26th Annual

Research Day at the Capitol

Virtual Poster Session
Opens Tuesday, March 30, 2021

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TUESDAY, MARCH 30, 2021

26th Annual
Research Day at the Capitol

Student Participant List & Poster Guide

	Student Researcher	University Represented	Research Topic	Hometown
1	Mrs. Kylee Alexander	Northwestern Oklahoma State University	Nurse Staffing & Patient Safety	Enid
2	Ms. Jamie L. Artussee	College of the Muscogee Nation	Water Quality	Henryetta
3	Ms. Riley Bagwell	Oklahoma Baptist University	Photovoltaics	Meeker
4	Ms. Dianna Arlene Baker	Rose State College	Microbiology	Oklahoma City
5	Ms. Emily Bedea	Southwestern Oklahoma State University	Infectious Disease	Clinton
6	Ms. Rylee K. Dunlap	Southeastern Oklahoma State University	Pandemic Trends	Caddo
7	Ms. Genevieve Gordon	University of Science and Arts of Oklahoma	Rhetoric Anti-Mask	Oklahoma City
8	Ms. Amanda Liske	Northeastern State University	Solvent Synthesis	Pauls Valley
9	Ms. Kayley McBride	University of Central Oklahoma	Cancer	Edmond
10	Ms. Melany Opolz	Cameron University	Photophysical Properties	Lawton
11	Ms. Emily Parker	Rogers State University	Spirituality & LGBTQ+	Owasso
12	Ms. Esmeralda Alcala	University of Oklahoma	Plant Virus	Enid
13	Mr. Aaron J. Austin	Oklahoma State University	Mesoscopic Structures	Edmond
14	Ms. Allana G. Caldwell	University of Oklahoma	Cell Cycle Biology	Stillwater
15	Mr. Daniel A. Cheong	University of Oklahoma	Functional Brain Imaging	Muskogee
16	Mr. Brenden M. Dominick	Oklahoma State University	Machine Learning	Stillwater
17	Ms. Caitlyn A. Hankins	University of Oklahoma	Self-Control Scales	Norman
18	Mr. Seth Harriet	OU Health Sciences Center	Flow-Diverting Stent	Edmond
19	Mr. Evan Isbell	The University of Tulsa	Battery Practices	Jenks
20	Mr. Samuel O. Kauffman	Oklahoma State University	Virtual Reality Simulator	Tulsa
21	Ms. Sierra X. Posey	Oklahoma State University	Anti-Fungal Activity	Coweta

Presented by:

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Poster #1
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NURSE STAFFING AND SAFETY OF PATIENTS

Nurses are a key feature in the health care system, and they have a large impact on patient care. Their roles consist of direct patient care, assisting with activities of daily living (ADLs), medication administration, advocating for their patients, and many other tasks. The purpose of this evidence-based project was to determine if adequate nurse staffing produced better patient outcomes. To answer this question, information was gathered from research databases such as CINHAL, EBSCOhost, and PubMed. Keywords that were searched included, nurse staffing, patient outcomes, mortality rates, and quality of care. The results showed that when nurse staffing was inadequate there were increased rates of mortality, readmissions, increased costs, and poor work environments. It was also found that when nurse staffing was increased there was a direct improvement in the quality of care, workplace morale, patient experiences, and more cost-effective units. This led to the conclusion that when adequate nurse staffing is a priority, there are improved patient outcomes throughout and after the patient's hospital stay. The impact of this study is related to nurses and their patients. If units could adequately staff, it would result in improved patient safety, reduced mortality, improved work morel, and a reduction in overall costs both for the hospital and the patients.

Poster #2
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WATER QUALITIES IN SELECTED AREAS OF OKMULGEE COUNTY

Introduction: Water is life. Considering the critical reliance that the earth has on water, the water qualities influence the human population, plants, and animals. Water quality is defined as being within the standard of federal and state regulations. One major source for water and nutrients is Deep Fork Refuge which provides shelter and food to over three hundred species of animals. Historically, Deep Fork has been known to be a site for human pollution. The Deep Fork Refuge pollutants could inflow to different Oklahoma water systems. Consequently animals may consume any pollution found at the refuge. Other sites such as Nichols Lake and Jim Hall Lake are water sources for a municipality and public recreational activities.

Methods: Areas which were studied in Okmulgee County included Deep Fork Refuge, Nichols Lake, and Jim Hall Lake. Chemical screenings were selected to determine the different toxins and the effects on the ecosystem within Deep Fork National Refuge. Other identified tests used were: Salinity Test (Deep Fork and Deep Fork Boardwalk); Lead (Nichols Lake, Jim Hall's Lake, and Deep Fork); DEHA (Detergent/Soap concentrations) Kit and Water Hardness: (Nichols Lake, Jim Hall's Lake, and Deep Fork).

Results: Based on these results, the water falls within the safe range for drinking according to the Oklahoma Department of Environment of Quality (ODEQ).

Conclusion: The water samples also had traces of minerals that were man-made and some pollutants that were left by mankind. However, these water systems did not test to have a significant, negative impact on the aquatic organisms.

Relevance of Study: One of the selected areas of water has been known to have accidents that may have contributed to the existence of human decomposition within the site. The municipality that receives its water from this source has not provided the correct environmental clean-up procedure nor have they informed the citizens about it. The water quality tests were important because these could have shown the potential health risks and issues with using this water. If these tests had come back with elevated concentrations, certain precautions would need to be taken among state and federal departments.

Poster #3
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SUBNAPHTHALOCYANINE ENSEMBLES – EFFICIENT ELECTRON ACCEPTORS IN ORGANIC PHOTOVOLTAICS

Reliable, renewable, and clean energy is growing in demand to keep up with our ever-growing society. With the consumption and depletion of the world's sources of fossil fuels to meet the increasing demand that society has on energy resources, it is important to think of ways to obtain reliable energy without the consumption of the already limited supply of fossil fuels. One of the most important pieces of technology and innovation is the development of the photovoltaic cell or the solar cell. Photovoltaic cells use the photons emitted from the sun to interact with semiconductors to generate clean useful electricity. With the high demand of cheaper and cleaner sources of energy, there has been a major breakthrough in organic photovoltaics leading to the discovery of myriads of electron donor-acceptor conjugates for harvesting solar energy. When compared with subpththalocyanines (SubPc), the subnaphthalocyanine (SubNPc) entities have a longer pi conjugation system producing a red shift in the absorption spectrum making it more appealing to the present-day scientists in organic photovoltaics. Apart from their use in organic photovoltaic cells, they are also considered to be suitable candidates in photodynamic therapy as photosensitizing agents. Given the importance of Subnaphthalocyanines, this research aims to investigate the axial reactivity of subnaphthalocyanines through the formation of covalent bond to synthesize efficient electron acceptors for organic photovoltaics.

Poster #4
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MICROBIOLOGY IN FRESH WATER AQUARIUM

Microorganisms surround us in our everyday lives. Some are even involved in our hobbies. An aquarium provides a passably controlled environment in which microorganisms can thrive and be isolated. The analysis was conducted to learn what types of microorganisms were needed to ensure a fish tank was a healthy and successful environment for its inhabitants. This experiment consisted of taking samples from various locations within a personal aquarium. The samples where incubated for a prescribed allotment of time. The samples where then placed onto a slide and analyzed under a compound microscope with various strengths of magnification. Many of the microorganisms found in the aquarium were the product of the carbon and nitrogen cycle taking place within the confines of the environment. At the conclusion of the paper, the experiment shed light on the microorganisms needed to preform those cycles efficiently and what would happen if an element of the cycle fell into disproportionate levels. Curiosity is what fueled the experiment, an interest in the inhabitants that exist unseen within the aquatic environment.

Poster #5
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IDENTIFICATION AND CHARACTERIZATION OF AN IMPORTANT METABOLIC ENZYME FROM STREPTOCOCCUS *SANGUINIS*, CAUSATIVE AGENT OF SUBACUTE INFECTIVE ENDOCARDITIS

In the United States, approximately 40,000 people will get diagnosed with subacute infective endocarditis (SIE) this year. A leading cause of this infection is a bacterium called *Streptococcus sanguinis*, which is present in the mouths of most of the human population. In certain populations, these bacteria can invade the heart valves and is the leading cause of SIE. Endocarditis is the inflammation of the heart and heart valves. Infective endocarditis, specifically, is the inflammation of the heart or heart valves due to bacteria. Bacteria can enter the bloodstream following everyday activities and can establish itself in the heart. Once bacteria invade the heart valves, it causes the heart valves to erode and commonly leads to heart failure. Without treatment, infective endocarditis is always fatal, and even with current treatment, patients have a mortality rate as high as 20%. Previous studies have focused on how the bacteria is able to attach to the surface of the heart, and the proteins that aid in this attachment have been well characterized. However, little is understood about how *S. sanguinis* can survive in these harsh conditions long enough to establish an infection. The protein carbonic anhydrase is an important metabolic enzyme that helps synthesize cellular components essential to the maintenance and survival of this bacterium. In addition to this, inactivating the protein carbonic anhydrase in other pathogens has been shown to decrease the bacteria's ability to cause infection. We hypothesize that inactivating the gene that produces the protein carbonic anhydrase would prevent *S. sanguinis* from causing the deadly disease. I used computational methods, to find the specific DNA that coded for carbonic anhydrase in *S. sanguinis*. The gene was synthesized, and I used standard methods to clone the gene in order to obtain pure protein. After some testing, I was able to demonstrate that the protein derived from the synthesized gene has carbonic anhydrase activity. Both the computational studies and lab studies led to the conclusion that my protein was a carbonic anhydrase. In the future, I would like to study the structure of my protein so an inhibitor can be found.

Poster #6
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COMPARATIVE STUDY OF NATIONAL AND STATE-WIDE COVID-19 PANDEMIC TRENDS

Coronavirus (COVID-19) has been a current issue worldwide, and the prevalence of COVID-19 comparing to that of seasonal influenza (flu) has been an important topic in the public community. This study focuses on comparing national COVID-19 to flu in order to explore the epidemical features of COVID-19 for better understanding of this virus. The pandemic trend of Oklahoma has also been compared to national data to demonstrate the state's standing in this pandemic event. Data were retrieved from the CDC, Worldometer, the COVID Tracking Project databases, and the Oklahoma Executive Order Report to look at the cases of cumulative, daily active, recovery, deaths, hospitalizations, ICU, and ventilator applications from 3/28/2020 to 10/31/2020. An unpaired, two-tailed, student t-test was used for statistical analysis. The results showed that there were two different COVID-19 peak phases which were phase one (P1) from 3/28/2020 to 6/15/2020 and phase two (P2) from 6/16/2020 to 10/31/2020. In general, COVID-19 showed higher rates for cumulative cases and hospitalizations than flu ($p<0.01$). However, the mortality of each virus showed no significant difference in the study. COVID-19 showed higher rates in the daily change of cumulative and recovery cases in P2 than in P1 ($p<0.01$), and no significant differences in daily active cases and death rate ($p>0.05$). The COVID-19 hospital admissions in both P1 and P2 had no remarkable difference; however, the ICU and ventilator cases in P2 had decreased ($p<0.01$). Upon comparing the data of Oklahoma to the nation, the confirmed positive cases, the hospitalization rates, and the death rates were 7.48%, 7.27%, and 1.09% in Oklahoma and 7.23%, 8.13%, and 2.44% in the nation. The results indicated that COVID-19 has stronger infectious capability and severity than flu, but the same mortality. COVID-19 P2 showed a reduced severity and mortality, but an increase in infectious capability comparing to P1. Oklahoma has a similar level of confirmed and hospitalized cases but a lower death rate than the nation. This study provides a broad epidemiological view of COVID-19 and solid evidence for future studies and preventions of this virus.

Poster #7
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MASKED MEANINGS: UNCOVERING THE RHETORICAL AND SYMBOLIC ROLES OF THE FACE COVERING IN ANTI-MASK DISCOURSE

At the heart of discourse surrounding the COVID-19 pandemic is an ongoing tension regarding the use of face masks, their efficacy in preventing the spread of the virus, and the extent to which authorities should enforce their use. The debate has led to the instilment of the mask as a symbolic image, weighty with polarized connotative meanings that depend on the ideological assumptions of different audiences. One audience views the mask as representative of oppression, blind obedience, and forced anonymity, while another understands mask-wearing as a gesture of precaution, courtesy, and community solidarity. The mask serves as the epicenter of ideological divisions that continually fight to attach to it their respective commonplaces and beliefs about the pandemic. The aim of this research is to examine how the mask functions rhetorically and how it mobilizes ideology and aids in the production of rhetorical arguments that shape public opinion about masks and the COVID-19 pandemic in general.

In my research, I will view mask discourse through several lenses of rhetorical analysis, including rhetorical theory on ideology, visual rhetoric, and the intersection of rhetoric and science. The foundational ideas and vocabularies of these disciplines, like those of literary critic Roland Barthes and science rhetorician Leah Ceccarelli, will help me integrate these perspectives throughout the project. Tapping into these already rich scholarly conversations—and placing them in conversation with one another—will allow me to get closer to a holistic understanding of the face mask's rhetorical significance and potency. The Classical rhetorical model of stasis theory will function as my project's organizing structure, helping explicate at what points our public discourse about face masks is breaking down. The results of this project will ultimately express how the rhetorical use of the face mask has compromised the public's trust in its effectiveness and hindered COVID-19 precaution efforts and offer potential solutions for science communicators. This research is not only timely, but essential to a larger conversation about the potentially dangerous ways objective and scientific meaning is obscured when important public health issues are abstracted and symbolized as markers of political ideology.

Poster #8
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SYNTHESIS OF NOVEL SOLVENT MOLECULES FOR USE IN SOLVATE IONIC LIQUIDS

Solvate ionic liquids (SILs) are a subgroup of ionic liquids in which an organic solvent, which contains atoms capable of donating one or more electron pairs, wraps around a solute cation molecule. In the context of petroleum research, SILs created from lithium salts may function as replacements for existing solvents in applications as diverse as heat transfer fluids, lubricants, or electrolyte solutions. Methyl capped ethylene glycols, or “glymes”, and crown ethers are commonly used for the molecular solvent portion of SILs. Replacing glymes with different molecular solvents which can coordinate with cations is a way to expand the array of properties allowed by SILs.

To study the formation and properties of new SILs and as a part of a larger project, this research focused on synthesizing novel solvent molecules by systematically replacing all or part of the oxygen atoms in glymes with tertiary amines. Six different solvents were targeted to be synthesized: 1,2-bis[2-(N,N-diethylamino) ethoxy]ethane (NOON), 1,2-bis-[2-N,Ndimethylamino-2-ethoxy)ethyl]ether (NOOON), 1-[2-(N,N-diethylamino) ethoxy]-2-(2-methoxyethoxy)ethane (OOON), 1-[2-(N,N-dimethylamino-2-ethoxy)ethyl]-2-[2-(2-methoxyethoxy) ethyl]ether (OOOON), 1,2-bis[(2-methoxy-N-ethyl)-N-methyl]ethylenediamine (ONNO), and 1-(N-methyl-N',N'-diethylethylene diamine)-2-(2-methoxyethoxy)ethane (NNOO).

The NOON and NOOOON molecules were prepared using a three-day synthetic procedure involving brominating a triglyme or tetraglyme followed by amination to make the target solvent. Infrared (IR) and proton nuclear magnetic resonance (^{1}H NMR) spectroscopy were used to confirm the structures and purity of the intermediates and products. Initially, the solvents OOON and OOOON produced integration values that were different than expected in the ^{1}H NMR spectra following synthesis. It was deduced that bromination with PBr_3 unintentionally cleaved off a methoxy group in addition to substituting the alcohol with bromine. A tosylation procedure utilizing p-toluenesulfonyl chloride proved a viable alternative to bromination and ultimately succeeded in synthesizing OOON and OOOON. The ONNO and NNOO solvents were prepared via a substitution reaction that involved two starting molecules- one containing a primary bromine and one containing nitrogen with lone pairs of electrons. These syntheses yielded acceptable integration values for both target solvents. These six novel solvent molecules and the methods used to produce them can now be applied in further research to determine the effects of solvents containing tertiary amines on the properties of SILs.

Poster #9
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ANTI-CANCER EFFECTS OF DANDELION'S EXTRACT ON CERVICAL CANCER CELLS

According to the American Cancer Society Journal, 1,806,590 new cancer cases and 606,520 cancer deaths are expected to occur in 2020 in the United States. Despite the development of many forms of cancer therapy, there continues to be a high rate of death among patients. Existing cancer therapies can be very expensive, placing immense economic distress on afflicted families who are coping with this disease. Certain plant-derived products have pharmaceutical uses due to their anti-cancer effects. Dandelion (*Taraxacum officinale*) could be one of them. Dandelion is widely accessible, it grows throughout the world and has long been consumed safely as part of Middle Eastern and Ancient Chinese Medicine due to its anti-inflammatory and anti-carcinogenic properties. The mechanism of its effect on cancer cells is still unclear. This study investigated the anti-cancer effects of Dandelion on cervical cancer cells known as HeLa cells. It was hypothesized that the anti-cancer activity of dandelion extract acts by disrupting key cellular processes in tumor cells, which could result in growth inhibition, cell death and an overall decrease in their invasiveness.

Dandelion Whole Extract (DWE) was prepared, filtered, freeze-dried and resuspended in cell-growth media. HeLa cells and normal human cervical cells (HCEC) were maintained under standard *in vitro* cell culture conditions, then treated with DWE concentrations between 8 to 0 mg/ml for 96 hours. For a more realistic 3-dimensional approach, cells were cultured into collagen lattices to form artificial tumors and treated with similar varying concentrations of DWE. Our results showed that DWE inhibited proliferation and invasion while promoting programmed cell death in HeLa cells, but did not have such effects on HCEC cells.

This study supports the possible use of dandelion as a natural source of anti-cancer compounds against cervical cancer. Screening compounds derived from herbal plants, like dandelion, is an exciting approach for discovering new anti-cancer drugs. This study could potentially improve cancer treatment by unveiling cellular and molecular mechanisms behind anti-proliferative and anti-invasion effects of dandelion that are getting popularized as a cancer treatment.

Poster #10
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INVESTIGATING PHOTOPHYSICAL PROPERTIES OF CYANINE DYE WITH AND WITHOUT GRAPHENE OXIDE NANOPARTICLES IN REVERSE MICELLES

Introduction: In chemistry and biology the role of confined water is an important field. Among the most widely studied of confined media is the environment of the reverse micelle. Reverse micelles (RMs) are nanometer sized water droplets in organic solvents stabilized by surfactants. The RMs may be an appropriate model system to study photophysics of probe molecules and biomolecule dynamics in cellular environments. Therefore, the understanding of photophysics of probe molecules such as Cyanine 5 (Cy5) dye in RM is pivotal as it can be used as dye labels for biomolecules to track and analyze their behaviors inside biological cells. Moreover, the understanding of the effect of Graphene Oxide (GO) nanoparticles on photophysics of dye molecules is crucial due to their uses in nanomedicine and cellular imaging.

Methods: A protocol was developed to use sodium di-2-ethylhexyl sulfosuccinate (AOT) RMs whose size can be modulated over a wide range of sizes, characterized by the molar ratio of water to surfactant: $w_0 = \frac{[H_2O]}{[\text{surfactant}]}$. Steady-state and time-resolved spectroscopies such as UV-Vis Absorption, Fluorescence emission and Time Correlated Single Photon Counting techniques were employed to determine various photophysical parameters such as quantum yield, fluorescence lifetimes, and band shifts, etc.

Results: The photophysical properties of Cy5 dye inside RMs of varying sizes were compared to the dye inside aqueous environment and it was found that the photophysical behavior of the dye is environment dependent. Furthermore, the experimental observation of the introduction of GO nanoparticles in RMs has revealed interesting photophysics of Cy5 molecules.

Conclusion: This investigation shows that the dyes in GO nanoparticles probably undergo aggregation and exhibit different photophysics in RMs. Furthermore, this study has provided the future protocols to study protein folding kinetics in connection with neurodegenerative diseases such as Alzheimer's.

Relevance of Study: The study provides a protocol for protein folding in connection with Alzheimer's Disease. Understanding the reason for the protein folding and mis-folding of the protein would be important to develop an effective cure for a disease that affects millions of people around the world.

Poster #11
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EXPLORING THE RELATIONSHIP BETWEEN SPIRITUALITY AND ATTITUDES TOWARD MEMBERS OF THE LGBTQ+ COMMUNITY

Spiritual and religious beliefs may impact individuals' feelings regarding the LGBTQ+ community. Until 2015, same sex marriage was not legal in the US. After legalization, there was backlash from many religious communities regarding this court ruling. Because much of the mid-western US is located within the "Bible Belt", individuals from this area may harbor negative attitudes towards LGBTQ+ issues as a function of their religious beliefs. However, growing numbers of religious individuals, primarily younger individuals, are LGBTQ+ community allies. Based on this information, the researcher hypothesizes that younger participants may hold more positive attitudes towards LGBTQ+ issues than older participants. Additionally, the researcher hypothesizes a positive relationship between degree of spirituality and positive attitudes toward the LGBTQ+ community. 50 participants, recruited through Facebook and Instagram, responded to items from two dimensions (*spiritual support* and *spiritual openness*) of Genia's (1997) *Spiritual Experience Index- Revised*. Kite and Deaux's (1986) *Homosexuality Assessment Scale* was adapted to measure attitudes toward LGBTQ+ issues. The majority of participants (84%) were between the ages of 18-24. 74.5% were female; 86% were White; and 66% had some college experience. A significant, positive correlation between age and positive attitudes toward LGBTQ+ issues (r= .383, p= .006) was found, indicating views toward LGBTQ+ issues become more positive over time. However, these results should be considered with skepticism due to the fact that the overwhelming majority of the sample was under 25 years of age. Findings revealed individuals identifying as atheists or non-religious (44%) held more negative views related to LGBTQ+ issues than their Christian (54%) counterparts: t(47)= -5.8, p= .000. Finally, there was a significant correlation (r= .82, p= .000) between positive views related to LGBTQ+ issues and spiritual support and a moderate correlation (r= .344, p= .024) between positive views of LGBTQ+ issues and spiritual openness. Results indicate that times may be changing and that religious individuals may be becoming increasingly supportive of the LGBTQ+ community.

Poster #12
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THE ROLE OF WRKY TRANSCRIPTION FACTORS IN VIRUS HOST INTERACTIONS DURING DROUGHT

The change in climate across the world has been a concern for the agricultural industry especially when it comes to drought. The common response so far has been to genetically modify the plants (GMOs) but there are many concerns with this practice. An alternative method is to stimulate the plant's immune system by infecting it with a specific plant virus which will handle drought stress better than an uninfected plant. To test this method, we analyze the gene expression of plants dealing with drought conditions through a group of transcription factors unique to plants called WRKY (named after the main amino acids in the sequence). In this study, the WRKY genes of interest are from the tomato plant, *Solanum lycopersicum*. The WRKY genes of interest are from the *Solanum lycopersicum* tomato plant, which we infected with Tobacco Mosaic Virus (TMV) or Satellite Tobacco Mosaic Virus (STMV). The methods used are stomatal conductance, RNA extraction and purification, reverse transcriptase PCR, gel electrophoresis, cDNA synthesis, quantitative PCR, and bioinformatics. Results from the stomatal conductance shows how the infected plants had a greater range compared to the uninfected. For the bioinformatic, I used Tair and Sol genomics data banks to compare similar genes, also called homologs, across species. I found the genes were involved in either pathogen or drought stress and were mainly in group three. Tracking the common WRKYs expressed after a plant is infected helps us understand the specific WRKYs activated for each virus. We hypothesize that the commonly expressed WRKY factors in different virus infections might also be responsible for drought tolerance.

Poster #13
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BORON DOPED CARBON: A TUNABLE MORPHOLOGY

Our group has successfully synthesized a new mesoscopic material via an Atmospheric Chemical Vapor Deposition (APCVD) technique in an attempt to dope boron on a form of Pseudo-Graphite known as GUITAR. By adding a boron precursor into the solution, we discovered new mesoscopic structures that have formed with varying tubular morphologies. We call these novel structures BOD (Boron Orthocarborane Doped) Carbon and intend to explore their growth characteristics and possible applications. Some of these applications include hydrogen storage and improved battery technologies.

We grow this material by utilizing a process called Atmospheric Chemical Vapor Deposition (APCVD). Through this method we flow nitrogen into a flask that is heated on a hotplate. The vapor is then carried through a tube furnace at 900 °C where the structures are then grown for various times. We have found that by manipulating time of the reaction and amount of boron in our mixture as well as cooling rate we can create different morphologies.

Due to the nature of the materials growth we hypothesize that it is possible to tune the structures to vary in their application. For instance, an important aspect of improving Li-Ion batteries is surface area of the electrode material. Naturally, BOD Carbon has a high surface area due to the tubular structure increasing the storage capacity and performance of Li-Ion batteries. This could indeed contribute to storage of other elements, such as hydrogen, as well.

By further exploring the potential of this material to cater to different applications we open the door to a variety of innovations. In the future, we plan to tune the structure and growth of this material in order to better understand the influence of outside elements in the reaction, such as utilizing nitrogen. Future measurements including cyclic voltammetry and hydrogen adsorption will help elucidate the materials usefulness for batteries electrodes and hydrogen storage potential. Further cataloging and control of the morphological changes BOD Carbon offers will reveal prospective applications, subsequently allowing us to engineer them accordingly.

Poster #14
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ANALYSIS OF ESCO2 DEGRADATION USING PIP-FUCCI RECOMBINANT PLASMIDS

Many proteins interact with cohesin to ensure the accurate alignment and segregation of sister chromatids during cell division. One of these proteins, the Establishment of Sister Chromatid Cohesion N-Acetyltransferase 2 protein (ESCO2), acetylates the SMC3 subunit of cohesin, which is essential for cohesion between the sister chromatids. Expression of Esco2 drops during S phase and previous research suggests that ESCO2 is subject to the CUL4 degradation pathway. Substrates of this pathway are degraded following the interaction of certain motifs with the Proliferating Cell Nuclear Antigen (PCNA). These motifs are called PCNA interacting protein motifs, or PIP boxes for short. PIP boxes that target the protein for degradation are referred to as PIP degrons. Four potential PIP boxes that are strongly conserved in ESCO2 gene were analyzed to determine whether they promote ESCO2 degradation by Cul4. To do this, we modified a cell cycle indicating plasmid, the PCNA Interacting Protein-Fluorescent Ubiquitination-based Cell Cycle Indicator (PIP-FUCCI) system, in which a known PIP degron Cdt1 is fused to the mVenus fluorescent protein. We replaced the Cdt1 degron with the sequences of interest from ESCO2 (referred to as PIP A through PIP D) and introduced these plasmids into HeLa cells. The cells were analyzed utilizing live cell imaging and flow cytometry. The fluorescent tags encoded by the recombinant plasmids were used as indicators for the stages of the cell cycle and were fused to the potential degrons. We propose that none of the PIP boxes act as PIP degrons due to the mVenus tag in our plasmid not degrading during the S phase of the cell cycle during both live cell imaging and flow cytometry, an indicator that the PIP boxes of interest were also unable to degrade during S phase. We are better able to understand the cell cycle and cohesion of sister chromatids by analyzing ESCO2 for potential PIP degrons. This research can also allow us to better understand the function of ESCO2, which plays an important role in several rare genetic disorders including Roberts Syndrome (RBS) and Sc Phocomelia Syndrome (SCPS).

Poster #15
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TASK-RELATED SYSTEMIC ARTIFACTS IN FUNCTIONAL NEAR-INFRARED SPECTROSCOPY

Introduction: Functional Near-Infrared Spectroscopy (fNIRS) is a neuroimaging technique that emits near-infrared light into the scalp and measures the light absorbed in the brain. It is relatively low-cost, portable, and noninvasive compared to other neuroimaging methods, such as functional magnetic resonance imaging (fMRI). However, data processing methods to improve fNIRS signals are still in their infancy.

Objective: One promising development in fNIRS data processing is through implementing short channel regression into conventional fNIRS. Short channel regression utilizes special channels of short source-detector separation in which the recorded signals originate from light that mainly penetrates the scalp. Thus, these short channels theoretically capture a physiological signal devoid of brain activity, which can be removed from long channel activity to improve the overall accuracy of fNIRS. This study is an investigational study of short channel activity during fNIRS neuroimaging.

Methods: We used short channel fNIRS on thirteen healthy human participants during a right-hand clenching task to monitor motor cortex activity. Data was processed in MATLAB with the Homer2 toolbox and custom-built scripts.

Results:

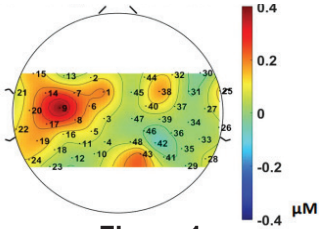

Figure 1

Figure 1. Across all sessions, the channel with the highest mean ΔHbO was identified as Channel 9. Channel 9 and its symmetrical channel (Channel 37) were used for further analysis.

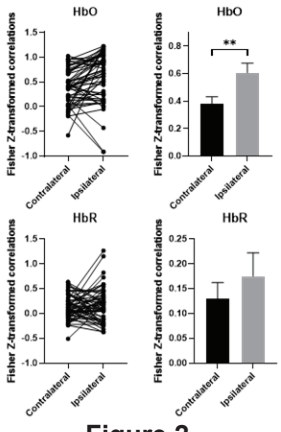

Figure 2

Figure 2. After comparing Channel 9 with its ipsilateral counterpart (Channel 37), we found a significant difference between the correlation of that channel's signal over time with that of its closest short channel compared to the same correlation on the ipsilateral side.

Conclusion: On the ipsilateral side, where no brain activity is expected, task-related changes were recorded in both long and short channels. These findings confirm the presence of physiological noise in fNIRS and also indicates the necessity for global signal removal to improve fNIRS accuracy.

Relevance: Overall, this study provides a guide for future studies using fNIRS and short channel regression in removing physiological noises. These results can help optimize how further brain studies should be conducted and facilitate our understanding of human brain function, leading to potential breakthroughs in treating mental disorders.

Poster #16
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USING MACHINE LEARNING TO CREATE PREDICTIVE MODELS FOR STORM DAMAGE IN THE UNITED STATES

The research objective of this project is to apply machine learning techniques to create a predictive model where given a particular month and a state, the model predicts the expected storm damage in dollars for that specified month and state in the USA. This knowledge could be of significant importance for emergency planners and future disaster relief funding in areas of high risk. We use the publicly available data collected from the National Center for Environmental Information including 300,000 data entries for weather events in the past five years. This data holds detailed information regarding the time, type, location, severity of storm events, damage, injuries, deaths, and the estimated damage caused by storms. It includes events such as hurricanes, ice storms, hail storms, and tornadoes. We consider both linear regression and neural network deep learning models. After preparing the data and running implementations for training and testing the models, the Neural Network (NN) model was found to perform very well on the test data. The NN has an accuracy score value of 76.80%, that is significantly higher than the linear regression model accuracy score of 25.39%. The proposed NN model can be used to make predictions about the expected loss in dollars associated with future storms and also assess the risk of having a severe storm. Given that a storm has occurred, and the amount of deaths, injuries, type of the storm, and the state are known, this model can predict the amount of storm damage that has happened. In this project, we used *Python 3.0* as the coding language, *Jupyter Notebook* as the user interface, and the *scikit-learn* as the main machine learning library.

Poster #17
Student Name: **Caitlyn A. Hankins**
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MEASURING SELF-CONTROL USING STRUCTURAL EQUATION MODELLING

Introduction: Research has shown that individuals with higher levels of self-control are less likely to engage in deviant or illegal behavior. In order to explore this relationship empirically, several different statistical scales have been developed in an attempt to measure self-control in different ways using survey data. In 2003, Marcus (2003) created his Retrospective Behavioral Self-Control Scale (RBS) and argued that it outperformed the Grasmick scale in several important ways. The sample for his analyses came from Germany, and we have reason to expect the cultural difference between Germany and the United States might lead to these scales performing differently across these different cultural environments.

Methods: Using a nationally representative sample of 1,300 respondents collected through YouGov, this study replicates Marcus' (2003) examination of his Retrospective Behavioral Self-Control Scale (RBS) compared to the Grasmick Scale. We compare the two scales with several advanced statistical models and structural equation approaches to scaling. In addition to mapping out the cross-cultural differences in self-control, we explore whether and to what degree the complexity of the RBS scale outperforms (or fails to outperform) the easier to collect and implement Grasmick scale.

Results: We find that while the cross-cultural difference between these scales are limited, the additional sophistication of the RBS scale does not necessarily change our predictions of how self-control shapes deviant behavior. When simply comparing the two basic models for the RBS and the Grasmick scale, there is no significant difference. After incorporating the control variables and the deviance scale into the models, the RBS still outperforms the Grasmick scale but only marginally.

Conclusion: The RBS is shown to have slightly better fit statistics across all of the models we examined; however, the Grasmick scale is much more robust. Therefore, since the statistical differences are so minimal, we can conclude that the Grasmick scale is a better approach to measuring self-control because of how straightforward it is.

Relevance of Study: This study provides an unbiased comparison of the two self-control scales and expands on the limited research of the RBS in the United States.

Poster #18
Student Name: **Seth Harriet**
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DESIGN, CHARACTERIZATION AND BIOANALYSIS OF MICRO-GROOVED FLOW DIVERTING STENTS

Flow diverting stents have become one of the most promising endovascular treatment of intracranial aneurysms. Flow diverting stent, also known as flow diverter (FD), regulates blood flow and hemodynamic parameters to dissolve aneurysm and remodel vascular network. However, recent studies show that FDs may fail due to migration, malposition and dislodgment, and can cause constant inflammation, late thrombosis, and embolism. In this research, we developed novel micro-grooved nitinol FDs and studied its efficacy by human umbilical vein endothelial cell (HUVEC) adhesion, proliferation and differentiation analysis. Novel FDs with 3 um, 6 um and 12 um deep micro-grooved patterns were designed and developed using 3D CAD modeling and laser machining. Programmable rotational arm was developed to precisely modulate laser source on the medical grade flexible nitinol tube. The developed nitinol FDs were polished using *in-housed* designed vibrating polishing machine. Surface characterization and quality were evaluated using scan electron microscope (SEM) and 3D profilometer images. The results demonstrated that various micro-grooved and non-grooved FDs without micro-cracks and smoother surface finish was possible using laser machine. The depth and profile of the grooves were within 1% variations of the CAD model. For bioanalysis, medical grade tubular silicon holders were made using 3D printed negative mold to keep the flow diverting stent upright. FDs with and without micro-grooved were placed in the silicon tubes and coated with collagen matrix and HUVECs. After 1, 3 and 5 days of seeding, the cell viability, proliferation, adhesion and differentiation were measured using MTT assays and fluorescence microscopy. MTT assays show that the live cells and cell growth are much higher in all of the grooved FDs. The endothelial cell proliferation and differentiation was also improved in grooved FDs compared non-grooved FDs. Results also show that the cell adhesion to grooved FDs was much higher than that of the non-grooved FDs. Particularly, the 6-um grooved FDS was the best among grooved FDs. This study will contribute in understanding the impact of surface engineering of FDs and hence, it will help to design more efficient and functional flow diverting stents for the treatment of aneurysm.

Poster #19
Student Name: **Evan Isbell**
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ASSESSING PUBLIC KNOWLEDGE AND HABITS OF BATTERY CHARGING

Although mobile phones have become integral in the workplace and society, we hypothesized that the public lacks knowledge – or is even misinformed – about the proper use and charging of lithium-ion batteries. Proper care is important because it leads to unnecessarily rapid decay in battery health. This increases costs for consumers and provides damaging environmental impacts. It is accepted in the research community that Li-ion batteries best maintain their long-term health when they are charged slowly, under steady state, kept around or below half capacity, cycled at small ranges, and with optimized charging software enabled [1]. Previous work has skimmed the surface on assessing public knowledge and habits about battery charging [2]. This work goes significantly beyond the prior work to guide public informational media, direct future battery research, and equip the general population with Li-ion battery intelligence.

To assess public knowledge and habits of battery charging, a survey was introduced to 453 respondents using the online crowd-sourcing service MTurk. When respondents were asked what they thought the best charging practice is for maintaining battery healthy over several years, 51% of participants responded that the best practice is to charge after draining completely, indicating a possible common belief among the population. When asked about their charging habits, 78% of respondents drain their batteries most of the way or entirely empty. This is indicative that a majority of the population regularly practices large cycling ranges. When asked about the new “battery optimization” software recently introduced into many smartphones (i.e., starting in 2019 with iOS 13 for the iPhone), almost half (47%) of respondents were unaware of its existence. Another interesting result was that 74% of respondents use the “stock” chargers that came with their device. Using an off-brand charger could speed up recommended C-rates of devices, causing further decay.

Moving forward, we hope to extend into (a) laboratory research to study battery charging, especially “partial charge-discharge” cycles, (b) public-informational work to promote knowledge about proper battery charging, and (c) further development of mathematical battery charging models to build upon existing work in the area [3].

[1] Woody, et al. Journal of Energy Storage 28 (2020): 101231.
[2] Saxena, Sanchez, Pecht. IEEE Industrial Electronics Magazine 11.2 (2017): 35-44.
[3] T. Raj, A. Wang, C. Monroe et al. Batteries and Supercaps (2020): 10.1002/batt.202000160

Poster #20
Student Name: **Samuel O. Kauffman**
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DESIGN OF A HUMAN-CENTERED COMPUTING (HCC) BASED VIRTUAL REALITY SIMULATOR TO TRAIN FIRST RESPONDERS INVOLVED IN THE COVID-19 PANDEMIC

Introduction: This research focuses on the design of a Virtual Reality (VR) simulator to help train nurses involved in testing and treatment of patients affected by the COVID-19 pandemic. This pandemic has placed an overwhelming strain on our Nation's ability to treat patients; the number of patients who need to be tested continues to rise. It is critical that our Nation have a larger pool of trained first responders. Currently, there is an urgent need to train such responders (nurses, physician assistants) to perform the testing and ventilator activities in a safe and efficient manner.

Methods: This research focuses on exploring HCC principles in designing a VR training simulator with two objectives: (i) increase the pool of first responders involved in COVID-19 testing and using ventilators on patients (ii) develop a more effective (and less risky) process to train and prepare such first responders. HCC principles are helping in the design of this simulator based on factors such as affordance, visual density and cognitive load.

Results: A preliminary version of this innovative 3D VR simulator has been built using the HTC Vive platform; nurses and hospital staff can wear 3D headsets and complete their training using this simulator. Initial assessment through interaction with collaborating hospitals underscore its ability to train nurses and other health care assistants effectively in a user-friendly manner.

Conclusion and Relevance: This simulator can enable the efficient and safe training of first responders involved in taking nasal samples for testing and for connecting patients to ventilators. By training virtually, they reduce their risk of infection while practicing virtually on becoming skilled at the various steps involved in the testing and ventilator setup tasks. This simulator will be distributed free of charge to all hospitals nationwide. This simulator is the first of its kind worldwide in helping us handle the outbreak of this pandemic. This project is funded by a special grant from the National Science Foundation (NSF).

Poster #21
Student Name: **Sierra X. Posey**
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ANTI-FUNGAL ACTIVITY OF LYSOSOMAL PROTEINS AND THEIR EFFECTS ON *CRYPTOCOCCUS NEOFORMANS*

Cryptococcus neoformans is an opportunistic fungal infection spread through airborne means. It affects immune compromised individuals such as people with HIV/AIDS and increases their susceptibility to the disease. Infected individuals become sick with Cryptococcal meningitis and have high mortality rates. Previous studies showed that dendritic cells (DCs) can kill *Cryptococcus* through phagocytosis and lysosomal killing from within the DC. The lysosomal extract from these DCs has anti-cryptococcal activity, and we now have mass spectrometry data identifying its contents. We hypothesized that DC lysosomal proteins nostrin, calmodulin, and coronin 1a have anti-fungal activity against *C. neoformans*. For these studies, we incubated lysosomal extract of these individual proteins with *C. neoformans* to measure anti-fungal activity. Our results showed nostrin and coronin-1A had significant antifungal activity, while calmodulin significantly increased cryptococcal growth. Cytotoxicity was tested in nostrin and it was not toxic to mammalian cells. Because calmodulin increased cryptococcal growth, we hypothesized that following incubation with *C. neoformans*, the media contained growth- enhancing nutrients. For this, we examined the media for macronutrients, amino acids, and metals following incubation of *C. neoformans* with calmodulin and other growth-enhancing lysosomal proteins S100A6, cystatin B, calnexin, striatin, and CRISP-1. We found that incubation of *C. neoformans* with calmodulin, cystatin B, and CRISP-1 led to increased biotin in the media, and trace elements including Cd, Fe, Mn were also increased following incubation of *C. neoformans* with calmodulin. Interestingly, some compounds alone increased trace metals, but incubation with *C. neoformans* brought those levels back to baseline amounts. Future studies will compare these components in the media to those from incubations with anti-cryptococcal molecules.

ESTABLISHED PROGRAM TO STIMULATE COMPETITIVE RESEARCH

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

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

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

On July 1, 2020, the National Science Foundation awarded Oklahoma a new $20 million EPSCoR Research Infrastructure Improvement (RII) Award that will support research and education programs across the state. During the five-year award, a team of more than 30 researchers from universities across the state will develop and test science-based solutions for complex problems at the intersection of land use, water availability, and infrastructure. The grant is also designed to provide education and workforce development programming to more than 150,000 Oklahomans of all ages.

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

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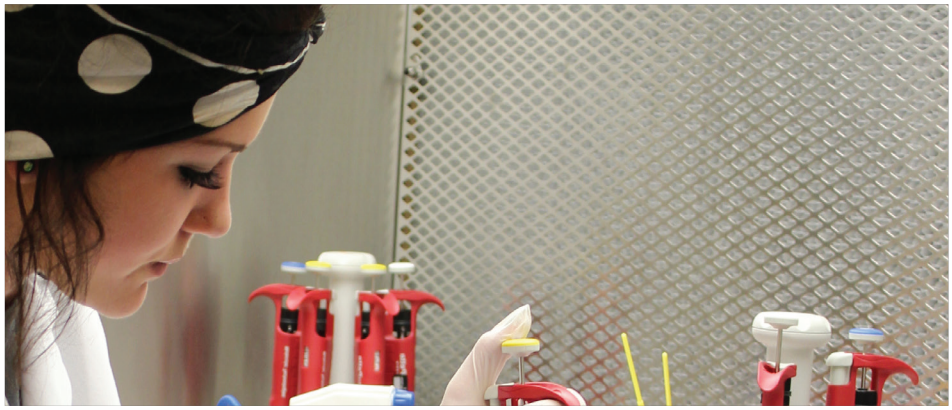
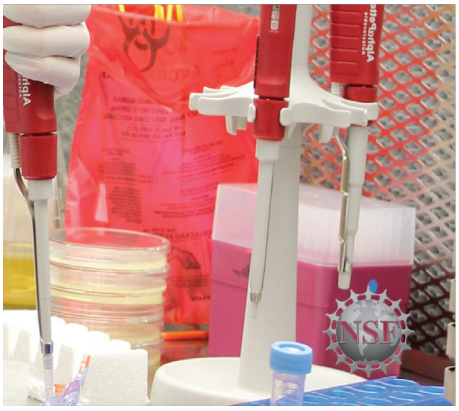


OKLAHOMA EPSCoR



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 **one 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 **63,950 K-12 students and teachers** have benefited from Oklahoma EPSCoR STEM education, outreach, and training programs (2013-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	$ 20 Million	Research Infrastructure
NASA	EPSCoR	$ 3.3 Million	Research Infrastructure (4 Awards)
DOE	EPSCoR	$ 0.8 Million	Research Infrastructure
NIH	IDeA	$107 Million	COBRE (11 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 Million
2008-2013	$15 Million	$ 70 Million
2013-2020	$21 Million	$332 Million
2020-2025	$20 Million	$ 3.7 Million
Total	**$72 Million**	**$455.7 Million**

Does not include:
NSF RII Award or State Funds

$452 MILLION NEW RESEARCH FUNDING GENERATED THRU TRACK-1

100 INSTITUTIONS SERVED VIA ONEOKLAHOMA CYBER

129 NEW TECHNOLOGIES & PRODUCTS

43 PATENTS & COPYRIGHTS

113K OKLAHOMANS STEM-TRAINED & EDUCATED SINCE 2013

25 NEW UNIVERSITY FACULTY

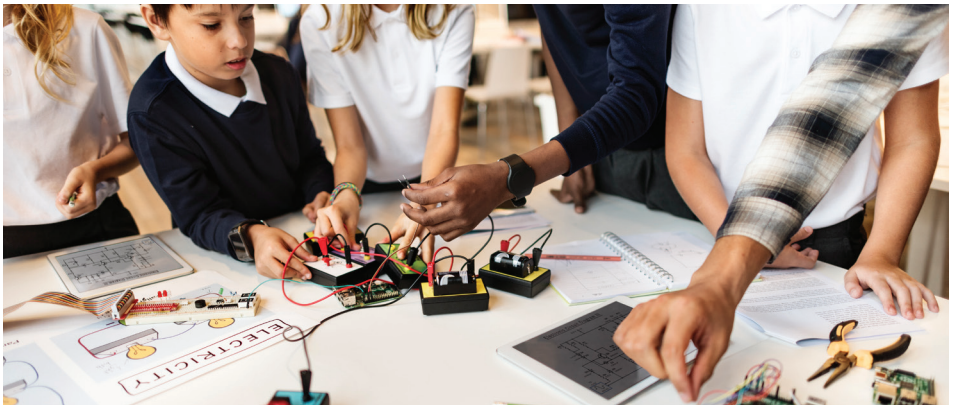
$170 MILLION ACTIVE GRANT AWARDS

38 COMPANIES

RESEARCH

OKLAHOMA EPSCoR

EDUCATION



SOCIAL - ECOLOGICAL

M-SISNet, a network of more than **1,500 geolocated households** across Oklahoma, was developed through EPSCoR to provide data on citizens' perceptions and responses to agricultural, hydrological, and meteorological systems. This information is critical for decision-makers and provides dynamic, research-quality data to scientists.

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

EPSCoR has been at the forefront of Oklahoma's new, emerging technologies; the state's nanotechnology industry was underpinned by EPSCoR research. To date, **120 new technologies** have been produced, along with **34 patents**, **9 copyrights**, and **9 marketed products; 38 companies** have resulted from these advances.

NSF EPSCoR: FOR OUR HIGH-TECH FUTURE

Oklahoma NSF EPSCoR outreach and education programs have served over **113,000 Oklahomans** since 2013, including more than **34,775 underrepresented minorities** and **67,875 women**. By training a skilled and diverse STEM workforce, we are ensuring that the state's emerging tech-based businesses and research labs will have a high-quality applicant pool to draw from for years to come.

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

- Statewide Research Collaborations
- Hands-on Science Programs, Courses and Curriculum for K-12 Students & Families
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- Innovative Instructional Materials and Resources for Educators
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