DIVISION OF
INSTITUTIONAL
DIVERSITY

**The Oklahoma Louis Stokes Alliance for Minority Participation**

# 27th Annual Research Symposium

**October 8-9th, 2021**
**Oklahoma State University**
**Student Union**
**Stillwater, Oklahoma**

# CONFERENCE PRESENTATION OPPORTUNITIES

Scholars are strongly encouraged to present research at the following conferences.

## National Conference on Undergraduate Research

Virtual

April 4-8, 2022

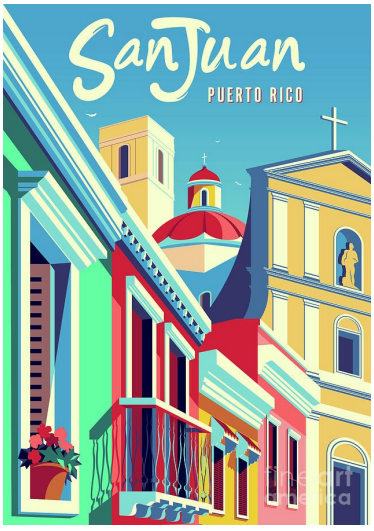
**Abstract deadline** November 19, 2021

## Oklahoma Research Day

March 2022

Cameron University, Lawton, Oklahoma

https://www.cameron.edu/academic_affairs/oklahoma-research-day




## SACNAS NDiSTEM 2022

San Juan, Puerto Rico

October 27-29, 2022

https://www.sacnas.org/what-we-do/conference/

# OK-LSAMP 27th Annual Research Symposium

# AGENDA

| | | | |
|---|---|---|---|
| **October 8th, 2021 La Quinta, Stillwater OK** | | | |
| 6:00 PM - 8:00 PM | Reception | Student Networking Event | Lobby |
| 6:00 PM - 7:30 PM | Alliance Meeting | OK-LSAMP Administration, Campus Program Managers and Invited Guests | Conference Rm/ Zoom meeting* |
| | | | |
| **October 9th, 2021 Oklahoma State University, Student Union** | | | |
| 8:30 AM - 11:00 AM | Registration/ Check-In | Poster Set-up: ALL POSTERS MUST BE IN PLACE BY 9AM | 203 Theater Lounge |
| 9:00 AM - 9:20 AM | Opening Remarks and Tribute to Dr. Mitchell | Brenda L. Morales, OK-LSAMP Director<br>Jason F. Kirksey, PhD, OK-LSAMP Principal Investigator<br>Vice President for Institutional Diversity, Oklahoma State University | 203 Theater/ Zoom meeting* |
| 9:20 AM - 10:15 AM | Workshop | International Experience during a Pandemic<br>OSU Study Abroad Office | 203 Theater/ Zoom meeting* |
| 9:45 AM - 10:15 AM | Judges Meeting | Judges Orientation | 412 Council Room |
| 10:15 AM - 10:30 AM | | BREAK | |
| 10:00 AM - 12:00 AM | Scholar Headshots | Professional photography headshots being taken | 4th floor SU |
| 10:30 AM - 11:30 AM | Non-Life Sciences | Poster Presentations: Each presenter must be by their poster | 465 Starlight Terrace / Microsoft Teams* |
| | Life Sciences | Poster Presentations: Each presenter must be by their poster | 465 Starlight Terrace / Microsoft Teams* |
| 11:45 AM - 1:30 PM | | LUNCH | 265 Ballroom |
| | Keynote Address | Justin Rice, PhD<br>NASA Goddard Space Flight Center, Greenbelt MD | 265 Ballroom/ OStateTV live link* |
| 1:30 PM - 1:45 PM | Group Photo | | Ballroom Lobby |
| 1:45 PM - 3:00 PM | Oral Presentations | *For Specific Times, See "Presentations Listed Alphabetically"* | |
| | | Biology & Microbiology | 408 Case Study 1 / Microsoft Teams* |
| | | Biochemistry | 413 Exhibit Rm 1 |
| | | Chemistry | 416 Case Study 2 / Microsoft Teams* |
| | | Engineering | 417 Exhibit Rm 2 / Microsoft Teams* |
| 3:00 PM - 3:15 PM | | BREAK | |
| 3:15 PM - 4:15 PM | Workshop | How to make the most of your internship or REU Panel<br>Moderator: Mario Borunda, Ph.D. Panel-ists: Tasia Bryson, PhD, and Darian James | 203 Theater/ Zoom meeting* |
| 4:30 PM - 5:00 PM | Awards Presenta-tion & Closing Remarks | 1st, 2nd, and 3rd Place Presentations<br>Life Science Poster Presentations<br>Non Life Science Poster Presentations<br>Oral Presentations<br>Clyde Wilson, PhD, Assistant Vice President for Institutional Diversity, Oklahoma State University | 203 Theater/ Zoom meeting* |

***Links and meeting numbers for Zoom and Microsoft Teams have been sent directly to all registered participants.**

# TABLE OF CONTENTS



## Wi-Fi Access

*Click on guest and use the following credentials*

Oklsamp_guest@okstate.edu

Symp2021

**Join the OK-LSAMP Program on social media**

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https://www.facebook.com/groups/oklsamp/

@oklsamp

@oklsamp

# KEYNOTE SPEAKER

**Dr. Justin L. Rice** is currently employed at NASA Goddard Space Flight Center as Deputy Manager of the Earth Science Data and Information System (ESDIS) Science Systems Development Office. He is responsible for increasing Earth Observing System (EOS) data accessibility and utilization by migrating select datasets, tools, and services from their on-premises systems to the Earthdata Cloud. To accomplish this, he manages enterprise-level development activities that span 12 data centers located at nine government and academic institutions across the United States. Altogether, this cloud migration undertaking leverages about 200 developers. Dr. Rice currently oversees 21 technical development teams or about 110 developers.

Prior to this position, he served in several other roles at NASA Goddard. For instance, he served as the ESDIS systems engineer for EOS missions and flight software developer for Goddard's first dual-core flight processor - which will be used for the Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission. He also worked as the Goddard dynamic simulator developer for the Deep Space Climate Observatory (DSCOVR) mission; cloud systems developer for the Earth Observing-1 (EO-1 ) mission; and embedded systems developer for the Soil Moisture Active Passive (SMAP) mission.

Dr. Rice's doctoral research investigated how algorithms and mathematical models, which describe mussel self-organization and clustering behavior, could be modified and used to address security vulnerabilities in cloud computing systems. He proposed a mussel-inspired defense strategy that relied on user account and workload clustering to mitigate co-residence profiling in cloud systems. He also performed a risk assessment to determine the likelihood an individual user would be victimized, given a successful non-directed exploit.

Dr. Rice is a native of Jackson, Mississippi. He holds a bachelor's and a master's degree in Computer Engineering from Jackson State University and a Ph.D. in Engineering from Louisiana Tech University. He fervently believes that education, hard work, and discipline are the keys to upward social mobility; and he works tirelessly to inspire the next generation to strive for greatness. In his spare time, Dr. Rice enjoys teaching, learning, community service, and anything that involves music.

**International Experience during a Pandemic** ***9:20am -10:15am***

**Tara Sepulveda**

In 2017 Tara studied abroad in Heredia, Costa Rica for six weeks. After she graduated in 2019 with a degree in Strategic Communications, she lived in Austin, Texas working with SOL Education Abroad, a study-abroad program provider. Currently she is pursuing a Master of Science in Global Studies with a focus in Public Diplomacy and Global Communications from Oklahoma State University and is a Graduate Assistant for the Study Abroad Office.

**Amanda Bolinger**

Amanda is currently a senior from Beaver, Oklahoma studying Animal Science: pre-veterinary. She is an honors college student and an undergraduate research assistant in OSU veterinary school's Comparative exercise physiology lab. Her goal is to someday become a large animal veterinarian specializing in equine sports medicine and rehabilitation. She is currently spending the fall semester at Keele University in the United Kingdom. She is an OSU institutional nominee for both the Rhodes and Marshall scholarships and she hopes to be returning to the UK for graduate studies.

**Casandra Salinas**

Casandra is from Atolinga, Zacatecas, Mex. Her love for science and mathematics, as well as her personal experiences led her to pursue a BSAG in Biochemistry and Molecular Biology degree at Oklahoma State University. Casandra participated in research as an OK-LSAMP, Niblack and McNair, Scholar. Her project in the Patrauchan Lab involved studying how the abnormal ion concentrations in the lungs of Cystic Fibrosis patients impacted the production of a virulent factor, rhamnolipid, in the opportunistic pathogen Pseudomonas aeruginosa. She has presented her work at multiple local, national and international scientific meetings. Currently Casandra is doing an internship at the Cellular Imaging and Energetics Lab in King Abdullah University of Science and Technology, in Thuwal, Saudi Arabia investigating the viroporin role of the E protein of SARS-COV-2.

**How to make the most of your internship or REU** ***3:15pm -4:15pm***

**Moderator:**

**Mario Borunda, PhD**

Dr. Borunda is an Associate Professor of Physics at Oklahoma State University. He received his Bachelor of Science degree in Physics and Mathematics from the University of Texas at El Paso (UTEP) in 2003, where he was an LSAMP fellow. He continued his studies in Physics, receiving his Ph.D. from Texas A&M University in 2008. He spent four years as a postdoctoral fellow at Harvard University. Dr. Borunda has also been a visiting researcher at Harvard University. Dr. Borunda's research explores electron transport and the properties of condensed matter. At OSU, his research has focused on quantum information, the quantum-to-classical boundary in chaotic systems, and theoretical methods to predict novel materials for energy production and electronic applications. Dr. Borunda is enthusiastic about working with minority students and has produced a positive impact with OK-LSAMP scholars, SACNAS, American Physical Society, and as President-elect of the National Society of Hispanic Physicists.

**Panelists:**

**Darian S. James, PhD**

Dr. Darian S. James earned her B.S. in Nuclear Engineering from South Carolina State University (2015), and her M.S. (2017) and Ph.D. (2021) from the University of Wisconsin-Madison in Biomedical Engineering. Her dissertation work focused on using minimally invasive imaging techniques to examine and characterize disease progression in a fatal lung disease called idiopathic pulmonary fibrosis. At UW-Madison Darian was a Graduate Research Scholar, and a National Science Foundation Graduate Research and LSAMP Bridge to the Doctorate Fellow. She currently works as an R&D (research and development) Professional Development Program Scientist at Pfizer. In her free time, Darian enjoys spending time with family and friends, traveling, giving back to the community, and working with the STEMming PhorwarD team to inspire, mentor, and support the next generation of underrepresented minorities in STEM.

**Tasia Bryson, PhD**

Dr. Tasia Bryson recently received her doctorate in Science Education at the Mallinson Institute of Science Education at Western Michigan University. Her research focuses on examining the impact of the advisor-advisee relationship on underrepresented students' degree completion in science graduate programs. Specifically, she is focused on examining how and why Black and Latinx students in STEM graduate programs select their advisors, and their perceptions of the advisor-advisee relationship. She earned her master's degree in Higher Education Administration and her bachelors' degree in Chemistry with a Biochemistry Specialization from Chicago State University. Currently, Dr. Bryson works as the Postdoctoral Research Fellow for the I CAN PERSIST STEM Initiative at the University of Massachusetts-Boston and she serves as the STEM Project Specialist for Chicago State University. Additionally, she is the founder and CEO of Scientists That Elevate Me, LLC which allows students nationwide to be exposed to and gain knowledge of various STEM academic opportunities and career options. Her efforts are geared towards increasing recruitment, retention, and graduation rates for Students of Color majoring in STEM programs. She is also extremely active within the Roseland Community in Chicago through the Kids Off the Block organization.

# LOUIS STOKES & LSAMP

In 1991, the National Science Foundation created six multi-institutional Alliance for Minority Participation (AMP) programs. In 1998, **Congressman Louis Stokes'** name was added to the program.

Congressman Stokes passed away 2015. The LSAMP community and the nation has lost a great man. You can read all about Congressman Stokes' career at:
http://history.house.gov/People/Detail?id=22311

**Dr. A. James Hicks** was named LSAMP program director in 1997. He received a Ph.D. in biology from the University of Illinois at Urbana and additional training at Harvard University, the National Institutes of Health, and the Missouri Botanical Gardens. When Dr. Hicks took over LSAMP, there were 25 Alliances in the nation. Dr. Hicks retired this past academic year December 2020. Today, there are close to 50 active LSAMP alliances with over 800 colleges and universities involved in increasing the quality and quantity of students from underrepresented populations who receive degrees in science, technology, engineering, and mathematics.

# A Brief History of OK-LSAMP

In 1992, the Oklahoma State Regents organized the Oklahoma Alliance for Minority Participation in Science, Engineering, and Mathematics (OKAMP SEM). Dr. Earl Mitchell, Oklahoma State University (OSU) Professor, was chosen to serve as Chair of the Alliance. In 1993, Dr. Mitchell, with the help of Dr. Ann Ackerman from South Oklahoma City Junior College, wrote and submitted an AMP proposal to the National Science Foundation (NSF). Included in the proposal was additional matching support for the program at the regional universities provided by the Oklahoma State Regents for Higher Education. In 1994, OSU, as the lead institution, along with seven partner institutions was awarded the grant. The OKAMP program was established to address the critical undersupply of minority students pursuing BS degrees in Science, Mathematics, Engineering, and Technology (SMET).

Today, 12 Oklahoma institutions of higher education make up the Oklahoma consortium. Through the years, many changes have been made including the addition of Congressman Louis Stokes' name to the AMP programs nation-wide, and the change of SMET to Science, Technology, Engineering, and Mathematics (STEM). A graduate school initiative - the Bridge to the Doctorate (BD) program was implemented with Oklahoma providing graduate support for 9 cohorts of BD Fellows since the BD initiative began.

Throughout the 2020-2021 Academic year the Oklahoma Alliance had over 240 scholars. Seventy of the 243 scholars successfully completed all necessary requirements to obtain a Bachelor of Science degree in a STEM field. Eighteen of twenty-three (78.3%) graduating seniors who applied to graduate school were accepted to a STEM graduate program. The Alliance recruited 74 new OK-LSAMP scholars during the past academic year. Despite the Alliance being five scholars short of its yearly goal, the OK-LSAMP program is on track to meet its five-year recruitment goal of a 25% increase of new scholars. OK-LSAMP Scholars participated in numerous activities promoting STEM and the OK-LSAMP program. They attended state, regional and national virtual conferences, as well as participating in research throughout the academic year.

# ADMINISTRATION

**Oklahoma State University, Lead Institution**

***Jason F. Kirksey, Ph.D.***, Principal Investigator
405-744-9154, jason.kirksey@okstate.edu
Dr. Kirksey is the Vice President for Institutional Diversity at Oklahoma State University (OSU). In this role, he serves as the chief diversity officer for the entire OSU system. In addition, Dr. Kirksey serves as Associate Professor in the Department of Political Science. His research interests include minority politics (especially African American and women), urban politics, the election system, and American government.

***Brenda L. Morales, M.S.***, Director
405-744-6710, brenda.morales@okstate.edu
Brenda received her B.S. degree from the University of Texas Pan-American, which led her to Oklahoma State University through a National Science Foundation - Research Experience for Undergraduates (NSF - REU). In Fall 2002 she made Oklahoma State University her choice to pursue a Master of Science degree in Psychology. She became Director of the OK-LSAMP program and the Bridge to the Doctorate program in 2016. The OK-LSAMP program is a consortium of 12 Oklahoma colleges and universities in which Brenda oversees the day-to-day and long-term activities associated with the NSF grant.

***Darlene Croci***, Grant Coordinator
405-744-7820, darlene.croci@okstate.edu
Darlene received her BS degree in Human Environmental Sciences from Oklahoma State University (OSU) in 1991. Upon graduation, she began working for OSU serving in various roles across campus. Darlene worked for 5 years for the Oklahoma Department of Career and Technology Education before returning to OSU in 2004. She served a five year term on the OSU Staff Advisory Council (SAC) - 2010-2015. Darlene became Grant Coordinator for OK-LSAMP September 2015.

***Sandra Whalen.***, Program Evaluator
405-325-2158, swhalen@ou.edu
Sandra received her M.Ed. In Adult and Higher Education from the University of Oklahoma and is Director of the Center for Institutional Data Exchange and Analysis (C-IDEA) at the University of Oklahoma. One of the main functions of the center is to coordinate the Consortium for Student Retention and Data Exchange (CSRDE). She has helped transition the CSRDE from solely a data exchange group to a national organization supporting higher education institutions interested in improving the success of their students. Sandra was instrumental in establishing the National Symposium on Student Retention in 2005, and creating the CSRDE monthly webinar series in 2007. Under her leadership, the CSRDE published "Building Bridges for Student Success: A Sourcebook for Colleges and Universities" in 2003.

# CAMPUS PROGRAM MANAGERS

## Cameron University

***Von Underwood***, Ph.D., 580-581-2491, vonu@cameron.edu

Dr. Von Underwood is the current Dean of the School of Arts and Sciences at Cameron University. He teaches world literature courses for the Department of Communication, English, and Foreign Languages. He has a Ph. D. in Comparative Literature from the University Professors' Program at Boston University, an A.M. in Creative Writing from Boston University, and a B.A. in International Studies and Philosophy from University of North Carolina at Chapel Hill.

## East Central University

***Karen Williams***, Ph.D., 580-559-5394, kwilliams@ecok.edu

Dr. Williams earned a BS in Physics and Mathematics from Arkansas Tech University, a MS in Physics from the University of Arkansas, and a PhD in Physics Education from The University of Oklahoma. Her research interests are varied from how students learn physics to ultrasound physics to applying photothermal deflection spectroscopy to the analysis of species in a flame. She is an American Association of Physics Teachers Fellow, Vice Chair Physical Sciences Section and Recording Secretary for the OK Academy of Science and Professor in the Physics Department at East Central University.

## Langston University

***Sharon Lewis***, Ph.D., 405-466-3316, lewissa@langston.edu

Dr. Lewis has a BS in zoology from Howard University as well as an MS in chemistry and a Ph.D. in chemistry/biochemistry from the University of Oklahoma. Her research interests include bioinformatics of bipolar disorder and asphalt chemistry. Currently, Dr. Lewis serves as an Associate Professor of Chemistry.

## Oklahoma State University

***George Brusch IV***, Ph.D., 405-744-9680, gbrusch@okstate.edu

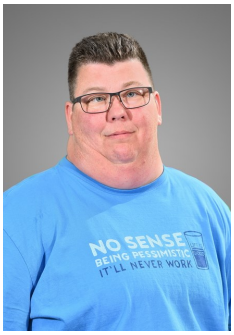
George received a BS in biology from California Polytechnic State University, San Luis Obispo and PhD in biology from Arizona State University. His research uses integrative methods to answer questions regarding animals that live in environmental conditions where resources are limited, specifically water. He is also passionate about outreach efforts and spending time with his wife and two daughters. He is currently an assistant professor in Integrative Biology at OSU.

**Oklahoma Panhandle State University**

***Ryan Blanton,*** Ph.D., 580-349-1550 , rblanton@opsu.edu

Dr. Blanton has a BA, MA, and PH.D. in anthropology, all from the University of Oklahoma. With a specialization in linguistic and medical anthropology, his research focus is the intersections of discourse, identity, and health. Past research projects include environmental racism, health inequality, and rural health economics and development. Dr. Blanton is the Vice President of Operations at Oklahoma Panhandle State University.

**Northeastern State University**




***Jody Buckholtz,*** Ph.D., 918-444-3839, buckholt@nsuok.edu

Dr. Buckholtz received a BS from the University of Central Arkansas and an MS and Ph.D. from the University of Arkansas. Her research interests include electrochemistry-oxygen reduction reaction catalysis, construction of reference electrodes for use in nonaqueous solutions, nitrate determination in rural well-water supplies, and ionic liquid uses as solvents for cellulose degradation. Dr. Buckholtz is an Associate Professor AISES Advisor and Supplemental Instruction Coordinator.

**Northwestern Oklahoma State University**

***Tim Maharry***, Ph.D., 580-327-8583, tjmaharry@nwosu.edu

Dr. Maharry has a BA with distinction in mathematics from Hastings College as well as an MS in applied mathematics and a Ph.D. in statistics from Oklahoma State University. His research interests include math education, statistical literacy, and numerical analysis. Currently, Dr. Maharry serves as Chair and an Associate Professor in the Department of Mathematics and Computer Sciences.

**Southeastern Oklahoma State University**

***Ning Wu,*** M.D., 580-745-2564, nwu@se.edu

Dr. Wu received his M.D. and Master of Medicine in Imaging Pathology from Capital Medical University, and his M.S. in Molecular Physiology from State University of New York at Stony Brook. His research interests include studying the molecular genetical mechanisms of human major depressive disorder, epidemiological investigation of populational based human diseases, and improving the learning and scientific inquiry skills of the undergraduate students in pre-health and biomedical courses. Dr. Wu is a Professor in the Department of Biological Sciences and a member of Oklahoma State Anatomical Board.

**Southwestern Oklahoma State University**

***Tim Hubin***, Ph.D., 580-774-3026, tim.hubin@swosu.edu

Dr. Hubin received a BS in chemistry and a BS in secondary science education from Kansas State University and worked as a postdoc at Caltech. Currently, he is working on the development and screening of transition metal complexes as drug molecules for several diseases including cancer, HIV, malaria, and fungal infections. He is also continuing a long-term project on "green" oxidation catalysts able to work in water and produce only water as byproduct. Dr. Hubin has received several awards for combined teaching and research accomplishments, including Oklahoma awards as a DaVinci Scholar and the Oklahoma Medal for Excellence, as well as the national award designation as a Henry-Dreyfus Teacher-Scholar.

**University of Central Oklahoma**

***Greg Wilson***, Ph.D., 405-974-3497, gwilson@uco.edu

Dr. Wilson has a BA in biology from Central College, an MS from Fort Hays State University, and a Ph.D. in zoology from Oklahoma State University. His research interests include using molecular techniques to investigate questions relating to genetics, phylogeography, molecular ecology, and systematics in an array of organisms, especially mammals. He is particularly interested in how heterogeneous landscapes impact contemporary genetic structure of extant populations. Currently, Dr. Wilson is the Assistant Vice President, Office of Research and Grants and a Professor in the Biology Department.

**University of Oklahoma**

***Rodney Bates***, Ph.D., 405-325-7407, rbates5@ou.edu

Dr. Rodney Bates is Director of Graduate Student and Postdoc Retention and Support in the Graduate College. Dr. Bates supports many aspects of the Graduate College's mission by providing direct mentorship and coaching to graduate students and postdocs, working with academic units to improve their climates, providing workshops and training to faculty, and enhancing the Graduate College's ability to recruit, support, and retain students and postdocs from historically underrepresented groups.

**University of Tulsa**

***Syed Raziullah Hussaini***, Ph.D., 918-631-2228, syed-hussaini@utulsa.edu

Dr. Razi is an Associate Professor in the Department of Chemistry and Biochemistry at the University of Tulsa. His research interests include medicinal chemistry, synthetic methodology, total synthesis of natural products, materials chemistry, electrosynthesis, and chemical education. Razi has worked with more than 60 students, ranging from visiting scholars to High School students, and authored 28 publications.

# ORAL PRESENTATIONS

# Listed Alphabetically

| First Name | Last Name | Univ | Discipline | Time | Room # |
|---|---|---|---|---|---|
| | | | *** Indicates a virtual presentation.** | | |
| Alexa | Benedict | SWOSU | Microbiology & Biochemistry | 2:05-2:20 | 413 Exhibit Rm 1 |
| Eleana | Cabello | OU | Biomedical Engineering | 2:05-2:20 | 417 Exhibit Rm 2 |
| Kaylee | Craig | CU | Chemistry | 1:45-2:00 | 416 Case Study 2* |
| Isabella | Hinojosa | OSU | Chemistry | 2:25-2:40 | 416 Case Study 2 |
| Trejon | James | LU | Biology | 2:25-2:40 | 408 Case Study 1 |
| Jihra | James | LU | Chemistry | 2:45-3:00 | 416 Case Study 2 |
| Andrianna | Buxton | LU | Biology | 2:05-2:20 | 416 Case Study 2 |
| Laura | Mejia | LU | Biology | 2:45-3:00 | 408 Case Study 1 |
| Star | Okolie | TU | Biochemistry | 2:25-2:40 | 413 Exhibit Rm 1 |
| Miguel | Payan | OU | Architectural Engineering | 1:45-2:00 | 417 Exhibit Rm 2* |
| Anai | Robinson | LU | Biology | 2:05-2:20 | 408 Case Study 1 |
| November | Sankey | OSU | Microbiology & Molecular Genetics | 1:45-2:00 | 408 Case Study 1* |
| Lucia | Torres | OU | Electrical Engineering | 2:25-2:40 | 417 Exhibit Rm 2 |
| Madison | Whitekiller | NSU | Biochemistry | 1:45-2:00 | 413 Exhibit Rm 1 |
| Stanley | Williams | TU | Chemical Engineering | 2:45-3:00 | 417 Exhibit Rm 2 |

# ORAL PRESENTATIONS

# Listed by Room Number

| First Name | Last Name | Univ | Discipline | Time | Room # |
|---|---|---|---|---|---|
| | | | * Indicates a virtual presentation. | | |
| November | Sankey | OSU | Microbiology | 1:45-2:00 | 408 Case Study 1* |
| Anai | Robinson | LU | Biology | 2:05-2:20 | 408 Case Study 1 |
| Trejon | James | LU | Biology | 2:25-2:40 | 408 Case Study 1 |
| Laura | Mejia | LU | Biology | 2:45-3:00 | 408 Case Study 1 |
| Madison | Whitekiller | NSU | Biochemistry | 1:45-2:00 | 413 Exhibit Rm 1 |
| Alexa | Benedict | SWOSU | Microbiology & Biochemistry | 2:05-2:20 | 413 Exhibit Rm 1 |
| Star | Okolie | TU | Biochemistry | 2:25-2:40 | 413 Exhibit Rm 1 |
| Kaylee | Craig | CU | Chemistry | 1:45-2:00 | 416 Case Study 2* |
| Andrianna | Buxton | LU | Biology | 2:05-2:20 | 416 Case Study 2 |
| Isabella | Hinojosa | OSU | Chemistry | 2:25-2:40 | 416 Case Study 2 |
| Jihra | James | LU | Chemistry | 2:45-3:00 | 416 Case Study 2 |
| Miguel | Payan | OU | Architectural Engineering | 1:45-2:00 | 417 Exhibit Rm 2* |
| Eleana | Cabello | OU | Biomedical Engineering | 2:05-2:20 | 417 Exhibit Rm 2 |
| Lucia | Torres | OU | Electrical Engineering | 2:25-2:40 | 417 Exhibit Rm 2 |
| Stanley | Williams | TU | Chemical Engineering | 2:45-3:00 | 417 Exhibit Rm 2 |

# POSTER PRESENTATIONS

# Listed Alphabetically

## Non-Life Sciences

*** Indicates a virtual presentation.**

| First Name | Last Name | University | Discipline | Poster # |
|---|---|---|---|---|
| Kaylee | Craig | CU | Chemistry | 5* |
| Jalen | Crutchfield | ECU | Physics | 3* |
| Gerald | DeRogers | OSU | Chemical Engineering | 7* |
| Mason | Egermeier | OSU | Civil & Environmental Engineering | 4 |
| Walter | Galie | TU | Chemistry | 8 |
| Leslie | Garcia | SWOSU | Chemistry | 9* |
| Isabella | Hinojosa | OSU | Chemistry | 13 |
| Chandler | Hummingbird | TU | Computer Science | 10 |
| Charles | Lett | LU | Computer Science | 15 |
| SheKayla | Love | CU | Chemistry | 11* |
| Ashtyn | McAdoo | SWOSU | Chemistry | 6 |
| Miguel | Payan | OU | Architectural Engineering | 1* |
| Shawn | Ray | OSU | Electrical Engineering | 14 |
| Ethan | Soemantri | OU | Mechanical Engineering | 2 |
| Makya | Stell | OU | Computer Engineering | 12 |
| Ryan | Webb | UCO | Chemistry | 16 |

# Life Sciences

*** Indicates a virtual presentation.**

| First Name | Last Name | University | Discipline | Poster # |
|---|---|---|---|---|
| Alex | Arreola | OSU | Microbiology | 32 |
| Saramarie | Azzun | OU | Cell & Molecular Biology | 17* |
| Andrianna | Buxton | LU | Biology | 33 |
| Eleana | Cabello | OU | Biomedical Engineering | 28 |
| Priscilla | Chatman | OSU | Microbiology/Cell & Molecular Biology | 19 |
| Karina | Cunningham | TU | Biology | 21 |
| Alissa | Eberhard | NSU | Cell & Molecular Biology | 34 |
| Ann Marie | Flusche | TU | Biology | 35* |
| Charles | Gates | LU | Biology | 29 |
| Meadow | Hansen Gonzalez | TU | Biological & Life Sciences | 26 |
| Antonio | Harris | LU | Biology-Genetics | 22 |
| Annabelle | Hawkins | SWOSU | Microbiology | 23 |
| Emily | Johnson | OSU | Microbiology/Cell & Molecular Biology | 39 |
| Gabrielle | Jones | OSU | Entomology | 18 |
| Kate | Kouplen | OSU | Nutritional Sciences | 36* |
| Christopher | Long | SWOSU | Biology | 24 |
| Kayli | Nail | OSU | Microbiology | 38* |
| Star | Okolie | TU | Biochemistry | 27 |
| Savannah | Porter | ECU | Biology | 30* |
| Emma | Quintana | SEOSU | Biology & Chemistry | 20 |
| Anai | Robinson | LU | Biology | 40 |
| Asuncion | Rubio | SEOSU | Bio/Chem | 31 |
| Maryam | Saleh | TU | Biochemistry | 37 |
| Jordan | Valenzuela | SWOSU | Biochemistry | 25 |

# PRESENTATION ABSTRACTS

**Arreola**

**DISCOVERY AND CHARACTERIZATION OF NOVEL FUNGAL DIVERSITY IN THE EQUINE ALIMENTARY TRACT**

Author(s): **Alex X. Arreola**
University of Scholar: Oklahoma State University
Location of Research: Stillwater, OK, USA
Funding: NSF, TRIO, Lew Wentz Foundation
Mentor(s): Dr. Mostafa Elshahed, Oklahoma State University

Fungi provide crucial ecosystem services in multiple ecosystems. Most fungi thrive as free-living organisms, but many forge symbiotic, predatory, pathogenic, and commensal relationships with algae, plants, and animals. One of the most peculiar groups of fungi are the anaerobic gut fungi (phylum Neocallimastigomycota) that reside in the alimentary tract of herbivores. Little is known regarding the scope of diversity of these elusive, anoxic microorganisms. Our work aims to characterize the diversity of AF's in the herbivorous gut on a global scale using culture independent approaches. We have collected >1,000 samples, from >50 type of animals, across 5 continents. My focus in this broader project is to examine patterns and determinants of the diversity of AF in equine alimentary tract. To this end, I extracted DNA from >100 fecal horse samples, and used polymerase chain reaction (PCR) to amplify a specific marker gene (D1/D2 LSU). Highthroughput sequencing was conducted, and analysis of the sequence data is currently underway. My preliminary analysis revealed a high level of AF diversity within the equine alimentary tract, as evident by the detection of > 30 different cultured and yet-uncultured AF genera in these samples. Moreover, a fraction of the sequenced obtained belong to multiple novel, hitherto undiscovered lineages, clearly indicated that the scope of AF diversity in the equine alimentary tract is much broader than previously suggested. Currently, I am attempting to identify and quantify the impact of various factors (animal feed, age, sex, location) in shaping the AF community in horses via implementing a wide range of statistical and phylogenetic approaches.

**Azzun**

**EXPLORATION OF MECHANISMS OF INHIBITION OF EXOSOME SECRETION BY NOVEL DRUGS IN OVARIAN CANCER CELLS**

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Funding: Summer Undergraduate Research Experience (SURE), OUHSC, Stephenson Cancer Center Pilot Project
Mentor(s): Bethany Hannafon, University of Oklahoma Health Sciences Center

Exosomes are small extracellular vesicles that contain macromolecular cargo and play a significant role in intercellular communication. Several studies have cited exosomes as having a role in ovarian cancer progression. Various drugs can inhibit exosome secretion in cancer cells through distinct mechanisms. Recent experiments in our laboratory identified two novel drugs called “Tumor EXosome inhibitors” (TEXi1 and TEXi2). We hypothesize that TEXi1 and TEXi2 will inhibit exosome secretion in ovarian cancer cells through mechanisms similar to known exosome inhibitors. We used two ovarian cancer cell lines (OVCAR-3 and OVCAR-4) and normal fallopian tube secretory epithelial cells (FT33). Cells were treated with solvent (DMSO), known exosome inhibitors (GW4869, Nexhinib20), Hsp70 inhibitor (MKT-077), TEXi1, or TEXi2 for 48 hours. Immunoblots were performed to evaluate expression of proteins involved in exosome biogenesis and secretion. Nanoparticle tracking analysis was used to determine if TEXi1 and/or TEXi2 treatment blocks total exosome secretion. We observed that TEXi1 and/or TEXi2 were effective in reducing exosome secretion as quantified by luciferase assay. Differential expression of several exosome markers was observed in the whole cell lysates following drug treatment. CD63 levels were reduced in exosomes following TEXi1 and TEXi2 treatment. These results were also validated using NanoSight. TEXi1 and TEXi2 inhibited exosome secretion in ovarian cancer cells, serving as potential treatment methods to prevent ovarian cancer progression. These findings can serve as further research to block ovarian cancer metastasis *in vivo*.

**Benedict**

*Streptococcus sanguinis* is a pathobiont found in healthy oral biofilms of humans. It is known as the causative agent of subacute infective endocarditis in susceptible populations including those with pre-existing heart defects. The metabolic status of *S. sanguinis* in the bloodstream and in the heart remains largely unknown. Degradation and synthesis of amino acids are hypothesized to be important for survival during the infection cycle of the bacterium. The metabolism of certain amino acids can cause enzymatic stress from the formation of a toxic enamine intermediate, 2-aminoacrylate (2AA).

Bacteria such as *Salmonella enterica* avoid 2AA stress via a family of proteins known as Reactive Intermediate Deaminases (Rid). *S. sanguinis* encodes a Rid gene from the subfamily RidA. This gene, SSA_0809, codes for an enamine deaminase protein herein known as SsRidA. Elucidating the structure and function of SsRidA has been the goal of this study. Using a bacterial SsRidA was confirmed to have *in vitro* and *in vivo* deaminase activity comparable to that of a well-characterized RidA protein from *S. enterica.* SsRidA had enamine deaminase activity nearly identical to SeRidA. SsRidA showed different substrate specificity with imino-histidine and imino-phenylalanine as compared to the SeRidA. Induction of 2AA stress led to a phenotype of *S. enterica* with inhibited growth that was restored with the SSA_0809 gene showing *in vivo* enamine deaminase function. SsRidA may have an important role in reducing the 2AA stress accumulated during the infection process. To elucidate the atomic structure of SsRidA, crystallization studies were performed to produce diffraction quality crystals using the hanging drop method.

**Buxton**

Comparing the Effects of Viral and Bacterial Infection on ERG Expression in Lung Blood Vessels

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12 July 2021

The cardiovascular system comprises the heart and blood vessels and plays an important role in inflammatory diseases. We have previously shown that in a mouse model of bacterial infection the transcription factor ERG is rapidly downregulated in the blood vessels of the lung. ERG is known to repress inflammatory pathways. Therefore, we believe that the downregulation of ERG promotes inflammation in the lung. An important question that remains is whether or not ERG downregulation is conserved between both bacterial and viral infections. To answer this question, we evaluated ERG expression in the lungs of mice infected with influenza virus. Mice were injected with either a lethal or sublethal dose of influenza. Two to six days after infection lung samples were collected to analyze ERG expression by western blot and immunofluorescence imaging. We found that lethal doses of influenza led to ERG downregulation in the lung vessels as previously observed for bacterial infections. Therefore, our data suggest that ERG downregulation in the lung is conserved for different infection models. In the future, studies will focus on what conserved pathways are responsible for ERG downregulation during bacterial and viral infection.

**Cabello**

**INVESTIGATION OF THE MECHANICAL, COLLAGEN MICROSTRUCTURAL, AND MORPHOLOGICAL PROPERTIES OF HUMAN INTRACRANIAL ANEURYSMS**

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Funding: Oklahoma Center for the Advancement of Science & Technology (HR18-002)
Mentor(s): Dr. Chung-Hao Lee, University of Oklahoma

Intracranial aneurysms (ICAs) are focal dilations of cerebral arteries caused by the weakening of the arterial wall. The resulting changed hemodynamics can further lead to stress and growth of the site until it eventually ruptures. The morbidity and mortality of a ruptured aneurysm are high, even after treatment, with many dying within months of the occurrence or suffering from lifelong disability [1]. Previous studies have separately examined the hemodynamics, mechanical properties, or morphology of human aneurysm tissues. The present work provides quantitative data on a resected human cerebral aneurysm's mechanical, collagen fiber microstructural, and morphological characteristics. The mechanical properties of the tissue were characterized using biaxial tension and stress relaxation tests. The tissue's collagen fiber architecture and its load-dependent changes were then examined using a polarized spatial frequency domain imaging system. The microstructural components of the tissue were quantified using histological procedures. This investigation extends on our previously developed characterization framework [2] and provides additional quantitative information on human cerebral artery aneurysms. Such investigations of these properties can provide essential insight into the evolution of aneurysms and their associated rupture risk, which can ultimately improve our fundamental understanding of aneurysm growth critical for the future development of aneurysm therapeutics with improved outcome.

[1] Hemphill J.C., III, *et al.* Stroke, 46(7):2032-60 (2015).
[2] Laurence D.W., *et al.* Scientific Report, 11: 3525 (2021).

**Chatman**

ANTIFUNGAL ACTIIVITY OF THE NOVEL COMPOUND EIPE-1 AGAINST CRYPTOCOCCUS NEOFORMANS

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Funding: OK-LSAMP, Cowboy Technologies
Mentor: Dr. Karen Wozniak, Oklahoma State University

*Cyroptococcus* neoformans is an opportunistic fungal pathogen of the respiratory tract, which is responsible for almost 200,000 deaths annually. Antifungal drugs have been used to treat fungal infections for many decades; however, due to similarities between fungal and mammalian cells, these drugs are often toxic. In these last few decades, the fungi have also become resistant to the antifungal drugs. EIPE-1 was synthesized from vanillin, and was shown to have activity against methicillin resistant *S. aureus* (MRSA), and other gram-positive bacterial pathogens. We hypothesized that EIPE-1 could be used to kill fungal pathogens. For this study, we tested EIPE-1 against *C. neoformans* using a minimum inhibitory concentration (MIC) assay and an in vitro model of intracellular fungal growth using RAW macrophages. EIPE-1 has antifungal activity in our MIC assay, with an MIC value of 1.749 µg/ml. In addition, after incubation of *C. neoformans* with RAW macrophages and EIPE-1, treatment with EIPE-1 had significant antifungal effects on *C. neoformans* compared to *C. neoformans* alone and compared to *C. neoformans* with RAW macrophages. In further studies, we will examine the mechanism of EIPE-1 anti-fungal activity, and we will also test EIPE-1 against other fungal pathogens including *Candida albicans.*

**Craig**

Analysis of Heme-Binding Proteins from *Listeria monocytogenes* Using Differential Scanning Calorimetry

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*Listeria monocytogenes* is a gram-positive bacterium that can cause severe infection in immunocompromised individuals. It is reliant on the acquisition of iron from its host to continuously spread throughout the body. Here we describe the thermal denaturation points of heme binding proteins Hbp1 and Hbp2, two iron scavenging proteins, using Differential Scanning Calorimetry. DSC is a useful technique used to characterize the thermal denaturation point of protein folding and unfolding events. As a result, the enthalpy and entropy of the protein unfolding event can be calculated. Conventional DSC results showed a reproducible denaturation point of 59.6 ± 0.3 °C for Hbp1 and a denaturation point of 65.6 ± 0.2 °C for Hbp2. Further investigation was completed to determine the role of bound ligands, such as heme, on overall protein stability. These thermodynamic values for protein denaturation can be applied to pharmaceutical studies to understand the role of these proteins as virulence factors for disease and their potential use as therapeutic targets.

**Crutchfield**

Abstract

The spin states of ultra-cold neutral atoms can be coherently manipulated with magnetic and optical fields to form complex many-body quantum states. This research builds upon previous work with entangling interactions with ultra-cold Rydberg atoms that were controlled via optical tweezers. This summer, I worked with an optical cavity as a part Raman laser system to control the quantum states of single cesium atoms. The purpose of this optical cavity research is to stabilize the frequency of light exiting the laser via laser locking, and filtering out unwanted sidebands that are byproducts of a phase modulator that generates the Raman tones on the optical field.

**Cunningham**

**INVESTIGATION OF THE EFFECTS OF LAND MANAGEMENT HISTORIES AND FERTILIZER TREATMENTS ON RHIZOBIAL *NIFH* GENE SOIL ABUNDANCE AND RHIZOBIAL *NIFH* GENE DIVERSITY IN THE *VICIA VILLOSA* COVER CROP**

Author(s): **Karina Cunningham**, Mary Hendon
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Funding: OK-LSAMP and NSF
Mentor: Jeanette Norton, Utah State University

The Vicia villosa (Vetch) cover crop fixes nitrogen through symbiotic processes with soil bacteria Rhizobium leguminosarum biovar viciae. This bacterium has a marker gene, *nifH*, that is part of the nitrogen-fixing enzyme. The objectives of our investigation were to assess how land management history and fertilizer treatment affected *nifH* gene diversity and *nifH* soil abundance. The goal of this study was to improve our understanding of the interaction between nitrogen fertilizer application and nitrogen-fixing bacteria. Root nodules and bulk soil samples from two fields with different land management histories were examined. Field one had a land management history of corn and was planted with a vetch cover crop organized in a randomized block design of 16 plots with four fertilizer treatments: control (no-nitrogen), low-ammonium sulfate (AS112 kg N/ha), high-ammonium sulfate (AS224 kg N/ha), and steer-manure compost (224 kg total N/ ha). Field two had a land management history of small grains and was planted with a vetch cover crop organized in a block design of 16 plots without fertilizer treatments. We hypothesized that *nifH* diversity and *nifH* soil abundance would vary depending on fertilizer nitrogen composition and land history. Real-time quantitative PCR was run on DNA isolated from bulk soil samples of the 32 plots to quantify *nifH* soil abundance. The real-time PCR showed no significant difference between fertilizer treatments in field one, but field two (small grain history) had a significantly higher abundance than field one (corn history). This result

**DeRogers**

**How a Battery Works**

**Background:** The steady increase in the consumption of fossil fuels in modern society has caused several serious environmental and human health issues. The burning of fossil fuels not only produces carbon dioxide emissions, which are contributing to global warming and poisoning the world's oceans but also releases toxic air-borne pollutants into the atmosphere[4,5]. Most commercial batteries are currently being mass-produced to power personal electronics, store renewable energy, and more recently, power electric automobiles. I believe we can utilize them for even more, but to do that we must understand, deeply, how a battery works.

**Research Objective:** Learn the chemistry process of a battery, so I can test the concept of toxic diesel soot being recycled and used in a Na-ion battery to make more affordable batteries and create sustainable material sources by harvesting industrial waste as a valuable material for batteries.

**Research Plan:** Through this research I will learn to manufacture Na-ion batteries as well as test them using a cyclic voltammetry and galvanostatic cycling. The learning process involves the fabrication of composite electrodes, usage of glove boxes, assembly of coin battery cells, and executing electrochemical measurements. I will closely work with the graduate students in the group. The performance of the diesel soot anode will be tested at various scan rates and electrolyte environment.

**Expected Results:** With the chemical knowledge behind the battery I can begin to see which technique provides the highest quality harvested diesel soot carbon, there will be enormous opportunities to fabricate more affordable Na-ion batteries for grid-scale storage. Furthermore, with an established high-quality baseline the progress of sodium-ion battery research can only increase allowing earlier entrance into the commercial and industrial worlds. This ultimately results in a cheaper, more available energy source for the masses.

**Eberhard**

**USING FLUORESCENT UPEC AS A MODEL TO STUDY INTERACTIONS WITH HUMAN BLADDER CELLS**

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Funding: The Oklahoma Louis Stokes Alliance for Minority Participation (OK-LSAMP) and the National Science Foundation (NSF)
Mentor(s): Janaki K. Iyer, Northeastern State University

*Escherichia coli* (*E. coli*) are opportunistic bacteria that reside in the intestines of humans and contribute to gastrointestinal health. However, there are some strains that can cause a variety of diseases including urinary tract infections (UTIs). UTIs caused by *E. coli* are the most common type of bacterial infections seen in women and are a significant public health concern. Uropathogenic *E. coli* (UPEC) have acquired specific virulence factors including adhesins and fimbriae, which lead to increased adherence and invasion into urinary tract cells in the host. The pathogenic mechanisms employed by UPEC that promote adhesion and invasion have yet to be fully elucidated. We propose to study the mechanisms of adherence and invasion of UPEC to host cells by generating UPEC expressing the green fluorescent protein (GFP). we hypothesize that the GFP-expressing UPEC will assist in studying host-pathogen interactions. To test this hypothesis, we transformed UPEC with a GFP encoding plasmid and successfully generated fluorescent UPEC. These fluorescent UPEC were used to infect human bladder epithelial cells (5637) at increasing multiplicities of infection (MOI) to study adherence and invasion. We successfully detected and quantified adherence and invasion of the fluorescent UPEC by different methods that include fluorescent microscopy, flow cytometry, and gentamicin-based invasion assays. Thus, with the assistance of GFP-expressing UPEC, we can efficiently gain more insight on host proteins that mediate adherence and invasion of UPEC. These findings will shed more light on the different

**Egermeier**

**MICROPLASTIC EXTRACTION FROM SEDIMENTS WITH A CONTINOUS FLOW ELUTRITION PROCESS**

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Funding: USGS
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The extent of microplastic contamination in Oklahoma's freshwater systems is completely unknown. Microplastics are polymers with a diameter less than 5mm. Microplastics enter the environment through recreational, agricultural, or industrial activities among other causes. Microplastics can be found in surface water and sediments of freshwater sources. For analysis purposes, microplastics can be extracted from sediments by exploiting differences in densities and settling velocities in a process known as elutriation. Our goal is to develop a continuous flow elutriation process to increase microplastics extraction efficiency and decrease elutriation time. For that purpose, samples of sediments were taken at several points along Boomer Creek through the city of Stillwater, OK. Samples were elutriated with a continuous flow to extract the lighter particles. Zinc chloride was used to further separate plastics and microplastics by density. Samples were filtered through 0.2 µm aluminum oxide filters and digested with hydrogen peroxide (30%) at 50 ºC for two days to remove organic matter. Microplastics were detected with Fourier-Transform Infrared (FTIR) spectroscopy using a cooled ATR detector. This procedure has led to the identification of various polymer types in the sediments of Boomer Creek. Further research is needed to continue optimizing extraction procedures and characterize other types of plastics in freshwater systems. Plastics such as polystyrene and polypropylene are expected to be identified due to their common use. Understanding the abundance of microplastics in Oklahoma's freshwater should be a priority because of their prevalence in the environment and the potential for dangerous health effects.

**Flusche**

**INCREASING QUERCUS POLLEN IN THE TULSA ATMOSPHERE: LONG-TERM TRENDS, VARIABILITY, AND INFLEUNCE OF METEROLOGICAL CONDITONS**

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Funding: The National Science Foundation (NSF), OK-LSAMP
Mentor(s): Professor Estelle Levetin, University of Tulsa

In the Tulsa area, *Quercus virginiana* pollen is largely represented by Oak (Quercus virginiana). In Oklahoma, there are over 21 different species of oak trees. These trees shed considerable amounts of pollen, which presents a significant challenge to allergy sufferers. The pollen is known to be allergenic and is a major component of the Tulsa atmosphere in March and April. This study examined airborne Quercus pollen data from 1988 to 2018 to determine long-term trends, pollen seasonal variability, and influence of meteorological variables on airborne pollen concentrations. Pollen was collected through means of a Burkard sampler and analyzed with microscopy. Monthly pollen concentrations and yearly pollen metrics showed a high degree of variability. In addition, there were increases over time in the seasonal pollen index and in peak concentrations. These increases parallel the increasing population of Quercus in the region. Pollen data were split into pre- and post-peak categories for statistical analyses, which revealed differences in correlations of the two datasets when analyzed with meteorological conditions. While temperature and humidity, among others, were significant in both datasets, other factors, like precipitation, were significant only in one dataset. Analyses using wind direction showed that southerly and southwestern winds contributed to increased pollen concentrations. This study confirms that Q. virginiana pollen has become an increasing risk for individuals sensitive to this pollen and emphasizes the need for long -term aerobiological monitoring in other areas.

**Galie**

**CONSTRUCTION OF A REUSABLE GEL-ELUTED LIQUID FRACTION ENTRAPMENT ELECTROPHORESIS (GELFrEE) USING 3D PRINTING**

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Location of Research: The University of Oklahoma, Norman, OK, USA
Funding: Dick Van Der Helm Research Award
Mentor(s): Dr. Si Wu, The University of Oklahoma

Gel-Eluted Liquid Fraction Entrapment (GELFrEE) is commonly utilized in proteomics research for size-based separation and fractionation of proteins. Commercial GELFrEE cartridges are wasteful due to their single-use application and, furthermore, are being discontinued for leaving researchers that utilize the technique without needed resources. We have designed a 3D-printed, reusable GELFrEE cartridge that can be utilized with existing GELFrEE instruments. This cartridge allows the user to clean and repeatedly refill the chambers with new gels eliminating unnecessary plastic waste. Additionally, we have optimized the construction of the cartridge with respect to the type of plastic as well as coating materials and sealing glues to avoid interaction with buffers, solvents, and proteins. The 3D-printed cartridge will further allow us to optimize the composition of the separating gel according to the experimental purposes. Lastly, the cartridge has been refined to successfully separate complex *E. coli* lysate utilizing twelve and fifteen percent acrylamide gel.

**Garcia**

**CROSS-BRIDGED TETRAAZAMACROCYCLE OXIDATION CATALYSTS DESIGNED TO BE COPOLYMERIZED: MAKING HETEROGENEOUS RECYCLABLE OXIDATION CATALYSTS FOR REMOVAL OF CEC FROM WASTEWATER**

Authors: **Leslie Garcia,** Makynna R. Koper, Elisabeth Allbritton, Ashtyn McAdoo, Tuyet Hoang, Elah Alcuitas, Timothy J. Hubin
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Funding: OK-LSAMP, National Science Foundation Oklahoma EPSCOR
Mentor: Timothy J. Hubin, Southwestern Oklahoma State University

Contaminants of Emerging Concern (CEC) are typically anthropogenic organic compounds such as dyes, pesticides, pharmaceuticals, etc., which are becoming increasingly prevalent in wastewater and tend to escape current water purification efforts. In this work, we describe synthetic strategies leading to polymerizable Cu, Fe, and Mn complexes of cross-bridged tetraazamacrocycles. Complexes of this type are known, water stable, broad spectrum homogeneous oxidation catalysts that can use green oxidants, such as hydrogen peroxide and dioxygen, to modify a variety of organic functional groups. In a viable wastewater purification scheme, such catalysts would need to be made heterogeneous so that they can be recycled and used to treat multiple aliquots of wastewater. We are developing monomeric analogues of the known cross-bridged tetraazamacrocycles which have polymerizable pendant arms, with a goal of copolymerization with known polymer types to produce heterogeneous recyclable oxidation catalysts. We present here allyl, benzyl, and primary amine pendant armed cross-bridged tetraazamacrocycles, their Cu, Fe, and Mn complexes, and our progress in producing polymeric materials incorporating them.

**Gates**

**ANNEXIN A2 EXPRESSION IN PROSTATE CANCER CELLS.**

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Funding: National Institutes of Health
Mentor: Pankaj Chaudhary, UNTHSC

Metastasis is a major cause of morbidity in prostate cancer patients, the primary mortality is metastasis to the bone tissue. Despite substantial efforts to understand prostate cancer metastasis, the mechanisms involved in preparing the metastatic niche for colonizing the prostate cancer cells are still not known. Therefore, there is an urgent need to identify essential regulators of bone metastasis in prostate cancer for therapeutic targets.

Annexin A2, a calcium-dependent phospholipid binding protein that is overexpressed in the poorly differentiated high-grade adenocarcinomas of prostate cancer. Phosphorylation of AnxA2 at tyrosine-23 creates an important event for the localization of AnxA2 to the cell surface. At the cell surface, it provides a binding site for tissue plasminogen activators, and converts plasminogen into plasmin. Which plays an important role in invasion and metastasis of cancer. However, the cell surface expression of AnxA2 in prostate cancer is unknown. Therefore, in the present study, we demonstrated the cell surface expression of AnxA2 in prostate cancer cells to delineate the mechanism of bone metastasis.

Prostate cancer cell lines, PC3 and DU145 were grown. Immunoblotting was used to detect the expression of pAnxA2-Y23 and AnxA2 proteins in cells. Our results demonstrated that the expression of pAnxA2-Y23 is very high in prostate cancer cells (PC3 and DU145 cells) compared to normal prostate epithelial cells. However, the expression of total AnxA2 in both prostate normal and cancer cell lines is comparable. Results suggest that the cell surface expression of AnxA2 is high in prostate cancer cells due to increased phosphorylation of AnxA2 at tyrosine 23.

**Hansen Gonzalez**

**Title: OSSETRA CAVIAR MICROBIOME**

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Funding: OK-LSAMP, National Science Foundation (NSF)
Mentors: Benjamin J. Reading- North Carolina State University; Scott A. Salger - Barton College

Ossetra caviar from Russian sturgeon *Acipenser gueldenstaedtii* is one of the most sought-after caviars in the world. Wild Russian sturgeon populations have been vastly depleted in their native locations, such as the Caspian Sea, due to overexploitation and habitat degradation. In fact, the importation of caviar from their native areas has become illegal in many countries. Russian sturgeon are now raised in aquaculture to overcome this challenge. As a result, aquaculture has become more popular as it farms sturgeon, and thus caviar, without putting them at risk. The purpose of this study was to investigate the microbiome of caviar and identify key differences among prokaryotic taxa to determine whether particular organisms correspond to better flavor profiles and overall product quality. Fifteen caviars of varying price ($60 to $595/oz.) were purchased from online vendors. Genomic DNA was extracted from the brine of each tin of caviar and prepared for sequencing. Sequences were then analyzed using the QIIME 2 microbiome bioinformatics platform. A diverse array of microorganisms were found to be present across all caviar samples. Although no differences in diversity were discovered when comparing the grade, osmolarity, salt content, pH, presence of sodium tetraborate (chemical preservative), container type, or diameter or moisture content of the roe, there were differences in the microbial composition of the caviars. This model may be used to infer the impact of microorganisms on the quality of caviar and explain how they may be used to improve the value and appeal of caviars produced in aquaculture.

**Harris**

**IL-4 AND IL-13 SYNERGIZE TO INCREASE GROWTH AND CCL4 CHEMOKINE mRNA EXPRESSION BY 4T1 MAMMARY ADENOCARCINOMAL TUMOR CELLS**

**Antonio Harris1**, Daniel Pina2, Sharon Njoki3, Michael Donkor4, Byron Quinn1 and Harlan P. Jones4
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Funding Source: NIH and NCI

Approximately, 1 in 8 women in the US will develop invasive breast cancer and 1 in 33 will die. Breast Cancer is a major health disparity for women all over the globe, having the largest impact on African American women under the age of 45. Despite medical advances, the 5-year survivorship among breast cancer patients remains significantly low largely due to high recurrence rates and propensity for metastasis to distal organs. (e.g., lung, liver, brain). Thus, further knowledge of the mechanisms which promote tumor development and progression is needed to advance cancer treatment. Tumor cells are known to secrete and express immune modulators as a mechanism to invade host antitumor immune responses. Using an experimental murine tumor cell line, our preliminary results demonstrate the expression of interleukin-4 receptor (IL-4R). We hypothesize that IL-4R activity plays a role in mediation of tumor cell function. In this study, 4T1 mammary adenocarcinoma cells were exposed to IL-4R ligands, interleukin-4 (IL-4), interleukin-13 (IL-13) and their ability to influence TNF-α, TGF-β1 and CCL4 expression by 4T1 cells. Our results demonstrated an increase growth and CCL4 mRNA expression in response to IL-4 in combination with IL-13, suggesting a potential target to mitigate tumor progression.

**Hawkins**

**INVESTIGATING IMPACTS OF SYRINGAFACTIN ON BACTERIAL CHEMOTAXIS**

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Funding: OK-LSAMP/NIH: OK-INBRE SMaRT
Mentor: Dr. Regina McGrane, SWOSU

*Pseudomonas syringae* is a bacterium that infects plants. Our laboratory demonstrated that *P. syringae* produced syringafactin has antimicrobial properties and repels human pathogens on semi-solid surfaces, suggesting syringafactin may be useful in controlling the growth of pathogenic bacteria. The purpose of this study was to determine whether syringafactin acts as a repellant of bacteria in liquid suspensions and identify potential *P. aeruginosa* receptors involved in syringafactin detection. To study if syringafactin works as a repellant in liquid, normalized cultures of *Eschericia coli*, *Salmonella enteritidis,* and *Pseudomonas aeruginosa* were exposed to suspended pipette tips containing syringafactin or sterile deionized water for 15 min. The contents of the pipette tips were then spread onto agar media, and colonies were counted to quantify bacteria that moved into the pipette tip. Samples from tips containing syringafactin were expected to have lower bacterial concentrations compared to samples from tips containing water. Surprisingly, our studies showed that samples with syringafactin were not significantly different from those with water. Therefore, we concluded that syringafactin does not work as a chemorepellant in liquids. To determine the chemoreceptors responsible for *P. aeruginosa* detection of syringafactin, we exposed *P. aeruginosa* mutants with disruptions in genes encoding for putative chemoreceptors to wild-type *P. syringae* on soft-agar media. The ability of the mutants to respond to and move away from *P. syringae* was observed. Mutants unable to move away from *P. syringae* on soft agar media likely have disruptions in syringafactin specific chemoreceptors. Collectively, this work is the first to demonstrate that syringafactin does not impact chemotaxis in liquids and attempt to identify chemoreceptors involved in detecting syringafactin.

**Hinojosa**

**Sulfur Protecting Groups and Oxidative Cyclization**

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**Abstract** Heterocyclic compounds are of crucial importance to medicinal chemists as the majority of active pharmaceutical ingredients contain at least one heterocycle in their scaffold. A muscarinic acetylcholine receptor antagonist is an example of a charged bioactive heterocycle containing both sulfur and nitrogen. Previous lab syntheses of structurally and chemically related compounds with potential bioactivity required a p-methoxybenzyl protecting group to prevent unwanted side-reactions from occurring. The conditions for its removal (triflic acid in trifluoroacetic acid) are very harsh which limits the functional groups tolerated on the molecule. Ergo, a new synthetic pathway was investigated.

Phenacyl, acetamidomethyl, and benzamidomethyl protecting groups were attached to the sulfur substituent of 2-aminobenzenethiol. The benzamidomethyl compound was successfully isolated and underwent the addition of a triazole on the primary amine. However, none of the newly synthesized compounds were easily isolated after their final step and thus deemed not ideal for new protection methods.

A *tert*-butyl thiol was added in a substitution reaction to 1-fluoro-2-nitrobenzene. The nitro group was converted to an amine in a subsequent reaction. The resulting compound had a high yield. The amine was then successfully converted to a triazole. The final compound, (4-(2-(*tert*-butylthio)phenyl)-4H-1,2,4-triazole) was isolated.

Removal of *tert*-butyl protecting group from 4-(2-(*tert*-butylthio)phenyl)-4H-1,2,4-triazole was attempted using bromine, iodine, triflic acid, and trifluoracetic acid. Triflic acid successfully deprotected the compound. Neither bromine nor trifluoracetic acid resulted in substantial deprotection. Iodine showed substantial deprotection resulting in a cyclized benzo[4,5]thiazolo[2,3-c][1,2,4]triazole detected by LCMS. Also detected was the cyclized product with the relocation of the *tert*-butyl onto the triazole, 1-(*tert*-butyl) benzo[4,5]thiazolo[2,3-c][1,2,4]triazol-1-ium. Both products were confirmed with NMR. Further investigation is being performed pertaining to the deprotection with iodine and the subsequent cyclization reaction.

**Hummingbird**

**Integrating Computer Game Technologies with Museum Experiences**

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From a cultural perspective, games teach knowledge and, sometimes, physical skills that each society values. Computer-based versions of traditional games can simulate those skills and help today's visitors experience a traditional Native American game. The objective of this project is to integrate interactive computer technology with museum exhibits in order to provide an enhanced experience for the museum visitors. The result of this work is a mini-game entitled Spear Thrower VR, a configurable of two spear-throwing simulations. The first is a game of skill for children to develop hand-eye coordination for using a spear and atlatl (spear-thrower). The second version is a skill game for adults called Chunkey which is played by American tribes in the Southeast and was played as far west as Cahokia on the Mississippi River, at least as early as 900CE. The game can support 1-4 players who interact with the game using extant Nintendo Wii remote motion controllers with optional attached Motion Plus extensions, depending on the preferred control scheme. The controllers can be moved to replicate the motions of throwing a spear in order to simulate the action within the games themselves. The program makes full use of both the Wii remotes' accelerometers, IR cameras, and Motion Plus gyroscopes in order to track the force, movement, and orientation of the Wii remotes in real world space to translate accurately within the game world. Both quantitative and qualitative measures will be used to assess the success of this project. Quantitatively, the research team

**J. James**

Sex-chromosomally driven differences in gene expression within microglia and other macrophages contribute to age-related disease. Of particular interest is age-related 'sterile' neuroinflammation which is more pronounced in females than males and may underlie sex differences in neurodegenerative disease prevalence. X-inactivation is an important dosage compensatory mechanism used to silence on of the two X-chromosomes in females. Maintenance of X-inactivation relies on epigenetic mechanisms, such as DNA hypermethylation. With aging, epigenetic machinery becomes dysregulated and several gene products escape X-inactivation. Our hypothesis is that X-chromosome DNA methylation will change with age in females in microglia within the brain and potentially in circulating macrophages as well, indicating escape from X-inactivation. To assay DNA methylation, we used Bisulfite Amplicon Sequencing (BSAS) of X-chromosomally-encoded immune mediators (Tlr7, Tlr8 Gpr34). Circulating Cd11b myeloid cells, close relatives of brain resident microglia were assayed initially using blood collected from male and female mice at young (6 mo) and old (25 mo) timepoints. Following red blood cell lysis, circulating Cd11b myeloid cells were isolated using magnetic-activated cell sorting (MACS). Cell input and Cd11b+ cells were analyzed by flow cytometry prior to isolation of DNA for BSAS. BSAS analysis did not reveal any significant differences in methylation by age or sex indicating that these genes do not escape X-inactivation in this cell population. Future studies will examine microglia, a much longer-lived cell population and more potential candidate genes for escape from X-inactivation.

**T. James**

**Potential Mediators of PTOA Pain**

**Trejon James,**
Tim Griffin, Ph.D. Aging and Metabolism

**Abstract**

Post traumatic osteoarthritis (PTOA) develops as a result of injury to the joint. This process involves progressive joint damage and chronic low-grade inflammation that leads to PTOA pain. This summer, I focused on damaging joint calcification and a serum macrophage-related inflammatory biomarker as potential mediators of PTOA pain. Progressive joint calcification is associated with sensory nerve growth, and soluble CD-14 is an activated macrophage biomarker associated with OA severity. Given that PTOA pain is related to both peripheral and central changes in the nervous system, we hypothesized that PTOA pain is more strongly correlated with circulating CD14 levels compared to joint calcification. We tested this hypothesis in lean and obese adult mice. 16-week-old male and female mice were fed either a high fat or control fat diet. At 36 weeks of age, mice were anesthetized and had a non-injury sham load or rapid compressive load applied to the knee to cause PTOA. Von Frey filament and Dynamic weight bearing tests were used to evaluate mechanical pain sensitivity before injury (baseline), and two- and four-weeks post injury. At 40 weeks of age, the mice were euthanized, and we collected knee joints and serum. We used micro-computed tomography to quantify joint fication, and we quantified serum CD14 using an enzyme linked immunosorbent assay. At baseline, diet did not alter pain sensitivity. Pain sensitivity increased two weeks after both compression injury and sham loading to a similar level in lean and obese mice. We are completing the four-week post injury data analysis, and we have collected all samples to measure serum CD-14 and joint calcification. We will compare the increase in pain sensitivity to serum CD-14 concentration and joint calcification volume to test our hypothesis.

**Johnson**

**A Reversal of *Caenorhabditis elegans* Ivermectin-Induced Paralysis through the LITE-1 Photoreceptor**

Author(s): **Emily S. Johnson**, Magera Shaw, Jacob R. Manjarrez, Ph.D.
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Funding: AFOSR FA9550-18-1-0308; OK-LSAMP,
Mentor(s): Dr. Jacob R. Manjarrez, Oklahoma State University Center for Health Sciences

*Caenorhabditis elegans* is an ideal model organism as it has an extensively studied anatomy, including a completely mapped and connected nervous system. This allows for neuronal signals and interactions with other cells, such as muscle cells, to be identified and examined. One of these interactions is that of the LITE-1 photoreceptor, which is contained in only two of the 302 *C. elegans* neurons. However, it seems to have an adverse effect on the muscular system, specifically when subjected to short wavelengths of light after ivermectin-induced paralysis. To study this relationship, the wild-type N2 strain with its functional LITE-1 photoreceptor is used along with a mutant KG1180 strain to determine the impact of LITE-1 on *C. elegans* ivermectin-induced paralysis. The N2 and KG1180 strains were grown as a synchronized population to obtain worms at the L4 stage and picked to 96-well plates for immobilization with 10μM ivermectin. Following incubation, the worms were exposed to different wavelengths of light using a SpectraX light source along with a LasX navigator template to facilitate the imaging and timing of the exposure conditions. During each exposure, the worms were exposed to white, ultraviolet (395/25 nm), blue (470/24 nm), and green light (542/33 nm), and were observed for the transition from paralysis to full-body movement. It was recorded that N2 worms revert towards mobility when exposed to ultraviolet and blue light, but not during exposure to white or green light. KG1180 worms, however, were not affected and remained paralyzed throughout

**Jones**

**A GWAS Study of Color and Texture on Natto Soybeans**

Gabrielle Jones, Jade Walker-Wilson, Joshua Winter, Leandro Mozzoni

**Abstract**

Soybeans are an essential component to the contemporary Japanese diet. Natto is a Japanese dish made by fermenting soybeans, and the physical properties of the unprocessed soybeans will affect the natto produced. Pale yellow soybeans that are slightly firm in texture are preferred. The genetic improvement of these qualities is achieved through breeding. A genome-wide association study (GWAS) is an important tool for soybean breeding and can be used to associate genomes with a certain genotype. Color and texture are the selected phenotypes in this study and a GWAS program was ran to associate the genotype markers with the phenotypes. None of the markers in the study reached the threshold of significance and therefore are not considered to be associated with one of the phenotypes. Further research is necessary.

**Kouplen**

ENZYMATIC ASSESMENT OF CELLS WITH DISTINCT TP53 MUTATION TYPES

**Author(s):** Kate Kouplen, Evan Hermann, and McKale Montgomery
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**Location of Research:** Oklahoma State University, Stillwater, OK, USA
**Funding:** National Cancer Institute grant R03 CA259595
**Mentor(s):** Dr. McKale Montgomery, Oklahoma State University

The p53 transcription factor, encoded by the human gene TP53, is the most commonly mutated gene in human cancers. Once the TP53 gene is mutated, p53 proteins not only lose their tumor suppression abilities but can also contribute to tumor growth. One-way mutant p53 can do this is by increasing iron uptake and availability by altering the regulation of iron-sulfur (Fe-S) cluster containing proteins. Understanding such alterations are important because Fe-S cluster proteins play a role in both energy metabolism and DNA repair enzymes, which can suppress the progression and expansion of cancerous tumors. This study's main focus was to examine how TP53 mutation status influences Fe-S cluster protein regulation, and subsequently iron homeostasis in tumor cells. First, we assessed the activity of the Fe-S containing enzymes cytosolic and mitochondrial aconitase in cell lines expressing a variety of TP53 mutations. Specifically, we will use cell lines that express the six most commonly observed TP53 mutations, which represent nearly 25% of all TP53 mutations in human cancers. We found that while aconitase activity decreased as expected following the removal of iron in cells expressing WTP53, the influence of iron chelation on aconitase activity in cells expressing mutant TP53 varied depending on mutation type. This data strongly suggests that TP53 mutations significantly influence how the activity of Fe-S cluster enzymes is regulated. Thus, our ongoing studies are focused on investigating how TP53 mutation status influences the regulation of genes involved with Fe-S cluster biogenesis and consequently, Fe-S cluster containing protein activity.

**Lett**

The Setwise Stream Classification Algorithm is a modern take on the subset of machine learning known as classification, potentially allowing larger and more complex datasets to be classified as they are received in real time. Previous research and implementation by others has shown that this form of classification is not only possible, but also highly accurate in comparison to density-based classification.

**Long**

**UV PHOTOPROTECTIVE COMPOUNDS IN *ZYGNEMA*: LIGHT TRIGGERS AND PHENOLIC CHEMISTRY**

Author(s): **C. Ethan Long** and Steven W. O'Neal
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Location of Research: Southwestern Oklahoma State University, Weatherford, OK, USA
Funding: OK-LSAMP
Mentor(s): Dr. Steven W. O'Neal and Dr. Regina McGrane, Southwestern Oklahoma State University

Filamentous algae, such as *Zygnema*, form loose floating mats in shallow areas of lakes and streams where the mats are exposed to extreme light conditions and high levels of UVB radiation in sunlight. The algal cells located on the surface of the mat are exposed to the highest levels of light intensity, while the cells deeper within the mat are exposed to lower levels. Previous work in this lab has shown that *Zygnema* produces phenolic compounds in response to high light intensity and that these compounds seem to contribute to a significant increase in tolerance to UVB radiation. This study focused on the nature of the light cues that trigger the production of phenolics. Specifically, the intensity of light needed to produce the UVB protective compounds and what wavelengths of light are most efficient in triggering the response. We began by growing five plates of *Zygnema* samples at a low light intensity for one week. The samples were then exposed to several light intensities ranging from ~15.6 - ~159.7 $\mu mol \cdot m^{-2} \cdot s^{-1}$ and allowed to grow for an additional week. The phenolic content, growth rates, and cell lengths were measured. There were significantly more phenolic compounds produced when the samples were exposed to higher light intensities compared to the lower light intensities. The cell lengths were also significantly shorter when exposed to higher light intensities. The growth rates remained unchanged across the treatments. Additionally, progress was made to identify the types of phenolic compounds being produced.

**Love**

Title: Studying Earth's Ionosphere with Ionosonde data and Ionosphere Reference International Model
Author: She'Kayla Love, Dr. Susmita Hazra

Due to Sun-Earth's interaction, the ionosphere of Earth changes frequently. As a part of this research, we are studying the F2 peak of the ionosphere using ionosonde data from different locations around the Earth. Currently, we are using the data from Ahmedabad (latitude 23.00 degree, longitude 72.50 degree) station, Norilsk (latitude 69.20 degree, longitude 88.00 degree) station, I-Cheon (latitude 37.14 degree, longitude 127.54 degree) station, Irkutsk (latitude 52.40 degree, longitude 104.3 degree) station, and Jeju (latitude 33.43 degree, longitude 126.30 degree) station. During winter time of the year 2012, Ahmedabad's F2 peak varies around ~5 MHz to ~15 MHz and the height varies from ~220 km to ~270 km. The IRI model predicted that the frequency should have been ~13 MHz to ~14 MHz and the height's around ~270 km to ~300 km. Norilsk's winter time F2 peak varies between ~2 MHz to ~3 MHz with a height between ~250 km to ~350 km. The IRI model predicted that the frequency should have been ~5 MHz to ~6 MHz with a height of ~280 km to ~300 km. I-Cheon's winter time F2 peak varies between ~2 MHz to ~4 MHz with a height between ~215 km to ~390 km. The IRI model predicted that the frequency should have been ~9 MHz with a height of ~240 km to ~260 km. Irkutsk's winter time F2 peak varies between ~2 MHz to ~3 MHz with a height between ~240 km to ~350 km. The IRI model predicted that the frequency should have been ~8 MHz to ~9 MHz with a height of ~230 km to ~250 km. Yakutsk's winter time F2 peak varies between ~2 MHz to ~3 MHz with a height between ~280

**McAdoo**

**NOVEL TETRAZAAMACROCYCLES AS CXCR4/CXCR7 DUAL ANTAGONISTS**
Authors: **Ashtyn G. McAdoo,** Elah M. G. Alcuitas Timothy J. Hubin
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Funding: OK-LSAMP, National Science Foundation Oklahoma EPSCOR
Mentor: Timothy J. Hubin, Southwestern Oklahoma State University

**Introduction**: Chemokine receptors, together with their specific natural ligands, play a role in many diseases including cancer. We propose to synthesize and evaluate novel bis and tris tetraazamacrocyclic CXCR4/CXCR7 dual antagonists based on our published potent CXCR4 antagonists. Upon synthesis and chemical characterization, and with the help of collaborators, we will evaluate the antagonism of CXCR4 and CXCR7 in cell lines previously developed for such studies—with the results of these screens feeding back into the iterative re-design of additional compounds. **Methods**: Synthetic routes were developed extending cross-bridged ligand syntheses to include novel meta-xylyl linkers. Another strategy has been attempted to include a 5th nitrogen in the macrocycle ring for linking that would then leave the four "cyclam" nitrogen atoms to interact both with the metal and potentially CXCR4/CXCR7. $Cu^{2+}$, $Ni^{2+}$, $Co^{2+}$, and $Zn^{2+}$, complexes were synthesized. Electrospray mass spectra, UV-Visible spectra, IR spectra, and $^{1}H$ and $^{13}C$ NMR spectra were collected to characterize the complexes. **Results**: The ligand synthesis of the novel linked ligands is more synthetically challenging than our typical ethyl cross-bridged ligands. However, single-macrocycle, bis-macrocycle and tris-macrocycle ligands have been made. Complexation with the desired metal ions proceeded as expected. Purification and characterization of the metal complexes is ongoing. **Conclusion**: CXCR4 antagonist tetraazamacrocycles utilizing meta-xylyl linkers and linking between a fifth added macrocycle nitrogen are challenging to produce. Once synthesized, metal ion complexation proceeds smoothly following known procedures. The resulting complexes will inform our understanding of the requirements for producing efficient conjugatable CXCR4/CXCR7 antagonists.

**Mejia**

Mitochondria are often described as the powerhouse of the cell by generating most of our adenosine triphosphate (ATP), which is the energy currency of a cell. In past studies, researchers have found that mitochondria regulate their shape, hypothesizing that different shapes lead to different functions, but no one knows exactly why. Mitochondria are also microscopic and often cannot be detected under a microscope unless stained. One of the challenges in why this question is not yet answered is because there are not many antibodies for mitochondrial proteins and thus researchers have also not been able to assess the localization or abundance of mitochondrial proteins in the cell. To overcome this problem, we used Crispr/Cas9 technology to label mitochondrial proteins of interest. In developing this technology, we used molecular biology to clone guide RNA and donor DNA for MIEF1, which is a mitochondrial fission promoting protein, to tag the endogenous protein with a fluorescent reporter, GFP. We then validated this reporter in NIH3T3 cells that our construct labels the expected mitochondrial protein. In future projects, we plan to use this construct to be able to label MIEF1 in neurons in vivo.

**Nail**

**BACTERIAL TWO HYBRID ANALYSIS OF CHLAMYDIA TRACHOMATIS PROTEINS**

Authors: **Kayli Nail**, Christian Holcomb, and Erika Lutter
Location of Research: Oklahoma State University, Stillwater, Oklahoma, United States

Funding: NIH and OK-LSAMP

Mentor: Dr. Erika Lutter, Oklahoma State University

*Chlamydia trachomatis* is an obligate intracellular bacterial pathogen which poses severe health problems throughout the world. There are over 90 million new cases annually, making it the most common sexually transmitted disease in the world. *Chlamydia* can pose significant problems during and after infection. It is imperative to understand how *Chlamydia* manipulates the host cell and potentially develop future treatments. The mechanisms by which *C. trachomatis* alters immune response is not well understood, but recent work has identified an interaction between the chlamydial inclusion membrane protein, CT226, and the potential interacting host proteins, Flightless homologue II (FLII), and Leucine Rich-Repeat Flightless-Interacting Proteins 1&2 (LRRFIP1 and LRRFIP2). FLII, LRRFIP1 and LRRFIP2 are known to interact as a complex and are upstream regulators of the inflammasome. Currently, it is unknown if CT226 interacts with one or all of the interacting partners and needs the actual interaction needs investigation. My hypothesis is that CT226 will directly interact with one of the 3 potential interacting partners (LRRFIP1, LRRFIP2, and FLII) and that we will be able to detect this interaction in the bacterial two hybrid system. Current efforts have focused on cloning CT226 into PUT18 and the three host proteins (FLII, LRRFIP1 and LRRFIP2) individually into PKNT25. PUT18 and PKNT25 are the bait and prey plasmids that have been adapted for use in the bacterial two hybrid system. Once each pair of plasmids are properly transformed (each *E. coli* strain will have two plasmids, one carrying CT226 and one carrying the potential interacting partner), they will be screened using traditional Beta-galactosidase assays or cAMP assays to determine

**Okolie**

**SCREENING WARRIOR HOPS FOR INHIBITORS OF CANCER CELL METABOLISM**

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Location of Research: University of Tulsa, Tulsa, OK, USA
Funding: University of Tulsa Department of Chemistry and Biochemistry, Chemistry Undergraduate Research Challenge, Tulsa Undergraduate Research Challenge
Mentor(s): Dr. Robert Sheaff

Hydroxychloroquine is an anti-malarial drug for which its use to combat COVID-19 has been controversial. Previous research has shown that the unique structure of hydroxychloroquine, which contains amine groups, one of which can be protonated and deprotonated at physiological pH, inhibits the normal metabolism of mitochondria in cells by sequestering protons, thereby reducing the gradient necessary to produce ATP. The purpose of this project is to examine the effects of components of Warrior Hops on cancer cell metabolism to better understand the mechanism of infection for SARS-CoV-2. Amine groups that can be protonated or deprotonated at physiological pH are common in plant steroids, so I am evaluating potential components of the herb Warrior Hops that can produce a similar or greater effect on mitochondria than hydroxychloroquine, while potentially avoiding the detrimental side effects that make hydroxychloroquine so controversial. In h293 cells (human embryonic kidney cells that metabolically mimic cancer cells), several fractions have been obtained that showed mitochondrial inhibition and the inhibition of ATP production in cells similarly to hydroxychloroquine, which acted as the positive control. This project is still in progress and will provide a better understanding of the mechanism of infection for COVID-19 on the cellular level.

**Payan**

**CHARACTERIZATION AND ANALYSES OF NONSTATIONARY, TRANSIENT WIND BEHAVIOR**

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Funding: National Science Foundation (NSF) Award #203775 & OU McNair Scholars Program
Mentors: Dr. Kurtis Gurley, University of Florida; Mariel Ojeda-Tuz, University of Florida

There is a growing need to monitor wind behavior and its damaging effects on the built environment, especially non-stationary, transient wind which tends to be sporadic. Characterization of these natural wind phenomena allow scientists and engineers to make practical recommendations that municipalities can decide to implement within their jurisdiction for safety reasons. The University of Florida's Boundary Layer Wind Tunnel (UFBLWT) has the capacity to simulate these natural phenomena using 8 large, industrial fans. However, these industrial fans fail to exhibit transient behavior because of the limiting acceleration of rotation per minute. Because of this, the Flow Field Modulator (FFM), an attachment to the BLWT composed of over 300 smaller fans, allows for a much better simulation of transient wind behavior. This project will closely analyze the efficacy of this attachment to produce realistic results that are similar to benchmark data, such as Hurricane Ike. This will be done by exploring different methods to analyze the time-history signals of these experiments. This consists of producing the first and second order statistical moments of these wind profiles which are mean velocity and turbulence intensity profiles, respectively, and through reiteration be able to model the aforementioned benchmark data using a machine learning algorithm.

**Porter**

**HTLV-1 Tax Viral Oncoprotein**

Authors: **Savannah Porter, Dr. Alisha Howard, and Dr. Karen Williams with OK-LSAMP**
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Location of Research: Center for Undergraduate Research and Learning (ECU), Ada, OK.
Funding: Oklahoma Louis Stokes Alliance for Minority Participation (OK-LSAMP)
Mentors: Dr. Alisha Howard and Dr. Karen Williams, East Central University

Tax, an oncoprotein virally expressed from Human T-cell Leukemia Virus (HTLV), is a transcriptional regulator with incompletely understood functions in host cells. HTLV is a retrovirus of clade deltraretroviradae with two known sub-types (HTLV Type-1 and HTLV Type-2). HTLV-1 is associated with a subset of patients in development of an extremely aggressive blood cancer called Adult T-cell Leukemia/Lymphoma (ATLL) but HTLV-2 is not. It is known that Tax recruits host activator and co-activator proteins to binds to the integrated viral promoter region of HTLV and rapidly activate viral gene expression. Tax coding regions vary in HTLV-1 and type-2 in the predicted transcriptional activation domain. Exploring interaction surfaces of Tax with various host proteins involved may help us understand the basic transcriptional activation mechanisms that are manipulated by the HTLV-1. To investigate this, we accumulated a library of Tax expression plasmids with the Tax wild-type and mutant coding sequences from HTLV-1. The mutants collected have been established to impair transcriptions or cytoplasmic activities of Tax and include in contrast the Tax coding sequence from HTLV-2. Once the mutants were obtained, we established a stock that can be used in the future for downstream expression, purification, and activity binding assays.

**Quintana**

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

Author(s): **Emma Quintana** and Ning Wu
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Location of Research: Durant, OK, USA
Mentor(s): Dr. Ning Wu, Department of Biological Sciences, Southeastern Oklahoma State University, Durant, Oklahoma 74701

The suicide rate in the USA has been on the rise, which affects specific age groups, genders, and race/ethnicity. Native American (NA) has been known to be on a higher level than the other races. This study focuses on differences in suicide rates between NA and the other races at particular age groups and different genders. Twenty years (1999-2019) of suicide data were retrieved from the CDC database. Microsoft Excel and t-test were employed for data processing and statistical analysis. The results showed that the suicide rate per 100,000 population increased 38.1% nationally with male increased 34.5% and female increased 55%. Male was 281.42% higher than female. NA was 44.48% higher than total nation in age group 10-39. In age group 40-84, US total was 81.46% higher than NA. Crossing race comparison among NA, African American (AA), Hispanic (His), Asian or Pacific Islander (AP), and White (W) showed NA and W were much higher than other races. NA showed 43.31% higher in the age group 10-34 than W. W showed 86.63% higher in the age group 35-84 than NA. NA showed 99.09% and 89.62% higher in the age group 10-64 than His and AP, respectively. AP showed 31.68% higher than NA in the age group 65-84. There was no significant difference between NA and His in the age group 65-84. NA was 94.07% higher than AA through all age groups. In summary, the suicide rate increased by about 38.10%. The suicide rates ranked as W>NA>AP>His and AA. NA was

**Ray**

**Dynamic Simulation and Modeling of Gripper for Applications in Autonomous Drone Catcher**

Author(s): **Shawn Ray**, Tony Chen, Kenneth Hoffmann, Dr. Mark Cutkosky
University of Scholar: Oklahoma State University
Location of Research: Stanford University, Virtual
Funding: Stanford SURF Program
Mentor(s): Dr. Mark Cutkosky, Tony Chen, Stanford University

With advancing technology allowing for drones to become more efficient and evasive in their flight paths, researchers are looking for ways to solve the question of how can these drone be caught midair? Drawing inspiration from nature, the Biomimetics and Dexterous Manipulation Laboratory has developed a method of catching drone's midair with an in-house designed and manufactured drone utilizing mechanisms from natures design. In implementing this drone design, simulations were needed to gain a better understanding of how the drone catcher would work as well as what data could be collected from a simulated collision. The 3D modeling software Solidworks was utilized to run a realistic simulation on the movement and motion of the main drone catching gripper. In running the simulations on the gripper collisions, it was found that this software was not capable of running high speed collisions at such a high rate of speed. In order for accurate simulations to be run, numerous calculations were needed to be evaluated in the span of a few thousandths of a second. This processing power could not be run on relatively powerful computers and the simulation was run at a slower, micro-gravity emulating, rate of speed. The resulting simulation gave a better understanding of how the drone catching device could capture objects midair, as well as how the mechanism worked within an instance of a collision.

**Robinson**

Anai Robinson
LSAMP Symposium
13 September 2021

Biochemical Aspects of Superoxide Dismutase Isolated from *Amaranthus spinosus*: A Therapeutically Important Plant Authors: S Sharma, S Bahuguna, N Kaur and N Chaudhary

The scavenging of superoxide radicals by antioxidant enzyme, superoxide dismutase (SOD) results in oxidative damage towards the DNA, lipids, and proteins within humans, hence the researchers within this study question a natural extract that is capable of regulating oxidative stress. The researchers investigated the presence of SOD activity within the seeds of *Amaranthus spinosus* and measured the relative SOD activity upon various biochemical parameters like pH, temperature, pH stability, and temperature stability. *A.spinosus* is a rich resourceful plant that has been used in countries like India, which utilizes the plant to treat blood disease, bronchitis, and diuretic along with China, where it is utilized to treat diabetes and broken bones. Amaranthus is rich with carotenoids such as thiamine, niacin, ascorbic acid, and beta-carotene that enables the identification of antioxidant activity.

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Sharma, S., Bahuguna, S., Kaur, N., & Chaudhary, N. (2014). Biochemical aspects of superoxide dismutase isolated from Amaranthus spinosus: a therapeutically important plant. International Journal of Genetic Engineering and Biotechnology, 5(1), 35-42.

**Rubio**

**NUTRITIONAL AND ANTI-NUTRITIONAL COMPONENTS OF REDBUD SEEDS**

Author(s): **Asuncion Eleazar Rubio*, Sergio A. Vazquez Gomez***, Cooper McKinney, Mackenzie Powell, Skylar Fletcher, and (***co-presenters**)
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Location of Research: Southeastern Oklahoma State University, Durant, OK, USA
Funding: National Institutes of Health NIGMS award P20GM103447 for OK-INBRE, NASA Oklahoma Space Grant Consortium, and OK-LSAMP.
Mentor(s): Dr. Nancy L. Paiva, Southeastern Oklahoma State University, Durant, OK, USA.

Redbud trees (*Cercis canadensis*) are small leguminous trees native to much of North America. Centuries ago, Native American tribes consumed roasted redbud seeds and raw redbud flowers. However, little chemical research has been done to assess the nutritional value of these foods. As a part of an on-going project, redbud seeds were examined for the accumulation of nutritional proteins, the accumulation of beneficial condensed tannins and presence of anthocyanidin reductase (ANR, important in biosynthesis of tannins), and heat-sensitive growth-inhibiting substances. Immature redbud seeds were periodically excised from pods during the summer and immediately frozen. Seed proteins were extracted and resolved on SDS-PAGE gels. Some gels were stained directly. Four major protein bands were present in the mature redbud seeds at approximately 60, 35, 18 and 17 kDa, but these do not start accumulating until the late June harvest, and later increase in intensity as the seeds increase in volume. Some gels were electro-blotted to PVDF membranes and processed with a custom developed anti-ANR serum; immuno-reactive bands were visible in 2 late June harvest lanes, but the bands are smaller than expected, suggesting ANR protein was present but degraded. Amino acid analysis is in progress. To test for growth-inhibiting substances, the growth of tobacco hornworms (*Manduca sexta*) was compared on media supplemented with cooked and uncooked ground redbud seeds, both mature and immature (green). Addition of either uncooked green

**Saleh**

**STUDYING THE EFFECTS OF ANTIBIOTICS ON MITOCHONDRIAL INHIBITORS**

Author(s): **Maryam Saleh** and Robert J. Sheaff
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Location of Research: The University of Tulsa, Tulsa, OK, USA
Funding: TU Department of Chemistry and Biochemistry, CSURP, OK-LSAMP
Mentors: Dr. Robert Sheaff, The University of Tulsa

Hydroxychloroquine has been shown to be a possible therapeutic in the treatment of COVID-19. It is an antimalarial drug, and part of its mechanism of action, according to studies, suggests that it sequesters protons in the intermembrane space of the mitochondria. Some data suggests that COVID-19 hijacks the mitochondria and sequesters protons, destroying the proton gradient required for ATP production and causing eventual cell death. In one proposed mechanism, hydroxychloroquine could show therapeutic effects by sequestering the protons in a gradual fashion, which prevents the virus from sequestering protons and therefore releasing its genome for replication. One goal of my research is to understand mechanisms of inhibition of mitochondrial ATP synthesis further by using a drug that may act similarly to hydroxychloroquine. According to a study, ivermectin helped treat COVID-19, but clinical trials showed that ivermectin with the tetracycline-class antibiotic doxycycline overcame the effects of ivermectin to a certain degree. The other goal of my research, therefore, is to understand why this occurs. I used cell cultures as my model and found that, rather than overcoming the effects of ivermectin, tetracycline seems to prevent ivermectin from mitochondrial inhibition. I also found that this effect seems to occur when tetracycline is administered first, with ivermectin administered after one hour or more; the effect is prevented when ivermectin is administered, left for two hours, and then tetracycline is added.

**Sankey**

**A TYPE 7 SECRETION SYSTEM IS REQUIRED FOR EFFICIENT HEME IRON ACQUISITION IN MYCOBACTERIUM TUBERCULOSIS**

Authors: **November Sankey** and Avishek Mitra
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Location: LSE 318, Oklahoma State University
Funding: OK-LSAMP, National Science Foundation (NSF)
Mentor: Dr. Avishek Mitra, Oklahoma State University

Before the SARS-CoV-2 pandemic, *Mycobacterium tuberculosis* (Mtb) was the leading cause of death worldwide by an infectious disease resulting in 1.4 million deaths annually. Mtb is transmitted through aerosols and enters the host alveolar passages, where it proliferates by efficiently inhibiting phagolysosome. An essential aspect of Mtb survival and virulence is the acquisition of iron within the macrophage. Even though iron is abundant in the human host it is sequestered within proteins such as transferrin (Tf), lactoferrin (Lf) or ferritin (F) or stored within heme (Hm). Mtb secretes siderophores to extract iron from host Tf, Lf or F, but siderophores cannot extract the iron from Hm. A major goal in our lab is to understand the different mechanisms that are employed by Mtb to acquire iron from Hm, which stores >80% of the host iron. In previous experiments we observed that in the presence of Hm Mtb upregulates genes that encode the components of the ESX-4 type 7 secretion system. In this study we explored the hypothesis that ESX-4 is required for Hm iron acquisition by Mtb. We constructed a Mtb ESX-4 mutant and then determined that the mutant has a growth defect specifically in the presence of Hm as the sole iron source. Then we tested the hypothesis that the ESX-4 mutant is required for secretion of specific proteins that is required for transporting Hm into the cell. We used mass spectrometry to analyze the culture filtrate proteins from WT Mtb and ESX-4 mutant strains and identified **h**eme **u**tilization **s**pecific **p**roteins (HUSPs) whose

**Soemantri**

Quantitative Assessment of Otitis Media with effusion with scanning laser Doppler vibrometer: A Preliminary Study

Author(s): **Ethan Soemantri, Ke Zhang, Junfeng Liang, Bin Zheng, Rong Gan, Chenkai Dai**
University of Scholar: University of Oklahoma, Norman, OK, USA
Location of Research: University of Oklahoma, Norman, OK, USA
Funding**:** University of Oklahoma Faculty Fund
Mentor(s): Dr. Chenkai Dai, University of Oklahoma
Otitis media with effusion (OME) is a common middle ear inflammation for preschool-age children, with the presence of fluid in the middle ear cavity (MEC). Although the biomechanical abnormalities induced by OME has been evaluated by many studies through measuring the vibration pattern of the tympanic membrane (TM), the precise and quantitative assessment of severity at different stages of OME is still not fully achieved, and the diagnosis still largely depends on the subjective rating of physicians. To provide reliable and objective evidence for the diagnosis, we developed a new algorithm to process the full-field TM surface motion data acquired by scanning laser Doppler vibrometer (SLDV). The frequency bands and areas on the TM highly sensitive to the effusion amount and viscosity in the MEC were identified.

**Stell**

**VISUAL SECURITY & SAFETY**

Author(s): **Makya Stell**, Jasmine DeHart, Christan Grant, Ph.D.
University of Scholar: University of Oklahoma, Norman, OK, USA
Location of Research: University of Oklahoma, Norman, OK, USA
Funding: OU Data Analytics Lab, The University of Oklahoma's School of Computer Science, OK-LSAMP
Mentor(s): Jasmine DeHart, Christan Grant, Ph.D., University of Oklahoma

Social Media Networks (SMNs) allow users to post private visual content (images and videos) that exposes sensitive information without warning or attempting to mitigate these risks. This information can be detrimental to one's finances, personal life, and reputation. Because users post this information using "trendy" hashtags and keywords, distinguishing exact triggers that prompt the need for mitigation has become increasingly difficult. Mitigation techniques are useful for protecting users from visual privacy leaks and ensuring their safety while enjoying SMNs. All SMN applications require camera permissions for users to have access to all of the features. This is useful for privacy considerations because the software will only monitor the device's camera activity on applications that have camera permissions. Visual security and safety can be achieved immediately by detecting visual privacy leaks and preventing users from uploading the information. Also, because users have complete control over whether or not the software is enabled, their privacy and freedom are respected. This form of mitigation will allow for future advancements in protection while still allowing the user complete control over what they decide to share on SMNs.

**Torres**

**PUDDLE DETECTION WITH COMPUTER VISION FOR SELF-DRIVING CARS**

Author: **Lucia Torres**
University of Scholar: University of Oklahoma, Norman, OK, USA
Location of Research: Advanced Radar Research Center (ARRC), Norman, OK USA
Funding: Internal
Mentor: Dr. Justin Metcalf, ARRC, University of Oklahoma

With the emergence of self-driving cars, accurate and robust automated techniques to detect hazards on the road are needed to prevent accidents in degraded driving conditions. An important class of road hazards are water puddles, which are the focus of this work. To specify, water is very hard to detect with a camera due to its low discrepancy between itself and the road. After performing a thorough literature review on detection with computer vision, a new technique to automatically detect water on the road was developed. This technique combines two different methods: texture-based and color-based detection. Using the computer vision and image processing toolboxes in MATLAB, an automated program was developed for the identification of puddles on the road. These detections are shown as overlays on the original image. The technique was tested in variety of situations and was shown to perform with high accuracy. While this work is limited to the detection of puddles, the same principles can be adapted for black ice and pothole detection. In the future, the information collected by the camera will be supplemented with radar data. It is expected that having two complementary sensors working together to detect hazards and obstructs on the road will yield more reliable performance and further contribute to the reality of self-driving cars.

**Valenzuela**

**BEYOND BIS-TETRAAZAMACROCYCLE TRANSITION METAL COMPLEXES AS CXCR4 ANTAGONISTS**

Authors: **Jordan A. Valenzuela**, Jonathan P. Ebel, Timothy. J. Hubin
University of Scholar: Southwestern Oklahoma State University, Weatherford, OK, USA
Location of Research: Southwestern Oklahoma State University, Weatherford, OK, USA
Funding: OK-LSAMP, National Science Foundation, and OCAST
Mentor: Timothy J. Hubin, Southwestern Oklahoma State University

Abstract: CXCR4 chemokine receptors are found on the surface of immune, and other, cells, and together with the specific natural ligand, stromal cell-derived factor-1α (SDF-1α, also known as CXCL12), have been revealed to play a role in a number of disease states. Within the last ten years the CXCR4 and CCR5 co-receptors have been revealed as the entry route for HIV into cells, generating interest in a new therapeutic approach to treatment via fusion inhibitor drugs rather than the current preference for reverse transcriptase and protease inhibitors. CXCR4 expression has also been reported in at least 23 different cancers. CXCL12 stimulation of tumor growth, angiogenesis, and metastasis of breast cancer cells has been described. Target organs for breast metastases such as liver, lung, and bone have high levels of CXCL12, triggering the specific migration of breast tumor cells that express the CXCR4 receptor. Due to the wide-ranging potential biomedical applications that might result, our aim is to develop new antagonists for the CXCR4 co-receptor. They are conformationally fixed macrocyclic compounds where the unrestrained equivalent is a known CXCR4 antagonist. The SWOSU-Hull collaboration has produced well over 50 metal complexes of bis-tetraazamacrocycle ligands for screening as CXCR4 antagonists. The bis-linked complexes are highly efficient antagonists, while single-macrocycle analogues are much less effective. Our objectives were to synthesize analogues of our most effective bis-tetraazamacrocycle metal complexes and to characterize their chemical and physical properties in preparation for determining their antagonism of CXCR4.

**Webb**

**Ryan Webb**
**Mentor: Dr. Ellis**
**University of Central Oklahoma**
Synthesis, Purification, and Characterization of Guest molecules for Inclusion in Cucurbit[n]urils

**Abstract** Cucurbit[n]uril (CB[n]) is a unique macrocycle that can bind small molecules with promising potential applications in drug delivery, molecular machines, and smart materials. This work focuses on the supramolecular equilibrium binding modes and the equilibrium binding constants of CB[n] with a variety of viologens, pyridinium species which have not previously been studied. The synthesis, purification and characterization of these guest species will be presented. The knowledge gained from the study of physical properties of these host guest systems which will aid in the future development of more complex systems.

**Whitekiller**

Automated Analysis Identifies Pericyte and Endothelial Cell Loss in Capillaries of Diabetic Mouse Models

Authors: Madison Whitekiller, Dr. Dustin Baucom, and Dr. Cammi Valdez
Abstract:
Diabetic retinopathy (DR) is a complication of diabetes that is caused by damage to the blood vessels in the retina. DR causes visual impairment and can lead to blindness. In the normal retina, there is tight regulation (1:1) of the two cell types, pericytes and endothelial cells, that make up capillaries. In diabetic patients, the ratio shifts (1:4) due to pericyte loss. This ratio is observed by manually counting each cell type in the retinal capillaries to help characterize vascular stability and integrity. The need for an automated program became apparent when the manual analysis of microvasculature images became too tedious and required increased reliability.
The analysis of mouse microvasculature is advantageous in studying the correlation of cell loss and vision loss in DR patients. To further investigate the impact of cell loss in retinal capillaries, we have developed a new automated tool. To identify the phenotypes of cells in the capillaries of mice, we used the free image

analysis software, CellProfiler. We developed a pipeline that was capable of identifying the microvascular cells. Any vessels larger than a capillary do not have true pericytes. Therefore, for an accurate quantitation, we developed an algorithm to eliminate cells present in vessels larger than capillaries. Based on criteria from our analysis, we were able to create a threshold to distinguish between pericytes and endothelial cells. Our findings suggest that the automated program we developed can reliably identify and quantify cells in the mouse retinal microvasculature without bias.

**Williams**

**OXIDATION OF MICROVASCULAR CARBON/CARBON COMPOSITES BY SUPER-CRITICAL CARBON DIOXIDE FLOW**

Author(s): **Stanley Williams,** Jose Cordeiro**,** Hema Ramsurn
University of Scholar: University of Tulsa
Location of Research: University of Tulsa, Tulsa, OK, USA
Funding: Francis Manning Undergraduate Research Grant, Tulsa Undergraduate Research Challenge, OK-LSAMP.
Mentor(s): Dr. Hema Ramsurn, Associate Professor, Russell School of Chemical Engineering, University of Tulsa

Concentrating solar power (CSP) systems are increasingly becoming a more significant part of the renewable energy grid in the United States. By concentrating sunlight into a single receiver, a working fluid is heated and usually sent to conventional steam turbines to produce electricity. The use of supercritical carbon dioxide ($sCO_2$) Brayton-cycles have been identified as a replacement for conventional steam turbines in CSP systems, providing higher thermal to electricity efficiencies. With this in mind, the direct use of $sCO_2$ as the heat transfer fluid in gas receivers has been proposed. Furthermore, conventional solar receivers are subjected to thermal stresses due to daily startup operations, and thus prone to fatigue failures. Therefore, the use of a novel Carbon/Carbon composite for a modular gas receiver is being investigated due to its lower coefficient of thermal expansion while maintaining high thermal conductivity and mechanical properties. Each composite module has an embedded micro-channel network through which sCO2 will be flowing. The chemical reaction between $sCO_2$ and the composite, though not significant at low temperatures, is enhanced at the high operating temperatures of the modules. Due to this effect, mass loss of the composite is a concern. Modeling the system using computational fluid dynamics (CFD) can help predict these effects, set operational temperature limits, or evaluate the use of protective coatings to decrease the mass loss. In this presentation, a CFD analysis of $sCO_2$ flow in a C/C composite micro-channel is performed with the reaction at the channel's

# SPECIAL THANKS

OK-LSAMP would like to thank the ***Division of Institutional Diversity*** (ID) for continued support and connections created among the other ID programs and organizations.

OK-LSAMP would especially like to thank the ***National Science Foundation*** and the LSAMP Program Director, ***Dr. A. James Hicks, Ph.D., Martha James and Dr. Sandra Romano, Ph.D.*** for their continued support of both the undergraduate and graduate LSAMP programs.

MOST OF ALL, OK-LSAMP would like to give praise and special thanks to the faculty and industry ***Mentors***. This program would not be the success it is without the expert support and guidance mentors provide to the scholars as they explore and enhance their research and scientific skills. We cannot say "Thank you" enough. OK-LSAMP is eternally grateful for the hard work and dedication of the ***OK-LSAMP Campus Program Managers*** on each campus. Their mentoring and guidance keeps scholars on track academically and professionally so they are ready for the rigors of graduate school, academia and/or industry careers.

# REGISTERED ATTENDEES

| NAME | INSTITUTION | DISCIPLINE |
|---|---|---|
| Adjei, Libby | Oklahoma State University | Upward Bound Director |
| AKINMOLAYAN, OLUWAFEMI | Oklahoma State University | Mechanical Engineering |
| Albinescu, Dragos | Northeastern State University | Organic Chemistry |
| Allen, Valentina | Okla Panhandle State Univ | Cybersecurity |
| Arreola, Alex | Oklahoma State University | Microbiology |
| Asher, Kallie | Northeastern State University | Biochemistry |
| Azzun, Saramarie | The University of Oklahoma | Cell and Molecular Biology |
| Bach, Christian | Oklahoma State University | Mechanical Engineering |
| Beasley, James | East Central University | Physics |
| Beckmann, Sabrina | Oklahoma State University | Environmental & Applied Microbiology |
| Benedict, Alexa | Southwestern Okla State Univ | Microbiology & Biochemistry |
| Biswas, Samarjith | Oklahoma State University | Mechanical & Aerospace Engineering |
| Boehme, Bobby | Southeastern Okla State Univ | Biology / Mathematics |
| Bourne, Christina | The University of Oklahoma | Biochemistry |
| Braun, Ashlea | Oklahoma State University | Nutritional Sciences |
| Britton, Shelby | Cameron University | Biology |
| Brusch, George | Oklahoma State University | Integrative Biology |
| Buchanan, Austin | Oklahoma State University | Industrial Engineering & Management |
| Buckholtz, Jody | Northeastern State University | Chemistry |
| Buxton, Andrianna | Langston University | Biology |
| Cabello, Aleana | The University of Oklahoma | Biomedical Engineering |
| Castillo, Nora | Okla Panhandle State Univ | Computer Information System |
| Castor, Guimy | The University of Oklahoma | LSAMP Evaluator |
| Caves, Jackson | Oklahoma State University | Mechanical Engineering |
| Chatman, Priscilla | Oklahoma State University | Microbiology/Cell & Molecular Biology |
| Chavedo, Itzel | Oklahoma State University | Animal Science |
| Christensen, Aaron | OSU-Center for Health Sciences | Director Graduate Programs |
| Clark, Kenslie | Southeastern Okla State Univ | Biology |
| Colston, Nicole | Oklahoma State University | NREM |
| Cooper, Delanie | Southeastern Okla State Univ | Biological Health Science |
| Cooper, Nasya | Langston University | Biology |
| Cox, Kiley | Oklahoma State University | Integrative Biology |

| NAME | INSTITUTION | DISCIPLINE |
|---|---|---|
| Craig, Kaylee | Cameron University | Chemistry |
| Cravens, Sherman | Langston University | Animal/Food Science |
| Croci, Darlene | Oklahoma State University | OK-LSAMP |
| Crutchfield, Jalen | East Central University | Physics |
| Cunningham, Karina | The University of Tulsa | Biology |
| Cupp-Sutton, Kellye | The University of Oklahoma | Chemistry |
| David, Jacob | Cleveland High School | Upward Bound |
| Davis, Lindsay | Langston University | Chemistry |
| De La Torre, Brandon | The University of Oklahoma | Medicine or Chemistry |
| DeRogers, Gerald | Oklahoma State University | Chemical Engineering |
| Dorko, Allison | Oklahoma State University | Math |
| Dumas, Zachary | University of Central Oklahoma | |
| Dunlap, Rylee | Southeastern Okla State Univ | Biological Health Sciences |
| Eberhard, Alissa | Northeastern State University | Cell and Molecular Biology |
| Egermeier, Mason | Oklahoma State University | Civil & Environmental Engineering |
| Ehirindu, Cecil | The University of Oklahoma | Health and Exercise Science |
| Ellis, Shawna | University of Central Oklahoma | Organic Chemistry |
| Fagge, Leo | Oklahoma State University | Mechanical & Aerospace Engineering |
| Fishbein, Mark | Oklahoma State University | Plant Biology, Ecology and Evolution |
| Flores, Saul | Oklahoma State University | Statistics - Actuarial Science |
| Flusche, Ann Marie | The University of Tulsa | Biology |
| Fornah, Alimamy | Cameron University | Ag Bio and Health Sciences |
| Fultz, Tionne | Oklahoma State University | Chemical Engineering |
| Galie, Walter | The University of Oklahoma | Chemistry |
| Garcia, Leslie | Southwestern Okla State Univ | Chemistry |
| Gates, Charles | Langston University | Biology |
| Gonzales, Andrew | The University of Oklahoma | |
| Guo, Yanting | The University of Oklahoma | Chemistry |
| Haley, Joseph | Oklahoma State University | Physics |
| Hamilton, Jackie | Cleveland High School | Upward Bound |
| Hansen Gonzalez, Meadow | The University of Tulsa | Biological & Life Sciences |
| Harris, Antonio | Langston University | Biology-Genetics |
| Hawkins, Annabelle | Southwestern Okla State Univ | Microbiology |
| Haygood, Lauren | Oklahoma State University | Geology |
| Hepworth, Allison | Oklahoma State University | Nutritional Sciences |
| Hinojosa, Marie | | |
| Hinojosa, Omar | | |
| Hinojosa, Isabella | Oklahoma State University | Chemistry |
| Holmes, Colton | OSU-Center for Health Sciences | Graduate Recruiter |

| NAME | INSTITUTION | DISCIPLINE |
|---|---|---|
| Horton, Christopher | OU Health Sciences Center | Biomedical Sciences |
| Hubin, Tim | Southwestern Okla State Univ | Chemistry |
| Huck, Lori | Oklahoma State University | Geology |
| Hummingbird, Chandler | The University of Tulsa | Computer Science |
| Hussaini, Syed | The University of Tulsa | Organic Chemistry |
| Ismail, Ahmed | Oklahoma State University | Physics |
| Iyer, Janaki | Northeastern State University | Biological Sciences |
| Jacobs, Sue | Oklahoma State University | School of Community Health Sciences |
| James, Trejan | Langston University | Biology |
| James, Jihra | Langston University | Chemistry |
| Jimenez, Stacy | Okla Panhandle State Univ | Biological Science |
| Johnson, Ryan | Tulsa Community College | Chemistry |
| Johnson, Emily | Oklahoma State University | Microbiology/Cell & Molecular Biology |
| Jones, Gabrielle | Oklahoma State University | Entomology |
| Jones II, Johnny | Oklahoma State University | Computer Engineering |
| Kara, Kursat | Oklahoma State University | Aerospace Engineering |
| Karr, Liz | The University of Oklahoma | Microbiology |
| Kaur, Pepper | Pawnee High School | Upward Bound |
| Kirksey, Jason | OSU-Institutional Diversity | VP and Chief Diversity Officer |
| Kouplen, Kate | Oklahoma State University | Nutritional Sciences |
| Lazcano, Carlen | Northwestern Okla State Univ | Biology |
| Lee, Chunghao | The University of Oklahoma | Bioengineering |
| Lett, Charles | Langston University | Computer Science |
| Lewis, Sharon | Langston University | |
| Lindsey, Dale | Oklahoma State University | Mechanical & Aerospace Engineering |
| Long, Christopher | Southwestern Okla State Univ | Biology |
| Love, SheKayla | Cameron University | Chemistry |
| Lutter, Erika | OKlahoma State University | Microbiology |
| Manjarrez, Jacob | OSU-Center for Health Sciences | Neurobiology and Biochemistry |
| Markham, Sydney | Oklahoma State University | Microbiology |
| Martinez, Alan | Pawhuska High School | Upward Bound |
| Mata, Sara | The University of Oklahoma | Research; Social Sciences |
| McAdoo, Ashtyn | Southwestern Okla State Univ | Chemistry |
| McCullagh, Martin | Oklahoma State University | Chemistry |
| McGrane, Regina | Southwestern Okla State Univ | Microbiology |
| Mejia, Laura | Langston University | Biology |
| Mesta, Jesus | Okla Panhandle State Univ | Computer Information System |
| Metcalf, Justin | The University of Oklahoma | Electrical Engineering |
| Mihai, Cornelia | Northwestern Okla State Univ | Chemistry |

| NAME | INSTITUTION | DISCIPLINE |
|---|---|---|
| Mitra, Avishek | Oklahoma State University | Cell and Molecular Biology |
| Moore, Celois | Langston University | Biology |
| Morales, Morales | Oklahoma State University | OK-LSAMP Director |
| Myers, Taylor | Langston University | |
| Nagel, Marli | Southeastern Okla State Univ | Chemistry/Biology |
| Naidoo, Gnanambal | Langston University | Biology |
| Nail, Kayli | Oklahoma State University | Microbiology |
| Okolie, Star | The University of Tulsa | Biochemistry |
| Orona, Cynthia | Oklahoma State University | Social Sciences |
| Owens, Deonna | Langston University | Computer Science |
| Patrauchan, Marianna | Oklahoma State University | Microbiology |
| Payan, Miguel | The University of Oklahoma | Architectural Engineering |
| Porras, Marely | University of Central Oklahoma | Biology- Biomedical Science |
| Porter, Savannah | East Central University | Biology |
| Quintana, Emma | Southeastern Okla State Univ | Biology & Chemistry |
| Ramirez, Brian | Pawnee High School | Upward Bound |
| Ray, Isabel | Okla Panhandle State Univ | Bio-Chemistry |
| Ray, Shawn | Oklahoma State University | Electrical Engineering |
| Rezaei, Leila | Oklahoma State University | Mechanical Engineering |
| Robinson, Anai | Langston University | Biology |
| Robles Garcia, Lucero | Okla Panhandle State Univ | Biology |
| Rodriguez, Belen | Oklahoma State University | Animal Science |
| Rodriguez, Brenda | Oklahoma State University | Animal Sciences |
| Rogers, Elizabeth | Oklahoma State University | |
| Rogers, Felicia | Nordam | Airplanes |
| Rubio, Asuncion | Southeastern Okla State Univ | Bio/Chem |
| Ruyle, Jessica | OU Advanced Radar Research Ctr | Electrical & Computer Engineering |
| Saleh, Maryam | The University of Tulsa | Biochemistry |
| Sankey, November | Oklahoma state university | Microbiology & Molecular Genetics |
| Seagraves, Nikki | University of Central Oklahoma | Biology |
| Shipley, Jay | | |
| Shipley, Christina | Oklahoma State University | Business |
| Soemantri, Ethan | The University of Oklahoma | Mechanical Engineering |
| Somalinga, Vijay | Southwestern Okla State Univ | Microbiology & Biochemistry |
| Soto, Elva | Oklahoma State University | Aerospace Engineering |
| Starks, Mia | Oklahoma State University | Computer Science |

| NAME | INSTITUTION | DISCIPLINE |
|---|---|---|
| Stell, Makya | The University of Oklahoma | Computer Engineering |
| Taplin, Jasmine | Oklahoma State University | Electrical Engineering |
| Taylor, April | Chickasaw Nation | Climate |
| Thompson, Marisa | Oklahoma State University | Counseling Psychology |
| Torres, Lucia | The University of Oklahoma | Electrical Engineering |
| Tucker, Ryleigh | University of Central Oklahoma | Actuarial Science |
| Underwood, Von | Cameron University | Dean of School of Arts & Sciences |
| Urquiza, Uzziah | Southwestern Okla State Univ | Molecular Cell Biology |
| Valdez, Cammi | Northeastern State University | Biochemistry |
| Valenzuela, Jordan | Southwestern Okla State Univ | Biochemistry |
| Vazquez Gomez, Sergio | Southeastern Okla State Univ | Biology/Chemistry |
| Watkins, Lauren | University of Central Oklahoma | Biomedical Sciences |
| Webb, Ryan | University of Central Oklahoma | Chemistry |
| Weston, Javen | The University of Tulsa | Chemical Engineering |
| Whalen, Sandra | The University of Oklahoma | Program Evaluator |
| White, Nicholas | Southeastern Okla State Univ | Chemistry |
| Whitekiller, Madison | Northeastern State University | Biochemistry |
| Williams, Stanley | The University of Tulsa | Chemical Engineering |
| Williams, Karen | East Central University | Physics |
| Wilson, Desi | Oklahoma State University | Ecology and Genetics |
| Wilson Jr, Clyde | Oklahoma State University | Higher Education |
| Winchester, Justin | Cameron University | Computer Science |
| Wu, Ning | Southeastern Okla State Univ | Biological Sciences |
| Wu, Si | The University of Oklahoma | Chemistry |
| Yoo, Heejin | Oklahoma State University | Plant Molecular Biology |

| Notes |
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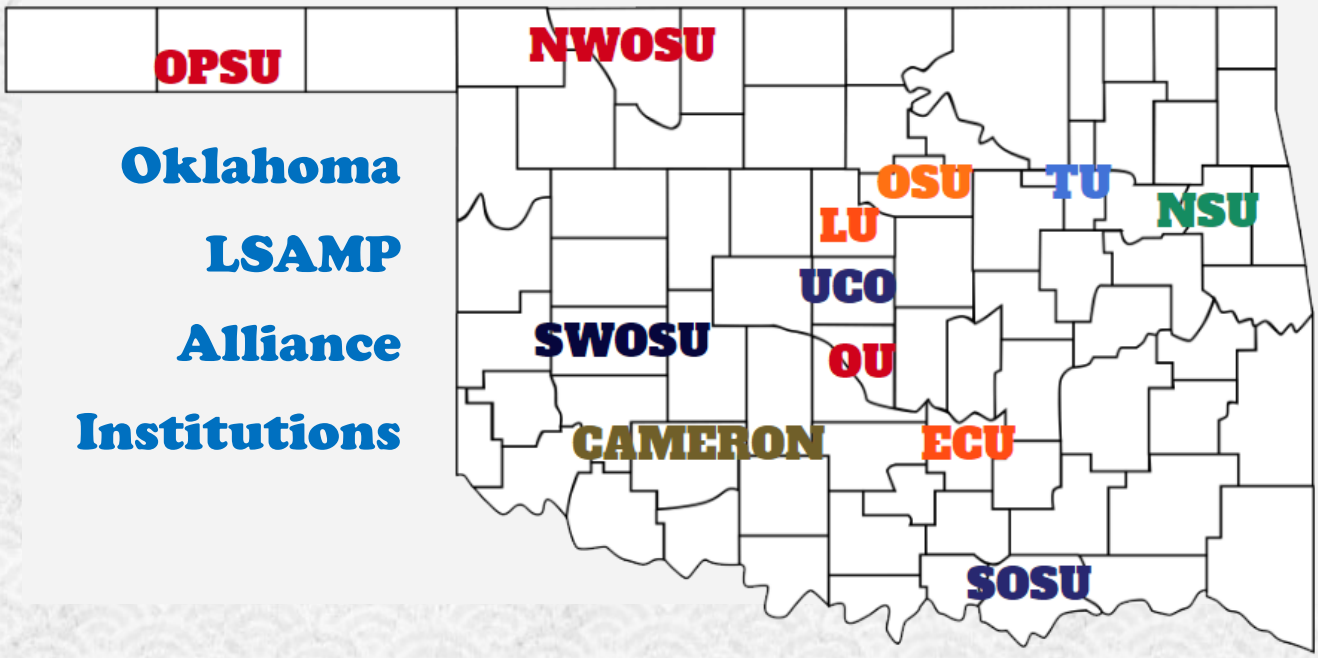


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