OKLAHOMA EPSCoR

23RD ANNUAL

Research DAY AT THE CAPITOL

MARCH 27, 2018

Celebrating exceptional undergraduate research conducted by students representing Oklahoma's outstanding colleges and universities

OKLAHOMA STATE REGENTS FOR HIGHER EDUCATION
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Oklahoma NSF EPSCoR is funded through awards from the National Science Foundation under Grant No. OIA-1301789 and Oklahoma State Regents for Higher Education.

OKLAHOMA EPSCoR 23RD ANNUAL RESEARCH DAY AT THE CAPITOL

TUESDAY, MARCH 27, 2018 * STATE CAPITOL OF OKLAHOMA * OKLAHOMA CITY, OK

AGENDA:

CAPITOL POSTER PRESENTATIONS & AWARDS CEREMONY

8:00 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** (Blue Room, 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, Sherry Marshall, Rodger McEver, and Brian O'Dell

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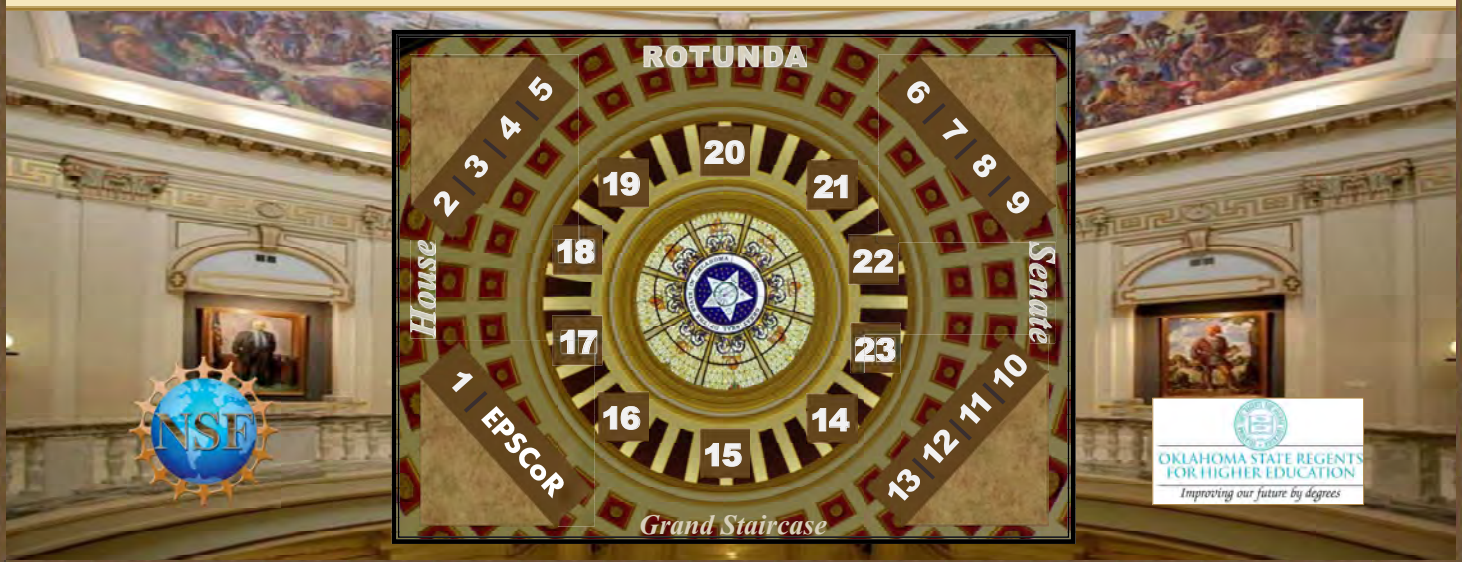
Research DAY AT THE CAPITOL

MARCH 27, 2018

PRESENTED BY: OKLAHOMA EPSCoR

Student Participant List & Poster Guide

	Student Researcher	University Represented	Research Topic	Hometown
1	Ms. Shana E. Butler	Rogers State University	Perceived Bias	Claremore
2	Ms. Christy M. Eslinger	Tulsa Community College	Pain Relief	Tulsa
3	Ms. Temisha Giles	College of the Muscogee Nation	Ecological Chemistry	Okmulgee
4	Ms. Lindsey J. Hendricks	Southwestern Oklahoma State University	Pesticide Effects	Bessie
5	Mr. Matthew B. Henry	East Central University	Fluid Flow	Paoli
6	Mrs. Jaclyn D. McCasland	University of Science & Arts of Oklahoma	Water Budgets	Chickasha
7	Mr. Myshal D. Morris	Langston University	Immune System	Tulsa
8	Ms. Brittany Palmer	Northwestern Oklahoma State University	Central Line Infections	Fort Gibson
9	Ms. Aleigh Peiroo	Cameron University	E. Coli	Lawton
10	Mr. Steven J. Shirley	Northeastern State University	Cancer Research	Broken Arrow
11	Mr. Connor West	University of Central Oklahoma	Laser Immunotherapy	Oklahoma City
12	Mr. Payton S. Whitehead	Southeastern Oklahoma State University	Enzyme Biochemistry	Colbert
13	Ms. Rebecca Yacyszyn	Rose State College	Native American Sovereignty	Yukon
14	Ms. Paul Delgado	University of Oklahoma	Diabetes in Latinos	Norman
15	Mr. Austin K. Fehr	The University of Tulsa	Microalgae	Oklahoma City
16	Mr. Nicholas Paul Foster	Oklahoma State University	Meteorological Drones	Edmond
17	Ms. Emily Gietzen	Oklahoma State University	Genetics	Pryor
18	Ms. Madison Granger	OU Health Sciences Center	Ovarian Cancer	Newcastle
19	Mr. Matthew D. Hart	Oklahoma State University	Genetics	Edmond
20	Mr. Devin W. Laurence	University of Oklahoma	Cardiovascular Biomechanics	Bartlesville
21	Mrs. Grace Katherine Ogden	Oklahoma State University	Herbicide Resistance	Perkins
22	Ms. Sijalu Paudel	OU Health Sciences Center	Cancer Research	Lawton
23	Mr. Erhan O. Sarica	The University of Tulsa	Oil-Water Separation	Broken Arrow



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
Shana E. Butler
Rogers State University
Hometown: Claremore, OK
Advisor: Dr. Sonya Munsell, RSU

Research Topic: **Perceived Bias**

Researcher(s): **Shana E. Butler**
Dept. of Psychology and Sociology
Rogers State University, Claremore, OK
Faculty Advisor: **Dr. Sonya Munsell, Rogers State University**

PERCEIVED MENTAL HEALTH COUNSELOR BIAS AND LGBTQ MENTAL HEALTH SERVICE UTILIZATION

Lesbian, gay, bisexual, transgender, and queer (LGBTQ) individuals experience higher rates of mental health and substance abuse disorders than heterosexual counterparts. However, fear of encountering heterosexist views may prevent LGBTQ individuals from seeking mental health services. Eliason and Hughes (2004) found counselors' attitudes toward transgender individuals and bisexuals were more negative than views toward lesbians and gay men, indicating a need to include transgender and queer voices in sexual prejudice research. The present study seeks to evaluate the relationship between perception of heterosexist bias of mental health providers and mental health help-seeking among LGBTQ populations. Participants (n = 53) completed an online survey containing measures to assess beliefs about mental health services, perception of counselors' beliefs toward transgender individuals, and perception of counselors' beliefs toward lesbians and gay men. Adaptations of existing scales were used to assess perceptions.

Initial bivariate analysis revealed a weak positive relationship between beliefs about mental health services and perception of counselors' attitudes toward lesbians and gay men. Additional analysis revealed a weak inverse relationship between beliefs about mental health services and perception of counselor's attitudes toward transgender individuals.

Preliminary results support previous research suggesting the lower the perceived mental health professional bias, the more positive the beliefs about psychological services. The inverse relationship between beliefs about mental health services and attitudes toward transgender individuals may indicate lesbian, gay, and bisexual respondents perceive an increased bias toward transgender individuals that does not affect personal attitudes about psychological services. The present study is limited by lack of transgender respondents and a small sample size. Data collection in progress.

To the researcher's knowledge, the present study is the first to evaluate LGBTQ population's perceptions of counselors' attitudes toward sexual minorities. Prior research has focused on lesbian, gay, and bisexual individuals, leaving transgender and queer-identified populations underrepresented. Sexual minority populations at high-risk for mental health impact must have equal representation in research to remove potential barriers to mental health service-seeking. The present study aims to evaluate potential barriers to mental health help-seeking amongst a minority population.

Exhibit #2
Christy M. Eslinger
Tulsa Community College
Hometown: Tulsa, OK
Advisor: Dr. Diana Spencer, TCC

Research Topic: **Pain Relief**

Researcher(s): **Christy M. Eslinger, K. Miller, and S. Das**
Dept. of Science and Mathematics (Biotechnology)
Tulsa Community College, Tulsa, OK
Faculty Advisor: **Dr. Diana Spencer, Tulsa Community College**

MODULATION OF NERVE GROWTH FACTOR (NGF) EXPRESSION IN TRINITROBENZENE SULFONIC ACID (TNBS) INDUCED COLITIS IN RAT COLON

In an effort to look at the pain pathways of the Enteric Nervous System or ENS, the expression of the neuroprotector, Nerve Growth Factor (NGF), and the neurotransmitter glutaminase (GLS) was measured. NGF is a protein in the structural family that includes BDNF, NT3, NT4/5 and promotes survival and growth of different elements of the peripheral nervous system. GLS is an enzyme of the glutamate-glutamine cycle that converts glutamine into glutamate for neurotransmission. It is a major excitatory neurotransmitter. Retrograde transported neurotrophic factor such as NGF is possibly responsible for the regulation of GLS expression. The goal is to combat the visceral pain produced from neuro-inflammation. We predicted the wild-type rats with TNBS (induced colon inflammation/colitis) would show an increase in NGF and GLS expression. Sprague-Dawley rats, 8-10 weeks old, were fasted for 24 hours, before colitis was induced. After sacrifice, the colons and DRG's were extracted. We analyzed the GLS and NGF message levels and proteins expression using PCR, RT-PCR, western blot, and immunohistochemistry. We rejected our alternate hypothesis and saw elevation of NGF & GLS protein expression in TNBS-induced colitis in WT rats. Looking further, we want to understand the relationship of NGF and GLS in neuro-inflammatory pain. GLS can possibly be targeted for pain management and can be used as a biomarker for pain. Broader impacts include the possibility of treating a person's pain without any opioid effects.

Exhibit #3
Temisha Giles
College of the Muscogee Nation
Hometown: Okmulgee, OK
Advisor: Ms. Cynthia Sanders, CMN

Research Topic: **Ecological Chemistry**
Researcher(s): **Temisha Giles**
Dept. of Natural Science
College of the Muscogee Nation, Okmulgee, OK
Faculty Advisor: **Ms. Cynthia Sanders, College of the Muscogee Nation**

ROAD SYSTEM ECOLOGY

Road systems can influence an area of an ecosystem. Water run-off and terrain erosion from a road influences what discharge goes into the nearby land. In the city of Okmulgee there are many areas in which industrial and agriculture can affect the ecosystem. A series of chemical soil and water quality testing was conducted to determine if indeed the local road system could influence these aspects of the ecosystem. Rural road sampling and areas in urban areas were selected. The study is currently continuing to discern the findings.

Exhibit #4
Lindsey J. Hendricks
Southwestern Oklahoma State University
Hometown: Bessie, OK
Advisor: Dr. Rickey Cothran, SWOSU

Research Topic: **Pesticide Effects; Sublethal Pesticides**

Researcher(s): **Lindsey J. Hendricks and R. Cothran**
Dept. of Biological Sciences
Southwestern Oklahoma State University, Weatherford, OK
Faculty Advisor: **Dr. Rickey Cothran, Southwestern Oklahoma State University**

PICK YOUR POISON:
SUBLETHAL EFFECTS OF PESTICIDES ON AMPHIPOD LIFE HISTORY TRAITS

Understanding sublethal effects of pesticides is critical because most pesticides are found at low concentrations in nature, which may harm organisms but not kill them. We know little of how sublethal concentrations affect ecosystems, which led me to explore the sublethal effects of malathion (an insecticide that targets the nervous system) on *Hyalella* amphipods (small, freshwater crustaceans). Individuals were collected from two populations in western Oklahoma that differ in proximity to agriculture. For both populations, I selected 60 male-female pairs of amphipods and equally distributed them across three treatments of malathion: no pesticide (0 ppb), low sublethal concentration (0.005 ppb), and high sublethal concentration (0.02 ppb). Each pair was exposed to the treatment concentration until they produced two broods of offspring. I measured how life history traits, which are traits directly related to survival and reproduction, responded to the malathion treatments. Specifically, I measured growth rate for both sexes. I also measured female fecundity (the number of offspring per female) and male gnathopod size (a claw-like appendage), which has been demonstrated to affect male mating success. For both populations, I found no evidence that sublethal concentrations of malathion affect life history traits. This provides some hope that populations can evolve pesticide tolerance to an insecticide that is commonly used in the home and garden and agricultural sectors. However, there are likely limits to the ability of populations to respond evolutionarily. Next, I plan to study the short-term effects of pesticides on behavior. Behavioral response variables will include the ability to find food and other resources and the ability to get away from predators. Effects of pesticides can have broad reaching consequences because amphipods are an important food source for fish and waterfowl, which in turn are an important food source for both wildlife and humans. Therefore, negative effects of pesticides on amphipods and other aquatic invertebrates may impact fishing and hunting, which are an important part of Oklahoma's economy.

Exhibit #5
Matthew B. Henry
East Central University
Hometown: Paoli, OK
Advisor: Dr. Nicholas Jacob, ECU

Research Topic: **Fluid Flow**

Researcher(s): **Matthew B. Henry**
Dept. of Mathematics and Computer Science
East Central University, Ada, OK
Faculty Advisor: **Dr. Nicholas Jacob, East Central University**

VELOCITY DENSITY FUNCTION WITH EDGEWORTH EXPANSION AND MACROSCOPIC PROPERTIES

Abstract

A system of particles in a non-equilibrium state will have a probability density function on the phase space describing the positions and momenta as well as macroscopic properties such as temperature, pressure, stress and heat. The Grad 13th moment approximation is centered at equilibrium and identifies these macroscopic properties as the moments of the momenta. Utilizing generalized Hermite Polynomials and centering the approximation at the Gaussian distribution to account for the non-equilibrium state severely complicates the tensor analysis. We provide a closed form expression of the non-equilibrium centered 13th moment expansion by utilizing a contraction of the stress tensor. It is the hope that this approximation will provide a solution to the Boltzmann Equation and help to create more efficient model for non-equilibrium interactions.

Societal Impact

Approximations of non-equilibrium gases and fluids provide insight to multiple different societal concerns. Oil production, turbulent weather and biological processes each have applications of my research and are concerns found in Oklahoma and across the globe. In oil applications, viscous fluids are flowing through pipes in each the extraction, refinement, and delivery processes. A better approximation of the fluid's dynamics within the pipe could provide the necessary knowledge to engineer better pipe materials and improve extraction. As for turbulent weather, gases in the atmosphere are constantly experiencing changes in macroscopic properties. Using this research, perhaps forecasters could better predict weather phenomena. This research is also applicable in medicine. All of the processes within the body take place with either a gas or fluid, if not both. Applying knowledge of a better approximation describing these fluids could provide medical researchers with facts about blood flow, air flow through the lungs, and assist biological engineers in building artificial replacements. From engineering to medicine, my research can benefit the state of Oklahoma and the world.

Exhibit #6
Jaclyn D. McCasland
University of Science and Arts of Oklahoma
Hometown: Chickasha, OK
Advisor: Dr. Leah Oxenford, USAO

Research Topic: **Water Budgets & Management**

Researcher(s): **Jaclyn D. McCasland[1] and L. Oxenford[2]**
[1]Division of Science, [2]Dept. of Biology
University of Science and Arts of Oklahoma, Chickasha, OK
Faculty Advisor: **Dr. Leah Oxenford, University of Science and Arts of Oklahoma**

EVALUATION OF SURFACE WATER RESOURCE MANAGEMENT TOOLS FOR SUSTAINABLE STEWARDSHIP OF THE USAO HABITAT AREA LOWER POND

Management of surface water resources is of increasing concern to central Oklahoma as runoff dominated systems become increasingly unreliable as dependable water sources due to drought. The purpose of this research is to determine the monthly bulk storage of the USAO Habitat Area lower pond by empirical and theoretical methods to assess the water storage volume and its correlation to water quality. Calibration of a local model is important for water management of the USAO Habitat Area resources because national data does not describe local conditions and lacks the resolution required to describe local weather patterns, and thus the Oklahoma Mesonet was applied to calculate the evapotranspiration term in the simplified water storage equation ($V = P_d + S_r$-ET) using the simple Abtew, Hargreaves and Samani, and Thornthwaite methods. Evapotranspiration is the only system output. System inputs include direct precipitation (P_d) on the surface area of the pond (6000-7000 m^2) and surface runoff (S_r) from the watershed that drains into the impoundment from an upland mixed grass prairie. System inputs were measured using the local Mesonet weather station (#27). Data collection spanned from January 2017 to November 2017. Water storage volume was calculated monthly from surface area and depth measurements. Water quality was monitored via grab sample with a Lamotte Freshwater Aquaculture Kit (Model AQ-2) for onsite nutrient testing and PASCO GLX Explorer for *in situ* measurements of turbidity(NTU) and conductivity (µS/cm). Water resource health was determined by correlating storage to water quality parameters (ammonium (NH_4+), Nitrate (NO_3-), Nitrite (NO_2-), Hardness (ppm), alkalinity (eq. $CaCO_3$), pH, dissolved oxygen, chloride (Cl-), and phosphate (PO_4^{3-})). It was found that the Simple Abtew method best reflected actual in-field measurements. Dissolved oxygen was loosely correlated (R^2=0.6388) and the ammonium ion concentration was strongly correlated (R^2=0.8503) to precipitation and runoff. A custom model to define the relationships between water quality and quantity for locally managed water resources is essential for water resource decisions. These tools will have an important societal impact for local water management strategies because it will save managers time and money in the assessment of available water resources and predicted quality issues.

Exhibit #7
Myshal D. Morris
Langston University
Hometown: Tulsa, OK
Advisor: Dr. Byron Quinn, LU

Research Topic: **Immune System**

Researcher(s): **Myshal D. Morris and B. Quinn**
Dept. of Biology
Langston University, Langston, OK
Faculty Advisor: **Dr. Byron Quinn, Langston University**

METABOLOMICS ANALYSIS OF THE DYSREGULATED IMMUNE SYSTEM IN ASTRONAUTS FOR EXTENDED SPACE MISSIONS USING GROUND ANALOGS

The impact of reduced gravity on cellular function is of intense interest for NASA's journey to Mars mission. Since the 1960s and 1970s, studies show dysregulation of the immune system occurring under space conditions in crewmembers. Immune system dysregulation results in the reactivation of latent viruses. Because of reduced gravity, reactivated chicken pox viruses were detected at higher levels in astronauts when they returned from Apollo missions. The hypothesis is that there is a difference in the metabolomics profile of immune cells under microgravity conditions versus cells in earth gravity conditions. Methods include growing immune cells using the clinostat model to simulate a microgravity environment and comparative analysis of cells in a static environment. Metabolomics data was collected using a mass spectrometer on each condition. Results of this experiment show that different metabolites are present in the simulated microgravity conditions compared to earth gravity conditions. In conclusion, the results indicate the important changes in cellular metabolic pathways with the introduction of microgravity conditions. Future work will consist of looking at possible countermeasures to enable safe return of crewmembers on extended NASA missions.

Societal Impact

The understanding of the immune system under different conditions allows for a more complete picture of how the immune system works in humans. These results could help identify new treatment methods for diseases by understanding complex molecular pathways of immune cells.

Exhibit #8
Brittany Palmer
Northwestern Oklahoma State University
Hometown: Fort Gibson, OK
Advisor: Dr. Leslie Collins, NWOSU

Research Topic: **Central Line Infections**
Researcher(s): **Brittany Palmer, S. Jin Cho, and T. Morgan**
Division of Nursing
Northwestern Oklahoma State University, Alva, OK
Faculty Advisor: **Dr. Leslie Collins, Northwestern Oklahoma State University**

CENTRAL LINE INFECTIONS AND CARE BUNDLES

With a rise in the use of central lines, in critically ill patients, the risk of central line associated bloodstream infections has increased. The purpose of this evidence-based project was to determine how to reduce bloodstream infections related to central lines. A central line, or central venous catheter, is a catheter inserted into a vein that passes through until it reaches an area near the heart. They are used for diagnostic purposes, such as collecting blood to check lab values, and for therapeutic purposes, such as receiving medication. Central lines are ideal for patients who require medication therapy over an extended period of time, weeks or even months. Central line bloodstream infections occur due to microorganisms at the site of insertion or inadequate care provided while the central line is in place. One option for decreasing central line associated bloodstream infections is using a care bundle intervention. The care bundle intervention in this project includes: optimal hand hygiene with skin antisepsis with chlorhexidine, maximum barrier precautions during insertion, choice of optimal insertion site, and daily evaluation of need and prompt removal of the line. The results concluded that the most effective approach to decreasing central line bloodstream infections was using maximum barrier precautions during insertion. After extensive research, the care bundle has shown to be effective in decreasing bloodstream infections related to the central line. The impact to society related to this intervention being in place, would result in less money lost during hospital stay, a decrease in healing time, and a decrease in the risk of death. All of these issues can be greatly reduced with the proper use of the care bundle intervention, mentioned above.

Exhibit #9
Aleigh Peiroo
Cameron University
Hometown: Lawton, OK
Advisor: Dr. Kyle Moore, CU

Research Topic: ***E. coli*** **- Bioenergetics and Membrane Protein Structure**

Researcher(s): **Aleigh Peiroo, K. J. Moore**
Dept. of Chemistry, Physics, and Engineering
Cameron University, Lawton, OK
Faculty Advisor: **Dr. Kyle J. Moore, Cameron University**

NOVEL CROSS-LINKING IN F_o PORTION OF *E. COLI* ATP SYNTHASE AND IMPLICATIONS FOR ENERGY GENERATION

The F_1F_o ATP synthase in E. coli is an essential enzyme complex that is responsible for most of the chemical energy inside the cell. The F_1F_o ATP synthase can be targeted by antibiotics since bacteria need F_1F_o ATP synthase to grow efficiently. High resolution models exist for all proteins in the complex except subunit *a*. Subunit *a* is the essential proton (H^+) channel that couples the exergonic transport of H^+ to ATP synthesis in the F_1 portion. Recently, low resolution structural evidence has provided the best picture of the H^+ channel in subunit *a*. However, previous biochemical data predicted a radically different channel structure compared to the new low resolution model. The structure of subunit *a* has a direct impact on its function as a proton channel and thus on the overall function of F_1F_o ATP synthase. In this study we report a novel Cys-Cys cross-link in the F_o portion that investigates the validity of the new model.

Exhibit #10
Steven J. Shirley
Northeastern State University
Hometown: Broken Arrow, OK
Advisor: Dr. Sapna Das-Bradoo, NSU

Research Topic: Cancer Research

Researcher(s): Steven J. Shirley, T. Noble, C. Eddington, B. Fultz, and S. Das-Bradoo
Dept. of Natural Sciences, Gregg Wadley College of Science and Health Professions
Northeastern State University, Broken Arrow, OK

Faculty Advisor: Dr. Sapna Das-Bradoo, Northeastern State University

DECIPHERING THE GENETIC LOCATION OF PROTEIN INTERACTIONS IMPORTANT IN REPLICATION AND DNA DAMAGE RESPONSE

New cancer therapies require understanding the roles and mechanisms of proteins, especially those keeping our genome stable. Many proteins involved in DNA replication, DNA Damage Response, and checkpoint activation are not fully understood. Most of these proteins are essential for the cell to survive and critical to prevent and shut down cancerous cells. Our laboratory's research focuses on two of these proteins and their genes: (1) Minichromosome maintenance protein 10 (Mcm10), an essential scaffolding protein, and (2) Pol2, the essential catalytic subunit of Polymerase Epsilon, an enzyme, which synthesizes DNA. Our laboratory previously found that Mcm10 interacts strongly with the C-terminus end of Pol2. Currently, my research is measuring the strength of interaction between Pol2 and Mcm10 and other subunits of Polymerase Epsilon. These results will help us identify specific amino acids on Pol2 that interact specifically with Mcm10. To achieve this goal, we mutated the Pol2 gene at different amino acid locations and then used yeast-two hybrid assay to quantify the interactions. My research, specifically, examined two mutant forms of Pol2 —a double mutant at locations 1425 and 1428 and a single mutant at 1442—and tested interactions with Mcm10 and Dpb2 (another subunit of Polymerase Epsilon). Protein-protein interactions were investigated by yeast-two hybrid using X-gal plates for qualitative analysis and Beta-galactosidase assay for quantitative measurements. The assays showed that both the single and double Pol2 mutants abrogated interaction with Mcm10, however, only the double mutant was able to still form a complex with Dpb2. These results suggest that 1425 and 1428 amino acid region on Pol2 is required to interact with Mcm10. Our research will help explain the genome maintenance pathways that are critical for cancer development.

Societal Impact

By understanding the mechanisms that prevent and correct DNA damage, we can significantly improve cancer diagnosis and treatment.

Exhibit #11
Connor West
University of Central Oklahoma
Hometown: Oklahoma City, OK
Advisor: Dr. Wei Chen, UCO

Research Topic: **Laser Immunotherapy**

Researcher(s): **Connor West, Y. Li, E. Layton, W. R. Chen, and F. Zhou**
Biophotonics Research Laboratory, Center for Interdisciplinary Biomedical Education and Research, College of Mathematics and Science; University of Central Oklahoma, Edmond, OK
Faculty Advisor: **Dr. Wei Chen, University of Central Oklahoma**

IMMUNOLOGICAL AND THERMAL PROPERTIES OF GOLD NANORODS IN LASER IMMUNOTHERAPY FOR CANCER TREATMENT

Laser immunotherapy (LIT) is a novel treatment method for various cancer types, notably late-stage metastatic cancers. LIT implements localized near-infrared light irradiation coupled with stimulation of the immune system using specific biomolecules. These two main tenets of LIT work together to provoke a systemic anti-tumor immune response against metastatic tumors. To compound the thermal effects of the near-infrared laser irradiation, highly specific photo-absorbent nanomaterials are implemented into LIT. As nanomaterials research continues to increase, various forms of nanomaterials are being developed for biomedical applications. LIT focuses on nanomaterials that can both convert near infrared light into thermal energy, as well as carry biomolecules for immune stimulation. Two specific nanomaterials have been used in our lab, Gold Nanorods (AuNR) and Single-Walled Carbon Nanotubes (SWNT), which can be manufactured to absorb specific wavelengths of light. Previous studies have proven that SWNTs are highly effective in both photothermal induction and drug delivery. While SWNTs have proven effective, evidence of their toxicity has become more prevalent, leading to the search for alternatives such as AuNRs, mainly due to the precedence for using gold derivatives in human applications. AuNRs can also absorb near infrared light, as well as can be conjugated with biological molecules to induce immune response. Temperature increase in both solutions and phantom gels has been explored using both nanomaterials with a 1064nm laser, and shown comparable results, leading to the belief that AuNRs could replace SWNTs in LIT. Experiments have been conducted to explore the immune effects of AuNRs conjugated with immune stimulating molecules and the cell viability following laser irradiation. With comparable thermal capacity to SWNT, and marked immune stimulation efficiency, AuNRs could be used in LIT as a cancer treatment modality. Future work will include in vivo LIT treatment using aggressively metastatic tumor models in animals, using AuNRs as both absorbers of laser energy and carriers of immunological stimulant.

Keywords: laser immunotherapy, metastatic cancers, carbon nanotubes, gold nanorods, photothermal effect

Exhibit #12
Payton S. Whitehead
Southeastern Oklahoma State University
Hometown: Colbert, OK
Advisor: Dr. Nancy Paiva, SOSU

Research Topic: Enzyme Biochemistry

Researcher(s): Payton S. Whitehead, L. Chandler, E. Landers, and N. L. Paiva
Dept. of Chemistry, Computer, and Physical Sciences
Southeastern Oklahoma State University, Durant, OK
Faculty Advisor: Dr. Nancy Paiva, Southeastern Oklahoma State University

INCREASED EXPRESSION AND PURIFICATION OF *MEDICAGO TRUNCATULA* CDNA-DERIVED ANTHOCYANIN REDUCTASE

Introduction: Condensed tannins are thought to benefit human health by serving as natural antioxidants, reportedly reducing cancer rates and heart disease. Anthocyanin reductase (ANR) was discovered to be a key enzyme controlling condensed tannin biosynthesis in dicot plants (Xie et al., 2003,) but little has been published about the biochemical characterization of ANR enzymes from different species. Our main emphasis of this project was on trying to improve the expression levels of ANR protein in an *E. coli* pMAL expression system using an available *Medicago truncatula* ANR cDNA clone by deleting a portion of the protein sequence, and by moving the plasmid construct from a cloning host to a expression host. With the ANR protein we will then produce anti-ANR antibodies for use in future biochemical assays.

Methods: Restriction enzyme digest was used to remove desired portion of the ANR sequence. Gel electrophoresis was used to confirm if desired cut product was obtained. SDS-PAGE gels were used to verify desired protein production. Affinity chromatography was used to purify protein.

Results: Partial deletion of the protein sequence, transfer of plasmid into a protease deficient host (NEB-Express), and use of protease inhibitors increased production and recovery of the ANR protein. A sufficient quantity of protein was then produced to be used to make antibodies.

Conclusion: Partial deletion of the gene sequence and optimization of conditions did produce a sufficient quantity of protein for antibody production.antibodies.

Societal Impact: By transforming and optimizing the production of ANR in vegetable bearing plants, we can begin to market produce that contains an increased amount of condensed tannins. In turn this will help to increase the overall health of the public who consume the healthier produce.

Research in this abstract was supported by the National Institute of General Medical Sciences of the National Institutes of Health under award number P20GM103447. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Exhibit #13
Rebecca Yacyszyn
Rose State College
Hometown: Yukon, OK
Advisor: Dr. S. Matthew DeSpain, RSC

Research Topic: **Native American Sovereignty**

Researcher(s): **Rebecca Yacyszyn**
Division of Social Sciences
Rose State College, Midwest City, OK
Faculty Advisor: **Dr. S. Matthew DeSpain, Rose State College**

LIPAN APACHE: SOVEREIGNTY THROUGH MOBILITY

My focus is on the Lipan Apaches of the 18th century and how they sustained their sovereignty in an era of constant turmoil because of expanding colonization, shifting political powers and attacks by other tribes. Sovereignty includes the political, cultural and linguistic means that a society employs to maintain their unique identity and cohesion as a community. Therefore, sovereignty is a complex issue that lies at the heart of how a nation sustains itself as a people and is relevant in both a contemporary and a historical sense.

Drawing on the works of prior scholars, notably Stephen Warren and his work offering a new look at the Shawnee tribal identity being derived from their mobility instead of a connection with one specific homeland; and Juliana Barr's cutting-edge theory of Indigenous borderlands, we begin to take a closer look at the Lipan Apache' sovereignty. Through the use of primary documents, such as Spanish maps and anthropological reports, we see the world of the Lipan begin to unfold. In the past, the wisdom of their migratory lifestyle has been called into question and their history somehow seen as less important because the boundaries of their territory shifted. Through this lens, the Lipan Apache emerge as a politically savvy people who sustained their sovereignty in the midst of a tumultuous era of change that included shifting geographical boundaries and political demographics.

This study utilizes ethno-history in order to focus on the Lipan as a tribal people themselves instead of the meta-narrative of the past, and is consistent with new trends in New Indian History. In addition, this work offers an Indian-centered voice that is relevant to today's society. As we look at the Lipan experience of the past, we see how they sustained their sovereignty and cultural cohesion and have been successful at remaining a culturally and politically sovereign people to the present day.

Exhibit #14
Paul Delgado
University of Oklahoma
Hometown: Norman, OK
Advisor: Dr. Sara Mata, OU

Research Topic: **Diabetes in Latinos**
Researcher(s): **Paul Delgado**
Dept. of Biology
University of Oklahoma, Norman, OK
Faculty Advisor: **Dr. Sara Mata, University of Oklahoma**

A PERSPECTIVE ON DIABETES IN THE OKLAHOMA CITY LATINO COMMUNITY

The growing Latino population is often plagued with a great deal of economic, social, and health needs unique to this community. Latinos have become the largest minority group in the U.S. They also bear a burden of social inequality in the U.S. suggesting that they might expect higher rates of illnesses and overall health problems. It is important to understand the nature of the health disparities faced by the Latino community. The Center for Disease Control and Prevention (CDC) has reported that the percentage of Hispanics between the ages of 18-74 diagnosed with diabetes is 16.9% (Schneiderman et al., 2014). This study explores the perspectives and knowledge of type 2 diabetic patients in the urban community of Oklahoma City. Seven patients diagnosed with diabetes served as research participants. The research began with a pre-survey allowing participants to self-report their attitudes and knowledge regarding diabetes. The treatment phase consisted of three classes in Spanish every other week. The course content included information on the nature of diabetes and preventive measures for improving health outcomes. A post-instruction questionnaire was administered at the end of the third class session. Data from the pre-survey and post-instruction questionnaire were analyzed. The purpose of the study was to test whether medical information provided in a populations' native language can alter outlooks and behaviors to prevent diabetes progression and improve health. Although not generalizable, the findings provide unique insight into the knowledge, behaviors, attitudes, and perspectives about diabetes self-management and the coping of the illness in the Latino community of Oklahoma City.

Exhibit #15
Austin K. Fehr
The University of Tulsa
Hometown: Oklahoma City, OK
Advisor: Dr. Tyler Johannes, TU

Research Topic: **Microalgae**

Researcher(s): **Austin K. Fehr**
Russell School of Chemical Engineering
The University of Tulsa, Tulsa, OK
Faculty Advisor: **Dr. Tyler Johannes, The University of Tulsa**

THE EFFECTS OF LIGHT SOURCES ON NUTRIENT PRODUCTION IN THE GROWTH PHASE OF *CHLAMYDOMONAS REINHARDTII*

The development of microalgae as a source of energy, medicine, and food is widely recognized as valuable, but the process is very complex and the effects of each individual variable are not yet fully understood. Light source is one important variable that greatly affects the growth rate and nutrient composition of algae and could be a simple method to control them in scaled operations requiring unique outcomes. The purpose of this research is to compare the growth rates of *Chlamydomonas reinhardtii*, a model alga strain, under differing light sources: Cool White and Gro-Lux. Cool White lights have a more evenly distributed spectrum whereas Gro-Lux lights have very high intensity around 440 and 660 nm (red and blue), which are substantially closer to the peak absorbances of chlorophylls a and b. The initial cell concentration, growth media composition, and electric power input to lights were controlled. The dry weight, as well as the concentrations of protein, carbohydrates, and chlorophylls *a* and *b* were measured during the growth phase. The dry weights did not differ significantly between the different light sources. This might give the impression that lights focused on the peak absorbances of chlorophylls *a* and *b* do not yield significantly greater growth; however, power input to the light sources is not the same as light flowrate per unit area, which was 1.5 times higher for Cool White than for Gro-Lux. Even at roughly equal dry weights, there was significant variation in the composition of nutrients. Cool White lights yielded 288% more carbohydrates whereas Gro-Lux produced 188% more protein and about 108% more chlorophyll. These results show that nutrient composition is affected by changing light exposure wavelengths, and could lead to greater control or optimization in the future.

Exhibit #16
Nicholas Paul Foster
Oklahoma State University
Hometown: Edmond, OK
Advisor: Dr. Jamey Jacob, OSU

Research Topic: **Meteorological Drones**

Researcher(s): **Nicholas Paul Foster, D. Johnson, and J. Jacob**
Dept. of Mechanical and Aerospace Engineering
Oklahoma State University, Stillwater, OK
Faculty Advisor: **Dr. Jamey Jacob, Oklahoma State University**

METEOROLOGICAL DATA COLLECTION WITH UNMANNED AIRCRAFT FOR THREE-DIMENSIONAL FORECASTING ADVANCEMENTS

Weather forecasting has advanced greatly with the advent of modern weather radar, but is still largely focused on macro scale phenomena. Much of the data is restricted to upper atmosphere phenomena, but our goal is to develop methods to collect data at lower altitudes where severe storms begin their development through convective initiation. Data within these lower altitudes might provide insight into the formation of severe storms and allow us to create three-dimensional weather forecasts at the meso-scale level with greater accuracy than currently.

The goal of this research is to develop low cost deployable dropsondes that can collect meteorological data at altitudes previously unreachable by other data acquisition devices. This data will then be provided to the National Weather Service for processing and analysis in order to create weather forecasts at the meso-scale level, providing the capability to improve timing and accuracy of severe storm predictions and “warn on forecast.” The team developed a sensor suite called MDASS, or *Meteorological Data Acquisition Sonde System*, that can collect and transmit live data necessary for developing such forecasts as well as be equipable to multiple platforms ranging from fixed-wing and multi-rotor unmanned aircraft to rockets. The data transmitted from MDASS can then be viewed and stored on a ground control station for real-time data analysis. This work can potentially provide insight into how and why severe storms form and thus improve their warning times, saving lives and property.

This work is supported in part by Oklahoma State University through the Lew Wentz Foundation and the Niblack Research Scholars program, and the National Science Foundation under Grant No. 1539070, Collaboration Leading Operational UAS Development for Meteorology and Atmospheric Physics (CLOUD-MAP).

Societal Impact Statement:
Meteorological data collected using unmanned aircraft can be used to create weather forecasts at the meso-scale level. This can provide the capability to improve timing and accuracy of severe storm predections and “warn on forecast,” potentially saving lives and property.

Exhibit #17
Emily Gietzen
Oklahoma State University
Hometown: Pryor, OK
Advisor: Dr. Erika Lutter, OSU

Research Topic: Genetics

Researcher(s): Emily Gietzen, E. Lutter, and P. Sah
Dept. of Microbiology and Molecular Genetics
Oklahoma State University, Stillwater, OK

Faculty Advisor: Dr. Erika Lutter, Oklahoma State University

GENETIC KNOCKDOWN SYSTEM FOR *CHLAMYDIA TRACHOMATIS*

Chlamydia trachomatis is an obligate intracellular pathogen that is commonly sexually transmitted among humans. In fact, it is the most commonly reported sexually transmitted disease in the United States. It is estimated that over three million people each year are infected with *Chlamydia*. Of these three million people, only about a third have been found to seek treatment. Even after treatment and clearance of the infection, long term health problems such as pelvic inflammatory disease, scarring of the fallopian tubes, tubal infertility and ectopic pregnancies are still of great concern. Until recently *Chlamydia* has been genetically intractable, thereby limiting genetic approaches. However, recent developments have allowed for the development of novel genetic tools which can be used to mutate specific genes. Unfortunately, gene inactivation by targetron or antibiotic cassette insertion can result in polar effects of neighboring genes making it difficult to study the genes within operons. This study focuses on developing a novel knockdown strategy by expressing the reverse complement specific *Chlamydia* genes on a shuttle plasmid. Once cloned the plasmids will be transformed back into *Chlamydia* and the genes expressed *in trans* will be transcribed and bind the RNA of the corresponding gene producing double stranded RNA which is degraded. This method will allow us to look at individual genes in an operon without the polar effects of mutations. This strategy is being used on an operon containing 6 genes. After the reverse complement of each gene is expressed, the decreased expression of the target gene will be assessed by reverse transcription PCR. The other genes in the operon will also be assessed to verify that their expression is not altered. These experiments will be the first to utilize a gene specific knockdown strategy in *Chlamydia* which can be utilized to understand the specific role of individual genes in host infection and *Chlamydia* pathogenesis.

Societal Impact Statement:

Chlamydia is the most commonly sexually transmitted disease in the United States and effects more than three million people every year. The long term effects of Chlamydia lead to ectopic pregnancies, infertility and cervical cancer and therefore must be researched further in order to help resolve these issues.

Exhibit #18
Madison Granger
OU Health Sciences Center
Hometown: Newcastle, OK
Advisor: Dr. Danny Dhanasekaran, OUHSC

Research Topic: Ovarian Cancer

Researcher(s): Madison Granger[1,3], R. Radhakrishnan[1,3], M. Jayaraman[1,2,3], J. H. Ha[1,2,3], and D. N. Dhanasekaran[1,2,3];
[1]Dept. of Cell Biology, [2]Stephenson Cancer Center;
[3]University of Oklahoma Health Sciences Center, Oklahoma City, OK

Faculty Advisor: Dr. Danny Dhanasekaran, University of Oklahoma Health Sciences Center

IDENTIFICATION OF NOVEL ONCOGENIC LONG NONCODING RNAS IN OVARIAN CANCER

Societal Impact Statement: Ovarian cancer is the most fatal gynecologic cancer having a five-year survival rate of only 46%. Since current treatment modalities including chemo- and radiation-therapy lack specificity, there is an intense focus on developing novel targeted therapies for ovarian cancer.

Introduction: One of the targets involves long non-coding RNAs (lncRNAs), which are RNAs longer than 200 nucleotides that do not code proteins. Instead, they regulate gene expression by interfering with mRNA transcription and translation, altering mRNA stability, and coactivating transcriptional enzymes. LncRNAs have already shown overexpression in several cancers. A lncRNA profiling that has been carried out in the laboratory indicated the upregulation of 3385 lncRNAs in ovarian cancer cells. In this study, six of those lncRNAs were selected for qPCR validation, and each showed upregulation.

Methods: The lncRNAs KLK8, MIR99AHG, LOC101927318, PRKCQAS1, PWARSN and LINC01508 were selected from the array. RNA was extracted from four cell lines, converted to cDNA, and then subjected to real time PCR. Gradients and melt curves helped determine annealing temperatures for the primers. The lncRNA expression was analyzed using the $2^{-\Delta\Delta Ct}$ method.

Results: Six of the lncRNAs from the array were selected for PCR validation. The gradients showed the optimal annealing temperature to be 65^0C for KLK8 and 56^0C for the other lncRNAs. The lncRNAs showed upregulations ranging from 3 to over 4000 times the control.

Conclusion: This study validated the upregulation of a panel of six lncRNA in ovarian cancer cells. Following further confirmation of these results in biological triplicates, these lncRNAs will be assessed for their utility as diagnostic, prognostic, and/or therapeutic targets in ovarian cancer.

Exhibit #19
Matthew D. Hart
Oklahoma State University
Hometown: Edmond, OK
Advisor: Dr. Winyoo Chowanadisai, OSU

Research Topic: Genetics

Researcher(s): Matthew D. Hart, M. Strong, T. Z. Tang, K. N. Jerome, and K. G. Wang
Dept. of Nutritional Sciences
Oklahoma State University, Stillwater, OK
Faculty Advisor: Dr. Winyoo Chowanadisai, Oklahoma State University

GENETIC VARIATION IN ZINC TRANSPORT ZIP13 AND IMPLICATIONS FOR CELL STRESS RELATED DISEASES

Genetics play a large role in determining disease risk in human populations. Loss of ZIP13, a gene which encodes a zinc transporter, has previously been associated with skin and connective tissue disease. However, evidence suggests that ZIP13 plays a critical role in the tissue health of many body tissues including the nervous system. We provide evidence that loss of ZIP13 may induce cell stress by promoting protein misfolding leading to poor cellular health in neuronal cell models. Neuroblastoma cells in which ZIP13 has been repressed fail to extend neurites when compared to control cells with appropriate amounts of ZIP13. We have also identified two drugs (4-PBA and TUDCA) which have shown the ability to restore neurite outgrowth in cells lacking ZIP13. These drugs have previously shown the ability to repress the cellular stress response associated with protein misfolding providing further evidence that loss of ZIP13 causes cell stress. Mutations in ZIP13 may be risk factors for a wide variety of diseases in which cellular stress is implicated including Alzheimer's Disease and type II diabetes. It is possible that individuals with these mutations could be identified and steps could be taken proactively to avoid the onset of these diseases or to lessen their severity. This work may eventually identify viable therapeutics for people afflicted by diseases induced by loss of ZIP13 and provide insight into the role of ZIP13 in tissues not classically associated with ZIP13 function.

Societal Impact Statement:

This work may eventually improve our understanding of genetic predisposition to a wide range of diseases and provide potential mechanisms of therapy which can be targeted personally based on genetic sequencing.

Exhibit #20
Devin W. Laurence
University of Oklahoma
Hometown: Bartlesville, OK
Advisor: Dr. Chung-Hao Lee, OU

Research Topic: Cardiovascular Research; Individualized Surgery

Researcher(s): Devin W. Laurence and C. -H. Lee
School of Aerospace and Mechanical Engineering
University of Oklahoma, Norman, OK
Faculty Advisor: Dr. Chung-Hao Lee, University of Oklahoma

AN INTEGRATED EXPERIMENTAL-COMPUTATIONAL APPROACH FOR MULTISCALE INVESTIGATIONS OF ATRIOVENTRICULAR HEART VALVES WITH APPLICATIONS TO INDIVIDUAL-OPTIMIZED SURGERY PLANNING

Societal Impact Statement

This work focuses on the use of an integrated experimental-computational approach for multiscale investigations of the atrioventricular heart valve (AHV) system. Through developing key insights into AHV function, this research will enable **patient-specific, simulation-informed,** pre-surgical recommendations to improve the durability of AHV surgical repair associated with the ~50,000 Americans who undergo AHV treatment per year.

Abstract

The mitral valve (MV) and tricuspid valve (TV) are AHVs, which facilitate the unidirectional blood flow through the heart during regular function. About 50,000 Americans undergo surgical repair annually to correct leaflet regurgitation; however, there is a disappointing recurrence rate (15-20%) of both mitral and tricuspid regurgitation approaching 10 years after the initial repair[1-3]. AHVs are composed of leaflets with complex mechanical behavior and tissue microstructure[4]. Previous computational models only focused on single-scale function at either the tissue- or organ-level[5]. The objective of our research is to better understand the distinct leaflet contributions to AHV mechanical behavior through a high-fidelity, multi-scale computational model that will accurately predict variations in biomechanical responses in healthy, diseased and surgically repaired tissues. The computational model is built and refined through an experimental-computational approach with three key ingredients: (i) biaxial experiments to quantify the AHV leaflets' mechanical behavior, (ii) development of a post-mortem beating heart apparatus for imaging functioning valves, and (iii) application of the acquired experimental information to validate the computational model. This approach will provide the groundwork for future extensions into patient-specific heart valve modelling and will ultimately facilitate objective recommendations for the timing and strategy of personalized AHV surgery, significantly improving long-term treatment outcomes.

References:

[1] Condado JA, et al., JIRC 2003, 16(6): 523-534, [2] Flameng, et al., Circ. 2003, 107(12): 1609-1613, [3] Taramasso M, et al., GTCS 2016, 38(9): 639-647, [4] Jett SV, et al., JMBBM, Submitted, [5] Lee C-H, et al., BMMB 2015, 14(6): 1281-1302.

Exhibit #21
Grace Katherine Ogden
Oklahoma State University
Hometown: Perkins, OK
Advisor: Dr. Misha Manuchehri, OSU

Research Topic: Herbicide Resistance

Researcher(s): Grace Katherine Ogden[1], M. Manuchehri[1], K. Cole,[1] J. Crose[1], and A. C. Hixson[2]
[1]Dept. of Plant and Soil Sciences, Oklahoma State University, Stillwater, OK;
[2]BASF Corp., Lubbock, TX
Faculty Advisor: Dr. Misha Manuchehri, Oklahoma State University

MANAGEMENT OF ITALIAN RYEGRASS IN OKLAHOMA WINTER WHEAT

Weeds cost producers more in potential losses than any other crop pest (Oerke, 2006). A common tool used to manage weed populations are herbicides. When herbicides are integrated into a weed management system, they can be a vital tool in efficiently producing a sustainable crop. Unfortunately, herbicide resistant weeds naturally exist in cropping systems and can quickly take over a field if multiple weed management strategies are not considered. Herbicide resistance is the inherited ability of a plant to survive and reproduce following exposure to a dose of herbicide normally lethal to the wild type (WSSA 2017). The number of herbicide resistant weeds, at the state, national, and global level, has been increasing at a drastic rate for the last four decades. Herbicides that once successfully controlled specific weeds are no longer successful, leaving growers with limited management options. One herbicide resistant weed of importance to Oklahoma winter wheat growers is Italian ryegrass [Lolium perenne L. spp. multiflorum (Lam.) Husnot]. Italian ryegrass is a winter annual weed with a life cycle that is very similar to winter wheat. Italian ryegrass densities of 158 plants m^{-2} has been found to reduce wheat grain yields in Oklahoma by 20% and wheat grain total price discounts by 26 cents/hectoliter (Medlin et al. 2009). There are several confirmed populations of Italian ryegrass that are resistant to the ALS herbicide mode of actions; however, 2016-17 field studies in Perkins, OK suggested that there also may be plants in the state that are resistant to ACCase herbicides. Greenhouse and field experiments were conducted in both 2016 and 2017 to confirm ACCase resistant populations and to identify successful herbicide management systems. Preliminary screenings confirm that ACCase resistance is developing in the state of Oklahoma and herbicides applied at the preemergence timing offer the best option to control these plants.

Societal Impact Statement:

Herbicide resistant weeds pose as a barrier between producers and their ability to efficiently produce a high quality crop. High quality crops are pivotal components of a safe food supply and tout a strong demand from consumers.

Exhibit #22
Sijalu Paudel
OU Health Sciences Center
Hometown: Lawton, OK
Advisor: Dr. Rajagopal Ramesh, OUHSC

Research Topic: Cancer Research

Researcher(s): Sijalu Paudel[1,5], J. Panneerselvam[1,3,5], R. Ahmed[1,3,5], M. Mehta[2,3,5], A. Munshi[2,3,5], and R. Ramesh[1,3,4,5];
[1]Dept. of Pathology, [2]Dept. of Radiation Oncology, [3]Stephenson Cancer Center, [4]Graduate Program in Biomedical Sciences;
[5]University of Oklahoma Health Sciences Center, Oklahoma City, OK

Faculty Advisor: Dr. Rajagopal Ramesh, University of Oklahoma Health Sciences Center

REGORAFENIB MODULATES YAP1 EXPRESSION IN LUNG CANCER

Societal Impact: Non-small cell lung cancer (NSCLC) represents 80-85% of lung cancers. It represents a very aggressive form of lung cancer and is characterized by resistance to chemo- and radiotherapy thus, finding new ways to inhibit NSCLC will increase the overall survival of lung cancer patients.

Introduction: Yes-associated protein 1 (YAP1) is a transcriptional effector of the Hippo pathway that regulates organ size at homeostasis and tumorigenesis. Overexpression and nuclear accumulation of YAP1 has been reported in various cancers including non-small cell lung cancer (NSCLC) and is associated with tumor initiation and progression. Further, YAP1 has been implicated in drug resistance and metastasis making it an attractive molecular target for NSCLC treatment. Regorafenib, is an oral multi- kinase inhibitor shown to inhibit angiogenesis, and metastasis in various cancers. However, the underlying mechanism of action of Regorafenib for the treatment of NSCLC remains unclear. Here we investigated the efficacy of Regorafenib and its impact on YAP1 in inhibiting human NSCLC cell growth.

Methods: Human NSCLC cells were treated with 1μM of Regorafenib and the growth inhibitory activity determined by trypan blue method. Molecular studies focused on determining YAP1 expression level and its sub-cellular localization in Regorafenib-treated cells by western blotting and immunocytochemistry. DMSO-treated cells served as vehicle control.

Results: Regorafenib treatment significantly reduced the cell viability of NSCLC cells compared to vehicle control. Western blot demonstrated that Regorafenib treatment increased phosphorylation of YAP1 at Ser127 ($pYAP1^{Ser127}$), indicating YAP1 inactivation. In accordance with this, immunofluorescence staining showed cytoplasmic accumulation of YAP1 in Regorafenib-treated cells compared with vehicle control.

Conclusion: Our study provides evidence that Regorafenib regulates YAP1 localization in NSCLC cells that contributes to its antitumor activity.

Exhibit #23
Erhan O. Sarica
The University of Tulsa
Hometown: Broken Arrow, OK
Advisor: Dr. Todd Otanicar, TU

Research Topic: **Oil-Water Separation**

Researcher(s): **Erhan O. Sarica and J. Patel**
Dept. of Mechanical Engineering
The University of Tulsa, Tulsa, OK
Faculty Advisor: **Dr. Todd Otanicar, The University of Tulsa**

MODIFIED GOLD NANOPARTICLE HYDROGEL SYNTHESIS AND SIZE OF HYDROGELS PERTAINING TO OIL-WATER SEPARATION

The purpose of this project is to develop a gold nanoparticle hydrogel and test various sizes of hydrogel, to see the oil-water separation efficiencies of both. The separation of oil and water is crucial due to the recent oil spills that have occurred offshore in the Gulf of Mexico. These types of particles could potentially be used as a sunlight driven method for oil-water removal. As the gold nanoparticle hydrogels are exposed to sunlight they will undergo heating at which point they will undergo a change of state, from hydrophilic (attracted to water) to hydrophobic (water repelling). When this change occurs, the oil is attracted to the hydrogel, due to the hydrophobic-hydrophobic nature of both. When hydrogels are present in an oil-water mixture, they tend to push water out, while the oil becomes entrapped in the matrix of the hydrogel. The oil water separation consisted of a mixture of about 0.4 g oil to 0.1 g hydrogel, which was placed on a heating plate to be heated to 40 degrees C while magnetically stirred for about 30 minutes after reaching this temperature. This reaction proceeds at this temperature because hydrogel undergoes a reversible size transition at 40 degrees C, which is evident by the fog like characteristic of the mixture. After the reaction has proceeded to completion, the hydrogel conglomerate is separated from the oil-mixture. Using a custom developed correlation the percent oil removed could be found. This procedure was repeated with different size ranges of hydrogel, which was used to construct a correlation between the size of the hydrogel and the percent oil removal. This correlation will be a gateway to future studies involving hydrogel like polymers that greatly increase the practicality and efficiency of the oil-water separation. We found that the hydrogel managed to capture more than 150% of its weight in oil.

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-four 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. Outreach and education programs presented and supported by EPSCoR ensure that the state's emerging high tech businesses and research labs will have a highly qualified and diverse applicant pool to draw from for the foreseeable future.

The National Science Foundation awarded Oklahoma EPSCoR $20 million in 2013 under grant number OIA-1301789 for the five-year Research Infrastructure and Improvement (RII) Award, "Adapting Socio-ecological Systems to Increased Climate Variability." Oklahoma State Regents for Higher Education will match the NSF award with an additional $800,000 per year to further support climate variability research and educational outreach programs throughout Oklahoma.

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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 the 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 42,900 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

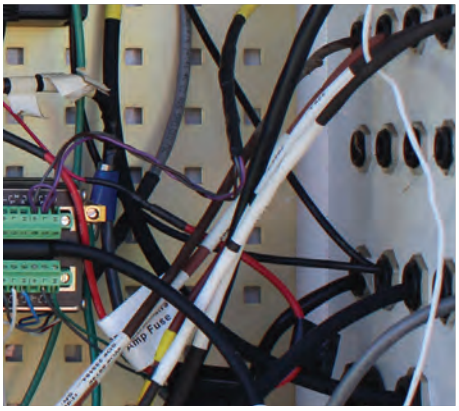
Program	Award	Amount	Type of Award	Total Awards
NSF	EPSCoR	$20.0 Million	Research Infrastructure	1 Award
NIH	IDeA	$19.7 Million	INBRE	1 Award
NIH	IDeA	$75.5 Million	COBRE	8 Awards
NIH	IDeA	$20.3 Million	OSCTR	1 Award
NASA	EPSCoR	$ 2.4 Million	Research Infrastructure	3 Awards

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
2013-2017	$20 Million	$331.6 Million
Total	**$51 Million**	**$452.1 Million**

Does not include:
NSF RII Award or State Funds

LEADING THE WAY



ENVIRONMENT

Through EPSCoR support, state-of-the-art data loggers (pictured above) and new rain gauges were installed at each of the Mesonet's 120 environmental monitoring stations in 2016. Original gauges, purchased in 1992, were refurbished to serve as a backup system. The newly installed equipment has reduced missing rainfall data by more than 11 percent.

CYBERINFRASTRUCTURE

In 2018 a University of Oklahoma astrophysics team discovered the first planets outside the Milky Way. The discovery was possible due to supercomputing developed through EPSCoR. The OneOklahoma Cyberinfrastructure Initiative, a national model for intrastate collaboration, serves over 100 institutions and has facilitated over $273 million in external funding.

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 OKLAHOMA

Oklahoma NSF EPSCoR outreach and education programs reached over 21,800 Oklahomans in 2017. Individuals representing every group within the science, technology, engineering, and math (STEM) pipeline were served to ensure that the state's emerging high tech businesses and research labs will have a highly qualified and diverse applicant pool to draw from in the foreseeable future.

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Oklahoma EPSCoR is proud to sponsor Research Day at the Capitol and other research & outreach programs that strengthen Oklahoma by encouraging exploration and growth in science, technology, engineering and mathematics.

Oklahoma NSF EPSCoR Programs:

- **Climate Variability Research: Oklahoma State University, University of Oklahoma, Noble Research Institute, The University of Tulsa, Langston University and Other Statewide University Partners**
- **Environmental Science Programs and Curriculum for K-12 Students**
- **Workshops for Students, Scientists and Engineers**
- **Hands-on Instructional Materials and Resources for Educators**
- **Technology Programs for Students**
- **Professional Development Opportunities**
- **Authentic Research Experiences for Undergrads and Teachers**
- **Ability-Enhancing Research Partnerships**
- **Tribal College Outreach**
- **Mentoring and GRE Prep**
- **Entrepreneur Workshops**
- **Online Authentic Climate Curriculum Resources for Teachers**
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