24TH ANNUAL

MARCH 26, 2019

RESEARCH DAY
AT THE CAPITOL

OK NSF EPSCoR is funded through National Science Foundation Grant No. OIA-1301789 & Oklahoma State Regents for Higher Education.

24TH ANNUAL

RESEARCH DAY AT THE CAPITOL

TUESDAY, MARCH 26, 2019 * STATE CAPITOL OF OKLAHOMA * OKLAHOMA CITY, OK

AGENDA:

CAPITOL POSTER PRESENTATIONS & AWARDS CEREMONY

7:30 a.m.	**Student Researchers Check In** (Rotunda, 4th Floor)
8:30 a.m. - 11:15 a.m.	**Scientific Posters on Exhibit** (Rotunda, 4th Floor)
11:30 a.m.	**Awards Ceremony** (Rotunda, 2nd Floor) Dr. Raymond L. Huhnke, OK NSF EPSCoR Project Director Dr. Jerry R. Malayer, OK EPSCoR State Director Dr. Glen D. Johnson, Chancellor of Higher Education
Noon	**Adjourn**

Special thanks to our esteemed poster competition judges:
Jon Biermacher, Elaine Hamm, Sherry Marshall and Brian O'Dell

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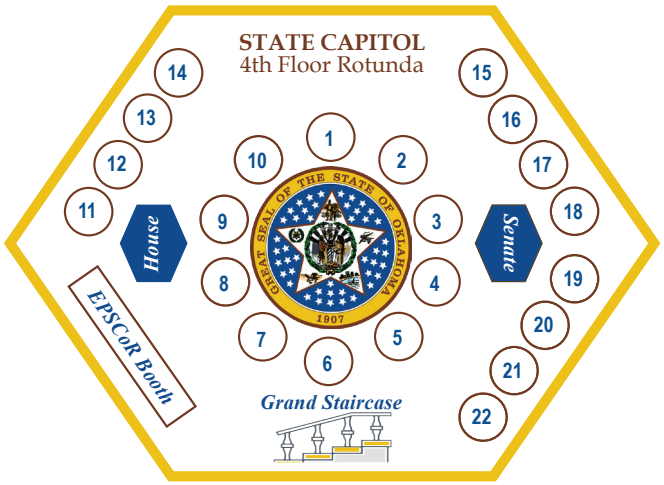
RESEARCH DAY AT THE CAPITOL

STUDENT PARTICIPANTS & POSTER GUIDE

	Student Researcher	University Represented	Research Topic	Hometown
1	Ms. Brooklynn Baker	Langston University	Immune Research	Midwest City
2	Ms. Cheney M. Bird	Northwestern Oklahoma State University	Head Lice Management	Alva
3	Ms. Emily Burgess	Southwestern Oklahoma State University	News Media Credibility	Weatherford
4	Mr. Alec T. Byrd	College of the Muscogee Nation	Water Quality	Okmulgee
5	Ms. Tu T. Doan	University of Central Oklahoma	Wound Healing	Edmond
6	Ms. Mariah B. Ewy	East Central University	DNA of Dried Bone	Perry
7	Ms. Michaela Marie Farrill	Rogers State University	Sex Roles	Shawnee
8	Ms. Gabrielle P. Ford	Southeastern Oklahoma State University	Pathogen Regulation	Durant
9	Mrs. Karissa Hodge	Northeastern State University	Cancer Research	Broken Arrow
10	Ms. Anna W. Paraskevopoulos	Cameron University	Foraging Behavior	Lawton
11	Ms. Halley Ponder	University of Science & Arts of Oklahoma	Recidivism Sociology	Duncan
12	Ms. Abigail M. Voth	Oklahoma Christian University	Autoimmune Disease	Enid
13	Ms. Rainee N. DeRoin	Oklahoma State University	Biofuel Feedstock	Broken Arrow
14	Ms. Carley V. Eastep	Oklahoma State University	Rheumatoid Arthritis	Jones
15	Mr. Matthew Baier	OU Health Sciences Center	Brain Injury	Edmond
16	Mrs. Sarah A. Gutierrez	The University of Tulsa	Plasma Catalysis	Broken Arrow
17	Mr. Ibikari Tamunosisi Legg-Jack	University of Oklahoma	Drug Synthesis	Oklahoma City
18	Ms. Samantha E. Shafer	Oklahoma State University	Biofilm Formation	Muskogee
19	Ms. Marjorie Sheaff	The University of Tulsa	Conductive 3D Printing	Owasso
20	Ms. Julia H. Tang	University of Oklahoma	Biomedical Engineering	Edmond
21	Mr. Liam Bennet Whiteman	Oklahoma State University	Mosquito Breeding Sites	Nichols Hills
22	Ms. Tyler Whitney	OU Health Sciences Center	Anxiety & Depression	Oklahoma City



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Exhibitor Abstracts

A showcase of research conducted
by
undergraduate students
representing Oklahoma's outstanding colleges and universities.

Note: Abstracts have been printed as submitted by the authors.

Exhibit #1
Brooklynn Baker
Langston University
Hometown: Midwest City, OK
Advisor: Dr. Byron Quinn, LU

Research Topic: Immune Research
Researcher(s): Brooklynn Baker, C. Quick Campbell, S. Ojha, and B. Quinn
Science Research Institute
Langston University, Langston, OK
Faculty Advisor: Dr. Byron Quinn, Langston University

THE USE OF MEDICINAL PLANT EXTRACTS TO MITIGATE THE EFFECTS OF MICROGRAVITY ON THE HUMAN IMMUNE SYSTEM FOR EXTENDED SPACEFLIGHT MISSIONS

The Mission to Mars is the next step to test the limits of scientific ingenuity. One human biology challenge that arises in preparing for the long duration space mission is the immune system dysregulation that occurs during spaceflight missions. It was believed that immune system dysregulation was limited to short term space flights, but researchers are noticing the irregularity of T-cell functionality in astronauts who are assigned long duration flights. Microgravity is found to be one of the key factor associated with the dysregulation of the human immune system. Due to the dysfunctionality of the adaptive immune system, reactivation of latent herpes viruses such as, Epstein-Bar virus (EBV) and Varicella-Zoster virus (VZV) is a common side effect and is quite detrimental to the health of astronauts. The **hypothesis** for this project is the use of natural medicinal phytochemicals found in plants extracts, will enhance the immune system during space flight missions and reverse the effects of microgravity on the human immune system. **Methods** used in this research involved the following, ethanol plant extracts were prepared and applied to the immune cells in clinostat and static conditions. Analysis of samples were done on a flow cytometer and ion mobility mass spectrophotometry was used for metabolomics analysis. Preliminary **results** show immune cells reactivating with the addition of the isolated plants extracts. In **conclusion**, medicinal plant extracts may play an important role in restoring immune function in astronauts on NASA's planned mission to Mars. Future studies will investigation the effects of combining high performing plant extracts together to optimize the activation of immune cells in microgravity.

Societal benefits of this project are extremely significant to human health. The medicinal plant extracts analyzed for immune-stimulatory effects may be applicable to providing very low-cost treatment of immune related diseases here on earth. This would be of huge impact to the economy as there is a growing concern of rising health cost.

Exhibit #2
Cheney M. Bird
Northwestern Oklahoma State University
Hometown: Alva, OK
Advisor: Dr. Leslie Collins, NWOSU

Research Topic: **Head Lice Management**

Researcher(s): **Cheney M. Bird and T. Adair**
Division of Nursing
Northwestern Oklahoma State University, Alva, OK
Faculty Advisor: **Dr. Leslie Collins, Northwestern Oklahoma State University**

NO NITS, AND OR BUTS

This research project examined current recommendations for pediculosis management in school age children. Current management in many school systems is a no-nit policy. Each year, 12 million to 24 million days of school are missed by students affected by head lice and there is considerable stigma surrounding head lice infestations in the United States. The financial burden and psychological effects head lice have on families and schools nationwide is unnecessary when considering the most current evidence based research. This research project was completed to dispel the myths surrounding head lice in schools. The most current research shows that the negative effects of students missing school due to head lice is far greater than any of the consequences that occur when a student with head lice remains in the classroom.

Exhibit #3
Emily Burgess
Southwestern Oklahoma State University
Hometown: Weatherford, OK
Advisor: Dr. Stephen Burgess, SWOSU

Research Topic: News Media Credibility

Researcher(s): Emily Burgess and A. Cornell
Dept. of Psychology
Southwestern Oklahoma State University, Weatherford, OK
Faculty Advisor: Dr. Stephen Burgess, Southwestern Oklahoma State University

I KNOW IT WHEN I READ IT: PERCEPTIONS OF RELIABILITY AND CREDIBILITY OF NEWS STORIES

We examined how news from different sources was perceived when cosmetic information that identified the source such as titles, bylines, ads, and the names of news organizations was removed. Advances in technology have enabled unparalleled access to news and other information while there has been a shift in the focus of who is responsible for creating and reporting publishable content from perceived experts (e.g., news editors, subject experts) to the consumers of the content. However, this access has been accompanied by an increase in the number of information sources. It may be more difficult to know which information is to be taken seriously, and which is to be viewed skeptically (Papadoplouos, et al, 2016).

Elements of the presentation of the sources of information influence perceptions of the credibility of a source (Westerman, 2014). Individuals are influenced by their core beliefs and tend to reject findings that threaten their world view (Lewandowsky & Oberaurer, 2016). Interestingly, level of education, scientific knowledge and scientific literacy are only moderate predictors of trust in science (Allum et al., 2008).

One hundred and three participants read three news stories about different topics and then completed a survey that measured their perceptions of the reliability, credibility, liberalism and conservatism, bias, accuracy, and likelihood to discuss or share the information contained in the story.

Differences in the average ratings of news sources were examined for each of the three topics. There was no significant pattern of differences between ratings of reliability, credibility, liberalism and conservatism, bias, accuracy, or likelihood to discuss or share the information contained in the story. 26.3% of the participants correctly identified the story as from either a conservative or liberal news source. There was not a significant relationship between participant's ratings of conservatism and liberalism of the story and the perceived status of the source of the story as a conservative or liberal news source.

Societal Impact: Overall the results suggest that the removal of bylines, ads, authorship and source details decreased the ability of the participants to correctly identify the degree of liberalism and conservatism of the news sources.

Exhibit #4
Alec T. Byrd
College of the Muscogee Nation
Hometown: Okmulgee, OK
Advisor: Ms. Cynthia Sanders,CMN

Research Topic: **Water Quality**

Researcher(s): **Alec T. Byrd and M. Lowe**
Dept. of Science
College of the Muscogee Nation, Okmulgee, OK
Faculty Advisor: **Ms. Cynthia Sanders, College of the Muscogee Nation**

THE IMPORTANCE OF WATER

There are many ways in the world that human impacts are affecting the environment. Humans can affect the environment is through habitat destruction and fragmentation. There can be different types of destruction. It can either result from natural causes or human causes. The causes from these destructions is elimination of the environment, a rise of animals on the endangered species list, destruction of forests, decrease in plants and a decrease in biodiversity.

Every individual has a role in the conservation of natural resource like in using water. Water is life and every drop is precious. All living creatures belong to mother earth and they all have their shine of resources available. These resources like land, energy, food, mineral, water, forest etc. have to be distributed in an equitable way for sustainable lifestyles of all creatures. Knowing the impact of human influence on ecosystems, those areas which are used for human use are likely to be more polluted. Water quality was determined by using chemical testing, bacterial identification, and microbial concentration. Alluvial water sources screened included recreation and potable usage. Aquatic ecosystem water screening was conducted locations within the Muscogee Creek Nation and nearby indigenous tribal boundaries.

Exhibit #5
Tu T. Doan
University of Central Oklahoma
Hometown: Edmond, OK
Advisor: Dr. Melville Vaughan,UCO

Research Topic: **Wound Healing**

Researcher(s): **Tu T. Doan**
Dept. of Biology
University of Central Oklahoma, Edmond, OK
Faculty Advisor: **Dr. Melville Vaughan, University of Central Oklahoma**

GLYCATED CHITOSAN REDUCES MYOFIBROBLAST PHENOTYPE IN ANCHORED COLLAGEN LATTICES

Glycated chitosan (GC) is a chemical made from the outer skeleton of shellfish; it is water-soluble when glycated, making it useful for biological experimentation. We combined GC in our *in vitro* model of wound healing to see if it would affect wound-healing cells named myofibroblasts. Myofibroblasts are present in scars and tissue contractures so keeping their activities in check might be a useful therapy. We mixed myofibroblasts and wound-healing collagen in the presence or absence of GC. We left the mixture (a gelled tissue) attached to the dish so the cells could reorganize collagen and generate tension like they do in contractures and scars. We observed collagen reorganization by measuring the compaction of the lattice each day; lattices with GC compacted less than those without. Because this happened, we predicted that the cells would also generate less tension. We released the lattice from attachment after 5 days to see how fast the lattice would contract; this is an effective way of measuring tension. GC inhibited this contraction. Because there was reduced tension, we predicted that myofibroblast presence would also be reduced. We stained the lattices to identify whether myofibroblasts were present in the lattice. GC reduced the presence of myofibroblasts compared to control (collagen and cells only) lattices. These results suggest that glycated chitosan can now be tested in more-appropriate models to see whether a therapeutic advantage can be found.

Exhibit #6
Mariah B. Ewy
East Central University
Hometown: Perry, OK
Advisor: Dr. Ken Andrews, ECU

Research Topic: DNA of Dried Bone

Researcher(s): Mariah B. Ewy[1], A. Howard[2], and [1]K. Andrews
[1]Dept. of Biology and [2]Dept. of Molecular Biology
East Central University, Ada, OK

Faculty Advisor: Dr. Ken Andrews, East Central University

EVALUATION OF DNA EXTRACTION PROTOCOLS FUNCTIONALITY FROM DRIED TESTUDINES BONE

There are numerous papers written about DNA extraction out of bones and animal tissue. The variety of DNA extraction protocols and the lack of performance across different organisms argues for a lack of consistency. To address this, we are training a more robust methodology using tissues refractory DNA extraction. Samples of turtle shell collections preserved in various ways make an ideal target for this project. Because little is known about DNA extraction from dried turtle shell, establishing a successful DNA Barcoding protocol in Testudines would have a two-fold benefit to the biological field through forensics and ecological studies. Different protocols have been evaluated attempting to extract DNA from dried Testudines bone, or shell. The first evaluated protocol is the Armed Forces DNA Identification Laboratory (AFDIL) protocol. This protocol was written to obtain DNA from human skeletal remains for identification. The second evaluated protocol was written by Cold Spring Harbor Laboratory and titled Using DNA Barcodes to Identify and Classify Living Things. This protocol was created to isolate DNA from plant, fungal, or animal samples. The third protocol evaluated was a Nature Protocol titled Ancient DNA Extraction from Bones and Teeth. The goal of this protocol is to maximize recovery of DNA from human bone and teeth. Polymerase Chain Reaction (PCR) was performed with all DNA extraction products to amplify specific single segments of DNA. All protocols were altered slightly to fit the resources available in the lab where the experiments were conducted. Each extraction protocol was unique in its methodology, however it may be beneficial to combine certain aspects of each protocol into one comprehensive protocol.

Societal Impact Statement: DNA extraction from dried bone tissue plays a vital role in forensics, especially when there is only osseous tissue remaining. The lack of soft tissues can be a large impediment to DNA characterization. Improvement of the process of extracting DNA from dried osseous tissue will greatly enhance the ability to learn about degraded biological tissues.

Exhibit #7
Michaela Marie Farrill
Rogers State University
Hometown: Shawnee, OK
Advisor: Dr. Sonya Munsell, RSU

Research Topic: Sex Roles

Researcher(s): Michaela Marie Farrill
Dept. of Psychology and Sociology
Rogers State University, Claremore, OK
Faculty Advisor: Dr. Sonya Munsell, Rogers State University

EXPLORING THE RELATIONSHIP BETWEEN SEX ROLES AND FEMINISM

This study was designed to explore potential differences in attitudes toward feminism based on whether participants were highly masculine, highly feminine, or androgynous. The hypothesis was that androgynous individuals would have the most positive attitudes toward feminism. 98 participants completed surveys consisting of questions from the12-item Bem Sex Role Inventory (BSRI) and the 24-item Sex Role Attitudinal Inventory (SRAI). Participant demographic characteristics were as follows: 80% were between the ages of 18-24; 71% were white; 60% were female. Results indicated that individuals who were more androgynous on the BSRI and had high SRAI scores were significantly more likely to agree with the feminist movement than those who identified as highly feminine or highly masculine: $F[(2, 95)= 4.273, p= .07]$. According to Swirsky and Angelone (2016), the ultimate goal of feminism is to create equality for all genders in all aspects of life. Additionally, when individuals stop adhering to traditional gender roles, which may be seen as restrictive, they are fighting for their equal rights (Wood & Eagly, 2015). This research suggests that equality can be found in a frame of reference as well as in everyday roles. Men and women can be androgynous and feminists, sharing the same goal: equality.

Exhibit #8
Gabrielle P. Ford
Southeastern Oklahoma State University
Hometown: Durant, OK
Advisor: Dr. Nancy Paiva, SE

Research Topic: Pathogen Regulation

Researcher(s): Gabrielle P. Ford[1, 2], D. Dyer[3], and L. Jackson[3]
[1]Dept. of Chemistry, [2]Dept. of Biological Sciences, Southeastern Oklahoma State University, Durant, OK; [3]Dept. of Microbiology and Immunology, University of Oklahoma Health Sciences Center, Oklahoma City, OK
Faculty Advisor: Dr. Nancy Paiva, Southeastern Oklahoma State University

DEFINING THE REGULON OF IRON-REGULATED SMALL RNA NrrF IN NEISSERIA GONORRHOEAE FA1090 WITH NEXT GENERATION ILLUMINA SEQUENCING

Introduction: *Neisseria gonorrhoeae* is a strict human pathogen colonizing mucosal membranes and the causative agent of gonorrhoeae. Pathogenesis is dependent on acquisition of iron from the host, with the ferric uptake regulator (Fur) protein as the principal regulator of intracellular iron stores. Increasingly, studies have shown regulation by small non-coding RNAs (sRNAs) to be critical for organisms to adapt to environmental stresses through post-transcriptional mechanisms. NrrF is an sRNA in N. gonorrhoeae responsive to iron and controlled by Fur. To investigate the role of NrrF in controlling gonococcal gene expression in response to iron availability, we compared the global transcriptional profiles of FA 1090, nrrF deletion mutant and complemented strain, using RNA-seq.

Methods: Total RNA was isolated from cells at stationary phase under iron-replete and –deplete conditions for all three strains. Genomic DNA and ribosomal RNA were removed and samples were sequenced using Illumina chemistry. The RNA-seq data was aligned to FA 1090 genome and analyzed using Strand NGS software. Changes in transcript levels of potential NrrF-regulated genes were confirmed with real-time PCR.

Results: Comparison of FA 1090 where NrrF is present to the mutant strain in iron poor or rich growth conditions revealed a list of 156 genes with a significant change in transcription levels. Genes present in two operons confirmed by real-time PCR have important implications in intracellular survival and biofilm formation and dispersal.

Conclusion: The data demonstrate an expanded list of potential genes controlled by NrrF dependent on iron availability. Understanding the control of NrrF over global transcriptional levels in response to iron availability will lead to an improved understanding of pathogenesis and may suggest targeted treatment strategies.

Societal Impact: According to the CDC 820,000 new infections occur each year and Neisseria gonorrhoeae has been classified by the World Health Organization as a “super bug” due to its increasing resistance to high levels of antibiotics. With the global rise of multi-drug resistant strains an untreatable gonococcal disease may be on the horizon. Iron is an essential element for survival of the organism in the host, therefore understanding how the iron-regulated sRNA NrrF regulates gene expression globally will be important for future targeted treatments.

Funding: OK-INBRE and NIH R01GM074692

Exhibit #9
Karissa Hodge
Northeastern State University
Hometown: Broken Arrow, OK
Advisor: Dr. Joseph Ahlander, NSU

Research Topic: Cancer

Researcher(s): Karissa Hodge
College of Science and Health Professions
Northeastern State University, Broken Arrow, OK
Faculty Advisor: Dr. Joseph Ahlander, Northeastern State University

REDUCING DIETARY PROTEIN INHIBITS COLON CANCER GROWTH AND INCREASES CHEMOTHERAPY EFFICACY IN *DROSOPHILA*

Cancer is the second leading cause of death in the United States and its treatment remains a challenging and complex issue facing the medical community. The malignancy of many cancers has been attributed to increased activation of cellular pathways responsible for cell growth, survival, and replication. Amino acids, the building blocks of protein, play a crucial role in activating cellular pathways that are shared between fruit flies (*Drosophila melanogaster*) and humans. Our goal was to use *Drosophila* as a model to study the effects of dietary protein on colon cancer growth, and the subsequent effects those diets have when combined with the chemotherapy drug methotrexate. Our study found that cancer growth was significantly lower in a 5% protein diet than in a 45% protein diet (p value < 0.05). Additionally, the 5% protein diet had a three-fold reduction in cancer relative to the 45% protein diet when paired with chemotherapy (p value < 0.001). These findings indicate that reducing dietary protein inhibits colon cancer growth and magnifies the effectiveness of chemotherapy with methotrexate. Consequently, these findings have implications for future research that may result in new dietary guidelines during cancer treatment that could be more effective at fighting cancer in a less toxic and costly manner.

Exhibit #10
Anna W. Paraskevopoulos
Cameron University
Hometown: Lawton, OK
Advisor: Dr. Diane Roeder, CU

Research Topic: Foraging Behavior

Researcher(s): Anna W. Paraskevopoulos[1], D. Roeder[1], and K. Roeder[2]
[1]Dept. of Agriculture, Biology, and Health Sciences, Cameron University, Lawton, OK
[2]Dept. of Biology, University of Oklahoma, Norman, OK
Faculty Advisor: Dr. Diane Roeder, Cameron University

TEMPERATURE REGULATES FORAGING BEHAVIOR AND NET ENERGY GAIN IN THE RED HARVESTER ANT, POGONOMYRMEX BARBATUS

Native ants are a key component of healthy grassland ecosystems, acting as seed dispersers, aerating soils, and allowing for greater water absorption. Harvester ants, such as *Pogonomyrmex barbatus*, also act as a warehouse for plant diversity by storing seeds. The efficacy of these ecosystem services is influenced by the abiotic conditions ants experience on a daily basis, which can either constrain or provide windows of opportunity for foraging activity. These ants are an ideal system in which to study how species will respond to increasing threats from climate change. Because grassland systems will likely experience increasing and longer durations of high temperature, opportunities for foraging activity will be under growing constraint as ants would reach their thermal limits more quickly. We investigate how daily fluctuations in temperature regulate foraging activity of the red harvester ant, *P. barbatus*. We examined the effect of 1) temperature on the time spent engaged in each component of a foraging trip (outbound trip, foraging, return trip), travel speed, and distance to foraging areas, 2) body and seed mass on travel speed, 3) temperature, travel speed, and seed mass on energy expenditure during foraging versus energy gained via seed collection. We tracked and collected data for 20 foragers at each of 15 colonies. We found that travel speed increased, and search time was constrained to shorter bouts as temperature increased. Ants did not decrease the distance to foraging areas, but instead completed each leg of the trip faster as temperature increased. Larger ants completed foraging trips more quickly. Seeds were usually small enough that travel rate was not influenced by seed size. Ants generally collected more energy than they expended during foraging. Although energy expenditure/intake was not related to temperature, ants stopped foraging when ground temperature reached 50°C, which corresponds with their upper thermal limit. Our results highlight the importance of daily temperature cycles in regulating how foraging drives energy gain. We suggest these behaviors will likely be constrained to shorter foraging bouts as the climate continues to change and surface temperatures more quickly exceed thermal limits, causing consequences for the ecosystem services these ants provide.

Exhibit #11
Halley Ponder
University of Science and Arts of Oklahoma
Hometown: Duncan, OK
Advisor: Dr. Christopher Garneau, USAO

Research Topic: Recidivism Sociology

Researcher(s): Halley Ponder
Dept. of Social Science
University of Science and Arts of Oklahoma, Chickasha, OK

Faculty Advisor: Dr. Christopher Garneau, University of Science and Arts of Oklahoma

INDIVIDUAL AND SOCIOLOGICAL FACTORS AFFECTING RECIDIVISM AMONG INCARCERATED PERSONS

This paper examines the factors affecting recidivism among incarcerated individuals using data from the United States Department of Justice. The aim of the analysis is to examine correlates of recidivism. Many correlates emerged with regards to types of crimes, arrest frequency, and types of incarceration institutions. The odds of spending time in a federal prison as opposed to state prison was the most substantial factor in comparison to the other variables in the crime category. Psychological factors were found to be insignificant predictors of recidivism. For the demographic variables, education and race were the most significant with African American incarcerated individuals having the highest odds of recidivism. Overall, it seems that sociological and not psychological variables are those that account for higher odds of recidivism. These results offer insight into how policymakers can move forward with initiatives to lessen recidivism.

Exhibit #12
Abigail M. Voth
Oklahoma Christian University
Hometown: Enid, OK
Advisor: Mr. Jeff McCormack, OC

Research Topic: Autoimmune Disease

Researcher(s): Abigail M. Voth[1], L. Long[1], and C. Montgomery[2]
[1]Dept. of Biology, Oklahoma Christian University, Edmond, OK
[2]Oklahoma Medical Research Foundation, Oklahoma City, OK
Faculty Advisor: Mr. Jeff McCormack, Oklahoma Christian University

MOLECULAR STUDIES OF A SARCOIDOSIS-ASSOCIATED GENETIC VARIANT IN ANXA11

Sarcoidosis is a disease characterized by the formation of granulomas, which are small accumulations of immune cells in tissues throughout the body. These granulomas can interfere with the tissues or organ function if they continue to grow and are not resolved. The investigation of the mechanisms in the formation of this disease holds societal impact as discovery in this field could lead to improvement in patient care for thousands who have sarcoidosis. The cause of the formation of these granulomas in sarcoidosis patients is unknown. Because the disease often shows a pattern of genetic inheritance, it is likely that variations found in sarcoid patients' DNA may predispose these individuals to developing the disease. A Genome Wide Association Search (GWAS) was performed on both unaffected individuals and sarcoidosis patients to identify variations that were observed with high frequency in sarcoidosis patients, when compared to control groups. Of particular interest, a variant in Annexin 11 (ANXA11) was found in high frequency in sarcoidosis patients. Because Annexin 11 plays a role in promoting cell death, inactivation of Annexin 11 could potentially result in the persistence and growth of the granulomas. We measured cell death in Jurkat T cells overexpressing the *wild-type* or mutant ANXA11 by flow cytometry using a stain that marked apoptotic cells. We observed that cells overexpressing *wild-type* ANXA11 had an increase in apoptosis. Conversely, cells overexpressing mutant ANXA11 showed a decrease in apoptosis when compared to the control. These results suggest that the mutant form of ANXA11 renders ANXA11 nonfunctional, causing cells to be more resistant to apoptosis. Consequently, this could contribute to the persistence of granulomas in some sarcoidosis patients. It is unlikely that this mutation in ANXA11 is the sole cause of the sarcoidosis, but it may be a contributing factor. Future experiments involve repeating the assays with additional controls and analyzing the effect of ANXA11 in primary blood monocyte cells.

Exhibit #13
Rainee N. DeRoin
Oklahoma State University
Hometown: Broken Arrow, OK
Advisor: Dr. Chris Zou, OSU

Research Topic: Biofuel Feedstock

Researcher(s): Rainee N. DeRoin[1,2], C. Zou[1], A. Saenz[2], and R. Will[1]
[1]Dept. of Natural Resource Ecology and Management Oklahoma State University, Stillwater, OK; [2]Dept. of Biosystems and Agricultural Engineering, Oklahoma State University, Stillwater, OK
Faculty Advisor: Dr. Chris Zou, Oklahoma State University

RESTORING EASTERN REDCEDAR ENCROACHED WATERSHEDS TO PRAIRIE OR SWITCHGRASS IMPROVES WATER QUALITY AND QUANTITY

Eastern redcedar represents a modern-day challenge to Oklahoma as it has encroached approximately eight million acres of land. This conversion is detrimental to the ecological and economic value of the land, reducing ecosystem water provisioning in particular. Eastern redcedar trees consume more water such that less is available for municipal and agricultural uses as well as ecological stream flows. Currently, efforts to reduce eastern redcedar encroachment have been unsuccessful; however, studies have shown eastern redcedar biomass to be a potential ethanol feedstock for the state. The purpose of this study is to compare eastern redcedar removal and replacement with native prairie or planted switchgrass on surface runoff, sediment yield, and biomass production. More specifically, this study monitors surface runoff and sediment yield of encroached eastern redcedar, harvested eastern redcedar, cultivated switchgrass, and native prairie using experimental watersheds (5-10 acres in size). Preliminary analysis shows that removal of eastern redcedar increased water yield by 4-5 fold. Growing switchgrass produced more biomass than restoration to native prairie, but water yield did not differ between the two. Sediment concentrations from encroached eastern redcedar watersheds were higher compared to native prairie watersheds. After harvest, previously encroached watersheds initially experienced an increase in sediment yield due to soil disturbance. After switchgrass and native vegetation re-established, sediment yields declined. These results indicate that water yield and biomass production can be increased by converting eastern redcedar woodlands to switchgrass for use as dedicated biofuel feedstock.

The Social Impact: The proliferation of eastern redcedar within the grassland and forest has resulted in higher wildfire risk, reduction in water quality and quantity, and loss of wildlife habitat. Eastern redcedar removal and herbaceous-based biomass production system promote sustainable natural resource and land management stewardship. It prevents eastern redcedar from re-infesting rangeland, produces biomass for bioproduct, and improves water availability and water quality for the ecosystem and municipal water use. Ultimately, switchgrass based biomass production system provides an active land management approach for the marginal lands and will improve the livelihood of rural communities in Oklahoma.

Funding: The United States Department of Agriculture National Institute of Food and Agriculture (Grant Number 2013-05799-1001450), the National Science Foundation (OIA-1301789), The Oklahoma-Louis Stokes Alliance for Minority Participation Bridge to Doctorate Fellowship (Grant Number HRD 1408748), The McNair (P217A170248-18)

Exhibit #14
Carley V. Eastep
Oklahoma State University
Hometown: Jones, OK
Advisor: Dr. Ashlee Ford Versypt, OSU

Research Topic: **Rheumatoid Arthritis**

Researcher(s): **Carley V. Eastep and A. Ford Versypt**
School of Chemical Engineering
Oklahoma State University, Stillwater, OK
Faculty Advisor: **Dr. Ashlee Ford Versypt, Oklahoma State University**

MATHEMATICAL MODELING OF THE INFLUENCE OF TOXIN EXPOSURE ON RHEUMATOID ARTHRITIS

Rheumatoid arthritis is a debilitating autoimmune disease that attacks the joints in the body. These attacks cause chronic inflammation that degrades the surrounding bone overtime. This disease affects around one percent of the population globally, and women are three times more likely to be diagnosed with this disease than men.

Rheumatoid arthritis research is broad with many scientific studies underway to identify causes, cures, and preventions. Previous studies have determined the mechanism of the disease once it becomes established in the body, but only limited published results focus on identifying triggers and mapping the physiological responses at the onset of arthritis. It is understood that environmental factors account for seventy percent of the disease generation, while genetics accounts for the other thirty percent. Recent studies have shown that the immune responses to environmental factors that lead to arthritis may begin in the gut, gums, or lungs years before symptoms appear. However, the links between the timing and extent of various environmental exposures on the onset and progression of arthritis are not clearly understood.

Mathematical models can provide insights into the complex linkages between molecular level actions of chemicals and their effects on the cellular, tissue, and whole body levels of physiology in diseases such as arthritis. The objective of our study is to build a mathematical model for the chemical and biological processes that are involved in the onset of arthritis. To model how environmental toxins such as herbicides and bacteria stimulate chronic inflammation, we have combined two previously published models into a more complex and informative model. This model tracks how the concentration of tumor necrosis factor (TNF), a chemical that triggers inflammation, changes in the joints, the bloodstream, and the surrounding tissue. The model predicts TNF regulation by the inflammatory stress on the immune system due to exposures to toxins. We will present simulation results for specific toxins can alter TNF regulation to lead to chronic joint inflammation. This work will impact society by improving fundamental understanding of the effects of toxins on arthritic autoimmune inflammation, laying the scientific foundation for advances in disease treatment and prevention.

Exhibit #15
Matthew Baier
University of Oklahoma Health Sciences Center
Hometown: Edmond, OK
Advisor: Dr. Hibah Awwad, OUHSC

Research Topic: Brain Injury

Researcher(s): Matthew Baier[1], E. C. Falcon[4, 5], C. W. Moehlenbrock[1], A. C. Edwards[1], M. R. Lerner[2], and H. O. Awwad[1, 3]; [1]Dept. of Pharmaceutical Sciences, [2]Dept. of Surgery, and [3]Oklahoma Center for Neuroscience, University of Oklahoma Health Sciences Center, Oklahoma City, OK; [4]Dept. of Chemistry and [5]Dept. of Biology, University of Central Oklahoma, Edmond, OK

Faculty Advisor: Dr. Hibah O. Awwad, University of Oklahoma Health Sciences Center

ELEVATED CEREBROSPINAL HISTAMINE LEVELS FOLLOWING TRAUMATIC BRAIN INJURY IN RATS

Introduction: Traumatic brain injury (TBI) is a leading cause of death and disability in American young adults, with approximately 5 million Americans currently living with a TBI-related disability. With no dependable biomarkers to predict recovery from TBI and no FDA-approved drug treatment, it is essential to identify potential biomarkers and to develop targeted drug therapies. Histamine, an inflammatory mediator and a neurotransmitter, has been shown to play a role in memory loss and long-term pain. Altogether this makes histamine a potential biomarker for TBI-related consequences and a target for drug development. However, its contribution to these consequences following a mild TBI (mTBI) remains unclear. Our objective was to determine changes in histamine levels following mTBI in our model and to correlate them with TBI related consequences.

Methods: Male Sprague Dawley rats received either a craniotomy and impact to the left cortex (mTBI), a craniotomy only (sham), or no surgery (naïve). Memory deficits and pain sensitivity were assessed by the Morris Water Maze and tail flick response, respectively. Cerebrospinal fluid (CSF) and plasma were collected from rats euthanized on days 1, 8, and 16 post-injury. Markers of injury and histamine producing mast cells were analyzed using immunoblots and immunohistochemistry. Histamine levels were measured using enzyme-linked immunosorbent assays.

Results: mTBI increased histamine by two-fold in CSF samples at day 1 post-TBI compared to non-injured rats (n=3-6), but not in plasma samples. Injury and mast cell (tryptase) markers were increased one day post-TBI and reduced on day 16 in CSF of TBI rats compared to non-injured rats. mTBI induced transient memory deficits and persistent pain hyperalgesia through days 8-9 compared to sham rats.

Conclusion: mTBI induced an increase in histamine and tryptase levels in CSF with little effect on plasma levels. Developing histamine as a biomarker and identifying drugs targeting histamine-modulated pathways could aid millions by potentially providing a predictor of injury prognosis and a potential therapy for patients suffering from TBI.

Funding: This work was supported by the University of Oklahoma Health Science Center Summer Undergraduate Research, OU Pharmacy Seed grant and an American Association of Colleges of Pharmacy New Investigator Award.

Exhibit #16
Sarah A. Guiterrez
The University of Tulsa
Hometown: Broken Arrow, OK
Advisor: Dr. Maria Carreon, TU

Research Topic: Plasma Catalysis

Researcher(s): Sarah A. Gutierrez, J. R. Shah, J. M. Harrison, and M. L. Carreon
Russell School of Chemical Engineering
The University of Tulsa, Tulsa, OK
Faculty Advisor: Dr. Maria Carreon, The University of Tulsa

PLASMA CATALYSIS FOR AMMONIA SYNTHESIS: UNDERSTANDING THE UNDERLYING MECHANISM

Ammonia is the second largest commodity in the global chemical industry due to its widespread use in synthetic nitrogen fertilizers. Its estimated production volume of 186.8 million tons resulted in approximately 300 million tons of CO_2 emissions for 2018. It is produced commercially via the energy-intensive Haber-Bosch process resulting in NH_3 yields from 8-15%. It has recently been observed that applying plasma can potentially shift the rate-limiting step away from nitrogen-dissociation. Additionally, employing an appropriate catalyst can increase the ammonia yield significantly. In order to do this, the underlying reaction mechanism must be well understood, as interactions between plasma and catalyst are the key towards plasma-catalytic ammonia synthesis.

Low melting point metals were utilized to understand plasma-catalyst synergy at a molecular level. Ammonia was produced in lab via an in-house built RF plasma reactor with a 1:4 N_2:H_2 gas flow ratio, at 400^{o}C and 0.26 torr pressure. Experimental data was collected using gas chromatography and emission spectroscopy. SEM was employed to characterize the catalysts. This experimentation led to ammonia yields of 19.9% with a gallium catalyst, 21.4% with indium, and 20.9% for a Ga-In alloy. Experimental analysis showed that the rate-limiting step had been shifted from nitrogen dissociation to surface interactions with the catalyst. In the future, additional metals, transition metals, and alloys will be applied to better understand plasma catalysis and further raise ammonia yields.

In addition to increasing the fundamental understanding of plasma-catalyst synergy—which can positively impact the plasma research community—this research has the potential to revolutionize ammonia production. Upon determining an ideal catalyst, ammonia production can be moved to a DBD plasma reactor with better scalability and reduced energy consumption. By incorporating on-site reactors run off of renewable energy, ammonia production can be decentralized from the current process, providing an immediate source of ammonia to rural farming communities. This ultimately reduces energy consumption, carbon emissions, and transportation costs, while continuing to satisfy the global demand for synthetic fertilizer.

Exhibit #17
Ibikari Tamunosisi Legg-Jack
University of Oklahoma
Hometown: Oklahoma City, OK
Advisor: Dr. Indrajeet Sharma, OU

Research Topic: **Drug Synthesis**

Researcher(s): **Ibikari Tamunosisi Legg-Jack and A. Hunter**
Dept. of Chemistry and Biochemistry
University of Oklahoma, Norman, OK
Faculty Advisor: **Dr. Indrajeet Sharma, University of Oklahoma**

ENANTIOSELECTIVE SYNTHESIS OF DIVERSE HETEROCYCLES THROUGH Cu(I) CATALYZED CONIA-ENE CYCLIZATIONS

Throughout the history of chemical synthesis, the development of *enantioselective transformations* has become a critical topic in the design of biologically active pharmaceuticals. A prime example of the importance of these transformations can be found in the story of the drug “thalidomide”. In the 1950s the drug molecule thalidomide was developed and sold as treatment for morning sickness during pregnancy. After approximately ten years on the market, there was a significant increase in birth defects found in children born to mothers who were prescribed thalidomide. During this time period, thalidomide was being administered as a racemic mixture (both enantiomers of the molecule present). While the *S*-enantiomer possessed the desired bioactivity, the *R*-enantiomer was responsible for the undesired birth defects. Given this history, enantioselective synthesis is of great importance in in drug discovery, but is often difficult to achieve synthetically. Enantiomers possess identical enthalpies and entropies and are produced in equal amounts unless a chiral feature is used during the transformation to impact the synthetic pathway in an enantioselective nature. The design and development of enantioselective transformations is of great importance to the chemical community, which is why the research project herein is focused on the enantioselective synthesis of tetrahydrofurans.

Molecules that possess the tetrahydrofuran scaffold are vital components of many bioactive molecules. Previous research efforts have been successful in synthesizing tetrahydrofurans using a gold catalyst but no enantiomeric excess is induced. To solve this problem, this research project has developed a novel enantioselective catalytic system using a readily available copper salt to induce up to a 98:2 enantiomeric ratio of the desired compound. Along with a journal publication, the success of this research project ensures that the tetrahydrofuran scaffold synthesized will have its desired bioactive effect, creating many possibilities for drug synthesis that can benefit many people.

Societal Impact Statement: Success in this research project allows for further development of many different types of drugs, as the tetrahydrofuran scaffold is vital for bioactivity. The development of drugs using this scaffold can have profound effects on Oklahoma, and the entire world.

Exhibit #18
Samantha E. Shafer
Oklahoma State University
Hometown: Muskogee, OK
Advisor: Dr. Matthew Cabeen, OSU

Research Topic: **Biofilm Formation**

Researcher(s): **Samantha E. Shafer and M. Cabeen**
Dept. of Microbiology and Molecular Genetics
Oklahoma State University, Stillwater, OK
Faculty Advisor: **Dr. Matthew Cabeen, Oklahoma State University**

FINDING NEW SIGNALING PATHWAYS THAT GOVERN BIOFILM FORMATION BY P. AERUGINOSA

Pseudomonas aeruginosa is an opportunistic pathogen that is often associated with severe forms of many infections, including bronchiectasis and infections in the gut. Mortality has been shown to increase in patients who become infected with *P. aeruginosa*. *P. aeruginosa* poses a special treatment challenge due to its propensity to form biofilms, in which cells are surrounded by a self-produced extracellular matrix of proteins, DNA, and polysaccharides. Biofilms can help bacteria evade the host immune response, and the matrix represents a barrier that protects bacteria against antibiotic therapy. Because biofilms are difficult to treat once established in an infection, new strategies to prevent biofilm formation are critical to combat these infections. However, effective prevention depends on a fuller understanding of the signaling pathways that control biofilm formation. To identify new control points in the pathways governing biofilm formation by *P. aeruginosa*, we use transposon mutagenesis in conjunction with a visual assay for colony morphology, in which colony wrinkling indicates biofilm formation. Using these screens, we have been able to identify many promising candidates. For example, we have mutations in the genes fdnG and PA14_42090 as having smoother colony morphology, suggesting that these genes are involved in biofilm formation. Conversely, we have found that mutations in the purU2 and trxB1 genes show increased colony wrinkling, suggesting that these genes normally suppress biofilm formation. We will continue characterizing these genes by deleting them from the genome to confirm their roles in biofilm production and then testing how their absence or presence affects other known biofilm signaling molecules. Our detailed characterization of these candidate genes will provide fundamental knowledge that can then be used to devise future treatments to prevent biofilm formation in patients infected with *P. aeruginosa.*

Exhibit #19
Marjorie Sheaff
The University of Tulsa
Hometown: Owasso, OK
Advisor: Dr. Gabriel LeBlanc, TU

Research Topic: Conductive 3D Printing

Researcher(s): Marjorie Sheaff
Dept. of Chemistry and Biochemstry
The University of Tulsa, Tulsa, OK
Faculty Advisor: Dr. Gabriel LeBlanc, The University of Tulsa

IMPROVED ELECTROCHEMICAL PERFORMANCE OF FUSED FILAMENT FABRICATION 3D PRINTED ELECTRODES USING HYDROXIDE TREATMENT METHODS

Fused filament fabrication is a method of 3D printing becoming common in home and laboratory use. Our laboratory focuses on applying 3D printing technology to electrochemical applications. 3D printing can be utilized to produce specialized electrochemical cells. The LeBlanc Research Group uses conductive filaments from two primary manufactures. We aim to produce useable electrodes from 3D printed material.

3D printing has effected numerous fields in science. However, electrochemistry has yet to truly reap the benefits of applied 3D printing technology. This is due to the minimal availability of effective conducting filaments for use in 3D printers. Aside from difficulty printing, conductive filaments are far less conductive than is necessary for use in electrochemical experiments. Our research has been working to develop effective methods to decrease resistance of conductive filament.

Strong hydroxide solutions have positive effects on the conductivity of conductive 3D filaments. The resistance of electrodes printed from conductive filaments decreases considerably after hydroxide treatment. This allows for specialized printing of e electrodes for use in electrochemical cells. Due to the strong nature of concentrated hydroxide solutions, we desired a safer yet equally as effective method to increase PLA-graphene filament conductivity.

Electrolysis can be used to generate H^+ and OH^-. Because hydroxide degrades PLA, we suspected a 3D printed electrode could replace a carbon rod or glassy carbon electrode in an electrolysis system. We hypothesized the current flow through the electrode would produce OH^- ions causing the PLA to degrade without harsh chemicals. Electrolysis conditions were varied and optimized conditions yielded a significantly lower resistance when compared to untreated electrodes. This low hazard and highly accessible method enables the use of 3D printed electrodes by more people for a variety of different electrochemical applications.

The advancements made in electrolysis applications to 3D printed electrodes suggests it is possible to produce working electrodes with 3D printing technology. Without the involvement of harsh chemicals, it would be possible for home printer owners to explore the possibilities of circuitry and electricity in terms of 3D printed components.

Exhibit #20
Julia H. Tang
University of Oklahoma
Hometown: Edmond, OK
Advisor: Dr. Han Yuan, OU

Research Topic: Biomedical Engineering

Researcher(s): Julia H. Tang[1], Y. Chen[1], L. A. DeStefano[2], T. Worth[2], M. Wenger[2], L. Ding[1], H. Yuan[1], M. A. Craft[2], and B. W. Carlson[2]
[1]Stephenson School of Biomedical Engineering, University of Oklahoma, Norman, OK; [2]Dept. of Psychology, University of Oklahoma, Norman, OK; [3]Nursing Academic Programs, University of Oklahoma Health Sciences Center, Oklahoma City, OK
Faculty Advisor: Dr. Han Yuan, University of Oklahoma

MULTIMODAL CHARACTERIZATION OF COGNITIVE FUNCTION IN MIDDLE-AGED AND OLDER ADULTS

Alzheimer's disease (AD) is an incurable neurodegenerative disease that affects the hippocampus and many parts of the cerebral cortex, leading to a decline in memory and other cognitive functions [1]. Early detection and intervention during the preclinical stages of AD has been suggested as an important preventative approach [2]. Current research of AD primarily uses magnetic resonance imaging (MRI), but that approach is expensive [3]. In order to characterize the age-related decline of memory function, my study has utilized electroencephalography (EEG), which is a broadly accessible neuroimaging technology to measure neuronal activities.

The study examined younger and older populations to investigate three measures: age, cognitive function (assessed by clinical and research-grade memory tests) and EEG. Two groups of clinically healthy subjects were recruited, including fifteen middle-aged (ages 30-45) and fifteen older (ages 50-64) participants. A 64-channel, high-density cap was utilized to record EEG. After removing artifacts in the recordings, peak frequency and amplitude of activities in the alpha band (8 Hz -13 Hz) was quantified for statistical analysis.

In the first domain, analysis showed that as age increased, memory scores followed a significant negative linear correlation; and as expected, there was a significant difference between the younger and older population within cognitive tests. In the second domain, an EEG biomarker, the alpha peak frequency displayed a strong negative correlation with increasing age. Lastly, we found significant correlations comparing the EEG biomarkers with memory test scores. These results coincide with existing literature that has shown that cognitive functions have strong relationships with alpha and theta bands, but none have compared their results to clinical cognitive tests [2].

Societal Impact: AD affects 10% of Americans over 65 years old and costed over $200 billion annually [4]. Through this investigation, we have developed a holistic approach on characterizing cognitive functions by using clinical and neuroimaging measures. My work has showed that an inexpensive approach using electroencephalogram (EEG) is sensitive enough to characterize the decline in cognitive functions during healthy aging. With this tool, any person in the future may receive accurate and early detection of AD when treatment is most effective.

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Exhibit #21
Liam Bennet Whiteman
Oklahoma State University
Hometown: Nichols Hills, OK
Advisor: Dr. Wyatt Hoback, OSU

Research Topic: Mosquito Breeding Sites

Researcher(s): Liam Bennet Whiteman, W. Hoback, T. Hess, and M. Reed
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Oklahoma State University, Stillwater, OK

Faculty Advisor: Dr. Wyatt Hoback, Oklahoma State University

IDENTIFICATION OF MOSQUITO BREEDING SITES AT THE NATIONAL GUARD TRAINING FACILITY AT CAMP GRUBER, OKLAHOMA

Of the 62 known mosquito species in Oklahoma, many are vectors of serious diseases that can be transmitted to humans. Camp Gruber, the site of the Oklahoma Army National Guard training facility, is near Braggs, OK and lies in an eco-region that is characterized by high precipitation and mild winters. Adult mosquito sampling was conducted between May and October 2018 using traps baited with carbon dioxide. A total of 10,399 individuals, belonging to 27 species and seven genera, were collected. About 70% (7,214) were *Culex erraticus*, a species which has a painful bite and can transmit West Nile virus, St. Louis encephalitis, and eastern equine encephalitis. The three other most common species were, *Psorophora columbiae* (905), *Aedes vexans* (763), and *Anopheles quadrimaculatus* (377). The Asian tiger mosquito, *Aedes albopictus* was also collected along with one specimen of the yellow fever mosquito, *Aedes aegypti* that appears to have arrived on base with the transfer of equipment from Louisiana. The distribution of adult mosquitoes is limited by breeding sites and more than 3,000 *Culex erraticus* were collected from one trap site, on one weekend. Mosquito larvae were also collected to from potential breeding sites. Although different species prefer different breeding sites, when suitable sites are not available, multiple species co-occur and compete. Larval identification is continuing, but a predatory mosquito larva, *Wyomia smithii*, which can provide natural control of pest species was identified among samples. Linking the adult trap catches to breeding sites that support larvae will allow more effective management strategies to protect troops during training. Because these soldiers return to their hometowns, this research will also protect the citizens of Oklahoma from the spread of mosquito-borne diseases.

Exhibit #22
Tyler Whitney
University of Oklahoma Health Sciences Center
Hometown: Oklahoma City, OK
Advisor: Dr. Mohiuddin Ahmad, OUHSC

Research Topic: Anxiety and Depression

Researcher(s): Tyler Whitney and M. Ahmad
Dept. of Cell Biology
University of Oklahoma Health Sciences Center, Oklahoma City, OK
Faculty Advisor: Dr. Mohiuddin Ahmad, University of Oklahoma Health Sciences Center

NEUROMODULATORS REGULATE PHOSPHORYLATION OF GLUTAMATE RECEPTORS IN THE LATERAL SEPTUM

Introduction/Societal Impact: The lateral septum (LS) is a subcortical structure located rostral to the hippocampus in mice. Studies in the LS have theorized its role as a regulator of motivational and emotional behavior such as is disrupted in depression and anxiety. Neuromodulators regulate the activity of AMPA Glutamate receptor subunits through phosphorylation at specific amino acid residues. This phosphorylation regulates receptor trafficking and channel properties affecting synaptic plasticity, which produces molecular substrates for memory formation and emotional behavior. The primary objective of this study was to examine the effects of various neuromodulators on the phosphorylation of AMPA receptor subunits at specific residues in the LS.

Methods: Experiments were performed by obtaining mouse coronal brain slices and perfusing them with specific agonists, antagonists, and kinase inhibitors. This was followed by homogenization of the slices and quantitative Western blot. Antibodies for specific sites on the GluA1 subunit (Ser845 & Ser831) were used for immunoblotting.

Results: Norepinephrine (NE) and serotonin increased phosphorylation at GluA1 Ser845 when compared to the control. The effect of NE was completely blocked by a β-Adrenergic receptor (AR) antagonist and partially by an α-AR antagonist. The effect of NE on Ser845 phosphorylation was not blocked by specific kinase inhibitors. Acetylcholine did not change the phosphorylation. Phosphorylation levels of the Ser831 site were not significantly affected by any of the neuromodulators.

Conclusion: NE increases the phosphorylation of the AMPA receptor subunit GluA1 at Ser845 in the LS through β-ARs and partially through α-ARs. Serotonin has a similar effect as NE in the LS; however, acetylcholine has no effect. The action of different neuromodulators regulating phosphorylation on AMPA receptors could indicate their role in synaptic plasticity and the involvement of the LS in emotional behavior. The investigation of these pathways would present new targets for the development of therapeutic strategies for depression and anxiety.

Funding: OK-INBRE Summer Program (to T.W.) and Project Investigator Award through OK-INBRE (P206M103447, to M.A.)

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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.

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

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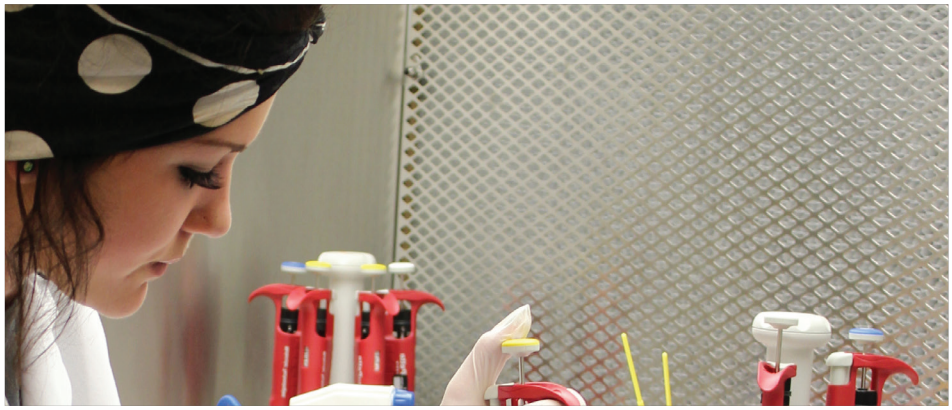

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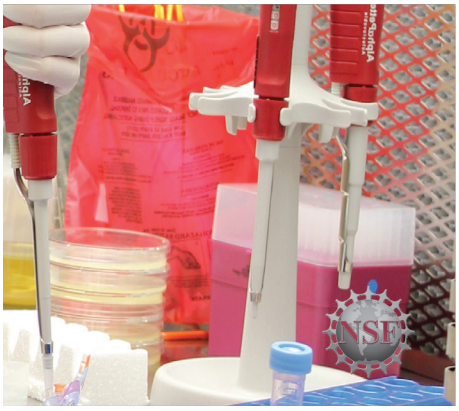


RESEARCH

EPSCoR researchers are performing cutting-edge science and making a difference in Oklahoma and the world. Our environmental research provides important answers about our changing planet, while ground-breaking cellulosic bioenergy research has the potential to generate the development of biorefineries, which are estimated to create 135,000 new jobs and generate $13.6 billion/yr.

PRODUCTS

Significant research products have been developed through Oklahoma EPSCoR, including a radiation dosimeter that protects over a million workers annually and raises an est. $100 million/yr. in revenue. Another company that got its start with EPSCoR provides important weather detection and forecasting services to industries such as airlines - raising profits, saving energy, and promoting safety.

EDUCATION

More than 47,500 K-12 students and teachers have benefited from Oklahoma EPSCoR STEM education, outreach, and training programs (2009-present), including an innovative statewide Girl Scouts STEM initiative; EPSCoR support has added more than 25 new faculty positions to Oklahoma universities. These programs and positions would not have been possible without EPSCoR funding.

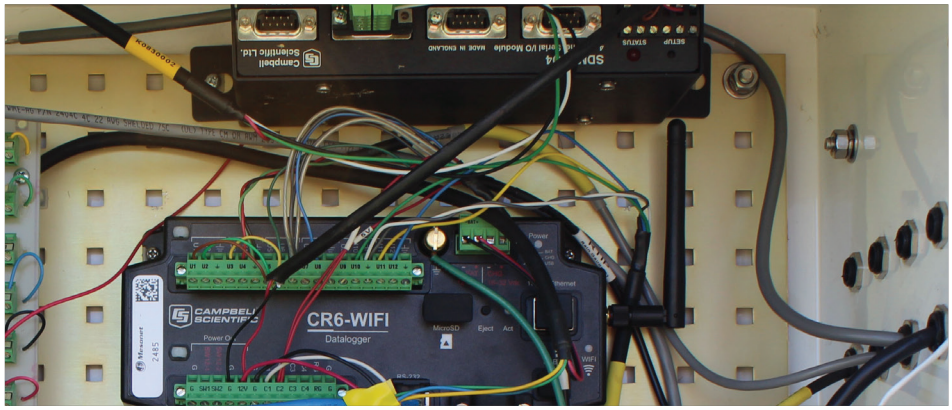
CURRENT ACTIVE OKLAHOMA EPSCoR/IDEA AWARDS

PROGRAM	AWARD	AMOUNT	TYPE OF AWARD
NSF	EPSCoR	$ 21 Million	Research Infrastructure
NASA	EPSCoR	$ 2 Million	Research Infrastructure (3 Awards)
DOE	EPSCoR	$ 0.7 Million	Research Infrastructure
NIH	IDeA	$125 Million	COBRE (9 Awards)
NIH	IDeA	$ 20 Million	OSCTR
NIH	IDeA	$ 19 Million	INBRE

NEW RESEARCH FUNDING

Oklahoma NSF EPSCoR RII Track-1 Awards		New Funds Generated*
2001-2008	$16 Million	$ 50.0 Million
2008-2013	$15 Million	$ 70.5 Million
2013-2019	$21 Million	$331.6 Million
Total	**$52 Million**	**$452.1 Million**

*Does not include:
NSF RII Award or State Funds*



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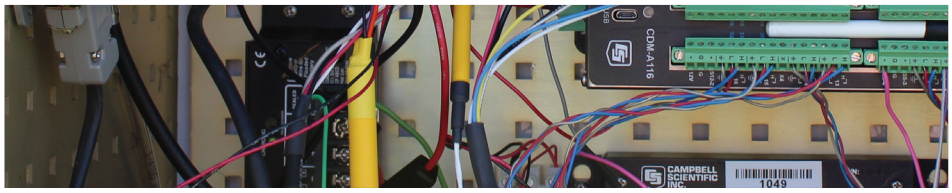

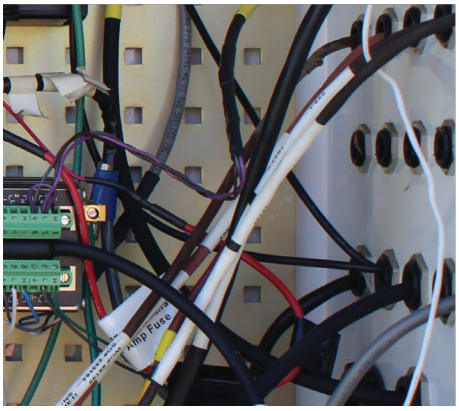

ENVIRONMENT

Through EPSCoR support, missing rainfall data was reduced to just 0.11% for 2018 in the Oklahoma Mesonet archive. Original 1990's equipment was replaced with state-of-the-art data loggers (pictured above) and rain gauges at each of the Mesonet's 120 environmental monitoring stations in 2016. The life expectancy of the new equipment is 20 years with periodic maintenance.

CYBERINFRASTRUCTURE

A University of Oklahoma astro-physics team discovered the first planets outside the Milky Way in 2018 and supercomputing developed through EPSCoR made it possible. A national model for intrastate collaboration, the OneOklahoma Cyberinfrastructure Initiative has served over 100 institutions and facilitated over $300 million in external funding to Oklahoma.

TECHNOLOGY

The Oklahoma nanotechnology industry, which was underpinned by EPSCoR research, has grown to more than 20 companies. Other significant tech advances based on EPSCoR funding include: 120 new technologies resulting in 18 new companies; 34 patents granted, and 9 copyrights issued resulting in 9 products marketed.

NSF EPSCoR: FOR OUR HIGH-TECH FUTURE

Oklahoma NSF EPSCoR outreach and education programs reached over 26,200 Oklahomans in 2018. Individuals representing every group within the science, technology, engineering, and math (STEM) pipeline were served, ensuring that the state's emerging high tech businesses and research labs will have a highly qualified and diverse applicant pool to draw from for years to come.

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