpful for learners who feel distressed or pressured, and the repeated recognition of positive-soothing emotions can be helpful for learners who feel overwhelmed by emotions. Whereas previous research in the scientific literature has focused on the benefits of positive emotions overall, my research is significant because it distinguishes the roles played by different positive emotions toward helping people learn difficult and complex tasks. I hope my research inspires future research and designs of applied interventions for managing emotions across a wide variety of vocations and hobbies.

ESTABLISHED PROGRAM TO STIMULATE COMPETITIVE RESEARCH

The Oklahoma Established Program to Stimulate Competitive Research (EPSCoR) program was initiated by the National Science Foundation in 1985 to strengthen Oklahoma's exploration and growth in science, technology, engineering and mathematics. Oklahoma NSF EPSCoR's central goal is to increase the state's research competitiveness through strategic support of research instruments and facilities, research collaborations, and integrated education and research programs.

The national NSF EPSCoR program is designed to benefit states, including Oklahoma, that have historically received lesser amounts of competitive research and development funding. Twenty-eight states, the Commonwealth of Puerto Rico, the Territory of Guam, and the United States Virgin Islands are currently eligible to participate.

EPSCoR provides support for key research areas at Oklahoma's public universities, while also establishing partnerships with higher education, government, and industry to affect lasting progress in the state's research infrastructure, research and development capacity, and R&D competitiveness. The goal is to stimulate lasting research infrastructure improvements in Oklahoma.

On July 1, 2020, the National Science Foundation awarded Oklahoma a new $20 million EPSCoR Research Infrastructure Improvement (RII) Award that will support research and education programs across the state. During the five-year award, a team of more than 50 researchers from universities across the state will develop and test science-based solutions for complex problems at the intersection of land use, water availability, and infrastructure. The grant is also designed to provide education and workforce development programming to more than 150,000 Oklahomans of all ages.

Oklahoma NSF EPSCoR is funded by the National Science Foundation and Oklahoma State Regents for Higher Education.

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