

NEWS FROM THE UNDERGRADUATE RESEARCH CENTER

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MTSU Representation at the World Congress on Undergraduate Research

In early April, eight MTSU students will travel to the University of Warwick in Coventry, England, to present their research at the World Congress on Undergraduate Research (WorldCUR).

WorldCUR is an immersive experience for students to share in scholarship with researchers from communities within the United Kingdom and around the world. Participants will attend plenary sessions and seminars, engage in social networking events, and present their research on the world stage.

WorldCUR will provide students with opportunities to engage in scholarly activities that stimulate debate, foster relationships, and celebrate creativity and innovation.

Many thanks to the faculty mentors who have supported our students and helped them achieve this outstanding accomplishment. We are also grateful to the academic departments who supported these students financially to make WorldCUR possible.

Check out pages 2-5 to view our MTSU representatives, their abstracts, and faculty mentors.

URC'S MISSION

The Undergraduate Research Center's (URC) mission is to be the central hub for communication about undergraduate research grant programs and other related opportunities on and off campus, to distribute university funds for undergraduate research and creative projects, and to promote dissemination of results through travel grants and by offering opportunities for students to present their research findings.

STUDENT ABSTRACTS: WORLDCUR 2023



**Faculty Mentor:
Dr. Kevin Bicker**

JANNA ABOU-RAHMA

Mechanism of Action of Antifungal Peptoids

Due to the rise of drug resistant strains of fungal pathogens such as *Cryptococcus neoformans* and *Candida albicans*, there has been a need to identify new antifungal agents. In comparison to naturally produced antifungal peptides, antifungal peptoids, which are like peptides but with side chains on the backbone nitrogen instead of carbon, are not recognized by proteases, giving higher bioavailability. Previous studies have shown that peptoids are effective fungicides. RMG8-8 and RMG9-11, two peptoids recently discovered in the Bicker Lab, have proven to be effective antifungal agents against *C. neoformans* and *C. albicans*, respectively. Reported here will be studies to determine the mechanism of action and other vital therapeutic properties of RMG8-8 and RMG9-11 using various biochemical and microbiological assays. Preliminary testing of critical micelle concentration, the minimum concentration of a compound needed to form micelles, indicate that RMG8-8 as well as RMG9-11 do not exist as micelles at their minimum inhibitory concentrations, but rather function unimolecularly, which may be therapeutically beneficial. Using a parallel artificial membrane permeability assay, it was found that RMG8-8 is likely unable to penetrate the blood brain barrier. However, RMG9-11 demonstrated good permeability, indicating that it may be able to penetrate the blood brain barrier to treat dangerous neurological infections of fungi. Subsequently, assays will be conducted in order to further understand the mechanism of action of both peptoid compounds to address the rising concern of drug resistant strains of fungal pathogens.



**Faculty Mentor:
Dr. Tiffany Rogers**

MARZEA AKTER

Effect of acute oxytocin administration on social behavior in male and female mice

Oxytocin is a neurotransmitter and hormone with a well-established role in prosocial behaviors in animals and humans. It is currently being tested in clinical trials for the treatment of social symptoms associated with autism spectrum disorders. However, the behavioral effects of oxytocin treatment have been variable with both prosocial (increased empathy) and antisocial (increased competitiveness) behaviors resulting in humans. Previous studies in our lab have shown increased anxiety-like behaviors in mice treated chronically with oxytocin (12 ug dose per day for 14 consecutive days, data unpublished). The current study aims to see the effect of acute oxytocin administration on social behavior in male and female mice to determine if the schedule of oxytocin administration affects behavioral outcomes. Adult C57BL/6J mice will be acutely pretreated with saline or oxytocin (12 ug) an hour before the behavior tests. Saline or oxytocin will be administered either intranasally (i.n., 12 ug in 12 uL, 6 uL per nostril) or intraperitoneally (i.p., 12 ug in 120uL). Mice will complete a battery of behavioral tests including the elevated plus maze (EPM), three-chamber sociability task (3C), and free dyadic social interaction (FDSI) after drug administration to determine changes in social behavior and anxiety-like behavior. Noldus EthoVision XT and human coders will code anxiety-like behaviors, social preference, and social novelty. I expect to find that acute oxytocin administration will increase sociability as measured by the 3C and FDSI tasks while avoiding increases in anxiety-like behaviors, as measured by the EPM task, associated with chronic administration.

STUDENT ABSTRACTS: WORLCUR 2023



**Faculty Mentor:
Dr. Anthony Newsome**

HUNTER BRADY

Chlorine Dioxide Gas as an Antiviral Agent: Development, Optimization, and Application, of an Antiviral Assay based on the MS2 Bacteriophage

Since the emergence of the SARS-CoV-2 virus, the etiological agent that causes COVID-19, the need to identify antiviral agents for disinfection purposes has dramatically increased. Chlorine dioxide gas has previously been identified as an antibacterial agent with strong oxidizing capabilities. The MS-2 bacteriophage has previously been identified as a suitable surrogate for the development and application of virucide decontamination methods by the Environmental Protection Agency. This study aimed to identify and assess the antiviral properties of chlorine dioxide gas and to identify optimum physical conditions for potential deployment in support of current antiviral disinfection needs. Using the MS-2 bacteriophage model system, preliminary studies used the double-layer agar plaque assay technique to evaluate the antiviral activity of chlorine dioxide gas. Results revealed up to a six-log (99.9999%) reduction of the MS-2 bacteriophage off of porous surfaces. These results suggest that chlorine dioxide gas is a suitable antiviral agent.



BROOKE BUSBEE & LESLIE GONZALEZ SALAZAR

READY (Research Experience Activity Designed for Youth) to SOAR Program and its Impact on Area High School Students

While the inclusion of high school students in summer research programs is gaining momentum on college campuses, short-term university-wide outreach programs focused on undergraduate research for high school students are less common. The READY (Research Experience Activity Designed for Youth) to SOAR program at Middle Tennessee State University (MTSU) aims to fill this gap by providing students with a short-term immersive research and creative activity experience. The goal of the program is to showcase MTSU's undergraduate research and creative activity opportunities to potential students through a single-day engagement event. The READY to SOAR program offers select junior and senior high school students the opportunity to visit campus, participate in a variety of informational sessions and group activities led by current undergraduate researchers, tour campus research facilities, and meet with faculty mentors. READY to SOAR participants are also exposed to a variety of creative performances at the afternoon Exposition session. To enlighten our understanding of how high school students view undergraduate research, we will be administering a pre/post questionnaire to all participants. The results of this study (conducted in March 2023) will aid our team in programmatic planning for future READY to SOAR events, help us to better understand how high school students perceive undergraduate research, and measure their level of interest in becoming involved in undergraduate research upon entering higher education.



**Faculty Mentor:
Dr. Jamie Burriss**

STUDENT ABSTRACTS: WORLDCUR 2023



**Faculty Mentor:
Dr. Frank Bailey**

YASEEN GINNAB

Analyzing the Ability of Astragalus Tennesseeensis to Accumulate Selenium

Selenium is an essential micronutrient that is naturally occurring in many soils, and can be accumulated by some plants. When accumulated in high amounts, the plant is called a selenium hyperaccumulator. *Astragalus bisulcatus* is one of the most well-studied hyperaccumulators. *Astragalus tennesseeensis* is a related species, which currently has no literature investigating its ability to accumulate selenium. This project will investigate whether *A. tennesseeensis* can accumulate selenium. Both species were grown in a greenhouse to compare their reactions to the presence of selenium. Sodium selenate (Na_2SeO_4) will be used for test groups. After treatment is completed, the plants will be digested in nitric acid and analyzed by atomic absorption spectrophotometry to determine the selenium content. *A. bisulcatus* is expected to thrive in the presence of selenium. Because there is no literature on *A. tennesseeensis* and selenium, I cannot predict whether it will accumulate selenium. However, the environment *A. tennesseeensis* typically grows in has relatively little selenium, so it is reasonable to assume that it will not be as efficient as *A. bisulcatus* and may not reach the threshold to be a hyperaccumulator. There are several ways to move forward from this project. A researcher can observe whether selenium is accumulated differently in the various plant parts. Another question is how the plant incorporates selenium into its tissues; selenium often replaces sulfur in amino acids and may be stored in several different forms.



**Faculty Mentor:
Dr. April Weissmiller**

JESSE SCOBEE

Investigating the Significance of the N-MYC-WDR5 Interaction in Pediatric Neuroblastoma

Neuroblastoma (NB) is the most common solid-tumor pediatric cancer, and high-risk cases associated with N-MYC amplification show a 50% 5-year survival rate. N-MYC is an oncoprotein transcription factor that causes the transformation of a healthy cell into a tumor cell, and thus functional inhibition of N-MYC is a sought-after therapeutic goal. Recently, the chromatin regulator WDR5 was discovered as an important MYC co-factor that can modulate MYC target gene expression, and evidence in N-MYC amplified NB cell lines shows extensive co-localization of N-MYC and WDR5 at genes involved in multiple important biological functions. These data suggest that the N-MYC-WDR5 interaction may control a variety of important N-MYC related functions, however a clear analysis focused on any single function individually is currently lacking. Thus, this study was designed to determine if blocking the N-MYC-WDR5 interaction alters expression of genes linked to apoptosis, a well-studied function of N-MYC. Using multiple engineered NB cell lines, we performed mRNA analysis of pro- and anti-apoptotic gene expression. Interestingly, results of this study reveal that blocking the N-MYC-WDR5 interaction does not cause overt changes in apoptotic gene expression, suggesting that blocking the N-MYC-WDR5 interaction may not be sufficient to induce apoptosis. However, future studies using different cell lines or alternative methods may be useful to confirm these results. Given the extent of N-MYC and WDR5 co-binding at genes involved in essential biological processes, future investigation is warranted to deduce the totality of cellular consequences that occur when WDR5 cannot bind N-MYC in these deadly malignancies.

STUDENT ABSTRACTS: WORLDCUR 2023



Faculty Mentor:
Dr. Kevin Bicker

ROSS SIBLEY

Synthesis and Characterization of Cyclic Peptoids Against *Cryptococcus neoformans* and *Candida albicans*

Antimicrobial resistant strains of fungal pathogens such as *Cryptococcus neoformans* and *Candida albicans* have risen to concerning heights, necessitating the discovery of a safe and effective novel antimicrobial agent. Antifungal peptoids, or peptidomimetic N-substituted glycines, have great potential when it comes to acting as antifungal agents due to greater bioavailability and stability towards proteases compared to their peptide counterparts. RMG8-8 and RMG9-11 are two peptoids recently discovered in the Bicker Lab with observed antifungal activity against *Cryptococcus neoformans* and *Candida albicans*, respectively. While these peptoids have comparable activity in vitro to current antifungals on the market, this study attempts to optimize antifungal activity by cyclizing the aforementioned linear peptoids with the hope that increased rigidity due to a locked conformation will increase the antifungal activity of the antifungal peptoids without affecting the observed permeability.

Additionally, peptoids are synthesized via solid-phase synthesis, a relatively cheap method that eliminates intermediate purification, further contributing to potential success as a viable treatment. To characterize the extent of efficacy, cyclic RMG8-8 (RHS3) and cyclic RMG9-11 (RHS6) have been tested for minimum inhibitory concentrations (MIC) against *Cryptococcus neoformans* and *Candida albicans* which will be reported.

Future analysis will include mammalian cytotoxicity on HepG2 liver cells and hemolytic activity against human erythrocytes (red blood cells) to determine whether these peptoids are viable options moving towards animal studies and clinical trials.



WorldCUR 2023

THE UNIVERSITY OF WARWICK



SCHOLARS WEEK 2023

Scholars Week 2023 will take place from March 20-24 and will showcase a variety of events at the college and university levels as we celebrate MTSU's commitment to research, creative activity, and scholarship. Events will be posted to our [website](#) as soon as they are confirmed so check back regularly.

Our annual **Research and Creative Activity Exposition** will include two poster sessions and a half-time show of creative performances on Friday, March 24, in the Student Union ballroom.

REGISTRATION NOW OPEN!!! Please click [HERE](#) to register to present your project at the Exposition. Prizes will be given for 1st, 2nd, and 3rd place in each college. FREE Italian buffet lunch and t-shirt for presenters, too! Deadline to register: February 28, 2023

THANK YOU to the 2023 Scholars Week Committee

Stacey Fields, Chair, *Elementary and Special Education, College of Education*

Casey Tomlin, Student Chair, *Forensic Science and Technology*

Jamie Burriss, *Program Manager, Office of Research and Sponsored Programs*

Katie Medrano, *Coordinator, Office of Research and Sponsored Programs*

Katherine Blankenship, *Health & Human Performance, College of Behavioral and Health Sciences*

Angie Bowman, *Health & Human Performance, College of Behavioral and Health Sciences*

Kevin Bicker, *Chemistry, College of Basic and Applied Sciences*

Kevin Ragland, *Tennessee STEM Education Center*

Christina Cobb, *University Studies, University College*

Matthew Duncan, *University Studies, University College*

David Butler, *Vice Provost of Research and Dean of Graduate Studies*

Dawn McCormack, *Associate Dean, Graduate Studies*

Karen Reed, *Library, James E. Walker Library*

Jordan Nelson, *Library, James E. Walker Library*

Meredith Dye, *Sociology and Anthropology, College of Liberal Arts*

Alicia Fuss, *Theatre and Dance, College of Liberal Arts*

Kristine Potter, *Media Arts, College of Media and Entertainment*

Laura Clippard, *Honors College, Honors College*

Stephanie Wagner, *News and Media Relations, Marketing and Communications*

Rebecca Seipelt, *Biology, College of Basic and Applied Sciences*

Saeed Foroundastan, *Engineering Technology, College of Basic and Applied Sciences*

Jim Rost, *Womack Educational Leadership, College of Education*

THE SOAR AMBASSADORS

PRESENT

SCHOLARS WEEK

"GET INVOLVED"

POP-INS!

FACULTY!! We come
to your class!

**What is
Scholars Week?**

When are the dates?

**What events are
happening?**

**HOW DO I SIGN UP TO
PRESENT?**

We will
answer all
these
questions
during our
quick 5
minute
visit!

**To request a pop-in from one of our
SOAR Ambassadors**

[CLICK HERE!](#)



FEATURED SOAR STUDENT

Student Organization for
the Advancement of Research

SAVANNAH LAWWELL

Major: Biology

Faculty Mentor: Dr. John DuBois

Current Research Focus:

Producing Pollen, Pollination and Assessment of Seed Yields and Cannabinoids in Feminized Industrial Hemp (*Cannabis sativa*)

Project Description:

Historically, *Cannabis sativa* has been used for a variety of things. The flowers and leaves have been used in medicines and recreational drugs. The seeds have been used for oils and foods, and the stem fibers have been used for clothing, paper, and ropes. Despite this, there is still limited knowledge about these versatile plants--especially when it comes to cannabinoid production. The two most well known cannabinoids are cannabidiol (CBD), which is non-psychoactive and used mostly in medicines, lip balms, and topical ointments, and tetrahydrocannabinol (THC), which is the psychoactive component used mostly in recreational drug use. In order to gain more knowledge, the purpose of my research was to determine baseline data of varying high-cannabidiol (CBD) strains of *Cannabis sativa* provided by Greenway Herbal Products, LLC. In order to gather this baseline data, I conducted several silver thiosulfate treatments on these different plants in order to create feminized pollen resulting in seed production. Once the buds and seeds were harvested, the seed yield and cannabinoid levels were determined in each plant. The harvested seeds were then germinated and grown up in order to determine their sex ratio and cannabinoid levels. The silver thiosulfate treatment protocol and data will be used in future research studies with *Cannabis sativa*.



Why does this topic interest you?

This project interested me because of the potential future applications for the agricultural and medical industries, and I wanted to challenge my own perspective by pushing myself out of my comfort zone with this project.

Do you have any advice for future researchers?

Do not be afraid to fail. Failure is often deemed as negative, and that is not the case. Failure is a natural part of not only research, but also of being human. I can promise you that every single researcher has failed in some capacity; I know I have multiple times. So, embrace your failures and figure out what can be learned from that moment.



spring luncheon & business meeting

THANKS TO ALL WHO ATTENDED!

For those who missed the meeting, below are some upcoming opportunities for involvement:

- Volunteer for Classroom Pop-Ins**
- Serve as a READY to SOAR group leader**
- Work a shift at Scholars Week**
- Graduation Distinction**

**QUESTIONS? Email Hunter Brady, SOAR President
at hwb2j@mtmail.mtsu.edu**

FEATURED FACULTY MENTOR DR. RYAN SETH JONES

Department: Education

Bio: Seth has spent most of his life in Tennessee. He attended elementary school and high school in Polk County, TN. He attended Tennessee Technological University for his undergraduate degree, majoring in Mathematics and Secondary Education. He taught high school math for six years before attending Vanderbilt University. At Vanderbilt he worked with Dr. Richard Lehrer, and became interested in how students come to understand and use data to make inferences. After graduating, he worked with Dr. Jere Confrey at North Carolina State University building innovative digital tools to support middle school math teachers. In 2016 he started working at MTSU.

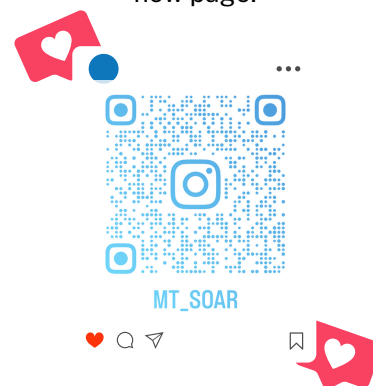
Research Interests: Seth studies ways of supporting students to use mathematics and science to construct and revise knowledge. He has conducted research that focuses on measuring the extent to which whole class discussions in middle grades classrooms support students to examine epistemological aspects of various statistical properties, worked on interdisciplinary teams to create innovative technologies for teachers and students in middle grades math classes, helped to develop new tools for assessing nuanced ways of thinking in middle grades students, and has developed frameworks and curricular approaches for interdisciplinary STEM learning environments organized around data modeling practices.



URECA Projects:

- Spring 2019 The Impact of 3D Biology Lessons Within the Classroom
- Spring 2019 Developing Procedures for Capturing Video and Audio of Small Group Interactions in Large Classroom Data Collection
- Fall 2018 The effects of 3D biology lessons on student learning

Follow us @mtsoar
and let others know about our
new page!



**Check out more
SOAR profiles here!**

[MTSU.EDU/URC/SOAR-
PROFILE/](https://www.mtsu.edu/urc/soar-profile/)

CONFERENCE SPOTLIGHT

Check out our undergrad researchers and their presentations at state, local, and national conferences



GARRICK MCGEE, EMMA SUMMERS, SARA MASHBURN, ALDEN MCGINNIS

Conference: American Speech-Language-Hearing Association Convention

Project Title: Word Learning in SLP Undergraduate Students: Textbook VS. Computer-Base

Faculty Mentor: Dr. Kathryn Blankenship

ALDEN'S CONFERENCE TAKAWAY

I ENJOYED THE OPPORTUNITY TO PRESENT OUR RESEARCH TO OTHER PROFESSIONALS IN THE SLP FIELD. IT WAS A GREAT EXPERIENCE, AND I LEARNED A LOT ABOUT PRESENTING RESEARCH AT A NATIONAL CONFERENCE."

INTERNSHIPS & RESEARCH OPPORTUNITIES

Check out the following opportunities for spring & summer research !

[2023 Summer Scholars Program](#)

- This 10-12 week, funded program gives students research-intensive training, in the field of anti-aging and rejuvenation biology at our Research Center in Mountain View, CA and in labs all over the country. Eligibility details are available [here](#), and placements are listed [here](#).

[2023 -2024 Postbaccalaureate Fellowship](#)

- This 10-month, funded program gives students the opportunity to conduct research in a gap year format, in the field of anti-aging and rejuvenation biology at our Research Center in Mountain View, CA and in labs all over the country. Eligibility details are available [here](#), and placements are listed [here](#).

[Summer REU in Sensing and Smart Systems-Florida Atlantic University](#)

- Florida Atlantic University's Institute for Sensing and Embedded Network Systems Engineering (I-SENSE) hosts an intensive summer research program in sensing and smart systems for talented undergraduate students across the country. Closely related to the Internet of Things, smart systems represent an emerging class of distributed systems that provide real-time awareness of conditions, trends, and patterns to support improved decision-making, and often, automation. The on-campus research will focus on I-SENSE's three main program areas: Infrastructure Systems, Marine and Environment and Health and Behavior.

[Claudine K. Brown Internship in Education - Smithsonian](#)

- The internships are intended to increase participation of underserved students who are under-represented in the education and museum leadership field. Interns experience opportunities in the central education office and collaborate with offices, museums, and research centers throughout the Smithsonian Institution where they help to create, develop, and disseminate innovative educational programs and resources at the Smithsonian, online, in the classroom and in communities. Each year, the Office of the Under Secretary for Education (OUSE) identifies new projects for the Claudine K. Brown Internship awardees. In 2023, the Claudine K. Brown interns will have an opportunity to learn through engagement with mentors at the OUSE central education office. In Summer 2023, internships will be offered remotely for 8 weeks.

[2023 DOE Scholars Program - Department of Energy](#)

- The DOE Scholars Program is designed to attract talented undergraduate and graduate students, and recent graduates to research, technical and professional opportunities within U.S. Department of Energy (DOE) and organizations that support the DOE mission. • Energy Sources and Security • Clean Energy • Energy Efficiency • Climate Change • Environmental Management • Nuclear Security • Artificial Intelligence • Emergency Response • Management and Operations • Cyber Security • Safeguards and Security As a participant in the DOE Scholars Program you will have the opportunity to explore a federal career with DOE and gain a competitive edge as you apply your education, talent and skills in a variety of settings within the DOE complex.

INTERNSHIPS & RESEARCH OPPORTUNITIES

Check out the following opportunities for fall research !

[AHA Supporting Undergraduate Research Experiences - Boston University](#)

- The AHA SURE Summer Program is an excellent way for undergraduate students to garner research experience under guided mentorship from experts in the field of cardiovascular research. Through a partnership with the American Heart Association, mentored 10- to 12-week summer research experiences are available for at least three students from racial/ethnic or LGBTQ+ groups under-represented in science.

[Astrophysics REU - West Virginia University](#)

- This is a 10-week summer program for undergraduate student research, funded by the National Science Foundation (NSF). West Virginia University is proud to host a REU site focused on astrophysical research. Research projects will focus on the Milky Way interstellar medium, transient astrophysical phenomena, pulsars, supermassive black holes, planetary atmospheres, young stellar clusters, and gravitational waves. Each student will be associated with a specific research project, where they will work closely with their faculty research mentor and other researchers. Students receive a \$5,000 stipend, \$300 in travel expenses, meals, and lodging.

[Cancer Research Summer Internship Program - University of Michigan - University of Michigan](#)

- As part of its Cancer Biology Training Program, the University of Michigan Rogel Cancer Center provides exposure to cancer research for highly motivated and talented college undergraduates. This program gives the successful applicants an opportunity to explore potential careers in the field of cancer research. Internships are aimed at students who are completing their sophomore or junior undergraduate year this spring. Applications are encouraged from individuals from minority groups that are currently underrepresented in biomedical and behavioral research. The program will run for a ten-week period in summer 2023 (May 24 - August 2). Students selected are matched with an appropriate U-M faculty. Interns are paid a stipend of \$5,500 and are responsible for their own housing and travel arrangements. Interns work directly in a cancer laboratory setting. Program mentors give presentations on their work in cancer every other week at an informal luncheon that interns are required to attend. At the end of the internship program, each intern will be asked to give a short presentation on their work.

Interested in more opportunities? [Click here](#) to explore more internship/research opportunities!

UNDERGRADUATE RESEARCH GRADUATION DISTINCTION



LEVELS OF RECOGNITION

Distinction in Undergraduate Research

- Students receive a dark blue, light blue, and white cord

Scholar Distinction in Undergraduate Research

- Students receive a dark blue, light blue and white cord
AND a medallion (see image to the right)

SUBMIT YOUR APPLICATION [HERE!!](#)

DISTINCTION CRITERIA

Distinction in Undergraduate Research

*Students must fulfill all requirements

Scholar Distinction in Undergraduate Research

*Students must fulfill all requirements

1 Successful completion of an Assistant level URECA project - 50 hours of research or more.

1 Successful completion of a Scholar level URECA project - 100 hours of research or more.

2 Poster presentation or creative performance at one of the URC's signature events: Fall Open House, Scholars Week, or Summer Research Celebration.

2 Poster presentation or creative performance at one of the URC's signature events: Fall Open House, Scholars Week, or Summer Research Celebration.

3 Active participation for at least one academic year in the Student Organization for the Advancement of Research (SOAR).

3 Active participation for at least one academic year in the Student Organization for the Advancement of Research (SOAR).

4 Confirmation of support from URECA faculty mentor.

4 Poster or presentation at the National Conference on Undergraduate Research or published in a peer-reviewed academic journal.

5 Confirmation of support from URECA faculty mentor.